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**MINISTÈRE
DES RICHESSES
NATURELLES**

DIRECTION GÉNÉRALE
DES MINES

PATIBRE (AXE) LAKE AREA

L . KISH

PRELIMINARY REPORT

MINISTERE DES RICHESSES NATURELLES

SERVICE DES GITES MINERAUX

PATIBRE (AXE) LAKE AREA

LAURENTIDES - LABELLE ELECTORAL DISTRICT

L. KISH

1976

PRELIMINARY REPORT

DPV-487

Placed on open file in January 1977

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INTRODUCTION

This report presents the preliminary results of two summers of detailed mapping. The aim of the field work was to establish a relation between stratigraphy and radioactivity in the Patibre Lake area, which is part of the Mont-Laurier - Cabonga radioactive district.

The map-sheet covers about 50 square miles and includes parts of Leman, Pérodeau, and Franchère townships. The centre of the map-area is 35 miles northeast of Mont-Laurier. The area is accessible by good gravel roads. The nearest settlement is Val-Viger. From here the road runs northward then turns to the northeast in Pérodeau township, where it follows the eastern side of Lièvre river. A great number of lumber-roads which branch off the main road were surveyed for mapping purposes and are indicated on the map.

The topographic elevation varies between 850 and 1850 ft. The hills in the central and southeastern part of the area exceed 1700 feet, and the elevation of the large plateau north-northeast of La Force lake is above 1750 ft. The low-lying areas in the north-western corner and along the valleys of Beaudin and Treillet creeks are sand-flats.

The area was covered by systematic traverses at 500-foot intervals, and sub-areas around radioactive occurrences were studied in more detail.

The partial chemical analyses given in this report were performed in the laboratories of the Centre de Recherche Minérale, ministère des Richesses naturelles. The intensity of gamma radiation in the field was measured with a McPhar TV-5 scintillometer. The background radiation (BGD) as used in this report is 150 CPM on the T₂ rate meter position of the scintillometer.

GENERAL GEOLOGY

The area is in the Grenville Geological Province and the majority of the rocks encountered are highly metamorphosed gneisses. Primary textures have been obliterated by a complete recrystallization, and a large portion of the gneisses have been deformed in a plastic state.

Two associations of gneisses can be distinguished in the field. The gneissic rocks of one group are essentially composed of feldspar, quartz, biotite and hornblende. There is a marked variation of the proportion of these minerals among the rock-types of the group. These quartzofeldspathic gneisses of uncertain origin constitute the Patibre Formation of the area. The second group of gneisses is characterized by the alternation of layers of markedly different mineralogy. The mineral assemblages indicate that these gneisses are metamorphic equivalents of clastic and chemical sediments. These paragneisses are grouped into the La Force Formation.

Other rocks present are diverse orthogneisses, granite and pegmatitic rocks. A tentative geological column is given in the Table of Formations.

TABLE OF FORMATIONS

P R E C A M B R I A N	INTRUSIVE ROCKS	Grey granite Pink granite and pegmatite
	META-INTRUSIVE ROCKS	Feldspar porphyry Hornblende-plagioclase gneiss Meta-gabbro
	LA FORCE FORMATION	White metamorphic pegmatite Meta-arkose Biotite paragneiss Rusty wathering gneiss Sillimanite gneiss Calc-silicate rocks, marble Quartzite
	PATIBRE FORMATION	Quartz-feldspar-biotite-hornblende gneisses.

Regional correlation (Kish, 1975) indicated that, in the Mont-Laurier - Cabonga area, the paragneisses of the Grenville Group form a basin, which is underlain by diverse quartzofeldspathic biotite-hornblende gneisses of the Pre-Grenville Group. The Patibre Lake area is the southeast extension of this complexly folded basin; the La Force Formation is correlated with the metasediments of the Grenville Group, whereas the Patibre Formation corresponds to the quartzofeldspathic rocks of the Pre-Grenville Group.

