CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA

MEMOIR 261

MINERAL INDUSTRY OF DISTRICT OF MACKENZIE, NORTHWEST TERRITORIES

BY

C. S. Lord

OTTAWA
EDMOND CLOUTIER, C.M.G., O.A., D.S.P.
KING'S PRINTER AND CONTROLLER OF STATIONERY
1951

Price, $1.25 No. 2500

Yellowknife, 1947. New townsite in foreground, old town in background on peninsula and islands in Yellowknife Bay.
(Courtesy of the National Film Board.)

CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

GEOLOGICAL SURVEY OF CANADA

MEMOIR 261

MINERAL INDUSTRY OF DISTRICT OF MACKENZIE, NORTHWEST TERRITORIES

BY

C. S. Lord

OTTAWA
EDMOND CLOUTIER, C.M.G., O.A., D.S.P.
KING'S PRINTER AND CONTROLLER OF STATIONERY
1951

Price, $1.25 No. 2500

CONTENTS

CHAPTER III—*Concluded*

CHAPTER IV

CHAPTER V

CHAPTER V—*Continued*

CHAPTER V—*Concluded*

CHAPTER VI

Illustrations

PREFACE

This report describes District of Mackenzie, the western and only district of Northwest Territories that has afforded significant mineral production. This vast, diverse, partly explored region extends north of the Arctic Circle to the Arctic Ocean, contains Canada's most northerly lode mine and oil wells, and during the past decade has contributed substantial amounts of gold, silver, radium, uranium, and oil. Mining is the principal industry of the district. Most of the recent activity has centred about the gold mining town of Yellowknife, once considered remote but now less than 24 hours by scheduled air lines from the metropolitan areas of eastern Canada.

The mineral industry of this part of Northwest Territories was first described by Dr. Lord in Memoir 230, issued by the Geological Survey of Canada in 1941. That report is now out of print. However, the present report includes all data found in the previous memoir, where still applicable, and includes other developments to the end of 1947, and later in specified instances. It contains an account of the many physical and economic factors affecting the mining industry, chapters on the general and economic geology of the district, and an extensive bibliography. Altogether, one hundred and thirty-nine mines, prospects, and mineral occurrences are described. These include most properties active in 1947, and many others; but the omission of a property does not necessarily imply that that property lacks merit. Figures pertaining to tonnages and grades of reserve ore and sub-ore are, in nearly all instances, owner's figures; but a few such calculations were made by officers of the Geological Survey of Canada during World War II, mainly for small deposits of scheelite and various minerals in pegmatite dykes.

GEORGE HANSON,
Chief Geologist, Geological Survey of Canada

OTTAWA, November 30, 1949

Mineral Industry of District of Mackenzie, Northwest Territories

CHAPTER I

INTRODUCTION

GENERAL STATEMENT

This report deals with the mineral industry of the District of Mackenzie, the only part of Northwest Territories that has been widely prospected or that has afforded significant quantities of minerals. The district lies north of British Columbia, Alberta, and Saskatchewan at the 60th parallel, east of Yukon, south of the Arctic coast, and west of the 102nd meridian, and has an area of about 527,490 square miles. It includes most of Yellowknife and Mackenzie mining districts. Although one of Canada's youngest mineral-producing districts, it is commonly considered as one of the most promising. Between 1932, when first production was recorded, and the end of 1949, it had afforded gold, silver, petroleum and natural gas, copper, lead, and tungsten valued at $31,788,071, in addition to pitchblende products valued at substantially more than $5,805,423[1]. Most production and prospecting have been confined to: (1) an area near Norman Wells; (2) a region extending southeasterly from Port Radium on Great Bear Lake to Yellowknife on Great Slave Lake; and (3) a quadrant of 150 miles radius extending north and east from Yellowknife. This report is particularly concerned with those areas. Gold deposits have afforded most mineral wealth to date[2], but many deposits of other minerals are known.

Most of the active mines and prospects in the district were examined by the writer in 1947. This report deals with these and other properties know to the Geological Survey of Canada to the end of that year, or, where stated, to more recent dates; but the omission of a property does not necessarily imply that that property lacks merit. The report includes all information found in Memoir 230 (Lord, 1941a)[3], where still applicable. For a useful compilation of data available prior to 1921, the reader is referred to a report by Camsell and Malcolm (1921). In addition to the usual descriptions of location, history, production, development, general geology, and mineral deposits, information is presented, where available, on such topics as ore reserves, mining and milling costs, and general operating data. The report is also intended to summarize available more general information of interest to the mining fraternity, including physical and economic conditions, regional geology, and general economic geology; and to provide a guide for those seeking further information through other publications, correspondence, or interviews.

[1] This is the value of pitchblende products produced to the end of 1941, as published by the Dominion Bureau of Statistics. The value of pitchblende products since 1941, although substantial, is not available for publication.

[2] This and all similar statements are made without reference to the undisclosed quantity and value of pitchblende produced in Northwest Territories since 1941.

[3] Dates, in parentheses, are those listed with the author's name in Bibliography, Chapter VI.

The writer gratefully acknowledges his indebtedness to officials and staffs of mining, exploration, and transportation companies, to prospectors, and to others interested in the Northwest Territories, for without their consistent co-operation this report would not have been possible. Invaluable field and office aid was afforded in many ways by officials of the Development Services Branch. Free use has been made of published and unpublished reports of present and former officers of the Geological Survey of Canada. J. A. Woodard acted as field assistant in 1947.

PHYSICAL FEATURES

(*See* Figure 1)

Most of the District of Mackenzie is drained northwesterly into the Arctic Ocean by Mackenzie River and its tributary lakes and rivers, whereas the eastern part is drained northerly and easterly by several rivers entering the Arctic Ocean or Hudson Bay. Prominent central features of the district are Great Bear Lake lying astride the Arctic Circle, and Great Slave Lake about 250 miles to the southeast. Great Slave Lake, with an area of about 11,170 square miles, is the second largest lake in Canada; from its west end Mackenzie River flows northwesterly more than 1,000 miles to the Arctic Ocean. Slave River, formed by the confluence of Athabasca and Peace Rivers, is the largest river entering Great Slave Lake. Other rivers entering the lake include: from the south, Hay, Taltson, and Snowdrift; from the east, Lockhart; and from the north, Barnston, Beaulieu, Yellowknife, Snare, and Marion. Great Bear Lake has an area of about 11,660 square miles, and is the largest lake lying entirely within Canada; Great Bear River drains it westerly to Mackenzie River at Fort Norman. Camsell River enters Great Bear Lake from the southeast; Sloan and Dease Rivers enter from the northeast. Principal rivers flowing northeasterly into the Mackenzie include, from southeast to northwest, Liard (of which South Nahanni River is a tributary), North Nahanni, Keele, Arctic Red, and Peel.

Main rivers in the eastern part of the District of Mackenzie are, from northwest to southeast: Coppermine, Burnside, and Back, flowing northerly or northeasterly into the Arctic Ocean; and Thelon (of which Dubawnt River is a tributary from the south), which rises a short distance east of Great Slave Lake and flows easterly to Chesterfield Inlet of Hudson Bay.

The District of Mackenzie contains parts of three physiographic divisions of Canada: the Canadian Shield in the northeast, the Cordillera in the southwest, and, between them, the Interior Plains.

The Canadian Shield occupies that part of the district lying northeast of a line passing northwesterly through Fort Smith, Slave River, and the north arm of Great Slave Lake; through Marian, Faber, Hardisty, and Hottah Lakes; through the southern bay of McTavish Arm of Great Bear Lake; and thence through a little known region towards Darnley Bay on the Arctic coast. The Shield is dotted with innumerable lakes of all sizes and shapes, many of which are studded with islands. Most of the region is one of low relief, with rocky hills and ridges rising abruptly 50 to 150 feet above intervening rock-bound lakes and swampy areas called muskegs.

Figure 1. District of Mackenzie, Northwest Territories, and parts of adjacent provinces and districts.

Nevertheless, the country becomes increasingly rugged northwesterly from Yellowknife to where, at and east of Great Bear Lake, relief exceeds 1,000 feet in places. Lakes near the borders of the Shield within the District of Mackenzie lie at relatively low elevations: thus, Great Bear Lake, 390 feet; Hottah Lake, 640 feet; Hardisty Lake, 699 feet; Faber Lake, 753 feet; Mazenod Lake, 765 feet; and Great Slave Lake, 495 feet. Elsewhere large lakes commonly occur at considerably greater elevations. Thus, southeast of Great Slave Lake, Nonacho and Thekulthili Lakes are 1,160 feet above sea-level; Abitau Lake, 1,775 feet; and, north and northeast of Great Slave Lake, MacKay, Aylmer, and Contwoyto Lakes are 1,415, 1,230, and 1,480 feet, respectively, above sea-level. Coppermine Mountains west of the lower Coppermine River rise to an estimated height of 2,000 feet, and Peacock Hills at the north end of Contwoyto Lake may attain an elevation of 2,500 feet. In places, as south of Darnley Bay and near Bathurst Inlet, the high plateau-like character of the Shield is maintained to the Arctic coast, where rugged hills rise 1,000 feet or more from the sea; elsewhere the descent to the sea is more gradual. Rock exposures are numerous within the Shield region. They are perhaps most numerous at Yellowknife Bay, where they may occupy nearly half the land area, but are less abundant northerly towards Great Bear Lake, and much less common in the barren grounds northeast of Great Slave Lake.

The southwestern part of the District of Mackenzie lies within the Cordilleran region, the northeast boundary of which extends from just west of Liard River, at the 60th parallel, trends northerly to cross to the east side of Mackenzie River at Camsell Bend, thence trends north and north-northwest to cross Great Bear River at St. Charles Rapids, thence northwest to cross Mackenzie River near Fort Good Hope, the Arctic Red River 60 miles from its mouth, and, finally, about north-northwest to pass 10 miles west of Fort McPherson and Aklavik and meet the Beaufort Sea at the west edge of Mackenzie River Delta (Bostock, 1948). The principal features within the Cordillera of District of Mackenzie lie in three northwesterly trending belts: Mackenzie and Selwyn Mountains southwest of Mackenzie River, Franklin Mountains mainly northeast of the river, and the intervening Mackenzie Plain.

Mackenzie Mountains occupy a broad, crescentic area, convex towards the northeast, stretching 425 miles southeasterly from south of Peel River near the 134th meridian nearly to Liard River at the 61st parallel. Their maximum width exceeds 100 miles. They are distinguished from Selwyn Mountains, which adjoin them on the southwest, not by any abrupt topographic boundary, but by absence of intrusions, by more conspicuous stratification, and more youthful topography. On the north and northeast they rise abruptly from the Mackenzie Plain. In the main, they comprise a compact mass of conspicuously layered, northwesterly trending ridges topped by peaks that commonly rise to elevations of more than 7,000 feet, and in some places are reported to exceed 9,000 to 10,000 feet. Small alpine glaciers are numerous. The Canyon Ranges, which form their northeastern front and occupy a belt up to 40 miles in width, include more subdued mountains, and high plateau areas traversed by deeply incised river valleys.

Throughout most of their length, Franklin Mountains lie a short distance east of, and parallel with, Mackenzie River. They extend from Fort Good Hope more than 400 miles southeasterly to the mouth of South Nahanni River and average less than 30 miles in width. They include (Bostock, 1948), from north to south, Norman, McConnell, Camsell, and Nahanni Ranges. Here and there peaks such as Mount Clark and Cap Mountain reach elevations of 4,700 feet or more.

Mackenzie Plain borders Mackenzie River from Camsell Bend in the south nearly to Fort Good Hope in the north, and at each end joins the Interior Plains. It averages about 30 miles in width. Mackenzie River and its main tributaries are entrenched in narrow, steep-sided valleys 200 to 500 feet below the general surface of the plain.

The Interior Plains occupy a northwesterly trending belt lying between the Canadian Shield on the northeast and the Cordillera on the southwest. At the 60th parallel the belt extends from Fort Smith on the east to Fort Liard on the west, and is about 400 miles in width; northeast of Fort Norman it is about 200 miles wide and includes all but the eastern part of Great Bear Lake; northwest of Great Bear Lake it is relatively unknown, but reaches the Arctic coast. The country is heavily wooded, mainly gently rolling, and for the most part underlain by nearly flat-lying sedimentary strata. Where best known, as between Great Bear Lake and Fort Smith, the northeast border is marked by easterly facing scarps or by low, drift-covered belts several miles wide. The scarps range in height from a few feet to perhaps 250 feet. The stream patterns are in marked contrast with those found in the Canadian Shield, and lakes are less numerous. Probably in most places solid rock is hidden by soil, moss, or swamp. Widely scattered determinations suggest that the surface of the region rarely attains elevations much in excess of 1,000 feet, but that a few hills and ranges are considerably higher. Some of these known prominences are: Horn Mountains northwest of Providence, 2,500 feet; Ebbutt Hills east of Camsell Bend, 1,875 feet; and Grizzly Bear Mountain and Scented Grass Hills on Great Bear Lake, 1,500 and 2,144 feet respectively.

POPULATION[1]

According to the 1941 census, 7,294 persons were resident in the District of Mackenzie, 2,113 of whom were white, 4,322 Indian or half-breed, 853 Eskimo, and 6 otherwise classified. The 1947 white population was substantially greater. 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, commercial fishing, transportation, or missionary work, or are employees of the Dominion Government. Natives engage mainly in trapping and hunting and, with few exceptions, take no part in mining or prospecting.

[1] Statistics supplied by R. Ziola, Chief, Occupation and Employment Statistics, Dominion Bureau of Statistics, Ottawa.

The following table shows the distribution of persons in the District of Mackenzie in 1941, the last year for which reliable figures are available.

Area	White	Indian[1]	Eskimo	Total
Aklavik and district	167	213	377	757
Arctic Red River	11	118	....	129
Baillie Island and points east to Pearce Point	14	....	255	269
Coppermine River and Coronation Gulf district	36	....	219	255
Fort Good Hope and district	14	337	....	351
Fort Liard and district	14	202	....	216
Fort McPherson and district	17	308	....	325
Fort Norman and district	63	200	1	264
Fort Providence and district	39	376	....	415
Fort Rae and district	81	686	....	767
Fort Reliance and district	9	85	....	94
Fort Resolution and district	136	499	....	635
Fort Simpson and district	76	378	....	454
Fort Smith and district	241	290	....	531
Fort Wrigley and district	6	77	....	83
Great Bear Lake[2]	1	174	....	175
Hay River and district	16	147	1	164
Yellowknife and district	1,172	232	....	1,410[3]
Total (District of Mackenzie)	2,113	4,322	853	7,294

[1] Includes half-breeds.
[2] Eldorado mine, at Port Radium, was not operating in 1941.
[3] Includes 3 Chinese, 1 Japanese, 1 other Asiatic, and 1 Negro.

SETTLEMENTS

Settlements north of Edmonton, Alberta, and of most concern to the mineral industry of the District of Mackenzie, are Waterways and Fort McMurray in Alberta, and Fort Smith, Hay River, Yellowknife, Port Radium, and Norman Wells 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 water-borne freight entering the District of Mackenzie. Docks and other facilities for handling this freight are located there.

Fort McMurray is at the junction of Clearwater and Athabasca Rivers, about 3 miles from Waterways. Fort McMurray is a seaplane base, and an airport a few miles from the town is a scheduled stop for aircraft of Canadian Pacific Airlines operating between Edmonton, Yellowknife, and other points.

Fort Smith 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 Fort Fitzgerald, Alberta. Fort Smith is the administrative headquarters for the District of Mackenzie. It is a point of re-embarkation for almost all water-borne freight entering the district and has an airport, various Government offices, a Government radio and meteorological station (Department of National Defence), and other facilities that might be expected in one of the most important settlements of Northwest Territories.

Hay River settlement, at the mouth of Hay River on the south shore of Great Slave Lake, is the northern terminus of the Mackenzie all-weather highway from Grimshaw, Alberta. Facilities include an airport, and radio and meteorological station operated by the Department of National Defence. In recent years, Hay River has become the centre of a thriving commercial fishing industry, and in 1949 it became the second Local Administrative District in the Northwest Territories. District affairs are conducted by a Local Trustee Board composed of two members elected locally and three appointed by the Commissioner of the Northwest Territories.

Yellowknife (*See* Plate I), on Yellowknife Bay on the north shore of Great Slave Lake, is about 600 miles north of Edmonton, Alberta. Founded in 1935, it is now the most modern and active, as well as the largest, settlement in Northwest Territories. Yellowknife is primarily a mining town, with a permanent population of about 3,500 (Northwest Territories and Yukon Services, 1948, p. 9). It affords, in some degree, all the usual services and facilities of a well-established, prosperous community with an assured future. The original settlement (old townsite) is on a rocky peninsula projecting into Yellowknife Bay, and on two adjacent islands. By 1947 a new, and much more spacious, townsite had been established about a mile inland from the original site, and is still (1949) being improved. Most business is conducted from the old townsite, but government offices, most residences, and essentially all recent structures are on the new townsite. Yellowknife contains offices of Mining Recorder, Stipendiary Magistrate, Resident Geologist, and other Government officials; Royal Canadian Mounted Police detachment; post office; airport, radio range, and meteorological station operated by the Department of Transport; radio station operated by the Department of National Defence; new public and high school, with an enrolment in March 1950 of about 215; hotels, one with fifty rooms; forty bed hospital, opened January 1948; restaurants; banks (Commerce, Imperial, and Toronto); drug, general, and hardware stores; Government liquor store; beverage rooms and cocktail lounge; meat market; cold storage plant (at Con mine); motion picture theatres; printing office; Church of England and Roman Catholic Churches; assay offices; laundries; a hockey arena and community hall; garages; bakeries; and soft drink bottling plants. A weekly newspaper is published. Several companies operate taxis, buses, or aircraft for charter. A telephone system links the old and new townsites and nearby mines. The town is provided with electric power, electric street lights, and a water and sewage system. Two doctors, a dentist, and lawyers are available; a golf course was opened recently; and a public library has been established. Docks for seaplanes, boats, and barges are at the old townsite, and oil storage tanks on an adjacent island. Many of the recent improvements have involved substantial capital expenditure by the Government of Canada.

Port Radium post office is on the property of Eldorado Mining and Refining (1944) Limited, at Labine Point near the east end of Great Bear Lake but was formerly situated at Cameron Bay, about 6 miles east of the Eldorado property. Except for a Royal Canadian Mounted Police detachment, and a radio and meteorological station maintained by the Department of National Defence, the surrounding community is the Eldorado mine and camp.

Oil wells, refinery, post office, aircraft landing field, and a Government radio and meteorogical station are situated at Norman Wells, on Mackenzie River about 45 miles northwest of Fort Norman.

GOVERNMENT AND ADMINISTRATION

The following account, supplied by the Department of Resources and Development, is applicable to 1950.

The Northwest Territories Act provides for a Territorial Government composed of a Commissioner of the Northwest Territories, a Deputy Commissioner, and five councillors appointed by the Governor in Council. The Commissioner in Council has power to make ordinances for the government of the Territories, under instructions from the Governor in Council or the Minister of Resources and Development, respecting direct taxation within the Territories in order to raise revenues, etc., and in respect to the establishment and tenure of territorial offices; the appointment and payment of officers, maintenance of prisons, municipal institutions, licences, solemnization of marriages, property and civil rights, administration of justice; and generally to all matters of a local or private nature in the Territories. The seat of government is at Ottawa.

Council meetings are held regularly. The Council functions not only as a legislative body, but in an advisory capacity to the Minister of Resources and Development on matters pertaining to the administration of the Northwest Territories. Careful consideration is given to matters affecting the well-being of the resident population, white and native. Appreciation of the fact that natives must, by reason of character, training, and environment, depend almost entirely on hunting and trapping for a livelihood is reflected in the provisions of the game regulations and in the large areas set aside as game sanctuaries and native game preserves.

The administration of the various Acts, Ordinances, and Regulations pertaining to the Northwest Territories is supervised by the Director of the Development Services Branch, Department of Resources and Development, who is also Deputy Commissioner of the Northwest Territories. His office is located at 150 Wellington street, Ottawa. The administrative office for Mackenzie District is at Fort Smith. Mining Recorder's Offices are maintained at Fort Smith and Yellowknife.

In 1947 the electoral district of Yukon was enlarged by the addition of that part of the District of Mackenzie lying west of the 109th meridian. The resultant electoral district is known as Yukon-Mackenzie River, and has been represented in Parliament since the Federal election of June 1949. Previously, no part of Northwest Territories had been represented in the Parliament of Canada.

The Yellowknife Administrative District was established on October 1, 1939, under the provisions of the Local Administrative District Ordinance. The affairs of the District are managed by a Local Trustee Board of eight members. Three members of the Board are appointed for a period of one year by the Commissioner of the Northwest Territories, and the remaining five are elected annually by the residents of the District. The Chairman is elected by the Board from among its own members. The Board functions in a manner similar to that of a town council, with authority to assess real property and raise taxes for municipal purposes, including maintenance of schools, roads, sidewalks, and water, sewer, and sanitation services.

The enforcement of law and order is the responsibility of the Royal Canadian Mounted Police, and detachments are established at strategic points throughout the Territories.

CLIMATE

The climate is one of long, cold to extremely cold winters; short, warm to briefly hot summers; and light precipitation. Most of the district has a sub-Arctic climate, that is, the average temperatures of the coldest months are below 32 degrees F., but the average temperatures of the 3 summer months are above 50 degrees F. This sub-Arctic weather is similar to that prevailing in Ontario north of Lake Superior, and thus cannot be considered a principal obstacle to development. However, a more severe, Arctic climate characterizes that small part of the district lying northeast of a line extending southeasterly from Bathurst Inlet: here, the winters are only slightly colder than elsewhere in the District of Mackenzie; but the summers are much cooler, the average temperature of the warmest month being below 50 degrees F. and above 32 degrees.

The mean annual temperatures in the District of Mackenzie range from about 8 degrees F. in the northeast to about 26 degrees F. in the southwest; the mean temperatures for the hottest month (July) from a little below 50 degrees F. in the northeast to about 60 degrees F. in the southwest; and the average temperatures during the coldest month (January or February) from about -15 degrees F. in the southwest to about -25 degrees F. in the extreme northeast. Extreme minimum temperatures recorded include -79 degrees F. at Fort Good Hope on Mackenzie River near the Arctic Circle, and about -78 degrees F. at Port Radium on Great Bear Lake. Extreme maximum temperatures of 90 degrees F., or more, have been recorded at many stations. The extreme maximum for Aklavik, near the mouth of Mackenzie River, is 88 degrees F.; for Fort Smith, at the 60th parallel, 103 degrees F. However, monthly maximum temperatures of 80 to 85 degrees F. are more common.

Annual precipitation averages about 10 inches along a line extending southeasterly from Aklavik to pass between Yellowknife and Fort Smith; northeast of this line it is probably somewhat less; southwest, more. About half the moisture falls as rain during the 4 summer months. The annual snowfall probably rarely exceeds 5 feet. Daily drifting is quite common, and probably a covering of more than 2 feet of snow is rare except in the more heavily forested regions of Mackenzie Valley. No permanent snow-fields or ice-fields of significant size are known, except in Mackenzie and Selwyn Mountains.

The following table summarizes temperatures and precipitation data for Yellowknife during 1947[1].

Month	Temperatures (degrees F.)			Precipitation Inches
	Maximum	Minimum	Mean	
January	19	−59·9	21·2	0·88
February	18	−60·2	−20·1	0·65
March	34	−35	3	0·23
April	45	−20	0	0·14
May	53	17	34	0·15
June	77	29	34	0·12
July	86	41	59	0·55
August	70	34	52	0·92
September	63	19	39	0·87
October	64	20	35	0·60
November	33	−13	10	0·69
December	21	−37	− 8	0·47
Total	....	....	....	6·27

[1] Data supplied by Royal Canadian Corps of Signals and Department of Transport, Yellowknife. Similar data for many other stations in Northwest Territories may be obtained from The Controller, Meteorological Service of Canada, 315 Bloor Street West, Toronto (5), Ontario.

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 30. The season of open water on the smaller inland lakes begins and ends several weeks earlier than on Great Bear and Great Slave Lakes. Lakes and rivers throughout the district are frozen for the remainder of the year except for about 3 weeks during the spring break-up and autumn freeze-up. A few weeks of fine, moderately warm weather are common just before spring break-up, and this period is usually used by prospectors and others wishing to extend the summer season.

The tentative southern limit of continuous permafrost[1] is a line that trends southeasterly from the Yukon-Northwest Territories border through Fort Simpson and Fort Providence; thence about through Yellowknife and around the east end of Great Slave Lake; and thence southerly along the 108th meridian to the 60th parallel (Jenness, 1949). Patches of permafrost probably occur at many places south of this line, particularly under muskeg. North of this line the ground thaws, during the summer, to a depth ranging from a few inches to several feet, but ground for many feet below this depth is permanently frozen. Thus, at Norman Wells, the zone of permafrost is as much as 267 feet thick (Jenness, 1949, p. 26); near Edorado mine it has been encountered at a depth of about 345 feet (Lord, 1941a, p. 6); and at the Giant mine at a depth of about 250 feet.

FLORA

Most parts of the district lie within one of three northwesterly trending regions (Robinson, 1945a, p. 33). These comprise the barren grounds in the northeast, the Mackenzie Lowlands forest region in the southwest, and between them the forests of the Northern Transition region. Small, forested areas otherwise classified lie south and southwest of Great Slave Lake.

Barren grounds lie northeast of an intricately sinuous, poorly defined line that trends northwesterly from the 102nd meridian at the 61st parallel to Artillery Lake, thence about west-northwest past the west end of MacKay Lake to Snare Lake, thence north to the Arctic Circle at Coppermine River and westerly around the northeast end of Great Bear Lake, and finally northwesterly towards the east side of Mackenzie River Delta. Most of this region supports only a tundra growth of mosses, lichens, and various low shrubs and grasses. Here and there, in sheltered places, are patches of ground birch, willow, or alder rarely exceeding a height of 2 or 3 feet. These and other growths sometimes afford emergency fuel, but most white men in the barren grounds will find gasoline or some other liquid fuel essential for all heating and cooking.

The Mackenzie Lowlands forest region occupies most of the district southwest of a line extending north from Fort Smith to Great Slave Lake, thence northwesterly through the north arm of the lake, thence north-northwest to Hottah Lake just south of Great Bear Lake, thence westerly south of that lake to Norman Wells, and finally northwesterly to the east side of Mackenzie River Delta (Robinson, 1945a, p. 33). This region is the most important forested area of Northwest Territories, and in addition

[1] Permanently frozen ground, or any soil or bedrock in which the temperature has been continuously below 32 degrees F. for a period of many years.

to the basin of Mackenzie River, embraces the lower parts of Liard, Peel, and Great Bear Valleys. It is heavily to sparsely wooded. White spruce, aspen, balsam poplar, and white birch are well represented; other trees include black spruce, tamarack, and Banksian pine. Some of the chief stands of merchantable timber are found along Slave River, where white spruce trees with butts up to about $2\frac{1}{2}$ feet in diameter afford much of the lumber and construction timbers used at Yellowknife and elsewhere near Great Slave Lake. Trees with butts 2 feet in diameter grow between Faber and Marian Lakes, north of Great Slave Lake. At Aklavik, on the Mackenzie River Delta, trees other than spruce seldom exceed 20 feet in height.

The intervening Northern Transition region supports a sparse, stunted growth of, mainly, black spruce; other varieties include white spruce, white birch, Banksian pine, tamarack, aspen, and balsam poplar. Widely scattered stands of spruce afford logs suitable for local lumber, fuel, and some mining purposes. Much of the region, however, has been burnt over during the past 20 years, particularly within a radius of 100 miles of Yellowknife.

About twenty varieties of edible roots, greens, and berries are known in the region (Porsild, 1937, 1945). No poisonous mushrooms, toadstools, or berries are known. The lichens are perhaps the most nourishing and plentiful edible plants.

Vegetables are grown at various settlements along the main waterways as far north as Aklavik, about 120 miles north of the Arctic Circle. The largest tracts of land under cultivation are at Fort Simpson and Fort Smith (Robinson, 1945a, p. 38) where in 1943, for instance, the potato crops amounted to 50 and 25 tons, respectively. Substantial market gardens are cultivated at Yellowknife, but in general the surrounding district is not suited to agriculture.

FAUNA

The mammals most commonly encountered are moose, black bear, and wolf; others, some of restricted distribution, include Barren Ground muskox, Dall's sheep, Mountain goat, several species of Barren Ground grizzly bear, coyote, Arctic fox (both white and blue varieties), red fox (various phases), lemming, beaver, muskrat, mink, marten, lynx, fisher, weasel, wolverine, skunk, and Arctic hare. Caribou, and perhaps locally moose, are the only mammals that can be relied upon as food for men or dogs. Barren Ground caribou are abundant in parts of the barren grounds during the summer, and in the bordering wooded areas during parts of the winter; groups of hundreds or thousands are often encountered in migrations from one seasonal range to another.

Spruce grouse, in the wooded areas, and ptarmigan in the barren ground are the only feathered game sufficiently widespread and abundant to be readily available for human food in an emergency. Geese and freshwater ducks breed in the marshes and lakes in Mackenzie and Slave Valleys; very few are found within the Canadian Shield. The only common duck in the barren grounds is the old squaw.

Fish are abundant in many of the lakes and rivers; they afford probably the most reliable source of emergency food, are an important item in the diet of natives and dogs, support substantial commercial fisheries in Great Slave Lake, and provide not a little sport. Lake trout (a few may attain a weight of 60 pounds) and whitefish are widely distributed and most important; pike are generally abundant; and inconnu, a fish commonly weighing between 8 and 20 pounds, inhabits Mackenzie and Slave Rivers and Great Slave Lake in large numbers. Other varieties include Arctic char (also called sea trout or salmon), grayling (or bluefish), suckers, freshwater herring, pickerel, and ling.

Hunting and trapping are restricted or forbidden in very large areas of the district. Such areas, within which, in general, white men are not allowed to hunt or trap, are Reindeer Reserve, Peel River Preserve, Mackenzie Mountains Preserve, Yellowknife Preserve, Arctic Islands Preserve, Slave River Preserve, and Thelon Game Sanctuary (Northwest Territories Administration, 1947).

The following summaries of Game Regulations and Sport Fishing Regulations have been published by the Northwest Territories and Yukon Services (1948, pp. 63, 64).

SUMMARY OF THE GAME REGULATIONS[1]

Hunting and trapping in the Northwest Territories are controlled by the provisions of the Northwest Game Act and Regulations. The wildlife resources of the Territories are limited, and as the native Indians, Eskimos, and half-breeds are dependent upon hunting and trapping for a livelihood, the issue of licences for these activities is restricted.

Licences to hunt and trap may be issued to the following persons only:—

(1) Residents of the Northwest Territories, as defined by Regulations, who on May 3, 1938, held hunting and trapping licences and who continue to reside in the Northwest Territories.

(2) The children of those who have had their domicile in the Northwest Territories for the past four years, provided such children continue to reside in the Northwest Territories and are dependent upon hunting for a livelihood.

(3) Such other persons as the Commissioner of the Northwest Territories may decide are equally entitled to licences under these regulations.

(Note)—Only British subjects with four years' residence in the Northwest Territories are eligible for licences under Clause 2.

A minor under the age of sixteen years shall not be eligible for licence. A minor, assisting his parents or guardians in connection with hunting or trapping operations, will not require licence.

Wildlife conditions have been aggravated by forest fires, and reduced precipitation has lowered water-levels, resulting in dried-up streams and lakes where wildlife formerly was abundant. As a result, the trapping of beaver and marten is restricted.

A licence to shoot game birds during the open season may be issued to any person who is ineligible for the regular hunting and trapping licence. The fees for game bird licences shall be:—

(a) For resident British subjects	$ 2.00
(b) For non-resident British subjects	5.00
(c) For other non-residents	10.00

The Northwest Territories Game Regulations make provision whereby explorers, surveyors, or prospectors engaged in any exploration, survey of mining operations, or other examination of the Territories may take or kill moose, caribou, and non-migratory birds such as ptarmigan if in dire need of such game for food. For the purpose of the regulations, in dire need means the shortage of food making it essential to kill such game for fresh meat (food) in order to sustain life or prevent starvation.

[1] Copies of the Regulations respecting Game in the Northwest Territories may be obtained on application to Northern Administrations, Development Services Branch, Department of Resources and Development, Ottawa, Canada.

SUMMARY OF SPORT FISHING REGULATIONS[1]

Angling in waters of the Northwest Territories by residents and non-residents is permitted without licence.

Fishing is prohibited each year for the undernoted species of fish as follows:

Whitefish, tullibee, and lake (salmon) trout—September 16 to November 30.

Pike and pickerel (walleye)—April 1 to May 15.

The use of spears, lights, firearms, and dynamite or other explosive material in killing fish is prohibited.

The use of bare, unbaited hooks or grapnels is prohibited.

Provision is made in the fishing regulations whereby explorers, prospectors, surveyors, or travellers, while engaged in exploration, mining, or survey operations, or other examination of the Northwest Territories, may fish at any time without a licence, but with legal implements, for their own domestic use.

Special regulations govern commercial fishing in the Territories.

[1] Additional information, including copies of the Regulations governing Fishing in the Northwest Territories, may be obtained from the Department of Fisheries, Ottawa, Canada.

CHAPTER II

GENERAL FACTORS RELATING TO THE MINING INDUSTRY

HISTORY OF MINING

The mineral resources of the District of Mackenzie received scant attention prior to about 1914. However, in December 1770 Samuel Hearne, employed by the Hudson's Bay Company, left Fort Prince of Wales (now Churchill, Manitoba) hoping to discover the source of samples of native copper that, at various times, had been brought to the Fort. In July 1771, near the mouth of Coppermine River, he relates that: "....I and almost all my companions expended nearly four hours in search of some of this metal [presumably native copper], with such poor success, that among us all, only one piece of any size could be found. This, however, was remarkably good, and weighed about four pounds" (Hearne, 1796, p. 173). Alexander Mackenzie, while ascending the river that bears his name, in the summer of 1789, observed "....pieces of Petrolium, which bears a resemblance to yellow wax...."(Mackenzie, 1801, p. 79) and ".... a coal mine...." (Mackenzie, 1807, p. 96). McConnell (1890) noted bituminous rocks at various places in Mackenzie River Valley in 1888. Probably a little prospecting was done along the Mackenzie River system by prospectors en route to Yukon after the discovery of gold on Klondike River in 1896. In any case, several samples from the Great Slave Lake area were submitted to the Geological Survey for assay in 1898: one of these, submitted by E. A. Blakeney from claims within 10 miles of the mouth of Yellowknife River, contained 2·158 ounces gold a ton (Hoffman, 1901, pp. 32, 33); another, a specimen of galena, contained 38·86 ounces silver a ton (Bell, R., 1902, p. 103). Two years later, cobalt and copper minerals were seen on the east shore of Great Bear Lake, possibly at what is now Labine Point, by an officer of the Geological Survey of Canada (Bell, J. M., 1903, p. 102A).

Perhaps the next outstanding historical event connected with the mineral industry was the staking of three leases in 1914 near oil seepages at what is now Norman Wells. Drilling was commenced in 1920, and discovered oil in commercial quantity. A small still, capable of producing gasoline and diesel fuel, was installed in 1921, and, although other wells were drilled during the next few years, little demand was found for its products until after the establishment of the Great Bear Lake camp.

A little prospecting and limited development work were done on metalliferous deposits near Great Slave and Great Bear Lakes in 1928 and 1929. This achieved little success except at the lead-zinc deposits near Pine Point. The Great Bear Lake area, however, quickly attracted world-wide attention following the discovery, in 1930, of silver and pitchblende at what is now Eldorado mine. In 1932 between 200 and 300 men, many of them prospectors, were at work at Great Bear Lake, and between 2,500 and 3,000 claims had been recorded by the end of the year (Kidd, 1933, p. 1). Eldorado mine, the first metal mine in Northwest Territories, attained production in December 1933.

While the Great Bear Lake camp flourished, Geological Survey parties were mapping Yellowknife Bay and the east arm of Great Slave Lake, and had ascended Yellowknife River to explore well into the barren grounds north of the east arm of the lake (Stockwell, 1933, 1936a-1936c). The first results of this work were available to the public in 1933, and in that year the centre of prospecting began to shift towards Yellowknife Bay. Although a few claims were staked on discoveries made in 1933, the Yellowknife camp is commonly considered to date from September 1934 when the Rich claims were staked on the east side of Yellowknife Bay following the discovery of a high-grade gold-bearing quartz vein. In 1935, an assistant on a Geological Survey party made the first discovery of visible gold on the west side of Yellowknife Bay, and in September this showing was staked as the A.Y.E. group. News of this discovery quickly spread. The adjoining Con claims were promptly staked, the adjacent Negus claims in January 1936. The first gold brick produced in Northwest Territories was poured at the Con mine in September 1938, and Negus mine first recovered gold in February 1939. Thus Yellowknife became an established gold camp: prospectors roamed as far as 150 miles northwest in the Russell Lake, Slemon Lake, Snare River, and Indin (then Wray) Lake areas; and as far as 75 miles north, northeast, and east to examine areas near Yellowknife River, Gordon Lake, Sunset Lake, and Beaulieu River area south to Great Slave Lake; and innumberable occurrences of free gold were found, many of high grade, some of commercial promise.

The first 5 years of World War II saw many changes in the mineral industry arising from shortages of labour and supplies, loss of markets, demands for so-called strategic minerals, and other factors. Despite difficulties other gold mines were brought into production, and gold mining remained the principal industry and expanded until 1942; thereafter it declined until, during part of 1944 and 1945, no gold was produced in Northwest Territories. In June 1940, Eldorado radium mine was closed because of disorganized markets, but 2 years later was reopened with little publicity, as a uranium mine, and has since operated continuously. Early in 1944, the organization was acquired by the present operators, the Crown-owned and operated company of Eldorado Mining and Refining (1944), Limited. A widespread search for other uranium deposits was undertaken by the Crown company and the Geological Survey of Canada with, mainly, undisclosed results. Events attending hostilities between the United States and Japan resulted in the emergency military enterprise known as the Canol Project, designed to develop the Norman Wells oil field and deliver oil by pipeline to a refinery at Whitehorse, Yukon. These objectives were achieved before economic consideration resulted in the abandonment of the project in 1945, and left an oil field that should continue to meet the requirements of the District of Mackenzie for many years. Scheelite, a tungsten mineral, was found in quartz veins at Gilmour Lake, east of Yellowknife, in 1940. Wartime demand immediately led to a widespread search under the leadership of the Geological Survey of Canada, and many other small deposits were found. In the meantime a number of tantalum- and lithium-bearing pegmatites had been recognized northeast, east, and southeast of Yellowknife, and by 1943 a concerted search for other deposits of these and related metals in the numerous pegmatite dykes was underway, in which the Geological Survey of Canada again played a prominent part.

The latest gold-mining boom in Northwest Territories stemmed from events of 1944, a year during which, as already stated, gold production temporarily ceased. In January, with no little courage in view of the low ebb of gold mining at that time, Frobisher Exploration Company, Limited, embarked on an extensive diamond drilling compaign at the Giant property. Results soon suggested a deposit exceeding in size and grade any known in Northwest Territories, and precipitated an unprecedented rush to stake, re-stake, prospect, and re-examine properties. By 1945 about two hundred mining companies and syndicates owned, or were interested in, mineral claims in the district, and exploration had extended 150 miles beyond Yellowknife. As the labour and supply situation improved, gold production was resumed at the Negus in 1945, at the Con in 1946, and at the Thompson-Lundmark in 1947. In the meantime, Neil Campbell, district geologist for the Consolidated Mining and Smelting Company of Canada, Limited, had reached the conclusion that the faulted extension of the Giant system of ore-bearing shear zones would occur at depth on the Con and Rycon, and Negus properties. This concept was confirmed when a drill-hole on the Negus property intersected the Campbell system at a depth of about 2,000 feet early in 1946, thereby greatly increasing the expectant depth and life of orebodies in the immediate vicinity of Yellowknife. By the end of 1947, prospecting, staking, and development work at non-producing gold properties had again reached a low ebb, and the public displayed little interest in other metals.

Outstanding events of 1948 included the production of the first gold brick at the Giant in June; the completion of the Snare River Power Project in October; and an increase in the milling rate at Negus mine from about 70 to 170 tons a day. In March, a concession of 500 square miles near Pine Point on Great Slave Lake, containing lead-zinc deposits, was granted to the Consolidated Mining and Smelting Company of Canada, Limited, and Ventures, Limited. A revival of interest in base metals followed, and a rush to stake such deposits was recorded late in the year. Most of this staking was done in the vicinity of Indian Mountain Lake, just north of the east arm of Great Slave Lake, and near O'Connor Lake south of the east arm.

The following table further indicates the trend in prospecting activity in Northwest Territories (mainly in the District of Mackenzie) since the first gold was produced in 1938[1].

Fiscal year ended March 31	Miners' licences issued	Miners' licences renewed	Entries granted for quartz mining claims	Claims in good standing at end of year
1938	512	358	1,787	....
1939	1,158	620	4,584	7,585
1940	224	514	831	4,690
1941	178	289	405	4,690
1942	131	230	362	3,165
1943	110	172	185	3,161
1944	204	226	674	3,500
1945	1,884	1,432	5,612	....
1946	1,432	1,516	8,625	....
1947	1,028	1,169	5,715	....
1948	557	909	2,301	....
1949	1,063	1,073	5,290	....

Claims recorded during the calendar years 1946, 1947, and 1948 numbered 5,365, 2,312, and 3,091 respectively. Of those recorded during 1948, 2,215 were recorded between September 1 and December 31.

MINERAL PRODUCTION[2]

Minerals produced in Northwest Territories to December 31, 1949, were valued at $37,593,494, as shown in Table I. Probably all of this came from the District of Mackenzie. Almost no minerals were recovered before 1932, and in that year production was valued at $21,423. In 1949, minerals recovered were valued at $6,868,301; this was about 0·8 per cent of the value of all minerals produced in Canada, and exceeded only Prince Edward Island and Yukon.

Gold accounts for about 73 per cent of the value of minerals produced to the end of 1949, and about 93 per cent of the value in 1949. Minor quantities of tantalite concentrates and possibly other materials produced in the district are not recorded.

[1] Data compiled from Annual Reports of the Department of Mines and Resources, for Fiscal years ended March 31, 1938, to March 31, 1949.

[2] The following account does not include pitchblende products recovered after 1941.

Table I

Mineral Production, Northwest Territories, 1932-49[(a)]

Year	Copper		Gold		Lead		Natural gas		Petroleum		Pitchblende products	Silver (b)		Tungsten concentrates		Totals (c)
	Pounds	$	Fine ozs.	$	Pounds	$	M cu. ft.	$	Barrels	$	$	Fine ozs.	$	Pounds	$	$
1932									910	9,251		38,433	12,172			21,423
1933									4,608	23,037	247,900	23,239	8,792			279,729
1934					3,531	86			4,438	22,188	159,400	37,778	17,930			199,604
1935			200	7,038	12,905	404			5,115	25,575	413,700	146,506	94,921			541,638
1936			1	35			1,100	245	5,399	26,995	605,500	317,014	143,059			775,834
1937							1,500	335	11,371	56,855	876,540	135,442	60,788			994,518
1938	75,567	7,535	6,800	239,190			1,500	335	22,855	68,565	1,045,458	581,902	252,993			1,614,076
1939	42,382	4,277	51,914	1,876,224			1,500	335	20,191	50,477	1,121,553	483,874	195,911			3,248,777
1940			55,159	2,123,621			1,500	335	18,633	37,265	410,176	59,505	22,760			2,594,157
1941	32,727	3,301	74,417	2,865,054			1,500	335	23,664	47,328	925,196	15,327	5,864	41,972	13,220	3,860,298
1942	74,963	7,561	99,394	3,826,669			1,500	335	75,789	108,477	(d)	22,531	9,500	98,218	23,725	3,976,267
1943			59,032	2,272,732			1,500	335	293,750	400,201	(d)	13,250	5,996	720	729	2,679,993
1944	11,902	1,428	20,775	799,838			1,500	335	1,223,675	632,587	(d)	13,677	5,881			1,440,069
1945			8,655	333,218			1,500	335	345,171	136,303	(d)	2,033	956			470,812
1946			23,420	860,685			1,500	335	177,282	173,392	(d)	6,112	5,113			1,039,525
1947			62,517	2,188,095					227,474	500,238	(d)	45,355	32,655			2,720,988
1948			101,625	3,556,875			150,000	15,000	350,541	676,574	(d)	25,382	19,036			4,267,485
1949 (e)			178,068	6,410,484			100,000	10,000	200,000	400,000	(d)	64,400	47,817			6,868,301
Totals	237,541	24,102	741,977	27,359,758	16,436	490	266,000	28,595	3,010,866	3,395,308	(c) 5,805,423	2,031,760	942,144	140,910	37,674	37,593,494

(a) Compiled from data published by Dominion Bureau of Statistics.
(b) Includes silver recovered from silver-pitchblende ores.
(c) Does not include pitchblende products recovered after 1941.
(d) Not available for publication.
(e) Data subject to revision.

TRANSPORTATION

SCHEDULED ROUTES

Means of transportation from Edmonton, Alberta, to points in the District of Mackenzie are: railway to Waterways, Alberta, and thence by boat and barge; railway or truck to Grimshaw, Alberta, thence by truck to Hay River on Great Slave Lake, and beyond by boat, barge, aircraft, or tractor; and by aircraft from the Edmonton airport. Mining and supporting enterprises contribute a large proportion of the passengers and goods carried.

Rail

Edmonton to Waterways, the southern terminus of water transportation, is 305 miles by Northern Alberta Railways. Class freight rates range from $1.37 (first class) to $0.31 (tenth class) per 100 pounds. Edmonton to Grimshaw, the southern end of the Mackenzie Highway, is 334 miles by another branch of the Northern Alberta Railways; and class freight rates range from $1.45 (first class) to $0.33 (tenth class) per 100 pounds (July 1949). Special rates apply to certain commodities moved to Grimshaw or Waterways in carload lots.

Water

Most freight entering the district is carried by boats and barges from Waterways, via Athabasca River, Lake Athabasca, and Slave River to Great Slave Lake; or beyond, via Mackenzie River to Great Bear River and Great Bear Lake; or farther north to Port Brabant, at the mouth of Mackenzie River, for transhipment to points on the Arctic coast. Waterways to Fort Fitzgerald, by water, is 290 miles. Rapids near the latter place necessitate a 16-mile portage, by road, to Fort Smith, whence navigable water extends about 1,400 miles to Port Brabant. Yellowknife is about 380 miles, by water, north of Fort Smith. Freight for Great Bear Lake is portaged by road around rapids on Great Bear River.

All waterways are ice bound about 8 months each year. Athabasca River may become free of ice early in May, and the Mackenzie River Delta channels late in the same month; the average date of break-up between Fort Simpson and Fort Good Hope is about May 15. However, ice in Great Slave Lake usually prevents traffic between Fort Smith and Mackenzie River until some time in June. Thus, during recent years navigation at Yellowknife has opened between June 9 (1949) and about June 26 (1947). Freeze-up occurs in late October at the Mackenzie River Delta, mid-November on upper Mackenzie River, and perhaps late November on Athabasca River. Great Slave Lake usually freezes over in December, but Yellowknife Bay may be ice-bound in late October or early November. The navigation season on Great Bear Lake generally lasts from about July 15 to October 15. The last scheduled south-bound boat usually leaves Aklavik early in September, and Yellowknife about mid-September. Unusual seasons may vary the above dates by as much as several weeks.

Freight is carried mainly on barges, pushed by diesel-powered, screw-propelled vessels. Stern-wheel, wood- or oil-fired steamers, with generous passenger accommodation, were formerly in general use, but by 1947 only two were in operation. A few refrigerator barges are used for the transportation of perishable commodities. Powered vessels are designed with shallow draught to negotiate Athabasca, Slave, and Mackenzie River deltas; with reasonable sea-going ability for use on Athabasca, Great Slave, and Great Bear Lakes; and sufficient power to handle barges against local strong currents encountered on upstream trips.

The principal navigation companies are Northern Transportation Company (1947), Limited, Hudson's Bay Company (Transport Department, Mackenzie River Division), Yellowknife Transportation Company, Limited, and McInnes Products Corporation, Limited. The first two of these shared the bulk of the traffic prior to the end of the 1947 transportation season; but thereafter the Hudson's Bay Company withdrew its services as a common carrier except to Port Brabant and points along the Arctic coast. Thus, the principal common carrier in 1948 became Northern Transportation Company (1947), Limited, and this company operated a fleet of about sixteen tugs and fifty-eight barges.

The following table summarizes water-borne freight moved during 1947 and 1948.

Company	Northbound	Southbound
	Tons	Tons
1947 (Drummond, 1948, p. 8)		
Hudson's Bay Company	16,000	2,000
Northern Transportation Company, Limited	19,000	3,000
McInnes Products Corporation, Limited	1,276	550
Yellowknife Transportation Company	2,015	5,237
1948 (Drummond, 1949, p. 8)		
All companies	33,349	8,111

Base rates[1] (class 5 items[2]) charged by Northern Transportation Company (1947), Limited, from Waterways, and effective May 1, 1948, included: to Fort Smith, $1.15 per 100 pounds; to Yellowknife, $1.90; to Akavik, $4.90; to Port Radium, $8.50. The rate from Norman Wells to Yellowknife was $3 per 100 pounds.

The time required for water-borne freight from Waterways to reach Yellowknife varies widely, but might average about a fortnight. Important factors influencing this schedule are train to boat connections at Waterways, boat to boat connections at the Fort Fitzgerald-Fort Smith portage, and navigation conditions at such places as the delta of Athabasca River, and on Great Slave and Athabasca Lakes. Normally, 6 weeks are required to move freight from Waterways to Port Radium, a distance of about 1,400 miles.

Air

Aircraft carry all mail, nearly all passengers, and important quantities of express and freight between Edmonton and the District of Mackenzie, and between various points within the district. All scheduled

[1] Further details as to freight rates, and information on schedules, may be obtained from the Managing Director, Northern Transportation Company (1947), Limited, Edmonton, Alberta.

[2] Ore in sacks, machinery, lumber, and hardware, groceries, general merchandise, and dry goods securely packed in cases, and similar items.

routes are operated by Canadian Pacific Air Lines, Limited. These connect with services afforded by Trans-Canada Air Lines at Edmonton, thus making possible, for instance, a scheduled flight from Toronto to Yellowknife in less than 24 hours. Landing fields permit the use of wheel-equipped aircraft at McMurray (Alberta), Fort Smith, Fort Resolution, Hay River, Yellowknife, Fort Providence, Fort Simpson, Wrigley, and Norman Wells. A landing field at Sawmill Bay, 35 miles southwest of Port Radium, is used by aircraft of Eldorado Mining and Refining (1944), Limited. Scheduled flights to points equipped with landing fields are made with wheel-equipped DC3 or similar aircraft; but scheduled flights elsewhere are made with Norseman aircraft equipped with floats or skis, according to season, and are subject to delays during spring break-up and autumn freeze-up.

The following schedules became effective May 12, 1949, but similar services were provided during 1947: daily except Sunday between Edmonton and Yellowknife, via Fort McMurray, Fort Smith, and Resolution; twice monthly between Edmonton and Norman Wells, via Fort McMurray, Fort Smith, Hay River, Providence, Fort Simpson, Wrigley, and Norman Wells; twice monthly between Norman Wells and Aklavik, via Fort Good Hope, Arctic Red River, and Fort McPherson; and monthly between Yellowknife and Coppermine, via Fort Rae, Indin Lake, and Port Radium.

The following rates[1] prevailed during 1949. One-way passenger fares between Edmonton and Yellowknife (654 miles), $80; between Edmonton and Norman Wells (1,100 miles), $161; and between Edmonton and Aklavik (1,402 miles), $215. Air express between Edmonton and Yellowknife costs 35 cents a pound. Air freight rates between Edmonton and Yellowknife, effective since November 1, 1947, range from 18·75 cents a pound for a shipment of 100 pounds, to 14·97 cents a pound for a shipment of 3,000 pounds or more.

The following table[2] summarizes traffic handled at the most active airport, Yellowknife, by Canadian Pacific Airlines, Limited, during 1947.

North to Yellowknife	
Passengers	2,822
Mail, pounds	216,614
Cargo, pounds	919,841
South from Yellowknife	
Passengers	3,112
Mail, pounds	33,425
Cargo, pounds	102,092

Road

During the winter of 1938-39, a winter tractor road was constructed between Grimshaw, on the Peace River line of Northern Alberta Railways, and Hay River, on Great Slave Lake 120 miles southwest of Yellowknife. This route was converted to a 386-mile, all-weather road by the autumn of 1948, and subsequently named the Mackenzie Highway. Freight, by truck, from Grimshaw to Hay River costs $40 a ton; and from Hay River to Yellowknife, by boat, $15 a ton (1949). When speed is essential, or

[1] Further details as to rates, and information on schedules, may be obtained from Canadian Pacific Air Lines, Limited, C.P.R. Building, Edmonton, Alberta.
[2] Data supplied by statistical Department, Canadian Pacific Airlines, Limited, Winnipeg.

during the winter, aircraft may be employed to carry the freight between Hay River and Yellowknife airports. The cost of freight to Yellowknife via the Mackenzie Highway exceeds the cost of water-borne freight, but is much less than the cost of air-borne freight. Moreover, the Mackenzie Highway route, as compared with the river route, offers the advantages of greater speed and all-year service. During the winter of 1948-49 a preliminary winter road was constructed from Hay River to Yellowknife via the northwest shore of Great Slave Lake, but was not much used.

The Canol Road from Whitehorse, Yukon, to Camp Canol (near Norman Wells) on Mackenzie River was built to facilitate construction and maintenance of the Canol pipeline. After the termination of the Canol Project in 1945, the road was allowed to deteriorate until it became unusable.

NON-SCHEDULED ROUTES

Water

By special arrangement with the established navigation companies, heavy machinery and supplies required for mining development may be landed as required on the main waterways, as, for instance, on the east arm of Great Slave Lake, or on the north arm, which opens into Slemon and Russell Lakes, or at designated points on Great Bear Lake. Rivers entering Great Slave and Great Bear Lakes, or the Arctic Ocean (except Mackenzie River), are interrupted by many falls and rapids, and are not navigable except by canoes that can be portaged around these obstructions. Almost the entire Canadian Shield region is admirably suited to canoe travel, an accepted means for transportation of prospecting parties.

Air

Aircraft have provided the principal means of transportation within the less accessible parts of the District of Mackenzie since about 1929. These have been mainly relatively small aircraft, equipped with floats or skis according to season; and capable of payloads ranging from 1,000 pounds or less to nearly 1 ton depending on gasoline load and other factors[1]. Such small aircraft, including the Bellanca Skyrocket, De Havilland Beaver, and Norseman, continue to supply much of the transportation required for outlying mining properties and by prospecting parties. During 1949 the following companies held licences for charter service from Yellowknife: Canadian Pacific Airlines, Limited, Charter Airways, Limited, and Yellowknife Airways, Limited. The current (1949) charter rate at Yellowknife for a Norseman, Bellanca Skyrocket, or similar aircraft is 75 cents a mile flown; for a De Havilland Beaver, 60 cents a mile; and smaller craft are available at lower rates. Aircraft operate throughout the year, except for a few weeks during freeze-up and break-up. In normal seasons, seaplanes can operate from Yellowknife Bay from about June 1 to October 20, and skiplanes after mid- or late November. Float-equipped aircraft usually can operate from Port Radium between about June 20 and October 10, and skiplanes from some date in November. Large lakes in the barren

[1] More precise information on the performance of aircraft in most general use may be obtained by correspondence as follows: (Bellanca Skyrocket) Northwest Industries, Limited, P.O. Box 517, Edmonton, Alberta; (De Havilland Beaver) The De Havilland Aircraft of Canada, Limited, Station "L", Toronto, Ontario; (Norseman V) Canadian Car and Foundry Company, Limited, 621 West Craig street, Montreal, Quebec.

grounds 200 miles northeast of Yellowknife may not permit seaplane operation until late in July, but the smallest usable lakes may be open late in June; float-equipped aircraft do not normally operate in this area later than September 15, although freeze-up is not likely until October.

In recent years considerable use has been made of DC3 aircraft for freighting to outlying mining properties served from Yellowknife. These aircraft have been used on wheels only, and carry a payload of about 4 tons. They operate from the airfield at Yellowknife to prepared runways on frozen lakes, or in one instance (Beaulieu Yellowknife Mines, Limited), to a landing strip built at nominal expense on a sand deposit. The charter rate for DC3 aircraft fromYellowknife, quoted by Canadian Pacific Airlines, Limited, for the winter of 1946-47, was $1.60 a mile flown; but appreciably lower rates were obtainable for contract operations involving substantial tonnages and distances. Thus, in April and May 1948, a mining company operating 150 miles northeast of Yellowknife moved equipment and supplies for a substantial drilling and surface exploratory program at a price of $108 a ton from Yellowknife (about 72 cents a ton-mile); DC3 and Anson aircraft were used.

Tractor

Much heavy freight is hauled from the nearest docking point to a mine or prospect by tractor over a winter road. Such roads, in favourable localities, follow lakes for long distances and generally are constructed at nominal cost: one, 65 miles long, was constructed from Yellowknife Bay in 1937 at a cost of about $140 a mile. Costs of freighting over winter roads within 150 miles of Yellowknife have ranged from about 30 to 60 cents a ton-mile during recent years. This method of freighting, to date, has proved to be slow and not too reliable; but, in many instances, reports suggest that first class equipment and organization were not available. Mining companies that have made considerable use of tractor freighting over winter roads from Yellowknife, or other points on Great Slave Lake, include: Beaulieu Yellowknife Mines, Limited (112)[1], Camlaren Mines, Limited (64), the Consolidated Mining and Smelting Company of Canada, Limited (Ruth group) (121), Discovery Yellowknife Mines, Limited (55), Mercury Gold Mines, Limited (24),North Inca Gold Mines, Limited (37), Sunset Yellowknife Mines, Limited (109), and Thompson-Lundmark Gold Mines, Limited (103).

COMMUNICATION

Post offices are maintained at Fort Smith, Hay River, Fort Resolution, Yellowknife, Fort Rae, Port Radium, Coppermine, Fort Providence, Fort Simpson, Wrigley, Fort Norman, Norman Wells, Fort Good Hope, Arctic Red River, Fort McPherson, and Aklavik. Yellowknife and Fort Smith receive mail several times a week, other places at less frequent intervals. All post offices are served exclusively by aircraft. Letters are carried at regular letter-postage rates if not overweight. Parcels are subject to a higher rate than those carried by ordinary means of transport; those in and out of Yellowknife, for instance, travel at a rate of 70 cents a pound or fraction thereof.

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

Radio stations operated by the Department of National Defence or Department of Transport are situated at many settlements. These stations are available for commercial messages, which may be exchanged with land lines of Canadian National and Canadian Pacific Telegraphs. Most mining properties actively engaged in development work, or in production, are equipped with radio; and by relaying messages through more powerful Government stations are in touch with commercial telegraph services. Most aircraft, boats, and even some taxis at Yellowknife, are equipped to send and receive messages by radio. Yellowknife and adjacent mines, as already mentioned, are served by the Yellowknife Telephone Company.

LABOUR

During 1947, thirty-nine active gold-mining companies in Northwest Territories employed 830 persons and paid salaries and wages amounting to $2,441,859; and the four producing gold mines (Con, Rycon, Negus, and Thompson-Lundmark) employed 443 persons, and paid out $1,291,225 in salaries and wages. In addition, about 260 persons were employed at the Eldorado uranium mine, a few others in other mining enterprises, and still others in various undertakings largely dependent upon mining. Wages paid by producing mines at Yellowknife, in agreement with Local 802, International United Mine, Mill and Smelter Workers (C.I.O.), include: blacksmiths, $1.08 to $1.18 an hour; carpenters, $1.08 to $1.18; drag-line operator, $1.43; electricians, $1.08 to $1.18; hoistman, $1.13; labourer (underground), $0.98; labourer (surface), $0.92; miner (raise or drift), $1.13; mucker, $1.01; mucking-machine operator, $1.08; painters $1.03 to $1.13; shovel operator, $1.40; steel sharpener, $1.13; truck driver, $1.01. From these wages, $2 is deducted each day for board and lodging. Similar wages are paid at outlying properties in production or in advanced stages of development. Miners and muckers generally receive bonuses in addition to their wages. Commonly, personnel hired in Edmonton are advanced airplane fare to Yellowknife; this is deducted from their wages over a period of several months, and returned after two hundred shifts have been completed. After three hundred shifts have been worked, a free return passage to Edmonton is provided. No Workmen's Compensation Board has been established in the Northwest Territories. However, the Workmen's Compensation Ordinance of 1948 provides that every employer shall enter into and maintain a contract of insurance in such form, for such amount, and with such insurer as the Commissioner of the Northwest Territories may approve, providing for payment of compensation to employees and their dependants in respect of personal injuries by accident arising out of and in the course of their employment, or disabilty by reason of industrial diseases due to the nature of their employment[1].

Accommodation, recreation, medical, hospital, and commissary facilities compare favourably with other young mining camps of Canada. Except in rare instances, Indians and Eskimos are not employed at the mines or by prospecting companies.

In order that full information about employment opportunities at Yellowknife be available throughout Canada, the Department of Labour has established at Yellowknife a National Employment Service office,

[1] Information relative to Workmen's Compensation arrangements supplied by R. A. Gibson, Deputy Commissioner, Northwest Territories Administration, April 1950.

the manager of which is actively in touch with those offering employment. Similarly, the National Employment Service at Edmonton, Alberta, and L. E. Drummond, Agent, Northwest Territories Administration, McLeod Building, Edmonton, are in a position to furnish reliable information about employment conditions in the District of Mackenzie, including Yellowknife.

PETROLEUM PRODUCTS

Petroleum products used in mining operations and by associated communities are required mainly for power and fuel. Consumption, during 1947, by the gold mining industry of Northwest Territories, is as follows: gasoline, 45,854 Imperial gallons, valued at $25,579; fuel oil and diesel oil, 1,017,060 Imperial gallons, valued at $267,191. The sole vendor is Imperial Oil Limited. Tanks owned by this company at Yellowknife have a total capacity of nearly 2,000,000 gallons (1948), about half of which is for light diesel oil. Heavy diesel oil and bunker fuel are not stored here, and these and other products are purchased for the mines directly from Norman Wells. Mines maintain their own storage facilities. All products (1948) come from Norman Wells, except such items as blending fluids, lubricating oils, and naptha, which are supplied from Calgary. Freight charges from Norman Wells on fuel oils used at Con mine at Yellowknife average 13·54 cents a gallon, or about 70 per cent of the cost of bunker fuel used for heating (White, Ross, and Campbell, 1949, p. 301). Products available from Imperial Oil Limited at Yellowknife (1948) include: Premier gasoline, 42·50 cents a gallon; naptha gasoline, 55·80 cents; Esso aviation gasoline (87 octane), 54·6 cents; Esso aviation gasoline (91 to 98 octane), 56·6 cents; light diesel oil, 31 cents; Marvelube, about $1.30 a gallon. Bunker fuel purchased by the mines at Yellowknife costs about 19½ cents a gallon. At Eldorado mine, on Great Bear Lake, heavy diesel oil costs (1947) 36·5 cents a gallon, and light diesel oil, 45·8 cents.

TIMBER, LUMBER, AND CORDWOOD[1]

Wood for mining purposes, construction timbers, and lumber is not readily available near Yellowknife and Port Radium, the principal mining communities of the district. One mine at Yellowknife purchases wood suitable for lagging from Indians at $20 a cord delivered, and cuts mine timbers on Wilson Island, about 65 miles southeast. Lumber and construction timbers, mainly white spruce, are obtainable from sawmills on Slave River, south of Great Slave Lake. Rough lumber from this source, in quantities used by the mines, costs $75 to $80 M ft., board measure, delivered at Yellowknife. Smaller quantities, for domestic use in Yellowknife, might cost as much as $110 M ft., board measure. Some British Columbia fir is imported for special purposes and, in 1947, cost one mine at Yellowknife $108 M ft., board measure.

Most spruce used by Eldorado mine for timber, lumber, and fuel comes from Leith Peninsula, about 50 miles southwest of the mine.

Most companies operating outlying properties, as, for instance, Thompson-Lundmark Gold Mines, Limited, and North Inca Gold Mines, Limited, 30 miles east-northeast and 130 miles north-northwest, respectively,

[1] *See* also Chapter I, p. 11.

from Yellowknife, have freighted all lumber and construction timbers from Slave River via Yellowknife; but sufficient spruce was found near the the property of Beaulieu Yellowknife Mines, Limited, 46 miles east of Yellowknife, to afford all required lumber, and construction and mine timbers. Lagging and other mine timber is usually obtainable near these outlying properties, except, of course, those situated in the barren grounds. Rough lumber, delivered at Thompson-Lundmark mine, costs about $130 M ft., board measure.

Wood is the principal fuel used for heating at outlying properties, and is used to a limited extent for this purpose at the mines near Yellowknife and Port Radium, and by domestic establishments in Yellowknife. The cost, delivered to outlying properties is about $12 a cord; at Yellowknife, $16 to $20 a cord. During 1947, according to the Dominion Bureau of Statistics, the gold mining industry used 4,346 cords, valued at $58,144. The wood is commonly measured in pole lengths of about 16 feet, a method that affords minimum fuel per cord.

The following is extracted from a report by the Northwest Territories and Yukon Services (1948, p. 61).

Under the Timber Regulations[1], annual permits are granted for the cutting of timber subject to payment of a permit fee of $1; payment of dues as set out in the Regulations; and to the payment of annual ground rental at the rate of $100 a square mile where the cut is to exceed 100 cords or where timber is required for sawmill purposes.....Applications for....timber....privileges should be filed with the Agent of Dominion Lands at Fort Smith,....or if the lands affected are near Yellowknife, with the Agent of Dominion Lands at Yellowknife.....

POWER

Most power is generated by diesel engines or by hydro-electric plants; neither wood nor coal is economically available for large steam plants. Prior to 1941, when hydro-electric power first became available, diesel engines were the principal source of power; and they are still used exclusively at all mines and advanced prospects except Giant Yellowknife, Con, Rycon, Negus, and Thompson-Lundmark. Diesel fuel is moved to properties on Great Bear and Great Slave Lakes by water during the summer, but is most economically transported to outlying plants by tractor train during the winter; thus storage facilities are required at each plant for about 1 year's supply.

Hydro-electric power became available in January 1941 with the completion, by the Consolidated Mining and Smelting Company of Canada, Limited, of the development of a site between Bluefish and Prosperous Lakes, 15 miles north of Yellowknife. The dam is at the outlet of Bluefish Lake, the power-house near Prosperous Lake. The power equipment consists of a turbine rated at 4,700 horsepower and a generator of 4,200 KVA capacity. Power is delivered at 33,000 volts. Transmission lines connect the plant with Giant Yellowknife, Con and Rycon, Negus, Ptarmigan (inactive), and Thompson-Lundmark mines, and with Yellowknife. The requirements of these properties and of Yellowknife exceeded the capacity of the plant, and this shortage of hydro-electric power prevailed

[1]Copies of Timber Regulations may be obtained from the Agents of Dominion Lands at Fort Smith or Yellowknife, Northwest Territories, or from the Lands Division, Development Services Branch, Department of Resources and Development, Ottawa.

until after the opening of the Snare River hydro-electric plant in 1948; and in the meantime no mine plant was operated solely on electric power. The cost of hydro-electric power supplied to mines by The Consolidated Mining and Smelting Company of Canada, Limited, was (1947) 1 cent to 1½ cents a kilowatt-hour. Electric power is distributed to consumers in Yellowknife by the Yellowknife Power Company, Limited. Domestic consumers are (1947) assessed a minimum charge of $3.15 for the initial 20 kilowatt-hours, 12 cents a kilowatt-hour for the next 25 units, 6 cents a kilowatt-hour for the next 55 units, and 3 cents a kilowatt-hour for all power in excess of 100 kilowatt-hours. Commercial firms pay a minimum charge of $3.15 for the first 15 kilowatt-hours used, and at a rate of 12 cents for the next 25 units, 6 cents for the next 60 units, and 4 cents for all power in excess of 100 kilowatt-hours.

The Snare River hydro-electric plant was constructed on behalf of the Department of Mines and Resources on Snare River, at the outlet of Bigspruce Lake, about 90 miles northwest of Yellowknife. The initial development made 8,350 horsepower available on October 4, 1948, and full development, if undertaken, will afford an additional output of about 20,000 horsepower. Power is transmitted at 115,000 volts on a 94-mile transmission line to a terminal sub-station on the property of Giant Yellowknife Gold Mines, Limited, 2½ miles north of Yellowknife, and there converted to 33,000 volts for delivery to consumers. The Snare River plant, its storage facilities, and transmission line are operated and maintained by the Northwest Territories Power Commission of the Department of Resources and Development. Power is sold to Giant Yellowknife Gold Mines, Limited, at a rate of $100 a horsepower-year (June 1949), and ample reserve power is available for other consumers.

Many other sites in the District of Mackenzie are known or believed to be suitable for the generation of hydro-electric power. These include the lower Lockhart River (125,000 horsepower); the Tazin-Taltson River system (200,000 horsepower); Great Bear River (30,000 horsepower); White Eagle Falls on Camsell River (4,000 to 6,000 horsepower); and Slave River near Fort Smith (220,000 to 506,000 horsepower, mostly in Alberta but convenient to the District of Mackenzie)[1].

OPERATING COSTS

Recent data on the cost of operating mines in Northwest Territories are based mainly on the experiences of Con, Negus, and Giant mines on Yellowknife Bay, and Thompson-Lundmark mine about 30 miles east of Yellowknife. These gold mines treat (1948) 100 to 275 tons of ore a day; use diesel or hydro-electric power, or both; and are more favourably situated with respect to transportation than most prospects in the district. Operating costs (1948), exclusive of depreciation and taxes, ranged between $12 and $18 a ton milled, and averaged between $16 and $17. The average operating cost, before depreciation and taxes, at sixty-one gold mines operating in Quebec, Ontario, and British Columbia during 1947, as published by the Dominion Bureau of Statistics, was $8.79 a ton milled.

[1] Further data pertaining to water power in the District of Mackenzie may be obtained from the Water Resources Division, Development Services Branch, Department of Resources and Development, Ottawa.

Some reasons for the relatively high operating costs near Yellowknife have been pointed out by White, Ross, and Campbell (1949, pp. 300, 301). Thus, at the Con mine in 1947, transportation cost $1.81 a ton milled; heating, $1.14 a ton; and operating loss on bunk-houses and cook-house, $0.78 a ton. Furthermore, the lack of cheap winter transportation to Yellowknife requires that a large inventory of essential supplies be kept on hand over the winter months. During 1948, at Con mine, these reached a maximum value of $927,000 and, through handling, warehousing, maintenance, and interest charges contributed materially to the cost of operation.

PROSPECTING COSTS

Some prospecting operations employing about ten men within 150 miles of Yellowknife cost between $400 and $500 a man each month in 1938-39. This cost included wages, supplies, assays, miners' licenses, recording fees, transportation to and from the district, airplane transportation within the district, and supervision; but did not include erection of frame buildings, or diamond drilling. No underground work was done.

MINING REGULATIONS[1]

The following summary of regulations governing the disposal of quartz mining claims on Dominion Lands in Northwest Territories was prepared by the Lands Division, Department of Resources and Development (1950).

Miner's Licences—Any person 18 years of age and over, and any joint stock company incorporated or licensed to do business in Canada, is eligible, on payment of the prescribed fee, to obtain a miner's licence. The annual fee for an individual miner's licence is $5; for companies, according to the schedule as set out in the regulations. Individual licences may be obtained from the Mining Recorders and Sub-mining Recorders in the Northwest Territories and at Edmonton, Alberta, or from the Lands Division, Development Services Branch, Department of Resources and Development, Ottawa. Company licences are obtainable only at Ottawa.

Number of claims which may be staked by licensee—Each licensee may, in any one mining division and in any one licence year (April 1-March 31), stake and record six (6) claims for himself and six (6) claims each for two other licensees (proxies), or a total of eighteen claims.

Size of Claims—Not to exceed 1,500 feet in length by 1,500 feet in breadth, with boundaries running as nearly as possible north, south, east, and west, and all angles to be as nearly right angles as possible. The total area of the claim should not exceed 51·65 acres. Claims to be marked on the ground with four legal posts, number one post to be placed at northeast corner, number two post at southeast corner, and so on. Boundary lines between each post to be marked out by removal of trees, brush, and obstructions, and by blazing trees at each side of and adjoining such boundary lines. In treeless areas, boundaries will be marked by intermediate stone mounds. Prospectors are urged to exercise care in planting claim posts and in cutting and marking boundary lines, and are also warned of the penalties which may be incurred in connection with oversized claims. Claims of up to 160 acres in area are granted for the development of iron and mica deposits.

Recording—Application for the granting of a claim must be made on the prescribed form to the Mining Recorder or Sub-mining Recorder for the district within fifteen days of staking if claim is located within ten miles of the office of the said Recorder or Sub-mining Recorder. An extra day is allowed for each additional ten miles or fraction thereof. The fee for recording a claim is $5, if recorded on stakers' licence; if recorded on behalf of another licensee the fee is $10 per claim.

[1] Copies of all Mining Regulations may be obtained from the Mining Recorders at Fort Smith and Yellowknife, N.W.T., or from the Lands Division, Development Services Branch, Department of Resources and Development, Ottawa.

Grouping—Adjoining claims not exceeding thirty-six in number may be grouped for the purpose of representation work. Fee for grouping certificate, $5.

Representation work—Claims may be held for a period of one year and thence from year to year, without the necessity of re-recording, provided that representation (development) work to the value of $100 is performed on the claim each year and is recorded with the Mining Recorder for the district, and that the owner renews his miner's licence annually. In general, after work to the value of $500, including cost of survey of the claim, has been performed, and other conditions met, a lease covering a period of 21 years may be applied for.

Copies of regulations governing the disposal of the following rights on Dominion Lands are also available: Placer Mining; Coal; Dredging; Petroleum and Natural Gas; Quarrying; Sand, Stone, and Gravel.

CHAPTER III

GENERAL GEOLOGY

SUMMARY STATEMENT

Very little geological mapping was done in the District of Mackenzie prior to 1921, and the examination of standard 1-mile and 4-mile map-areas did not commence until 1936. Most work has been done on a reconnaissance scale of 1 inch to 4 miles, and large areas remain unmapped (*See* Figure 2). A few economically important areas at Great Bear Lake, Indin Lake, Yellowknife, Gordon Lake, and Ross Lake have been mapped on scales ranging from 1 inch to 1 mile to 1 inch to 500 feet.

The best known parts of the Canadian Shield lie within 200 miles of its western border. Large areas of Archæan, Early Proterozoic, and Late Proterozoic sedimentary and volcanic strata occur there, but are less extensive than areas underlain by granitic rocks. The latter are in most instances of undifferentiated, Precambrian age but here and there Archæan and Proterozoic intrusions have been recognized. Geological mapping west of the Canadian Shield, within the Interior Plains and Cordilleran regions, has been confined to the vicinity of the main waterways; strata of all periods of Palæozoic time have been recognized, Cretaceous formations are widespread, and a few small areas of Tertiary sedimentary rocks are known.

PRECAMBRIAN

Sedimentary and Volcanic Rocks

ARCHÆAN

Point Lake-Wilson Island Group. The oldest known rocks in the district are sedimentary and volcanic strata of the Archæan Point Lake-Wilson Island and Yellowknife groups. The Point Lake-Wilson Island group (Stockwell, 1933, 1936b, 1936c) comprises the Wilson Island phase exposed on islands in the east arm of Great Slave Lake, and the Point Lake phase exposed at various places on the mainland between the north shore of Great Slave Lake and Point Lake on Coppermine River. In 1938 (Henderson), the latter term was replaced by Yellowknife group.

The Wilson Island phase is typically developed on Wilson Island in Great Slave Lake (Stockwell, 1936b). Here the strata are probably considerably more than 11,000 feet thick, and comprise acidic lava flows interlayered with conglomerate and arkose, overlain by crossbedded and ripple-marked quartzite, with dolomite and schist, and succeded by phyllite and schist, with a few beds of quartzite. Quartzose sedimentary gneiss and specularite iron formation form part of these strata on nearby islands. The formations are closely folded, with dips ranging from 45 degrees to vertical, and in many places are overturned. The oldest exposed members are in contact with intrusive granitic rocks, or are separated by faults from younger strata.

Correlation Chart and Table of Formations for District of Mackenzie, Northwest Territories, with Selected References to Publications of the Geological Survey of Canada.
(Precise correlation is not intended across double vertical lines.)

ERA	PERIOD	EPOCH	LOWER MACKENZIE RIVER (WRIGLEY TO AKLAVIK, AND INCLUDING KEELE, GREAT BEAR, AND ARCTIC RED RIVERS, WESTERN GREAT BEAR LAKE, AND NORMAN WELLS AREA)		UPPER MACKENZIE RIVER (FORT PROVIDENCE TO WRIGLEY, INCLUDING NORTH NAHANNI AND ROOT RIVERS)		WESTERN GREAT SLAVE LAKE (INCLUDES SLAVE, LITTLE BUFFALO, BUFFALO, HAY, AND LA MARTRE RIVERS)	
REFERENCES			BELL, J.M., 1902; BELL, J.M., 1903; HUME AND LINK, 1945; KEELE, 1910; KINDLE AND BOSWORTH, 1921; STEWART, 1945; STEWART, 1947; WILLIAMS, 1923.		HUME, 1922. WHITTAKER, 1922; WHITTAKER, 1923; WILLIAMS, 1922.		CAMERON, 1917; CAMERON, 1918; CAMERON, 1922; HUME, 1921; HUME, 1926; LORD, 1942; STEWART, 1947.	
			FORMATION	CHARACTER	FORMATION	CHARACTER	FORMATION	CHARACTER
CENOZOIC	QUATERNARY	PLEISTOCENE AND RECENT		GLACIAL DRIFT, SAND, GRAVEL, CLAY, SILT		GLACIAL DRIFT, SAND, GRAVEL, CLAY, SILT, MARL		GLACIAL DRIFT, SAND, SILT, GRAVEL
CENOZOIC	TERTIARY			IMPERFECTLY CONSOLIDATED GRAVEL, SAND, AND CLAYS, WITH LIGNITE				
MESOZOIC	CRETACEOUS	UPPER AND/OR LOWER CRETACEOUS	EAST FORK, LITTLE BEAR, AND SLATER RIVER FORMATIONS, SANS SAULT GROUP, AND UNDIFFERENTIATED FORMATIONS	SHALE, SANDSTONE, CONGLOMERATE, LIMESTONE, BENTONITE, COAL	RABBITSKIN AND MOUNTAIN FORMATIONS	SANDSTONE, SHALE	MEANDER, MOUNTAIN	SHALE, SANDSTONE
PALÆOZOIC	CARBONIFEROUS	PENNSYLVANIAN AND/OR MISSISSIPPIAN						
PALÆOZOIC	DEVONIAN	UPPER DEVONIAN	IMPERIAL FORMATION	MAINLY SANDSTONE AND SHALE, MINOR LIMESTONE	HAY RIVER SERIES	LIMESTONE, SHALE	HAY RIVER SERIES	DOLOMITIC LIMESTONE, SHALE
PALÆOZOIC	DEVONIAN	UPPER DEVONIAN	FORT CREEK FORMATION	UPPER SHALE MEMBER WITH MINOR SANDSTONE AND LIMESTONE; BITUMINOUS SHALE; CORAL REEF AND LIMESTONE (PETROLEUM AT NORMAN WELLS OIL FIELD); LOWER SHALE MEMBER	SIMPSON	SHALE	SIMPSON	SHALE, LIMESTONE
PALÆOZOIC	DEVONIAN	MIDDLE DEVONIAN	RAMPARTS FORMATION	LIMESTONE, SHALE. INCLUDES BEAVERTAIL, RAMPARTS, AND HARE INDIAN RIVER MEMBERS	PINE POINT	LIMESTONE	SLAVE POINT	SHALY LIMESTONE
PALÆOZOIC	DEVONIAN	MIDDLE DEVONIAN			HORN RIVER	SHALE	PRESQU'ILE	CRYSTALLINE DOLOMITE, DOLOMITIC LIMESTONE, SHALY LIMESTONE, (LEAD-ZINC DEPOSITS, AND BITUMEN)
PALÆOZOIC	DEVONIAN	MIDDLE DEVONIAN					PINE POINT	LIMESTONE
PALÆOZOIC	SILURIAN OR DEVONIAN		BEAR ROCK FORMATION	BRECCIATED DOLOMITE AND LIMESTONE, GYPSUM, ANHYDRITE				
PALÆOZOIC	SILURIAN		RONNING GROUP; LONE MOUNTAIN, MOUNT KINDLE AND FRANKLIN MOUNTAIN FORMATIONS	LIMESTONE, DOLOMITE, CHERT, ANHYDRITE, GYPSUM	LONE MOUNTAIN, MOUNT KINDLE, AND FRANKLIN MOUNTAIN FORMATIONS	LIMESTONE, DOLOMITE, SHALE	FITZGERALD	DOLOMITE, DOLOMITIC LIMESTONE, GYPSUM, ANHYDRITE
PALÆOZOIC	ORDOVICIAN			SANDSTONE, ARGILLITE, DOLOMITE, LIMESTONE				RED LIMESTONE, DOLOMITIC LIMESTONE, SHALE, SALT, GYPSUM; BUFF DOLOMITE, SANDSTONE, ARKOSE. (MAY INCLUDE SOME SILURIAN STRATA)
PALÆOZOIC	CAMBRIAN AND/OR OLDER		MACDOUGAL AND KATHERINE GROUPS; SALINE RIVER, MOUNT CAP, AND MOUNT CLARK FORMATIONS	LIMESTONE, SHALE, SANDSTONE, QUARTZITE, CONGLOMERATE, SALT, AND GYPSUM	SALINE RIVER, MOUNT CAP, AND MOUNT CLARK FORMATIONS	SHALE, SANDSTONE, CONGLOMERATE, QUARTZITE		
PROTEROZOIC (LATE PRECAMBRIAN)	LATE PROTEROZOIC							
PROTEROZOIC (LATE PRECAMBRIAN)	LATE PROTEROZOIC							
PROTEROZOIC (LATE PRECAMBRIAN)	EARLY PROTEROZOIC							
PROTEROZOIC (LATE PRECAMBRIAN)	EARLY PROTEROZOIC							
PROTEROZOIC (LATE PRECAMBRIAN)	EARLY PROTEROZOIC							
PROTEROZOIC (LATE PRECAMBRIAN)	EARLY PROTEROZOIC							
ARCHÆAN (EARLY PRECAMBRIAN)								
ARCHÆAN (EARLY PRECAMBRIAN)								

ERA	PERIOD	EPOCH	LIARD RIVER		EASTERN GREAT SLAVE LAKE		NONACHO LAKE-TALTSON RIVER	
REFERENCES			HAGE, 1945; McCONNELL, 1890.		STOCKWELL, 1933; STOCKWELL, 1936b; STOCKWELL, 1936c.		HENDERSON, 1939b; HENDERSON, 1939c; WILSON, 1941a.	
			FORMATION	CHARACTER	FORMATION	CHARACTER	FORMATION	CHARACTER
CENOZOIC	QUATERNARY	PLEISTOCENE AND RECENT		GLACIAL DRIFT, SAND, SILT, GRAVEL, CLAY		GLACIAL DRIFT, SAND, AND GRAVEL		GLACIAL DRIFT, SAND, AND GRAVEL
CENOZOIC	TERTIARY			SHALE, CONGLOMERATE, SANDSTONE, BENTONITE. (MAY BE UPPER CRETACEOUS)				
MESOZOIC	CRETACEOUS	UPPER AND/OR LOWER CRETACEOUS	KOTANEELEE AND FORT NELSON FORMATIONS; FORT ST. JOHN GROUP	SANDSTONE, SHALE, CONGLOMERATE, AND COAL				
PALÆOZOIC	CARBONIFEROUS	PENNSYLVANIAN AND/OR MISSISSIPPIAN		LIMESTONE, SHALE, BITUMINOUS SHALE, SANDSTONE, AND CHERT				
PALÆOZOIC	DEVONIAN	UPPER DEVONIAN		SHALE, IN PART BITUMINOUS				
PALÆOZOIC	DEVONIAN	MIDDLE DEVONIAN	NAHANNI	DOLOMITIC LIMESTONE, LIMESTONE				
PALÆOZOIC	SILURIAN OR DEVONIAN							
PALÆOZOIC	SILURIAN			SILICEOUS LIMESTONE AND DOLOMITE				
PALÆOZOIC	ORDOVICIAN							
PALÆOZOIC	CAMBRIAN AND/OR OLDER							
PROTEROZOIC (LATE PRECAMBRIAN)	LATE PROTEROZOIC					DIABASE DYKES AND SILLS		DIABASE DYKES
PROTEROZOIC (LATE PRECAMBRIAN)	LATE PROTEROZOIC				ET-THEN GROUP PREBLE FORMATION MURKY FORMATION	SANDSTONE, QUARTZITE CONGLOMERATE		
PROTEROZOIC (LATE PRECAMBRIAN)	EARLY PROTEROZOIC				GRANITIC INTRUSIONS	DIORITE, QUARTZ DIORITE, GRANODIORITE, SYENITE	GRANITIC INTRUSIONS	GRANITE, GRANODIORITE, AND ALLIED ROCKS
PROTEROZOIC (LATE PRECAMBRIAN)	EARLY PROTEROZOIC				GREAT SLAVE GROUP (UPPER PART) PEARSON FORMATION TOCHATWI FORMATION STARK FORMATION GREAT SLAVE GROUP (LOWER PART) PETHEI FORMATION KAHOCHELLA FORMATION SOSAN FORMATION	ANDESITE, BASALT, TRACHYTE SHALE, ARGILLITE, SANDSTONE DOLOMITE, LIMESTONE, BRECCIA, SHALE LIMESTONE, DOLOMITE, "ALGAL STRUCTURES" SHALE, SLATE, ARGILLITE, IRON FORMATION, LIMESTONE, TUFF, BRECCIA, AGGLOMERATE, ANDESITE SANDSTONE, QUARTZITE, ARKOSE, AND CONGLOMERATE	NONACHO GROUP	CONGLOMERATE, SLATE, GREYWACKE, ARKOSE, QUARTZITE, AND METAMORPHOSED EQUIVALENTS
ARCHÆAN (EARLY PRECAMBRIAN)					GRANITIC INTRUSIONS	GRANITE, GRANODIORITE, QUARTZ DIORITE	GRANITIC INTRUSIONS	GRANITE, GRANODIORITE, AND ALLIED ROCKS
ARCHÆAN (EARLY PRECAMBRIAN)					POINT LAKE-WILSON ISLAND GROUP WILSON ISLAND PHASE	RHYOLITE, TRACHYTE, CONGLOMERATE, ARKOSE, QUARTZITE, IRON FORMATION, DOLOMITE, PHYLLITE, SEDIMENTARY GNEISS AND SCHIST		GREYWACKE, ARKOSE, QUARTZITE, MINOR VOLCANIC ROCKS

ERA	PERIOD	EPOCH	GREAT SLAVE LAKE TO GREAT BEAR LAKE (CANADIAN SHIELD REGION ONLY)		GREAT BEAR LAKE		ARCTIC COAST (WEST OF KENT PENINSULA)	
REFERENCES			FOLLINSBEE, 1949; FORTIER, 1946; FORTIER, 1947; HENDERSON, 1941c; HENDERSON, 1941d; HENDERSON, 1949; HENDERSON AND BROWN, 1948; JOLLIFFE, 1942a; JOLLIFFE, 1946; KIDD, 1936; LORD, 1942a; LORD, 1949; PARSONS, 1948; STOCKWELL, 1933.		FENIAK, 1947; FENIAK, 1949; FORTIER, 1948b; JOLLIFFE AND BATEMAN, 1944; KIDD, 1932a; KIDD, 1933; KIDD, 1936; PARSONS, 1948; THURBER, 1946;		O'NEILL, 1924.	
			FORMATION	CHARACTER	FORMATION	CHARACTER	FORMATION	CHARACTER
CENOZOIC	QUATERNARY	PLEISTOCENE AND RECENT		GLACIAL DRIFT, SAND, GRAVEL, SILT, AND CLAY		GLACIAL DRIFT, SAND, GRAVEL, SILT, AND CLAY		GLACIAL DRIFT, SAND, GRAVEL, MUD, AND SILT
CENOZOIC	TERTIARY							PARTLY CONSOLIDATED SHALE WITH LENSES OF LIMESTONE. FOSSILIFEROUS
MESOZOIC	CRETACEOUS	UPPER AND/OR LOWER CRETACEOUS						
PALÆOZOIC	CARBONIFEROUS	PENNSYLVANIAN AND/OR MISSISSIPPIAN						
PALÆOZOIC	DEVONIAN	UPPER DEVONIAN						
PALÆOZOIC	DEVONIAN	MIDDLE DEVONIAN						
PALÆOZOIC	SILURIAN OR DEVONIAN							
PALÆOZOIC	SILURIAN							MAINLY THIN-BEDDED CHERTY DOLOMITE (PROBABLY INCLUDES SOME LOWER ORDOVICIAN OR UPPER CAMBRIAN STRATA)
PALÆOZOIC	ORDOVICIAN							SEE SILURIAN
PALÆOZOIC	CAMBRIAN AND/OR OLDER							SEE SILURIAN
PROTEROZOIC (LATE PRECAMBRIAN)	LATE PROTEROZOIC			DIABASE DYKES AND SILLS		DIABASE DYKES AND SILLS		DIABASE DYKES AND SILLS
PROTEROZOIC (LATE PRECAMBRIAN)	LATE PROTEROZOIC				HORNBY BAY GROUP	SANDSTONE, QUARTZITE, CONGLOMERATE	COPPERMINE RIVER SERIES	AMYGDALOIDAL BASALT AND CONGLOMERATE OVERLAIN BY INTERBEDDED RED TO BROWN SHALE AND SANDSTONE. (DEPOSITS OF NATIVE COPPER AND COPPER SULPHIDES)
PROTEROZOIC (LATE PRECAMBRIAN)	EARLY PROTEROZOIC		GRANITIC INTRUSIONS	GRANITE, GRANODIORITE, AND ALLIED ROCKS; INTRUSIVE FELDSPAR AND FELDSPAR-QUARTZ PORPHYRY IN NORTHWEST	GRANITIC INTRUSIONS	GRANITE, GRANODIORITE, AND ALLIED ROCKS; INTRUSIVE FELDSPAR AND FELDSPAR-QUARTZ PORPHYRY (MAY INCLUDE SOME UNDIFFERENTIATED ARCHÆAN INTRUSIONS)	GRANITIC INTRUSIONS (?)	MAY INTRUDE GOULBURN QUARTZITE
PROTEROZOIC (LATE PRECAMBRIAN)	EARLY PROTEROZOIC		SNARE GROUP	SLATE, SHALE, ARGILLITE, PHYLLITE, CHERTY ARGILLITE, CHERT, GREYWACKE, QUARTZITE, ARKOSE, CONGLOMERATE, DOLOMITE WITH "ALGAL STRUCTURES," LIMESTONE, AND METAMORPHOSED EQUIVALENTS; ANDESITE, DACITE, TUFF, BRECCIA; EXTRUSIVE FELDSPAR AND FELDSPAR QUARTZ PORPHYRY. (VOLCANIC ROCKS PROBABLY PREDOMINATE IN UPPER PART. MAY INCLUDE SOME UNDIFFERENTIATED CAMERON BAY STRATA.)	CAMERON BAY GROUP	RUSTY CRUMBLY CONGLOMERATE WITH RARE GRANITIC PEBBLES, ARKOSE, SANDSTONE, ARGILLITE, TUFF; INTERLAYERED WITH ANDESITE AND TRACHYTE FLOWS, PROBABLY MAINLY IN UPPER PART. (THIS GROUP MAY BE MUCH YOUNGER THAN ECHO BAY GROUP, POSSIBLY LATE PROTEROZOIC.)	GOULBURN FORMATION	QUARTZITE, CONGLOMERATE
PROTEROZOIC (LATE PRECAMBRIAN)	EARLY PROTEROZOIC				ECHO BAY GROUP (UPPER PART)	AMYGDALOIDAL AND PORPHYRITIC ANDESITE FLOWS AND PYROCLASTIC ROCKS; MINOR SEDIMENTARY STRATA. (PROBABLY INCLUDES SOME INTRUSIVE PORPHYRITIC ROCKS)		
PROTEROZOIC (LATE PRECAMBRIAN)	EARLY PROTEROZOIC				ECHO BAY GROUP (LOWER PART)	CHERTY ARGILLITE, PYROCLASTIC ROCKS, QUARTZITE, CONGLOMERATE, CHERT WITH ALGAL-LIKE STRUCTURES, LIMESTONE; MINOR INTRUSIVE AND EXTRUSIVE PORPHYRITIC ROCKS, COMMONLY FELDSPAR AND FELDSPAR-HORNBLENDE PORPHYRY. (ECHO BAY STRATA CONTAIN URANIUM-SILVER DEPOSITS OF ELDORADO MINE.)	EPWORTH FORMATION	CHERTY DOLOMITE WITH "CONCRETIONARY STRUCTURES"; MINOR CONGLOMERATE, ARKOSE WITH GRANITE FRAGMENTS, AND SANDSTONE
ARCHÆAN (EARLY PRECAMBRIAN)			GRANITIC INTRUSIONS	GRANITE, GRANODIORITE, QUARTZ DIORITE, AND ALLIED ROCKS. (MAY INCLUDE SOME UNDIFFERENTIATED PROTEROZOIC INTRUSIONS.)			GRANITIC INTRUSIONS	GRANITE AND (?) ALLIED ROCKS
ARCHÆAN (EARLY PRECAMBRIAN)			YELLOWKNIFE GROUP	GREYWACKE, ARKOSE, IMPURE QUARTZITE, SLATE, ARGILLITE, MINOR CONGLOMERATE, AND METAMORPHOSED EQUIVALENTS. ANDESITE, BASALT, DACITE, RHYOLITE, MINOR PYROCLASTIC ROCKS, AND METAMORPHOSED EQUIVALENTS. (INCLUDES POINT LAKE PHASE OF POINT LAKE-WILSON ISLAND GROUP. YELLOWKNIFE GROUP CONTAINS MOST KNOWN GOLD DEPOSITS AND ALL PRODUCING GOLD MINES.)				SCHIST INCLUSIONS IN GRANITIC INTRUSIONS

G.S.C.

Yellowknife Group. The term Yellowknife group has been applied to all Archæan volcanic and sedimentary strata north of Great Slave Lake. They are best exposed near Yellowknife (Jolliffe, 1942a, 1946) and in the adjacent Beaulieu River area (Henderson and Jolliffe, 1941), but extend 180 miles north to the Ingray Lake area (Lord, 1942a), and 230 miles northeast to Aylmer Lake (Lord, 1949). Similar, unmapped strata occur near Lake Beechey, 300 miles northeast of Yellowknife. The oldest Yellowknife rocks are massive and pillowed greenstones derived from andesitic and basaltic flows, associated with minor dacites, rhyolites, and pyroclastic beds. This assemblage is as much as 33,000 feet thick at Yellowknife Bay (Jolliffe, 1942a). At Prosperous Lake, near Yellowknife Bay, this volcanic assemblage is separated from the overlying sedimentary strata by an angular unconformity (Jolliffe, 1946); but elsewhere the volcanic rocks grade through interbanded flows and sedimentary rocks to sedimentary formations without recognized intervening erosion or structural discordance.

The sedimentary strata consist of a great thickness of well-bedded greywacke, arkose, impure quartzite, slate, and argillite, with minor conglomerate near the base; or, near granitic intrusions, of gneiss, or quartz-mica schists with knots of andalusite, cordierite, staurolite, garnet, and sillimanite. Many beds grade from coarse at the bottom to fine at the top. The strata generally dip at angles greater than 45 degrees, and in many instances are vertical or overturned; they lie in a series of closely spaced isoclinal folds. The volcanic members dip at similarly steep angles but are not as closely folded. The oldest, volcanic members of the group are commonly in contact with granitic rocks that intrude them.

Early Proterozoic

Early Proterozoic sedimentary and volcanic rocks have been mapped as the Great Slave group, Nonacho group, Snare group, and Echo Bay group; and those mapped as Cameron Bay group, Epworth formation, and Goulburn formation may be of similar age.

Great Slave Group. This group (Stockwell, 1936b, 1936c) is exposed on the islands of the east arm of Great Slave Lake. It is divisible into a lower and an upper part. The lower part comprises three formations, named in ascending order, the Sosan, Kahochella, and Pethei formations. The Sosan formation, about 3,000 feet thick, consists of sandstone, quartzite, arkose, and conglomerate. The Kahochella formation is composed of about 1,000 feet of shaly sediments with laminated limestone, jasper, and oolitic iron formation, and associated andesite lava flows and pyroclastic rocks. The Pethei formation comprises about 1,500 feet of limestone and dolomite, with algal structures at some horizons. This formation is missing in places, thus suggesting that erosion preceded the deposition of the upper part of the group, which consists of a lower, Stark formation, the Tochatwi formation, and an upper, Pearson formation. The Stark formation, possibly 1,000 feet thick, comprises interbedded varicoloured dolomite, shale, and limestone, some layers of which are brecciated; the Tochatwi formation, about 300 feet of shaly sediments and sandstone; and the Pearson formation, 70 to 150 feet of andesite, basalt, and trachyte lava flows, with minor interbedded argillite. Most of the clastic members of the group are red or brown, and many beds exhibit ripple-marks and crossbedding. Concretions occur here and there in shale and argillite. The strata form an easterly trending synclinorium 150 miles long; the beds on the north limb dip 5 to 10 degrees south, whereas the strata on the south limb are folded in a series of easterly trending anticlines and synclines with limbs dipping between 30 and 70 degrees. The members of the Great Slave group were deposited on an old erosion surface that bevelled granitic intrusions and the upturned edges of older sedimentary rocks.

Nonacho Group. The Nonacho group, described by Henderson (1939b, 1939c), occurs near Nonacho Lake, south of the east arm of Great Slave Lake. It is composed mainly of arkose and quartzite, but includes a basal conglomerate as much as 2,000 feet thick, and slate and greywacke. One rock type grades into another, and beds and lenses of conglomerate and slate occur interbedded with arkose and quartzite. Near contacts with intrusive granitic rocks, the slates have been converted to phyllites, and the arkoses and quartzites to fine-grained, glassy, pink rocks. Cross-bedding, ripple-marks, and mud-cracks are characteristic features of the series. The strata generally lie in open folds, with the dips on the limbs averaging between 45 and 60 degrees, but have been more intensely folded near contacts with younger granitic intrusions. The formations rest unconformably on older granitic rocks, and have been correlated with the lower part of the Great Slave group.

Snare Group. Sedimentary and volcanic rocks of the Snare group form several elongated basins in an area extending north from the north arm of Great Slave Lake nearly to Great Bear Lake (Lord, 1942a, pp. 17-26; Parsons, 1948a). The basal beds are coarse-grained quartzites, arkoses, and pebbly quartzite or conglomerate. These are overlain by dolomite, or grade upward into a thick series of interbedded argillaceous rocks, greywackes, quartzites, and dolomite or limestone. Over large areas the argillaceous rocks and greywackes, or their altered equivalents, are the most abundant strata. Massive and pillowed, andesitic, basaltic, and dacitic lavas and minor pyroclastic rocks accompany the northern strata, along Wopmay River, and, for the most part, probably overlie the sedimentary formations. Snare strata at Hottah Lake are accompanied by extrusive feldspar and feldspar-quartz porphyry (Henderson, 1949); and similar porphyritic rocks probably occur within the group in other areas, where, however, they have not been differentiated from lithologically similar intrusive porphyries.

The Snare sedimentary rocks are relatively unaltered except where cut by granitic intrusions and feldspar and feldspar-quartz porphyries. In such instances, some shales, slates, argillites, and greywackes have been altered to phyllite, knotted quartz-mica schist, and gneiss. These altered rocks are lithologically similar to those of the Yellowknife group, but commonly have more gentle dips, are more thinly bedded, and, here and there, contain beds of dolomite, limestone, or white quartzite. Other strata have been altered to banded black, grey, green, and pink cherty argillites; or to hard, dense rocks containing various proportions of quartz, garnet, pyroxene, epidote, and other minerals, interlayered with impure crystalline limestone. Some of the highly altered phases of the Snare group were formerly called the Marian group and thought to be of Archæan age (Lord, 1939). The term Marian group has since been discarded.

Common structural features of the Snare group include crossbedding and ripple-marks in the quartzites and other coarse-grained formations. Some beds or groups of beds in the dolomite contain algal-like structures similar to those in the dolomites of the Great Slave group. The least altered Snare strata lie in broad, open folds, and dips of less than 20 degrees are common; these rocks rest unconformably on older granitic intrusions or on steeply inclined formations of the Yellowknife group. The Snare strata that have been metamorphosed by granitic and porphyritic intrusions dip at steeper angles, but the dips rarely exceed 65 degrees and are commonly less than 45 degrees.

The rocks of the Snare group are correlated with those of the Great Slave group and Nonacho group.

Echo Bay Group. The oldest rocks recognized within an area of about 30 square miles at Port Radium, on Great Bear Lake, belong to the Echo Bay group (Feniak, 1947; Fortier, 1948b; Jolliffe and Bateman, 1944; Kidd, 1933; Thurber, 1946). Sedimentary strata predominate in the lower part, volcanic rocks in the upper part. Jolliffe and Bateman recognize two divisions: (1) a lower division of massive crystalline tuff, thinly banded cherty sedimentary strata, bedded tuff and other pyroclastic rocks, and minor limestone, and feldspar and hornblende-feldspar porphyry, probably mainly intrusive; and (2) an upper division of porphyritic and amygdaloidal andesite lava flows separated by a little massive or stratified tuff. Other geologists working in the vicinity have likewise adopted a twofold division, but Thurber (1946) recognizes three conformable divisions in the nearby Glacier Bay-Cameron Bay area, namely: (1) a lower division of interbedded tuff, banded, cherty argillite, chert, minor limestone, porphyritic and amygdaloidal flow rocks, flow breccias, and agglomerates; (2) an intermediate division of interbedded argillite, tuff, arkose, pebble-conglomerate, porphyritic and amygdaloidal andesite, flow breccia, and agglomerate; and (3) an upper division of coarse-grained amygdaloidal and porphyritic andesite, breccia, and agglomerate, with minor sedimentary rocks. The base of the Echo Bay group has not been recognized, but Thurber (1946, p. 2) found the exposed Echo Bay assemblage to be about 6,300 feet thick, whereas Feniak (1947, p. 8) reports a minimum thickness of 9,300 feet on Dowdell Peninsula.

The rocks have been altered mainly by hydrothermal processes, which formed such minerals as quartz, hematite, magnetite, sericite, chlorite, and carbonate; but the degree and character of this alteration vary widely from place to place. Perhaps the most noticeable features of this alteration are the widespread red staining and the almost complete absence of schist or gneiss.

Internal structural features of the Echo Bay group include mud-cracks, ripple-marks, and grain-graded beds within argillaceous formations, and algal-like structures within chert layers (Thurber, 1946, p. 2). Dips are commonly less than 45 degrees, although locally they are much steeper. Faults and fractures are numerous. The roots of the Echo Bay group lie in younger granitic intrusions.

The rocks of the Echo Bay group are lithologically similar to those of the northern belts of the Snare group, and the two assemblages are, at least in part, correlative.

Cameron Bay Group. Rocks of the Cameron Bay group have been recognized along the east side of Great Bear Lake from Echo Bay in the south to Norrie Bay in the north (Feniak, 1949; Fortier, 1948b; Kidd, 1933; Thurber, 1946). Similar rocks occur in the Camsell River area to the south (Parsons, 1948a). Members of the group consist of loosely consolidated conglomerates, arkoses, sandstones, argillites, and tuffs, interlayered, especially in the upper part (Feniak, 1949), with trachyte and andesite lava flows. The conglomerates are maroon or chocolate coloured, with ferruginous cement, and break around rather than through the pebbles and cobbles. Forty to 70 per cent of the pebbles and cobbles are of typical Echo Bay volcanic rocks (Thurber, 1946, p. 6). A few pebbles are of syenite or granite.

Cameron Bay formations are gently inclined to about the same degree as nearby, underlying Echo Bay strata and strike about parallel with them. Contacts between the rocks of the two groups are obscured by drift or water, or are faults, but available evidence suggests that a period of erosion preceded the deposition of the Cameron Bay strata. The Cameron Bay rocks are intruded by granitic and porphyritic rocks (Feniak, 1949).

The correlation of the Cameron Bay group is uncertain. The rocks may be only slightly younger than those of the Echo Bay group and correlative with parts of the Great Slave and Snare groups. On the other hand granitic pebbles in the Cameron Bay conglomerates (Feniak, 1949, p. 4; Kidd, 1936, pp. 7, 8; Thurber, 1946, p. 6) resemble rocks that intrude the Echo Bay group, and suggest that a polonged time interval separated the periods of deposition of the two groups. If so, the Cameron Bay may be of Late Proterozoic age, possibly correlative with the Et-Then group.

Epworth Formation. This formation (O'Neill, 1924, pp. 21, 36) is exposed on the Arctic coast just east of Darnley Bay, at Port Epworth, and between Cape Barrow and Bathurst Inlet; inland it outcrops between the Dismal Lakes and Coppermine River. It consists mainly of grey, buff, or light brown, cherty dolomite in beds ranging in thickness from a few inches to 5 feet. Some layers contain concretionary structures. At Port Epworth the formation rests on older granite, and members at or near the base comprise, in ascending order, a few inches of conglomerate, 3 to 5 feet of arkose with granite fragments, and 75 feet of impure dolomites and sandstones. At Pierce Point the formation is at least 1,800 feet thick. The Epworth strata are gently folded along axial lines trending a little east of north, and commonly dip at less than 20 degrees. The formation may be of about the same age as similar strata of the Great Slave and Snare groups.

