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LA GRANDE RIVIERE AREA (NOUVEAU-QUEBEC) - PRELIMINARY GEOLOGICAL REPORT

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LA GRANDE RIVIÈRE AREA

(1976 PROJECT)

New-Quebec Territory

K.N.M. Sharma

Preliminary report

1977

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GOUVERNEMENT DU QUEBEC

MINISTERE DES RICHESSES NATURELLES

SERVICE DE L'EXPLORATION GEOLOGIQUE

LA GRANDE RIVIERE AREA

(1976 PROJECT)

QUEBEC TERRITORY

Preliminary geological report

by

Kamal N.M. Sharma

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New Québec Territory

by

K.N.M. Sharma

INTRODUCTION

The area mapped during the summer of 1976 covers about 6420 km^2 between latitude 53°25' and 54°00', and longitudes 72°30' and 74°00'. It includes townships numbered 3428 to 3433, 3328 to 3333, 3228 to 3233, and parts of 3128 to 3133. Its central part is about 440 km from Chibougamau, 555 km from Matagami, and about 385 km from Fort George on James Bay. The LG-4 and Polaris camps of the Société d'énergie de la Baie James are situated on La Grande Rivière within the area. The road joining LG-3 and LG-4 camps, which is only partly completed, passes through the central part of the area. Large sections in the north-central part of the area will be submerged as a result of the hydro-electric projects under way along La Grande Rivière. These are in the vicinity of La Grande Rivière between LG-4 and Polaris camps, and also along Laforge river.

Access

The area is easily accessible by float-planes based in Chibougamau, Matagami or in Fort George. The northern 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 Québecair between Bagotville and LG-2. There are airstrips near LG-4 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 and some of them may be traced for tens of kilometers. Washboard moraines (annual moraines) which were quite common in the areas mapped to the west are absent in the presnt map-area.

The topography, in general, is rather subdued over most of the area, but is quite mountainous in the regions surrounding Tilly lake and LG-4. An indistinct to distinct ENE to E trend predominates in areas occupied by volcano-sedimentary rocks. There is no distinct trend in parts occupied by granitic rocks.

The area mapped belongs to the hydrographic basin of La Grande Rivière. Laforge river, which is the only other major river in the area, drains into La Grande Rivière which in turn drains westward into the James Bay. The majority of the lakes are quite shallow. and thus require special attention while canoeing or float-plane landing.

Flora and fauna

The forest cover in the map-area is irregular; it varies from scanty in large parts affected by old forest fires to heavy in several other locations. The vegetation is dense in low lying ground but sparse or absent 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 streams and lake shores, and in areas affected by forest fires. In general, the trees have a small butt diameter due to rigorous climatic conditions. Dense growths of alders are common along streams. Caribou moss, shrubs and lichen are abundant. Edible berries include blueberries, gooseberries, black and red currant.

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

The species of birds observed include common loon, Canada goose, black duck, pintail , red-breasted marganser, 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.

Northern pike abound in the lakes and rivers. Speckled trout (Red trout) and gray lake trout were caught only in some smaller lakes where there were no pike. Speckled trout were also caught near some rapids and waterfalls in La Grande Rivière and Laforge river. The lake trout are more easily taken in lakes and rivers from ice break-up until the beginning of July, whereas the best fishing period for speckled trout is from late July to the end of August.

Method of work and acknowledgements

Field work was carried out by a party of 22 persons, including 10 geologists, based at Polaris lake (La Grande Rivière) north of Sauvolles 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 shores and of 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: G. Woussen, A. Giret, K. St.Seymour, G. Fortin, D. Moisan, R. Farley, M. Tremblay, R. Cavanagh, and A. Oyé. L. Miousse and N. Morin acted as cook and assistant cook respectively. L. Noël, J. Noël, G. Harvey, P. Gravel, W. Larouche, R. Beaulieu, M. Amiot, M. Lalancette, and A. Beaudoin 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, 1974 and 1975.

No exploration activity was reported by mining companies within the map-area, but during the 1976 field season the James Bay Development Corporation, in association with Eldorado Nuclear Ltd. and Seru Nucléaire (Canada) Limitée, carried out some exploration work. The Société d'Energie de la Baie James was carrying out a systematic drilling program in the vicinity of LG-4 and east of Tilly lake in order to examine the bedrock within and around the area that will be flooded by the hydroelectric project.

