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PRELIMINARY REPORT ON THE GABRIEL LAKE AREA (EAST PART) AND THE FORT CHIMO AREA (WEST PART), NEW QUEBEC

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GEOLOGICAL SURVEYS BRANCH

PRELIMINARY REPORT
ON THE
GABRIEL LAKE AREA (EAST PART)
AND THE
FORT CHIMO AREA (WEST PART)
NEW QUEBEC

BY
LÉOPOLD GÉLINAS



QUEBEC
1960

PRELIMINARY REPORT*

on the

GABRIEL LAKE AREA (EAST PART)

and the

FORT CHIMO AREA (WEST PART)

by

Léopold Gélinas

INTRODUCTION

The area mapped during the summer of 1958 includes the eastern part of the Gabriel Lake topographic sheet and the western part of the Fort Chimo topographic sheet. It is bounded by longitudes $68^{\circ}15'$ and $68^{\circ}45'$ and by latitudes $58^{\circ}00'$ and $58^{\circ}15'$ and comprises 320 square miles.

Chimo, situated on the west bank of Koksoak river approximately 30 miles from Ungava bay and 800 miles north of Quebec City, is the most active centre in the region. It is the site of an air base, which was built by the American army during World War II and where more than 1,000 men were stationed. The base was handed over to the Canadian Government at the close of the war. Since that time most of the barracks have been demolished and an Eskimo village has been built on the site. A meteorological station is located nearby. Fort Chimo is on the east bank of Koksoak river, 5 miles down-stream from Chimo. Since September 1959, however, the Eskimos have settled in ever-increasing numbers on the west bank of Koksoak river.

A regular air service connects Chimo and Montreal via Roberval. The area is also accessible by sea during the navigation season, which extends from July 15th to the end of September. A float-plane base is located on Stewart lake, 8 miles north of Chimo. A road built by the Department of Mines in the autumn of 1957 connects the airport at Chimo with Stewart lake. Travel

* Translated from the French.

within the area is very easy. The southern and eastern limits can be reached via Koksoak river, which is navigable throughout the area. Float-planes have no difficulty landing on Gabriel lake.

GENERAL GEOLOGY

All consolidated rocks of the area are Precambrian. The western part is underlain mainly by quartzofeldspathic gneisses. The central part is occupied by a large dome of quartzofeldspathic gneisses. This is surrounded by biotite-rich gneisses, garnetiferous in places, and associated with thin layers of amphibolite, impure dolomite and quartzite. Biotite gneisses with microcline porphyroblasts are also found in the central core. The eastern part is underlain mostly by pegmatite.

A few pegmatite dykes are found in the western part of the area. They become more and more numerous towards the Stewart Lake dome. Here the dykes are narrow and form part of a very complex network. East of Stewart lake, the pegmatites are dominant and, in some places, constitute more than 85 per cent of the exposures. Remnants of gneiss appear amongst the pegmatites.

Diabase dykes cut the gneissic complex and the pegmatites near Koksoak river.

Regional metamorphism in the area is high grade, as is indicated by the presence of olivine and diopside in the impure dolomites, hypersthene in the amphibolite, and sillimanite in the schists.

Table of Formations

Pleistocene and Recent	Sand, gravel, erratic blocks and clay	
Precambrian	Diabase	
	Pegmatite	Pegmatite with or without sillimanite. Quartzofeldspathic veins with nodules of sillimanite
	Amphibolite	Amphibolite with or without garnet Amphibolite with hypersthene
	Gneisses and Schists	<u>Gneiss rich in biotite:</u> with or without garnet, with or without porphyroblasts of microcline. Quartzite; impure dolomite (with olivine, diopside and actinolite); biotite schist with nodules of sillimanite; epidote- bearing quartzofeldspathic gneisses; quartzofeldspathic gneisses
	Unconformity?	
	Gneiss	Quartzofeldspathic gneisses.

PRECAMBRIAN

Quartzofeldspathic Gneisses

Quartzofeldspathic gneisses predominate in the western part of the area and in the centre of the Stewart Lake dome. They also occur as remnants in the pegmatites east of Stewart lake.

