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GEOLOGICAL SURVEY

PRELIMINARY REPORT

# BEAULIEU RIVER AREA, NORTHWEST TERRITORIES

BY

J. F. Henderson

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## INTRODUCTION

Beaulieu River area lies east of Yellowknife Bay, on the north shore of Great Slave Lake between longitudes 112 and 114 degrees and latitudes 62 and 63 degrees. Preliminary geological mapping of the area in 1935[x] showed a wide belt of sediments extending from Gordon Lake south to the shore of Great Slave Lake, and in 1936 high-grade gold-quartz veins were discovered on Gordon Lake. The discovery of these deposits aroused much interest in areas to the south underlain by similiar sediments. The present season's work has shown that much of Beaulieu River area is underlain by sediments, and that a wide belt of volcanic rocks or greenstone occurs in the north-eastern part.

All parts of the area may be reached from Great Slave Lake; no point is more than 40 minutes flying time from the air base at Yellowknife. The area is dotted with lakes and these, with the rivers, make any locality easily accessible by canoe.

The inland lakes and rivers are open for travel by canoe or airplane from about June 5 to October 1. Great Slave Lake is not free of ice in the spring until about June 15 and begins to freeze over early in October. In normal seasons the ice on the lakes is thick enough for aircraft on skis from the last week in November to the last week in April.

## GENERAL CHARACTER OF THE AREA

The topography of Beaulieu River area is typical of the Canadian shield. The country appears flat when viewed from the top of the higher hills, but in detail the topography is rugged and harsh with rocky hills and ridges rising abruptly from lake or muskeg to heights of 200 to 300 feet.

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[x] Jolliffe, F.: Geol. Surv., Canada, Preliminary Report 36-5, 1936.

The area is dotted with rock bound lakes. The streams draining the lakes flow in poorly defined valleys and are interrupted by many rapids and falls. The shape of the lakes is to some extent controlled by the bedrock in which they lie. Thus, many shores of lakes in sediments, and to a lesser degree in greenstone, parallel the strike of the bedding or schistosity, whereas lakes within granite areas are generally irregular in outline.

Areas underlain by granite are somewhat more rugged than those underlain by sediments, but the most rugged topography is formed by the volcanic rocks. The greenstone belts southeast of Gordon Lake and along the northern reaches of Beaulieu River form prominent ranges of hills rising 150 feet or more above the areas of granite and sediments adjoining them.

Throughout most of the area the bedrock has been swept clean of overburden by glaciers and, with the exception of small swampy areas between the rocky ridges, the surface is almost continuous rock outcrop. However, in the northeastern part of the area in the vicinity of Payne and Meander Lakes many of the hills are composed of glacial material. Although in this locality a large proportion of the bedrock is covered by a veneer of sand and gravel, rock outcrops are fairly numerous.

The country is well wooded, but the trees for the most part are small and stunted. Spruce, Banksian pine, birch, and tamarack are the most common species. The greater part of the area has been burned over within the last 40 years.

Fish are plentiful in the lakes and streams. Northern pike, suckers, and, in the larger lakes, trout and whitefish, are the common varieties. Game is not plentiful in the summer months, although a number of moose and black bear were seen. Caribou are reported to be numerous during the winter months.

## GENERAL GEOLOGY

### Summary Statement of Formations

Late Precambrian

Diorite, gabbro (sills and dykes)
(Intrusive contact)

Great Slave group
Conglomerate, arkose
(Unconformity)

Early Precambrian

Granite, granodiorite, and allied rocks
(Intrusive contact)

Diorite, gabbro, pyroxenite, etc.
(Intrusive contact)

Yellowknife group
Greywacke, impure quartzite and arkose, slate and argillite, quartz-mica schist.

Basalt, andesite, dacite, rhyolite, tuff, and agglomerate.

## Yellowknife Group

### Volcanic Rocks

The volcanic rocks are most widespread in the northeastern part of the area where they form several distinct belts. Narrow belts of greenstone also outcrop 6 miles west of Jennejohn Lake near the western boundary of the area, and on the shore of Great Slave Lake northeast of Narrow Island.

