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LA GRANDE RIVIERE AREA (1975 PROJECT)

NEW QUEBEC TERRITORY

Ministère des Ressources Naturelles Québec	
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Preliminary Geological Report

by

Kamal N.M. Sharma

Québec

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INTRODUCTION

The area mapped during the summer of 1975 covers about 2480 square miles between latitudes  $53^{\circ} 25'$  and  $54^{\circ} 00'$ , and longitudes  $74^{\circ} 00'$  and  $75^{\circ} 30'$ . It includes townships numbered 3422 to 3427, 3322 to 3327, 3222 to 3227, and parts of 3122 to 3127. Its central part is about 265 miles from Chibougamau, 305 miles from Matagami, and about 175 miles from Fort George on James Bay. The LG-3 camp of the James Bay Development Corporation, situated on La Grande Rivière is about 20 miles to the west of the western limit of the map-area, and the LG-4 camp is about 25 miles to the east of the eastern limit of the map-area. The road joining LG-2, LG-3 and LG-4 camps passes through the southern part of the area, south of Guyer lake. Some parts of the area in the vicinity of La Grande Rivière, Julie river, De Pontois river, and Grande Pointe lake will be affected by the hydro-electric projects under way along La Grande Rivière.

ACCESS

The area is easily accessible by float-planes based in Chibougamau, Matagami or in Fort-George. The central parts of the area may also be reached from Fort George by La Grande Rivière canoe route.

There are regular flights by Nordair between Montreal and LG-2 via Matagami, and by Quebecair between Bagotville and LG-2. The road joining LG-2, LG-3, LG-4 and Polaris camps is expected to be ready by 1976. There are air-strips near LG-3 and Polaris camps.

#### GLACIATION, TOPOGRAPHY AND DRAINAGE

The topography of the region is that characteristic of a heavily glaciated terrane as evidenced by the multitude of lakes and swamps. It is a result of the interaction of the geological structure and the relative resistance of different lithological units to glacial, fluvio-glacial, fluvial and marine erosion and deposition. The direction of the movement of ice as determined by glacial striae, glacial grooves, chatter marks etc. is mainly SW to WSW. Eskers are common in low-lying areas. Washboard moraines (annual moraines) which were quite common in the areas mapped to the west are rather absent from the present map-area.

The topography, in general, is rather subdued over most of the area, but is quite mountainous in the west-central part and west of the Tilly lake. An indistinct to distinct E-W trend predominates in the southern part of the area occupied by volcano-sedimentary rocks. There is no distinct trend in the northern and central parts occupied by the granitic rocks.

The area mapped belongs to the hydrographic basin of La Grande Rivière. The major rivers such as De Pontois, Corvette, Julie

and Tilly rivers drain into La Grande Rivière which in turn drains westward into the James Bay.

#### FLORA AND FAUNA

The forest cover in the map-area is quite irregular; it varies from scanty in parts affected by old forest fires to heavy in several other locations. The vegetation is dense in low lying ground but sparse or devoid in elevated parts. Black spruce and jack-pine are the most abundant conifer trees with minor tamarack and rare fir trees. Birch and poplar are common near water, such as streams and lake shores, and in areas affected by forest fires. Dense growths of alders are common along streams. Caribou moss, shrubs and lichen are abundant. Edible berries include blue, goose, black and red currant berries.

Fur bearing animals include beaver, otter, muskrat, marten, wolf, lynx, rabbit etc. A few black bears, moose and caribou were also seen.

W. Gaboriault identified several species of birds: common loon, Canada goose, black duck, pintail, red-breasted margsanser, osprey, herring gull, common tern, hawk owl, belted kingfisher, tree swallow, gray jay, spruce grouse, northern three-toed woodpecker, common raven, robin, hermit thrush, yellowthroat, rusty blackbird etc.

