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PRELIMINARY REPORT ON PIVERT LAKE AREA, MISTASSINI TERRITORY AND NEW QUEBEC

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PRELIMINARY REPORT

ON

PIVERT LAKE AREA

MISTASSINI TERRITORY AND NEW QUEBEC

BY

E. H. CARLSON



QUEBEC
1962

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INTRODUCTION

The Pivert Lake area, mapped by the writer during the summer of 1961, is located about 100 miles east of James bay and 175 miles north-northwest of Chibougamau. Eastmain river almost coincides with the northern boundary. The area covers about 235 square miles, and includes the quadrangle bounded by latitudes $52^{\circ}00'$ and $52^{\circ}15'$ and by longitudes $76^{\circ}00'$ and $76^{\circ}15'$, as well as the northwest portion of the adjacent quadrangle to the east. The area joins to the east with the Natel Lake area, mapped by Eakins in 1960.

Access is easiest by floatplane, with landings possible on Eastmain river, except along the 4-mile stretch of Grand-Détour rapids, and on Pivert lake in the centre of the area.

Low and swampy ground characterizes a great part of the area, with irregular hills rising gradually a few hundred feet above the general level. Eastmain river flows westward to James bay and provides the major drainage for the general region.

The forest cover blanketing the low hills consists largely of black spruce and jack pine. Locally balsam fir is abundant. Along the streams, and locally on sheltered slopes, white birch, poplar, alders and willows are common. Larch is found in swampy areas. A dense brush consisting chiefly of Labrador tea covers the area. Several old burns extend from a few miles south of Eastmain river almost to the south end of the quadrangle.

The outcrops along Eastmain river were first described by A.P. Low (1896). Dome Mines prepared a reconnaissance map of the general vicinity in 1935-1936. Shaw (1941, 1943) and Heywood (1958) also did reconnaissance work in the region.

GENERAL GEOLOGY

The bedrock exposed in the area is Precambrian in age, and consists for the most part of a thick sequence of rocks of mainly sedimentary and volcanic origin which now is highly deformed, metamorphosed, and locally granitized. Metamorphism has been to the epidote-amphibole facies although, locally, lower grade rocks are found. The regional structural trend is east-northeast, with outcrop patterns suggesting large plunging folds.

This sequence was intruded by dykes and sills of diorite during two separate periods. Three types of late, intrusive granitic rocks are found in the area: two bodies of a biotite granite, and stocks of a quartz monzonite and a porphyritic orthoclase granite. Sharp deviations from the regional trend, especially in the southeastern part of the area, suggest forceful injection of the intrusive bodies. Including the eastward extension of the porphyry, the intrusions underlie an area, elongate in a west-northwest direction, exceeding 20 miles in length and 7 miles in width and, thus, of batholithic proportions. Small dykes of lamprophyre cut the granite, and may be related to larger gabbro dykes, found in the southern half of the area.

TABLE OF FORMATIONS

CENOZOIC	RECENT AND PLEISTOCENE	Eskers, ground moraine, glacial outwash, alluvial deposits	
P R E C A M B R I A N	LATER PRECAMBRIAN	Basic and ultrabasic dykes	lamprophyre, gabbro, and pyroxenite
		Granitic intrusive bodies	porphyritic orthoclase granite, quartz monzonite, biotite and hornblende granite; dykes of aplite, pegmatite, and microgranite.
		Diorite dykes and sills	younger porphyritic diorite older diorite
	EARLIER PRECAMBRIAN	*	gneissic granodiorite, migmatite, coarse granitic gneiss and pegmatitic granite; includes metamorphosed sedimentary rocks and small intrusive bodies of dioritic to granitic composition.
		*	paragneiss and para-schist; minor metamorphosed volcanic rocks and gneissic granodiorite
		*	metamorphosed volcanic rocks; includes tuffs, agglomerates, and metamorphosed sedimentary rocks

* Relative stratigraphic position not certain

EARLIER PRECAMBRIAN ROCKS

Metamorphosed volcanic rocks

Metamorphosed volcanic and associated rocks are exposed northeast of the Grand-Détour rapids and are continuous with the thick sequence of metamorphosed volcanic rocks to the east mapped by Eakins in 1960.