In the northeastern part of the area the Cameron River belt of volcanic rocks extends from the northeast shore of Ross Lake northwest to Cameron River and thence northeast along the south bank parallel to the northeast branch of the river to the northern boundary of the area. The flows are predominantly dark green to black andesites and basalts with interbedded basic tuffs and agglomerates. A white weathering band of rhyolite and acidic tuff outcrops near the contact with the sediments northwest of Ross Lake. The basic lavas rise several hundred feet above the sediments, and this together with the contrast in colour of the white tuff and rhyolite with the black weathering flows forms a striking feature visible for many miles.

A second belt of volcanic rocks extends from Victory Lake southeast to Beaulieu River, and thence northeast along Tumpline and Turnback Lakes. This belt is composed of approximately equal proportions of acid and basic lavas. The acid rhyolitic flows are light grey to white weathering rocks which, when viewed from a distance, are similar in colouring and topographic expression to granite areas. On close examination the common variety is a very fine-grained, grey, flinty rock that weathers light grey to pink and locally contains phenocrysts of glassy to opalescent quartz up to one-sixteenth inch in diameter. Not all the rhyolites are flow rocks; some occur as dykes and small irregular bodies cutting both acid and basic flows. Much of the intrusive rhyolite is a quartz porphyry. The close association and similarity in composition and appearance of the extrusive and intrusive rhyolites indicate that they are genetically related. The intrusive phases are probably in part feeder dykes to the flows. It is possible, however, that some of the intrusive porphyries may be younger than the volcanic rocks and related to the granite, but no evidence suggesting this was found. The rhyolitic flows have large quantities of agglomerates and tuffs. associated with them. The agglomerates are commonly composed of fragments of rhyolite from an inch to more than a foot in diameter in a tuffaceous or fine fragmental matrix. Fine-grained, bedded, siliceous tuffs are also plentiful. The basic flows occur interbedded with the rhyolites and are similar in composition and appearance to the basic flow rocks of the Cameron River belt.

The third and largest belt of volcanic rocks lies along Beaulieu River northeast of Turnback Lake. The lava flows of this belt are predominantly fine-grained, light green weathering rocks of andesitic composition. Pillow and flow structure is well developed. Light grey weathering rhyolitic flows with associated rhyolite porphyry dykes occur interbedded with the andesites, but make up a relatively small proportion of the whole. West of Beaulieu River, particularly west of the lake where the east and north branches of the river join, pyroclastic rocks in remarkable variety occur interbedded with the flows. They include agglomerates, flow breccias, and coarse and fine tuffs. The volcanic rocks along the banks of Beaulieu River are highly sheared. Andesites have been altered to chlorite schists and the more acid rhyolites and tuffs to sericite-quartz schists. Small carbonate veinlets are abundant in the basic chlorite schists. Inland, to the east and west of the river, the rocks are more massive and the original pillow and flow structures are well preserved.

In general, the contact of the volcanic rocks with large areas of granite is sharp. Although numerous granite dykes cut the greenstones near the contact and the granite contains many large inclusions of greenstone for some distance from the contact, the granite itself shows little or no evidence of contamination and the contact zone is seldom more than one-quarter mile in width. However, the greenstone-granite contact in the northeast corner of the area east of Beaulieu River and west of Payne Lake is marked by a zone of mixed rocks up to 1 mile or more in width. The mixed rocks consist of greenstone cut by a variety of granitic dykes. The number of dykes gradually increases as the main body of granite is approached until the amount of granitic material becomes greater than the amount of greenstone and the rock may be better described as granite with greenstone inclusions. The granite dykes are of varying composition. Most of them, particularly at some distance from the main granite body, are grey to green hybrid granites with a large content of hornblende and small content of quartz. Others are more acid and closely akin in composition and appearance to the main granite mass. Greenstone cut by many granite dykes is commonly recrystallized to a medium-grained, dark green, speckled, dioritic hornblende-feldspar rock which in places retains original pillow and flow structures. Contacts between granite dykes and recrystallized greenstone are usually sharp and well defined.

The narrow, isolated belt of greenstone crossing the northeast branch of Beaulieu River 2 miles east of the main greenstone belt is riddled by granite dykes which in places make up as much as 50 per cent of the whole mass. It grades to the north and south into rocks that are mainly granite, but contain a large proportion of greenstone. The narrow band or zone of mixed rocks extends 8 miles to the southeast where it joins the main belt of greenstone 2 miles southwest of Payne Lake; it is not differentiated from granite on the map.

