RG 2001-07

GEOLOGY OF THE MARICOURT AREA

RG 2001-07

GEOLOGY OF THE MARICOURT AREA (24D)

Martin Simard
Charles Gosselin
Jean David

Accompanies map
SI-24D-C2G-00K

The Rivière Delay valley.

2002

Québec

Geology of the Maricourt area (NTS 24D)

Martin Simard
Charles Gosselin
Jean David

RG 2001-07
(Accompanies map SI-24D-C2G-00K)

Abstract

This report contains the results of a geological survey carried out during the 1999 summer season at a scale of 1:250,000. It covers the area represented by NTS sheet 24D (Lac Maricourt), located about 250 kilometres southwest of Kuujjuaq. The Maricourt area is transected by the boundary between the Bienville Subprovince and the Minto Subprovince. The latter is represented in our area by the Goudalie and Utsalik domains. The results of our studies lead us to include the entire area in the Minto Subprovince, and thus reconsider the location of the boundary of the Bienville.

The bedrock in the area is Archean in age, with the exception of a few outcrops of Paleoproterozoic sedimentary rocks of the Sakami Formation, and a few Proterozoic diabase and lamprophyre dykes. Volcano-sedimentary rocks belong to the two oldest units in the area, namely: the Gayot Complex (2.86 Ga) mainly composed of volcanic rocks, and the Garault Complex dominated by sedimentary rocks. Tonalitic rocks belong to three lithodemic suites. The Brésolles Suite (2803±8 Ma) is composed of tonalitic gneiss, the Coursolles Suite mainly consists of hornblende-biotite tonalite and the Favard Suite (2.74 Ga) is essentially composed of massive to foliated trondhjemite. The last two units may be related and form a single continuous suite. Granulitic assemblages located in the northwest and western parts of the area were included in the Du Gué Complex. This unit appears to be a metamorphosed equivalent of a part of the Favard Suite. It also includes younger intrusions belonging to an enderbite-charnockite suite.

Late plutonic suites were also defined. These include the granodioritic and granitic Desbergères, Maurel and Tramont suites, as well as a volumetrically restricted suite of mafic-ultramafic intrusions named the Châteauguay Suite. The Desbergères Suite (2683+4/-2 Ma), composed of massive granodiorite, may represent the final phase of migmatization of the Coursolles and Favard tonalitic suites. The Maurel Suite (2.68 Ga) is characterized by granodiorites with a megaporphyritic texture and a strong magnetic susceptibility. The granitic Tramont Suite is the youngest Archean unit in the area. It forms plutons and injections that cross-cut all other Archean units. The Châteauguay Suite is younger than tonalitic units, but older than Tramont granites. Its relationship with other late suites could not be established.

The regional metamorphic grade reached the amphibolite facies, except for lithological assemblages in the Du Gué Complex, where metamorphic conditions reached the granulite facies. A mineral retrogression phenomenon, either associated with hydrothermal alteration or with greenschist-facies retrograde metamorphism, has particularly affected volcano-sedimentary rocks, gneisses of the Brésolles Suite and late fault zones.

In the Maricourt area, several phases of deformation successively occurred. Relics of an early D1 phase of deformation are detected in enclaves hosted in Brésolles gneisses and Favard tonalites. Phase D2 is responsible for the regional S2 foliation, which is the most penetrative structural element in the area. This foliation was reoriented and folded by three subsequent phases of deformation. Phase D3 produced N-S to NE-SW folds without schistosity. Phase D4 is characterized by folds oriented WNW-ESE to NW-SE along with a well-developed system of NW-SE faults. Finally, phase D5 is represented by NE-SW thrust faults.

Regional mapping has led to the discovery of several mineral occurrences and showings associated with volcanic rocks, metasediments or ultramafic rocks. Showings associated with volcanic or metasedimentary rocks correspond to disseminated or semi-massive sulphide zones as well as oxide or sulphide-facies iron formations, reaching from a few decimetres to a few metres in thickness. Most of these zones yield anomalous copper values, and more rarely, zinc, cobalt, silver, tungsten or gold values. Mineralized zones associated with ultramafic rocks, and more specifically those encountered in the Gayot volcano-sedimentary Complex, attract our attention. The recent discovery of important Cu-Ni-PGE mineralization by Virginia Gold Mines in the Venus Belt (Gayot area) has outlined the economic importance of this complex. In the Maricourt area, the Moyer and Angilbert South belts consist of sequences assigned to the Gayot Complex. More detailed exploration work is however necessary to fully assess the potential of these newly identified belts that extend for a few tens of kilometres along strike.

DOCUMENT PUBLISHED BY " GÉOLOGIE QUÉBEC "

Director
Alain Simard

Head of the Service géologique du Nord-Ouest
Robert Marquis

Document accepted for publication on the 01/05/25

Critical review
Pierre Pilote

Translation
Michelle Mainville

Edition and page setting
Jean-Pierre Lalonde
Kamal N. M. Sharma

Computer assisted drawing
Martin Simard
Charles Gosselin
Sonya Chalifour
Nathalie Drolet

Technical supervision
André Beaulé

Dépôt légal – Bibliothèque nationale du Québec
ISBN : 2-551-21406-8

CONTENTS

(continues on the following page)

(Table of Contents continued...)

INTRODUCTION

This mapping survey was carried out in the summer of 1999 as part of the Far North Project undertaken in 1997 by the Ministère des Ressources naturelles du Québec (MRNQ). The objectives of this vast project are to complete the geological mapping coverage, to acquire new geoscience data and open new territories to mining exploration north of the 55th parallel. This survey was conducted at a scale of 1:250,000 and it covers NTS sheet 24D (Maricourt Project, Figure 1). The study area covers a surface area of about 13,700 km^2, bounded by longitudes 70°00' and 72°00' and latitudes 56°00' and 57°00'.

The Maricourt area is situated next to a previous survey carried out in the Gayot area to the south (Figure 1; Gosselin and Simard, 2000a). Northward, it is in contact with the Nedlouc area (Parent *et al.*, 2000) and Aigneau area (Leclair *et al.*, 2000a; Berclaz *et al.*, 2000). This particular situation enabled us to establish certain stratigraphic and structural correlations between these different regions. Based on the subdivisions of the NE Superior Province (Card and Ciesielski, 1986; Percival *et al.*, 1991, 1992), the western half of the Maricourt area is reportedly underlain by the Bienville Subprovince and the eastern half by the Minto Subprovince (Figure 1). The Minto Subprovince is represented in our area by the Goudalie and Utsalik domains (Figure 1; Percival *et al.*, 1991, 1992). The boundaries between these vast assemblages were generally, and more specifically in our area, interpreted from geophysical data. The results of our studies have allowed us to reconsider the location of these boundaries and rather indicate that the entire region belongs to the Minto Subprovince (Figure 2).

