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FROMONT-LAPARRE LAKES AREA

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DEPARTMENT OF NATURAL RESOURCES

GEOLOGICAL EXPLORATION SERVICE

GEOLOGY OF THE FROMONT-LAPARRE LAKES AREA

Mistassini Territory

Preliminary report

by

E.H. Chown

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INTRODUCTION

The area consists of the Lac LaParre, 23 D/4 (NTS), map sheet and the southern half of the Lac Fromont 23 D/5 sheet. Both areas lie between 71°30' and 72°00 longitude, and extend from 52°22, a total area of approximately 560 square miles. The centre of the area is about 200 miles northeast of Chibougamau, and 150 miles west of Gagnon. It is accessible by aircraft based at either of these two places, or from Temiscamie River base, 90 miles to the southwest. Canoe travel within the area is possible along a chain of lakes in the centre, and along a few of the larger rivers.

The area lies across the divide between the Rupert and Eastmain systems, which flow into James Bay. Most of the LaParre area drains southwest via the Temiscamie River to Lake Albanel, whereas the northern part flows directly into the Eastmain River, which traverses the Fromont Area.

The southern two-thirds of the Laparre area is a plateau, 2200' 2000' in elevation, tilted slightly southwards. The plateau is punctuated by a few lov hills, and strongly grooved by southwest trending streams and glacial deposits. The north rim of the Otish Mountains, a strip of sharply dissected bedrock hills about 5 miles wide runs through the area trending a few degrees south of west. These hills rise to 2800' elevation and slope gently to the plateau to the south or drop abruptly to the low swampy plain of the Eastmain River. (1600' elevation,) which lies north of them.

Previous geological mapping in the area was done at a scale of one inch to 8 miles by Eade (1966). The area to the east was mapped

at a scale of one inch to one mile by Chown (1970) and that to the south at a scale of one inch to four miles, by Chown (1971b).

The area was mapped in the summer of 1969, with a brief visit to two properties in 1970. Considerable exploration work has been done by various mining companies in the area, and as a result large tracts of land were not traversed in any detail as previous surveys have yielded no outcrop. Detailed traverses were confined to the strip of mountains and to areas in the southern plateau, where aerial survey, air photograph examination or work by mining companies indicated a high probability of outcrop occurrence. No attempt has been made to traverse north of the mountains.

Table of Formations

		Ultrabasic Rocks	Pyroxenite, Gabbro
Proterozoic		Conflans Gabbro	Gabbro, uralitized gabbro sills and dykes.
		intrusive contact	
	Otish Group	Peribonca Fmn.	Unit B. purple argillaceous arkose.
			Unit A pink arkose, subarkose, dolomite
		Indicator Fmn.	Grey to pink subarkosic sandstone.
			Grey green, coarse arkosic grit and conglomerate
		unconformity	
Archean		Basement Complex	Granitic and Quartzo Feldspathic Gneiss Quartz diorite Amphibolite-migmatite Metavolcanic rocks, (amphibolite)

GENERAL GEOLOGY

An Archean basement complex comprising a four mile wide strip of metavolcanic rocks striking south of east, and a large mass of quartz diorite underlies most of the north lip of the mountains. Archean granitic gneiss and migmatite underlie much of the lower ground. The foliation in most of these rocks trends east-west and dips steeply.

The Archean rocks are overlain unconformably by gently dipping sedimentary rocks of the Otish Group (Early Proterozoic) comprising the Indicator and Peribonca Formations. The Indicator Formation crops out intermittently throughout the southern plateau, and occurs in minor outliers and fault blocks in the mountains. It is made up of a basal unit of coarse grit and conglomerate and an upper unit of well sorted grey to pink subarkose and arkose. The Peribonca Formation occurs only in a small fault slice in the southern part of the Laparre area and consists of 600-700' of pink subarkose and 50-70' of dolomite and 200' or less purple argillaceous arkose.

