DP 483

Geological reconnaissance of an area north and east of lake St. John from Chibougamau road east to the Shipshaw watershed

EXPLORATION GEOLOGIQUE

MINISTÈRE
DES RICHESSES
NATURELLES

DIRECTION GÉNÉRALE
DES MINES

LAKE ST. JOHN AREA

GEOLOGICAL RECONNAISSANCE FROM CHIBOUGAMAU ROAD (E) TO THE SHIPSHAW WATERSHED

S.H. Ross

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of

L A K E S T. J O H N

from

Chibougamau Road East to the Shipshaw Watershed

by

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INTRODUCTION

General Statement

During the field season of 1950 geological reconnaissance surveys of lumber company roads and adjacent watercourses draining into Lake St. John were made north and east of the lake.

The exposures shown on the accompanying maps were located by: (1) road mileage with pace and compass offsets; (2) pace traverses along telephone lines; (3) lake shore and stream traverses; (4) pace-and-compass traverses from roads to fire towers. The geological data so obtained were supplemented by information from aerial photographs.

The areas examined are on the rocky highlands of the Laurentian plateau. They are between longitude 70° 40' W and 73° 30' W and latitudes 48° 40' N and 50° N.

This report is based mainly upon observations made along drainage systems of the Ashuapmouchouan, Mikosas, Rat, Petite Peribonca, Alex, and Shipshaw rivers and the south 65 miles of the Chibougamau road in Chibougamau, Roberval, and Chicoutimi Counties.

All bearings mentioned in this report refer to true north. The magnetic declination at Chigoubiche Lake on the west edge of the area is N 20° W and is 23° W at Onatchiway Lake 112 miles east.

Acknowledgements

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Previous Work

A detailed study of the southern margin of St. John lake was made in 1913 by J.A. Dresser.[1] The Simard Map Area, on the north shore of Saguenay river north of Arvida, was mapped geologically by B. T. Denis in 1932.[2] The following year Denis [3] mapped the north and northwest margin of the lake. A geological reconnaissance of the Peribonca river, 80 airline miles north of Passe Dangereuse was completed by the author [4] in the summer of 1942. During the summer of 1948 R. J. Jooste[5] mapped geologically the Bourget Area on the north shore of Saguenay river north of Chicoutimi. In 1948 the British Schools Exploring Society carried out a topographical and geological survey of an area of the Rat river in the vicinity of Lac Jourdain and Lac au Foin. The results of this work were published in the Annual Report of the Society. [6]

GENERAL CHARACTER OF THE AREA

Topography

The Lake St-John region consists of a terraced lowland, which surrounds the lake and is in turn surrounded by rocky highlands of the Laurentian Plateau which rise 500 feet above the lowland. The elevation of the highlands is between 800 and 1200 feet above sea level. The lake is rudely circular and lies in the southeast part of the Lake St. John Depression, The boundary of the Depression on the west is well defined and the hills of the Plateau rise abruptly above the level of the lowlands (Plate 1); but on the north and northeast a transitional zone of rocky outcrops and ridges lies between the highlands and the lowlands.

The relief of the highland region as a whole is uniform, but locally it is quite marked where numerous small ridges and hills rise several hundred feet above steep-walled narrow valleys.

Drainage

The area is in a youthful stage of physiographic development. (Plate 11). The main streams flow southward parallel to the regional trend of the prominant ridges. The smaller river systems consist largely of strings of lakes connected by "narrows" commonly with rapids or falls. (Plate 11 A) Jourdain lake is

NOTE: All the plates mentioned in this report are missing

really a series of lakes nine miles long. The Rat river forms a 6-mile lake in its lower course and has many water falls near its headwaters. Glaciation has increased former relief. Since the post-Champlain uplife streams have cut deeply into unconsolidated sediments, and swamps and miskegs have formed where drainage was inadequate.

Structure

Faulting and regional jointing are of paramont importance and are demonstrated by their effects on drainage. The pattern of major streams in the area is controlled by joints two of which strike N 51° W and N 36° E.

As seen from the air the long dimensions of lakes, ponds, and swamps tend to be parallel to the strike of gneissic structure of the underlying rocks.

GENERAL GEOLOGY

General Statement

Paleozoic rocks crop out in the basin of St. John lake, but the bedrock formation of the uplands which are the subject of this report are Precambrian and principally granites, granitic gneisses, and anorthosite. Remnants of Grenville crystalline limestone, quartzite, and some paragneisses are also present. Till and fluvioglacial deposits cover much of the bedrock.

