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PRELIMINARY REPORT, GEOLOGY OF MATONIPI LAKE AREA, SAGUENAY COUNTY

P.R. NO. 521

DEPARTMENT OF NATURAL RESOURCES

RENÉ LÉVESQUE, MINISTER

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SAGUENAY COUNTY

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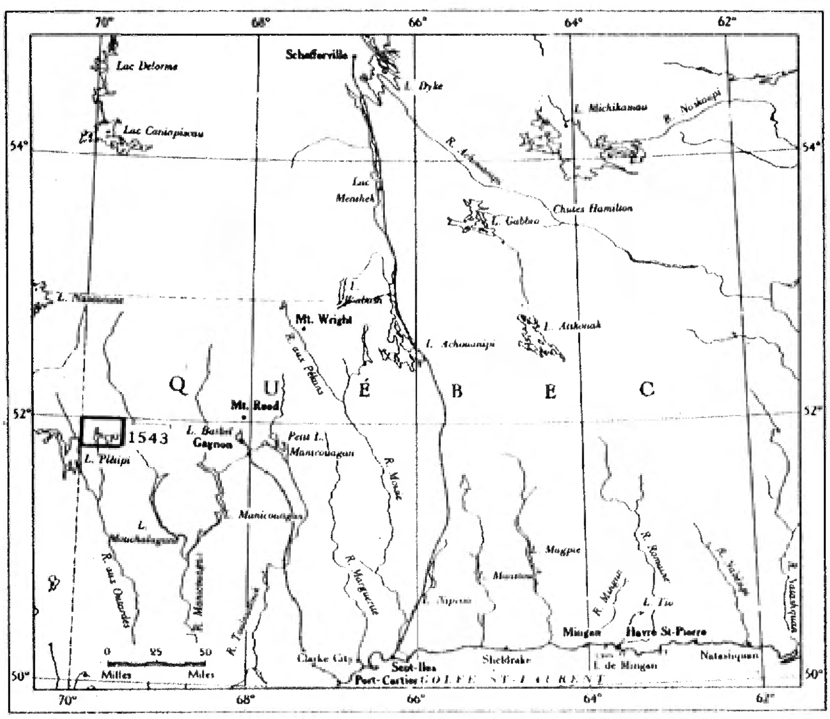
by

Jean Bérard



QUEBEC

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GEOLOGICAL EXPLORATION SERVICE

H. W. MC GERRIGLE, CHIEF

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FOREWORD

The mapping of close to 1,500 square miles in the Plétipi Lake area in the course of the summer of 1963 constituted the largest single mapping project made by the Geological Exploration Service of the Department of Natural Resources during the year. A geological field party of 23 men, under the general supervision of Jean Bérard, worked from a base camp situated on the north shore of Plétipi lake, and was serviced by a "Beaver" float-plane for supplies, transporting men, and setting up fly camps.

The mapped area is on four sheets each being 30' longitude by 15' latitude presented as follows: the Upper Outardes River area, by J. Bérard (52°00' - 52°15'; 70°00' - 70°30'); the Boivin Lake area (in two sheets) by E.H. Chown (51°45' - 52°00'; 70°00' - 71°00'); and the Matonipi Lake area (described in the present report), by J. Bérard (51°45' - 52°00'; 69°30' - 70°00').

Preliminary Report

on

MATONIPI LAKE AREA*

Saguenay County

by

Jean Bérard

INTRODUCTION

The Matonipi Lake area comprises the townships of Blanchin, Pinet, Audubon, Dion and part of the townships of Le Strat and Sénécal. This area of 370 square miles lies in Saguenay county, close to the east shore of Plétipi lake, 200 miles north-northwest of Baie-Comeau and 350 miles north of Quebec.

Float-planes are the best means of access to the region. The closest bases are Gagnon and Manicouagan-5, situated 75 and 95 miles respectively from the centre of the map-area. The navigable routes are of little practical value, although the Bersimis Indians use them periodically. Some mount Outardes river to Plétipi lake, whereas others follow Mouchalagane river to reach Matonipi lake.