The gneisses are greyish-white or red, and both varieties are found in the same outcrop in many places. The variation in colour does not necessarily indicate a difference in mineralogic composition. The gneisses in the western part of the area are well-layered, whereas only a few of those in the Stewart Lake dome show good layering. The layers are several inches thick and are distinguished from one another by variations in the percentage of biotite. All outcrops, however, possess a good schistosity.

The quartzofeldspathic gneisses are composed of 40%-70% quartz, 20%-40% feldspar, 5% or less biotite, hornblende in some places, and such accessories as sphene, allanite, zircon, apatite, and magnetite. Oligoclase is the more abundant of the two feldspars (oligoclase and microcline).

In the western part of the area, layers of gneiss rich in diopside, actinolite and calcite are interlayered with the quartzofeldspathic gneisses. The layers are several feet thick. One large layer of garnetiferous biotite schist, containing nodules of sillimanite, outcrops within the quartzofeldspathic gneisses in the southwest corner of the area. Between Stewart lake and Fort Chimo numerous quartzite lenses are found parallel to the gneissosity of the quartzofeldspathic gneisses. The thickness of these quartzite layers generally ranges from 4 to 8 inches, but some layers are as much as 25 feet thick in places.

Gneisses and Schists

Gneisses rich in biotite, sometimes garnetiferous, surround the Stewart Lake dome. They also occupy a large portion of the region southwest of Chimo. Several lenses are found between Stewart lake and Koksoak river, and a large bed occurs in the southwest corner of the area.

The gneisses have a rusty-brown weathered surface and a greyish-blue fresh surface. They are well-layered. The layers are distinguished by differing percentages of biotite. Small eyes of microcline, one-half inch in diameter, are found in the layers and, in some places, layers 3 to 6 inches thick are composed almost entirely of these eyes. Individual layers can be traced 15 or more feet in some exposures.

Quartz is usually the predominant mineral of the biotite-rich gneisses, comprising 30 to 50 per cent of the rock. The other essential minerals are oligoclase (20 to 40%), microcline (less than 10%, except in the augen facies where it is more than 25 per cent), biotite (10 to 25%), and hornblende (less than 3%). The accessory minerals are apatite, epidote, zircon, sphene, allanite and pyrite.

The biotite-rich gneiss is garnetiferous in places, but the amount of garnet rarely exceeds 5 per cent.

Southwest and north of Chimo and northwest of Stewart lake similar gneisses are found. They are distinguished from those previously described by the presence of microcline porphyroblasts scattered uniformly throughout the rock. The long dimension of the porphyroblasts ranges from one to two inches. The matrix of these gneisses has essentially the same composition as that of the other biotite gneisses. The only variation is the constant presence of disseminated garnets.

In several places the porphyroblasts form distinct eyes and the rock is a typical augen gneiss. Many of the augen are composed of microcline grains surrounded by myrmekite. The augen gneisses contain more microcline than the prophyroblastic gneisses described above.

The epidote quartzofeldspathic gneisses outcrop in a band about 2 miles west of Chimo. This gneiss is pale rose or grey and is generally well-layered; however, the layering is locally obscured by porphyroblasts of hornblende and feldspar.

The essential minerals are, in order of importance, quartz, plagioclase, biotite, microcline, epidote, hornblende, and a clinopyroxene, probably diopside. The accessory minerals are zircon, sphene, allanite and apatite.

The garnetiferous biotite schist with nodules of sillimanite outcrops 3 miles west of Chimo on the south bank of Koksoak river. The schist is greyish-blue, fine-grained and well-layered. In some places the layers are several inches thick and are easily distinguished from one another by variations in the percentage of biotite. The sillimanite nodules are white and protrude here and there from the weathered surface.

The essential minerals are quartz, plagioclase, microcline, biotite, muscovite, and, in some places, garnet. The muscovite is found as large leaves or as small agglomerations disseminated in the schists. It is also found associated with the sillimanite in the nodules. The large leaves cut across the schistosity of the rocks. The sillimanite in the nodules is mostly of the 'fibrolite' variety.

The garnetiferous biotite schists are intimat-

ely associated with the nodular schists. They are found east of Gabriel lake, and differ from those described above only in the absence of muscovite and sillimanite nodules.