TABLE OF FORMATIONS

QUATERNARY	Recent Pleistocene	UNCONSOLIDATED DEPOSITS Gravel, sand, sandy clay, clay, and till
PRE-CAMBRIAN	Grenville	PEGMATITE GRANITE AND GNEISSIC GRANITE Biotite granite, biotite-hornblende granite, and hornblende granite SYENITE Hornblende syenite, and biotite syenite ANORTHOSITE Anorthosite, gabbro anorthosite, gabbro and diorite PARA-ROCKS Chrystalline limestone, quartzite, and paragneiss and amphibolite

Grenville Series

The oldest rocks in the region are crystalline limestones, quartzites, and paragneisses. Limestone and quartzite can be recognized with certainty; lithologically paragneiss is difficult to distinguish from certain gneisses of igneous origin. For this report, thin-layered garnetiferous gneisses are considered metamorphosed sediments and a part of the Grenville series.

Paragneisses with several small lenses of quartzite and crystalline limestone of the Grenville Series occur along the Mikosas river in Damville and Chomedey townships and along the Murdock road south of Murdock Depot in Ramezay and Dumais townships. Similar rocks occur along the road north of St. Eugène in Pelletier township, in the vicinity of Au Chien lake and on Chigoubiche river.

A band of crystalline limestone, 4½ miles long, and ½ mile wide has been described by Denis [2] along Rat river in the vicinity of St. Eugène in Pelletier township. Paragneiss, consisting of biotite, plagioclase and quartz, is associated with the limestone.

Lenticular masses of crystalline limestone, quartzite, and garnetiferous biotite paragneiss crop out along the Murdock road beginning six miles south of Murdock Depot at intervals

for five miles southward North of Murdock Depot, along the road which follows the east bank of Mikosas river, garnetiferous paragneiss crops out at intervals for 30 miles. Garnetiferous amphibolite outcrops on the roadside half a mile west of Au Chien lake.

Lithology:

Crystalline Limestone. - The Grenville crystalline limestone of Pelletier township is a white, coarsely crystalline impure variety. The impurities consist mainly of small flakes of biotite and graphite and grains of hornblende, pyroxene, quartz, and feldspar. The crystalline limestone body along Murdock road is similar to that of St. Eugène band.

Quartzite. - Small masses of garnetiferous quartzite and paragneiss, striking N 13° W dipping 45° east, crop out at intervals along Murdock road south of Murdock Depot for a distance of four miles. The quartzite is composed essentially of quartz with flakes of biotite and a few scattered grains of feldspar. Inn the garnetiferous facies, layers consist of garnet one to two mm diameter.

Paragneiss:

The paragneisses of the region may be assigned to two principal varieties, one characterized by biotite and the other by hornblende. The garnetiferous biotite gneiss is composed of quartz, biotite, and potassic feldspar (Plate IX).

The garnetiferous hornblende gneiss is thin layered and composed of orthoclase, quartz, and hornblende. The accessory constituents in the paragneiss are apatite, and zircon.

The paragneisses are thin-layered, strongly schistose, and commonly weather rusty. The layering is parallel to the schistosity as defined by the parallel arrangement of mica plates.

Amphibolite:

This rock is a hornblende gneiss or schist. In addition to hornblende it consists of feldspar and pyroxene. It is fine grained, one mm or less in grain size. The Du Portage river body is heavily mineralized with magnetite and ilmenite. Magnetite and ilmenite occur as veinlets along fractures and as irregular masses.

Anorthosite

Anorthosite crops out extensively in the eastern part of the area from Alex lake eastward to Shipshaw drainage basin. This rock is part of the mass which extends east of the maps and comprises 20,000 square miles. (Plate IV)

Lithology:

Anorthosite. As mapped anorthosite includes areas of gabbro-anorthosite, gabbro, and diorite. In general it is massive, coarsely crystalline rock composed almost entirely of intermediate plagioclase. The weathered surface is

commonly white. Fresh surfaces vary in color from light gray to dark, bluish gray and black or mauve. In the normal facies the average grain size is about 4 mm. Some crystals are 1½ inches and a few are 4 inches long. In porphyritic facies some crystals are 8 inches long. (Plate V). The most common dark mineral is biotite. The anorthosite grades into gabbro anorthosite and gabbro, in which biotite, hornblende, and pyroxene are the common dark minerals. Some of the hornblende is uralite. Hypersthene crystals as much as three inches long occur in the gabbro anorthosite at a number of places, notably along the road in the vicinity of Grand lake and on the shores of Pemouscachiou and Shipshaw lakes. The Shipshaw lake anorthosite is rich in ilmenite and magnetite with intergrown ilmenite.