## Sedimentary Rocks

The sedimentary rocks of the Yellowknife group extend as a belt up to 20 miles in width from the northern boundary of the area south to the shore of Great Slave Lake. On the accompanying map the sediments are divided into two units: (1) relatively unaltered sediments; (2) knotted quartz-mica schists. This division is based on degree of metamorphism and is entirely arbitrary. A complete gradation exists between the two units.

Relatively Unaltered Sediments. The sediments are a monotonous succession of greywacke, impure arkose and quartzite, slate, and argillite. The most common type is greywacke. The greywackes are fine-grained rocks weathering grey to buff. On fresh fracture the individual grains can be distinguished only in the coarser, more gritty beds. On a clean-weathered surface, however, individual grains may be recognized, and in many places a single bed or series of beds may show a gradation in size of grain from coarse at the bottom to fine at the top. As the beds throughout the area are vertical or inclined at very steep angles, gradation in grain size is extremely useful in determining the top and bottom of the beds. As a rule the thicker beds are more massive and are composed of coarser, more sandy material than the thinner beds, which are usually schistose. Beds with grains up to one-eighth inch in diameter occur, but are not common. The greywackes are completely recrystallized and are composed mainly of quartz, some feldspar, and 20 to 30 per cent dark and light mica. Rocks classed as impure arkoses and quartzites have a smaller content of mica and a larger content of quartz and feldspar. They are somewhat coarser grained than the greywackes and weather a slightly lighter shade of grey, but are otherwise similar. The slates are coal black to grey, thinly bedded rocks with pronounced cleavage.

The thickness of the beds averages 1 to 2 feet, but locally in the coarser clastics the beds are so thick and massive that bedding is difficult to recognize. Beds of slaty material are much thinner, averaging 1 to 6 inches; many of the beds are finely laminated. All types of sediment occur interbedded one with the other. One type may predominate in one locality, but a large proportion of the other types are usually present.

A narrow band of conglomerate outcrops along the contact between sediments and volcanic rocks northeast of Victory and Ross Lakes. The plane of contact is vertical and marked by a cliff of the volcanic rocks about 200 feet in height. The conglomerate outcrops along the southwest face of the cliff and is exposed over a width of 150 feet, although a drift-filled valley to the southwest may be in part underlain by it. The conglomerate band may be traced from the south end of the small lake 500 feet east of Ross Lake southeast along the contact of the sediments with the volcanic rocks and granite for a distance of 4 miles to a point about 2 miles northwest of the inlet of Victory Lake.

The conglomerate consists of well-rounded pebbles of granite, greenstone, light grey felsite, and grey quartzite in a coarse, limy sandstone or grit composed in large part of carbonate. The pebbles average 2 to 3 inches in diameter with occasional boulders up to 1 foot in size. As the contact with the volcanic rocks is approached the sandy matrix becomes tuffaceous and the proportion of greenstone pebbles increases until the conglomerate is entirely composed of them. The conglomerate thus grades into a volcanic agglomerate, which in turn grades into ropy andesitic flows. Similarly, east of the southeast end of Ross Lake the base of the conglomerate grades within 2 feet into a coarse rhyolitic agglomerate or breccia composed of fragments of rhyolite in a matrix of smaller fragments. Apparently no erosion interval or time break of importance preceded the deposition of the conglomerate.

Knotted Quartz-mica Schists. The sediments are thermally metamorphosed over large areas to knotted quartz-mica schists. The degree of metamorphism of the sediments is no doubt closely connected with proximity to granite batholiths, although other factors may also be important.

A perfect gradation exists between the relatively fresh sediments and the quartz-mica schists. As the degree of metamorphism increases small flakes of mica gradually develop along the cleavage planes in the sediments, so that the rocks when split along these planes have a glistening micaceous surface. Spherical or ovoid knots of harder, lighter coloured material develop. These knots vary in size from very small to 2 inches in length, with an average size of $\frac{1}{4}$ to $\frac{1}{2}$ inch. The knots are much more resistant than the rock as a whole, and stand out conspicuously on the weathered surface. They develop in all the beds, but tend to form first and most abundantly in the more argillaceous material. The knots represent the initial stages of the development of new minerals in the sediments. In the early stage little difference in mineral composition between the knot or nodule and the enclosing rock is apparent. In the more advanced stage the knots are formed of a mineral that is probably cordierite packed full of inclusions of biotite, muscovite, quartz, and feldspar.