Pike and walleye abound in the lakes and streams. Speckled trout

(Red trout) and gray lake trout were caught only in some smaller lakes where there are no pike and walleye, and which are separated from bigger lakes by rapids and waterfalls. Speckled trout were also caught near some rapids and waterfalls in La Grande Rivière. White fish and carpe were found in some lakes which are connected by streams to the La Grande Rivière. The fish are more easily taken in lakes and rivers from the time the ice breaks through the month of July.

#### METHOD OF WORK AND ACKNOWLEDGEMENTS

Field work was carried out by a party of about 20 men, including 10 geologists, based at La Grande Rivière north of Guyer lake. A "Beaver De Havilland" float-plane was at the disposition of the party. The geological exploration work was accomplished by foot-traversing, geology of lake shore and of the navigable rivers and streams. All geological information was recorded on an Outcrop Input Document especially designed for the rocks of the Superior Province.

The senior field assistants during the summer field work were: A. Grenon, P. Guénard, L. Giorgi, C. Ducrot, J. Beaulieu, S. Bureau, P. Archambault, D. Chalamet and I. Abbotts. G. Bouchard and C. Gauthier acted as cook and assistant cook respectively. L. Noël, J. Noël, G. Harvey, M. Boucher, M. Foster, L. Levesque, W. Gaboriault and M. Pagé acted as canoemen. All the members of the party carried out their respective assignments in a highly satisfactory manner.

#### PREVIOUS WORK

The present map-area formed a part of a large scale reconnaissance mapping programme, at 8 miles to the inch, undertaken by the Geological Survey of Canada during the field seasons of 1957, 1958 and 1959. The results of this work are contained in a report by K.E. Eade (1966).

The areas to the west of this map-area were mapped at 1 mile to the inch scale by Sharma in 1973 and 1974.

No exploration activity was reported by mining companies within the map-area, but during the 1975 field season the James Bay Development Corporation in association with Eldorado Nuclear Ltd. and S eru Nucl eaire (Canada) Limit ee carried out some exploration work.

#### GENERAL GEOLOGY

All the crystalline rocks of the area, except for the Proterozoic Sakami Formation, form part of the Superior Province of the Precambrian Canadian shield and represent a typical assemblage of volcano-sedimentary rocks and associated granitic rocks, characteristic of Archean geology. The majority of the rocks in the southern part of the area are metavolcanic and metasedimentary, and are the oldest exposed rocks. They have been intruded by plutonic rocks varying in composition from diorite to quartz diorite to granodiorite to granite, which occupy the greater part of the north and center of the area. All these rocks have suffered deformation and metamorphism during the Kenoran orogeny around 2500 million years ago. The metamorphic grade

ranges from greenschist to lower amphibolite facies. The major structural trend is ENE-WSW. The dykes of gabbro, diabase and pegmatite, and quartz veins are the youngest rocks. The proterozoic rocks of the Sakami Formation form three outliers in the map-area.

TABLE OF FORMATIONS

QUATERNARY	Fluvial, marine, glacial and fluvio-glacial deposits	Sand, gravel, clay, silt, moraine, boulders and string-bogs
PROTEROZOIC	Sakami Formation	Pink to white sandstone Orange to pink sandstone Reddish conglomerate, arkose, mudstone and siltstone
ARCHEAN	Dykes	Diabase and gabbro dykes, Pegmatite dykes and masses - mostly unmetamorphosed
	Acid to Intermediate Plutonic Rocks	Granite-coarse grained, pink, massive to foliated, with minor variations to granodiorite and quartz-diorite Quartz-diorite-granodiorite with minor diorite and granite Granite-coarse to very coarse grained white to pink to red, in general migmatitic in origin
	Metasedimentary Rocks	Iron Formations Migmatites after the metasedimentary rocks Metasedimentary Rocks-rusty brown weathering and friable when weathered, with minor bands of basalt and amphibolite
	Volcanic Rocks	Rhyolitic tuff with interlayered basic lava and metasediments Intermediate lava-andesitic to dacitic, with minor interlayered basic lava and metasediments Ultrabasic Rocks-pyroxenites, peridotites, serpentinites and their metamorphosed equivalents Amphibolite and coarser gabbroic portions of basic lava Basic lava-predominantly basalt, with minor bands of interlayered metasedimentary rocks, intermediate to acid lavas and tuffs. In places coarse grained gabbroic and amphibolitic