Access

The area may be reached by floatplane or helicopter from Kuujjuaq, located 250 km to the northeast, or from a floatplane base on Lac Pau located near the Réservoir de Caniapiscau 200 km to the south (Figure 1). A landing strip suitable for Twin Otter aircrafts is also present near an outfitter located about 10 km west of Lac Maricourt, in the central part of the area. This landing strip is rarely used, and is only operational in the summer months.

Methodology

Field work conducted in the summer of 1999 was performed by a team of six geologists and six assistants. The base camp was located on the shores of Lac Maricourt, in the centre of the area (Figure 3). The survey was completed by performing traditional traverses by foot, as well as a series of spot checks by helicopter, in more remote areas. On

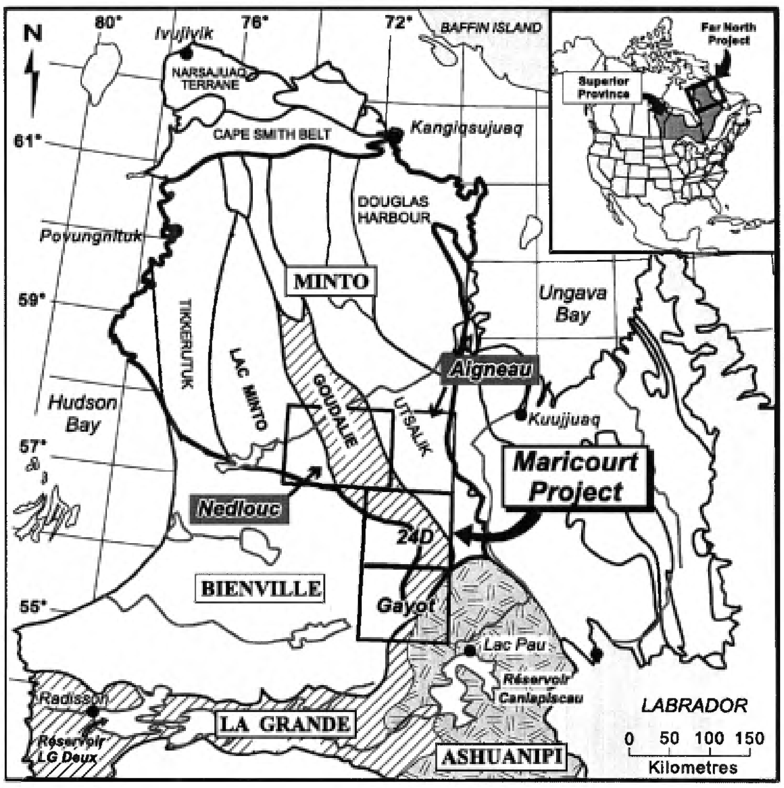


FIGURE 1 – Location of the Maricourt area (NTS 24D) relative to the principal tectono-stratigraphic assemblages of the northern Superior Province (modified from Card and Cieselski, 1986; Percival *et al.*, 1992).

