RP 411(A)

PRELIMINARY REPORT ON TOCO - TEMISCAMIE AREA, MISTASSINI TERRITORY

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GEOLOGICAL SURVEYS BRANCH

PRELIMINARY REPORT

ON

TOCO-TÉMISCAMIE AREA

MISTASSINI TERRITORY

BY

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QUEBEC
1960

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INTRODUCTION

Location

The Toco-Témiscamie area, mapped during the summer of 1959, is bounded by latitudes 51°30' and 51°45' and by longitudes 72°00' and 72°30'. It comprises an area of 376 square miles.

The area is located about 200 miles north of Lake St-Jean and 140 miles northeast of Chibougamau lake. It lies immediately to the north of the Béthoulat lake area (Neale, 1952) and to the east of the Papachouésati area (Chown, 1960) and touches the northeast corner of the Takwa River area (Neilson, 1951).

Means of Access

Air transportation, from an air base at Chibougamau (Caché lake), offers the easiest means of access. It is also possible to reach the area by canoe from Chibougamau by means of Waconichi, Mistassini and Albanel lakes, and then by ascending the Témiscamie river. This trip can be made in three or four days and involves three portages.

With the exception of the Témiscamie river, the rivers of the area are not navigable, or at least are very difficult to negotiate by canoe. However, early in the spring, or after an extremely heavy rain, it is possible to ascend them with the aid of a tow-line. The Toquecc river may be reached from the Témiscamie river by means of Roxie lake, a short distance south of the present area. Two portages, kept in good condition by the Mistassini Cree Indians, join these two rivers to Roxie lake.

Access to the northern border and to the southeast corner of the area is difficult because of the lack of navigable waterways. However, it is possible for float-planes to land

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* Translated from the French

on certain lakes, as well as on the Témiscamie river.

Resources

With the exception of beaver, which is everywhere abundant, game is scarce in the area, especially in the sections that have been affected by forest fires. Nonetheless, moose, bear, otter, mink and partridge were seen, as were the tracks of wolves, foxes and hares. Several species of duck and a small number of Canada geese make their nests at the shores of many of the small lakes. The northwest, southwest and southeast corners of the area were spared from the forest fires that devastated virtually all of the region, except the swampy areas and some of the hills bordering the Témiscamie river.

Black spruce, tamarack, gray pine, birch and balsam fir are the most common types of trees.

Topography

The area is southwest of the height of land between the St. Lawrence River drainage system and that of the Hudson Bay. It drains into James bay, via Mistassini lake.

The Témiscamie river drains the eastern half of the area. It is fed by three tributaries which have their sources to the north of the area. The Toqueco river drains the western half of the area, with the exception of the northwest corner, which is drained by Kapaquatch river, and the Magyar Lake basin, which drains toward the west by means of Old Man river.

The area has little relief, except to the southeast of Témiscamie river. Here, elevations reach 2,000 feet, or about 600 feet above the level of the river.

The present topography, throughout practically all of the area, dates from the last glaciation. The hills, streams, and lakes and swamps are all elongated S.30°W.

A blanket of glacial debris up to 50 feet thick covers the northern half of the area. On this blanket is superimposed a linear pattern made up of parallel hills and valleys.

Almost all of the area to the north of the Témiscamie river is strewn with angular granitic erratics,as well as well-rounded boulders of white quartzite. The granitic boulders are local in origin, but the quartzite boulders have come from a few miles outside of the present area to the north, where beds of quartzite have been noted.

Drumlins found in the area are the result of combined glacial erosion and deposition on the lee side of

rock outcrops. Many of these hills are quite long and may attain a height of several hundreds of feet.

The area in the vicinity of the Toco, Toqueco, Témis and Misca rivers is covered by a ground moraine which varies in composition from a sandy till to an accumulation of angular boulders. The topography of this moraine-covered district is very irregular, being made up of hills and depressions that are semi-circular in section. The average local relief is about 25 feet.

To the north of the Toco and Toqueco rivers, as well as to the south of the Toqueco, tillites and sandstones of Pleistocene age were mapped. These rocks are only partly consolidated and are very friable. However, a few beds are quite resistant to weathering agents and some overhang beds of unconsolidated sand.