Goulburn Formation. This formation (O'Neill, 1924, pp. 23, 36), observed only in Bathurst Inlet, is composed of pink and grey, crossbedded quartzites with interbedded conglomerates. Some of the conglomerates contain pebbles apparently of Epworth dolomite. The formation is more than 4,000 feet thick. It has not been seen in contact with older formations, but may be cut by granitic rocks. A period of gentle folding and deep erosion followed the deposition of the Epworth rocks and preceded the formation of the Goulburn strata (O'Neill, 1924, p. 36).

Late Proterozoic

Et-then Group. This group outcrops on islands in the east arm of Great Slave Lake, and consists of two formations (Stockwell, 1936b, 1936c). The Murky formation of conglomerate, as much as several thousand feet thick, forms the base of the series, and the Preble formation of coarse, feldspathic, crossbedded and ripple-marked sandstones and quartzite the upper part. The strata are nearly horizontal, and were laid down on an old erosion surface that truncates the folded strata of the Great Slave group and the granitic rocks that intrude them. The Et-then group is correlated with the Athabaska series on Lake Athabasca.

Hornby Bay Group. This group, near Hornby Bay on the east side of Great Bear Lake, has been described by Kidd (1933, p. 13) and Feniak (1949). The strata comprise coarse, brown, crumbly weathering conglomerate, and buff, pink, mauve, white, grey, and red, ripple-marked and crossbedded sandstone and quartzite. The series is at least several hundred feet thick, but the top has not been seen. The strata dip up to 20 degrees, and are thought to be separated from older granitic intrusions and members of the Cameron Bay group by an angular unconformity. The group is correlated with the Et-then.

Coppermine River Series. The Coppermine River series occurs on the Arctic coast near Darnley Bay, near Coppermine, and in Bathurst Inlet, and inland along Coppermine River and the Dismal Lakes (O'Neill, 1924, pp. 23, 24, 36). Its known total thickness is about 48,000 feet. The lower half of the series consists of amygdaloidal basaltic lava flows with minor interlayered conglomerate. These are overlain by dark red to brown, sandy shales and sandstones. The strata dip about 12 degrees north in the Coppermine River basin, and commonly at lower angles elsewhere. The older Goulburn formation was eroded before the Coppermine rocks were deposited; and in some instances the Goulburn strata are missing and Coppermine rocks rest unconformably on Epworth strata. The Coppermine series is correlated with the Et-then and Hornby Bay groups.

Intrusive Rocks

Summary Statement

Known instrusive rocks in the Mackenzie district, are, with minor exceptions, confined to the Canadian Shield, where they underlie more than half the mapped area and, presumably, are of Precambrian age. Most are massive or gneissic granite, granodiorite, quartz diorite, and allied rocks, in some instances accompanied by genetically related, fine-grained, porphyritic rocks of similar composition. Many granitic bodies, especially near their borders, contain much, more or less granitized, schistose and gneissic material derived from sedimentary or volcanic rocks; and in some places this material forms a map-unit lying between normal granitic rocks on the one hand and metamorphosed sedimentary or volcanic formations on the other. Granitic intrusions of late Archæan and late Early Proterozoic ages have been identified; and inconclusive evidence suggests that granitic intrusions of other Precambrian ages may be present. None is known to intrude Late Proterozoic rocks. No physical or chemical properties have proved to constitute reliable criteria whereby Archæan intrusions may be differentiated from Proterozoic; and these intrusions have been separated only where their relations to adjacent Proterozoic sedimentary or volcanic rocks have been demonstrated. Proterozoic instrusions have thus been recognized at many places, Archæan instrusions at a few. Dykes, sills, and irregular bodies of diabase intrude Late Proterozoic sedimentary and volcanic rocks but, so far as known, do not intersect younger formations.

Archæan

Granitic rocks of late Archæan age have been recognized in the east arm of Great Slave Lake (Stockwell, 1936b, 1936c), in the Taltson River and Nonacho Lake areas to the south (Henderson, 1939b, 1939c), and in the Snare River and Ingray Lake areas to the northwest (Lord, 1942a). They intrude rocks of the Point Lake-Wilson Island and Yellowknife groups, or formations of equivalent age, and are overlain unconformably by Great Slave, Nonacho, or Snare rocks.

Stockwell (1933, p. 54) has described a chloritized granite at Point Lake that may be older than the adjacent, presumably Yellowknife, strata. The possible occurrence of granitic intrusions older than at least part of the Yellowknife group is likewise indicated by the presence of granitic pebbles in conglomerate of the Yellowknife group near Yellowknife Bay (Jolliffe, 1946).

Archæan and/or Early Proterozoic

Large mapped areas of the Canadian Shield contain no Proterozoic sedimentary or volcanic rocks, and in such places Proterozoic granitic intrusions have not been separated from those of Archæan age. However, in the Gordon Lake South (Henderson, 1941c) and Ross Lake (Fortier, 1947a) areas, muscovite-biotite granite with much pegmatite cuts an older biotite granite or granodiorite. Swarms of gabbro dykes cut the older granite, but are cut by the younger body. Thus an appreciable interval of time intervened between the emplacement of the two granitic bodies, and the younger muscovite-bearing intrusion is possibly of Proterozoic age, the older, Archæan. Granitic intrusions of two ages, the younger characterized by muscovite and much pegmatite, have also been noted at other places, including the Prosperous Lake (Jolliffe, 1946), Beaulieu River (Fortier, 1946), MacKay Lake (Henderson, 1944), Lac de Gras (Folinsbee, 1947), and Aylmer Lake (Lord, 1948) areas. Thus, some or all of these areas may contain Archæan and Proterozoic granitic intrusions.

Early Proterozoic

Early Proterozoic granitic intrusions and genetically related rocks have been identified in the east arm of Great Slave Lake (Stockwell, 1936b, 1936c), in Taltson River and Nonacho Lake areas (Henderson, 1939b, 1939c), and between Fort Rae on Great Slave Lake and Hornby Bay on Great Bear Lake (Feniak, 1947, 1949; Fortier, 1948b; Jolliffe and Bateman, 1944; Lord, 1942a, 1947; Parsons, 1948a; Thurber, 1946). Small bodies of diorite, quartz diorite, granodiorite, and syenite intrude sedimentary formations of the Great Slave group on Great Slave Lake, and are overlain unconformably by Et-then strata. Along the south shore of the east arm of the lake, a white, microcline-albite-muscovite granite cuts dolomites of the Great Slave group, and similar granite cuts Nonacho strata some 45 miles to the south (Henderson, 1948a, p. 44). Between the north arm of Great Slave Lake and Great Bear Lake, granitic rocks intrude Snare strata in almost all places where they have been found in contact. Scattered bodies of intrusive feldspar and feldspar-quartz porphyry are probably genetically related to the Proterozoic granitic rocks and likewise cut the Snare group of rocks. So far as known, all intrusive rocks at Great Bear Lake are of Proterozoic age. They are mainly fresh, massive granite and granodiorite, and feldspar and feldspar-quartz porphyries. In general, they intrude Echo Bay and Cameron Bay rocks, but not the Hornby Bay strata. However, Kidd (1936, pp. 7, 8) has described an occurrence of granite at Balachey Lake that may intrude Echo Bay rocks but not Cameron Bay formations.

Late Proterozoic

The youngest known Precambrian rocks are numerous dykes, sills, and irregular bodies of fresh diabase and similar rocks. They intrude the Late Proterozoic Et-then, Hornby Bay, and Coppermine River series and older rocks, but are not known to cut nearby Palæozoic strata.

Structure

Folds

The general trend of Archæan and Early Proterozoic sedimentary and volcanic rocks mapped to date varies from about north, near the 60th parallel, through northeast in the Nonacho Lake, east arm of Great Slave Lake, Beaulieu River, and MacKay Lake areas, to northwest in the Lac de Gras and Aylmer Lake areas. Where Early Proterozoic and Archæan stratified rocks are in contact, an angular unconformity intervenes, and the older formations have clearly suffered at least two periods of deformation, the later in Proterozoic time. In the mapped areas northeast of Yellowknife Bay, however, Proterozoic strata are missing, and direct evidence of Proterozoic deformation is lacking. Nevertheless, as Fortier (1946, 1947a), Henderson (1941b, 1941c, 1943), and Jolliffe (1942a) have pointed out, the Archæan, Yellowknife rocks have been deformed at least twice; and the later deformation resulted in cross-folds, the axes of which trend about northwest. Fortier (1946) has further demonstrated that these cross-folds in the Yellowknife-Beaulieu region were developed at about the same time as the emplacement of the youngest granite, a muscovite-bearing rock accompanied by much pegmatite. As already shown, this granite might be of Early Proterozoic age and, if so, the northwesterly trending cross-folds are likewise of Early Proterozoic age. Late Proterozoic strata, as already mentioned, are horizontal or gently inclined where examined.

Faults

Numerous major faults have been recognized. Many of these are marked by nearly straight topographic features or lineaments. These lineaments are very common features, and some, perhaps many, of them may mark other unrecognized faults of various magnitudes (Wilson, 1941b, 1948). Many of the known faults are of Proterozoic age, but none is known to displace nearby Palæozoic strata.

Faults have been studied in greatest detail in the much faulted Yellowknife Bay area. There two types of faults intersect volcanic rocks of the Yellowknife group (Henderson and Brown, 1948, pp. 3-5): (a) early, prediabase faults, and (b) late, post-diabase faults. The early faults are chlorite schist shear zones, a few inches to several hundred feet wide. Many of them strike north to northeast and dip steeply west. The movement, where determined, is mainly with the dip, the western side having moved up relative to the eastern side (Campbell, 1948, p. 247). Quartz veins and gold-bearing orebodies were formed in the shear-zone faults before the emplacement of the Late Proterozoic diabase dykes and the formation of the post-diabase faults. The post-diabase faults are narrow fissures marked by brecciated rock or gouge. The major faults of this age strike between north and northwest and are nearly vertical. The movement along them is mainly horizontal and 'left-hand', the east side having moved north relative to the west side. Along the largest of these, the West Bay fault, the west side has moved 16,140 feet south and 1,570 feet down relative to the east side (Campbell, 1948, p. 256). Across a width of 10 miles the total horizontal offset produced by faults of this type is about 11 miles (Jolliffe, 1942b, p. 702).

The northwesterly trending post-diabase faults of Yellowknife Bay may extend 130 miles northwest to Indin Lake where a similar set of nearly vertical left-hand faults has been recognized (Lord, 1942a, p. 42).

Several large faults strike about northeast along and south of the east arm of Great Slave Lake. The most prominent of these (McDonald fault) lies along the south side of McDonald Lake and may be more than 300 miles long. They have displaced the Late Proterozoic Et-then strata but are older than the Late Proterozoic diabase dykes (Stockwell, 1936b). Wilson (1941b, p. 498) suggests that vertical movements were in opposite directions at either end of the McDonald fault, and that right-hand horizontal displacements amounting to several miles may have occurred along this and adjacent faults.

Many known faults at and south of Great Bear Lake trend about northeast. These are mainly steeply inclined right-hand faults wherein, so far as known, the horizontal movement far exceeds the vertical. Many are marked by large quartz veins or stock-works, and some contain pitchblende deposits. Some afford evidence of recurrent movement at widely separate intervals (Jolliffe, 1942b, p. 701). The faults in the Eldorado mine area affected all rocks, although the latest, Late Proterozoic diabase, suffered only minor displacement (Murphy, 1948, p. 262).

PALÆOZOIC SEDIMENTARY ROCKS

Summary Statement

Great thicknesses of Palæozoic sedimentary rocks underlie much of the Cordilleran and Plains regions and, in contrast with the Precambrian assemblage of the Canadian Shield, are not accompanied by volcanic rocks, nor, in the mapped areas, by significant intrusions. Several gaps are recognized in the Palæozoic succession. Thus, at the western boundary of the Canadian Shield, Ordovician or Silurian strata rest on an uneven erosion surface that truncates a variety of Precambrian rocks, whereas in the lower Mackenzie River and Franklin Mountains areas Cambrian formations were laid down but Ordovician beds are generally missing. Another hiatus marks Lower Devonian time; no strata of this age have been identified despite the widespread occurrence of Silurian and Middle and Upper Devonian formations. A later period of erosion extended from the Upper Devonian epoch into the Mesozoic era except in the Liard River area where Mississippian and possibly Pennsylvanian, but not Permian, strata have been recognized. Large unexplored areas in Mackenzie and Selwyn Mountains are thought to be underlain mainly by Palæozoic beds.

Cambrian and/or Older

Small areas of Cambrian or older sedimentary rocks are exposed in the upper Carcajou River area southwest of Norman Wells, in the vicinity of Clark Mountain 20 miles east of the mouth of Keele River, and in the Cap Mountain area northeast of Wrigley.

Southwest of Norman Wells (Hume and Link, 1945, pp. 7, 8) the Katherine group of interbedded quartzites and black platy shales underlies Cambrian strata and is, therefore, of Cambrian age or older. The Cambrian Macdougal group, about 1,000 feet thick, consists of limestones, shales, sandstones, and gypsum.

In the Clark Mountain and Cap Mountain areas about 100 miles southeast of the upper Carcajou River area, Williams (1923, p. 72) mapped 375 feet of Precambrian (?) shales disconformably overlain by 1,300 feet or more of Cambrian shales, quartzites, sandstones, conglomerate, salt, and gypsum. The Cambrian strata comprise a lower, Mount Clark formation, an intermediate, Mount Cap formation, and an upper, Saline River formation. The Mount Clark formation has been tentatively correlated with the Katherine group and the Mount Cap and Saline River formations with the Macdougal group (Hume and Link, 1945, p. 8).

Ordovician

No rocks of Ordovician age have been identified positively near Norman Wells nor in Franklin Mountains.

Keele (1910, p. 27) reported more than 4,000 feet of Ordovician strata in Mackenzie Mountains below the mouth of Twitya River. These strata comprise sandstones, argillite, dolomite, and limestone.

On the west shore of the north arm of Great Slave Lake, Hume (1926, pp. 59-61) identified Ordovician rocks consisting of a little varicoloured sandstone overlain by red limestone, dolomitic limestone, shale, and gypsum, or yellow to buff dolomitic limestone. The sandstone is believed to rest unconformably on Precambrian rocks.

At Rivière la Martre, near the north end of the north arm of Great Slave Lake, are several hundred feet of strata comprising, from bottom to top, sandstone and arkose, sandy dolomite and dolomite, and finely crystalline, buff weathering, grey dolomite. The crystalline dolomite contains abundant Upper Ordovician (Richmond) fossils (Lord, 1942a, pp. 36-38). The strata are horizontal or dip gently west or southwest. They rest on an erosion surface of Precambrian granitic rocks.

Silurian

Silurian strata occur in Mackenzie Mountains, in many places in Franklin Mountains, on Liard River at the mouth of South Nahanni River, on the west side of the north arm of Great Slave Lake, west of Slave River, and on the Arctic coast.

About 1,400 feet of limestones and chert of the Ronning group occur in the Norman Wells district, mainly west of Mackenzie River (Hume and Link, 1945, pp. 10-16). They are generally regarded as resting on Cambrian strata, but the lower limits are somewhat indefinite.

The Bear Rock formation, comprising 250 feet of brecciated dolomites and limestones, gypsum, and anhydrite, is exposed on Bear Rock at Fort Norman, and at other places in that district near and west of Mackenzie River. The brecciated rocks are highly porous, and in places highly bituminous. The formation is separated by a sharp disconformity from underlying, Silurian strata of the Ronning group. Some observers report that the formation grades into overlying, undoubtedly Middle Devonian strata, whereas others recognize a disconformity at its top. The age of the Bear Rock formations has not been established by fossils, and may be Silurian or Devonian (Hume and Link, 1945, pp. 6, 16-19).

Williams (1923, p. 74) divides 1,875 feet of Silurian strata at Mount Charles, in Franklin Mountains east of Mackenzie River, into three conformable formations as follows: a Lower Silurian, Franklin Mountain formation of limestone; a Middle Silurian, Mount Kindle formation of limestone, chert, and dolomite; and an Upper Silurian, Lone Mountain formation of dolomite and brecciated sandy dolomite. The Franklin Mountain formation probably rests disconformably on the Cambrian, Saline River formation. It and the succeeding Mount Kindle formation have been correlated with the Ronning group, and the Lone Mountain formation with the Silurian or Devonian Bear Rock formation (Hume and Link, 1945, pp. 6, 15).

More than 500 feet of Silurian limestones and dolomites have been identified at the mouth of South Nahanni River (Hage, 1945) where they constitute the oldest exposed strata.

Coarse, porous, dolomitic limestones outcrop southwest of Gypsum Point on Great Slave Lake (Hume, 1926, p. 61). These are correlated with the Fitzgerald dolomites and gypsum, about 275 feet thick, exposed on Salt River west of Fort Smith (Cameron, 1922a, pp. 18, 19). A well drilled in search of oil at Windy Point on the north shore of Great Slave Lake encountered about 600 feet of red shale, gypsum, and salt lying below the Fitzgerald dolomites and resting unconformably on Precambrian rocks. These red beds have been dated Silurian by Cameron (1922a, p. 16), but later work (Hume, 1926) suggests that they may be of Ordovician age.

Grey cherty dolomites occur at various places along the Arctic coast between Parry Peninsula and Coppermine (O'Neill, 1924, pp. 25-26). They are commonly thin bedded; some layers are cherty, whereas a few others show concretionary structures, ripple-marks, or mud-cracks. The strata commonly dip at angles of less than 12 degrees, and strike and dip about parallel with the underlying, Precambrian, Coppermine River strata.

So far as known, the dolomites comprise a conformable series. They have afforded a very few Silurian fossils, and fragments of dolomite on the beach at Bernard Harbour contain Upper Cambrian or Lower Ordovician fauna.[1]

Devonian

Although no Lower Devonian strata have been identified with certainty, Middle and Upper Devonian formations are widespread within a belt embracing Mackenzie River and western Great Slave Lake and extending southeasterly from the Mackenzie River Delta to the 60th parallel.

In the lower Mackenzie River area, Devonian time is represented by a conformable series comprising, from bottom to top, the Middle Devonian Ramparts formation, and the Upper Devonian Fort Creek and Imperial formations (Hume and Link, 1945, pp. 19-39). The Ramparts formation, 1,250 to 1,650 feet thick, has been recently redefined by Hume and Link (1945, p. 19) as consisting of a lower, limestone member; a middle, shale member; and an upper, limestone member. The upper member includes the former Ramparts and Beavertail limestones of Kindle and Bosworth (1921); the middle member is the former Hare Indian River shales of Kindle and Bosworth (1921).

The Fort Creek formation, 1,600 to 1,800 feet thick, consists of lower dark platy shales, reef limestones, and bituminous shales, and upper grey shales with thin sandstone beds. The bituminous shale may have been an important source of oil (Hume and Link, 1945, p. 34). In the Norman Wells area, the reef limestones comprise 75 to 125 feet of bedded limestones overlain by the productive layer of reef materials composed of stromatoporids, corallites, and coral sand. The reef materials are missing in places; elsewhere they range up to more than 400 feet in thickness (Hume and Link, 1945, p. 29).

The Imperial formation, originally named the Bosworth formation by Kindle and Bosworth (1921), ranges in thickness from about 437 to 1,900 feet. It consists of sandstones and shales; includes the youngest Palæozoic rocks in the Norman Wells area; and grades into the underlying Fort Creek shales. It was eroded to various depths before being buried by Cretaceous strata, and in places, as at the Ramparts of Mackenzie River, was entirely removed.

In the upper Mackenzie River area, between Great Slave Lake and Fort Simpson, about 1,050 feet of Devonian strata have been named (Whittaker, 1922, 1923), in ascending order, Middle Devonian, Horn River shales and Pine Point limestones; and Upper Devonian, Simpson shales and Hay River limestones and shales. These strata are nearly horizontal and locally dip as much as 3 degrees. Lower Devonian or older strata have not been recognized.

In the western Great Slave Lake area, about 2,125 feet of strata comprise, in ascending order, the Pine Point, Presqu'île, and Slave Point divisions of Middle Devonian age, and the Simpson and Hay River divisions of Upper Devonian age (Cameron, 1922a, p. 13). The Pine Point strata are shaly limestones and limestones, locally bituminous. Presqu'île rocks comprise dolomites, dolomitic limestones, and shaly limestones. They are locally cavernous or porous, bituminous, and much fractured; and oil

[1] Identified by L. D. Burling, Geological Survey of Canada.

seepages and springs of cold, sulphur-bearing water occur in them near Windy Point on the north shore of the lake. The overlying grey shaly Slave Point limestones are slightly bituminous. The Upper Devonian Simpson shales are overlain by the Hay River series comprising a lower unit mainly shaly strata and an upper unit of predominantly hard dolomitic limestone. The Devonian strata are nearly horizontal, locally inclined as much as 6 degrees, and lie on an erosion surface that crosses the Silurian, Fitzgerald dolomites.

The Devonian assemblage in the Liard River area consists of more than 2,450 feet of strata. The Middle Devonian, Nahanni formation of dolomitic limestone and limestone is overlain by a thick series of bedded, partly bituminous, Upper Devonian shales, and rests disconformably on Silurian strata (Hage, 1945, pp. 4-8). The Upper Devonian shales are correlated with the Hay River shales.

Carboniferous

More than 2,000 feet of Carboniferous strata have been identified in the Liard Range, west of Liard River, where they comprise a lower unit of limestone, with some interbedded shale, and an upper unit of sandstone, with interbedded black bituminous shale capped by chert (Hage, 1945, pp. 8-19). They thin to the east and may extend only a few miles east of the mountains. The lower unit is of Mississippian age, the upper of Mississippian or Pennsylvanian age, or both. The relation of the Carboniferous strata to underlying or overlying beds is not known.

MESOZOIC SEDIMENTARY ROCKS

Cretaceous

Cretaceous sedimentary formations are the only known Mesozoic rocks. The principal known area occupied by them extends from Peel and Arctic Red Rivers through Norman Wells to eastern Great Bear Lake; other known areas are on Liard River, in the Horn Mountains northwest of Fort Providence, and on Hay River.

Recent studies of several thousand feet of Cretaceous formations in the Lower Mackenzie River area have identified Upper and Lower Cretaceous strata, but no generally accepted subdivision into formations has been attained (Hume and Link, 1945, pp. 5, 39; Stewart, 1945, pp. 3, 6-8, and 1948, p. 97). Hume and Link (1945, p. 5) have adopted a tentative, fourfold subdivision, which, in ascending order, is: Division A, of sandstone shale, and conglomerate, with Lower Cretaceous fossils in its upper sandstones; Division B, mainly shales, unfossiliferous; Division C, sandstones, shales, and coal, carrying Upper Cretaceous fauna; and Division D, grey, non-fossiliferous shales. The Cretaceous beds were deposited on an erosion surface that truncated the Upper Devonian, Imperial and Fort Creek formations, and the Middle Devonian limestones (Hume and Link, 1945, p. 39).

Cretaceous strata on Great Bear River are fossiliferous, almost horizontal shales and sandstones; and similar, non-fossiliferous beds outcrop here and there on Great Bear Lake (Bell, J. M., 1902, p. 25; 1903, p. 100).

More than 3,300 feet of Cretaceous strata are exposed in the Liard River area (Hage, 1945, pp. 19-23). The Lower Cretaceous, Fort St. John group, more than 2,250 feet thick, consists of crossbedded sandstones and shales. The Upper Cretaceous assemblage is composed of non-marine sandstone, shale, conglomerate, and coal, and marine dark grey shale. It has been divided into a lower, Fort Nelson formation, an intermediate, Kotaneelee formation, and an upper, unnamed formation. Structures in Lower and Upper Cretaceous strata appear to conform to, and merge with, those in the Palæozoic formations. The Cretaceous strata may rest on Upper Devonian beds in the Plains area southeast of Liard River (Whittaker, 1922, p. 54), and on Mississippian or Pennsylvanian formations in the folded Liard Range northwest of the river.

About 80 feet of Cretaceous, Mountain shales are exposed in a heavily drift-covered area near the top of Horn Mountain (Whittaker, 1922, p. 54). The beds are horizontal, and have not afforded diagnostic fossils.

Non-fossiliferous shales and interbedded soft sandstones are exposed on Hay River near the 60th parallel (Cameron, 1922a, p. 29). They probably overlie nearly horizontal Upper Devonian limestones, but the contact has not been seen.

CENOZOIC SEDIMENTARY ROCKS

Tertiary

The largest known area of Tertiary beds is on Mackenzie River near Fort Norman, where they consist of as much as 1,600 feet of poorly consolidated gravels, sands, and clays, with lignite (Hume and Link, 1945, p. 44). The beds contain Lower Eocene plants (Hume, 1922, p. 76), and are separated from the underlying Cretaceous beds by an angular unconformity (Hume, 1923, p. 60).

Upper Eocene or Oligocene, partly consolidated shales with lenses of limestone have been reported (O'Neill, 1924, p. 27) from Darnley Bay on the Arctic coast. The assemblage is more than 125 feet thick, and nearly horizontal.

Pleistocene and Recent

Unconsolidated deposits of Pleistocene or Recent age occur throughout the District of Mackenzie but, in general, have received only casual study. They vary greatly in thickness and character from place to place, and include till, sand, gravel, silt, clay, mud, peat, and soil. Within the Canadian Shield the deposits are thin and local near Yellowknife Bay, Beaulieu River, and south of Great Slave Lake; they obscure more bedrock in the area between Great Slave and Great Bear Lake; and they mantle still greater areas within the barren grounds to the northeast. Deep accumulations of unconsolidated materials probably cover most bedrock in the Interior Plains region adjacent to the Canadian Shield, within a wide area extending from Slave River and the north arm of Great Slave Lake to Fort Liard, and in other parts of Mackenzie River Valley. Except, perhaps, for Richardson Mountains and adjacent areas in the extreme northwest corner (Bostock, 1948, p. 37), and parts of Mackenzie and Selwyn Mountains (Bostock, 1948, pp. 19-28; Keele, 1910, p. 45), the District of Mackenzie was probably entirely covered by a Pleistocene ice-sheet. Ice, accumulating in one or more centres in the eastern part of the district, or farther east or southeast, flowed northerly and northwesterly to the Arctic coast and Great Bear Lake, and westerly and southwesterly across Great Slave Lake and adjacent regions; other widely divergent directions of flow have been recorded from a few places, as at Aylmer Lake (Lord, 1948). In Mackenzie River Valley it probably combined with ice from Mackenzie Mountains, and flowed northerly (Keele, 1910, p. 46). The resulting deposits are best known in the Canadian Shield region, where they comprise till, eskers, drumlins, and related accumulations. The eskers are particularly remarkable features. Available data (Flint, 1945) suggest that they fan northwesterly, westerly, and southwesterly from a centre near Dubawnt Lake; and that they may be most abundant within a belt extending northwesterly from this centre through upper Coppermine River. One esker is probably more than 300 miles long (Wilson, 1945, p. 152). Raised beaches and widespread deposits of clays and silts around and between Great Bear and Great Slave Lakes were formed in late Pleistocene or Recent time when these lakes were far more extensive than at present. Although some evidence indicates that the two lakes may have coalesced (Lord, 1942a, pp. 39-40) there is no evidence that marine deposits were formed. After the retreat of the ice-sheet from the Canadian Shield and vicinity, the sea encroached on a depressed land, as evidenced by raised marine beaches and other deposits. These lie, in places, more than 500 feet above present sea-level (Flint, 1945). They occur along the Arctic coast east of the Mackenzie River Delta, and probably extended far up Back and Thelon Rivers into the District of Mackenzie. Extensive, Recent deposits of sand, gravel, silt, and mud border Slave and Mackenzie Rivers, particularly in their delta areas.

MESOZOIC OR CENOZOIC INTRUSIONS

Granitic intrusions of Mesozoic or Cenozoic age are known only in Selwyn Mountains near Macmillan Pass, where stocks of granite, granodiorite, or allied rocks are of Upper Cretaceous or later age (Kindle, 1946, pp. 19-21). Elsewhere, these mountains, in Mackenzie district, are unexplored. However, prospectors have reported granitic rocks from near the sources of South Nahanni and Flat Rivers, 150 miles to the southeast.

STRUCTURE OF PALÆOZOIC, MESOZOIC, AND CENOZOIC STRATA

All formations within the Interior Plains are, so far as known, horizontal or gently inclined. Near the Canadian Shield, as previously mentioned, they dip away from the underlying, deeply eroded complex of Precambrian rocks.

Southwest of the Interior Plains lie the Cordillera, which, in the District of Mackenzie, comprise mainly, from southwest to northeast, Selwyn and Mackenzie Mountains, the Mackenzie Plain, and Franklin Mountains (Bostock, 1948). These are all arcuate features, convex to the northeast.

Little is known of the structure of Selwyn Mountains. They consist of folded, presumably mainly Palæozoic strata and, unlike Mackenzie Mountains to the east, contain granitic intrusions.

Mackenzie Mountains are characterized by broad, arcuate folds arranged *en échelon*. Faulting is subordinate to folding. Plateau areas are striking features; the strata in some, as in the Plains of Abraham on the Canol Road, are very gently folded, but little information is available on the structure of others. Mackenzie Mountains, unlike the Rocky Mountains to the south, have no belt of foothills on their eastern front (Hume and Link, 1945, p. 5).

Franklin Mountains comprise four *en échelon* ranges, some of arcuate form. The southern Nahanni Range (Bostock, 1948) extends north from Nahanni Butte on Liard River. Near the south end of the range the eastern ridge is a large fault block that has been thrust upward along a west-dipping fault (Hage, 1945, p. 27). West of this ridge are lower, parallel, anticlinal ridges. As already mentioned, these folds appear to have involved Palæozoic and Cretaceous strata to about the same degree. At its north end, near the mouth of North Nahanni River, Nahanni Range ends in the Mackenzie Plain.

Camsell Range trends north, and its south end lies west of the north end of Nahanni Range. It is probably composed mainly of westerly dipping, Middle Devonian and older strata bordered on the east by a westerly dipping thrust fault (Bostock, 1948, p. 16; Hume and Link, 1945, p. 45). The range ends before reaching the southwest side of Mackenzie River near Wrigley.

East of the north end of Camsell Range, and east of Mackenzie River, is the south end of the McConnell Range. This range trends northwesterly parallel with the river and, at its south end, is a southerly plunging anticline. Northwesterly, the structure becomes more complex, and faults are known (Hume and Link, 1945, p. 46). North of Great Bear River, the range bends from about north-northwest to west-northwest to adjoin the northeast side of Norman Range.

Norman Range, the northwestern member of Franklin Mountains, is an anticlinal structure (Stewart, 1948, p. 100) slightly convex toward the northeast. It ends in the Mackenzie Plain at Mackenzie River upstream from Fort Good Hope.

The Mackenzie Plain north of Wrigley and south of Fort Good Hope is a basin between Mackenzie Mountains on the west and Franklin Mountains on the east. In it are many gentle folds and minor faults (Hume and Link, 1945, p. 46). In the Norman Wells area the basin is broken into northwesterly trending, gently arcuate, anticlinal ridges with small faults. The folds are about parallel with Norman Range to the northeast across Mackenzie River or, in some instances, may be extensions of the folds of that range. The ridges expose mainly Palæozic formations, and between the ridges are basins of mainly Cretaceous, but including some Tertiary, strata. As previously mentioned the Palæozoic and Cretaceous were folded before the Tertiary beds were deposited (Hume, 1923, p. 60).

CHAPTER IV

ECONOMIC GEOLOGY

GENERAL STATEMENT

The District of Mackenzie has produced copper, gold, lead, radium, silver, tungsten, and uranium from lode deposits; and petroleum and natural gas. No commercial placer deposits are known. Products recovered during 1948 came from five gold mines at or near Yellowknife (Con and Rycon, Giant, Negus, and Thompson-Lundmark mines), a uranium-radium mine on Great Bear Lake (Eldorado mine), and oil wells at Norman Wells on Mackenzie River.

The eastern part of the district is underlain by Precambrian rocks of the Canadian Shield, and has afforded all production except oil and gas. It contains deposits of beryllium, copper, gold, lead and zinc, lithium, silver, tantalum and columbium, tin, tungsten, uranium and radium, and other materials. Although only a very small part of it has been thoroughly explored, it has, nevertheless, been more extensively prospected than the western part of the district, and contains nearly all the known mineral properties (*See* Figure 3). Gold has been most sought for, and gold properties are most numerous. In 1948 and 1949, several advanced gold prospects were under development or were dormant, but perhaps most prospecting effort was directed towards a search for deposits of copper, lead, zinc, and uranium.

The western part of the district is underlain by Palæozoic and younger sedimentary rocks. It contains coal, gypsum, petroleum and natural gas, and salt, but only a few known deposits of metallic minerals.

DEPOSITS OF METALLIC MINERALS

Arsenic and Antimony

Orebodies of the Akaitcho (71)[1], Con and Rycon (73), Crestaurum (74), Giant (76), and Negus (80) properties in the Yellowknife Bay greenstone belt probably contain not more than 10 per cent metallic minerals, mainly pyrite and arsenopyrite but in part antimonial minerals such as stibnite and jamesonite. Analyses of samples received by the Bureau of Mines, Ottawa, for metallurgical tests suggest that the arsenic content ranges from 0·4 to 3·3 per cent, the antimony content up to 0·8 per cent. Current (1949) and projected treatment of these ores involves roasting of flotation concentrates containing most of the metallic minerals, but no provision has been made for recovery of arsenic or antimony.

Beryllium

Beryllium, as the mineral beryl, is common within Yellowknife and Beaulieu River areas and has been found in the Lac de Gras and Aylmer Lake areas, as far as 210 miles northeast of Yellowknife. Beryl occurs

[1] Numbers, in parentheses, are those of mineral properties shown on Figure 3.

as scattered crystals in pegmatite bodies associated with muscovite-biotite granite, and is commonly accompanied by such minerals as spodumene, cassiterite, and tantalite-columbite. No commercial deposits are known. Near Blaisdell Lake (92) the beryl-bearing dykes are up to 2,000 feet long and 10 feet wide; and 240 feet of the best dyke contains about 1·5 per cent beryl across 7 feet. The crystals average more than an inch across and several inches long, and in one instance the basal section of two intergrown beryl crystals measured 12 by 18 inches.

Bismuth

Small quantities of native bismuth occur in the uranium-radium ore at Eldorado mine (13), with native silver on the property of Camsell River Silver Mines, Limited (20), and with gold on the Mindot group (91) 53 miles northeast of Yellowknife.

Cobalt and Nickel

Cobalt and nickel minerals, such as safflorite-rammelsbergite, smaltite-chloanthite, cobaltite, and niccolite, characterize many of the uranium and silver deposits of the Great Bear Lake area; and about 20 tons of cobbed cobalt ore were recovered at Eldorado mine (13) during 1937 and 1938. Other, minor occurrences of cobalt and nickel arsenides occur near the north shore of Great Slave Lake, on the B.M. group (129) and at François River (128). At the latter place, veins with a maximum width of 15 inches, containing niccolite and other minerals, cut augite diorite.

Copper

Recorded copper production to the end of 1948 amounted to 237,541 pounds, valued at $24,102. This came partly from the gold-tungsten property of Philmore Yellowknife Gold Mines, Limited (137), on Great Slave Lake, and partly from the uranium-radium deposits of Eldorado mine (13).

Deposits in which copper minerals predominate occur on Great Bear Lake near Hunter Bay, near Coppermine River and the Dismal Lakes, on Bathurst Inlet at the Arctic coast, and in the east arm of Great Slave Lake. None is known to be of commercial value. They may be classified as follows and examples given:

(a) Copper sulphides in large ('giant') quartz veins: B group (2); Consolidated Mining and Smelting Company group, Hunter Bay (8); Polaris, Vega, and Star claims (9).

(b) Native copper or copper sulphides in basaltic lavas of the Coppermine River series: A group (1); American Metal Company of Canada, Limited (3); copper deposits of Bathurst Inlet (6); D group (4).

(c) Other copper deposits: Great Slave Lake, miscellaneous mineral occurrences (131).

A little bornite, chalcopyrite, and chalcocite occur in 'giant' quartz veins near Hunter Bay and the Dismal Lakes. Some of these veins are several hundred feet wide. The quartz commonly exhibits crustiform and banded structures, and may be of more than one age. Copper deposits are common in the basaltic lavas of the Coppermine River series near Coppermine River, the Dismal Lakes, and Bathurst Inlet, and probably elsewhere.

They include: (1) native copper in minute flakes in massive basalt; (2) native copper in amygdules; (3) native copper as sheets, some as much as $\frac{1}{8}$ inch thick, in cracks in basalt; and (4) bornite, chalcocite, covellite, and chalcopyrite, with a quartz and carbonate gangue, in shear and fracture zones that traverse basalt. The last type is regarded as most promising. Little information is available on the copper deposits of the east arm of Great Slave Lake. Some are veinlets or stock-works of veinlets, of quartz and carbonate carrying a little chalcopyrite. Veinlets of quartz and carbonate with a few grains of bornite have been noted in diabase.

Copper, Lead, and Zinc

Some base metal deposits contain sulphides of copper, lead, and zinc in more or less equal amounts; these deposits are referred to here. Others, containing lead or zinc, or both, without significant copper, are referred to under 'Lead and Zinc' (p. 56).

Chalcopyrite, galena, and sphalerite have replaced parts of shear zones in lava flows and associated rocks on the Homer (79) and nearby properties 12 miles north of Yellowknife. These deposits contain a little silver. Indium was detected in a spectroscopic examination of a sample of sphalerite, galena, and pyrite from the Homer group.

About 50 miles east-northeast of Yellowknife a granitic intrusion forms a salient projecting southerly into volcanic and sedimentary rocks of the Yellowknife group. An unknown proportion of the salient is muscovite-biotite granite with much pegmatite. Within a belt about 50 miles long and 5 miles wide extending around the end of this salient from Ross Lake to Turnback Lake, are scattered gossans. Some of these, as on the Bobjo (104), Ruth (106), and X.L. claims (110), mark deposits of galena, sphalerite, chalcopyrite, and other minerals that have replaced calcareous or tuffaceous layers in sedimentary strata at or near their contact with volcanic rocks. So far as known, these deposits contain little gold or silver. None is known to be of commercial value, although the deposits on the X.L. group occur here and there for a distance of 1,900 feet.

Gold (Placer)

Placer gold deposits of unknown size and grade are reported from the mountainous South Nahanni River area (134). Others might occur at other places in Selwyn Mountains or adjacent areas, but none is known or likely to exist within the Canadian Shield.

Gold (Lode)

Gold recovered to December 31, 1948, or during the first 11 years of nearly continuous production, amounted to more than 500,000 ounces, valued at nearly $21,000,000. This was about 68 per cent of the value of all mineral products of Northwest Territories to that date, except for pitchblende products of recent years. About 83 per cent of this gold came from Con and Rycon (73) and Negus (80) mines at Yellowknife, and these, with the nearby Giant mine (76), constitute the current (1949) producers. During 1948 these mines treated about 680 tons of ore a day; the grade of this ore was between 0·5 and 1 ounce a ton. Former gold producers, idle in mid-1949, include Philmore (137), Ptarmigan (82), Ruth (121), and Thompson-Lundmark (103). Nearly all known gold deposits occur north of Great Slave Lake and east of a line extending north-northeast from the north arm of the lake through Basler, Mattberry, Norris, and Arseno Lakes, and thence northeast to Redrock Lake on Coppermine River. Nearly all occur within sedimentary and volcanic rocks of the Archæan, Yellowknife group. Most of them are auriferous quartz veins or quartz bodies associated with a little schist or other altered wall-rock, and in most instances contain not more than about 1 per cent of such minerals as pyrite, galena, sphalerite, chalcopyrite, and arsenopyrite. Visible gold is common. Some very large deposits in the vicinity of Yellowknife are characterized by several per cent metallic minerals, including much arsenopyrite and pyrite, small amounts of lead, copper, and iron sulpharsenides and sulphantimonides, and tellurides. Many gold deposits contain a little tourmaline and are probably genetically related to muscovite-biotite granite of Archæan or Proterozoic age. Most gold deposits do not contain important quantities of other valuable metals, except silver. However, gold is accompanied by much tungsten and copper at the Philmore mine; and many quartz veins, important because of their gold content, contain a little scheelite, whereas others, primarily scheelite deposits, contain a little gold. Although known gold deposits are most numerous in areas underlain by sedimentary members of the Yellowknife group, the largest and most productive orebodies have been found in volcanic rocks of that group. These have been developed by mine workings to a depth of 1,775 feet (1948), and undoubtedly extend to greater depths. This far exceeds the depth of developed ore in sedimentary areas.

Most known gold deposits belong to one of the following classes:

Classification of Lode Gold Deposits of the District of Mackenzie

Quartz veins or bodies mainly of quartz

- In Archæan, Yellowknife or Point Lake-Wilson Island groups
  - In volcanic rocks
    - In shear zones transecting andesitic lava flows
      Examples[1]: Akaitcho Yellowknife Gold Mines, Limited (71); Con mine (73), Con system of shear zones; Crestaurum Mines, Limited (74); Giant Yellowknife Gold Mines, Limited (76); Negus Mines Limited (80), in part; North Inca Gold Mines, Limited (37), A zone; Rycon mine (73), in part.
    - In shear zones involving inter-flow tuffs
      Example: Sunset Yellowknife Mines, Limited (109).
    - In joints in andesitic lava flows
      Examples: Mindot group (91); Snowden Yellowknife Mines, Limited (43).
    - In acidic lava flows and pyroclastic rocks
      Example: Salmita Northwest Mines, Limited (46), T vein.

[1] Properties with double underline are present or former gold producers; those with single underline have not produced gold but report substantial deposits of ore grade or near ore grade.

In sedimentary rocks
Transecting beds, in shear zones
Examples: J.E.S. group (58); Rich group, Yellowknife Mines, Limited (83); Slemon Yellowknife Mines, Limited (50), No. 1 vein.

Transecting beds, walls not sheared
Examples: J.F. group (88); Old Parr group (93), Galena vein; Ptarmigan mine (82).

Parallel to beds, in shear zones
Examples: Camlaren Mines, Limited (64), Hump vein; D.A.F. group (89); Philmore mine (137); T.A. group (126); Thompson-Lundmark mine (103).

Parallel to beds, walls not sheared
Examples: Beaulieu Yellowknife Mines, Limited (112); Old Parr group (93), several veins; Ruth mine (121).

Along axial parts of folds
Examples: Camlaren Mines, Limited (64), No. 31 vein; Pan group (86), in part.

In crests or troughs of folds
Examples: Camlaren Mines, Limited (64), "hump" of Hump vein; Pan group (86), in part; S.D.C. group (100).

Along or near contacts
Between sedimentary and volcanic rocks
Examples: Diversified Mining Interests (Canada), Limited (34); Jeja No. 2 claim (47); Lexindin Gold Mines, Limited (35); North Inca Gold Mines Limited (37), Main zone; Salmita Northwest Mines, Limited (46), B and South veins.

Between other types of rocks
Examples: Con mine (73), in part; Mon group (67); Negus mine (80), in part; Rycon mine (73), in part.

In Proterozoic, sedimentary rocks
Minor reported occurrences.

In dykes and sills of various ages
Examples: Baltic group (108); Colomac Yellowknife Mines, Limited (28); Ena group (124); Goldcrest Mines, Limited (27); Indian Lake Gold Mines, Limited (28); Viking Yellowknife Gold Mines, Limited (57).

Bodies of mineralized rock
In Archæan, Yellowknife group
In volcanic rocks (tuffs)
Examples: Andrew Yellowknife Mines, Limited (53); Spinet Gold Mines, Limited (26), North orebody; Snare River Exploration Company, Limited (51).

In sedimentary rocks
Example: Spinet Gold Mines, Limited (26), South orebody.

In Proterozoic, Snare group sedimentary rocks
Example: Doris Yellowknife Gold Mines, Limited (25).

Quartz Veins in Archæan Volcanic Rocks

Quartz veins, or bodies mainly of quartz, within shear zones crossing andesitic lavas (greenstones) of the Yellowknife group have afforded most gold recovered to date (1949), and contain by far the greatest known reserves of gold ore. Nearly all current production (Con and Rycon, Giant, and Negus mines) is from orebodies of this class. Ore deposits at these mines may be divided into two, perhaps intergrading, types. Ore deposits of the first type are best exposed at Rycon and Negus mines, where they afforded all gold produced at these mines prior to 1948. They are well defined, small veins of nearly pure quartz in steeply inclined narrow shear zones. The shear zones transect lava flows, or occur along the borders of meta-gabbro and meta-diorite dykes that intersect the lava flows. The shear zones range up to thousands of feet in length; their maximum width is about 30 feet, their average width probably less than 5 feet. One has been opened to a depth of 1,425 feet. The quartz veins, which occur here and there in the shear zones, are as much as 400 feet long and about 12 feet wide; but they probably average less than 3 feet in width. The quartz is light to dark grey, mottled, or banded parallel with the walls. The largest ore shoot extended from the surface to the 950-foot level, with an average drift length between 100 and 200 feet, and an average width between 2 and 7 feet. The average width of all known ore shoots probably does not exceed 2½ feet. Many contain more than an ounce of gold a ton. Metallic minerals, constituting not more than 1 per cent of the veins, include pyrite and much less arsenopyrite, sphalerite, gelena, chalcopyrite, sulphantimonides, sulpharsenides, tellurides, and visible gold.

The second type of ore deposits found within shear zones crossing andesitic lavas of the Yellowknife group is represented by those that occur within the Con and Giant-Campbell systems of shear zones. These deposits contain the largest known reserves of gold ore in Northwest Territories. The first mentioned, smallest, and most completely explored of these systems crosses the Con property and has afforded most of the gold produced at that mine. It is more than 6,500 feet long, dips northwesterly, and marks the position of a thrust fault. Its productive part comprises several connected shear zones and enclosed masses of unsheared rock. The average width of the system may be 50 feet; its maximum width exceeds 200 feet. The orebodies attain a maximum drift length of 400 feet or more, and widths up to 40 feet; and they and the enclosing shear zones have been explored by mine workings to a depth of 1,400 feet. The Giant-Campbell system crosses the Negus, Con and Rycon, and Giant properties, but, between the latter two, is offset more than 3 miles by the West Bay fault. Although the system has not been extensively explored by the Negus and Con and Rycon mines, it has been opened at various places between the 1,425-foot (Negus) and 2,300-foot (Con) levels, and is (1949) supplying essentially all ore treated at Negus mine. This part of the system dips about 45 degrees northwesterly and may be as much as 600 feet wide. At the Giant mine it has a length of at least 12,000 feet and a horizontal width of perhaps 1,000 feet. It consists of several member shear zones of northerly or northeasterly trends, and various dips. These member shear zones have lengths ranging up to 3,800 feet or more, and widths up to perhaps more than 150 feet. The intervening rock is unsheared. Insufficient work has been done to establish the relations of the member shear zones to one another, or to determine the dip of the system on the Giant property. It has been suggested[1] that the Giant-Campbell system of shear zones marks a zone of major faulting. Shear zones and material of ore grade at the Giant property have been encountered in drill-holes to a depth of 770 feet. Orebodies range from 3½ to about 50 feet wide,

[1] Henderson, J. F.: personal communication, 1949.

and have a maximum drift length of 1,200 feet. Diamond drilling to January 1946, to a maximum depth of 770 feet, indicated 3,035,000 tons containing 0·41 ounce gold a ton; and underground work in part of this drilled area, to May 31, 1948, indicated 520,000 tons above the 250-foot level containing 0·60 ounce gold a ton. The ore deposits occur here and there within the members of the Con and Giant-Campbell systems. They are large, lenticular masses of fine-grained quartz with numerous partings of sericite schist, and are separated from the chlorite schist of the unmineralized parts of the zones by envelopes of sericite schist. Quartz comprises 30 to 90 per cent of the orebodies, metallic minerals perhaps 1 to 7 per cent. The latter are mainly arsenopyrite and pyrite, but include a little sphalerite, galena, chalcopyrite, stibnite, jamesonite, other sulphantimonides or sulpharsenides, and finely divided gold.

Sulphide minerals, with or without gold, commonly occur in shear zones following bands of weak tuffs lying between more competent greenstones. A little underground work has been done on one of these deposits by Sunset Yellowknife Mines, Limited, where a shear zone 1 foot to 20 feet in width involves an interflow tuff band several feet thick. Bodies of massive pyrite, associated with a little quartz, occur here and there across 2 or 3 feet of the shear zone. These bodies contain considerable gold in places, but no ore.

Rare, small, in part high-grade gold-bearing quartz veins occur in joints in andesitic lavas, as on the Mindot group (91). The walls are not sheared. The enclosing fracture may continue many feet beyond the end of a vein or may be only a little longer than the vein. Veins of this class may attain a maximum width of a foot or so, and a length of more than 100 feet; but the presence or position of other similar veins nearby cannot ordinarily be predicted.

Gold-bearing quartz veins are not known to be numerous within acidic volcanic rocks. Nevertheless, the T vein on the property of Salmita Northwest Mines, Limited, occurs within sheared, probably rhyolitic agglomerate. The vein is about 125 feet long and 1 foot wide at the surface and contains abundant visible gold with a very little arsenopyrite, pyrite, and tourmaline.

Quartz Veins in Archæan Sedimentary Rocks

Sedimentary strata of the Yellowknife group contain a host of quartz veins, many of them gold bearing. A few of these occupy shear zones, in some instances faults, that cross the bedding at wide angles; and some members of this class contain small bodies of high-grade auriferous quartz. Thus, 163 feet of No. 1 vein on the property of Slemon Yellowknife Mines, Limited, averages 2·2 feet wide and contains 0·65 ounce gold a ton; and 16 tons shipped from the Rich group Yellowknife property yielded 13·6 ounces of gold a ton.

A few other veins of nearly pure quartz that cross the Yellowknife strata at wide angles have unsheared walls. One of these contains the orebodies of the Ptarmigan mine. This vein is exposed for 1,300 feet at the surface where it averages 12 feet in width. It strikes north 65 degrees west and is nearly vertical, whereas the adjacent beds strike north 10 degrees west and dip easterly at 65 to 75 degrees. The vein is a continuous body of quartz, but includes a little wall-rock. Metallic minerals probably constitute less than 1 per cent of the vein, and include pyrite, sphalerite, galena, arsenopyrite, chalcopyrite, pyrrhotite, and visible gold; these are associated with a little feldspar, carbonate, tourmaline, and scheelite. The vein was explored by drifts to a depth of 900 feet and contains highly irregular ore shoots not readily distinguished from adjacent low grade quartz. Nearly 12,000 ounces of gold were recovered from 24,429 tons of ore treated.

Veins parallel, or nearly parallel, with the enclosing strata, and bordered by sheared rock, have afforded most gold ore recovered from Archæan sedimentary formations. This class includes veins of the Thompson-Lundmark mine, in Yellowknife strata, and the Philmore mine, in formations of the Wilson Island phase of the Point Lake-Wilson Island group. The Fraser vein and the Kim vein-zone were mined at the now (1949) idle Thompson-Lundmark property. The Fraser vein dips 45 degrees northeast. Its drift length to an explored slope depth of 750 feet averaged about 560 feet, and its width 1·7 feet. The quartz vein matter was well banded parallel with the walls, and contained a little pyrite, galena, gold, and tourmaline. Most of the gold occurred in an orebody now removed, with a maximum drift-length of 435 feet, a dip-length of about 700 feet, and an average width of about 2 feet. Above the 600-foot level, this deposit afforded 73,215 tons of ore containing 0·66 ounce of gold a ton. The Kim vein-zone is at least 1,750 feet long, and dips about 45 degrees northeast. At the surface it averages 6½ feet in width for a length of 1,500 feet and contains about 25 per cent quartz, commonly as three veins each of which is nearly free of included rock. The quartz is ribboned parallel with the walls and contains a little pyrite, galena, sphalerite, chalcopyrite, visible gold, and tourmaline. To December 31, 1947, the vein had been opened by drifts to a slope depth of 600 feet. These workings disclosed a maximum drift-length of about 300 feet and an average aggregate width of about 2 feet of quartz. Some or all of this material has since been extracted (1949).

Gold is associated with ferberite (a tungsten mineral), chalcopyrite, pyrite, and other minerals at the Philmore mine on Outpost Islands in Great Slave Lake. The gold-tungsten deposits occupy parts of nearly vertical silicified shear zones that lie parallel, or nearly parallel, with the enclosing quartz-mica schist and gneiss. Ore extracted probably averaged between 0·60 and 0·75 per cent WO_3, and between 0·5 and 1·0 ounce gold a ton. It came from an orebody that extended from the surface to below the 425-foot level, and had a maximum drift-length of more than 250 feet, and an average width of about 2 feet.

Numerous veins with unsheared walls parallel the enclosing strata. Many are remarkably persistent, although the width of most does not exceed a few inches. They commonly occur within the slaty upper part of a bed or lie between a slaty top of a bed and the greywacke base of the adjoining bed. Many are minutely crenulated or drag-folded, others nearly straight. Some veins of this type contain small pockets of high-grade or even spectacularly rich gold-bearing quartz, but only at the Ruth mine is this class of vein known to contain ore. No. 2 vein at this property occurs within a band of thin-bedded slate that is enclosed by thick-bedded greywacke. The vein is exposed for 1,250 feet, and averages 15 inches in width.

The walls are sharp, but not sheared, and nearly straight. The quartz contains thin partings of slate or altered slate, and a little arsenopyrite, pyrite, scheelite, feldspar, and gold. Three hundred feet of the vein, where it bends slightly, averages 0·62 foot in width and contains about 3 ounces of gold a ton. The Norman vein, owned by Beaulieu Yellowknife Mines, Limited, may be 1,800 feet long, yet its width averages 6 inches or less. It is composed of drag-folded, fractured, grey quartz that precisely parallels the enclosing similarly folded slate layer. The quartz contains inclusions of slate, a little scheelite, and less than 1 per cent pyrite and other metallic minerals. At the surface, near where the vein and beds bend around the axial part of a sharp fold, 8 feet of the vein averages 16 inches in width and contains considerable gold.

Highly irregular, discontinuous, sparsely mineralized quartz veins are common here and there along the ruptured axial parts of tight isoclinal folds. Many of these folds can be traced for long distances. Veins of this class are particularly well displayed in the vicinity of Gordon Lake where some, such as the '31' vein of Camlaren Mines, Limited, contain small, spectacularly rich occurrences of coarse gold. None is known to contain an orebody.

Other deposits of gold-bearing quartz in Archæan, sedimentary formations are saddle reefs or more irregularly shaped deposits that occupy crests or troughs of steeply plunging folds. For instance, the 'hump' of the Hump vein of Camlaren Mines, Limited, is a saddle-shaped quartz body that straddles the axis of an anticline and plunges about 50 degrees northeasterly with the plunge of the fold. The saddle continues to the 350-foot level without any indication of ending. It is in a slaty band enclosed by stronger greywacke. During folding the slaty rocks were crumpled and thickened as they were bent around the axis, and thereby created the favourable zone in which the quartz was deposited. The quartz is coarsely crystalline and white, and contains pyrite, chalcopyrite, galena, sphalerite, and abundant finely divided gold. A less regular body of quartz has been introduced along a faulted, nearly vertically plunging drag-fold on the S.D.C. group. It contains considerable gold, but it is not ore. The quartz outcrop has a length of about 200 feet, and a maximum width of about 40 feet. The central part is entirely quartz, but at either end and along the margins it contains much wall-rock. The quartz is mineralized with arsenopyrite, pyrrhotite, galena, pyrite, chalcopyrite, and sphalerite, and in places these minerals are abundant. It also contains a little feldspar and visible gold.

Quartz Veins along or near Contacts between Archæan Rocks

Quartz veins, some of considerable promise, occur in Archæan rocks along or near contacts between (a) sedimentary and volcanic rocks, or (b) other types of rocks. Examples of the first class, explored by much diamond drilling but otherwise mainly unexposed, are the quartz bodies of the Main zone of North Inca Gold Mines, Limited, No. 1 zone of Diversified Mining Interests (Canada), Limited, and No. 1 zone of Lexindin Gold Mines, Limited. These zones are quartz-vein stock-works, probably parts of a major, wide, steeply inclined schistose structure that lies within Yellowknife sedimentary strata 10 to 350 feet east of volcanic rocks of that group. Only parts of this structure have been explored but substantial deposits of about ore grade, comprising mineralized quartz and associated schist, have been found here and there along it for a length of about 2 miles. Another deposit of this class is (1949) being explored on Jeja No. 2 claim by Bulldog Yellowknife Gold Mines, Limited. Here, a single quartz vein more than 1,000 feet long and 2 or 3 feet wide lies within sedimentary formations of the Yellowknife group a few feet east of volcanic rocks. Surface sampling in 1948 indicated five ore shoots with a total length of 242·5 feet, an average width of 3·12 feet, and an uncut grade of 1·79 ounces of gold a ton.

Ore-bearing quartz veins on or near contacts between other types of rocks occur, as previously mentioned, in shear zone faults that commonly follow the borders of meta-gabbro and meta-diorite dykes at Con, Rycon, and Negus mines.

Quartz Veins in Proterozoic Sedimentary Rocks

A few gold-bearing quartz veins have been reported from Proterozoic sedimentary rocks, but none has been seen by the writer[1].

Quartz Veins in Dykes and Sills of Various Ages

Stock-works of gold-bearing quartz veins occupy parts of several dykes and sills of acidic or intermediate composition. The quartz bodies are generally small, irregular, and erratically distributed, and occupy only a small part of the intrusions. Several of the intrusions, some of which are large, have been explored with the object of outlining large bodies of relatively low-grade gold ore that would consist of barren dyke or sill rock enriched by a little gold-bearing quartz. The most extensively explored deposit of this class is on the adjoining properties of Colomac Yellowknife Mines, Limited, and Indian Lake Gold Mines, Limited, near Indin Lake. A steeply inclined quartz-albite dyke, 110 feet wide, has been traced more than 20,000 feet. Fractures, which form a complex system within the dyke, are occupied here and there by glassy white quartz veins that range from thin seams to veins 2 or 3 feet wide. The quartz contains a little pyrite, pyrrhotite, arsenopyrite, sphalerite, visible gold, and tourmaline. Underground work on one level, undertaken jointly by these companies, indicated an average grade of about 0·08 ounce of gold a ton to each vertical foot of 21,000 tons.

Bodies of Mineralized Archæan Volcanic Rocks

In a few instances, considerable gold has been found in tabular bodies of mineralized rock, and, so far as known, the gold is by no means confined to the associated minor vein quartz. Several of these occurrences are in bands of highly altered tuffs or tuffaceous sediments between sedimentary strata of the Yellowknife group; and the best exposed example of this class is on the property of Andrew Yellowknife Mines, Limited, 68 miles northwest of Yellowknife. No. 2 zone on this property is exposed for 1,600 feet, averages about 10 feet in width, and dips 70 degrees northeast parallel with the enclosing biotite hornfels and impure quartzites. Granitic rocks outcrop 1,400 feet northeast of the zone. The rock within the zone, which

[1] A gold deposit in Proterozoic sedimentary rocks, owned by Doris Yellowknife Gold Mines, Limited, is classified below (*See* page 56).

weathers rusty, is mainly fine-grained, well-bedded, dark green or black amphibolite, some of which contains much fine-grained pyrite as lenticles and scattered grains. Here and there a little glassy quartz, without significant amounts of metallic minerals, forms veinlets or irregular masses within the pyritized amphibolite. Some, but not all, of the bodies of pyritic amphibolite and minor quartz carry gold, and the gold content is not known to be related to the amount of quartz present. Assays of samples taken at the surface for a length of 350 feet of the zone indicate an average content of 0·15 ounce gold a ton across a width of about 6 feet.

Bodies of Mineralized Archæan Sedimentary Rocks

The South zone of Spinet Gold Mines, Limited, 145 miles north-northwest of Yellowknife, is the sole example of this class known to the writer. Inasmuch as it does not outcrop, and has been explored only by diamond drill-holes, its classification and description are subject to revision. It strikes about east, is steeply inclined, and lies within schistose strata of the Yellowknife group, 10 to 50 feet south of a parallel, tabular, felsitic body that may be a sill or an extrusive rock. Recrystallized andesitic tuffs and lava flows outcrop north of the felsite. The zone comprises schistose greywacke and quartz-mica schist, mineralized with a little pyrite, pyrrhotite, and visible gold. So far as known, it is not much different from adjacent, nearly barren rock, and the gold-bearing parts are best identified by assays. Drilling is reported to have indicated an ore shoot 325 feet long and 3 feet wide, containing 0·61 ounce gold a ton (cut grade).

Bodies of Mineralized Proterozoic Sedimentary Rocks

A gold-bearing zone in Snare group slates 145 miles north-northwest of Yellowknife has been drilled by Doris Yellowknife Gold Mines, Limited. The zone is composed of rusty, slabby, locally contorted slates cut by a few seams and lenses of quartz generally not more than a few inches wide, and is not sharply separated from adjacent less rusty slates. It is about parallel with the cleavage of the enclosed and adjacent slates, and is at least 670 feet long and about 20 feet wide. Galena, sphalerite, pyrite, arsenopyrite, and chalcopyrite are abundant here and there in quartz and slate. It is reported that, to a depth of 300 feet, 81,000 tons contain 0·228 ounce gold a ton.

Iron

Sedimentary iron deposits containing specularite and oolitic hematite occur in Precambrian strata on Iron Islands (136) and Utsingi Point (130) in Great Slave Lake. A bed of hematite 20 feet thick is interstratified with Silurian rocks about 20 miles east of Wrigley on Mackenzie River (Kindle, 1920). None of these deposits is of present commercial value.

Lead and Zinc

Lead and zinc deposits, unaccompanied by important amounts of other metals, occur on the Arctic coast at Galena Point and Detention Harbour (5); near Indian Mountain Lake and O'Connor Lake, north and south, respectively, of the east arm of Great Slave Lake; and near Pine Point (139) on the south shore of that lake. The last is the only known important metalliferous deposit in Palæozoic strata; the other lead and zinc deposits are in Precambrian rocks. Available reports indicate that the most promising of the Arctic coast deposits is at Detention Harbour. Those near Indian Mountain and O'Connor Lakes were staked late in 1947 and in 1948, but have not (1949) been examined by the Geological Survey of Canada. Galena, sphalerite, and pyrite form replacement deposits in Devonian dolomite near Pine Point. Work done many years ago indicated that the dolomite beds are horizontal or gently inclined, and that the ore minerals occur as impregnations along favourable beds, or along vertical or inclined joints, or as cement to fragments of dolomite breccia. Results of recent (1948, 1949) extensive diamond drilling are not available for publication.

Lithium

Lithium minerals, chiefly spodumene and amblygonite, are widely distributed in pegmatites associated with muscovite-biotite granite. No significant quantities have been extracted. Most known occurrences are in the Yellowknife and Beaulieu River areas, but others have been found in the Lac de Gras and Aylmer Lake areas, as far as 210 miles northeast of Yellowknife. The lithium minerals are commonly associated with such minerals as beryl, cassiterite, and tantalite-columbite. The McDonald dyke on the Ramona claims of DeStaffany Tantalum Beryllium Mines, Limited (123), is perhaps the most promising known deposit. The outcrop of the dyke is nearly 400 feet long, its average width about 25 feet. The spodumene-bearing part of the dyke is about 400 feet long and 19 feet wide, and contains about 30 per cent spodumene by weight. The largest observed crystal face of spodumene measures 10·7 feet by 1 foot. About twenty other spodumene crystals approach these dimensions, and most of the mineral is in crystals more than a foot long.

Molybdenum

Molybdenite occurs in a porphyry dyke on the Arseno group (69), about 9½ miles north of the head of Yellowknife Bay.

Silver

Silver recovered to the end of 1948 amounted to 1,966,766 ounces, valued at $893,882. It was derived partly from the gold mines previously mentioned and partly from the uranium, radium, and native silver deposits of Great Bear Lake. The latter are referred to more fully on page 59. Current silver production comes mainly from the gold mines. Native silver occurs in a 6-inch quartz vein in gabbro on the Lil and Lilex groups (68) near Yellowknife.

Tantalum and Columbium

Tantalite-columbite is found in numerous pegmatite bodies in the Yellowknife and Beaulieu River areas and a few occurrences have been noted in the Lac de Gras and Aylmer Lake areas, as much as 240 miles northeast of Yellowknife. The pegmatite bodies are related to intrusions of muscovite-biotite granite. No deposit has attained sustained production, but small mills were erected on the properties of DeStaffany Tantalum

Beryllium Mines, Limited (127), Peg Tantalum Mines, Limited (97), and on Freda No. 1 claim (102). Although these mills operated for short periods at various times during 1946, 1947, and 1948, their combined output of tantalite-columbite concentrates during this 3-year period was probably less than 5 tons. The grades of these products are not known but, in part at least, were unsatisfactory. The Waco pegmatite sill on the property of Thompson-Lundmark Gold Mines, Limited (103), has not been sampled by the Geological Survey of Canada, but probably contains encouraging amounts of tantalite-columbite.

The tantalite-columbite is commonly associated with such minerals as beryl, cassiterite, and spodumene. Tantalite-columbite ($(Fe,Mn)O.(Ta,Cb)_2O_5$) is a mineral of widely varying composition. All gradations are possible from high-gravity ferrotantalite ($FeO.Ta_2O_5$) through mangantantalite ($MnO.Ta_2O_5$) and ferrocolumbite ($FeO.Cb_2O_5$) to relatively low-gravity mangancolumbite ($MnO.Cb_2O_5$). Thus, field tests of specific gravity may be used to indicate approximate composition. Furthermore, a high tantalum content is commonly characterized by blocky, purple-black crystals, whereas columbite-rich varieties are generally steel-grey and platy. Tantalite-columbite in District of Mackenzie ranges from almost pure tantalite, as in some specimens from the property of Peg Tantalum Mines, Limited, to columbite containing about 30 per cent tantalite, as at Prelude Lake (101). Tantalite-columbite occurs in grains up to 3 by $5\frac{1}{2}$ inches, but is erratically distributed even in the most promising deposits.

Thorium

Thorium-rich monazite occurs in slightly radioactive beach placers at Yamba Lake (44), 190 miles northeast of Yellowknife. The monazite was derived from a gneiss formed by the injection of a granite magma into sedimentary schists of the Yellowknife group.

Hematite-bearing dolomite of the Proterozoic, Great Slave group, at McLean Bay (133) in the east arm of Great Slave Lake, contains thorium and uranium. The radioactivity is readily detected with a field Geiger counter.

Tin

Probably the first tin found in Northwest Territories was identified in 1937 when 0·20 per cent was detected by the Bureau of Mines, Ottawa, in ore from the No. 1 shaft of what is now the property of Philmore Yellowknife Gold Mines, Limited (137). The tin-bearing mineral may be cassiterite. So far as known no tin has been recovered at this property.

Very small amounts of tin, at least some of which is associated with stibnite and other soft grey metallic minerals, occur in the gold-bearing quartz veins at Con and Rycon (73) and Negus (80) mines. None has been recovered, and the tin-bearing mineral has not been identified.

Most known tin deposits are pegmatite dykes or sills related to muscovite-biotite granite and containing cassiterite and other minerals such as tantalite-columbite, beryl, and spodumene. These deposits are common in the Yellowknife and Beaulieu River areas. The cassiterite occurs as about equidimensional aggregates up to about an inch across. It is brown-black, and closely resembles tantalite-columbite. No commercial deposits are known, but a little concentrate recovered from the Best Bet sill by DeStaffany Tantalum Beryllium Mines, Limited (127), contained 13·41 per cent tin.

Tungsten

The only recorded tungsten production was during 1941, 1942, and 1943, and the concentrates recovered during this period amounted to about 70·5 tons, valued at $37,674. These came almost entirely from the gold-tungsten-copper property then known as International Tungsten Mines, Limited, later Philmore Yellowknife Gold Mines, Limited (137). Inasmuch as the value of gold recovered far exceeded that of tungsten, this property has been classified and discussed as a gold mine. The average grade of the ore mined probably averaged between 0·60 and 0·75 per cent WO_3, and between 0·5 and 1·0 ounce gold a ton. The principal tungsten mineral is ferberite, but scheelite has been identified in concentrates.

Tungsten, as scheelite, occurs in a host of deposits in the Yellowknife and Beaulieu River areas. In a few instances basic dykes, granitic rocks, or limy beds of the Yellowknife group carry a little disseminated scheelite; but most of the mineral occurs in quartz veins. These veins are most widely distributed in sedimentary strata of the Yellowknife group, where they occur in much the same manner as quartz veins containing mainly gold; but others, as at Tibbitt Lake (107), are in altered gabbro dykes and sills.

Scheelite occurs in many gold-bearing veins, such as those of Con and Rycon (73), Negus (80), and Ruth (121) mines. Generally it is present in small amounts, but here and there forms shoots carrying 1 to 3 per cent WO_3. These scheelite-rich shoots are commonly low in gold.

Several quartz veins near Gilmour Lake, 45 miles east of Yellowknife, contain scheelite deposits grading between 1 and 2·5 per cent WO_3. The deposits range in length from 9 to 50 feet, and from about 1 foot to 4·5 feet in width. They have been found on the Dot and Eva claims (114), Storm group (119), and Arctic Circle Syndicate claims (111).

Titanium

Titaniferous magnetite bands, up to 5 feet wide, occur in basic intrusive rocks on François River, near the north shore of Great Slave Lake (Jolliffe, F.[A.W.], 1936, p. 8).

Uranium, Radium, and Silver

Uranium, radium, and silver deposits characterize an area that extends about 200 miles south-southeast from the east side of Great Bear Lake nearly to the north arm of Great Slave Lake. This area is further characterized by the lack of known, significant gold deposits. So far as known all consolidated rocks in this area are of Proterozoic age. Most of the deposits contain, in addition to uranium, radium, and silver, a variety of minerals containing cobalt, nickel, copper, and bismuth, in a gangue of quartz, manganiferous carbonates, and other minerals. Much of the silver occurs as the native metal. Banded, drusy comb quartz is common. Specularite is a common associate of the uranium and radium mineral, pitchblende. The only current (1949) producer, and the only property of known economic importance, is Eldorado uranium-radium mine (13). Former producers, which afforded only or mainly silver, are the Bonanza group (15) and the property of International Uranium Mining Company, Limited (18).

The uranium, radium, and silver deposits of this metallogenetic province may be grouped with examples, as follows:

(a) Uranium and radium deposits, some of which contain silver: Cormac group (22); Eldorado mine (13); Gold-Uranium Exploration, Limited (23); Thompson group (17); Workman Island (10).

(b) Silver deposits with minor uranium and radium: Bonanza group (15); Camsell River Silver Mines, Limited (20); Echo Bay group (14); International Uranium Mining Company, Limited (18).

The Eldorado mine has supplied almost all uranium and radium produced in Canada. The deposits occur as stock-works of veins in steeply inclined fault zones that cross sedimentary and porphyritic rocks of the Echo Bay group. These rocks have been reddened by the introduction of much hematite. The largest of the zones is up to 40 feet wide, more than 5,000 feet long, and has been the locus of extensive and repeated movements. The vein matter includes quartz, carbonates, hematite, chlorite, pitchblende, chalcopyrite, cobalt and nickel minerals, native bismuth and silver, argentite, galena, and pyrite. Silver was abundant at the surface, but is a minor constituent of the ore at depth. Wall-rocks are commonly altered to a dense red rock containing quartz, hematite, and other minerals. Most of the orebodies occur where the veins cut sedimentary rocks. They contain lenticular streaks of pitchblende, and have a maximum length of about 700 feet and a maximum vertical dimension of more than 600 feet.

The silver deposits have many features in common with the Eldorado deposit, but on a much smaller scale. Native silver is the principal ore mineral, and the hematitic wall-rock alteration is less marked or lacking. The veins of International Uranium Mining Company, Limited, which have afforded considerable silver and a little pitchblende, are in granodiorite.

DEPOSITS OF NON-METALLIC MATERIALS

Barite

Barite occurs on the east arm of Great Slave Lake (131) as veins up to 3 feet wide, and as parts of veinlets of quartz, chalcopyrite, and other minerals.

Clay

Late Pleistocene or Recent clays and silts (Lord, 1942a, pp. 39, 40) are widespread north of the north arm of Great Slave Lake near Russell and Slemon Lakes, and occur here and there at least as far north as Rebesca Lake and lower Wopmay River. They enclose a few sandy beds. The clays afforded about 43,000 cubic yards of impervious core material used in the Snare River dam of the Northwest Territories Power Commission.

Coal

Coal seams, generally of unknown size and quality, occur in Cretaceous and Tertiary strata. None has been mined. Coal of Cretaceous, or probable Cretaceous, age has been noted on Liard River (Hage, 1945, p. 30), in the Norman Wells area (Hume and Link, 1945, pp. 5, 39-44), and at

Etacho Point on the west shore of Great Bear Lake. The Liard River coal forms seams at least 20 inches thick, and some, at least, is of good bituminous rank. The coal at Etacho Point (7) is lignite, and may be of Tertiary age. Seams outcrop at intervals for 1½ miles, and the exposed width of one ranges from 12 to 17½ feet.

Seams of Tertiary (Eocene) lignite outcrop in many places in the Fort Norman area, where some are 8 to 10 feet thick (Hume and Link, 1945, p. 44).

Fluorite

At Bigspruce Lake on Snare River, abundant purple fluorite occurs in a small body of crystalline limestone intruded by nepheline syenite or related rocks (Lord, 1942a, p. 35).

Gems or Semi-precious Stones

Various minerals, some of them widespread, might, if found to be of suitable colour and quality, be of interest as gems or semi-precious stones. With minor exceptions, none has been extracted as such. All examples mentioned below are from Precambrian rocks. Pink or pale violet crystals of andalusite, up to several inches long, are not uncommon in pegmatite dykes or high temperature quartz veins cutting Yellowknife strata. Beryl is widespread in pegmatite dykes; it is green, white, light blue, or golden yellow. Dichroic cordierite, as crystals up to 4 inches long, occcurs in injection gneiss near Ghost Lake (52) and at other places to the east and southeast. Deep blue corundum (sapphire) is found as crystals up to half an inch across in pegmatitic quartz bodies at the Philmore mine (137). Richardson (1851, p. 312) reported jade (nephrite) from Rae River near the Arctic coast. Sodalite occurs in a stock of nepheline-sodalite syenite and related rocks at Bigspruce Lake on Snare River (Lord, 1942a, p. 34). Many pegmatite bodies contain tourmaline and, although most is black, blue-green and red varieties have been reported (Jolliffe, 1944a).

Gypsum and Anhydrite

Gypsum and anhydrite are common near Slave River, western Great Slave Lake, and in the Mackenzie River basin. They have been reported from Cambrian, Ordovician, Silurian, and Devonian (?) strata (*See* Correlation Chart and Table of Formations, page 30).

Mica

Honey-yellow to colourless muscovite mica is a prominent constituent of the numerous pegmatite dykes and sills associated with muscovite-biotite granite in the Yellowknife and Beaulieu River, and other areas. Many of these pegmatite bodies contain such minerals as beryl, cassiterite, tantalite-columbite, and spodumene. The mica occurs in books and prisms up to several inches across. None of the mica deposits is known to be of commercial value.

Nepheline Syenite

Nepheline syenite and related rocks outcrop at Bigspruce Lake on Snare River as an oval body about 5½ miles long (Lord, 1942a, pp. 34, 35).

Petroleum and Natural Gas

All petroleum and natural gas produced in Northwest Territories has come from the Norman Wells field on Mackenzie River. No other oil pools are known. Production to the end of 1948 amounted to 2,837,663 barrels of petroleum, valued at $3,148,877, and a little gas. The area within which other oil pools might occur extends about 800 miles north-northwest from Liard and Slave Rivers at the 60th parallel, to the mouth of Mackenzie River. Much of it is untested. The rocks within this area include several thousand feet of gently folded, mainly marine, Palæozoic strata; and in places these are overlain unconformably by Cretaceous and Tertiary formations. Bituminous beds occur in Middle and Upper Devonian formations, and petroleum seepages have been reported at various places from Liard River and Great Slave Lake, in the south, to Fort Good Hope in the north. Reservoir rocks include the cavernous, Middle Devonian Presqu'île dolomite in the Great Slave Lake area, and a reef limestone within Upper Devonian, Fort Creek shales in the Norman Wells field.

The Norman Wells field (16) has sixty-four productive wells, many now capped or plugged. All produce by natural flow, and production attained its maximum rate of about 4,300 barrels a day in 1944. Recoverable reserves in March 1945 were 36,250,000 barrels from a drainable area of 2,600 acres. The strata dip about 5 degrees southwest. The productive, Upper Devonian reef limestone thins and ends up the dip, thereby forming a stratigraphic trap to impound the oil. The top of the reef limestone is 1,000 to 2,000 feet below the surface.

Exploration outside the Norman Wells field, in the Mackenzie River basin, comprises nineteen test wells. The most southeasterly of these is about 100 miles from the proven field, the most northwesterly about 60 miles. With one exception these penetrated the entire thickness of the Fort Creek formation and all underlying formations thought likely to carry petroleum. None encountered oil (Stewart, 1947, p. 3).

The only other test holes are in the Great Slave Lake area. This area, being nearer the Canadian Shield, has been eroded to greater depths, with the result that less than 2,000 feet of Palæozoic strata remain, and the reservoir Presqu'île dolomite and older formations outcrop. A well was drilled at Windy Point, on the north shore of Great Slave Lake, in 1920 and 1921. It was spudded in on the crest of a broad anticline, near oil seepages in Presqu'île dolomite. The hole penetrated all underlying Palæozoic formations, but encountered no oil (Cameron, 1922, p. 16; Stewart, 1947, pp. 3, 4). Seven holes have been drilled near the south shore of the lake, most of them in 1946. These explored an anticline in Presqu'île dolomite at a depth of about 700 feet. Salt water and hydrogen sulphide gas were encountered, but no oil (Stewart, 1947, pp. 4-7).

Peat

Peat-like accumulations of mosses and other vegetable matter, some of which are 5 to 10 feet thick, occur here and there in the timbered areas of the Canadian Shield; but substantial deposits of this material are not known to occur within the barren grounds, where they would be of interest as a possible fuel.

Salt (Sodium Chloride)

Salt has been reported from Cambrian, Ordovician, and Silurian strata in the Mackenzie River and western Great Slave Lake areas (*See* Correlation Chart and Table of Formations, page 30). It is commonly associated with gypsum. None has been extracted.

Salt springs occur along the foot of an east-facing escarpment on Salt River west of Fort Smith. The brine is a saturated salt solution wherein the contained solids are almost entirely sodium chloride. About 4 tons of salt were formerly collected from these springs annually (Cameron, 1922, pp. 17, 42, 43).

A well drilled for oil at Windy Point on the north shore of Great Lake Slave penetrated four salt beds between depths of 1,070 and 1,380 feet. The total estimated thickness of these beds is about 60 feet. They are associated with gypsum, anhydrite, and red shale, possibly of Silurian age (Cameron, 1922, pp. 16, 43).

Sand and Gravel[1]

Deposits of sand and gravel, such as eskers and associated deposits, and raised beaches, are numerous in the Canadian Shield. They are commonly readily identifiable on air photographs.

[1] *See also* Pleistocene and Recent, page 43.

CHAPTER V

DESCRIPTION OF PROPERTIES

A Group (1)[1]

Reference[2]: Kidd, 1932b, p. 60.

The A group of claims lay about 20 miles north of the narrows between the Dismal Lakes and about 46 miles west-southwest of the mouth of Coppermine River. The claims have lapsed. A deposit on the A group $1\frac{1}{4}$ miles northwest of the workings on the adjacent B group (2), has been described by Kidd as follows:

> ....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.

Akaitcho Yellowknife Gold Mines, Limited (71)

(*See* Figure 4)

References: Bureau of Mines, 1937a. Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-J-9. Jolliffe, 1938, pp. 16-17; 1946. Lord, 1941a, pp. 94-95. Stephens, 1947a.

INTRODUCTION

Akaitcho Yellowknife Gold Mines, Limited, owns the A.E.S. group of twenty-four claims 4 miles north of Yellowknife. The property is bounded on the north by the Fox and Lynx claims of Lynx Yellowknife Gold Mines, Limited (78), on the east by the Goodwin claims of Atlas Yellowknife Mines, Limited, and on the south by the Giant claims of Giant Yellowknife Gold Mines, Limited (76). The Yellowknife substation of the Northwest Territories Power Commission is about $1\frac{1}{2}$ miles south of the Akaitcho property. A gravelled road connects the property with Yellowknife by way of the Giant mine. The writer examined the property in October 1947, and briefly in September 1948: the following account describes the property at about the latter date. C. E. Anderson is resident engineer and A. S. Dadson consulting geologist. As neither the main known orebodies nor enclosing shear zone outcrop, free use was made of diamond drill data and interpretations supplied by the Company.

HISTORY

The claims were staked in February 1936 and at other times for the Aerial Exploration Syndicate, and a little work was done on at least one gold-bearing vein prior to 1938. The property was later acquired by

[1] This number appears on Figure 3, and indicates the approximate location of the deposit.
[2] For complete data on this or other such references, *See* Bibliography, Chapter VI.

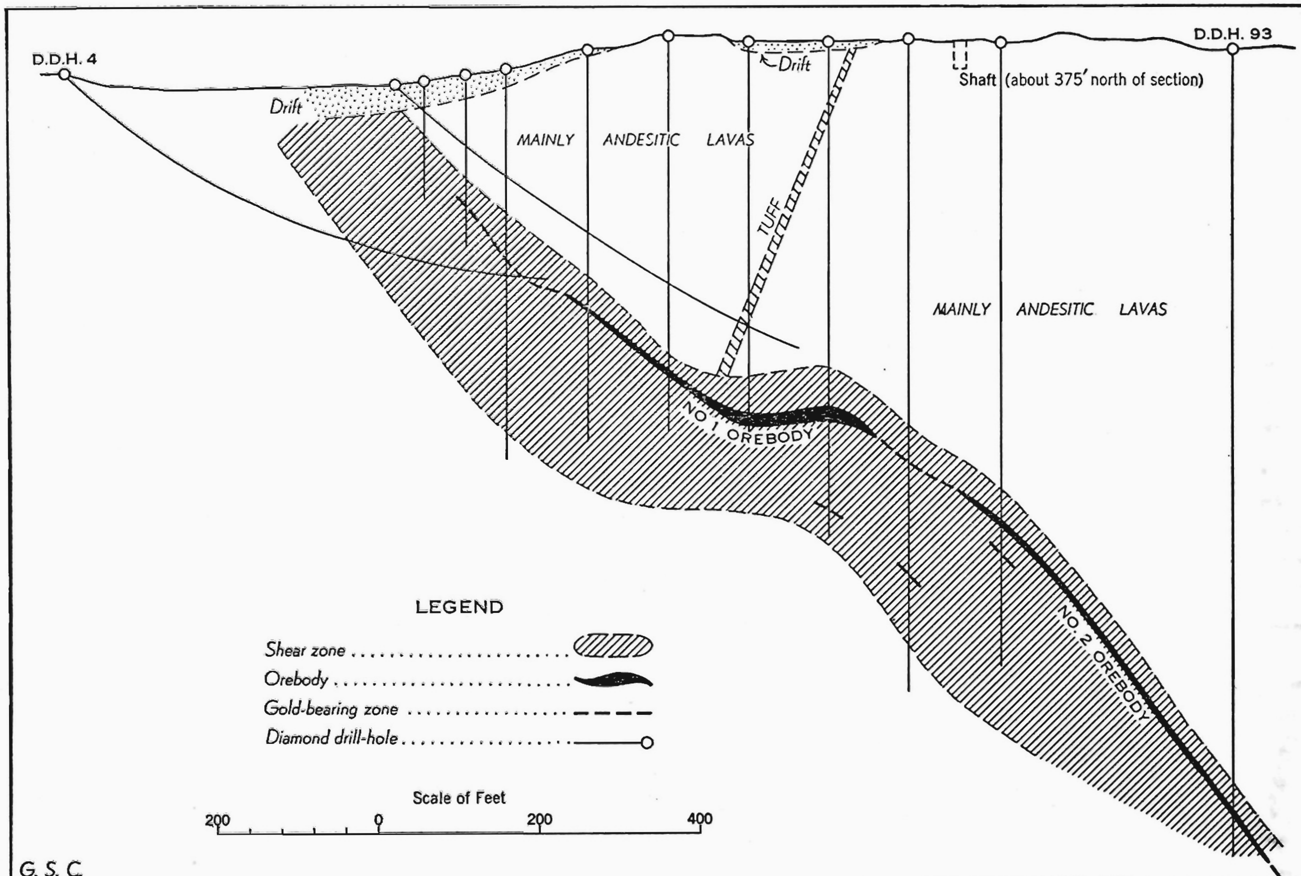

Figure 4. Cross-section through ore-bearing shear zone on property of Akaitcho Yellowknife Gold Mines, Limited, from data supplied by the company, October 1947.

Frobisher Exploration Company, Limited, and diamond drill-holes Nos. 1 to 26 completed between late 1944 and June 28, 1945. A few of these holes were only a few hundred feet west of the main (then undiscovered) orebodies, but were inclined towards the east on the incorrect assumption that the ore-bearing structures dipped westerly. Nevertheless, hole No. 4 encountered gold in November 1944 by, as was afterwards shown, intersecting an easterly dipping ore-bearing shear zone from the foot-wall side. Akaitcho Yellowknife Gold Mines, Limited, was incorporated in January 1945, but the management was retained by the Frobisher company. Geological work during 1945 enabled N. H. C. Fraser, who had directed the initial drilling, to conclude that No. 4 drill-hole had intersected an easterly dipping ore-bearing zone. As a result, vertical holes, Nos. 27 to 98 inclusive, were drilled between May 23, 1946, and July 13, 1947, and three or four orebodies indicated. Work subsequent to August 1946 was directed by C. E. Anderson. A detailed geological map of the property was completed during the summer of 1947. During the summer of 1948 a shaft was started, several buildings erected, and other preparations made for future underground exploration.

ORE RESERVES

Material of about ore grade has been encountered by diamond drill-holes in three or four orebodies. No. 1 orebody is reported[1] to contain 260,000 tons of indicated ore averaging 0·65 ounce of gold a ton (uncut grade), or 0·48 ounce (cut grade). A dilution factor of 15 per cent was used when calculating this reserve.

The owners consider that the widely spaced samples from the other orebodies do not warrant an official estimate of their ore content.

An unofficial estimate of indicated and possible ore in all orebodies encountered by drilling to July 13, 1947, has been reported (Stephens, 1947a, p. 85) as about 500,000 tons containing about 0·75 ounce of gold a ton.

CAMP AND PLANT

The camp, near the shaft collar, includes three frame bunk-houses sheathed with asbestoside, and two, 40 by 100 feet, Butler prefabricated steel and aluminium buildings. The latter are to house shops, warehouse, office, hoist, and compressor.

Other items at the property are reported to include a 60- by 36-inch hoist, a compressor with a capacity of 1,000 cubic feet of air a minute, and part of a steel headframe.

DEVELOPMENT

Diamond drilling totals 56,800 feet. Most of this work consists of vertical holes that explore the gently inclined ore-bearing shear zone within an area about 1,000 feet wide that extends about 2,300 feet northerly from the south boundary of the property to the Akaitcho fault. The longest hole attained a depth of more than 1,100 feet.

A three-compartment vertical shaft, between No. 1 and No. 2 orebodies, was 36 feet deep when sinking was stopped in August 1948.

[1] Akaitcho Yellowknife Gold Mines, Limited: Annual Report for the year ending June 30, 1948, and Report on Operations covering Period July 1st, 1947, to October 31st, 1948, p. 2.

GEOLOGY

The claims are underlain mainly by volcanic rocks of the Yellowknife group. Near the known orebodies these are massive or pillowed, partly amygdaloidal andesitic lavas that strike north 20 degrees east and probably dip about 70 degrees northwest. A few indistinct spherulites occur here and there. The lavas are separated by a band of thin-bedded, black, light grey weathering tuff as much as 10 feet thick. These beds probably face easterly, as suggested by gradation in size of grains, and thus are probably overturned. The lavas and tuffs are cut by a porphyritic gabbroic dyke, locally known as Bird porphyry, that outcrops about 600 feet west of the shaft; this dyke is about 50 feet thick, strikes about parallel with the lavas and tuffs, and probably dips about 30 degrees east.

The steeply inclined Akaitcho fault strikes about north 35 degrees west, crosses the property, and lies about 1,600 feet north of the shaft. The formations on the northeast side of the fault moved northwest relative to those on the southwest side. The apparent horizontal offset may be about 1 mile[1].

DESCRIPTION OF DEPOSITS

The ore-bearing shear zone cuts the lavas, tuffs, and possibly, in places, the porphyry. The zone strikes north to north 20 degrees east, dips easterly at angles of between 35 and 55 degrees, and may be as much as 200 feet thick. Its hanging-wall probably reaches bedrock surface in a drift-filled area about 700 feet west of the shaft. The zone has been explored by drill-holes to a vertical depth of about 1,110 feet, and for a length of about 2,300 feet from near the southern boundary of the property north to the Akaitcho fault. Only a few holes have passed through the zone. The easterly dip of the zone is interrupted at one place to form a terrace-like structure 100 feet or so in width. This trends about north 10 degrees east and has been traced about 1,200 feet northerly from the south boundary of the property. In the northern part of the explored area, the porphyry dyke lies above and about parallel with the zone; farther south it lies very near the hanging-wall of the zone; and in the southern part of the explored area it has not been recognized and might lie within the shear zone. The rock within the zone is mainly a dark green chloritic schist cut by a few veinlets of white quartz or quartz and carbonate. Some drill core from the zone contains light green sericitic or siliceous patches set in a dark green chloritic schist. The schist zone grades into the non-schistose wall-rocks.

The gold-bearing orebodies within the zone commonly lie closer to the hanging-wall than to the foot-wall. No. 1 ore shoot approximately coincides with the terrace-like structure and is 1,200 feet long, about 225 feet wide, and averages 6·7 feet in thickness. It lies about 375 to 500 feet below the surface. No. 2 ore shoot lies east of and nearly parallel with No. 1, and about 600 to 950 feet below the surface. Scattered drill-holes suggest that it has a length of at least 1,200 feet. No. 3 ore shoot has been probed by three drill-holes, lies about 400 feet north of No. 1, and 400 to 625 feet below the surface. Several samples of ore grade have been encountered 50 to 120 feet below No. 1 orebody. The foot- and hanging-walls of

[1] Akaitcho Yellowknife Gold Mines, Limited: Annual Report for the Year Ending June 30, 1947, and Report on Operations covering Period July 1st, 1946, to December 31st, 1947, p. 6.

the orebodies are commonly well defined; but along the strike and up and down the dip ore grades into material containing only a little gold. Ore is an intimate mixture of fine-grained quartz, carbonate, sericite, metallic minerals, and scattered specks of buff-coloured leucoxene (?). Quartz comprises 30 to 50 per cent of the ore. Metallic minerals constitute less than 5 per cent of the ore, and include pyrite, fine-grained acicular arsenopyrite, and smaller amounts of soft, grey minerals, possibly jamesonite, stibnite, bournonite, tetrahedrite, and others. The soft, grey metallic minerals commonly indicate high-grade ore. Visible gold is rare.

A gold deposit that lies between two lakes about 3,400 feet west-southwest of the shaft has been described by Jolliffe (1938, pp. 16-17) as follows:

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 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 [a pale red to white natural alloy of silver and 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.

Algood Gold Mines, Limited (21)

INTRODUCTION

Algood Gold Mines, Limited, owns a gold prospect in the barren grounds, on the north side of Regan Lake, about 275 miles northeast of Yellowknife. The property comprises the Algood Nos. 1 to 24 claims, Makrak Nos. 1 to 17 claims, and five others. A Norseman aircraft operated by Don Cameron Exploration Company, Limited, provided ordinary transportation services between the property and Yellowknife. Daily radio communication was maintained, under favourable circumstances, with Yellowknife. When the writer examined the property late in August 1947, A. H. Manifold was in charge of a crew of eleven men, eight of whom constituted a diamond drill crew. N. H. C. Fraser was consulting geologist.

[1] Riley, C.: personal communication.

HISTORY

The Algood and Makrak claims were staked in August 1946 on behalf of Don Cameron Exploration Company, Limited. Algood Gold Mines, Limited, was incorporated in January 1947 to acquire these claims, and acquired five other adjoining claims by staking during 1947. Exploratory work commenced late in June 1947 when men and supplies, and camp, diamond drill, and other equipment were flown to the property from Yellowknife by a DC3 aircraft. This aircraft was equipped with wheels, and landed on the ice of Regan Lake. The first float-equipped aircraft arrived there July 16. Work continued until August 31, when the camp was closed. The property remained inactive during 1948.

CAMP AND EXPLORATORY WORK

The camp, on the north shore of Regan Lake, included two Jamesway huts and several tents. Oil was used for heating.

Work done during 1947 comprised detailed geological mapping, systematic prospecting (involving panning about 400 samples), and diamond drilling. About 3,011 feet of drilling was completed as follows: on No. 1 deposit, eleven holes totalling 1,577 feet; on No. 2 deposit, four holes totalling 434 feet; and on the No. 3, or Alksne deposit, thirteen holes totalling 1,000 feet.

GEOLOGY

The rocks underlying the Algood property are mainly sedimentary and, although this district has not been mapped by the Geological Survey of Canada, they are tentatively correlated with the Yellowknife group. They are grey weathering slates and greywackes intercalated with a few arkose-like layers. In rare instances beds were observed to grade from coarse at the bottom to fine at the top. The strata strike about north 50 degrees west and dip 65 to 85 degrees southwest. Here and there they display small drag-folds or minor faults. The formations are intersected by two diabase dykes; one, 200 feet or more in width, trends about north-northwest, and the other, about 30 feet wide, trends about northeast.

DESCRIPTION OF DEPOSITS

The mineral deposits are covered by much drift. Even nearby outcrops are masked by lichens and commonly occur as loose piles of frost-heaved blocks and slabs. Because of this broken rock surface and the abundant ground water, the deposits were explored mainly by diamond drilling; and, as a result, surface examination afforded a very imperfect idea of the nature of the occurrences.

No. 1 Deposit is on the Algood Nos. 9 and 15 claims. The rock is slate and greywacke, and a little thin-bedded green rock, possibly recrystallized tuff. The strata strike north 60 degrees west and dip about 75 degrees southwest. A little quartz and mineralized rock is exposed here and there at the surface in rusty, frost-heaved outcrops. The quartz is grey and glassy or sugary, and contains arsenopyrite, pyrite, chlorite, and a white carbonate mineral. Vugs were noted in the quartz and pyrite. The adjacent rock contains arsenopyrite, pyrite, magnetite, and hematite. The formations in the vicinity of the deposit have been probed by eleven diamond drill-holes along a strike length of about 750 feet. Three of these holes intersected what may be a continuous zone of quartz and mineralized rock 200 feet or more in length. It trends about parallel with the enclosing formations, and the samples from the three drill-holes averaged 0·31 ounce of gold a ton across a true width of 2·2 feet. Samples from some of the other drill-holes contained significant amounts of gold.

No. 2 Deposit is on Algood No. 5 claim about 1,600 feet southeast of No. 1 deposit. It is reported to be a rusty, northwesterly trending shear zone enclosing lenticular bodies of quartz. Samples from four diamond drill-holes contained negligible amounts of gold.

No. 3 or Alksne Deposit is on Algood No. 11 claim about 3,200 feet south of No. 1 deposit. The enclosing slates and greywackes strike north 60 degrees west and dip 80 degrees southwest. Many small drag-folds were noted, and here and there the strata appear to be offset a few feet by left-hand faults that strike about northeast. The deposit is probably a zone of lenticular quartz bodies in mineralized slate. It outcrops as widely scattered groups of rusty, loose blocks for a length of about 1,200 feet on an average trend of about north 70 degrees west. Near its southeast end it trends about north 60 degrees west. Farther northwest it seems to occur as a number of *en échelon* segments arranged so as to suggest that they represent parts of a once continuous zone displaced by a series of transverse left-hand faults. Each segment, however, strikes about north 60 degrees west parallel with the adjacent strata. The quartz is grey or blue; it contains pyrite, and fragments of slate with numerous needles of arsenopyrite. The slate wall-rock also contains much similar arsenopyrite. Thirteen drill-holes have probed the zone for a length of 1,200 feet. Five of the six holes that explored the northwestern 740 feet of the zone afforded samples with true widths ranging from 1·2 to 17·5 feet and corresponding assays from 0·12 ounce to 0·44 ounce of gold a ton. Of the 17·5-foot sample, 4½ feet assayed 0·60 ounce a ton.

Prospecting disclosed gold occurrences at other places on the property.

GENERAL DATA

Diamond drilling was contracted to Boyles Brothers Drilling Company, Limited, and their experience was of considerable interest inasmuch as this operation, well within the barren grounds, had been expected to offer substantial difficulties due to permafrost and broken, frost-heaved rock. However, no serious difficulties were encountered. The drill was operated on three 8-hour shifts daily, and unheated water was used. The longest hole measured 217 feet, and holes were inclined at angles of 45 and 50 degrees. The usual tripod was found unnecessary, and rods were pulled by hand during the later drilling. Two core barrels were used, so that rods could be re-inserted in a hole before it could freeze. Core recovery averaged nearly 97 per cent but no sludge was recovered. Drilling was done in two contracts: the first contract, about 2,000 feet, was accomplished in 15 days; and the second, 1,000 feet, was completed in 10 days.

Field assistants employed by the Algood Company were paid $200 to $225 a month. Board and travel expenses to and from Edmonton were provided by the company.

American Metal Company of Canada, Limited (3)

Reference: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheets 86-N-7, 86-N-8, and 86-O-5.

The American Metal Company of Canada, Limited, owns the Lars, Metal, Dick, Jenney, and Marge groups of claims between Coppermine River and the Dismal Lakes. This area is north of the Arctic Circle, in the barren grounds, and about 45 miles southwest of Coppermine, a settlement at the mouth of Coppermine River. The claims have not been examined by the writer, and the following account, to December 31, 1944, is derived mainly from data supplied by C. P. Jenney, manager and geologist for the company.

The area was examined in 1929, 1930, and 1931 by Dominion Explorers, Limited, Northern Aerial Minerals Exploration, Limited, and the Consolidated Mining and Smelting Company of Canada, Limited. Copper was found, many claims were staked, and a little surface work done. Most or all of these claims have since lapsed, but some of the more promising were re-staked by the American Metal Company of Canada, Limited, in 1943, and other staking and exploratory work was done by this company in 1944 and 1945.

The claims are underlain by basaltic lavas of the Proterozoic, Coppermine River series. The lava flows strike west or northwest and dip about 12 degrees north or northeast; they range from 50 to 250 feet in thickness. Native copper occurs in amygdules and in narrow cracks, but none of these occurrences is known to be of economic interest. The most important known occurrences are deposits of chalcocite, calcite, and minor quartz in strong shear or fracture zones that transect the lava flows. These zones range up to about 175 feet in width and are steeply inclined; several have been traced 1,000 feet or more, and some are probably faults. So far as known no economically mineable deposits have been found.

The Lars group of nine claims was staked by Lars Johnson and Garfield Smith between July 27 and August 9, 1944. The claims lie about 16 miles north-northeast of the outlet of the Dismal Lakes. No. 1 shear zone has been traced 1,075 feet, strikes north 25 degrees west, and is probably nearly vertical. Exposed widths range from 25 to 175 feet. Seams of chalcocite occur in the zone.

The Metal group of twenty-seven claims was staked by Lars Johnson and Garfield Smith in June, July, and August 1944; it lies about 10 miles north of the outlet of the Dismal Lakes. High-grade chalcocite float is widespread. A fault, believed to be more than 45 miles long, trends about north 55 degrees east across the claims.

The Dick group of about thirty claims is about 17 miles northeast of the outlet of the Dismal Lakes, and near the sources of Burnt and Willow Creeks, which flow easterly into Coppermine River. No. 1 shear zone is said to be similar to the No. 1 shear zone of the Jenney group, described below.

The Jenney group of twenty-four claims, about 5 miles east of the Dick group, is on Burnt Creek about 4 miles from its junction with Coppermine River. No. 1 shear zone strikes north 50 degrees east and is about vertical. It has been traced 3,200 feet, varies up to 25 feet in width, and contains, in places, chalcocite and basalt fragments cemented by abundant calcite.

The Marge group of twenty-one claims is about 2½ miles southeast of the Jenney claims and about 3 miles southwest of the mouth of Burnt Creek. No. 1 shear zone strikes about north 60 degrees east, has been traced 3,800 feet, and has a maximum known width of about 50 feet. It contains lenses and veins of chalcocite, calcite, and a little quartz. The maximum known width of chalcocite is 4½ feet.

Andrew Yellowknife Mines, Limited (53)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-O-4. Lord, 1942a.

Andrew Yellowknife Mines, Limited, owns and has been actively exploring the Bugow group of twenty claims, 68 miles northwest of Yellowknife and 25 miles slightly east of north from Fort Rae. The property is about 2 miles north of Russell Lake, which is navigable by shallow-draught barges from Great Slave Lake. Aircraft such as the Norseman V operate with difficulty from a small lake on the west boundary of the property. When the claims were visited in July 1947, Technical Mine Consultants, Limited, with G. M. Radisics as Yellowknife representative, were acting as managers; L. O. Gouin was in charge of the crew of five men housed in a tent camp on Bugow No. 12 claim; and C. L. Hershman was consulting engineer. Radio provided two-way communication with Yellowknife.

The company was incorporated in 1945, and acquired its property from Frederick Yellowknife Mines, Limited. Extensive trenching was done on seven mineralized zones in the spring of 1946. Thirty-eight diamond drill-holes, mainly designed to explore the mineralized zones at a depth of 100 feet, were completed as follows: 1946, 3,089 feet; early summer of 1947, 4,348 feet. The property was inactive during the winter of 1946-47. Work done during the spring and summer of 1947 comprised, in addition to drilling: (1) excavation, on the most promising part of the No. 2 zone, of an open-cut about 340 feet long, 5 to 22 feet wide, and 5 feet deep; (2) thorough sampling of the zone thus exposed by channel and bulk methods, and the requisite crushing and splitting of the resultant six hundred and fifty-eight, 40 pound bulk samples prior to shipment to Yellowknife; (3) geological mapping of all claims; and (4) a survey of all claims by a Dominion Lands surveyor. On completion of this program later in the summer all work was suspended indefinitely, and the camp abandoned and partly dismantled.

The claims are underlain mainly by buff-surfaced biotite hornfels and impure quartzites of the Yellowknife group[1]. A few beds display distinct nodules of andalusite or other metamorphic minerals. The strata commonly trend between north-northwest and northwest, and are steeply inclined or vertical. They are intersected by a few pegmatite dykes presumably related to a granitic batholith, the southwestern part of which outcrops in the northeast corner of the property. Glacial striæ trend about south 50 degrees west.

Here and there the sedimentary strata enclose well-bedded rusty bands, 1 foot to 20 feet in width, of dark grey to black amphibolite and various garnetiferous rocks, pseudo-conglomerate with pebble-like quartz

[1] This description of the general geology is compiled from data supplied by Andrew Yellowknife Mines, Limited, supplemented by observations made by the writer in the vicinity of the mineralized zones.

bodies, and a little vein quartz. The amphibolite, in particular, commonly contains much pyrite. These bands probably are highly altered tuffs and tuffaceous sediments. Some are exposed at intervals for lengths of 1,000 feet or more, and one, known to the owners as the No. 2 zone, contains a little gold.

No. 2 zone outcrops on Bugow Nos. 3 and 6 claims, strikes northwest, and dips about 70 degrees northeast parallel with the enclosing strata. Its course is slightly sinuous. It averages 10 feet or more in width and is exposed by outcrops, twenty-four trenches, and the open-cut previously mentioned, for a length of about 1,600 feet. Numerous diamond drill-holes have probed the zone at a depth of about 100 feet. Granitic rocks outcrop 1,400 feet to the northeast. The rocks near the northeast wall of the zone are buff, fine- to medium-grained, indistinctly bedded hornfels and impure quartzites. They contain elongated nodules of andalusite or similar minerals that, because they are commonly oriented with their long axes about parallel with the dip of the strata, appear as rounded spots on nearly horizontal outcrops. The strata lying within a few feet of the northeast wall of the zone commonly contain a few garnets. On its southwest side the zone is bordered by about 50 feet of coarse-grained, mainly massive, rarely banded, grey to brown, sericitic rock; no abrupt change distinguishes this material from the bedded nodular hornfels and impure quartzites adjoining it on the southwest, and, probably, it is an altered sedimentary rock. All these wall-rocks are cut by rare pegmatite dykes none of which is known to penetrate the mineralized zone.

The rocks within the No. 2 zone are dark green or black, commonly weather rusty, and comprise an interlayered assemblage of: fine-grained amphibolite; tough, fine- to medium-grained, siliceous biotite-garnet rock; fine- to coarse-grained biotite-garnet-chlorite rock; and pseudo-conglomerate. The amphibolite is probably most abundant, commonly displays well-defined beds 2 inches or less in thickness, and contains much fine-grained pyrite as minute lenticles and seams parallel with the banding, and as scattered grains. The garnetiferous rocks are most common near the walls of the zone, but also occur interlayered with the amphibolite; in most instances they are massive or indistinctly banded and contain little or no pyrite. Some of the amphibolite or, possibly, siliceous biotite-garnet rock contains streaks of scattered pebble-like quartz bodies and resembles a conglomerate. The pebble-like bodies are $\frac{1}{2}$ inch to 2 inches long, and round, elliptical, or lenticular in plan. At least some are rod-like in shape and, as the rods stand nearly vertically, present a pebble-like appearance in horizontal outcrops. Some of the quartz bodies are lenticular parts of attenuated quartz veinlets that parallel the bedding, and possibly all are parts of disrupted, formerly continuous or nearly continuous veinlets. Other, glassy quartz forms continuous veinlets or irregular masses that cut all rocks within the zone. It adheres firmly to the enclosing rocks, does not contain significant amounts of metallic minerals, and locally comprises as much as 20 per cent of the zone. A sheared zone, 6 inches to 3 feet in width, is at or close to the southeastern 300 feet of the southwest wall of the No. 2 zone. Elsewhere the shear zone is less well-defined, discontinuous, and not confined to the vicinity of the wall.