The fact that rocks of contrasting chemical composition, such as calc-silicate rock adjacent to sillimanite gneiss, are closely interlayered suggests that they were isochemically reconstituted during the regional metamorphism, and the migration of the major elements was very restricted.

STRUCTURAL AND STRATIGRAPHIC RELATIONS

Foliation, compositional layering and lineation (axes of minor folds) are the outcrop features that can be used to establish the structure in the area. Plastic deformation and partial melting created complex structural relations and individual members of the formations cannot be traced for appreciable distances.

In general, the axes of major folds trend northeast. In the northern part of the area the axes plunge gently to the northeast; doubly-plunging folds are common in the central part. A deformation superimposed on the northeast structure is found in parts of the area, and is shown by broad folds along north-northwest-trending axes.

Repetition of beds due to tight isoclinal folding can be observed at outcrop scale. Because of the complex fold-pattern, the original thickness of the members of the formations is difficult to estimate.

Faults are common in the area between Bouleau and Patibre lakes, where metasediments of La Force Formation have been displaced along northwest-striking, near vertical fault planes, and are found in fault-contact with the quartzofeldspathic gneisses of the Patibre Formation.

The rocks of the Patibre and La Force Formations were deformed simultaneously during the last major geological event in the Grenville and their original contact became a zone of transition in which the rocks of both formations may be present. " Ic" on the map indicates places, where relic-beds of quartzite and boudins of calc-silicate rocks are infolded in the quartzofeldspathic gneisses. On the outcrop the passage from Patibre to La Force Formation can be

spotted by the appearance of a rusty brown stain commonly associated with the rocks of the La Force Formation.

Because of its limited variation in mineralogy and texture, the Patibre Formation is not subdivided stratigraphically. However, in the La Force Formation a tentative subdivision is possible. In the lower part of the formation calc-silicate rock, meta-arkose, and white metamorphic pegmatite are common, whereas an abundance of rusty weathering gneiss and sillimanite gneiss characterizes the higher stratigraphic horizons. Quartzite and biotite paragneiss occur throughout the formation. Thick beds of marble, such as are found near Baskatong lake, are not present in the Patibre Lake area.

DESCRIPTION OF THE ROCKS

The descriptions are based on hand-specimen observations. Microscopic textures and modal compositions will be given in the final report.

THE GNEISSES OF THE PATIBRE FORMATION

These are fine-grained rocks, and are composed essentially of feldspars, quartz, biotite, and hornblende. The tenor of dark minerals is generally below 5%, and rarely exceeds 10%. The rocks are foliated and layered.

The predominant rock-type is a thin-layered, pale grey, leucocratic gneiss. Others types distinguished in the field, and shown the map-sheet, are:

- a pale pink, foliated granitic gneiss, that contains relatively high tenors of quartz and K-feldspar; (1a on the map);
- a grey biotite-hornblende gneiss (included in 1a), and

- a dark hornblende-biotite gneiss in which the hornblende is in unevenly distributed clusters. (lb on the map).

In some places the transition from a pale quartzofeldspathic gneiss to a dark biotite gneiss is gradational, but in other places the contacts between light and dark varieties are well defined.

Regular, thin layers in some quartzofeldspathic gneisses may be a relict sedimentary feature. The mineral composition of the gneisses does not reveal their origin, for rocks derived from mature and chemical sediments are not found in the Patibre Formation.

Evidence of plastic deformation and partial melting are abundant. Some of the Patibre gneisses are migmatitic and are commonly injected and mixed with pink granitic and pegmatitic material.

THE ROCKS OF THE LA FORCE FORMATION

In contrast to the gneisses of the Patibre Formation, the members of La Force Formation are characterized by great mineralogical variation. The distinctive mineral assemblages of the majority of the paragneisses reflect their sedimentary origin. Rocks derived from mature clastic and chemical sediments are quartzite, sillimanite gneiss, marble, and calc-silicate rock. Other members of the formation, interlayered with these gneisses, are biotite paragneiss, rusty weathering gneiss and meta-arkose.