Swamps and semi-muskeg are very common throughout the area. A few of the larger swamps enclose crescent-shaped lakes which are strung out en échelon. The water of these lakes is held back by arc-shaped natural dams, the convex sides of which face toward the bottom of the slope. The natural dams are made up of reticulated peat.

The valley of Témiscamie river probably has a tectonic origin. To the east, the river descends between steep rocky sides, along which are found concordant terraces made up of cross-bedded sand. In this vicinity, the sand terrace is about 35 feet above the level of the river. Downstream, because of the slope of the river bed, the terraces overhang the river by 45 to 55 feet, forming banks on either side which have an angle of repose of about 45°.

This sand terrace, which encloses at the same time the Témis, Misca and Témiscamie rivers, is part of a very large delta that formed when the total discharge of the rivers was greater than it is at the present time. On aerial photographs, successive meanders and terraces are quite apparent.

GENERAL GEOLOGY

All the rocks in the area are Early Precambrian in age, with the exception of several diabase dykes of unknown age and a few beds of sandstone and tillites of Pleistocene and Recent age.

Following a division established by Neale (1952), the Early Precambrian rocks are divided into two distinctive groups: the Western complex and the Eastern complex. These two groups of rocks are conveniently separated by a presumed fault that follows the valley of the Témiscamie river. The rocks close to this zone are generally crushed and sheared.

The gneissic structure of the rocks of the Western complex, is extremely variable. Near the southern border of the area these rocks are, in general, oriented east-west, whereas near the Témiscamie they are parallel to the river. To the northeast, the complex has a general northeast orientation.

On the other hand, the gneissic structure of the rocks of the Eastern complex trends east-northeast for the most part.

The Western complex consists principally of biotite gneiss and hornblende-biotite gneiss, both injected in variable proportions by granite, and biotite-rich pegmatites. Also, there are large intrusive masses of granite and of pegmatite which contain inclusions of amphibolite and biotite gneiss. Some bodies of diorite and of amphibolite seem to cut these older rocks. A few outcrops of metasedimentary rocks, injected by dioritic sills, were mapped at the northern border of the area.

The Eastern complex is made up of four distinct units. The oldest is an assemblage of biotite paragneiss, banded composite gneiss and garnet-bearing amphibolites. This unit is cut by three types of intrusive rocks which vary in composition from anorthosite with dioritic or gabbroic facies to pyroxene-hornblende granite and biotite granite gneiss. The last-mentioned cuts all other rocks of the Eastern complex.

Table of Formations

Cenozoic	Recent	Deltaic sand
	Pleistocene	Drumlins, moraines, eskers, tillites, sandstones
Unconformity		
Precambrian		Diabase dykes
Early Precambrian	Eastern Complex	Pink biotite granite gneiss
		Pyroxene-hornblende granite gneiss, a little biotite-hornblende augen gneiss
		Pyroxene diorite, anorthosite
		Amphibolite, garnet-bearing amphibolite, biotite schist, sericite schist, composite gneiss
	Western Complex	Diorite, amphibolite
		Biotite granite and pegmatite
		Biotite granite gneiss, biotite-hornblende granite gneiss; some granite and pegmatite injections; inclusions of amphibolite; porphyroblastic microcline gneiss
		Sandstone, microsandstone, lavas?, dioritic sills

Western Complex

Metasedimentary rocks and associated dioritic rocks

A narrow band of metasedimentary and igneous rocks is exposed along the northern border of the area. The metasedimentaries consist of impure, greenish grey, fine-grained sandstones and microsandstones. These rocks resemble lavas. They have been intruded by dioritic sills.

Biotite gneiss; lit-par-lit granite and pegmatite injections

Grey or pink biotite gneiss, with or without hornblende, covers about one-half of the area. The main mineral constituents are microcline, quartz, biotite and plagioclase, with lesser amounts of hornblende, magnetite and epidote.

The granite and pegmatite injected into the granitic gneiss may make up so much of the rock in places that the original gneiss is very difficult to recognize. In such places, the gneiss is found in the granite as dark-coloured inclusions, or as inclusions so nearly assimilated by the granite that only an alignment of ferromagnesian minerals remains.