Some of the pyritic amphibolite contains important amounts of gold and is differentiated from similar, essentially barren, rock only by sampling and assaying. The gold content is not known to be related to the amount of vein quartz present. Visible gold was found in one diamond drill core, but has not been noted in the surface exposures[1]. Bulk samples from the open-cut near the southeast end of the exposed part of the No. 2 zone indicate a body of sub-ore 348 feet long at the surface, containing 0·15 ounce of gold a ton across an average width of 5·9 feet, or 0·09 ounce a ton across a width of 11·6 feet. Channel samples from a 300-foot length of this body indicated 0·22 ounce of gold a ton across 6·9 feet, or 0·19 ounce across 8·1 feet.

A similar zone lies 800 feet northwest of the No. 2 zone. It strikes about north 30 degrees west and is exposed by outcrops and nine trenches for a length of about 1,200 feet. It is not known to be continuous with No. 2 zone. Five diamond drill-holes encountered, at a depth of about 100 feet, a mineralized body 400 feet long and 8·7 feet wide, with an indicated grade of 0·15 ounce of gold a ton.

Anna Group (38)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 86-B-3. Lord, 1941a, pp. 64-65; 1942a, pp. 49-50. Tremblay, 1948, p. 7.

The Anna group of claims is on the east side of a bay on the south shore of Indin Lake, 8 miles due south of the camp of North Inca Gold Mines, Limited (37), and about 120 miles north-northwest of Yellowknife. It is believed to be, in part, a restaking of the former Ann group, staked for Territories Exploration Company, Limited, following a discovery of spectacular gold ore in the Barker vein on September 11, 1938. Prior to August 1939 this vein was explored by nine trenches and had afforded about 1,600 pounds of selected ore containing about 83 fine ounces of gold. So far as known, no other ore was recovered from the vein and none remains. Diamond drilling is reported to have been done on Anna No. 2 claim, presumably in the vicinity of the Barker vein. The Anna group was at one time optioned to American Yellowknife Gold Mines, Limited.

The Barker vein was examined by the writer in 1939 and described (Lord, 1941a, pp. 64-65) as follows:

> 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 cuts the lavas about ¼ mile west of the vein and strikes north 10 degrees west.
>
> The Barker vein is....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....[northeast]. 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 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

[1] Radisics, G. M.: personal communication.

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.

Arctic Circle Syndicate[3] (111)

References: Bureau of Mines, 1942a. Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheets 85-I-7 and 85-I-10. Henderson and Jolliffe, 1941.

The Arctic Circle Syndicate staked the following claims near Gilmour Lake, 45 miles east of Yellowknife, during the spring and summer of 1941: (1) A.C. Nos. 1 to 27, east from the north end of Gilmour Lake; (2) A.C. No. 28, 6 miles east of the north end of Gilmour Lake; (3) A.C.S. Nos. 1 to 17, near the southwest tip of Gilmour Lake; (4) A.C.S. Nos. 19 to 30, 2 miles southeast of Gilmour Lake; and (5) Victory group of claims, 4 miles north of the north end of Gilmour Lake.

The Syndicate prospected these claims with ten men, under M. P. Manolovici and S. Walker, from about May until about August 1, 1941. Subsequently some prospecting was done on unstaked ground north of Gilmour Lake. Several scheelite-bearing quartz veins were found during 1941, and three of these, occurring in Yellowknife sedimentary rocks, are described below. Development work was confined to trenching and stripping.

Vein 57 (McDonald vein) is on A.C. No. 17 claim, and parallels the bedding of the enclosing slaty rocks. It strikes north 45 degrees west, dips 75 degrees northeast, and is exposed for 80 feet. The southern 56 feet averages 6 inches in width and contains about 0·5 per cent WO_3 as scheelite. Nine feet northwest of this shoot the vein is offset 2 feet by a fault, and so far as known the quartz north of the fault does not contain scheelite.

Vein 109 is on A.C. No. 27 claim, about 2½ miles east-southeast of the northeast tip of Gilmour Lake. The vein is parallel with the enclosing sedimentary rocks, and strikes north 65 degrees west and dips 35 to 65 degrees northeast. It is exposed for about 230 feet, with an average width of 30 inches. For 155 feet the vein contains 0·15 per cent WO_3 across an average width of 2·3 feet.

Vein 120 (Bureau of Mines, 1942a), also known as the 'V' vein, is on Victory No. 1 claim, about 4 miles north of the north end of Gilmour Lake. The vein outcrops in the form of a 'V' with the apex towards the south: the west limb trends about north 25 degrees west and is exposed for about 65 feet; the east limb trends about north 5 degrees east and is exposed

[1,2] Johnston, A. W.: Formerly field manager, Territories Exploration Company, Limited; personal communications.

[3] Described from data supplied by A. W. Jolliffe and the Consolidated Mining and Smelting Company of Canada, Limited.

for about 65 feet. The vein is thickest near the north end of the east limb where for 9 feet it averages 4·4 feet in width and contains 1 per cent WO_3. About 15 tons of scheelite-bearing quartz was mined from this body.

Vein 141 is on A.C. No. 28 claim. A 34-foot section of the vein averages 1·3 feet in width and contains 1·1 per cent WO_3. About 5 tons of vein material were mined from this part of the vein.

Ardogo Group (63)

The following description is by J. F. Henderson, who examined 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.

Arseno Group (69)

Reference: Jolliffe, 1938, pp. 18, 38; 1946.

The Arseno group, 9½ miles north of the head of Yellowknife Bay, has lapsed since the following descriptions were prepared by Jolliffe.

This group of ten claims was staked in May 1936 by A. Swanson and others. [Half a mile] 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 [Yellowknife group]. 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.

A quartz-feldspar porphyry....northwest of the north end of Likely Lake carries molybdenite. This body is at least 105 feet wide (the northwest edge is drift covered) and trends northeast for several hundred feet through recrystallized basic lavas. Most of the porphyry is massive, homogeneous, well-jointed, and weathers light grey with rusty stains along the joints. A fresh surface shows many quartz and feldspar crystals up to one-quarter inch across in a fine-grained pale pink groundmass. Along and near its eastern border it is greatly sheared, showing a few glassy quartz crystals up to one-eighth inch across in a foliated, light green, fine-grained, soft groundmass, probably composed largely of sericite and carbonate. At places in this sheared part along joint planes, and in tiny quartz veinlets in the massive porphyry, pyrite, pyrrhotite, molybdenite, and fluorite occur. A chip sample (6 pounds) taken across 105 feet showed on assay: gold none; silver, none; molybdenite, 0·24 per cent.

Art Group (39)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 86-B-3. Tremblay, 1948, pp. 6 and 7.

The Art group of twelve claims is at the southwest end of Damoti Lake, about 120 miles north-northwest of Yellowknife.

According to Tremblay:

On the Art No. 2 claim a few quartz stringers cut pillowed basic volcanic rocks [of the Yellowknife group] slightly recrystallized to an amphibolite or hornblende schist. The stringers appear to be concentrated along three bands about 2 feet apart. The zones are apparently vertical, strike north 30 degrees east, and average only a few inches in width. They consist mainly of black quartz, cut by veinlets of milky white quartz and carrying some pyrite and chalcopyrite. The wall-rocks have been intensely carbonatized and are slightly mineralized with pyrite. No free gold was seen although its occurrence has been reported. Five trenches have been excavated across these bands of quartz stringers, but no reports on this exploratory work have been seen.

A.Y.E. Group (72)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-J-8. Jolliffe, 1938, pp 18, 19; 1942a.

The A.Y.E. group is on the west side of Yellowknife Bay between the Con and Rycon (73) and Giant (76) mines, and in part adjoins the northwest boundary of the latter property. The claims are now (1947) owned by Kamcon Mines, Limited. Jolliffe reports on this group as follows:

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 [1938] being developed by Kamlac Gold Mines, Limited. Gold has been found within several veins of 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 [Yellowknife group] 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.

B Group (2)

Reference: Kidd, 1932b, pp. 59-60.

The following description by Kidd is based on field work done by him in 1931.

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 base 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 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, chal copyrite 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.

Baltic Group (108)

Reference: Henderson, 1939a, p. 14.

The Baltic claims, staked for D. F. Kidd in August 1937,....[were] located at the northwest end of Hearne Lake. A quartz-feldspar porphyry dyke striking north cuts the sediments [Yellowknife group] 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.

Beaulieu Yellowknife Mines, Limited (112)
(*See* Figure 5)

References: Bureau of Mines, 1946c. Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-I-7. Fortier, 1946. Hellens, 1948, pp. 24-25. Henderson, 1943. Henderson and Jolliffe, 1941.

The main property of Beaulieu Yellowknife Mines, Limited, comprises Norma Nos. 1 to 12 claims, inclusive. These lie about 46 miles east of Yellowknife and 3 miles north of Campbell Lake. DC3 and smaller aircraft land on a recently constructed airstrip 5 miles northwest of the camp, and aircraft equipped with floats or skis land, during appropriate seasons, on a small lake about 3,500 feet southwest of the camp. A tractor road about 60 miles long, via Jennejohn, Harding, and Hearne Lakes, provides alternative access from Yellowknife during the winter. The writer examined the property early in July 1947, and again, briefly, on September 26. The staff included: A. O. Ames, managing director; C. A. Stocking, engineer and mine superintendent; A. D. Wilmot, geologist; and L. E. Johnson, mill superintendent. In December the mine was examined by M. Feniak of the Geological Survey of Canada who supplied data on underground development to December 30, 1947.

HISTORY, PRODUCTION, AND ORE RESERVES

The Norma claims were staked in the summer of 1939 by S. Hanson and associates of Yellowknife. Norma Tungsten and Gold Mines, Limited, later completed a little surface exploratory work and then suspended operations. About 15 tons of high-grade gold ore from the "A" and "B" pits on the Norma vein is said to have been treated in a small Gibson mill in 1942. In 1945, the property was optioned by E. Schnee and, in August, Beaulieu Yellowknife Mines, Limited, was formed to explore the property. Diamond drilling commenced in October and was continued under the direction of Mining Research Corporation of Toronto until December. A second program of drilling, under the supervision of E. Schnee, commenced in January 1946 and was completed a few months later, and, according to the owners, indicated that orebody "A" contained, to a depth of 230 feet, some 14,000 tons of material assaying about 1 ounce of gold a ton. In July, A. O. Ames was appointed resident managing director to superintend a program involving camp construction, underground exploration, and mill erection. Late in August, A. F. Banfield made a detailed study of the geology and previous exploratory work in the vicinity of "A" orebody. Winter operations were confined mainly to surface construction and freighting, but considerable freight remained to be flown to the property during the summer of 1947. A two-compartment vertical shaft was started in May 1947 and completed in July. Lateral work commenced forthwith, the company at about the same time intimating an indicated ore reserve, above the 300-foot level, of 105,000 tons averaging about 1 ounce of gold a ton. Milling commenced October 23, 1947, and, to November 30, is reported to have treated 252 tons of vein material, providing about 7½ ounces of gold bullion. Milling was stopped shortly thereafter. In a publicized report attributed to A. D. Hellens, indicated ore reserves on December 21, 1947, were computed as 1,200 tons of fair-grade ore to a depth of 225 feet; development below that depth had not located quartz of ore grade.

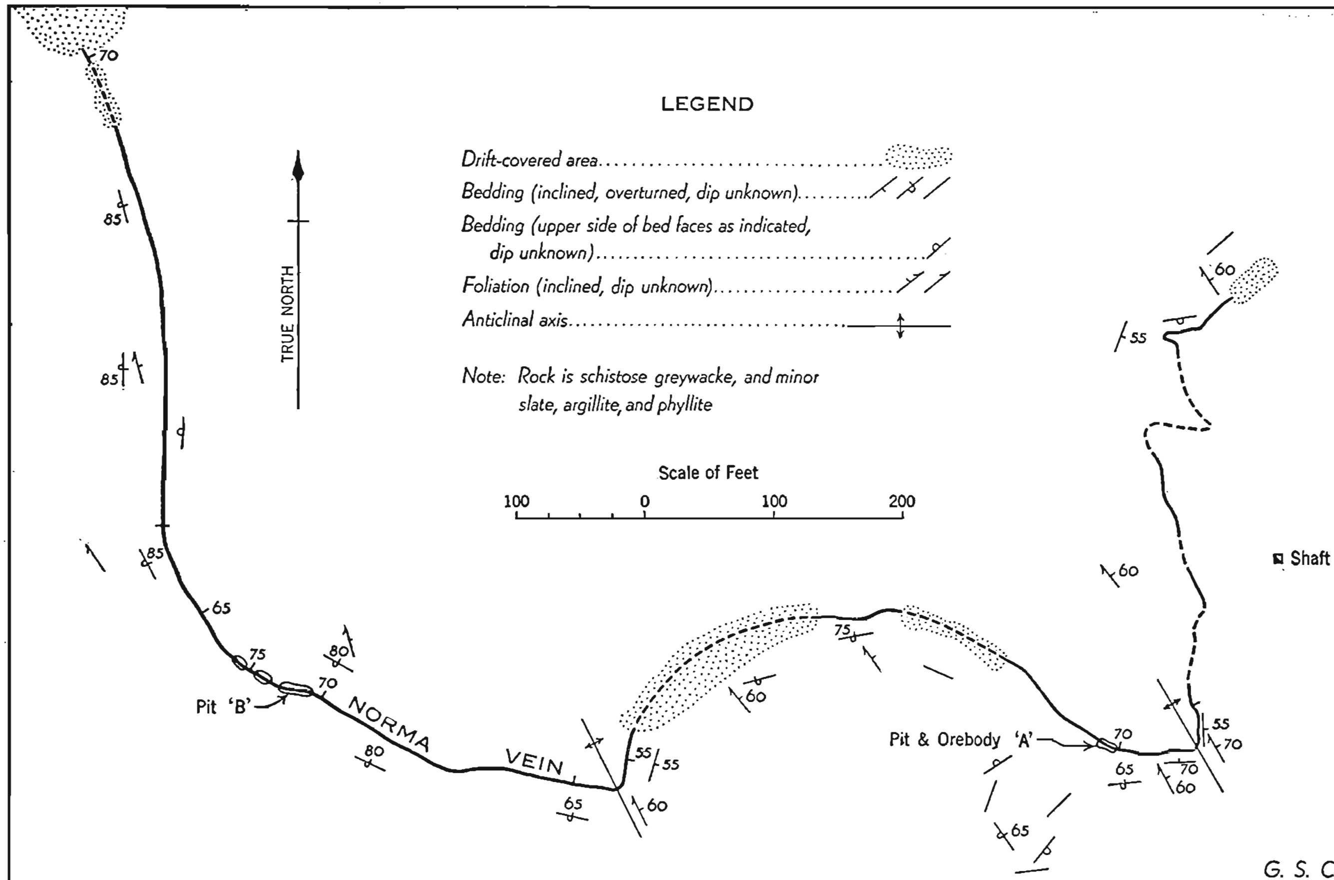

Figure 5. Plan of Norma vein, adapted from survey by Beaulieu Yellowknife Mines, Limited.

CAMP AND PLANT

The camp and plant are on Norma No. 9 claim. Buildings and other structures include: an insulated three-story combined general office, warehouse, engineering office, and staff house; insulated interconnected kitchen, dining hall, and bunk-houses; power and hoist house; mill building and assay office; dry; steel and timber shop; boiler house; garage; headframe; and an ore bin of about 75 tons capacity. All buildings are of frame construction from rough lumber sawn on the property. Sawdust or moss was used for insulation where required. Oil storage tanks have an aggregate capacity of about 35,000 gallons. Water for mine, mill, and camp is pumped about 1,800 feet from a nearby lake to a wood-stave tank, the water pipe being laid alongside a steam pipe in an insulated wooden box. A radio receiver and 35 watt transmitter provide communication with Yellowknife.

Electric power for the camp, mill, and a 30-horsepower Sullivan electric hoist is generated by a Cumming-General Electric diesel-electric unit with an output of 125 KVA and a Waukesha-General Electric unit rated at 35 KVA. Two D 13,000 Caterpillar diesel engines drive two Sullivan compressors with a total rated capacity of about 900 cubic feet of air a minute. Other mechanical items include an International tractor with blade, an Allis Chalmers tractor, and a Ford 3-ton truck.

DEVELOPMENT

Surface exploratory work consists of numerous pits, trenches, and stripped areas, mainly on the Norma vein; and about 15,000 feet of diamond drilling, mostly in the vicinity of "A" and "B" pits. None of the drill-holes, however, was tested for vertical or lateral deviation, an omission that is said to have led to sizable errors in ore calculations. A two-compartment vertical shaft, 320 feet deep, provides entry to workings on the 175- and 300-foot levels designed to explore the "A" ore shoot that outcrops in "A" pit. Workings on the 175-foot level comprise (December 30, 1947) 162 feet of crosscuts and 151 feet of drifts, and on the 300-foot level, 94 feet of crosscuts and 274 feet of drifts. A raise connects the 300-foot level with the surface.

GEOLOGY

The rocks near the Norma vein are mainly well-bedded schistose greywackes of the Yellowknife group. These weather brown, and occur in beds $1\frac{1}{2}$ to 7 feet or more in thickness. Commonly they grade from coarse at the bottom to fine at the top, or from schistose greywacke at the bottom to slate at the top. These upper, slate parts of the beds range in thickness from less than an inch to about a foot, the thickest layers lying at the tops of the thickest greywacke beds. Rare bands, a foot or so thick, of black to grey, thin-bedded slate or phyllite, are interlayered with the greywacke beds.

The strata are intricately folded. Dips range from about 55 degrees to vertical, and in places the beds have been overturned as much as 25 degrees. The slate and phyllite layers are involved in drag-folds a few inches to a foot in amplitude. The strata display flow cleavage and S-shaped fracture cleavage, the planes of which trend about north 30 degrees west and dip about 60 degrees northeast approximately parallel with the axial planes of the major folds. Thus beds that strike westerly generally dip northerly and are overturned, whereas those that strike northerly dip easterly and are not overturned. Drag-folds immediately adjacent to the Norma vein indicate that the axes of the major folds plunge steeply to the northeast.

DESCRIPTION OF DEPOSITS

Norma Vein. The Norma quartz vein outcrops on Norma No. 9 claim for a possible length of 1,800 feet. In plan (*See* Figure 5) it has the form of a large 'U', open to the north, with one major irregularity in curvature in its southern part. The eastern part of the vein trends southerly, lies about 70 feet west of the shaft, and has been traced, with some uncertainty and at scattered intervals, about 450 feet to a point 150 feet south-southwest of the shaft. Thence it bends abruptly westward and has been traced with reasonable certainty for 1,350 feet, first through successive courses of northwest, west, and southwest, then through an abrupt bend to the west, and thence finally through a long comparatively smooth curve to nearly north. The northeast and northwest ends of the vein outcrop pass beneath overburden. The vein averages 6 inches or less in width and rarely exceeds 18 inches. Throughout much, and possibly most, of its known length it lies within or at the top of a slate band, a few inches to 1 foot thick, that grades stratigraphically downwards into several feet of increasingly coarse-grained schistose greywacke. Thus, where the vein trends about west, as near pits "A" and "B" where the vein and beds dip northerly and the latter are overturned, the hanging-wall is slate or slaty greywacke of the vein-bed, and the foot-wall is a thin parting of slate of the same bed or coarse, basal greywacke of the contiguous, younger bed. Underground exploration showed the vein to be about 16 feet wide for a length of about 50 feet on the 175- and 300-foot levels.

The vein is composed mainly of rusty weathering grey quartz, which, although greatly contorted, drag-folded, and fractured, precisely parallels the accompanying similarly distorted slate layer. Other narrower and shorter, but parallel and otherwise similar veins are common between the adjacent strata. The walls are generally sharply defined and not notably sheared. The quartz contains various proportions of black slaty rock, and a little carbonate, feldspar, scheelite, biotite, and chlorite. Specimens from the extreme northwest end of the exposed vein contained a few colourless hexagonal crystals identified as fluorapatite[1]. A minute crystal of, probably, monazite was found embedded in the fluorapatite. Metallic minerals comprise much less than 1 per cent of the vein; pyrite is most plentiful, and others include arsenopyrite, galena, chalcopyrite, marcasite, sphalerite(?), pyrrhotite(?), and gold. Much of the pyrite and most of the arsenopyrite occur as scattered crystals in the wall-rock and in inclusions of this rock. Visible gold is commonly associated with galena and other sulphide minerals.

Younger, coarse milky white or glassy quartz cuts the grey quartz of the Norma and parallel veins. It also transects the adjacent strata as veinlets that parallel the foliation, or as irregular bodies and interlacing veinlets concentrated near the axial parts of folds. This quartz is less fractured and contains more feldspar than the grey quartz. It contains a little pyrite, but is not known to contain significant amounts of gold.

[1] Identification by H. V. Ellsworth, Mineralogical Section, Geological Survey of Canada.

The principal known concentrations of gold in the Norma vein are in the "A" ore shoot, 190 feet southwest of the shaft, and at "B" pit 630 feet farther west. The "A" ore shoot outcropped at "A" pit on the southwest flank of a sharp anticlinal fold, and at the surface lies 70 feet west of the axis of this fold. The orebody and vein strike west-northwest and dip about 70 degrees north-northeast. The plunge of the orebody parallels its dip. At the surface the shoot is 8 feet long, averages 16 inches in width, and is reported to contain 1·64 ounces of gold a ton; on the 175-foot level it has a drift length of 23 feet, averages 15 inches in width, and contains 0·55 ounce of gold a ton. Much greater widths of quartz have been exposed underground, as previously mentioned, but are not ore. No ore has been encountered on the 300-foot level although a little gold has been seen. Much of the slaty hanging-wall rock has been altered to a chloritic schist with which the quartz is in sharp contact. On the north wall of the "A" pit this schist outcrops as a rusty band 6 to 18 inches wide but probably ends a few feet east of the pit and ore shoot. The foot-wall rock is commonly a micaceous greywacke and, because it has been partly replaced by quartz, locally appears to grade into the vein quartz. Most of the visible gold is close to hanging-wall slate and schist or near inclusions of slate, and some occurs in chloritic seams in these inclusions. The notably sheared hanging-wall appears to be a feature confined to the vicinity of the ore shoot. Another structural feature unique to this part of the vein is a loop-like fold involving the beds immediately southwest of the ore shoot (*See* Figure 5). The strata are here greatly contorted and broken, and the details of the structure are further obscured by numerous stringers and irregular bodies of milky quartz; nevertheless, the outcrop diameter of this loop-like structure may be about 60 feet. Possibly the presence of "A" orebody should be attributed, in part at least, to these two local structures.

At "B" pit the vein strikes west-northwest, and dips about 70 degrees north-northeast. Surface sampling by the owners indicated that approximately 40 feet of the vein averages 1 foot in width and contains more than 1 ounce of gold a ton. Diamond drill-holes in this vicinity probed the the vein at shallow depths but, although some high-grade quartz was encountered, failed to outline a commercial orebody.

Easton Vein. The Easton quartz vein was found late in the summer of 1947, but was not seen by the writer. It outcrops on Norma No. 8 claim and is reported (Hellens, 1948, p. 25) to have been exposed for a length of 105 feet, to have a maximum width of about 4 feet, and to narrow to a few inches at each end of the exposure. Sampling by company engineers is said to have yelded erratic assay results ranging from 0·01 ounce to about 4 ounces of gold a ton.

MILL

Tests to indicate a suitable method of treating the ore were carried out by Nepheline Products, Limited, on a 1,600-pound sample from the "A" pit. This sample assayed: gold, 1·62 ounces a ton; and silver, 0·22 ounce a ton. The mill was designed by Aerofall Mills, Limited, of Toronto, and is housed in a building 65 feet long and 35 feet wide. Ore from the 75-ton ore bin entered a 7- by 4-foot Aerofall mill capable, according to the designers, of delivering 35 tons of suitably ground ore in 24 hours when using ore as the crushing and grinding medium, or 55 tons or more in 24 hours when operating with an appropriate ball charge. The ground ore then passed over a single-cell jig and twelve 3- by 8-foot blanket tables. The concentrates from the jig and tables were treated in an amalgam barrel and gold amalgam recovered. The anticipated gold recovery was 76 per cent, but the actual gold recovery, from disappointingly low-grade material, was about 50 per cent.

COSTS AND GENERAL OPERATING DATA

Total expenditures to November 30, 1947, by Beaulieu Yellowknife Mines, Limited, amounted to (Hellens, 1948, p. 25) $795,052, as follows: supplies and inventory, $105,444; buildings and installations, $92,253; roads, docks, and airstrip, $9,201; plant and machinery, $160,035; equipment and tools, $58,798; exploration and development, $183,067; stoping $2,459; mill operations, $6,988; outside exploration, $4,747; mine office and supervision, $33,320; general expense, $65,048; miscellaneous accounts, $73,693.

The shaft was sunk by contract at $45 a foot, this amount being the cost of labour and explosives only. The specified minimum rock opening was 6½ by 11½ feet.

General freight was hauled by tractor from Yellowknife to the Beaulieu mine during the winter of 1946-1947 at a contract rate of $30 a ton. The contracting parties obtained a pay-load of lumber on the return trip to Yellowknife.

Considerable heavy freight remained to be transported to the property after the 1947 break-up, and this necessitated the use of aircraft. To provide landing facilities for large, wheel-equipped aircraft capable of transporting the required material without excessive cost, an airstrip was constructed on a nearby, sparsely timbered sand deposit. The runway measures about 4,000 feet by 200 feet and is flanked by suitably cleared borders about 200 feet wide. Construction was done at nominal cost by a bulldozer operating three shifts a day for 2 weeks, and provided a satisfactory landing surface for fully loaded DC3 aircraft. Commencing July 1, 1947, essentially all freight from Yellowknife, and a little from Edmonton, was flown to this airstrip by a DC3 aircraft operated by Uscan Engineering Corporation, Limited. At the charter rate of $110 an hour flying time each trip from Yellowknife cost the Beaulieu company about $110. Pay loads approximated 4 tons.

On July 6, 1947, when engaged in shaft sinking and mill construction, the company employed about fifty persons, eight of these being staff. All lumber and timbers required for buildings and other structures, including the headframe and orebin, were sawn at the property from local spruce. The cost of each meal served was $1.21, before apportioning cooks' wages.

Bet Group (40)

Reference: Lord, 1942a, p. 50.

The former Bet group of claims was owned by the Bar-bet Mining Development Company, Limited, of Yellowknife. The claims lay about ½ mile west of the southwest end of Damoti Lake, and adjoined the Ann group on the south. The following description is from notes by J. T. Wilson, who examined the property in September 1939.

Six trenches near the northeast corner of Bet No. 4 claim have an average length of about 20 feet, and would lie on and about at right angles to a line trending north 25 degrees east. The underlying strata are dark grey, siliceous argillite and fine-grained, dark green andesite of the Yellowknife group. Here and there the strata display vertical foliation that trends north 25 degrees east. Feldspar-quartz porphyry, some of which cuts the Yellowknife formations, outcrops nearby. The trenches expose irregular stringers and lenses of white quartz, many of which are nearly parallel with the foliation of the enclosing rock. Most of the quartz bodies are less than 6 inches wide, but one attains a maximum width of 2 feet or more. Six feet of one trench displays about 40 per cent quartz, and 15 feet of another, about 30 per cent. Numerous rock fragments, and a little pyrite, galena, sphalerite, chalcopyrite, pyrrhotite, and malachite were noted in the quartz, and gold and arsenopyrite have been reported.

Bidd Consolidated Mines, Limited (33)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 86-B-6. Stanton, 1947, pp. 22, 23.

Bidd Consolidated Mines, Limited, has explored the Rolex group of six claims at the north end of Float Lake, 130 miles north-northwest of Yellowknife. The following description is by Stanton, who visited the property in 1946. At that time the work done included trenches on several quartz showings, and several hundred feet of diamond drilling. The strata referred to belong to the Yellowknife group.

About 600 feet northeast of the north end of Float Lake, test pits have been dug in a large, circular mass of quartz, measuring about 80 by 75 feet. Most of the quartz is white, glassy, and unmineralized. Locally it is reddish to rusty and sugary. Grey quartz stringers extend over a considerable area to the northeast and southwest of this large mass. The quartz mass is in slates and shaly greywacke striking northeasterly and dipping 85 degrees northwest. Local contortion and minor drag-folding were observed. The zone is crossed by a diabase dyke 50 feet wide, striking north 50 degrees west.

Immediately north of Float Lake several pits have exposed a narrow zone of quartz veins and stringers for a distance of 500 feet. The quartz is white to grey, and in general glassy. The zone strikes north 15 degrees east, and is in slaty rocks that strike north 15 degrees east and dip vertically. Some shearing has developed along bedding planes. Mineralization is sparse, although a little rust occurs locally.

Some trenching has been done elsewhere on the property on quartz veins and stringers in slates and greywackes, but values in gold are reported to be low.

Blaisdell Lake Pegmatites (92)

References: Henderson and Jolliffe, 1941. Jolliffe, 1944a, pp. 22, 23.

Blaisdell Lake is 34 miles northeast of Yellowknife. Beryl was first reported near the lake in 1937, by a Geological Survey field party. Pegmatite bodies within a mile or two of the lake were re-examined in 1943 by A. W. Jolliffe, and his report is quoted below.

The area is underlain by nodular sedimentary rocks intruded by two bodies of.... granite[1]. One of these is less than a mile across and forms most of the peninsula on the north side of the lake; the other extends 5 miles northwest from the lake. Pegmatite dykes and sills cut these bodies and the surrounding sedimentary rocks.

[1] Probably pegmatitic muscovite granite.

Of nearly fifty dykes examined, beryl with tantalite-columbite (and/or cassiterite) were found in twelve, and a further twenty were found to contain beryl alone. Most of the pegmatites carry tourmaline; minor occurrences of lithiophilite, molybdenite, arsenopyrite, and pyrite were noted.

The beryl-bearing dykes are up to 2,000 feet long and 10 feet wide. The best concentration seen is in a dyke cutting granite a few feet west of the granite-sediment contact, three-quarters of a mile north of Blaisdell Lake. The dyke strikes north-northwest parallel to the contact, dips 75 degrees to the west, and was followed for 700 feet. Two sections, each about 30 feet long and 7 feet wide, carry about 4 per cent beryl (estimated by measuring areas of beryl crystals exposed on the glaciated surface). The intervening dyke section is 180 feet long, 7 feet wide, and contains some beryl and tantalite-columbite. Over a total length of 240 feet the dyke should average close to 1·5 per cent beryl across 7 feet. The mineral is in distinct pale greenish yellow crystals averaging more than an inch across by several inches long. Within the southern high-grade shoot, a basal section of two intergrown beryl crystals measures 12 by 18 inches. As most beryl crystals in this dyke and elsewhere have lengths measuring three to four times their maximum widths, it is probable that these two crystals will aggregate nearly half a ton.

B.M. Group (129)

Reference: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 75-L-5.

The B.M. group of sixteen claims is 80 miles east of Yellowknife, or 4 miles northwest of Sachowia Point on the north shore of the east arm of Great Slave Lake. The claims were staked by W. C. Drysdale on behalf of the Consolidated Mining and Smelting Company of Canada, Limited, in August 1940. The property has not been examined for the Geological Survey of Canada, but is reported[1] to contain a small deposit of cobalt and nickel arsenides.

Bobjo Group (104)

Reference: Henderson, 1939a, p. 14.

According to Henderson, the Bobjo claims lie about 1 mile west of the south end of Victory Lake, and adjoin the Irma claims (105) on the northwest. They include the northwest and west contact of the northwest end of a belt of volcanic strata of the Yellowknife group; sedimentary strata of the same group adjoin the volcanic rocks. Shear zones along the contact contain much pyrite and chalcopyrite, and carry quartz veins and lenses containing galena, sphalerite, chalcopyrite, and pyrite.

Bonanza Group (15)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 86-K-4. Feniak, 1947, pp. 25-26. Kidd, 1932a, pp. 67-68; 1933, pp. 26-28; 1936, pp. 39-40.

The Bonanza group is on Dowdell Peninsula, about 6 miles south-southwest of Port Radium. The claims were staked in 1931 by G. A. LaBine, E. C. St. Paul, and others, for Eldorado Gold Mines, Limited.

Silver occurs at two localities ½ mile apart and about 2 miles east-southeast of Dowdell Point. El-Bonanza Mining Corporation, Limited, was incorporated in January 1934 to develop the eastern (El-Bonanza) deposit, and did some surface and underground work on it in 1934 and

[1] Campbell, N.: District Geologist, the Consolidated Mining and Smelting Company of Canada Limited; personal communication.

1935, shipping 6,506 pounds of high-grade silver ore to Trail, British Columbia, in 1935. So far as known no work has been done on this deposit since 1936.

The western (Bonanza) deposit was explored underground by Eldorado Gold Mines, Limited, in 1938, and a little silver ore was extracted and treated in the company's mill at Labine Point (13).

No detailed description of the underground workings is available. The surface geology of the deposits, as described by Feniak and Kidd, is summarized below.

The western deposit is in a band of sedimentary rocks that ranges up to 300 feet in width and trends about northwest. The strata are mostly well-banded, hard, fine-grained, grey and pink, highly altered rocks; they strike about northwest and dip nearly vertically. Granite is intrusive into the strata on the south side of the band, and granodiorite on the north side. The granite is younger than the granodiorite. 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, either niccolite or bornite, and at least two, unidentified, soft grey, metallic minerals. A stripped part of the zone, measuring (Kidd, 1933, p. 27) 30 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 to 50 per cent. Eight areas of similar size contain silver and occur in another stripped part of the zone that measures 54 by 16 feet.

At the eastern deposit silver occurs in two zones. The occurrences resemble those of the western deposit, but contain a little pitchblende (Feniak, 1947, p. 25), bornite, galena, covellite, sphalerite, tetrahedrite, malachite, fluorite, and quartz. The carbonate gangue, at least in part, is calcite rather than manganiferous carbonate (Kidd, 1936, p. 40).

The silver occurrences are younger than the granodiorite and may be genetically related to the granite, which, like them, contains a little fluorite (Feniak, 1947, p. 25).

Bore Group (94)

References: Bureau of Mines, 1944a and 1944c. Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-I-11. Fortier, 1947a. Jolliffe, 1944a, pp. 20-22.

The Bore group of three claims is at the south end of Sproule Lake, 34 miles northeast of Yellowknife and 10 miles north of Thompson-Lundmark mine (103). The claims were staked in September 1943 and were owned by Radium Luminous Industries, Limited. They were examined in 1943 by A. W. Jolliffe (1944a, pp. 20-22) and in 1944 by Y. O. Fortier (1947a). The following description is from the former report.

With one exception, the dykes described here strike northwesterly and dip between 30 and 70 degrees to the southwest. They are contained in a belt up to 200 feet wide and more than 1,700 feet long, which passes beneath Sproule Lake to the northwest and beneath a wide muskeg to the southeast. Individual dykes within the belt are up to $3\frac{1}{2}$ feet wide and are almost certainly continuous for as much as 500 feet. The dykes cross nodular greywacke that strikes northeast and has an overturned dip of 65 to 70 degrees northwest.

The mineral content varies considerably within a single dyke, or even within a single outcrop. Rare-element minerals indentfied are spodumene, amblygonite, beryl, cassiterite, tantalite-columbite, lithiophilite, and indicolite (blue-green tourmaline).

Spodumene occurs in rudely radiating columnar crystals up to a foot long within the central parts of certain dyke sections. Much of it, particularly the smaller crystals, is altered to a very fine-grained, yellow-green, micaceous aggregate. Amblygonite is commonly concentrated near the hanging-wall and occurs in equidimensional crystals up to 8 inches across, but averages less than an inch. Over lengths of 10 to 15 feet the two lithium minerals may constitute as much as a quarter of the dyke area. Beryl occurs sparingly in a few sections as white to light green crystals up to 2 inches across. Muscovite constitutes less than 5 per cent of most dykes and occurs chiefly along the borders; less commonly it is present as medium-grained aggregates up to a foot long within quartz along the central parts of the dykes. Lithiophilite was found in three places. Tiny blue-green crystals of indicolite occur in muscovite along the dyke margins; black bands less than an inch wide in the bordering sedimentary rocks may represent introduced tourmaline.

Cassiterite and tantalite-columbite are the only minerals of possible present economic interest. They occur chiefly in cleavelandite in the middle and upper parts of the dykes, but were seen enclosed by several other minerals and in the footwall as well. Cassiterite occurs as dark brown to jet-black irregular aggregates up to $1\frac{1}{4}$ inches by 1 by $\frac{3}{8}$ inch. Tantalite-columbite is in blue-black crystals having a distinctive bladed or tabular habit up to $1\frac{1}{4}$ inches by $\frac{3}{4}$ by $\frac{3}{16}$ inch. From these upper limits the crystals of both minerals range downwards to almost microscopic size.

Four samples, each weighing about 55 pounds, were blasted from dyke sections showing most cassiterite on the weathered surface; two of these contained 0·06 and 0·41 per cent tin, the others none (Bureau of Mines, 1944c, p. 5).

Four samples totalling 230 pounds were taken from dyke sections showing most tantalite-columbite on the weathered surface. Concentration tests by the Bureau of Mines (1944c, pp. 7, 9) showed that similar material would afford 0·95 pound to 2·45 pounds of concentrate per ton of ore treated, and that the coarser fractions (-20+35 mesh) of the concentrate would contain about 30 per cent cassiterite, the balance being mainly tantalite-columbite of undetermined composition. The material tested appeared to be unacceptable as a tantalum ore.

Bud Group (12)

Reference: Kidd, 1936, p. 40.

The Bud group of twenty-two claims has lapsed since Kidd published the following description.

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 quartizite. 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.

Camlaren Mines, Limited (64)

References: Bureau of Mines, 1939a. Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-I-14. Henderson, 1939a; 1941c; 1943. Henderson and Fraser, 1948. Henderson and Jolliffe, 1939.

INTRODUCTION AND HISTORY

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 A.X. Syndicate. The property includes islands near the east side of Gordon Lake about 7 miles from the south end of the lake. The claims are about 50 miles northeast of Yellowknife, and connected with that settlement by a 65-mile winter road. Some ore was indicated by diamond drilling prior to July 1937. Exploration was carried on continuously, under the direction of A. K. Muir, from the summer of 1937 to December 1938, but the property has been idle since.

DEVELOPMENT

The company spent $411,874 on the property from July 1937 to December 1939. Diamond drilling done by Camlaren Mines, Limited, totals 14,994 feet.

Diesel power was installed and most underground work done on the discovery or 'Hump' vein. This vein outcrops on 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 near this vein is 380 feet deep. Drifts and crosscuts on the 200- and 350-foot levels total 2,241 feet.

No. 2 shaft was sunk to explore the '31' vein, which outcrops on the northeast shore of Zenith Island, 1 mile southwest of the 'Hump' vein. The shaft is 220 feet deep, and crosscuts and drifts served by it 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.

ORE RESERVES

According to the company, underground work on the 'Hump' vein indicated 13,177 tons of ore. 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 (uncut grade); 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 (cut grade).

DESCRIPTION OF DEPOSITS

The veins and ore deposits have been described by Henderson (1939a' pp. 10-11) and quotations to follow are from his report.

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[1]........

[1] No. 1 shaft is on this island.

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 imediately 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 botton. 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.

A shaft has been sunk to a depth of 300 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 anticline 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.

The sediments in which [the '31' vein] 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.

The ['H'] 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 orebodies were found in this vein.

Camsell River Silver Mines, Limited (20)

References: Bureau of Mines, 1948c. Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 86-F-12. Kidd, 1933, p. 29; 1936, pp. 30-32. Lord, 1941a, pp. 56-58. Mines Branch, 1935b. Parsons, 1948a, pp. 9-10.

INTRODUCTION

The property of Camsell River Silver Mines, Limited, on Camsell River 9 miles from the mouth, comprises the Otter, A.V.G., A.G.X., Oxo, Mabel, F. and H., and See claims, about thirty-seven in all. The property is 35 miles south of Eldorado mine (13) and 4½ miles west-southwest of White Eagle Falls. Work done during 1947 was under the supervision of A. V. Giauque, and N.W. Byrne of Yellowknife was consulting engineer. The property has not been examined by the writer, and the following description is mainly a summary of previous publications.

HISTORY

Native silver was found on the Otter group of claims in 1932 by W. J. Workman and E. B. McLellan. Underground and surface work was done on the deposit by White Eagle Silver Mines, Limited, during the next year or so. Interest in the district subsequently waned and other, nearby claims eventually lapsed. Adjacent ground, probably in part previously staked as the How and Elite groups, was staked by A. V. Giauque and associates in 1945 and 1946; and these, with the Otter group acquired from White Eagle Silver Mines, Limited, are now owned by Camsell River Silver Mines, Limited, which was incorporated in 1946. Trenching, geological mapping, and diamond drilling were done by the latter company during the spring and summer of 1947, but the property was inactive in August and September.

DEVELOPMENT

The camp is on the east shore of Rainy Lake on the Otter Nos. 3 and 4 claims.

No. 1 zone, on Otter No. 2 claim, strikes northwesterly and dips about northeast. An adit, with its portal on the north bank of Camsell River, crosscuts 40 feet to intersect the zone, which it then follows northwest for 300 feet. About 175 feet from the portal a crosscut extends northeast from the drift for 110 feet. A winze, about 100 feet deep, was sunk from this crosscut and another crosscut extends southwest from the bottom of the winze and intersects the zone. Some drifting was done on this level.

A shaft on A.V.G. No. 1 claim, on the north side of Camsell River about ½ mile northeast of the adit, is reported to be 60 feet deep.

Twenty-six X-ray diamond drill-holes, totalling about 1,750 feet, are said to have been completed during 1947; some of these explored No. 1 zone.

No. 1 zone is described in the following summary of Kidd's accounts.

Rocks near the deposit are mostly andesitic tuffs and agglomerates; associated with them is a fine-grained altered diabase that may be intrusive, but is of nearly the same age. Granitic intrusive rocks outcrop about 1 mile east. 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. The fracture zone ranges from 1 inch to 3 or 4 feet in width 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. Evidence of banding and crustification is common in the veins, and the vein filling is mostly quartz and coarse, pink, manganese-bearing dolomite; these minerals are associated with 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 wall-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.

Fifty-four pounds of oxidized ore from No. 1 zone, shipped in 1947 for milling and metallurgical tests, assayed (Bureau of Mines, 1948c, p. 3): silver, 2,442·66 ounces a ton; and lead, 7·30 per cent. The zone is reported (Parsons, 1948a, p. 10) to contain pitchblende.

A deposit previously described by Kidd as occurring on the How group is probably at the shaft on A.V.G. No. 1 claim. A summary of previous descriptions follows.

The deposit occurs in a fine-grained, grey, volcanic rock that contains feldspar phenocrysts in places, and a little disseminated pryite. 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, and is intersected by a network of veinlets that range up to 8 inches in width. 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. The last occurs in tiny leaves in cracks in chloritized rocks near the veins. In one place in the zone, flakes of silver averaging $\frac{1}{16}$ 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.

A deposit described by Kidd as occurring on the Elite group is probably on F. and H. No. 1 claim, about 1 mile south-southeast of the adit. The 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 1 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 for lengths of from 20 to 200 feet. The diabase dyke is younger than the fractures and crosses all of them; it cuts and displaces the longest fracture, but is not itself 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, gersdoriffite (?), galena, native silver, argentite, covellite, and an unidentified bismuth-lead-copper mineral. Chlorite has formed in the wall-rock. Native silver is present in three of the veins and may occur in a fourth. It occurs as masses of abundant wires in a quartz gangue; these silver-bearing 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 intoduced after the fractures had formed it was not necessarily introduced after the vein filling, though the absence of vein minerals in it suggests that it was.

Canadian Gold and Metals Mining Company, Limited (41)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 86-B-3. Tremblay, 1948, p. 6.

According to Tremblay,

Canadian Gold and Metals Mines, Limited, owns the P.B. group of twelve claims that adjoins to the east the property of Russ-Rae Yellowknife Mines, Limited [42]. During the summer of 1946 trenching and drilling were done on the P.B. Nos. 3, 4, and 5 claims. This exploratory work was designed to explore quartz stringers reported to carry visible gold. Diamond drilling comprised eight holes varying in length from 64 to 85 feet and totalling 564 feet. The results of the drilling are not known. The quartz veins are slightly mineralized, and occur in basic volcanic rocks.

The P.B. claims are on the west side of Damoti Lake about 4 miles north-northeast of the camp of Snowden Yellowknife Mines, Limited (43), and about 123 miles north-northwest of Yellowknife. The volcanic rocks referred to belong to the Yellowknife group.

Chalco Group (31)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 86-B-6. Stanton, 1947, p. 23.

The Chalco group of about five claims is on the northeast bay of Chalco Lake, about 130 miles north-northwest of Yellowknife. Chalco No. 1 claim is underlain by strata of the Yellowknife group. Stanton provided the following description after an examination in 1946.

....Several test pits have been dug on a showing situated on the Chalco No. 1 claim about 600 feet north of Chalco Lake. The showing consists of several quartz lenses and stringers in rather massive, buff, quartzitic greywackes that strike from north 15 to 25 degrees east. The quartz zone parallels this strike and was traced for 150 feet, but may extend farther. In one place, narrow quartz stringers and gash veinlets occur sparsely and irregularly across a width of 30 feet, but in general the zone, where seen, consists of discontinuous quartz lenses from 6 inches to 4 feet wide. The quartz is grey to mottled, and glassy to sugary. Sphalerite, galena, chalcopyrite, pyrrhotite, and pyrite are distributed erratically, and it is reported that no gold was obtained by panning.

C.O.D. Group[1] (122)

The C.O.D. group of twenty-one claims lay about $1\frac{1}{2}$ miles south of François Lake and about 65 miles east of Yellowknife. The claims were staked in June and August 1941, following discoveries of scheelite-bearing quartz veins by H. Drever and A. D. Tidsbury for the Consolidated Mining and Smelting Company of Canada, Limited. The claims subsequently lapsed.

The underlying rocks are argillite and greywacke of the Yellowknife group. About 4 miles to the northeast the metamorphosed equivalents of these strata are intruded by a granitic batholith.

At least thirty scheelite-bearing quartz veins were examined by the stakers. Most of these veins occur in bands of thin-bedded argillite and, although relatively persistent and uniform in width, are characteristically narrow and of low grade. The better grade veins, on the other hand, are irregular in outline and relatively short. The distribution of scheelite-bearing shoots within the veins is erratic. The scheelite is white or, rarely, pale buff, and in addition to quartz, is accompanied by grossularite (?), garnet, feldspar, actinolite, a carbonate, and epidote. The garnet comprises 30 to 60 per cent of the gangue material in many of the better grade scheelite-bearing bodies and might be a source of trouble were mining and milling attempted. Veins 7[2] and 8[2] are perhaps the most promising.

Vein 7 is on C.O.D. No. 12 claim. It lies approximately parallel with the bedding of the crumpled slaty rocks in which it occurs, strikes about north 65 degrees east, and dips about 60 degrees southeast. Three disconnected, irregular bodies of quartz contain scheelite and occur within a length of 36 feet. The western body, 16 feet long, is barren at each end but 10 feet of it averages about 2 feet wide and contains more than 1 per cent WO_3. The eastern body is 7 feet long, averages 7 inches wide, and contains 0·7 per cent WO_3. The central body is 7 feet long, averages 15 inches wide, and contains 0·8 per cent WO_3. Other, barren quartz outcrops east and west of the scheelite-bearing bodies.

Vein 8 is on C.O.D. No. 19 claim. It lies parallel with the bedding of the enclosing sedimentary rocks, strikes north 55 degrees west, and dips steeply southwest. It is exposed for 115 feet with an average width of about 10 feet. Both ends of the vein are covered by drift, but rock exposed 50 to 100 feet northwest and southeast of the vein contains only barren quartz stringers. Scheelite occurs near the northwest end of the exposed part of the vein in a shoot 25 feet long and 5 feet wide containing 0·2 per cent WO_3.

---

[1] Described from data supplied by R. E. Folinsbee and the Consolidated Mining and Smelting Company of Canada, Limited.

[2] Numbers assigned by the Consolidated Mining and Smelting Company of Canada, Limited.

Colomac Yellowknife Mines, Limited, and Indian Lake Gold Mines, Limited (28)

References: Bureau of Mines, 1947a. Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 86-B-6. Lilge, 1947. Stanton, 1947, pp. 12-14. Stanton, Tremblay, and Yardley, 1948.

Colomac Yellowknife Mines, Limited, owns twenty-four claims; and twenty claims owned by Indian Lake Gold Mines, Limited, adjoin these on the south. These groups lie astride the north end of Baton (Long) Lake, and about 30 miles north-northeast of the north end of Indin Lake or 135 miles north-northwest of Yellowknife. These properties, and adjacent claims owned by Dyke Lake Gold Mines, Limited, Hearne Yellowknife Mines, Limited, Indyke Gold Mines, Limited, and Nareco Gold Mines, Limited, were explored under the direction of Central Mining Services, Limited, of Toronto. E. F. Creelman was consulting geologist and N. S. Edgar resident manager. The writer visited the Colomac and Indin Lake properties on August 12, 1947, after all work had stopped, and, accordingly, the following remarks are derived mainly from published accounts and data kindly supplied by Central Mining Services, Limited.

Gold was found in 1945 in a lode comprising quartz veinlets in a quartz-albite dyke. The dyke forms part of a ridge on the west side of Baton Lake, and trends about north-northeast parallel with the Lake. It extends throughout the length of the Colomac and Indian Lake properties; and has been traced north of the Colomac property onto Nareco ground, and south of the Indian Lake property onto Indyke ground. In the autumn of 1945 the dyke was partly explored by diamond drilling on Colomac and Indian Lake properties. As a result, an intensive program of exploration, involving geological mapping, surface prospecting and sampling, diamond drilling, and underground work, was undertaken during 1946 from a tent camp established on the west shore of Baton Lake. Although the geological examination and other surface work was extended to cover the claims owned by the four adjacent companies, most diamond drilling and all underground work was confined to the Colomac and Indian Lake properties. Diamond drilling continued until about 47,000 feet had been completed, of which about 40,000 feet were on the main lode. To allow a thorough sampling of the lode a crosscut-adit was driven 570 feet westerly into the hillside about 250 feet north of the Colomac-Indian Lake boundary, and at an elevation that provided backs of as much as 130 feet at the lode. The dyke was encountered about 280 feet from the portal. Drifts, with crosscuts at intervals of about 150 feet, explored the dyke about 520 feet north and 610 feet south from the crosscut-adit. Underground workings total about 2,500 feet.

As many as twelve samples for assay were obtained for each round advanced in the lode: chip samples were cut from the face and each wall; a sample was collected from the cars of muck; and all muck from the round was crushed, reduced in volume, and so split as to provide eight other samples. The average grade of the lode, as calculated from these bulk samples, was reported to be 25·8 per cent greater than the grade determined from diamond drill samples.

Other samples, for metallurgical tests, were shipped to the University of Alberta and the Bureau of Mines, Ottawa. The latter sample (Bureau of

Mines, 1947a), weighing 1,593 pounds, assayed: gold, 0·0825 ounce a ton; silver, 0·07 ounce a ton; iron, 5·13 per cent; and sulphur, 0·74 per cent. Cyanidation tests indicated a gold recovery of nearly 94 per cent, whereas nearly 85 per cent of the gold was recovered by a straight amalgamation process.

All work at the properties ceased in November 1946. Shortly thereafter the Colomac and Indian Lake companies reported that the lode contained about 21,000 tons of material a vertical foot and graded $2.98 a ton in gold (gold valued at $35 an ounce).

When visited by the writer on August 12, 1947, the camp was abandoned, and essentially all equipment and supplies had been removed. Ice rendered most of the south drift inaccessible. Ice crystals near the face of the north drift indicated that these workings were in the zone of permafrost.

A description of the geology of the deposit has been published by Stanton, and is quoted below:

The most intensively explored lode is an intrusive quartz-albite dyke, which for the most part is sill-like, paralleling the regional trend of the intruded andesitic volcanic rocks. For part of its length the dyke lies at the contact of andesite and diorite. It has been traced by company geologists for more than 20,000 feet, in which distance it varies in width from about 35 to 240 feet, and has an average mapped width of 110 feet. The northern half of the dyke has an average strike of north 10 degrees east, the southern half of north 23 degrees east. Drilling has indicated a steep easterly dip of about 80 degrees.

The dyke is a medium-grained grey to dark grey rock that weathers pale grey, white, or pale pink. The rock infrequently contains bluish white quartz phenocrysts about ⅛ inch in diameter. Under the miscroscope it is seen to consist essentially of albite and quartz, these two minerals constituting from 75 to 85 per cent of the rock, the relative ratios of the two varying with the degree of silicification the rock has undergone. In the least silicified specimen studied, albite constitutes 65 per cent and quartz 15 per cent of the section, whereas a silicified specimen collected underground contained 40 per cent albite and 35 per cent quartz. The more silicified phases of the rock show a coarse, micrographic quartz replacement of the albite. The remainder of the rock is composed of chlorite and chloritized amphibole, biotite, carbonate, iron sulphide (commonly pyrrhotite), with minor amounts of sericite, epidote, titanite, apatite, and zircon. The ferromagnesian content is relatively low, despite the dark colour of the rock, and was found to range from 3 to 11 per cent in the specimens studied. For the purpose of this report the dyke material is termed a quartz-albite rock.

As exposed by underground workings, the dyke itself is the host for numerous glassy white quartz veins ranging from thin seams to veins 2 to 3 feet in width. The quartz veins follow a fracture pattern within the dyke, probably the most prominent set having shallow easterly and westerly dips. Both flat and steeply dipping faults of small displacement offset the quartz veins locally. Contacts between vein quartz and the quartz-albite dyke are in places quite sharp, but in others show an almost imperceptible gradation from massive quartz, through very highly silicified quartz-albite rock, to typical dyke material.

Gold values are associated with the glassy white quartz. Gold occurs as coarse free gold in the quartz, and is also reported to be associated with pyrite. In general, the quartz veins terminate abruptly at the contact of the quartz-albite dyke with the andesite wall-rock. A few small quartz-carbonate veins occur locally within the andesite, but these do not appear to contain gold.

Metallic minerals include pyrite, pyrrhotite, arsenopyrite, sphalerite, and visible gold. A little black tourmaline is associated with the quartz. Pyrite is the dominant metallic mineral in the veins, and also occurs as thin films along some chloritic slickensided surfaces within the dyke. Pyrrhotite is finely disseminated throughout much of the quartz-albite host rock, but does not appear to carry gold. Neither arsenopyrite nor sphalerite is common. Arsenopyrite is present locally as crystals up to ½ inch in length, and is commonly associated with the tourmaline. The sphalerite is a medium-brown variety.

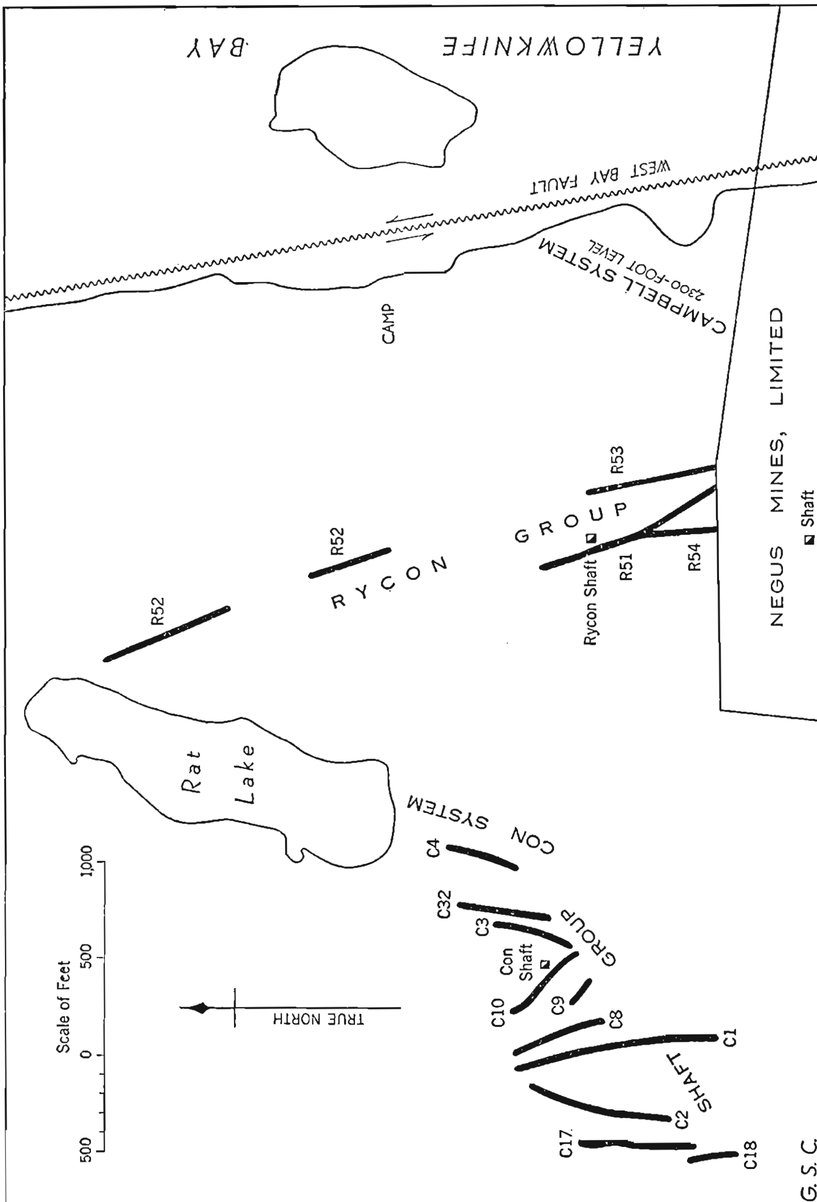

Figure 6. Part of property of Con and Rycon mines, showing groups and systems of shear zones.

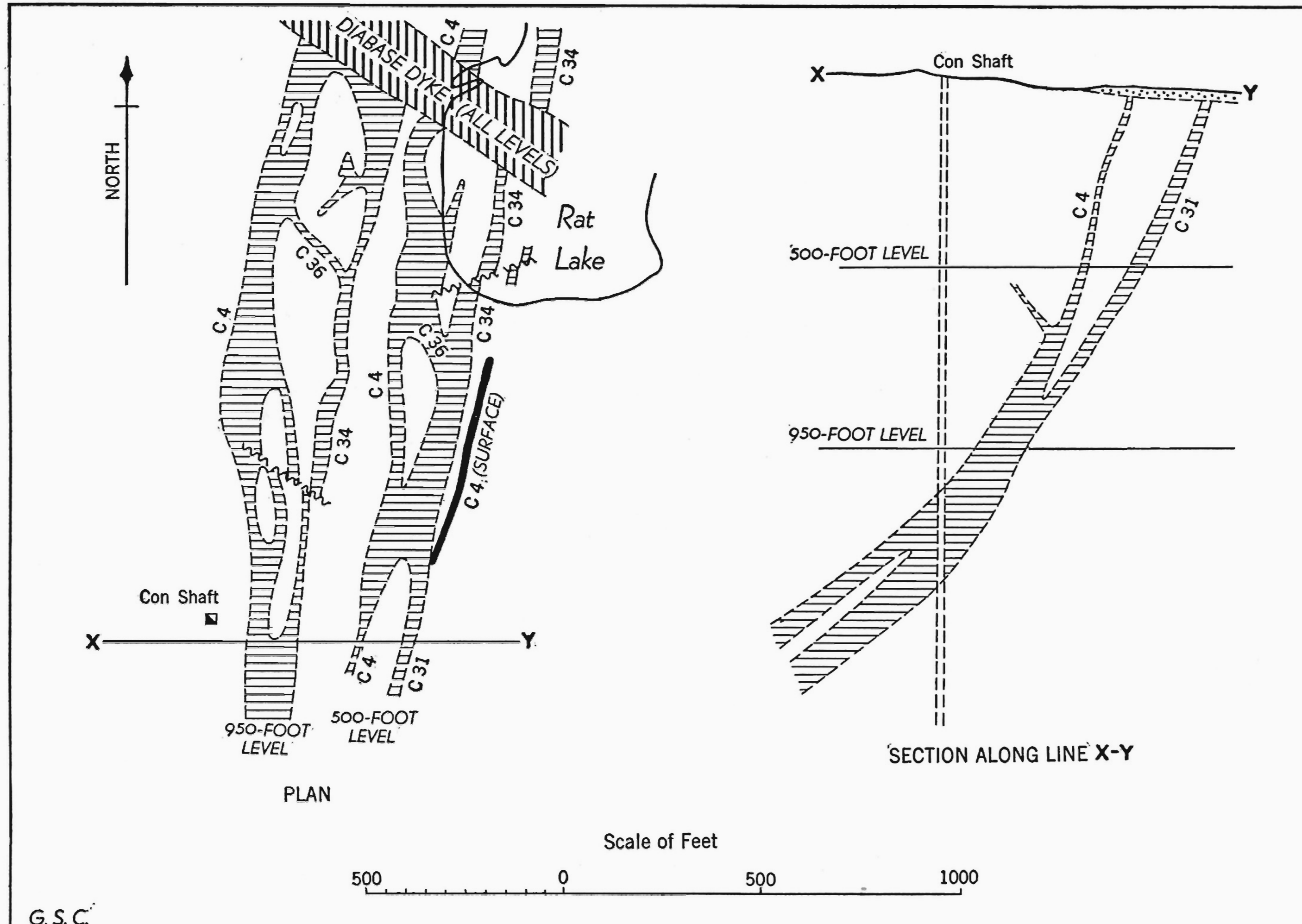

Figure 7. Con system of shear zones, showing members C4, C31, C34, and C36; generalized from data supplied by the Consolidated Mining and Smelting Company of Canada, Limited.

Con and Rycon Mines (73)

(*See* Figures 6 and 7)

References: Bureau of Mines, 1940d. Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-J-8. Campbell, 1948. Henderson and Brown, 1948. Henderson and Jolliffe, 1939. Jolliffe, 1938, pp. 19-28; 1942a. Lord, 1941a, pp. 105-112. Ridland, 1941. White, Ross, and Campbell, 1949.

INTRODUCTION

The Con and Rycon gold mines are on the west side of Yellowknife Bay about 2 miles south of Yellowknife. The Rycon mine is on the P. and G. group of four claims owned by Rycon Mines, Limited. The Con mine, about 2,000 feet west of the Rycon mine, is on the Con group of fourteen claims owned by the Consolidated Mining and Smelting Company of Canada, Limited. Other, adjacent claims are included in the Con-Rycon property. The Consolidated Company controls Rycon Mines, Limited, and operates the Con and Rycon mines from a common mining and milling plant and camp. Gravelled roads, and telephone, connect the mines with Yellowknife. The writer visited the mines in October 1947, and made free use of the many data supplied by C. E. White, operating superintendent; F. Burnet, mine superintendent; R. H. Ross, mill superintendent; and N. Campbell, district geologist for the Consolidated Mining and Smelting Company of Canada, Limited. Except where otherwise stated the following remarks were applicable in October 1947.

HISTORY

The Con claims were staked for the Consolidated Mining and Smelting Company of Canada, Limited, in September and October 1935. When, late in 1936, plans were made for the erection of a 100-ton mill, the property had been 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. A three-compartment vertical (Con) shaft was started near the prospect shaft in the summer of 1937, and mill construction began in September. On September 5, 1938, the first gold brick was poured, and the mine became the first gold producer in Northwest Territories.

The P. and G. claims, adjoining the Con group, were staked by G. Latham and T. Payne in August 1936, and initial development work was done by Ryan Gold Mines, Limited. In August 1937, the Consolidated Mining and Smelting Company of Canada, Limited, obtained a controlling interest in the property and later formed Rycon Mines, Limited, to explore and develop the property. A three-compartment vertical (Rycon) shaft was started near R51 shear zone in December 1938; and in 1939 the first ore from the mine was received at the Con mill.

A hydro-electric plant, built by the Consolidated Mining and Smelting Company of Canada, Limited, on Prosperous Lake, 16 miles north of the mines, commenced delivery of power early in 1941. By March 1942 the capacity of the Con mill had been increased to about 350 tons a day, and a roaster added for the treatment of sulphide ore. Although wartime restrictions on gold mining prevented full use of the enlarged plant, the roaster was operated from April to November 1942. Milling stopped on September 11, 1943, because of labour shortage and other conditions attending World War II, but started again on August 20, 1946. In the meantime, development work was continued by a small crew and the Con shaft deepened to about 1,500 feet; and a geological investigation, carried out by N. Campbell in 1944, resulted in the discovery, on Negus and Con-Rycon properties, of the Campbell system, the faulted extension of the Giant system of ore-bearing shear zones. By the end of 1947 the Con shaft had been deepened about 900 feet and a crosscut started easterly on the 2,300-foot level towards the Campbell system of shear zones, which was intersected in October 1948.

PRODUCTION AND ORE RESERVES

Data supplied by the Dominion Bureau of Statistics, and tabulated below, show that Con and Rycon mines, from September 5, 1938, to December 31, 1948, treated 501,376 tons of ore and recovered 286,871 ounces of gold and 71,678 ounces of silver; concentrates stored for future treatment contained additional gold and silver.

Year	Ore treated	Metals recovered		Concentrates recovered	Estimated gold in concentrates
		Gold	Silver		
	Tons	Ounces	Ounces	Tons	Ounces
1938	13,832	6,794	1,256	...	...
1939	43,463	35,144	8,353	...	...
1940	58,606	33,795	7,645	...	...
1941	59,820	40,912	9,837	...	...
1942	72,204	42,065	11,827	...	...
1943	38,321	22,976	5,133	...	...
1944	...	...	...	...	...
1945	...	...	...	...	...
1946	19,918	7,648	2,051	660	1,248
1947	94,515	42,284	11,120	4,253	5,905
1948	100,697	55,253	14,456[1]	2,036	2,303
Totals	501,376	286,871	71,678	6,949	9,456

[1] Estimated.

Approximately 70 per cent of the gold recovered during 1947 and 1948 came from the Con mine.

Ore reserves at the Con mine on December 31, 1948, were: probable ore, 291,970 tons containing 0·57 ounce gold a ton; indicated ore, 86,600 tons containing 0·43 ounce gold a ton.

Ore reserves at Rycon mine on December 31, 1948, were 56,215 tons averaging 0·50 ounce gold a ton.

CAMP AND PLANT

The camp and plant are the oldest and most elaborate in the district. The camp buildings are at the shore of Yellowknife Bay, mainly on Rose and Star claims. Office and mining and milling plants are near the Con shaft about 3,500 feet west of the camp and mainly on Con No. 5 and Con

No. 7 claims. Buildings are of frame construction, and sheathed with asbestoside; they are supplied with steam heat from two, 125-horsepower oil-fired boilers at the camp, an 80-horsepower oil-fired boiler at the Con mine, and an electric boiler in which all surplus electric power is used.

Machinery includes two Canadian Ingersoll-Rand XVH compressors, each rated at 1,750 cubic feet of air a minute and driven by a 300-horsepower English Electric motor; two Canadian Ingersoll-Rand XVH compressors, each rated at 650 cubic feet of air a minute and connected to a 125-horsepower General Electric motor; a 312 KVA Westinghouse generator driven by a Ruston diesel engine (standby unit); and a Canadian Ingersoll-Rand, type PEI, 96-inch by 70-inch, two-drum electric hoist with a Model D, Lilly control.

Electric power, at 33,000 volts, is received from the Prosperous Lake hydro-electric plant over a steel-tower transmission line 22 miles long. Transformers at the property convert this to 2,200 and 550 volts.

DEVELOPMENT

By August 31, 1948, drifts, crosscuts, and other lateral workings at Con and Rycon mines totalled 54,966 feet; and lateral work done during the first 8 months of 1948 amounted to about 5,726 feet. Although many veins and shear zones have been explored by trenches and diamond drill-holes from the surface, most underground development work has been done on and near the C4, C31, C34, and C36 members of the Con system of shear zones, and C10, C32, R51, and R54 shear zones. Zones C10 and C32 are near the Con shaft, and the C4 member of the Con system outcrops about 800 feet northeast of this shaft. R51 and R54 zones are near the Rycon shaft, which is 2,200 feet east of the Con shaft.

The main, three-compartment, vertical (Con) shaft, on Con No. 5 claim, is 2,460 feet deep and affords access to lateral workings on the 125-, 250-, 375-, 500-, 650-, 800-, 950-, 1,100-, 1,250-, 1,400-, and 2,300-foot levels. Drifts have been opened on all except the 2,300-foot level; and most of these trend a little east of north. Crosscuts on the 500- and 950-foot levels extend easterly about 1,950 feet from the Con shaft to connect with the Rycon workings; and a branch of the latter crosscut skirts the west and south borders of the Negus (80) property to serve short drifts about 2,600 feet southeast of the Con shaft. A crosscut on the 2,300-foot level extends several thousand feet easterly from the Con shaft to the Campbell system of shear zones.

The Rycon mine is explored by drifts on the 125-, 250-, 375-, 500-, 650-, 800-, and 950-foot levels; these trend about north-northwest. The Rycon shaft, on P. and G. No. 4 claim, is used only for ventilation and connects the 125- and 250-foot levels with the surface. An inclined raise connects the deeper levels with the 250-foot level.

GEOLOGY

The Con-Rycon property occupies part of the Yellowknife greenstone belt that extends southerly through the Negus (80) property and northerly through the Giant (76), Akaitcho (71), Crestaurum (74), and other properties. The rocks within the developed area (mainly the Con Nos. 5, 7, and 9, and the P. and G. Nos. 3 and 4 claims) are mostly lava flows of the

Yellowknife group. These are dark green, basaltic to andesitic, massive, pillowed, or variolitic flows interlayered here and there with a little tuff or coarse fragmental volcanic material; the flows strike about north 60 degrees east, and dip steeply southeast or are nearly vertical.

The volcanic flows are cut by numerous meta-gabbro and meta-diorite dykes. These are fine- to medium-grained, dark to light green weathering, rarely porphyritic rocks with sharp, chilled borders. The dykes range in width up to about 150 feet, strike about north 35 degrees west to north 10 degrees east, and dip westerly.

A medium-grained, grey, equigranular, granitic rock, with disseminated pyrite and rare grains of molybdenite(?), was encountered on the 950-foot level in the southeast part of Con No. 9 claim. It intrudes the adjacent volcanic flows and probably the meta-gabbro and meta-diorite dykes, and may be a stock-like body, the domed roof of which does not reach the surface.

Fresh, rusty brown weathering diabase dykes composed of about equal parts of plagioclase and pyroxene are the youngest rocks recognized. One of these, commonly known as the Con dyke, is about 150 feet in width, nearly vertical, and has been traced 8,000 feet northwesterly across the property, and beyond.

Two types of faults are common. Early, pre-diabase, shear-zone faults range up to several hundred feet in width and are marked by chlorite schist; many strike between north-northwest and north-northeast, dip westerly, and thus transect the lava flows. Some of them border meta-gabbro and meta-diorite dykes. The movement, where determined, was mainly parallel with the dip, the westerly side having moved up relative to the easterly side (Campbell, 1948, p. 247). Quartz veins and the known gold-bearing orebodies were formed in the shear-zone faults before the emplacement of the diabase dykes and the formation of post-diabase faults.

The late, post-diabase faults are clean-cut, narrow fissures marked by a little brecciated rock or gouge, or both. The larger faults strike between north and north-northwest and are nearly vertical. The largest is the West Bay fault; it trends a little west of north, is nearly vertical, and, where it crosses the Con-Rycon property, lies beneath Yellowknife Bay a few hundred feet east of, and parallel with, the shore. Campbell (1948, p. 256) states that the west side has moved 16,140 feet south and 1,570 feet down relative to the east side.

DESCRIPTION OF DEPOSITS

As previously stated, the gold-bearing veins and ore deposits occupy parts of the early, pre-diabase, shear-zone faults (*See* Figure 6). The Con system of shear zones (including members C4, C31, C34, and C36) is, near the surface, about 600 feet east of the Con shaft; the shaft group (including shear zones C10, C17, C32, and many others) lies near and southwest of the Con shaft; the Rycon group (R51, R52, R53, and R54) outcrops near and north of the Rycon shaft; and the Campbell system of shear zones, although it does not outcrop, is about 3,500 feet east of the Con shaft at the 2,300-foot level. The shear zones transect the basaltic and andesitic lava flows, and in some instances follow the borders of meta-gabbro and meta-diorite dykes; many branch, or join other shears. The zones on which most work has been done strike between northwest and north-northeast, and dip westerly between 35 and 80 degrees; widths range from a few inches to 150 feet or more. Although offset here and there by post-diabase faults, the Con and Campbell systems of zones are probably many thousand feet long. Other shear zones, only a few feet wide, have been traced more than 1,000 feet. The rock in the zones is mainly chlorite schist, and the walls are commonly sharp, or definable within a few feet. The largest ore shoots are lenticular, well-mineralized bodies of interlayered cherty quartz and sericite schist; others are parts of relatively narrow, sparsely mineralized, nearly pure quartz veins. An envelope of sericite schist separates the orebodies from the enclosing chlorite schist. Most stopes are above the 650-foot level, but ore occurs on deeper levels, including the 1,400-foot level. Current (1949) exploration on the 2,300-foot level in the Campbell system is the deepest being undertaken by any gold mine in Northwest Territories. The orebodies of the Con mine are, in general, much larger than those of the Rycon mine. The drift length of Con orebodies ranges up to 400 feet or more, their width up to about 40 feet; and some contain more than 1 ounce of gold a ton.

A great variety of very fine-grained, sparsely disseminated, metallic minerals occur in the orebodies, but probably nowhere constitute more than a few per cent of the ore. Arsenopyrite and pyrite are most common, and visible gold occurs in many places. Other reported (Ridland, 1941) metallic minerals are: hematite, sphalerite, chalcopyrite, gudmundite, boulangerite, jordanite, guitermantite, jamesonite, galena, pyrrhotite, altaite, stibnite, tennantite, chalcostibite, marcasite, leucopyrite, nagyagite, chalcocite, and covellite. Most visible gold occurs in quartz. Tin has been detected by assay of mineralized vein matter from Con, Rycon, or Negus mines (Jolliffe, 1938, p. 22). Small amounts of scheelite occur in the C17, C34, R51, and other veins.

The Con System of shear zones has afforded most of the ore extracted at the mines. It strikes about north 20 degrees east and dips westerly at from 70 to less than 45 degrees; but the foliation of the schist of the shear zones almost everywhere dips 65 or 70 degrees west. In places (*See* Figure 7) a western (C4) member, two eastern (C31 and C34) members, a transverse (C36) member, and various horses of unsheared rock have been distinguished; elsewhere the member shear zones coalesce to form one shear zone as much as 150 feet wide, or exploratory work has been insufficient to permit correlation between levels. The maximum width of the system is at least 200 feet, the average about 50 feet. In many places the walls of the shear zones are sharp; elsewhere the schist grades into massive greenstone through several feet of partly sheared rock. The system has been traced by drifts and underground drill-holes for at least 2,600 feet, and surface geological work suggests that it is more, probably much more, than 6,500 feet long. Only the C4 member outcrops in the explored area, and, although exposed by trenches at intervals for about 550 feet, only the most northerly trench, at the edge of a drift-covered area that extends north to Rat Lake, contains ore. The average width of this member, at the surface, is probably less than 8 feet.

The orebodies, which occupy parts of the shear zones, are lenticular masses of dull grey cherty quartz ribboned with sericite schist and mineralized with fine arsenopyrite, pyrite, and other minerals. The metallic minerals comprise perhaps 1 or 2 per cent of the ore. Arsenopyrite is particularly abundant in ore from the C34 shear zone. Here and there, particularly on the lower levels, the ore is cut by veinlets and irregular masses of barren white quartz. The orebodies are separated from the chlorite schist of the shear zones by an envelope of sericite schist; and this extends a few inches to 1 foot beyond the walls of the orebodies and perhaps 50 feet beyond their drift-ends. Most of the known ore of the Con system has been found above the 650-foot level where the structure has a relatively steep dip; other ore, in more widely spaced shoots, has been opened by drifts down to and including the 1,400-foot level. The structure has not been explored by drifts at greater depths. The ore shoots tend to occur where the shear zones transect massive lava flows and, accordingly, to pitch steeply south. By September 1939, 1,200 feet of drift in the C4 shear zone on the 250-foot level had exposed 648 feet of ore in six shoots that averaged about $5\frac{1}{2}$ feet in width and contained about 1·3 ounces of gold a ton; two of these shoots, 287 and 100 feet in length, had average widths of, respectively, 3·8 and 17 feet. Comparable success has attended the search for ore on the 375-, 500-, and 650-foot levels, where ore has been stoped from the C4, C34, and C36 shear zones. An ore shoot on the 1,400-foot level is 268 feet long, averages 5·6 feet in width, and contains 0·65 ounce gold a ton (uncut).

The shear zones of the Con system, and in places the orebodies within them, are cut by the Con diabase dyke. The separation due to the dyke produces an apparent offset of about 50 feet for the shear zones.

The Shaft Group of shear zones strikes, in most instances, between northwest and north-northeast. The zones are commonly 2 or 3 feet wide, dip 45 degrees or less, and follow the borders of meta-gabbro and meta-diorite dykes. Here and there they contain quartz veins with abundant visible gold; the veins are rarely more than $1\frac{1}{2}$ feet wide, and are separated from the chlorite schist by a few inches of sericite schist. Ore has been mined from the C10, C17, and C32 zones, and the deepest stope is on the 650-foot level.

C10 shear zone strikes about north 40 degrees west, dips 50 degrees southwest, and has been traced on the surface for about 250 feet. Where exposed on the 125- and 250-foot levels it is 1 foot to 8 feet in width and averages 3 feet. The walls are sharp. An ore shoot was about 250 feet long on the surface, 187 feet long on the 125-foot level, and did not extend to the 250-foot level; it averaged about 15 inches wide, and has been mined to the surface.

C17 shear zone strikes north, dips about 65 degrees west, and has been traced on the surface for 650 feet. It 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 in width and contains gold. Two small stopes were opened in this zone on the 500-foot level.

C32 shear zone was not examined.

The Rycon Group of shear zones commonly follow the borders of meta-gabbro and meta-diorite dykes, and each is characterized by narrow veins of nearly pure quartz. The southern members of the group extend south into the property of Negus Mines, Limited (80), where they contained orebodies. The Rycon ore shoots tend to pitch about 45 degrees southerly, probably about parallel with the intersections of the westerly dipping shear zones with the southeasterly inclined lava flows. R51 and R54 shear zones have been explored by drifts, and R52 and R53 shear zones by surface work.

R51 shear zone strikes north 25 degrees west and dips about 65 degrees southwest. At the surface it has been traced for 1,200 feet, of which the southern 160 feet lie on Negus property. On the 125- and 250-foot levels it is reported to have been followed about 900 feet and 1,060 feet, respectively. On the 500-foot level it has been traced perhaps 750 feet; and shorter lengths have been opened on the 650-, 800-, and 950-foot levels. At the surface the shear zone ranges in width from 4 to 14 feet, and averages about 7 feet; on the 500-foot level it may average 3 feet. In many, but not all, places the walls of the zone are sharp. Lenses of nearly pure, mottled black, grey, and white quartz occur in parts of the shear zone; many of these contain gold and some are of ore grade. The largest quartz lens is reported to be about 180 feet long and to range in width up to nearly 5 feet. Exposed quartz in 750 feet of the shear zone at the surface averages $1\frac{1}{2}$ feet in width. Some quartz is banded parallel with the walls by seams of pyrite or other minerals, or by bands of quartz of various colours and textures. In places the quartz lenses have sharp walls; elsewhere they grade along and across the strike to schist. Despite reports of considerable gold in quartz at the surface, no orebodies were found between the surface and the 125-foot level. Most ore was encountered between the 250- and 500-foot levels. Six drift-lengths of ore on the 250-foot level had an aggregate length of 471 feet, averaged about $2\frac{1}{2}$ feet in width, and contained 0·25 ounce to 1·42 ounces gold a ton; the largest body was 156 feet long, and averaged 2·7 feet in width. Four drift-lengths of ore on the 500-foot level total 325 feet, average about 2 feet in width, and contain 0·62 ounce to 3·25 ounces gold a ton; the largest body is 174 feet long and 1·9 feet wide. An ore shoot on the 950-foot level is 78 feet long and 2·7 feet wide.

R52 shear zone strikes about north 25 degrees west and dips between 60 and 75 degrees southwest; it has been traced on the surface for about 2,000 feet. The shear zone ranges in width from $1\frac{1}{2}$ to more than 4 feet. In places it contains banded white to grey quartz up to 2 feet wide, some of which contains gold. The zone has been explored by diamond drill-holes.

R53 shear zone strikes about north 10 degrees west and dips westerly at about 60 degrees. It is exposed on the surface at intervals for 670 feet on Rycon property and an additional 140 feet on Negus property. It ranges from 1 foot to $2\frac{1}{2}$ feet in width and in places contains a quartz vein up to 9 inches wide; here and there the quartz contains plentiful visible gold.

R54 shear zone (formerly known as R51W) strikes about north 10 degrees west and, at the surface, joins the west side of R51 shear zone 200 feet south of the Rycon shaft. The zone dips between 60 and 80 degrees west at the surface, and, although covered with drift in places, has probably been traced 450 feet on Rycon property and an additional 70 feet on Negus property. The surface width varies from a few inches to 5 feet and averages about 1 foot. The zone contains a vein of mottled and streaked, white to black quartz; this averages about 9 inches in width at the surface and displays abundant visible gold near the Rycon-Negus boundary. A high-grade ore shoot on the 250-foot level is 290 feet long and 0·9 foot wide; and two high-grade shoots on the 500-foot level have a total drift length of 177 feet and average about 1·2 feet in width.

The Campbell System of shear zones was intersected by one drill-hole on Con-Rycon property; this was drilled easterly, at a dip of about 45 degrees, from a station on the 950-foot level about 500 feet east-southeast of the Rycon shaft. The drill is reported to have encountered approximately 600 feet (true width) of variously schistose rock before entering a fault (the West Bay or an adjacent fault) at a depth of about 2,300 feet. The system strikes a little east of north, and dips about 45 degrees west; it extends south-southwest into Negus property, and north-northeast to the West Bay fault. The crosscut from the Con shaft on the 2,300-foot level did not reach the system until after the writer's visit.

UNDERGROUND OPERATIONS

Stopes have been opened on all levels of the Con mine down to and including the 1,100-foot level; but, as in the Rycon mine, most ore extracted has come from above the 500-foot level. Known ore above the 125-foot level of Con mine has been removed. Most ore is mined in shrinkage stopes. Several of these stopes were started without timber, by breaking boxholes from the drift to the foot-wall of the orebody; ore from these boxholes is scraped from the floor of the drift into mine cars, or into ore passes leading to lower, haulage levels. Open stopes are used to extract ore from some gently inclined, narrow orebodies, as south of the Con shaft and in the Rycon mine.

Detachable bits were used on rock drills after October 1947. Their use immediately effected a saving of about twenty men, and was expected to effect further economy because of increased drilling speed and a saving of time formerly consumed in handling conventional drill steel.

Electric, battery locomotives are used for most tramming. The crosscut on the 2,300-foot level, from Con shaft to the Campbell system, is provided with 30-pound rails laid at 24-inch gauge; other levels have 16-pound rails laid at 18-inch gauge. Ore is hoisted through the Con shaft in two skips of 4 tons capacity operating in counter-balance.

Natural ventilation of the Con and Rycon mines above the 950-foot level is provided by downcast air through the Rycon shaft, and upcast air through the Con shaft. Artificial ventilation is required on the lower levels of the Con mine.

Water is pumped from the mines at a rate of about 100 gallons a minute. Salt water, under considerable pressure, was encountered at several places in the Con shaft below the 1,850-foot level.

Car and diamond drill samples are not reduced ('cut') before being used to calculate average grades of ore. Calculations involving face samples, on the other hand, are 'cut' as follows: a true average is calculated; all higher assays are next reduced to the true average; and the 'cut' grade then calculated by re-averaging. Nevertheless, ore grades as determined by milling during recent years have confirmed grades calculated from uncut samples. Grades of orebodies determined from uncut diamond drill samples are commonly conservative.

Much underground diamond drilling is done to outline the shear zones, particularly in the Con system where the walls of the drifts are commonly probed by horizontal holes at intervals of 100 feet.

MILL

The mill treats (October 1947) about 275 tons of ore daily; Rycon ore is treated during the first part of each month, and Con ore during the latter part. The ores are stored in separate 100-ton bins and pass through separate crushing and grinding circuits, the Con circuit incorporating a 12- by 6-foot Hadsel mill, and the Rycon circuit a 20-inch Ty gyratory crusher and 6-foot by 48-inch Hardinge ball mill. Secondary grinding is carried out in a 5- by 9-foot Allis-Chalmers ball mill. The underflow from a Hydroseparator in the Con circuit and the sands from a Dorr duplex classifier in the Rycon circuit are passed over a jig, the product from which contains about 20 per cent of the gold in the ores. The overflows from the Hydroseparator and Dorr classifier are about 80 per cent minus 200 mesh in size and pass into a common circuit involving cyanidation and flotation of the cyanide tails. Bullion recovered by cyanidation contains about 60 per cent of the gold in the ore. The gold-bearing flotation concentrates are stored pending future treatment; this will involve roasting and cyanidation of the product. A thirteen-spindle Allis-Chalmers roaster was erected adjacent to the mill for this purpose and operated from April to November 1942.

During the first 9 months of 1947, Con mill-heads averaged 0·51 ounce gold a ton, and Rycon mill-heads 0·55 ounce gold a ton; and about 85 per cent of the gold contained in the ores was recovered as bullion (other gold was contained in the flotation concentrates stored). Overall gold recovery, when the roaster is operated, is expected to exceed 90 per cent.

COSTS AND GENERAL OPERATING DATA

Pre-production expenses at the Con mine amounted to about $1,100,000. The following operating costs were supplied by the Dominion Bureau of Statistics:

—	1947	1948
Development and exploration	$ 1.32	$2.48
Mining	5.49	6.13
Milling	3.38	4.71
Other costs	4.13	4.33
Totals, exclusive of taxes and depreciation	$14.32	$17.65

Water-borne freight from Waterways, Alberta, costs 2 cents a pound, from Norman Wells 3 cents a pound. Total transportation charges in 1947 amounted to about $170,000, or about $1.80 a ton of ore milled: these comprised water-borne freight from Waterways, Alberta; water-borne freight (oil) from Norman Wells; air transport of personnel; air-borne freight; and freight moved by truck and tractor via the winter road from Grimshaw, Alberta. Freight is moved most economically by water during the summer season of June to September; as a result, reserve equipment and supplies, at times valued in excess of $900,000, are kept on hand to maintain operations during the winter months.

About 226 persons were employed during 1947, of whom 118 worked underground; and salaries and wages amounted to $850,856. During 1948, 242 persons were employed, 123 of whom worked underground; and salaries and wages totalled $870,722[1]. Wage rates[2], some of which are listed below, are as instituted April 1, 1947, by agreement with International United Mine, Mill and Smelter Workers (C.I.O.), Local 802. Two dollars a day are deducted for board, except that the cook-house employees receive free board.

Category	Wage per hour
	$
Diamond driller (surface)	1.23
Miner (shaft)	1.18
Miner (raise or drift)	1.13
Miner (stope)	1.08
Mucking machine operator	1.08
Mucker (hand)	1.01
Labourer (underground)	.98
Labourer (surface)	.92
Timberman	1.13
Steel sharpener	1.13
Sampler	1.01
Tractor driver	1.01
Bulldozer operator	1.18
Mechanics, and machinist	1.08 to 1.18
Blacksmiths	1.08 to 1.18
Pipefitters, and plumber or steamfitter	1.08 to 1.18
Electricians	1.08 to 1.18
Painters	1.03 to 1.13
Carpenters	1.08 to 1.18
Helper (miner's)	1.01
Helper (mill)	.98
Helper (tradesman's)	.98

Recreation facilities at the property include a curling rink; a privately operated theatre, seating about 200 persons; and a recreation hall providing for bowling, billiards, badminton, and reading.

Bunker fuel and diesel oil come from Norman Wells. The following quantities (mainly bunker fuel) were used: 1947, 421,830 gallons, valued at about $100,000; 1948, 481,556 gallons, valued at $104,761.

Electric power, generated at the Prosperous Lake hydro-electric plant and delivered at the mine, costs 1 cent a kilowatt-hour. Electric power consumed in 1947 amountd to 15,320,168 kilowatt-hours; in 1948, 12,297,891 kilowatt-hours.

Mine timbers used in 1947 were cut by Consolidated employees on Wilson Island in Great Slave Lake, about 65 miles southeast of the mine. Lagging is purchased from Indians at $20 a cord, delivered.

Most heating is done with bunker fuel oil; but during 1948, 1,200 cords of wood, valued at about $21,000, were consumed. Heating costs about $1.15 a ton of ore milled.

Despite a charge of $2 a day for meals served, the loss incurred by the boarding house amounts to about 75 cents a ton of ore treated.

[1] Data supplied by Dominion Bureau of Statistics.
[2] Data supplied by Dominion Department of Labour.

Consolidated Mining and Smelting Company Group, Hunter Bay (8)

Reference: Kidd, 1932b, p. 56.

The following description is by Kidd.

This group of claims lies 5 miles northeast of the settlement at Hunter bay[1]. 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.

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.

Copper Deposits of Bathurst Inlet (6)

References: O'Neill, 1924, pp. 61-71. Stockwell and Kidd, 1932, pp. 82-83.

These deposits were described by O'Neill and his description was summarized by Stockwell and Kidd as 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.

---

[1] Thirty miles north-northeast of Port Radium.

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 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.

Cormac Group and Vicinity (22)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 86-D-9. Henderson, 1949. Jolliffe, 1935. Kidd, 1936, pp. 26-29. Mines Branch, 1936b.

The Cormac group of six claims is on the north side of the east arm (Arden Bay) of Beaverlodge Lake, about 95 miles south of Port Radium. About the same ground was staked as the Tatee and Bee claims by D. Arden and E. H. Hargreaves in January 1934, and at later dates. Development was undertaken by Hottah Lake Mines, Limited, a company organized for that purpose. Work commenced in the spring of 1934, and pitchblende occurrences were explored by pits, trenches, and a shaft 50 or 60 feet deep. About 1½ tons of hand-cobbed ore was shipped to the Mines Branch (1936b, p. 231), Ottawa, where it was found to contain 40·5 per cent U_3O_8. Only a negligible amount of pitchblende was left in the workings from which the ore was extracted. Work was discontinued after sinking the shaft, and the claims lapsed. In April 1943, the claims were re-staked in part as the Cormac group. In 1945 an area including the Cormac claims was geologically mapped and prospected for the Geological Survey. The following account is derived mainly from the resulting report (Henderson, 1949) and is descriptive of the Cormac group and adjacent ground; but the deposits described are not certified to lie within the Cormac claims.

The oldest rocks are a series of interbedded volcanic and sedimentary rocks of the Proterozoic, Snare group. They comprise, in part, massive and fragmental feldspar and feldspar-quartz porphyries, and minor dacite flows and quartzite. The quartzite forms a band several hundred feet wide that lies generally northwest of the porphyries and dacite, trends northeast, and is separated from the older porphyries and dacite along a steeply dipping, disconformable contact. The quartzite is a very pure, fine-grained, white or light green rock, associated here and there with thin beds of grit and conglomerate. Bedding is obscure except where impure beds, now altered to slates and sericite schists, occur; these commonly strike northeasterly and dip steeply northwest. Ripple-marks are fairly common. Massive, dark green, medium-grained, altered gabbro intrudes the rocks of the Snare group. A diabase dyke is the youngest rock recognized.

Nine deposits of pitchblende are in quartzite along or near the contact with the underlying porphyries and dacites. Deposits No. 3 and No. 4 have been mined out. They were in the form of small lenses of pitchblende and hematite in quartzite, and probably the 1½ ton sample sent to the Mines Branch at Ottawa in 1934 included most of the ore from these deposits. Deposit No. 10 occurs in gritty quartzite associated with a 3-foot bed of conglomerate. It consists of a vein-zone of quartz stringers up to 14 inches wide carrying some pitchblende, and is exposed for a length of 35 feet. The vein-zone dies out along the strike in both directions. The other occurrences in the quartzite are small and unimportant.

No. 3 deposit lay near the southwest end of the property, 1,750 feet north of a group of three cabins on the lakeshore. No. 4 deposit lay immediately north of No. 3, and No. 10 about 6,000 feet northeast of No. 3. These deposits have been described by Henderson as follows:

No. 3. A shaft has been sunk in quartzite about 6 feet northwest of the contact with the porphyry....

According to Jolliffe [1935, p. 93], who visited the property when the shaft was being sunk, 'a small amount of secondary uranium minerals prompted the location' and 'an irregular compound pitchblende lens (was) exposed in the west wall of the pit..... The maximum dimensions of this lens exposed in cross-section during the development work measured slightly over six feet. Throughout this length there were three swells with intervening pinches. The top swell at its widest portion measured 6 inches across, the middle 8 inches, and the bottom one 7 inches'.

The shaft is reported to have been sunk to a depth of 50 feet. No pitchblende was found beneath the lens described above.

No. 4....A pit about 25 by 20 feet at the surface and 12 to 15 feet deep, with the bottom covered by water, has been sunk in the quartzite. In the northeast bottom corner of the pit a 3-inch seam of chlorite lies between two massive quartzite beds. It occurs only in the bottom of the pit as it pinches out before it reaches the surface, but patches of it can be seen along the northwest wall of the pit where it has not been mined out. The quartzite near the chlorite patches on this wall of the pit is coated with uranium stain.

The chlorite has apparently been introduced along a crush zone parallel to the bedding for the quartzite along the chlorite seam on the northwest wall is fractured. There is practically no pitchblende left in this pit.....

Jolliffe [1935, p. 91] describes the lenses that were mined out of this pit as follows: 'Three rudely lenticular pockets were located containing pitchblende and hematite disseminated through quartz....In view of the transitional character of the borders of these lenses the following measurements are only approximate. The pocket nearest the surface was more or less equi-dimensional and about 2 feet across. In the same vertical line were found two other lenses of which the upper had a maximum width of about 3 feet and was only a few inches deep. The bottom lens measured about 1 foot across its largest dimension. Intervening barren vein material separated these lenses'.

No. 10....The pitchblende occurs along a zone of quartz stringers in quartzite, conglomerate, and argillite that strikes northeast and dips 55 to 60 degrees northwest. Three large trenches and a small pit have been dug across the zone in a length of 70 feet. The conglomerate bed, which is about 4 feet thick, is composed of quartz and porphyry pebbles up to 1½ inches in diameter in a coarse, gritty quartzitic matrix. The conglomerate grades upward into a coarse, gritty quartzite containing a few scattered pebbles, and the vein zone containing the pitchblende is in the gritty quartzite but, to the southwest, angles off into an overlying, greenish, thinly bedded argillite, and breaks up into a network of quartz stringers containing no pitchblende.

The small southwesterly pit is in the vein zone after it has passed into the argillite, and the Geiger counter gives no appreciable reaction either in it or to the southwest of it. The large trench, 5 feet to the northeast, is 12 by 5 feet at the surface, and 6 feet deep, with the longer dimension along the vein zone. The vein zone is exposed at both ends, and lies between the 4-foot conglomerate bed to the southeast and the 1-foot bed of coarse, gritty quartzite succeeded by argillaceous sediments to the northwest. The vein zone, which consists of stringers of comb quartz with some associated hematite and pitchblende along the walls of the stringers, is 4 to 6 inches wide, increasing in width to 14 inches at the northeast end of the trench. There is much uranium stain along the vein zone.....

In the next trench to the northeast, which is 15 feet long, 3 feet wide, and 3 feet deep, with its longer dimension normal to the structure, the vein zone is exposed at the southeast end. It is not as well defined as in the last-described trench, but there are a few quartz stringers with much stain and a little pitchblende.....

The next trench is 30 feet northeast of the one last described, and is about 20 feet long, 3 feet wide, and 3 feet deep, and normal to the rock structure. The trench is in conglomerate and gritty quartzite, but there is no well defined vein exposed in it although one 2-inch quartz veinlet at the southeast end of the trench contains a little uranium stain.....

In summary the best part of this showing is exposed in the two southwesterly trenches, where a zone of quartz stringers 4 to 14 inches wide carrying pitchblende is exposed over a length of 35 feet. This zone dies out to the southwest, where it passes into slaty argillite, and apparently also to the northeast, where it has not been picked up in the most northeasterly trench.

Crestaurum Mines, Limited (74)

References: Bureau of Mines, 1948a. Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-J-9. Jolliffe, 1946.

INTRODUCTION

The property of Crestaurum Mines, Limited, is 8 miles north of Yellowknife and $\frac{1}{4}$ mile east of Ryan Lake. It consists of sixteen claims and fractional claims of the Goldcrest, Midas, and Varga groups. A road, partly gravelled, connects with Yellowknife by way of the Akaitcho (71) and Giant (76) properties. The shaft was flooded and the property inactive when examined in October 1947.

HISTORY

The Midas claims were staked by H. E. Weaver in April 1944, and the Goldcrest claims by C. Campbell in June. These claims were acquired by Transcontinental Resources, Limited, in August. The No. 1 (main) shear zone was found in September, and four pits blasted through thick overburden in the early winter proved this zone to contain high-grade gold ore. Trenching was discontinued in January 1945 and diamond drilling started in February and continued until late in the year. Crestaurum Mines, Limited, was incorporated in October 1945 to develop and exploit the property. About fifty-five men were employed during the summer of 1946 under the direction of E. C. Rudd, a shaft started, and the road from Yellowknife to the Giant mine extended north to the property. No. 3 vein was found by J. D. Mason in August. In January 1947, four adjacent Varga claims were purchased from Frobisher Exploration Company, Limited. Underground work stopped in February, and the shaft flooded. The summer of 1947 was occupied by diamond drilling, detailed geological mapping, prospecting, and minor construction; and No. 2 vein was found by W. Blair.

CAMP AND PLANT

Buildings, some of which are sheathed with asbestoside, include a two-story warehouse, shaft house, assay office, dry, power house, blacksmith and steel shop, garage, a temporary cook-house, two temporary bunkhouses, and three residences.

Other structures include a 65-foot headframe, storage facilities for 10,000 gallons of oil, and near the Giant (76) dock on Yellowknife Bay, tanks for 52,000 gallons.

Mechanical equipment at the property includes: two Caterpillar D 17,000 diesels each connected to an Ingersoll-Rand compressor with an output of 680 cubic feet of air a minute; a portable, diesel driven, Ingersoll-Rand air compressor with a capacity of 360 cubic feet a minute; a 44KVA Canadian General Electric alternating current generator driven by a Caterpillar D 4,400 diesel; an Ingersoll-Rand two-drum, air operated, 9-inch by 8-inch, type PSR hoist; two 150-horsepower wood-fired, heating boilers; an Eimco loader; a Mancha storage battery locomotive (Little Trammer); a 2-ton skip; and two trucks.

DEVELOPMENT

Much stripping and trenching have been done where practicable. About 37,000 feet of diamond drilling was reported[1] completed prior to December 31, 1947, mainly on No. 1 shear zone.

Underground work consists of a three-compartment vertical shaft with crosscuts extending 200 and 160 feet northwesterly from the shaft on the 170- and 295-foot levels, and a station at the 420-foot level. No. 1 shear zone is reported to be about 30 feet beyond the face of the 170-foot level crosscut, to be partly exposed by the 295-foot level opening, and to be about 40 feet northwest of the 420-foot level station.

GEOLOGY

The rocks near the principal gold deposits are mainly andesitic lavas of the Yellowknife group, part of a belt that extends southerly through the Giant (76), Con and Rycon (73), and Negus (80) mines. The lavas are cut by dykes and possibly sills of altered basic intrusive rocks. The east edge of a granitic batholith, intrusive into the lavas, lies $\frac{1}{4}$ to $\frac{1}{2}$ mile northwest of the deposits.

The lavas trend northeasterly and are steeply inclined. They are cut by shear zones and quartz veins that trend in various directions; but only the principal known gold-bearing shear zones (Nos. 1, 2, and 3) were examined, and these trend northeasterly.

DESCRIPTION OF DEPOSITS

No. 1 Shear Zone strikes north 35 degrees east and dips about 45 degrees southeast. It is partly exposed on Goldcrest No. 2 claim, 2,100 feet southwest of the shaft, by two trenches about 60 feet apart; elsewhere it lies beneath a deep, drift-filled draw that strikes about north 35 degrees east. The zone has been traced by diamond drill-holes for a length of about 5,000 feet; the deepest hole intersected it at a depth of 1,000 feet, but most of them cut it at a depth of less than 400 feet.

The trenches are in a draw about 30 feet wide, bordered on the southeast by fine-grained, pitted, chloritic schist and on the northwest by massive greenstone. The hanging-wall and about 11 feet of the shear zone are exposed, but not the foot-wall. The hanging-wall dips about 60 degrees southeast, about parallel with the schist in the zone. The zone consists

[1] Mason, J. D.: Transcontinental Resources, Limited, personal communication.

of a well-banded, sparsely mineralized mixture of very fine-grained dull grey quartz; white, medium- to coarse-grained quartz; fine-grained rusty carbonate; and chlorite and sericite schist. The quartz occurs as seams and lenses parallel with the foliation of the schist. The principal metallic minerals are arsenopyrite, pyrite, stibnite[1], and jamesonite (?) (Bureau of Mines, 1948a, pp. 2, 3); others include galena, sphalerite, chalcopyrite, pyrrhotite, magnetite, and visible gold. Much of the arsenopyrite occurs as abundant, minute needles in schist. A sample of ore from these trenches, shipped for milling and metallurgical tests, assayed (Bureau of Mines, 1948a, p. 2): gold, 1·175 ounces a ton; silver, 0·225 ounce a ton; antimony, 0·80 per cent; arsenic, 1·48 per cent; lead, 0·38 per cent.

Diamond drill samples of about ore grade have been obtained from depths down to about 400 feet. Two ore shoots are reported at a depth of about 100 feet below the outcrop, as follows: south ore shoot, 470 by 3·2 feet, grade 0·51 ounce gold a ton; north ore shoot, 750 by 2·5 feet, grade 0·59 ounce a ton; combined tons per vertical foot, 306. The length of the north ore shoot is said to have been increased to about 900 feet by drilling done in 1947. The ore shoots probably have a gentle northeasterly pitch.

No. 2 Shear Zone is on Midas Nos. 3 and 4 claims, about 1,600 feet north-northeast of the shaft. The zone lies within pillowed andesitic lavas, except that it cuts, but does not appreciably displace, a feldspar-quartz porphyry dyke about 20 feet in width. The zone strikes north 45 degrees east and dips 70 degrees southeast. It has been drilled to a depth of about 250 feet. It is exposed by twenty-seven trenches for a length of about 340 feet, and passes under a lake at both ends. The width of the zone varies from 6 inches to 6½ feet, and averages about 2 feet. Its strike is fairly constant except that, about midway along the exposures, it bends from northeast to north-northeast and back to northeast; and the northeast half of the vein is thus offset about 20 feet northwesterly relative to the southwest half. The zone attains its maximum width just southwest of this bend, and its minimum width where it intersects the porphyry dyke. The zone is a banded mixture of various proportions of chloritic schist, buff weathering carbonate, white, medium- to coarse-grained quartz, and very fine-grained, dull grey quartz. The quartz attains its maximum width of about 1 foot just southwest of the bend in the zone, and there contains visible gold; this part of the vein is reported to assay several ounces of gold a ton for a length of 60 feet. Other minerals in the vein include pyrite and arsenopyrite, and a little black weathering stibnite (?), chalcopyrite, and malachite. The schist near the gold-bearing quartz commonly contains abundant very fine-grained acicular arsenopyrite and a little pyrite.

No. 3 Shear Zone outcrops on Goldcrest No. 1 fraction, 250 feet east of the shaft. It strikes north 45 degrees east, dips about 45 degrees southeast, and is exposed for about 480 feet by twenty-four trenches. The walls of the zone are well defined and the adjacent rocks are andesitic lavas. Its width varies from 1 foot to 6 feet and averages about 2½ feet. The zone probably narrows and ends near the most northerly trench. Beyond the most southerly trench it passes beneath a waste-rock fill; and its

[1] Specimen collected by the writer and identified by E. Poitevin, Chief, Mineralogical Section, Geological Survey of Canada.

possible extension has been exposed 800 feet to the southwest, by three trenches, for a length of about 75 feet. The zone contains various proportions of fine-grained dull grey quartz, coarse-grained glassy to white quartz, chloritic and sericitic schist, and fine- to medium-grained white carbonate. Here and there the dull grey quartz forms well-defined seams, 1 inch or so wide, parallel with the zone walls and foliation of the schist. The glassy or white quartz occurs mainly in the northeastern part of the zone. Arsenopyrite and pyrite occur in the schist and quartz, and stibnite (?) in the quartz. One hundred and eighty feet of the zone is reported to average about 0·5 ounce gold a ton across a width of slightly more than 1 foot.

COSTS AND GENERAL OPERATING DATA

Milling and metallurgical tests indicated that much of the gold is intimately associated with arsenopyrite, pyrite, and the antimony mineral jamesonite. Nevertheless, more than 90 per cent of the gold should be recovered by a process involving the following procedures: concentration of the free gold by means of traps and blankets; amalgamation of these concentrates; flotation of the blanket tailing; and roasting and cyanidation of the flotation concentrate.

Exploration, development, and related administrative expenditures to September 30, 1947, have amounted to $415,349.32[1].

The shaft sinking contract price was $78 a foot (labour and explosives), the rock opening allowing inside-timber shaft dimensions of 8½ by 17 feet.

Diamond drilling was done by contract at $2.50 a foot under an agreement whereby the contractors provided fuel and equipment and paid for board at a rate of $2.50 a man a day, and the Crestaurum Company provided transportation.