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 metavolcanic and metasedimentary rocks, which are the oldest exposed rocks, occur in a few ENE to E trending belts. They have been intruded by plutonic rocks with a composition predominantly in the quartz diorite-granodiorite range, but which may also be dioritic or granitic in places. These plutonic rocks occupy the major part of the map-area. All the rocks 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. In the north-central part of the area, the Proterozoic rocks of the Sakami Formation form a large outlier which extends from Laforge river to Tilly lake.

Metavolcanic rocks

The metavolcanic rocks occur in five ENE to E trending belts situated in the southwestern and southeastern parts of the map-area. The belt which passes through Paris lake is the eastward extension of the belt mapped during the 1975 field season. The predominant rock-type in the southern part of this belt is basalt accompanied

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

by metasedimentary rocks, iron formations and some ultrabasic rocks, whereas the northern part consists mainly of metasedimentary rocks with very minor basalt and iron formations. In the small band of volcanic rocks mapped east of Corvette lake, basalt is associated with peridotite characterized by a pitted appearance due to the weathering out of olivine phenocrysts. This peridotite is similar to that observed south of Guyer lake last summer. Similarly basalt is abundant in the two small bands of volcanic rocks that pass through Farley and Jean-Guy lakes, and in a larger band which passes through Loup lake. Here again the other rocks that may be present in minor amounts are metasedimentary rocks, iron formation, and ultrabasic rocks. Only very minor amounts of basic and acid tuffs have been noted locally associated with the metavolcanic rocks. In addition, some metavolcanic rocks are always found in areas mapped as metasedimentary rocks.

The volcanic rocks can easily be traced on the aeromagnetic maps by a 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 consequent 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 nematoblastic actinolite with minor epidote, chlorite, biotite, clacite and quartz. The plagioclases have also suffered saussuritization and sericitization to varying degrees. The quartzofeldspathic 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 and 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 serpentinized peridotites and pyroxenites. 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. They show a brownish or rusty weathered crust and are very dark green to nearly black on fresh surface. They are quite dense, tough and hard to break. Petrographic study reveals that olivine phenocrysts are set in a highly serpentinized matrix. The olivine phenocrysts are also serpentinized to varying degrees. 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 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 original pyroxenes have been completely transformed to radiating aggregates of columnar to fibrous actinolite, accompanied by chlorite, calcite and iron-oxides.

Metasedimentary rocks

The metasedimentary rocks form two important E-W trending bands in the north-central and northwestern parts of the map-area. The other three smaller occurrences of metasedimentary rocks are near the western limit of the area. In addition, some metasedimentary rocks are invariably present in areas mapped as volcanic belts. The metasedimentary rocks are mainly represented by biotite paragneiss which shows varying degrees of migmatization in different places.

The band of metasediments and migmatites situated south of Tilly, Yago and Schipa lakes is variable in width. South of Tilly and Yago lakes the northern limit of the metasedimentary rocks is in faulted contact with the Sakami Formation, whereas the southern limit

of this band is in contact with the quartz diorite - granodiorite. Near Schipa lake,a thin band of quartz diorite separates the metasedimentary rocks from the rocks of the Sakami Formation. Four distinct rock-types can be identified in this band: (a) Biotite and/or amphibole paragneiss, (b) Migmatite with pink or white pegmatitic mobilizate and restites of amphibolites and paragneisses, (c) Quartzite and quartz-magnetite iron formation, (d) Deformed conglomerates.

The paragneisses are fine to medium grained and are composed of plagioclase, quartz, biotite and/or hornblende. In schistose varieties of the paragneisses garnet is also observed. The paragneisses generally show rusty weathering and become friable when weathered. The minor folds observed in the paragneisses are small recumbent folds with their band of metasedimentary rocks, especially near Tosca, Odile and Luc lakes, radioactive anomalies were noted with the help of scintillation counter.

The migmatites consist of pink or white pegmatitic mobilizate bands up to 5 meters thick alternating with discontinuous horizons of well foliated paragneisses and amphibolites up to a few meters thick. The pegmatites contain 95% or more potash feldspar and quartz, and the mafic minerals present include magnetite and biotite.

Grey quartzite and quartz-magnetite iron formations were observed interlayered with the metasedimentary rocks in this band south of Tilly lake. Their thickness varies from a few centimeters to up to 10 meters. The occurrence of these grey quartzites is of particular significance: angular fragments of this quartzite were found in the deformed conglomerate unit associated with the metasedimentary rocks and also in the conglomerates of the Proterozoic Sakami Formation. The fact that the quartzite fragments occur in the deformed conglomerates tends to prove that the top of the sedimentary cycle is towards the south and that the beds are overturned. The fragments of grey quartzite and of amphibolite were also observed within the quartz diorite near the limits of the metasedimentary band, thus indicating

the intrusive character of the quartz diorite.