### METAVOLCANIC ROCKS

The metavolcanic rocks form east-west trending belts in the southern part of the area where they are associated with the metasedimentary rocks, these represent the oldest rocks. The most predominant member among the volcanic rocks is basalt, particularly in the belt which passes through Marie, Kristine and Guyer lakes. Ultrabasic flows, which may be similar to komatiite chemically, have been discovered in the volcanic belt which passes through Léger lake south of Guyer lake. The ultrabasic rocks are represented by serpentized peridotites and pyroxenites. Southwards within the same belt the volcanic rocks are mainly represented by gabbroic and basaltic flows. In a few places well preserved as well as deformed pillows with good chilled margins have been observed in basalts and in the ultrabasic rocks. The tops of the flows are towards the south. Very minor amounts of intermediate lavas, rhyolite, and ultrabasic, basic or acid tuffs have also been noted locally. Rhyolite can be mapped separately near Andrea lake. A certain amount of metasedimentary rocks and several important horizons of quartz-magnetite iron formations occur interlayered with the volcanic rocks. Similarly some volcanic rocks are found in areas mapped as metasedimentary rocks.

The volcanic rocks can easily be traced on the aeromagnetic maps by the characteristic high anomaly. They can also be distinguished on the air-photos by their dark colour and tendency to form elongated ridges.

Basalt is generally grey-green on the weathered surface and dark

grey to black or grey-green to very dark green when fresh; it is very fine, fine or medium grained, massive to well foliated or even schistose. In places, some layers are coarse grained and thus gabbroic in character. Metamorphism and accompanied recrystallization has resulted in an increase in their grain size and a change in their original mineralogical composition and texture. The original pyroxenes have been completely transformed to an assemblage containing highly neoblastic actinolite with minor epidote, chlorite, biotite, calcite and quartz. The plagioclases have also suffered saussuritization and sericitization to varying degrees. Some quartz is also present. The quartzo-feldspathic material has acquired a granoblastic texture. Some of the highly schistose varieties of the basalts are rich in chlorite, biotite and epidote. The accessory minerals present include zircon, iron-oxides, sphene, pyrite, calcite. The basic tuffs are characterized by their finely layered nature and by the presence of a thin weathered crust.

The ultrabasic rocks are represented by serpentized peridotites and pyroxenites. These rocks are particularly well exposed south of Guyer lake in the region of Leger lake where some well preserved pillows were observed. Two principal varieties of peridotites are distinguishable in the field - a porphyritic variety and a massive homogeneous variety. The porphyritic peridotites are characterized in the field by their pitted appearance caused by the weathering out of olivine phenocrysts which are on the average about 1 cm. in diameter. The rock has a brownish or rusty weathered crust and is very dark green to nearly black on fresh surface. They are quite dense, tough and hard to break. Pe-

trographic study reveals that the olivine phenocrysts are set in a highly serpentized matrix. The olivine phenocrysts are also serpentized to varying degrees and are surrounded by a thin rim of radiating actinolite needles or fibres. The occurrence of actinolite around olivine phenocrysts suggests the possibility of the presence of an earlier pyroxene rim around the olivine, which was completely transformed to actinolite. The matrix of the porphyritic peridotites is very rich in serpentine, although rare relics of olivine can also be observed in some thin-sections. The other minerals that may be present in the matrix are actinolite, talc, chlorite, epidote, iron-oxides and calcite. The distribution pattern of iron-oxides and actinolite gives an indication of the original grain margins of the serpentized olivine in the matrix. Iddingsite is found associated with the phenocrysts as well as with the matrix.

The massive homogeneous variety of the peridotites is also characterized by a brownish weathered crust and very dark green to nearly black fresh surface. They are also highly serpentized with only a few relics of olivine. Other minerals that may be present include actinolite, chlorite, epidote, calcite, talc, iddingsite, and iron-oxides. Here again the arrangement of iron-oxides and actinolite indicates the original grain boundaries in the rock.