The larger part of the sequence consists of fine- to medium-grained schistose amphibolites and hornblende schists, in general, poorly exposed. A band of mostly well-bedded tuff and agglomerate occurs in the easternmost portion of the area mapped. Thin beds of fine-grained, biotite-quartz schist and gneiss, and hornblende gneiss are locally interbedded with the metavolcanic rocks..

In the northern half of the quadrangle, and best exposed in the northwest part, a series of greenschists, schistose amphibolites, hornblende schists and gneisses, tuffs, and agglomerates forms a sequence approximately 2,000 to 3,000 feet thick. It locally includes thin beds of metamorphosed sedimentary rocks.

This series can be traced for many miles within the area. Metamorphism apparently increases toward the south, judging from the more abundant garnet to the south and the presence of green-schist at the north edge of the belt.

It is not certain that the sequence of metamorphosed volcanic rocks exposed east of Clearwater river is of the same age as the volcanic-derived rocks in the northern half of the quadrangle.

Metamorphosed sedimentary rocks

Three belts of metamorphosed sedimentary rocks are found in the area. One extends northward from the Grand-Détour rapids to the Eau-Claire rapids and is well exposed in the rapids themselves. It consists of hornblende schists and gneisses, quartzo-feldspathic gneisses, schistose ortho- and para-amphibolites, and gneissic granodioritic rocks. These rocks are well banded and locally finely laminated. Bedding is locally preserved and parallels foliation in several places. The western contact is more or less gradational into gneissic granodioritic rocks and migmatites although, locally, it is quite sharp.

A second band is exposed at the extreme southern edge of the area and extends to the south. It is 2,000 to 3,000 feet thick within the area. The rocks consist of uniformly foliated hornblende gneisses and schists, schistose amphibolites, biotite-quartz gneisses and schists, locally developed augen gneisses, muscovite-quartz schists and gneissic graudiorites. They are well banded and, in many places, are finely laminated. Where noted, bedding parallels foliation. The southern contact with gneissic granodioritic rocks and migmatites is gradational.

The third belt of metamorphosed sedimentary rocks grades into the main development of metamorphosed volcanics in the northern part of the area. This belt is poorly exposed but appears to be a few thousands of feet thick. It consists chiefly of hornblende gneisses and schists, biotite-quartz gneisses and schists, and biotite schists. Rocks derived from volcanics occur in the lower(?) portion of the series, and in the upper(?) portion, bands of gneissic granodiorite become more prominent.

Gneissic granodiorite and migmatite

This thick sequence underlies about 50 per cent of the area and includes a wide variety of rocks. Several of the formations are excellently exposed along the Grand-Détour rapids.

Typically, these rocks consist of light grey, well foliated, medium-grained, biotite- and hornblende-bearing granodiorites. They may grade directly into paragneisses and schists or into intrusive rocks of quartz dioritic to granitic composition. The migmatitic rocks are more local; they are well banded and usually somewhat contorted, but in general their foliation parallels that of the gneissic granodiorite into which they grade. The intrusive bodies usually retain a faint foliation parallel to the regional trend, although the foliation may vary considerably even within a small area, or be entirely absent.

In the southern half of the quadrangle, coarse granitic gneisses and migmatites trend east-northeast. As this belt merely represents a change in grain size, the contacts are inferred. The rocks are light-coloured, coarse grained, strongly foliated and often well banded. Many localized areas contain weakly foliated porphyroblastic granites, pegmatitic granites of replacement origin, or small intrusive bodies ranging from granodiorite to granite in composition. Most of these intrusive bodies are also syntectonic, although a few cut the younger porphyritic diorite.

Older diorite

The older diorite is found throughout the area but is concentrated in the east-central part. It has been deformed along with the original sedimentary and volcanic sequences, and its mode of occurrence is thus obscure; it probably occurred as sills, dykes, and irregular bodies. The diorite is somewhat variable in texture but is typically fine grained, dark grey, and composed chiefly of hornblende and plagioclase. It is not strongly foliated, except where shearing has locally developed a hornblende schist.