The deformed conglomerates outcropping south of Schipa lake are grey to grey-pink in colour and consist of stretched fragments 2 to 20 cms in length. More than 90% of the fragments are granitoid and the rest are the fragments of amphibolites and iron-rich quartzites. The matrix of the conglomerate is composed of feldspars, quartz, biotite and amphibole. In places, where the biotite is abundant, garnet was also observed. The conglomerates contain 5 to 10% mobilizate.

The second important band of metasedimentary rocks which cuts La Grande Rivière is associated with a very high aeromagnetic anomaly, especially near its western limit near Capricorn and Greece lakes. The high magnetic anomaly is attributed to the abundance of quartz-magnetite iron formations interstratified with the rusty weathering biotite paragneisses. 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. Some iron formations are associated with dark green coloured bands containing mostly grunerite, magnetite and quartz. Certain iron formation bands show intricate minor folds. Considering the abundance of iron formations, this band of metasedimentary rocks may prove to be one of the richest sources of iron in La Grande Rivière area. The metasedimentary rocks consist of quartz, plagioclase, biotite and/or amphibole, garnet, muscovite, magnetite, pyrite, chlorite etc. A few pyritiferous horizons were also noted in the metasediments. The metasedimentary rocks show migmatization to varying degrees due to the presence of pink or white pegmatitic mobilizate. Some outcrops may be composed essentially of pegmatites with only a few bands of paragneisses.

Other smaller occurrences of metasedimentary rocks are near La Grande Rivière north of Simone lake, and north of Paris lake. Here also the metasediments are represented by biotite paragneisses associated with minor iron formations and volcanic 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 also in the dioritic and granitic range in places. These plutonic rocks occupy the major part of the map-area. In places they are 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 volcano-sedimentary 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.

Petrographic study of the quartz diorite-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 tone 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. 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 and shows alterations to biotite, chlorite and epidote. The accessory minerals include zircon, sphene, apatite, iron-oxides.

In most cases the plagioclase shows much saussuritization and sericitization, sometimes with development of large grains of sericite, muscovite, epidote and calcite. In only a few thin sections was completely fresh plagioclase 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 quartzofeldspathic 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 quartz, nearly complete transformation of the mafic minerals to chlorite and extreme sericitization and saussuritization of plagioclase.

Two varieties of cataclasites may be distinguished. The first variety is medium to fine grained, white and characterized by the abundance of muscovite flakes on the foliation plane and by quartz ribbons. It is found mostly near Yago lake. The second variety is pinkish or reddish green due to the pinkish or reddish colouration of the feldspars set in a highly chloritic matrix. This is the most common type of cataclasite observed. As noted earlier, the cataclasites developed along two principal fracture systems. One set of fractures with an orientation of NW to NNW corresponds to a major fracturation along which the late gabbro and diabase were emplaced. This fault system has also resulted in en-échelon displacement of the Proterozoic rocks of the Sakami Formation. The second set of fractures, along which some rare gabbro-diabase dykes and sheared basic dykes have been observed, has an ENE to E orientation and is somewhat less developed.

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 and may show alterations to biotite, chlorite and epidote. The accessory minerals include zircon, sphene, apatite and iron-oxides.

The plagioclase may show alteration to varying degrees.

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

Mapping experience over the past four 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, a highly migmatized nature and the frequent occurrence of bands and lenses of amphibolite and hornblendite.

Granite pegmatites occur locally in different parts of the area. They are pink to grey pink, coarse to very coarse grained, and generally porphyritic with large 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, tourmaline and iron-oxides.

Dykes

The dykes of gabbro, diabase and pegmatite, and the quartz veins are the youngest rocks of the area and 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, NW to NNW trending gabbro-diabase dykes are mappable, whereas very few dykes with an ENE trend are of such a good dimension. The larger dykes possess good chilled margins and can be traces for long distances on air-photos and sometimes on aeromagnetic maps. For the first time, a gabbro-diabase dyke was observed traversing the Proterozoic rocks of the Sakami Formation. This was at Yago lake, east of Tilly lake. 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; the term diabase is used for finer grained varieties and gabbro for the coarse. In places pegmatitic phases of gabbro are also observed. Ophitic to subophitic texture is common. Compositionally they consist of plagioclase, olivine, pyroxene, hornblende, biotite and iron-oxides. Deuteric alteration has resulted in extensive saussuritization and sericitization of plagioclase. The plagioclase of these dykes possesses 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 and sometimes olivine 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 and pyroxenite dykes emplaced along joint planes or fault planes were also observed. These dykes are not mappable. The occurrence of a high aeromagnetic anomaly near the eastern part of Tilly lake is attributed to a dyke swarm containing basic to ultrabasic dykes of both NNW and ENE trends. Only a few of the dykes encountered here are mappable.