Notwithstanding the alteration of the sediments to knotted micaceous schists the original sedimentary structures are retained to a remarkable degree. Bedding and crossbedding are perfectly preserved and gradation in size of grain may be recognized on the weathered surface in some of the coarser, more sandy beds. Granite and pegmatite dykes occur cutting the schists, but are relatively rare except near contacts with the granite. Large areas contain no granitic material whatever.

Contacts of the quartz-mica schists with the granite are in general sharp throughout most of the area. At some localities, in particular along the granite sedimentary contacts near Prelude, Reid, Jennejohn, and Harding Lakes, a zone of injection gneisses $\frac{1}{4}$ to 1 mile or more in width is developed along the contact. The injection gneisses are simply a more highly altered phase of the schists coarse enough in grain to be called gneisses and containing much granitic material as lit-par-lit injections and dykes. They are not differentiated from the knotted quartz-mica schists on the map.

## Structure

The sedimentary and volcanic rocks lie in a series of tight, closely spaced, isoclinal folds. The dip of the strata is, consequently, steep to vertical in most parts of the area, and in many places the beds are overturned. In a small area east of

Tibbitt Lake where the structure was worked out in some detail the distance between anticlinal crests is about one mile; where argillaceous slaty beds predominate, as within Gordon Lake area, the distance between crests is much less.

A line drawn from the south end of Gordon Lake to Hearne Lake passes through the centre of the zone of least altered sediments. This imaginary line also parallels the trend of the axes of the folds, which is approximately north-south. To the east and west of this line, as the degree of metamorphism of the sediments increases, the regular north-south trend disappears, and in the knotted quartz-mica schists the trends are extremely irregular. This is particularly noticeable when viewed from the air. Where the trend of the bedding is extremely irregular, with numerous drag-folds and contortions, the sediments are mica schists; where the trend is regular, striking in a general north-south direction, the sediments are relatively unaltered greywackes, slates, etc.

## Relation of the Sediments to the Volcanic Rocks

To the northeast of Ross and Victory Lakes, as has already been described, tuffaceous and agglomeratic beds grade into conglomerate, which in turn grades into normal sediments. Southeast of Victory Lake two belts of volcanic rocks are interlayered with the sediments, pinching out to the northeast and joining to the southeast to form one wide belt. No evidence of an unconformity is apparent between the volcanic rocks and the sediments. On Tumpline Lake and along Beaulieu River the volcanic rocks grade into tuffaceous sediments which, in turn, grade into true sediments. No abrupt boundary can be distinguished between the three types. Excellent determinations of tops of sediments and tuffs by gradation in size of grain from coarse at base to fine at top indicate that the main body of sediments is younger and stratigraphically overlies the volcanic rocks. Similar relations were observed along the contacts on Cameron River and along Beaulieu River near the junction of the north and northeast branches.

The relations between sedimentary and volcanic rocks described above do not indicate a structural unconformity within the group, nor is there evidence of a stratigraphic break of importance. However, the presence of conglomerate with granite pebbles at one locality suggests that although the period of vulcanism gave place to a period of sedimentation with no intervening period of erosion in this area, erosion must have been proceeding not far away.

## Diorite, Gabbro, Pyroxenite, etc.

The largest body of basic intrusive rocks within the area lies one mile east of Francois River, ½ mile north of the shore of Great Slave Lake. The mass is a complex of pyroxenite, gabbro, diorite, and anorthosite, all of which are probably differentiation products of the same parent magma. In places gabbro, anorthosite, and titaniferous magnetite occur as alternating bands, from an inch to several feet in thickness. The Francois River basic intrusive rocks are definitely older than the surrounding granite.

Several dykes and sills of diorite and gabbro cut the sediments in the vicinity of Tibbitt and Tumpline Lakes. The larger dykes such as outcrop near Tibbitt Lake are massive, dark green weathering rocks of medium to coarse grain. They are composed of dark green hornblende, secondary amphibole, and altered plagioclase. The composition is somewhat variable, with local segregations of material of coarser grain and of either more basic or more acid composition than the average. The smaller dykes, 100 feet or less in width, are of similar composition, but of finer grain and in general more schistose and highly altered than the larger bodies.

Two dykes southeast of Tumpline Lake are cut by granite which is definitely younger. The dykes in the vicinity of Tibbitt Lake are also assumed to be pre-granite in age, although definite proof is lacking.