The pyroxenites are generally fine grained rocks, but may also be medium to coarse grained. These rocks are light green on the weathered surface and dark olive green on fresh surface. The fine grained varieties possess a shiny appearance because of reflections from fine

actinolite needles. The original pyroxenes have been completely transformed to radiating aggregates of columnar to fibrous actinolite, accompanied by chlorite, calcite and iron-oxides. In only some thin-sections the distribution pattern of iron-oxides indicates the probable original grain margins of the pyroxenes. The rocks with compositions intermediate between peridotite and pyroxenite are also present in this belt of volcanic rocks.

Rhyolite mapped near Andrea lake is white to very light grey in colour and shows shiny reflections from quartz phenocrysts. Petrographic study shows that it is a very fine grained rock with a highly quartzo-feldspathic matrix, containing phenocrysts of quartz, plagioclase and microcline. The plagioclase phenocrysts show sericitization. There is also development of sericite, muscovite, biotite and epidote resulting from metamorphism.

The intermediate lavas, observed only in rare cases, are much lighter in colour in comparison to basalts. They vary in colour from dark grey to light grey-green. They are characterized by the abundance of quartzo-feldspathic minerals and by a diminution of the mafic minerals content.

#### METASEDIMENTARY ROCKS

The largest exposure of the metasedimentary rocks is mapped in the southwestern part of the map-area in close association with the east-west trending volcanic belts. Near the southern limits of the volcanic belt which passes through Léger lake the amount of ultrabasic

rocks decreases and the volcanic rocks are mainly represented by gabbroic and basaltic flows. Further to the south, the volcanic rocks decrease in importance and a predominantly metasedimentary sequence of rocks starts with a basal conglomerate. This conglomerate is an excellent marker horizon and can be followed over a long distance along strike. It contains pebbles of basic volcanic rocks, granitic rocks and iron-formations. The metasedimentary rocks south of this conglomerate almost always contain a certain amount of interlayered volcanic rocks and quartz-magnetite iron-formations.

The metasedimentary rocks occurring in the vicinity of the volcanic belts are quite fine grained and dark grey in colour. It is only in a few rare thin-sections that the observation of well preserved original detritic character proves that these fine grained metasediments were originally graywackes, siltstones or argillites. But, in general, such primary textures and structures are more or less completely modified by metamorphism and accompanied recrystallization, with the result that the rocks have acquired a good granoblastic texture as shown by their quartzo-feldspathic grains, whereas the mafic minerals define a good foliation by their preferred orientations. The mafic minerals present in these metasediments may include a combination of the following minerals: biotite, chlorite, amphibole, epidote, iron-oxides, muscovite, sericite, garnet etc.

Further south, away from the volcanic belts, the metasedimentary rocks are somewhat coarse grained biotite and/or amphibole paragneisses, light grey to dark grey in colour, with a good granoblastic

texture of the quartzo-feldspathic grains, and a good foliation shown by the preferred orientation of the mafic minerals. These paragneisses are well layered, commonly rusty weathering, friable when weathered, and much more migmatized than the finer grained metasediments described above. They are commonly associated with varying amounts of white to pink granite and pegmatite of migmatitic origin and show the development of garnet porphyroblasts in places. It is quite common to observe a complete gradation from good paragneisses to migmatite to granite-pegmatite based upon the percentage of the mobilizat present. Some outcrops may be composed entirely of white or pink granite-pegmatite with little evidence of the presence of paragneisses. Garnet is observed in this granite-pegmatite also. The mafic minerals commonly present in these metasediments are biotite, and hornblende, but chlorite, actinolite, garnet, epidote, iron-oxides, muscovite, zircon etc. have also been observed. The plagioclase may be fresh or saurruritized and sericited to varying degrees. Microcline is rather rare.