QUARTZITE

Quartzite is abundant in association with both calcareous and aluminosilicate rocks. It is medium grained, and contains glassy quartz. Several varieties of quartzite have been recognized, among which biotite quartzite and feldspathic quartzite are the most abundant. Less common are a reddish, hematite-stained variety, and a diopside-bearing quartzite. In the impure quartzites the feldspar has a chalky alteration on the weathered surface, and the biotite is aligned. Some impure quartzite, in which 2 to 3 cm clots of quartz and

feldspar are surrounded by a quartz-biotite mixture, looks like recrystallized conglomerate.

CALC-SILICATE ROCK, MARBLE

The common calc-silicate rock in the area is a dark diopside-quartz rock with variable but minor amounts of feldspar, graphite, sphene and mica. A less common variety is composed of quartz, plagioclase, scapolite, diopside and sphene. This latter forms regular layers with other paragneisses, whereas the dark, diopside-rich variety is frequently in discontinuous, boundinaged layers.

Marble generally occurs as narrow, continuous layers. It is a medium- to coarse-grained rock, which weathers to a carbonate sand.

SILLIMANITE GNEISS

This paragneiss is fine grained and thinly layered. The sillimanite is present as oriented needles and is intimately mixed with biotite and muscovite. Layers rich in sillimanite are wrinkled and wavy. Graphite is a common accessory mineral, but garnet is present only locally.

RUSTY WEATHERING GNEISS

This quartz-rich, fine-grained rock contains abundant pyrite and graphite, and weathers readily to a soft, rusty brown mass. The fresh surface is pale grey and because of the scarcity of mica the foliation is not distinct. The rusty gneiss is common adjacent to sillimanite gneiss, but is also found next to calc-silicate rock, in which case it contains fine-grained scapolite and diopside.

BIOTITE PARAGNEISS

The most abundant rock-type of La Force Formation is a quartz-feldspar-biotite gneiss, which may contain some muscovite, graphite, garnet, hornblende or sphene. It is thinly layered and may be prophyroblastic. Locally this gneiss has been partially mobilized and has a migmatitic texture.

In places this biotite paragneiss resembles the biotite gneiss of the Patibre Formation. For a stratigraphic interpretation it is important to make a distinction between these mineralogically similar but genetically different rock-types: the biotite paragneiss of La Force Formation occurs with or near quartzite, calc-silicate rock, sillimanite gneiss, and in general, rusty rocks; on the other hand, an association with pale quartzofeldspathic gneisses and hornblende gneisses places the biotite gneiss in the Patibre Formation.

The biotite paragneiss adjacent to larger pegmatitic masses has the same mineral composition as that found in the areas with no pegmatite present. This suggests that it is not the source material of the common white pegmatite in the area.

META-ARKOSE

The meta-arkose is a pink or creamy colored rock composed of quartz, K-feldspar and minor plagioclase. Because of its leucocratic character, the layering, which is marked by the changes in quartz-feldspar ratio, is poorly visible. Chemical analysis of a meta-arkose shows that its composition closely resembles that of an average granite, the difference being a slightly lower Fe content in the former.

	Meta-arkose H-42-3		Alkali granite Average (Nocholds, 1954)
	%		%
SiO ₂	74.63		73.86
Al ₂ O ₃	14.07		13.75
MgO	0.10		0.26
CaO	1.18		0.72
Na ₂ O	3.70		3.51
K ₂ O	5.40		5.13
Fe total as Fe ₂ O ₃	0.57	Fe ₂ O ₃	0.78
		FeO	1.13

Among the La Force gneisses the most susceptible to melting under the conditions of the amphibolite grade regional metamorphism, are the meta-arkose and the feldspathic quartzite.