Structure and metamorphism

The metasedimentary and metavolcanic rocks of the area have been folded into tight 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 pattern of major folds and faults present in the area, air-photo lineanments 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 upper greeschist to lower amphibolite facies, as evidenced by frequent occurrence of the assemblage epidote, chlorite, actinolite, hornblende, muscovite, sericite, calcite, garnet in the metasedimentary and metavolcanic rocks, and in the minerals of retrograde metamorphism in the plutonic rocks. The presence of sillimanite was noted in only one outcrop in the map-area.

Sakami Formation

Detritic sediments of the Proterozoic Sakami Formation form two major outliers in the map-area: (1) south shore of Tilly lake, and (2) from east of Tilly lake to Laforge river. They are in faulted contacts with the surrounding Archean rocks. North of the Sakami Formation the rocks are essentially quartz diorites which are more or less migmatized, whereas the rocks to the south are mainly migmatized metasediments with associated iron formations and conglomerates. All the faults which limit the Sakami Formation are shown on the geological map. 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. In the Archean rocks, the faulting has resulted in the development of cataclastic, sheared and mylonitized zones. These faults can be traced for long distances. Many of the joint planes in the vicinity of the faults are coated with specular hematite.

Excellent sections of the Sakami Formation are exposed in these two outliers. The formation is divided into three units of slightly differing lithologies and variable thickness: (1) The lowest exposed unit consists of coarse red polymictic conglomerate, red arkosic sandstone, and red shale, mudstone and siltstone. The presence of channels, partial fining upward cycles, and the local derivation of the clasts indicate that this part of the formation represents alluvial filling of small grabens under oxidizing conditions. The polymitic conglomerates contain angular to subangular fragments of pink pegmatite, white vein quartz, grey quartzite, iron formation, granite, quartz diorite, mudstone. The size of the fragments varies from a few millimeters to more than 50 cms. The matrix is composed of sandy or argillaceous material. (2) The middle unit, which is gradational into the upper and lower units, is composed of coarse pink sandstone, minor quartz pebble conglomerate lenses and red shales. (3) The upper unit is characterized by fine grained, orange, pink and white sandstones (orthoquartzites). 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 sand grains, whereas in the white sandstones this ferruginous coating is insignificant. All the sandstones contain ferruginous, argillaceous, silty or authigenic quartz matrix. The upper unit is also characterized by the presence of large scale cross-beds up to 20 m thick. An eolian origin is considered for a major portion of this unit.

ECONOMIC GEOLOGY

Several large zones of quartz-magnetite iron formations were discovered associated with the metavolcanic and metasedimentary rocks of the area. In particular, the band of metasedimentary rocks which passes through Capricorn lake, Greece lake and La Grande Rivière is associated with a very high aeromagnetic anomaly. Field work in this area has indicated that the high magnetic anomaly may be attributed to the abundance of iron formations interstratified with the rusty

weathering biotite paragneisses. This band of metasedimentary rocks may prove to be one of the richest potential sources of iron in the entire La Grande Rivière area.

Disseminated pyrite and chalcopyrite are commonly observed in the metavolcanic, metasedimentary and ultrabasic rocks. A few chalcopyrite and pyrite bearing veins and a few silicified zones containing these minerals were noted in the metavolcanic rocks. Some pyrrhotite mineralization was also observed in the ultrabasic rocks.

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

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

Three circular aeromagnetic anomalies near the shores of Tilly lake are most probably due to the presence of magnetite-rich sands.

Interesting radioactive anomalies were discovered in the east-west trending band of migmatized metasediments situated south of Tilly, Tosca and Schipa lakes. The migmatite consists of alternating zones of biotite paragneiss, amphibolite and pink or white pegmatite which represents the mobilizate. The white pegmatite is finer grained than the pink pegmatite, is characterized by the presence of smoky quartz in addition to ordinary quartz, and generally occurs between the metasediments and the pink pegmatite. In most parts of the map-area the regional background radioactivity, as determined by Scintrex Scintillation Counter (Model BGS-1), ranges between 10 and 20 counts/second. However, in certains parts of this metasedimentary band even the background radioactivity is about three times higher, ranging between 40 and 70 counts/second. Locally zones with up to 800 counts/second were discovered. The favourable zones are located in: (a) the white pegmatite and (b) associated with clots of black metallic minerals found in the pegmatites. There is a development of radial fractures up to 2 or 3 cms long around these minerals. It is probable that this entire band of metasedimentary rocks may be favourable for radioactive

mineralization and, therefore, it is recommended that further detailed work be carried out in this migmatite zone east of Tilly lake.