Hydro-electric power became available at the Yellowknife substation, 5½ miles south of the property, in October 1948.

D Group (4)

Reference: Kidd, 1932b, pp. 60-61.

The claims of the D group have lapsed, and the area formerly occupied by them may, partly or entirely, be included by the Dick group of The American Metal Company of Canada, Limited (3). Kidd examined the D claims in 1931, and has reported on them as follows:

> 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. C. Duncan [1931] reports that an average of four channel samples across a width of 8 feet gave 9·96 per cent copper. 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

[1] Crestaurum Mines, Limited: Annual Report, September 30, 1947.

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.

D.A.F. Group (89)

(*See* Figure 8)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-I-14. Henderson, 1941c.

The D.A.F. group consists of fourteen claims and fractional claims. It lies 48 miles northeast of Yellowknife, and on the east shore of the south

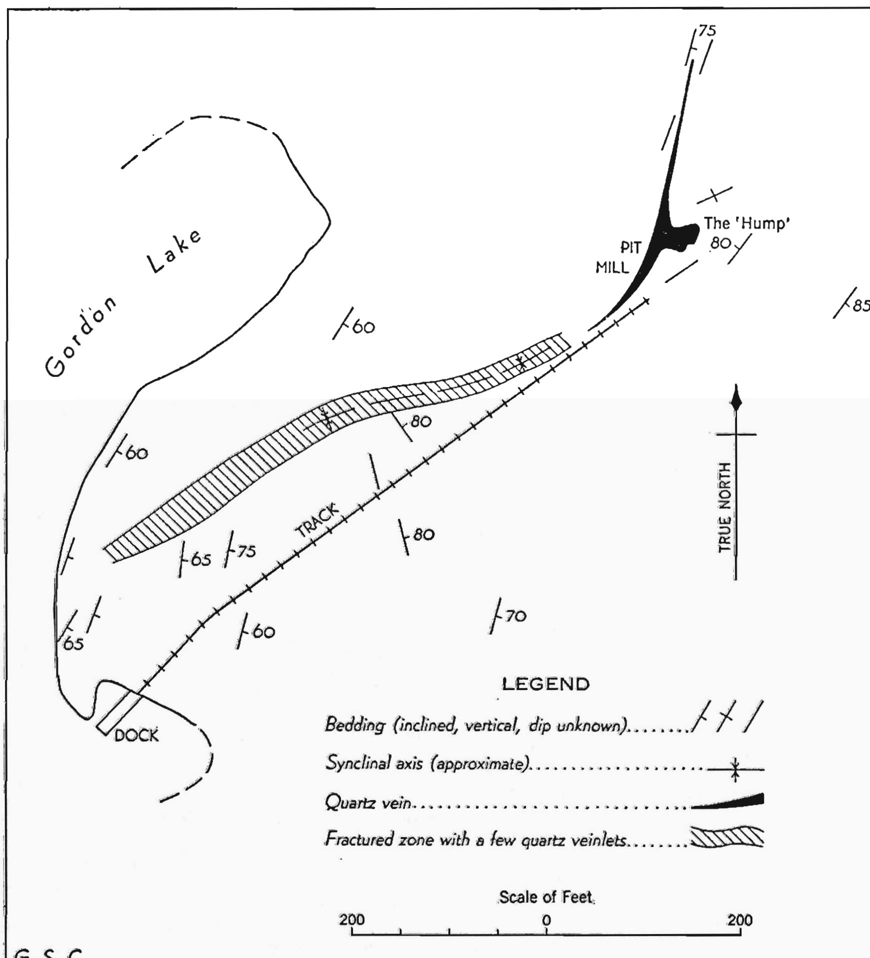

Figure 8. Sketch of part of D.A.F. No. 4 claim, Gordon Lake.

end of Gordon Lake. It was examined by the writer on August 31, 1947, at which time ten persons were at work. Except where otherwise stated, the following description applies as of that date.

The claims were staked by J. R. Woolgar and G. Wonnacott in June 1946, after the discovery of a high-grade gold-bearing vein on what became D.A.F. No. 4 claim. The property was optioned to Zolota Yellowknife Mines, Limited, in October, but after trenching and diamond drilling, this company relinquished its option in April 1947. During the late summer of 1947 the owners, in partnership with J. McAvoy, erected a small improvised mill to treat ore from the discovery vein. The mill operated from September 21 to October 12 and the property then closed. About 18 tons of ore was treated, and 49·75 crude ounces of gold (estimated 800 fine) recovered by amalgamation.[1] In April 1948 the property was acquired by West-Bay Yellowknife Mines, Limited. A new mill, with a rated capacity of 5 to 10 tons a day, is reported to have been erected in May 1948 and about fifteen men subsequently employed under the direction of J. McAvoy. The first gold bar was recovered on June 22, and the property was again closed about August 31, 1948. During June, July, and August, 289 tons were treated, and afforded 221·309 fine ounces and 10 crude ounces of gold, and 28·61 fine ounces of silver.[2]

Tailings are reported to contain 0·28 ounce gold a ton.

A narrow-gauge track connects a dock on Gordon Lake with the tent camp, and with the mill and vein 650 feet northeast of the dock. Freight is hauled up this track by a small, air-operated hoist.

Nearly all exploratory work has been done on or near the discovery vein. This work includes eleven rock trenches, diamond drilling (reported as 6,700 feet done mainly by Zolota Yellowknife Mines, Limited), and a pit from which the milled ore was derived. On July 17, 1948, the pit had the following maximum dimensions: length, 40 feet; width, 12 feet; slope depth (parallel with dip of vein), 22 feet.[3]

The rocks near the vein are greywacke, slate, and phyllite of the Yellowknife group. The greywacke weathers grey to pale buff, and on some fresh surfaces exhibits a sheen due to secondary biotite. Slate and phyllite are much less common than greywacke. Bedding is obscure near the vein despite numerous outcrops, and only here and there were tops of beds identified; the structure, accordingly, was not determined with certainty. The beds strike between north 35 degrees west and north 65 degrees east, and in most instances dip 60 to 85 degrees easterly or are vertical. About 250 feet west-southwest of the south end of the vein the attitude of the beds suggests that the axis of a steeply plunging, open syncline strikes east-northeast towards the vein. The axial zone coincides with a zone of fractured rock, 20 to 40 feet wide, that extends southwesterly nearly to the shore of Gordon Lake and east-northeast to the south end of the vein. It may be that the synclinal axis extends northeasterly through the 'Hump', or widest part of the vein, and beyond; and that the vein north of the 'Hump' lies on the west flank of the syncline.

The vein strikes north 10 to 40 degrees east and dips 55 to 75 degrees southeast or east; it is arcuate in plan, convex towards the southeast. It is exposed for a length of 320 feet and, except for a protuberance described as the 'Hump', varies from about $1\frac{1}{2}$ to $10\frac{1}{2}$ feet in width and averages about $4\frac{1}{2}$ feet. The 'Hump', in plan, is a hook-shaped mass of quartz

[1] Woolgar, J. R.: personal communication.
[2] McAvoy, J.: personal communication.
[3] Feniak, M.: Geological Survey of Canada, personal communication.

and included rock that projects about 35 feet east-southeast from the vein; the northerly wall, corresponding with the inner side of the hook, dips about 60 degrees north-northeast. Southwest of the 'Hump' the attitude of the wall-rocks is not known. North-northeast of the 'Hump' the beds are parallel with the vein; those on the west wall are slate, those on the east wall greywacke. The southern half of the vein contains minor inclusions of rock, and the walls are sharp and commonly bordered by a few inches of sheared slate within which occur parallel quartz veinlets. The northern half of the vein comprises a zone of sheared slate, 2 or 3 feet wide, containing 10 to 50 per cent quartz as veinlets and irregular lenses. The quartz throughout the vein is mainly dark grey to white, and commonly well fractured. It contains white to red feldspar and less than 1 per cent of the metallic minerals pyrite, galena, chalcopyrite, sphalerite (?), and gold. Quartz from the pit south of the 'Hump' afforded spectacular specimens wherein the gold occurred mainly as thin films.

DeStaffany Tantalum Beryllium Mines, Limited

(Moose, Big Hill, Tan, and Best Bet Claims) (127)

References: Bureau of Mines, 1943b; 1944a; 1944c; 1945b. Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-I-1. Fortier, 1947a. Jolliffe, 1944a.

INTRODUCTION

The properties of DeStaffany Tantalum Beryllium Mines, Limited, include the Moose group of fifteen claims on the north side of Hearne Channel, in the east arm of Great Slave Lake, 72 miles east-southeast of Yellowknife; the Big Hill No. 2 claim 4 miles west-southwest, the Tan group of four claims 5 miles west-northwest, and the Best Bet No. 1 claim 5 miles northwest of the Moose group. They are accessible by aircraft, or by boat or tractor through Hearne Channel. Ramona Nos. 1 to 4 claims, staked west of Buckham Lake in 1947, are described elsewhere (123). G. D. DeStaffany is managing director. The following data are derived mainly from published and unpublished reports by A. W. Jolliffe, who visited the Moose and Tan groups in 1943; Y. O. Fortier, who examined the Best Bet No. 1 claim in 1945; and M. Meikle, who inspected operations on the Moose group in 1946 for the Bureau of Northwest Territories and Yukon Affairs.

HISTORY, PRODUCTION, PLANT, AND DEVELOPMENT

In July 1942, Moose Nos. 1 and 2 claims were staked on behalf of DeStaffany Tungsten Gold Mines, Limited, to cover scheelite occurrences found by G. D. DeStaffany and A. Greathouse. The following year the group was enlarged to include two pegmatite dykes carrying rare-element minerals. Three Tan claims were staked in July and August 1943 on behalf of the same company. The Best Bet No. 1 claim was staked in 1944. These properties, and the Big Hill No. 2 claim, were subsequently acquired by DeStaffany Tantalum Berryllium Mines, Limited, incorporated in 1945. By July 1946 a crew of six men were employed, a $5\frac{1}{2}$- by 7-foot shaft had been sunk to a depth of 40 feet on Moose No. 11 or No. 12 claim, and a mill erected on Moose No. 11 claim at the shore of Great Slave Lake. The mill, designed to produce a tantalite-columbite concentrate, comprised a small ore bin, jaw crusher, rolls, and a two-stage dry classifier. It had a capacity of about 5 tons a day. Power was supplied by a D 3,400 Caterpillar diesel engine.

The following production data were supplied by the company.[1] The mill did not operate in 1946, and ran only during parts of September and October in 1947. During this period ore treated amounted to 3,800 pounds from Best Bet No. 1 claim and 30 tons from the Moose group. About 1,200 pounds of concentrates were recovered. Samples of these concentrates, supplied by the company, were analysed by the Bureau of Mines, Ottawa, with the following results: (1) Best Bet No. 1 claim: Ta_2O_5, 57·76 per cent; Cb_2O_5, 7·92 per cent; tin, 13·41 per cent; TiO_2, 0·22 per cent; (2) Moose group: Ta_2O_5, 35·03 per cent; Cb_2O_5, 41·36 per cent; tin, 0·30 per cent; TiO_2, 0·99 per cent. About 1,400 pounds of concentrate of unspecified grade was recovered from the Best Bet No. 1 claim in 1948.

GEOLOGY

The rocks at and near the properties include nodular quartz-mica schist and hornfels derived from greywackes and other sedimentary rocks of the Yellowknife group; an elongated body of younger, pegmatitic muscovite granite some 7 miles long; and related pegmatite dykes and sills. The principal known occurrences of tantalite-columbite and associated minerals are in the pegmatite dykes and sills within 2½ miles of the granite intrusion.

DESCRIPTION OF DEPOSITS

Moose Dyke. This dyke is on the Moose group and has been described by Jolliffe as follows:

> The dyke extends for about 1,400 feet north from a point less than 150 feet from (and about 60 feet above) Great Slave Lake. Its outcrop is up to 200 feet wide and is interrupted about midway of its length by a muskeg 400 feet across, and, in its southern half, by an east-west fault that causes a left-hand displacement of 120 feet. The dyke walls commonly dip 30 to 85 degrees to the west. The country rock is nodular greywacke that strikes northeasterly and dips to the southeast. The dyke apparently pinches out at both ends.
>
> Minerals identified in the dyke include microcline, cleavelandite, quartz, muscovite, spodumene, amblygonite, graphite, beryl, tantalite-columbite, cassiterite, tourmaline, and lazulite. The only minerals that are sufficiently abundant to be of possible economic interest are tantalite-columbite, and the lithium minerals spodumene and amblygonite.
>
> Tantalite-columbite is found throughout the dyke but in widely varying amounts. It occurs chiefly in very thin radiating plates that are up to 3½ inches across. The greatest concentration seen extends south from the fault for about 100 feet along and near the foot-wall (east side) of the dyke, and averages about 5 feet wide.
>
> Lithium minerals are erratically distributed throughout the Moose dyke, but time did not permit evaluation of these. In the middle section (between the fault and muskeg) bands up to 50 feet long and 5 feet wide carry more than 25 per cent spodumene. Amblygonite is likewise an important constituent of the dyke. The largest crystal face of spodumene seen measured 2 by 4 feet, and of amblygonite, 2 by 3 feet. These were observed in the northern section where lichens and moss prevented close examination. Both appear to be parts of still larger crystals. One specimen of each of spodumene and amblygonite on analysis [by R. J. C. Fabry, Mineralogical Section, Geological Survey of Canada] showed 3·65 per cent and 4·68 per cent lithium oxide, respectively.

Three samples, weighing from 60 to 135 pounds, were taken by the Geological Survey and submitted to the Bureau of Mines (1943b) for

[1] DeStaffany, G. D., President, DeStaffany Tantalum Beryllium Mines, Limited: personal communication.

concentration tests. One of these came from the east side of the dyke, south of the fault, where visible tantalite-columbite was most abundant. Tests indicated 11·2 pounds of recoverable concentrate a ton. The concentrate recovered had a specific gravity of 5·7719, and contained chiefly columbite carrying about 20 to 25 per cent tantalum pentoxide; a small amount of tin; and no titanium, rare earths, or tungsten.

Tests on another sample, taken north of the fault but south of the muskeg, indicated 4·6 pounds of recoverable concentrate a ton. The concentrate recovered had a specific gravity of 6·1918, and contained tantalite-columbite carrying 30 to 40 per cent tantalum pentoxide, and about 8 per cent cassiterite.

A third sample, from north of the muskeg, afforded 1·7 pounds of concentrate a ton, the specific gravity of the concentrate being 5·7962.

Big Hill No. 2 Claim. The deposits on Big Hill No. 2 claim have not been examined by the Geological Survey of Canada. A sample of pegmatite weighing 44 pounds, and said to have come from the V vein on this claim, contained 0·129 per cent tantalum-columbium pentoxide, $(Ta,Cb)_2O_5$, and 0·12 per cent tin dioxide (Bureau of Mines, 1945b, p. 2).

Tan Group. Four pegmatite sills, on or near the Tan claims, have been described by Jolliffe, and the following account is extracted and summarized from that source.

The northernmost sill (No. 1. . . .) was traced for 265 feet and shows an average width, where exposed, of 5 feet. It strikes north 20 degrees east, has a vertical dip, and is parallel to bedding in the enclosing nodular greywacke. Altered spodumene up to a foot long, and tantalite-columbite in crystals up to ⅜ inch across, are sparsely and irregularly distributed.

Sill No. 2 [about 1,000 feet southwest of Sill No. 1] is exposed at intervals for 225 feet and maintains a constant width of about 10 feet. It strikes north 20 degrees east, dips steeply west, passes under muskeg and lake to the north, and to the south disappears beneath drift that extends for several hundred feet. Cleavelandite, quartz, and muscovite are the common constituents together with some grey feldspar in crystals up to a foot across, which show a ragged outline. Spodumene and amblygonite are common in crystals up to 18 and 8 inches long, respectively; the former may constitute about 10 per cent of the sill. A few small aggregates of blue lazulite are also present. Tantalite-columbite and cassiterite are comparatively evenly distributed throughout the pegmatite, even to within an inch or two of the walls; the majority of freshly broken surfaces show either or both minerals. Tantalite-columbite is in tabular crystals up to ¾ inch long and appears more abundant than cassiterite, which is in more or less equidimensional aggregates up to ¼ inch across.

Sill No. 3 [about 3,500 feet south-southwest of Sill No. 1] probably averages 10 feet wide, trends northwesterly for about 300 feet, and dips about 70 degrees to the northeast. . . It is separated by a 15-foot wedge of nodular sedimentary rocks into a southeastern part, which is almost continuously exposed for 125 feet, and a northwestern part, which is exposed at intervals for about 160 feet. Ten shallow pits have been sunk in the sill at irregular intervals. The common minerals present are cleavelandite, microcline (in crystals up to 16 by 17 by 12 inches), quartz, and muscovite. Rare-element minerals include spodumene, amblygonite, beryl, lithiophilite, lazulite, tantalite-columbite, and cassiterite. In addition, one crystal of pyrite was noted; graphite is common in seams within and bordering the microcline, and tourmaline-rich selvages less than an inch thick border the walls of the sill. There are probably other minerals that were not identified. Tantalite-columbite and cassiterite are rather evenly distributed throughout the pegmatite; on the average, one crystal or aggregate up to an inch across of either or both minerals can be seen per square foot of naturally exposed surface. The pegmatite material exposed in the pits does not appear to be of a higher grade than elsewhere in the sill. A sample weighing 23 pounds, considered to be representative of the pegmatite, was obtained from dumps at the various pits and was concentrated in Ottawa.

This sample yielded 32·6 grams of concentrates, or an indicated recovery of 6·25 pounds from each ton of material treated (Bureau of Mines, 1944a, p. 6). A weighted average sample of the concentrates recovered contained[1]: tantalum-columbium pentoxide, 66·70 per cent; tin dioxide, 15·96 per cent; and titanium dioxide, 0·20 per cent.

Sill No. 4 [approximately 500 feet south-southwest of Sill No. 3] consists of scattered exposures along a line trending about north 25 degrees east for a total length of about 120 feet. About 150 feet farther north on strike a small outcrop of pegmatite in drift may represent a continuation of this sill. Furthermore, limited geological mapping in the vicinity suggests that sills No. 3 and No. 4 may be parts of the same pegmatite exposed on opposite limbs of an anticlinal fold cresting north; if this is so, the body would approach 1,000 feet in length. In those places where both walls can be seen, sill No. 4 is from 10 to 20 feet wide and dips about 60 degrees west. The mineralogy is similar to that in sill No. 3. Tantalite-columbite occurs in crystals up to $\frac{3}{4}$ inch long. One small fragment largely free from gangue showed a specific gravity of 7·54.[2]

Best Bet Sill.[3] This pegmatite sill is on Best Bet No. 1 claim. It conforms to the bedding of the enclosing nodular quartz-biotite schists, striking north 30 degrees east and dipping steeply northwest. It is 290 feet long and averages 25 feet in width. The texture ranges from granitic to coarsely pegmatitic. Quartz and feldspar, including the variety cleavelandite, are the main gangue minerals; feldspar forms crystals up to $1\frac{1}{2}$ feet long, and quartz occupies patches as much as several feet across. Muscovite is disseminated in small amounts throughout, but here and there forms large aggregates. A little graphite was also noted.

The observed rare-element minerals in the sill are amblygonite, spodumene, tantalite-columbite, cassiterite, beryl, and lithiophilite. Amblygonite is the most abundant. A medial zone in the sill, 115 feet long and averaging 12 feet wide, is 50 per cent amblygonite, and thus probably contains 66 tons of the mineral for each foot of depth.

An area near the north end of the sill, measuring 25 by 45 feet at the surface, contains 19 per cent spodumene and 12 per cent amblygonite; such material contains $12\frac{1}{2}$ tons of spodumene and $7\frac{1}{2}$ tons of amblygonite for each foot of depth. One crystal of spodumene is 14 feet long and 2·6 feet wide. Six crystals are 6 feet or more in length.

Stout gains of tantalite-columbite (presumably a high-tantalum variety) and cassiterite occur together in the sill. The largest observed grain of tantalite-columbite measured 4 inches by $\frac{3}{8}$ inch, and the largest observed cassiterite, about 1 inch long. The average grain size of both minerals is less than $\frac{1}{2}$ inch. Thin plates (probably a high-columbium variety) up to 10 inches long by $\frac{1}{20}$ inch thick were also found. The tantalite-columbite and cassiterite are most abundant in the medial and upper parts of the sill. These minerals aggregate less than 1 per cent of the sill.

Tantalite-columbite also occurs in stout grains in aggregates of muscovite. Six such aggregates were noted, and their combined outcrop area is 47 square feet. A chip sample collected from them by the Geological Survey contained[4]: tin, 3·72 per cent; tantalum pentoxide, 3·56 per cent; and columbium pentoxide, 0·09 per cent.

Beryl, in crystals up to 3 inches in diameter, constitutes less than 1 per cent of the sill.

Six patches of lithiophilite were observed, the largest 2 by 4 inches.

---

[1] Analysis by H. V. Ellsworth, Mineralogical Section, Geological Survey of Canada.
[2] Determined by H. V. Ellsworth, Mineralogical Section, Geological Survey of Canada.
[3] The following account is summarized from data supplied by Y. O. Fortier.
[4] Analysis by Bureau of Mines, Ottawa.

DeStaffany Tantalum Beryllium Mines, Limited

(Ramona Claims) (123)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-I-7. Jolliffe, 1944a, pp. 13-15.

The Ramona group of four claims is 5 miles southwest of the north end of Buckham Lake, or about 50 miles slightly south of east from Yellowknife. A winter road from the Ruth mine (121) extends southwesterly from Buckham Lake about 20 miles to François Bay on Great Slave Lake.

W. L. McDonald of Yellowknife reported to the Geological Survey in 1940 the discovery of a pegmatite dyke (now locally known as the McDonald dyke) containing abundant large spodumene crystals. The deposit was examined by A. W. Jolliffe in August 1943. In September it was staked by Mr. McDonald, on behalf of Frobisher Exploration Company, Limited, as the Lita Nos. 1 to 4 claims. These claims lapsed, and were re-staked in 1947 for DeStaffany Tantalum Beryllium Mines, Limited, as the Ramona group.[1]

The following quotations are from a report by Jolliffe.

The pegmatite body strikes north 80 degrees west, has an average dip of 60 degrees to the south, and is apparently conformable with bedding in the enclosing nodular greywacke of the Yellowknife group. Its outcrop is nearly 400 feet long and 12 to 55 feet wide with a true average width for this length of about 25 feet..... At both ends the pegmatite body passes beneath drift that extends for 100 feet or more in either direction along the strike. No other pegmatite outcrops were seen.

Sections across the McDonald pegmatite show four main mineral zones, of which the two central ones are spodumene-bearing. Along either edge is a band consisting of quartz, feldspar, and light yellow muscovite in about equal proportions and with crystals uniformly about an inch across. The band along the footwall side is up to 3 feet wide, whereas that along the hangingwall is up to 8 feet. These pass gradationally into a spodumene-rich central section that may be divided into upper and lower parts of about equal width. In the upper (southern) half, the quartz and feldspar (mainly pink cleavelandite) occur commonly in discrete masses up to several feet across. Very little mica is present with these minerals, but "books" up to 6 inches across and 3 inches thick of golden yellow muscovite occur at intervals along and near the upper contact with the even-granular hangingwall zone. The lower (northern) half of the spodumene-rich section consists of intergrown quartz, cleavelandite, and a little muscovite up to several inches across. The crystal aggregates become smaller and the proportion of mica increases towards the footwall.

Beryl, amblygonite, and lithiophilite occur in the upper half of the central zone but together aggregate less than 1 per cent.

These differences in mineral content and grain size between the upper and lower halves of the central zone are not displayed by the spodumene. Both parts contain about 30 per cent spodumene by weight, and the crystals (which are commonly elongated at about right angles to the walls) are equally large in each. [About 50 feet from the west end of the dyke]....a crystal face of spodumene is exposed for a length of 9·7 feet and is up to 0·75 foot wide. Immediately south....another face measures 8 feet by 2·3 feet. [Fifty to one hundred feet from the east end of the dyke]....numerous large crystals extend to within a foot or two of either wall; the largest crystal face measures 10·7 feet by 1 foot. About twenty other spodumene crystals in both halves of the central zone approach these dimensions; from these upper limits the crystals range in size to some that are only about an inch across. By far the greater proportion of the spodumene is in crystals more than a foot long. The mineral contains less than 5 per cent visible impurities (chiefly quartz stringers), and none of the dull dark green or yellow micaceous alteration products, common in other spodumene-bearing dykes, is evident. A 5-pound sample of spodumene chips collected throughout the pegmatite was crushed and divided in a Jones sampler and analysed[2] with the following results:

[1] DeStaffany, G. D., President, DeStaffany Tantalum Beryllium Mines, Limited: personal communication.

[2] Analyst, R. J. C. Fabry, Mineralogical Section, Geological Survey of Canada.

Analysis of Composite Spodumene Sample, McDonald Pegmatite

	Per cent
SiO_2	64·09
Al_2O_3	27·06
FeO	1·25
CaO	0·51
MgO	0·27
Li_2O	5·70
Na_2O	1·59
K_2O	0·15
MnO	0·02
	100·64

Although lichens prevented close search, tantalite-columbite was found up to within 5 feet of either wall, and at intervals of less than 10 feet along the outcrop. The mineral appears to be more common and in larger crystals in the upper half of the spodumene-rich central zone. Three patches were seen containing tantalite-columbite up to $2\frac{1}{4}$ by $1\frac{1}{4}$ inches by 1 inch. Elsewhere in the pegmatite body several crystals averaging about a millimetre across may occur in each square foot throughout areas up to 50 square feet.... The larger crystals are more or less equidimensional; the smaller ones have a bladed habit. Most of them occur in cleavelandite. Two of the coarse clusters are associated with white beryl, spodumene, and amblygonite; the other with spodumene alone. Masses of pure quartz and pure cleavelandite up to several feet across are nearby in all cases. Specific gravity determinations were made on seven of the larger crystals of tantalite-columbite. The results ranged from 6·4 to 7·2535 and averaged 6·76. Most of the crystals contained some gangue.

The spodumene-bearing part of the pegmatite is about 400 feet long and averages 22 feet wide (about 19 feet true width at an average dip of 60 degrees). A body this size will contain about 750 tons per vertical foot. The mineral content of this part of the pegmatite was obtained by running a series of taped traverses, each 10 to 20 feet long and aggregating 290 feet, along which the intercepts of the various minerals were measured. No particular system could be followed in laying down these traverses, due to irregularities in the surface and in the moss and lichen cover. However, most of them were taken about parallel to the walls as most of the spodumene is elongated at about right angles to this direction; no traverse was measured in which the line followed the elongation of any large spodumene crystal. According to theory, the lineal percentage of any mineral thus obtained is equal to the areal or volume percentage, from which the weight percentage can be calculated. The areal percentage of spodumene along traverse lines ranged from 6 per cent to 45 per cent and averaged 27 per cent. This is equivalent to 30·7 weight per cent spodumene.

No close estimate could be made of the tantalite-columbite content of the entire pegmatite mass. Three areas, totalling 18 square feet, were found that contain tantalite-columbite aggregates sufficiently coarse so that areal percentages could be measured. Assuming the mineral to have an average specific gravity of 6·8...., the pegmatite represented by the 18 square feet would carry about 1·3 weight per cent of tantalite-columbite. Probably the rest of the deposit (about 95 per cent) would carry only a very small fraction of this amount, but this will not be known until large-scale bulk sampling is done.

Dick Group[1] (113)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheets 85-I-7 and 85-I-10. Henderson and Jolliffe, 1941.

The Dick group comprises sixteen claims staked by the owner, G. D. DeStaffany, in June 1940. Dick Nos. 8 to 12 claims are at the south end of Gilmour Lake. Dick Nos. 1 to 7 claims and Nos. 13 to 16 lie northwest from the north end of Gilmour Lake.

[1] Described from data supplied by A. W. Jolliffe and the Consolidated Mining and Smelting Company of Canada, Limited.

The claims were staked following a discovery of gold-bearing quartz, and scheelite was later found in quartz veins. Prospecting and trenching were undertaken from June to September 1940, and some work was done during 1941. Several quartz veins have been found.

Vein 4 is on the Dick No. 4 claim. It strikes north 40 degrees west, dips steeply northeast, and lies parallel with the enclosing Yellowknife sedimentary beds. The vein for 110 feet averages 1½ feet in width and contains 0·3 per cent WO_3 as scheelite.

Vein 17 is on the Dick No. 3 claim and parallels the enclosing Yellowknife sedimentary beds. It strikes north 25 degrees west, dips 80 degrees northeast, and is exposed at intervals for 600 feet or more. Twenty-seven feet of the vein averages about 6 inches in width and contains about 0·5 per cent WO_3 as scheelite.

Discovery Yellowknife Mines, Limited (55)

(*See* Figure 9)

References: Bureau of Mines, 1947b; 1948b. Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-P-4. Byrne, 1948a.

INTRODUCTION

Discovery Yellowknife Mines, Limited, is exploring a gold prospect at the west end of Giauque Lake[1], 52 miles north-northeast of Yellowknife. The property comprises the Avis Nos. 1 and 2 claims, Lux Nos. 1 to 4 claims, Discovery and Quinn fractional claims, and the nearby but not contiguous Ash group of six claims. The following description applies to the Lux, Avis, Discovery, and Quinn claims. T. D. Anderson was mine manager and N. W. Byrne of Yellowknife was consulting engineer when the writer examined the property in June and September 1947.

Summer access is provided only by aircraft capable of landing on Giauque Lake. Winter access is provided by aircraft capable of landing on ice, or by tractor train over a winter road from Yellowknife via Prosperous and Duncan Lakes.

HISTORY

The Lux and Avis claims were staked by A. V. Giauque and others in the summer of 1944 and subsequently acquired by the Jakeway Prospecting Syndicate. Discovery Yellowknife Mines, Limited, formed in February 1945, completed the initial diamond drilling program on the property prior to August of the same year. The North vein was found in November 1945 by a company employee, Bert Wagenitz. An extensive program of diamond drilling, designed to explore this vein and adjacent ground, commenced in January 1946, and continued through to September of the same year. Substantial underground development was soon decided upon, and an appropriate mining plant and supplies were ordered in June 1946. Pending the arrival of this order, a smaller, portable plant was flown to the property in October 1946 and the shaft was started in November. This plant was used until March 1947, when the first units of the permanent plant were installed. Underground operations proceeded continuously throughout 1947, and exposed gold-bearing quartz in the North vein and West zone. Milling commenced January 1, 1950.

[1] This name conforms with local usage and, as shown on Mineral Claim Sheet 85-P-4, designates the lake flowing easterly into Thistlethwaite Lake.

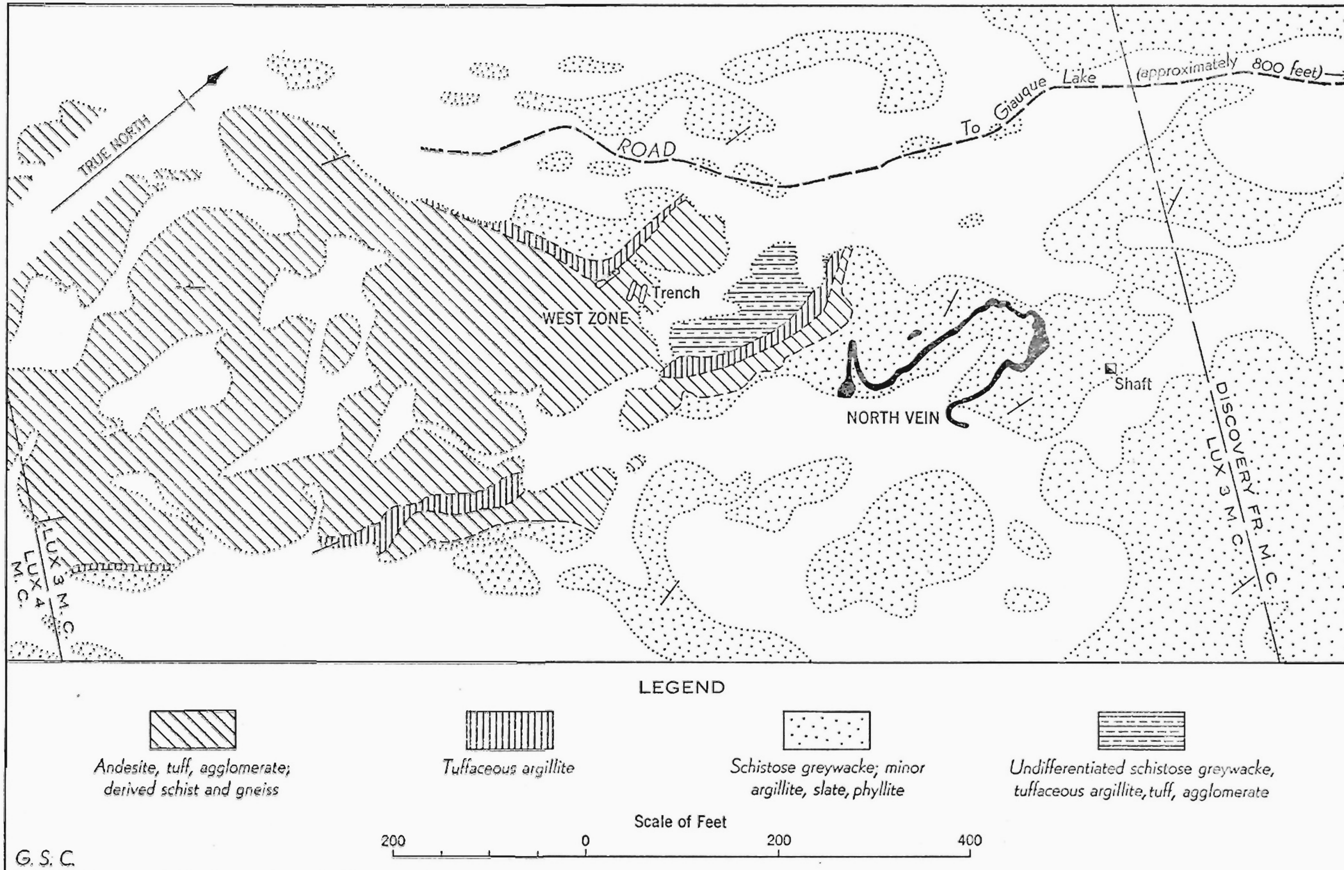

Figure 9. Surface plan, Discovery Yellowknife Mines, Limited, Giauque Lake; modified from company survey.

ORE RESERVES

Possible ore in the North vein, to a depth of 300 feet, as indicated by diamond drilling during 1946, has been calculated as 66,000 tons with an average gold content of 1·05 ounces (uncut) or 0·78 ounce (cut)[1]. Ore reserves in 1948 were estimated (Byrne, 1948a) as follows: North vein to a depth of 375 feet, 47,700 tons averaging 0·86 ounce gold a ton; West zone between the 125- and 375-foot levels, 32,000 tons containing 0·37 ounce a ton.

CAMP AND PLANT

The camp and mining plant are on Lux No. 3 and Discovery fractional claims, about 900 feet southwest of, and 150 feet above, a dock on Giauque Lake. Buildings were erected during 1947, and are of substantial frame contruction designed to provide comfortable accommodation throughout the year for as many as sixty men. Most are sheathed with asbestoside and, where necessary, are fully insulated and lined with Insul Board. Buildings include: a two-story bunk-house; a two-story combined warehouse, office, commissary, and staff house; cook-house with electric refrigerator; dry; blacksmith and machine shop; power and hoist house; boiler house; and carpenter shop. The 65-foot headframe, of British Columbia fir, is completely enclosed and provided with an ore bin of about 40 tons capacity. Radio provides two-way communication with Yellowknife.

The surface mining plant includes two D 13,000 Caterpillar diesel engines each driving a Gardner Denver compressor with a rated output of 440 cubic feet of air a minute, an 8- by 6-inch Ingersoll Rand two-drum air hoist, and a D 3,400 Caterpillar diesel-electric set with an output of 21 KVA. Camp and plant are heated by a 40-horsepower wood-fired boiler. Water for camp and mine use is pumped from Giauque Lake, through 850 feet of pipe encased in a steam-heated insulated box, to a 5,000 gallon wood-stave tank. Ten 2,200-gallon tanks are used for storing diesel fuel. Rolling stock consists of an Allis-Chalmers A-C 10 tractor with blade and winch, and a 2-ton, 4 by 4 Chevrolet truck.

DEVELOPMENT

The property was explored from the surface by a few trenches and by diamond drill-holes aggregating about 23,500 feet. This work, completed by September 1946, was done mainly on Lux No. 3 claim, but a little was done on Discovery fractional and Lux No. 4 claims, which adjoin Lux No. 3 to the north and south respectively.

Underground exploratory openings, to September 30, 1947, all on Lux No. 3 claim, comprise: a three-compartment vertical shaft 275 feet deep with stations at depths of 125 and 250 feet; 1,012 feet of drifts and crosscuts on the 125-foot level; and 276 feet of drifts and crosscuts on the 250-foot level. Openings on the 125-foot level include: 456 feet of drifts on the North vein; a crosscut about 240 feet in length extending southwesterly from the North vein to the West zone; and, from the end of this crosscut, a drive in the West zone extending about 100 feet southeasterly. Drifts on the 250-foot level total 227 feet and are confined to the North vein.

[1] Discovery Yellowknife Mines, Limited: First Annual Report, for the year ending September 30, 1947.

GEOLOGY

The explored area is underlain by volcanic and sedimentary rocks of the Yellowknife group. A belt of andesite, tuff, agglomerate, and derived rock outcrops as a prominent ridge on Lux Nos. 3 and 4 claims and on the property of La Salle Yellowknife Gold Mines, Limited (56), which adjoins the latter claim on the south. This belt is more than a mile long, as much as 800 feet wide, and trends about north 40 degrees east to narrow and end near the centre of Lux No. 3 claim. Andesite probably predominates within this belt and is a fine- to medium-grained, dark green to black rock, here and there displaying well-formed pillows. The tuff and agglomerate are well-bedded, dark green or black rocks. The beds range in thickness from a few inches to 3 feet or more, the agglomerate, containing fragments as much as several inches in diameter, generally comprising the thickest beds. Pink garnets, from $\frac{1}{16}$ to $\frac{1}{4}$ inch in diameter, are abundant in a few of the tuff beds. Pyrrhotite and pyrite, as disseminated grains and minute streaks and lenticles, are common within the volcanic assemblage and have resulted in many rusty patches and zones.

Grey-surfaced, thin-bedded, hard, black, tuffaceous argillite outcrops as two narrow bands on Lux No. 3 claim. One of these lies along the west side of the volcanic rocks, and the other lies within, but close to, their east side. It is possible that these argillites, if completely exposed, would be found to comprise a continuous band, bent in the form of a crude U open to the southwest, that everywhere lies at or close to the border of the northeast tip of the volcanic belt.

Elsewhere the explored area is underlain by fine- to medium-grained schistose greywacke and minor argillite, slate, and phyllite. Imperfect nodules of cordierite, andalusite, and other minerals are common. Foliation has obliterated much of the bedding, which, however, may still be identified here and there within the thin-bedded argillaceous members.

In general the formations strike between northeast and northwest and dip steep westerly. In a few places near the northeast side of the volcanic belt the shape of the pillows suggests that these volcanic rocks underlie and are, therefore, older than the sedimentary strata that adjoin them on the northeast. So far as known, the latter strata succeed the volcanic members without angular discordance. The detailed structure is not known, mainly because of the scarcity of exposures displaying attitudes and tops of beds and flows. However, deformation was probably particularly intense near the northeast tip of the volcanic belt, where the rocks of the latter, mainly originally andesitic tuffs and agglomerates, have been squeezed and recrystallized to amphibole-feldspar schists and gneisses and partly enclose a body of conspicuously drag-folded and fractured greywackes, tuffaceous argillites, and minor pyroclastic rocks. Furthermore, greywackes and associated sedimentary rocks for several hundred feet east and northeast of the tip of the volcanic belt, and including those adjacent to the North vein, are likewise greatly fractured and deformed, and are cut by numerous small quartz stringers and lenses. Foliation is generally about parallel with the bedding, even in some instances where the latter is involved in small drag-folds. However, in the conspicuously drag-folded body of undifferentiated schistose greywackes and other rocks (*See* Figure 9) the foliation, in part at least, maintains a north-northeasterly strike about parallel with the steeply inclined limbs of the folds, and, in consequence, transects the beds in the axial parts of these folds. The plunge of drag-folds within this body was not measured but is probably very steep.

DESCRIPTION OF DEPOSITS

North Vein. This vein lies within sedimentary rocks a few hundred feet east-northeast of the northeast end of the volcanic rocks. As explored to date, it occurs in the form of an anticline, the axis of which plunges 80 degrees north. The limbs trend about south and dip west, the western limb at about 75 degrees and the eastern, 85 degrees. The vein thus outcrops as a U, open to the south, the arms of which lie about 70 feet apart. The general course of the vein on the 125- and 250-foot levels is similar to that on the surface except that, because of the divergence in dip, the parts occupying the east and west limbs of the structure lie a little farther apart. Below the 250-foot level the vein has been probed by a few drill-holes, the deepest of which intersected it in the axial part of the structure at a reported vertical depth of about 430 feet.

The immediately adjacent wall-rocks are fine-grained schistose greywackes, argillites, and phyllites. They are commonly thin bedded, and in rare instances display a few ovoid knots, and imperfect crystals of andalusite. Many beds are distinctly foliated parallel with the bedding, and are involved in a few, small, steeply plunging drag-folds, each of which displaces the course of the beds a foot or so. Bedding and foliation adjacent to the limbs of the vein-structure trend about north and dip steeply west; on the 150-foot level, close to the axis and on the hanging-wall of the vein, they strike about west and dip 80 degrees north. Here and there on the same level, glistening grey phyllite and fine-grained, schistose greywacke display innumerable minute crenulations; these generally plunge 70 to 80 degrees north, but steep southerly plunges were also noted.

Before construction began at the property, the vein was probably nearly continuously exposed at the surface for a length of about 420 feet, passing at each end beneath muskeg. An accurate estimate of its average outcrop width was not possible at the time of examination, but it is probable that average, maximum, and minimum outcrop widths are similar to those encountered on the 125-foot level. Its greatest exposed length is found on the latter level where, for a length of 456 feet, it averages about $2\frac{1}{2}$ feet wide and varies in width from a few inches to about 9 feet. On the east limb of the structure the vein was explored to where it ended; and on the west limb it was followed to where it was lost among several highly irregular quartz bodies. Drifting on the 250-foot level was in progress at the time of the last examination, but widths encountered there were comparable to those of the corresponding part of the vein on the 125-foot level. The vein is composed mainly of quartz. The walls are sharp and, commonly, the quartz adheres to the wall-rock; in some instances, however, it parts readily from the rock and is bordered by less than an inch of schist. Where quartz adheres to the wall-rock the latter generally contains abundant coarse dark brown mica within $\frac{1}{4}$ inch or so of the contact. In places, especially on the west limb of the vein-structure, numerous veinlets branch from the main vein and extend as far as several feet into the adjacent formations. The vein is generally sinuous or intricately contorted, but on the east limb of the structure it is in part nearly straight. Almost everywhere, however, the walls parallel the adjacent strata. Most of the quartz is medium grained, and banded or mottled in shades of grey. That occupying the east limb of the structure, for instance, is well banded parallel with the walls. These bands comprise layers of light grey quartz alternating with nearly straight layers or partings, 1 inch or less in thickness, of silicified biotitic rock, or of quartz rich in biotite resulting from the partial replacement of layers of wall-rock. Elsewhere, the dark, commonly micaceous quartz occupies discontinuous, straight or sinuous layers or irregular ill-defined patches interspersed among lighter grey varieties. A second, and probably younger, type of quartz is coarse grained and white or glassy. It forms veinlets, as much as several inches wide, that transect the medium-grained, mottled and banded vein material and do not, as a rule, extend beyond the vein walls.

The North vein contains, in addition to quartz and biotite, small amounts of pyrite, pyrrhotite, chalcopyrite, arsenopyrite, pentlandite, magnetite, hematite, ilmenite, gold, feldspar, and an unidentified carbonate mineral. The metallic minerals probably constitute much less than 1 per cent of the vein, and are found mainly in or close to the micaceous layers and partings of the medium-grained quartz.

An orebody occupies the widest part of the vein at the surface and on the 125- and 250-foot levels (*See* Figure 9), and thus comprises that part of the vein that extends southeasterly from the axis or most northerly part of the vein-structure. Its dimensions and grade on the 125-foot level are reported[1] to be: length, 93 feet; average width, 5·5 or 5·9 feet[2]; and gold content, 1·21 or 1·365 ounces a ton. Those on the 250-foot level are reported by the same source as: length, 105 feet; average width, 4·34 or 7·2 feet; and gold content, 1·232 or 1·217 ounces a ton. Most of the gold seems to occur within about 1½ feet of the southwest wall of the orebody, where, also, pyrite and pyrrhotite are particularly abundant. The orebody, in addition to being much wider than most other parts of the vein, contains the greatest concentration of veinlets of the coarse-grained, white or glassy quartz. Furthermore, it is less well banded and slightly more sinuous than the vein to the south, and much less contorted and less variable in width than the vein to the west and southwest. A bulk sample from this orebody, submitted to the Bureau of Mines, Ottawa, assayed (1947b, p. 3): gold, 1·69 ounces a ton; silver, 0·26 ounce a ton; iron 2·06 per cent; and sulphur, 0·19 per cent. Tests made on this sample indicated that a high percentage of the gold can be recovered by cyanidation, amalgamation, or blanket concentration, or combinations of these procedures.

Other gold-bearing quartz, some of which may be ore, occurs in the west limb of the structure. This part of the vein, as already stated, is narrower and much more contorted than that comprising the orebody described above.

West Zone. About 350 feet southwest of the North vein, scattered small quartz bodies cut volcanic rocks to comprise what is known as the West zone. Very little, however, is known of the distribution of these

[1] Discovery Yellowknife Mines, Limited: First Annual Report, for the Year Ending September 30, 1947.

[2] The first figure quoted for average width or gold content was derived from channel samples, and the second from car samples.

bodies, and no well-defined containing structure has been recognized. The volcanic rocks, derived from andesitic tuffs and agglomerates, are hard, fine grained, dark green, black, or rusty, and are faintly foliated to gneissic aggregates of amphibole, feldspar, quartz, pyrrhotite, pyrite, and, in some instances, garnet. The foliation and gneissic banding trend about north and dip about 85 degrees west. The zone is exposed by three trenches and, at September 30, 1947, by a straight drive about 100 feet long that lies below these trenches on the 125-foot level. The drive trends south 30 degrees east. Quartz comprises only a small proportion of these exposures; it forms veins 1 inch to 6 inches wide, and lenticular or irregular masses. The veins strike and dip in many directions. The quartz is glassy, adheres firmly to the enclosing rock, and contains patches of rock in addition to a little pyrrhotite, pyrite, and white feldspar. Encouraging amounts of gold are reported to have been encountered in some of this quartz, but none was seen.

UNDERGROUND OPERATIONS

Workings are provided with 18-inch gauge track and about 15-pound rails. Broken rock and ore are loaded into mine cars by a Gardner-Denver mucking machine, trammed by hand, and hoisted to surface in cars. Hoisting is done in cages operating in two of the three shaft compartments. The underground openings have not required timber supports to date. Very little water enters the workings. Permafrost extends at least as deep as the 125-foot level, where ice was encountered in a minor fault fissure in the West zone. Late in September 1947, underground exploration was proceeding at a rate of two rounds daily, one in the West-zone drive on the 125-foot level, and one on the North vein on the 250-foot level. Detachable bits are used with all rock drills.

Samples for assay are obtained from two channels on each drift face, and from cars. Channel samples are later cut from the backs of all drifts. In the rare instances where assays indicate a gold content in excess of 3 ounces a ton the higher figure is reduced ('cut') to 3 ounces before being used in ore computations. Gold content calculated by averaging assays from channel samples commonly differs materially from that computed from assays of car samples. The operators consider the latter the most reliable.

COSTS AND GENERAL OPERATING DATA

Expenditures to September 30, 1947, totalled $645,391.73 and included: buildings and structures, $105,578.39; equipment, $76,989.64; shaft and underground development, $186,322.91; and surface exploration and diamond drilling, $145,430.62[1].

Shaft sinking and drifting were done by contract, the former at $68.50 a foot and the latter at $12 a foot. These figures include the cost of labour and explosives only.

Standard surface diamond drilling was done by contract at $2.50 a foot under an agreement whereby the contracting company was charged board for the drill crew at a rate of $2.50 for each man each day, and Discovery Yellowknife Mines, Limited, provided transportation for men,

[1] Discovery Yellowknife Mines, Limited: First Annual Report, for the Year Ending September 30, 1947.

equipment, and gasoline from Yellowknife. The contract price for underground diamond drilling is $1.50 a foot, with the same arrangements for board and transporation and with the mining company providing power.

About 150 tons of freight was flown to the property from Yellowknife during March 1947 by DC3 aircraft at a cost of about $40 a ton. Freight by tractor train during the same winter was hauled at a contract rate of $26 a ton.

Employees totalled about 40 persons, as follows: staff, 7; surface, 18; underground, 15. Hourly wages included: surface labour, $1 to $1.25; carpenter, $1.50; miner, $1.25; helper, $1.15; mucking-machine operator, $1.25; trammer, $1.15. One dollar a day was deducted from these wages for board. Cook and night cook received $250 and $200 a month, respectively, and free board.

Diesel fuel, delivered at the property by tractor train, costs about 41 cents a gallon. Wood for fuel, cut by contract, costs $12 a cord delivered in pole lengths.

Lumber for all ordinary construction was sawn at the property from local timber.

Diversified Mining Interests (Canada), Limited[1]

(*Arseno and R.A. Groups*) (34)

(*See* Figure 10)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 86-B-6. Stanton, 1947, pp. 7-10. Stanton, Tremblay, and Yardley, 1948.

INTRODUCTION

Diversified Mining Interests (Canada), Limited, has explored gold-bearing quartz veins on a property comprising Arseno Nos. 1 to 3 and the contiguous R.A. Nos. 1 to 10 and 13 to 15 claims. The claims are on Leta Arm, a bay on the north side of Indin Lake, about 130 miles north-northwest of Yellowknife. They lie between the Leta group of Lexindin Gold Mines, Limited (35), on the north, and the North and Tartan 44 groups of North Inca Gold Mines, Limited (37), on the south. Aircraft from Yellowknife provided the only means of access used, but probably a winter road following a direct route from Yellowknife could be constructed at nominal cost. The property was first examined for the Geological Survey of Canada by M. S. Stanton in 1946. The writer visited the property in August 1947. At that time, the principal gold-bearing zone, most of which lies beneath Leta Arm, had been explored mainly by diamond drill-holes. Accordingly, much information was derived from drill plans and records courteously provided by the company. Diamond drill-core was not examined. J. R. Macdonald was mine manager, and J. F. Wright managing director and geologist.

HISTORY

Probably part of the property was staked first by Territories Exploration Company, Limited, and subsequently allowed to lapse. The Arseno claims were staked early in 1945, and the R.A. group in March

[1] Reorganized and name changed to Progress Diversified Minerals Limited in 1949. Indigo Gold Mines, Limited, acquired three claims of Arseno group and fifteen claims of R.A. group from Progress Diversified Minerals, Limited, in 1949.

1945[1]. Diversified Mining Interests (Canada), Limited, was incorporated in March 1945 to acquire this and other property. Gold was found on Arseno No. 2 claim (No. 2 deposit) in June, on Arseno No. 1 claim (No. 1

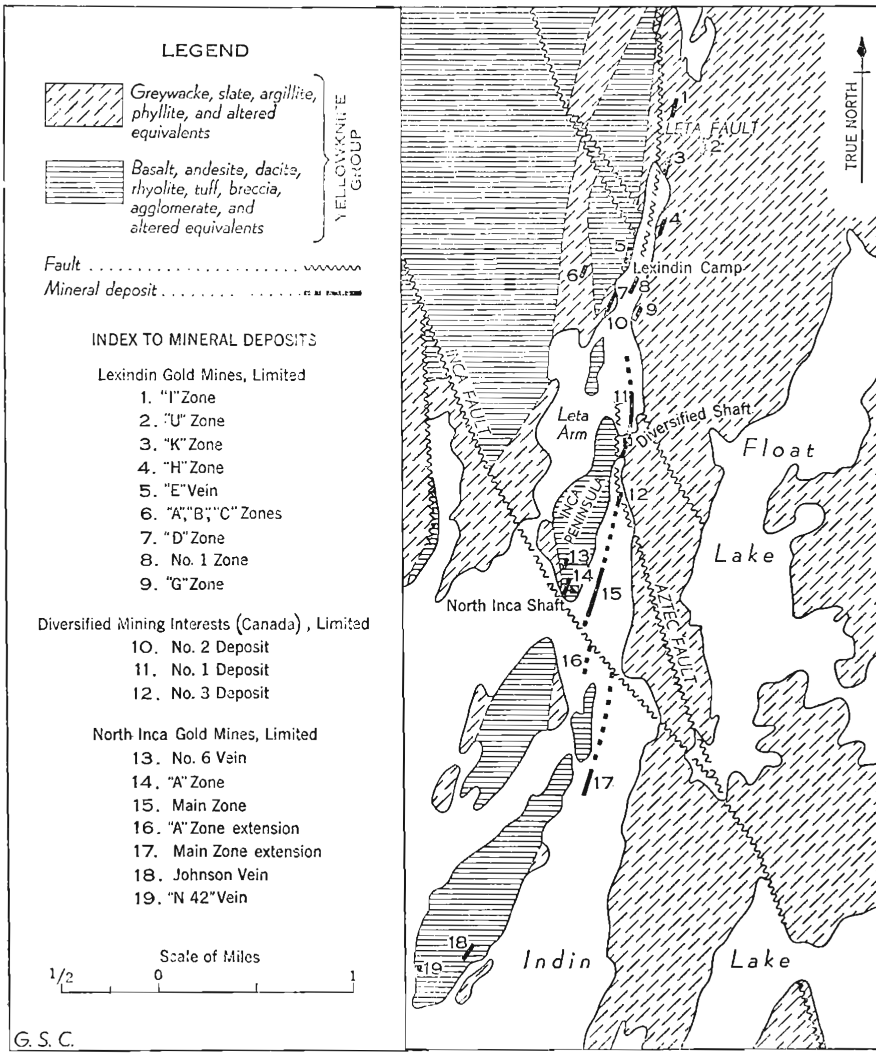

Figure 10. Generalized geology, and location of principal mineral deposits on properties of Lexindin Gold Mines, Limited (Leta group), Diversified Mining Interests (Canada), Limited (Arseno and R.A. groups), and North Inca Gold Mines, Limited (North and Tartan 44 groups).

deposit) in July, and on Arseno No. 3 claim (No. 3 deposit) in September. Before freeze-up, a little X-ray diamond drilling, under the direction of W. Manley, was done on Nos. 1 and 2 deposits. The main drilling program,

[1] J. R. Macdonald, mine manager: personal communication.

mostly on No. 1 deposit, was supervised by J. D. Wright, and completed between March 10, 1946, and June 3, 1947. A mining plant and supplies were flown to the property in February 1947, and J. R. Macdonald took charge of underground work and surface construction. A shaft was collared on April 17. Lateral work on the first level commenced in July and continued until late in the year, when operations ceased and the workings were allowed to flood. No significant work was done during 1948.

CAMP AND PLANT

The camp and plant are near the southeast corner of Arseno No. 1 claim. The camp includes a two-story frame bunk-house designed to accommodate 38 men, a cook-house with a seating capacity of about 50, and a temporary frame structure housing the office, warehouse, and commissary. The bunk-house and cook-house are insulated, and sheathed with asbestoside. Other shelter is provided by various tents on frames.

Two Canadian Ingersoll-Rand compressors, each with rated output of 760 cubic feet of air a minute, are driven through V-belts by two Waukesha spark diesel engines (Models 145HK). These engines were not housed at the time of the writer's visit. A double-drum, air-operated, 8- by 6-inch Canadian Ingersoll-Rand hoist services the shaft. Other items are a 40-foot headframe, various oil storage tanks with an aggregate capacity of about 28,000 gallons, and a 10,000 gallon wood-stave water tank. Under favourable conditions a radio transmitter and receiver afforded daily contact with Yellowknife.

DEVELOPMENT

The main or No. 1 deposit trends northerly across a narrow neck of land connecting a peninsula on the west with the mainland on the east. The operators recognize three nearly parallel zones of quartz veins within this deposit. They are designated 1-A, 1-B, and 1-C, from east to west; 1-B and 1-C zones lie about 90 and 130 feet, respectively, west of 1-A zone. Quartz has been exposed in 1-A zone by a little stripping and trenching at intervals for 450 feet, almost the entire width of the neck of land. Quartz of 1-B zone has been stripped for about 40 feet at the south edge of the outcrops. Four or five quartz exposures of 1-C zone are displayed along a length of 240 feet. No. 1 deposit and adjacent ground have been probed by diamond drill-holes along a strike length of about 1,500 feet. The southern part of this length lies beneath the outcrop area, and the remainder beneath Leta Arm to the north. About fifty-one holes were completed, with an aggregate length of about 17,500 feet. Most of these holes intersected the deposit at vertical depths of less than 300 feet, but a few cut it at depths of between 300 and 500 feet. A three-compartment shaft, 202 feet deep, is about 40 feet east of the outcrop of 1-A zone. Development work (December 1947) on the 175-foot level comprised: crosscuts, 176 feet; drifts, 959 feet; and diamond drill-holes, 1,729 feet. The drifts are about equally distributed north and south of the crosscut from the shaft, and nearly all drifting was intended to explore 1-A zone.

No. 2 deposit, about 3,500 feet north of the shaft, has been probed by five drill-holes totalling 1,069 feet.

No. 3 deposit, about 1,500 feet south-southwest of the shaft, has been explored by trenches and six drill-holes totalling about 2,000 feet.

GEOLOGY

The rocks near the mineral deposits are volcanic and sedimentary members of the Yellowknife group (*See* Figure 10). The volcanic rocks, schistose greenstones derived mainly from andesitic or dacitic lavas and related pyroclastic facies, form a northerly trending belt lying a short distance west of the deposits. The rocks enclosing the deposits are well-cleaved slates, schistose argillaceous greywacke, and schistose greywacke or fine-grained, fissile, quartz-mica schist. Cleavage and bedding trend about north and are vertical or nearly so. Leta fault, a break traced for many miles, strikes about north. Most of it lies within the sedimentary strata near the volcanic contact, but near No. 1 deposit it separates the volcanic and sedimentary belts. Neither the direction nor the amount of displacement along the fault is known. The Aztec fault trends north-northwest, probably marks a left-hand displacement, and may join the Leta fault just south of No. 1 deposit.

DESCRIPTION OF DEPOSITS

Very little underground work had been done at the time of the writer's visit and, unless otherwise stated, the following descriptions apply to surface exposures.

No. 1 Deposit. The three zones (1-A, 1-B, and 1-C) of No. 1 deposit are marked by scattered exposures of lenses and veins of quartz in slate and schistose argillaceous greywacke. Here and there the quartz bodies are enclosed in rusty, sheared slate, but insufficient surface work has been done to demonstrate that any of the zones represents a sharply defined continuous body of distinctively sheared rock or that the various quartz bodies approach continuity. The southern exposed ends of the zones lie 75 to 200 feet east of the northerly trending Leta fault that separates the sedimentary host rocks from dacitic volcanic rocks to the west. The exposed parts of the zones trend east of north and thus, in that direction, diverge from the fault. None has been traced southerly to the fault.

Zone 1-A has been traced at intervals on the surface for 450 feet and, by drilling, northerly for another 650 feet or more beneath Leta Arm. Its strike changes from about north 30 degrees east, near its most southerly outcrop, through about north 10 degrees east near its most northerly outcrop, to nearly north beneath Leta Arm. Its dip is nearly vertical, perhaps averaging steeply west. Exposed widths of rusty, sheared slate and associated quartz range from about 1 foot to 20 feet or more. The zone is about parallel with the bedding and cleavage of the enclosing strata. The rock within the zone, between the shaft and the shore of Leta Arm 220 feet to north, is a flaky, black, graphitic slate impregnated with crystals of pyrite. This rock weathers rusty at the surface and is sharply separated, at its exposed west wall, from the grey, less sheared wall-rock. South of the shaft the rock immediately adjacent to the quartz exposures is not much more sheared than elsewhere. Quartz is exposed at five places along the outcrop length of the zone. It occurs as veins and lenses that, for the most part, are nearly parallel with the foliation of the enclosing rock. In places several veins or lenses occur side by side. The amount of quartz in the various trenches varies widely. Thus, about 120 feet southwest of the shaft only one vein, 6 inches to 1 foot wide, was noted, whereas north of the shaft, near the lakeshore, three parallel quartz bodies display an aggregate width of about 9 feet. The walls of the quartz bodies are sharp. Much of the quartz is mottled white and dark grey. The white variety is fine grained and sugary, whereas the grey variety is coarse grained and glassy. The white variety commonly encloses the grey, and the boundaries between the two are sharp in places, gradational elsewhere. The proportions of grey and white quartz vary widely from place to place. Veinlets, $\frac{1}{16}$ to 1 inch wide, of milky white, vuggy quartz, with pyrite and rusty weathering carbonate, cut the mottled quartz. Metallic minerals generally do not comprise more than 1 per cent of the vein matter. They include, in approximate order of abundance, pyrite, arsenopyrite, pyrrhotite, galena, chalcopyrite, sphalerite(?), and gold. A soft, grey, unidentified mineral, possibly jamesonite, has been reported (Stanton, 1947, p. 8).

Not all core was recovered during diamond drill operations and, accordingly, the company does not consider that the drilling data provide a reliable means of estimating the average grade and tonnage of vein material intersected. However, their best available data are reported[1] to indicate ore as follows[2]. North of the shaft, nine holes cutting the zone at depths of 70 to 225 feet, suggest an ore shoot 600 feet long, with an average width of 3·5 feet and a grade of 0·72 ounce of gold a ton (uncut) or 0·63 ounce a ton (cut). Twelve holes cutting the zone at depths of 225 to 450 feet indicate ore for a length of 1,000 feet, with an average width of 4·7 feet and a grade between 0·36 and 0·44 ounce a ton. Ore indicated by these twenty-one holes amounts to 118,000 tons, grading 0·46 ounce of gold a ton. Drifting on the 175-foot level is reported[3] to have encountered three shoots of gold-bearing vein matter as follows: (1) 280 to 330 feet south of the shaft—average width, 4·0 feet; grade, 0·46 ounce gold a ton; (2) 155 to 205 feet north of the shaft—average width, 3·5 feet; grade, 0·75 ounce a ton; and (3) 240 to 448 feet north of the shaft—average width, about 9·5 feet; grade, about 0·21 ounce a ton. A sample of vein material taken from this level for a mill test is reported to have assayed 0·335 ounce of gold a ton.

Several steeply dipping, probably left-hand faults are said[4] to have offset the gold-bearing veins slightly.

Zone 1-B was observed only at the southern rock outcrops where a quartz lens is exposed for about 40 feet and ranges in width from about 4 inches to a foot or more. The adjacent greywacke and argillite strikes north 50 degrees east and is vertical or dips steeply northwest. The vein crosses the bedding in places, and elsewhere is parallel with it. The zone is said to have been traced by drill-holes for about 560 feet, to parallel 1-A zone, and to contain gold.

Zone 1-C is about parallel with zone 1-A. The most southerly pit displays about a 4-foot width of rusty, nearly vertically sheared slate, which encloses a quartz lens up to $1\frac{1}{2}$ feet wide. Widely scattered quartz bodies exposed at intervals for 240 feet north of the pit are from a few inches

---

[1] Diversified Mining Interests (Canada), Limited: First Annual Report for the Year Ending December 31st, 1946.

[2] This report does not differentiate, except where indicated below, between cut and uncut grades.

[3] Diversified Mining Interests (Canada), Limited: Second Annual Report for the Year Ending December 31st, 1947.

[4] Macdonald, J. R., mine manager: personal communication.

to about 2 feet wide. Diamond drilling is said to have traced the zone for a length of about 540 feet and to have encountered encouraging amounts of gold.

No. 2 Deposit was not examined by the author. It is reported to contain gold. No work has been done on it since it was described by Stanton as follows:

> The zone consists of quartz lenses and stringers occupying shears in slates and greywacke. The southernmost exposure consists of vitreous to sugary, white, pinkish and grey quartz veins and stringers across a width of about 10 feet. There are two main veins, each 1½ to 2 feet in width, with an intervening area of quartz stringers and silicified sedimentary rock. The quartz is mineralized with pyrite and chalcopyrite. The veins are in a shear zone striking north and dipping vertically. A considerable amount of soft, graphitic material occurs on the west side of the vein. Roughly 200 feet north of this exposure is a mineralized quartz vein or lens 2½ to 3 feet wide, which is exposed for 35 feet. The main lens appears to be open towards the south, but breaks up northwards into several quartz stringers in the form of a stockwork. The vein quartz is dark grey, and is transected by white quartz veinlets. About 100 feet farther north, trenching and stripping expose two shear zones for a length of 65 feet. These are separated by about 25 feet of cleavable slaty rock that is locally slightly knotted. The shear zones strike from north 15 to north 20 degrees east, and a little dark grey and rusty quartz occurs as stringers in parts of them.
>
> The above zones extend northwards into Lexindin ground, and, including the part in Lexindin, can be traced for about 550 feet, terminated at each end by the lake.

No. 3 Deposit was not examined by the writer. It is reported to have been traced for about 240 feet and may be a part of No. 1 deposit, displaced towards the southeast by the intervening left-hand Aztec fault. No work has been done since it was described by Stanton as follows:

> The showing consists of irregular quartz stringers and lenses within a shear zone in greywackes and argillites. The zone has been uncovered for about 115 feet, has a maximum observed width of about 8 feet, and an average trend of north 15 degrees east. Trenching reveals that the quartz masses are extremely irregular in shape and size, and occur as pods and stringers lying in rusty crenulated schist. Exposures are terminated at the south by the lake. The direction of schistosity is variable, but at the southern exposures is north 25 degrees east; dips are vertical. Quartz is grey to white and rusty, and is mineralized by pyrite, which has undergone considerable oxidation to limonite. Visible gold was observed at one place. Arsenopyrite is reported, and, as with the No. 1 deposit, is believed to be generally indicative of gold.

UNDERGROUND OPERATIONS, COSTS, AND GENERAL OPERATING DATA

In August 1947, only one of the two hoisting compartments in the shaft was in use, and all rock, supplies, and persons were handled in a bucket. All mucking was done with a Gardner-Denver loader. About 200 feet of lateral work had been done on the 175-foot level and no timbering had been required. No permafrost had been encountered in the underground workings or in the diamond drill-holes from the surface[1]. Later in the year the width of the gold-bearing zone was found to exceed the width of the drift, and closely spaced diamond drill-holes were used to probe the drift walls and determine the full width and gold content of the zone.

A metallurgical test of ore from the 175-foot level is reported[2] to have indicated that medium fine grinding followed by cyanidation would afford a 97 per cent gold recovery.

[1] Macdonald, J. R., mine manager: personal communication.

[2] Diversified Mining Interests (Canada), Limited: Second Annual Report for the Year Ending December 31st, 1947.

Development cost to December 31, 1947 (not including head office expense), was reported as $280,094.48. The shaft (two hoisting compartments 4½ by 5 feet inside timbers and a manway 4 by 5 feet inside timbers) was sunk by contract, at $65 a foot, including charges for supervision, hoistman, deckman, steel sharpener, and all underground labour and explosives[1]. The published true cost, exclusive of collar, was $18,157.47, or about $90 a foot. The approximate true cost of surface diamond drilling is said to be $4.50 a foot.

All freight, including plant and fuel, was transported to the property by aircraft. Early in 1947, 385 tons were flown from Yellowknife by a DC3 aircraft at a cost of $110 a ton. The company operates a Fairchild Husky aircraft for emergency freight, supplies, and personnel.

On August 1, 1947, twenty-six men were employed, including airplane pilot and mechanic, and agent at Yellowknife. The scale of wages was that used at the Con mine (73) at Yellowknife.

Diversified Mining Interests (Canada), Limited

(*Mag Group*) (32)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 86-B-6. Stanton, 1947, pp. 7, 10.

The Mag group of twelve claims is at the northeast end of Chalco Lake, about 132 miles north-northwest of Yellowknife. It is controlled by Diversified Mining Interests (Canada), Limited, and lies about 7 miles northeast of the Arseno and R.A. groups (34) where the same company has done considerable development work.

The Mag group was examined by Stanton in August 1946 when stripping and trenching was in progress on several showings. His descriptions follow.

Mag No. 11 *Claim.* About 2,000 feet north of the inlet of Indin River at Chalco Lake, and on the east side of the river, is a pit exposing a mineralized zone at the contact of a diabase sill with rusty graphitic slates that strike northeasterly and dip steeply northwest. The zone is mineralized with pyrite, marcasite, pyrrhotite, and chalcopyrite, and diabase is locally traversed by lenses and veinlets of quartz and carbonate.

Mag No. 9 Claim. About 1,000 feet north of the above showing, and on the west side of Indin River, are two pits exposing several small quartz lenses and stringers across a width of as much as 2½ feet, and for a length of about 25 feet. The quartz lies in a rusty graphitic shear zone in slates and greywackes at and near the contact with a small sheared acid sill. The zone trends north 40 to 50 degrees east and dips vertically to steeply west. Minerals include pyrite and pyrrhotite, and a little gold is reported to have been recovered in panning. The quartz is grey and vitreous, locally rusty, and is associated with carbonate. About 150 feet southwest of these exposures, trenching has been done along a rusty zone in a sheared acid sill cutting argillaceous greywackes. A little grey to rusty quartz is present and is mineralized with pyrite.

Mag No. 3 *Claim.* About 3,000 feet north of the above showings, trenching on the southwest bay of a small lake has exposed a few stringers and lenses of vitreous to rusty quartz in folded slates and greywackes. The slates are in part graphitic. The zone does not appear to extend far along the strike.

Mag Nos. 4 and 2 Claims. Some 2,000 feet northwest of the Mag No. 3 showing, near the boundary of Mag No. 4 and Mag No. 2 claims, surface stripping has exposed quartz veins and stringers across a width of about 20 feet. The zone occurs at the contact of a sheared, rhyolitic volcanic rock to the west and greywacke to the east. The contact

[1] Macdonald, J. R., mine manager: personal communication.

strikes north 20 degrees east and dips about vertically. It is mineralized with dark grey, glassy to rusty quartz. Considerable limonitic oxidation occurs on fracture surfaces, but very little pyrite was seen. Some black graphitic slate occurs at the exposure. When examined work had only commenced, and no information concerning length or grade is known.

The volcanic and sedimentary rocks belong to the Yellowknife group.

Doris Yellowknife Gold Mines, Limited (25)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 86-B-5. Lord, 1942a, pp. 46-47.

A gold prospect, comprising Avis Nos. 1 to 12 claims and the contiguous A.S. Nos. 1 and 2 claims, has been explored by Doris Yellowknife Gold Mines, Limited. The claims are on the east side of the north end of Norris Lake, about 145 miles north-northwest of Yellowknife. The following description is derived from data supplied by G. M. Webster, who directed the work of the Doris Yelowknife company; from notes by J. T. Wilson, who visited the property for the Geological Survey in August 1939; and from a brief examination by the writer on July 24, 1947, after all work had stopped.

The property was first staked as the Midas group by Victor Stevens and Malcolm Norris in July 1938. The main gold-bearing zone, on the south side of a bay that forms the northeast corner of Norris Lake, was explored by eleven pits and trenches in 1938 or 1939, but no work was done in 1940. The claims were allowed to lapse. They were re-staked, early in 1945, as the Avis and A.S. claims, by Ole Haug and associates, and, in September 1946, were optioned by Doris Yellowknife Gold Mines, Limited. About 8,000 feet of diamond drilling was completed by the spring of 1947, after which work stopped.

The rock is rusty weathering, black slate of the Proterozoic, Snare group. The slate cleaves along planes commonly spaced less than $\frac{1}{4}$ inch apart and probably about parallel with the bedding. The cleavage planes strike about north-northeast and dip about 75 degrees west-northwest. Many are stained with iron oxide or are occupied by seams of earthy iron oxide.

The gold-bearing zone consists of rusty, slabby, locally contorted slates cut by a few seams and lenses of quartz. The zone strikes about north-northeast down a steep hillside into Norris Lake, and probably dips steeply westerly about parallel with the cleavage of the enclosing slates. As exposed by the trenches it is, in places, 20 feet or more in width, but it does not appear to be sharply separated from adjacent less rusty slates without vein quartz. The most southerly trench exposes the zone about 350 feet south of the lake; and farther south the slates, although well exposed, appear devoid of significant amounts of metallic minerals or vein quartz. Diamond drill-holes have traced the zone about 320 feet north-northeast of the lakeshore, and to a depth of about 300 feet below the lake bottom. The quartz occurs as veins and irregular lenses ranging from less than an inch to about 2 feet in thickness. Surface exposures suggest that these comprise not more than 10 per cent of the zone. Many of the veins parallel the cleavage planes of the slates. Most of the vein material is milky white, massive quartz with minor rusty weathering carbonate; but a little consists of $\frac{1}{8}$- to $\frac{1}{2}$-inch bands of medium-grained white quartz separated by thinner partings of slate or phyllite. Metallic minerals are abundant and occur in quartz and slate. They include galena, sphalerite, fine-grained pyrite, arsenopyrite, and chalcopyrite. No gold was seen. Here and there these minerals are sufficiently abundant to afford massive specimens 6 inches or more in diameter. Gold occurs in mineralized bands within the zone. Thus, a picked sample collected by the Geological Survey in 1939 from the most heavily mineralized parts of most of the trenches, and containing quartz, arsenopyrite, galena, sphalerite, pyrite, and chalcopyrite, contained[1]: gold, 0·7 ounce a ton; silver, 0·73 ounce a ton. The company reports a mineralized body about 670 feet long. The lower edge of this plunges 45 degrees north-northeasterly, and extends from the surface to a known depth of about 300 feet below the lake bottom. The mineralized body is said to average 5·82 feet in width, and, allowing for a pillar to support the lake bottom, to contain 81,000 tons of material with an uncut grade of 0·228 ounce of gold a ton.

Dot and Eva Claims (114)

References: Bureau of Mines, 1941c. Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-I-7. Henderson and Jolliffe, 1941.

Dot Nos. 1 to 6 claims, and Eva Nos. 1 and 2 claims are on the west shore of Gilmour Lake about 45 miles east of Yellowknife. They were owned by the A.M. Mining Syndicate in 1941. Scheelite found in the Discovery vein on Dot No. 5 claim in 1940 was the first occurrence of this mineral in Northwest Territories to receive widespread attention; and its discovery resulted in an intensive search for scheelite in 1941. The property was examined in 1940 and 1941 by A. W. Jolliffe, who supplied most of the data incorporated in the following remarks.

Gold was the first metal discovered on the claims, which were staked by Alex. Mitchell on June 12 and 13, 1940. The claims were prospected until September, and scheelite was discovered in the Discovery quartz vein on Dot No. 5 claim. A selected sample from this vein, sent to the Bureau of Mines, Ottawa, for assay, contained 35 per cent tungstic oxide (WO_3). Four men commenced development work on this vein in January 1941, and during the first 3 months of the year excavated a trench 50 feet long to a maximum depth of 15 feet. About 30 tons of vein material, containing 2·18 per cent WO_3, was piled near the trench. A 200-pound presumably cobbed sample of vein material from this trench contained 8·90 per cent WO_3 (Bureau of Mines, 1941c, p. 2). The remainder of the spring, and the summer, were spent in prospecting the claims, and other scheelite-bearing quartz veins were found. Work on the claims stopped in September 1941.

The veins occur in folded sedimentary rocks of the Yellowknife group. The axes of many of the folds trend a little west of north and in most places the rocks dip more steeply than 75 degrees. Most veins are parallel with the beds.

The Discovery vein lies along a bedding plane in altered sedimentary rocks. It strikes north-northwest and dips steeply east. Most rocks in the vicinity are quartz-mica schist and slate. Those bordering the vein

[1] Assay by Bureau of Mines, Ottawa.

contain actinolite and graphite and may be altered calcareous and tuffaceous beds. The vein lies about 50 feet east of, and about parallel with, an axis of an anticline, which plunges about 85 degrees south. A trench 50 feet long exposes 50 feet of vein that averages 0·9 foot in width and contains about 2 per cent WO_3. The vein narrows to the south, and about 10 feet south of the trench passes under drift and muskeg. North of the trench, quartz lenses and stringers are exposed for 24 feet, followed by a body of quartz 20 feet long and 4 inches wide, containing about 1 per cent WO_3. Other quartz bodies, some of which contain a little scheelite, occur farther north along the strike of the vein. The quartz is glassy to milky white, and contains reddish brown to light grey scheelite, carbonate, clinozoisite(?), actinolite, arsenopyrite, pyrite, and other sulphide minerals. The scheelite occurs as aggregates that range in size from small specks up to about 12 square inches. The sulphides comprise less than 1 per cent of the ore and contain gold.

Duck Lake Group (75)

Reference: Stockwell and Kidd, 1932, pp. 74, 75.

The Duck Lake group....[comprised] 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 [Yellowknife group] 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[1].

Echo Bay Group (14)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 86-K-4. Kidd, 1932b, pp. 66-67; 1933, pp. 21-24; 1936, p. 37.

The Echo Bay group of ten claims is about 1 mile east-northeast of Port Radium, and adjoins the east boundary of the property of Eldorado Mining and Refining (1944), Limited (13). The following is a summary of reports by Kidd.

The claims were staked for the 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, all of 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

[1] Assay by A. Sadler, Mines Branch, Department of Mines, Ottawa.

disseminated chalcopyrite or galena. Metallic minerals in the zones are in part disseminated throughout the fractured rock and in part occur in veins or stock-works 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.

Eldorado Mining and Refining (1944) Limited (13)

(*See* Figure 11)

References: Bell, J. M., 1903. Bureau of Mines, 1937b; 1938b. Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 86-K-4. Christie, 1947. Howard, 1946. Jolliffe and Bateman, 1944. Kidd, 1932b, pp. 47-69; 1932c; 1932d; 1932e; 1933; 1936, p. 486. Kidd and Haycock, 1935. Lord, 1941a, pp. 38-47. Mines Branch, 1932; 1934a; 1936d. Murphy, 1946; 1948. Parmelee, 1938. Pochon, 1938. Smith, 1938. Spence, 1932a; 1932b; 1932c; 1938. Walli, Ryan, and Smith, 1938.

INTRODUCTION

Eldorado uranium-radium mine, owned and operated by the Crown company, Eldorado Mining and Refining (1944) Limited, is the most northerly lode mine in Canada. It is at Port Radium[1], on Labine Point on the east shore of Great Bear Lake, and 29 miles south of the Arctic Circle. The adjacent territory is notably rugged, with a relief of about 1,000 feet; steep cliffs, some of which rise directly from the lake, are characteristic, and rock outcrops comprise perhaps 75 per cent of the land surface. Concentrates produced at the mine are sent to a refinery at Port Hope, Ontario, for further treatment. The property comprises fifty-three claims and fractions. It may be reached from Edmonton or Yellowknife by aircraft or from the railroad at Waterways by boat. Radio service is provided by the Royal Canadian Corps of Signals from a station at the mine. The writer visited the property in July 1939 and September 1947. At the latter date the staff included: E. J. Bolger, mine manager; R. N. Sexsmith, assistant mine manager; J. D. Belec, mine superintendent; R. E. Miller, mill superintendent; and A. W. Estey, geologist. E. B. Gillanders became mine manager later in the year. Data gathered by the writer during his visits have been supplemented by the free use of published and unpublished accounts, especially those of Jolliffe and Bateman, and Murphy. An effort to comply with the Atomic Energy Regulations of Canada, in spirit as well as letter, has resulted in the ommission of much pertinent information.

HISTORY

Cobalt and copper minerals, now known to be common associates of uranium ore, were seen on the east shores of Great Bear Lake, possibly at Labine Point, by an officer of the Geological Survey of Canada in 1900 (Bell, J. M., 1903, p. 102). The Eldorado deposits were staked in May

[1] The post office of Port Radium was formerly on Cameron Bay, about 4 miles east of the mine.

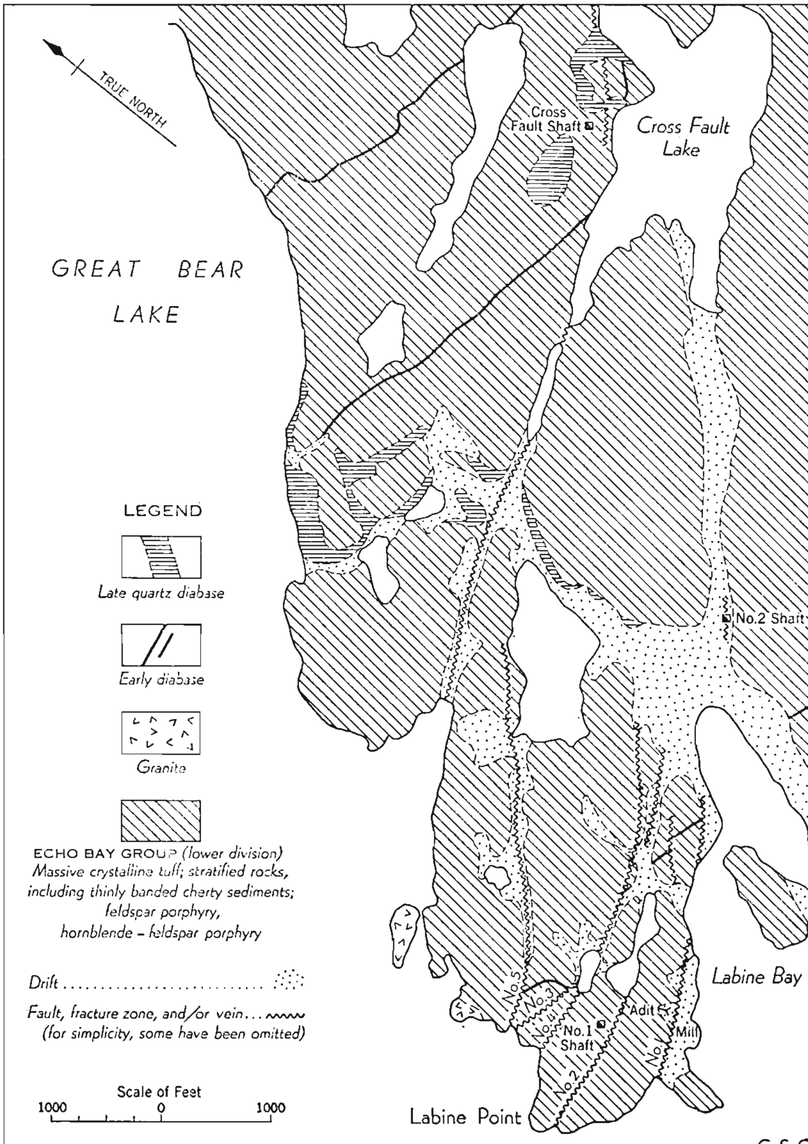

Figure 11. Eldorado mine and vicinity, Great Bear Lake. After Jolliffe and Bateman (1944).

1930 by G. A. LaBine and E. C. St. Paul. These men were soon joined by C. LaBine, L. Seaberg, and S. Cragg, and other claims promptly staked. Before the party left the district, early in September, veins in Nos. 1, 2, and 3 fault zones had been examined on the surface, trenches and pits excavated, and the veins were known to contain uranium and radium (as pitchblende), silver, cobalt, bismuth, and other metals. Underground work commenced in 1932, and a plant designed to concentrate 25 tons of ore a day began operation in December 1933. In the meantime, high-grade ore had been shipped to Port Hope, Ontario, where a refinery had been erected, and in May 1933 the first gram of radium was recovered. The mine and mill operated almost continuously until closed temporarily in the early summer of 1940 by circumstances attending the early phases of the second World War. During this initial production period, the property was under the direction of E. J. Walli until the end of 1939 and E. J. Bolger during 1940. About one hundred men were employed in 1940, and the mill treated about 100 tons of ore daily. Radium, as bromide and sulphate, was the most valuable item recovered at the refinery, but other products included various forms of uranium for use in the glass and pottery industry and research, polonium, silver-copper concentrate, silver sulphide, and cobalt-copper-nickel concentrate. Eldorado mine was, at that time, one of two principal sources of radium in the world.

Developments pertaining to atomic fission and its possible military applications were responsible for the reopening of Eldorado mine in April 1942, this time primarily as a source of urgently required uranium. The property was still owned by Eldorado Gold Mines, Limited, and managed by E. J. Bolger. Although the mine had been flooded since 1940 it was dewatered without undue difficulty, and by 1943 the excessively caved workings had been sufficiently repaired to permit mining at a normal rate. On January 28, 1944, a government order was issued whereby Eldorado Gold Mines, Limited, was acquired by the present operators, the Crown-owned and operated organization known as Eldorado Mining and Refining (1944) Limited. Eldorado mine is today, so far as known, one of the world's two foremost producers of uranium; and radium, its former prime product, is a valuable by-product.

DEVELOPMENT

Most development work has been and is being done in and near four fault zones that in general strike between east and northeast. No. 1 fault zone outcrops at the camp on the north shore of Labine Bay, and No. 2, No. 3, and No. 5 (Dumpy) fault zones lie about 550, 1,100 and 1,550 feet, respectively, north of it. The principal entry to the mine is a crosscut adit, about 25 feet above lake level, that extends 390 feet northwest from the portal to a drift on No. 2 zone. A vertical shaft (No. 1 shaft), with two hoisting compartments, is connected to this drift 275 feet west of the adit and provides entry to all other underground openings on Nos. 1, 2, 3, and 5 zones. The shaft collar is about 100 feet north of the outcrop of No. 2 zone and 80 feet above the back of the adit level.

No. 2 shaft, about 3,900 feet east-northeast of No. 1 shaft, is not used. It is reported to have served workings on the 125-foot level.

A little exploratory work was done from the three-compartment Cross Fault shaft, about 8,200 feet northeast of No. 1 shaft.

GEOLOGY

Probably all rocks near Eldorado mine are of Proterozoic (Late Precambrian) age. The oldest and most abundant rocks are those of the lower division of the Echo Bay group, and comprise tuff(?), stratified rocks, and porphyry. The tuff(?) is a dense, dark grey, massive, brown weathering rock, and its age relative to other members of the division has not been established. The stratified rocks are mainly pink, green, and grey, thin-bedded, cherty sediments and other vaguely banded, altered, siliceous rocks of uncertain origin. A little thin-bedded argillite and limestone has been recognized. The porphyry is a purplish grey, mainly massive, rectangularly jointed rock that weathers buff to reddish brown. It contains white, pale green, or pale pink, altered feldspar phenocrysts, and less prominent amphibole phenocrysts, in a very fine-grained groundmass. The porphyry occurs within the stratified rocks, commonly as nearly concordant bands and masses. Much of it is devoid of structures indicative of volcanic origin and, although sharp contacts with the stratified rocks are rare, here and there appears to truncate the strata at small angles and to send stubby apophyses into them, or, in one instance, to enclose a few blocks of sedimentary rock. Thus, geologists responsible for the most recent detailed studies in the mine have suggested that the porphyry may be, at least in part, intrusive (Jolliffe and Bateman, 1944; Murphy, 1946, p. 428). On the other hand, local fragmental facies, banding, and, in one instance, pillows (Murphy, 1946, p. 428) suggest a volcanic origin.

Rocks of the upper division of the Echo Bay group outcrop southeast of Labine Bay and comprise porphyritic and amygdaloidal andesitic lavas and associated pyroclastic members.

Granodiorite intrudes the Echo Bay assemblage about 2 miles northeast of the mine.

Coarse-grained, pink granite intrudes rocks of the Echo Bay group. It outcrops on the lakeshore about 1,100 feet northwest of No. 1 shaft and presumably underlies a large area beneath Great Bear Lake west of the mine. Aplite dykes, presumably related to this intrusion, cut the granite and adjacent, older rocks.

Diabase dykes are the youngest rocks recognized and are of at least two ages: the early dykes are steep and locally amygdaloidal, whereas the late intrusions, of medium-grained quartz diabase, are gently inclined or horizontal and commonly exhibit columnar jointing.

The Echo Bay strata, in general, strike northeasterly, and dip southeasterly away from the granite. The most intense folding has occurred in the mine area, within about 1,000 feet of the granite. Here the members of the lower division of the Echo Bay group are involved in, from west to east, a syncline and an anticline, the axes of which trend about north-northeast. Many smaller folds are present, and dips range from nearly horizontal to vertical. Southeast of the mine area (that is, southeast of Labine Bay) members of the upper and lower divisions strike about northeast and dip southeasterly: the dips decrease progressively from about 50 degrees at the southeast shore of Labine Bay to about 20 degrees ½ mile farther southeast.

Numerous steeply inclined faults and fracture zones, many of which trend northeasterly, traverse the region. The faults displace the early diabase and older rocks, but the late diabase has suffered only slight fracturing and displacement. The fault zones range up to 40 feet or more in width and contain brecciated rock commonly partly cemented with quartz, hematite, and other vein matter.

The rocks are not schistose, nor have they undergone significant thermal metamorphism. The characteristic alteration, presumably hydrothermal, has resulted in a widespread reddening of the rocks. This alteration appears to have been most intense in the mine area, and has affected all rocks except the late diabase; the stratified rocks, nevertheless, seem to have been most susceptible, though the degree of alteration varies widely from place to place within the mine area. Where most effective, as near ore-bearing veins, it has converted all rocks to a hard, dense, massive, mainly reddish brown and pink, jasper-like material containing quartz, hematite, magnetite, white mica, chlorite, carbonate, and other minerals.

DESCRIPTION OF DEPOSITS[1]

The known orebodies at Eldorado mine occur in fault zones designated, from south to north, as Nos. 1, 2, 3, and 5 (*See* Figure 11). The zones strike between northeast and south 70 degrees east and, where explored, have an average strike of about north 65 degrees east. The dips, in most instances, vary from 60 degrees north to vertical. The width of the zones ranges from 2½ to about 40 feet. No. 1 zone is widest, and has been followed by workings and diamond drill-holes for more than 5,000 feet; it marks an apparent, left-hand horizontal displacement of 300 feet (Murphy, 1946, p. 429). The other fault zones have been explored for shorter distances and probably represent smaller displacements. The faults involve all members of the lower division of the Echo Bay group, and the granite, aplite, and early diabase; only very minor movement has occurred since the emplacement of the late diabase. Where exposed underground the fault zones lie mainly within the stratified rocks and porphyry of the Echo Bay group, and in many instances narrow where they enter the porphyry. They comprise sliced and brecciated rock and commonly contain one or more seams of gouge. Most gouge is developed in No. 1 zone, where the foot-wall is marked by a seam up to 3 feet wide, and smaller seams occur here and there throughout the broken rock. Narrower seams of gouge are found in various parts of other zones; in some instances they form the walls, but elsewhere the strongly fractured rock of a fault zone grades into relatively massive wall-rock.

All productive zones contain vein matter, but its amount and character vary widely from place to place. In many instances the fractured rock is cemented by a stock-work of veins; elsewhere several veins may lie about parallel with the walls and be separated by layers of rock, and, in rare instances, only one vein is encountered. The veins vary in thickness from less than 1 inch to 10 feet, and occur in the fault zones irrespective of the character of the wall-rocks. In places, as in No. 3 zone, the vein matter is less abundant than the fractured rock, whereas in other places, as in No. 1 zone, it may comprise 50 per cent or more of the fault zone. The principal vein-forming minerals are quartz, carbonates, hematite, chalcopyrite, nickel-cobalt minerals, pitchblende, bismuth, silver, argentite, galena, and pyrite. A more complete list[2], as identified by Kidd and Haycock

[1] Deposits explored from No. 2 shaft (flooded) and Cross Fault shaft were not examined, and are not described in this report.

[2] The minerals in this list are not named in order of abundance.

(1935), comprises: pitchblende, magnetite, hematite, pyrite, arsenopyrite, limonite, safflorite-rammelsbergite, smaltite-chloanthite, skutterudite, and nickel-skutterudite, glaucodot, cobaltite, gersdorffite, polydymite, löllingite, niccolite, native bismuth, molybdenite, sphalerite, galena, tetrahedrite, freibergite, bornite, chalcopyrite, chalmersite, chalcocite, covellite, stromeyerite, jalpaite, argentite, hessite, native silver, pyrolusite, psilomelane, polianite(?), quartz, dolomite, manganiferous carbonate, barite, and witherite(?). Surface and near-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. Murphy (1946, pp. 430-431), from field studies, has identified three or four stages of vein deposition within No. 1 zone: massive white quartz with a little chlorite and pyrite formed first; more abundant, banded and vuggy hematitic quartz, rose-red chert-like material, carbonate, and chalcopyrite followed; bands of pitchblende, silver, bismuth, and other minerals, including those of cobalt and nickel, constitute a third stage or one closely related to the hematitic quartz veins in which they occur; and small veins of quartz, carbonate, and chalcopyrite, which cut the late diabase, represent the youngest recognized stage. The veins in No. 5 zone resemble, on a smaller scale, those of No. 1 zone, but not all stages of deposition have been identified in the veins of No. 2 and No. 3 zones.

Ore shoots, as previously stated, have been found in Nos. 1, 2, 3, and 5 zones. The principal ore mineral is massive, rarely colliform pitchblende and this constitutes only a small percentage of the vein material. Most commonly it occurs as persistent veins a few inches wide, or as a network of veinlets and small isolated grains; solid masses up to several feet wide have been found. The orebodies range from 50 to 700 feet in length, and have been followed down the dip more than 600 feet (Murphy, 1946, p. 433). In many instances their width does not exceed 4 feet, but here and there they are 15 feet wide. The limits of the orebodies are generally well defined, and the vein matter in the intervening parts of the zones is essentially devoid of pitchblende. Those in the particularly strong No. 1 fault zone occur mainly on or near the foot-wall, apparently without regard to the nature of the wall-rocks. On the other hand, in No. 2 zone that traverses sediments, porphyry, and early diabase, most of the ore shoots occur in finely banded sediments. Other ore occurs where the zone follows the contact of the sediments and early diabase, and although some ore shoots in sediments persist a short distance into adjacent porphyry no ore is found entirely enclosed by this rock. No significant change in mineralization with depth has been noted, except that silver ore shoots do not occur more than a few hundred feet from the surface, and botryoidal pitchblende is less common at depth than at the surface.

Much of the rock within and near the mineralized fault zones, except the late diabase, has been altered to a dense, hard, red, jasper-like material containing quartz, finely disseminated hematite, and other minerals. The degree to which this alteration has been effective varies widely: where important amounts of vein matter are present it commonly forms an envelope, several feet thick, within which it has obliterated the original nature of the rock; and this envelope appears to be particularly thick in the vicinity of ore shoots. It is probably related to the second, hematitic quartz period of vein deposition (Murphy, 1946, p. 432). Chloritized rock characterizes other parts of the fault zones.

The pitchblende is younger than the early diabase but older than the late diabase.

The solutions from which the pitchblende was deposited are not known to be genetically related to any recognized intrusion.

UNDERGROUND OPERATIONS

Orebodies in No. 1 and No. 3 zones are mined mainly in cut-and-fill stopes. By this sytem, rock fill derived mainly from development work provides a base for planks onto which the ore is blasted; the broken ore is then removed, more rock fill added, and the planks re-laid to receive more ore. This method has been adopted to avoid excessive dilution, and for safety reasons. Ore shoots in No. 2 zone, on the other hand, are mined mainly by resuing: the ore, commonly $1\frac{1}{2}$ to 2 feet wide, is first broken and removed; and the stope is then widened to about 4 feet to provide the requisite rock fill.

Mucking machines are used for loading cars in development headings. Storage battery locomotives haul waste rock and ore in 20-cubic-foot cars operating on 18-inch gauge track laid with 16-pound rails. Ore and rock are hoisted in mine cars in two compartments of No. 1 shaft to the adit level, whence it is trammed to the mill or waste dump.

Most drifts and crosscuts, except those in No. 1 zone, require little timber support. Local round timber is used where supports are required.

Air for ventilation is provided by an axial flow blower. Air is downcast in the workings of Nos. 2 and 3 zones and upcast in the shaft and No. 1 zone. Downcast air is heated, when necessary, by steam coils served by an oil-fired, 60-horsepower boiler.

Centrifugal electric pumps discharge about 800 gallons of water a minute from the mine and consume a substantial proportion of the electric power generated. Most of the water enters the mine through No. 1 zone, but No. 2 zone provides a considerable flow. Grouting, as a means of stemming the inflow, has not been very successful due, in part, to the low rock temperatures.

Permafrost, in the vicinity of the mine, has been found as much as 345 feet below the surface. It was encountered in No. 2 zone on the 125-foot level and in parts of the 250-foot level, but at no place in the mine was it found on the 375-foot level. The following rock temperatures were obtained by the mine staff from drill-holes that penetrated 20 to 30 feet into the walls of the workings:

Depth below adit level	Rock temperature
Feet	Degrees Fahrenheit
70	27
250	30
375	34
500	35
650	37
800	38

Routine sampling of drifts and raises involves face, back, and muck samples. The U_3O_8 content of most samples is determined by electronic methods.

COSTS AND GENERAL OPERATING DATA

Most heavy freight between railhead at Waterways, Alberta, and Eldorado mine is carried by tugs and barges operated by Northern Transportation Company, Limited, a wholly owned subsidiary of Eldorado Mining and Refining (1944) Limited. General freight by this route costs $8\frac{1}{2}$ cents a pound, is handled about sixteen times, and must negotiate a portage between Fort Fitzgerald and Fort Smith on Slave River, and another on Great Bear River. This route is usable only when Great Bear Lake is free, or nearly free, of ice: navigation ceased on October 20, 1946, and commenced again about August 3, 1947.

The Aircraft Division of Eldorado Mining and Refining (1944) Limited operates two Norseman and two DC3 aircraft. A landing strip has been cleared at Sawmill Bay, on Great Bear Lake about 35 miles southwest of the mine, and daily round trips (except Sunday) are flown by the DC3 aircraft between Edmonton and Sawmill Bay. These aircraft transport all passengers, most provisions, and emergency supplies. Concentrates are sent to Edmonton by air in quantities sufficient to ensure full payloads on the aircraft; otherwise they are shipped by boat to Waterways. Norseman aircraft on skis or floats operate from the mine. In the summer of 1946 float-equipped aircraft operated until October 12; skis were first used on November 1, and, in 1947, the first float-equipped aircraft landed on June 21.

Employees are reimbursed for their incoming fare after working two hundred shifts, and for outgoing fare after completing three hundred shifts; and are granted 1 month's leave, without pay but with free transportation, each year. The staff includes a doctor and nurses, and a hospital has facilities for minor and, if necessary, major surgical operations. It has not been proved that workers suffer ill effects directly attributable to radioactivity; many employees, however, do not remain at the mine longer than about 1 year. Recreation facilities include a pool hall, two bowling alleys, library, camera club, and, in winter, curling rinks. No union has been recognized.

Heavy diesel oil costs 36·5 cents a gallon landed at the mine, and light diesel oil 45·8 cents a gallon. These oils are supplied by Imperial Oil Limited from their wells and refinery at Norman Wells on Mackenzie River, and are transported by barges except for an $8\frac{1}{2}$ mile pipeline across the portage on Great Bear River. Tanks, and oil barges kept at the mine during the winter, provide storage facilities for about 800,000 gallons.

Spruce timber is used for wood fuel, most lumber, and mine timbers. Most of it comes from Leith Peninsula on Great Bear Lake, as far as 50 miles southwest of the mine.

Ena Group (124)

Reference: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-I-7.

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 the Consolidated Mining and Smelting Company of

Canada, Limited, 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 by the writer on August 26, 1939. The claims were later abandoned, and re-staked, in part, as the Boland group.

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 $2\frac{1}{2}$ 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 northwest. 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 latter 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 contains much fine-grained quartz, and 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 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 nearly parallel the west wall of the dyke. The largest single quartz lens seen was 12 feet long and $1\frac{1}{2}$ 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.

E.P. Group (90)

Reference: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-I-14.

The E.P. claims are about 50 miles northeast of Yellowknife. The following description was supplied by J. F. Henderson, who visited the property in 1939.

[1], [2] Assayed by Bureau of Mines, Department of Mines and Resources, Ottawa.

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. DeStaffany 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 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. In it quartz stringers and lenses make up perhaps 30 per cent of the exposed rock. 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.

Etacho Point Coal Deposits (7)

Reference: Kidd, 1933, pp. 33-36.

Coal deposits at Etacho Point, about 90 miles west of Port Radium, were examined by Kidd in 1932, and the following is a summary of his report.

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 with the shore; they dip 25 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 is probably Cretaceous or Tertiary. The coal seams outcrop in the bluffs along the shore at intervals for 1½ miles. In most places several seams of coal are separated by a few feet of clay, sand, or silt. What may be a single seam is exposed in four places within a distance of about 7,000 feet, and the exposed width ranges from 12 to 17½ feet. Six channel samples were taken from coal seams along the shore and were cut across widths ranging from 2 to 13 feet. These were analysed in the Fuel Testing Laboratories, Mines Branch, Department of Mines, Ottawa, and the following table gives the average of these analyses:

—	Coal as received	Dried
Moisture, per cent	45·9	....
Ash, per cent	10·3	18·4
Volatile matter, per cent	21·8	40·5
Fixed carbon (by difference), per cent	22·0	41·0
Sulphur, per cent	0·3	0·5
Calories per gram gross	2,754	5,144
B.t.u. per lb. gross	4,953	9,262
Fuel ratio	1·05	

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.

Felix Gold Mines, Limited (30)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 86-B-6. Stanton, 1947, pp. 20-22.

Felix Gold Mines, Limited, has explored a property on the west side of Chalco Lake, about 132 miles north-northwest of Yellowknife. The property comprises the 4x4, D.K., Remo, and K groups, forty claims in all.

The following description by Stanton is based on an examination in 1946; the volcanic and sedimentary rocks referred to are members of the Yellowknife group.

A-Zone (Remo Nos. 6 and 12 Claims). A-zone lies 250 feet west of the central west shoreline of Chalco Lake, and consists of a heavily mineralized zone on either side of, and paralleling, a narrow diorite or diabase dyke or sill intrusive into greywackes, slates, and graphitic schist. The average trend of the mineralized area is north 30 degrees east. Where exposed, the rusty, mineralized zone varies from 5 to 35 feet in width. Small, grey quartz stringers are present throughout much of the zone, and locally the quartz widens to form irregular masses up to 10 feet in width. Local dragging, contortion, and shearing are indicated. The zone is heavily rusted, and contains pyrite, marcasite, and pyrrhotite. It is exposed by trenching at intervals along a strike length of about 1,400 feet.

B-Zone (Remo Nos. 12, 11, and 5 Claims). About 1,000 feet north of the northern workings on the A-zone is a trench exposing a zone of grey to white quartz lenses and stringers lying in slates and greywackes just east of the contact with rhyolitic lava, and occurring across a width of as much as 15 feet. The sedimentary rocks strike north 50 degrees east.

About 1,800 feet southwest of the above showing is a 70-foot-wide zone of sheared graphitic slate and graphite schist striking north 45 to 50 degrees east and dipping vertically to 85 degrees northwest. Rhyolitic lava lies both east and west of the graphite schist. A large amount of pyrite occurs as narrow seams throughout the graphite [schist], which is locally contorted and intensely sheared. The weathered surface is rusty from limonitic oxidation. Near the east side of the zone is a 3-foot-wide zone of stringers of grey to rusty glassy quartz with a little associated carbonate. The remainder of the trench exposes the mineralized graphite schist, with infrequent small quartz stringers. A narrow diorite dyke lies just west of the showing.

N-Vein (Remo No. 11 Claim). The N-vein lies 1,000 feet west of the northern workings described under the B-zone. It consists of a quartz vein lying in a 12-foot-wide bed of black graphitic slate and weathered schists interbedded with chloritized andesites. The vein is composed of black, glassy quartz containing a little pyrite and less chalcopyrite. White to buff carbonate is locally present. The vein has a maximum width of 7 feet, appears to pinch out at the south end, and narrows to the north. The zone trends from north 20 to 30 degrees east, and the vein dips about 75 degrees east. It is exposed by six trenches for a length of 200 feet.

G- and H-Zones (L.K. No. 11 and 4x4 No. 1 Claims). These zones are on the west side of a small lake lying 1,500 feet west of the northwest bay of Chalco Lake. They consist of zones of small quartz lenses lying in rusted greywacke between two small parallel diorite dykes or sills at and near the contact with a narrow belt of rhyolitic lava. Quartz is white, pinkish, and grey, glassy to sugary, and is mineralized with a little pyrite. The zone lies on strike with the B-zone farther south.

J-Zone (4x4 No. 2 ? Claim). The J-zone lies about 1,400 feet northeast of the G- and H-zones. It consists of a rusty mineralized zone between two parallel brownish weathering diorite dykes lying at and near the volcanic-sedimentary contact, and contains a few quartz stringers.

K-Zone (4x4 No. 2 Claim). The southernmost showing of the K-zone lies about 250 feet northeast of the J-zone, and may be due to a small fault displacement of the latter. The northernmost working lies 1,000 feet from the other along a strike of about north 40 degrees east. Between these two workings, the zone is exposed by several trenches and strippings. The mineralized section occurs along a diorite sill lying at the contact of a narrow band of andesitic volcanic breccia to the west and greywackes to the east. The sill has been chilled to a dense, fine-grained to glassy rock across a width of about 7 feet, and in places the mineralized part is in the outer edge of this chilled phase, near and at the contact with andesitic breccia. A rusty zone also occurs east of this sill and lies between two parallel diorite sills. Graphite schist occurs locally. The dominant mineral is pyrite, with possibly very minor chalcopyrite, and occurs across widths of as much as 15 feet. A little glassy white to brownish quartz is present locally as stringers.