Dolomite and Quartzite

Many bands of impure dolomite outcrop among the biotite-rich gneisses without microcline porphyroblasts and among the schists that are to be described below. The bands are lenticular and are rarely more than 3 feet thick. They are creamy yellow or, in places, orange. Dolomite and calcite are the principal constituents. Yellowy-orange and some green grains of serpentine are plentiful. Diopside and actinolite are also present. Under the microscope most of the serpentine grains were seen to enclose olivine.

Several beds of quartzite outcrop among the gneisses and schists. Their average thickness is approximately 6 inches, but some beds are 4 to 5 feet thick.

Amphibolite

Bands of amphibolite are widespread within the gneisses and schists and are most common in the biotite gneiss. Many are too thin to be shown on the accompanying map. Only one small exposure was observed in the quartzofeldspathic gneisses of the Stewart Lake dome. With rare exceptions, the bands of amphibolite are parallel to the layering of the gneiss, and the contacts with the bordering rocks are distinct. A few amphibolite beds cut the layering in the southwest corner of the area.

The amphibolites are mainly composed of hornblende, accompanied by plagioclase, quartz, microcline and biotite. Epidote, apatite and zircon are the accessory minerals. Some of the amphibolites are completely devoid of garnets; others contain many.

On the east bank of Koksoak river, 2 miles south of Fort Chimo, a large band of amphibolite contains several hypersthene crystals. In the vicinity of Chimo, a thin band of amphibolite contains grains of a clinopyroxene in addition to the hornblende.

Pegmatite

Pegmatites are abundant in the area. Dykes, found in the western and central parts, become gradually more numerous as the centre of the area is approached. In the western part of the area and west of Chimo the pegmatites occur as isolated dykes more than 100 feet thick. Among the quartzofeldspathic gneisses west of Stewart lake, the dykes are less than 4 feet thick and occur in complicated networks. The pegmatites in the eastern half of the area form great, multiple-branching masses.

The most important of these is between Stewart lake and Koksoak river. Here, the gneisses that outcrop between the pegmatites constitute less than 20 per cent of the total mass. A smaller mass is found east of Koksoak river, north of latitude $68^{\circ}20'$, and still smaller masses occur in the southeast corner of the area. The thicknesses of the dykes in these masses varies from several feet to about 100 feet.

Quartzofeldspathic Dykes with Sillimanite Nodules

Dykes with nodules of sillimanite outcrop in the vicinity of Chimo. They distinctly cut the schistosity and bedding of the intruded rocks. Their dips vary between 38 degrees and vertical. The matrix containing the nodules is composed of an equigranular aggregate of quartz and feldspar with small, scattered leaves of biotite and muscovite. Both microcline and oligoclase are present. Grains of zircon and garnet, as well as rosettes of sillimanite, are also present.

The nodules of sillimanite are clearly visible on the weathered surface of the dykes. They are ellipsoidal and have a common orientation within a dyke. The contact between the nodules and the matrix is sharp and is easily distinguished with the naked eye. The nodules are composed of an aggregate of quartz grains and are full of colourless sillimanite needles which occur as fibrous trains enveloping the quartz grains. The trains are pale brown and consist of compact bundles of thin sillimanite fibers. Alongside the trains, acicular crystals of sillimanite appear in random orientation and penetrate the adjacent quartz grains. The percentage of sillimanite in the nodules varies between 30 and 45; that of the quartz, between 55 and 70. Small leaves of biotite with hazy contacts appear in the sillimanite. In some places muscovite forms a thin fringe around the borders of the nodules and is also found on the borders of the fibrous trains. It occurs as scattered tufts within the nodules. Grains of zircon and garnet were noted in some nodules.

Diabase

On the west bank of Koksoak river, dykes of diabase cut the gneissic complex. Many dykes also outcrop around the village of Fort Chimo. The dykes vary in length, as exposed, from 100 feet or less to more than one mile, and the thickness also is variable. The diabase is reddish brown on weathered surface, greenish black on fresh surface, and generally fine-grained, although, in places, it is coarse-grained.