The area is in the Laurentian Highlands. These highlands are not rugged in this region and consist of numerous hills with concordant summits. Matonipi, Matonipis and Larocque lakes lie in the middle of an immense flat basin 20 miles in diameter and surrounded by hills having a maximum relief of 850 feet. Within this basin the maximum relief is about 300 feet and the hills are elongated parallel to bedrock structures. The lithology and structure reflect both the topography and drainage. The rivers which feed the principal lakes flow south and follow

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* Translated from the French.

the general grain of the bedrock. A chain of small lakes located about 3 miles west of Matonipi lake follows the long curve of a fold which terminates abruptly at Capou lake. The highest elevations in the area are northwest of Matonipi lake; these are about 1,000 feet above the level of the lake.

With the exception of a few small lakes which drain into Mouchalagane river, all the waters of the area flow into Outardes river. The waters near the west border of the area flow directly into Plétipi lake, whereas the principal lakes drain into Matonipi river, a tributary of the Outardes.

GENERAL GEOLOGY

The Matonipi Lake area is underlain by an assemblage of rocks similar to those which are found farther east around Gagnôn. The consolidated rocks are all Precambrian in age.

Paragneiss constitutes almost all the bedrock, and a very small portion of this rock is slightly metasomatized by granitic and pegmatitic material. The rocks which occur in the heart of the area are variegated paragneisses such as biotite gneiss, biotite-hornblende gneiss with or without garnet, quartzo-feldspathic gneiss, quartzite, crystalline limestone and ironstones. All these rocks display an excellent layering, which may be traced for long distances. However, at a distance from the basin of Matonipi and Larocque lakes, the rocks are subjected to a slight metasomatism. This is especially true of the rocks located northwest of Matonipi lake.

Glacial and fluvioglacial deposits cover much of the area, especially in the zones of low elevation, and outcrops of basement rocks are scarce, except south of Matonipi and Matonipis lakes.

Paragneiss

Almost 98% of the consolidated rocks of the area are paragneiss of the epidote-amphibolite and lower amphibolite facies. It is possible to distinguish the paragneisses of detrital origin from those of chemical origin. The latter include the ironstones and limestones which are exposed principally around Matonipi lake.

Gneiss of detrital origin constitutes about 80% of the paragneisses. These rocks may be subdivided into several categories: biotite gneiss, biotite-muscovite gneiss, biotite-hornblende gneiss, detrital gneiss with calcareous cement, and impure quartzites and amphibolites. This assemblage of gneisses displays excellent layering, commonly occurring in tiers where

Table of Formations

Pleistocene	Till, fluvioglacial sand	
Precambrian		Ultrabasic rocks
		Granite and pegmatite
	Paragneiss	Iron formation Quartzite, minor quartz-muscovite-garnet schist Crystalline limestone
		Biotite gneiss, biotite-muscovite gneiss, biotite-hornblende gneiss, amphibolite with or without garnet, calcareous gneiss, impure quartzite

the rock is not too deformed. Individual layers in general range between 1/8 inch and 4 feet in thickness, but average about 10 inches. Layering is particularly well developed in the rocks which crop out south of Matonipi and Matonipis lakes. At these localities the individual layers dip moderately and may be traced for many miles. The gneisses are roughly estimated to be more than 10,000 feet thick.

Biotite-gneiss, Biotite-muscovite Gneiss, Biotite-hornblende Gneiss

These different varieties of gneiss are intimately associated in alternating light and dark layers. The gneisses of detrital origin are all dark grey on a weathered surface but their layering is exposed by differential erosion of beds more or less rich in biotite or in feldspar. Certain horizons of impure quartzite and limestone, which will be described in a later section, are intimately associated with the detrital paragneisses.

Biotite gneiss, biotite-muscovite gneiss and biotite-hornblende gneiss are generally fine to medium grained, but much of the rock contains porphyroblasts of microcline. The principal minerals of the gneisses are quartz (25-65%), microcline (0-35%), plagioclase (0-40%), and epidote (trace-15%). Other minerals present are muscovite, biotite, sphene, apatite and zircon. Some rocks contain hornblende, but when they do there is no muscovite. Garnets occur locally both in the biotite-plagioclase gneisses and in the hornblende-bearing rocks.

It is interesting to note that all the gneisses, whether rich in plagioclase or rich in muscovite, present the same appearance to the naked eye. However, with the microscope, one can see that certain gneisses are impoverished in microcline and others, in plagioclase, whereas most contain variable quantities of the two feldspars.