## Granite, Granodiorite, and Allied Rocks

The granitic rocks include a wide variety of acid intrusives that are characterized by light grey to pink colour and medium to coarse grain, and are composed of quartz, feldspar, and biotite, muscovite, or hornblende. The two most common types may be classed as biotite granite and muscovite granite. The biotite granite is the more common; it forms the larger batholiths and the small stocks and bosses south and east of Tumpline Lake and on Watta, Hearne, and Tibbitt Lakes. It is commonly a light grey to pink weathering, medium-grained rock composed of 25 to 35 per cent quartz, 55 to 65 per cent albite-oligoclase with a small proportion of microcline, and 5 to 10 per cent black biotite mica. The biotite is generally present as well-formed hexagonal plates and may be accompanied by some hornblende.

The muscovite granite forms many of the smaller batholiths or bosses such as those outcropping within the knotted quartz-mica schists on and between Hidden, Sparrow, and Wedge Lakes, the long granite tongue southwest of Tumpline Lake, and the boss to the west of this tongue. It is essentially similar to the biotite granite except that the grain is generally coarser, a pale greenish yellow muscovite mica is present in place of the biotite, and the proportion of microcline to plagioclase is somewhat greater.

A third type, which may be called a chlorite granite, forms the oval mass surrounded by greenstone in the northeast quarter of the area west of Beaulieu River. It is a light grey to pinkish, medium-grained rock which on fresh fracture breaks along slip planes coated with chlorite. The average composition is about 25 to 35 per cent smoky to opalescent quartz, 55 to 65 per cent sericitized microcline, microcline-perthite, and albite-oligoclase, and 5 to 10 per cent chlorite. The chlorite granite differs from the biotite and muscovite varieties in the greater degree of alteration and granulation, and the preponderance of potash feldspar over plagioclase.

The contact of the chlorite granite with the greenstone is extremely sharp; a few granite dykes cut the greenstone near the contact, but they are not common. A peculiar fragmental phase of the granite occurs along the northeast contact, one-half mile southeast of two small lakes at the northern end of the granite body. The fragmental phase where observed in contact with the greenstone is about 2 feet in thickness. It grades into normal granite to the west and, to the east, is in direct contact with the greenstone which dips steeply to the east away from the granite. The fragmental rock is composed of angular to sub-rounded granite fragments in a coarse greenish matrix of smaller fragments. The rock has the appearance of a conglomerate or recomposed granite, but may be merely a brecciated zone in the granite along the contact. Granite dykes cut the greenstone, 100 feet to the south, establishing the intrusive relation of at least some of the granite to the greenstone, and thus suggesting that the fragmental rock is merely a brecciated zone in the granite along the contact rather than a conglomerate. However, it is possible that granite of more than one age is present at this locality, and a more detailed examination must be made before the nature of the contact can be definitely established.

With exception of the one locality described above where the relations are in doubt, the granitic intrusives are definitely younger than the volcanic and sedimentary rocks of the Yellowknife group.

A number of dykes of aplite and quartz-feldspar porphyry cut the sediments northwest of Hearne Lake and near the small granite bodies 4 miles northwest of Hearne Lake and on Tibbitt Lake. Some of them contain iron sulphides. Most of the dykes are only a few feet in width and can be traced for only short distances. The largest one that was observed outcrops on the west shore of Hearne Lake ½ mile from the north end. The dykes bear no relation to the extrusive quartz porphyries associated with the volcanic rocks of the Yellowknife group. They are probably related to the granite.

## Great Slave Group

Sediments belonging to the Great Slave group form Blanchet and Seton Islands in Great Slave Lake*. An area of

* Geol. Surv., Canada, Map 377A.

sediments, probably belonging to the Great Slave group but too small in extent to show on the map, outcrops on the shore of the small northeasterly trending lake 5 miles south of Payne Lake. An arkosic conglomerate outcrops for 300 feet along the northwest shore of the lake 1,200 feet southwest of the north end. The rock is grey to purple in colour and composed of scattered, well-rounded pebbles up to 4 inches in diameter of vein quartz, quartzite, and granite in a rather coarse arkosic sandstone matrix. A thin veneer of conglomerate also occurs on the nearby granite and on the two small islands to the south. The conglomerate is younger than the granite and rests unconformably upon it.

