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Preliminary report on Gabriel lake area (west half), New Quebec

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GEOLOGICAL SURVEYS BRANCH

PRELIMINARY REPORT

ON

GABRIEL LAKE AREA (WEST HALF)

NEW QUEBEC

BY

LÉOPOLD GÉLINAS

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INTRODUCTION

The west half of Gabriel Lake area, mapped by the writer during the summer of 1957, comprises 160 square miles bounded by longitudes 68°45' and 69°00' and latitudes 58°00' and 58°15'. It lies east of Thévenet Lake area (East Half) of Gélinas (1958). The centre of the area is about 18 miles west of Fort Chimo and 700 miles north of Roberval.

Fort Chimo is located on the west bank of Koksoak river, 30 miles upstream from Ungava bay. It is easily accessible by boat during the short navigation season and is linked with Roberval and Montreal by a regular airplane service. Also, there is a hydroplane base on Stewart lake, about 3 miles to the west. A road, built by the Quebec Department of Mines in the fall of 1957, links the hydroplane base with the airport and village.

The northern and central parts of Gabriel Lake area are accessible by hydroplane, with landings possible on Fortin and Green lakes. The southern part of the area is accessible by canoe either from Green lake or by Koksoak river.The southeastern corner of the map-area is 16 miles up Koksoak river from Fort Chimo. The interior of the area is inaccessible by water.

TOPOGRAPHY

The highest hills, rising slightly more than 800 feet above sea-level,are in the eastern part of the area. East of Turcotte lake, quartz-feldspar gneiss forms a plateau which extends two miles into the adjacent area to the east and almost to the southern limit of the present area. North of Turcotte lake, however, this gneiss is covered by a thick sheet of glacial drift. The gneiss on this plateau forms low and continuous ridges which outline the trend of the structure.

From Green lake to the northwest corner of the map-area, ridges of amphibolite alternate with narrow, steep valleys underlain either by biotite schist or by shear zones in the amphibolite.

A broad valley extends from the southern border of the area to Green lake. From Green lake, the main valley extends northwest into Thévenet Lake area (East Half).

In the southern part of the area, on the western side of the main valley, two terraces dip gently toward the valley floor. The main valley floor is characterized by a small clay belt in which Cailloux brook flows.

The southwestern part of the area is covered by a thick mantle of glacial drift. Here the topography is gentle, with the exception of two major north-south valleys and prominent high exposures of gneiss in the south.

GENERAL GEOLOGY

General Statement

All the consolidated rocks of the area are of Precambrian age. The southern part is underlain mainly by pink and grey gneiss and a relatively narrow belt of biotite schist. The eastern part is underlain mainly by grey gneiss. Between these areas of gneiss is a sector, narrow in the south but wider in the centre and north, consisting mainly of a great variety of schists. Of these, biotite-muscovite schist (with or without garnet), diopside-biotite schist, and sillimanite schist are the most common. Quartzose gneiss, impure dolomitic marble and calc-silicate rock are also present in this sector.

All these gneisses and schists have layers of amphibolite of varying thickness parallel to the schistosity. In general, the amphibolite layers are thinner in the gneisses than in the schists.

Several dykes of pegmatite cut this complex.

TABLE OF FORMATIONS

Pleistocene and Recent	Sand, gravel, erratic boulders, and clay	
Precambrian	PEGMATITE	
	AMPHIBOLITE	Blotchy amphibolite, diopsidic amphibolite, ultramafic amphibolite, amphibolite with or without garnet
	SCHIST and GNEISS	Quartz-feldspar gneiss, quartzose gneiss, quartzite, iron formation, biotite-diopside schist, calc-silicate rock, impure dolomitic marble, nodular sillimanite biotite-muscovite schist with or without garnet, biotite-muscovite schist with traces of sillimanite and garnet, biotite-muscovite schist with or without garnet
	Major Unconformity ? ? ? ? ?	
	PINK and GREY GNEISS	Pink gneiss (quartz, microcline, plagioclase with minor biotite), Grey gneiss (quartz, plagioclase with minor biotite)

PRECAMBRIAN

Pink and Grey Gneisses

Pink and grey gneisses outcrop in the southern part of the area, and usually occur in alternating zones 20 to 40 feet wide. These layers form flat ridges which perfectly outline the structure of the bedrock. Most of the area south of the schist belt consists of grey gneiss.

