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Preliminary report on De Freneuse lake area (east half), New Quebec

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PRELIMINARY REPORT

ON

DE FRENEUSE LAKE AREA (EAST HALF)

NEW QUEBEC

BY

PIERRE SAUVÉ

QUEBEC
1957

P. R. No. 358

M-D-4532

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DE FRENEUSE LAKE AREA (EAST HALF), NEW QUEBEC

by

Pierre Sauvé

INTRODUCTION

The east half of De Freneuse Lake area in the Territory of New Quebec, includes approximately 160 square miles, bounded by longitudes 69°00' and 69°15' and by latitudes 58°15' and 58°30'. Its centre is 30 miles northwest of Fort Chimo airport. The area is best reached by float plane from Stewart lake, three miles northwest of Fort Chimo.

The area was mapped at the scale of half a mile to one inch during the field season of 1957. It lies north of an area mapped by Gélinas (1958) in 1956, and east of an area mapped by the writer (1956) in the same year.

The local relief of the eastern two-thirds of the area is relatively pronounced owing to the scarcity of glacial drift and the almost continuous exposure of bedrock. The western third, in contrast, is generally covered with drift and the surface is low and rolling.

The area is underlain by moderately to highly metamorphosed rocks of Precambrian age. Most of the rocks in the western part of the area belong to the "Labrador Trough" or "Labrador Geosyncline". Microcline gneisses which, in part, are probably metamorphosed "Trough" rocks, are abundant in the eastern part.

GENERAL GEOLOGY

Table of Formations

Recent and Pleistocene		Till, sand, gravel.
Precambrian		Pegmatite
	Metamorphosed igneous rocks	Amphibolite, ultramafic rock, blotchy gabbro.
	Metasedimentary rocks	Mica schist, microcline gneiss, garnet schist, staurolite-garnet schist, sillimanite schist. Grunerite-garnet iron formation. Tremolite marble, diopside marble, actinolite and diopside calc-silicate rocks.
	? Major Unconformity ?	
	Basement (?) rocks	Microcline gneiss.

Microcline Gneiss

Microcline gneiss underlies much of the eastern part of the area, and a second mass is represented in the southwest corner. A small amount of gneiss (not shown on the map) also occurs among mica schists on the southeast shore of Klein lake. The gneisses are white to pink and generally medium-grained. The layering is commonly poor, irregular, and cut by aplitic stringers. The gneisses consist mainly of microcline, quartz, and sodic plagioclase, with minor biotite, muscovite, hornblende, epidote, tourmaline, apatite, and other minerals.

Most of the gneisses in the southeastern part of the area are fine-grained, more evenly layered than is usual, have few crosscutting aplitic stringers, and may be richer in mica than the average gneiss. They are intermediate in appearance and composition between the mica schists and the medium-grained gneisses, and are of sedimentary origin.

Metasedimentary Rocks

Schists

Mica schists make up much of the bedrock in the western part of the area. They vary from fine- to medium-grain , and from light to dark grey. Schistosity, everywhere well developed, is made more obvious locally by thin, quartz-feldspar stringers arranged parallel to it. The schistosity is intensely folded in the wide belt of schists in the western part of the area. Near the nose of some folds, it is crumpled into minute, closely-spaced, V-spaced corrugations. Compositional banding suggestive of bedding is seen in some places and is nearly always parallel to the schistosity. The schists are made up of biotite, muscovite, quartz, plagioclase, and minor amounts of chlorite, epidote, tourmaline, apatite, and carbonate. The mica content varies widely; with its decrease the rocks may pass into feldspathic schist or gneiss.

Garnet-bearing schists occur at many places. They are most common near the microcline gneisses. They are scarce in the wide belt of schists except in its eastern part. Garnet crystals, some more than one inch in diameter, are common.

Staurolite schist is present south and southwest of Olmstead lake and near iron formation one mile west of the south end of Klein lake. This schist, normally garnet-bearing, is in thin lenses a few hundred feet long. Some of the lenses appear to represent the same stratigraphic horizon. The staurolite crystals are up to one inch long and commonly well formed. Many are twinned.

Sillimanite schist is abundant just west of the eastern gneisses, and some is found in the gneisses. The sillimanite commonly occurs as fibrous crystals forming nodular clusters or rosettes. The nodules are one-quarter inch to one inch in diameter and stand out in relief on the weathered surface. In many cases, the core of the nodules is made of garnet. Kyanite is present in a sillimanite schist west of the north end of Olmstead lake.