Another patch of conglomerate, 100 by 600 feet in area resting unconformably on granite, was observed 8 miles north 30 degrees west of the area of conglomerate described above. These small areas of conglomerate are probably remnants of the Great Slave group of sediments to the south, which at one time covered a much larger area than they now do.

## Diorite and Gabbro

Basic dykes that range in composition from diorite to gabbro are the youngest known rocks within the area. The larger dykes up to several hundred feet in width may be traced for miles, and have a more or less constant trend of about north 70 degrees east. Most of them, however, are only a few feet in width and have variable strikes.

The late basic dykes weather a characteristic rusty reddish brown. On fresh fracture the rock is mottled grey, with about equal proportions of basic grey plagioclase feldspar and black to greenish augite. The contact of the dykes with the enclosing rock is always sharp and well defined, with the dyke at the margin chilled to a dense, fine-grained rock. The grain size at a distance from the margin depends on the size of the dyke—the smaller dykes are dense black trap rocks across their entire width whereas in the larger dykes the crystals are $\frac{1}{4}$ inch or more in length.

The granite northeast of Victory Lake is cut by hundreds of hornblende-gabbro dykes from 2 to 50 feet or more in width, with a fairly uniform strike of south 20 degrees east. These dykes are believed to be older than the basic dykes described above. They weather dark green to black, and are medium- to fine-grained rocks composed of approximately equal proportions of hornblende and plagioclase. Many of the dykes are porphyritic, with scattered white weathering feldspar phenocrysts up to $1\frac{1}{4}$ inches,in size. Inclusions of basic volcanic rocks also occur in the granite near the contact. They are somewhat similar in appearance to the dykes, but are finer grained, do not show chilled margins, and are more schistose and altered than the dykes. The dykes are much more similar in appearance and composition to the basic intrusives near Tibbitt and Tumpline Lakes, which are in part at least pre-granite in age, than to the late gabbro and diorite dykes. They are probably of intermediate age; that is they are younger than the early basic intrusives of pre-granite age and older than the late basic dykes.

## ECONOMIC GEOLOGY

### Camlaron Mines, Limited

Camlaron Mines, Limited was organized in 1937 to acquire part of the claims on Gordon Lake held jointly by Mining Corporation of Canada and the A.X. Syndicate. The property consists of forty-eight claims, and includes the original discovery vein known as the "Hump", on which a shaft is at present being sunk, and the "31" vein. In a report issued by the company, January 25, 1938, it was stated that the shaft had reached a depth of 200 feet and that crosscutting to the vein was under way.

The "Hump" vein outcrops on the southern tip of the north-south trending island in Gordon Lake at the northern boundary of the map-area. The vein is in thinly bedded slates and greywackes striking north 30 to 35 degrees east and dipping 75 to 80 degrees west. The vein is a composite body of quartz consisting of: (1) the vein proper, 3 to 4 feet in width, striking parallel to the schistosity at north 30 degrees east and dipping 80 to 85 degrees northwest; and (2) a dome or saddle-shaped mass of quartz about 18 by 20 feet in area to the northwest of but joined to the vein proper. The quartz of the saddle or dome is distinctly banded, due to incomplete replacement of the sedimentary beds by the quartz. From this banding it is evident that the bed or beds of sediments replaced by the quartz lie along the crest of an anticlinal fold plunging 45 to 55 degrees northeast.

Northwest of the vein the sediments strike north 30 to 35 degrees east and the tops of beds face northwest. The nearest outcrop to the southeast that gives a satisfactory determination of the tops of the beds is on the point 200 feet away where the beds strike north 30 to 35 degrees east and dip and face 85 degrees southeast. An anticlinal axis must lie somewhere between these two outcrops. It is reasonable to conclude that the anticlinal crest along which the vein has formed marks the axis of this fold. It is possible, however, that the main anticlinal axis lies to the east of the vein, in which case the anticlinal crest along which the vein has formed is a secondary or drag-fold on the northwest flank of the larger fold.

The vein is composed of coarsely crystalline white quartz with vug-like cavities lined with well-formed quartz crystals. The quartz saddle is distinctly banded, due to incomplete replacement of the beds of greywacke and slate by vein material. Slip surfaces along the bands are coated with black graphitic material. Pyrite and chalcopyrite are the most abundant sulphides, although galena and sphalerite are plentiful. Brown weathering carbonate, rich in iron, is plentiful as veinlets cutting the quartz. The sulphides are coarsely crystalline; cubes of pyrite up to ¼ inch in size are not uncommon. Visible gold occurs as a fine powder through the quartz, usually in more or less close association with the sulphides. Sphalerite, and to a lesser degree galena, are almost invariably associated with vein material that is high in gold but the presence of sphalerite does not necessarily imply the presence of gold.