Much of the pink gneiss consists of pink and grey layers about an inch thick. The most common minerals are quartz, plagioclase, microcline, and biotite. The pink layers generally have a higher percentage of microcline and a lower percentage of biotite than the grey layers. In places the gneissosity is very weakly developed and can only be distinguished by the arrangement of minor amounts of biotite.

The grey gneiss also is in layers about an inch thick. It is medium to coarse in grain, and composed of quartz, plagioclase, and traces of biotite. Variation in the percentage of biotite characterizes the gneissosity.

Common accessory minerals in both the pink and grey gneisses are: hornblende, sphene, zircon, apatite, and chlorite. Flakes of muscovite are present throughout.

Many contacts between grey gneiss and pink gneiss are gradational, and colour variations do not necessarily imply different compositions.

SCHISTS and GNEISSES

Biotite-muscovite schists are common in the central part of the area. They occur northwest of Green lake in a valley which extends into Thévenet Lake area, and also north of the lake where they are intercalated with layers of amphibolite. These biotite-muscovite schists are similar to those in the southern part of the area, in the schist belt between the pink and grey gneiss areas.

The rocks are grey, medium-grained and highly schistose. They consist of alternating layers, rich and poor in biotite, and varying from dark grey to blue grey. The schistosity planes are parallel to this layering. Lenses of coarse-grained quartz, and a few small agglomerations of microcline, occur between the schistosity planes. The lenses are 3 to 10 inches long and average 2 to 4 inches thick.

The main constituents of the biotite-muscovite schist are, in order of decreasing percentage: quartz, plagioclase, biotite, and muscovite. The accessory minerals are epidote, sphene, chlorite, and pyrite. Red garnets are present locally.

In the southern part of the area, some calc-silicate rock is associated with the biotite-muscovite schist.

Variation of the biotite-muscovite schist include, in particular, nodular sillimanite schist and schist with traces of sillimanite. The former occurs in

several places in the central sector of the area, east of Cailloux brook in the south where it forms a prominent flat ridge, and in two bands northeast of Green lake. The latter schist type has three main occurrences: near Hay lake, 3 miles east of Fortin lake, and south of Turcotte lake. These schists differ little except in the proportion of sillimanite nodules.

The nodular sillimanite schist generally weathers rusty brown to a depth of several inches. The fresh rock is light grey, coarse-grained, and has thin lenses and irregular patches rich in biotite. The schistosity planes are wavy. The schist with traces of sillimanite is medium to coarse in grain, and is characterized by the absence of layers (obliterated during the process of crystallization and the formation of a well-developed schistosity).

The nodules of sillimanite are white, ¼-inch to 2 inches in diameter, oblate and resistant to weathering. Their boundaries with the matrix are sharp. In some exposures, a thin envelope of biotite flakes is wrapped around the nodule, and, in a few other places, the envelope consists of muscovite. The nodules are generally an agglomeration of quartz grains and sillimanite.

In some places, the nodules of quartz and sillimanite have in their centres a small garnet of about 1/8-inch diameter. Commonly these garnets weather out, leaving cavities with several facets. This texture is the main characteristic of the nodular sillimanite schist occurring in the valley northeast of Green lake, and was noted, also, on the east side of Cailloux brook 2 miles north of the southern boundary.

The few thin sections of this rock studied indicate that the main minerals present are quartz, plagioclase and biotite, with muscovite, sillimanite, and garnet as accessories. The garnet occurs inside the nodules and also in the matrix. Sillimanite is also closely associated with biotite, where it occurs between the cleavage planes, and needles of sillimanite form rosette textures in some of the biotite flakes.