WHITE METAMORPHIC PEGMATITE

There are two types of pegmatitic rocks in the area, and they are readily distinguished by their color. A pink granitic pegmatite is generally associated with a pink granite; these are described later. A white metamorphic pegmatite is invariably found with the paragneisses; consequently it is considered as a member of the La Force Formation. Both pegmatites have been generated locally by partial melting of the gneisses, and are thus different from complex pegmatites which are genetically related to large granitic masses, have intrusive contacts, and are zoned.

The white metamorphic pegmatite of La Force Formation is a medium to coarse-grained rock composed of colorless quartz and white feldspars. On the weathered surface the rock is creamy-yellow and has rusty spots due to oxidation of tiny pyrite grains. Biotite is present locally, and magnetite is characteristically absent.

The white pegmatite has diffuse contacts with the meta-arkose and feldspathic quartzite, but its contacts are sharp against rocks of contrasting compositions, eg. calc-silicate rocks.

In larger masses, the white pegmatite forms sub-parallel sills in the paragneisses.

META-GABBRO, HORNBLLENDE-PLAGIOCLASE GNEISS

Dark, amphibole-rich rocks form elongated masses, which may be relict dikes or sills. They are common in the southeast quarter of the area. The meta-gabbro is recrystallized and has been deformed with the gneisses. Near the centre of larger masses a relict ophitic texture is clearly recognizable, but in general the rock has lost its igneous texture, and has become a hornblende-biotite-plagioclase gneiss or ortho-amphibolite.

Hornblende-biotite-plagioclase gneisses also occur in discrete masses somewhat removed from the meta-gabbros.

FELDSPAR PORPHYRY

A slightly gneissic porphyritic rock forms small masses in association with the Patibre gneisses in the southeastern part of the area. The phenocrysts are bluish K-feldspar, and they are surrounded by a very fine grained mixture of quartz, feldspar, biotite and possibly some other mafic minerals.

PINK GRANITE AND PEGMATITE

Pink granite and pegmatite are generally associated with the gneisses of the Patibre Formation. An exception is the northern part of the map-area, where pink pegmatite is also abundantly mixed with the paragneisses.

In places there is a continuous transition from a granitic to a pegmatitic texture, whereas in other places pegmatitic rocks with different grain size cut each other. These show that the mixing of the granitic and pegmatitic liquid was complex. In the centres of the larger pegmatitic masses, graphic texture is common.

The pink pegmatite differs in composition from the above described white pegmatite in its higher Fe content. Magnetite is a common and readily visible accessory mineral.

An equigranular pink biotite granite was noted in several places in the southeast quarter of the map-area. This granite may not be genetically related to the pink granitic pegmatite.

GREY GRANITE

A fine-grained grey granite forms irregular masses, mainly in the area underlain by the paragneisses. This rock cuts the gneisses and their associated pegmatites. In places a slightly gneissic texture is produced by the alignment of tiny mica flakes.

ECONOMIC GEOLOGY

The Patibre Lake area is part of the Mont-Laurier - Cabonga radioactive district, and the radioactive occurrences have the same characteristics and problems as those of other radioactive districts of the Grenville Province. The main problems, which greatly complicate grade and tonnage calculations, are the patchy, discontinuous character of the radioactivity in the rocks, and the variation in Th/U ratios. These basic problems are related to the high P-T conditions of the regional metamorphism. It was concluded earlier that the amphibolite grade metamorphism did not involve extensive migration of

the major elements. (Exceptions are the rocks with near-granitic composition, which were partially melted). The effect of the metamorphism on the solubility and migration of the minor elements, particularly U and Th, is not known. It seems that under the conditions of the regional metamorphism these elements may have moved differentially, and both concentration and Th/U ratios may have changed.

The radioactive occurrences in the area are found in a tightly folded, generally gently dipping sequence of paragneisses. They are associated with feldspathic and biotite quartzite, quartz-rich biotite paragneiss, and white pegmatite, all members of La Force Formation. There seems to be a concentration of the radioactivity in the white pegmatite.