LATER PRECAMBRIAN INTRUSIVE ROCKS

Younger porphyritic diorite

Scattered throughout the area are dykes, sills, and irregular bodies of a porphyritic diorite. Typically this is a medium to dark grey rock with prominent subhedral hornblende phenocrysts up to $\frac{1}{4}$ inch long embedded in a fine-grained groundmass of

plagioclase, hornblende, biotite, and quartz. The hornblende laths are often crudely aligned in flow structure, and a weak schistosity, induced by shearing, is locally developed. In general, it has undergone little deformation. The two most prominent dyke trends are N70°-90°E., and N10°-30°W., both sets dipping steeply to vertical. The porphyritic diorite cuts the granitic gneiss and some of the local intrusive bodies; other small intrusive bodies, however, cut the diorite, as do the pegmatite and lamprophyre dykes.

Biotite granite

Two large bodies of biotite granite occur in the area, separated by 3,000 to 4,000 feet of metamorphosed sedimentary and volcanic rocks; these bodies may join west of the area. The granite is typically a pinkish-white, medium-grained rock consisting of approximately 55% potash feldspar, 15% quartz, 5% biotite, and 25% plagioclase. Locally, however, especially at the southern contact of the northern body, hornblende is the predominant mafic mineral. The texture is in general uniform, and inclusions are not common. Locally, biotite flakes are faintly aligned and, except in contact areas, the common trend is west-northwest. The contact is sharp, except in areas of gneissic granodiorite and granitic gneiss. Lack of strong shears, associated quartz veins, and pronounced foliation, distinguishes the biotite granite from earlier intrusive granites. Locally, small pegmatite and aplite dykes are numerous.

Quartz monzonite

A stock of a distinctive quartz monzonite is found in the central part of the area. It is typically a light yellowish-grey, medium-grained rock, consisting of about 45% orthoclase, 30% plagioclase, 15% quartz, 8% hornblende, and 2% biotite. The texture is quite uniform, although sparsely distributed orthoclase phenocrysts up to 3/8 inch long are found. Locally, small sub-rounded inclusions and mafic clots are present. Hornblende laths are crudely aligned in many places, trending predominantly west-northwest except in contact areas. The contacts are sharp where exposed.

The quartz monzonite has undergone little deformation, in general. However, in contact areas, it may be fractured, sheared, and intruded by small microgranite dykes and quartz veins. Small dykes of pegmatite and aplite intrude the main mass here and there.

Porphyritic orthoclase granite

An intrusive stock of porphyritic orthoclase granite with a few small apophyses occurs in the southeast portion of the area; this body is continuous to the east with the "porphyritic and pegmatitic granite" mapped by Eakins in 1960. It consists typically of a medium-grained, light-grey rock characterized by numerous euhedral phenocrysts of orthoclase 1/2 inch long, and smaller lath-shaped phenocrysts of hornblende. The phenocrysts are embedded in a medium-grained matrix of orthoclase, quartz, biotite, hornblende, and plagioclase. Hornblende generally is more abundant than biotite.

Numerous sub-rounded inclusions, mostly of dioritic and amphibolitic rocks, are found in the granite. These, along with the phenocrysts, accentuate flow structures, which trend northwest except where they parallel the contacts. The contacts are sharp except in local, narrow zones of assimilation where the typical phenocrysts are not well developed.

Dykes of pegmatite, aplite, and microgranite cut the porphyritic granite. Two types of pegmatite dykes occur, one of which carries rare elements.

Basic and ultrabasic dykes

Numerous dense, black dykes of lamprophyre, 1 to 5 feet wide, are scattered throughout the area. They strike north for the most part, have steep to vertical dips, and cut both granite and pegmatite.

Three, irregular, dyke-like bodies of gabbro occur in the central and southwestern part of the area. They are medium grained, dark greenish grey and composed chiefly of a greenish plagioclase and pyroxene, with some hornblende. The gabbro has a chilled margin of lamprophyre, suggesting that the two are related. Although local deflections of the compass needle were noted, no magnetic minerals were seen in these outcrops.