Zones B, G, H, J, and K are all in line along the same strike, occur under similar geological conditions at and near the sedimentary-volcanic contact, and are associated with diorite sills. The total length covered by these zones along the strike is about 7,000 feet, and the several zones are not necessarily continuous. Mineralization is strong, but it is reported that gold values are very low.

François River Niccolite Deposit (128)

Reference: Henderson, 1939a, p. 15.

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.

Freda No. 1 Claim (102)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-I-11. Fortier, 1947a. Henderson and Jolliffe, 1941.

Freda No. 1 claim is about 31 miles east-northeast of Yellowknife and 2 miles north of the Thompson-Lundmark mine (103). The latter property maintains contact with Yellowknife by aircraft, by tractor trains in winter, and by radio and telephone. Most of the following data were supplied by Y. O. Fortier, from information gained in 1944.

The Freda No. 1 claim was staked by E. Sutherland of Yellowknife in September 1944, to cover a pegmatite dyke found that summer by the Geological Survey; this dyke became known as the Freda dyke. A little stripping and blasting was done in 1945. From September to the end of November 1946, L. F. Gauvreau supervised the erection of a small mill, the extraction of about 120 tons of pegmatite from the Freda dyke, and the recovery of cobbed ore and concentrates the combined tantalite content of which he estimated to be 500 pounds.[1] A sample of the concentrates supplied by Mr. Gauvreau and assayed by the Bureau of Mines, Ottawa, contained: tantalum pentoxide, 46·19 per cent; columbium pentoxide, 31·18 per cent; tin, 1·83 per cent; titanium dioxide, 0·57 per cent. So far as known, no significant work was undertaken during 1947.

The claim is underlain by nodular quartz-biotite schist derived from greywackes and other sedimentary rocks of the Yellowknife group. These strata, in general, strike about north and dip steeply. Younger, pink to to light grey, pegmatitic muscovite granite with a little tourmaline outcrops about $1\frac{3}{4}$ miles west-northwest and about $4\frac{1}{2}$ miles west-southwest of the claim. The Freda dyke is one of the many pegmatite bodies believed to be genetically related to these granite intrusions, and, like the granite, intrudes the schist.

The dyke is exposed for a length of 297 feet; the western 192 feet trends south 83 degrees east with an average horizontal width of 16 feet, whereas the eastern 101 feet trends south 48 degrees east and has an average width of 7 feet. The dip varies from 10 to 33 degrees south or southwest. The enclosing schist contains tourmaline within an inch or so of the pegmatite.

The dyke varies in mineral content and texture from place to place. The southeastern 36 feet contains albite (cleavelandite), quartz, microcline, muscovite, and a little amblygonite and tourmaline. Patches of fine-grained granitic or aplitic textured material occur in a medial zone and contain minute grains of cassiterite. A grab sample of this material contained[2]: tin dioxide, 0·02 per cent; tantalum pentoxide, none, and columbium pentoxide, none. A zone 2 to $2\frac{1}{2}$ inches wide, about 36 feet long, lying along the foot-wall (northeast wall) of the dyke contains cassiterite ranging from minute particles to grains as large as $\frac{3}{8}$ inch in diameter. A grab sample from this zone contained[2]: tin dioxide, 0·63 per cent; and no tantalum or columbium pentoxide.

From 36 to 56 feet from its southeast end, the dyke is coarser grained, contains abundant cleavelandite, and muscovite in books and fine-grained patches up to 5 by 12 inches. A few patches of aplitic material were noted. Cassiterite occurs as grains that average $\frac{1}{3}$ inch in diameter, the largest being $1\frac{1}{2}$ inches long. More than three dozen such grains were noted, mainly in the lower (northeast) half of the dyke.

Thence, to a point about 140 feet from the west end of the dyke, the rock is a mixture of coarse pegmatite and aplitic material, the latter comprising 25 to 30 per cent of the exposed area of the dyke. A little cassiterite was seen, and a grab sample of rock taken over a length of 60 feet contained[3] a very little tin and no tantalum or columbium.

[1] Gauvreau, L. F.: personal communication, Ottawa, February 19, 1948.
[2] Analysis by Bureau of Mines, Ottawa.
[3] Assay by Bureau of Mines, Ottawa.

The western 140 feet of the dyke is mainly coarser grained pegmatite. Microcline and quartz are the most abundant constituents, one crystal of the former measuring 4 by 1½ feet. Cleavelandite and muscovite are present; amblygonite, as grains up to 6 inches by 1 inch, locally comprises 5 per cent of the rock; six crystals of beryl up to 6 inches in diameter were noted; spodumene is rare. Both tantalite and cassiterite were observed. Most tantalite is in pink microcline, but some is in cleavelandite, quartz, muscovite, or beryl. It is abundant within an area measuring 4 by 4 feet: here a patch 9 by 5 inches is more than 60 per cent tantalite; another patch 10 by 3 inches is more than 50 per cent tantalite; and many scattered grains up to 1¼ inches by ¾ inch were noted.

Galena Point Lead Deposits (5)

References: O'Neill, 1924, p. 47. Stockwell and Kidd, 1932, p. 78.

Lead deposits on Galena Point, 10 miles southeast of Cape Barrow on the Arctic coast, have been described by O'Neill as follows.

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.

A galena deposit of unknown extent was found at Detention Harbour, a few miles west of Galena Point, in 1931. Claims were staked for the Pederson Whaling Company (Stockwell and Kidd, 1932, p. 78). This, or a nearby deposit, is reported to have been re-staked for Gateway Gold Mines, Limited, in 1949, and to be larger than the deposits described by O'Neill.

Ghost Lake Cordierite Deposits (52)

References: Folinsbee, 1940. Lord, 1942a, p. 53. Yardley, 1949a.

Cordierite, some of which may be of gem quality, was found in 1939 by the Geological Survey 7 miles south of Ghost Lake on the 115th meridian. It superficially resembles fractured, transparent to translucent, blue quartz, but fragments of crystals, when held up to the light and rotated, vary in colour from intense blue to dull yellow. The mineral is the variety of cordierite (or iolite) known as dichroite. The rock near the occurrence is contorted and banded gneiss, porphyritic biotite granite, and fine-grained, equigranular granite. The gneiss is intruded by numerous seams and lenses of granitic and pegmatitic material and grades into the granitic rocks. The outlines of the body of gneiss are not known. In a few places it contains abundant amphibole or chlorite and displays a few recognizable pillows, indicating that it is derived from volcanic rocks; in other places it is well banded and probably has been derived from sedimentary rocks; elsewhere its origin is unknown.

The gneiss is composed of quartz, biotite, sillimanite, reddish almandite garnet, cordierite, microcline, andesine, tourmaline, spinel, and fine-grained graphite, in widely varying proportions. Garnets are common, and vary in abundance from band to band. They occur as crystals, and as aggregates of garnet and quartz that range up to about 4 inches in diameter. Pegmatitic stringers and lenses in the gneiss contain quartz, feldspar, biotite, garnet, cordierite, graphite, and other minerals. Cordierite is abundant in places, but less so than garnet. It occurs as irregular masses and as prismatic crystals. The largest observed crystals are about 4 inches long and 2 inches in diameter. Much of it is thoroughly fractured, but a few fragments collected were sufficiently free of fractures to be cut into small gem-stones. Some of it is partly altered to a micaceous mineral, probably pinite.

So far as known, dichroite is most plentiful at the above locality, but it and fine-grained graphite occur in similar deposits at several places between this deposit and Ranji Lake, and also about 3 miles northwest of the west end of Ghost Lake.

Giant Yellowknife Gold Mines, Limited (76)

(*See* Figures 12 and 13)

References: Bateman, 1949b. Bureau of Mines, 1945a, 1946a, 1946b. Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheets 85-J-8 and 85-J-9. Campbell, 1948. Dadson, 1949. Dadson and Bateman, 1948. Jolliffe, 1938, pp. 29-32; 1942a; 1946. Lord, 1941a, pp. 99-102.

INTRODUCTION

Giant Yellowknife Gold Mines, Limited, controlled and managed by Frobisher Limited, owns the Giant mine, Northwest Territories' most recent and perhaps most widely known gold mine; and the spectacular results of a diamond drilling program at the property in 1944 and 1945 were in a large measure responsible for the ensuing widespread and greatly intensified interest in gold mining in Northwest Territories. The mine is on the west side of the north end of Yellowknife Bay, about $1\frac{1}{2}$ miles north of Yellowknife. Docks on Yellowknife Bay, near the south end of the property, afford facilites for boats and barges from Norman Wells and Fort Smith; and about $3\frac{1}{2}$ miles of gravelled road, and a telephone line, connect the mine with Yellowknife. The property comprises twenty-five claims and fractions as follows: Giant Nos. 1 to 20 claims, Giant No. 21 fraction, Giant-X fraction, and Giant-X Nos. 1, 3, and 5 claims. It is bordered on the north by the property of Akaitcho Yellowknife Gold Mines, Limited (71). The mine was visited by the writer in September 1939, October 1947, and September 1948; and except where otherwise stated the following account is applicable at about the last-mentioned date. The staff includes A. K. Muir, general manager since 1943; A. W. T. Freakes, superintendent; J. D. Bateman, resident geologist; and K. C. Grogan, mill superintendent. E. V. Neelands is consulting engineer, and A. S. Dadson consulting geologist. The author has made free use of information supplied by the mine staff, and of data contained in the exceptionally complete Annual, Summary, and Interim reports issued by the company.

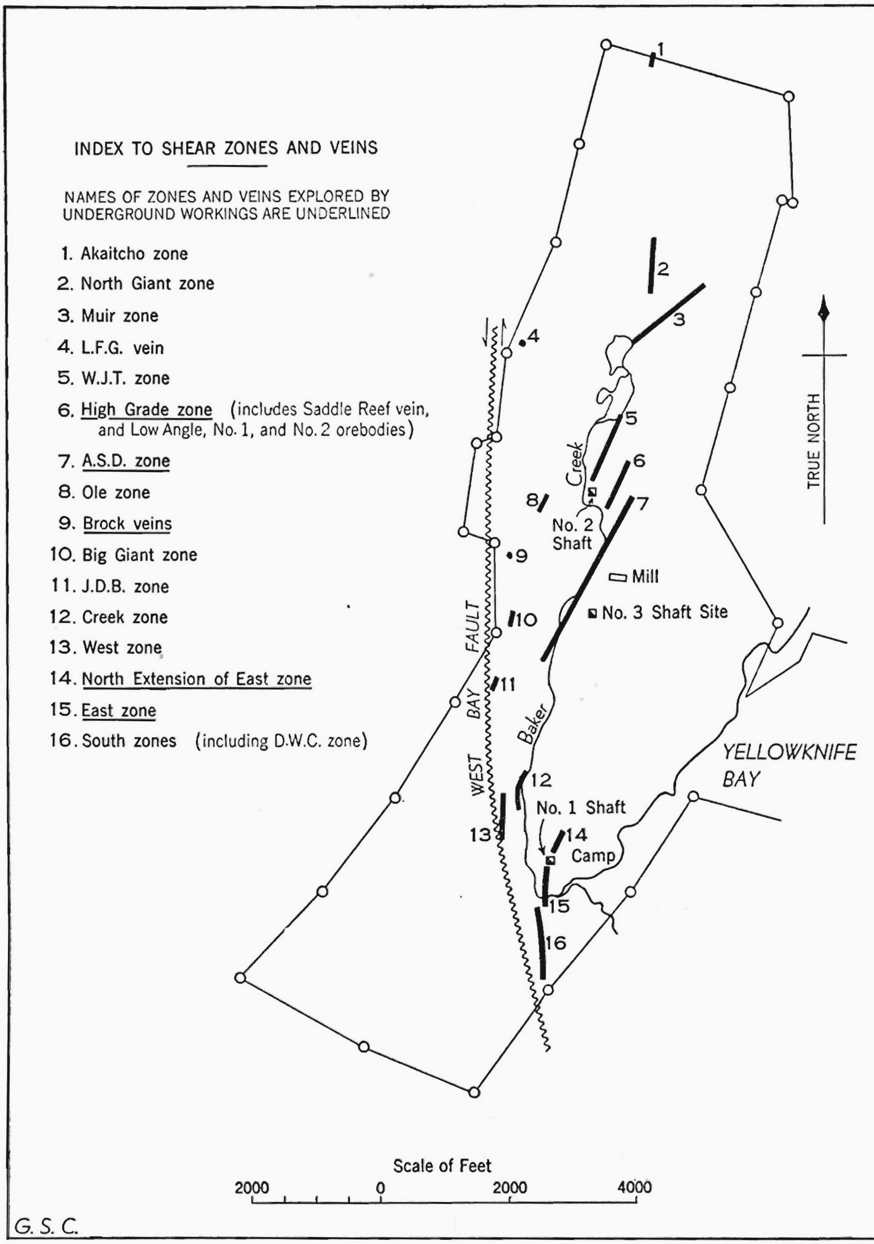

Figure 12. Property of Giant Yellowknife Gold Mines, Limited, showing location of principal known gold-bearing shear zones and veins.

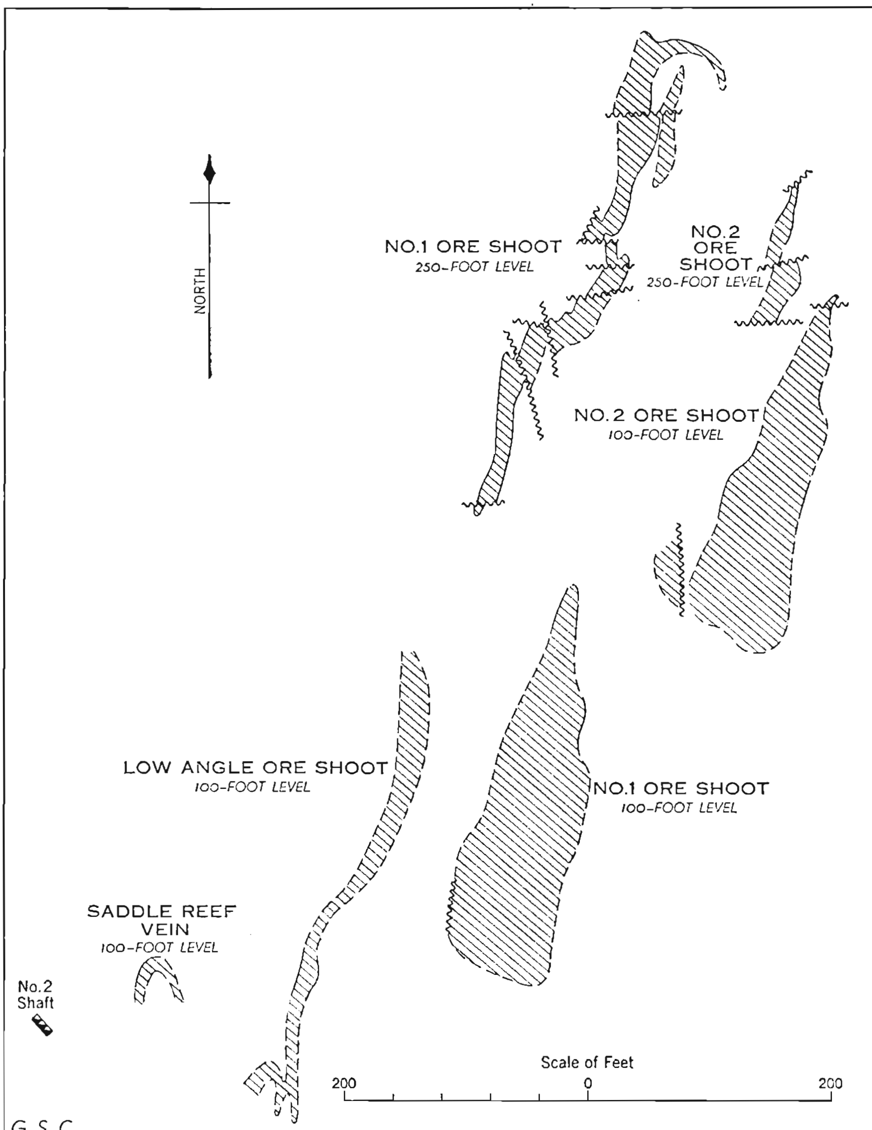

Figure 13. Plan of orebodies, High Grade zone, Giant Yellowknife Gold Mines, Limited.

HISTORY

The property was staked by C. J. Baker and H. M. Muir for Burwash Yellowknife Mines, Limited, in July 1935, and subsequently acquired by Giant Yellowknife Gold Mines, Limited, incorporated in 1937. Some work was done on the claims by several companies, including the Consolidated Mining and Smelting Company of Canada, Limited, and Anglo-Huronian, Limited, during parts of 1936, 1937, and 1938. Exploration was carried on continuously by Giant Yellowknife Gold Mines, Limited, from April 1, 1939, to June 15, 1940, under the management of D. A. G. Smith. In July 1938, D. W. Cameron discovered an outcrop of a gold-bearing shear zone (now known as the D.W.C. zone) near the southeast boundary of the property; and his re-examination of this deposit in 1941 led Frobisher Exploration Company, Limited (now Frobisher Limited), to acquire operating control of the Giant company in June 1943. A geological examination by A. S. Dadson in the summer of 1943 led to the concept that the drift-filled Baker Creek Valley, an area neglected by previous exploration, was underlain by a major system of gold-bearing shear zones. Diamond drilling, based on this hypothesis, commenced in January 1944, and when discontinued, 2 years later, had indicated the largest tonnage of gold ore known in Northwest Territories. No. 1 shaft was started on September 24, 1945, and completed the following January. Development work from this shaft was discontinued in September 1946. No. 2 shaft was started on April 15, 1946, and lateral development commenced there a few months later. By November, equipment for a 500-ton mill had been ordered, and construction of the Snare River hydro-electric power plant, started by the company, had been taken over by the Department of Mines and Resources. During the summer of 1947 excavations were completed for the crushing, milling, and roasting plants, and No. 3 shaft was collared near the crushing plant; and before the end of the year all major plant items were at the property. Plant construction was carried on throughout the winter. No. 2 shaft was deepened to 780 feet by February 1948. Milling commenced on May 12, 1948, but much of the gold remained in flotation concentrates that were stored pending completion of the roaster early in 1949. The first gold brick was produced on June 3, 1948, and the inaugural brick-pouring ceremony, attended by several hundred guests, including the Minister of the Department of Mines and Resources and other officials of the Dominion Government, was held on August 24. The 90-mile transmission line connecting the mine with the Snare River hydro-electric plant was completed by Giant Yellowknife Gold Mines, Limited, on behalf of the Department of Mines and Resources, by July 31, 1948, and electric power became available from Snare River on October 4, 1948.

PRODUCTION

The following hand-sorted ore from the Brock veins was shipped to Trail, British Columbia, for treatment: in 1939, 74 tons containing 647 ounces of gold and 45 ounces of silver; in 1940, 46·6 tons containing 261 ounces of gold and 38 ounces of silver. The net return from these shipments was about $26,000. Metals were not produced again until 1948 when, from May 12 to December 31, 8,152 ounces of gold, 2,000 ounces of silver, and 5,167 tons of concentrates (estimated to contain 33,509 ounces of gold) were recovered from 49,985 tons of ore, mainly from the High Grade zone.

ORE RESERVES

The following ore reserves were calculated from surface diamond drilling to January 1946[1].

Location	Tons (including 20 per cent dilution)	Gold		Maximum depth to which estimate made
		Uncut[1]	Cut[1]	
		Ounces	Ounces	Feet
No. 1 Shaft area—				
East zone	315,000	0·41	0·35	350
North Extension of East zone	45,000	0·45	0·39	300
South zones—				
Unnamed zone	105,000	0·30	0·27	300
D.W.C. zone	15,000	0·40	0·37	100
West zone	445,000	0·30	0·23	250
Creek zone	180,000	0·19	0·19	500
South A.S.D. zone	690,000	0·28	0·25	550
No. 2 Shaft area—				
High Grade zone	720,000	0·67	0·46	535
North A.S.D. zone	520,000	0·44	0·38	770
Total	3,035,000			
Averages		0·41	0·33	

[1] *See* Underground Operations, p. 169, for definitions of these terms.

Estimates of ore above the 250-foot level, based on underground development to May 31, 1948, were as follows[2]:

Location	Tons (including 20 per cent dilution)	Gold
		Ounces
High Grade zone—		
No. 1 and No. 2 ore shoots	400,000	0·64
Saddle Reef vein	5,000	0·60
Low-angle ore shoot	55,000	0·41
A.S.D. zone	60,000	0·47
Total	520,000	
Average		0·60

[1] Giant Yellowknife Gold Mines, Limited: Annual Report for Year Ending June 30, 1947, p. 4.
[2] Giant Yellowknife Gold Mines, Limited: Annual Report for Year Ending May 31, 1948, p. 4.

Ore dumps contained the following ore when milling started on May 12, 1948:

Location	Tons	Gold	
		Uncut	Cut
		Ounces	Ounces
No. 1 shaft	4,500	0·48	0·44
No. 2 shaft	16,880	0·88	0·69
Total	21,380	....	....

CAMP AND PLANT

The main camp, near No. 1 shaft, is on the west shore of Yellowknife Bay on Giant Nos. 15 and 17 claims; it includes offices, staff house, several residences and apartments, several bunk-houses, including a two-story structure accommodating one hundred and twenty men, commissary, cook-house, curling rink, and various warehouses, shops, and garages. Most buildings are sheathed with asbestoside. Steam for heating is supplied from a 150-horsepower oil-fired boiler. The docks are in the camp area.

No. 1 shaft, on Giant No. 15 claim, is equipped with a 55-foot temporary headframe and a two-drum, Canadian Ingersoll-Rand electric hoist. The power plant included (October 1947) two electrically driven compressors supplying about 700 cubic feet of air a minute, and two 400-horsepower Dominion diesel engines driving English Electric generators with a combined output of 764 KVA at 2,400 volts. The main oil storage tanks are near No. 1 shaft.

No. 2 shaft, 5,700 feet north of No. 1, is on Giant No. 10 claim and equipped with a 55-foot temporary headframe and a two-drum Canadian Ingersoll-Rand 200-horsepower electric hoist. Two Canadian Ingersoll-Rand compressors, type XVH, are driven by English Electric synchronous motors and provide a combined capacity of 1,500 cubic feet of air a minute (October 1947). Oil storage tanks are nearby.

No. 3 shaft site is on Giant No. 12 claim, about 1,800 feet south of No. 2 shaft. The crushing plant, mill, roaster plant with 150-foot stack, and related structures occupy an area that extends about 1,400 feet northeast from the shaft site.

The Yellowknife substation of the Northwest Territories Power Commission is on Giant No. 12 claim, about 1,000 feet west of the mill. Electric power from the Snare River hydro-electric plant reaches the substation at 110,000 volts and is used in the various plants at 2,200 and 550 volts. The 33,000 volt transmission line of the Consolidated Mining and Smelting Company of Canada, Limited, from Prosperous Lake to the Con mine, crosses the property.

DEVELOPMENT

To December 31, 1948, development work included more than 148,000 feet of diamond drilling, and 10,114 feet of drifts and crosscuts, as detailed below.

The following table[1] summarized work done from July 1935 to August 31, 1939, mainly west of Baker Creek Valley.

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

A little trenching and diamond drilling were done between September 1, 1939, and June 15, 1940, but no significant work was done between the latter date and December 31, 1943.

Work done between January 1, 1944, and December 31, 1948, is tabulated below. Most of this work was done along the southerly trending Baker Creek Valley; it partly explored an area about 11,900 feet long from south to north, but left unexplored about 2,400 feet of property lying between this area and the north boundary of the property.

	Feet
Shafts..	1,301
Drifts and crosscuts..................................	9,902
Raises..	1,382
Diamond drilling, surface (199 holes to a maximum depth of about 770 feet)......................................	83,920
Diamond drilling, mainly or entirely underground...........	54,551

No. 1 vertical shaft has three compartments; it is 522 feet deep, with stations at depths of 200, 325, and 450 feet. Work done from this opening includes 2,656 feet of drifts and crosscuts, 37 feet of raises, and 9,847 feet of underground diamond drill-holes. Drifts extend north-northeast and south-southwest from the shaft on the 200-foot level, and south-southwest on the 325-foot level; no drifting has been done at the 450-foot level.

No. 2 vertical shaft, also a three-compartment opening, is 779 feet deep, with stations at depths of about 100, 250, 425, and 575 feet. Work done from this shaft includes 7,246 feet of drifts and crosscuts, 1,345 feet of raises, and many thousand feet of underground diamond drill-holes. The drifts and crosscuts explore an area extending about 1,000 feet northeast from the shaft, and most are on the 100-, 250-, and 425-foot levels.

No. 3 shaft has been sunk only a few feet, and collared. It is intended to be a five-compartment, main production shaft. Its location, adjacent to the main crushing plant, required early collaring to avoid damage to the plant.

[1] Data supplied by C. L. Hershman, formerly consulting engineer, Giant Yellowknife Gold Mines, Limited.

The Brock shaft, about 1,500 feet northwest of No. 3 shaft site, is about 126 feet long, and is inclined about 33 degrees west. A drift, at a vertical depth of about 55 feet below the collar, extends about 190 feet north from the shaft.

The Ole inclined shaft, about 1,800 feet north-northwest of No. 3 shaft site, is reported to be about 70 feet long; a little crosscutting is said to have been done from it.

GEOLOGY

The property lies within the Yellowknife greenstone belt, a band of mainly volcanic rocks $1\frac{1}{2}$ miles or more in width, that extends northerly along the west side of Yellowknife Bay and Yellowknife River; other properties occupying parts of the greenstone belt include Negus (80), Con and Rycon (73), Akaitcho (71), and Crestaurum (74). The rocks underlying the Giant property are mainly lava flows of the Yellowknife group. These are green, basaltic, andesitic, and dacitic, massive, pillowed or variolitic flows interlayered here and there with a little tuff. The flows strike about northeast; they face southeast and are commonly nearly vertical or inclined steeply northwest.

The volcanic flows are cut by numerous meta-gabbro and meta-diorite sills, dykes, and irregularly branching bodies. These are fine- to medium-grained, dark to light green weathering, rarely porphyritic rocks with sharp, chilled borders. The dykes range up to about 100 feet in width and commonly strike about northwest; one large sill-like body is about 500 feet wide.

Fresh, rusty brown weathering diabase dykes composed of about equal parts of plagioclase and pyroxene are the youngest rocks recognized. Most of these strike about northwest. They range in width up to about 100 feet.

Faults and shear zones are numerous. Two types of faults have been recognized: (1) early, pre-diabase faults and (2) late, post-diabase faults. The pre-diabase faults are marked by chlorite schist shear zones many feet in width; they strike between northeast and northwest, and thus commonly transect and displace the lava flows. The principal known gold-bearing orebodies occur in pre-diabase shear zones that may be related to these faults, and the ore was formed before the emplacement of the diabase dykes and the formation of the post-diabase faults.

The late, post-diabase, post-ore faults are clean-cut narrow fissures marked by a few feet, or less, of brecciated rock or gouge, or both. They strike in various directions and many are nearly vertical. The largest is the nearly vertical West Bay fault that strikes north 12 degrees west across the southern part of the property before bending abruptly to strike about north along and just west of the western boundary of the claims. Campbell (1948, p. 256) calculated that the west side moved 16,140 feet south and 1,570 feet down relative to the east side.

DESCRIPTION OF DEPOSITS

The Giant system of shear zones comprises various member shear zones within which occur the principal known orebodies. This system has been traced, by diamond drilling, about 12,000 feet north-northeast from the West Bay fault. Its southwesterly counterpart, on the west side of the fault, is under development about 3½ miles south, at the Con-Rycon and Negus mines, where it is known as the Campbell system. The principal member shear zones of the Giant system are, from south to north: South zones, East zone, North Extension of East zone, West zone, Creek zone, A.S.D. zone, High Grade zone, W.J.T. zone, Ole zone, Muir zone, and North Giant zone (*See* Figure 12). Several of these zones form small outcrops; but others, such as East zone, North Extension of East zone, West zone, A.S.D. zone, and High Grade zone do not outcrop, nor is any known orebody of the Giant system exposed at the surface. The zones have been explored mainly by diamond drilling, although a relatively small amount of underground work has been done from No. 1 and No. 2 shafts. In many instances the diamond drill intersections have proved difficult to interpret and correlate; the data are thus susceptible to more than one explanation, and much more underground work must be done before the precise form and structure of the shear zones are known. They have been explored by drilling to a maximum depth of about 770 feet, and the length of the longest known zone, the A.S.D., may exceed 3,800 feet. The maximum width of the zones may exceed 150 feet. Their strike varies from about north at the south end of the Giant system to north 60 degrees east near the north end of the explored length of the system. So far as known, the strike of the shear zones diverges about 10 degrees from that of the enclosing lava flows, except that at the Muir zone the divergence may be as much as 30 degrees. Dips vary widely from zone to zone and within individual zones; perhaps the most common dips are between steeply east and gently west or northwest, but parts of some zones appear to be nearly horizontal or involved in drag-folds. The inclination of the enclosing lava flows is, so far as known, consistently steep, and the shear zones, therefore, probably transect them in dip as well as in strike. The rock within the shear zones is chlorite schist, sericite-chlorite schist, or sericite schist, the latter types generally being confined to the vicinity of orebodies. In most instances the planes of schistosity are inclined between 60 and 80 degrees west or northwest regardless of the apparent inclination of the shear zones, and thus commonly cross the zones at wide angles. Numerous, small drag-folds occur in the schist. The chlorite schist is impregnated with fine-grained calcite and other carbonates and cut by irregular veinlets of white quartz and calcite, but generally does not contain significant amounts of gold; and it may either grade abruptly into the unsheared enclosing lava flows or be separated from them by a wide transition zone. The schists commonly contain white or tan, $\frac{1}{16}$ to $\frac{1}{8}$-inch specks of an unidentified mineral, forming what is known locally as 'snowflake alteration'. Much deeper exploration will be required to determine the dip of the Giant system of shear zones; and it is not yet clear whether the various member shear zones represent: (1) faulted segments of one or more major shear zones; (2) individual but related zones; (3) remnants of one or more fold-like shear zones truncated and thus separated by the erosion surface; (4) branches, separated by unsheared rock masses, of a regional shear zone system; or (5) whether some other explanation applies.

Orebodies are irregular or lenticular parts of the shear zones, and are composed of 30 to 90 per cent fine-grained quartz, sericite schist, and about 7 per cent metallic minerals. The quartz occurs as seams and lenses commonly about parallel with the foliation of the enclosing schist. The most abundant metallic minerals are pyrite and fine-grained arsenopyrite;

others include stibnite and probably other soft grey minerals, pale yellow sphalerite, chalcopyrite, galena, and visible gold. Ore has been encountered in diamond drill-holes to a depth of about 770 feet, and in underground workings to a depth of 425 feet. The orebodies range in width from about $3\frac{1}{2}$ to perhaps 50 feet. An ore shoot in the East zone and North Extension of the East zone is at least 1,200 feet long on the 200-foot level, but its vertical range may not average much more than 200 feet. The greatest drift-length of ore in the High Grade zone is on the 250-foot level where No. 1 ore shoot, which pitches gently north, is 476 feet long. The grade of ore developed to May 31, 1948 (mainly in the High Grade zone), after allowing for 20 per cent dilution by barren rock, was 0·60 ounce gold a ton[1]. The orebodies are enclosed in an envelope of sericite and chlorite-sericite schist, except that those in the East zone and North Extension of the East zone are enclosed in chlorite schist. The composition of the shear zones changes gradually along the strike, from sericite schist near the ore, through chlorite-sericite schist, to chlorite schist; but the corresponding change is abrupt across the strike, taking place within a few feet or inches. Bodies of ore, or sub-ore, may occupy 10 to 90 per cent of the width of a shear zone. The boundaries of the ore or sub-ore against barren schist are commonly abrupt and can be determined visually; but where sub-ore intervenes between ore and barren schist, sampling and assaying is required to define the ore boundaries. The boundaries of the orebodies may approximately parallel the boundaries of the enclosing shear zones, and in many instances have been observed to cross the schistosity at wide angles. In places in the East zone the ore crosses the schistosity and is involved in structures resembling drag-folds; and the attitude of the schistosity within the ore conforms to that without and is approximately parallel with the axes of the drag-folds. It is not known whether the borders of the enclosing shear zone show a similar fold-like form.

Two stages of gold deposition have been recognized (Dadson and Bateman, 1948, p. 274). Gold of the first stage is very fine, and is intimately associated with arsenopyrite; whereas that of the second stage is accompanied by soft grey minerals and sphalerite, may be visible, and is associated with quartz that cuts the arsenical ore.

The ore-bearing shear zones are offset by a multitude of minor, post-ore faults, which are apparently more numerous within the zones than beyond. Most of them are steeply inclined, and some mark right-hand, others left-hand, displacements. They contain narrow seams of gouge and breccia, and veinlets of vuggy quartz and calcite without significant amounts of gold.

A more detailed description of some of the shear zones and orebodies follows.

South Zones. These include the D.W.C. zone, and lie 700 to 1,850 feet south of No. 1 shaft and about 150 to 400 feet east of the West Bay fault. They comprise two or more ore-bearing shear zones that strike about north and dip west. Drill-holes indicate two orebodies, the largest of which is about 300 feet long.

[1] Giant Yellowknife Gold Mines, Limited: Annual Report for Year Ending May 31, 1948, p. 4.

East Zone, and North Extension of East Zone. These zones lie beneath a massive rock ridge and have been explored from No. 1 shaft, the East zone by drifts on the 200- and 325-foot levels, its North Extension by a drift on the 200-foot level. The zones are separated, near the shaft, by a post-ore diabase dyke 40 feet wide, but are otherwise continuous except for offsets due to minor faults. The zones strike about north 20 degrees east, whereas the adjacent lava flows strike about north 30 degrees east. The dip of the zones apparently varies from steeply west to nearly horizontal. The schistosity, however, dips between 70 and 80 degrees west and strikes about north 20 degrees east. Although the ore is locally nearly horizontal, most of it dips about 60 degrees west. Drifting on the 200-foot level of the East zone encountered 725 feet of ore with an average horizontal width of 32·5 feet and an average grade of 0·55 ounce gold (uncut) or 0·50 ounce (cut). The bottom of this shoot is near the 325-foot level where work disclosed three short lengths of ore, the best being 115 feet long with an average horizontal width of 20 feet and an average grade of 0·36 ounce gold (uncut) or 0·34 ounce (cut). In the North Extension of the East zone the drift on the 200-foot level encountered 440 feet of ore with an average horizontal width of 3·5 feet and an average grade of 0·75 ounce gold (uncut) or 0·63 ounce (cut). This orebody is broken by numerous minor faults. Faults appear to be more numerous within the shear zones than within the adjacent wall-rock, and most numerous within the ore. About 5½ tons of ore from these zones was analysed by the Bureau of Mines (1946b, p. 2) with the following results: gold, 0·42 ounce a ton; silver 0·085 ounce a ton; iron, 7·64 per cent; arsenic, 1·56 per cent; and sulphur, 3·64 per cent. Another sample (Bureau of Mines, 1946a, p. 2) contained, in addition to the above elements, a little copper and zinc, but no antimony, and the following metallic minerals were noted: abundant pyrite and arsenopyrite, minor chalcopyrite, sphalerite, tetrahedrite-tennantite, and gold. The ore in these zones, relative to that of the High Grade zone, contains less quartz, much less abundant (generally none) soft grey metallic minerals, and has sharper walls against the enclosing schist; and it otherwise differs by being enclosed in chlorite schist rather than in chlorite-sericite schist.

West Zone. This zone does not outcrop. It lies about 1,100 feet northwest of No. 1 shaft and not more than a few hundred feet east of the West Bay fault. Diamond drill-hole intersections have proved difficult to correlate; but the zone strikes about north and in most places probably dips west at angles ranging from gentle to steep. Ore-grade material has been intersected in drill-holes along a strike length of about 600 feet.

Creek Zone. This zone underlies Baker Creek a few hundred feet east of the West zone, and outcrops about 1,500 feet north of No. 1 shaft. It strikes about north 15 degrees east and dips about 75 degrees west to an explored depth of about 500 feet. The zone may have been traced for 1,000 feet. Its maximum width exceeds 100 feet. So far as known, it contains only low-grade gold-bearing material.

A.S.D. Zone. This zone strikes about north 25 degrees east, dips steeply southeast to steeply northwest, and has a known length of about 3,800 feet. It does not outcrop, but its northern part, near the surface, is about 700 feet east of No. 2 shaft. It has been explored by numerous diamond drill-holes; and by about 200 feet of drifts from the No. 2 shaft on the 250-foot level, and about 600 feet on the 425-foot level. Diamond drilling indicates a maximum width of about 150 feet, and an average width of about 60 feet. In the southern part, the shear zone and ore have been intersected to a maximum depth of 590 feet; in the central part, ore-grade material has been found at a maximum depth of 450 feet and the shear zone at 470 feet; and in the northern part, the deepest intersection, at a depth of about 770 feet, afforded 55·5 feet of core containing 0·57 ounce gold a ton. The largest orebody has been indicated by diamond drilling: it is in the south part of the zone, is 1,450 long, averages about 17 feet in width, and to a depth of 550 feet is reported to contain 690,000 tons grading 0·28 ounce gold a ton.

High Grade Zone. This zone includes the Saddle Reef vein, Low Angle ore shoot, No. 1 ore shoot, and No. 2 ore shoot (*See* Figure 13). It has been explored by diamond drilling to a depth of more than 500 feet, and from No. 2 shaft by workings on the 100- and 250-foot levels. The workings explore an area about 300 feet wide that extends about 1,000 feet northeast from the shaft; and although they have developed substantial orebodies, do not precisely define the form and attitude of the enclosing wide shear zone. Near the shaft, the shear zone probably has the form of a north-plunging open syncline, possibly accompanied by an adjacent north-plunging anticline; 350 feet northeast of the shaft the shear zone dips about 10 degrees northwest and is 70 to 90 feet thick; and 700 feet north-east of the shaft (Dadson and Bateman, 1948, p. 277) diamond drill data suggest that it dips about 20 degrees northwest. In spite of the apparent gentle dip of the zone as a whole the foliation of the sericite, chlorite-sericite, and chlorite schist within the zone in most instances dips about 65 degrees northwesterly. The enclosing rocks are lava flows and minor thin-bedded tuffs; and so far as known these strike about north-northeast and dip about 80 degrees west-northwest.

The principal orebodies are characterized by abundant quartz, visible gold of the second stage of mineralization accompanied by soft grey metallic minerals and pale yellow sphalerite, and an envelope of sericite and chlorite-sericite schist that separates them from the surrouding chlorite schist. The ore may conform approximately to the outline of the shear zone, and thus lie across the schistosity. Ore has been encountered on the 100-foot level in the Saddle Reef vein about 100 feet northeast of the shaft, and thence in turn, towards the northeast, in the Low Angle ore shoot, No. 1 ore shoot, and No. 2 ore shoot; the latter three bodies, in plan, lie *en échelon,* each striking about north-northeast.

The Saddle Reef is a quartz vein opened only on the 100-foot level. It has the form of a north-plunging anticline overturned towards the east so that both limbs dip west. The vein is 7 feet or more in thickness and contains a moderate tonnage of high-grade, free-milling gold ore.

The Low Angle ore shoot has been explored only on the 100-foot level, there by a crosscut and several diamond drill-holes. It strikes about north 20 degrees east and has been traced 260 feet or more. Three hundred and fifty feet northeast of the shaft it is about 15 feet thick and dips 10 degrees west-northwest. At most other places nearer the shaft it dips between 15 and 30 degrees west-northwest.

No. 1 ore shoot may be separated from the Low Angle orebody by a band of steeply inclined, thin-bedded, sericitized tuffs. On the 100-foot level, No. 1 ore shoot strikes north 10 degrees east and is about 320 feet long; and its horizontal width ranges from 15 to 90 feet. The upper limit of the ore has not been defined. The orebody dips 20 to 50 degrees west. Its lower edge plunges about 20 degrees north from the 100-foot level, and reappears on the 250-foot level, whence a drift extends north 25 degrees east and exposes ore for a length of 476 feet (May 31, 1948). The horizontal width of the ore on this level ranges up to 20 feet or more. A drift length of 220 feet of ore on the 100-foot level contained 0·83 ounce gold a ton (uncut) or 0·52 ounce (cut). The 476 feet of ore encountered in the drift on the 250-foot level averaged 1·12 ounces gold a ton (uncut) or 0·78 ounce (cut).

No. 2 ore shoot strikes north 20 degrees east on the 100-foot level, where it is about 300 feet long. Its horizontal width on that level varies from 10 feet to more than 100 feet. The upper limit of the orebody has not been outlined. The dip of the ore between the 100- and 250-foot levels about 850 feet northeast of the shaft is steeply west. The lower edge of the ore plunges about 30 degrees north from the 100-foot level, and reappears on the 250-foot level, whence ore is exposed for about 120 feet by a drift that extends north-northeast. The horizontal width of the ore on this lower level ranges (September 4, 1948) from 3 to 25 feet. A drift length of 270 feet of ore on the 100-foot level averaged 1·34 ounces gold a ton (uncut) or 0·65 ounce (cut).

No. 1 and No. 2 orebodies are cut by numerous minor faults.

Ole Zone. This zone lies about 800 feet west of No. 2 shaft and 750 feet east of, and parallel with, the West Bay fault. The zone has been described as follows (Jolliffe, 1938, p. 31):

> 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 in 1939 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 orebody.

Muir Zone. This zone lies about 3,000 feet north-northeast of No. 2 shaft. It strikes about north 60 degrees east, whereas the adjacent lava flows strike north 30 to 45 degrees east. Exploratory diamond drilling indicated narrow, moderate grade ore shoots along a length of 600 feet[1].

North Giant Zone. This zone is about 3,800 feet north-northeast of No. 2 shaft. It is reported to strike about north, and to have been explored by diamond drill-holes with inconclusive results.

Brock Veins. These veins outcrop about 1,600 feet southwest of No. 2 shaft. They have been described as follows (Lord, 1941, pp. 101-102):

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 lie 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 southeast. 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..... 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 ag-

---

[1] Giant Yellowknife Gold Mines, Limited: Annual Report for Year Ending June 30, 1946, p. 3.

gregate length of 137 feet, to average 0·44 foot 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.

Akaitcho Zone. Diamond drilling on the property of Akaitcho Yellowknife Gold Mines, Limited (71), which adjoins the Giant claims on the north, has indicated substantial orebodies in an easterly dipping shear zone that has been traced to within about 50 feet of the north boundary of the Giant property. This zone may extend southerly onto Giant claims about 6,800 feet north-northeast of No. 2 shaft, but no effort has been made to find it.

UNDERGROUND OPERATIONS

All current underground work is served by No. 2 shaft. Seven stopes, all between the 100- and 250-foot levels, were being prepared for mining, or were in operation, by October 31, 1948. One of these was in the north A.S.D. zone. The others were in the High Grade zone; one in the Saddle Reef vein, two in No. 1 ore shoot, and three in No. 2 ore shoot. Initial mining was done by shrinkage methods, the ore being allowed to spill onto the haulage levels from boxholes driven in the foot-wall of the orebodies at 25-foot intervals. Mucking machines were used to load the spilled ore into the ore trains. Ore is hauled in 2-ton cars on the 250-foot level; and in 1½-ton cars on the 425- and 575-foot levels. Storage battery locomotives are used and tracks are laid at 24-inch gauge. The shaft measures 17 feet 6 inches by 6 feet 4 inches, outside timbers, each of the three compartments being about 5 feet by 5 feet, inside timbers. Ore and waste are hoisted in skips from the 250-foot level, and in cars from the 425- and 575-foot levels. Ore and waste passes and loading pockets being constructed will eventually permit hoisting all ore and waste in skips, from pockets on the 250- and 575-foot levels. Ore is trucked from the shaft to the mill.

No. 1 shaft (now idle) has the same dimensions as No. 2, and the tracks in the workings therefrom are laid at 18-inch gauge.

Permafrost has been found in the workings to a depth of 180 feet, and in diamond drill-holes to a depth of about 250 feet; it appears to be most extensive beneath areas of drift and other overburden.

To May 31, 1948, 520,000 tons of ore had been developed in the No. 2 shaft area by about 6,700 feet of drifts and crosscuts, or nearly 80,000 tons for each thousand feet of lateral development. However, the highly irregular shape, moderate dips, and considerable widths of the orebodies required that this work be accompanied by much underground diamond drilling, amounting to 17,778 feet by December 31, 1947. Much of the underground work in progress in September 1948 was concerned with preparing known orebodies for mining, rather than with exploration for additional ore.

The following system of sampling was in force in October 1947. Drifts in ore or possible ore were sampled after each round by a channel sample across the face and a chip sample from the entire face. Channel samples were cut in 5-foot lengths along the backs and from each wall of crosscuts where ore or possible ore was suspected. In addition, samples were taken from cars underground and on the deck. 'Cut' average grades are obtained by re-averaging after reducing all assays greater than 1·5 times the 'uncut' average to that average. Pending further operating experience it is not known whether the 'uncut' or the 'cut' average grade most nearly indicates the gold content of the ore; and in most instances company records show both 'uncut' and 'cut' average grades.

MILL

The treatment plant has a rated capacity of about 500 tons a day. It comprises a crushing plant with a daily capacity of 1,500 to 2,000 tons, and separate milling and roasting plants each rated at 500 tons a day. Excavations have been prepared for additional milling and roasting units, so that these plants can be erected later without damage to the present structures. The treatment plant site affords rock foundations for most structures, provides room for enlarging the plant to a rated capacity of about 1,500 tons a day, and is conveniently located near No. 3 shaft site and the large, undeveloped orebodies of the A.S.D. zone. The conveyor gallery leading from the crushing plant to the mill crosses an area of deep overburden: here the supporting piling was set in permanently frozen ground, and heaving of the piles by the surface soil, which alternately freezes and thaws according to season, has been prevented by a greased sheath of burlap and other materials. A boxed and insulated pipeline, about 4,500 feet long, carries water to the mill from a pump-house on Yellowknife Bay.

Research leading to the design of the treatment plant was done in the Ore Dressing and Metallurgical Laboratories of the Bureau of Mines, Ottawa, and by Nepheline Products, Limited, at Lakefield, Ontario. Tests by the Bureau of Mines on ore from the No. 1 shaft area showed that fine grinding was necessary to separate the intimately associated gold and arsenopyrite; that straight cyanidation of the ore, or any of its products, in the natural state would yield unsatisfactory results; and that a process involving roasting of a flotation concentrate, followed by cyanidation of the calcine, would recover 84 to 87·7 per cent of the gold in the ore treated.

After suitable crushing and grinding a little of the gold in the ore is caught by jigs in the ball mill-classifier circuit. The remainder of the ore is concentrated by flotation, the concentrate roasted to remove as much as possible of the arsenic and antimony, and the resulting calcine treated by ordinary methods of cyanidation to afford the remaining recoverable gold. To December 31, 1948, the only bullion recovered was that yielded by amalgamation of the product of the jigs; and the gold-bearing flotation concentrates were stored pending the completion of the roaster early in 1949. Cyanide and flotation tailings will be impounded separately to facilitate possible future re-treatment.

The following data apply to the first 5 months' operation, June 1 to October 31, 1948[1]. During this period, 35,918 tons of ore (235 tons a day) were treated, and the average grade was 0·83 ounce of gold a ton. About 17·1 per cent of the contained gold was recovered by amalgamation of the jig product. The ratio of concentration attained by flotation was 11 to 1, and the resulting 3,318 tons of concentrates contained 75·4 per cent of the gold in the mill heads. The operators estimated that 86 per cent of the gold in this concentrate will be recovered by future roasting and cyanidation. Thus the estimated overall gold recovery for the first 5 months' operation is about 82 per cent.

[1] Giant Yellowknife Gold Mines, Limited: Annual Report for the Year Ending May 31, 1948, and Summary Report for the period June 1, 1948, to October 31, 1948, p. 8.

COSTS AND GENERAL OPERATING DATA

The following operating costs for 1948 were supplied by the Dominion Bureau of Statistics: development and exploration, $1.65 a ton; mining, $5.21; milling, $4.63; other costs, $5.05; total, exclusive of taxes or depreciation, $16.54 a ton.

No. 1, three-compartment shaft cost $157.47 a foot; No. 2, three-compartment shaft $142.93 a foot. Drifts and crosscuts cost about $34 a foot, and raises (5 by 7 feet) about $27 a foot. The contract price for underground diamond drilling is about $1.35 a foot (Giant Yellowknife Gold Mines, Limited, supplies compressed air and is reimbursed for board received by the drill crew).

About two hundred and twenty-two men were employed during 1948, as follows: surface, one hundred and fifty-six; underground, fifty-nine; mill, seven (eleven during the operating period May to December). Salaries and wages amounted to $912,385. The scale of wages is in accordance with an agreement reached in June 1947 between the operators and International United Mine, Mill, and Smelter Workers (CIO), Local 802; it is the same as that in use at Con and Rycon mines (73). Workmen's compensation is paid by Prudential Insurance Company in accordance with the schedules set by the Workmen's Compensation Act, Province of Alberta. Fares are paid from the point of employment to Yellowknife after two hundred shifts have been completed, and return fares after three hundred shifts.

Tanks provide storage for about 700,000 gallons of fuel and diesel oil as follows: bunker fuel, about 375,000 gallons; heavy diesel oil, about 220,000 gallons; light diesel oil, about 105,000 gallons. In 1948 (diesel engines idle after October 4) fuel and diesel oil used amounted to 747,157 gallons valued at $156,930, delivered at the mine.

Prior to October 4, 1948, power generated by diesel engines was supplemented by electric power received from the Prosperous Lake hydro-electric plant of the Consolidated Mining and Smelting Company of Canada, Limited. After that date, diesel engines became standby units and all power came from the Snare River hydro-electric plant of the Northwest Territories Power Commission at a cost of $100 a horsepower-year.

Rough local spruce lumber cost (1947) about $80 M ft. board measure, British Columbia fir about $108.

Gold Group (77)

Reference: Stockwell and Kidd, 1932, pp. 72, 73.

The Gold group . . . [comprised] 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 [Yellowknife group?] 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[1].

[1] Assay by A. Sadler, Mines Branch, Department of Mines, Ottawa.

Gold-Uranium Exploration, Limited

(*Bingo Group and Vicinity*) (23)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 86-D-16. Henderson, 1949. Kidd, 1936, pp. 29-30. Mines Branch, 1936c.

Gold-Uranium Exploration, Limited, owns a uranium prospect on Stairs Bay at the southeast end of Hottah Lake. The property is about 95 miles south of Port Radium, and 1 mile or 2 miles northeast of the Cormac group (22).

About the same ground was staked in 1934 by C. A. Watt and W. L. Olmstead as the W.L.O. group. These claims were abandoned in 1936, but were re-staked for the Tasman Syndicate in 1940 as the Bingo group of nineteen claims. An area including these claims was prospected and geologically mapped by the Geological Survey in 1945. Thirteen of the Bingo claims were acquired by Gold-Uranium Exploration, Limited, in 1947, and according to the company about 3,700 feet of diamond drilling was done on the group in that year. The following account is derived from a report by Henderson, and is descriptive of the Bingo group and adjacent ground in 1945; but the deposits described are not certified to be on the Bingo claims.

The most abundant rocks on the property are granite and granodiorite, probably of Proterozoic age. They are massive, red-brown weathering, medium-grained rocks averaging 20 to 25 per cent quartz, 60 to 70 per cent feldspar (one-half to two-thirds orthoclase), and 10 to 20 per cent chlorite pseudomorphic after biotite. Bodies of older, Snare group quartzite occur in the granite and granodiorite. Numerous gabbro dykes and small irregular masses intrude the granitic rocks; some are sill-like with gently dipping contacts, whereas others are dykes with vertical contacts. Many trend about northeast. The gabbro is a rusty weathering, reddish green, fine- to medium-grained rock with ophitic texture. It is composed of sassuritized plagioclase and hornblende, the latter containing abundant specularite along cleavage cracks. The margins of the gabbro bodies are sheared, the central parts massive. Diabase dykes are the yongest rocks recognized.

Pitchblende occurs in quartz veinlets along joints in the gabbro dykes and sill-like bodies. Twenty-five such occurrences were examined; most are a fraction of an inch wide, and can be traced only a few feet. They occur within an area 1,000 feet wide extending 4,500 feet southwest from the cabins on the southwest side of Stairs Bay; most of them are grouped 1,000 feet or 4,500 feet southwest of the cabins. The largest deposit is within the latter group, and has been described as follows:

> ....A trench 40 feet by 5 feet by 3½ feet deep has been blasted out along a quartz vein. The vein strikes east to a little south of east, dips 45 degrees north, and ranges in width from 2 inches at the west end of the trench to 8 inches at the east end. It can be traced 30 feet beyond the eastern end and 15 feet beyond the western end of the trench for a total length of 85 feet. The vein is composed of quartz and hematite, and much of the hematite is crystalline specularite. The hematite, and specularite are generally concentrated along the margin of the vein, with comb quartz and some flakes of specularite in the centre, but in places the vein is composite, with bands of hematite and quartz repeated twice or more. Of the vein exposed in the trench the eastern 25 feet is strongly radioactive, with much uranium stain present. The Geiger counter responds strongly..... The western 15 feet of the vein in the trench is feebly radioactive, with a little stain exposed in places..... Beyond the trench to the east and west the vein is not radioactive.

A small pile of hand-cobbed earthy hematite with pitchblende lies near the trench. It probably came from a 12-foot section of the vein at the eastern end of the trench, where some small pods or lenses of similar material up to ½ inch wide occur in the vein. The sample sent to the Mines Branch at Ottawa [Kidd, 1936, p. 29] that assayed 13·70 per cent U_3O_8 probably came from this trench.

Goldcrest Mines, Limited (27)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 86-B-6. Stanton, 1947, pp. 18-20.

Goldcrest Mines, Limited, owns the A.E. group of about twenty claims, ½ mile west of Long Lake and about 135 miles north-northwest of Yellowknife. So far as known the property was inactive during 1947. The following report is by Stanton, who visited the claims in 1946.

Exploratory work has included mapping, trenching, and diamond drilling, the last, at the close of 1946, totalling 10,356 feet.

Work has been concentrated on three zones: (1) an intrusive quartz-albite sill or low-angle dyke; (2) quartz veins in mineralized sericitic quartz-porphyry lying 700 feet east of the dyke; and (3) quartz veins in dark quartz-feldspar porphyry lying 400 feet west of the dyke.

(1) The quartz-albite dyke lies chiefly on the No. 18 claim of the property, and just west of two small lakes situated 1,500 to 2,000 feet west of Long Lake. For much of its length it cuts a more basic, coarser, quartz diorite body intrusive into andesites. The quartz diorite contains milky blue quartz eyes from ⅛ to ¼ inch in diameter. The Goldcrest dyke is a medium-grained, grey-green to dark grey rock that weathers to pale grey, white, or pink. Under the microscope it is seen to be composed essentially of albite and quartz, with chlorite, carbonate, sulphide, titanite, and minor sericite and apatite, and is very similar to the Colomac-Indian Lake dyke[1] the southern part of which lies about 1,200 feet east. Locally the quartz-albite dyke contains small 'eyes' of bluish quartz. Disseminated pyrrhotite locally occurs within the dyke material, and as with the Colomac-Indian Lake body, it is intersected by glassy white quartz veins carrying pyrite. It is reported that the dyke has been traced for a length of 5,000 feet on Goldcrest property and has a maximum width of 200 feet. It has an average strike of about north 25 degrees east, and dips steeply to the east.

Exploratory work was concentrated on a program of diamond drilling, and a total of 6,835 feet were drilled to explore the dyke along a length of 2,000 feet, with deepest drilling to a vertical depth of 400 feet. It is reported that of this 2,000 feet, a section 1,500 feet long with an average width of 25·6 feet averaged $5.05 a ton in gold, the estimate being based on 11 drill holes. It is also reported that a narrow, higher grade section occurs near the foot-wall of the dyke.

(2) About 700 feet west of the northern end of the Goldcrest dyke some trenching has exposed a fracture zone in a narrow body of siliceous to sericitized quartz porphyry in andesite. The quartz porphyry is fine grained, grey to green, and contains quartz 'eyes' up to ⅛ inch in diameter.

A small band of dense, brittle rhyolite is locally associated with this rock. The maximum width of the quartz porphyry in the vicinity of the workings is probably 60 feet, and appears to be the northern end of the quartz-porphyry sill or interbedded flow the southern end of which has been explored by drilling on the Nareco property[2]. A considerable amount of glassy grey quartz cuts the quartz porphyry, and some pyrrhotite is present. Locally, abundant, coarse, well-formed arsenopyrite crystals occur within the massive sericitized quartz porphyry, and geniculate twinning of the sulphide is common. Three areas of trenching were observed over a strike length of 1,000 feet. It is reported that seven holes have been drilled in this zone, one of which encountered 7 feet of ore that assayed 0·42 ounce gold a ton.

(3) Four hundred feet east of the Goldcrest quartz-albite dyke and lying between two small lakes, an 80-foot-wide sill or flow of dense, siliceous, greenish to blackish quartz or quartz-feldspar porphyry is interbedded with andesite. The matrix of the porphyry

---

[1] *See* Colomac Yellowknife Mines, Limited, and Indian Lake Gold Mines, Limited (28), page 95.

[2] Nareco Gold Mines, Limited.

is fine grained, and contains bluish quartz eyes and feldspar phenocrysts from $\frac{1}{16}$ to $\frac{1}{8}$ inch in diameter. This quartz porphyry has been fractured, and in places contains numerous gash veinlets of glassy white quartz. A little pyrite is present locally. The zone has been explored by trenching and diamond drilling.

Goodrock Gold Mines, Limited (65)

This company, during 1942 and possibly 1943, explored the tungsten prospects of a group of claims lying on the east side of Gordon Lake west of Bars Lake. The property adjoined the Storm group (66) on the north.

The property had been explored previously by Galloway Gordon Lake Mines, Limited, incorporated in March 1938. Work accomplished by this company included surface trenching, about 1,500 feet of diamond drilling, and a shallow shaft on No. 1 vein. The property was at that time regarded as a gold prospect. In March 1942, a controlling interest in the claims was acquired by Goodrock Gold Mines, Limited. Work directed by C. Watt, for this company, proved the presence of scheelite in one or more quartz veins.

The property was examined for the Geological Survey by J. F. Henderson in 1939, and the following is mainly his description.

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 (No. 1) showing lies about 900 feet east of the southeast end of a lake-like bay of Gordon Lake lying west of Bars Lake. 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 it 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 wall-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 minerals resemble those 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 No. 2 quartz vein, which is near the east shore of the bay of Gordon Lake and about 1,400 feet northwest of No. 1 vein. Five trenches have been excavated across No. 2 vein within a length of 350 feet. 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 parallel the bedding, strike north 25 degrees east, and dip 75 to 80 degrees southeast. The zone containing the quartz ranges in width from 5 to 18 feet. The amount of quartz exposed in the trenches varies considerably; in several trenches the quartz lenses comprise perhaps 80 per cent of the zone; in others, slate and greywacke are more abundant than quartz. A little 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 best scheelite deposits known to the Goodrock company were examined by A. W. Jolliffe in July 1942, and the following is a summary of the data obtained at that time.

One showing is in No. 1 vein about 100 feet southwest of the shaft and consists of two sections separated by an interval of 40 feet where the vein is poorly exposed. The two sections have a combined length of 75 feet and average 2 to 3 feet in width. Examination with an ultraviolet lamp indicated an average grade of 0·1 per cent WO_3 but, because of the small size of the scheelite grains and for other reasons, the vein was not well suited to grading by this method.

The second of the two best showings, as chosen by the management, is about 1,500 feet northeast of the shaft. It is in a quartz vein that may be continuous with No. 1 vein. The deposit is 40 feet long, averages between 3 and 4 feet in width, and, as determined by an ultraviolet lamp, contains slightly less than 0·1 per cent WO_3. The vein is considerably wider than 4 feet, but the scheelite is mainly restricted to a zone near the northwest wall. The scheelite generally occurs in aggregates less than $\frac{1}{10}$ inch across.

Great Slave Lake, Miscellaneous Mineral Occurrences (131)

References: Bell, R., 1902. Hoffmann, G. C., 1901, pp. 32, 33; 1902, p. 42. Lausen, 1929. Stockwell and Kidd, 1932, pp. 76-78.

Various known and reported mineral occurrences in the east arm of Great Slave Lake, containing copper, lead, zinc, barium, fluorine, and other elements, have been described by Stockwell and Kidd.

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 [Great Slave] 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 [Et-Then 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"[1] 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.[2] 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.[2] 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.

In addition to these occurrences Lausen [1929, pp. 391, 392] 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[3] lake 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 [Bell, R., 1902, p. 108]. 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 [Bell, R., 1902, p. 108]. An assay of quartz, stained and, in parts, coated with hydrated peroxide or iron, from a large vein on the west side of East bay, showed neither gold nor silver [Hoffman, 1902, p. 42]. 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 [Hoffman, 1901, pp. 32, 33].

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

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

[2] Assay by A. Sadler, Mines Branch, Department of Mines, Ottawa.

[3] Now known as Stark Lake.

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 granite 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.

Homer Group (70)

References: Bureau of Mines, 1944b. Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-J-9. Jolliffe, 1938, pp. 32-34; 1946.

The Homer group of twelve claims is on Homer Lake, 10 miles north of the head of Yellowknife Bay. It was staked in September 1933 by H. T. Dixon on behalf of Yellowknife Gold Mines, Limited, and has been trenched and diamond drilled.

The following description is by Jolliffe (1938):

[About ¼ mile west of the south end of Homer Lake]. . . .a quartz-porphyry dyke about 100 feet wide trends northeast for at least 800 feet through massive, green-weathering rocks [Yellowknife group], 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 ground-mass, 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.
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.

[1] Spectroscopic examination by H. V. Ellsworth, mineralogist, Geological Survey of Canada.

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.[1]

Huhill Yellowknife Mines, Limited (54)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-O-3. Lord, 1939, p. 16; 1941a, pp. 66-67; 1942a, p. 52.

Huhill Yellowknife Mines, Limited, owns the following sixteen claims on Mosher Lake, 55 miles northwest of Yellowknife: Hill Nos. 1 to 6, Monty Nos. 1 to 6, and Rose Nos. 1 to 4. Mosher Lake is on Wecho River, which, 5 miles to the west, enters Russell Lake, an arm of Great Slave Lake. The transmission line of the Northwest Territories Power Commission, connecting the Snare River hydro-electric plant with Yellowknife, is about 3 miles northeast of the property. The writer visited the property in 1938.

The Corinne group of twenty-one claims was staked on Mosher Lake early in the summer of 1938 and the claims recorded in the names of A. C. Mosher of Haileybury, Ontario, H. Lajeunesse, C. J. Mosher, and H. Grozelle. The claims subsequently lapsed, and part of the property is reported to have been re-staked in 1944 by the Yellowknife Mining Syndicate, from which the Hill, Monty, and Rose claims were subsequently acquired by Huhill Yellowknife Mines, Limited. The owners reported that nine diamond drill-holes totalling 3,794 feet were drilled in 1946, and thirty-one holes totalling 10,229 feet in the winter of 1947. Visible gold is reported to have been encountered in many of the holes.

The following description was applicable in 1938.

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 Mosher Lake about ½ mile east

[1] Personal communication from C. J. Baker.

of its outlet. A northwesterly trending fault probably passes close to this island. Stripping on the northeast shore of the island has exposed a stock-work of quartz in fresh black slate and greywacke. This stock-work 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 stock-work follows the beds, which may be drag-folded in the area that has been stripped. The greywacke and slate are crumpled within the quartz stock-work. The quartz is mottled grey and white and contains a little rusty weathering carbonate, pink feldspar, pyrrhotite, pyrite, chalcopyrite, arsenopyrite, and free gold, and is reported to contain some sphalerite.

International Uranium Mining Company, Limited[1] (18)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 86-F-13. Furnival, 1939a; 1939b. Kidd, 1933; 1936. Lord, 1941a, pp. 49-55. Mines Branch, 1935a. Parsons, 1948a, pp. 10-12.

INTRODUCTION

International Uranium Mining Company, Limited, owns about thirty-two claims on the north shore of Contact Lake, about 9 miles southeast of Port Radium and Eldorado mine (13). The claims comprise M1 to M24 inclusive, M26, S1, S2, and E1 to E4 inclusive[2]. The topography is rugged, and the relief may be 1,000 feet. Bare rock is exposed over wide areas. The property is accessible by aircraft from Yellowknife, or by boats of Northern Transportation Company, Limited, from Waterways, Alberta. Radio affords communication with the Port Radium station of the Royal Canadian Corps of Signals. D. A. G. Smith was superintendent when the writer visited the property in July 1939 and September 1947. The following description applies at about the latter date, unless otherwise stated.

HISTORY

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. By that time most known ore had been extracted. The property was subsequently acquired by International Uranium Mining Company, Limited, incorporated in 1942. A program of diamond drilling, geological mapping, and prospecting with a Geiger counter was completed during the summers of 1944 and 1945. The property was reopened in January 1946, and the underground workings of the former owners subsequently dewatered. Underground work by the present owners commenced in October, but was interrupted when the mill and power house were destroyed by fire in November. The power plant was repaired by February 1947, and the workings again dewatered. Underground exploratory work began again in March, and was still in progress on December 31, 1947.

---

[1] Reorganized and name changed to Acadia Uranium Mines, Limited, in 1949.
[2] Smith, D. A. G.: personal communication.

PRODUCTION AND ORE RESERVES

Production[1] to December 31, 1947, in so far as available, is tabulated below.

—	Ore milled	Concentrate produced	Contents of concentrate	
			Silver	U_3O_8[1]
	Tons	Tons	Ounces	Pounds
1934	....	....	14,330[2]	....
1935	....	....	....	....
1936	948	7	33,341	....
1937	1,299	14½	70,546	....
1938	3,058	19	92,614	....
1939	6,658	118	225,926	6,933
1947	....	....	29,402[3]	....
Total	11,963	158½	466,159	6,933

[1] The quantity of U_3O_8 recovered prior to 1939 is not known.
[2] From crude ore.
[3] From 21,092 pounds of cobbed ore shipped in August 1947.

Ore reserves, as estimated by the company in 1944, were 4,000 tons, containing about 50 ounces of silver a ton. Tailings were likewise estimated as 9,940 tons containing 270,000 ounces of silver and 4,000 pounds of U_3O_8.

CAMP AND PLANT

The camp is on the northeast shore of Contact Lake.

The shaft and mining plant are about 1,600 feet east of the camp, about 100 feet above it, and at the foot of an abrupt hill. Plant buildings include a dry, steel shop, temporary power house, and combined shaft and hoist house. Machinery includes a D 13,000 Caterpillar diesel driving a Gardner-Denver compressor with a capacity of 365 cubic feet of air a minute; an Ingersoll-Rand, single drum, 8-inch by 6-inch, type SSR, air-operated hoist; two steam boilers, 20 and 60 horsepower, for heating plant buildings; a D 4 Caterpillar tractor with bulldozer blade; and a 6-ton Athey wagon.

DEVELOPMENT

Twenty-five diamond drill-holes totalling 7,137 feet were completed in 1944; and fifteen holes totalling 8,189 feet in 1945.

Drifts and crosscuts to December 31, 1947, totalled 3,660 feet as follows; first (adit) level, 486 feet; second level, 2,309 feet; and third level, 865 feet.

Underground work has opened three zones; these strike between east and northeast and, named from northwest to southeast, are No. 1, No. 3, and No. 2 zones. The first level is an adit, mainly on No. 1 zone. A two-compartment vertical shaft, 70 feet west of the adit portal and about 210 feet deep, provides entry to the second and third levels, about 100

[1] Data to end of 1937 supplied by C. L. Hershman, formerly General Manager, Bear Exploration and Radium, Limited; subsequent data supplied by Dominion Bureau of Statistics.

and 190 feet below the first level. The first and second levels are connected by an inclined, two-compartment winze. The second level consists of drifts on the three zones, and a connecting crosscut driven southeasterly from the drift on No. 1 zone. The third level is a drift on No. 1 zone. To August 31, 1947, most drifting had been done on No. 1 zone; but about 540 and 190 feet had been completed on Nos. 2 and 3 zones, respectively.

GEOLOGY

Probably all rocks near the mine are of Proterozoic age. The mine workings lie within a belt of granodiorite, 1 mile to 2 miles wide, which trends northwesterly. The granodiorite is a massive, medium-grained, brown weathering rock composed of about 15 per cent quartz, 35 per cent hornblende and biotite, 25 per cent orthoclase, and 25 per cent plagioclase. About 1,000 feet southwest of the shaft, fresh, pink, coarse-grained biotite granite is in contact with the granodiorite. The contact is not well defined, and in places appears to be gradational. A few pink aplitic dykes, possibly related to the granite, cut the granite and granodiorite.

The granodiorite near the workings 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 of quartz and carbonate occur in some of these zones and have provided the silver and pitchblende ore mined to date.

DESCRIPTION OF DEPOSITS

No. 1 Zone outcrops for about 350 feet immediately east of the shaft and passes under drift at each end. Its average strike is about north 70 degrees east, its dip about vertical to 75 degrees north-northwest. 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 oi fractures that branch and join, and are distributed across widths of as much as 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 slightly sheared or contains a little gouge. At the surface the most persistent fractures trend about north 75 degrees east and other fractures diverge from the northwest sides of these, trend about northeast, and curve to a trend about north 75 degrees east. The dip of individual fractures in the zone ranges between 70 degrees southeast and 70 degrees northwest. 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 oi other metallic minerals. The veins range in width from thin seams to more than 2 feet; in many places only one vein occurs in a fractured zone, but in some places several veins lie within 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 with the vein walls and many of them are less than ½ inch in width. Much of the quartz is glassy or white and is finely banded parallel with the walls, the banding 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 crystal-lined 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 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 foot to 4 feet and in some places contains a seam of stiff gouge 1 inch 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 two stopes with an aggregate drift length of 270 feet, and on the third level 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 them. Four ore shoots were encountered in the adit; they ranged from 30 to 74 feet in length and their 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 (Furnival, 1939b, p. 764) 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 (Furnival, 1939b; Kidd, 1936, p. 39) 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 (Furnival, 1939b, p. 768) 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.

Veins in No. 1 zone that contain silver and pitchblende cut pink aplitic dykes that may be genetically related to the pink biotite granite, and no rocks younger than the dykes have been recognized at the mine.

No. 2 Zone. The western outcrop of this zone is about 650 feet east of the shaft. The zone outcrops or is covered by a very little drift for about 1,300 feet. It strikes about north 80 degrees east and dips southerly at 65 to 80 degrees. About 380 feet of the zone is stripped and trenched, and the width of this part 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. 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.

The zone has been explored on the second level for a length of about 540 feet (August 31, 1947) and there ranges from a few inches to about 2 feet in width and averages about a foot. It contains quartz-carbonate seams throughout the length of the drift; these range up to about 1 foot in width, and contain angular fragments of altered granodiorite. Granodiorite for as much as 1 foot on either side of the fractured zone has been altered to a red or dark green rock, probably by the formation of hematite and chlorite. The exposed part of the zone contains a little chalcopyrite, but no ore or important amounts of silver or pitchblende.

No. 3 Zone lies in a drift-filled draw and is, in part at least, a shear zone. It is traced by three pits for a length of 350 feet and strikes north 55 degrees east and dips nearly vertically. The western pit lies about 800 feet east-northeast from the shaft. The zone is exposed by two drifts on the second level for a total length of more than 300 feet. It ranges in width from 1 foot to more than 6 feet, consists of sheared granodiorite, and in places contains 1 inch 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 silver or pitchblende was seen.

COSTS AND GENERAL OPERATING DATA

The following data on permafrost were obtained[1] when the property was reopened in 1946. Solid ice was encountered in the shaft to a depth of 35 feet. A coating of ice was found on the shaft walls to a depth of 100 feet, and in the second level drift on No. 1 vein east of the stopes. Ice was found in vugs in quartz in No. 3 vein on the second level (at a place about 130 feet below the surface) during drifting operations. No ice was found when the third level was dewatered.

[1] Smith, D. A. G.: personal communication.

Drifting, to minimum dimensions of 4 by 6½ feet, is done by contract. The drifting crews are paid $10 to $12 a foot advanced, and buy powder, caps, and fuse; the company supplies power and supervision.

Freight or express by Norseman aircraft from Yellowknife costs 34 cents a pound. Heavy freight and supplies, shipped with Northern Transportation Company boats, costs $170 a ton from Waterways and $97 a ton from Norman Wells. It is delivered to the southeast arm of Echo Bay (of Great Bear Lake), about 2 miles northeast of the property, and moved from there by the mining company's tractor and Athey wagon.

The following data[1] pertain to the operation of Norseman aircraft at Contact Lake.

—	1946	1947
Date of arrival of first float-equipped aircraft	June 14	June 28
Date of departure of last float-equipped aircraft	Oct. 21	....
Date of arrival of first ski-equipped aircraft	Nov. 21	....
Approximate date on which ice left Contact Lake	June 15	July 5

About twenty men were employed at the property during 1947—five underground and fifteen on the surface. Wage rates were the same as at Eldorado mine (13), and no charge was made for board.

Oil and gasoline come from Norman Wells, and are transported and stored at the property in steel drums. Diesel fuel costs 65½ cents a gallon delivered in Echo Bay, and gasoline 88 cents a gallon.

Logs (minimum butt diameter, 9 inches; minimum length, 12 feet) for sawmill use cost the company $1 each piled at Thomson Lake, about 5 miles southwest of the camp. Fuel wood costs about $16 a cord, delivered at the boilers and cut for use.

Irma Group (105)

Reference: Henderson, 1939a, p. 14.

According to Henderson the Irma group of claims lay ½ mile south of Victory Lake, southwest of the Ruth claims (106), and were staked in July 1939 by D. F. Kidd. They were underlain by rocks of the Yellowknife group, and lay along a contact between volcanic rocks on the southwest and sedimentary rocks on the northeast. Sulphide minerals and vein quartz occur in shear zones along the contact of rhyolite flows with sedimentary strata.

Iron Islands Iron Deposits (136)

Reference: Stockwell and Kidd, 1932, pp. 84, 85.

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.

[1] Supplied by D. A. G. Smith.

The islands consist chiefly of quartzite[1] 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 the south end of Iron Islands and in argillaceous quartzites 2 miles southwest and 3 miles northwest of Basile Bay.

Jeja No. 2 Claim (47)

(*See* Figure 14)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 76-D-3. Folinsbee, 1949.

Jeja No. 2 claim is in the barren grounds about 150 miles northeast of Yellowknife and about 80 miles north-northwest of the nearest shore of the East Arm of Great Slave Lake. The claim is on the east shore of what is locally known as Bulldog Lake, a small lake draining into the south end of Matthews Lake. The Matthews vein on this claim was examined by the author in August 1947, and unless otherwise stated, the following notes describe the property as seen at that time.

The claim is one of a number staked by J. W. Matthews in May 1945. A little trenching was done on the Matthews vein in 1946. Bulldog Yellowknife Gold Mines, Limited, was incorporated in January 1948 to acquire this and thirty-five adjacent claims of the Jeja, R.E.P., and Mad

[1] Wilson Island phase of Point Lake-Wilson Island group.
[2] Analysis by A. Sadler, Mines Branch, Department of Mines, Ottawa.

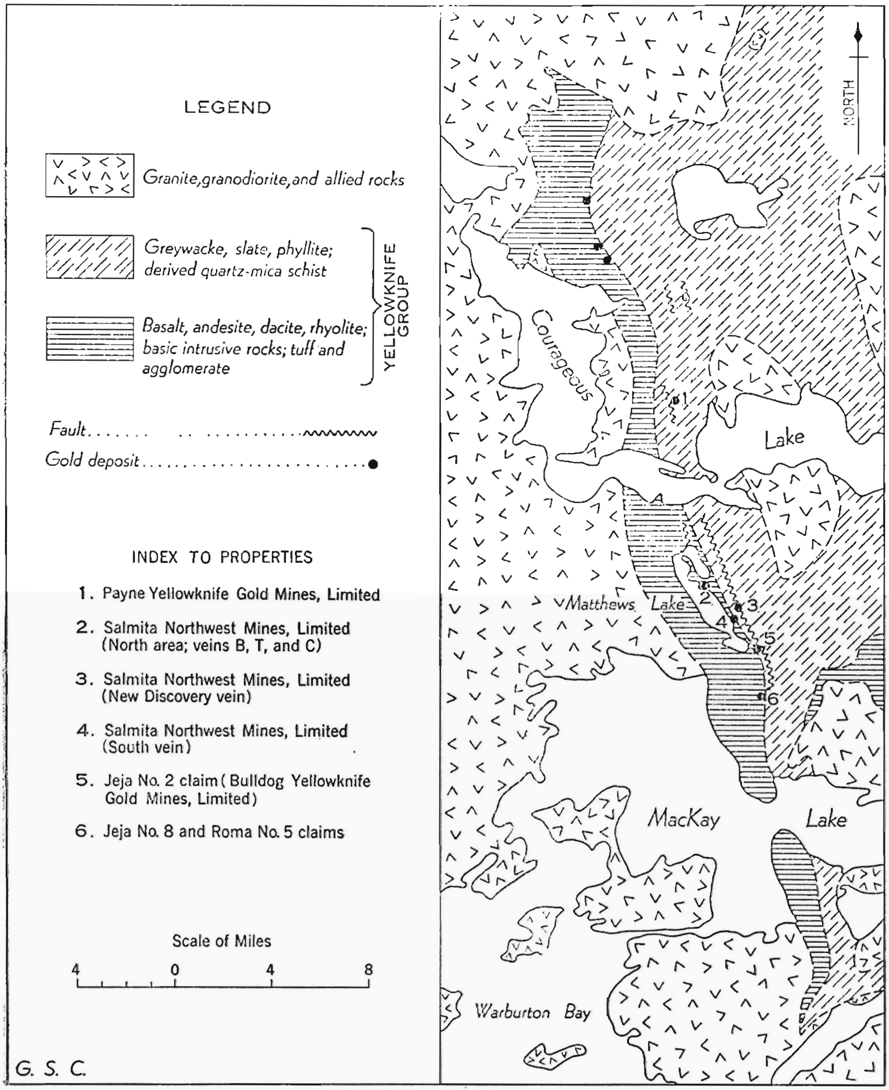

Figure 14. Geology and mineral properties of Courageous Lake gold belt.

groups and to explore these claims under the management of Trans-American Mining Corporation, Limited. During 1948, the Bulldog company did geological mapping, trenching and stripping, and several thousand feet of diamond drilling on the Matthews vein.

The claim is underlain by volcanic and sedimentary rocks of the Yellowknife group. These rocks and the contact between them strike about north-northwest and dip easterly at 75 to 85 degrees. The contact is nearly parallel with the west boundary of the claim and an estimated 50 to 150 feet east of it. The volcanic rocks are part of a belt 1¼ mile to 3 miles or more in width that extends north-northwest for many miles and appears on the properties of Salmita Northwest Mines, Limited (46), and Payne Yellowknife Gold Mines, Limited (45). Near the contact on Jeja No. 2 claim these rocks are banded, medium-grained, dark green or black amphibolites or garnetiferous amphibolites, probably recrystallized tuffs. The adjacent sedimentary strata are schistose greywackes, slates, and phyllites.

The Matthews vein strikes north 20 degrees west and dips northeasterly at 75 to 85 degrees. It lies within the sedimentary formations, a few feet east of, and about parallel with, the east contact of the volcanic rocks. The vein and its vicinity have been explored at intervals for a length of 1,120 feet by thirteen trenches. Nine of these trenches display vein quartz at intervals for a length of 1,055 feet. The long gaps between trenches did not permit correlation of vein matter from trench to trench; but additional exploration probably will disclose substantial lengths of continuous quartz bordered here and there by parallel veins or stockworks of quartz veinlets. The maximum exposed width of quartz is 9½ feet, the average width about 3 feet. Ninety-five per cent, or more, of the vein matter is quartz. Some quartz is coarse grained and dark grey, with scattered light grey patches, whereas another, locally high-grade variety is fine grained, dark to light grey, and cleaves into thin slabs parallel with the walls. The walls are sharp and free, and commonly bordered by 6 inches to 3 feet of sheared or fractured, rusty slate or phyllite. The nearby amphibolite commonly contains scattered grains of arsenopyrite, occasionally seams of pyrite. The quartz contains a very little arsenopyrite, and gold was seen in five of seven trenches representing a vein length of 765 feet. Surface sampling of the vein in 1948, after much stripping and trenching had been done, is reported[1] to have indicated five ore shoots with a total length of 242·5 feet, an average width of 3·12 feet, and an average uncut grade of 1·79 ounces gold a ton. Twenty-four of the twenty-eight diamond drill-holes that explored the vein in 1948 are likewise reported to have indicated an average true width of 2·78 feet and an average uncut grade of 0·41 ounce gold a ton.

Jeja No. 8 and Roma No. 5 Claims (48)

(*See* Figure 14)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 76-D-3. Folinsbee, 1949.

Jeja No. 8 claim is about 150 miles northeast of Yellowknife, 2 miles south of Jeja No. 2 claim (47), and 2 miles south-southeast of the south end of Matthews Lake. The ground immediately north of Jeja No. 8

[1] Trans-American Mining Corporation, Limited: Annual Report for Period Ending June 30, 1948, p. 6.

claim is probably on Roma No. 5 claim. The claims were visited briefly on August 19, 1947. All distances measured during the examination were obtained by pacing and are, therefore, approximate.

The claims were staked in May 1945, Jeja No. 8 by J. W. Matthews and Roma No. 5 by R. Onyschuk. A little trenching was done during 1946, but, so far as known, no important work was done during 1947 or 1948.

The examination was confined to a series of seven trenches arranged along a line that trends about north along the east side of Jeja No. 8 claim onto Roma No. 5 claim. Small lakes lie immediately north and south of this line of trenches.

The southern three trenches are in the southeast corner of Jeja No. 8 claim and lie at 100-foot intervals along a line trending north 10 degrees east. They expose rust-stained rock, in part dark green or black, and banded amphibolite that strikes about north and dips 75 to 85 degrees east. Lenticular bodies of quartz, as much as 1 foot wide, occur in the amphibolite, and some of the rock near the quartz contains tourmaline and much arsenopyrite. Fine-grained quartz-mica schist, slate, and phyllite outcrop about 200 feet east of the trenches.

The northern four trenches are in the northeast corner of Jeja No. 8 claim and probably the adjacent southeast corner of Roma No. 5 claim. They form a line that trends about north 15 degrees east for a length of about 800 feet. The exposed rocks are probably altered tuffs; they are dark green and brown, banded amphibolites that strike about north 20 degrees east and dip easterly at 80 degrees. Sedimentary rocks outcrop about 300 feet east of the trenches. In and near the trenches the amphibolites contain abundant disseminated arsenopyrite, smaller amounts of pyrrhotite, pyrite, and chalcopyrite(?), and, adjacent to quartz veins, tourmaline. The most northerly trench is on the south shore of a small lake, and the two nearest trenches are 500 and 600 feet south of it. These three trenches expose irregular quartz bodies intimately mixed with mineralized, rusty amphibolite. From south to north, they were estimated to expose 70 per cent quartz across a width of 24 feet, 75 per cent quartz across two sections with a total width of 9·5 feet, and 75 per cent quartz across a width of 10 feet. The quartz is coarse grained, and white to dark grey. At the lake shore it contains a very little pyrite, arsenopyrite, visible gold, and scheelite. It is doubtful if comparable amounts of quartz occur between these trenches. The fourth trench, about 800 feet south of the lake, contains considerable disseminated arsenopyrite and a little pyrrhotite, but almost no quartz.

J.E.S. Group (58)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-O-1. Jolliffe, 1939.

The J.E.S. group of fifteen claims is at the north end of Johnston Lake, and about 40 miles north of Yellowknife. J.E.S. Nos. 1 to 9 claims were staked by J. E. Stevens and S. Hooker in May and October 1941; and J.E.S. Nos. 10 to 15 claims were staked for the Consolidated Mining and Smelting Company of Canada, Limited, in May 1944. In 1945, Nos.1 to 9 claims were under option to this company, and considerable trenching and at least thirteen diamond drill-holes completed. The property has not been visited by an officer of the Geological Survey of Canada, and the following account is derived mainly from data supplied by the company.

The claims are underlain by greywacke and slate of the Yellowknife group. The strata strike about northeast and dip steeply northwest or southeast. They are cut by a few diabase dykes, which commonly strike about northwest or northeast.

The main or No. 1 vein is on J.E.S. Nos. 2, 6, and 7 claims, about 300 feet southwest of the northeast corner of J.E.S. No. 6. The vein strikes about north 20 degrees west, and thus crosses the enclosing strata; it is reported to occupy a minor fault. The vein has been traced for more than 650 feet by trenches and ten diamond drill-holes. For 220 feet, the vein averages 2 feet in width and contains 0·45 ounce gold a ton. Other, shorter lengths also contain a little gold.

J.F. Group (88)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-I-14. Henderson, 1941c.

The J.F. group of twelve claims is 45 miles northeast of Yellowknife and on the west side of an arm that extends northwesterly from the south end of Gordon Lake. The property was examined briefly on August 14, 1947.

The claims were staked by J. Buchan and F. Buchan on August 16, 1945. E. Boffa, T. Payne, and associates subsequently acquired a controlling interest in the property.[1]

The underlying rocks are mainly greywackes and slates of the Yellowknife group. The strata strike northwesterly and are steeply inclined. They are cut by a few diabase dykes.

The main, known, gold-bearing quartz vein, discovered May 28, 1947, is on the west shore of the south end of a bay of a small lake, and is said to be in the southeast corner of J.F. No. 12 claim. The adjacent beds strike about north 55 degrees west and dip 85 degrees southwest. The vein strikes north and dips 20 to 40 degrees west. It is continuously exposed by a trench for about 170 feet, attains a maximum width of 3 feet, and averages about $1\frac{1}{2}$ feet. The north end of the trench is at the lake shore, where the vein, about 9 inches wide, appears to end against a northwesterly striking, steeply inclined fracture, possibly a minor right-hand fault. The vein ends against a similar fracture at the south end of the trench, and is there $1\frac{1}{2}$ feet wide. This fracture is probably a right-hand fault marking a horizontal displacement of not more than a few feet; and a stripped area about 40 feet south of the trench has exposed a quartz vein about 6 inches wide, possibly the faulted extension of the vein exposed in the trench. About 60 feet north of the south end of the trench the vein is offset a few feet by a right-hand fault that strikes about north 20 degrees west, and dips steeply southwest. The vein walls are bordered by as much as 1 inch of loose rusty rock, or by undisturbed slate and argillaceous greywacke with a little disseminated pyrite. The quartz is dark grey and contains a little arsenopyrite, pyrite, galena, and minor chalcopyrite.

[1] Personal communication from E. Boffa, Yellowknife.

No gold was seen, but a picked sample of slightly rusted quartz with pyrite and arsenopyrite contained[1]: gold, 1·35 ounces a ton; silver, 0·01 ounce a ton.

Jol Group (95)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-I-11. Fortier, 1947a. Jolliffe, 1944a, pp. 9-13.

The Jol group of five claims is 1 mile east of Upper Ross Lake, about 45 miles east-northeast of Yellowknife, and adjoins the east boundary of the Peg group of Peg Tantalum Mines, Limited (97). The claims were staked in September 1943 on behalf of Radium Luminous Industries, Limited. They were examined by A. W. Jolliffe and Y. O. Fortier. So far as known they have not been extensively explored.

The prinicipal underlying rock is granodiorite. This is cut by numerous pegmatite dykes, many of which trend about southwest and dip southeast. The pegmatite dykes are offshoots from a pegmatitic muscovite granite body that is younger than the granodiorite and outcrops 1 mile to 1½ miles southeast and east of the claims. Tantalite-columbite and beryl have been noted in the dykes.

July Group (115)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-I-7. Henderson and Jolliffe, 1941. Lord, 1941a, p. 120.

The July group of seven claims is 50 miles east of Yellowknife, 5 miles north-northeast of the north end of Campbell Lake, and 4 miles east-northeast of the Norma claims of Beaulieu Yellowknife Mines, Limited (112). The following account is based on data obtained at the property by the writer in August 1939 and on information supplied by R. J. Stevens of Yellowknife, in June 1947.

The claims were staked by R. J. Stevens and S. Hooker in July 1939, and five men employed on surface work from about August 1 to September 15. Trenching is reported to have been done during the summer of 1941. About 1,000 feet of X-ray diamond drilling (twelve holes) was completed by R. J. Stevens in 1946. Four lodes or quartz veins, known as A, B, C, and D, have been found.

The claims are underlain by greywacke and slate of the Yellowknife group. These rocks are not much altered, and do not contain knots of metamorphic minerals. The beds commonly strike about northwest and are steeply inclined; here and there they are involved in tight folds, the axial parts of which, in many instances, are occupied by lenses and stringers of quartz.

The main, or 'A' lode, is near the boundary between July Nos. 1 and 2 claims. It has been explored along a length of 550 feet by about thirteen trenches and three diamond drill-holes. The lode trends about north 60 degrees west, about parallel with the enclosing, steeply inclined strata. It comprises irregular lenses and interlacing stringers of quartz in greywacke and slate. Many of the quartz bodies strike about north 25 degrees west parallel with steeply inclined joints. The lode may contain 25 per cent, or more, of quartz across a width of 30 feet for a length of 400 feet;

[1] Assayed by Bureau of Mines, Ottawa.

but it lacks sharp walls, and rock with quartz bodies grades irregularly into rock without quartz bodies. A little quartz is coarse grained and milky or glassy; but most is fine grained and light or dark grey, and contains feldspar, many inclusions of wall-rock, a little pyrite, and possibly a very little arsenopyrite, chalcopyrite, pyrrhotite, galena, sphalerite, and visible gold. A little pyrite and arsenopyrite(?) occur in the included fragments of rock and in rock bordering quartz bodies. Several of the most southerly trenches, and two of the drill-holes in the same vicinity, are reported to have afforded samples containing encouraging amounts of gold.

'B' lode is said to be on July No. 6 claim. It has been probed by five diamond drill-holes, and is reported to be exposed for a length of 50 feet, to average 6 feet in width, and to comprise a series of quartz lenses in the axial part of a drag-fold. It is said to contain visible gold and to have afforded high-grade samples across widths of 1 foot to 2 feet.

'C' vein, reported to outcrop in the north part of July No. 1 claim, is said to be narrow and lenticular.

'D' vein, said to be near the boundary between July Nos. 1 and 2 claims, has been probed by four diamond drill-holes; these afforded only low-grade samples.

June Group (116)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-I-7. Henderson and Jolliffe, 1941. Lord, 1941a, pp. 119-120.

The June group of seven claims is 47 miles east of Yellowknife, 4 miles north-northeast of the northeast end of Campbell Lake, and about 1½ miles east-northeast of the shaft of Beaulieu Yellowknife Mines, Limited (112). The property is part of a group of thirty-six claims staked for the Consolidated Mining and Smelting Company of Canada, Limited, by C. Brock and G. 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. Diamond drilling is reported to have been done during 1941. The following description was applicable when the author examined the property 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 vertically; 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 with 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 it is in stringers that range up to about 3 inches in width and lie parallel with 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, but a little 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 variety. 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 vertically, but in many places from 100 to 200 feet on either side of the line the beds strike about northeast and dip steeply northwest or vertically. 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 $\frac{1}{2}$ mile southwest of Discovery zone and on the northwest side of a small lake. A trench in muskeg exposes an area of rock 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 are 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 stock-work in slightly sheared greywacke trends about north 25 degrees west for an unknown distance and was not stripped or trenched. This stock-work may be a continuation of the quartz in the trench, but was reported to contain almost no gold.

The following minerals are reported[2] to occur in the quartz veins: pyrite, arsenopyrite, sphalerite, galena, native copper, and feldspar.

Kal Group (96)

Reference: Henderson, 1939a, p. 13.

The Kal group of twelve claims, 2 miles north of Pensive Lake, was staked by Miller and Williamson in the summer of 1938, and has been described by Henderson as follows:

> The gold occurs in vein quartz lying along a faulted drag-fold in overturned slates and greywackes [Yellowknife group] 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.

[1] Clayton, G. E.: personal communication.
[2] Campbell, N.: personal communication.

Keno Vein (62)

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 consists of two parallel members, the westerly being 1 foot to 3 feet and the easterly 3 to 38 feet in width. To the south the two members join. They parallel 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.

La Salle Yellowknife Gold Mines, Limited (56)

Reference: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-P-4.

La Salle Yellowknife Gold Mines, Limited, owns a gold prospect comprising Bruce Nos. 1 to 8 and Avis Nos. 3 to 6 claims. These lie 50 miles north-northeast of Yellowknife, and adjoin the south boundary of the property of Discovery Yellowknife Mines, Limited (55). A lake about 1 mile long enables aircraft to dock at the tent camp on Bruce No. 4 claim at the south end of the property. The claims were visited on June 27, 1947. J. F. Blue was in charge of five men and G. M. Webster of Yellowknife was consulting engineer.

The property was staked by A. V. Giauque and associates during the summer of 1944. La Salle Yellowknife Gold Mines, Limited, was incorporated in 1944 and, during 1945 and 1946, completed 15,934 feet of diamond drilling. This work appears to have been hastily planned and inadequately supervised and, so far as known, no detailed records are available. Work ceased in June 1946, and, following a reorganization of the company, commenced again in April 1947 under the direction of J. F. Blue. From April to July 1947, when the camp was again closed, a small crew, provided with minimum accommodation, was engaged in geological mapping, stripping, trenching, and sampling. As a result of this work the owners considered two small quartz veins, designated by them as Vein 4 and Vein 5, to be the most promising known gold deposits.

The claims, where mapped, are underlain by rocks of the Yellowknife group. A belt of andesitic rocks, as much as 800 feet wide, outcrops as a prominent ridge that trends about northeast through the Bruce claims, and beyond to the property of Discovery Yellowknife Mines, Limited. These are rusty weathering, fine- to medium-grained, dark green to black, recrystallized rocks containing feldspar, amphibole, and other minerals. In part they are massive or indistinctly foliated and may be lavas. Here and there they are bedded or display distorted fragments similar in composition to the matrix, and are tuffs and agglomerates. Grey-surfaced, thin-bedded, black, probably tuffaceous, argillite and fine-grained greywacke outcrop at intervals near the southeast border of the andesitic rocks and may be interlayered with them. A few of these beds contain well-sorted grains, and face southeast, away from the andesitic assemblage. Elsewhere, the strata lying on either side of the volcanic belt are mainly schistose greywackes, presumably steeply inclined and trending about northeast.

Most exploration has been done on Bruce Nos. 7 and 8 claims, within an area about 2,000 feet long, from southwest to northeast, and 500 feet or more broad, embracing the southeastern half of the volcanic belt and adjacent, tuffaceous sedimentary strata. Most of the diamond drill-holes were directed from southeast to northwest, and many started near the southeast border of the andesitic belt, crosscut it for a length of 300 feet or more but did not, so far as known, encounter ore. Surface prospecting, however, disclosed several quartz veins within the explored area. Most of these strike between north-northeast and north-northwest, and trend obliquely away from the southeast contact of the volcanic assemblage within which they lie. Some of these veins contain gold. Two were examined by the writer and are described below.

Vein 4 is on Bruce No. 7 claim on the steep, southeastern slope of the ridge that marks the belt of andesitic rocks. Drift and muskeg lie at the foot of this slope and may cover the contact between the andesitic rocks and sedimentary strata. The wall-rock is fine-grained, dark green, recrystallized and foliated andesitic agglomerate. The foliation strikes northeast and is nearly vertical. No bedding was recognized. The vein strikes about north 15 degrees west and dips about 40 degrees west. It is nearly continuously exposed for 120 feet and averages about a foot in width. At the south end of the exposure it is 1·2 feet wide and passes under talus at the base of the slope; and at the north end it is 0·5 foot wide, and disappears in rusty fractured rock that has not been thoroughly stripped. The vein walls are commonly sharp, and the quartz separates readily from the wall-rock, which, however, is not sheared parallel with the vein walls. The quartz is well fractured, light to dark grey, and contains less than 1 per cent of arsenopyrite and pyrite. The company's consulting engineer reports that sampling indicated 0·889 ounce of gold a ton across an average width of 1·02 feet for a length of 129 feet.

Vein 5, also on Bruce No. 7 claim, lies about 600 feet northeast of Vein 4 and in similar agglomerate. It strikes about north, dips 40 to 50 degrees west, is continuously exposed for about 90 feet, and averages nearly $1\frac{1}{2}$ feet in width. At the north end of the exposure it is about 0·5 foot wide, and passes under drift; and at the south end it narrows to a thin seam before passing beneath drift. The vein is otherwise similar to Vein 4 except that visible gold is abundant. The owners state that samples indicate an average grade of 0·787 ounce of gold a ton across a width of 1·37 feet for a length of 92 feet.

Leta Explorations, Limited (29)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 86-B-6. Stanton, 1947, p. 20.

Leta Explorations, Limited, has done surface trenching and diamond drilling on the Lobo group of about twenty-one claims, $3\frac{1}{2}$ miles west-northwest of Chalco Lake.

The following description is by Stanton, based on an examination in 1946. The sedimentary strata referred to are members of the Yellowknife group.

....Surface trenching and X-ray diamond drilling have been done on showings on the Lobo No. 21 claim. Other showings on the group, if present, have not yet been visited.

The showing on the Lobo No. 21 claim is near the west shore of a small lake. Trenching and stripping have been done across a width of 60 feet of the main showing. The zone consists of numerous quartz veinlets, stringers, and lenses lying in sheared greywacke and slate. Graphite schist occurs locally. At the workings, the sedimentary rocks strike generally north 20 degrees east and dip vertically. Local drag-folds have developed and these plunge northward at about 55 to 60 degrees, and the quartz masses, to some extent at least, follow along these folds. This may account for the fact that the zone does not appear to continue along the strike. The quartz is glassy white to grey. Individual quartz lenses vary greatly in size, the largest seen being 3 feet wide. Minerals include sparse pyrite and galena. A little ferruginous carbonate is associated with the quartz.

One hundred and fifty feet southwest of the above showing, trenching and stripping expose a zone of quartz veins, lenses, and stringers across a width of about 10 feet, lying in slates and greywackes that strike north 40 degrees east and dip vertically. The quartz is white to grey, glassy, and mineralization is sparse. Fifty feet southwest along strike, trenching exposes only a few white to grey quartz stringers in sedimentary rocks. A little limonitic rust was noted.

Numerous other pits and strippings occur on the property, in slates and highly sheared greywackes, but no quartz veins or metallic minerals were seen. At least seven holes totalling 700 feet have been drilled across the zone.

Lexindin Gold Mines, Limited

(Leta Group) (35)

(*See* Figure 10)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 86-B-6. Stanton, 1947, pp. 16-18.

INTRODUCTION

Lexindin Gold Mines, Limited, owns the Leta group of twenty claims at the north end of Leta Arm, a bay on the north shore of Indin Lake. The property lies immediately north of that of Diversified Mining Interests (Canada), Limited (34), and about 130 miles north-northwest of Yellowknife. It comprises a rectangular area about 1 mile from east to west and $2\frac{1}{4}$ miles from north to south. Aircraft afford access from Yellowknife. A. F. Seraphim was in charge when the author visited the property on August 7, 1947; work stopped shortly thereafter.

HISTORY

The Leta claims were staked late in 1944, on behalf of Leta Explorations, Limited, by F. Hoey and R. Hingst, and were acquired by the present owners in the spring of 1945. Trenching and a little diamond drilling were done during the summer of 1946, and encouraging drill cores recovered from the main (No. 1) zone. Drilling was resumed in December, and continued until August 8, 1947, when all work ceased. The property was inactive during 1948.

EXPLORATORY WORK

Thirty-two diamond drill-holes, totalling 14,161 feet, have been completed. Most of this work was done on No. 1 zone, which lies beneath Leta Arm; but about one-quarter of this footage was used to probe beneath Leta Arm and for a short distance north of the Arm, in a fruitless effort to locate the northerly extension of No. 1 zone. About 1,000 cubic yards of rock have been blasted from trenches and pits.

GEOLOGY

The claims are underlain by volcanic and sedimentary rocks of the Yellowknife group. The volcanic rocks, altered andesitic and dacitic lavas (greenstones) and related pyroclastic facies, form a northerly trending belt up to about $\frac{1}{4}$ mile wide on the west side of Leta Arm. Steeply inclined greywackes, slates, and argillites, which trend north or north-northeast, outcrop on either side of the volcanic belt and underlie Leta Arm. Leta fault, a steeply inclined fault that has been traced many miles north of the property, intersects the sedimentary strata and extends southerly through the property. It lies beneath Leta Arm and, on Diversified property to the south, crosses the neck of land that joins Inca Peninsula to the mainland. Two left-hand faults strike about northwest and traverse the Lexindin property west of Leta Arm. Deposits of gold-bearing quartz have been found in volcanic and sedimentary rocks, but the main (No. 1) zone lies in the latter.

DESCRIPTION OF DEPOSITS

No. 1 *Zone* (*See* Figure 10, locality 8), on Leta No. 8 claim, lies beneath Leta Arm and, accordingly, the following description is based on diamond drill data supplied by the owners. The zone is about 350 feet east of, and approximately parallel with, the contact between the enclosing sedimentary strata and the volcanic rocks. It has been explored by eighteen drill-holes to a vertical depth of about 400 feet for a length of 500 feet. The zone strikes north 40 degrees east, and dips about 75 degrees northwest. Its width ranges from about 5 to 20 feet and may average nearly 10 feet. The zone approximately parallels the enclosing strata in dip and strike, but not exactly so, as it is bounded by different beds from place to place. To the southwest it enters the property of Diversified Mining Interests (Canada), Limited, and to the northeast ends against a graphitic shear zone, probably a fault. As previously mentioned, No. 1 zone has not been located north of this shear zone, although drill-holes have probed the ground in this direction for 4,300 feet.

The graphitic shear zone strikes about north 30 degrees east, is nearly vertical, and 15 to 40 feet in width. The relative attitudes of it and the No. 1 zone are such that their intersection plunges steeply north-northeast and thus, with increased depths, progressively greater lengths of No. 1 zone are expected to lie between the south boundary of the property and the graphitic, sheared, probable fault zone.

The rocks within No. 1 zone are sheared, thin-bedded slate and argillaceous greywacke. These are cut by a multitude of quartz veins comprising 50 per cent or more of the zone. The quartz is sugary and mottled, and contains a little pyrite, arsenopyrite, pyrrhotite, chalcopyrite, and visible gold. Most diamond drill-holes intersected the zone at vertical depths of about 200 or 325 feet. The reported[1] dimensions and grade of the gold-bearing material encountered at these horizons are tabulated below; but the true grade might differ substantially from that indicated by the samples from the widely spaced drill-holes at the 325-foot horizon.

Approximate vertical depth	Number of diamond drill intersections	Length	True width	Gold (uncut grade)
Feet		Feet	Feet	Ounce a ton
200	8	400	3·7	0·475
325	5	460	3·0	0·20

Other deposits on the Leta group have been described by Stanton, as quoted below:

A-, B-, and C-Zones (Leta No. 9 Claim) [*See* Figure 10, locality 6]. These three zones lie about 1,300, 900, and 500 feet respectively west of the west shore of Leta Arm. They were not inspected, but are reported to be a northerly trending series of grey quartz lenses in silicified zones and in sheared greywackes. The C-zone is reported to be mineralized with some pyrite, pyrrhotite, chalcopyrite, and galena.

D-Zone (Leta No. 8 Claim) [*See* Figure 10, locality 7]. This zone is on the west shore of Leta Arm at the southern end of the Lexindin property, and is the northern extension of No. 2 zone of Diversified Mining Interests, Limited. Trenching exposes two grey quartz veins or lenses, each 12 to 14 inches wide, lying in sheared sedimentary rock and separated by about 20 feet of schist and slaty greywackes. The schistosity strikes north 15 to 20 degrees east and has a steep to vertical dip. The quartz is mineralized with pyrite.

E-Vein (Leta No. 5 Claim) [*See* Figure 10, locality 5]. The E-vein is on the west side of Leta Arm about 1,100 feet north of the D-zone. It is a grey-white to brownish, glassy to sugary quartz vein 2½ feet wide, exposed for 35 feet along the strike. It trends north 35 degrees east, and dips about 70 degrees northwest. The vein is in highly sheared slaty argillites near the contact with pale green carbonatized volcanic rocks to the west.

G-Zone (Leta No. 7 Claim) [*See* Figure 10, locality 9]. This zone is near the east shore of Leta Arm east of the D-zone on the opposite shore. It consists of quartz veins and lenses in massive and sheared greywacke striking north 10 to 15 degrees east. The quartz is white and grey, glassy and sugary, and is mineralized with pyrite and arsenopyrite. The main vein is up to 2½ feet wide, but pinches and swells along the strike and down the dip, and divides into two or more veins. The zone has been explored by trenches for 150 feet along its strike. In the northern trench, it consists of numerous quartz stringers and lenses in rusty schist across a width of about 12 feet. It is reported that gold can be panned from the oxidized material.

H-Zone (Leta No. 5 Claim) [*See* Figure 10, locality 4]. The H-zone is on the east shore of Leta Arm, about 2,000 feet north of the G-zone, and has been exposed by trenching for 125 feet along strike. It consists of a series of quartz stringers and lenses occupying a shear zone in greywackes. At the southern exposure, on the shore, the lens is 1½ feet wide, narrowing northwards. A trench 20 feet farther north exposes three or four narrow quartz stringers across a width of 10 feet. Northward, trenching exposes a 20-foot zone of rusty, sheared greywackes containing a few small quartz stringers and lenses. The strike of the schistosity varies, but averages north 35 degrees east.

[1] Lexindin Gold Mines, Limited: Annual Report for the Year Ended December 31st, 1947.

