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Preliminary Report

on

MICHAUD LAKE AREA

Duplessis County

by

Duncan S. McPhee

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INTRODUCTION

The Michaud Lake area, Duplessis county, bounded by latitudes $50^{\circ}30'$ and $50^{\circ}45'$ and by longitudes $62^{\circ}00'$ and $62^{\circ}30'$, comprises an area of about 380 square miles. The center of the area is about 65 miles northeast of Havre St-Pierre and about 30 miles north-northeast of Natashquan, both of which are on the north shore of the Gulf of St. Lawrence. Mapping in the eastern half during the summer of 1959 was continued in the western half in 1960.

The area may be reached easily by sea plane from bases at Havre St-Pierre and Longue-Pointe-de-Mingan. Several large lakes and sections of Aguanus river are suitable for landing. It may also be reached by canoe along the Grand Watshishu, Little Watshishu, Nabisipi, or Aguanus rivers. However, travel along them is difficult because of the numerous portages required, and, in the late summer, because of the low water level.

Natashquan is serviced regularly during the summer by ships of the Clark Steamship Company, Limited.

Topography

In the western part of the area differential erosion of the gabbro sills and sedimentary rocks has produced a well defined ridge and valley topography. Long north-northwesterly trending ridges of gabbro alternate with narrow valleys underlain by the sedimentary rocks of the Wakeham group. Many of the lakes occupy these valleys. The remainder of the area, which is underlain by granitic rocks, has a gently undulating surface.

The area, as a whole, slopes gently to the south. Along the northern boundary, some hill summits reach 1200 feet above sea level, whereas in the south the Nabisipi river is 200 feet above sea level.

The area is drained through the four previously mentioned rivers, which flow into the Gulf of St. Lawrence. In the western half, the drainage is particularly well controlled by the north-northwest-trending structures. The numerous lakes in the area are joined by a series of rapids and falls.

GENERAL GEOLOGY

All the consolidated rocks of the area are Precambrian in age. Slightly metamorphosed quartzites and schists of the Wakeham group intruded by sills of gabbro outcrop over most of the western half and in two localities along the eastern boundary. A few isolated exposures were found south of Vigneault lake. A roughly circular plug of massive to slightly foliated granite cuts the sedimentary rocks around Gallienne lake.

Grenville-type granitic rocks and paragneisses predominate in the eastern half. Several irregular bodies of massive and gneissic granite, sills and irregular stocks of gabbro and pegmatite intrude this complexly folded assemblage. Dykes of granite porphyry cut across granitic gneisses, gabbros and quartzites east of the Gallienne Lake granite mass and in the south central gabbro sill.

TABLE OF FORMATIONS

PLEISTOCENE AND RECENT		Clay, sand, gravel and erratic boulders
PRECAMBRIAN	Intrusive rocks	Granite porphyry Pegmatites
		Basic dykes
		Massive biotite granite Gneissic biotite granite
		Schistose gabbro Hornblende gabbro and amphibolite Pyroxene gabbro
	Wakeham group	Grey micaceous quartzite Hematite-rutile quartzite White quartzite Epidote quartzite Conglomerate Quartz-mica schist Garnet-mica schist Garnet-staurolite-kyanite schist
	Metasedimentary and igneous rocks (Grenville-type)	Augen granite gneiss Banded granitic gneiss Paragneisses

PARAGNEISSES AND IGNEOUS ROCKS ("Grenville Type")

Paragneisses and Schists

The paragneisses and schists mark the eastern edge of the main Wakeham basin along a north-south line that crosses the area near its centre. They extend irregularly into the eastern half to occupy most of its centre. These seemingly oldest rocks commonly grade into adjacent granitic gneisses either by granitization or injection of granitic and pegmatitic material. They are easily distinguished from the Wakeham sedimentary rocks by their coarser granularity, granulose texture, mineralogical composition and well defined banding.

The commonest paragneiss is a quartzofeldspathic biotite gneiss which can be recognized by its well defined regular alternated pale and dark layers that probably represent the original bedding. The pale layers are essentially composed of variable amounts of quartz and feldspar whereas the dark layers although of the same mineralogical composition, contain a greater proportion of biotite, locally accompanied by hornblende.