Surface sampling by the company of the exposed part of the vein gave an average gold content, after reduction of high erratics, of 2.1 ounces of gold a ton. In diamond drilling, two holes cut widths of 20 feet or more of quartz—one intersection being approximately 80 feet northeast of the surface exposure of the vein at a vertical depth of 120 feet and the other 230 feet northeast of the surface exposure at a vertical depth of 280 feet. These two holes are believed to have intersected the downward extension of the quartz saddle, thus checking the determination of the plunge from banding in the quartz at the surface at about 50 degrees northeast. The gold content of the quartz cut by these holes was extremely high, running several ounces to the ton. Several other holes intersected narrower widths of 2 to 5 feet of quartz containing more moderate values in gold. These holes are assumed to have intersected the vertically dipping part of the vein, and to have passed either above or below the quartz saddle. Officials of the company calculate the gold content of five diamond drill intersections of the vein over a length of 200 feet, at a depth of about 125 feet, to average 1.25 ounces of gold a ton, with an avergae width of 7.7. feet. The five holes include one of the holes believed to have cut the quartz saddle that gave an intersection of high-grade vein material of more than 20 feet. This intersection accounts for the wide average width of the five vein intersections.

The "31" vein outcrops on the northeast shore of the large island in Gordon Lake, one mile southwest of the "Hump" vein. Structurally the vein is very similar to the "Hump" vein. The sediments in which it occurs are greywackes and slates, with a general strike of north 35 degrees east and vertical or very steep dip. The steeply dipping beds on either side of the vein zone face in opposite directions; thus the vein zone lies along the crest of a tight anticlinal fold. The vein material has come in along the broken crest of the fold as a series of irregular, discontinuous, quartz lenses more or less parallel to the schistosity or axial plane of the fold. The vein matter is similar to that of the "Hump" vein, but sulphides are not as plentiful and 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. Gold values are erratic, and surface sampling results were disappointing. Several shallow diamond drill holes intersected variable widths of quartz that were difficult to correlate one with the other. Some of the drill intersections returned high, but erratic, assays in gold.

## Other Gold Occurrences

The Ruth claims were staked by D.F. Kidd at the southeast end of Victory Lake in July 1937. The claims include the point of land extending into Victory Lake that is underlain by sediments and a narrow belt of volcanic rocks. A heavily mineralized shear zone occurs along the northeast contact of the lavas with the sediments. The sediments are fine-grained, knotted, quartz-mica schists. The volcanic rocks are green weathering andesites and light grey to buff weathering, fine-grained, banded rhyolites that in places contain small phenocrysts of quartz and feldspar. Some of the rhyolite may be intrusive. Intrusive aplitic dykes, probably related to the small granite body to the southeast, also 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 the contact and heavily impregnated in places with pyrite, chalcopyrite, and pyrrhotite. A number of quartz veins or lenses of bluish quartz, heavily mineralized in places with galena, pyrite, chalcopyrite, and some arsenopyrite and sphalerite, lie along the shear zone. No work had been done on the claims at the time of the writer's visit in July, 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. A considerable amount of trenching and stripping has since been done at different localities along the contact and encouraging assays in gold are reported from channel samples taken from the trenches.

The Irma claims were staked in July 1937 for D.F. Kidd. They lie to the southwest of the Ruth claims along the northeast contact of the belt of volcanics $\frac{1}{2}$ mile south of Victory Lake. Sulphides and vein quartz occur in shear zones along the contact of rhyolite flows with the sediments.

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

The Baltic claims, staked for D.F. Kidd in August 1937, are located at the northwest end of Hearne Lake. A quartz-feldspar porphyry dyke striking north cuts the sediments on the west shore of the lake ½ mile from the north end. It varies from 75 to 250 feet in width and extends north from the shore of Hearne Lake for at least 1 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 blocky, 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 10 to 15 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. Values in gold are reported from grab samples of quartz containing arsenopyrite.