Impure dolomitic marble. Two layers of dolomitic marble outcrop northeast of Green lake. One extends to the north, beyond the area; the other layer is discontinuous and could not be traced north of Fortin lake. Two small exposures of impure dolomitic marble are present in the southwestern part of the area in the biotite schist belt, where they are in contact with the pink and grey gneiss. A thin lentil of impure dolomitic marble outcrops northeast of Murray lake close to the quartz-feldspar gneiss contact.

The dolomitic marble is medium-grained, well foliated and either white or orange on the weathered surface. It contains scattered clusters of white tremolite or light green actinolite. Fine-grained, laminated quartzite, in layers from less than an inch to about 6 inches thick, parallels the foliation. All the quartzite is bordered by a reaction rim of diopside which isolates it fron the dolomitic marble.

Northeast of Green lake, the reaction of dolomitic marble with the quartzite band results in layers of diopside without any quartz. However, several layers of diopside have in their central parts a thin band of quartzite or a series of lenses. The diopside grains are usually ½ to 1 inch long. The parting of the mineral is well developed and, as a result, on the weathered surface, each grain of diopside looks like a package of blades. Each blade, about 1/16-inch thick, forms a very narrow ridge on the grain surface, often with slight displacement along the parting.

A few veins of diopside cut the layers of diopsidic quartzite. They are about 6 inches thick and a few have small lenses of quartz.

Biotite-diopside schists outcrop in the southern part of the area east of Cailloux brook, southeast of Green lake, west of Turcotte lake (one band), and as small occurrences here and there in the other schists of the area.

The rock weathers dark grey. It is characterized by thin lenses rich in quartz which stand out in a matrix composed mainly of quartz, plagioclase, biotite, calcite, diopside and actinolite.

In a few places, these schists are in sharp contact with nodular sillimanite schists. They also occur with quartzose gneiss, calc-silicate rock and biotite-muscovite schist, with either sharp or gradational contacts.

Quartzose gneiss forms a continuous unit extending from the southeast corner to the northwest corner of the area. The outcrop is relatively narrow in the south, wider west of Turcotte lake, and widest east of Fortin lake. Layers of quartzose gneiss occur in nodular sillimanite schist, east of Murray lake and north of Fortin lake. Small lentils of quartzose gneiss are found in schist along the eastern side of Cailloux brook.

The quartzose gneiss is medium- to coarse-grained, with plagioclase and quartz grains ranging in diameter from 1/8 to 1/4 inch. The gneiss has a relatively high percentage of quartz compared with plagioclase; locally, it grades into an impure quartzite. Biotite and muscovite are the usual minor minerals; however, northeast of Fortin lake, there is a high percentage of calcite, diopside and actinolite, and east of Green lake, a few nodules of sillimanite were seen.

Evidences that the quartzose gneiss has a sedimentary origin are as follows:

1. Its high percentage of quartz; in a few places the gneiss grades into an impure quartzite.

2. The existence of a wide variation in the percentage of the constituent minerals along the strike and across the strike.

3. Northeast of Fortin lake, no sharp contact exists between biotite schist and quartzose gneiss. Some interlayers and common interlenses (3 to 7 inches long) of biotite schist are present in the quartzose gneiss and parallel the gneissosity.

4. The local occurrences of nodules of sillimanite and the irregular distribution in the quartzose gneiss of diopside, calcite and actinolite also support a sedimentary origin.

5. The inequigranular size of the constituent minerals could be a relict structure of the arenaceous sediments.

Quartz-feldspar gneiss. This gneiss forms a continuous belt along the eastern boundary of the map-area. It also occurs, along with a variety of biotite schists, 2 miles east of Fortin lake.

The quartz-feldspar gneiss is grey and medium- to coarse-grained. On the weathered surface, the gneissosity is brought out by alternating resistant and less

resistant layers averaging 2 inches thick. Southwest of Raphael lake, thick layers of quartz-feldspar gneiss alternate with lentils 5 to 10 feet thick of grey gneiss with abundant diopside and actinolite. The contact between layers and lentils is gradational.