I-Zone (Leta No. 13 Claim) [*See* Figure 10, locality 1]. This zone lies about 1,500 feet north of the north tip of Leta Arm, and just east of a small lake. The zone is exposed by ten trenches and by stripping for a length of more than 500 feet, although the southern 120 feet appears weak or barren. Surface examination indicated two, northerly trending, approximately parallel zones. These lie in greywackes and argillites that strike from north 15 to 20 degrees east and dip from vertical to about 80 degrees east. At the northernmost trench, the west zone is exposed as a white to rusty quartz vein 1 foot wide in rusty, sheared sedimentary rock. Southwards the zone widens lens-like to a maximum of 40 feet, and consists of a series of mineralized white to grey quartz stringers, lenses, and veinlets in rusty greywackes and carbonatized argillites. Farther south, the zone splits in two, or contains a barren horse, and lenses out. Much of the host material for the quartz stringers is sheared greywacke that has weathered into a rusty decomposed regolith. The schist zones also contain blocks and lenses of a dark grey, fine-grained, hard, igneous rock, composed dominantly of quartz and albite, and which commonly contains coarsely crystalline arsenopyrite. Pyrite and pyrrhotite are commonly present in both quartz and schist.

The east zone is narrower, is separated from the west zone by 25 to 50 feet of sedimentary rock, and is exposed by four trenches for a length of more than 300 feet. It is composed of grey to white quartz stringers and gash veinlets in fractured and brecciated greywackes. Where exposed the zone has a maximum width of 20 feet.

K-Zone (Leta No. 2 Claims) [*See* Figure 10, locality 3]. This zone is at the north end of Leta Arm on the east shore, and about 1,500 feet south of the I-zone. It is a series of narrow lenses and stringers of grey to white quartz occupying parts of a rusty shear zone in greywacke. The shearing strikes from north to north 10 degrees east, and dips about 80 degrees west. Trenching exposes the zone for about 200 feet. One or two small, parallel quartz veins lie a few feet to the east. The shear zone varies in width from 4 to 20 feet. About 200 feet farther south, at the lake shore, a few small quartz stringers occur in slates and greywackes that strike north 15 degrees east and dip 80 degrees east.

U-Zone (Leta No. 12 Claim) [*See* Figure 10, locality 2]. This zone, 1,500 to 1,800 feet northeast of the north end of Leta Arm, consists of showings of grey quartz lenses, stringers, and veinlets in slates and shaly greywackes. The most easterly showing, which strikes north 25 degrees east, has been opened by trenches for about 80 feet. Considerable limonitic, rusty material is present, and it is reported that gold was obtained from this in panning.

About 300 feet west of the above showing, another has been exposed along strike for 150 feet and across a width of 20 feet. It consists of discontinuous grey to white quartz lenses and stringers in rusty slates that strike north 15 degrees east and dip about 80 degrees east.

About midway between the above two showings is a lens of grey glassy quartz 25 feet long and with a maximum width of 3 feet. It lies in greywackes and strikes north. The above three showings may not all be included within the U-zone.

Lexindin Gold Mines, Limited

(Lex Group) (36)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 86-B-6. Stanton, 1947, pp. 14-16.

Lexindin Gold Mines, Limited, owns the Lex group of fifteen claims at Lex Lake, about 2 miles northwest of their Leta group (35). The Lex group is about 130 miles north-northwest of Yellowknife.

Stripping and trenching were done on seven zones, and diamond drilling on some of these. By December 31, 1945, diamond drilling amounted to 3,005 feet. No work was done on the claims during 1947. The property was examined by Stanton in 1946 and zones A, B, C, D, E, G, and H described as follows:

A-Zone (*Lex No. 4 Claim*). This showing lies immediately west of the large island in Lex Lake. Trenching exposes quartz-carbonate veinlets and stringers filling fractures in recrystallized andesites. Metallic minerals include pyrrhotite and coarse arsenopyrite crystals up to an inch in length. The zone trends north 30 degrees east, and must be close to the andesite-greywacke contact beneath the lake. It was explored by three diamond drill holes along a strike length of 460 feet, and although wide is reported to carry low average gold values.

B-Zone (*Lex Nos. 3 and 5 Claims*). The B-zone is on the west side of the blunt peninsula immediately east of the large island in Lex Lake. It consists of a series of quartz lenses lying within pale green dacitic volcanic rocks. Trenching exposes three main lenses within a length of 600 feet. The vein quartz is white to grey, and has some associated carbonate, and quartz widths, where seen, range from 1 foot to 7 feet. Strikes are north 25 degrees west at the south exposure, north 50 degrees west at the central lens, and north 60 degrees east at the north exposure. The dip of the south lens is 85 degrees west. Pyrite is the principal metallic mineral, with minor pyrrhotite and chalcopyrite. Gold values are reported to be low.

Immediately northeast of the volcanic rocks is a narrow belt of slates and shaly greywackes, and surface mapping suggests that the peninsula forms the east limb of a large drag-fold whose major axis lies in the southwest part of Lex Lake. The plunge is not known, but shearing suggests it may be about 60 degrees to the south.

C-Zone (*Lex Nos. 3 and 5 Claims*). The C-zone is about 500 feet east of the B-zone, and lies in a sheared region near the contact between pale green dacitic volcanic rocks to the east and a narrow belt of slates and shaly greywackes to the west. Some grey quartz and carbonate occupy parts of the zone. Metallic minerals include pyrite and pyrrhotite. Trenching has traced the zone for 100 feet, and four drill holes have explored the zone for a length of 300 feet. A narrow zone of rather low gold values is reported.

D-Vein (*Lex No. 1 Claim*). This vein occurs on the small peninsula halfway along the west shore of Lex Lake. It is a northerly-striking grey vitreous quartz vein lying in greywackes and exposed by stripping for 50 feet. Some pyrite mineralization occurs, and a little gold is reported in panning.

E-Zone (*Lex Nos. 1 and 10 Claims*). The E-zone lies 175 feet west of the D-zone. Trenching exposes grey glassy quartz lenses in sheared greywackes for a distance of several hundred feet. It is reported that no gold values were obtained in panning.

G-Zone (*Lex No. 1 Claim*). The G-zone was located on a point on the west side of Lex Lake about 2, 200 feet south of the E-zone, and consists of white to bluish grey quartz lenses in argillites and shaly greywackes. It is reported that trenching and panning for a length of 500 feet gave negative results.

H-Zone (*Lex No. 12 Claim*). The H-zone lies about 1,600 feet west of the D-zone, and carries arsenopyrite and some grey to white quartz in recrystallized andesites.

The volcanic and sedimentary formations referred to are those of the Yellowknife group.

Lil and Lilex Groups (68)

Reference: Jolliffe, 1940a, p. 8.

The Lil and Lilex groups of eighteen claims were about 29 miles north of Yellowknife, on the south side of the Mon group (67). 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.

Lita Nos. 5 and 6 Claims (125)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-I-7. Jolliffe, 1944a, pp. 15, 16.

Lita Nos. 5 and 6 claims lay on the west side of the north end of Buckham Lake, about 55 miles a little south of east from Yellowknife. They were staked in September 1943 by W. L. McDonald for Frobisher

Exploration Company, Limited, but appear to have been re-staked as P.N. Nos. 1 and 2 claims. Spodumene-bearing pegmatites, locally known as the Campbell pegmatites, have been described by Jolliffe as follows:

Scattered exposures of pegmatite occur within an area extending southwesterly along the north shore of Buckham Lake for about 2,400 feet, and inland for less than 200 feet. The country rock is nodular greywacke that strikes northeast and dips about 75 degrees northwest, parallel or nearly so to the pegmatite bodies. Some of the five pegmatites described separately below may be parts of the same body.

The northernmost pegmatite is represented by two outcrops 50 feet apart, up to 35 feet in diameter, and wholly surrounded by drift. One hundred and thirty feet south across the bedding a second sill begins in nodular greywacke and can be traced 250 feet southwest to where it ends in drift; in this distance it is up to 30 feet wide and averages 15 feet. Five hundred and fifty feet southwest across drift a third sill outcrops at intervals for a length of about 200 feet; it has an average width of 4½ feet. Parallel to this, and 150 feet to the southeast, a fourth sill lies along the lake shore for 150 feet and averages 5 feet in width. About 900 feet farther southwest a fifth pegmatite body has an exposed length of 350 feet and is up to 50 feet wide, but tapers to about 10 feet at either end where it passes beneath drift.

The pegmatite bodies all carry about 50 per cent cleavelandite, 20 per cent quartz, 5 per cent muscovite, and variable amounts of coarse microcline-perthite. Spodumene occurs in crystals up to nearly 4 feet long and may comprise between 15 and 25 per cent of the rock. The distribution of spodumene is less regular than in the McDonald deposit. Other rare-element minerals present include amblygonite, lithiophilite, beryl, lazulite, and tantalite-columbite. In the four northern sills the tantalite-columbite occurs as scattered tiny blades up to ¼ inch long, chiefly within cleavelandite. In the southernmost pegmatite body it is present in crystals up to 1½ inches by ½ by ⅛ inch, one of which, containing some gangue, showed a specific gravity of 6·4 on a Westphal balance.

Lucky Group[1] (117)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-I-7. Henderson and Jolliffe, 1941.

The Lucky group of nine claims, about ½ mile west of Gilmour Lake, was staked by A. Woyna in June 1940. A little surface work was done during the summer of 1940 and several quartz veins found.

Vein 5 is on the Lucky No. 2 claim. It strikes north 15 degrees west, dips easterly at 85 degrees, and is parallel with the bedding of the enclosing Yellowknife sedimentary rocks. The vein is exposed for 100 feet or more. The southern 29 feet averages 6 inches in width and contains about 1·4 per cent WO_3 as scheelite. A fault crosses the vein 4 feet north of this shoot, and the vein north of the fault is offset 2 feet west relative to the vein south of the fault. Only a very little scheelite occurs north of the fault.

Lynx Yellowknife Gold Mines, Limited (78)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-J-9. Jolliffe, 1938, p. 29; 1946.

Lynx Yellowknife Gold Mines, Limited, owns the Fox claim and about thirteen adjacent claims of the Fox group. The Fox claim is 1¾ miles northwest of the head of Yellowknife Bay, and adjoins the northwest boundary of the property of Akaitcho Yellowknife Gold Mines, Limited (71). The northwesterly trending Akaitcho fault lies between the Fox claim and the main known Akaitcho gold deposits. The following quotation is from a report by Jolliffe in 1938.

[1]Described from data supplied by A. W. Jolliffe and the Consolidated Mining and Smelting Company of Canada, Limited.

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 1936-37 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 [Yellowknife group] occur in the generally massive, green to brown-weathering country rock. 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.

Considerable work, including diamond drilling, geological mapping, and surface prospecting, was done on the Fox group by Lynx Yellowknife Gold Mines, Limited, during 1945, 1946, and 1947. Drilling during 1947 amounted to about 9,000 feet. No orebodies were found, but the zone described above is reported to have been traced several thousand feet farther northeasterly. It is now known to dip gently southeast, whereas the schistosity in the surface trenches is steeply inclined.

McLean Bay Uranium and Thorium Deposit (133)

Reference: Lang, 1949, p. 13.

Lang has described a radioactive deposit near the southeast shore of McLean Bay, about 130 miles east of Yellowknife, as follows:

Uranium and thorium occur in hematite-bearing dolomite of the Great Slave group, of Proterozoic age, on the south shore of the east arm of Great Slave Lake. It is not yet definitely known whether the radioactive minerals in the dolomite are original sedimentary constituents or whether they were introduced...

Mercury Gold Mines, Limited (24)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 86-B-12. Lord, 1941a, pp. 61-62; 1941b, pp. 7-8; 1942a, pp. 45-46.

INTRODUCTION

Mercury Gold Mines, Limited, owns a gold prospect about 150 miles north-northwest of Yellowknife, and 2 miles east of Arseno Lake. The property comprises the following thirty-seven claims: Dingo Nos. 1 to 6, 11 to 16, 19 to 35, and 37 to 39, and J.M. Nos. 1 to 5. The claims lie about 350 feet above Arseno Lake, which enters Emile River about 6 miles southwest of the property. Probably more than 85 per cent of the bedrock on the claims is covered with drift or muskeg. Aircraft from Yellowknife land on Arseno Lake, or on a small lake (4,500 feet long) on the south part of the property. Tractor trains have used a 120-mile winter route to the property from Fort Rae on the North Arm of Great Slave Lake; the route is mainly over ice and is reported to be good except for the climb of several hundred feet from Emile River to the property. The writer visited the claims in 1939, and geologically mapped the surrounding area in 1940. A. W. Jolliffe briefly examined the property in September 1941. The following account is based on data gathered at these times, and on information supplied by the company through J. D. Mason.

HISTORY

The Dingo claims were staked by J. D. Mason in July 1939, and a few men were employed on the property, under his direction, during the summers of 1939 and 1940. Thereafter, about twelve men under the direction of W. G. Stewart, were employed in trenching and diamond drilling until about September 5, 1941, when work stopped. Mercury Gold Mines, Limited, was incorporated in May 1940. A steam mining plant (since partly removed) and other items, amounting to about 100 tons, was hauled to the property by tractor trains from Fort Rae in April 1941. This freighting was done by Yellowknife Transportation Company, Limited. A site suitable for the development of hydro-electric power on Emile River, about 8 miles southwest of the property, was investigated from February to September 1941; and as a result about 1,200 horsepower were reported to be available without unusual construction problems. The camp was reopened in 1946 under the direction of K. Kidder, when about fourteen men completed a program involving diamond drilling, a magnetometer survey, bulk sampling, prospecting, and geological mapping at 1 inch to 400 feet. No work was done during 1947 or 1948.

CAMP

The camp, of three log cabins, is on Dingo No. 26 claim.

EXPLORATORY WORK

Many quartz veins have been explored by stripping, trenching, and diamond drilling. Diamond drilling done in 1941 amounted to 5,342 feet; in 1946, about 7,600 feet.

Ordinary channel samples cut from the veins gave inconsistent results, and a system of bulk sampling was finally adopted as more satisfactory. Veins were stripped of overburden and a fresh surface exposed by blasting. Samples from the entire surface of each vein were then blasted off in 5-foot sections, passed through a small crusher, and reduced to suitable bulk in a Jones splitter. The reduced samples were sent by aircraft to Yellowknife for assay.

GEOLOGY

Lava flows of the Yellowknife group are the most abundant rocks on the property. They are medium-grained, dark green, steeply inclined greenstones that probably strike about north-northwest. Pillows and banded flow structures were noted here and there.

Altered dioritic rock is common within the lava flows, probably, in part at least, as dykes and sills.

Medium- to coarse-grained, pink, granitic rock outcrops along the east side of the property, and pink aplitic dykes that cut the adjacent greenstones are probably related to it.

The lavas are also cut by acidic porpyhry dykes that weather light grey and contain a few small phenocrysts of quartz or feldspar, or both, in a light to dark grey, very fine-grained groundmass. The dykes range up to about 30 feet in width, are steeply inclined, and commonly strike about north-northwest. Although well mineralized in places, they are not known to contain significant amounts of gold.

DESCRIPTION OF DEPOSITS

Numerous quartz veins, some of which contain gold, occur in shear zones cutting the lava flows, the altered dioritic rocks, or the porphyry dykes; or in shear zones lying at the borders of the porphyry dykes. Shear zones and veins commonly strike between north-northwest and west-northwest and dip steeply northeast. The exposed parts of most veins are between 6 inches and 6 feet wide and may average 2 or 3 feet. In most places the quartz has sharp walls against the enclosing schist. The veins are commonly sinuous, and are offset here and there by minor faults. In many instances metallic minerals constitute several per cent of a vein, and here and there they form as much as 30 per cent. They include the following, in approximate order of abundance: chalcopyrite, pyrrhotite, pyrite, galena, marcasite(?), sphalerite, a soft, fibrous, grey, sectile metallic mineral that contains bismuth, and native copper and gold. Visible gold is rare. Non-metallic minerals noted in the quartz include chlorite, pink feldspar, a pale buff carbonate, and pale violet fluorite. Quartz bodies containing considerable gold were indicated by bulk samples taken at the surface but, so far as known, diamond drilling failed to indicate substantial orebodies at depth. The most promising veins are reported to be Nos. 1, 2, 4, and 18, as described below.

No. 1 Vein, on Dingo Nos. 12, 14, and 15 claims, is said to strike about north 30 degrees west and dip about 70 degrees northeast. It has been explored by trenches and numerous diamond drill-holes. Bulk sampling at the surface is reported to indicate that 175 feet of the vein averages 5·8 feet in width and contains 0·4 ounce gold a ton.

No. 2 Vein was formerly known as the Galena vein. It is on Dingo No. 4 claim, and has been explored for a length of 850 feet or more by trenches and diamond drill-holes. The vein strikes about north 35 degrees west, and dips about 80 degrees northeast. The following description was applicable in 1939:

At the northwest end of the trenches the vein branches and passes under drift; at the southeast end of the trenches it passes under muskeg that borders a lake. The vein is in a shear zone in greenstone. The shear zone ranges from 2 to 6 feet in width and may branch in places. The width of the quartz vein ranges from 1 foot 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 branch 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 about 0·25 ounce of gold a ton over an average width of about 2½ feet.

Later data supplied by the owners indicated that 932 feet of the vein averaged 2·58 feet in width and contained 0·28 ounce gold a ton.

No. 4 Vein is on the Dingo No. 2 claim. The following information was derived from owners' data. The vein has been explored by a few diamond drill-holes and stripped for 330 feet or more. It strikes about north 45 degrees west, dips 85 degrees southwest to 65 degrees northeast, and is broken by several faults with an apparent maximum horizontal displacement of 12 feet. Visible gold was noted in several places. Bulk sampling of 300 feet of the vein, which averages 1·25 feet in width, indicated a grade of 0·35 ounce gold a ton.

No. 18 Vein, discovered in 1946, is also described from owners' data. It is on the Dingo No. 5 claim about midway between Nos. 2 and 4 veins. It strikes about north 65 degrees west. Two hundred and forty feet of the vein at the surface averages 1·3 feet in width and contains, according to bulk sampling, 0·32 ounce gold a ton.

Mindot Group (91)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-I-14. Henderson, 1941c.

The Mindot group of twenty-eight claims is 53 miles northeast of Yellowknife, on the east side of Allan Lake, an expansion of Cameron River. Aircraft operate with ease from Allan Lake, and a winter tractor road leads from Yellowknife to Camlaren mine (64), 7 miles northwest of the property. The writer visited the claims on September 1, 1947, and at that time three men, under the supervision of E. M. Johnston, were engaged in prospecting from a tent camp on Allan Lake.

The claims were staked on behalf of Gateway Gold, Limited, by H. Drever and E. M. Johnston in May and August 1947. A vein discovered by H. Drever on August 5, 1947, afforded high-grade samples of gold-bearing quartz and shortly thereafter attracted widespread interest. The writer's examination was confined to this vein and its immediate vicinity.

The claims are underlain by volcanic rocks of the Yellowknife group. These are pillowed andesitic lavas and related pyroclastic rocks, and comprise part of a belt of similar rocks, about 2 miles wide and more than 25 miles long, that lies along the southeast side of Cameron River. This belt is bordered on the northwest by younger, sedimentary strata of the Yellowknife group, and on the southeast by granodiorite and related rocks of post-Yellowknife age.

The quartz vein examined, said to be on Mindot No. 14 claim, is about $\frac{3}{4}$ mile south of the camp on Allan Lake. The adjacent rocks are well-pillowed, jointed, basaltic or andesitic lavas and have been recrystallized to fine-grained aggregates of, mainly, feldspar and amphibole. They weather dark green to nearly black, and contain rare $\frac{1}{8}$-inch, white amygdules and scattered, rounded to angular feldspar phenocrysts commonly $\frac{1}{4}$ to $\frac{1}{2}$ inch long. The pillows are not distorted and, by their shape, indicate that the flows face northwesterly. The flows are probably steeply inclined and trend about northeast. The vein has an average strike of about north 30 degrees east and in most places dips between 20 and 35 degrees southeast; local steeper or more gentle dips were noted. It is exposed by seven trenches for a length of 84 feet, and averages slightly less than 1 foot in width. The vein ends as a thin film of quartz about 45 feet beyond the most northerly trench, and a joint in which this film occurs extends a few feet farther north before it, too, ends. A quartz vein, 2 or 3 inches wide, is exposed on a cliff face about 75 feet south 30 degrees west from the most southerly trench and may be continuous with the vein exposed in the trenches. The vein walls, where not obscured by iron oxide, are sharp and unsheared. The adjoining lava, for as much as 3 inches from the vein, contains disseminated crystals of arsenopyrite up to $\frac{1}{4}$ inch long; or has weathered to soft rusty material. The vein quartz is white, light grey, or rarely dark grey, and is coarse grained and glassy. Much of it is thoroughly shattered, and stained with iron oxide. No rock inclusions were noted. Vugs, 1 inch or more in diameter, are common and are lined with projecting quartz crystals. Primary metallic minerals comprise less than 1 per cent of the vein and include, in approximate order of abundance, chalcopyrite and arsenopyrite, native bismuth[1], and gold. The last two minerals were seen only in Trench 6[2]. Secondary minerals, in addition to much iron oxide, include malachite and native copper. The gold occurs as films, in quartz or in contact with bismuth or arsenopyrite. The following chip samples[3], collected by the Geological Survey of Canada, were assayed by the Bureau of Mines, Ottawa.

Trench	True width sampled	Gold	Silver	Tellurium
	Feet	Ounces a ton	Ounces a ton	
1	1·0	0·30	0·06	None detected
3	0·6	1·51	0·88	None detected
5	0·8	1·88	0·30	None detected
7	1·2	0·085	0·075	None detected

Mon Group (67)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-J-16. Jolliffe, 1940, p. 8.

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 [Yellowknife group] (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.

[1] Identified by E. Poitevin, Chief, Mineralogical Section, Geological Survey of Canada.
[2] Trenches are spaced at approximately equal intervals along a vein length of 84 feet, and numbered 1 to 7 from south to north.
[3] No sample was taken from Trench 6, which, apparently, contained the most gold.

Murphy-Bell Group (79)

Reference: Stockwell and Kidd, 1932, pp. 73, 74.

The Murphy-Bell group. . . [now lapsed] comprised 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 [Yellowknife group], 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, 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.

Negus Mines, Limited (80)

References: Bureau of Mines, 1940c; 1941d; 1943a. Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-J-8. Campbell, 1947b. Henderson and Brown, 1948. Jolliffe, 1938, pp. 19-28; 1942a. Lord, 1941a, pp. 112-118. Ridland, 1941.

INTRODUCTION

Gold is produced on the Negus group of six claims by Negus Mines, Limited. The claims are on the west side of Yellowknife Bay 2 miles south of Yellowknife, and immediately east and south of the Con and Rycon (73) properties. The mine is connected with Yellowknife by a good gravelled road and by telephone. It was examined in July 1939, October 1947, and September 1948; and, with a few stated exceptions, the following account applies on about the last date. The staff includes: J. G. McNiven, mine manager; E. C. Rudd, assistant manager and mine superintendent; and T. W. Dawson, mill superintendent.

HISTORY

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 done during the winter of 1937-38. Negus Mines, Limited, was incorporated in January 1938 with W. G. Stewart as manager. 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

[1] Assay by A. Sadler, Mines Branch, Department of Mines, Ottawa.

plant was ordered in the spring of 1938. Sinking commenced on the main, vertical shaft (No. 2 shaft), 600 feet northwest of No. 1 shaft, in September 1938. The 50-ton mill began operations on February 5, 1939, and at that time no work, except diamond drilling, had been done below the 100-foot level. The mine became the second gold producer in the Northwest Territories when the first gold brick was poured on February 21, 1939. J. G. McNiven was appointed mine manager at about that time. The first dividends afforded by any mine in Northwest Territories were paid by the Negus company in April 1941. The mill operated continuously until October 18, 1944, when it was closed due to a labour shortage and other problems attending World War II. Development work, however, continued on a reduced scale, and No. 2 shaft was deepened from the 950-foot to the 1,250-foot level. When milling was resumed on July 16, 1945, Negus became, for about a year, the only producing gold mine in Northwest Territories. Operations in 1945 showed a net loss, as did those for 1946 and 1947. In the meantime, a geological investigation, carried out by N. Campbell[1] in 1944, led to the concept that the southwesterly extension of the Giant (76) system of ore-bearing shear zones had been displaced southeasterly by the West Bay fault and that a wide shear zone or zone of shears would be found at depth on the Negus (and Con and Rycon) property. Whereas previous mining had been done near and south of No. 2 shaft, the new zone was expected to lie well east of the shaft (then about 1,340 feet deep). This theory was confirmed early in 1946 when diamond drill-hole No. 10-1, directed downwards and easterly from the lowest, 1,250-foot station in No. 2 shaft, intersected gold-bearing material in what promptly and appropriately became known as the Campbell system of shear zones. Two other holes, soon drilled from the surface in about the same vertical plane as hole No. 10-1, encountered other gold-bearing sections in the Campbell system and established its upward continuation and westerly dip. Between December 1, 1946, and about August 1947, No. 2 shaft was deepened to about 1,940 feet. Crosscuts easterly from the shaft on the 1,775-foot and 1,425-foot levels encountered gold in the Campbell system in February 1948 and June 1948, respectively. In the meantime, during the summer of 1947, freight received at the property provided for enlarging the capacity of the mill from 70 to 170 tons a day, corresponding additions to the plant, and the construction of various buildings and quarters; and by the end of 1947 known ore in the old workings above the 1,250-foot level became nearly exhausted[2]. By July 1948 the mill was treating about 167 tons of ore daily, most of which came from the Campbell system.

PRODUCTION AND ORE RESERVES

Negus mine, as mentioned, was the second gold mine in Northwest Territories to reach the producing stage. However, because it stopped milling for only a relatively brief period during wartime, it has now more milling time to its credit than any other gold mine in this part of Canada. The following table shows metals produced between February 5, 1939, and December 31, 1948, but does not include gold and silver contained in flotation concentrates stock-piled during 1948.

[1] District Geologist, The Consolidated Mining and Smelting Company of Canada, Limited.
[2] Negus Mines, Limited: Ninth Annual Report, the Fiscal Year Ended December 31, 1947, p. 6.

Year	Ore treated	Gold	Silver
	Tons	Fine ounces	Fine ounces
1939	18,996	15,995	3,613
1940	21,580	21,075	4,378
1941	22,310	18,349	3,676
1942	25,458	19,637	3,884
1943	22,333	19,080	4,791
1944[1]	18,869	20,723	5,420
1945[2]	10,039	8,655	2,033
1946	24,419	15,772	4,051
1947	25,356	17,118	4,763
1948	51,497	23,303	5,989
Total	240,857	179,707	42,598

[1] Mill idle from October 18 to December 31.
[2] Mill idle from January 1 to July 16.

Ore reserves on December 31, 1946, were reported by the company as 38,700 tons averaging 0·63 ounce gold a ton, and 3,000 tons of possible ore averaging 0·80 ounce gold a ton. No more recent estimate has been released by the owners. Most indicated or possible ore is in the Campbell system, but, to September 15, 1948, insufficient work had been done there to warrant a statement of ore reserves[1].

CAMP AND PLANT

The camp buildings and mine office are on the west shore of Yellowknife Bay. They include a two-story combined office and staff quarters, a two-story recreation hall, cook-house, food warehouses, garages, seven residences, and nine new bunk-houses. The bunk-houses replace a former two-story bunk-house destroyed by fire in December 1946, and are designed to provide safer accommodation. Each is sheathed with asbestoside and contains four double rooms, a living room, and a wash room.

A village about ¼ mile south of the camp contains company and privately owned residences.

The mining and milling plant, at No. 2 shaft about 1,700 feet west of the camp, includes mill, shafthouse and 90-foot enclosed headframe, power-house, hoist house, warehouses, shops, assay office, and refinery. Electric power is received over a 2,300-volt transmission line from a substation at Con mine, and converted to 550 volts at the Negus transformer station. A Canadian Ingersoll-Rand XVH compressor, rated at 840 cubic feet of air a minute, is driven by a 175-horsepower 550-volt electric motor; two Belliss and Morcom compressors, with a combined output of 1,500 cubic feet of air a minute, are operated by horizontal Ruston diesel engines; and an alternating current, 600 volt, 125 KVA generator is connected to another horizontal Ruston diesel engine. A 200-horsepower electric motor drives a Canadian Ingersoll-Rand, two-drum, 36-inch by 48-inch, type PEI hoist. Other equipment includes three storage battery locomotives and two Eimco loaders.

[1] Negus Mines, Limited: Ninth Annual Report, the Fiscal Year Ended December 31, 1947, p. 4.

Steam heat is provided for plant and camp buildings by two oil-fired boilers situated about 500 feet west of the camp. The boilers are rated at 78 and 100 horsepower.

Oil tanks at the property have a combined capacity of about 250,000 imperial gallons, and are used for diesel and bunker fuel oil.

DEVELOPMENT

A three-compartment vertical (No. 2) shaft, about 1,940 feet deep, provides access to all underground workings. Stations are 100, 200, 300, 425, 550, 675, 800, 950, 1,100, 1,250, 1,425, 1,600, and 1,775 feet below the collar. Drifts and crosscuts totalled 32,470 feet on July 31, 1948, as follows: 100-foot (first) level, 2,905 feet; 140-foot sub-level, 1,544 feet; 200-foot (second) level, 6,229 feet; 300-foot (third) level, 5,193 feet; 425-foot (fourth) level, 3,165 feet; 550-foot (fifth) level, 694 feet; 675-foot (sixth) level, 1,849 feet; 800-foot (seventh) level, 1,276 feet; 950-foot (eighth) level, 1,035 feet; 1,100-foot (ninth) level, 1,427 feet; 1,250-foot (tenth) level, 1,303 feet; 1,425-foot (eleventh) level, 3,071 feet; 1,600-foot (twelfth) level, 26 feet; and 1,775-foot (thirteenth) level, 2,753 feet.

Most of these workings are beneath an area about 1,000 feet square, known to the operators as the 'north ore zone'. This lies mainly on Negus No. 4 claim, and is bounded on the north, and in part on the south, by the property of Rycon and Con mines. It contains No. 2 shaft and shear zones Nos. 2, 3, and 15; the drifts trend a little west of north and extend down to the 1,425-foot level.

The 'south ore zone' lies beneath a rectangular area about 450 feet wide that extends 1,200 feet south from the southeast corner of the 'north ore zone'. It lies mainly on Negus No. 3 claim, and is bounded on the west by property of Con mine. It contains No. 1 shaft, and Nos. 1, 9, and other shear zones. The drifts trend a little west of north. Drifts on the 100-, 200-, 300-, and 425-foot levels are continuous with those of the 'north ore zone'; other drifting has been done on the 140-foot sub-level. The deepest, 425-foot level is close to the west boundary of the Negus property.

A crosscut extends about 950 feet easterly from the second level drift of the 'south ore zone', and provides entry to a drift on the northwesterly dipping No. 26 shear zone. A crosscut on the third level connects with other drifts in the vicinity of this zone.

Crosscuts easterly to the westerly dipping Campbell system, from No. 2 shaft on the 1,425-foot and 1,775-foot levels, aggregate about 2,700 feet. Drifts from these crosscuts total about 1,500 feet.

GEOLOGY

The Negus claims have been mapped on a scale of 1 inch to 500 feet by the Geological Survey of Canada (Henderson and Brown, 1948). The oldest and by far the most abundant rocks underlying the claims are massive, pillowed, and variolitic, basaltic and andesitic lava flows of the Yellowknife group. They strike about north 60 degrees east, dip steeply southeast, and face southeast; and comprise part of a belt of similar rocks that extends northerly along the west shore of Yellowknife Bay through the Con and Rycon (73), Giant (76), Akaitcho (71), and other gold properties. In most places the rocks are not sheared, but are broken by closely spaced irregular joints. The pillows are not much distorted. Here and there the flows are interbedded with tuffs or other fragmental volcanic material.

The volcanic flows and fragmental rocks are cut by numerous fine- to medium-grained meta-gabbro and meta-diorite dykes, some of which contain phenocrysts of white feldspar. The dykes range up to 50 feet or more in width, show chilled contacts with the lava flows, strike between north-northeast and north-northwest, and are nearly vertical or dip steeply westerly.

The lava flows and basic dykes are intruded by a few aplitic and granitic dykes that range in width from a few inches to a foot. A granitic stock, probably of about the same age, is reported to have been intersected near the west boundary of Negus No. 4 claim by a diamond drill-hole on the 800-foot level. The stock is not known to reach the surface.

The youngest rocks are relatively fresh, rusty brown weathering diabase dykes.

Many faults have been recognized. The earliest are pre-diabase faults marked by chlorite schist 'shear-zones'. These commonly strike between north-northeast and north-northwest, dip steeply west, and transect the lava flows; some follow the borders of meta-gabbro and meta-diorite dykes.

The latest, post-diabase faults are marked by narrow seams of brecciated rock or gouge. These faults include the steeply inclined West Bay fault; it strikes north 10 degrees west and lies beneath Yellowknife Bay about 1,900 feet east of No. 2 shaft. Campbell (1947b, p. 523) has calculated that the west side moved 16,140 feet south and 1,570 feet down relative to the east side.

The Negus fault, possibly of intermediate age, strikes about north 60 degrees east and lies about 1,000 feet southeast of No. 2 shaft. The movement is left hand. The fault displaces several early, pre-diabase shear-zone faults, and is displaced by late faults.

The veins and orebodies occupy parts of the early, pre-diabase shear-zone faults, and were formed prior to the emplacement of the diabase dykes and the development of the post-diabase faults.

DESCRIPTION OF DEPOSITS

Ore mined prior to 1948 came from narrow, well-defined quartz veins in Nos. 1, 2, 3, 9, 15, 26, and other shear zones. Most of these zones trend a few degrees west of north and dip westerly at about 55 degrees. They range up to about 27 feet in width, but their average width probably does not exceed 5 feet. Some have been followed by drifts for 800 feet, and are probably longer. One, No. 15, has been opened to a vertical depth of 1,425 feet. As already stated, the zones tend to occur along the borders of meta-gabbro and meta-diabase dykes, and to conform to these bodies in strike and dip. The rock in the shear zones is grey, green, or buff, flaky, chlorite-sericite schist, and the borders of the zones are commonly sharp or grade through only a few inches of partly sheared lava and dyke rocks to unsheared rock. Bodies of quartz within the shear zones occur in lengths up to about 400 feet and widths up to about 12 feet; their average width is much less. The quartz is mostly light and dark grey and mottled, but some is milky white, or glassy and black. In places the light and dark varieties of quartz intergrade; and here and there white quartz, with vuggy cavities and coarse, rusty weathering carbonate occurs as veinlets that cut dark grey quartz. Practically all gold occurs within quartz, but not all quartz is of ore grade; and in many places the limits of ore-grade quartz must be determined by sampling and assaying. Quartz of ore grade has been encountered to a vertical depth of 1,425 feet, and ore has been mined to a depth of 1,250 feet. As previously stated, most known ore in these zones has been removed. The average width of the ore shoots probably did not exceed $2\frac{1}{2}$ feet. They contained high-grade ore because after dilution, sorting, and a treatment loss of about 10 per cent, the ore treated from 1939 to 1947 afforded 0·6 to more than 1 ounce of gold a ton. Their dip length commonly exceeded their drift length. In most cases the pitch of the orebodies was about 90 degrees. The most productive ore shoot had an average drift length of between 100 and 200 feet and was mined from the 950-foot level to the surface. Quartz of ore grade is commonly light and dark grey and mottled, with sharp, free walls against the enclosing schist. The quartz may be sliced by fractures parallel with the walls, and contains up to about 1 per cent metallic minerals, some of which occur in streaks parallel with the walls. Soft grey metallic minerals commonly indicate high-grade ore. Pyrite is the most plentiful metallic mineral; there is some arsenopyrite, sphalerite, chalcopyrite, and visible gold; jordanite, pyrrhotite, stibnite, tennantite, nagyagite, sylvanite, jamesonite, covellite, and chalcocite are reported (Ridland, 1941) in small amounts. Scheelite[1] occurs in many places as lenses a few feet long and 6 to 8 inches wide, and grading about 3 per cent WO_3. One scheelite-bearing shoot on the 425-foot level is 70 feet long, 6 inches wide, and estimated to contain 1·4 per cent WO_3.

Ore mined during the latter part of 1948 came mainly from the Campbell system of shear zones[2]. The system is about 1,100 feet east of No. 2 shaft at the 1,775-foot level and does not outcrop. It is 300 to 400 feet wide, strikes about north-northeast, and dips about 45 degrees west-northwest. It has been partly explored by drill-holes and mine workings for a dip length of at least 1,500 feet, and on the 1,775-foot level for a drift length of more than 600 feet. The zone consists of chlorite schist, within which occur orebodies of quartz and sericite schist well mineralized with pyrite, arsenopyrite, gold, and other minerals. Development work on the 1,775-foot level has indicated 350 tons of possible ore a vertical foot, averaging 0·48 ounce gold a ton (cut grade) or 0·66 ounce a ton (uncut grade); and on the 1,425-foot level, 300 tons of possible ore a vertical foot. On the latter level a stope 70 feet long and 55 feet wide afforded, in August 1948, 2,300 tons of ore containing about 0·62 ounce of gold a ton. The Campbell system is displaced by the Negus fault, and all exploration of the system, except one drill-hole, has been done north of the fault.

More detailed descriptions of Nos. 1, 2, 3, 9, 15, and 26 shear zones, and their contained veins follow.

No. 1 Shear Zone outcrops at No. 1 shaft, 600 feet southeast of No. 2 shaft, and was traced on the surface for at least 170 feet. It strikes a little west of north and dips 65 degrees west. The zone ranges from 5 to 10 feet in width, and on the 100-foot level enters a zone of fractured rock that extends north to No. 15 vein. The quartz in No. 1 zone ranges up

[1] These data have been supplied by A. W. Jolliffe and R. E. Folinsbee.

[2] The following account is summarized mainly from data contained in the Ninth Annual Report of Negus Mines, Limited, and applies to September 15, 1948.

to at least 3 feet in width. One ore shoot examined in 1939, and opened on the first three levels, had an average drift length of about 80 feet and averaged about 1½ feet in width. Ore has come from three stopes; one extends from near the surface to the 200-foot level; another from the surface at No. 1 shaft to the 425-foot level; and the third from the 100-foot level to slightly below the 300-foot level.

No. 2 Shear Zone outcrops 150 feet east of No. 2 shaft, and was traced for 230 feet on the surface. It strikes a little west of north and dips about 70 degrees west. The zone ranges in width from 1½ to 3 feet, and the vein up to about 1½ feet. An ore shoot was mined from the 200-foot level nearly to the surface; on the 100-foot level it was 95 feet long and 0·6 foot wide.

No. 3 Shear Zone outcrops 80 feet east of No. 2 shaft. It strikes a little west of north, dips about 50 degrees west, and was traced 220 feet on the surface. On the 100-foot level, where the zone is up to 2½ feet wide, an ore shoot 146 feet long averaged 1·26 feet in width. Two stopes, with average drift length of about 110 feet, afforded ore from about the 425-foot level to the surface; and a little ore was derived from a stope about 60 feet long on the 675-foot level.

No. 9 Shear Zone outcrops 50 feet west of No. 1 shaft and No. 1 shear zone. It was traced 200 feet on the surface, where it contains a vein about 100 feet long. It strikes north to north-northwest and dips about 65 degrees west. The zone ranges in width from about 3 feet to at least 8 feet, and the vein up to at least 3 feet. The shear zone may join a zone of fractured rock that extends north to No. 15 vein. An ore shoot on the 100-foot level was 150 feet long and 1½ feet wide; on the 300-foot level there were two drift lengths of ore, each about 65 feet long and 2½ feet wide. Ore has been mined from the 425-foot level to the surface, and on the 425-foot level is less than 50 feet from the west boundary of the property.

No. 15 Shear Zone has been the most productive. Its outcrop, 410 feet east of No. 2 shaft, is 60 feet long. The zone strikes north 5 to 25 degrees west, and dips westerly at about 55 degrees. It ranges in width from 3 to 27 feet; has been explored by drifts on all levels down to and including the 1,425-foot level; and averages about 5½ feet in width on the 1,100- and 1,250-foot levels. The veins vary in width from a few inches to about 12 feet. Much of the gold-bearing quartz on the 200- and 300-foot levels is grey and mottled, and contains pyrite, soft grey metallic minerals, and other minerals; but a common variety on lower levels is white, with pyrite and sphalerite as the principal metallic minerals. The most productive shoot, as previously noted, has been mined from the 950-foot level nearly to the surface: on the 200-foot level it was 197 feet long and averaged 6·85 feet in width; on the 100-, 200-, and 300-foot levels it averaged 140 feet in length and 4½ feet in width; and on the 950-foot level occurred as two lengths of medium-grade ore, one 90 feet long and about 2½ feet wide, the other 180 feet long and about 2 feet wide. Another ore shoot was stoped from the 550-foot level to a little above the 200-foot level; these stopes have an average drift length of about 100 feet. Three, widely separated orebodies were encountered in about 800 feet of drifting on the 1,100-foot level; these had an aggregate drift length of 185 feet, and an average width of about 1·75 feet. The deepest ore mined on the property, except that from the Campbell system, came from two shoots on the 1,250-foot level; one was 70 feet long and about 2 feet wide, the other 110 feet long and about $2\frac{1}{2}$ feet wide. A little gold-bearing quartz is reported on the 1,425-foot level, the deepest opening in No. 15 shear zone.

No. 26 Shear Zone is about 700 feet east of No. 1 shear zone on the 200-foot level. It strikes north 25 degrees east and dips 45 degrees or more gently northwest. About 900 feet of drifting on the 200-foot level disclosed two ore shoots with a total drift length of about 80 feet, an average width of about $1\frac{1}{2}$ feet, and a gentle southerly pitch. The largest shoot (October 1947), with a drift length of about 60 feet and a pitch length above the 200-foot level of about 200 feet, afforded about 6,000 tons of high-grade ore before being abandoned prior to October 1947. No ore was found on the 300-foot level. The 100-foot level was not opened; it would have been about 40 feet below the surface.

UNDERGROUND OPERATIONS

Prior to 1948, veins in Nos. 1, 2, 3, 9, and 15 shear zones, in the north and south ore zones, had provided most of the ore treated. The width of these veins was commonly less than minimum practicable stope width. A little ore, as in No. 2 vein, was mined by a method known as 'resuing', which avoids dilution of vein material by barren rock. Elsewhere ore was mined by ordinary or modified shrinkage methods, or by other methods designed to minimize dilution. The stopes on No. 26 vein are so gently inclined that the broken ore was removed by scraping or washing. Many of the more recent stopes were started with pillars and boxholes so as to save timber. Some of the abandoned stopes have been filled, mainly with waste rock from development headings.

Ore and rock are trammed by electric locomotives. Track on all levels above the 1,425-foot level is 18-inch gauge; and on the 1,425- and 1,775-foot levels is 24-inch gauge. The ore is hoisted in skips of 2 tons capacity; a skip operates in one compartment of the shaft and a skip and cage in another. Drifts and crosscuts do not ordinarily require timber supports. Water that enters the mine is not sufficient to hamper operations.

The gold content of the veins is determined by one channel sample from each face, and from car samples. 'Cut' averages are usually calculated by averaging the uncut assays, then reducing all higher assays to this average, and re-averaging. Milling has proved this method to be too drastic.

MILL

During 1947, the mill treated 25,356 tons of ore, or an average of 70·9 tons each operating day. The average gold content of the ore treated was about 0·75 ounce a ton. The ore was first passed over a picking belt and about 8·5 per cent discarded as barren rock. After crushing, the ore was ground to 75 per cent minus 200 mesh and passed over a jig and blanket tables. The products of these machines contained about one-third of the recoverable gold, and this was amalgamated and sent to the refinery. The ore that passed over the jig and tables was treated in a standard cyanide circuit, and the product sent to the refinery. The tailings contained about 10 per cent of the gold in the ore. Metallurgical tests (Bureau of Mines, 1941d, pp. 2 and 14) indicated that this gold probably occurred as very fine particles in pyrite or arsenopyrite, or both; and that its recovery would involve concentration of these minerals followed by roasting and cyanidation. Bullion recovered in 1947 contained about 28 per cent silver.

When, in 1948, the mill was enlarged preparatory to treating the more refractory ore from the Campbell zone, flotation machines were added to treat the cyanide tailings. During the first few months' operation on ore mainly from the Campbell zone, about 80 per cent of the gold was recovered by amalgamation and cyanidation, and much of the remaining gold was contained in the flotation concentrates that were stored for future treatment.

COSTS AND GENERAL OPERATION DATA

Total expense at the property before production commenced was $579,171.67; camp buildings, mining plant, mill, and equipment cost $255,057.84, and development cost $217,012.98.

Operating costs during 1947 (milling rate 70·9 tons a day), after deferring about half the development cost for future write-off, and excluding depreciation, were $23.85 a ton milled, distributed as follows: mine development, $4.76 a ton; mining, $6.21 a ton; milling, $3.69 a ton; mine office and general expenses, $8 a ton; and administration and corporate expenses, $1.19 a ton[1]. By July 1948 (milling rate about 167 tons a day) operating costs, excluding depreciation, deferred development, and Dominion taxes, were $12.55 a ton milled[2].

During the first 8 months of 1947, the true cost per foot of certain underground operations was: diamond drilling, $2.054; shaft sinking, $141.414; drifts and crosscuts, $22.652; and raises, $28.628.

Freight by boat from Waterways, Alberta cost $40 a ton; from Norman Wells, $60 a ton. During 1946, the cost of water-borne freight amounted to $53,502 or about $2.20 a ton milled, as follows: oil from Norman Wells, $27,402; general freight from Waterways, $26,100. Transportation charges on items from Waterways averaged nearly 10 per cent of their value. The amount expended for transportation in 1947 exceeded that for 1946. The cost of transporting employees by aircraft between Edmonton and the mine averages about $2,000 a month.

About one hundred and thirty-three men were employed during July 1948: fifty-four in the mine, twenty in the mill, and fifty-nine in the camp, office, and elsewhere on surface. The scale of wages is the same as used at Con mine (73), and employees are charged $2 a day for board. Employees receive free transportation from Edmonton to the mine provided they complete two hundred shifts, and from the mine to Edmonton when they complete three hundred shifts.

The cost of fuels at the mine in 1947 was: bunker fuel oil from Norman Wells, 19.58 cents a gallon; light diesel oil from the same source, 31.15 cents a gallon; wood (estimated), $20 a cord.

[1] Negus Mines, Limited: Ninth Annual Report, the Fiscal Year Ended December 31, 1947, p. 6.
[2] Op. cit., p. 4.

All power was generated by diesel engines until January 1941, when the first electric power was received from the Prosperous Lake hydro-electric plant of the Consolidated Mining and Smelting Company of Canada, Limited. Since that time diesel engines have been used to supplement the available electric power. The latter cost 1 cent a kilowatt hour in 1947.

Heating of camp and plant, by oil in winter and wood at other times, cost $51,322.63 in 1946, or about $2.10 a ton of ore milled.

Meals were served during 1947 at a true cost of about 87 cents each.

Nib Group (81)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-J-9. Jolliffe, 1938, p. 36.

The Nib claims lie 7½ miles north of the head of Yellowknife Bay. Part of the original group of claims has lapsed since the following description was prepared by Jolliffe.

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[1]. A trench 25 feet long and 6 feet deep crosses quartz-mica schist and slate [of the Yellowknife group], 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 interveining 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.

Norman Wells Oil Field (16)

(*See* Figure 15)

References: Hopkins, 1943b. Hume, 1923, pp. 47-64; 1933, pp. 290-305; 1944, pp. 54-58. Hume and Link, 1945. Jenness, 1949. Kindle and Bosworth, 1921. Lord, 1941a, pp. 60-61. McConnell, 1890. Stewart, 1944; 1945; 1947; 1948.

INTRODUCTION

Oil is produced and refined by Imperial Oil Limited at Norman Wells, on Mackenzie River, about 90 miles south of the Arctic Circle and 45 miles northwest of Fort Norman. Mackenzie River Valley is here about 25 miles wide, poorly drained, and covered by much muskeg and many small lakes. Freight reaches Norman Wells by boat and barge via Athabasca, Slave, and Mackenzie Rivers, from railhead at Waterways, Alberta. Mail,

[1] Upper Walsh Lake is shown as Banting Lake on Map 868A. The location of this deposit might also be described as a quarter mile north of the north end of Walsh Lake.

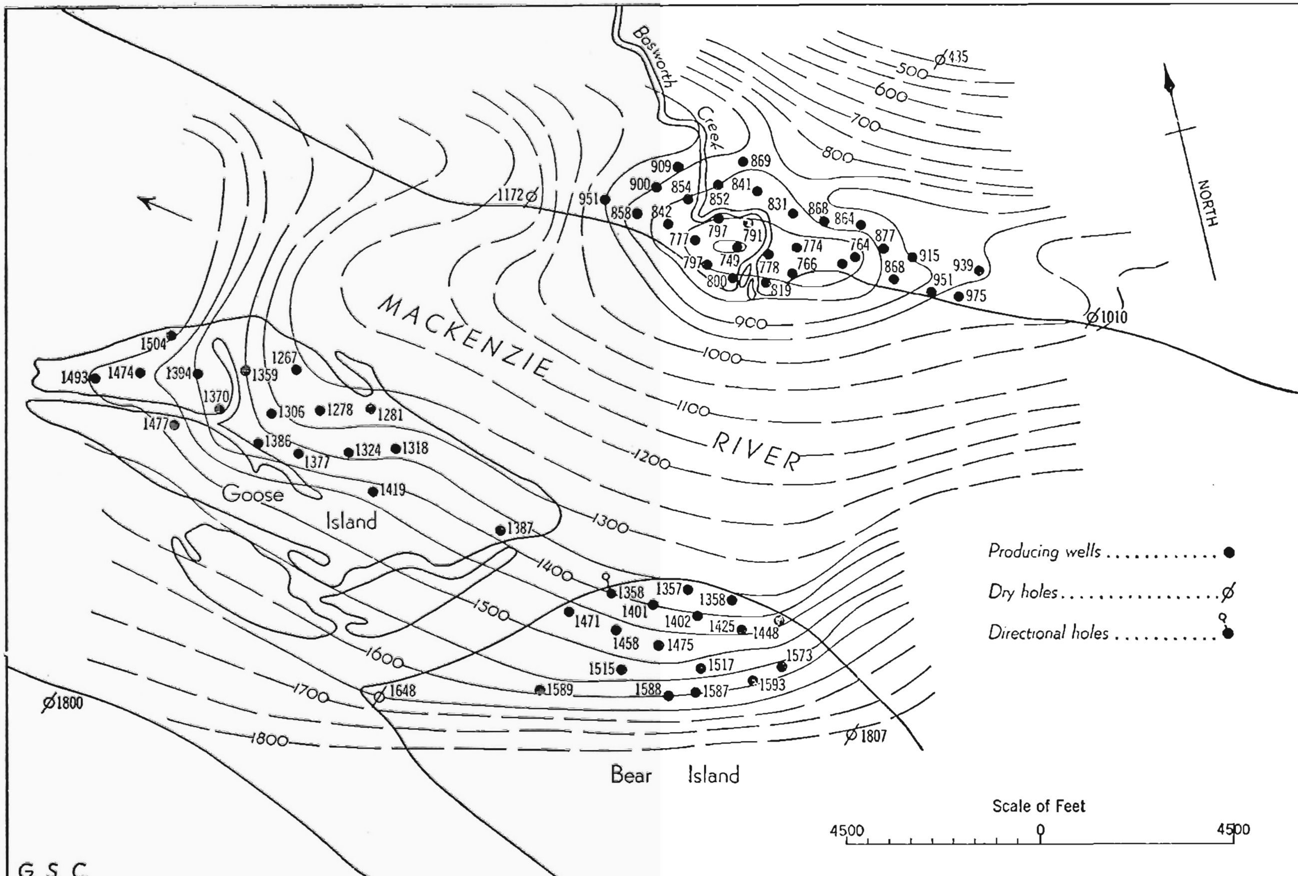

Figure 15. Structure-contour map of Norman Wells oil field. Contours on top of reef limestone; contour interval, 50 feet. Figures indicate depth below sea-level. After Stewart (1948, p. 102).

passenger, and express service is maintained by aircraft of Canadian Pacific Airlines between Edmonton and an airport about 1 mile from Norman Wells main camp. A government radio station is located nearby. A 578-mile road and telephone line formerly connected Norman Wells with Whitehorse, Yukon, but the road is now impassable for ordinary vehicles. The following account has been summarized from published reports, mainly those of the late J. S. Stewart, who, in turn, expressed his indebtedness to United States Army officers and officials of Imperial Oil Limited. The writer has not visited the area.

HISTORY

R. G. McConnell noted bituminous rocks at various places in Mackenzie River Valley in 1888, but failed to record oil seeps in the present productive area. In 1914 T. O. Bosworth caused three leases to be staked near oil seeps on the north bank of Mackenzie River at the mouth of what became known as Bosworth Creek. These claims were acquired in 1918 by the Northwest Company, a subsidiary of Imperial Oil Limited. The site for the first well (Discovery No. 1) was selected on these leases by T. A. Link in 1919. Drilling was commenced in 1920, and oil encountered in commercial quantity at a depth of 783 feet. A small still, capable of producing gasoline and diesel oil, was installed in 1921. No. 2 well, also productive, was drilled in 1924 and 1925. Wells Nos. 3 and 4 were drilled in 1939 and 1940 in response to the increased demand for petroleum products that attended mining developments near Yellowknife and at Eldorado mine (13) on Great Bear Lake. Both wells produced oil. A refinery was built in 1939, and its initial capacity of 840 barrels a day was increased in 1943 to about 1,200 barrels a day. Events attending hostilities between the United States and Japan resulted in a development program known as the Canol Project. The project was the result of an agreement between the Governments of the United States and Canada whereby the former undertook the exploration and development of the Norman Wells oil field; the construction of a pipeline, with a minimum capacity of 3,000 barrels a day, from Norman Wells to Whitehorse, Yukon; and the construction of a refinery at Whitehorse. Imperial Oil Limited agreed to undertake or supervise drilling and oil production. Work on the project commenced in May 1942. The pipeline and refinery at Whitehorse began operating on April 30, 1944, and the flow of oil through the pipeline subsequently attained a maximum of about 4,000 barrels a day. Drilling was confined mainly to the proven Norman Wells field. Drilling and production under the project agreement ended in March 1945, and the contract with Imperial Oil Limited was terminated in May 1945. Inasmuch as the operation and maintenance of the pipeline and Whitehorse refinery would not have been a commercially profitable enterprise, the pipeline was closed, and many of the wells plugged or capped; and the Norman Wells field reverted to its former purpose of supplying the requirements of the District of Mackenzie, mainly fuel for the mines at and between Great Bear and Great Slave Lakes. The field should continue to meet these requirements for many years.

PRODUCTION AND RESERVES

The following table of crude petroleum production was compiled from reports of the Dominion Bureau of Statistics:

Year	Barrels	Value $
1932[1]-1942	192,973	476,013
1943	293,750	400,201
1944	1.223,675	632,587
1945	345.171	136,303
1946	177,282	173,392
1947	227,474	500,238
1948	350,541	676,574
Total	2,810,866	2,995,308

[1]First recorded production.

Production during the life of the Canol Project amounted to about 1,858,000 barrels.

Products of the Norman Wells refinery include aviation and motor gasoline, light and heavy diesel oils, and bunker fuel oils.

Recoverable oil reserves, estimated immediately after the termination of the Canal Project in March 1945, were 36,250,000 barrels from a drainable area of 2,600 acres (Stewart, 1948, p. 101). An additional 1,410 acres, beneath Mackenzie River, is not economically drainable, even by directional drilling.

DEVELOPMENT

Sixty-seven wells totalling 129,429 feet were drilled during the term of the Canol Project, and sixty of these encountered oil in commercial quantity. By March 1945 the field had sixty-four productive wells, four of which were drilled prior to the Project.

GEOLOGY

The principal strata are of Devonian age. The Middle Devonian, Ramparts formation consists of a lower, marine shale member; a middle, limestone and shale (Ramparts) member; and an upper, limestone (Beavertail) member. The overlying, Upper Devonian, Fort Creek formation comprises four members, which, described in ascending order, are marine shale, reef limestone, bituminous shale, and shale with local sandstone and limestone. The overlying Imperial (Bosworth) formation, also of Upper Devonian age, is mainly sandstone and shale. An unconformity separates the Devonian strata from overlying Cretaceous formations.

The strata commonly strike northwesterly and dip about 5 degrees southwest.

Oil is produced from the reef limestone member of the Fort Creek formation. The reef is a local feature up to 400 feet thick, and has grown on a barren basal limestone layer about 100 feet thick. The porous reef thins and ends up the dip, and the contained oil is thereby trapped by the enclosing impervious strata. Oil saturated sections of the reef vary from a few feet to 388 feet in thickness. Wells drilled to date have encountered the top of the reef limestone member at depths ranging from about 1,050 to 1,900 feet, and outlined a potentially productive area of 4,010 acres.

GENERAL DATA

Drilling was done with standard tools prior to 1942, and mainly by rotary rigs during the term of the Canol Project. Permafrost was encountered to depths of 267 feet (Jenness, 1949, p. 26). Rock temperature at a depth of about 1,000 feet is 61°F., and increases with depth at a rate of 0·0258° F. per foot.

The wells produce by natural flow. The reservoir rock is very susceptible to acid treatment, which, in general, was found to double the initial rate of flow of oil. The estimated efficient potential daily capacity of most of the wells was less than 100 barrels a day, but most exceeded this rate. Casing-head pressures were generally less than 750 pounds a square inch. The specific gravity of the crude oil varied from 39 to 41·5° A.P.I. It is a paraffin-base oil with a pour-point of minus 70°F.

North Inca Gold Mines, Limited (37)

(*See* Figure 10)

References: Bureau of Mines, 1947c. Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheets 86-B-3 and 86-B-6. Lord, 1941a, pp. 62-64; 1942a, pp. 47-49. Stanton, 1947, pp. 11-12. Wood, 1948b.

INTRODUCTION

North Inca Gold Mines, Limited, under the control and management of Trans-American Mining Corporation, Limited, is (December 31, 1948) actively exploring gold-bearing shear zones on the North and Tartan 44 groups of claims. This property extends south from Leta Arm of Indin Lake and is about 130 miles north-northwest of Yellowknife. It comprises the following thirty-three or thirty-five claims and fractional claims: North Nos. 1 to 16; Tartan 44, Nos. 7 to 18; Dip Nos. 1 and 2; and North Fraction Nos. 17 to 19. The ownership of ground staked by the company as North Fraction Nos. 20 and 21 has not been established by survey (April 1, 1948). The property embraces a compact area measuring about 4½ miles from north to south and about 1 mile from east to west. About 60 per cent of the area is covered by Indin Lake. On the north and northeast the claims adjoin the property of Diversified Mining Interests (Canada), Limited (34), and on the east the Bum group owned by Frobisher Limited. The only established means of access to the property from Yellowknife is by aircraft. Mail planes operated by Canadian Pacific Air Lines on a regular schedule between Yellowknife and Port Radium stop there on request. A radio transmitter and receiver provide daily communication with Yellowknife. The writer visited the property in 1939 and 1947, and M. S. Stanton in 1946. The following description is applicable as of August 1947 unless otherwise stated. W. M. Gilchrist is mine manager. A. P. Beavan, chief geologist for Trans-American Mining Corporation, Limited, has been responsible for general supervision and most geological work. Inasmuch as most exploration has been done by diamond drilling, many of the following data have been derived from records supplied by the company. Only a few representative diamond drill cores were examined.

HISTORY

Part, perhaps most, of the ground now being explored by North Inca Gold Mines, Limited, was first staked by Territories Exploration Company, Limited, as the Pa and Ma groups, in August 1938. This organization did a little surface work on the Brown veins (A-1 and A-2 veins of North Inca Gold Mines, Limited) and the Johnson vein. The Brown veins and vicinity were diamond drilled by Frobisher Exploration Company, Limited (now Frobisher Limited), during February and March 1941 under an arrangement with Territories Exploration Company, Limited. This work was under the direction of D. W. Cameron. The results were not encouraging, and the claims subsequently lapsed. In the spring of 1944 the North claims were staked by J. Tibbit and W. A. McKeown, and the Tartan 44 claims by J. M. McMeekan and associates. North Inca Gold Mines, Limited, was incorporated in 1945 to acquire and explore these claims, and other claims were later added by purchase and by staking. Work commenced in January 1946 with the construction of a winter camp and, on March 19, 170 tons of freight arrived by tractor train from Grimshaw, Alberta. Diamond drilling commenced February 15 and continued until May 1947, most or it being done during 1946. Other work accomplished during 1946 included detailed geological mapping of the property (scale: 1 inch to 400 feet) and surface prospecting. Early in 1947, about 200 tons of freight was flown to the property from Yellowknife. In April, underground work was recommended, and W. M. Gilchrist appointed mine manager. By October, when work was temporarily suspended, a shaft had been collared, a headframe erected, and part of the mining plant and equipment installed preparatory to shaft sinking. The camp was reopened on February 10, 1948, and additional freight required for sinking was flown from Yellowknife. A little diamond drilling was done from the ice. By May 1, all was in readiness for sinking. During the remainder of the year the shaft was sunk to the 175-foot level, some drifting and crosscutting done in the A zone, and, subsequently, further sinking done preparatory to exploring the Main zone on the 325-foot level.

CAMP AND PLANT

The camp is on North No. 1 claim, on the east side of Inca Peninsula. Permanent frame structures comprise warehouse, assay office, and an insulated, asbestoside-sheathed, combined cookery, dining hall, and storehouse. The mine office is housed in a log cabin, and other buildings are mainly tents on wood frames and floors.

The mining plant, on North No. 2 claim on the east side of the southern tip of Inca Peninsula, was incomplete when visited early in August 1947. A site adjacent to the shaft was being levelled preparatory to erecting buildings, and the following items were on hand: a horizontal, fire tube, locomotive type boiler of about 100 horsepower capacity (to be wood fired for plant heating); a semi-portable unit comprising a D 13,000 Caterpillar diesel engine directly connected to a Gardner-Denver vertical air compressor with a rated output of 365 cubic feet of air a minute; a single-drum, 10-inch by 12-inch, type SSR, Canadian Ingersoll-Rand hoist (to be operated by compressed air); a 31 KVA General Electric generator driven by a Cummins diesel; and one each D-4 and D-6 caterpillar tractors. Parts were also on hand for the erection of prefabricated steel buildings for hoist room and power-house.

DEVELOPMENT

Most work has been done on or near the following veins, or zones of veins (*See* Figure 10): (1) A zone, which trends northerly from the southern point of Inca Peninsula; (2) Main zone, which trends northerly beneath Indin Lake about 600 feet east of A zone; (3) No. 6 vein, on Inca Peninsula about 800 feet north-northwest of A zone; (4) Johnson vein, on the east side of a large island, and about 10,400 feet south of A zone; and (5) N 42 vein, 1,200 feet southwest of Johnson vein. A little surface work has been done on all except the Main zone, which does not outcrop. Surface diamond drilling by the North Inca company, to April 1, 1948, amounted to: 1946, 21,224 feet; 1947, 6,630 feet; 1948, 1,500 feet; total, 29,354 feet. Most of this drilling was designed to explore the A and Main zones. An estimated 2,000 feet of drilling was done by Frobisher Exploration Company, Limited, in the vicinity of A zone in 1941. In 1947, one exploratory hole (1,159 feet) was drilled jointly with Frobisher Limited near the east boundary of the North Inca property (*See* Figure 10, locality 17).

As of October 30, 1948, a three-compartment shaft, 196·5 feet deep, located on the east side of Inca Peninsula between the A and Main zones, provided entry to A zone on the 175-foot level. Work on this level at that date amounted to: drifts, 443 feet; crosscuts (west from shaft), 263 feet; and diamond drilling, 1,835 feet.

GEOLOGY

The property is underlain by volcanic and sedimentary rocks of the Yellowknife group. The volcanic rocks, outcropping on a chain of rugged islands and Inca Peninsula, occupy a belt $\frac{1}{4}$ to $\frac{1}{2}$ mile wide that trends north-northeast and nearly bisects the property. These rocks are mainly altered andesitic and dacitic lavas (greenstones) and related tuffs, breccias, and agglomerates. The sedimentary strata, presumably younger than the volcanic members, are mainly greywacke, argillite, slate, and phyllite. They occur on both flanks of the volcanic belt and, for the most part, lie beneath Indin Lake. The Yellowknife rocks are cut by much younger, post-ore, diabase dykes. The volcanic and sedimentary strata trend about north-northeast, and are vertical or dip steeply east-southeast or west-northwest. In some instances they are overturned slightly. Foliation in the volcanic rocks is about parallel with the stratification. Steeply dipping shear zones that trend north 10 degrees east to north 35 degrees east are found within both volcanic and sedimentary rocks and contain the most promising known gold-bearing quartz veins. Stanton believes one of these (the Main zone) to be the Leta fault, a major structure of unknown displacement that trends northerly through and beyond the properties of Diversified Mining Interests (Canada), Limited (34), and Lexindin Gold Mines, Limited (35). Steeply inclined, left-hand faults that strike about northwest offset the rocks of the Yellowknife group and, at least in some instances, the northerly trending shear zones and their associated quartz veins. One of these faults, the Inca, lies beneath Indin Lake, and traverses the property very close to the southern tip of Inca Peninsula. According to Beavan[1] rocks on the southwest side of the fault have been displaced 1,470 feet towards the southeast, and an estimated 500 to 750 feet downwards, relative to those on the northeast side.

DESCRIPTION OF DEPOSITS

A Zone (*See* Figure 10, localities 14 and 16). The three parallel veins of this zone outcrop at the lakeshore at the south tip of Inca Peninsula, near the south boundary of North No. 2 claim. They are designated A-1, A-2, and A-3 from east to west. A-1 and A-2 veins formerly were known as the east and west Brown veins. The country rock is light green foliated greenstone, probably derived from andesitic or dacitic lava and agglomerate. The foliation strikes about north 10 degrees east and is nearly vertical.

A-1 and A-2 veins at the surface are two parallel quartz veins separated by about 12 feet of rock. They strike about north 10 degrees east and dip easterly at angles varying from 75 degrees east to vertical. They are nearly parallel with the foliation of the enclosing schist, but in places may cross the foliation at small angles. A-1 vein is stripped for 145 feet, and the width of the exposed part 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 it ends on the surface but plunges north beneath the schist. About 110 feet north, a lens of quartz about 27 feet long and up to 2½ feet wide outcrops on the strike of A-1 vein. 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 A-1 vein.

A-2 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; at the north end it passes under drift but probably ends a few feet beyond.

A-1 and A-2 veins are broken into three approximately equal lengths by two faults. These faults are nearly vertical and trend about northwest. The veins on the northeast side of each fault are offset a few feet northwest relative to the veins on the southwest side.

The walls of the veins are sharp, and are bordered by about 3 inches to 2 feet of rusty sericite-carbonate schist containing a little pyrite and arsenopyrite. Most of the quartz in the veins is much fractured and mottled dark grey to white. It includes a few seams of schist and these lie parallel with the walls. The mottled quartz is cut by sharply defined milky white quartz seams up to 1 inch wide; these contain open, crystal-lined cavities and an iron-bearing carbonate mineral. A few thread-like seams of chalky white feldspar were noted. Metallic minerals constitute less than 1 per cent of the veins and include pyrite, arsenopyrite, gold, and a very little galena, chalcopyrite (?), and pyrrhotite (?). Visible gold is plentiful in grey quartz.

[1] North Inca Gold Mines, Limited: First Annual Report for the Period Ending December 31, 1946.

A-3 vein was not examined, but is reported to outcrop about 75 feet west of A-2 vein and to be exposed for a length of about 10 feet. It is said to contain visible gold, to be less than 1 foot wide, and to lie within a shear zone about 6 feet wide.

Diamond drill-holes have traced the A zone for a length of about 400 feet on Inca Peninsula. They have intersected ore to a depth of about 240 feet, and quartz stringers and shear zones to slightly greater depths. Beneath Indin Lake, about 100 feet south of the shore of Inca Peninsula, A zone is terminated by the Inca fault; and its extension south of the fault, offset about 1,500 feet to the southeast, is said to have been intersected by a drill-hole (*See* Figure 10, locality 16).

Drilling of the A zone north of the Inca fault is reported[1] to indicate 23,000 tons of ore averaging 0·54 ounce of gold a ton (uncut) across a true mining width of $2\frac{1}{2}$ feet[2]. This is contained in three shoots with an aggregate length of 630 feet. A-1 vein, at the surface, displayed a shoot 50 feet long and 3·1 feet wide containing 1·18 ounces of gold a ton. Drilling indicated an orebody containing 7,000 tons grading 0·77 ounce of gold a ton (uncut) with the following dimensions: length, 180 feet; depth, 245 feet; true width 1·7 feet. A-2 vein contains an indicated orebody of 3,750 tons grading 0·50 ounce gold a ton (uncut) with dimensions as follows: length, 150 feet; depth, 125 feet; true width, 2·25 feet. A-3 vein contains 7,700 tons of indicated ore grading 0·60 ounce gold a ton (uncut) with the following dimensions: length, 300 feet; depth, 125 feet; true width, 2·25 feet. All ore shoots appear to plunge north.

The Main Zone (*See* Figure 10, localities 15 and 17), as already mentioned, does not outcrop on the North Inca property. It comprises a stock-work of quartz veinlets and larger bodies within a sheared zone in sedimentary strata at or near the contact between these strata and the belt of volcanic rocks that borders them on the west. The zone strikes about north-northeast, parallel with the contact, and is broken into two segments by the transverse, left-hand Inca fault. North of the Inca fault the zone probably extends nearly 4,000 feet north-northeast to the south side of the Aztec fault, where it lies on the property of Diversified Mining Interests (Canada), Limited (34), and is known as No. 3 deposit. The part of the zone lying south of the Inca fault has been displaced about 1,500 feet southeast, relative to that part north of the fault. This displaced part is known as the *Main Zone extension* and is said to have been intersected by a drill-hole about 3,200 feet south of the fault.

Most drilling (nineteen holes from the surface) has been done on that part of the zone extending about 900 feet northerly from the Inca fault. This part lies mainly within North No. 2 claim very close to its eastern boundary. The zone strikes about north 20 degrees east and dips about 85 degrees northwest. Its true width ranges from about 6 to 50 feet. The borders of the zone are fairly well defined. The rock within the zone is black graphitic schist, slate, sheared argillaceous greywacke, and minor sheared greywacke. It is well cleaved, commonly affording drill cores composed of a series of thin, button-like disks, and is readily

[1]North Inca Gold Mines, Limited: First Annual Report for the Period Ending December 31, 1946; Annual Report for the Period Ending December 31, 1947.

[2] This assumed minimum practicable mining width is greater than the average width of the veins.

recognized during drilling by an abnormal loss of core. It contains scattered grains of pyrite and arsenopyrite and, where arsenopyrite is particularly abundant, may contain a little gold. Scattered seams of white or mottled quartz occur within the sheared rock. Here and there 2 or 3 feet of solid quartz was cored, but most seams are a few inches or less in width. The quartz contains a little (probably less than 1 per cent) arsenopyrite, pyrite, pyrrhotite(?), chalcopyrite(?), and visible gold.

Not all quartz is of ore grade, and those parts of the zone that afforded assays of ore grade contain much sheared rock in addition to quartz. In most holes, several lengths of core containing significant amounts of gold were encountered. Ore-grade intersections were obtained along a length of 600 feet (in eleven holes) between vertical depths of 160 and 300 feet. The drill-hole data, however, do not justify the assumption that all intersections are parts of a single orebody; rather, they may represent parts of several parallel lenticular bodies of unknown aggregate length. However, the average grade of these intersections is reported[1] to be 0·96 ounce of gold a ton (uncut) or 0·48 ounce (cut) across an estimated true width of 3 feet.

The drill that probed the Main Zone extension afforded core lengths of 2·5 and 2·8 feet reported to assay 0·20 and 0·19 ounce of gold a ton, respectively.

No. 6 Vein (*See* Figure 10, locality 13), not examined by the writer, outcrops on North No. 2 claim, and is believed to be the deposit described by Stanton as follows:

> A short distance northwest of the "A" zone exposures, a strong shear zone is exposed at and near the contact between volcanic and sedimentary rocks. Some quartz is present in part of the zone, but values in gold are reported only from a small white quartz vein lying within sheared carbonatized volcanic rock near its contact with sheared greywackes and slates about 500 feet north of the lake.

The Johnson Vein (*See* Figure 10, locality 18) has not been examined by the author since 1939. It is on North No. 4 claim and is a quartz vein in sheared and otherwise altered agglomerate. It is exposed for 100 feet or more, strikes about northeast, and dips about 45 degrees northwest. The vein filling resembles that of the veins of A zone, and contains a little visible gold. Diamond drilling by North Inca Gold Mines, Limited, failed to encounter ore.

N 42 Vein (*See* Figure 10, locality 19) is on North No. 4 claim. It is reported[1] to be in dacitic lava, to strike about north-northeast, and to dip 70 degrees west-northwest. Its exposed length is not reported, but is probably less than 150 feet. The vein is of milky white quartz up to 3 feet wide, and is said to contain only a little gold.

COSTS AND GENERAL OPERATING DATA

Laboratory tests by the Bureau of Mines on a sample of ore from the A-1 vein indicated that cyanidation or flotation methods, preceded by blanket or table treatment to remove the coarse gold, would extract 98·89 per cent or more of the gold. Simple amalgamation, blanket, and table

[1] North Inca Gold Mines, Limited: Annual Report for the Period ending December 31, 1947.

methods afforded recoveries of 94·7, 92·80, and 89·50 per cent, respectively. The sample tested contained no wall-rock, and assayed: gold, 5·85 ounces a ton; silver, 0·575 ounce a ton.

A sample derived from the assay pulps from the drill cores of the Main zone was tested by Nepheline Products, Limited, of Lakefield, Ontario, and indicated[1] the ore from this zone to be similarly amenable to ordinary metallurgical processes.

Deferred development expense by the company to December 31, 1947, was $396,129.73[2].

A contract for surface diamond drilling was let at $2.50 a foot. The contractors supplied gasoline and oil and paid $2.50 a man a day for board. The North Inca Company provided transportation from Yellowknife.

All freight from Yellowknife to the property, during the winters of 1947 and 1948, was moved by aircraft. In 1947, about 200 tons were moved by DC-3 aircraft at costs ranging from about $88 to $110 a ton, and in 1948 the same type of aircraft moved 241 tons at a cost of $118.75 a ton. These craft operated on wheels from the ice of Indin Lake. An unsuccessful attempt was made, during the summer of 1947, to dam and drain a shallow bay of Indin Lake and thus provide a summer landing strip for similar aircraft. Personnel and incidental freight is handled by a Fairchild C71 aircraft, owned by Trans-American Mining Corporation, Limited, and operating on skis or floats according to season.

About twenty-three men were employed in August 1947. The scale of wages was that prevailing at the Con and Rycon mines (73) at Yellowknife, and $1 a day was charged for board. Salaried employees received, annually, one month's holiday with pay and free transportation to and from Edmonton.

A survey of possible nearby hydro-electric power sites was completed by Wood for the Dominion Water and Power Bureau in 1947. Two sites on Snare River below Indin Lake, and about 16 and 25 miles south of the property, would yield an estimated 5,200 and 5,700 horsepower, respectively. On upper Snare River, between Indin and Snare Lakes, two sites, about 9 and 12 miles east of the property, could be developed to generate 4,800 and 4,500 horsepower, respectively.

Although some timber for cordwood and other purposes is available locally, all lumber and construction timbers used at the property up to August 1947 had been brought from mills on Slave River.

Old Parr Group[3] (93)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-I-12. Henderson and Jolliffe, 1941.

The Old Parr group of fifteen claims is 33 miles northeast of Yellowknife, 9 miles north of the Thompson-Lundmark mine (103), and about 1 mile west of Sproule Lake. The property was visited for a few hours on July 19, 1947.

The claims were staked early in May 1947 by M. Bode and L. Garskie, and industriously prospected by the latter throughout the summer. In

---

[1] Beavan, A. P.: personal communication.

[2] North Inca Gold Mines, Limited: Annual Report for the Period ending December 31, 1947, p. 2.

[3] Optioned by Garskie Gold Mines Limited in 1950.

the course of this work several trenches and pits were blasted and other areas stripped. Numerous small occurrences of free gold were encountered, several of them spectacular enough to attract widespread interest and comment.

The principal rocks on the claims are metamorphosed strata of the Yellowknife group. The beds vary in thickness from a few inches to several feet, are for the most part well defined, and commonly grade from brown weathering hornfels or schistose greywackes at the base to black slate at the top. Here and there they display a few nodules of metamorphic minerals such as andalusite and cordierite. One pegmatite dyke cuts the strata and doubtless others outcrop. These are probably related to a granite batholith, the nearest known part of which outcrops about 3 miles northeast of the claims. The formations are also intersected by numerous quartz veins. Gold has been found in several of these, principally on Old Parr Nos. 4, 5, and 8 claims within a southwesterly trending belt some 2,300 feet long and as much as 500 feet wide. In this area the strata trend southwesterly, dip steeply, and are, at least in places, overturned.

Two of the gold-bearing veins, known to the owners as the Galena veins, outcrop on Old Parr No. 5 claim. They are separated by 2 to 4 feet of rock, trend north 30 degrees west, and dip between 85 degrees southwest and 60 degrees northeast. The enclosing rock is nodular hornfels or schistose greywacke in thick, indistinct beds that strike about north 80 degrees east and stand nearly vertically. Three pits, one of them 7 feet deep, trace the veins for a length of 55 feet. The northeast vein averages 1·6 feet, the southwest vein 0·7 foot in width. Northwest of the pits, narrower widths of quartz outcrop at intervals for a length of 80 feet and may represent an extension of one or both of the veins. Scattered rock exposures still farther northwest did not reveal vein material. In the southeastern pit the veins end against a fissure that trends about east. This structure probably marks a fault that displaced the vein, but the direction and magnitude of the displacement were not determined. The walls of the veins are sharp and not notably sheared, but the quartz separates readily from the rock. The principal gangue is medium-grained light grey quartz. Sulphide minerals comprise 1 to 10 per cent of the veins; pyrite and galena are most abundant, but sphalerite, pyrrhotite, and chalcopyrite were noted and fine visible gold is common. The sulphide minerals occur in small pockets, lenses, or thin seams parallel with the vein walls. Many of them have been leached from the vein leaving cavities stained with yellowish green oxidation products and lined with quartz crystals.

Most of the known gold-bearing quartz bodies, however, are about parallel with the enclosing strata. They are narrow twisted veins or irregular lenticular bodies and are confined mainly to slaty tops of beds, or to slaty beds or groups of beds. They vary from thin films to about 1 foot in thickness. Most of the known spectacular gold occurrences are in these bodies, mainly within a narrow belt that extends about south 60 degrees west for 1,500 feet from the cabin (which, in turn, is 400 feet north of the Galena veins). This belt includes what the owners have designated as the Caribou, Jewelry Shop, and High Grade pits. The strata and veins also trend about south 60 degrees west, and it may be that these veins lie within a belt wherein slaty strata are particularly abundant. The veins are exposed here and there; some are only a few feet long and locally as much as 1 foot wide, whereas scattered exposures at the north end of the belt suggest that one might be as much as 300 feet long and average a few inches in width. These veins contain a little pyrite and galena and here and there much gold. The gold occurs as coarse grains or fills minute fractures that transect the quartz and extend an inch or so into the unsheared wall-rock. As a consequence, specimens commonly break along these fractures and display broad films of the metal.

Oro Group (11)

Reference: Kidd, 1933, p. 31.

The Oro group claims have lapsed. They were on and near the shore of Great Bear Lake about 3 miles north of Port Radium. In 1932, visible gold was reported to have been discovered on the property by prospectors of Great Bear Lake Mines, Limited. The occurrence was examined briefly by Kidd and described as follows.

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.

Pan Group (86)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-P-3. Henderson, 1941b. Lord, 1941a, pp. 70-72.

The Pan group of claims is on the south side of Murray Lake and about 48 miles northeast of Yellowknife and 6½ miles west of the Camlaren property (64). The claims are crossed by a 60-mile winter road from Yellowknife. Relief is about 50 feet and rock is well exposed. The claims were staked for the Consolidated Mining and Smelting Company of Canada, Limited, by Gordon Murray in August 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 to December 15, 1938. About eight men were employed under the direction of J. Kilburn and G. Clayton from about March 15 to August 15, 1939, when the camp was dismantled and equipment removed from the property. More than 110 pits or trenches were excavated, but no diamond drilling or underground work was done. The property was examined by the writer in 1939.

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 steeply northeast or are 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. It 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, arsenopyrite(?), and gold. Most known gold occurs in quartz on Pan Nos. 2, 7, and 8 claims, as described below.

Gold-bearing quartz occurs near the centre of Pan No. 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 in width, 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 No. 7 claim about 800 feet east of the occurrence described on Pan No. 2 claim. The slate and greywacke strike about north 30 degrees west, dip 80 degrees northeast to vertically, and are folded so that two adjacent anticlinal axes lie about 175 feet apart. Two highly irregular bodies of quartz parallel the bedding, lie 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. It has a maximum width of about 8 feet and includes about 20 per cent wall-rock. Near each end it splits into many quartz stringers and merges into the wall-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, is reported to have contained about 0·5 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 No. 8 claim, about 1,200 feet southeast of the deposit described on Pan No. 2 claim. The slate and greywacke trends about northwest and dips nearly vertically, and many beds are less than 4 inches thick. The axial plane of a syncline is southwest of the veins and trends northwest. The axial plane of an anticline northeast of the veins and about 200 feet from the axial plane of the syncline strikes about northwest in most places, but north of the veins the plane may have been warped and may strike about west-southwest for about 50 feet parallel with 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. It 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 3 inches wide, which contains plentiful white weathered feldspar. In many places the wall-rock is cut by a multitude of quartz veinlets, but so far as known these do not contain appreciable quantities of gold.

Payne Yellowknife Gold Mines, Limited (45)

(*See* Figure 14)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 76-D-3. Folinsbee, 1949.

On August 16, 1947, the writer visited the Mint group of sixty-two claims, a gold prospect owned by Payne Yellowknife Gold Mines, Limited. The property is on the north side of Courageous Lake, about 150 miles northeast of Yellowknife, and in the barren grounds. It is accessible by aircraft from Yellowknife, and while active was equipped with a radio transmitter and receiver. When the writer visited the property, J. K. Diebel was in charge of the crew of four men engaged in diamond drilling.

The claims were staked in August 1946 by L. Kaip, T. Payne, W. E. Peters, and A. Ritz, and acquired later that year by Payne Yellowknife Gold Mines, Limited. Camp, equipment, and supplies were flown to the property in May and June 1947 by a DC-3 aircraft. The aircraft operated on wheels from the airport at Yellowknife and landed on the ice of Courageous Lake. Trenching and stripping of known mineral occurrences yielded unimpressive results, as did subsequent diamond drilling, and work ceased in August. No work was done in 1948.

Four Jamesway huts with fibreglass insulation provided a satisfactory camp. Oil was used for heating. Other items flown to the property included an International T-6 tractor with bulldozer blade, a diamond drill (to provide ⅞-inch core), and requisite gasoline and fuel oil.

Exploratory work for 1947, as reported by the company, included geological mapping, 1,167 cubic yards of stripping by bulldozer, 120 cubic yards of rock excavation, and nine diamond drill-holes totalling 813 feet. Most of this work was done on Mint Nos. 11, 4, and 57 claims.

The formations trend about north and are nearly vertical. The oldest rocks are volcanic members of the Yellowknife group. They outcrop near the west boundary of the property and are part of a belt of volcanic rocks, 1 mile to 3 miles or more in width, that extend many miles north-northwest and south-southeast of the property. Where exposed on the property these rocks are commonly quartz-sericite schists derived from rhyolitic or dacitic volcanic rocks. Elsewhere the property is underlain mainly by greywacke, slate, and phyllite of the Yellowknife group. Here and there the tops of beds can be identified by gradation of grain size; in places they face east, in other places west. A few altered, arkose-like bands are interlayered with these strata. Steeply inclined diabase dykes or sills intersect the Yellowknife rocks and strike about north.

Lenticular quartz veins occur here and there within the sedimentary strata. Many are nearly parallel with the enclosing beds. Coarse, disseminated arsenopyrite crystals are commonly found in the wall-rocks. Many of the veins are bordered, on one side or the other, by arkose-like beds[1].

Visible gold was first found close to the boundary between Mint Nos. 11 and 12 claims, probably on Mint No. 11. The rocks there are fresh greywacke and black slate; these strike north, dip 80 degrees west, and face west. They are not sheared. A zone of scattered, irregular quartz lenses and veinlets trends north parallel with the beds and is exposed for a length of 95 feet by three pits. Drift mantles bedrock north and south of the exposed section except in a trench 70 feet south of the southern pit and in a stripped area that extends 25 feet north from the northern pit; no vein material was seen in either of these excavations. Two barren quartz lenses, each about 1½ feet wide, are exposed in the southern, No. 1 pit. No. 2 pit is 35 feet north of No. 1 pit, and exposes the zone for a strike length of 27 feet. About midway in this strike length two quartz lenses and associated veinlets display an aggregate width of about 3½ feet and are separated by about 2½ feet of rock; but no vein quartz was seen at the north or south end of the pit. No. 3 pit is 15 feet north of No. 2, and contains a quartz vein up to 6 inches wide. The quartz bodies of the zone are commonly cemented firmly to the wall-rock. The quartz is dark grey

[1] Diebel, J. K.: personal communication.

and glassy; it is essentially devoid of included rock or of sulphide minerals, but contains a little visible gold in pits Nos. 2 and 3. Coarse free gold is said to have been found in pit No. 2. Slate adjacent to quartz commonly contains disseminated crystals of arsenopyrite as much as $\frac{1}{8}$ inch in length. The zone was explored by two diamond drill-holes, one beneath each of pits Nos. 2 and 3. These are reported to have intersected a little low-grade quartz about 40 feet vertically below the pits.

Visible gold is reported to have been found in quartz on Mint No. 4 claim, about 7,200 feet south-southwest of the occurrence on Mint No. 11 claim. A trench 33 feet long and 8 feet wide had been excavated in grey phyllite, foliated in a north 5 degrees east direction, parallel with the long axis of the trench, and about vertically. The trench was flooded when examined; no quartz was visible on the south face, but a vein about 2 inches wide was seen on the north face, and a highly irregular quartz body was visible beneath the water in the middle of the trench. Arsenopyrite crystals were found in the phyllite. The quartz is mottled dark and light grey, and contains pockets of iron oxide and scales of silvery white mica. Coarse gold is reported[1] to occur in the veinlet at the north end of the trench, but was not seen by the writer. Other trenches and stripped areas in the vicinity, and three diamond drill-holes, failed to disclose significant amounts of vein matter or gold.

Visible gold is reported to have been found in float on Mint No. 57 claim, but stripping and two diamond drill-holes failed to reveal its source.

Peg Tantalum Mines, Limited (97)

References: Bureau of Mines, 1944a; 1944c. Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-I-11. Fortier, 1947a. Jolliffe, 1943; 1944a.

INTRODUCTION

The property of Peg Tantalum Mines, Limited, comprises the Peg Nos. 1 to 10 claims. These lie 44 miles east-northeast of Yellowknife and between Upper Ross and Redout Lakes. Aircraft from Yellowknife land on Upper Ross Lake, and equipment and supplies are hauled from the lake to the property over $1\frac{1}{2}$ miles of rough tractor road. Alternative access from Yellowknife, in winter, is by a 70-mile tractor road via Jennejohn, Ried, Hidden, Thompson, and Ross Lakes. The author visited the property on July 18, 1947. J. E. Doyle was then resident manager, and J. F. Wright, consulting geologist. The writer has made liberal use of reports by Fortier and Jolliffe who had previously studied the area and its tantalite-columbite deposits in some detail.

HISTORY

Tantalite-columbite was first discovered in pegmatite dykes near Upper Ross Lake by the Geological Survey in the summer of 1943. Four Peg claims, covering some of these discoveries, were staked by J. R. Saunders of Yellowknife in September. These and other claims were subsequently acquired by Peg Tantalum Mines, Limited, incorporated in 1944. About nine men were employed during the summer of 1945, under the direction of J. C. Finnan, and a little mineralized pegmatite was hand-cobbed

[1] Diebel, J. K.: personal communication.

and piled. Mill machinery consigned to the property from Yellowknife by tractor train reached Ried Lake in the spring of 1946; and, due to transportation difficulties, was flown from there to Upper Ross Lake by Canso aircraft. By September of that year twenty-one men were employed, a mill was under construction, part of the mill equipment had reached the mill site, and some dyke rock had been extracted by quarrying. The mill operated intermittently during a 5-week period ending late in November 1946, when operations ceased because of mechanical and metallurgical difficulties. During this period of mill construction and initial operation, widely publicized statements appeared in the press regarding the erection of a refinery in Edmonton, by Tantalum Mining and Refining Corporation of America, Limited, to treat tantalite-columbite ores from the Northwest Territories; and it was further intimated that the Peg Tantalum property was to be the principal source. Milling was resumed in April 1947 and continued, with interruptions, until mid-July, J. E. Doyle in the meantime replacing J. C. Finnan as resident manager. By July 18, milling had ceased and a crew of nine men was extracting ore from No. 1 dyke and preparing facilities for transporting it to the mill. During the remainder of the summer the company is reported[1] to have operated the mill, at intervals, as a sampling plant, and to have broken additional dyke rock; and in the meantime press reports announced the cessation of all activities at the Edmonton refinery.

PRODUCTION

The following tabulated data were supplied by J. E. Doyle from company mill records to July 18, 1947. No information was available regarding the tantalite-columbite content of either the rock treated or concentrate recovered; presumably the grade of the latter was unsatisfactory. Essentially all material treated came from No. 3 dyke.

Month and year	Rock treated	Concentrate recovered
	Tons	Pounds
October and November 1946	200[1]	150
April 1947[2]	147	450
May 1947	359	2,100
June 1947	142	705
July 1947[3]	92	345
Totals	940	3,750

[1] No record of tonnage treated during October and November was available. This figure is an estimate supplied by J. C. Finnan to K. J. Christie, Inspector of Mines, December 2, 1946.
[2] The mill did not operate between late November 1946 and about April 20, 1947.
[3] Milling ceased prior to the writer's visit on July 18.

On July 18, 1947, an estimated 40 tons of broken dyke rock was ready for transportation to the mill. The company estimated that an additional 150 tons was quarried during the balance of the summer, and during that period an unspecified amount was treated in the mill. The writer has no information as to the mineral content of this material, nor of the amount or grade of concentrates recovered.

[1] Doyle, J. E.: personal communication, Yellowknife, September 27, 1947.

ORE RESERVES

So far as known the company has no proven ore reserves. Indicated ore reserves, based on work by the Geological Survey (Jolliffe, 1943, p.1; and 1944a, pp. 12-13) amounted to 1,500 tons containing 13,500 pounds of recoverable concentrate averaging about 75 per cent tantalum pentoxide. This material was in No. 1 dyke to an assumed depth of 40 feet, and has since been partly extracted.

CAMP AND PLANT

The camp consists of a frame cook-house about 24 by 30 feet, sheathed with asbestoside; and several tents, on wood frames, as living quarters. A tractor road leads to other structures about 1,000 feet north-northeast of the camp. These comprise: office, about 15 by 30 feet; combined blacksmith shop and warehouse, about 18 by 27 feet; mill building, about 50 by 70 feet; coarse-ore bin; and trestle, about 400 feet long, from this bin to a quarry on No. 3 dyke. Power for the mill is provided by two 43-horsepower Caterpillar diesel engines. Water is pumped to the mill from a lake 500 feet to the north. Air for quarrying operations is supplied by a portable unit consisting of a Caterpillar D 13,000 diesel engine connected to a Gardner-Denver type WBH 365 D compressor. Diesel fuel is stored in three 2,200 gallon tanks, and in 45-gallon steel drums. Other mechanical equipment includes a Caterpillar D 2 tractor, a Warsop gasoline rock-drill, and an X-ray diamond drill. Office equipment includes a radio receiver and transmitter, providing communication with Yellowknife.

DEVELOPMENT

Development work to July 18, 1947, had been essentially confined to the surfaces of No. 1 and No. 3 dykes. The sole pit on the former measured about 15 by 6 by 1½ feet deep. An excavation in No. 3 dyke had been advanced, at road level, into an upward-sloping surface and measured about 50 feet long, 25 feet wide, and from 2 to 9½ feet deep; smaller excavations had been made nearby in the same dyke. Here and there, a little rock had been blasted from No. 8 and No. 11 dykes, possibly to provide bulk samples for analysis, but no further information was available.

GEOLOGY

The oldest rocks on the property are composed mainly of granodiorite containing about 10 per cent of biotite, but numerous inclusions of schists have resulted in local quartz-biotite gneiss and quartz-diorite phases. The granodiorite is well foliated, and locally brecciated. Numerous dioritic dykes, some with large phenocrysts of plagioclase, intrude the granodiorite, and most of them strike northwesterly, about parallel with the schist inclusions in the granodiorite, and dip steeply northeast. The dykes are cut by pegmatite and quartz veins and, 1¾ miles east of the property, by granite. The granite contains some 40 per cent potassium feldspar, mostly microcline, about 20 per cent plagioclase, 30 per cent quartz, and muscovite, biotite, and tourmaline in variable amounts. The pegmatite is genetically related to the granite and forms dykes and irregular bodies that range up to more than 500 feet in length and 40 feet in width. These commonly trend southwest and dip about 50 degrees southeast, towards the granite. The pegmatite is composed mainly of feldspars (including microcline-perthite and albite, the latter commonly of the variety cleavelandite), quartz, and muscovite. The texture varies from aplitic to pegmatitic. Few of the dykes show any marked banding parallel with the walls. Rare-element minerals identified include (in about their order of relative abundance) beryl, tantalite-columbite, tourmaline, spodumene, amblygonite, lithiophilite, and lazulite. So far as known those lying 1 mile to 2 miles from the granite border contain most tantalite-columbite. The Peg Tantalum property lies within this favourable zone.

The rocks exposed in the vicinity of the Peg Tantalum camp and plant comprise about equal parts of granodiorite and dioritic dyke rock; and pegmatite dykes underlie probably less than 5 per cent of this restricted area.

DESCRIPTION OF DEPOSITS

The mineral deposits are those parts of the pegmatite dykes that contain tantalite-columbite ($(Fe,Mn)O.(Ta,Cb)_2O_5$). Although the pegmatite bodies are numerous, by no means all of them are known to contain significant amounts of this mineral, and data available to the writer indicate the presence of ore-grade material in No. 1 dyke only. So far as known, the owners have made no attempt to systematically or accurately evaluate all available pegmatite exposures. Their efforts to July 1947 had been confined mainly to No. 1 and No. 3 dykes, these being two of the four dykes previously selected by the Geological Survey, after preliminary examination, as probably containing most tantalite-columbite. Furthermore, mining of these dykes appears to have followed closely the described (Jolliffe, 1944a, Figure 2) surface concentrations of tantalite-columbite.

As is to be expected, the tantalite-columbite is erratically distributed within the pegmatite. It occurs in blocky crystals up to 2 inches square and several inches long, and in plates up to 2 inches by 4 inches. A high tantalum content is commonly associated with the blocky crystals, whereas high-columbium varieties seem to be characterized by thin platy forms. Tantalite-columbite occurs characteristically within albite near quartz lenses, but was found in each of perthite, quartz, muscovite, and beryl. It is probably most common in the medial and upper parts of the dykes. Specific gravity determinations on six samples of tantalite-columbite from various dykes and on two lots of concentrates from No. 1 dyke indicate that the tantalum pentoxide content ranges from 63 to more than 80 per cent. A platy variety of the mineral, submitted by J. R. Saunders to the Fansteel Metallurgical Corporation, North Chicago, Illinois, was reported by that organization to contain only 14 per cent tantalum pentoxide and to be columbite[1]. Apparently both high-tantalum and high-columbium varieties occur on the property, the former being much the more common. A more detailed description of the productive dykes (Nos. 1 and 3) follows.

No. 1 Dyke. This dyke outcrops about 1,000 feet west of the mill. Its surface length is about 110 feet, and it strikes north 55 degrees east and dips 30 to 60 degrees southeast. It has a general lenticular outline and a maximum true width, at the surface, of about 7½ feet. The dyke transects granodiorite, and dioritic dykes that cut the granodiorite. The

[1] Personal communication from J. R. Saunders to A. W. Jolliffe (1944a, p. 11).

widest part of the dyke contains most visible tantalite-columbite. Six samples taken from this part of the dyke by the Geological Survey (Jolliffe, 1944a, pp. 11-13) and treated by the Bureau of Mines (1944c) indicated a shoot 65 feet long with an average true width of about 6 feet, from each ton of which could be recovered 9·13 pounds of concentrate containing about 75 per cent tantalum pentoxide and less than 3 per cent combined tin and titanium oxides.

No. 3 Dyke. This dyke is about 500 feet southeast of the mill. Its outcrop is nearly 200 feet long and passes under drift at each end. The dyke is highly irregular in outline but has a general northerly trend. Where known, the dip is about 50 degrees east. Solid pegmatite is exposed across true widths of as much as 21 feet. The wall-rock is mainly diorite dyke-rock but here and there is older granodiorite. The original surface of the dyke displayed scattered crystals of tantalite-columbite throughout a length of 150 feet. Most of this surface pegmatite has since been extracted and, in the process, a quarry or open-cut advanced into the dyke at road level. When examined by the writer, the pegmatite in the face of this quarry, and that piled nearby, contained a few thin plates of tantalite-columbite, presumably the high-columbium variety. It was, nevertheless, clearly below ore grade.

MINING AND MILLING

The small amount of pegmatite extracted to date has, as previously mentioned, come from surface workings, mainly from a quarry on No. 3 dyke and from a maximum depth of $9\frac{1}{2}$ feet. An inclined trestle, designed to permit the haulage of this material to the mill in mine cars, was not used; instead, the rock was transported by tractor and sled.

It is very doubtful if a substantial operation could be sustained by open-cut or quarry methods. Besides being difficult or impracticable during the winter season, such methods could not be carried to any great depths on dykes dipping, as many of these do, at angles of about 50 degrees.

The mill has a capacity of possibly 50 tons each 24 hours of operation. Pegmatite of unknown grade was passed through a jaw crusher and a 3-foot by 6-foot Hardinge rod mill, over a two-compartment 8-inch by 12-inch Denver jig, and then to screens. The resultant, finest, minus 20 mesh product was then passed through a Fahrenwald sizer and over two Wilfley tables, each producing a tailing, middling, and concentrate. The middling products were combined with plus 20 mesh, minus $\frac{3}{16}$-inch material from the screens and treated in a 16-inch by 10-foot Denver spiral classifier. The overflow from the classifier was re-tabled. As previously stated, the resultant concentrates were of unknown but presumably unsatisfactory grade. According to company records the ratio of concentration was about 400:1 during the period April to July 1947.

Pensive Yellowknife Gold Mines, Limited (98)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-I-11. Bureau of Mines, 1940b. Fortier, 1947a. Lord, 1941a, pp. 79-80.

Pensive Yellowknife Gold Mines, Limited, owns the Rare-Ness group, a gold prospect of about fourteen claims on the east side of Upper

Pensive Lake, 38 miles northeast of Yellowknife. The claims are 9½ miles north-northeast of the Thompson-Lundmark mine (103), whence a winter tractor road leads to Yellowknife.

The Rare and Ness claims are (1947) part of an original property of about seventy claims recorded late in 1938 and owned by the Harry A. Ingraham Trust in 1939. The initial work was done on the present property during the latter part of 1939 when four men sank a prospect shaft near the southwest corner of Rare No. 15 claim, erected a small amalgamation mill, and recovered a little gold. Cabins were erected in 1940. A wood headframe was erected at the shaft in the spring of 1941, and a tractor brought in to drive an air compressor, fan, and hoist. Four men were employed from May 1 until late in the year; the shaft was deepened to a reported depth of about 50 feet and some ore milled. A little work is reported to have been done since, but the property was inactive in 1947 and 1948.

The property is underlain by intricately folded and faulted argillite, slate, and greywacke of the Yellowknife group.

The productive vein was examined by Lord in 1939 and described as follows:

> Near the southwest corner of the Rare 15 claim a pit[1] 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.

Philmore Yellowknife Gold Mines, Limited (137)

References: Bruder, 1941. Buffam, 1942. Bureau of Mines, 1938a; 1938e; 1940f; 1942c. Bureau of Northwest Territories and Yukon Affairs, 1947a, parts of Mineral Claim Sheets 85-H-11, 12, 13, and 14. Ellsworth and Jolliffe, 1937. Hawley, 1939. Jolliffe, 1937a; 1942c. Lord, 1941a, pp. 125-126.

INTRODUCTION

Philmore Yellowknife Gold Mines, Limited, owns the Fox group of eighteen claims on Outpost Islands, the most westerly islands in the east arm of Great Slave Lake. The property is about 55 miles south-southeast of Yellowknife, and a former producer of gold, tungsten, and copper. The following account is based mainly on data collected by Jolliffe in 1936 and June 1942. The property has not been visited by an officer of the Geological Survey since 1942.

[1] This pit was later deepened as a shaft that on September 13, 1941, was 44 feet deep and measured 5 by 8 feet at the bottom. So far as known all ore treated came from the quartz vein exposed by this pit and shaft to a depth of about 50 feet.

HISTORY

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. Work ceased at the latter date, and at that time the main (No. 1) shaft was about 450 feet deep, and drifts and crosscuts, opened on five levels, totalled about 1,700 feet. The mine was then abandoned and remained idle until it was reopened by Slave Lake Gold Mines, Limited, on September 5, 1940, with J. C. Byrne as manager. It was dewatered to the 200-foot level by November 17, and mining commenced on December 5, 1940. Erection of a 50-ton mill had begun in the meantime and milling started about February 1, 1941. Only gold was recovered at first, but on May 1, 1941, the recovery of tungsten concentrates commenced. The operators were handicapped by lack of working capital[1] and were, consequently, unable to do sufficient development work to maintain ore reserves. The mill was shut down on August 9, 1942, at which time the No. 1 (main) ore shoot was essentially exhausted between the 425-foot level and the surface. Underground work continued until the property was closed in October 1942. During this production period the efforts of the company were devoted chiefly to the recovery of gold; but some tungsten was recovered. The property was examined during the summer of 1942, on behalf of the Metals Controller, as a possible source of tungsten, then a metal in short supply. International Tungsten Mines, Limited, incorporated in 1942, acquired the property of Slave Lake Gold Mines, Limited, and optioned it to the Consolidated Mining and Smelting Company of Canada, Limited, during part of 1943. Philmore Yellowknife Gold Mines, Limited, incorporated in 1945, acquired the assets of International Tungsten Mines, Limited, in April 1946. So far as known, no significant work was done at the property between October 1942 and December 31, 1948.

PRODUCTION AND ORE RESERVES

The following production data were supplied by the Dominion Bureau of Statistics:

Year	Ore treated	Concentrates shipped	Gold (in bullion)	Gold (in concentrates)	Silver	Copper (in concentrates)	WO_3 (in concentrates)
	Tons	Tons	Ounces	Ounces	Ounces	Pounds	Pounds
1941	12,956	Not available	5,637	373	27	35,420	8,732
1942	7,368	297	3,172	723	48	77,443	18,968
Totals	20,324	....	8,809	1,096	75	112,863	27,700

Reserve ore in place underground, as of September 1942, amounted to about 11,000 tons grading about 0·6 ounce gold a ton, 0·6 per cent WO_3,

[1] Slave Lake Gold Mines, Limited: Report to Bondholders and Shareholders for the Period Ending December 31st, 1941, p. 2.

and 0·7 per cent copper. This ore is in No. 1 ore shoot of the west zone, mainly below the 425-foot level. About 10,000 tons of recoverable tailings contain about 0·26 ounce gold a ton, and 0·48 per cent WO_3.

DEVELOPMENT

Surface work includes pits on eight or more mineralized zones, and about 11,000 feet of diamond drilling.

Underground workings are served by two shafts on an island about 2,800 feet long from west-southwest to east-northeast, and about 500 feet wide. The main (No. 1) vertical shaft is about 450 feet from the east end of the island. This shaft has two compartments, is about 525 feet deep, and serves drifts at depths of 50, 125, 200, 325, 425, and 525 feet. The collar of the shaft is in the hanging-wall of the west zone, but between the 200- and 300-foot levels the shaft enters the foot-wall. An inclined winze connects the 425- and 525-foot levels. Drifts and crosscuts totalled about 3,500 feet in June 1942, about 4 months before work stopped. A drift on the 200-foot level extends about 900 feet west-southwest from No. 1 shaft to connect with a raise to the surface. The raise was designed as an orepass to handle ore from No. 2 shaft.

No. 2 shaft, about 50 feet deep in June 1942, is 2,040 feet west-southwest of No. 1 shaft, and about 300 feet from the west end of the island. A surface tramway is reported to connect No. 2 shaft with the raise from the 200-foot level drift from No. 1 shaft.

GEOLOGY

The islands are underlain by metamorphosed sedimentary rocks of early Precambrian age, and 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. The strata are cut by a few narrow basic dykes, and by small bodies of quartz containing mica, andalusite, and rare grains of blue corundum (sapphire). Near the mineralized shear zones the strata strike about north 70 degrees east and dip about 80 degrees southeast. Here and there drag-folds offset the beds to the right and pitch about 70 degrees east-northeast. One such drag-fold lies immediately east of No. 1 orebody.

DESCRIPTION OF DEPOSITS

Sheared and silicified zones with disseminated metallic minerals occur in quartz-mica schist and gneiss and lie parallel with the bedding, or nearly so. Some work has been done on eight or more zones that outcrop on a group of four 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 and 85 degrees east and dip southerly at angles between 75 and 85 degrees. They are exposed at the surface for lengths up to 1,550 feet and range in width up to about 10 feet. 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 with 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, and gold. Chalcopyrite and pyrite constitute up to 20 per cent of the mineralized zones. Scheelite is said to be common in the tungsten concentrates, and has been detected in the tailings; it has not (June 1942) been identified in place. In 1937 the Bureau of Mines detected 0·20 per cent tin, probably as cassiterite, in a shipment of 1,063 pounds of ore from the 50-foot level of No. 1 shaft.