Granitic Gneisses

This rock occurs in two localities within the area: about 4 miles south of Bies lake in a transition zone between the paragneisses and the augen gneiss and in a tongue-shaped mass 2 miles east of the north centre of the area, where it is truncated by gabbro which contains 4 bands of the rock. It is generally pinkish to medium-grey and is characterized by its regular layers, 1 to 2 feet thick, of quartz-biotite gneiss alternating with quartz, feldspar gneiss with some biotite. The abundance of the quartzofeldspathic material in this rock justifies the classification into the granitic gneisses.

Augen Granite Gneiss

The augen granite gneiss occurs as a small mass at longitude $62^{\circ}15'$ between Nabisipi river and the southern boundary, a medium-sized body in the southeast just west of Aguanus river, and a very large, irregular body in the northeastern part of the area. Gradation zones between the banded granitic gneiss and the augen granite gneiss can be seen in a few places in the western half of the area. It is characterized by augen of pink feldspar, up to $1\frac{1}{2}$ inches long and $\frac{3}{4}$ inch wide, contained in a matrix similar to the banded granite gneiss.

Although some of the augen granite gneiss of the area may be a facies of an intrusive granite, most of it probably results of transformation of sedimentary rocks and even mafic rocks by metasomatic processes. The character of each of these units, including the paragneisses, would indicate different reactions to the metamorphic processes.

WAKEHAM GROUP

Quartzites and sedimentary schists of the Wakeham group form an extensive sedimentary sequence in this part of the North Shore of the Gulf of St. Lawrence. It extends inland from the coast at Baie Johan Beetz for about 60 miles and is about 40 miles wide at latitude $50^{\circ}30'$. They also occur east of Natashquan river, east and northeast of the Michaud Lake area.

Rocks of the Wakeham group underlie most of the western half of the area as far east as the boundary with granites and gneisses and they appear along the eastern border as part of the western limit of the Natashquan River sequence. Like in most of the Wakeham basin these rocks trend north-northwesterly.

The grey micaceous quartzite is the most common member of this sedimentary sequence. In most places it is a fine-grained, light to medium grey rock. Quartz is the main constituent and feldspar, biotite, muscovite, epidote, magnetite, and calcite may also be present. The beds vary from thin to very thick in which case the rock seems to be massive; ripple marks and cross-bedding may be present.

The hematite-rutile quartzite occurs locally throughout the area of Wakeham sedimentary rocks. It appears as black beds 1/10 inch thick alternated with other beds of grey micaceous quartzite or white quartzite, 1/4 inch to several inches thick.

The white quartzite is a variety of these rocks that is composed almost entirely of rounded quartz grains. It is interbedded with the grey micaceous and the hematite-rutile quartzite.

Epidote quartzite was observed near Vigneault lake and along Aguanus River, one mile south of the northern boundary of the area. It is a light to medium greyish-green rock. In one occurrence it consisted of alternating beds of white quartzite and pale green epidote and in the other case beds 1/4 to 1/2 inch thick locally with interbeds of medium-green epidote from 1/8 to 1/4 inch thick.

Conglomerate is exposed on the lake north of Auger lake and in the south-central part of the area. Well-rounded pebbles of white quartzite up to 2 inches in diameter occur in a matrix of grey biotite quartzite.

Schists interbedded with the quartzite occur in an ill-defined belt that extends throughout the central part of the area.

Quartz-mica schists are well developed along the eastern shore of Auger lake and extend to the north and south. They are fine-grained and dark to light grey or greenish-grey. The beds are generally very thin. The surface of some exposures is pitted; the cavities being about 1/10-inch in diameter result of the weathering of garnet porphyroblasts.

Garnetiferous-mica schist is particularly common on the lake north of Auger lake. The garnets usually occur in bands and are rarely fresh. There is usually a transition from schistose rocks in which micas predominate to beds of massive, impure, grey quartzite.