The occurrences are distributed in radioactive belts. The major prospects of the area are found in a belt that extends sub-parallel to Lièvre river, and turns toward Bear lake in the northern part. These prospects have been described in some detail in a previous report (Kish, 1975). Some general features are repeated in the paragraphs that follow.

The radioactive prospects around Bear lake in the northern part of the area are owned by *Canadian Johns-Manville Co.* Three of the company's base lines are indicated on the map. (BL-JMV). Biotite paragneiss, feldspathic quartzite, meta-arkose, white pegmatite, and calc-silicate rock are common, but rusty weathering graphitic gneiss is scarce, and sillimanite-bearing rocks are virtually absent.

Radioactivity is found in the feldspathic quartzite, porphyroblastic biotite paragneiss, and white metamorphic pegmatite. The visible radioactive mineral is uraninite which occurs as 1-2 mm. large black cubes. They are unevenly disseminated in the radioactive zone. In near surface specimens the uraninite is altered, and is surrounded by a rusty brown halo. Yellow uranophane stain is seen on the surfaces

exposed to humidity and oxidizing conditions. The Th content of the occurrences around Bear lake is very low, and the Th/U ratios do not exceed 0.1.

Between Beaudin creek and Lièvre river, directly west of Bear lake, the sedimentary belt is not exposed. Outcrops begin again farther southwest, along and in the vicinity of the Pérodeau-Leman township line and east of the outlet of Magin (Tom Dick) brook. Here the same general rock-types are present, but the proportions are changed: feldspathic quartzite is more abundant and calc-silicate rocks are less common than around Bear lake.

The radioactive zones in this part of the area are owned by *Mont Laurier Uranium Mines Ltd.* The base line of the company's "northern zone" is the Pérodeau-Leman township line (section between mile-posts VIII and IX). The base line of the "Dom Dick zone" is southwest and subparallel to the township line (marked "BL -MLU" on the map).

The radioactive rocks are feldspathic quartzite and white pegmatite. The radioactive minerals are concentrated along biotite-rich, warped shear surfaces, but are also found elsewhere in the rocks. These minerals are: uraninite, as tiny black cubes, and uranothorite as beige, altered prisms. Depending on the degree of alteration (probably a function of depth), and the proportion of the two radioactive minerals in the analyzed samples, the Th/U ratios vary considerably, but in the majority of samples the ratios are between 1.0 and 1.5.

The radioactive belt southwest of the "Dom Dick" zone is disrupted by faults. It re-appears beyond the southwestern limit of the map-area (Hanson zone).

A second radioactive belt of paragneisses, of smaller extent, occurs north of La Force lake, on the northern down-slope of the

La Force plateau. Here the proportion of the feldspathic quartzite and biotite quartzite in the paragneisses is higher than that around Bear lake, but calc-silicate rock and white pegmatite are less abundant. Uraninite is the radioactive mineral, and is found in the quartzites. The Th content of the occurrences is very low.

Two base lines, established by *Gulf Minerals Ltd.*, are indicated on the map-sheet (BL-GLF).

Scintillometric readings several times higher than the background were noted in the impure quartzite of the complexly folded paragneiss belt that extends in a northeast-southwest direction from the south end of La Force lake. Some of these localities are marked (BGD) on the map.

The only vein-type mineralization in the area is about one mile west of Patibre lake. Here 1 to 2 cm thick veins of black uranium-oxide, similar in hand-specimen properties to pitchblende, cut the gneisses of the Patibre Formation. The occurrence is of limited extent on the surface, and was not found in depth by diamond drilling.

Several outcrops of the grey granite in the southeastern corner of the map-area have higher than background radiation.