In most places the mineralized material in the shear zones 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. Tungsten, as ferberite, has been found in four shear zones and may occur in others. Ferberite is a dark brown to black mineral and occurs as plates up to one-eighth inch across in quartz surrounding fragments of rock.

Almost all underground work has been done on the west zone. This zone outcrops 30 feet southwest of No. 1 shaft and thence 260 feet south 65 degrees west to the lake shore. The zone extends beneath overburden to the shaft and dips about 80 degrees south. A zone that may be a continuation of the west zone outcrops 100 feet east of the shaft and 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; the width east of the shaft is not known because the zone is not well exposed. All ore mined came from No. 1 ore shoot in the west zone. This ore shoot outcropped about 125 feet west of the shaft and has been explored by drifts to a depth of 525 feet, and by drill-holes for an additional 175 feet. It pitches about 70 degrees east, approximately parallel with the pitch of the drag-fold immediately east of it. The following are the approximate drift lengths of gold ore as indicated by stope plans to June 1942: 50-foot level, 230 feet; 125-foot level, 250 feet; 200-foot level, 230 feet; 325-foot level, 170 feet; 425-foot level, 140 feet. Gold ore was also found on the 525-foot level. Drift lengths of tungsten-bearing material (grade 0·5 per cent or more) are commonly greater. The average width of the ore shoot is about 2 feet. The average grade of the ore mined from this orebody probably averaged between 0·60 and 0·75 per cent WO_3, and between 0·5 and 1·0 ounce gold a ton.

An ore shoot at No. 2 shaft is said to be 185 feet long at the surface where it has an average width of 1·4 feet, and contains 0·65 ounce gold a ton and a little tungsten.

MILL

The mill treated about 45 tons a day during June 1942. Products recovered were gold bullion and copper-gold and tungsten-gold concentrates. Gold recovery was probably between 80 and 90 per cent. Tungsten recovery for 13 months commencing May 1, 1941, was about 10 per cent. Tailings were impounded for future treatment.

COSTS

Operating costs per ton for the 6 months ended December 31, 1941, were $18.89[1], distributed as follows: development, $3.97; mining, $4.33; milling, $5.06; mine overhead, $1.61; other costs (including depreciation and pre-production expense write-off), $3.92.

Pine Point Concession (139)

References: Bell, J. M., 1929b; 1930; 1931. Bell, R., 1902. Cameron, 1917; 1922a. Lord, 1941a, pp. 130-132. Stockwell and Kidd, 1932.

The Pine Point concession, which contains deposits of lead and zinc, is on the south shore of Great Slave Lake. It is about 110 miles south of Yellowknife, and 24 to 52 miles east of Hay River settlement. The latter place is the northern terminus of the Mackenzie highway from Grimshaw, Alberta. The northwest corner of the concession is the south shore of Great Slave Lake at the 115th meridian. The boundary extends 15 miles south from this point; thence 28 miles east; thence 22 miles north to Great Slave Lake; and thence westerly along the shore of the lake to the 115th meridian. The concession is being explored by the Consolidated Mining and Smelting Company of Canada, Limited, and Ventures, Limited.

Although deposits of lead and zinc near Pine Point were well known since about 1898 they were not actively explored until 1929. In that year Northern Lead Zinc, Limited, with finances provided by the Consolidated Mining and Smelting Company of Canada, Limited, and Ventures, Limited, initiated a vigorous program of geological mapping, pitting, and drilling. Before the work was stopped by conditions attending the ensuing depression, reports indicated lead-zinc ore amounted to about 500,000 tons. A review of this work in 1946 and 1947 led the latter two companies to apply to the Department of Mines and Resources for exclusive prospecting rights within an area of about 500 square miles surrounding the claims of Northern Lead Zinc, Limited. The concession area was granted by Order-in-Council in March 1948, for a period of 3 years, subject to the condition that a minimum of $50,000 be spent on exploratory work during the first year, and at least $75,000 during each of the succeeding 2 years. Preliminary work commenced about June 4 and diamond drilling about July 15. Operations for 1948 ended with freeze-up about November 30. Work done to that date included thirty-two drill-holes totalling about 6,000 feet, the construction of requisite roads, camps, and an airstrip about ½ mile long, and the installation of a radio station whereby communication was maintained with the Con mine at Yellowknife. The main object of this preliminary drilling was to determine the structure, stratigraphy, and other geological guides to future exploration. The results have not been made public.

The deposits and adjacent geology were described by Stockwell and Kidd 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 [Bell, J. M., 1931, p. 617].

[1] Slave Lake Gold Mines, Limited: Report to Bondholders and Shareholders for the Period ending December 31st, 1941.

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 [Cameron, 1922a, p. 13] and is at least 255 feet thick on the property of the Northern Lead Zinc, Limited [Bell, J. M., 1931, p. 615].

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 [1902] in 1899, by Cameron [1917, 1922a] in 1916, and were described in 1929, 1930, and 1931 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 [Bell, J. M., 1931, p. 615].

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 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 $\frac{1}{4}$ to $\frac{1}{2}$ 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

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

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 south-east 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 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 [Bell, J. M., 1931] small amounts of quartz and sericite. 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 [Bell, J. M., 1931, p. 618] beds of low mineral-ization 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. Mack-intosh 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 pro-portions, 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 [Bell, J. M., 1931, p. 618] 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.

P.L.D. Group (118)

Reference: Lord, 1941a, pp. 120-122.

The P.L.D. group of twenty-three claims lay 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 claims were staked late in July 1939 by Peter Davidson and Peter Lauder, and were 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 by the writer on August 22, 1939. They have since lapsed.

The property lay within an area of greywacke, slate, and quartz-mica schist of the Yellowknife group. Some of these rocks contain small, rounded knots, ranging up to $\frac{3}{4}$ 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 strike north 20 degrees west and dip steeply east. Quartz of No. 1 zone occurs as irregular stringers within an area about 200 feet long and 90 feet wide and parallel with the sediments. Quartz may constitute 5 per cent of this area, and the enclosing rock is not notably altered or sheared. This zone of rocks 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 exposed by the trench, and most quartz occurs as stringers that range up to 2 inches in width. It 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.

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 with the walls of the zone, and this sheeted zone may be continuous for 1,100 feet. It trends parallel with 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 $\frac{1}{2}$ inch to $1\frac{1}{2}$ 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 exposed by 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, but 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 stock-work of quartz stringers. The enclosing quartz-mica schist and slate strike north 25 degrees west and dip 80 degrees northeast; the rock within the fractured zone may be a little more slaty than the rock on either side. The zone parallels the enclosing sediments, is exposed for 135 feet, and passes under muskeg at each end. The exposed part ranges from 25 to 45 feet in width and in most places the fractured rock grades into unfractured rock. The zone is explored by five crosscuts trenches. These average about 10 feet long and the exposed rock contains about 20 per cent quartz. This 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 variety. The quartz contains fragments of schist and slate, and a little chlorite, pyrite, and arsenopyrite. The metallic minerals also occur here and there in the adjacent wall-rock. No gold was seen, but a sample cut across 3 feet of quartz and rock in one trench is reported[1] to have contained about $\frac{1}{3}$ ounce of gold a ton.

Polaris, Vega, and Star Claims (9)

Reference: Kidd, 1932b, pp. 56-58.

These claims lay 2 miles west of the mouth of Sloan River, on the north shore of Hunter Bay of Great Bear Lake. The following description is by Kidd.

> 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 overburden. 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 $\frac{1}{2}$ 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, 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.

Prelude Lake Pegmatites (101)

Reference: Jolliffe, 1944a, p. 33.

An area of about 10 square miles immediately north of Prelude Lake was prospected for beryl by the Geological Survey in June 1943. This area, about 17 miles northeast of Yellowknife, included the Dike group of claims staked that year for Frobisher Exploration Company, Limited. These claims have lapsed.

[1] Payne, T.: personal communication.

The area [according to Jolliffe] is underlain by closely folded, altered, sedimentary rocks [of the Yellowknife group], cut by irregular bodies of pegmatite and pegmatitic granite. In general, the larger the body, the greater the proportion of granite. Beryl was found in fifty-six of the one hundred pegmatites examined and displays crystals faces up to 7 inches wide and 17 inches long. Minerals common to all pegmatites are grey and pink feldspar, quartz, muscovite, and black tourmaline. The beryl-rich sections commonly occupy medial positions in the pegmatites, and in places contain, in addition to the above-mentioned minerals, minor amounts of green and red tourmaline, lithiophilite, tantalite-columbite (specific gravity 5·94 on one specimen. . . .), with crystal faces up to ¼ inch by 1¼ inches, lazulite, gahnite (zinc spinel), and several unknown minerals.

The three most important beryl concentrations known are in dykes about 5,500, 7,000, and 16,000 feet north of the most northerly bay of Prelude Lake, but none is of ore grade.

Prospect Street Syndicate (99)

References: Bureau of Mines, 1948d. Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-I-14. Henderson, 1941c.

INTRODUCTION

Prospect Street Syndicate owns one hundred and thirty-five claims as follows: the A.M., Arab, Bunt, Cam, Dod, Mer, Plum, Q.T., Ron, and W.A.B. groups of twelve claims each; the N.L. and Webb groups of six claims each; and the Beth group of three claims. These cover a compact area measuring about 6½ miles from south-southwest to north-northeast. They lie mainly on the east side of Cameron River, and about 45 miles northeast of Yellowknife, 8 to 14 miles south of the Camlaren mine (64), and 1½ to 7½ miles north of the north end of Upper Ross Lake. Numerous rock ridges rise an estimated 300 feet above Cameron River and trend north or northeast. Several lakes on the property are suitable for the use of aircraft from Yellowknife; and one of these, the site of the present camp, is ¾ mile long, ¼ mile east of Cameron River and 3 miles north of the north end of Ross Lake. A winter road to the property of Peg Tantalum Mines, Limited (97), connects Ross Lake with Yellowknife. The writer visited the property on July 19, 1947. R. W. Edie was in charge of exploration. G. Murphy of Yellowknife and F. P. Webb of Hartford, Connecticut, were co-managers of the syndicate.

HISTORY, CAMP, AND DEVELOPMENT

The claims were staked by G. Murphy and associates in the spring of 1945 and acquired by Prospect Street Syndicate later that year. To date (December 31, 1947) this organization has been engaged in exploring its extensive holdings, and completing such work as is required to maintain the claims in good standing. About 1,000 feet of X-ray diamond drilling was completed in 1946, and more than 1,500 feet during the spring and summer of 1947. In addition to prospecting, some trenching and stripping are reported to have been done at various localities each year. The camp, at the time of the writer's visit, consisted of five tents.

GEOLOGY

The claims are underlain mainly by volcanic rocks of the Yellowknife group. These comprise andesite, dacite, and basalt lavas with minor interlayered tuff and agglomerate. Pillow structures are common. These rocks trend north or northeast and face west or northwest. They are overlain, along the west border of the claims, by greywacke, slate, and other sedimentary strata of the Yellowknife group. The volcanic rocks have been intruded by a batholith of granodiorite and related rocks, the west contact of which lies about ½ mile east of the claims. Near this contact the volcanic members have been invaded by many granodiorite dykes. Dykes of hornblende gabbro and similar rocks, some with scattered phenocrysts of pinkish to white weathering feldspar, cut the granodiorite and volcanic rocks, resulting in the rather complex contact zone found immediately east of the southern half of the property. Diabase dykes occur here and there; they are relatively fresh, weather red-brown, trend about northwest, and are the youngest rocks recognized.

DESCRIPTION OF DEPOSITS

Rusty shear zones containing quartz, pyrite, pyrrhotite, arsenopyrite, and gold are reported[1] to have been exposed on Q.T. No. 11, N.L. No. 2, and Arab No. 53 claims.

However, throughout the summer of 1947, the Frank quartz vein was regarded by the owners as the most promising known gold occurrence, and this was examined briefly by the writer. It was discovered on June 4, 1947, on Ron No. 27 claim, about ⅓ mile west of the granodioritic batholith. The enclosing rocks are white weathering, medium-grained granodiorite almost devoid of ferromagnesian minerals; and fine- to medium-grained, black, dioritic rock. The latter is in part massive, but elsewhere displays foliation that trends about north 30 degrees west and dips 65 to 80 degrees northeast. Some of the dioritic rock may be recrystallized andesitic lava, and thus older than the granodiorite. Nevertheless, within 100 feet of the vein, similar dioritic rock contains scattered ½-inch pink or white feldspar(?) phenocrysts, displays chilled borders, and doubtless occurs as dykes younger than the granodiorite. Accordingly, a detailed examination of the dioritic wall-rock might reveal that some of it, although devoid of prominent phenocrysts, likewise represents a dyke or dykes younger than the granodiorite.

The vein strikes about north 15 degrees west, dips easterly at about 80 degrees, and is exposed by fourteen trenches for a length of nearly 140 feet. Its average true width at the surface is about 3½ feet. At the south end of the exposure it narrows and ends in granodiorite. Elsewhere the rocks adjoining the vein are mainly dioritic types (altered andesitic lava and/or basic dyke rock) except that granodiorite outcrops here and there, mainly on the east wall. At the north end of the exposures the vein bends so as to strike about north, and passes beneath drift. The wall-rocks, for as much as a foot or so from the quartz, are a little more fractured than elsewhere. In part the walls of the vein are free and sharp; elsewhere branch veinlets pass from the main vein into the wall-rock, and in part parallel the foliation. Other veins and groups of veinlets are exposed here and there in the nearby rocks. Abundant gold was seen in the vein in two trenches about 65 and 75 feet from the south end of the vein. Here the quartz is medium grained and grey, and contains arsenopyrite, chalcopyrite, pyrite(?), and galena(?). The arsenopyrite occurs as seams up

[1] Data from a report by W. L. McDonald, Consulting Geologist, Yellowknife, submitted to Prospect Street Syndicate, September 4, 1946.

to ½ inch or more in width, and as disseminated crystals. Many rusty cavities found in the quartz were probably formerly filled with this mineral. A surface assay plan supplied by the owners indicates an ore shoot 99 feet long, with an average width of 3·2 feet and gold content of 0·61 ounce a ton. Eight short diamond drill-holes are reported to have explored the vein after the writer's visit, but the sampling results are not known.

Ptarmigan Mines, Limited (82)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-J-9. Henderson and Jolliffe, 1939, p. 332. Jolliffe, 1938, pp. 35-36; 1946. Lord, 1941a, pp. 97-99.

INTRODUCTION

Ptarmigan Mines, Limited, is a former gold producer located about 6 miles northeast of Yellowknife. The company is controlled by the Consolidated Mining and Smelting Company of Canada, Limited, and owns the Jack and Lily groups of about twenty-four claims. A 5-mile gravelled road connects the mine with a dock on the east side of Yellowknife Bay; and motorboat service was operated between the dock and Yellowknife settlement. H. M. Powell was mine manager. The property was last visited by the writer in 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 the Consolidated Mining and Smelting Company of Canada, Limited. Ptarmigan Mines, Limited, was incorporated in October 1938. A three-compartment vertical shaft was begun in October 1938. A 100-ton mill commenced operations on November 27, 1941, and afforded the first gold brick on January 3, 1942. Milling stopped on August 31, 1942, when the property was closed because of unusual conditions attending World War II. No work has been done since (December 31, 1948).

PRODUCTION AND ORE RESERVES

The following production data were supplied by the Dominion Bureau of Statistics.

Year	Ore treated	Gold	Silver
	Tons	Ounces	Ounces
1941	3,096	883	172
1942	31,333	11,038	2,355
Totals	34,429	11,921	2,527

So far as known no statement of ore reserves has been released by the operators.

DEVELOPMENT

The three-compartment vertical shaft, near the northeast corner of Jack No. 6 claim, is 923 feet deep; it affords access to the underground workings, all of which are on or near No. 1 vein. The shaft is about 40 feet north of the vein, which is opened by drifts that totalled (September 1941) about 5,760 feet, as follows: 150-foot level, 1,000 feet; 300-foot level, 1,000 feet; 450-foot level, 750 feet; 600-foot level, 2,160 feet; 750-foot level, 350 feet; and 900-foot level, 500 feet. Raises connected the 750-foot with all overlying levels and the surface.

GEOLOGY

The strata near No. 1 vein are sedimentary members of the Yellowknife group, now fine-grained quartz-mica schist interlayered with a little slate. A very few rounded nodules of metamorphic minerals occur here and there and range up to $\frac{1}{2}$ inch in diameter. Tourmaline-bearing muscovite-biotite granite and pegmatite outcrop 3 miles northeast of the shaft and are intrusive into the sedimentary strata. The beds at the vein strike about north 10 degrees west, dip easterly at 65 to 75 degrees, and are overturned. The axes of some folds in the vicinity strike northwesterly about parallel with the No. 1 vein. The Ptarmigan fault is about $\frac{1}{4}$ mile east of the shaft, and strikes about north 10 degrees west; its relation to No. 1 vein has not been established.

No. 1 *Vein*

Although several veins are reported on the property only No. 1 vein is known to contain orebodies. It strikes north 65 degrees west, is about vertical, and is exposed on the surface for 1,300 feet on Jack Nos. 5 and 6 claims and Lily No. 2 claim; both ends are hidden by drift. The vein is a continuous body of quartz, but includes a little wall-rock. The observed width at the surface ranges from 1 foot to 25 feet, and the maximum width may be 45 feet; the average width is about 12 feet. Near the northwest end of the outcrop the vein averages about 4 feet in width, and near the southeast end about 8 feet. The dimensions on the 150- and 300-foot levels are about the same as at the surface. The south wall of the vein is commonly sharp, tight, and sinuous, but in places it is nearly straight and slightly sheared. The north wall is commonly highly irregular, and many tongues from the vein enter the wall-rock; in places the vein is separated from the wall-rock by a stock-work 10 feet wide composed of schist and quartz veinlets. A fault outcrops about 620 feet northwest of the shaft, is about vertical, and strikes about north; the vein on the west side of the fault is displaced 13 feet north relative to the vein on the east side. 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. Milky white quartz, as veinlets up to 3 inches wide with indefinite boundaries, cuts the grey quartz and here and there occupies the full width of the vein or occurs near the north wall. Some grey quartz is ribboned by seams parallel with the walls and $\frac{1}{2}$ inch to 3 inches apart; the seams contain micaceous minerals, and some are slightly sheared and have smooth faces. Much of the ribboned quartz occurs near the south wall. Minerals other than quartz probably constitute less than 1 per cent of the vein in most places. Pyrite, sphalerite, and galena are the most plentiful metallic minerals; other minerals include arsenopyrite, chalcopyrite, pyrrhotite, native copper, gold, brown tourmaline, pale green feldspar, carbonate, and a very little scheelite. Much of the pyrite and sphalerite occur in the quartz as irregular patches; most of the pyrite in these patches is very fine grained, occupies drusy cavities, and is moulded on clear quartz crystals. Where the quartz contains appreciable quantities of gold it also contains other minerals, notably pyrite, sphalerite, galena, and tourmaline. Gold commonly occurs in ribboned, grey quartz where much of the visible metal forms thin flakes on or near the seams.

The ore shoots are highly irregular, and dimensions are not available for publication. Much of the known ore on the 150- and 300-foot levels occurs near the south wall of the vein, but not all quartz near this wall is ore. Probably many of the ore shoots are narrower than the vein. Their boundaries cannot ordinarily be determined by inspection, and much sampling and assaying were required to avoid excessive dilution by barren or low-grade quartz. Apparently this difficulty in distinguishing ore-grade quartz resulted in some dilution; and satisfactory calculations of the gold content of the ore were made by first averaging the assays, then reducing ('cutting') assays higher than this average to 1·5 times the average, and finally re-averaging to obtain a 'cut' grade.

OPERATING COSTS

Operating costs, before taxes and depreciation, were: 1941, $13.67 a ton; 1942, $11.99 a ton.

Rich Group Yellowknife Mines, Limited (83)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-J-8. Jolliffe, 1936, pp. 4, 5; 1938, pp. 36-38; 1942a. Mines Branch, 1936a.

Rich Group Yellowknife Mines, Limited, owns the Rich claims on the east shore of Yellowknife Bay opposite Yellowknife. The following quotations are by Jolliffe (1938):

> 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..... 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.........

Rich Group Yellowknife Mines, Limited, incorporated in 1945, acquired the Rich claims and is reported to have completed about 9,200 feet of diamond drilling in 1945. So far as known the property has been inactive since.

---
[1] Personal communication from the late L. T. Burwash.

....The country rock [near the discovery vein] is greywacke and slate 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].

Russ-Rae Yellowknife Mines, Limited (42)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 86-B-3. Tremblay, 1948, p. 6.

Russ-Rae Yellowknife Mines, Limited, owns the Linda group of twelve claims and the Quebec group of six claims. These claims are about 2 miles west of Damoti Lake, about 2½ miles north of the camp of Snowden Yellowknife Mines, Limited (43), and about 123 miles north-northwest of Yellowknife.

According to Tremblay:

....On the Linda No. 11 claim two exploratory trenches were cut in August 1946 to test a few quartz stringers reported to contain visible gold. The veins occur in slightly mineralized basic volcanic rocks.

The volcanic rocks referred to form part of the Yellowknife group.

Ruth Group (The Consolidated Mining and Smelting Company of Canada, Limited) (121)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-I-7. Henderson and Jolliffe, 1941.

The Ruth group of fourteen claims lies 4 miles west of François Lake and 57 miles east of Yellowknife. It may be reached by airplane from Yellowknife, or by tractor train over a 32-mile winter road from the company's wharf at the mouth of François River on Great Slave Lake. The author examined the property on September 18, 1947, and found the camp deserted and underground workings flooded.

---

[1] Personal communication from the late L. T. Burwash.

HISTORY AND PRODUCTION

The claims were staked by J. Michelson on behalf of the Consolidated Mining and Smelting Company of Canada, Limited, during the summer of 1940. About twelve men were employed at the property in 1941 when a shaft was sunk on Ruth No. 4 claim. A 25-ton mill was freighted to the property by tractor train during the following winter. The mine operated for about a month in July and August 1942, and the mill from August 1 to 12, inclusive. The property was then shut down because of a shortage of labour and, to December 31, 1949, had not been reopened.

From August 1 to 12, 1942, 186·8 tons of ore was treated, resulting in a recovery of 152·45 ounces of gold and 23·14 ounces of silver. A picking belt enabled the operators to reject about 30 per cent waste rock from the material mined; and an ultraviolet lamp installed over the belt provided a means of sorting scheelite-rich fragments.

Data on ore reserves are not available for publication.

CAMP AND PLANT

The camp is a few hundred feet west of a deep narrow lake used for aircraft landings. The buildings include a cottage, two-story bunk-house, cook-house, two-story combined office and staff-house, mill, dry, hoist house, and steel shop. They are of frame construction, uninsulated, sheathed with rubberoid, and in fair repair. The mill has been partly dismantled and some items removed from the property.

DEVELOPMENT

Surface work includes more than ninety trenches on six veins, and most of these trenches are on Nos. 1, 2, and 3 veins. About twenty, short diamond drill-holes have explored Nos. 1 and 2 veins from the surface, and some underground diamond drilling has been done on the latter vein. No. 2 vein was opened by a two-compartment shaft, collared in the vein, and inclined 80 degrees east parallel with the dip of the vein. This shaft, on Ruth No. 4 claim, is about 200 feet deep, and a little drifting was done on the 100- and 200-foot levels. Stopes were opened above the 100-foot level.

GEOLOGY

The property is underlain, except for minor dykes and sills, by greywacke and slate of the Yellowknife group. The greywacke occurs in beds up to many feet in thickness. It is a buff weathering, dark grey rock. On suitably broken surfaces it displays a slight sheen due to mutually parallel biotite flakes. Many beds grade from coarse grained at the bottom to fine grained and slaty at the top. The slate beds are black and commonly well cleaved. Here and there they exhibit numerous tiny spots or aggregates of micaceous material, each about $\frac{1}{16}$ inch in diameter. Near Nos. 1, 2, and 4 veins the beds strike about north 10 degrees east and dip 75 to 85 degrees east or are vertical. They form a tight anticline, the axial plane of which strikes about parallel with the beds and dips about 80 degrees east. A few hundred feet south of No. 2 vein the beds bend around the fold axis and indicate an almost vertical plunge. Elsewhere the axial part of the fold is marked by a zone of broken rock cut here and there by irregular quartz bodies, or is covered with drift.

The greywackes and slates are cut by a few sills or dykes of white weathering quartz-feldspar porphyry, up to 6 feet or more in width. These bodies outcrop 100 to 200 feet or more east of, and nearly parallel with, the anticlinal axis. They contain a little arsenopyrite, and are cut by transverse irregular veins of glassy quartz.

DESCRIPTION OF DEPOSITS

No. 1 Vein is on Ruth No. 3 claim. The enclosing strata strike north 15 degrees east, dip easterly at 80 degrees, and face east. The vein is parallel with the strata. It is exposed for a length of 430 feet by seventeen trenches and has an average width of about 2 feet. In the most northerly trench it is about 1 inch wide and occurs in a slate band about 3 feet wide. In the most southerly trench it is about 1 foot wide. The wall-rock is mainly slate. The vein matter is mainly quartz, except that in places inclusions of slate are abundant. The vein contains a little arsenopyrite, scheelite, and gold. Arsenopyrite also occurs in the wall-rock within a few inches of the vein, and in slate inclusions. The vein is reported to contain an ore shoot 50 feet long and 1·4 feet wide, with an average cut grade of 0·50 ounce of gold a ton.

No. 2 Vein is on Ruth Nos. 3 and 4 claims. The enclosing formations strike between north and north 20 degrees east, dip 80 degrees east, and face east. The vein is nearly if not precisely parallel with the enclosing formations. It occurs within a band of thin-bedded slate that is enclosed by thick-bedded greywacke. The vein is exposed for a length of 1,250 feet by more than thirty trenches and has an average width of about 15 inches. Near its north end it is about 25 feet west of the south end of No. 1 vein and probably 100 feet east of the anticlinal axis. Near its south end it enters the axial part of the anticline and there branches. The vein walls are sharp, but not sheared. They have been partly altered to biotite and contain a little arsenopyrite. The vein is mainly fine-grained, white to light grey quartz, but here and there contains thin partings of slate partly or entirely altered to biotite. The quartz contains a little arsenopyrite, pyrite, pale brown scheelite, feldspar, an unidentified soft, grey metallic mineral, and visible gold. About midway in its exposed length the vein bends slightly, the concave side of the curve being towards the west. An ore shoot at this bend, according to surface sampling by the owners, is 300 feet long, averages 0·62 foot in width, and contains 3·69 ounces gold a ton (uncut grade) or 2·86 ounces a ton (cut grade). The WO_3 content of the shoot, according to sampling by the Geological Survey of Canada, is about 0·1 per cent. The shaft was sunk in this ore shoot. To a depth of 90 feet, the average width of the vein was reported to be about the same as at the surface, and the grade somewhat higher. A selected sample of scheelite-rich vein material[1] from the shaft dump assayed: WO_3, 1·68 per cent; gold, 0·035 ounce a ton. This suggested that a low-gold, scheelite concentrate might be obtained by hand sorting from a picking belt with the aid of an ultra-violet lamp.

No. 3 Vein is on Ruth Nos. 7 and 13 claims, about 1 mile north of the shaft. It was not examined by the writer, and the following description

[1] Sample taken by R. E. Folinsbee, Geological Survey of Canada, 1941, and assayed by the Bureau of Mines, Ottawa.

is from data supplied by the owners. The vein strikes north 10 to 20 degrees east, parallel with the enclosing strata. It is exposed at intervals for a length of nearly 1,800 feet by twenty-four trenches and averages about 1 foot in width. It contains an ore shoot 120 feet long and 1·5 wide, averaging 0·30 ounce gold a ton. Scheelite was found in the vein by the Geological Survey of Canada in 1941.

No. 4 Vein is on the Ruth No. 3 claim, about 150 feet west of No. 1 vein. It is explored by seven trenches for a length of 625 feet and consists of scattered, irregular, discontinuous quartz bodies in a zone of fractured sediments. This fractured zone strikes about north 5 degrees east and may mark the axial part of an anticline. The quartz is reported to contain a little gold and scheelite.

Ruth Group[1]

(*Victory Lake*) (106)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-I-11. Fortier, 1947a, p. 4. Henderson 1939a, pp. 13, 14.

The Ruth group of thirteen claims is (1947) about 45 miles east-northeast of Yellowknife. Some diamond drilling is reported to have been done on the property since it was described by Henderson as follows:

> 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[2]. 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 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.

Ryan Group (132)

The Ryan group of nine claims included a copper prospect at the mouth of Barnston River, on the north shore of Great Slave Lake, about 125 miles east-northeast of Yellowknife. The claims were staked in August 1939 by J. Russell and T. O. Evans for the Ryan Exploration and Development Company, Limited, of Edmonton. No work was done on the property in 1940, but five men were employed there for about 6 weeks during the summer of 1941 under the direction of T. O. Evans. The property was not visited by an officer of the Geological Survey, and the following notes are mainly from data supplied by the owners in 1942.

---

[1] Not to be confused with another Ruth group (121), 4 miles west of François Lake, owned by the Consolidated Mining and Smelting Company of Canada, Limited.

[2] The sedimentary and volcanic rocks belong to the Yellowknife group.

Three pits, each 6 feet square, were sunk in rock to depths ranging from 14 to 21 feet. They are about 1,000 feet apart. The character and structure of the country rock are not known. The pits are reported to expose considerable chalcopyrite across widths of several feet near the surface, but none below a depth of about 12 feet.

Salmita Northwest Mines, Limited (46)

(*See* Figure 14)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 76-D-3. Folinsbee, 1949.

INTRODUCTION

Salmita Northwest Mines, Limited, owns a gold prospect comprising Salerno Nos. 1 to 18 and L.T. Nos. 1 to 3 claims. The property is in the barren grounds on the east side of Matthews Lake, which lies between MacKay and Courageous Lakes, 150 miles northeast of Yellowknife. Chartered aircraft, and a Seabee amphibian aircraft owned by the company, are the only means of transportation between the property and Yellowknife. The camp is equipped with radio transmitter and receiver. A crew of five men was at the property when the writer visited it in August 1947. J. T. Burton was consulting engineer. Most of the bedrock adjacent to the known gold occurrences is covered with drift. Much of the exploration has been done by diamond drilling; but no complete record of this work has been seen by the writer.

HISTORY

Salerno Nos. 1 to 18 claims were staked in July 1945 by M. Mitto and F. Salerno, and later that year Salmita Northwest Mines, Limited, was incorporated to acquire and develop them. The L.T. claims were staked in November 1946. The first diamond drilling commenced in May 1946 and explored the South vein and the North area. Other drilling is reported to have been done late in the summer of 1947, and in 1948.

CAMP AND EQUIPMENT

The camp, on a prominent point on the east shore of Matthews Lake, comprised three Jamesway huts, each 16 by 16 feet, and two tents. Oil was used for heating. Mining equipment on August 20, 1947, consisted of a sinking bucket and several rough hewn timbers for a headframe.

EXPLORATORY WORK

The property has been explored by trenching, stripping, and diamond drilling. To December 31, 1947, nearly all of this work had been done on the South vein and in the North area. Diamond drilling to that date probably amounted to several thousand feet. D. Zorgo, of Montreal, was engaged as a geophysicist and spent several weeks at the property during 1947.

GEOLOGY

The claims are underlain by volcanic and sedimentary rocks of the Yellowknife group. These strike about north-northwest parallel with the east shore of Matthews Lake, and are vertical or dip steeply east-northeast. The contact between the volcanic rocks on the west and the sedimentary strata on the east lies a few hundred feet inland from the east shore of the lake and, for a length of about $2\frac{1}{2}$ miles, nearly coincides with the medial line of the Salerno group of claims. The volcanic rocks are part of a belt, 1 mile to 3 miles or more in width, that extends many miles north-northwest and south-southeast of the property. A granitic batholith borders this belt on the west, and the sedimentary strata, invaded here and there by granitic stocks, extend east from the belt for many miles. Although the volcanic belt is mainly greenstone, that part exposed on the claims is mainly white to light green weathering rhyolitic or dacitic lavas, tuffs, and agglomerates; locally these rocks are interbedded with dark green, garnetiferous members, probably altered andesitic tuffs, and slate or phyllite. The sedimentary strata east of the volcanic rocks are greywackes or derived fine-grained quartz-mica schists, and slates or phyllites. A vertical strike fault with a left-hand displacement of about 1,400 feet cuts the sedimentary members. The known gold deposits are quartz veins in sedimentary or volcanic rocks close to their contact.

DESCRIPTION OF DEPOSITS

Gold was first found in the *South Vein* (*See* Figure 14, locality 4), on Salerno No. 2 claim near the south boundary of the property. The vein is about 500 feet east of Matthews Lake. Foliated porphyritic rhyolitic rocks extend from the lakeshore to an outcrop 50 feet west of the vein; the foliation in these rocks strikes north 25 degrees west and dips 75 or 80 degrees northeast. The rocks within 20 feet of the west wall of the vein are thin-bedded, light grey, sandy textured tuffs(?) and black slates that strike about north 20 degrees west. East of the vein is black slate, phyllite, and fine-grained quartz-mica schist; these rocks strike about parallel with the tuffs and slates and dip easterly at 80 degrees. The quartz vein is exposed for a length of 90 feet. It strikes north 40 degrees west, and probably dips about 80 degrees northeast. It is 1 foot wide where it passes under drift at the southeast end; and several lenticular quartz seams up to 3 inches wide are exposed by 18 feet of stripping beyond the northwest end. The width of the vein ranges from 1 foot to 3·5 feet. The walls are sharp and tight. Tongues of quartz project from the main vein, and these and lenticular quartz bodies in the nearby wall-rock in part parallel the enclosing strata, in part transect them. The quartz is dark grey and glassy, coarse grained and white, or grey and sugary textured. It contains a few partings of slate and a very little arsenopyrite, tourmaline, and visible gold. Slate adjacent to quartz contains scattered grains of arsenopyrite and pyrite. Thirty diamond drill-holes explored the vein and its vicinity for a strike length of 500 feet. These are said to have afforded encouraging samples from directly below the exposed part of the vein, but not elsewhere.

The New Discovery Vein (*See* Figure 14, locality 3) is on the L.T. No. 2 or 3 claim, about $\frac{1}{2}$ mile north-northeast of the South vein. A well-defined draw, 30 to 50 feet wide, strikes south 15 degrees east for about 250 feet from a bay on the west side of a small lake. The rocks on either side of the draw are greywackes or fine-grained quartz-mica schists, and slates or phyllites. The strata strike about parallel with the draw and are vertical or inclined steeply east, except at the walls of the draw, where they are crumpled, broken, and in places injected by irregular quartz bodies. The bottom of the draw is covered with drift. About 30 feet south of the lake, the east half of a trench transverse to the draw has exposed 26 feet of quartz. Neither wall of the quartz body is exposed. The quartz is fine grained and grey, and contains rare grains and streaks of pyrite. One grain of sphalerite was seen. Chip samples taken by the writer averaged 0·12[1] ounce of gold a ton across the width of 26 feet. One sample representing 4·6 feet of this width contained 0·23 ounce of gold a ton.

The North area (*See* Figure 14, locality 2) is about 2 miles north-northwest of the South vein, and probably on Salerno Nos. 14 and 16 claims. It is underlain mainly by grey, foliated rhyolitic lavas and pyroclastic rocks, and sedimentary strata outcrop about 700 feet east of it. It contains veins B, T, and C.

B Vein strikes north 20 degrees west and is nearly vertical. Its west wall is mainly dark grey slate that lies parallel with the vein. Its east wall is a dark green and brown, banded, medium-grained feldspar-amphibole rock, probably an altered tuff. In places this rock also appears on the west wall of the vein and there contains a few garnets. The vein is exposed for a length of 71 feet by a rock trench 91 feet long, and drift lies north and south of the trench. The vein varies from a narrow seam near the south end of the trench to a body 9 feet wide near the north end; and at the north end of the trench it is about 6½ feet wide. The walls are in places sharp and free, but elsewhere quartz grades into a pink and green altered rock cut by quartz veinlets. The vein quartz is coarse grained, grey, and mottled, or fine grained and white. It contains partings of rock and a little pink feldspar, tourmaline, yellowish green mica, pyrite, arsenopyrite, galena, sphalerite, and possibly unidentified soft grey metallic minerals. The metallic minerals comprise less than 1 per cent of the vein matter, but pyrite and arsenopyrite are plentiful in some inclusions of rock. Gold was not seen. Chip samples were cut by the writer 7·5, 28, and 54·5 feet south of the north end of the trench. These represented widths of 9·0, 6·0, and 4·3 feet, and contained[2] 0·60 ounce, 0·75 ounce, and 1·35 ounces gold a ton, respectively. A selected sample of quartz and galena, 58·5 feet south of the north end of the trench, contained[2] 2·89 ounces gold a ton. The vein had been explored by one diamond drill-hole prior to the writer's visit. Additional drilling is reported to have been done since.

T Vein lies about 350 feet southeast of B vein. The adjacent formations are light grey, well cleaved, streaked, rhyolitic rocks, probably sheared rhyolitic agglomerate. The cleavage planes strike north 10 to 20 degrees west and are nearly vertical. The vein strikes north 20 degrees west and dips easterly at about 80 degrees. It is exposed by a trench 150 feet long. Lenticular quartz, up to 1 foot in width, is exposed at intervals between 10 and 45 feet north of the south end of the trench. The vein is continuously exposed in the next 90 feet of the trench and has an average width of about 1 foot. It ends before reaching the north end of the trench. The walls of the vein are sharp and free. In places the vein parallels the cleavage of the adjacent rocks, elsewhere it cuts the cleavage at small angles. The quartz is fine grained and grey, and contains a very little

[1] Assays by Bureau of Mines, Ottawa.
[2] Assayed by Bureau of Mines, Ottawa.

arsenopyrite, pyrite, and tourmaline. Pale, visible gold is common. The schistose wall-rock contains a little arsenopyrite. Bulk samples along a length of 115 feet and across an average width of 17 inches are reported to have averaged 1·42 ounces of gold a ton. Prior to the writer's visit, the vein had been explored for a length of 500 feet by about twenty-three shallow diamond drill-holes. Encouraging intersections, some of high grade, are reported to have been encountered for a length of about 325 feet.

C Vein is about 350 feet east of B vein. The enclosing rock is a flaky sericite schist, probably derived from a rhyolitic lava or agglomerate. The vein strikes north 20 degrees west and is nearly vertical. It is exposed by a trench for a length of about 90 feet. The maximum width of the vein is 2 feet, the average width probably a little less than 1 foot. No gold or other metallic mineral was seen in the quartz.

S.D.C. Group (100)

Reference: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-I-14. Jolliffe and Henderson, 1939, pp. 328-330. Lord, 1941a, pp. 77-79.

The S.D.C. group of forty-three claims, 42 miles northeast of Yellowknife and about 8 miles south of Gordon Lake, is owned by Dome Mines, Limited. The main deposit (1938) is on S.D.C. No. 2 claim, about 1 mile north of the point of entry of Cameron River into Dome Lake. The property was staked in July 1938 and some diamond drilling and trenching were done that summer. About twenty men were employed on the property from early March to early July 1939. The company then reported[1] that further work would have been warranted had the property been in a district where average costs prevailed.

The following description of the principal known deposits was supplied by J. F. Henderson, who examined the property in 1938.

The main 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 for 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 veins branch from the main mass of quartz and lie along probable branches 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 rock.

[1] Dome Mines, Limited: Report to Shareholders for the financial Year Ending December 31st, 1939, p. 20.

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, $\frac{1}{8}$-inch feldspar crystals occur throughout the quartz, particularly near the margins. Sulphides are erratically distributed throughout the quartz, but the greater part is well, in places heavily, mineralized with arsenopyrite, pyrrhotite, galena, pyrite, chalcopyrite, and sphalerite. Surface exposures of quartz are 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, and channel samples from the trenches are said 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. Within this area vein quartz constitutes a variable but relatively small proportion of the whole. Arsenopyrite is abundant in both wall-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. In places the vein contains much galena, sphalerite, pyrrhotite, pyrite, chalcopyrite, and arsenopyrite.

Visible gold has also been found in quartz veins in the sediments about $\frac{1}{3}$ mile west of the northwest end of the "S"-shaped lake that lies 1 mile north of Dome Lake. 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 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.

Sentinel Mines, Limited (87)

Reference: Henderson, 1939a, pp. 12, 13.

Claims owned by Sentinel Mines, Limited, west of Gordon Lake, are reported to have lapsed in 1947. They were examined in 1938 by Henderson, and described as follows:

> Sentinel Mines hold a group of claims north of the large bay [Knight Bay] on the west side of Gordon Lake. A large amount of trenching and surface work has 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 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 by 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.

Slave Lake Oil Syndicate (135)

Reference: Bateman, 1947.

Slave Lake Oil Syndicate was formed at Yellowknife in September 1947, with J. D. Bateman, A. W. T. Freakes, and L. W. Nelson as joint managers. An area north of the west end of Great Slave Lake, from Windy Point to Fort Providence, was investigated briefly late in 1947. Syndicate officials believe that structures and other factors favourable for the accumulation of oil pools in the porous, Middle Devonian Presqu'île dolomite might exist in this region. The syndicate subsequently obtained a permit, dated at Ottawa, January 22, 1948, to explore 63,800 acres surrounding Fort Providence. No drilling had been done to December 31, 1948.

Slemon Yellowknife Mines, Limited (50)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-N-1. Hoffman, A., 1947, pp. 310-311. Lord, 1941a, p. 66; 1942a, pp. 51-52.

Slemon Yellowknife Mines, Limited, owns sixty-eight claims as follows: Au Nos. 1 to 17, Au No. 24, R.O. Nos. 1 to 22, Faye Nos. 1 to 11, Cher Nos. 1 to 4, Pincher Fraction, Penny Nos. 1 to 6, and Johnny No. 1. These lie about 78 miles northwest of Yellowknife and form a compact group extending about 4 miles northeast from the junction of Snare River and Slemon Lake. Relief on the property amounts to several hundred feet. Slemon Lake is navigable by shallow-draught barges from Great Slave Lake. Aircraft operate from a dock on a lake-like expansion of Snare River, whence a tractor road extends about 1½ miles east-northeast to the camp. The property was last visited in July 1947. Technical Mine Consultants, Limited, with G. M. Radisics as Yellowknife representative, were acting as managers; and K. J. Sidwell was in charge of the crew of sixteen men housed in tents on Au No. 5 claim. Radio provided two-way communication with Yellowknife.

Gold was found in what is now known as No. 1 vein, in the summer of 1939, by Roy Lundmark and associates, then employed by the American Metal Company, Limited. The find was not considered important by the company, and on August 24 and 25, a group of Au claims was staked by the discoverers on their own behalf. This ground was prospected by four men for several weeks that summer, most work being done on No. 1 vein. Surface work and about 2,500 feet of diamond drilling were done on this vein, and on what is now known as No. 3 zone, by Canbrae Exploration Company, Limited, during the summer of 1940; but this company relinquished its option later that year. In 1945, F. W. Thompson discovered gold nearby, and staked the R.O. group of claims for Frederick Yellowknife Mines, Limited. Slemon Yellowknife Mines, Limited, incorporated the same year, acquired the Au and R.O. groups by purchase, and the balance of its property by staking in the spring of 1946. Surface exploration by this company commenced in March 1946, and continued until September. Operations recommenced in March 1947, but were suspended indefinitely late that summer after more than 6,500 feet of diamond drilling had been done on, mainly, No. 1 vein and No. 3 zone, and two shallow incline pits had been sunk on No. 1 vein. During the same period forty claims were surveyed by a Dominion Lands surveyor. At the time of the writer's last visit the survey was in progress and No. 3 zone was being drilled.

The claims lie within a northwesterly trending belt of sedimentary strata, some 8 miles wide, that is bordered on either side by younger granitic rocks. The strata are greywacke, impure quartzite, slate, and argillite of the Yellowknife group. They are cut by a few quartz porphyry dykes and sills up to 5 feet or more in width and, on Au No. 8 claim, by fine- to medium-grained acidic rocks presumably related to the nearby granitic intrusions. Gold-bearing quartz is reported from several places. These occurrences include simple quartz veins or groups of quartz veins cutting the sedimentary strata, and stock-works of quartz veins in quartz porphyry sills. The owners consider that No. 1 vein, and a group of veins or other quartz bodies comprising No. 3 zone, contain most gold. These deposits are described below.

No. 1 Vein outcrops on the Au No. 4 claim, about 1,900 feet east of the camp and 2 miles north-northeast of the nearest part of Slemon Lake. The enclosing rocks are well-bedded black slate and greywake. The strata strike about north 25 degrees west and dip about 85 degrees northeast. Many of the beds are less than 6 inches thick. The vein is traced on the surface about 250 feet by an almost continuous rock trench. It strikes about north 40 degrees west, dips from 45 to 85 degrees northeast, and is bordered in most places by a few inches of fractured rock. Towards the northwest it narrows, and ends in unfractured rock. At the southeast end it disappears in a fractured zone from 1 to 5 feet wide, which is visible on the strike of the vein for 60 feet before it passes under drift. The quartz is mainly fine grained and grey, and in part is ribboned by seams that parallel the walls and contain chlorite and pyrite. A little quartz is coarse grained and white, and some of this occurs as veinlets cutting the fine-grained variety in which most of the metallic minerals occur. Minerals other than quartz constitute less than 1 per cent of the vein and include coarse-grained pyrite, very fine-grained pyrite (or marcasite?), pyrrhotite, chalcopyrite, galena(?), arsenopyrite(?), gold, and feldspar. A little violet quartz is reported to have surrounded some of the grains of visible gold in the outcrop. Much of the gold occurs near the foot-wall of the vein[1]. The entire surface of the vein for a length of 190 feet was

[1] Radisics, G. M.: personal communication.

removed as bulk samples, each sample being derived from a 2-foot length of vein. These samples, according to the company's assay plan, indicated that for a length of 163 feet the vein averages 2·2 feet in width, and contains 0·65 ounce of gold a ton; and that for 56 feet it has an average width of 1·3 feet and contains 2·06 ounces of gold a ton.

No 1 vein has been explored underground by two pits, 15 and 27 feet deep, and by about forty-three diamond drill-holes along a strike length of 240 feet. Most of the drill-holes intersected the vein at vertical depths of 100 feet or less, and the deepest intersections were at a depth of about 150 feet. The cores provided high-grade samples of vein quartz from depths as great as 115 feet. However, to date, a satisfactory correlation of the various quartz bodies encountered has not been achieved and, apparently, the deposit is more complex at depth than at the surface.

No. 3 Zone is on Au Nos. 7 and 8 claims, about 2,000 feet north-northeast of No. 1 vein. Here, within an area 150 feet in diameter, five trenches with a total length of about 140 feet, and about twenty-seven diamond drill-holes (mainly vertical and 150 to 200 feet long) have encountered numerous veins or other bodies of quartz, some of which contain much gold. The explored area is on the west side of a northerly trending muskeg about 100 feet wide. Most of the rocks in the vicinity, and all within the explored area, are greywackes, impure quartzites, or thin-bedded slates and slaty greywackes. Some beds contain nodules of andalusite or other metamorphic minerals. Within the explored area, and elsewhere nearby and west of the muskeg, the strata commonly strike northwest and dip about 65 degrees northeast. East of the muskeg, directly opposite the explored area, they are much contorted, but in most instances trend between east and northeast and are nearly vertical or dip northerly. Despite this marked discordance in attitude displayed by the strata on opposite sides of the muskeg, no evidence of a fault zone was recognized[1] in drill cores from beneath the muskeg. The strata on the east edge of the muskeg are cut by irregular masses of a fine-grained, white weathering, acidic rock, and outcrops of similar but coarser grained intrusive rock occur in muskeg and drift about 200 feet southeast of the explored area.

Lenticular quartz veins outcrop here and there within parts of the explored area. They strike in many directions, and are commonly gently inclined. They are not confined to any recognized structure nor do they form a simple pattern. The largest are 15 feet or more in length and 1 foot to 2 feet in width. The walls are free and sharp but not sheared. The quartz is coarse grained and white. In part it contains pockets of coarse-grained pyrite, and vugs up to several inches long into which project quartz crystals as much as ½ inch in diameter. Some veins contain little or no pyrite, but others contain 50 per cent or more of this mineral. No gold was seen. Two selected samples of quartz with abundant coarse-grained pyrite, collected by the writer, contained[2]: (1) gold, 4·16 ounces a ton; silver, 1·96 ounces a ton; and (2) gold, 0·65 ounce a ton; silver 0·67 ounce a ton.

Diamond drill-holes intersected numerous bodies of gold-bearing quartz beneath a part of the explored area measuring about 100 feet by

[1] Radisics, G. M.: personal communication.
[2] Assay by Bureau of Mines, Ottawa.

60 feet. Much of this quartz is at a depth of less than 100 feet. For instance[1], vertical hole No. 38, at a depth of 16 feet, entered 8·6 feet of quartz containing 0·92 ounce of gold a ton; at 28 feet, 7·0 feet of quartz containing 0·42 ounce a ton; and, at about 42 feet, 10·2 feet assaying 0·34 ounce a ton. Vertical hole No. 45, about 25 feet northwest of hole No. 38, at a depth of 12 feet entered 19·1 feet of quartz assaying 0·97 ounce of gold a ton; at 37 feet, 1·6 feet assaying 1·22 ounces a ton; and at 56 feet, 2·2 feet assaying 0·35 ounce a ton. Although the various quartz masses could not be correlated from hole to hole with any degree of certainty they may, judging from the limited surface data, represent a number of lenticular, vein-like, perhaps interconnected bodies of various but commonly gentle dips.

Snare River Exploration Company, Limited (51)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-N-1. Lord, 1942a.

The S.R. group of eighteen claims was staked by J. A. Banks and J. Cronin in the spring of 1947 on behalf of Snare River Exploration Company, Limited. The property is on the north shore of Slemon Lake about 2 miles east of the mouth of Snare River. It was examined briefly by the writer on July 24, 1947.

On, probably, S.R. Nos. 4 and 5 claims, a northeasterly facing rock cliff as much as 30 feet high extends about north 30 degrees west from the lake shore for a distance of 1,400 feet or more. Bedrock along the base of the cliff is covered by muskeg and drift. Rock along the face of the cliff has been exposed at intervals for about 1,350 feet by five trenches, and a few shallow pits have been blasted here and there a short distance southwest of the brow of the cliff.

The rocks in the explored area are mainly well-bedded greenish grey greywacke and slate of the Yellowknife group. The strata trend about north-northwest, about parallel with the cliff, and dip steeply east-northeast. They are interlayered with bands, 2 inches to 2 feet in width, of dark green to black, fine- to coarse-grained, rusty weathering amphibolite, which may be recrystallized tuffaceous beds. At the lake shore the amphibolite layers comprise about 30 per cent of a 75-foot section of interlayered amphibolite, greywacke, and slate.

The amphibolite contains a little pyrite, and, here and there, irregular veinlets of glassy quartz with a little pyrite and arsenopyrite. Most of the rock work done by the owners is designed to expose rusty amphibolite, which, they claim, commonly provides a few colours of gold when crushed and panned. A sample taken by the writer from a trench about 1,300 feet north-northwest of the lake shore, and chipped across 2·2 feet of amphibolite containing 25 per cent vein quartz with coarse-grained pyrite and arsenopyrite, assayed[2]: gold, 0·50 ounce a ton; silver, 0·27 ounce a ton. Another sample, from a trench about 800 feet from the lake shore, chipped across 2·0 feet of amphibolite, including an aggregate of about 1 foot of quartz containing pyrite and specularite, contained[2]: gold, 0·15 ounce a ton; silver 0·14 ounce a ton. Both these samples were taken at places characterized by unusually plentiful vein quartz and metallic minerals.

---

[1] Data provided through the courtesy of G. M. Radisics.
[2] Assay by Bureau of Mines, Ottawa.

Snare River Mines, Limited (49)

References: Lord, 1939, pp. 15-16; 1941a, p. 65; 1942a, p. 51.

Snare River Mines, Limited, is reported to have done considerable work during 1945 and 1946 on a group of claims on Snare River. The claims are 14 miles southwest of the Snare River hydro-electric plant of the Northwest Territories Power Commission, and about 85 miles northwest of Yellowknife. According to the company, about 7,400 feet of diamond drilling indicated about 50,000 tons of gold-bearing material of moderate grade.

The property is believed to include part or all of the former Delora claims previously described (Lord, 1942a, p. 51) as follows:

> The claims are on a small lake on Snare River about 14 miles upstream from Slemon Lake. The camp and trenches are on the east shore of the lake.
>
> ....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....[the] lake about one-half mile east of the main body of granite 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....[the] 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....[the] 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 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.

Snowden Yellowknife Mines, Limited (43)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 86-B-3. Tremblay, 1948, pp. 5-6.

The property of Snowden Yellowknife Mines, Limited, comprises the Tig and Ott group of six claims each, the Doins group of thirteen claims, and a few other claims in the vicinity. The property is on the northwest side of Damoti Lake, about 120 miles north-northwest of Yellowknife. All access to date has been by aircraft, and a radio transmitter and receiver provide communication with Yellowknife. When the writer visited the property early in August 1947, P. Gliddon was in charge of the crew of six, and J. T. Burton was reported to be consulting engineer.

The Doins claims were staked by P. A. Schwerdt in 1939, but later allowed to lapse; they were restaked for him early in 1945. The Snowden company was incorporated in 1945, and in that year acquired the Tig and Ott claims from Quebec Yellowknife Gold Mines, Limited; the Doins claims were acquired in May 1946. Exploration commenced early in June 1946, the camp was maintained by two men during the following winter, and additional work done throughout the summer of 1947. By the end of 1947, exploratory work, mainly on the Doins claims, comprised stripping, trenching, and 1,000 feet or more of X-ray diamond drilling. Most or all of the drilling was done on Doins No. 4 claim near the Pond and 'Splash' veins. Additional drilling is reported to have been done in 1948.

The camp is on the northwest shore of Damoti Lake, probably on the southeast corner of Doins No. 5 claim and the northeast corner of Doins No. 14 claim. It includes four log buildings serving as cook-house, bunk-house, office, and superintendent's cottage; and several tents.

Equipment includes a portable Wisconsin-Ingersoll-Rand compressor, plugger, and a Longyear X-ray diamond drill.

The Doins claims are underlain by volcanic and sedimentary rocks of the Yellowknife group. These rocks trend north-northeast to northeast and are vertical or dip about 80 degrees west-northwest or northwest. The oldest, volcanic members are greenstones, and underlie the northwest part of the Doins group. They are basaltic, andesitic, or dacitic lavas with minor pyroclastic rocks; here and there they have been carbonatized. A band up to $\frac{1}{4}$ mile wide, of rhyolitic lavas and pyroclastic rocks and their carbonatized equivalents lies immediately southeast of the greenstones. Southeast of the rhyolitic rocks, along the northwest shore of Damoti Lake, are well-bedded greywacke, argillite, and slate. Quartz veins have been found at many places in the volcanic rocks, but most of them, so far as known, are essentially devoid of gold.

Five mineral zones, known from west to east as the Hill-top showing, the Chuck vein, the Wally vein, the Pond vein, and the G-zone (or 'Splash' vein), have been described by Tremblay as follows. All occur within the greenstones.

The Hill-top showing, lying about 4,200 feet northwest of the Snowden camp on Damoti Lake, is a strong shear zone, traced for 250 feet and examined by trenching. The shear zone occurs in carbonatized, mineralized, basic volcanic rocks, strikes north 35 degrees east, and appears to swing in a northwesterly direction in the most northern trench. Four trenches, varying from 20 to 60 feet in length and reaching in places a depth of 10 feet, have been excavated across this shear zone. These trenches show that the shear zone is mineralized with pyrite and chalcopyrite, is much carbonatized where most sheared, and is cut by a few quartz-carbonate-rich stringers. No visible gold was noted by the writer.

The Chuck vein, about 2,700 feet northwest of Snowden camp, is a lenticular body of milky white quartz occurring in slightly carbonatized, mineralized, basic volcanic rocks. The vein averages 8 feet in width, strikes north 37 degrees east, and appears to be vertical. Apart from a few small clusters of sulphide minerals scattered throughout, this body of quartz appears to be barren. The intruded rocks, however, along the eastern contact of the vein are heavily mineralized with pyrite and chalcopyrite, and free gold has been reported.

The Wally vein, located a few feet west of a pond about 2,400 feet northwest of Snowden camp, has been trenched and examined for gold. It strikes north 30 degrees east, dips 60 degrees west, and averages 3 feet in width. This vein, of apparent lenticular shape, consists of milky white quartz carrying some pyrite and chalcopyrite. A little free gold has been reported.

The Pond vein is adjacent to and east of the pond, strikes north 35 degrees east, and appears to be a succession of several small lenticular bodies of quartz in slightly carbonatized basic volcanic rocks. The quartz carries some pyrite and chalcopyrite, and although free gold has been reported, none was seen.

The G-zone [or 'Splash' vein] lies about 250 feet east of the pond, and has been explored by drilling and trenching. When visited, at least 1,000 feet of drilling had been done to explore the area east of the pond in general and the G-zone in particular, across which four trenches had been excavated. The zone is, apparently, about 30 feet wide, strikes north 35 degrees east, and contains an irregular succession of small quartz veins that strike about south 55 degrees east and dip about 30 degrees northeast. As these veins strike and dip parallel with the joints in the intruded volcanic rocks, it appears that they occupy joint fissures. The wall-rocks in the vicinity of the veins are slightly carbonatized and mineralized. The veins themselves consist of milky white quartz and carry a little pyrite, chalcopyrite, and free gold.

South Nahanni River Placer Gold Deposits (134)

References: Berton, 1947a; 1947b. Bureau of Northwest Territories and Yukon Affairs, 1947c. Lambert, 1937. Patterson, 1947. Snyder, 1937.

Placer gold has been reported for many years from South Nahanni River and its tributary, Flat River. This district has recently received widespread publicity in the popular press wherein it has usually been referred to as the 'Headless Valley' region. Many of these accounts, catering to public fancy, probably greatly exaggerated stories of pestilence, murder, and mystery that have become associated with the region.

South Nahanni River, situated in the southwestern part of Mackenzie district, has its source near the Yukon-Northwest Territories border, and flows southeasterly to join Liard River about 55 miles north of Fort Liard. Flat River joins the Nahanni from the west. The area drained by these rivers includes part of Selwyn and Mackenzie Mountains and contains peaks rising to 8,000 feet or more above sea-level. The area has not been examined by the Geological Survey of Canada. Topographic maps[1] with contours at intervals of 1,000 feet are available, on a scale of 1 inch to 8 miles, showing South Nahanni River and vicinity as far upstream as Virginia Falls, 90 miles from its mouth, and most of the Flat River drainage basin. Air photographs are available for the contoured areas. The country tributary to South Nahanni and Flat Rivers is practically uninhabited. Seaplane, McMillan, and Clark Lakes in the upper Flat River basin afford suitable landing places for aircraft with pontoons. The Snyder Expedition of 1937 employed river boats and aircraft for transportation.

The following account of the region was compiled by the Bureau of Northwest Territories and Yukon Affairs.

According to a report published in the 1937 Canadian Alpine Journal describing the Snyder Expedition to the region that year, gold was first discovered at the mouth of Flat River in 1900. A later strike made in 1904 caused a small rush to the district. Among those taking part in the rush was William McLeod of Fort Liard, who came out the following year with several ounces of what was reported to be coarse gold. Accompanied by his brother Frank and another man, McLeod went up the South Nahanni River again late in 1905. Nothing more was heard from them and a search party was organized and set out in 1908. The bodies of the McLeod brothers were located on the lower river at a point now known as 'Deadman's Valley'. The third member of the party was never heard of again.

A few years later a trader at Ross River Post, Yukon Territory, received a letter from a prospector, one Jorgenson, advising that the latter had made a rich strike. The trader, Poole Field, traversed the continental divide by dog team to the rendezvous indicated near the mouth of Flat River, only to find on arrival the headless body of Jorgenson. About 1930 another prospector, Phil Powers, failed to return from a trip up the river, and his remains were subsequently found in the burned ruins of his cabin.

In 1933 a prospector named John Stanier found in the canyon of McLeod Creek, a tributary of Flat River, several rusted shovels and old sluice boxes, indicating an early placer working. The site was believed to be that of the lost McLeod mine, until another old placer working was located in 1934 on Bennett Creek, above McLeod Creek, by a prospector named Gus Krause. The latter site is believed to be that located by McLeod. Showings of coarse gold were found by Krause, but discoveries to date have not indicated any great values.

[1] South Nahanni, and Simpson-Liard Sheets: National Topographic Series, Surveys and Mapping Branch, Department of Mines and Technical Surveys, Ottawa.

Spinet Gold Mines, Limited (26)

References: Bureau of Mines, 1947d. Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 86-B-6. Stanton, Tremblay, and Yardley, 1948.

The property of Spinet Gold Mines, Limited, is at Spider Lake, about 145 miles north-northwest of Yellowknife and 14 miles north of Indin Lake. It consists of about one hundred and six claims, comprising the Lux, H.C., Tex, Mex, Fly No. 1, and Fly No. 2 groups. The property is timbered, but very sparsely so at its northeastern corner where it lies at the edge of the barren grounds. Aircraft afford access from Yellowknife; and the camp was equipped with a radio transmitter and receiver. Operating control of the company is in the hands of Trans-American Mining Corporation, Limited, with A. P. Beavan, their chief geologist, responsible for general supervision of operations. The camp was under the joint management of R. Alexander and R. Day when visited by the writer from August 10 to 12, 1947. The principal known gold-bearing zones are almost completely concealed by drift and water, and many of the following data were supplied by the company.

The Fly claims were staked during the summer of 1945, by W. Bohm, W. Faber, and A. Gamble, for Trans-American Mining Corporation, Limited. The other claims of the property were staked on behalf of Springer Sturgeon Gold Mines, Limited. Some trenching and sampling were done by the Trans-American company late in 1945. Spinet Mining Company, Limited, a private company, was formed in January 1946 to acquire the properties of the Trans-American and Springer Sturgeon companies; and was later succeeded by Spinet Gold Mines, Limited, incorporated in October 1946. Supplies and equipment arrived by tractor train from Grimshaw, Alberta, early in 1946. Diamond drilling commenced in March, and continued, with brief interruptions, until July 11, 1947. The camp was closed later that summer, and the property remained inactive throughout 1948.

The camp, of ten tents on wood floors and frames, is on Fly No. 10 claim, on the south shore of Treasure Island in Spider Lake.

Nearly all exploration was done by diamond drilling. This work amounts to 18,150 feet, of which 16,434 feet was done on or near the south shore of Treasure Island to explore the North, South, and East zones.

The rocks near the explored, mineralized zones on the south shore of Treasure Island are mainly volcanic and sedimentary members of the Yellowknife group. They outcrop in belts that trend easterly across the southern point of the island. The most northerly and presumably oldest rocks are amphibolites, probably recrystallized andesitic or basaltic lavas in which a faint foliation strikes about north 80 degrees east and dips about 80 degrees north. They are hard, black, fine-grained, rather fresh rocks that, under the microscope, display a felt of amphibole laths in a scant groundmass of finer grained sodic plagioclase and quartz. Similar rocks probably extend northward across the island. Feldspar-amphibole-biotite gneiss adjoins the amphibolite on the south, and outcrops as a band 40 to 150 feet wide and 1,200 feet long that strikes about north 85 degrees east. This is a well-foliated, fine-grained, green rock and weathers grey or greenish grey. In part it is well banded, the bands ranging in width from $\frac{1}{2}$ inch to 3 inches, and containing various proportions of plagioclase or other feldspar, quartz, pale green amphibole laths, and biotite. Foliation and banding approximately parallel the borders of the band, and dip steeply north. The gneiss may be a recrystallized tuff or tuffaceous sediment. The sedimentary strata south of the gneiss range from schistose greywacke to fine-grained, nodular, quartz-biotite schist. Well-preserved, steeply inclined bedding was observed in a few places; on the west shore of the point it strikes about east-southeast, but elsewhere it is crumpled and strikes in many directions. However, correlation of minor calcareous and garnetiferous layers encountered by the diamond drill-holes is reported to indicate that the sedimentary strata trend about parallel with the band of gneiss to the north.

A tabular body of light grey to pale pink felsitic rock, known to the company as the Gamble 'dyke', separates the gneiss from the sedimentary strata or lies near the contact between these rocks. This body dips 75 to 85 degrees north, ranges in thickness from 20 to 40 feet, and outcrops, except for short gaps, for a length of 1,500 feet. The felsite is massive, and weathers chalky grey to pale pink. A thin section examined under the microscope showed it to contain scattered phenocrysts of albite in a fine-grained groundmass of interlocking grains of plagioclase and quartz. It is cut by a multitude of glassy to grey, sugary quartz bodies, ranging from thread-like veinlets to masses several feet in width. Many tiny aggregates and films of pyrrhotite were noted in the felsite. The north border of the felsite body is commonly in sharp contact with the gneiss; and tongues of felsite project into the gneiss. In places the contact is marked by a breccia of felsite cemented by drusy, glassy quartz, and may be a fault. Diamond drill cores show bands of gneiss interlayered with felsite, and, here and there at the surface, narrow, tabular, felsitic bodies outcrop within the gneiss a few feet north of the main felsite mass. The south contact does not outcrop and, accordingly, it is not known whether the felsite is an intrusive, sill-like body or an extrusive rock. It does, however, lithologically resemble rhyolitic lavas that commonly occur between andesitic lavas and sedimentary strata in the adjacent district[1].

The amphibolite, gneiss, sedimentary rocks, and felsite are cut by a diabase dyke that trends north-northeast. Two or more right-hand faults offset the diabase, and the horizontal component of this offset is as much as 130 feet. The faults trend about parallel with the Gamble 'dyke', and lie at its northern edge, or within the volcanic rocks.

The principal known gold deposits are those of the North, South, and East zones. The North and South zones lie, respectively, north and south of the Gamble 'dyke' and strike and dip about parallel with it. The North zone, on Fly No. 10 claim, lies beneath Spider Lake except that what may be its east end outcrops on the west shore of the south point of Treasure Island. The outcrop, a few feet in diameter, is about 100 feet north of the Gamble 'dyke' and comprises rusty, drag-folded, banded feldspar-amphibole-biotite gneiss cut by quartz. A chip sample[2] across 4 feet of the rusty gneiss contained about 30 per cent quartz and assayed: gold, 1·06 ounces a ton; silver, 0·52 ounce a ton. The zone as explored by drill-holes beneath

[1] Tremblay, L. P.: personal communication.
[2] Sample taken by the writer and assayed by the Bureau of Mines, Ottawa.

the lake is said to comprise gold-bearing sections of similar gneiss; and these are identified by assay rather than by visual inspection of core samples. The gold-bearing sections of gneiss contain a little pyrite, pyrrhotite, and probably minute amounts of other sulphide minerals, but not all gneiss with these minerals contains significant amounts of gold. Drill-holes to a depth of about 180 feet are reported[1] to have indicated an ore shoot 75 feet long with an average width of 8·5 feet, and containing 0·416 ounce of gold a ton (uncut grade), or 0·231 ounce a ton (cut grade).

The South zone, on Fly Nos. 10 and 11 claims, is concealed by muskeg and other overburden. In most places it lies 10 to 50 feet south of the Gamble 'dyke'. The zone comprises gold-bearing rock, mainly schistose greywacke and derived quartz-mica schist, with a little pyrite, pyrrhotite, sphalerite(?), chalcopyrite(?), galena(?), and visible gold. The gold-bearing parts of the greywacke and schist may contain a little more introduced quartz than elsewhere; but, so far as known, they are not much different from adjacent, nearly barren rock and are best identified by assay. The zone is reported to have been drilled to a vertical depth of about 500 feet. Ore grade material has been intersected to a depth of 350 feet. Drilling is reported[2] to have indicated an ore shoot 325 feet long averaging 3 feet in width, containing 1·11 ounces gold a ton (uncut grade), or 0·61 ounce a ton (cut grade).

The East zone, said to lie 1,000 to 1,800 feet east of the South zone, is reported to have been explored by a few drill-holes to a vertical depth of about 240 feet, and to have afforded gold-bearing samples.

A sample of diamond drill sludge and assay rejects from core samples, submitted to the Bureau of Mines (1947d, pp. 2-4)[3] for metallurgical tests, assayed: gold, 0·33 ounce a ton; silver, 0·13 ounce a ton. Tests proved 98·49 per cent of the gold to be extractable by cyanidation, or 64·4 per cent by amalgamation.

Spud Arsenault Mines, Limited (59)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheets 85-P-3 and 85-P-4. Henderson, 1941b.

INTRODUCTION

The gold prospect owned by Spud Arsenault Gold Mines, Limited, lies on the northwest side of Mac Lake, 52 miles about north-northeast of Yellowknife, and 8 miles west of Gordon Lake. The property was intended to comprise Sparta Nos. 1 to 6 claims, Jumbo Nos. 1 to 12 claims, Take Nos. 1 to 6 claims, F.M.K. Nos. 3 to 6 claims, and W.G.J. Nos. 1 to 5 claims. However, a survey may be required to establish the ownership of some of this ground. A winter tractor road from Yellowknife to the property of Camlaren Mines, Limited (64), passes 3 miles south of Mac Lake. This lake, although strewn with many rock reefs, is suitable for the use of Norseman and smaller aircraft during summer and winter. The property was inactive when the author visited it in July 1947.

[1] Trans-American Mining Corporation, Limited: Annual Report for the Period Ending June 30, 1947, p. 9.
[2] Op. cit., p. 9.
[3] This report does not state from what zone or zones the sample was derived.

HISTORY

The Sparta claims were staked by U. J. (Spud) Arsenault in the summer of 1945. These and the adjoining claims of the present property were subsequently purchased, with much publicity, by Spud Arsenault Mines, Limited, incorporated for that purpose in May 1946. Lumber was flown to the property shortly thereafter, and a camp, of six tents on substantial wood frames and walls, was erected on the northwest shore of Mac Lake. Diamond drilling commenced August 17, 1946, and ceased on December 8 of that year. A. D. Wilmot was the supervising engineer employed by the owners. Drill core was then suitably labelled and racked at the camp site, and the camp abandoned. No further work was done to the end of 1948.

DEVELOPMENT AND COSTS

The claims have been explored by a few trenches, mainly on Jumbo No. 3 claim, and by diamond drilling. A diamond drilling contract was negotiated by the company whereby $2.40 a foot was paid for X-ray holes, $3.75 a foot for E holes. Under this agreement the company supplied engineering services and camp accommodation, whereas the drill contractor provided transportation, drill equipment, men, drill and camp supplies, and board. The drilling was done on Sparta Nos. 2 to 5 claims, and comprised: E holes ($\frac{7}{8}$-inch core), 5,466 feet; X-ray holes ($\frac{5}{8}$-inch core), 4,528 feet.

GEOLOGY

The principal known veins occur on the Sparta group and the adjacent Jumbo Nos. 2 and 3 claims. These claims are underlain by sedimentary rocks of the Yellowknife group, intersected by a few pegmatitic and granitic dykes probably genetically related to a granite body, $1\frac{1}{4}$ miles in diameter, that outcrops 1 mile southeast of the claims, on the east side of Mac Lake.

The sedimentary rocks, originally mainly greywackes, have been altered to brown-surfaced quartz-mica schists and hornfels. Many layers display numerous knots or nodules of pink andalusite, and cordierite and biotite, whereas others are devoid of these structures. The recrystallization that resulted in the formation of these schists and hornfels has commonly obliterated the bedding, although here and there the occurrence of thin slaty beds, or of knots confined to definite layers, permits reliable determinations of attitudes. Nevertheless, only in rare instances are tops determinable. The beds trend north to northwest and dip, in general, 35 to 55 degrees east or northeast.

DESCRIPTION OF DEPOSITS

North Sparta Vein. The North Sparta quartz vein is the most promising known gold deposit on the property. Two natural exposures of gold-bearing quartz were found in the northeast corner of Sparta No. 3 claim at the southeast edge of a small lake. Elsewhere the vein was covered by muskeg and drift. One of these natural exposures is about 6 feet in diameter, is completely submerged, and lies a few feet from the lake shore (July 8, 1947); some of this quartz may be an outcrop of the vein, but some is float, probably only slightly removed from its original position.

The other natural exposure, 25 feet to the northeast, is of about the same size and almost surely in place; it is completely surrounded by muskeg. A pit, 50 feet south 15 degrees east from the most southwesterly natural exposure, is now flooded, but is reported to have encountered a sizable body of quartz. A partly flooded trench displays quartz 30 and 55 feet south 70 degrees east from the most northeasterly natural exposure. Thus quartz has been found at intervals in the muskeg and lake along a V-shaped course, the western limb of which trends about north-northwest for about 80 feet, and the northern limb, east-southeast for approximately 75 feet. Elsewhere the vein is known only from diamond drill records. These suggest that it maintains a similar course at depth, probably complicated by local irregularities; and that the north limb dips about 30 degrees northerly, and the west limb about 45 degrees easterly. The north limb of the vein-structure has been probed along a strike length of approximately 150 feet and to a vertical depth of 160 feet or more; and the west limb for a shorter distance and to a vertical depth of about 230 feet. The thickness of the vein varies widely from place to place, from a few inches to 20 feet or more. The greatest thicknesses, so far as known, occur within about 75 feet of the surface and near the junction of the two limbs.

Most of the exposed rock within the explored area is indistinctly bedded, fine- to medium-grained quartz-mica schist, in part nodular. The exposed parts of the quartz vein, however, are commonly bordered by intricately folded, thin-bedded, black slate and slaty greywacke. Available outcrops do not lend themselves to precise structural determinations. Nevertheless, it is not improbable that the strata near the exposed parts of the vein occupy a sharp fold, the axial plane of which strikes northwesterly and dips gently northeasterly. The plunge of this fold would approximately parallel that of the minor folds in the slate; these plunge about 25 degrees north 35 degrees east. It may be that the North Sparta vein parallels the beds involved in this fold and was deposited mainly within a band of slate and slaty greywacke that afforded particularly favourable conditions near the fold axis.

The vein material exposed at the lake shore is mainly grey to white, medium-grained quartz. Sulphide minerals comprise several per cent of the mass. Pyrite is most abundant, but galena, sphalerite, pyrrhotite, chalcopyrite, and gold were also noted. The pyrite is fine grained and occurs as thin films in the quartz, or as scattered aggregates as much as 1 inch in diameter; many of the latter have been almost completely oxidized and removed, leaving numerous tiny grains of gold adhering to the quartz crystals that project into the resultant cavities. Here and there galena or sphalerite fill other small cavities in the quartz.

Some of the exposed quartz is unquestionably of ore grade. Diamond drill-holes are reported to have encountered numerous sections of good grade quartz, but by no means all parts of the vein constitute ore.

South Sparta Vein. This quartz vein trends north 10 degrees west and dips easterly at about 35 degrees. It reaches the surface of bedrock along the east shore of a small lake but, except for one outcrop and a trench, is covered by muskeg and water. About 40 feet east of the vein the ground rises abruptly about 15 feet to the general level of the surrounding country. The vein, at the bedrock surface, lies mainly on Sparta

Nos. 3 and 4 claims, close to their mutual, northerly trending boundary. Its most northerly known part, as determined by drilling, lies about 400 feet south of the most southerly known part of the west limb of the North Sparta vein, and trends directly towards it as though the two veins were connected. However, a few diamond drill-holes that probed the intervening, muskeg-covered ground failed to establish the continuity of these veins.

Diamond drill-holes about 50 feet apart traced the vein for a length of 760 feet. Most of these intersected it at vertical depths of less than 60 feet, but a few cut it at a depth of about 130 feet. The trench and outcrop extend its known length to nearly 900 feet.

The adjacent, indistinctly bedded, quartz-mica schists strike north or a little west of north and dip about 35 degrees east. The vein, as exposed in the trench, is 1 foot wide, and its walls are sharp and tight. Another trench, about 160 feet north, was flooded at the time of the writer's visit. A mass of solid quartz about 7 feet in diameter outcrops beside the flooded trench, but no wall-rock is visible. The quartz is grey to white and of medium grain. It contains scattered nests of very fine-grained pyrite as much as 1 inch in diameter, and prisms of black tourmaline up to $\frac{1}{4}$ inch in diameter. Diamond drill records provided by the owners indicate that the vein is essentially continuous throughout the explored length, and that it consists of a mixture of quartz and schist across widths ranging up to 70 feet. It probably parallels the enclosing strata in both strike and dip. None of the vein material is known to be of ore grade and much of it contains only traces of gold.

Jumbo Vein[1]. The Jumbo quartz vein was not examined. It occurs on Jumbo No. 3 claim, and lies within and close to the southwest edge of a muskeg- and drift-filled draw. The vein, draw, and adjacent strata trend approximately north 55 degrees west. The strata dip about 40 degrees northeast, and probably the vein does likewise. Five trenches expose the vein for a length of 400 feet. Channel samples from these trenches, ranging in length from 1·2 to 2·7 feet, contained negligible amounts of gold.

Star Group (84)

Reference: Stockwell and Kidd, 1932, p. 74.

The Star group....[comprised] 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 [of the Yellowknife group], 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[2]. No sulphides were seen in the other two outcrops.

[1] The following data are derived from a geological map, on a scale of 1 inch to 200 feet, prepared by A. D. Wilmot for Spud Arsenault Mines, Limited.

[2] Assay by A. Sadler, Mines Branch, Department of Mines, Ottawa.

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 23·3 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.

Storm Group[1]

(Consolation Lake) (119)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-I-10. Henderson and Jolliffe, 1941.

The Storm group, comprising Storm Nos. 1 to 6 claims, is on the east side of Consolation Lake about 1 mile northwest of the north tip of Gilmour Lake. The claims were staked in the spring of 1940 by J. Irwin and H. Lang, and in 1941 were controlled by Storm Yellowknife Syndicate. In 1942, J. D. Mason and W. L. McDonald, operating under the name of Tungsten Developers, erected a small mill on the property. By September when work stopped, they reported having milled 11 tons of ore. The resulting concentrates, amounting to 1,917 pounds, were shipped to the Bureau of Mines, Ottawa, and contained about 35 per cent WO_3 as scheelite.

The ore treated probably came from Vein 25 on Storm No. 5 claim. The vein strikes north, dips steeply east, and crosses the bedding of Yellowknife group rocks. It is 60 feet long, has a maximum width of about 5 feet, and narrows to a thin seam of quartz at each end. An ore shoot (1941) 15 feet long averaged 2·7 feet in width and contained 2·5 per cent WO_3 as scheelite.

Storm Group[1]

(Gordon Lake) (66)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-P-3. Henderson, 1941b.

The Storm group of eleven claims is a tungsten (scheelite) prospect on the east shore of Gordon Lake 2½ miles northeast of the Camlaren property (64). The claims were staked by C. Brock, G. E. McLeod, and H. Campbell, on behalf of the Consolidated Mining and Smelting Company of Canada, Limited, during the summers of 1941 and 1942. Exploratory work done between August 1 and December 31, 1942, comprised stripping, pitting, sampling on Nos. 2 and 3 veins, and the sinking of two shallow prospect shafts on No. 2 vein. At about the latter date the owners concluded that the erection of a mill for the extraction of scheelite was not economically feasible.

The claims are underlain by fresh argillite and greywacke of the Yellowknife group. The strata are strongly folded along northeasterly trending axes. A granitic batholith intrudes similar rocks about 8 miles east of the property; and a few post-granite diabase dykes have been

[1] Described from data supplied by A. W. Jolliffe and the Consolidated Mining and Smelting Company of Canada, Limited.

noted on the claims. Several quartz veins, and gold and scheelite, have been found; but so far as known the most important mineral occurrences are No. 2 and No. 3 scheelite-bearing quartz veins.

No. 2 vein strikes north 55 degrees east and probably dips about 85 degrees southeast. The vein was explored at the surface for about 600 feet; to the southwest it passes beneath a lake, and to the northeast it branches and probably ends within 250 feet. The vein commonly comprises 10 to 15 feet of nearly solid quartz, but displays many embayments and tongue-like protuberances, and here and there contains angular fragments of sedimentary rock. It is probably nearly parallel with the enclosing strata. The wall-rock is not sheared, nor is it notably altered by the quartz. The vein is intersected by several narrow shear zones, some of which are faults. The quartz is mainly mottled grey and white. It contains minute amounts of pyrite, pyrrhotite, chalcopyrite, and galena, but, so far as known, no significant amount of gold. Scheelite occurs in the quartz as aggregates ranging from minute grains to others measuring several inches in longest dimension. It is commonly associated with a carbonate, and is most abundant near the southeast (hanging) wall. It occurs in patches, the quartz beyond the patches being nearly devoid of the mineral. The mottled quartz is cut by veinlets of white, coarse-grained quartz carrying a little feldspar but no scheelite. Two mineralized bodies were identified by surface sampling to October 21, 1942: one, at No. 2 shaft 250 feet northeast of the lake, was 61 feet long, 7·0 feet wide, and contained 0·38 per cent WO_3; the second, at No. 1 shaft about 375 feet northeast of the lake, was 69 feet long, 5·9 feet wide, and contained 0·51 per cent WO_3. A sample comprising 215 pounds of material from No. 1 shaft to a depth of 12 feet assayed[1]: tungstic oxide, 0·32 per cent; phosphorus, 0·12 per cent; gold, trace.

No. 3 vein, found by a Geological Survey party on August 25, 1942, is about 1 mile north 35 degrees east from the south end of No. 2 vein, and about 200 feet south of the north boundary of the property. The maximum dimensions of quartz exposed in place were 30 by 3 feet, and large blocks of loose quartz suggested that the total width was at least 10 feet, rather than 3 feet. Coarse scheelite was observed in many places. Single aggregates of scheelite up to 10 square inches were noted, and clusters of aggregates made up as much as 30 square inches in less than a square foot of vein surface.

Sunset Yellowknife Mines, Limited (109)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-I-16. Henderson and Jolliffe, 1941. Hoffman, A., 1947.

INTRODUCTION

Sunset Yellowknife Mines, Limited, owns a gold prospect 70 miles east-northeast of Yellowknife. The property is 15 miles north of Desperation Lake and on the east side of a widened part of Beaulieu River locally known as Sunset Lake. The mineral claims comprise R.V. Nos. 1 to 12 and Alice Nos. 1 to 22. Access from Yellowknife is by aircraft

[1] Assay by Bureau of Mines, Ottawa, December 9, 1942.

capable of landing on Sunset Lake or by tractor train over a 100-mile winter road via Jennejohn, Ried, Hidden, Thompson, Ross, Victory, and Detour Lakes.

The last float-equipped airplane to use Sunset Lake in 1946 landed there on October 8[1], and freeze-up occurred on October 14. The first float-equipped airplane to arrive in 1947 landed on June 20, about 2 days after break-up. The writer visited the property in July 1947. W. J. Hylands was in charge, and R. D. Hoffman, consulting engineer.

HISTORY AND DEVELOPMENT

The area was prospected by F. W. Thompson, then manager of the Thompson Prospecting Syndicate, immediately after break-up in 1938. Gold was found in July and claims were staked. The property was acquired by Sunset Yellowknife Mines, Limited, in 1945, and in the spring and summer of that year this company completed 1,907 feet of diamond drilling on the Alice shear zone on Alice Nos. 1 and 4 claims, and 1,342 feet on what the owners consider a less promising zone on the Alice No. 15 claim. Operations then ceased, but were resumed in February 1946 and continued through to November of that year. Equipment consigned to the property by tractor train early in 1946 failed to arrive; nevertheless, lumber was flown to Sunset Lake, a camp erected, and in the autumn a two-compartment vertical shaft was sunk to a depth of 28 feet in the Alice zone. Another period of inactivity ended in March 1947 when a mining plant and other essentials arrived by tractor train. The shaft in the Alice zone was deepened to 145 feet. Drifts were opened on the 125-foot level and extended about 100 feet north and south from the shaft before the property closed on September 10, 1947. No other work has been done to December 31, 1948.

CAMP AND PLANT

The camp is on Alice No. 15 claim, on a sandy point on the east shore of Sunset Lake. It includes three frame structures and several tents. The former comprise: combined office and staff quarters, 16 by 24 feet; bunk-house, 16 by 32 feet; and cook-house, 16 by 32 feet. These structures are sheathed with Supermax, but were not designed for winter use and are not insulated. A radio receiver and transmitter housed in the office building provide contact with Yellowknife.

A rough road from the camp leads northeasterly $1\frac{1}{4}$ miles to the shaft and mining plant on Alice No. 1 claim. Buildings are non-insulated frame structures sheathed with Supermax and consist of: hoist and compressor house, 16 by 32 feet; steel and blacksmith shop, 16 by 20 feet; assay office, 16 by 20 feet; and dry, 12 by 16 feet. The headframe, 42 feet high, was constructed from 8-inch by 8-inch spruce timbers. Diesel fuel is stored in 45-gallon steel drums. Air, from a WL 60 Sullivan compressor rated at 327 cubic feet a minute and driven by an International diesel engine, passes through a 42-inch by 8-foot air receiver. A Canadian Ingersoll-Rand 6-inch by 8-inch, Model PSR, single-drum hoist is driven by compressed air. Other equipment includes a Gardner-Denver steel sharpener, a portable WK 70 Sullivan compressor with a rated capacity of 105 cubic feet of air a minute, and a D 4 Caterpillar tractor.

---

[1] Data supplied by W. J. Hylands, Manager, Sunset Yellowknife Mines, Limited.

GEOLOGY

The claims are underlain mainly or entirely by volcanic members of the Yellowknife group. Near the Alice zone these are mostly fine- to coarse-grained greenstones derived from andesitic and dacitic lavas, and are massive, pillowed, or schistose. The flows are probably 75 to 150 feet thick, and are commonly separated by bands of acidic tuff a few inches to 6½ feet thick. The tuff is a greenish grey, thin-bedded, fine-grained to cherty-textured rock that weathers light grey or white and breaks with a conchoidal fracture. The flows and intercalated tuff bands strike about north 20 degrees west, and according to diamond drill records dip westerly at approximately 85 degrees. It is not known whether the flows face east or west. Much of the rock is foliated about parallel with flow boundaries, but the degree of foliation varies widely from place to place. Shearing appears to have been concentrated, in some instances, along and near the flow contacts; there the greenstone has been converted to chlorite schist, and the tuff, where involved, to soft, flaky, light grey or white sericite schist. Some of these shear zones are many feet wide. They are commonly rusty due to oxidation of pyrite, and some, such as the Alice shear zone, contain vein quartz and significant amounts of gold.

ALICE SHEAR ZONE

The Alice shear zone is considered by the owners to contain the most promising known mineral occurrences on the property. It trends about north 20 degree west and outcrops mainly on Alice Nos. 1 and 4 claims, and on the southern part of R.V. No. 10 claim. Although surface exposures suggest a steep easterly dip, diamond drill records indicate that its average dip is about 85 degrees west. It lies on the north side of a small lake and is exposed by scattered outcrops and twelve pits and trenches for a length of about 900 feet beyond a pit 120 feet north of the lake. Seven diamond drill-holes explored 480 feet of this exposed length, the deepest intersecting the zone at a depth of about 270 feet. The shear zone follows a band of chert-like inter-flow tuff that varies in thickness from a few inches to 6½ feet. The zone ranges in width from 1 foot to approximately 20 feet, and involves mainly lava lying immediately east of the tuff. The west edge of the zone is commonly well defined, but is in part gradational; in general it lies within the tuff, but here and there it may lie a little west of it. The east edge everywhere lies east of the tuff band and is marked only by a gradual lessening in the degree of foliation displayed by the involved lava. The rocks within the zone are sericite and chlorite schist derived from the tuff and lava, and scattered veinlets and lenses of quartz a few of which attain local widths of a foot or more. Pyrite is abundant across widths of a few inches to 7 feet mainly adjacent to the west wall, and occurs in sericite schist, chlorite schist, and some quartz; other quartz contains only a little ferruginous carbonate and rare needles of (?) tourmaline. The average width of the well-mineralized part of the exposed shear zone is probably between 2 and 3 feet, and its exposed surface length about 500 feet. Almost all pyrite in the surface exposures has been converted to iron oxide that, in addition to staining all mineralized schist, now lines numerous cavities in quartz and is the principal constituent of seams, 1 inch to 4 inches wide, that parallel the schistosity.

Gold occurs here and there in the heavily pyritized part of the shear zone. Two pits afforded rich gold samples. One of these, 400 feet north of the lake and known as No. 6 pit, is now the shaft site and could not be examined. A channel sample, 3·1 feet long, cut from the floor of this pit, is reported to have assayed 0·90 ounce of gold a ton. The other high-grade pit, known as No. 1, is 480 feet north of No. 6, and a channel sample 1·6 feet long from the south face is said to have assayed 5·56 ounces of gold a ton. Other pits provided comparatively low-grade samples, as did most diamond drill cores. Nevertheless, No. 5 drill-hole, which intersected the mineralized zone about 140 feet below No. 1 pit, afforded 1·8 feet of core that assayed about 1·2 ounces of gold a ton and contained the only visible gold found in the Alice shear zone[1].

The shaft was being sunk at the time of the writer's visit and was not examined. It had attained a depth of 73 feet. Material on the shaft dump provided the only available unoxidized material from the mineralized part of the shear zone. It showed white quartz, from a vein or veins at least 1 foot wide, which, in part, contained more than 50 per cent pyrite by volume. The pyrite is fine to coarse grained, and has almost completely replaced parts of the adjacent schist. A selected sample of very slightly oxidized pyrite from the dump, containing 25 per cent quartz and schist, assayed[2]: gold, 6·37 ounces a ton; silver, 0·65 ounce a ton. Another selected sample, apparently perfectly fresh, and containing 50 per cent quartz and schist, assayed[2]: gold, 1·56 ounces a ton; silver 0·22 ounce a ton. These results indicate that substantial amounts of gold occur in pyrite below the lower limit of appreciable oxidation.

Although most known gold occurs in fine-grained pyrite associated with minor quartz, not all such material is of ore grade[3]. Assay plans indicate that ore was encountered on the south side of the shaft from 28·3 to 53·6 feet below the collar. This shoot had an average width of 1·4 feet, and contained 2·6 ounces of gold a ton. It comprised fresh pyrite associated with a little quartz, and occurred along the east side of the tuff band. Abundant pyrite was found in parts of the drifts on the 125-foot level, but contained only a little gold distributed in an apparently erratic manner.

COSTS AND GENERAL OPERATING DATA

Labour and explosives required to sink the shaft, which measures 6 by 12 feet, outside timbers, cost $52 a foot. Contractors hauling freight by tractor from Yellowknife to the Sunset property early in 1947 charged $42 a ton.

About twenty-one men, including a staff of three, were employed during July 1947. At that time two shifts a day were engaged in sinking the shaft.

All lumber and timber used on the property came from Yellowknife: that used in camp construction, by Canso aircraft; shaft timbers by Anson aircraft, and the balance by tractor train.

[1] Hylands, W. J.: personal communication.

[2] Assay by Bureau of Mines, Department of Mines and Resources, Ottawa.

[3] Data on underground exploration were supplied through the courtesy of R. D. Hoffman, consulting engineer, Sunset Yellowknife Mines, Limited.

T.A. Group (126)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-I-7. Henderson and Jolliffe, 1941.

The T.A. group is a gold prospect of twenty claims owned by the Consolidated Mining and Smelting Company of Canada, Limited. It is 52 miles east-southeast of Yellowknife and 4 miles west of the north end of Buckham Lake. Aircraft land on a lake about 1 mile long, locally known as Bull Moose Lake. A trail from a campsite on the west shore of this lake leads about 1,800 feet north-northwest to a shaft. The writer examined Veins 3 and 4 near this shaft on September 19, 1947. The camp was in a state of complete disrepair, and the shaft flooded.

The claims were staked in September 1939 by C. S. McDonald and U. J. Arsenault. A little hand-sorted ore, reported to have contained about 10 ounces of gold a ton, was mined at the property during the winter of 1940-41 and sent by airplane to the Con mill (73) at Yellowknife. Six men were at the property early in 1941, but work ceased early in the summer. So far as known, no additional work has been done at the property (December 31, 1948).

Many parts of the property are reported to have been explored by trenches or diamond drill-holes, or both. Veins 3 and 4 have been stripped and trenched, and these and adjacent parallel veins were explored by seventeen diamond drill-holes. A two-compartment shaft, inclined about 70 degrees east-northeast, was sunk on Vein 4 on T.A. No. 7 claim. About 80 feet of drifting is said to have been done from this shaft at a depth of about 50 feet. Apparently neither power tools nor mechanical hoist were used.

The claims are underlain by sedimentary strata of the Yellowknife group. They were originally greywackes and minor interlayered argillites, but, where examined, the greywackes have been altered to brown weathering, nodular, schistose greywackes, and the argillites to phyllites or nodular fine-grained mica schists. Near Veins 3 and 4 the beds form a gentle arc convex toward the northeast and dip 65 or 70 degrees east or northeast. In the southern part of this structure, near Vein 4, they strike about north 10 degrees west, and in the northwestern part, near Vein 3, about north 60 degrees west. Quartz veins and seams are numerous. They commonly parallel the enclosing strata and some are minutely folded and greatly fractured. So far as known, Veins 3 and 4 are the most promising.

Vein 3 is on T.A. No. 2 claim near its south boundary. It strikes north 60 degrees west and dips 65 degrees northeast about parallel with the adjacent formation. Except for a gap of 35 feet it is continuously exposed by trenches for a length of 190 feet, the southeast end being 150 feet north of the shaft on No. 4 vein. The average exposed width is about 1 foot. The southeastern part of the vein, and its wall-rocks, are involved in several drag-folds up to about 1 foot across. The quartz in this part of the vein is cleaved along planes that strike about north 40 degrees west and dip 65 degrees northeast, perhaps parallel with the axes of the drag-folds. The quartz in the vein is very fine grained and grey to white. It contains a little pyrite and feldspar. Surface sampling is reported to have indicated a gold content of 0·58 ounce a ton (uncut) or 0·46 ounce a ton (cut) across a width of 1·1 feet for a length of 60 feet. Diamond drill-holes have probed beneath the exposed vein, and along its probable strike to the northwest and southeast, for a total distance of about 600 feet.

Vein 4 probably crosses the boundary between T.A. No. 7 claim and the more northerly T.A. No. 2 claim. The vein strikes north 15 degrees west and dips easterly at 65 to 80 degrees. It is almost continuously exposed for a length of about 475 feet except that a 110-foot length near the north end is covered by broken rock and quartz from the shaft. The north end of the vein is about 50 feet south of the most southeasterly exposure of Vein 3. South of the shaft dump it ranges in width from less than 1 inch to about 1 foot, averaging about 3 inches. The foot-wall is schistose nodular greywacke and trends parallel with the vein. The hanging-wall is nodular mica schist derived from argillite and argillaceous greywacke; these strata either parallel the vein, or where they strike towards it are crumpled and sheared near the vein wall. Beneath the shaft dump the vein is reported to widen gradually, from a few inches, near the shaft, to 5 feet or more at the north edge of the dump. The vein is exposed for about 30 feet north of the dump. Here it swells greatly, branches, and includes much wall-rock; however, a rectangular area measuring 20 feet on each side contains about 30 per cent vein quartz. The adjacent beds are sharply folded, but in plan are generally convex towards the northeast and dip about 65 degrees in that direction. The vein walls are sharp and tight. The vein narrows abruptly and probably ends about 30 feet north of the dump. The quartz is medium to fine grained, and white to grey. It contains feldspar, biotite, fragments and seams of wall-rock, and a very little pyrite, pyrrhotite(?), and visible gold. Surface sampling is reported to have indicated a high-grade ore shoot, 6 inches to 6½ feet wide, that extends about 60 feet north from the shaft to include the swollen part of the vein.

T. and B. Group[1] (60)

References: Bureau of Mines, 1944a; 1944c.

The T. and B. group of four claims was staked in 1938 by prospectors employed by the Consolidated Mining and Smelting Company of Canada, Limited. The claims lay about 10 miles west of Gordon Lake, and about 2 miles west of Mac Lake.

Numerous pegmatite dykes occur in knotted quartz-mica schists of the Yellowknife group. Tantalite occurs in two pegmatite dykes from 2 to 6½ feet wide exposed for about 200 feet. These strike about north 60 degrees west and dip about 75 degrees northeast. The adjacent rock contains much tourmaline and sericite. In addition to tantalite, the dykes contain cleavelandite, orthoclase, microcline, quartz, muscovite, beryl (in crystals up to 4 by 10 inches), spodumene, garnet, graphite, and pyrite. The tantalite occurs in aggregates up to 1 inch across. A

[1] Described from data supplied by A. W. Jolliffe and the Consolidated Mining and Smelting Company of Canada, Limited.

sample, said to have come from the T. and B. claims, was examined by H. V. Ellsworth of the Geological Survey, in 1938. It was found to be a high-tantalum tantalite, carrying about 0·2 per cent titanium oxide. Preliminary sampling by the Consolidated Mining and Smelting Company of Canada, Limited, failed to disclose tantalum deposits of ore grade.

Thompson Group (17)

Reference: Kidd, 1933, p. 26.

The Thompson group of eighteen claims has lapsed. It lay 8 miles south-southeast of Port Radium and has been described by Kidd as follows:

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[1] 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 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[2] of a selected sample of this material gave:

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.

Thompson-Lundmark Gold Mines, Limited (103)

(*See* Figure 16)

References: Bureau of Mines, 1940a; 1941b. Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheets 85-I-11 and 12. Fortier, 1946; 1947a. Hoffman, A., 1947. Lord, 1941a, pp. 83-90.

INTRODUCTION

Thompson-Lundmark Gold Mines, Limited, operated a producing gold mine on Thompson Lake, about 30 miles east-northeast of Yellowknife. The property comprises forty-six claims, including the Kim and Waco groups of thirty-eight claims. It is reached from Yellowknife by aircraft in summer or winter, and in winter by tractor over a 55-mile road via Jennejohn, Ried, and Hidden Lakes. The author visited the property in August 1939, and again in July 1947 when preparations were being made

[1] Bow Lake, about 2 miles long, is about 1 mile southwest of the northwest end of Contact Lake.
[2] Mines Branch, Department of Mines, Ottawa.

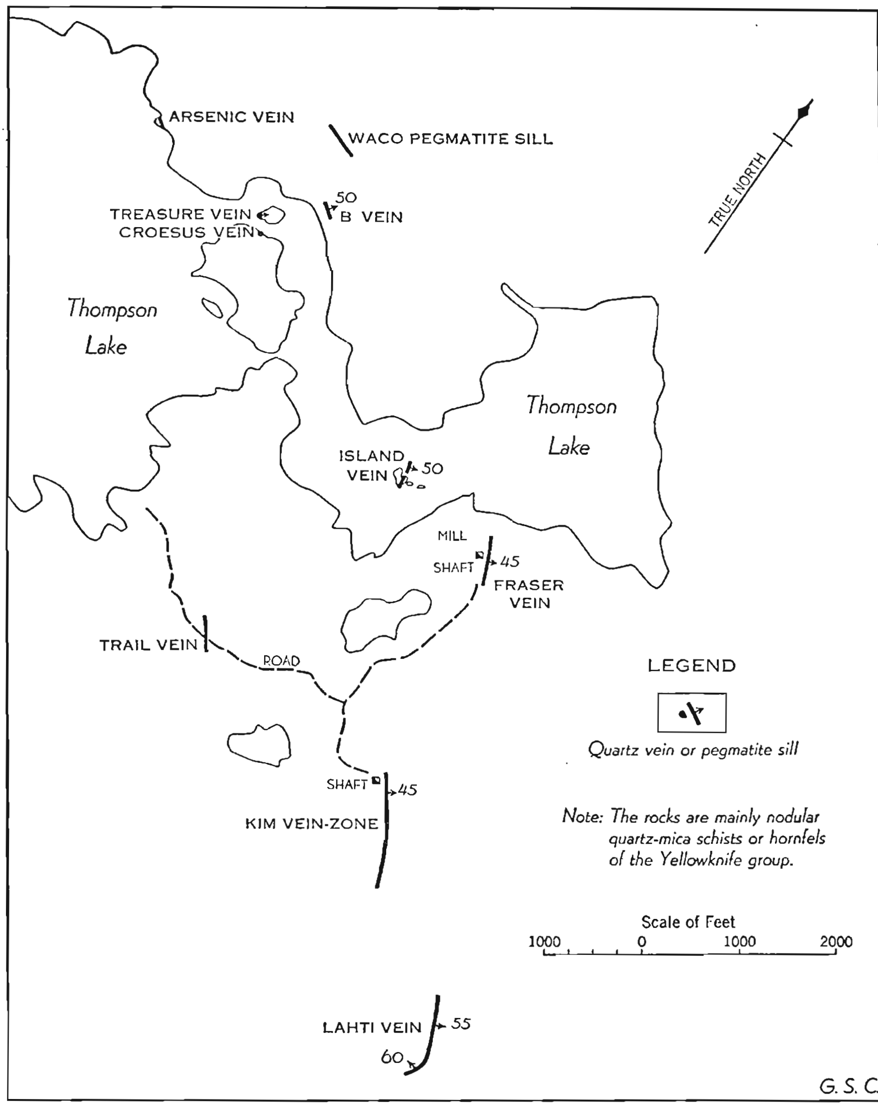

Figure 16. Part of Kim and Waco groups, Thompson-Lundmark Gold Mines, Limited; from survey by the company.

to resume production. Another brief inspection was made on September 25, 1947. Y. O. Fortier has provided the most recent data pertaining to the general geology of the property and the adjacent territory. The staff, in 1947, included: D. R. Wilson, mine manager; J. E. Rae, mine engineer; and R. C. Evans, mill superintendent. R. D. Hoffman is consulting engineer. Unless otherwise stated the following remarks describe the property as of about July 1947.

HISTORY

Fred Thompson, flying from Sunset Lake to Yellowknife in 1938, noted an area of numerous pegmatite dykes and quartz veins in the vicinity of the present Thompson-Lundmark mine. He and Roy Lundmark examined this area a few weeks later, and on or about July 22 made independent, almost simultaneous, discoveries of visible gold. The Kim, Waco, and other groups of claims were staked on behalf of the Lahti-Lundmark, Burmos, and Thompson Prospecting Syndicates, and covered these discoveries and other ground to the north and south. Spectacular occurrences of free gold were found during the staking, on what soon became known as Treasure Island. Thompson-Lundmark Gold Mines, Limited, acquired its property on incorporation in August. The Treasure and Kim veins were explored by trenches and diamond drill-holes later that year. A shaft was started on the latter vein on February 8, 1939, and underground work proceeded under the direction of A. K. Muir, with E. V. Neelands acting as consulting engineer. The Fraser vein was found during the summer of 1939. In August of that year underground work on the Kim vein was stopped and a shaft started on the Fraser vein where a sizable ore shoot was revealed by 1940. In that year operating control of the property passed into the hands of the Consolidated Mining and Smelting Company of Canada, Limited, under an agreement whereby that company, with Ventures Limited, was to provide funds to bring the property into production, and to operate it for a period thereafter. A mill was duly erected and treated ore from the Fraser vein from August 19, 1941, until September 20, 1943, when operations were suspended due to the scarcity of labour; the Kim shaft had been allowed to flood on March 20, and the Fraser shaft on September 18. A reported operating profit of about $786,000 for this milling period enabled Thompson-Lundmark Gold Mines, Limited, to repay the funds advanced by the Consolidated Mining and Smelting Company of Canada, Limited, and Ventures Limited. In 1946, further outstanding interests of these two companies were settled, and operating control reverted to the owners. Rehabilitation of the property commenced on August 1, under the direction of D. R. Wilson, and a little surface diamond drilling was done on the Kim, Island, and Trail veins later that year. The surface plant was renovated, the Fraser shaft and workings were dewatered, and underground work commenced in March 1947. Milling started about September 1, and the first gold brick was poured on September 20, exactly 4 years after the initial suspension of operations. Ore was at first drawn from the Fraser vein and from the dump at the Kim shaft. However, the workings served by the Kim shaft were pumped dry by November 24, connected with the 750-foot level of the Fraser shaft on October 5, and early in 1948 the Kim vein became the sole source of ore. Milling ceased in May 1949, and the property was abandoned shortly after.

PRODUCTION

Bullion recovered from ore treated to December 31, 1948, had a gross value of $2,460,067 as follows[1]:

Year	Ore treated	Gold recovered	Silver recovered	Gross value of metals recovered
	Tons	Ounces	Ounces	Dollars
1941	11,915	8,231	1,598	317,501
1942	37,755	22,587	4,373	871,294
1943	23,545	16,814	3,287	648,609
1947	11,309	3,062	652	107,639
1948	37,757	14,653	2,904	515,024
Total	122,281	65,347	12,814	2,460,067

ORE RESERVES

Ore reserves as of October 1943 were reported as 62,586 tons containing 0·40 ounce of gold a ton (uncut grade), made up as follows: Fraser vein, 9,560 tons containing 0·51 ounce a ton; Kim vein-zone[2] and dump, 53,026 tons containing 0·38 ounce a ton.

CAMP AND PLANT

The camp and plant structures are grouped near the Fraser shaft within 600 feet of the south shore of the east arm of Thompson Lake. Camp buildings include a recently constructed two-story bunk-house for fifty men, a two-story combined cook-house and commissary, three steam-heated residences, a steam-heated apartment house, a three-bed hospital, and a curling rink. Other structures include a two-story building providing office, warehouse, and staff quarters, headframe and shaft house, mill building, boiler house, refinery, assay office, garage, power and hoist building, dry, steel shop, blacksmith shop, machine shop, and carpenter shop.