All the major fault systems that limit the Sakami Formation, as well as the ones that affect the Archean rocks, can be of importance in the search for uranuim in the area.

The Sakami sandstone has a very high percentage of 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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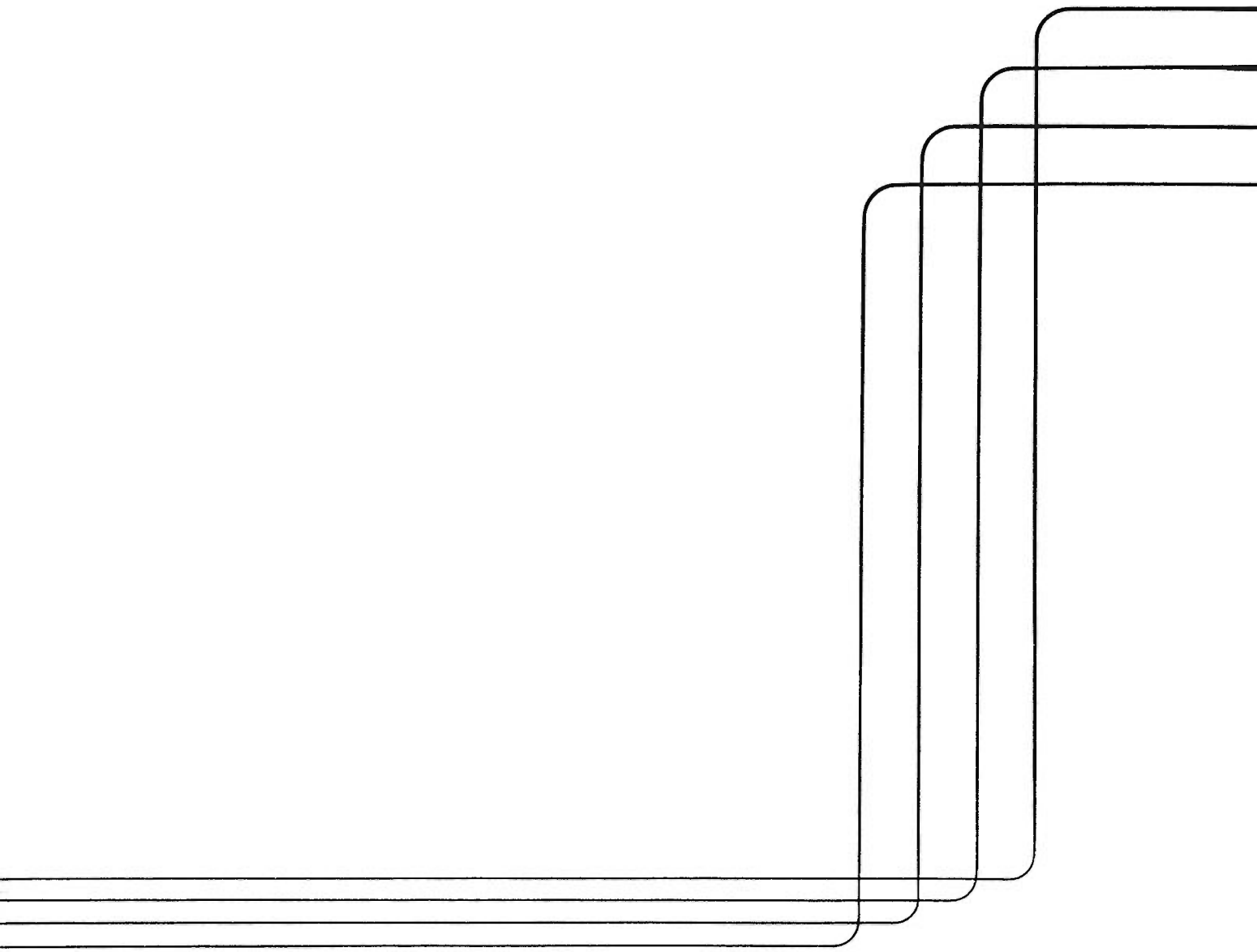

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