Marble and Calc-Silicate Rocks

A thin band of white, tremolite-phlogopite marble occurs above the gneisses near the southwest corner of the area. It contains layers composed mainly of tremolite rosettes. Marble also outcrops west of the eastern gneisses. North of Olmstead lake, there is one main band of marble with members or lenses of meta-quartzite and schist. Three bands, separated by schists, are present south of the lake. These may represent a single formation repeated by folding, or may be separate formations. The marble is light grey to bluish-grey and greenish-grey on the fresh surface, and grey, buff, or orange on the weathered surface. Part of the marble is fairly pure but more commonly it contains abundant layers rich in tremolite and diopside. Bands or quartzite and of quartz-diopside rocks, a few feet to a few tens of feet thick, occur in the marble. The diopside is commonly white to light green, very coarse-grained, and shows good parting.

A calc-silicate rock or actinolite schist lies some distance above the marble in the southwest corner of the area. Besides tremolite-actinolite, it contains carbonate, calcic plagioclase, biotite, quartz and sphene. The rock is grey to green, medium- to coarse-grained, and easily recognized by visible actinolite. The schistosity is poorly to well developed.

Some calc-silicate rocks outcrop among the gneisses near the eastern edge of the area. They consist of variable proportions of diopside, actinolite, epidote, microcline, plagioclase, and quartz. They grade into diopside-free, epidote- and actinolite-bearing microcline gneiss which, locally, is crisscrossed by fractures containing epidote and actinolite.

Actinolite breccia occurs at the northeastern edge of the thick amphibolite sill north of Olmstead lake. A smaller occurrence (not shown on the map) lies a short distance west of the north end of the lake. The rock consists of pink, microcline-gneiss fragments, a few inches in size, set in a green matrix rich in actinolite and epidote. In places, the fragments are elongated, their edges rounded, and the rock passes into an augen gneiss.

Iron Formation

Three thin bands or lenses of iron formation outcrop at the southern edge of the area. One is ½ mile east of Klein lake, the others are ¾ mile and 1½ miles west of the lake. The two western occurrences definitely are separate members. The occurrence ¾ mile west of Klein lake is at roughly the same stratigraphic horizon as some iron formation exposed near the southeast corner of the De Freneuse Lake Area, West Half (Sauvé, 1956). It is a few tens of feet thick. The two other occurrences are thinner and are probably lenses.

The iron formation is medium- to very coarse-grained, well layered, and weathers red. It consists mainly of garnet, iron amphibole, and quartz. Magnetite is present in some layers. Thin meta-quartzite layers, possibly recrystallized chert, are present.

Metamorphosed Igneous Rocks

The amphibolites are mainly fine- to medium-grained rocks varying, in general, from green in the western part of the area to black in the eastern part. Most are highly schistose, but a few are massive. The schistosity is commonly parallel to the contacts of the amphibolite sills and to the schistosity of the adjoining metasedimentary rocks. The amphibolites are composed mainly of hornblende, plagioclase, and epidote with minor quartz, biotite, sphene, and other minerals inclusive, in some cases, of garnet. Long crystals of a light brown amphibole are seen in some hand specimens.

Amphibolite commonly occurs in bands that parallel the schistosity of the country rock. Many bands are highly contorted. Some, in the eastern part of the area, pinch and swell within short distances. The amphibolite bands were originally, in part, gabbro or diabase sills and, in part, groups of basalt flows. A few thin amphibolite dykes cut across the foliation of the gneisses in the eastern part of the area. They are also schistose and their schistosity parallels the foliation of the gneisses.

Lenses of ultramafic rocks occur in some of the amphibolite sills. A few sills contain many lenses distributed along the strike. The spacing between these lenses varies widely from place to place. The weathered surface of the ultramafic rock is generally tan or brown, although some is whitish. The fresh surface is commonly bluish-grey and shows abundant fibrous minerals.

"Blotchy gabbro" is fairly abundant in the central and southeastern parts of the area near the boundary between schists and gneisses. It generally forms only a part of the sills in which it is found. The patches or blotches are commonly ½ inch to 4 inches in size, and many consist of single plagioclase crystals with some garnet near the centre. The matrix is rich in hornblende. In many cases, the patches have been flattened considerably during folding.

Pegmatite

Pegmatite dykes, commonly less than 50 feet wide, cut the gneisses in the eastern part of the area and the schists bordering them to the west. Most cut the schistosity at a small angle. Groups of closely spaced, sub-parallel dykes are present. Direct connections between dykes were seen here and there. The pegmatite may be pink or white. It consists of quartz, microcline, plagioclase, and minor biotite, muscovite, tourmaline, and garnet. Pegmatite is the youngest consolidated rock in the area.