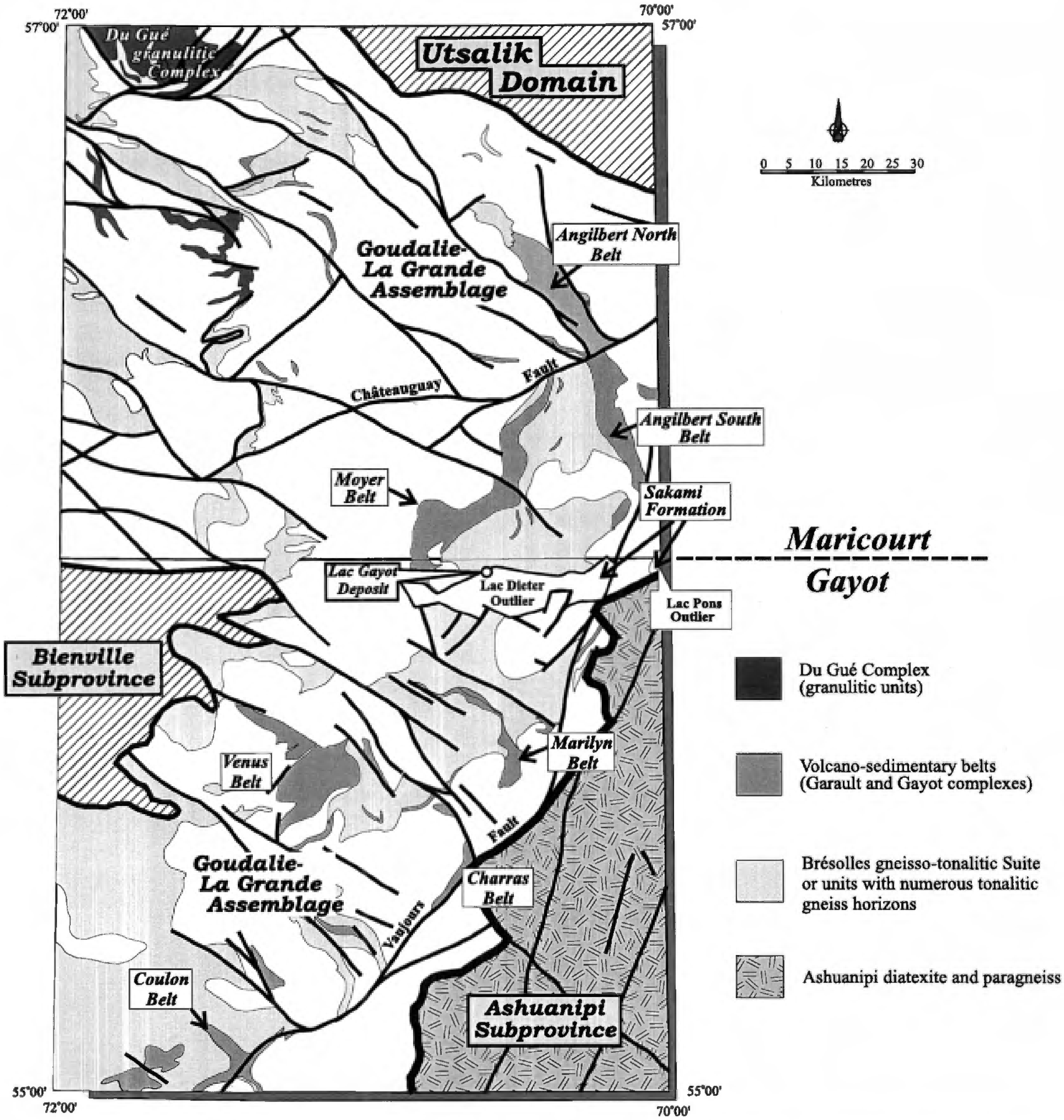
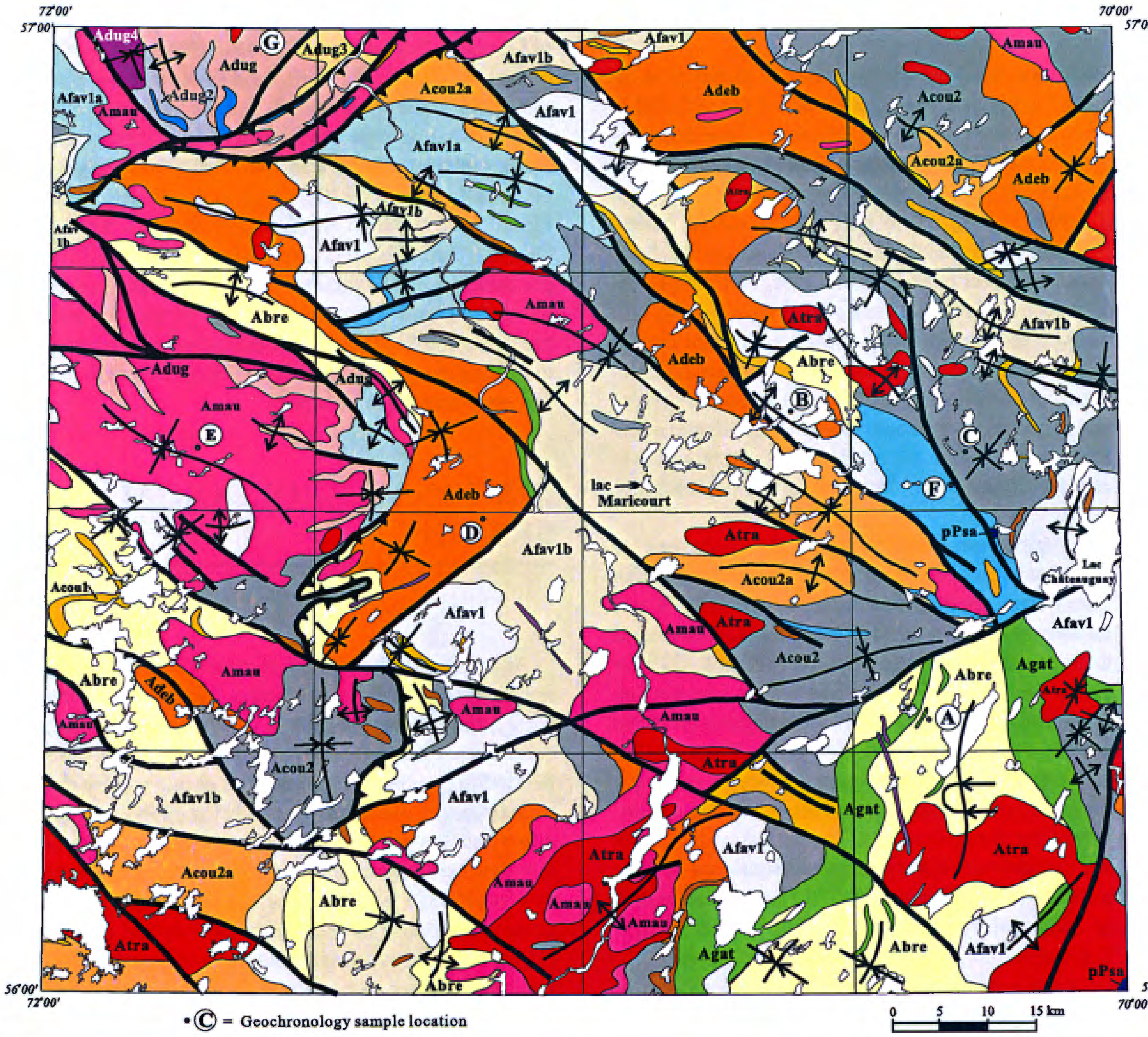


FIGURE 2 – Boundaries of the principal tectono-stratigraphic assemblages discussed in this report ; location and identification of the principal volcano-sedimentary belts in the Goudalie – La Grande Assemblage in the Maricourt and Gayot areas.

average, fourteen traverses were performed in each 1:50,000 NTS sheet. Outcrops are generally well distributed over the entire land surface. However, vast zones occupying several tens of square kilometres are entirely covered by glacial deposits or swamps, particularly in the SW and SE quadrants of the map area.

Lithogeochemical analyses were carried out in order to better define the mapped lithologies and to characterize the observed mineral occurrences. Seventy-eight (78) rock samples were analyzed for major elements, trace elements and rare earth elements. One hundred and eight (108) additional samples were also analysed for trace elements of economic interest. All the analytical data were integrated into the Geomining information system (SIGÉOM) of the Ministère des Ressources naturelles du Québec. About 180 thin sections were used to conduct a petrographic study of the various lithological assemblages present in the area. Finally, seven (7) samples were collected for U-Pb age dating. The latter analyses were carried out in the laboratories of the Université du Québec à Montréal by Jean David, and the results will be presented in the chapter entitled "GEOCHRONOLOGY".



PROTEROZOIC

Diabase dyke

Sakami Formation (pPsa)

Feldspathic sandstone, quartzitic sandstone, mudshale and conglomerate

ARCHEAN

Tramont Suite (Atra)

Leucocratic granite,fine to coarse-grained, massive;pegmatite

Châteauguay Suite (Achg)

Gabbro and pyroxenite, massive to foliated

Maurel Suite (Amau)

Granodiorite to granite, megaporphyritic, magnetic

Desbergères Suite (Adeb)

Homogeneous hornblende-biotite granodiorite

Du Gué granulitic Complex (Adug)

Undivided (OX tonalite, paragneiss, tonalitic gneiss, diatexite, enderbite)

(Adug4) Diatexite

(Adug3) Enderbite-charnockite, megaporphyritic

(Adug2) Red biotite trondhjemite

(Adug1) Migmatized OX paragneiss; oxide-facies iron formation horizons

Favard Suite (Afav)

(Afav1b) Migmatized trondhjemite

(Afav1a) Trondhjemite associated with horizons of tonalitic gneiss, paragneiss and amphibolitized mafic volcanic rocks

(Afav1) Trondhjemite

Coursolles Suite (Acou)

(Acou2a) Migmatized tonalite

(Acou2) Hornblende-biotite tonalite

(Acou1) Diorite, quartz diorite and gabbro

Brésolles Suite (Abre)

Biotite-hornblende tonalitic gneiss

Garault Complex (Agar)

Paragneiss with biotite, hornblende-biotite and sometimes garnet;quartzitic sandstone; sericite schist; andesite, diorite and gabbro

Gayot Complex (Agat)

Basalt; ultamafic rocks; tuffs of felsic to intermediate composition; oxide-facies iron formation

FIGURE 3 – Simplified geology of the study area (sheet 24D).