PLEISTOCENE

The Pleistocene glaciers crossed the region from south to north. This is indicated by the direction of

glacial striae and by the distribution of erratic blocks. With the exception of glacial erratics of known source, the summits of the hills are bare and some are polished. The northwest part of the area is covered by a sandy deposit dotted with lakes of different shapes. A sandy terrace was observed about two miles west of Stewart lake. A level about 50 feet high and marked by discontinuous terraces is present along both banks of Koksoak river. On the north bank of Koksoak river a second terrace, at an elevation of 150 feet, rests on bedrock. Many small terraces were noted between the two main ones. On the south shore of the Koksoak, a terrace, at an elevation of 150 feet, covers a large portion of the gneissic complex. It is discontinuous and is probably an extension of the terrace observed east of the village of Fort Chimo, which is roughly at the same elevation.

The terraces are composed mainly of sand and gravel with some large boulders, and their surfaces are covered by large erratics.

METAMORPHISM

The regional metamorphism in the area is high grade, as indicated by examination of the three main varieties of rock. The impure dolomites contain actinolite, diopside and olivine. Olivine was not observed in the dolomites in adjacent areas to the west. A band of amphibolite was found with hypersthene in excess of hornblende. Sillimanite-garnet gneisses outcrop southeast of Gabriel lake. Finally, the abundance of microcline porphyroblasts in the biotite gneisses with complete absence of muscovite suggests a high metamorphic grade.

STRUCTURE

Schistosity and Bedding

The schistosity of the gneisses and schists of the area is parallel to the bedding. This observation is confirmed from the northern part of the region at the periphery of the Stewart Lake dome. Here, the schistosity and the bedding reflect the plunge of the folds.

Folds

The Stewart Lake dome was the only fold identified with certainty. It is inclined to the northeast. Many minor folds complicate the southeast end. Several secondary folds affect the eastern flank.

There is a strong possibility that the quartzofeldspathic gneisses that outcrop in the western part of the area occupy the centre of a major anticline. The sillimanite- and garnet-bearing schists that outcrop six miles southeast of Gabriel lake are probably in an extension of the synclorium mapped in the northeast corner of the adjacent region (Gélinas, 1958).

The structure of that part of the area east of Stewart lake is not entirely known. The hinge of the important folds is outside of the area mapped. Many northwesterly-trending secondary folds were observed despite the pegmatitic masses that tend to obscure the structure.

Stratigraphy and Correlation

The presence of quartzofeldspathic gneisses in the centre of the Stewart Lake dome offers a possibility of correlation with the quartzofeldspathic gneisses outcropping in the domes of the west half of the Gabriel Lake area (Gélinas, 1958) and of the east half of the Thévenet Lake area (Gélinas, 1958). All of these gneisses possess common lithologic characters. If this correlation is accepted, the gneisses rich in biotite and garnet, which overlie the quartzofeldspathic gneisses, are lithologic equivalents of the biotite and muscovite schists in the adjacent areas. The gneisses rich in biotite and garnet, with their lenses and thin bands of impure dolomite and quartzite, constitute a lithologic assemblage similar in all respects to the biotite and muscovite schists. However, muscovite is absent in most of the gneisses that surround the Stewart Lake dome. It is substituted for by a small amount of hornblende that crystallized when the quantity of alumina in the gneiss became less than the total quantity of soda, potash and lime. It is also true that the presence of the microcline porphyroblasts compensates for the absence of muscovite in the area. When muscovite becomes unstable, microcline porphyroblasts are able to form. The excess alumina is then distributed amongst the neighbouring ferromagnesian.

It is, therefore, possible that the biotite and muscovite schists in the adjacent areas extend into the Fort Chimo area. This would also indicate that the sequence of gneisses rich in biotite and garnet, with or without microcline porphyroblasts, is the metamorphic equivalent of the sedimentary rocks of the Labrador geosyncline, or trough, since the biotite and muscovite schists undoubtedly belong to the "Labrador geosyncline or trough".

ECONOMIC GEOLOGY

A pronounced rusted zone appears in the biotite-rich gneisses one mile southeast of Gabriel lake. Numerous traces of pyrite were observed in the vicinity of Chimo. None of the pegmatites examined contained any minerals of economic interest. The terraces are composed of sand and gravel and are described in the section on Pleistocene.

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