Garnetiferous-staurolite-kyanite schists are exposed in a narrow, arcuate band for a distance of 6 miles along the river and lakes west and south of Gallienne lake. Staurolite and kyanite occur as highly weathered, white to grey, porphyroblasts in a fine-grained matrix of quartz and micas, which frequently contain porphyroblasts of garnet. The kyanite and staurolite crystals are commonly up to 3 inches long.

Intrusive Rocks

Gabbro

The oldest intrusive rocks in the area are a series of sheet-like bodies of gabbro which have intruded the Wakeham sedimentary rocks, the paragneisses, and the granitic gneisses.

Individual sheets vary in width from a few feet to over a mile. They also vary widely in length. The sill west of Holt lake has been traced southwest to the St. Lawrence River (Blais, 1955; Cooper, 1957) and northwest for at least 6 miles

(Grenier, 1957). Many of the sills, however, are less than 1/4 mile long. Most of the sheets are concordant with the sedimentary rocks, but several cut the bedding at small angles.

A few of the larger bodies cutting the granitic gneisses consist of pyroxene gabbro. This rock is medium-grained, dark purplish-grey, and massive. It has an ophitic texture and is composed of pyroxene, hornblende, plagioclase, and biotite.

The hornblende gabbro, which is the most common of the basic rocks in the eastern half of the area, is greenish-black, massive, and medium- to coarse-grained. It consists of hornblende and plagioclase, with minor amounts of biotite, epidote, and magnetite. Locally at the contact with sedimentary rocks, it is fine grained. In places it has an ophitic texture and resembles a diabase.

A schistose gabbro is found in a band half a mile wide in the central part of the area and in the northeastern corner. It consists of hornblende, plagioclase, and biotite and is frequently highly foliated. The foliation is generally parallel to the bedding of the quartzites and to the foliation of the gneisses. In the south, it contains a few small bands of quartzites.

Gneissic Granite

Large areal extents of gneissic granite are found in the eastern half of the area. It outcrops particularly in southeast and east central parts of the area and around des Quatre lake. Around Gallienne lake a plug has both gneissic and massive granites and is exposed over an irregular area of 35 square miles. A small sill of this rock is exposed southwest of the lake.

The gneissic granite is medium- to coarse-grained, pink to pinkish-grey, and consists of biotite, quartz, and feldspar. It has a pronounced gneissic structure as shown by lenses and bands of quartz and feldspar separated by thin, biotite-rich layers. It contains inclusions of paragneisses, granitic gneisses, and gabbro. Although much of this gneissic granite is of intrusive origin, some of these rocks may be the more granitized equivalents of paragneiss banded granite gneiss, and augen gneiss.

Massive Granite

Small stocks of massive granite are exposed along the southern boundary, around Rochette lake in the east centre and along a northwesterly trending line in the north central part of the area. The rock is coarse-grained and is composed of feldspar, quartz, and biotite, with in places, small amounts of muscovite.

Also, massive granite is also found in the plug around Gallienne lake. Xenoliths of quartzite and gabbro found within this body indicate that it is younger than the surrounding rocks.

Basic Dykes

Several basic dykes are found cutting the Gallienne lake granite. They vary in thickness from 3/4 inch to 40 feet. They have chilled margins and generally contain some quartz.

Pegmatites

In the eastern half of the area numerous dykes and sills of pegmatite cut all the other rocks. In the western half they are much less common. Only the larger bodies have been shown on the accompanying map. The pegmatites may be of

more than one age. The pegmatites in the southern granite body grade into coarse-grained granite in several exposures, suggestive of a genetic association.

The pegmatites are very coarse-grained and consist of pink, perthitic feldspar and quartz which occasionally are in graphic intergrowth. Common accessory minerals are biotite and muscovite. Beryl, magnetite, and molybdenite are less common.

Granite Porphyry

Two narrow, sill-like bodies of granite porphyry are found in the western half of the area. The longer body, in the north near longitude $62^{\circ}18'$, cuts granitic gneisses, quartzites, and gabbro. The smaller occurs within the large, composite body of schistose gabbro.

The rock is made up of phenocrysts of pink feldspar up to 1/4 inch long and bluish quartz inserted in a fine-grained, foliated, grey to light pink, quartzofeldspathic matrix.