Two dyke-like bodies of a very coarse-grained, green pyroxenite, probably at least several hundred feet thick, were found. One cuts the quartz monzonite in the central part of the area; the other occurs in migmatitic rocks west of Eau-Claire river.

CENOZOIC HISTORY

Pleistocene glaciers moved across the area in a uniform south-southwest direction, as indicated by numerous striated rock surfaces and the elongation of a few, large, drumlin-like hills. The retreating glaciers deposited a thick cover of drift over most of the area, leaving only ridge tops barren. Several long (up to 10 miles), irregular eskers, 15-30 feet high, were observed; these mostly parallel the direction of ice advance, although some trend more westerly.

Several old terrace remnants composed of sand and poorly sorted gravel are found along Eastmain river. These remnants now stand 12 to 50 feet above the present level of the stream. In the southeast corner of the area, several terraces about 12 feet high and composed mostly of sand may represent glacial outwash.

STRUCTURE

Folds

A large west-plunging synclinal structure, which appears to be slightly overturned to the north, is inferred in the northern half of the area. Several smaller folds occur along the north limb.

These plunge west-southwest and appear to be slightly overturned to the southeast. These smaller folds may represent a later set, and lineations in the area also suggest two periods of folding.

In addition to the numerous minor folds and drag folds, small, tight, isoclinal folds parallel to foliation are apparent in some of the rocks where banding is distinct.

Faults

The most pronounced fault trend in the area strikes N. 70° - 90° E., and is steeply dipping. This trend approximately parallels the trend of the fold axes. The related fault and shear zones are best exposed along Eastmain river in the gneissic granodioritic rocks. One such shear in the north-central part of the area is 7 to 12 feet thick; the granodiorite was highly sheared and mylonitized, mineralized with barren quartz, and subsequently drag folded. Several other faults and shears of this trend occur along the Great Bend rapids; most are small, but locally a few shear zones exceed 8 feet in thickness. Several of the smaller shears of this set have been intruded by dykes of intermediate to basic composition; a few of these dykes have been later sheared and locally intensely mylonitized. The direction of movement along these zones is not known; drag, however, suggests a strong strike-slip component. They represent one of the earliest developed fracture sets.

Other prominent fracture and minor fault sets strike N. 30° - 50° E. and N. 40° - 60° W., and also dip steeply to vertical.

ECONOMIC GEOLOGY

Disseminated sulphides — The most pronounced area of pyrite mineralization occurs along the Eau-Claire River rapids, in metamorphosed sedimentary rocks. Locally, pyrite has replaced the rock bedding and foliation planes, where it forms thin bands up to 2mm. thick. Pyrite occurs in notable amounts throughout the metamorphosed volcanic sequence in the northwestern part of the area. At one locality, a small amount of disseminated chalcopyrite was noted.

Pegmatite dykes — Several rare-element-bearing pegmatite dykes are found in the south-central part of the area, where they appear to be associated with porphyritic orthoclase granite. They occur chiefly on the southwest margin of the west apophysis, extending as far as 3 miles southwest of the surface contact. They are mostly 2 to 10 feet thick, but a few exceed 30 feet. The strike is northwest in general and the dip is steep north. The pegmatites are composed chiefly of quartz, potash feldspar, muscovite, and albite. Locally, spodumene is quite abundant, and there are small pockets of biotite, tourmaline, and lepidolite, with scattered pods of molybdenite. No beryl was noted.

Quartz-molybdenite veinlets — Two small quartz-molybdenite veinlets were found, one in the area of pegmatite dykes, and the other near the Eastmain, below the Grand-Détour rapids. The former occurs in granitic

gneiss, and consists mostly of quartz, with some feldspar and small scattered pods of molybdenite; it is 2 inches thick, strikes N. 65° E., and dips 65° north. The latter, composed chiefly of quartz and feldspar, is $1\frac{1}{2}$ inches thick and contains a band of molybdenite $1/8$ inch thick in the centre. This vein strikes east, dips vertically, and occurs in a medium-grained hornblende diorite.

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