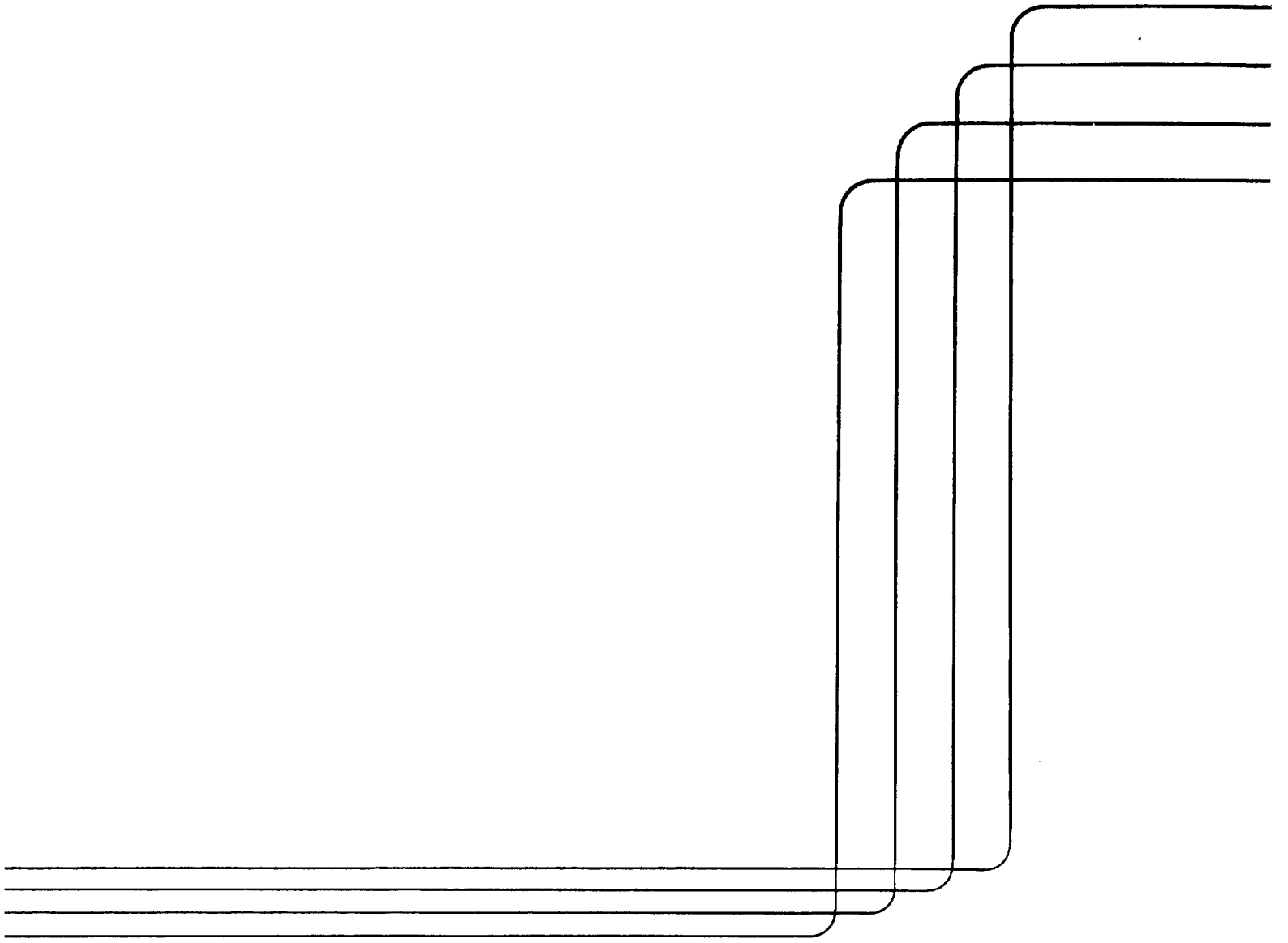
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Mars 1977