Previous Work

Reconnaissance mapping was carried out in this area by the Geological Survey of Canada, at a scale of 1:1,000,000 in the early 1960s (Stevenson, 1968). Work by Card and Ciesielki (1986), on the subdivision of major tectono-stratigraphic assemblages of the Superior Province, studies by Percival *et al.* (1991, 1992), more specifically on the Minto Subprovince, and by Ciesielski (1999) on the Bienville Subprovince, are important contributions that have helped us position the Maricourt area within a global framework.

The area was also covered by a lake sediment survey carried out in 1997 by the Ministère des Ressources naturelles du Québec, in partnership with several mining exploration companies (Géologie Québec, 1998). Unpublished maps showing the results of this survey were graciously provided by Jean Choinière and Marc Beaumier of Géologie Québec.

Important exploration work targeting the discovery of uraniferous deposits in Paleoproterozoic sedimentary rocks of the Sakami Formation was conducted between 1976 and 1981 by the company Uranerz. This work was concentrated in the northern part of the Gayot area (Orr, 1978 and 1979) in order to assess the potential of the Lac Gayot uraniferous deposit discovered in 1976 (Figure 2). This deposit contains an estimated reserve of 50 Mt at 0.10% U_3O_8. Uranerz also explored the Lac Pons outlier (Figure 2), which covers a surface area of about 1-2 square kilometres in the southeasternmost part of our area (Figure 3). The company Eldorado Nuclear also carried out exploration work focussed on uranium from 1977 to 1981 (Meusy, 1982). They concentrated on Sakami sedimentary rocks of the Lac Dieter outlier (Figure 2), in the vicinity of properties held by Uranerz.

Recently, a few exploration permits were granted in the area, following the release of lake sediment geochemistry data derived from the 1997 survey (Géologie Québec, 1998), the results of a geological survey in the Gayot area (Gosselin and Simard, 2000a) as well as preliminary results of our field work carried out in the summer of 1999 (Gosselin *et al.*, 1999).

Acknowledgements

We wish to thank sincerely all the members of our field crew for their helpful participation in the field work performed during the summer of 1999. In addition to the authors, the team was composed of geologists Sonya Chalifour, Emmanuelle Giguère, Isabelle Lafrance, and Ehouman N'Dah, geological assistants Suzanne Caron, David Clark, Sarah Forté, Sophie Lafontaine, Frédéric Robin and Bernard Vachon and finally our camp handyman Guy Bouchard and our cook Paul-Émile Cyr. Sonya Chalifour also participated in the production of the geological maps and the figures included in this report.

We also wish to thank Jean-Yves Labbé and Pierre Lacoste of Géologie Québec as well as Jean Bédard of the Geological Survey of Canada for their field visits and the constructive discussions they generated. We express our gratitude to Michel Chapdelaine of Virginia Gold Mines, who provided some material which was used for a Master's project by Isabelle Lafrance on the Venus volcano-sedimentary belt. Finally, we wish to thank our collegues from Géologie Québec: Jean Choinière and Marc Beaumier in providing previously unpublished maps of lake sediment geochemistry data, Denis-Jacques Dion for preparing geophysical maps, Kamal Sharma for his expertise in igneous and metamorphic petrography and Pierre Pilote for a critical review of the manuscript of this report.

REGIONAL GEOLOGICAL SETTING

According to the subdivisions of the northeastern Superior Province (Card and Ciesielski, 1986; Percival *et al.*, 1991, 1992), the Maricourt area is composed of two geological subprovinces: the Bienville and the Minto (Figure 1). The Minto Subprovince is represented in our area by the Goudalie and Utsalik domains (Percival *et al.*, 1991, 1992). Subprovince and domain boundaries were largely interpreted from regional aeromagnetic maps. However, recent publications by Ciesielski (1998, 1999) have modified the location of the eastern boundary of the Bienville, beyond our study area (Figure 2). Our work has therefore allowed us to examine these boundaries and position them in a more detailed geological framework (Figure 2).

The Issue Concerning the Goudalie – La Grande Assemblage (Goudalie Domain)

The Goudalie Domain is described as an assemblage of tonalitic rocks, including an older basement of tonalitic gneiss with volcano-sedimentary supracrustal rock belts as well as late tonalitic, granodioritic and granitic intrusions (Percival *et al.*, 1992). This description corresponds fairly accurately with our observations in the Maricourt and Gayot areas (Gosselin and Simard, 2000a). However, the particular issue which arose in 1998 in the Gayot area, was not fully resolved and persists in the Maricourt area. A brief review of the situation is in order. The junction between the Goudalie Domain and the La Grande Subprovince is reportedly located in the central part of the Gayot area (Percival *et al.*, 1992; Figure 1). Our work in this region had not enabled us to clearly differentiate rocks of the Goudalie from those of the

La Grande Subprovince (Gosselin and Simard, 2000a). It had been proposed to temporarily consider the two entities as a single tectono-stratigraphic assemblage called the "Goudalie – La Grande Assemblage". We further propose to extend the "Goudalie – La Grande Assemblage" in the Maricourt area (Figure 2) since the principal features characterizing this assemblage in the Gayot area are observed in the Maricourt area. However, certain new characteristics may eventually lead to a subdivision between the Goudalie and the La Grande, namely the appearance in Maricourt of an important unit of hornblende tonalite (Coursolles Suite), the progressive northward decrease in "older" tonalitic gneisses (Brésolles Suite), the presence of important migmatization phenomena (migmatized sub-units in the Favard and Coursolles suites) as well as the appearance of units metamorphosed to the granulite facies in the northern half of the area (Du Gué granulitic Complex).

From a structural standpoint, the "Goudalie – La Grande Assemblage", as defined in the Gayot area, is characterized by its NE to NNE orientation, disturbed by a highly penetrative deformation system oriented NW. In Maricourt, the NE to NNE structural trend is restricted to the sector located south of the Châteauguay fault (Figure 2). North of this element, the NW orientation is dominant and extends far beyond the study area (Percival *et al.*, 1992; Parent *et al.*, 2000).