Gabbro

Gabbro is abundant along Rat river in the central portion of the area. It crops out along the Caribou Lake road continuously from a point one mile east of the Rat River road to Caribou lake, a distance of four miles. Another large mass, cropping out along the east shore of Aux Rats lake is exposed along the Rat river road for 1½ miles. A body, ¾ mile long, crops out along the Rat River road near mile 90. Other bodies of gabbro, including dikes cutting anorthosite, occur, from west to east in the area, on Chibougamiche river; west of Jim lake on the

on the Murdock road; at the mouth of Long lake on Petite Peribonca river; at the dam on des Aigles lake; on the east shore at the south end of Shipshaw lake; on the big point of Au Poivre lake; on the Beauchêne river; and at widely separated intervals along the Shipshaw road.

Lithology. - The gabbro is a massive, medium-grained rock and commonly dark green. Layer structures are common. Hypersthene is the dominant ferromagnesian constituent. Biotite is invariably present, hornblende is more erratic in occurrence than biotite. In some places rocks resembling the gabbro have plagioclase more albitic than labradorite. Some rocks should be termed diorite but are for this report considered with the gabbro. Zones in the Lac des Aigles body have fine grained, disseminated pyrite.

Diorite

Several large masses and numerous small bodies of diorite occur in the region. One large mass crops out north of the village of N. D. de Lorette one mile west of the south end of Aux Rats lake. Another crops out on the west bank of Petite Peribonca river from six to eight miles north of l'ouest lake. Small bodies are prominent along the Chibougamau road and Shipshaw road.

Lithology. - The diorite is medium grained (3 mm) massive or gneissoid, gray to almost black. An average specimen has

hornblende 25%, biotite 25%, and the remainder is andesine or in some places oligoclase-andesine. Hornblende attains a maximum of 60 per cent and biotite 55 per cent of some rocks of the group. Quartz, if present, commonly is less than five per cent.

Syenite

The syenite occurs in Alex river watershed and extends eastward from Petite Peribonca river to Alex lake, that is approximately 21 miles. It is flanked on the south by pink biotite granite and gneissoid granite and on the east by anorthosite. Its maximum explored width, north of Bleuets Secs lake is nine miles. Another large mass, intruding anorthosite, crops out ¾ mile east of the Shipshaw road between Tête Blanche river and the headwaters of La Hache river. Creek Rough, a tributary of Tête Blanche, flows across this body for a mile. A large mass crops out along the Chibougamau road between Pemoka and Vermillion rivers, a distance of 16 miles. Smaller bodies crop out on the south shore of au Poivre lake; west of Au Poivre lake along Beauchêne river; and on the east shore of Pemouscachiou lake.

Lithology. - The syenite is a very coarse grained (10mm), leucocratic, light brown, or greenish gray and pink rock commonly

porphyritic with potash feldspar phenocrysts attaining a length of $1\frac{1}{2}$ inches. The rock consists of mainly orthoclase with micrographic texture, microperthite, microcline, and about ten per cent of either hornblende or biotite. A small amount of quartz, not exceeding ten per cent of rock is commonly present. Some facies of the Creek Rough body grade into granite with graphic texture. On the other hand the Alex River syenite is practically quartz free.

Granite and gneissic granite

The greatest development of this rock is along the east and west branches of Rat river in the central part of the area, (Plate VI) and along Mikosas river. Other large areas are the Chibougamau road, along Chigouhiche and Ashuapmouchouan rivers, and east of Bleuets Secs lake. It forms the prominent ridges and cliffs along the valleys of these waterways. (Plate VII) The strike of the gneissic structure is commonly northeast. Horizontal and vertical jointing structures are prominent.