Structure

The structure of the area is not well understood. An anticline is present in the gneisses near the southwest corner of the area. From evidence seen in the west half of De Freneuse Lake Area (Sauvé, 1956), a syncline is possibly present in amphibolite about one mile west of Klein lake.

The main belt of schists east of De Freneuse and Klein lakes is intensely folded, with fold axes plunging southeast. The major structure here may be anticlinal, as most of the tops of the drag-folded amphibolites 2 miles east of the south end of Klein lake seem to face east. This conclusion is based on the pattern of the drag-folds in the amphibolite and their southeasterly plunge.

An anticline occurs in the gneisses and amphibolite east of the south end of Olmstead lake. Therefore, the schists, marble, and fine-grained gneisses found southeast of the lake are presumably stratigraphically above the medium-grained gneisses. Also, the tops of the main marble band that strikes into Olmstead lake and of the associated schist and amphibolite may face west. If so, there is either a longitudinal fault or a syncline between these westward-facing beds and the eastward-facing, drag-folded amphibolite found southwest of Olmstead lake.

The plunge of most fold axes in the area is to the southeast. However, in the southwestern part the folds plunge northwest.

Metamorphism

The eastward increase in metamorphism found in the rocks of the "Labrador Trough" farther west is also apparent in this area. Garnet is found in some schist in the southwestern part of the area; staurolite, in the central and south-central parts; and sillimanite, in abundance farther east near the gneisses. Similarly tremolite marble occurs in the southwestern part of the area, but diopside as well as tremolite is found in marble in the sillimanite zone to the east.

Origin of the Gneisses

The contact between the schists and the underlying gneisses in the southwestern part of the area is parallel to the bedding in the schists and it possibly marks a major uncomformity. This view is based on the following observations.

The schists are only moderately deformed, are well-layered, and, although bedding is faintly preserved, they contain bands of marble and actinolite schits, along with abundant amphibolites. The metamorphic grade is possibly that of the staurolite zone or even lower. The schists pass abruptly into fairly homogeneous gneisses with very poor banding. The marked contrast between the two suggests that the schists are only moderately metamorphosed whereas the gneisses are highly metamorphosed. If this is so, the best explanation may be that the gneisses represent the "crystalline basement" on which the "Trough" sediments were deposited.

However, as the lowest grade of metamorphism necessary for the formation of the microcline gneiss is not known the above explanation or theory can not be accepted without question. The presence of microcline gneisses derived from "Trough" rocks only two miles east of the boundary between schists and gneisses indicates that the gneisses to the southwest might be of the same metamorphic grade as the mica schists.

In the southeastern part of the area, the passage from schists to interbanded schists and fine-grained gneisses is gradual, and these gneisses are presumably metamorphosed "Trough" rocks. The medium-grained gneisses found in the northeastern part of the area could be derived from the "Trough", the basement, or a mixture of both. High metamorphic grade and lack of mapping in adjacent areas to the north and east make these problems difficult to resolve.

Eastern Contact of the Trough

There has been some speculation about the nature of the "eastern contact" of the "Labrador Trough". On the Tectonic Map of Canada (1950) for instance, it is represented that a long and important fault separates the "Trough" rocks from gneisses to the east. Clearly, this is not the case near the latitude of the De Freneuse area. Fahrig (1955, 1956), mapping for the Geological Survey of Canada south of latitude 58°, also marks the eastern boundary of the "Trough" by a fault. However, he states that the rocks east of the fault are of the same sedimentary series as the "Trough" strata. Many faults with large displacement have been found north of latitude 58° in the course of work done by the Quebec Department of Mines. But, in all cases, the rocks on both sides of every fault are "Trough" rocks of similar metamorphic grade which generally can be correlated. Placing the eastern boundary of the "Trough" at any one of these faults would be arbitrary and would have no real significance.

Going eastward in the "Trough" (near latitude $58^{\circ}15'$), no natural boundary is encountered until the gneisses are met with in the Thevenet and de Freneuse areas. As mentioned above, the change from schists to gneisses may represent, in part, a major unconformity and, in part, a slight increase in metamorphic grade or metasomatic effectiveness. Although this change could be chosen as marking the eastern contact of the "Trough", the gneisses east of it have been deformed during the same period of orogeny, and, therefore, belong to the same structural province.

Economic Geology

Pyrrhotite and pyrite are common in many shear zones within amphibotite near the western edge of the area, 5 miles north of the southwest corner. However, analyses of a few samples have returned only very low values in copper, nickel, and zinc. Specks of chalcopyrite are seen here and there in the amphibolite.

The iron formation is poorly exposed. Where observed, it is only a few tens of feet thick and contains only a small percentage of magnetite.

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