Utsalik Domain

The Utsalik Domain was defined in the Rivière-aux-Feuilles area by Percival *et al.* (1992) as an assemblage characterized by a high magnetic susceptibility, mainly composed of homogeneous, massive to foliated granodiorite. Further south, work by Parent *et al.* (2000) identified particularly heterogeneous granodioritic (Monchy Suite) and tonalitic (Sullupaugalik Suite) units that may possibly represent a migmatization front separating the Utsalik from the Goudalie. In the Aigneau area (Figure 1), recent mapping by the MRN (Leclair *et al.*, 2000a; Berclaz *et al.*, 2000) helped define a domain dominated by granitic rocks and minor proportions of tonalitic and granulitic units.

In the NE part of the Maricourt area, the Utsalik Domain, as defined by Percival *et al.* (1992), is characterized by a strong positive aeromagnetic anomaly (Figure 4). Its southern boundary with the "Goudalie – La Grande Assemblage" is marked by an important fault zone (Figure 3). There are no obvious lithological, structural or metamorphic differences however between the two entities. The NE sector is composed of granodioritic and tonalitic units comparable to those defined elsewhere in the area; these were therefore assigned to the same lithodemic suites. The area is however characterized by the abundance of late granodioritic to granitic injections, probably due to the proximity of the Aigneau area where these intrusive phases dominate.

Bienville Subprovince

The Bienville Subprovince is considered as an essentially plutonic domain mainly composed of orthogneiss and tonalitic and granodioritic intrusions (Card and Ciesielski, 1986; Hocq, 1994; Percival *et al.*, 1992). Ciesielski (1998, 1999) defined the Bienville as a gneisso-plutonic terrain dominated by granodioritic and granitic assemblages. The nature of the subprovince itself and its regional boundaries remain ambiguous in many respects. Its northern boundary with the Minto Subprovince remains poorly known. Hocq (1994) mentions than the Tikkerutuk Domain may represent the northward extension of the Bienville (Figure 1). The Tikkerutuk is mainly composed of massive to foliated, and locally gneissic hornblende-biotite granodiorite (Percival *et al.*, 1992).

The southern boundary of the Bienville with the La Grande Subprovince is better constrained. It is marked by the late tectonic, porphyritic Bienville plutonic Suite (Hocq, 1994), an example of which is the Radisson monzonitic pluton (Goutier *et al.*, 1998) dated at 2712±3 Ma (Mortensen and Ciesielski, 1987).

The eastern boundary of the Bienville was modified on numerous occasions. Card and Ciesielski (1986) initially traced the Bienville up to the Labrador Trough, between the Minto northward and the La Grande and Ashuanipi to the south. Later, Percival *et al.* (1992) subdivided the Minto Subprovince into several domains based on their work along the Rivière-aux-Feuilles. These boundaries were extended southward using regional aeromagnetic maps, and the Bienville contact was brought back to the west. This boundary was then located in the centre of the Gayot and Maricourt areas (Figure 1). More recently, Ciesielski (1998) traced the contact of the Bienville to the south of the Maricourt area based once again on regional aeromagnetic maps. He mentioned however, in a synthesis report on the Bienville Subprovince (Ciesielski, 1999) that the northern and eastern contacts with the Minto Subprovince were not known and had been traced arbitrarily.

In the Gayot area, the boundary between the Minto and the Bienville was considerably modified (Figure 2) given the presence of "La Grande"-type tonalitic gneisses dated by Jean David at 2803±8 Ma (Gosselin and Simard, 2000a) and located in a sector traditionally believed to be in the Bienville (Figure 1). In the Maricourt area, the presence of similar tonalitic gneisses as well as the abundance of tonalitic units characteristic of the "Goudalie – La Grande Assemblage" suggest that the Bienville boundary is located beyond the study area. For the moment, we have traced it near the northwestern boundary of the Gayot area (Figure 2), which roughly corresponds to the recent interpretation proposed by Ciesielski (1998). The strong positive aeromagnetic anomaly found in the SW quadrant of the Maricourt area and which has contributed in interpreting the presence of the

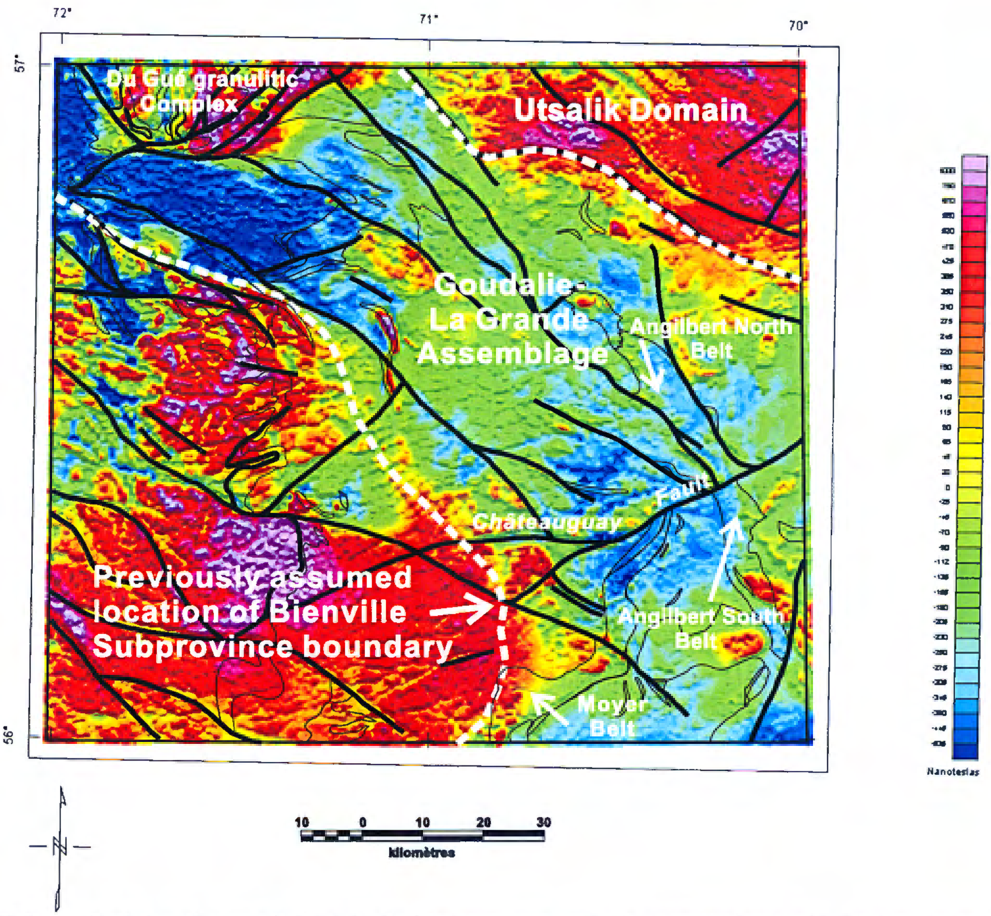


FIGURE 4 – Shaded total magnetic field in the Maricourt area, and the correspondence with the boundaries of major tectono-stratigraphic assemblages, the location of important faults, the Du Gué granulitic Complex and the principal volcano-sedimentary belts. (Map prepared by D. J. Dion and M. Copti)

Bienville (Figure 4), may be explained at least in part, by the presence of extensive late intrusive bodies with a porphyritic texture, characterized by a high magnetic susceptibility (Maurel Suite). Work scheduled for the summer 2000 and 2001 in the Lac des Loups Marins and Lac Bienville areas located further west should contribute in providing a better regional understanding of the nature and boundaries of this subprovince.