Lithology. - The gneiss is a medium grained ($2\frac{3}{4}$ mm), well foliated, mottled pink, white or flesh-colored rock. The granite consists essentially of potassic feldspar, oligoclase, quartz, biotite, and / or hornblende and in places microperthite. "Augen" structure, consisting of ovoids of microline one inch

long or rarely three inches long, is fairly common. Gneissoid biotite granite, the most common type, averages 28 per cent biotite. Gneissoid hornblende granite averages 26 per cent hornblende. Quartz makes up about 23 per cent of the gneiss.

Granite

The granite is closely associated with the gneiss, facies of which have been injected, lit-par-lit, by granite and granite pegmatite. The granite forms tabular bodies or domical masses the margins of which generally have gneissic structure. The granite cuts every major rock type in the area and is itself cut in all directions by thin branching dikes of pegmatite and aplite, a few inches to several feet thick and accompanying quartz veins and stringers.

Lithology. - The granite is medium grained, and pink or flesh-colored. Porphyritic facies of the granite have microcline phenocrysts averaging ½ inch diameter. The rock is microcline, quartz, and biotite with small amounts of oligoclase. Biotite averages 10 per cent and quartz 25 per cent of the rock composition.

Pegmatite

Pegmatite dikes and associated quartz veins characteristic of other regions of Precambrian rocks in eastern Canada are found in the region. They vary greatly in thickness, from stringers an inch or less to dikes and sills many feet thick. Two definite types can be recognized, both are pink or red in colour. The first consists almost entirely of feldspar and a small amount of quartz. The second type consists of feldspar with considerable biotite. They are very coarse grained and in parts of the dikes the feldspars attain a length of six inches. Both types are granite pegmatites and are closely related to the pink biotite granite that they cut. In several places pegmatite dikes form steep-sided ridges standing 20 to 30 feet above the adjacent gneiss. The magmatic component of the injection gneiss along the west branch of Rat river is a pegmatite of the quartz-feldspar type.

STRUCTURE

The general structure of the area is complex. Sediments are absent except for a few scattered remnants in the western part of the region. Layers of garnet in garnetiferous gneiss on the Chigoubiche river strike N 25° W. Garnetiferous layers in the paragniess along Murdock road strike N 13° W and dip 45° east. However, layers of garnet in Rat River watershed, 25 miles east, strike N 35° E.

Regional jointing is best seen in its effect on drainage. Most of the lakes and streams as seen from the air trend northwest and northeast. This orientation may be controlled by joints and faults.

Along the Chibougamau road and Mikosas river in the western part of the region the gneissic banding strikes northwesterly. (N 21°- 23°) In the central and eastern region the trend of the gneissic structure is northeasterly except in the vicinity of Au Chien lake at the headquarters of Rat river. Here, the structure is northwesterly. Thus the region can be divided into two structural units by a line drawn west of Rat River watershed passing northeast through its headquarters.

PLEISTOCENE AND RECENT

In the Pleistocene the St. John Lake region was invaded by continental ice sheets which moved in a general southeast direction. Following the retreat of the ice the low ground was occupied by an arm of the Champlain Sea and clays and sands were deposited. Morainic deposits cover the slopes of the rounded hills of the highlands and fill the intervening hollows. Glacial erratics as much as 25 feet diameter are common. (Plate VII) Drumlins occur east and west Jourdain lake. North of Jourdain lake Rat River road follows many eskers across low ground. (Plate VIII)

ECONOMIC GEOLOGY

Deposits of limestone, mica, magnetite, ilmenite and magnetite intergrown with ilmenite are found in the region.

Limestone

The St. Eugene crystalline limestone which is quarried on lot 43 of range IV, Pelletier township, and used for lime by the Lake St. John Power and Paper Company of Dolbeau, has been described by Denis[2].

Mica

Muscovite mica occurring in pegmatite and granite is being mined at the Delisle mine, about 1½ miles southwest of L'ouest lake in Hudon township. This deposit has been examined and described by Bourret.

Titaniferous Iron Ore

Ilmenite and titaniferous iron ore deposits occur in anorthosite and gabbro anorthosite on both sides of Shipshaw lake.

Shipshaw lake, at the headquarters of the Shipshaw river, empties into Pemouscachiou lake to the south. Both lakes and river north of Shipshaw lake lie in a valley whose direction, N 14° E, has been controlled by jointing. Shipshaw lake is seven miles long and varies in width from 500 to 5000 feet, averaging 2200 feet. A few small, bouldery islands, the largest 1500 feet long, occur near the shore of the lake at

its widest part and in the narrows at the south end. The surrounding country is low. The shore is rocky and slopes steeply into deep water. Rock outcrops on the shore line are common but small.