Bands of quartz-magnetite iron-formations, varying in thickness from a few inches to several hundred feet thick, occur interlayered with the metavolcanic and metasedimentary rocks of the area. The iron formations show a very good layered structure defined by the presence of magnetite rich layers and quartz rich layers. The quartz is probably recrystallized chert. Some disseminated pyrite is also present in the iron formations. Some iron formations are associated with dark green coloured bands containing mostly grunerite, magnetite and quartz.

The metasedimentary rocks mapped in the eastern part of Grande

Pointe lake are the continuation of a very extensive belt of these rocks mapped to the west during the summer of 1974. Here the close association of the metasedimentary rocks and quartz diorites makes it difficult to show the exact distribution of these rocks at the present scale of mapping. Thus, the quartz diorites found immediately to the east of the area mapped as metasediments invariably contain a few bands and lenses of metasedimentary rocks. The quartz diorite is younger than the metasediments as evidenced by its intrusive nature.

A small area of metasediments is also mapped in the southeastern part of the map-area, near Smokycat lake, in close association with a belt of metavolcanic rocks.

#### PLUTONIC ROCKS

The metasedimentary and metavolcanic rocks have been intruded by plutonic rocks with a composition predominantly in the quartz diorite-granodiorite range, but may also be dioritic and granitic in places. These plutonic rocks occupy most of the northern two-thirds of the map-area. In places these rocks are quite porphyritic due to the presence of microcline and plagioclase phenocrysts. The plutonic rocks show the effects of deformation and metamorphism by the development of cataclastic textures and foliation developed to varying degrees. In general, the plutonic rocks are more foliated and sheared in the vicinity of metasedimentary and metavolcanic rocks, and are quite massive or only faintly foliated away from their contact with these rocks. The granites and pegmatites seem to be the least deformed among the intrusive rocks.

Petrographic study of the quartzdiorite- granodiorite indicates that these rocks are coarse grained, massive to foliated, occasionally porphyritic, grey to grey-pink to grey-green to pink to pink green in colour. In places these rocks tend to acquire a greenish grey to reddish grey colour caused by highly saussuritized and sericitized plagioclase which is the main feldspar present. The relatively undeformed and massive varieties possess a good hypidiomorphic texture due to the presence of euhedral to subhedral plagioclase grains, and anhedral microcline and quartz grains. In general, well twinned microcline is present in only very minor amounts. The quartz diorites may contain practically no microcline, whereas the granodiorites may contain up to 20% or more microcline. The rocks containing microcline may show perthitic texture and the development of myrmekites in plagioclase grains adjacent to microcline grains. The quartz content of the rock varies from 5 to 30% and the mafic content from 7 to 25%. Hornblende is the predominant mafic mineral which shows alterations to biotite, chlorite and epidote. The accessory minerals include zircon, sphene, apatite, iron-oxides etc.

In most cases the plagioclase shows much saussuritization and sericitization, sometimes with development of big grains of sericite, muscovite, epidote and calcite. It is only in a few thin sections that completely fresh plagioclase can be seen. The massive to faintly foliated varieties of quartz diorite-granodiorite preserve the original igneous texture as shown by the sutured grain margins of the quartzo-feldspathic grains and by automorphic plagioclase grains. With increasing deformation and the development of foliation, the originally coarse feldspar and quartz grains tend to surround themselves with finer grained polygonal

grains as a result of cataclasis and recrystallization. Some of the highly deformed varieties of quartz diorites encountered near the faults which limit the Proterozoic Sakami Formation are simply cataclasites, mylonites and in extreme cases chlorite schists. These rocks are characterized by completely polygonal texture, development of quartz ribbons, highly strained nature of quartz, nearly complete transformation of the mafic minerals to chlorite and the extreme sericitization and saussuritization of plagioclase.

The varieties poor in quartz and richer in mafics give rise to a rock of dioritic composition. The plagioclase of the diorites is generally euhedral to subhedral. Hornblende is the principal mafic mineral which may show alternations to biotite, chlorite and epidote. The accessory minerals include zircon, sphene, apatite, iron-oxides etc. The plagioclase may show alternations to varying degrees.