Paleoproterozoic Deposits

Paleoproterozoic deposits belonging to the Sakami Formation cover small surface areas of a few square kilometres located in the SE corner of the area, as well as about ten kilometres west of Lac Châteauguay, in the east-central part of the map (Figure 3). They mainly consist of sandstones, which vary from feldspathic to quartzitic in composition, and a few conglomerate horizons. This formation was defined by Eade (1966) to designate a series of Proterozoic outliers of sedimentary rocks unconformably overlying the Archean basement (Aphebian unconformity). These isolated outliers are considered as preserved remnants of a basin that extended from Lac Cambrien about 50 km east of our area, to James Bay (Marcoux, 1979). Sakami outliers occur within two main zones oriented ENE. The first roughly corresponds to the La Grande Rivière basin, and the second occurs near latitude 56°00', between longitudes 69°00' and 73°00' (Figure 1).

LITHOSTRATIGRAPHY

The Maricourt area is mainly underlain by Archean rocks. A few Proterozoic diabase and lamprophyre dykes are also present, as well as small outliers of Paleoproterozoic sedimentary rocks belonging to the Sakami Formation. The area comprises several lithological assemblages that were divided into lithodemic suites and complexes. Informal subunits assigned to these various assemblages are also described in order to better define the specific nature of certain mapped areas. Some of the stratigraphic units observed in the study area had already been defined further south in the Gayot area (Gosselin and Simard, 2000a). The legend in Figure 3 and on the geological map (Gosselin and Simard, 2000b) lists all the units encountered in the area in chronological order, as defined based on observed cross-cutting relationships and preliminary isotopic ages obtained in the Maricourt and Gayot areas.

Volcano-sedimentary rocks belong to the oldest lithological assemblages. They are mainly concentrated in the Moyer and Angilbert South and North belts (Figure 2). They are divided into two distinct units: the Gayot Complex, dominated by volcanic assemblages of tholeiitic affinity, and the Garault Complex, largely composed of sedimentary rocks and minor calc-alkaline volcanic rocks.

Tonalitic gneisses of the Brésolles Suite cover vast expanses mainly in the western and southeastern parts of the area (Figure 3). These gneisses cut across or enclave the volcano-sedimentary complexes.

Tonalitic units are the most widespread lithologies. They belong to two distinct lithodemic units: the Coursolles Suite composed of hornblende-biotite tonalite with early dioritic phases, and the Favard Suite mainly composed of trondhjemite. The two suites may be genetically related and represent a single diorite-tonalite-trondhjemite evolution series.

The Du Gué Complex occurs in the NW corner of the area. It also occurs as mega-enclaves hosted in the Maurel Suite, in the western part of the area (Figure 3). It consists of rocks metamorphosed to the granulite facies. These lithological assemblages represent, at least in part, metamorphosed equivalents of the Favard Suite. The complex also includes younger intrusions of enderbite, charnockite and diatexite.

All these units are cross-cut by younger granodiorite and granite intrusions divided into three distinct suites. The Desbergères Suite consists of homogeneous granodiorite which may represent the final product of a migmatization process that affected both Coursolles tonalites and Favard trondhjemites. Evidence to support this statement includes the presence of migmatized units Acou2a and Afav1b (Figure 3), which contain an increasing number of mobilizate bands that grade into a granodiorite unit very similar to the Desbergères granodiorite. The Maurel Suite is represented by massive homogeneous granodioritic to granitic rocks with a very characteristic porphyritic texture. The Tramont granitic Suite is the youngest Archean unit. It consists of fine to medium-grained massive pink granite, very homogeneous and practically exempt of mafic minerals. This granite occurs as plutons or dykes of variable thickness, that cut across all other Archean lithological assemblages.

Massive, weakly deformed gabbro dykes were observed in a few locations, and were assigned to the Châteauguay Suite. These cut across tonalites and trondhjemites of the Coursolles and Favard suites, and are themselves injected by granite and pegmatite dykes of the Tramont Suite.

Proterozoic rocks are not abundant in the area. The Sakami Formation, composed of undeformed sedimentary rocks, was observed on a few outcrops in two locations only. A few thin lamprophyre dykes are found in the NE part of the area. The strong carbonatization affecting the rock gives it an orange colour on weathered surfaces. Over one hundred diabase dykes were observed on various outcrops in the area. They are generally less than 30 m thick and have limited lateral extent. These dykes have widely variable orientations, and may belong to different families.

Archean Volcano-Sedimentary Units

Volcano-sedimentary units are mainly concentrated in three large belts located in the southeastern part of the area (Figure 3): the Moyer, Angilbert North and Angilbert South belts. The southern tip of the Moyer belt was mapped during the 1998 summer program in the Gayot area, and assigned to the Gayot Complex (Gosselin and Simard, 2000a) which is characterized by the predominance of volcanic rocks. Work performed in the Maricourt area helped extend the Moyer belt over a distance of nearly 50 km towards the NE and confirm that it is indeed part of the Gayot Complex. The Angilbert North and South volcano-sedimentary belts had never been reported. They are oriented along a NW-SE axis, and are separated by an important regional fault, the Châteauguay fault (Figure 2). The two belts extend over more than 70 km along strike and are 5 km wide on average. The Angilbert South belt is mainly composed of tholeiitic volcanic rocks similar to the Moyer belt. It was therefore assigned to the Gayot Complex, although it does contain a higher proportion of sedimentary rocks. The Angilbert North belt, on the other hand, is dominated by metasedimentary assemblages, that alternate with minor quantities of calc-alkaline volcanic rocks and tonalitic gneisses. These rocks were assigned to a new unit, the Garault Complex. A few other small volcano-sedimentary belt segments are also present in the area, although they are much more restricted in size. These were assigned to one of the two complexes based on their dominant lithological assemblages.