In places where the paragneisses have been intensely deformed, the rocks have a preserved layering, which shows variations of composition. These rocks are most affected by the formation of large porphyroblasts of microcline and pale grey plagioclase <u>in situ</u>. A stretching of the bands, which has produced boudinage and numerous drag folds, is also common.

South of Matonipis lake, certain horizons of little-deformed paragneiss contain fragments of pink granite, quartz and amphibolite, which give the rock the appearance of a conglomerate. These fragments are rounded and slightly elongated in the plane of the layering. It is possible that this is a conglomerate, as is evident from the variety of fragments. But other small outcrops of apparent conglomerate are actually rocks with layers stretched into boudins. These rocks resemble the conglomerates described above, when viewed in section.

Amphibolite

Amphibolite constitutes only a very small part of the paragneiss. It is found within the biotite paragneiss in layers several feet thick. It is black, medium grained and composed of hornblende (70%), quartz (15%) and plagioclase, garnet, sphene, epidote and biotite.

Calcareous Paragneiss

Small quantities of calcareous paragneiss occur within the biotite paragneiss. Nothing in their appearance distinguishes these rocks from the enclosing gneisses, except perhaps their slightly more rugged weathered surface. However, where this rock is submerged along a lakeshore, it acquires a characteristic brownish tint. Three localities of calcareous paragneiss are shown on the accompanying map, but it is easy to imagine that there are many localities where the rock has escaped observation because of its friability, its similarity to the other biotite gneisses and especially because of its rarity.

The principal constituents of this rock are calcite (45%), microcline (30%), quartz (15%), biotite and muscovite (15%), and traces of epidote.

The total thickness of calcareous paragneiss is about 35 feet, and the average layers are 2 to 3 inches thick.

Impure Quartzite

Impure quartzite, or quartzo-feldspathic gneiss, is associated with calcareous paragneiss. The total thickness of this formation ranges from 30 to 80 feet, whereas individual layers range between 4 and 15 inches thick. The rock is grey or pinkish grey, vitreous, medium grained, equigranular, and has a saccharoidal texture. When deformed, as is the case southwest of Matonipi lake, it has a nematoblastic texture with elongated quartz grains forming an excellent lineation. Fuchsite is found on the foliation planes in many specimens.

Six localities where impure quartzite crops out are shown on the accompanying map; these aid in solving the general structure.

Apart from this band of quartzite associated with the calcareous paragneiss, less important layers ranging from several inches to 5 or 6 feet thick were noted in the biotite paragneiss sequence. Cross-bedding was noted at one locality.

The principal constituents of impure quartzite are quartz (75%), microcline (15%), muscovite and biotite (7%) and a little epidote, chlorite and zircon.

Crystalline Limestone

Crystalline limestone appears to overlie biotite paragneiss directly, but some less important layers occur within these rocks. The limestones crop out in general west of Matonipi lake where they cover an area of about 20 square miles. Other very small outcrops appear along the northeast shore of Matonipi lake and south of Matonipis lake.

Because of the intense deformation to which the crystalline limestone was subjected, the total thickness is difficult to estimate, but it appears, from the area covered, that this formation was originally 300 to 400 feet thick or thickner.

The limestones are dark grey or tan on weathered surfaces, and grey, white, pink, yellowish, or greenish on a fresh surface. The weathered surface is generally rugged, but it becomes very irregular where there is an abundance of silicates. The grain size is generally coarse. Facies rich in tremolite, actinolite, and apatite are more resistant to erosion, and form lumps and layers in relief. Beside calcite, the principal minerals are dolomite and ferro-dolomite, which in places constitute an important portion of the rock, tremolite in masses of fine radiating needles, diopside, phlogopite, quartz, actinolite, magnetite, specularite, and biotite.

White, radiating crystals of tremolite are observed in the limestone bedding planes, whereas pale green actinolite needles fill secondary fissures perpendicular to bedding. In many localities the limestone contains continuous layers of quartzite 1/2 inch to 4 inches thick. This quartzite is white and vitreous, and contains calc-silicate minerals and calcite.

Crystalline limestone is situated at the base of the iron formation, and the transition from one formation to the other takes place over a zone of alternating layers of the two types of rock.

Quartzites

Quartzites are associated with ironstones and are distinguished from them by their low content of iron oxides. They are found west of Matonipi lake and close to Tertre lake, where they constitute layers several dozens of feet thick. Though the rocks are very hard, they have been strongly deformed and in places show very serrate chevron folds. The colour of the rock is generally steel grey.