Bands and inclusions of amphibolite and coarse hornblendite are commonly observed in the quartz diorite, granodiorite and diorite in different parts of the map-area.

Mapping experience over the past three years in La Grande Rivière area has made it apparent that there are several generations of quartz diorite-granodiorite and diorite. Some varieties of these rocks may actually be older than the volcanic and sedimentary rocks, and thus represent the primitive Archean basement. These "older" quartz diorites are characterized, in general, by the development of a good foliation, highly migmatized nature and the frequent occurrence of bands and lenses

of amphibolites and hornblendites. Good examples of the quartz diorites belonging to this category are exposed near the rapids and water falls along La Grande Rivière north of Guyer lake. On the other hand, the frequent occurrence of inclusions of metavolcanic rocks, and lit-par-lit injections of quartz diorite-granodiorite-diorite in the metavolcanic and metasedimentary rocks suggests the presence of younger granitic rocks. At the present scale of mapping it is difficult to successfully separate the various generations of these granitic rocks because of their similar appearance in the field.

Granite occurs locally in different parts of the area. It is pink to grey-pink, coarse to very coarse grained, and generally porphyritic with big microcline crystals showing good carlsbad twinning visible in hand specimen. The predominant feldspar is microcline. Other minerals present in the rock include quartz, plagioclase, hornblende, biotite, chlorite, epidote, zircon, sphene, apatite, iron-oxides etc.

#### DYKES

The dykes of gabbro, diabase, pegmatite and quartz veins are the youngest rocks of the area which traverse all the previously mentioned rocks. Most of the gabbro-diabase dykes are unmetamorphosed, although a few older, metamorphosed and foliated gabbro-diabase dykes - now represented by amphibolites - have also been noted. Some of the unmetamorphosed gabbro-diabase dykes are mappable and possess a general NW to NNW trend, except for one dyke found in the eastern part of Grande Pointe lake which has an ENE trend. The larger dykes possess

good chilled margins and can be traced for long distances on air-photos and sometimes on aeromagnetic maps. The rock is dark grey to nearly black or grey-green when fresh, and dark brown to grey-brown on the weathered surface. The grain size varies from fine to coarse, and the term diabase is used for the finer grained varieties and gabbro for the coarse grained varieties. Ophitic to subophitic texture is common. Compositionally they consist of plagioclase, pyroxene, hornblende, biotite and iron-oxides. Deuteric alteration has resulted in extensive saussuritization and sericitization of plagioclase. In some cases epidote is also noted. The plagioclase of these dykes possess a greenish tint because of extreme saussuritization. Greenish plagioclase phenocrysts are quite common. The chilled margin rock is characterized by the presence of euhedral plagioclase phenocrysts in a matrix composed of devitrified glass.

Petrographic study leads to the identification of two main classes of gabbro-diabase dykes: - (1) olivine bearing dykes, and (2) quartz bearing dykes. The former show euhedral to subhedral serpentinized olivine phenocrysts in the chilled margin as well as in the central parts of the dyke; the latter dykes contain quartz which is interstitial to plagioclase and pyroxene.

A few rare occurrences of serpentinized peridotite dykes emplaced along joint planes or fault planes were also observed. These dykes are not mappable.

### STRUCTURE AND METAMORPHISM

The metasedimentary and metavolcanic rocks of the area have been folded into tight major E-W to ENE-WSW trending structures and minor N-S to NNW-SSE open structures. Because of the present scale of mapping and the difficulty of access to certain areas occupied by metavolcanic and metasedimentary rocks, it was not possible to follow the various structures in detail in the field. However, to demonstrate the complexity of folding and the pattern of major folds and faults present in the area air-photo lineaments are shown on the geological maps. The metavolcanic and metasedimentary rocks possess a good compositional layering and a good foliation parallel to it. In places the volcanic rocks, particularly the basalts, have been metamorphosed to fine to medium grained amphibolites with a well developed foliation. The various tuffs preserve their original finely layered nature. The plutonic rocks have also developed a foliation to varying degrees in different parts of the area.