The Conflans Gabbro intrudes the basement complex along the edge of the sedimentary basin in three cone sheets which coalesce and pass upwards into sills on entering the sedimentary rocks. South of the rim of hills, the gabbro runs as a series of dykes trending roughly north-south and east-west. A small plug of pyroxenite intrudes granitic gneisses north of the main range of hills.

The sedimentary rocks dip gently south except where disturbed by faults.

Strike-slip faults trending 010 and 070 occur throughout the region and the 010 trending faults are dominant in this area.

Traces of uranium mineralization occur in the conglomerates of the Indicator formation, and in fractures in all rocks, particularly the Peribonca dolomite in the Laparre area. Occurrences of CU and Cu-Ni mineralization are known in the metavolcanic belt and the pyroxenite plug respectively.

The low-lying areas north and south of the mountains are heavily mantled with glacial debris, and the northern plain has an additional cover of swamp deposits.

Metavolcanic Rocks:

The metavolcanic rocks are similar to those described to the southwest (Chown 1971a) and east (Chown 1970). All are metamorphosed to the amphibolite grade and are composed of andesine and blue green hornblende in roughly equal quantities and minor amounts of opaques, epidote and biotite. They may divide texturally into metabasalt, metagabbro and fragmental metavolcanic rocks. All are brown on weathered surfaces and blue-black or green on fresh surfaces.

Most of the exposed metavolcanic rocks have a fine grained massive texture, foliated locally, especially along narrow zones. Distinct relict pillows in these rocks, (both deformed and undeformed) confirm that the bulk of them are former flows, probably basalt. The narrow foliated zones in these rocks show good correlation from outcrop to outcrop, where exposure is good, and are probably interflow zones.

Two lenses of amphibolite with a very coarse relict gabbroic

texture represent either penecontemporaneous sills (Chown 1971a) or very thick flows.

Some of the interflow areas are filled with compositionally banded and bedded amphibolite that is thought to be metamorphosed basic tuffs. Significantly most of these rocks are biotite bearing, suggesting an admixture of potassium bearing sedimentary or tuffaceous material.

The fragmental rocks are less resistant than the more massive amphibolites, and may underlie a large percentage of the low lying areas of the belt.

Migmatite:

Two migmatite zones are present in the map area. One occurs as a thin strip along the north border of the belt of metavolcanic rocks, and is structurally contigous with it, and the second occurs a few miles north as a northeast trending lens 1-1/2 miles long enveloped in massive quartz diorite.

The migmatite is a mixture of biotite amphibolite in blocks, lenses and discontinuous layers, interpersed with coarse grey pegmatite and aplite. The amphibolite blocks have a thin (1-2mm) selvage of biotite adjacent to these dykes and sills of pegmatite. The grain size of the plagioclase and hornblende in the blocks is 1-2mm, considerably coarser than in the main amphibolite. The hornblende and biotite have strong preferred orientations in individual blocks, and this is generally quite consistent over the whole outcrop. Pegmatite dykes and sills are composed of plagioclase and quartz, some of the larger contain some pink K feldspar.

Contacts between the migmatite and the quartz diorite are gradational, but are abrupt at the scale of the map.

Quartz Diorite:

A massive to slightly foliated quartz diorite crops out extensively in the chain of hills traversing the map area. It also occurs in adjacent parts of the Pluto Lake Area (Chown 1970) where it was noted but not separated on the map, and to the southwest (Chown 1971a).

The quartz diorite weathers a silvery white, and is mottled grey and dark green on fresh surfaces. It is composed of slightly tabular, waxy grey plagioclase(50%) quartz(35%)and dark green to black hornblende(15%). The hornblende is rudely aligned in some parts of the mass. Addition of pink K feldspar in patches and streaks is coincident with a conversion of hornblende to biotite, and converts the rock to a granitic gneiss. The addition of K feldspar appears to commence north of Noquaneau Lake and increases to the east and north.