Gayot Complex (Agat)

The Gayot Complex was first identified in the Gayot area (Gosselin and Simard, 2000a), south of our map area. Two U/Pb zircon ages were obtained in 1998 in this area. The first comes from a crystal tuff in the Coulon belt, which yielded an age of 2.86 Ga (Figure 2; Table 1; Gosselin and Simard, 2000a). The second was taken in a quartz-feldspar porphyry (QFP) intercalated between basalt flows in a small band located south of the Venus belt. An age of about 2.70 Ga was obtained. This QFP horizon appears to represent a late felsic injection genetically unrelated to the volcanic sequences. Furthermore, field observations in the Gayot and Maricourt areas support the hypothesis that the Gayot Complex is for the most part older than Brésolles gneisses dated at 2803±8 Ma (Table 1). It must be pointed out that no age dating was carried out in the Gayot Complex of the Maricourt area.

The Gayot Complex occupies the entire Moyer belt, the south half of the Angilbert belt (Angilbert South) as well as a few small remnants of volcanic rocks (Figure 3). It is generally identified as informal unit Agat1, mostly composed of tholeiitic basalts, with lesser quantities of mafic to

TABLE 1 – Preliminary regional stratigraphic correlations established from a compilation of geochronological data available for the Gayot, Maricourt, Nedlouc and other areas mapped in 1999 under the Far North Project (from Gosselin and Simard, 2000a; Parent *et al.*, 2000; Berclaz *et al.*, 2000; Leclair *et al.*, 2000b).

Ga	**Gayot area (1998)** Gosselin and Simard, 2000	**Maricourt area (1999)** (this report)	**Nedlouc Area (1998)** Parent *et al.*,(2000)	**La Potherie Area (1999)** Leclair *et al.*,(2000b)	**Aigneau Area (1999)** Berclaz *et al.*, (2000)
2.65					
	▲ Maurel Suite, I1B-I1C, [PO] (2.68 Ga)	▲ Maurel Suite, I1B-I1C, [PO] (2.685 Ga) Desbergères Suite, I1C, [HJ] (2683 +4/-2 Ma)	▲ Rivière-aux-Mélèzes Suite, M21 (2.67 Ga) ▲ Morrice Suite, I1B (2682 ±4 Ma)		
2.70	▲ I1C, [PO] hosted in a volcanic band south of the Venus belt (2.70 Ga)		▲ Lippens Suite, I1T (2.70-2.71 Ga); ▲ Rivière-aux-Feuilles Suite, I1D (2.70 -2.71 Ga)		
		▲ Coursolles Suite, I1D, HB (2718 +11/-8 Ma)	▲ Duvert Complex, (2713±6 Ma) x Rivière-aux-Feuilles Suite, I1C (2724 Ma)		
	▲ Favard Suite, I1E (2.73 Ga)	▲ Du Gué Complex, I1D, OX (2.729 Ga)		▲ La Chevrotière Suite, I1B, [MP] (2732 +4/-2 Ma)	
2.75		▲ Favard Suite, I1E (2749±4 Ma) ▲ Brésolles Suite, I1E injections (2754+11/-9 Ma) and inherited zircons (2.8 -2.9 Ga)	▲ Charnière Suite, I1E (2.74 - 2.75 Ga)		
2.80	▲ Brésolles Suite, M1 (I1D) (2803±8 Ma)	▲ Garault Complex, M8, SR (2.786 Ga)	x Vizien Complex , (2786 Ma) ▲ Dupire Complex, (2787±4 Ma)	▲ Rochefort Suite, I1D (2779 Ma) x I1D, BO (2782 Ma)	▲ Sullupaugalik Suite, I1D, BO (2805 +9/-4 Ma)
	▲ Gayot Complex, Coulon belt, Crystal tuff (2.86 Ga)			x I1C (2831 Ma) x M1 (I1D) (2940-3010 Ma) x M1 (I1D) (3100 Ma)	

- U/Pb dates : x - taken from Percival *et al.*, (1992), and Skulski *et al.*, (1996) ▲ - new data obtained under the Far North Project (Jean David).
- see lithological and mineralogical abbreviations, and textural symbols in Sharma (1996).

ultramafic intrusions and pyroclastic rocks. Horizons of tonalitic gneiss, sedimentary rocks and oxide-facies iron formations also occur in this sequence. Unit Agat2 is predominantly mafic to ultramafic intrusive rocks. It is composed of gabbros alternating with pyroxenite horizons, and more rarely, a few dioritic intrusions. This unit forms a thin horizon at the SW tip of the Moyer belt, as well as a narrow belt in the NW part of the area.

Basalts constitute the dominant lithology in the complex. They often occur as banded horizons a few decimetres to a few metres thick, alternating with more massive horizons of the same thickness. These different types of basalts probably represent different volcanic facies where primary textures were obliterated by metamorphism and deformation. Fresh basalts show a dark greyish green colour and their weathered surface is brownish green. These rocks are fine-grained and mainly composed of hornblende and plagioclase.

Gabbros and ultramafic rocks generally form sills a few metres to a few tens of metres thick, inserted in the basalt sequence. Gabbros are fairly widespread. They are medium-grained, massive, greenish grey rocks with a brownish green weathered crust. Ultramafic rocks are mainly concentrated in the SW part of the Moyer belt and at the southern tip of the Angilbert South belt. A few horizons were also observed in the NE part of the Moyer belt. These mainly consist of pyroxenite and peridotite, more rarely hornblendite, occurring as 1 to 20-m thick horizons, sometimes lenticular, alternating with basalts or gabbros. It is possible that some of these horizons may represent komatiitic lavas rather than intrusions. In fact, spinifex komatiites were observed in the Gayot complex, more specifically in the Venus belt (Figure 2). Ultramafic rocks have a very dark green to black colour in fresh surface, with a brownish weathered crust. Pyroxenites mainly consist of clinopyroxene, with a few grains exhibiting beautiful zoning patterns. Clinopyroxene sometimes forms cumulate textures with interstitial plagioclase. Green hornblende is often superimposed upon pyroxene grains. The rock also contains spinel and magnetite. Peridotites are generally strongly serpentinized and contain variable proportions of olivine and pyroxene. A few very fine-grained samples may represent ultramafic lavas. Peridotites mainly consist of serpentine that defines a well-developed foliation, along with about 20% small anthophyllite grains occurring as fine needles or in sheafs.

Pyroclastic rocks are common but only account for a minor proportion of the sequence. They form horizons of decimetric to decametric thickness, composed of felsic to intermediate tuffs that alternate with other lithologies in the Gayot Complex. They generally consist of banded ash tuffs, crystal tuffs and lapilli tuffs. These rocks are light green, whitish grey or beige. They often display a rusty weathered surface due to the presence of small sulphide grains disseminated in the rock. They are generally strongly foliated. Their mineral composition, determined under the microscope, consists of variable quantities of quartz and plagioclase. They contain about 20% chlorite, an alteration product of biotite, since they have undergone hydrothermal alteration or late retrograde metamorphism. This alteration also translates into a strong sericitization of plagioclase grains.