The grade of metamorphism ranges from greenschist to lower amphibolite facies, as evidenced by frequent occurrence of the assemblage epidote, chlorite, actinolite, muscovite, sericite, calcite, garnet etc. in the metasedimentary and metavolcanic rocks, and in the minerals of retrograde metamorphism in the plutonic rocks.

### SAKAMI FORMATION

The Proterozoic rocks of the Sakami Formation form three outliers in the map-area: - (1) near Harry and Elizabeth lakes, (2) near Canard lake, and (3) near Tilly lake. They are in faulted contacts with the

surrounding Archean rocks. All the faults which limit the Sakami Formation rocks are shown on the geological maps. The only effect of faulting on the rocks of the Sakami Formation is the tilting of the beds, which are otherwise subhorizontal and completely unmetamorphosed. But in the Archean rocks the faulting has resulted in the development of cataclastic, sheared and mylonitized zones. Some of these faults can be traced for long distances, particularly the one limiting the Sakami Formation on the south shore of Tilly lake. Many of the joint planes in the vicinity of the faults are coated with specular hematite.

Excellent sections of the Sakami Formation are exposed near the northwestern part of Tilly lake. Here the lower parts of the formation consist of reddish conglomerate, shale, mudstone, siltstone, arkose and sandstone. The shaly and muddy rocks represent at least half the thickness of the section exposed here. The reddish colour is due to the ferruginous limonite matrix. Some of the red sandstones may even be classified as a type of iron formation with the presence of this ferruginous matrix which may account for up to 30% of the whole rock. Diagenesis has resulted in the development of some goethite and sericite. The upper parts of the Sakami Formation here are occupied by orange, pink and white sandstones. In all the sandstones the quartz and feldspar grains are well rounded and well sorted. The pink or orange colour of the sandstone is attributed to a thin coating of ferruginous material around the quartz and feldspar grains, whereas in the white sandstones this ferruginous coating is very insignificant. All the sandstones contain ferruginous, argillaceous, silty or authigenic quartz matrix. Some joint planes in the sandstones show the development of good quartz

crystals. The conglomerate units, observed near the lower portions of the section, vary in thickness from a fraction of an inch to a few feet. They are reddish in colour and contain angular to subangular pebbles of vein-quartz, granitic rocks, cherts, and iron formations. The sedimentary structures observed include cross-bedding, mud-cracks, rolling of mud sheets etc.

#### ECONOMIC GEOLOGY

Disseminated pyrite and chalcopyrite are commonly observed in the metavolcanic, metasedimentary and ultrabasic rocks. Chalcopyrite is less common than pyrite. A few chalcopyrite and pyrite bearing veins and a few silicified zones containing these minerals have been noted in the metavolcanic rocks. Some pyrrhotite mineralization was also observed in the ultrabasic rocks. The ultrabasic flows in the southern part of the map-area present a good potential for nickel mineralizations.

Several important zones of quartz-magnetite iron formations were discovered interlayered with the volcano-sedimentary rocks of the area. The iron formation bands vary in thickness from a few inches to several hundreds of feet thick.

Some of the reddish sandstones and arkoses found in the lower part of Sakami Formation are quite ferruginous.

Many of the joint planes in the vicinity of the faults are coated with specular hematite.

In places, the lowermost conglomeratic and shaly units of the Sakami Formation show above back-ground radioactivity. Detailed exploration of the unconformity between the Archean rocks and the Sakami Formation may thus be good prospecting ground for uranium mineralization.

All the major fault systems which limit the Sakami Formation, as well as the ones that affect the Archean rocks, can be important in search for the remobilized uranium in the area.

North of Guyer lake, a wide beach along La Grande Rivière contains radioactive sands.

The Sakami sandstone has a very high percentage of  $\text{SiO}_2$  and because of its uniform composition may be used as a source of silica. Due to its hardness, resistance to erosion, beautiful colour, and uniform composition, this sandstone may also be exploited for building stone.

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