In two places to the east of the Toqueco river, the contaminated granite grades into a porphyritic microcline granite.

Granite and pegmatite

In addition to the granite of the lit-par-lit injections, bodies of massive granite and pegmatite are present and are indicated separately on the map. In places, they contain angular inclusions of amphibolite. The granite is pink or grey in colour and medium- to coarse-grained. A few pegmatites, with crystals up to 2 feet or more long, are made up of 60 per cent microcline, 5 per cent plagioclase, 25 per cent quartz and 10 per cent combined biotite, hornblende and magnetite. Graphic texture is widespread.

Diorite

In the eastern part of the area, masses of dark grey to black, medium- to coarse-grained diorite cut the biotite gneiss and the biotite-hornblende gneiss. It is worthy of note that the granites and pegmatites are much less abundant in this part of the area than in the western part.

The diorites generally are gneissic but some are massive. The important minerals are hornblende (65 per cent), plagioclase (25 per cent), biotite (5 per cent) and quartz.

Eastern Complex

Amphibolite, mica schists

Amphibolite and garnetiferous mica schists are abundant in the southeast corner of the area. The amphibolite constitutes about 85 per cent of the group. These rocks are medium- to coarse-grained and contain 5 to 25 per cent brown or red garnet. In some places, garnets from 2 to 3 inches in diameter are found in the coarse-grained facies, although the average size is about ½ inch. The amphibolites have a very prominent vertical lineation, and are essentially made up of needles of hornblende 1/8 to ½ inch long bound together by allotriomorphic feldspar crystals.

The mica schists are found as thin bands among the amphibolites. They contain an average of 40 per cent biotite, 20 per cent or less of hornblende, and 40 per cent plagioclase, with quartz and garnet.

At one place in the southeastern portion of the area, two outcrops of massive, fine-grained actinolite schists were seen. This rock seems to have been derived from a metamorphosed lava.

Diorite and anorthosite

A long body of dioritic anorthosite is exposed to the southeast of Témiscamie river. This mass is separated in one place by a pyroxene granite which could only be an acid facies of the anorthosite. The anorthosite body is one mile to 3 miles wide. It does not reach the eastern limit of the area, but it is possible that it reappears farther to the east. The dioritic masses to the north of the Témiscamie river are possibly related to the dioritic facies of this anorthosite.

The anorthosite is grey on the fresh surface, medium- to coarse-grained, and made up of 90 per cent andesine with pyroxene and ilmenite. The dioritic facies covers a larger surface area than the anorthosite itself, making up nearly 80 per cent of the mass. It is composed of 20 to 45 per cent pyroxene and 30 to 50 per cent antiperthitic andesine, with calcite and ilmenite.

In places, the anorthosite has an augen texture, and encloses a large number of small, stretched, granite and syenite dykes showing *en boudinage* structure. These dykes may also be broken by a multitude of small faults.

Along the shear zone bordering the Témiscamie river, the diorite has been converted into a breccia in which the matrix is made up of calcite, green pyroxene, biotite, apatite, and hornblende. The fragments themselves have been trans-

formed into a biotite gneiss containing pyroxene, hornblende, calcite and apatite.

The anorthosite and diorite massif is probably younger than the amphibolite, since diorite dykes cut the latter. Also, the anorthosite is older than the biotite granite, which transects it in many places.

Pyroxene-hornblende granite gneiss

A body of pyroxene-hornblende granite borders the eastern side of the anorthosite massif and cuts it in one place. This rock usually is rusty weathering.

The typical rock is made up of 45 to 55 per cent brown to pink, automorphic, potassic feldspar, 10 to 40 per cent blue or clear quartz, 5 to 10 per cent grey plagioclase and about 10 per cent combined ferromagnesians and magnetite. Much of the pyroxene is rimmed with secondary hornblende.

A syenitic facies of the rock is dominant in the vicinity of Kranck lake. This facies lacks quartz and contains biotite surrounded by feldspar crystals.