Granitic gneiss and Quartzo feldspathic gneiss:

The low-lying parts of the area north of the mountains and the area southwest of the metavolcanic rocks are underlain by quartzofeldspathic and granitic gneisses. These are mainly layered to streaky gneisses which weather white to pink. On fresh surfaces their layered and foliated nature is more apparent. They are composed of alternating layers 2-20 cm thick of a coarse grained quartz plagioclase-biotite gneiss and grey to pink granite and pegmatite composed of quartz, K feldspar and plagioclase.

Rocks in some areas contain K feldspar in the gneissic portions as well as the granite veins and the rock grades into gneissic granite.

Otish Group:

Sedimentary rocks of the Otish Group, Early Proterozoic in age, overlie the Archean basement unconformably. The rocks are part of a large remnant of a sedimentary basin that covered at least 2000 sq. miles. The basal contact is not exposed within the area, but is known from several locations in the Otish Mountains to lie on a regolith covering the old land surface.

Preliminary investigations of drill hole information in the Papaskwasati Formation, an equivalent formation 70 miles to the southwest indicate that the Pre-Proterozic land surface had over 2000' of relief. It is suggested that the western end of the Otish Basin, within the Fromont-Laparre Area, was a rather sharp trough with a high north lip, represented by the resistant quartz diorite and metavolcanic hills now emerging from under a sedimentary cover.

The Otish Group underlies all the plateau area south of the mountains and is extensively covered with glacial debris. The Indicator Formation crops out throughout most of this area, and the Peribonca formation occupies a small area between faults near the southern edge of the area.

Indicator Formation:

The type section for the Indicator Formation near Lake Conflans (Chown and Caty, in preparation) is 1200' thick and

consists of a basal unit of grey conglomerate and coarse arkosic sandstone overlain by a thick sequence of more mature sandstones, chiefly subarkose. Three intercalations of conglomerate and arkose (grit) occur within this upper unit at the type section, and these die out to the east, but increase to the west.

In the Fromont-Laparre Area, the basal unit of conglomerate and arkose is well exposed at the eastern edge of the area along the north rim of the basin. It is less prominent farther west, and is only found in a few small outcrops around Riddell Lake. In contrast, the upper unit has changed markedly from its occurrence in the type area, and appears here to be composed of sandstone with numerous conglomeratic intercalations. A vertical drill hole east of Laparre Lake passes through 2000' of Indicator Formation and just enters the top of the basal unit. Addition of 500' of basal unit and a possible 500' of overlying material brings the maximum thickness of the formation to 3000'.

It is not possible, with the poor exposure, and lack of good criteria, to trace individual layers very far, however, where possible the rocks have been subdivided into the two lithologic units, conglomerate and grit, or sandstone.

The conglomerate and grits are white-weathering rocks. The lowermost unit is grey green on fresh surfaces and the upper ones are a very pale pink colour. The conglomerate is an oligomictic pebble conglomerate, with over 95% of the clasts made of vein quartz. Granite, feldspar, amphibolite, jasper and chert pebbles make up the remainder. Some of the upper conglomerates around Laparre Lake have many clasts of cobble size. All clasts, are well

rounded in contrast to the angular coarse arkosic matrix. The rock occurs in thick (1-2m) massive beds virtually devoid of any internal structure. Arkosic grit interbedded with the conglomerate is a very coarse grained, poorly sorted sandstone composed of angular to subrounded quartz and feldspar, with randomly distributed rounded quartz pebbles. (The rock is strongly condensed).

The outcrop pattern of the lower conglomerates and grit unit suggests that the high rim of hills bounding the basin on the north had at least three sharp valleys in it, which were filled by this unit. These valleys are north of the west end of Darnajou Lake and east and west of Noquaneau Lake, where sedimentary rocks extend farther north onto the basement complex.

The sandstone unit is composed of grey to pale pink moderate to well sorted subarkose. The rocks weather to a white colour and have a very pronounced bedding with 16cm to 1m spacing. Individual beds are massive or have a fine bedding lamination, shown by alternate layers of selectively sorted grains. Some beds are cross laminated in trough and planar type. The rocks are made up of moderately to well rounded quartz and feldspar grains cemented by grain interpenetrations and some matrix (particularly the pink rocks.) A few minor shale beds grey or pink in colour, are interspersed in this unit.