A thin iron formation, about 3,000 feet long, occurs in the quartz-feldspar gneiss 3 miles east of Fortin lake, and suggests that this gneiss is of sedimentary origin. Such an origin also is suggested by the presence of a band of quartzite 2 miles south of Hay lake, of lentils rich in diopside, calcite and actinolite, and of a few nodules of sillimanite.

Augen gneiss. This gneiss outcrops 4 miles east of Fortin lake and also in the northeast corner of the area. The augen consist of lenticular aggregates of feldspar crystals enclosed in a grey gneiss matrix. They have an average diameter of one inch and comprise 10 to 20 per cent of the rock volume.

AMPHIBOLITE

Amphibolite layers are present in all the mapped units of the area. The average thickness of the layers is 60 feet, but, in some places in the schist area, they are as much as 1,000 feet thick. The layers of amphibolite are generally parallel to the schistosity of the adjacent rocks, and the contacts are straight and well defined. In general, also, the individual layers are homogeneous mineralogically. Scattered white streaks of quartz and feldspar in the dark green matrix of medium- to fine-grained hornblende parallel the contacts of the layers.

North of Green lake and to the northwest corner of the area, the amphibolites are characterized by two types of alternating layers. One type, averaging 20 to 30 feet thick, is mineralogically homogeneous. It is highly schistose for the most part. The other type, also approximately 20 to 30 feet thick, is characterized by well-marked light and green layers about one inch thick.

The amphibolites consist of medium- to coarse-grained hornblende with streaks of plagioclase, biotite, and quartz. Much of the hornblende contains rounded inclusions of quartz and a minor amount of sphene, allanite and clinozoisite. Minute flakes of muscovite are scattered throughout the plagioclase grains. Traces of chlorite are common between small books of biotite. Apatite and zircon are rare; garnet is present in some samples.

Ultramafic amphibolites are closely associated with the thicker layers of amphibolite and, in some cases, the contacts between the two are sharp. Northwest of Fortin lake and north of Hay lake, the ultramafics occur as irregular bodies within the amphibolite layers. In two occurrences, west of Fortin lake and again southeast of Green lake, lenses of ultramafics parallel the schistosity of the biotite schist. The ultramafic amphibolite is massive. It is green on the fresh surface and reddish brown on the weathered surface. Locally, however, it grades to a pale greenish white.

Diopsidic amphibolite outcrops in the southern part of the area on the west side of Cailloux brook as a large band within dark green amphibolite. It is characterized by thin layers and lenses of green needles of hornblende set in a medium-grained matrix consisting of diopsidic grains with white streaks of quartz and feldspar. The lenses are 3 to 8 inches long, and have sharp contacts.

Blotchy amphibolite (leopard amphibolite) outcrops at the northern boundary of the area, due north of Fortin lake, and extends southward about half a mile. The blotchy amphibolites are characterized by white spots of clinozoisite, feldspar and tiny needles of amphibolite set in a medium-grained matrix of hornblende, biotite, and feldspar.

Most of the amphibolites described above are believed to be the metamorphic equivalents of gabbro sills; some may have been of volcanic origin.

PEGMATITE

Pegmatite dykes are common in this area, more so than in the adjacent area to the west (Gélinas, 1958). Northwest of Fortin lake, large and persistent pegmatite dykes cut the schists. Generally, these either parallel the schistosity or cut it at a slight angle, although many are almost at right angles to the schistosity.

The emplacement of many of the pegmatites was structurally controlled. About one mile north of the southern border, on the western side of Cailloux brook, a large pegmatite dyke coincides with a fault plane. One mile farther north, on the eastern side of Cailloux brook, a pegmatite outcrops along the axis of a tight minor fold. In the northeast corner of the area, several pegmatite dykes occur in a zone of tight folds, perpendicular to the fold axes.