In addition to the quartz which constitutes 90% of the rock, the quartzite contains specularite, a little mica and traces of several other minerals such as chlorite, apatite, and possibly epidote and garnet. Layers of quartz-schist containing 60% quartz, 30% muscovite and pink garnet occur within the quartzite. This rock is a lustrous white colour on a fresh surface and is pale grey on a weathered surface. Idioblastic garnets are surrounded by muscovite.

Ironstones

The ironstones of the area have attracted prospectors for a long time, because of their similarity to rocks in the south part of the Labrador Trough and the Gagnon area. These rocks occur in many distinct facies, the principal being specularite, magnetite, silicate and carbonate ironstones.

The oxide facies, magnetite and specularite, is most abundant northwest of Matonipis lake, and constitutes close to half the iron formation west of Tertre and Matonipi lakes.

Specularite ironstone is almost entirely constituted of this mineral, except for 15 to 40% of granular quartz. The proportions of these minerals vary much from one layer to another and the average content of iron oxides is about 30%. Some of the rock contains small amounts of magnetite.

The magnetite ironstone is generally black, dull, fine grained and strongly magnetic. It alternates commonly with silicate and carbonate ironstones. Grunerite and actinolite are found in interbeds west of Matonipis and Tertre lakes where magnetite ironstone is abundant.

Silicate and carbonate ironstones abound around Matonipi lake and close to Tertre lake, but they rarely occur in the sequence west of Matonipis lake. These rocks are generally in thin interbeds in the quartzite and magnetite ironstone. Their colour ranges from rusty brown to black, and the grain size ranges from 1/2 mm. to 5 cm. depending on the degree of recrystallization. The principal constituents of silicate and carbonate ironstones are ferro-dolomite, quartz, actinolite, grunerite, specularite and magnetite.

The iron formations are strongly folded into chevrons and it is easy to see that the different outcrops are only repetitions of the same horizons. The thickness of this formation is more than 300 feet. The most interesting localities from the economic point of view are situated west of Matonipi and Tertre lakes and also close to the northwest shore of Matonipis lake.

Intrusive Rocks

Intrusive rocks are of very minor importance in the region, composing less than 2% of the consolidated rocks. They may be divided into two groups: granitic and ultrabasic rocks.

Granitic Rocks

The paragneisses contain veins and pockets of granite and pegmatite, and the importance of these veins increases with the distance away from Matonipi and Matonipis lakes. The granitic content increases in the localities where the paragneiss has been strongly deformed, and the rock approaches a migmatite. In the northwest corner of the area granite and pink or white biotite and muscovite pegmatite cut the paragneiss and infiltrates along the bedding planes. In other places granite appears in lenses of variable dimensions. Near the outlet of Matonipis lake an intrusive-appearing mass occurs in the middle of the paragneiss, not far from the iron formation. The contacts between this rock and the paragneiss are not exposed, but it appears that the material was rendered mobile at the time of regional deformation. Pegmatite cuts all the lower sediments and at least one pegmatite dyke cuts crystalline limestone.

Ultrabasic Rocks

Two dykes of ultrabasic rock occur in the biotite gneiss. One of these dykes, located 5 miles north of Matonipis lake, is close to 150 feet wide. It trends southeast and cuts the regional schistosity at an acute angle. The other dyke, about 75 feet wide, is situated south of Matonipi lake and lies parallel to the layers of the biotite gneiss

These ultrabasic rocks are black or dark green on a fresh surface and black or dark brown with rusty spots on a weathered surface. The grain size ranges from fine to pegmatitic. Large crystals of secondary amphibole are visible in the exposure north of Matonipis lake.

Actinolite (40-65%) and anthophyllite in acicular crystals several millimetres long (10-20%), as well as a little calcite, biotite, quartz, talc, apatite and magnetite, are the principal minerals. Quartz and pink potassic feldspar are present along fractures.

The ultrabasic rocks appear to be the youngest of the area, but they have been subjected to the last regional deformation.