Peribonca Formation

The Peribonca Formation occupies a small area around X Lake near the southern edge of the map area. It is in part a thin slice of rocks down-dropped between two faults, that extends farther

south and underlies Indicator Lake. The thickest section of Peribonca Formation, however, lies east of this slice and represents a further down dropping possibly where two strike slip faults with hinge displacements meet.

Member A of the formation occurs in the extensive fault-slice and also underlies the other small basin. The upper member, Member B, has limited occurrence adjacent to the fault and is only known from drill holes and a few small outcrops. The total thickness of these units is unknown, but estimated from measured sections outside the area, and drill hole information to be around 1000'.

Member A

The lower member of the Peribonca Formation is a pink to grey well sorted sandstone, arkose in composition. The dominant pink colour is caused by minute grains of ferruginous matrix which is locally reduced giving the occasional grey beds or spots. The sandstones are largely cemented by fine granular dolomite, although some beds have a quartz cement. The unit is extensively cross bedded and finely laminated, the lamination being caused by selective sorting in successive layers.

The uppermost part of Member A is a dolomite which crops out in only one locality, but is known for several drill holes. The unit is 50' thick. It is grey white on weathered surfaces and white to pink on fresh surfaces. Parts of the outcrop display good algal bedding, but much of the dolomite

has been recrystallized and then replaced by coarse grained crystalline dolomite. Gashes and veins of very coarse dolomite cut across the primary and replacement structures. Some parts of the unit are seamed by chert veins.

The exposures are right at the hinge of a tight fold and the dolomite in this area is extensively brecciated. Breccia textures may be partly caused by partial solution of the dolomite, as it is thin or absent in some of the drill sections.

Member B

The upper member of the Peribonca Formation is an argillaceous purple sandstone. The few outcrops are brown weathering and strongly decomposed. The argillaceous nature of the outcrops has prompted some suggestion that these are red shales or argillites, however the drill cores show that while many beds are shale, the dominant lithology of the unit is a very shaley sandstone. The sandstone is a moderately sorted, well rounded arkose with a high content of matrix. The rock has a good bedding lamination, particularly in the sandy layers. The purple colour is noticeably paler in the coarse grained sandy layers.

Conflans Gabbro:

The sequence of gabbro sills and dykes which intrudes the Otish Group in a regular manner in areas to the east (Chown 1970) assumes a rather irregular form in the Fromont Laparre Area. The gabbro intrusions exposed in the mountains along the

boundary of the two map sheets form three interconnected cone sheets. The gabbro apparently intruded through the basement in low to moderately dipping cone sheets and then spread into the bedded rocks as either parallel sills of near vertical dykes.

The three cone sheets centre on Darnajou Lake astride the eastern border, the hill 3 miles west of Darnajou Lake, and Noquaneau Lake. All cone sheets are roughly similar, with gentle sill-like northern lips, dipping southward 5-10°, which swing into dyke-like eastern and western sides dipping inwards 60-70°.

The southern rim of the cones is a dyke or sill of gabbro intruding sedimentary rocks, and generally dipping north 45°. The two eastern cone sheets appear to connect and have a joint southern rim in the large dyke which extends to the southeast.

Part of the control of these intrusions may be the very irregular basement - sedimentary cover interface. The Darnajou and West Darnajou cones appear to connect just north of the west and of the lake, across a valley filled with sedimentary rocks, yet they intrude basement rocks along the north rim, and sides.

South of the cone sheets, the gabbro intrudes the sedimentary rocks as a series of dykes. Sills occur in the eastern part of the area capping hills of sedimentary rock.