In addition to the properties mentioned above, some development work was carried out by Ventures, Limited, on claims to the south of Camlaren holdings, and by Borealis Company, Limited, on claims north of the large bay on the west shore of Gordon Lake. Companies that did development work on Gordon Lake north of the map-area during 1937 include the Gordon Lake Syndicate, Jolliffe Lake Syndicate, Sun Bear Mines, Limited, McVittie Graham Mines, Limited, and Eldorado Gold Mines, Limited.

## Niccolite Vein near Francois River

This deposit has been fully described by Stockwell[1].

[1] Stockwell, C.H.: "Great Slave Lake-Coppermine River Area, Northwest Territories"; Geol. Surv., Canada, Sum. Rept. 1932, Pt. C, pp. 37-64.

No further work has been done on the property since his examination.

The deposit occurs in augite diorite east of Francois River about $1\frac{1}{2}$ 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.

## Prospecting Notes

Quartz veins are numerous throughout both the sedimentary and volcanic rocks of the Yellowknife group. The quartz of the veins within the greywackes, arkoses, slates, and volcanic rocks is generally white to milky, and in the least thermally altered rocks such as those underlying Gordon Lake it contains much rusty weathering carbonate. In the knotted quartz-mica schists the veins are more numerous, and are commonly composed of a glassy blue to white quartz with scattered, small, chalky white to pink weathering feldspar crystals along the margins. The main factor in the development of the knotted quartz-mica schists is proximity to granite batholiths, with attendant higher temperatures and pressures. The change in the character of the quartz veins from milky white quartz with carbonate in the less altered sediments to glassy blue quartz with feldspar in the knotted quartz-mica schists is also to be attributed to higher temperatures and pressures at the time of the formation of the veins.

The gold-bearing veins on Gordon Lake are lower temperature veins than the majority of those occurring within the knotted quartz-mica schists. From this it might be concluded that the favourable rocks in which to prospect are limited to the sediments and volcanics that have escaped pronounced thermal metamorphism. This conclusion, however, is hardly justified. In the first place it has not been shown that the high-temperature type of vein may not contain gold in commercial quantities. In fact, several promising gold discoveries have been made in the adjoining Yellowknife area in highly altered quartz-mica schists in which most of the quartz appears to be of the high-temperature variety. In the second place it is not known whether or not the lower temperature veins were formed at the same time and derived from the same source as the high-temperature veins. A.W. Jolliffe[x] in detailed mapping of the adjoining Yellowknife area has found certain lines of evidence leading him to believe that

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x Personal communication

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the gold-bearing quartz may be much later in age and not genetically related to the high-temperature quartz veins or to the granite. If this is correct, where favourable structure (faults, shear zones, etc.) exists, the lower temperature veins should be found in the quartz-mica schists and possibly even in the granites, as well as in the less altered sediments and volcanics.

Structural control has played a most important role in the localization of the gold-bearing veins so far found within the area. At Gordon Lake beds of tightly folded sediments have been strongly bent, and in places broken, along anticlinal crests and synclinal troughs. Vein material has been introduced along these zones of weakness. During folding, shearing movement tends to be most pronounced along contacts between different kinds of rocks. Thus contacts between sediments and volcanics have been the loci of strong shearing movements, and the resulting shear zones have afforded channelways for vein-forming solutions. Sulphides and vein quartz are plentiful along contacts between volcanics and sediments throughout the area. They deserve careful prospecting. Areas where the sediments are intruded by many basic dykes, as around Tibbitt Lake, are also worthy of attention. Areas around small granite,stocks, such as those near Hearne, Watta, and Tibbitt Lakes, and the area around the granite prong southwest of Tumpline Lake, are theoretically favourable localities for mineral deposits. Sulphides are fairly plentiful at the latter locality, particularly within the tuffaceous and agglomeratic beds and along the contacts of the volcanic rocks and sediments. A number of aplite and quartz-porphyry dykes cut the sediments north and west of Hearne Lake. Most of them are small, but they are worth investigation. Faults within sedimentary and volcanic rocks are always of interest to the prospector. With the exception of the north-south fault displacing the basic dyke south of Wedge Lake, no faults with large displacement were definitely identified within the area. This may reflect the reconnaissance nature of the geological mapping rather than an actual scarcity of faults. The highly schistose condition of the greenstones along the upper reaches of Beaulieu River in the north-east quarter of the area may indicate a north-south fault parallel to the river. Elsewhere in the area rectilineal topographic features such as straight river courses, lake basins, etc., may likewise indicate faults.