Pleistocene and Recent

The principal glacial deposits are the tills composed of unsorted blocks, pebbles and sand and spread over almost the whole area; they show the imprint of glacial movement in a southerly direction (S.15°W.). The other deposits, subglacial and periglacial, are the very numerous serpentinous eskers in the bottom of present-day valleys, the abandoned fluvioglacial deltas at the entrances of the principal rivers, and the terraces hung on the flanks of the valleys abandoned by the recession of the rivers. Several marshes and lakes lie on these sand terraces. In the north half of the area the numerous erratic blocks in places form fields several square miles in extent, where walking in very difficult. Many of these blocks have diameters of 15 to 20 feet. The terraces cut in the deltaic sands north of Matonipi lake form steps with a rise of 80 feet, and cover the crystalline limestone and iron formation.

STRUCTURAL GEOLOGY

Schistosity and Layering

In the north half of the area, the schistosity is generally north-south with a gentle to moderate dip to the east, but more frequently to the west. In the south, however, the schistosity forms convolutions around Capou lake, south of Matonipis lake and close to Tertre lake. Layers generally dip to the centre of the convolutions, and the dips of the schistosity around Capou lake increase with proximity of the lake, as if it were an immense vortex with an axis inclined 40° to the northwest.

The schistosity follows the layering faithfully, thus giving a true picture of the major lines of regional folding. The layering is generally well developed thanks to the variations in the composition of the gneisses. The biotite-rich layers alternate with others where this mineral is rare or disseminated. However, northwest and northeast of the area, the biotite schists are contorted and injected with lenses and tabular bodies of pink granite which partially mask the layering, but the schistosity is preserved.

Lineation

Three types of lineation may be distinguished: the orientation of mineral grains, the axes of small drag and shear folds, and the axes of the more recent, open folds.

Hornblende grains in the amphibolite are commonly oriented north-south with a plunge, in some places, to the north and, in others, to the south, depending on the attitude of the secondary folds with east-west axes.

The lineation of small shear and drag folds is generally north-south, as are the major fold axes. However, where the secondary folds have disrupted the folds already formed, this primary lineation faithfully follows the tortuous trend of the major axes. Another type of lineation occurs in small amounts throughout the area superimposed perpendicular to the two others described above. This lineation is the axes of open secondary folds.

Near Capou lake, converging lineations occur perpendicular to the axes of large secondary folds. At this locality, the rocks have been deformed into a vortex, and rods of rock with a diameter 1/2 inch to 10 inches are very common. These rods show a general abrupt plunge down the dip of the schistosity.

The crystalline limestones, the quartzites and the iron formations have an excellent, small fold-axis lineation in all localities.

Folds

The folds which affected all the rocks of the area are multiple, with different orders of magnitude, and show at least two major periods of deformation. The better developed north-south folds are responsible for the predominant schistosity. The axial planes are generally inclined to the west; however, several vertical or east-dipping axial planes are present. Southwest of Matonipi lake, the large folds which are otherwise north-south have been rearranged and strongly deformed by an orogenic force directed from the south. The crystalline limestones deformed plasticly, accounting for the presence of numerous chevron folds, not only in the limestones, but also in the neighbouring rocks.

The first deformations, coming from the east, were much more intense than those which followed from the south. This is shown by the comparison between the shear folds and chevron folds with north-south axial planes, and the more open folds related to the first deformation.

Faults and Joints

Many indications of faults are seen in the field, such as zones of broken rocks healed by red microcline, milky quartz and chlorite. However, these crush zones are not continuous, or, where they are, the unconsolidated deposits mask them. South of Matonipis lake, three parallel faults cut the biotite paragneiss perpendicular to the layering. The fault farthest west has a zone of shearing more than 200 feet wide, and it appears that the west side has been raised. In the north half of the area there are numerous small zones of shearing parallel to schistosity.

Joints are ubiquitous and are randomly oriented. A statistical study shows, however, a concentration lying east-west and quasi-perpendicular to the axes of the large primary folds.

ECONOMIC GEOLOGY

The economic interest of the area lies in the ironstone units which crop out west and southwest of Matonipi lake, northwest of Matonipis lake, and near Tertre lake. Specularite-quartz ironstone offers the most attraction, but the showings are small and scattered. Moreover, certain of the showings are partly covered by Matonipi and Matonipis lakes or by drift.

Many companies have successively done geological and geophysical work on the iron formations, and, in the course of the summer of 1963, The Hanna Mining Company did detailed mapping and diamond drilling in the area. For the moment, the iron offers the only economic interest in the area. No zones of sulphides worth attracting attention were seen.

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