Electric power reaches the property by a 33,000 volt transmission line from a hydro-electric plant on Prosperous Lake, 25 miles to the west. This power enters a transformer station on the property, where it is converted to 550 volts for use in the powerhouse. Emergency electric power at the same voltage is available from a 75 KVA generator driven by a D 13,000 Caterpillar diesel engine. Two Canadian Ingersoll-Rand, 15 by 9 by 8 inch, XVHB2 compressors driven by 125-horsepower synchronous motors provide a combined capacity of 1,340 cubic feet of air a minute. A Canadian Ingersoll-Rand, two-drum, 42- by 30-inch, type PEI hoist is operated by a 125-horsepower, 250-volt, direct current shunt-wound motor; current for this motor is supplied by a motor-generator-flywheel unit with an output of 100 KVA. Steam for heating is supplied by a 50-horsepower Pacific type Watrous boiler and a 25-horsepower locomotive type Case boiler. Other equipment includes two tractors and two trucks. Radio and telephone provide communication with Yellowknife.

[1] Data supplied by Dominion Bureau of Statistics, Ottawa.
[2] A minimum stope width of 3·5 feet was used in these calculations.

DEVELOPMENT

Work has been done on the Fraser vein, Kim vein-zone, and Arsenic, Treasure, Croesus, B, Island, Trail, and Lahti veins (*See* Figure 16). Surface and underground diamond drill-holes total about 14,500 feet[1]. Shafts, crosscuts, drifts, and raises, essentially all on or near Fraser vein and Kim vein-zone, aggregate about 10,500 feet.

The Fraser vein and vicinity is explored by twenty-one trenches, and diamond drill-holes totalling 3,332 feet (surface, 1,941 feet; underground, 1,391 feet). Underground workings are served by a three-compartment shaft (manway, skip, and counter-balance), 834 feet deep, lying in the foot-wall of the vein and inclined 47 degrees northeasterly nearly parallel with the dip of the vein. Drifts on the 150-, 300-, 450-, 600-, and 750-levels (slope depths) total 2,814 feet.

Surface exploratory work on and near the Kim vein-zone, about 2,500 feet south-southeast of the Fraser shaft, consists of fifty-one trenches, and twenty-one diamond drill-holes totalling 3,947 feet. Entry to underground workings is provided by a two-compartment shaft (manway and skip), 650 feet deep, lying in the foot-wall of the vein and inclined 50 degrees northeasterly nearly parallel with the dip of the vein. Stations in the shaft are 150, 300, 450, and 600 feet (inclined distance) from the collar, and short crosscuts from them connect with drifts totalling 2,518 feet.

A drive about 2,100 feet long, from the 750-foot level of the Fraser workings, was connected by short raises to the 600-foot level of the Kim workings late in 1947.

A little trenching has been done on the Arsenic vein, on the north shore of Thompson Lake, about 5,500 feet west-northwest of the Fraser shaft.

The Treasure and Croesus veins are on islands about 4,000 feet west-northwest of the Fraser shaft. Exploratory work in this area to December 31, 1939, comprised a pit, 12 feet deep, on the Treasure vein and twenty-two diamond drill-holes with a total length of about 2,500 feet. Thirty-five tons of quartz were extracted from the Treasure vein in 1942.

The B vein is about 3,800 feet west-northwest of the Fraser shaft and 750 feet northeast of the Treasure and Croesus veins, and, so far as known, is stripped only.

The Island vein outcrops on a small island 1,100 feet west of the Fraser shaft. In addition to stripping, the vein and its vicinity have been probed by about fifteen diamond drill-holes, the deepest of which attained a vertical depth of 500 feet.

The Trail vein, 3,000 feet southwest of the Fraser shaft, has been stripped, and was investigated by one diamond drill-hole 100 feet long.

The Lahti vein, about 5,000 feet south-southeast of the Fraser shaft, has been stripped, and has been explored by about twenty trenches and a few short diamond drill-holes.

GEOLOGY

Most of the rocks underlying the property are well-bedded, nodular, quartz-mica schists or hornfels of the Yellowknife group. They strike northwesterly and dip 45 to 65 degrees northeasterly. An axial plane of

[1] All footages are to July 1, 1947, unless otherwise stated.

an anticline may be a little less than 1,000 feet southwest of the Kim shaft, trend about northwest, and dip steeply northeast. Cleavage in the Yellowknife formations likewise trends northwest and dips steeply northeast. About 3 miles to the southwest similar strata are intruded by tourmaline-bearing pegmatitic muscovite granite. The strata underlying the claims are cut by white to grey gold-bearing quartz veins genetically related to this granite, and by slightly younger pegmatite bodies also related to the granite (Fortier, 1946). Still younger, milky white quartz veins intersect the pegmatite bodies but, so far as known, contain only insignificant amounts of gold. One of the pegmatite bodies contains considerable tantalite-columbite.

DESCRIPTION OF DEPOSITS

Fraser Vein. The Fraser vein strikes about north 25 degrees west, dips about 45 degrees northeast, and parallels the bedding of the adjacent sedimentary strata. It is exposed on the surface for 540 feet, where its width ranges from 6 inches to 4½ feet and averages about 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 vein was explored on the 150-, 300-, 450-, 600-, and 750-foot levels for an average length of about 560 feet, and the average width of all underground exposures in the drifts was 1·7 feet. On the 750-foot level it is exposed for 370 feet and averages 2·2 feet in width. Underground diamond drill-holes, from a crosscut on the 750-foot level, have traced the vein an additional 300 feet down the dip. The walls of the vein, where observed, are sharp, and the vein material, which is quartz, parts readily from the wall-rock, which is quartz-mica schist and slate or argillite. A foot more of rock adjacent to the hanging-wall is crushed or sheeted parallel with the vein and in part contains a little gouge. A narrower zone of less strongly fractured rock adjoins the foot-wall. At the south ends of the drifts the quartz narrows or ends, but slightly fractured rock persists beyond the faces. Near the north ends of the drifts the fractured zone ends, and the vein becomes irregular in trend and width. Most of the vein comprises medium-grained, grey, and glassy quartz. It is well banded with dark streaks parallel with the walls, and commonly cleaves along these streaks. It contains a little tourmaline, pyrite, galena, and gold. Some of the gold occurs in coarse grains, and on the surface some of these grains are surrounded by violet quartz. The wall-rocks do not contain significant amounts of gold. Most of the known gold occurred in an orebody, now mostly extracted, that extended from the surface nearly to the 750-foot level and pitched about 85 degrees northerly. No ore was found on the 750-foot level, but cores from several of the diamond drill-holes that probed the vein below that level contained visible gold. Drifts in the orebody on the 150-, 300-, 450-, and 600-foot levels encountered ore-lengths ranging from 293 to 435 feet and an average vein width of about 2 feet. This orebody, above the 600-foot level, from August 19, 1941, to September 20, 1943, provided 73,215 tons of ore (vein material, and wall-rock unavoidably extracted during mining) containing 0·66 ounce of gold a ton.

Kim Vein-zone. This vein-zone contains several, closely spaced, parallel quartz veins separated by layers of fractured wall-rock. The zone strikes between north 25 degrees west and north 40 degrees west, dips about 45 degrees northeast, and is parallel with 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 in width from 4 to 13 feet, and averages 6½ feet. The wall-rock is mostly nodular quartz-biotite schist in beds up to several feet thick. The rock within the zone is fractured quartz-biotite schist or thin-bedded phyllite devoid of nodules; it contains a little pyrite and commonly cleaves into slabs, about an inch thick, that parallel the walls of the zone and have polished, green surfaces. As much as 2 inches of rock adjoining the quartz has been altered to an aggregate of tourmaline, white mica, and other minerals. The zone commonly contains three quartz veins, but in places may include either more or fewer than this. On the 150-foot level there are three veins; on the 300- and 450-foot levels two, or less commonly only one; and on the 600-foot level one or two, and here and there three veins. The veins range in width up to 6 feet, but in most places are less than 1 foot wide, and the average combined width of all quartz veins in the zone is probably between 1½ and 2 feet. Except for a few folds with amplitudes up to about 10 feet, the veins are generally nearly parallel with the walls of the fractured zone in which they occur. Contacts between the quartz veins and the enclosing rock are commonly sharp and tight, but here and there the quartz grades into the rock through a few inches of banded quartz and rock. The quartz is mainly white to grey and glassy and is ribboned by tourmaline-rich seams that parallel the vein walls. A little milky white quartz occurs as vein-like bodies that transect this quartz and the tourmaline-rich bands in it. The veins contain fragments of tourmalinized and pyritized wall-rock. Rarely, lenses of quartz-mica pegmatite cut banded, gold-bearing vein quartz with tourmaline, and penetrate the walls. In a few places the quartz veins are offset a few feet by faults. In addition to tourmaline and biotite, the veins contain a very little pyrite, galena, sphalerite, chalcopyrite, and visible gold.

Development work to March 20, 1943, provided the following data on ore shoots in the Kim vein-zone and, as the Kim workings were not again accessible until late 1947, these data are applicable, without major changes, to December 31, 1947. Four hundred and fifty feet of the zone at the surface has an average width of about 10 feet and contains three quartz veins with an average aggregate width of 2·33 feet and a weighted average gold content of 0·68 ounce a ton. Underground development disclosed an ore shoot with an average northerly pitch of about 65 degrees and the following approximate drift-lengths of ore: 150-foot level, 300 feet; 300-foot level, 240 feet; 450-foot level, 260 feet; and 600-foot level, 230 feet. This shoot contains an average total width of quartz of about 2 feet, and is reported to contain 49,990 tons of probable ore averaging 0·38 ounce of gold a ton.

Arsenic Vein. This vein is reported to contain only a little gold.

Treasure Vein. This 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. The rock here 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 mass is tight and approximately parallels the strike of the enclosing rock, but many small veinlets from the main mass enter the wall-rock. The southwest, northwest, and southeast margins of the quartz lie beneath 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 schist 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 in width from 10 to 60 feet. 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. Thirty-five tons of quartz extracted from this vein in the summer of 1942 yielded 0·79 ounce of gold a ton[1].

Croesus Vein. This vein outcrops as a mass of quartz at the lake-shore 110 feet south 50 degrees east from the Treasure vein. The exposed mass trends south 80 degrees east, 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, contains feldspar and white mica, and is reported to contain very little gold.

B Vein. The B vein strikes north 50 degrees west, dips about 50 degrees northeast, and is parallel with the bedding of the adjacent sedimentary rock. 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. 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.

Island Vein. This vein strikes north 10 degrees west, dips easterly at about 50 degrees, and is probably nearly parallel with the adjacent strata. It is exposed for the width of the island on which it occurs, which is 105 feet; diamond drill-holes north of the island traced it for another 200 feet, but it was not found in drill-holes south of the island. The surface width of the vein ranges from 4 inches to 2 feet and averages 9 inches. Wall-rock, which is not sheared, separates readily from the vein matter, which is quartz. In places about an inch of rock next to the quartz consists mainly 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. Surface samples indicated an ore shoot 75 feet long and

[1] Thompson-Lundmark Gold Mines, Limited: Eighth Annual Report of Thompson-Lundmark Gold Mines, Limited.

9 inches wide containing 1·46 ounces of gold a ton. Diamond drill-holes traced this orebody north, beneath the lake, another 75 feet. A sample from a drill-hole that intersected the vein at a slope depth of 200 feet below the outcrop of this ore shoot contained very little gold.

Trail Vein. The Trail vein was not seen by the writer, but is reported to be a quartz vein exposed for a length of 428 feet, to have an average width of about 6 inches, and to lie parallel with the enclosing strata, which there trend about northwest. Surface sampling indicated: a southern section 40 feet long and 0·7 foot wide containing 0·77 ounce of gold a ton; a central section 80 feet long and 0·4 foot wide containing 0·66 ounce a ton; and a northern section 110 feet long and 0·4 foot wide containing 1·70 ounces a ton. These sections are separated by vein material that is below ore grade. The one diamond drill-hole that intersected the vein is reported to have encountered about the same width of quartz as exposed at the surface.

Lahti Vein. This vein has been 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 this end the strike of the vein swings to north 5 degrees west, 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 10 feet wide that 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 enclosing 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. For 250 feet from its south end the vein cuts across these beds, which are not sheared; for the remainder of its exposed length the vein parallels the bedding of the wall-rock, and lies in a zone of fractured rock that ranges up to 6 feet in width. The quartz contains a little pyrite, galena, sphalerite, visible gold, biotite, chlorite, sericite, and a green, fibrous mineral; in places some of these minerals are concentrated in bands that parallel the vein walls. The vein is not known to contain ore.

Waco Pegmatite Sill[1]. This sill is about 4,500 feet northwest of the Fraser shaft and about 700 feet north of Thompson Lake. So far as known, no work has been done on it.

The sill was found by the Geological Survey in 1944. It trends northwesterly parallel with the enclosing nodular schists, and is nearly vertical. It is exposed at intervals along a length of 415 feet and varies in width from 20 to 35 feet. The walls are fairly straight.

The principal minerals are feldspars, quartz, and lesser amounts of muscovite. Pink perthitic feldspar occurs as crystals up to a few feet long. White, radiating cleavelandite is also present. The quartz is white to smoky, crystalline, sub-vitreous, and banded in places. Muscovite is usually in blocks up to 2 inches long, but here and there occurs in patches of fine-grained material a few feet in diameter.

The rare-element minerals noted are spodumene, beryl, amblygonite, and tantalite-columbite; only the latter is of possible economic interest. Many crystals of spodumene were seen, but this mineral constitutes less

[1] Described from data supplied by Y. O. Fortier.

than 5 per cent of the exposed parts of the sill. Amblygonite, commonly associated with the spodumene, is less abundant. Beryl is in crystals up to 12 inches long and is usually surrounded by milky quartz; it is most abundant where tantalite-columbite is most concentrated, but even there comprises less than 5 per cent of the sill.

Tantalite-columbite occurs in stout grains up to 3 by 5½ inches. It is most abundant in the muscovite patches. The sill was not sampled by the Geological Survey, but a preliminary inspection indicated an encouraging tantalite-columbite content.

UNDERGROUND OPERATIONS

As previously mentioned, most known ore in the Fraser vein above the 750-foot level had been removed prior to September 20, 1943. The stopes were left unfilled, supported only by timber props, and were still open in July 1947.

Ore mined from the Kim vein is hauled by an electric locomotive to a loading pocket and 8-inch grizzly on the 750-foot level at the Fraser shaft. It is then hoisted to the surface in a skip, with a capacity of about 1⅓ tons, operating in the central compartment of the shaft. Men and supplies enter the mine by the same skip. The Kim shaft provides ventilation.

Drifts and crosscuts do not require timber supports. Two electric pumps at a sump in the Fraser shaft each have a rated capacity of 200 U.S. gallons a minute. One is retained as a standby unit.

The Fraser workings are free of permafrost and no ice was found in them when dewatered during the winter of 1946-47. Permanently frozen ground was, however, encountered when drifting north from the Kim shaft on the 150-foot level, and ice is reported to have been found in this shaft as far as 400 feet (inclined distance) from the collar when the workings were pumped in 1947.

Three shifts were employed daily in the drive connecting the Fraser and Kim workings, and the face was advanced about 400 feet a month. The work was facilitated by the use of a Sullivan Jumbo, an Eimco mechanical loader, and a Mancha Little Trammer electric locomotive. The drive is nearly parallel with the strike of the formations and did not require timbering.

Drift samples from the Fraser vein show that the ore shoot averaged 1·85 feet in width and contained slightly more than 1 ounce of gold a ton (uncut grade). The stopes, after blasting, had an average width of about 3½ feet, and, after drawing, about 4 feet, the increase beyond 3½ feet being due mainly to caving of the fractured, barren hanging-wall. Accordingly, dilution amounted to nearly 120 per cent, and the grade of ore drawn from the stopes, as calculated from uncut face samples from the drifts and corrected for dilution by barren rock, was nearly 0·5 ounce of gold a ton. On the other hand, samples taken from the muck as the drifts advanced through the ore shoot indicated an average uncut grade of 0·43 ounce a ton. The true grade of ore treated, after 6·4 per cent of the material drawn from the stopes had been sorted as waste and discarded, was 0·66 ounce of gold a ton. Thus, ore grades calculated from uncut drift samples were conservative.

During production, samples were taken from each car of ore drawn from the stopes. The grade of the ore as calculated from these samples, after all samples containing more than 3 ounces of gold a ton had been reduced (cut) to 3 ounces, was in error by only about 2 per cent.

MILL[1]

Ore from the mine (passed through an 8-inch grizzly underground) is stored in a 70-ton bin in the shaft-house, whence a conveyor belt leads to another, 180-ton bin. Ore drawn from this bin is dried as required for efficient grinding and then enters a 4- by 12-foot Hadsell mill where it is reduced to 55 per cent minus 200 mesh. After passing through Polycones and an agitator this product is fed onto blanket tables where some of the gold is recovered. The balance of the gold recovered is obtained by standard methods of cyanidation and zinc dust precipitation. Formerly, about 70 per cent[2] of the gold was trapped on the blanket tables.

The previous operators treated about 95 tons of ore a day, and recovered 98 per cent of the contained gold. The capacity of the mill as operated during December 1947 was about 100 tons a day, and 97·8 per cent of the gold in the ore was recovered.

COSTS AND GENERAL OPERATING DATA

The operating cost from August 19, 1941, to April 30, 1943, was $12.54 a ton milled, distributed as follows: mining, $5.87 a ton; milling, $2.03 a ton; and other costs, $4.64 a ton. This cost includes $1.09 a ton expended on development. The average operating cost from September 1, 1947, to June 30, 1948, exclusive of write-offs, was $15.65 a ton milled, as follows: development, $2.75 a ton; mining, $5.22 a ton; milling, $2.86 a ton; other expenses at property, $4.82 a ton[3].

The main haulage drive from the 750-foot level of the Fraser workings to the Kim workings was completed at a cost of $12.75 a foot for labour and explosives.

From 1941 to 1943, inclusive, 2,305 tons of freight were hauled to the property by local contractors using tractor trains at a cost, to the company, of $16 a ton including loading and unloading. Early in 1947 the company operated its own tractor train and brought freight from Yellowknife at a cost (excluding depreciation on tractor and equipment) of $12 a ton.

The average number of employees during the production period of of 1941-43 was eighty-five, including fifteen classified as staff (employees on salaries). Employees on July 16, 1947, numbered fifty-eight, including a staff of twelve. The scale of wages at this date was the same as that at Con and Rycon mines (73), with a daily deduction of $2 a man for board. Many employees are hired at Edmonton under a contract whereby their travelling expenses to the property are reimbursed after two hundred shifts have been worked, and return expenses paid after three hundred shifts have been completed. Other employees have been hired, on a similar plan, at Cobalt, Ontario. A qualified first-aid man is employed.

---

[1] The following data, unless otherwise stated, pertain to the mill as operated in September 1947.
[2] Hoffman, R. D.: personal communication.
[3] Ninth Annual Report of Thompson-Lundmark Gold Mines, Limited, p. 6.

A fund to provide for hospitalization and medical care at Yellowknife is afforded by joint contributions from each employee and the company. A curling rink provides winter recreation.

Electric power is purchased from the Consolidated Mining and Smelting Company of Canada, Limited, owners of the hydro-electric plant at Prosperous Lake, for 1½ cents a kilowatt-hour. Power consumed during the 1941-43 production period totalled 5,459,160 kilowatt-hours, or 74·6 kilowatt-hours for each ton of ore milled.

Rough lumber, from mills on Slave River, costs about $130 M ft. board measure at the mine.

About 2,000 cords of firewood and 200 cords of mine timber were used each year of the first production period. During the winter of 1942-43, contractors cutting wood near the mine were paid $10 a cord delivered in 4-foot lengths, and the mine operators supplied a tractor, fuel and lubricating oils, and tractor maintenance. Other wood, cut by contractors during the same winter at Hidden Lake about 5 miles south-southwest of the mine, cost $12.50 a cord delivered. Payments were based on measurements made when the wood was in pole lengths (about 16 feet). Hidden Lake is the current source of wood. The cost of wood fuel for heating in 1942 (the only calendar year of continuous production) amounted to about 65 cents for each ton of ore milled.

Tibbitt Lake Scheelite Deposits[1] (107)

Reference: Fortier, 1947a.

The Geological Survey examined scheelite occurrences at Tibbitt Lake, 33 miles east-northeast of Yellowknife, during the summer of 1942. The area remained unstaked throughout the season.

The most abundant rocks in the area are argillite, greywacke, and other strata of the Yellowknife group. These lie in tight folds, the axial planes of which strike about north and dip steeply east. The strata are cut by altered basic dykes and sills that trend about north and occupy much of a zone, ½ to 1 mile wide and 6 miles long, that extends north along the east side of Peninsula Lake, Tibbitt Lake, and Cameron River. Probably the dykes and sills were originally gabbro; many are now amphibole schists. They range from a few feet to 1,000 feet in width, and some have been traced several thousand feet. They are cut by aplite dykes and pegmatitic quartz veins.

About one hundred and fifty quartz veins containing scheelite were found during the summer of 1942. Those of best grade occur in the altered gabbro bodies and were examined in detail; but others were noted in the sedimentary strata. All known scheelite-bearing veins in the altered gabbro are narrow, and less than 50 feet long. Most of these are in dykes or sills less than 300 feet wide. Some are pegmatitic quartz veins containing clinozoisite crystals up to 4 inches long, and garnets up to 1 inch in diameter. Others may have resulted from the replacement of the gabbro along narrow

[1] Described from data supplied by E. D. Kindle, Geological Survey of Canada.

zones of fracturing or shearing. These veins consist mainly of clinozoisite, garnet, and chlorite, with a little plagioclase, quartz, and carbonate; and form brown to grey altered parts of the dykes or sills, with gradational boundaries up to a few inches wide separating them from the gabbro. Scheelite in both types of veins is white or light grey and closely resembles weathered feldspar and clinozoisite. Groups of scheelite crystals in the larger pegmatitic veins range up to 2 inches in diameter, but elsewhere vary from $\frac{1}{8}$ to $\frac{3}{4}$ inch. The grade of one hundred and fifteen veins was determined: forty-one carry more than 0·3 per cent WO_3, and twelve of the forty-one contain more than 1·0 per cent WO_3.

Most of the known scheelite occurs in Zone A, Zone B, and in a group of veins on Peninsula Lake. Zone A is half a mile north-northeast of the north end of Tibbitt Lake. It is part of a gabbro sill(?) wherein scheelite-bearing veins are unusually numerous. The zone is about 600 feet long, 30 or 40 feet wide, and occurs along the east edge of the sill. The sill is there about 200 feet wide, strikes about north 25 degrees west, and, at its northeast edge, dips about 70 degrees northeast. Most of the scheelite-bearing veins strike between north and north 25 degrees west, and dip between 65 degrees northeast and vertically. They range in length from 5 to 30 feet, in width from 0·2 foot to 5 feet, and contain up to 1·6 per cent WO_3. The average grade of all the tungsten-bearing parts of the veins is about 0·25 per cent WO_3. The most promising part of the zone is near the north end where a block 110 feet long, 4 feet wide, and 55 feet deep includes many veins and may contain 0·15 per cent WO_3.

Zone B is about 300 feet east of the south end of Zone A. It comprises three quartz veins at the south end of a gabbro sill(?). The 'sill' is about 50 feet wide and strikes north. The veins outcrop within an area 30 feet long and 12 feet wide, strike about northwest, and are vertical. One is at the contact of the gabbro and greywacke; the others are within the gabbro. One vein is 30 feet long, averages 2·7 feet in width, and contains 0·36 per cent WO_3; another is 17 feet long, averages 0·5 foot in width, and contains 0·40 per cent WO_3; and the third vein is 12 feet long, has an average width of 0·5 foot, and contains 0·10 per cent WO_3.

Numerous scheelite-bearing veins occur in a gabbro sill(?) at the south end of Peninsula Lake, about 4 miles south of zones A and B. The 'sill' is about 40 feet wide, strikes south, and extends about 340 feet south from the lake. The best known vein is 100 feet south of the lake and strikes north 20 degrees east: it is 46 feet long, 0·8 foot wide, and contains 0·43 per cent WO_3.

Try Me Group (61)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-P-3. Lord, 1941a, pp. 69-70.

The Try Me group of claims on Mac Lake lies about 50 miles northeast of Yellowknife townsite and about 10 miles northwest of the Camlaren property (64). Rock is exposed over wide areas. The claims were staked for the 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 Try Me Nos. 3 and 4 claims; 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. The property was examined by the writer 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 in length up to 5 inches and average about 1½ inches. The nearest granite is on the east side of Mac Lake about ½ mile northeast of the vein and 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 Try Me Nos. 3 and 4 claims 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 with 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 foot 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 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 in width from 6 inches to 10 feet, 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 stock-works 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. Visible gold is reported to occur in the vein, but none was seen. So far as known no ore occurs in the vein, although the quartz is reported to contain more than an 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.

Utsingi Point Iron Deposits (130)

Reference: Stockwell and Kidd, 1932, pp. 84-85.

Utsingi Point, in Great Slave Lake 86 miles east of Yellowknife, is the southern tip of Pethei Peninsula. The following account is by Stockwell and Kidd.

....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.

Viking Yellowknife Gold Mines, Limited (57)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-O-1. Byrne, 1948a, pp. 58-61. Jolliffe, 1939; 1940a. Lepp and Byrne, 1948.

INTRODUCTION

The property of Viking Yellowknife Gold Mines, Limited, is nearly 45 miles north-northeast of Yellowknife and about 8 miles southwest of that of Discovery Yellowknife Mines, Limited (55). The Viking property comprises Arlene Nos. 1 to 6 claims, B.B.B. Nos. 1 to 12, Ola Nos. 6 to 24, and D.E.I. Nos. 1 to 12; or forty-eight claims in all. It is accessible by aircraft, and by winter road from Yellowknife by way of the Discovery property. H. Lepp was in charge when the writer visited the property late in June 1947. N. W. Byrne of Yellowknife was consulting engineer.

HISTORY

The Arlene, B.B.B., and Ola claims were staked in the spring of 1945 and optioned by Athona Mines (1937), Limited, in January 1946. The same company subsequently purchased the adjoining D.E.I. claims. A program of trenching and diamond drilling, commenced in the spring of 1946, was completed early in 1947, and a prospect shaft was started in April. Viking Yellowknife Gold Mines, Limited, was formed in May to proceed with underground exploration, and continued operations until, about September 30, 1947, the camp was closed for the winter.

CAMP AND PLANT

The camp, on the west shore of a lake locally known as Morris Lake, consists of a cook-house of frame construction and several tents. About 3,500 feet southwest, on Ola No. 9 claim, a 32-foot headframe and an ore bin of about 30 tons capacity serve an inclined prospect shaft. Adjacent structures include two frame buildings, each 14 by 22 feet; one serves as a combined dry and shop; the other houses a Chrysler motor connected to a Holman compressor with a rated output of about 135 cubic feet of air a minute, and a Holman single-drum air winch. Gasoline is stored nearby in a 2,200-gallon tank.

DEVELOPMENT

Surface exploratory work comprises about 800 linear feet of rock trenches, standard-core diamond drill-holes aggregating 13,123 feet, and about 500 feet of X-ray diamond drill-holes. Almost all of this is on the Main zone, on Ola No. 9 and B.B.B. No. 1 claims; a little, including five X-ray diamond drill-holes, is on the East zone that outcrops on B.B.B. No. 4 claim, about 3,000 feet south of the Main zone. Underground workings are confined to the Main zone. By late June 1947, they consisted of a two-compartment, 7-foot by 9-foot prospect shaft, 160 feet deep, inclined 65 degrees in a direction north 35 degrees east, and a station at a vertical depth of about 150 feet. Work on this level during the remainder of the summer is reported to have totalled several hundred feet of drifts and crosscuts, and 734 feet of diamond drill-holes.

GEOLOGY

The claims are underlain mainly by sedimentary formations of the Yellowknife group. These weather light brown and comprise interbedded, fine- to medium-grained, schistose to massive greywacke, argillite, slate, and phyllite. The beds are nearly straight for the lengths ordinarily observed, trend north 30 to north 60 degrees east, and are vertical or steeply inclined towards the southeast. In general, foliation has obscured grain gradation whereby the tops of beds, and thereby detailed structure, might be determined; but, presumably, the strata occupy a series of tight isoclinal folds.

DESCRIPTION OF DEPOSITS

Main Zone. Gold has been found in a quartz diorite sill that cuts the Yellowknife strata, this occurrence being designated by the operators as the Main zone. The sill outcrops at intervals for a length of approximately 2,400 feet and varies in thickness from about 15 to 60 feet. It strikes nearly north 35 degrees east and dips about 80 degrees southeast parallel with the enclosing strata. It has been probed by thirty-five diamond drill-holes along a strike length of 2,900 feet; most of these intersect it at a depth of about 150 feet, but several cut it at greater depths.

The sill rock is massive, hard, and medium grained. Fresh surfaces are dark grey or greenish grey, but the weathered surface is rusty. Rounded, fibrous greenish spots, $\frac{1}{16}$ to $\frac{1}{8}$ inch in diameter, were found nearly everywhere, but appear to be particularly numerous within a few inches of intersecting quartz bodies, or bordering tiny fissures without noticeable amounts of vein matter. Minute grains and blebs of pyrrhotite occur throughout, and, together with a little pyrite, probably comprise several per cent of the rock. Striated prismatic crystals of arsenopyrite are commonly abundant within an inch or so of quartz seams, and a few attain lengths in excess of 1 inch; rare, smaller crystals occur elsewhere. Thin sections examined under a microscope showed the sill to consist chiefly of various proportions of altered acid plagioclase and fibrous radiating sheafs of weakly pleochroic amphibole, the latter forming the spots visible in hand specimens. Other non-metallic minerals include biotite, quartz, and sphene.

The quartz diorite is cut by numerous quartz bodies, which in general do not extend into the adjacent strata. The quartz is commonly concentrated near or at the walls of the sill, particularly the northwest wall, and effectively prevented an examination of the sill in contact with sedimentary rocks. It occurs as veins and irregular masses ranging from less than an inch to many feet in width. In some of the trenches these bodies approximately parallel the sill walls in strike and dip, but no such pattern is apparent in the shaft. It is doubtful if quartz comprises as much as 10 per cent of the exposed parts of the sill; nevertheless, the proportion varies widely from place to place and locally considerably exceeds this figure. The quartz is light and dark grey and mottled, and adheres firmly to the wall-rock. Here and there it contains tabular bodies of quartz diorite as much as a foot thick and several feet long, or nests and seams of fibrous green amphibole, or, mainly near its borders, scattered crystals and aggregates of pink and white feldspar. Metallic minerals, comprising less than 1 per cent of the vein matter, are mainly arsenopyrite, pyrite, and pyrrhotite; others noted are galena, chalcopyrite, and sphalerite. Gold is reported to occur in quartz and in the sill rock, but possibly the latter occurrences lie close to quartz bodies. Both the quartz bodies and enclosing quartz diorite are cut by rare veinlets of drusy white calcite and (?) pyrite.

Diamond drill cores provided numerous widely distributed gold-bearing samples, some of them of ore grade. Particularly promising samples were derived from the northern, approximately 570 feet of the exposed length of the sill; and within this part unusually encouraging samples were obtained near the foot-wall of the sill. Nevertheless, in view of the apparent erratic distribution of gold and quartz here and elsewhere in the sill, there was no assurance that the drill-core samples were truly representative. Accordingly, the owners sank the present prospect shaft in the northern exposed part of the sill with the express purpose of obtaining truly representative bulk samples of the most promising known part of the deposit, thereby providing more reliable data for estimating the commercial possibilities of the Main zone.

East Zone. Gold-bearing quartz of the East zone is exposed along the southeast edge of an outcrop bordered by muskeg. The enclosing rocks are fine-grained, indistinctly foliated greywacke, and thin-bedded argillite and phyllite. The strata are a little contorted near the quartz, but have an average trend of north 55 degrees east and are vertical or dip very steeply southeast. A highly irregular quartz vein outcrops for about 150 feet on a strike of north 55 degrees east. At the northeast end of its outcrop it is a foot wide and passes beneath muskeg. Approximately 70 feet southwest it is about 20 feet wide, and is composed almost entirely of quartz; a trench here opens the vein for part of this width. At the southwest end of the vein outcrop, the quartz is a few inches wide and, farther southwest, the rock surface is covered with moss and lichens. The quartz is glassy, mottled in shades of grey, and commonly adheres firmly to the wall-rock. It contains a very little pyrite, pyrrhotite, galena, chalcopyrite, and visible gold. The vein was explored by several diamond drill-holes to a depth of 90 feet. These are reported to have encountered less quartz and gold than found in the outcrop, although 2·5 feet of core from a depth of 90 feet is said to have assayed 1·64 ounces of gold a ton.

UNDERGROUND OPERATIONS, COSTS, AND GENERAL OPERATING DATA

As already stated, the shaft was designed to provide entry for the purpose of underground sampling. This required that it be sunk within the steeply dipping quartz diorite sill so as to provide continuous material for bulk samples, and that it be inclined at an angle of less than 70 degrees to avoid certain costly regulations specified by law for steeper shafts. These requirements were accordingly complied with by the rather unusual procedure of inclining the shaft so that its horizontal projection is parallel with the strike of the quartz-bearing sill. It was sunk at a contract rate of $40 a foot, including labour and explosives. Its cost, when power, supervision, and other camp expenses were apportioned to it, ranged from $49.80 to $56.12 a foot[1].

Underground work proceeded at the rate of one machine-shift a day throughout the summer. Liddicoat detachable bits were used on rock drills.

Two bulk samples were obtained from each round blasted, one from the broken rock underground and the other from this rock after it had been hoisted to the surface. Each sample was later crushed and reduced in bulk for shipment to Yellowknife for assay. These samples thus indicate the tenor of the mixture of sill rock and quartz encountered by all underground openings.

The Athona Company paid diamond drill contractors $2.50 a foot drilled, less board for drill crews at $1 a man-day, and provided camp facilities and transportation. Ten men were employed at about the time of the writer's visit.

Walsh Lake Group (85)

Reference: Stockwell and Kidd, 1932, p. 73.

The Walsh Lake group has lapsed since the following description was prepared by Stockwell and Kidd.

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 [Yellowknife group]. 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[2]. A 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.

---

[1] Lepp, H.: personal communication.
[2] Assay by A. Sadler, Mines Branch, Department of Mines, Ottawa.

Walter Group (19)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 86-F-12. Parsons, 1948a, p. 12.

The Walter group of four claims is on the north shore of Camsell River, $2\frac{1}{2}$ miles downstream from White Eagle Falls, or about 31 miles south of Port Radium. The claims were staked by employees of Eldorado Mining and Refining (1944), Limited. According to Parsons:

....a system of diabase dykes cuts brecciated granite, and the granite has been injected by quartz-carbonate stringers that contain pyrite, chalcopyrite, and hematite.

Wilson Island Gold-Quartz Veins (138)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-H-14. Stockwell and Kidd, 1932, pp. 75, 76.

Gold-bearing quartz veins on Wilson Island have been descibed by Stockwell and Kidd as follows:

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[1]. 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[2].

The rocks [Wilson Island group] 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 $\frac{3}{4}$ 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[3]. 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[4]. 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. West of the shafts a few small quartz veins carry

[1] Or about 60 miles southeast of Yellowknife.

[2] The claims referred to have lapsed.

[3] These claims were later abandoned, and apparently restaked as part of the Victory group of twelve claims.

[4] Assay by A. Sadler, Mines Branch, Department of Mines, Ottawa.

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 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.

WO_3 Group[1] (120)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheets 85-I-7 and 85-I-10. Henderson and Jolliffe, 1941.

The WO_3 group of claims is about 2 miles west of the north end of Gilmour Lake. The WO_3 claims Nos. 1 to 6 were staked by A. Woyna in April 1941, and Nos. 7 to 10 were staked later.

Vein 56 was the principal vein known in 1941. It occurs in sheared tuffaceous rocks of the Yellowknife group and is parallel with the bedding. The vein is exposed in many places along a length of about 650 feet, with an average strike of about north 70 degrees east. Two hundred and thirty-seven feet of the vein averages 1 foot in width, and contains 0·3 per cent WO_3 as scheelite. The strike of this part of the vein ranges from north 70 degrees east at the west end to north 55 degrees east at the east end; and the dip ranges from 35 to 50 degrees northwest.

Workman Island Pitchblende Deposit (10)

Reference: Kidd, 1936, pp. 40-41.

Workman Island is in Great Bear Lake, 10 miles north of Port Radium. The following description is by Kidd, based on his examination in 1934.

> 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.

X.L. Group (110)

References: Bureau of Northwest Territories and Yukon Affairs, 1947a, Mineral Claim Sheet 85-I-10. Lord, 1941a, pp. 81-82. Meen, 1939.

The X.L. 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 aircraft. Bedrock is well exposed and the relief may be 100 feet. The property was visited by the writer 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

---

[1] Described from data supplied by A. W. Jolliffe and the Consolidated Mining and Smelting Company of Canada, Limited.

was done on a deposit of copper, lead, and zinc that lies partly on X.L. No. 1 claim and partly on X.L. No. 2 claim; this 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 orebodies were found. Work was directed by A. S. Dadson and J. R. B. Jones.

Rocks near the deposits are highly altered sedimentary and volcanic strata of the Yellowknife group, and lie at the eastern edge of a body of granite that is about 18 miles wide. The strata strike north 30 degrees east and dip agout 65 degrees southeast. They occur in troughs in the granite, and are cut by granite and related pegmatite. The sedimentary rock, originally greywacke and shale, has been altered to quartz-biotite gneiss, but the bedding is well preserved. Some strata, probably originally calcareous tuffs, have been altered to coarse-grained amphibole gneiss that contains black to green amphibole, biotite, garnet, quartz, and other minerals; the amphibole laths range up to about 2 inches and many of the garnet crystals are 1 inch in diameter. Here and there, 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.

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 northwest 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 southwest end the mineralized gneiss and associated rock narrows to a point and ends in granite. Rock outcrops are scarce immediately southeast of the southern 1,000 feet of the zone, but it is probably bounded by pegmatite and granite throughout most of this length. Throughout the northern 900 feet the zone is bordered on its southeast side by quartz-biotite gneiss that is cut by much pegmatite, but nearly solid granite and pegmatite outcrop about 800 feet southeast of the zone. Gneisses cut by much granite and pegmatite outcrop for more than 600 feet beyond the northern end of the mineralized zone.

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 four or more mineralized bands are distributed throughout a width of 130 feet. The proportion of sulphide minerals to gneiss varies greatly within short distances within each body, and so far as 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 the 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 X.L. Nos. 1 and 2 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	....	....

Yamba Lake Monazite Deposits (44)

Reference: Folinsbee, 1949.

Yamba Lake is in the barren grounds, 20 miles north of the outlet of Lac de Gras, and about 190 miles northeast of Yellowknife. Esker sands in the vicinity contain a little thorium-rich monazite derived from the disintegration of a gneiss formed by the *lit-par-lit* injection of granite magma into sedimentary schists of the Yellowknife group. Through wave action on the esker sands the monazite has been further concentrated into a slightly radioactive beach placer found by the Geological Survey in 1947.

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

CHAPTER VI

BIBLIOGRAPHY[1]

Alcock, F. J.
(1930): Zinc and Lead Deposits of Canada; Geol. Surv., Canada, Econ. Geol. Ser. No. 8.

Ames, A. O.
(1946): The Northwest Territories in 1945; Western Miner, vol. 19, No. 4, April 1946, pp. 55-57.

Anonymous
(1948): The Snare River Power Project, N.W.T.; The Precambrian, vol. 21, No. 12, December 1948, pp. 6-8.

Armstrong, J. E.
(1947): The Arctic Archipelago; in Geology and Economic Minerals of Canada (Third Edition); Geol. Surv., Canada, Econ. Geol. Ser. No. 1, pp. 311-324.

Back, G.
(1836): Narrative of the Arctic Land Expedition to the Mouth of the Great Fish River and along the Shores of the Arctic Ocean, in the Years 1833, 1834, and 1835; John Murray, London, 663 pp.

Barnes, F. Q.
(1949): Correlation of Granitic Rocks, Aylmer Lake Area, Northwest Territories; unpublished Master of Arts thesis, University of Toronto.

Bateman, J. D.
(1945): A Day in the Arctic; Geol. Surv., Canada, Bull. No. 1, 9 pp.

(1947): Petroleum Possibilities in the Great Slave Lake Area; Western Miner, vol. 20, No. 11, November 1947, pp. 72-76.

(1949a): Prospecting with the Geiger Counter; Can. Inst. Min. Met. Bull., vol. 42, No. 445, May 1949, pp. 222-227; and Can. Inst. Min. Met. Trans., vol. 52, pp. 111-116.

(1949b): Permafrost at Giant Yellowknife; Trans. Roy. Soc., Canada, 3rd ser., vol. 43, sec. 4, pp. 7-11.

Bell, J. M.
(1902): Report on the Topography and Geology of Great Bear Lake and of a Chain of Lakes and Streams thence to Great Slave Lake; Geol. Surv., Canada, Ann. Rept. (New Series), vol. 12, 1899, pt. C, pp. 1-36.

(1903): Mackenzie District; Geol. Surv., Canada, Ann. Rept. (New Series), vol. 13, 1900, pt. A, pp. 95-103.

(1929a): Great Slave Lake; Roy. Soc., Canada, Proc. and Trans., 3rd ser., vol. 23, sec. 4, pp. 5-38.

(1929b): The Lead-Zinc Deposits near Pine Point, Great Slave Lake; Can. Inst. Min. Met. Trans., vol. 32, pp. 122-139.

(1930): Lead-Zinc Zones of Great Slave Lake; in Zinc and Lead Deposits of Canada; Geol. Surv., Canada, Econ. Geol. Ser. No. 8, pp. 219-224.

(1931): The Genesis of the Lead-Zinc Deposits at Pine Point, Great Slave Lake; Econ. Geol., vol. 26, pp. 611-624.

[1] It has been found impracticable to list the numerous Annual, Progress, Interim, and other reports issued by various mining companies. Nevertheless, many of these reports have been consulted, as indicated by footnotes in Chapter V.

Bell, R.
(1902): Report on Explorations in the Great Slave Lake Region, Mackenzie District; Geol. Surv., Canada, Ann. Rept. (New Series), vol. 12, 1899, pt. A, pp. 103-110.

Berry, A. M.
(1945a): Transportation in the Northwest Territories; The Precambrian, vol. 18, No. 11, November 1945, pp. 13-15.

(1945b): Transportation in the Northwest Territories; Nor'West Miner, vol. 13, No. 5, December 1945, pp. 19-21.

Berton, P.
(1947a): Headless Valley; Ottawa Journal, February 4 to February 17, 1947.

(1947b): Valley of Mystery; MacLean's Magazine, March 15, 1947, pp. 23, 33, 36, 37.

Blanchet, G. H.
(1926): Great Slave Lake Area, Northwest Territories; Northwest Territories and Yukon Branch, Department of Interior, Ottawa.

Bolger, E. J., and Staff
(1946): The Eldorado Enterprise; Can. Inst. Min. Met. Bull., September 1946, pp. 423-438; and Can. Inst. Min. Met. Trans., vol. 49, pp. 423-438.

Bostock, H. S.
(1948): Physiography of the Canadian Cordillera, with Special Reference to the Area North of the Fifty-fifth Parallel; Geol. Surv., Canada, Mem. 247.

Brown, I. C.
(1949): Structure of the Yellowknife Gold Belt, N.W.T.; unpublished Ph.D. thesis, Harvard University, May 1949.

Brown, W. L.
(1948): Actual Prospecting from Air Paid off in New Discoveries; Northern Miner, March 4, 1948, p. 38.

Bruder, C.
(1941): Mining Tungsten, Gold, and Copper at Outpost Islands; The Precambrian, vol. 14, No. 2, February 1941, pp. 2-5.

(1942): Canada has Tungsten Producer in Northwest Territories; Eng. Min. Jour., May 1942, pp. 47-49.

Buffam, B. S. W.
(1942): Report on International Tungsten Mines, Limited, Great Slave Lake, N.W.T.; unpublished report submitted to the Metals Controller, September 2, 1942.

Bureau of Mines
(1937a): Gold Ore from the A.X. Syndicate, Yellowknife River, Great Slave Lake, N.W.T.; Investigations in Ore Dressing and Metallurgy, January to June 1936, Investigation No. 669, pp. 47-52.

(1937b): Silver-Bearing Mill Tailing and Concentrate from the Eldorado Gold Mines, Limited, Echo Bay, Great Bear Lake, N.W.T.; Investigations in Ore Dressing and Metallurgy, January to June 1936, Investigation No. 683, pp. 162-175.

(1937c): The Canadian Mineral Industry in 1936; Pub. No. 786, 78 pp.

(1938a): Gold-Copper Ore from the Slave Lake Gold Mines, Limited, Great Slave Lake, N.W.T.; Investigations in Ore Dressing and Metallurgy, January to June 1937, Investigation No. 713, pp. 75-84.

(1938b): Silver-Pitchblende Ore and Mill Tailing from Eldorado Gold Mines, Limited, Echo Bay, Great Bear Lake, N.W.T.; Investigations in Ore Dressing and Metallurgy, January to June 1937, pp. 148-149.

Bureau of Mines—*Continued*

(1938c): Concentration and Amalgamation Tests on a Sample of High Grade Gold Ore from the Chan Yellowknife Gold Property, in the Yellowknife District, N.W.T.; Ore Dressing and Metallurgical Laboratories, June 1, 1938, unpublished summary report.

(1938d): Microscopic Examination of Sample of Gold Ore from the Chan Yellowknife Property, Yellowknife, N.W.T.; Ore Dressing and Metallurgical Laboratories, July 29, 1938, unpublished summary report.

(1938e): Experimental Tests on a Sample of Gold Ore from the Slave Lake Mine on Outpost Island, Great Slave Lake, N.W.T.; Ore Dressing and Metallurgical Laboratories, October 24, 1938, unpublished summary report.

(1938f): The Canadian Mineral Industry in 1937; Pub. No. 791, 99 pp.

(1939a): Gold Ore from the Camlaren Mine at Gordon Lake, N.W.T.; Investigations in Ore Dressing and Metallurgy, January to June 1938, Investigation No. 737, pp. 47-57.

(1939b): Gold-Silver Ore from the Negus Mines, Limited, Yellowknife River Area, Northwest Territories; Investigations in Ore Dressing and Metallurgy, January to June 1938, pp. 108-114.

(1939c): The Canadian Mineral Industry in 1938; Pub. No. 804, 102 pp.

(1940a): Gold Ore from the Thompson-Lundmark Gold Mines, Limited, Yellowknife, Northwest Territories; Investigations in Ore Dressing and Metallurgy, July to December 1938, Investigation No. 761, pp. 118-127.

(1940b): Gold Ore from the "Harry A. Ingraham Trust", Yellowknife, Northwest Territories; Investigations in Ore Dressing and Metallurgy, January to June 1939, Investigation No. 769, pp. 97-107.

(1940c): Amalgamation, Cyanidation, and Calcination of a Gold Ore from the Negus Mines, Limited, Yellowknife, Northwest Territories; Report of the Ore Dressing and Metallurgical Laboratories, May 29, 1940.

(1940d): Amalgamation, Cyanidation, and Calcination of a Gold Ore from the Con Mine, Yellowknife, Northwest Territories; Report of the Ore Dressing and Metallurgical Laboratories, Investigation No. 867, July 2, 1940.

(1940e): Examination of a Specimen of Rock from Aklavik, Northwest Territories; Report of the Ore Dressing and Metallurgical Laboratories; Investigation No. 912, November 7, 1940.

(1940f): Amalgamation and Concentration of a Gold-Copper-Tungsten Ore from the Slave Lake Gold Mines, Limited, Great Slave Lake, Northwest Territories; Report of the Ore Dressing and Metallurgical Laboratories, Investigation No. 923, November 26, 1940.

(1940g): The Canadian Mineral Industry in 1939; mimeographed edition, March 1940.

(1941a): High Grade Gold Ore from Chan Yellowknife Gold, Limited, Yellowknife Area, Northwest Territories; Investigations in Ore Dressing and Metallurgy, July to December 1939, Investigation No. 777, pp. 33-38.

(1941b): Gold Ore from the Thompson-Lundmark Mine, Yellowknife, Northwest Territories; Investigations in Ore Dressing and Metallurgy, July to December 1939, Investigation No. 786, pp. 94-99.

(1941c): Concentration of Scheelite from the Ore of the A.M. Mining Syndicate, Gilmour Lake, Beaulieu River Area, Northwest Territories; Rept. of the Ore Dressing and Metallurgical Laboratories, Investigation No. 1004, April 30, 1941.

Bureau of Mines—*Continued*
(1941d): Amalgamation and Cyanidation of a Gold Ore from Negus Mines, Limited, Yellowknife, N.W.T.; Report of the Ore Dressing and Metallurgical Laboratories, Investigation No. 1076, August 22, 1941.

(1941e): The Canadian Mineral Industry in 1940; mimeographed edition, March 1941.

(1942a): Concentration of Cobbed Scheelite Ore from the Gilmour Lake Area, Northwest Territories; Report of the Ore Dressing and Metallurgical Laboratories, Investigation No. 1147, January 21, 1942.

(1942b): Gold Ore from Prosperous Lake, Yellowknife District, Northwest Territories; Report of the Ore Dressing and Metallurgical Laboratories, Investigation No. 1231, May 22, 1942.

(1942c): Recovery of Scheelite from the Mill Tailing from International Tungstens, Limited, Outpost Island, Northwest Territories; Report of the Ore Dressing and Metallurgical Laboratories, Investigation No. 1283, August 13, 1942.

(1942d): The Canadian Mineral Industry in 1941; mimeographed edition.

(1943a): Gravity Concentration of Scheelite Ore from the Negus Mine, Yellowknife, Northwest Territories; Report of the Ore Dressing and Metallurgical Laboratories, Investigation No. 1379, April 1, 1943.

(1943b): Concentration of Tantalite Ore from the Moose Property (DeStaffany Tungsten Gold Mines, Limited), Yellowknife Area, Northwest Territories; Report of the Ore Dressing and Metallurgical Laboratories, Investigation No. 1554, December 14, 1943.

(1943c): The Canadian Mineral Industry in 1942; mimeographed edition.

(1944a): Interim Report on Tin and Tantalum Ore from the Ross Lake Area, Northwest Territories; Report of the Ore Dressing and Metallurgical Laboratories, Investigation No. 1565, January 6, 1944.

(1944b): Concentration of Ore from Diamond Drill Cores from the Homer Group, Walsh Lake Area, Yellowknife District, Northwest Territories; Report of the Ore Dressing and Metallurgical Laboratories, Investigation No. 1626, April 12, 1944.

(1944c): Concentration of Tantalum and Tin Ores from the Yellowknife-Beaulieu Area, Northwest Territories; Report of the Ore Dressing and Metallurgical Laboratories, Investigation No. 1616, April 13, 1944.

(1944d): The Canadian Mineral Industry in 1943; mimeographed edition, April 1944.

(1945a): Summary of Experimental Test Work to date on Gold Ore from the Giant Yellowknife Gold Mines Property at Yellowknife, Northwest Territories; Report of the Ore Dressing and Metallurgical Laboratories, Investigation No. 1788, February 19, 1945.

(1945b): Concentration of Tantalite Ore from Bighill No. 2, near Hearne Channel, Great Slave Lake, Northwest Territories; Report of the Ore Dressing and Metallurgical Laboratories, Investigation No. 1881, June 5, 1945.

(1945c): The Canadian Mineral Industry in 1944; Pub. No. 815, 102 pp.

(1946a): Summary of Experimental Test Work on Ore Shipment "A" from Giant Yellowknife Gold Mines Property, at Yellowknife, Northwest Territories; Report of the Ore Dressing and Metallurgical Laboratories, Investigation No. 2078, July 17, 1946.

(1946b): Summary Results of Flotation Pilot Plant operations on Ore Shipment "C" from Giant Yellowknife Gold Mines at Yellowknife, Northwest Territories; Report of the Ore Dressing and Metallurgical Laboratories, Investigation No. 2100, September 3, 1946.

Bureau of Mines—*Concluded*
(1946c): Concentration and Cyanidation Tests on a Shipment of Gold Ore from Beaulieu Yellowknife Mines, Limited, Yellowknife District, Northwest Territories; Report of the Ore Dressing and Metallurgical Laboratories, Investigation No. 2127, November 14, 1946.

(1946d): Catalogue and Index of Bureau of Mines Reports; Pub. No. 818, 66 pp.

(1946e): The Canadian Mineral Industry in 1945; Pub. No. 820, 103 pp.

(1947a): Laboratory Tests on a Low-grade Gold Ore from the Properties of Colomac Yellowknife Mines, Limited, and Indian Lake Gold Mines, Limited, in the Yellowknife District, Great Slave Lake Area, Northwest Territories; Report of the Ore Dressing and Metallurgical Laboratories, Investigation No. 2168, January 23, 1947.

(1947b): Laboratory Tests on Two Samples of High Grade Gold Ore from the Property of Discovery Yellowknife Mines, Limited, Yellowknife District, Great Slave Lake Area, Northwest Territories; Report of the Ore Dressing and Metallurgical Laboratories, Investigation No. 2226, May 15, 1947.

(1947c): Laboratory Tests on a High Grade Gold Ore from the property of the North Inca Mine in the Yellowknife District, Northwest Territories; Report of the Ore Dressing and Metallurgical Laboratories, Investigation No. 2250, June 30, 1947.

(1947d): Laboratory Tests on a Gold Ore from the Property of Spinet Gold Mines, Limited, at Spider Lake, Yellowknife District, Northwest Territories; Report of the Ore Dressing and Metallurgical Laboratories, Investigation No. 2329, December 10, 1947.

(1947e): The Canadian Mineral Industry in 1946; Pub. No. 824, 137 pp.

(1948a): Preliminary Metallurgical Tests on a Sample of an Arsenical Gold Ore, Containing Antimony, from Crestaurum Mines, Limited, Yellowknife, Northwest Territories; Report of the Ore Dressing and Metallurgical Laboratories, Investigation No. 2343, January 21, 1948.

(1948b): Summary Results and Conclusions from Test Work on a Gold Ore from the Property of Discovery Yellowknife Mines, Limited, Yellowknife District, Northwest Territories; Report of the Mineral Dressing and Metallurgical Laboratories, Investigation No. 2371, March 1, 1948.

(1948c): Amalgamation, Concentration, and Cyanidation Tests on a Complex, High-grade Silver Ore from the Camsell River Mines, Limited, Great Bear Lake District, Northwest Territories; Report of the Mineral Dressing and Metallurgical Laboratories, Investigation No. 2390, March 23, 1948.

(1948d): Experimental Tests on a Gold Ore from the Frank Vein of the Prospect Street Syndicate, Yellowknife, N.W.T.; Report of the Mineral Dressing and Metallurgical Laboratories, Investigation No. 2403, April 30, 1948.

(1948e): Prospector's Guide for Uranium and Thorium Minerals in Canada.

Bureau of Northwest Territories and Yukon Affairs
(1943): Mining in the Northwest Territories During 1942; The B.C. Miner, vol. 16, January 1943, p. 31.

(1944): The Northwest Territories, Administration, Resources, Development; Lands, Parks, and Forests Branch, Department of Mines and Resources, 59 pp.

(1946): Yellowknife, Northwest Territories, Canada; Lands, Parks, and Forests Branch, Department of Mines and Resources.

Bureau of Northwest Territories and Yukon Affairs—*Concluded*
(1947a): Various Mineral Claim Sheets issued by the Lands, Parks, and Forests Branch, Department of Mines and Resources.

(1947b): The Northwest Territories, Administration, Resources, and Development; Lands, Parks, and Forests Branch, Department of Mines and Resources, 60 pp.

(1947c): General Information Concerning the South Nahanni River or Headless Valley Region; Lands, Parks, and Forests Branch, Department of Mines and Resources, 3 pp.

Byrne, N. W.
(1948a): Discovery Nears Production; Western Miner, vol. 21, No. 10, October 1948, pp. 54-58.

(1948b): Shaft Sinking Costs at Viking Yellowknife; Can. Min. Jour., vol. 69, No. 11, October 1948, pp. 58-61.

(1948c): Report from Yellowknife; Western Miner, vol. 21, No. 11, November 1948, pp. 45-47.

Cameron, A. E.
(1917): Reconnaissance on Great Slave Lake, Northwest Territories; Geol. Surv., Canada, Sum. Rept. 1916, pp. 66-76.

(1918): Explorations in the Vicinity of Great Slave Lake; Geol. Surv., Canada, Sum. Rept. 1917, pt. C, pp. 21-28.

(1922a): Hay and Buffalo Rivers, Great Slave Lake and Adjacent Country; Geol. Surv., Canada, Sum. Rept. 1921, pt. B, pp. 1-44.

(1922b): Post Glacial Lake in the Mackenzie River Basin, N.W.T., Canada; Jour. Geol., vol. 30, pp. 337-353.

Campbell, N.
(1947a): The West Bay Fault, Yellowknife; Western Miner, vol. 20, No. 5, May 1947, pp. 46-55.

(1947b): The West Bay Fault, Yellowknife; Can. Inst. Min. Met. Trans., vol. 50, pp. 509-526.

(1947c): Regional Structural Features of the Yellowknife Area; Western Miner, vol. 20, No. 11, pp. 62-67.

(1947d): Regional Structural Features of the Yellowknife Area; Econ. Geol., vol. 42, No. 8, December 1947, pp. 687-698.

(1948): West Bay Fault; in Structural Geology of Canadian Ore Deposits; Can. Inst. Min. Met., Jubilee Volume, pp. 244-259.

Camsell, C.
(1906a): Summary Report on the Region Southwest of Fort Smith, Slave River, N.W.T.; Geol. Surv., Canada, Ann. Rept. (New Series), vol. 15, 1902-03, pt. A, pp. 151-169.

(1906b): Report on the Peel River and Tributaries, Yukon and Mackenzie; Geol. Surv., Canada, Ann. Rept. (New Series), vol. 16, 1904, pt. CC, pp. 1-49.

(1906c): Report on the Peel River in the Yukon and Mackenzie District; Geol. Surv., Canada, Sum. Rept. 1905, pp. 36-46.

(1915): An Exploration of the Region Between Athabaska and Great Slave Lakes, Alberta and Northwest Territories; Geol. Surv., Canada, Sum. Rept. 1914, pp. 55-60.

(1916): An Exploration of the Tazin and Taltson Rivers, Northwest Territories; Geol. Surv., Canada, Mem. 84, 134 pp.

Camsell, C.—*Concluded*
(1917): Salt and Gypsum Deposits of the Region Between Peace and Slave Rivers, Northern Alberta; Geol. Surv., Canada, Sum. Rept. 1916, pp. 134-145.

(1937): Great Bear Lake, Air Exploration and its Sequel; Can. Geog. Jour., vol. 14, pp. 127-151.

(1939): Gold, Silver, Radium, Uranium from the Territories; Northern Miner, Annual Number, p. 10.

(1941): Northwest Territories have Increased Production; Northern Miner, Annual Number.

(1943a): Mining in the Yukon and Northwest Territories; B.C. Miner, vol. 16, No. 4, April 1943, pp. 32-34.

(1943b): Planning the New Northwest; Can. Geog. Jour., vol. 27, No. 6, December 1943, pp. 251-262.

(1944): Mineral Development in the Northwest and Yukon Territories; Western Miner, vol. 17, No. 12, December 1944, pp. 42-44.

(1946): The New North; Can. Geog. Jour., vol. 33, No. 6, December 1946, pp. 264-277.

(1947): Canada's New Northwest; The King's Printer, Ottawa, 155 pp.

Camsell, C., and Malcolm, W.
(1921): Mackenzie River Basin; Geol. Surv., Canada, Mem. 108, 154 pp.

Canada Gazette
(1947a): Mining Districts, Land Districts, and Timber Districts in the Northwest Territories, Orders in Council, P.C. 4780; The Canada Gazette, No. 52, vol. 81, December 27, 1947, pp. 5107-5109.

(1947b): Regulations for the Disposal of Coal Mining Rights the Property of the Crown in the Northwest Territories and Yukon Territory, Orders in Council, P.C. 4846; The Canada Gazette, No. 52, vol. 81, December 27, 1947, pp. 5109-5113.

(1947c): Regulations for the Disposal of Timber in the Northwest Territories, Orders in Council, P.C. 5007; The Canada Gazette, No. 52, vol. 81, December 27, 1947, pp. 5113-5116.

Carpenter, H. C. H., and Fisher, M. S.
(1932): A Metallographic Investigation of Native Silver; Inst. Min. Met. Trans., vol. 41, pp. 382-433.

Christie, K. J.
(1947): Mining Progress in the Northwest Territories; Western Miner, vol. 20, No. 11, November 1947, pp. 101-103, 106, 108, 110, 112.

(1949): Chapter of Great Development Written in Mining History of Northwest Territories; The Precambrian, vol. 22, No. 1, January 1949, pp. 15, 17.

Clarke, C. H. D.
(1940): A Biological Investigation of the Thelon Game Sanctuary; Nat. Mus., Canada, Bull. 96, 135 pp.

Cochran, H. G.
(1943): Gas for the March on Japan; Can. Min. Jour., October 1943, pp. 641-646.

Cooke, H. C.
(1946): Canadian Lode Gold Areas (Summary Account); Geol. Surv., Canada, Econ. Geol. Ser. No. 15.

(1947): The Canadian Shield; in Geology and Economic Minerals of Canada (Third Edition); Geol. Surv., Canada, Econ. Geol. Ser. No. 1, pp. 11-99.

Dadson, A. S.
(1949): The Giant Yellowknife Gold Mine, Yellowknife, N.W.T.; Giant Yellowknife Gold Mines, Limited, March 30, 1949, 14 pp.

Dadson, A. S., and Bateman, J. D.
(1948): Giant Yellowknife Mine; in Structural Geology of Canadian Ore Deposits; Can. Inst. Min. Met., Jubilee Volume, pp. 273-283.

Dawson, C. A.
(1947): The New Northwest; University of Toronto Press, Toronto, 334 pp.

Denis, H. B.
(1946): Prospecting Possibilities in the Northwest Territories; Can. Inst. Min. Met. Bull., October 1946, pp. 617-624.

De Wet, J. P.
(1944): Exploration for Oil in the Northwest Territories; Can. Min. Jour., September 1944, pp. 606-615.

Dominion Forest Service
(1939): Native Trees of Canada; Lands, Parks, and Forests Branch, Department of Mines and Resources, Bull. No. 61.

Douglas, G. M.
(1914): Lands Forlorn, a Story of an Expedition to Hearne's Coppermine River; G. P. Putman's Sons, The Knickerbocker Press, New York, 285 pp.

Douglas, J.
(1913): The Copper-bearing Traps of the Coppermine River; Can. Inst. Min. Met. Trans., vol. 16, pp. 83-101.

Dowling, D. B.
(1922): Geological Structure of the Mackenzie River Region; Geol. Surv., Canada, Sum. Rept. 1921, pt. B, pp. 79-90.

Drummond, L. E.
(1939a): Way Down the Mackenzie River; The Precambrian, vol. 12, No. 4, April 1939.

(1939b): Costs and Conditions of the Northwest; The Precambrian, vol. 12, No. 12, December 1939, pp. 2-5.

(1939c): Progress of Mining in the Canadian Northwest; Can. Inst. Min. Met. Bull., December 1939, pp. 552-558.

(1941): Mining Grows Apace in the Northwest Territories; The Precambrian, vol. 14, No. 6, June 1941, pp. 2-5.

(1948): Twelfth Annual Report of the Alberta and Northwest Chamber of Mines and Resources.

(1949): Alberta and Northwest Chamber of Mines and Resources; Thirteenth Annual Report, 1948.

Duncan, G. C.
(1931): Exploration in the Coppermine River Area, Northwest Territories; Can. Inst. Min. Met. Bull., March 1931, pp. 363-382.

Ellsworth, H. V.
(1932): Rare-Element Minerals in Canada; Geol. Surv., Canada, Econ. Geol. Ser. No. 11.

Ellsworth, H. V., and Jolliffe, F. [A. W.]
(1937): Some Recently Discovered Minerals of the Great Slave Lake Area, N.W.T.; University of Toronto Studies, Geol. Ser. No. 40, pp. 71-81.

Feniak, M.
(1947): The Geology of Dowdell Peninsula, Great Bear Lake, Northwest Territories; Geol. Surv., Canada, Special Report, October 1947.

(1949): MacAlpine Channel Area, Northwest Territories; Geol. Surv., Canada, Paper 49-19.

Fenton, C. L., and Fenton, M. A.
(1939): Pre-Cambrian and Paleozoic Algae; Bull. Geol. Soc. Am., vol. 50, pp. 89-126.

Ferrier, W. F.
(1920): Annotated Catalogue of and Guide to the Publications of the Geological Survey of Canada, 1845-1917; Geol. Surv., Canada, Pub. No. 1723.

Finnie, R.
(1940): Lure of the North; MacKay, Philadelphia.

(1941): Canada Moves North; Can. Geog. Jour., vol. 23, November 1941, pp. 255-262.

(1942): Canada Moves North; MacMillan, Toronto.

(1945): Canol; Taylor and Taylor, San Francisco, 210 pp.

(1947): The Epic of Canol; Can. Geog. Jour., vol. 34, No. 3, March 1947, pp. 137-139.

(1948): Canada Moves North (Revised Edition); MacMillan, Toronto, 239 pp.

Flint, R. F.
(1945): Glacial Map of North America; Geol. Soc. Amer.

(1947): Glacial Geology and the Pleistocene Epoch; John Wiley and Sons, 589 pp.

Foerste, A. F.
(1926): Cephalopoda from the Ordovician and Silurian of Great Slave Lake; Geol. Surv., Canada, Bull. No. 44, pp. 65-72.

Folinsbee, R. E.
(1940): Gem Cordierite from the Great Slave Lake Area; Am. Min., vol. 25, p. 216.

(1947): Lac de Gras, Northwest Territories; Geol. Surv., Canada, Paper 47-5.

(1949): Lac de Gras, District of Mackenzie, Northwest Territories; Geol. Surv., Canada, Map 977A.

Forbes, A. H.
(1948): Gazetteer of Northern Canada and Parts of Alaska and Greenland; mimeographed publication of Royal Canadian Air Force.

Fortier, Y. O.
(1946): Yellowknife-Beaulieu Region, Northwest Territories; Geol. Surv., Canada, Paper 46-23.

(1947a): Ross Lake, Northwest Territories; Geol. Surv., Canada, Paper 47-16.

(1947b): Geological Mapping of the Ross Lake Area, using Air Photographs; Photogrammetric Engineering, vol. 13, No. 4, pp. 545-548.

(1948a): Flights in 1947 over the Region of the North Magnetic Pole and the Mainland between the Arctic Coast, Great Slave Lake, and Hudson Bay, Northwest Territories; Geol. Surv., Canada, Paper 48-23.

(1948b): Geology of Glacier Lake Area, Great Bear Lake, Northwest Territories; Geol. Surv., Canada, Special Report.

(1949): Indin Lake Map-area (East Half), Northwest Territories; Geol. Surv., Canada, Paper 49-10.

Foster, W. W.
(1946): Expansion Northwestward; Western Miner, vol. 19, No. 2, February 1946, pp. 46-48.

Franklin, J.
(1823): Narrative of a Journey to the Shores of the Polar Sea in the Years 1819-20-21 and 22, with an Appendix on Various Subjects Relating to Science and Natural History; John Murray, London.

Franklin, J., and Richardson, J.
(1828): Narrative of a Second Expedition to the Shores of the Polar Sea in the Years 1825, 1826, and 1827; John Murray, London.

Furnival, G. M.
(1934): Silver Mineralization at Great Bear Lake; Can. Min. Jour., vol. 55, No. 1, pp. 5-8.

(1935a): A Silver-Pitchblende Deposit at Contact Lake, Great Bear Lake Area, N.W.T., Canada; unpublished Ph.D. thesis, Massachusetts Institute of Technology, May 1935.

(1935b): The Large Quartz Veins of Great Bear Lake, Canada; Econ. Geol., vol. 30, No. 8, pp. 843-859.

(1939a): Geology of the Area North of Contact Lake, N.W.T., Canada; Am. Jour. Science, vol. 237, July 1939, pp. 476-499.

(1939b): A Silver-Pitchblende Deposit at Contact Lake, Great Bear Lake Area, Canada; Econ. Geol., vol. 34, No. 7, November 1939, pp. 739-776.

Geological Survey, Canada
(1941): Great Slave Lake to Great Bear Lake, Northwest Territories; Geol. Surv., Canada, Paper 41-2.

(1945): Geological Map of the Dominion of Canada; Geol. Surv., Canada, Map 820A.

(1946a): Publications (1909-1946 inclusive) of the Geological Survey and National Museum; Geol. Surv., Canada.

(1946b): Published Maps (1917-1946) inclusive; Geol. Surv., Canada.

(1947): Geology and Economic Minerals of Canada (Third Edition); Geol. Surv., Canada, Econ. Geol. Ser. No. 1.

Gibson, R. A.
(1941): Recent Mining Developments in the N.W.T.; The Miner, vol. 14, No. 1, January 1941, pp. 32-33.

Gilbert, G.
(1931): Copper on the Coppermine River, N.W.T.; Econ. Geol., vol. 26, No. 1, January-February, pp. 96-108.

Graton, L. C.
(1913): Notes on Rocks from Coppermine River Region, Canada; Can. Inst. Min. Met. Trans., vol. 16, pp. 102-114.

Hage, C. O.
(1945): Geological Reconnaissance along the Lower Liard River, Northwest Territories, Yukon, and British Columbia; Geol. Surv., Canada, Paper 45-22.

Hanbury, D.
(1904): Sport and Travel in the Northland of Canada; Edward Arnold, London.

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

Haycock, M. H.
(1935): Microscopic Character of Pitchblende Ore from Beaverlodge and Hottah Lakes, N.W.T.; Can. Min. Jour., vol. 45, April 1935, p. 146.

Hearne, S.
(1796): A Journey from Prince of Wales Fort on Hudson's Bay to the Northern Ocean; P. Byrne and J. Rice, Dublin.

Hellens, A. D.
(1948): Beaulieu Yellowknife Mines, Limited; The Northern Miner, January 22, 1948, pp. 24-25.

Henderson, J. F.
(1937): Nonacho Lake Area, Northwest Territories; Geol. Surv., Canada, Paper 37-2.

(1938): Beaulieu River Area, Northwest Territories; Geol. Surv., Canada, Paper 38-1.

(1939a): Beaulieu River Area, Northwest Territories; Geol. Surv., Canada, Paper 39-1.

(1939b): Taltson Lake, District of Mackenzie, Northwest Territories; Geol. Surv., Canada, Map 525A.

(1939c): Nonacho Lake, District of Mackenzie, Northwest Territories; Geol. Surv., Canada, Map 526A.

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

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

(1941a): MacKay Lake Area, Northwest Territories; Geol. Surv., Canada, Paper 41-1.

(1941b): Gordon Lake, District of Mackenzie, Northwest Territories; Geol. Surv., Canada, Map 644A.

(1941c): Gordon Lake South, District of Mackenzie, Northwest Territories; Geol. Surv., Canada, Map 645A.

(1943): Structure and Metamorphism of Early Precambrian Rocks between Gordon and Great Slave Lakes, N.W.T.; Am. Jour. Sci., vol. 241, pp. 430-446.

(1944): MacKay Lake, District of Mackenzie, Northwest Territories; Geol. Surv., Canada, Map 738A.

(1946): Pitchblende Occurrences between Beaverlodge and Hottah Lakes, Northwest Territories; Geol. Surv., Canada, Special Report.

(1948a): Extent of Proterozoic Granitic Intrusions in the Western Part of the Canadian Shield; Trans. Roy. Soc., Canada, 3rd ser., vol. 42, sec. 4, pp. 41-54.

(1948b): The Relation of Gold Deposits to Structure, Yellowknife, N.W.T.; The Precambrian, vol. 21, No. 7, pp. 6-11.

(1949): Pitchblende Occurrences Between Beaverlodge and Hottah Lakes, Northwest Territories; Geol. Surv., Canada, Paper 49-16.

Henderson, J. F., and Brown, I. C.
(1948): Yellowknife, Northwest Territories; Geol. Surv., Canada, Paper 48-17.

Henderson, J. F., and Jolliffe, A. W.
(1939): Relation of Gold Deposits to Structure, Yellowknife and Gordon Lake Areas, Northwest Territories; Can. Inst. Min. Met. Trans., vol. 42, pp. 314-336.

(1941): Beaulieu River, District of Mackenzie, Northwest Territories; Geol. Surv., Canada, Map 581A.

Hoffman, A.
(1947): Free Gold, the Story of Canadian Mining; Rinehart, New York and Toronto, 420 pp.

Hoffmann, G. C.
(1901): Report of the Section of Chemistry and Mineralogy; Geol. Surv., Canada, Ann. Rept. (New Series), vol. 11, 1898, pt. R, pp. 1-55.

(1902): Report of the Section of Chemistry and Mineralogy; Geol. Surv., Canada, Ann. Rept. (New Series), vol. 12, 1899, pt. R, pp. 1-64.

Hopkins, O. B.
(1943a): Oil from the Arctic; Imperial Oil Review, Fall 1943, pp. 2-6.

(1943b): The Canol Project; Can. Geog. Jour., vol. 27, No. 5, November 1943, pp. 238-249.

Howard, H. M.
(1946): Milling at Eldorado; Can. Inst. Min. Met. Bull., September 1946, pp. 435-438; and Can. Inst. Min. Met. Trans., vol. 49, pp. 435-438.

Hume, G. S.
(1921): Great Slave Lake Area, N.W.T.; Geol. Surv., Canada, Sum. Rept. 1920, pt. B, pp. 30-36.

(1922): North Nahanni and Root Rivers Area, and Caribou Island, Mackenzie River District; Geol. Surv., Canada, Sum. Rept. 1921, pt. B, pp. 67-78.

(1923): 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.

(1924): Mackenzie River Area, District of Mackenzie, N.W.T.; Geol. Surv., Canada, Sum. Rept. 1923, pt. B, pp. 1-15.

(1926): Ordovician and Silurian Fossils from Great Slave Lake; Geol. Surv., Canada, Bull. 44, pp. 59-64.

(1933): Oil and Gas in Western Canada (Second Edition); Geol. Surv., Canada, Econ. Geol. Ser. No. 5.

(1944): Petroleum Geology of Canada; Geol. Surv., Canada, Econ. Geol. Ser. No. 14, 64 pp.

(1947): The Interior Plains; in Geology and Economic Minerals of Canada (Third Edition); Geol. Surv., Canada, Econ. Geol. Ser. No. 1, pp. 189-219.

Hume, G. S., and Link, T. A.
(1945): Canol Geological Investigations in the Mackenzie River Area, Northwest Territories and Yukon; Geol. Surv., Canada, Paper 45-16.

Ingall, E. D.
(1926): Deep Borings in the Prairie Provinces and Northwest Territories; Geol. Surv., Canada, Sum. Rept. 1925, pt. B.

(1927): Deep Borings in the Prairie Provinces and Northwest Territories; Geol. Surv., Canada, Sum. Rept. 1926, pt. B.

(1928): Deep Borings in the Prairie Provinces and Northwest Territories; Geol. Surv., Canada, Sum. Rept. 1927, pt. B.

Jenness, J. L.
(1949): Permafrost in Canada; Arctic, vol. 2, No. 1, May 1949, pp. 13-27.

Jolliffe, A. W.

(1937a): Geology and Gold Deposits of Outpost Islands, Great Slave Lake, Northwest Territories; Geol. Surv., Canada, unpublished manuscript.

(1937b): Mineral Possibilities of Northwest Territories; Can. Inst. Min. Met. Trans., vol. 40, pp. 663-677.

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

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

(1940a): Quyta Lake and Parts of Fishing Lake and Prosperous Lake Areas, Northwest Territories; Geol. Surv., Canada, Paper 40-14.

(1940b): Gold Mining in the Northwest Territories, 1938; Dominion Bureau of Statistics, Annual Report on the Mineral Production of Canada during the Calendar Year 1938, pp. 98-100.

(1942a): Yellowknife Bay, District of Mackenzie, Northwest Territories; Geol. Surv., Canada, Map 709A.

(1942b): Structures in the Canadian Shield; Trans. Amer. Geophysical Union, pp. 700-707.

(1942c): Tungsten Ore, Slave Lake Gold Mines, Limited; unpublished report, June 1942.

(1943): Tantalite-bearing Pegmatites East of Upper Ross Lake, Yellowknife-Beaulieu Area, Northwest Territories; Geol. Surv., Canada, Special Report.

(1944a): Rare Element Minerals in Pegmatites, Yellowknife-Beaulieu Area, Northwest Territories; Geol. Surv., Canada, Paper 44-12.

(1944b): Gold Mining in Northwest Territories, 1942; Dominion Bureau of Statistics, Annual Report on Mineral Production in Canada During the Calendar Year 1942, pp. 136-137.

(1944c): Expanding Mineral Frontiers in the Northwest Territories; The Precambrian, vol. 17, No. 5, May 1944, pp. 5-7, 13, 15.

(1945a): Prosperous Lake, Northwest Territories; Geol. Surv., Canada, Paper 45-4.

(1945b): Yellowknife Faults and Orebodies; The Precambrian, vol. 18, No. 5, May 1945, pp. 7-11.

(1945c): Aeroprospecting in the Yellowknife Area; Can. Inst. Min. Met. Bull., No. 401, September 1945, pp. 588-609.

(1946): Prosperous Lake, District of Mackenzie, Northwest Territories; Geol. Surv., Canada, Map 868A.

Jolliffe, A. W., and Bateman, J. D.

(1944): Eldorado Mine Area, Northwest Territories; Geol. Surv., Canada, Special Report.

Jolliffe, A. W., and Folinsbee, R. E.

(1941): Scheelite Deposits, Yellowknife-Beaulieu Region, Northwest Territories; Geol. Surv., Canada, unpublished manuscript dated November 1941.

(1942): Grading Scheelite Deposits with an Ultra-violet Lamp; Can. Inst. Min. Met. Bull., No. 358, February 1942, pp. 91-98; and Can. Inst. Min. Met. Trans., vol. 45, pp. 91-98.

Jolliffe, F. [A. W.]
(1935): Pitchblende in a Giant Quartz Vein, Beaverlodge Lake, Northwest Territories; unpublished Ph.D. thesis, Princeton University.

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

Keele, J.
(1910): A Reconnaissance Across the Mackenzie Mountains on the Pelly, Ross, and Gravel Rivers, Yukon and Northwest Territories; Geol. Surv., Canada, Report No. 1097.

Keenleyside, H. L.
(1948): Mineral Output in N.W.T. Moving up and other Developments Important; The Northern Miner, November 25, 1948, pp. 122, 123.

(1949): Recent Developments in the Canadian North; Alumni Lecture to McMaster University, Hamilton, Ontario, May 14, 1949.

Kidd, D. F.
(1932a): Great Bear Lake Developments, 1932; Geol. Surv., Canada, Special Report.

(1932b): Great Bear Lake-Coppermine River Area, Mackenzie District, N.W.T.; Geol. Surv., Canada, Sum. Rept. 1931, pt. C, pp. 47-69.

(1932c): Pitchblende Deposits at Great Bear Lake; in Rare-Element Minerals of Canada; Geol. Surv., Canada, Econ. Geol. Ser. No. 11, pp. 139-146.

(1932d): A Pitchblende-Silver Deposit, Great Bear Lake, Canada; Econ. Geol., vol. 27, No. 2, March-April 1932, pp. 145-159.

(1932e): Great Bear Lake-Coppermine River Area; Can. Inst. Min. Met. Bull., September 1932, pp. 512-523.

(1933): Great Bear Lake Area, Northwest Territories; Geol. Surv., Canada, Sum. Rept. 1932, pt. C, pp. 1-36.

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

Kidd, D. F., and Haycock, M. H.
(1935): Mineragraphy of the Ores of Great Bear Lake; Bull. Geol. Soc. Am., vol. 46, pp. 879-960.

Kindle, E. D.
(1946): Geological Reconnaissance along the Canol Road from Teslin River to Macmillan Pass, Yukon (Second Edition); Geol. Surv., Canada, Paper 45-21.

Kindle, E. M.
(1918): Notes on Sedimentation in Mackenzie River Basin; Jour. Geol., vol. 26, pp. 341-360.

(1919): Discovery of a Portage Fauna in the Mackenzie River Valley; Geol. Surv., Canada, Mus. Bull. 29, pp. 1-8.

(1920): Notes on the Iron Ores of the Mackenzie River Valley; Geol. Surv., Canada, Sum. Rept. 1919, pt. C, pp. 1-3.

(1921): The Mackenzie River Oil Region; Can. Inst. Min. Met. Trans., vol. 24, pp. 75-80.

Kindle, E. M., and Bosworth, T. O.
(1921): Oil Bearing Rocks of Lower Mackenzie Valley; Geol. Surv., Canada, Sum. Rept. 1920, pt. B, pp. 37-58.

LaBine, G. A.
(1941): Canadian Radium and Uranium; Can. Min. Jour., vol. 62, No. 9, September 1941, pp. 622-623.

Lambert, H. F.
(1937): The Harry Snyder Canadian Expedition, 1937; Canadian Alpine Journal, vol. 25, pp. 1-19.

Lands and Development Services Branch
(1948a): Regulations for the Disposal of Quartz Mining Claims on Dominion Lands in the Northwest Territories; Effective 31st January, 1948; Department of Mines and Resources.

(1948b): The Northwest Territories [during 1947]; Western Miner, April 1948, pp. 85-87.

(1949): Physical Geography of the Canadian Western Arctic; in Canada Year Book, 1948-49, Dominion Bureau of Statistics, pp. 9-18.

Lands, Parks, and Forests Branch
(1937): Canada's Western Northland, its History, Resources, Population, and Administration; Department of Mines and Resources, 162 pp.

Lang, A. H., Bostock, H. S., and Fortier, Y. O.
(1947): Interim Catalogue of the Geological Survey Collections of Outstanding Air Photographs; Geol. Surv., Canada, Paper 47-26.

Larkin, D. A.
(1948): *Pontoporeia* and *Mysis* in Athabaska, Great Bear, and Great Slave Lakes; Fisheries Research Board of Canada, Bull. 78 (includes data on soundings in Great Bear and Great Slave Lakes).

Lausen, C.
(1929): A Geological Reconnaissance of the East End of Great Slave Lake; Can. Inst. Min. Met. Bull., February 1929, pp. 361-392.

Lepp, H., and Byrne, N. W.
(1948): Shaft Sinking at Viking Yellowknife Mines; Can. Inst. Min. Met. Bull., No. 438, October 1948, pp. 580-582.

Lilge, E. O.
(1947): Some Geology and Mineralogy of the Indin Lake Area, N.W.T.; Western Miner, vol. 20, No. 4, April 1947, pp. 52-59.

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

(1940): Gold Mining in Northwest Territories, 1939; Dominion Bureau of Statistics, Summary Review of the Gold Mining Industry in Canada, 1939, pp. 37-38.

(1941a): Mineral Industry of Northwest Territories; Geol. Surv., Canada, Mem. 230, 136 pp.

(1941b): Ingray Lake Area, Northwest Territories; Geol. Surv., Canada, Paper 41-3.

(1941c): Gold Mining in Northwest Territories, 1939; Dominion Bureau of Statistics, Annual Report on the Mineral Production of Canada During the Calendar Year 1939, pp. 69-70.

(1941d): The Thompson-Lundmark Gold Mines; The Miner, vol. 14, No. 12, December 1941, pp. 31-33.

(1942a): Snare River and Ingray Lake Map-Areas, Northwest Territories; Geol. Surv., Canada, Mem. 235, 55 pp.

Lord, C. S.—*Concluded*
(1942b): Snare River, District of Mackenzie, Northwest Territories; Geol. Surv., Canada, Map 690A.

(1942c): Ingray Lake, District of Mackenzie, Northwest Territories; Geol. Surv., Canada, Map 697A.

(1942d): Mineral Industry of Northwest Territories, 1940 and 1941; Geol. Surv., Canada, unpublished manuscript.

(1942e): Gold Mining in Northwest Territories, 1940; Dominion Bureau of Statistics, Annual Report of the Mineral Production of Canada During the Calendar Year 1940, pp. 67-68.

(1943): Gold Mining in Northwest Territories, 1941; Dominion Bureau of Statistics, Annual Report on the Mineral Production of Canada During the Calendar Year 1941, pp. 73-75.

(1947): Camsell River, Northwest Territories; Geol. Surv., Canada, Paper 47-4.

(1949): Aylmer Lake, Northwest Territories; Geol. Surv., Canada, Paper 49-2.

Lord, C. S., Hage, C. O., and Stewart, J. S.
(1947): The Cordilleran Region; in Geology and Economic Minerals of Canada (Third Edition); Geol. Surv., Canada, Econ. Geol. Ser. No. 1, pp. 220-310.

Lothian, W. F.
(1945): Mining Developments in the Northwest and Yukon Territories; Western Miner, vol. 18, No. 4, April 1945, pp. 56-59.

(1946a): Mineral Development in the Northwest Territories in 1945; The Precambrian, vol. 19, No. 1, January 1946, pp. 5-9.

(1946b): Advance in the Northwest Territories; Western Miner, December 1946, pp. 49-52.

Manifold, A. H.
(1947): The Mineralogy and Geology of the Akaitcho Area, Yellowknife, Northwest Territories; unpublished M.A.Sc. Thesis, University of British Columbia, April 1947.

Mathews, T. C., and Spaulding, E. D.
(1948): Tractor Train Freighting in the Arctic; World Oil, vol. 128, No. 31, pp. 214-218, 220, 221.

Meen, V. B.
(1939): Vesuvianite from Great Slave Lake Region, Canada; University of Toronto Studies, Geol. Ser. No. 42, pp. 69-74.

Meikle, M.
(1942): Progress of Mining Activities in N.W.T.; The Miner, April 1942, p. 34.

(1944): Mining Developments in the Territories; The Miner, vol. 17, No. 4, April 1944, pp. 44-45.

(1947): The Northwest Territories; Western Miner, vol. 20, No. 4, April 1947, pp. 70-74.

Merrill, R. J.
(1947): The Geology and Ore Deposits of Akaitcho Yellowknife Gold Mines; unpublished M.Sc. Thesis, Queen's University.

Miller, M. L.
(1949): Carp Lakes, Northwest Territories; Geol. Surv., Canada, Paper 49-8.

Mines Branch
(1932): Preliminary Report on Method of Extracting Great Bear Lake Pitchblende for the Extraction of Radium; Investigations in Ore Dressing and Metallurgy, 1931, Report No. 418, pp. 138-148.

(1934a): Methods of Treating Great Bear Lake Pitchblende; Investigations in Ore Dressing and Metallurgy, 1932, Report No. 476, pp. 249-262.

(1934b): Report of Radium-measuring Laboratory; Investigations in Ore Dressing and Metallurgy, 1932, Report No. 477, pp. 262-265.

(1934c): Precautions for Workers in the Treating of Radium Ores; Investigations in Ore Dressing and Metallurgy, 1932, Report No. 478, pp. 265-267.

(1934d): Health Hazards in the Production and Handling of Uranium; and Precautions taken during a Laboratory Investigation of the Treatment of Radium-Bearing Ores; Investigations in Ore Dressing and Metallurgy, July to December 1933, Investigation No. 550, pp. 181-192.

(1935a): Silver and Silver-Pitchblende Ore from Bear Exploration and Radium, Limited, Great Bear Lake, N.W.T.; Investigations in Ore Dressing and Metallurgy, January to June 1934, Investigation No. 557, pp. 30-43.

(1935b): Silver Ore from White Eagle Silver Mines, Limited, Camsell River, Northwest Territories; Investigations in Ore Dressing and Metallurgy, January to June 1934, Investigation No. 569, pp. 124-137.

(1935c): The Canadian Mineral Industry in 1934; Pub. No. 760, 119 pp.

(1936a): High Grade Gold Ore from Burwash Yellowknife Mines, Limited, Yellowknife River, Mackenzie District, Northwest Territories; Investigations in Ore Dressing and Metallurgy, January to June 1935, Investigation No. 631, pp. 200-206.

(1936b): Radium Ore from the Tatee and Bee Claims, Great Bear Lake Development Company, Limited (Hottah Lake Gold and Radium Mines, Limited), East Arm of Beaverlodge Lake, Hottah Lake Area, Mackenzie District, N.W.T.; Investigations in Ore Dressing and Metallurgy, January to June 1935, pp. 229, 231.

(1936c): Radium Ore from the WLO and WK Claims, Stairs Bay, south arm of Hottah Lake, Hottah Lake Area, Mackenzie District, N.W.T.; Investigations in Ore Dressing and Metallurgy, January to June 1935, p. 230.

(1936d): Silver-Copper Flotation Concentrate from Eldorado Gold Mines, Limited, Labine Point, Great Bear Lake, N.W.T.; Investigations in Ore Dressing and Metallurgy, January to June 1935, p. 231.

(1936e): The Canadian Mineral Industry in 1935; Pub. No. 773, 100 pp.

Monkman, B. A.
(1946): Water Power Resources of the Yellowknife Area; Western Miner, vol. 19, No. 6, pp. 49-53.

Murphy, R.
(1946): Geology and Mineralogy at Eldorado Mine; Can. Inst. Min. Met. Bull., September 1946, pp. 426-435; and Can. Inst. Min. Met. Trans., vol. 49, pp. 426-435.

(1948): Eldorado Mine; in Structural Geology of Canadian Ore Deposits; Can. Inst. Min. Met., Jubilee Volume, pp. 259-268.

McConnell, R. G.
(1890): Report on an Exploration in the Yukon and Mackenzie Basins, N.W.T.; Geol. Surv., Canada, Ann. Rept. (New Series) 1888-89, vol. 4, pt. D.

Macdonald, H.
(1943): Freight Forwarders to the Arctic; Western Business and Industry, December 1948, pp. 44-45, 104.

Macdonald, M.
(1943): Down North; Oxford University Press, Toronto.

McDonald, R. C.
(1932): Surveys at Great Bear Lake, 1931; Can. Inst. Min. Met. Trans, vol. 35, pp. 209-223.

McDonald, W. L.
(1926): Geological Notes of Portions of the Great Slave Lake Area; in Blanchet, G. H., Great Slave Lake Area, Northwest Territories; Northwest Territories and Yukon Branch, Department of Interior, Ottawa.

MacKay, B. R.
(1947): Coal Reserves of Canada; Reprint of Chapter 1 and Appendix of Report of the Royal Commission on Coal, 1946. (Reprint issued by King's Printer and Controller of Stationery, Ottawa, 1947.)

MacKenzie, A.
(1801): Voyages from Montreal on the River St. Laurence [sic], through the Continent of North America, to the Frozen and Pacific Oceans, in the Years 1789 and 1793; London.

MacKinnon, J. A.
(1949): Base Metal Discoveries Arouse Interest at Yellowknife; Western Miner, vol. 22, No. 4, April 1949, pp. 80-82.

Ney, C. S.
(1947): Mode of Discovery of Important Ore Deposits During the Past Decade in Northwest Territories; Western Miner, vol. 20, No. 4, pp. 39-45.

Norie, J. P.
(1931): Prospecting and Exploration of Dominion Explorers, Limited, in Great Bear Lake-Coppermine River Area; Can. Inst. Min. Met. Bull. No. 227, pp. 349-362.

Northwest Territories Administration
(1947): Regulations Respecting Game in the Northwest Territories, Edition of August 1947; Department of Mines and Resources, 57 pp.

Northwest Territories and Yukon Services
(1947): Important Advance in Gold Mining Recorded by Northwest Territories; The Precambrian, vol. 21, No. 1, January 1948, pp. 21, 23.

(1948): The Northwest Territories, Administration, Resources, Development; Lands and Development Services Branch, Department of Mines and Resources, 67 pp.

O'Neill, J. J.
(1924): The Geology of the Arctic Coast of Canada West of the Kent Peninsula; Report of the Canadian Arctic Expedition, 1913-18, vol. 11 (Geology and Geography), pt. A, pp. 1-107.

Palache, C., and Berman, H.
(1933): Oxidation Products of Pitchblende from Bear Lake; Am. Min., vol. 18, No. 1, p. 20.

Parker, J. M.
(1948): Prospecting for Oil in the Northwest Territories; World Oil, vol. 128, No. 5, pp. 210-212, 214, 215, 218.

Parsons, W. H.
(1948a): Camsell River Map-area, Northwest Territories; Geol. Surv., Canada, Paper 48-19.

(1948b): Geology of the Camsell River Map-area and General Correlation of Precambrian rocks of Mackenzie District, Northwest Territories; unpublished M.A. thesis, Queen's University.

Patterson, R. M.
(1947): River of Deadman's Valley; The Beaver, Outfit 278, June 1947, pp. 8-13.

Parmelee, H. C.
(1938): Radium from the Arctic; Eng. Min. Jour., April 1938, pp. 31-35.

Petty, H. N.
(1939): Mackenzie River Transport; The Beaver, March 1939, pp. 48-50.

Pike, W.
(1892): The Barren Grounds of Northern Canada; Macmillan, New York.

Pochon, M.
(1937): Radium from the Canadian Arctic; Eng. Min. Jour., September 1937, pp. 39-41.

(1938): Radium Extraction from Pitchblende at Port Hope Refinery; The Miner, vol. 11, No. 10, October 1938, pp. 34-38.

Porsild, A. E.
(1937): Edible Roots and Berries of Northern Canada; Nat. Mus., Canada.

(1945): Emergency Food in Arctic Canada; Nat. Mus., Canada, Special Contribution 45-1, 20 pp.

Richardson, J.
(1851): Journal of a Boat Voyage through Rupert's Land and the Arctic Sea; London.

Ridland, G. C.
(1941): Mineralogy of the Negus and Con Mines, Yellowknife, Northwest Territories, Canada; Econ. Geol., vol. 36, No. 1, January-February 1941, pp. 45-70.

Riley, C.
(1933a): Some Mineral Relationships in the Great Bear Lake Area; Can. Min. Jour., vol. 54, No. 4, pp. 137-141.

(1933b): A Chalcocite Deposit, Great Bear Lake, Canada; Econ. Geol., vol. 28, No. 5, pp. 496-501.

(1935): The Granite Porphyries of Great Bear Lake, Northwest Territories, Canada; Jour. Geol., vol. 43, No. 5, July-August 1935, pp. 497-523.

(1938): Some Observations on Structure at Gordon Lake, N.W.T.; Can. Min. Jour., vol. 59, No. 10, October 1938, pp. 558-560.

(1946): Some Recent Geological Data on the Yellowknife Area; Can. Min. Jour., vol. 67, No. 7, pp. 708-717.

Robinson, H. S.
(1933): Notes on the Echo Bay District, Great Bear Lake, Northwest Territories; Can. Inst. Min. Met. Bull., No. 258, pp. 609-628.

Robinson, J. L.
(1945a): Land Use Possibilities in Mackenzie District, N.W.T.; Can. Geog. Jour., vol. 31, No. 1, July 1945, pp. 30-47.

(1945b): Water Transportation in the Canadian Northwest; Can. Geog. Jour., vol. 31, No. 5, November 1945, pp. 237-256.

(1946): Weather and Climate of the Northwest Territories; Can. Geog. Jour., vol. 32, No. 3, March 1946, pp. 124-139.

(1948): Canada's Western Arctic; Can. Geog. Jour., vol. 37, No. 6, December 1948, pp. 242-260.

Robinson, M. J., and Robinson, J. L.
(1946a): Exploration and Settlement of Mackenzie District, N.W.T. (Part I); Can. Geog. Jour., vol. 32, June 1946, pp. 246-255.

(1946b): Exploration and Settlement of Mackenzie District, N.W.T. (Part II); Can. Geog. Jour., vol. 33, July 1946, pp. 42-49.

Rutherford, R. L.
(1939): Pre-Cambrian Algal Structures from the Northwest Territories, Canada; Am. Jour. Sci., 5th ser., vol. 17, pp. 258-259.

Sampson, E.
(1941): Notes on the Occurrence of Gudmundite; Econ. Geol., vol. 36, No. 2, pp. 175-184.

Sandberg, A.
(1913): The Copper Bearing Traps of the Coppermine River; Can. Inst. Min. Met. Trans., vol. 16, pp. 83-101.

Simpson, T.
(1843): Narrative of the Discoveries on the North Coast of America; Richard Bentley, London.

Smith, D. A. G.
(1938): Milling Pitchblende-Silver Ores at Eldorado Plant; Eng. Min. Jour., April 1938, pp. 35-38.

Smith, H. T. U.
(1948): Giant Glacial Grooves in Northwest Canada; Am. Jour. Sci., vol. 246, No. 8, pp. 503-514.

Snyder, H.
(1937): Exploring Upper Nahanni River and Snyder Mountains in 1937; Can. Geog. Jour., vol. 15, October 1937, pp. 168-202.

Spence, H. S.
(1932a): The Pitchblende and Silver Discoveries at Great Bear Lake, Northwest Territories; Mines Branch, Investigation of Mineral Resources and the Mining Industry, 1931, sec. III, pp. 55-92.

(1932b): Radium and Silver at Great Bear Lake; Min. Met., vol. 13, No. 303, pp. 147-151.

(1932c): Character of the Pitchblende Ore from Great Bear Lake, N.W.T.; Can. Min. Jour., vol. 53, No. 11, pp. 483-487.

(1938): Radium and Uranium in Canada; in the Mineral Industry During 1937, vol. 46, McGraw-Hill Book Company, Inc., New York and London, pp. 528-535.

Springer, Frank
(1926): Upper Devonian Crinoids from the Mackenzie River Valley; Geol. Surv., Canada, Bull. 42, pp. 127-132.

Stanton, M. S.
(1947): Chalco Lake Map-area, Northwest Territories; Geol. Surv., Canada, Paper 47-18.

Stanton, M. S., Tremblay, L. P., and Yardley, D. H.
(1948): Chalco Lake, Northwest Territories; Geol. Surv., Canada, Paper 48-20.

Stephens, F. H.
(1947a): Akaitcho's Future Assured; Western Miner, vol. 20, No. 11, November 1947, p. 85.

(1947b): Yellowknife, 1947; Western Miner, vol. 20, No. 11, November 1947, pp. 55-58.

Stewart, J. S.
(1944): Petroleum Possibilities in the Mackenzie River Valley, N.W.T.; Can. Inst. Min. Met. Trans., vol. 47, pp. 152-171.

(1945): Recent Exploratory Deep Well Drilling in Mackenzie River Valley, Northwest Territories; Geol. Surv., Canada, Paper 45-29.

(1947): Exploration for Petroleum, Northwest Territories, 1946; Geol. Surv., Canada, Paper 47-2.

(1948): Norman Wells Oil Field, Northwest Territories, Canada; in Structure of Typical American Oil Fields, vol. 3, Am. Assoc. Pet. Geol., April 1948, pp. 86-109.

Stirrett, J. R.
(1948): Discovery of Pitchblende at Great Bear Lake; Can. Min. Jour., vol. 69, No. 11, October 1948, pp. 62-63.

Stockwell, C. H.
(1933): Great Slave Lake-Coppermine River Area, Northwest Territories; Geol. Surv., Canada, Sum. Rept. 1932, pt. C, pp. 37-63.

(1936a): Great Slave Lake, East Arm, Northwest Territories; Geol. Surv., Canada, Paper 36-16.

(1936b): Eastern Portion of Great Slave Lake (West Half), District of Mackenzie, Northwest Territories; Geol. Surv., Canada, Map 377A.

(1936c): Eastern Portion of Great Slave Lake (East Half), District of Mackenzie, Northwest Territories; Geol. Surv., Canada, Map 378A.

Stockwell, C. H., and Kidd, D. F.
(1932): Metalliferous Mineral Possibilities of the Mainland Part of the North West [sic] Territories; Geol. Surv., Canada, Sum. Rept. 1931, pt. C, pp. 70-85.

Thomson, E.
(1932): Mineralogy of the Eldorado Mine, Great Bear Lake, N.W.T.; University of Toronto Studies, Geol. Ser. No. 32, pp. 43-50.

(1934): The Mineralogy of the Silver-Uraninite Deposits of Great Bear Lake, N.W.T.; University of Toronto Studies, Geol. Ser. No. 36, pp. 25-32.

Thurber, J. B.
(1946): Glacier Bay-Cameron Bay Area, Great Bear Lake, Northwest Territories; Geol. Surv., Canada, Special Report.

Traill, R. J.
(1933): Extraction of Radium from Great Bear Lake Pitchblende; Can. Inst. Min. Met. Trans., vol. 36, pp. 448-467.

Tremblay, L. P.
(1948): Ranji Lake Map-area, Northwest Territories; Geol. Surv., Canada, Paper 48-10.

Tyrrell, J. B.
(1896): Report on Exploration in the Region between Athabaska Lake and Hudson Bay; Geol. Surv., Canada, Ann. Rept. (New Series), vol. 7, 1894, pt. A, pp. 38-48.

(1898): Report on the Doobaunt, Kazan, and Ferguson Rivers and the north-west Coast of Hudson Bay, and on two Overland Routes from Hudson Bay to Lake Winnipeg; Geol. Surv., Canada, Ann. Rept. (New Series), vol. 9, 1896, pt. F, pp. 1-218.

(1912): The Coppermine Country; Can. Inst. Min. Met. Trans. vol. 15, pp. 508-534.

Tyrrell, J. W.
(1897): Across the Sub-arctics of Canada; William Briggs, Toronto, 280 pp.

(1902): Report on an Exploratory Survey between Great Slave Lake and Hudson Bay, Districts of Mackenzie and Keewatin; Department of Interior, Topographic Surveys Branch, Bull. No. 12, 62 pp.

Walker, W. S.
(1942): Tungsten Prospecting in the Gilmour Lake Area, and some Notes on the Ultra-violet Ray Method; Can. Min. Jour., vol. 63, March 1942, pp. 145-149.

Walli, E. J., Ryan, J. P., and Smith, D. A. G.
(1938): The Eldorado Operation at Great Bear Lake; Can. Inst. Min. Met. Trans., vol. 41, pp. 61-76.

Warren, P. S.
(1947): Cretaceous Fossil Horizons in the Mackenzie River Valley; Jour. of Pal., vol. 21, No. 2, March 1947, pp. 118-123.

Washburn, A. L.
(1947): Reconnaissance Geology of Portions of Victoria Island and Adjacent Regions, Arctic Canada; Geol. Soc. Am., Mem. 22, 142 pp.

White, C. E., Ross, R. H., and Campbell, N.
(1949): The Con-Rycon Mine, Yellowknife, N.W.T.; Can. Inst. Min. Met. Trans., vol. 52, pp. 133-147.

Whittaker, E. J.
(1922): Mackenzie River District Between Great Slave Lake and Simpson; Geol. Surv., Canada, Sum. Rept. 1921, pt. B, pp. 45-55.

(1923): Mackenzie River District Between Providence and Simpson, N.W.T.; Geol. Surv., Canada, Sum. Rept. 1922, pt. B, pp. 88-100.

Wickenden, R. T. D.
(1947): Pleistocene Glacial Deposits; in Geology and Economic Minerals of Canada (Third Edition); Geol. Surv., Canada, Econ. Geol. Ser. No. 1, pp. 325-346.

Williams, M. Y.
(1922): Exploration East of Mackenzie River Between Simpson and Wrigley; Geol. Surv., Canada, Sum. Rept. 1921, pt. B, pp. 56-66.

(1923): Reconnaissance Across Northeastern British Columbia and the Geology of the Northern Extension of Franklin Mountains, Northwest Territories; Geol. Surv., Canada, Sum. Rept. 1922, pt. B, pp. 65-87.

(1924): Franklin Mountains, District of Mackenzie; Bull. Geol. Soc. Am., vol. 35, pp. 449-464.

Wilson, J. A.
(1943): Northwest Passage by Air; Can. Geog. Jour., vol. 26, March 1943, pp. 107-129.

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

(1939b): Eskers Northeast of Great Slave Lake; Trans. Roy. Soc., Canada, 3rd ser., sec. 4, vol. 33, pp. 119-130.

(1941a): Fort Smith, District of Mackenzie, Northwest Territories; Geol. Surv., Canada, Map 607A.

(1941b): Structural Features in the Northwest Territories; Am. Jour. Sci., vol. 239, No. 7, pp. 493-502.

Wilson, J. T.—*Concluded*
(1945): Further Eskers North of Great Slave Lake; Trans. Roy. Soc., Canada, 3rd ser., sec. 4, vol. 39, pp. 151-153.

(1946): Winter Manoeuvres in Canada; Can. Geog. Jour., vol. 32, No. 2, February 1946.

(1947): Exercise Musk-ox, 1946; The Polar Record, vol. 5, January-July 1947, pp. 14-26.

(1948): Some Aspects of Geophysics in Canada with special Reference to Structural Research in the Canadian Shield (Part 2: An Approach to the Structure of the Canadian Shield); Trans. Amer. Geophysical Union, vol. 29, No. 5, October 1948, pp. 691-726.

Wilson, J. T., Mousuf, A. K., and Collett, L. S.
(1948): Bibliography of Radioactive Rocks in Canada; Canadian Geophysical Bulletin, vol. 2, No. 2, pp. 13-27.

Wood, G. H.
(1938): Preliminary Report on the Power Resources of the Yellowknife and Beaulieu Rivers, Northwest Territories; Dominion Water and Power Bureau, January 12, 1938.

(1946): Power Possibilities of the Yellowknife Mining Area; Dominion Water and Power Bureau, Report No. 2194.

(1948a): Reconnaissance of La Martre Falls, La Martre River, Northwest Territories, 1947; Dominion Water and Power Bureau, Report No. 2220, January 8, 1948.

(1948b): Power Possibilities for Indin Lake and Courageous Lake Mining Areas, Northwest Territories; Dominion Water and Power Bureau, Report No. 2229, January 20, 1948.

Yardley, D. H.
(1949a): Wecho River (East Half), Northwest Territories; Geol. Surv., Canada, Paper 49-14.

(1949b): Some Effects of Frost Thrusting in the Northwest Territories; unpublished paper, University of Minnesota, April 2, 1949.

Yellowknife Board of Trade
(1949): Northern Incomes and Income Tax; News of the North, Yellowknife, March 4, 1949, p. 2.

INDEX