The gabbro weathers pale tan and is black or dark green on fresh surfaces. The colour reflects the degree of uralitization of the original pyroxenes of the rock. At contacts the gabbro is extremely fine grained, becoming rapidly coarser away

from the contact. Most specimens are medium grained with a visible diabasic texture. The centres of thick dykes and sills are coarse grained and gabbroic in texture. Specimens taken more than 35m above a sill or sheet contact have a pockmarked weathering surface and on fresh surfaces show the cleavage faces of large (1-?cm) poikilitic pyroxene crystals. The Noquaneau and West Darnajou cone sheets are partly differentiated, and show a rough upward gradation from fine contact to medium grained gabbro, to gabbro with poikilitic pyroxene as occurs in most sills in the area. At 100-140m above the contact the large plagioclase laths are very strongly aligned in a platy fabric and enclosed in large clinopyroxene crystals. Above this narrow zone the rock is markedly pegmatitic, very coarse grained for about 30m before the grain size decreases to the upper chilled contact.

The basement core of the West Darnajou cone sheet is cut by a north-south dyke of porphyritic gabbro containing pale green, zoned, altered plagioclase crystals up to 15 cm long.

The gabbro near contacts and in dykes cutting sedimentary rocks in particular is strongly uralitized and some specimens partly altered to chlorite and epidote. The texture of the original rock is still visible, although the grain boundaries of the minerals are much less clear. The rock has an overall greenish caste.

Ultrabasic Rocks:

One large plug of ultrabasic rock intrudes the basement north of the range of mountains. The resistant rock forms a

large isolated hill on the Eastmain River Plain.

The central core of the plug is composed of pyroxenite, pale tan on weathered surfaces and green or black on fresh surfaces. The rock is very coarse grained and composed of an interlocking mesh of pyroxene crystals partly converted to talc and magnesian amphibole in some specimens.

The southeast portion of the plug, a low-lying shoulder on the hill, is composed of mafic gabbro. This rock is similar to the pyroxenite but contains 15-20% plagioclase.

The exact age of the ultrabasic rocks is unknown. Some indirect evidence from adjacent areas suggests that the ultrabasic sequence may be younger than the Conflans gabbro.

Pleistocene:

Glacial striae, crag and tail, and roches moutonnées in the area indicate that the last glacial advance was towards the south-west.

The lowlands north of the mountains are characterized by hummocky moraine and organic deposits of peat and muck (Hughes 1964), whereas ground moraine and glacio-fluvial deposits dominate the cover south of the mountains. Drumlinoid ridges occur in the plateau south of the mountains and in some of the higher ground north. Several prominent eskers and esker complexes pass through the area in a southwesterly direction following the major fault valleys through the mountains. Prominent meltwater channels are noted in valley deposits around the mountains.

The northern extension of a broad sand terrace, possibly a remnant outwash lake which occurs around Lake Indicator, extends into the southern portion of the area.

STRUCTURAL GEOLOGY

The belt of metavolcanic rocks which projects into the area from the west offers the only clue to the structure of the Archean rocks. Massive to slightly foliated quartz diorite is exposed elsewhere in the area.

Foliations in the metavolcanic rock strike south of east and dip North. Dips at the south edge of the belt are 10-30 degrees, steepening near the middle to 40-50° and at the northern edge 60 to vertical. Bedding in the fragmental rocks is parallel to the foliation. Top determinations on pillows in the southern segment of the belt indicate that the sequence is upright. No determinations were possible along the north edge of the belt. It is suggested that the belt is an isoclinal syncline overturned to the south. Stronger foliation in the overturned limb has eliminated primary features and makes confirmation impossible. It is possible that the entire sequence is one limb of a syncline, but this is rejected as no exposures of the syncline's other limb are known.

Lineations in the metavolcanics are of two types, long axes of boudins, which are horizontal and presumably parallel to the axis of folding, and hornblende and stretched pillow axes which plunge steeply down dip and represent the direction of tectonic transport.

Faulting

A pattern of vertical strike-slip faults striking 060 and 010 is well developed in the region, particularly in areas east and

southeast (Chown 1970) of the present area. The 010 set dominates the structural pattern in the Fromont-Laparre area, but the subordinate 060 set is present.