Shipshaw lake is underlain by anorthosite and gabbro anorthosite throughout its entire length with the exception of a body of hornblende gabbro which crops out on the shore east of the narrows. The anorthosite is massive and coarse grained with crystals of labradorite attaining six inches long. The rock is mainly biotite and labradorite. It grades into gabbro anorthosite consisting of labradorite, biotite, hornblende, and pyroxene. Ilmenite and titaniferous iron ore occur as irregular masses and lenticular veinlets, ½ inch thick and several inches long, in anorthosite, gabbro anorthosite and gabbro and appear to have crystallized after the silicates.

Segregations of ilmenite and titaniferous iron ore measuring up to a foot in diameter and making up from five to ten percent of the rock occur at intervals along the shore of Shipshaw lake throughout a distance of six miles. Selected samples of the mineralization analyzed by Price Brothers Lumber Company at Kenogami gave 39 per cent ilmenite and 42 per cent magnetite.

Magnetite Intergrown With Ilmenite

A deposit of titaniferous iron ore occurs on Du Portage river in St. Onge township. It occurs in a disc-shaped body

of amphibolite, 3000 feet long and averaging 350 feet in width, cutting anorthosite, which lies directly south of and parallel to Du Portage river at the ecluse $\frac{1}{4}$ mile south of the Alex road. The amphibolite trends N 30° E. (Plate X), To the south it terminates abruptly against anorthosite at a north-south fault dipping 55° west. To the north it pinches out and disappears at the shore of the lake expansion of Du Portage river. At its south extremity the amphibolite dips 15° to the northeast and resembles a sill intruding the anorthosite.

The occurrence of magnetite mixed with hornblende and pyroxene and in almost pure dikelets in the amphibolite indicates a deep-seated differentiation and injection mode of origin. The host rock may have been a lamprophyre sill or flat-lying dike intruding the anorthosite.

Neither magnetite nor ilmenite occur in the adjacent anorthosite. Grab samples of magnetite-rich amphibolite assayed 23.4 per cent iron.

Magnetic Anomalies

Strong local magnetic anomalies have been known to exist in the area east of Lake Onatchiway since 1923 when C. P. Berkey( ) of Columbia University organized an expedition to investigate the mineral resources of the St. John Lake district.

Additional work in the area carried out by G. W. Waddington in 1943 for the Quebec Department of Mines and the engineers for Price Brothers Lumber Company indicated the presence of three large zones of magnetic anomaly. The location of these zones is shown on the accompanying topographical map compiled by the engineering staff of the Chicoutimi Office of Price Brothers Lumber Company.

The main zone is in the form of a band, one to two miles wide, extending in a direction N 15° E from Fire Tower No. 4 on Lake Onatchiway to Lac Grand, a distance of roughly 20 miles. Three traverses were run to cross this band from east to west. One from the Lac Ross road to the fire tower; one from Lac au Poivre down the Beauchêne river to Lac Onatchiway; and one from Lac Louise down the Francois Gagnon river to Lac Onatchiway. Strong local attraction (20° horizontal deflection) was encountered 6000 feet east of the fire tower. There were no outcrops in the vicinity of the magnetic attraction, the nearest consolidated rock being the anorthosite mass at the fire tower about a mile west of the magnetic anomalie. No magnetic attraction nor magnetic minerals were observed on either of the other two traverses.

The other two zones, roughly 5 miles long and one mile wide, are located west of Lac au Poivre and at the headwaters of the La Hache river and Creek Rough.

The Lac au Poivre zone, trending N 20° W, crosses the southwest arm of the lake. Anorthosite float on the shore of Lac au Poivre is occasionally mineralized with narrow stringers of magnetite. Similar deposits probably derived from the Lake Shipshaw ilmenite and titaniferous magnetite band or its equivalent to the north and transported southward by glacial ice may account for the magnetic anomalies in the area.

The La Hache. - Creek Rough zone parallels the main band and is underlain by hornblende syenite. Three traverses across this zone, down the La Hache river and Creek Rough failed to locate strong local magnetic attraction. At one point where a slight local horizontal deflection of the compass needle was noted no rock outcrops were available for examination.

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