Pleistocene and Recent

Pleistocene glaciation has left broad, U-shaped valleys, roches moutonnées, glacial striae, chatter marks, polished surfaces, and unconsolidated deposits in the area. Glacial striae and chatter marks indicate that the direction of ice flow varied from south to $S.15^{\circ}E.$ in the western half and from south to $S.5^{\circ}W.$ in the eastern half.

A till deposit of argillaceous sand containing rounded boulders up to 1 foot in diameter extends across the southern end of Watshishu lake and possibly

force its outlet to run westward instead of flowing directly southward into Holt lake.

Recent deposits of unconsolidated material along Nabisipi river consist of a sequence of laminated bluish clay overlain by beds of stratified sands, which are frequently crossbedded, and occasionally interstratified with beds of gravel or boulders.

Sand plains bottomed by clay are found along Aguanus river in the southeastern corner of the area and south of Michaud lake as far as Nabisipi river.

STRUCTURAL GEOLOGY

Orientation of the main topographic features of the area correspond to structural trends of the underlying rocks. Structurally the area may be divided in two structural units: the part underlain by quartzites and gabbro sills, and that of paragneisses, granitic gneisses and granites.

The Wakeham sedimentary rocks and associated gabbro sills show consistent north to northwest trends throughout the area; déviations are only local. The sediments are all steeply dipping. Tops of beds determined by means of cross-bedding and ripple marks, face west. Dips are generally steep and in some places overturned into isoclinal folds parallel to the main trends.

Drag folds observed throughout the area of Wakeham rocks have axes that plunge 30° to 45° in a south-southeast direction and indicate that these rocks are on the eastern limb of a large syncline (Claveau, 1949).

The north-northwest trend of the quartzites and schists has been deflected into a broad arcuate pattern parallel to the edge of the Gallienne lake granite.

The structure within the granitic terrane is complex. Several folds of the foliation have been outlined on the accompanying map, but their significance is not clear. Many axes trend northeast and east-northeast whereas others are oriented northwesterly. However, the attitude of the foliation around des Quatre lake would indicate the presence of a series of folds in which are implicated paragneisses, augen gneiss and gneissic granite. Such relationships are in agreement with the interpretation of progressive development of granitic rocks starting with paragneisses through rocks intermediate in composition between the latter and the granitic gneisses.

The nature of the boundary between the two structural units is considered by the author as a transition zone along which the quartzites with minor schists and gabbro have been more resistant to metamorphic processes than the adjacent gneisses to the east. In adjoining areas indications of faulting were observed.

Small shear zones and minor faults trending in a northeast direction were observed northwest and north of Gallienne lake. In the eastern half of the area several minor fault zones were recognized.

ECONOMIC GEOLOGY

Beryl

In the eastern half of the area, beryl crystals up to 9/10 inch across and 2 to 3 inches long with some molybdenite flakes were found in a pegmatite dyke on the eastern side of the southern bay of Baies lake. These crystals were observed over a width of 3 feet and a length of 100 feet, but were not abundant.

Molybdenite

Several irregularly scattered flakes of molybdenite were observed in the Baies lake pegmatite.

Iron

The Wakeham quartzites contain bands of disseminated iron oxides, generally less than 1/10-inch thick and of limited extent.

Chalcopyrite

Very small concentrations of chalcopyrite were found in veins in a few exposures of gabbro.

Pyrite

Disseminated pyrite occurs locally in the gabbro sills and as small, well formed cubes in some of the Wakeham schists.

REFERENCES

- Blais, R.A. (1955) Pashashibou Area, Drucourt and Costebelle Township, Saguenay County, Que. Dept. Mines, P.R. 316.
- Cooper, G.E. (1957) Johan Beetz Area, Electoral District of Saguenay, Que. Dept. Mines, Geol. Rept. 74.
- Claveau, J. (1949) Wakeham Lake Area, Saguenay County, Que. Dept. Mines, G.R. 37.
- Grenier, P.E. (1957) Beetz Lake Area, Electoral District of Saguenay, Que. Dept. Mines, G.R. 73.
- McPhee, D.S. (1959) Aguanish Area, Saguenay Electoral District, Que. Dept. Mines, P.R. 403.