Much of this granite has been converted into a pale pink augen gneiss in which the grains of potassic feldspar are isolated in a green chloritic matrix. It is interesting to note that this granitic augen gneiss grades into the augen-textured anorthosite mentioned above. Only the colour of the feldspar changes. Neale (1952) has established that this pyroxene granite is an acid facies of the anorthosite. Several of the writer's observations in the field support this assertion.

Gneissic biotite granite

Gneissic biotite granite occurs only in the southeast corner of the area. It is the youngest intrusive rock of the Eastern complex, with the exception of a few rare diabase dykes. A well developed augen structure is present in about 60 per cent of the rock. This granite is pink or grey on the fresh surface, white weathering and usually coarse-grained. The principal constituents are potassic feldspar (50 per cent) and quartz (25 per cent). The accessory minerals (25 per cent) include plagioclase, biotite, hornblende, garnet, and magnetite. This granite cuts the anorthosite and the pyroxene granite.

Diabase dykes

The diabase dykes can be subdivided into two groups: those that are oriented N.45°W. and found to the north of an imaginary line joining the northeast corner of the map to the middle of the southern border, and those that are oriented N.45°E. and found to the south of this same imaginary line.

The thickness of the dykes varies from a few inches to 350 feet or more. Only those more than 15 feet wide are shown on the accompanying map. The borders of the diabase dykes are microgranular, whereas the centres are coarse-grained. Some dykes are porphyritic, with white feldspar crystals from ½ inch to 2 inches long. Xenoliths of granite have been noted in these dykes, and apophyses of diabase penetrate the gneiss that borders the dykes.

STRUCTURAL GEOLOGY

Gneissosity and lineation

The direction and dip of the gneissic structure of the rocks of the Western complex varies greatly from one place to another and even across the same outcrop. Thus, it is difficult to establish the structural pattern of this assemblage of rocks. However, in general, the granitic gneisses of the southwest corner of the area trend east or even southeast, whereas, in the northeast corner, the trend is north-northeast.

The Eastern complex, on the other hand, has a very consistent east-northeast trend. Only the amphibolite massif seems to depart slightly from this trend. The lineation, in the amphibolite and in the adjacent biotite granite gneiss, is vertical or nearly so and is very strongly developed.

Faults

A major fault is believed to follow the middle of the Témiscamie River valley in this area and in the area to the south, mapped by Neale (1952).

In the present area, the fault is buried beneath a thick cover of stratified sand, but there are many signs which indicate its presence: (a) the strongly mylonitized and sheared rocks along the west side of the valley; (b) the variation in gneissosity and lineation between the Eastern complex and the Western complex; (c) the presence of a tectonic breccia over a distance of two miles, in the middle of the valley; and (d) the presence of a large number of shear zones and minor faults on either side of the valley. Some faults and shear zones exist also along and near the Camie river. These faults accompany breccias that are cemented by calcite, chlorite, rock dust and sulphides.

In the southeast corner of the area, a fault separates the biotite granite from the amphibolite.

Folds

The biotite gneisses of the Western complex are much deformed. They have been injected by granite and are half assimilated by the latter.

In the Eastern complex, some small folds have been observed, and large-scale folds in the amphibolite are indicated by variations in the direction of dip of the gneissic structure.

ECONOMIC GEOLOGY

At present, no mining rights are held in the area. A group of claims, covering some 20 square miles near the Toco and Toqueco rivers, was recently abandoned. During the summer of 1959, a prospector examined the rocks of the eastern half of the area.

Pyrite, pyrrhotite and traces of chalcopyrite have been found in practically all of the shear zones. The pegmatites and granites in the western part of the area contain a small percentage of magnetite.

The body of anorthosite and diorite to the south of Témiscamie river contains magnetite and ilmenite either in the form of massive lenses or disseminated through the rock. These minerals, in places, make up 15 to 20 per cent of the rock.

A tectonic breccia found along Témiscamie river is made up of rock fragments cemented by calcite containing large flakes of biotite, crystals of pyroxene, apatite and hornblende. This cement is radioactive, but chemical analyses of a group of samples did not yield any uranium.

The terraces of stratified sand along the valley of Témiscamie river constitute a major source of supply of this material.

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