Commonly, the pegmatites in the gneisses are pink, and those in the schists are white. The pink colour generally coincides with a higher percentage of potash feldspar. However, the pink may change along strike to white without any mineralogical variation. The fact remains, however, that about 85 per cent of the pegmatites occurring in the gneisses have a pink color.

A few pegmatites, near the eastern boundary, are zoned, with a white margin consisting of medium- to coarse-grained quartz and feldspar, and a pink inner zone consisting mainly of microcline with few blebs of quartz.

Near the southern boundary, on the west bank of Cailloux brook, several pegmatite dykes parallel the schistosity. Perpendicular to their trend, and restricted to the dykes, are wide lenses of quartz that extend from wall to wall.

PLEISTOCENE

The Pleistocene glaciers crossed the area in a direction approximately N.10°W., as attested by striae, "roches moutonnées", and boulder trains. Divergences in this general trend usually are caused by topographic irregularities such as ridges and valleys.

Except for a few scattered erratics of known source, the tops of the ridges are generally bare. The valleys are floored by glacial drift. The southern part of the map-area and also a wide area in the northeast are blanketed with sand and gravel.

METAMORPHISM

All the schists of the Gabriel Lake area are sedimentary rocks of the Labrador Trough that have been subjected to a higher grade of metamorphism than rocks in the rest of the Trough to the west. In the eastern part of the area, the quartzose gneisses are intimately associated with the schists, and almost certainly were derived from sedimentary rocks of the Labrador Trough. The quartz-feldspar gneisses near the eastern boundary are also assumed to have been derived from sedimentary rocks of the Trough. The origin of the pink and grey gneisses in the southwest corner of the area is less certain.

Most of the schists, and probably all the gneisses of Gabriel Lake area, belong to the sillimanite zone of metamorphism. The biotite-muscovite schists near the southwest corner of the area, and also those underlying the valley west of Green lake, may also belong to this zone. However, a few garnets constitute the only index mineral found in these two areas.

STRUCTURE

Schistosity, gneissosity, lineation. The orientation of the gneissosity and schistosity reflects the folded structure of the area. The schistosity planes are always parallel to the bedding, wherever observed. The lineation trends southeasterly and plunges at 25° to 35° in that direction.

Folds. The major structural feature of the area southwest of Green lake is the southern part of a major doubly-plunging anticline. This anticline plunges about 30° to the southeast, and the northern extension of it, in Thévenet Lake area (East Half), plunges northwest. The anticline has a core of pink and grey gneisses and flanks of schists.

On the south limb of this anticline in Thévenet Lake area (East Half), the gneisses and schists dip about 80° southwest. Near the western boundary of Gabriel Lake area, the dip changes to about 80° northeast, and farther southeast, in Gabriel Lake area itself, the dip is about 45° to the northeast.

In the vicinity of Hay lake, two synclines and two anticlines plunge at angles of 15° to 25° to the east. Broad in their western extremities, these folds are tightly compressed near the eastern boundary of the area. Farther south, the quartz-feldspar gneisses are folded into a series of minor folds with axes plunging towards the east.

Faults. The few faults noted in Gabriel Lake area are transverse and displace schists and amphibolites a matter of 2,000 feet or less. One, north of Green lake, is marked by a narrow valley. This fault can be traced more than 6 miles. At its western end, a short subsidiary fault branches to the west-southwest. Both the main and the subsidiary fault die out in the valley northwest of Green lake.

North of Green lake, a few amphibolite layers adjoining the fault are brecciated and show considerable drag.

ECONOMIC GEOLOGY

One mile west of Cailloux brook, near the southern boundary, massive limonite occurs in the schist near an amphibolite layer. North of Green lake, a few mineralized shear zones are found within amphibolite and, at several places, disseminated chalcopyrite, pyrite, and pyrrhotite also occur in amphibolite.

Lenses of iron formation are present but are poorly exposed and have a low magnetite content.

REFERENCES

Gélinas, L. 1958: Thévenet Lake Area (East Half), New Quebec; Que. Dep't Mines, P. R. 373