Most of the 010 faults appear to have a sinistral strike-slip movement with minor vertical movement. Much of this vertical movement may vary from place to place, any many of the faults are hinge faults. This is most marked in the fault which strikes through the small inlier of Peribonca formation. South of the area the vertical movement is east side up and within the area the movement sense is east side down. The fault apparently dies out to the north and its strike slip component is taken up by a fault about a mile to the east. The zone of fracturing in the Peribonca rocks is inferred to be the result of the transferrence of stress between these two faults. The faults occurring between these two faults maybe in part secondary faults produced by the main faults. The 010 strike slip faults are best shown by the series of prominent valleys cutting across the hills of basement rocks along the north rim of the sedimentary basin. Two strike slip faults trending 030 cut the metavolcanic rocks in the northwest. It is possible that these are an earlier set of faults.

The 060 set of faults should have destral movement on them, and some which offset dykes appear to. Most have minor vertical movement, generally south side up.

Faulting effects are limited to a very narrow zone. Minor slickensided zones occur near the faults, but the rocks are unmetamorphosed adjacent to the fault zone. One fault zone is exposed in a valley north of Darnajou Lake. The zone is two to

three feet wide filled by a breccia of angular fragments of granite gneiss and gabbro (the two adjacent wall rocks) cemented by very coarse (up to 1 cm) crystalline calcite. Joints in the area are either related to a major regional pattern as in much of the basement complex, or primary features as the cooling joints in the gabbro and the bedding joints in the sedimentary rocks. A few local joint sets are clearly related to faults, and are commonly slickensided.

ECONOMIC GEOLOGY

Minor concentrations of uranium and thorium minerals occur in rusty zones in the quartz pebble conglomerates of the Indicator Formation cropping out along the north rim of the sedimentary basin and in one deep drill hole south of the rim. Numerous boulders of fractured dolomite, sandstone and gabbro filled with seams of pitchblende occur in the vicinity of the down faulted block of Peribonca Formation in the southern part of the Laparre area. To date the bed rock occurrence of this mineralization has not been located, although radioactive water is issuing from at least one drill hole. The occurrence of fracture fillings of the pitchblende type with an associated hematitic alteration, in this and other parts of the region suggests that future prospecting for uranium in the Otish Mountains should pay attention to the possibilities of small, fault controlled high-grade uranium deposits, rather than large low grade conglomerate deposits.

Minor concentrations of copper in the metavolcanic rocks and copper-nickel in the ultrabasic rocks in the north were first discovered in 1956, and were reclaimed in 1969 and additional exploration work has been done on them. The copper occurs as minor disseminations of chalcopyrite and pyrite in the metafragmental sequence of amphibolite.

Chalcopyrite and pyrrhotite disseminations in a partly brecciated pyroxenite plug north of the mountains suggest that further attention should be given to the widespread series of late ultrabasic intrusions throughout the region.

Glacial outwash complexes, eskers and moraines contain an adequate supply of road building materials for the region. The Peribonca dolomite might make an attractive decorative building stone.

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Legend

7	Glacial Deposits	
6	Ultrabasic rocks	6a pyroxenite 6b gabbro
5	Conflans Gabbro	5b basal sill 5d dyke or cone sheet
4	Peribonca Formation	4d dolomite 4b upper member 4a lower member
3	Indicator Formation	3b sandstone 3a conglomeratic sandstone and conglomerate
2	Granitic complex	2c quartzo-feldspathic gneiss 2b migmatite 2a quartz diorite
1	Metavolcanic rocks	1c fragmental amphibolite 1b metagabbro amphibolite 1a metabasalt amphibolite

Symbols

Bedding horizontal, inclined, vertical (layered in igneous rocks)

Foliation inclined, vertical

Cleavage inclined

Joints horizontal inclined vertical

Trend and plunge of mineral lineation

Axis of boudins, horizontal

Pillows, top indicated

Fault, vertical movement, horizontal

Axial trace of syncline, overturned

Geological contact, assumed, defined with dip

Outcrop, small, large

Blocks

Esker

Diamond drill hole