Sedimentary rocks are not abundant in the Gayot Complex, except in the northern half of the Angilbert South belt, where paragneisses frequently form thick horizons (several tens of metres thick), alternating with basalts. The paragneisses are medium grey in fresh surface and yellowish grey in weathered surface. They are fine to medium-grained and are generally banded. These rocks are sometimes slightly migmatized. Paragneisses contain between 10 to 20% biotite crystals, more or less chloritized, oriented parallel to the foliation. Garnet was observed in a few locations.

In the Gayot Complex, iron formations form decimetric to decametric horizons intercalated in basalt and paragneiss sequences, or more rarely associated with pyroclastic rocks. These iron formations generally belong to the oxide facies, but sulphide-facies rocks are sometimes present. They consist of alternating bands (1 to 10 cm) of magnetite and chert. The most important iron formation horizons are located in the SW part of the Moyer belt, intercalated in the mafic rock sequence. A sample of iron formation associated with volcanic rocks of the Gayot Complex, located in the Venus belt, contained up to 5.6 g/t Au (Gosselin and Simard, 2000a).

Tonalitic gneiss horizons similar to those of the Brésolles Suite are often observed within the Gayot Complex. They are particularly abundant in the northern half of the Moyer belt, where they account for nearly 50% of the total volume of lithological assemblages. This part of the belt consists of a considerable proportion of tonalitic gneiss horizons between a few metres to over one hundred metres thick, that alternate with volcano-sedimentary rock horizons. In the vicinity of these gneissic horizons, volcanic rocks are highly injected with the tonalitic material, or form stretched enclaves within the gneissic sequence. These occurrences illustrating the relative timing of volcano-sedimentary rocks and gneisses were observed in several locations within and along the margins of the Moyer belt, as well as in volcanic rock remnants hosted in the Brésolles Suite. These observations suggest that the volcano-sedimentary rocks of the Gayot Complex are older than Brésolles gneisses.

Garault Complex (new unit, Agar)

The Garault Complex groups lithological assemblages that form the northern half of the Angilbert volcano-sedimentary belt as well as a few much smaller belt segments located elsewhere in the area (Figure 3). This new unit is characterized by the predominance of sedimentary rocks, mainly represented by biotite paragneisses, muscovite schists, arenaceous sandstones and conglomerate beds. A sericite schist sampled for geochronological purposes yielded an age of 2.786 Ga. The complex also includes minor quantities of effusive and intrusive, intermediate to mafic volcanic rocks with a calc-alkaline affinity, as well as tonalitic gneisses.

Sedimentary rocks are dominated by biotite paragneisses and muscovite schists. The paragneisses are pale grey, fine to medium-grained and often show a banded aspect. They are composed of variable proportions of quartz and plagioclase, with minor potash feldspar. They also contain between 10 and 25% biotite flakes, more or less chloritized, frequently superimposed by muscovite flakes. Small crystalline tourmaline grains are often present, superimposed upon the biotite and muscovite. Garnet was observed in several locations. At the northern tip of the Angilbert belt, the biotite takes on a reddish tinge, indicating higher-grade metamorphic conditions. These biotites are often chloritized, suggesting that retrograde metamorphism or late alteration has also affected this part of the belt.

Compared to paragneisses, muscovite schists show a similar grain size but a lighter, almost white colour. They have a much higher quartz content, and contain less than 5% biotite and 10 to 15% muscovite. Biotite, muscovite and tourmaline exhibit the same types of associations and overgrowth relationships. The increasing metamorphic grade in the northern part of the Angilbert North belt translates into the appearance of sillimanite. Paragneisses and schists are affected by a strong foliation and are weakly migmatized. A fault zone marks the eastern boundary of the belt, and the rocks in its vicinity are very strongly deformed. The exact origin of these rocks is unknown, but the paragneiss may correspond to a wacke based on the percentage of biotite present in the rocks, whereas the schist is presumably derived from a quartz arenite or from felsic volcanic rocks.

A few horizons of quartzitic sandstone between one and ten metres thick were also observed. These sandstones are whitish, medium-grained and strongly deformed. They consist of over 95% quartz grains with a pronounced undulatory extinction and sutured grain boundaries. They contain a few muscovite flakes oriented parallel to the foliation. Tourmaline grains are also present, superimposed upon the muscovite. These rocks were observed in contact with an undeformed Proterozoic arkosic sandstone belonging to the Sakami Formation, west of Lac Châteauguay (Figure 3). In this location, Archean arenaceous sandstones are particularly deformed and contain fuchsite. In this area, a few m-scale horizons of highly deformed polygenic conglomerate were also observed.

Volcanic rocks observed in the Garault Complex consist of intermediate to mafic lavas, gabbros and diorites. Intermediate tuffs are sometimes present, as well as rare felsic horizons. No ultramafic rocks were observed in this complex. Volcanic rocks occur in horizons of a few metres to a few hundred metres thick, intercalated with paragneisses. Mafic lavas are dark greenish grey whereas intermediate lavas are generally lighter coloured. These rocks are massive or banded, fine-grained, generally well foliated, and their primary textures have been obliterated by deformation and metamorphism. Gabbros and diorites are fairly common in the Garault Complex. They occur as dykes or sills intercalated in paragneiss sequences, or alternating with lavas in volcanic rock sequences. These rocks show the same colour range as lavas with similar compositions, are medium-grained and are generally strongly foliated. Their thickness varies from a few metres to a few tens of metres.

Tonalitic gneisses were observed in a few locations in the Angilbert North belt. These consist of banded gneisses similar to those in the Gayot Complex and the Brésolles Suite. The gneisses form horizons of a few metres to a few hundred metres thick. They are most abundant in the NW part of the Angilbert North belt, where the Garault Complex comes in contact with gneisses of the Brésolles Suite (Figure 3).

Tonalitic Units

Archean tonalitic units cover an important surface area within the study area. Tonalitic rocks belong to three major lithodemic units: the Brésolles, Coursolles and Favard suites. The gneisso-tonalitic Brésolles Suite is the oldest tonalitic unit (2803±8 Ma). This unit, fairly abundant in the Gayot area to the south, was recognized northward up to the northern part of the Maricourt area, but seems to disappear further north (Parent *et al.*, 2000).

The Coursolles and Favard suites group all other tonalitic assemblages in the area. The Coursolles Suite consists of hornblende tonalite and early dioritic and gabbroic phases. The Favard Suite, on the other hand, mainly consists of trondhjemite. Based on field observations, the emplacement of trondhjemites postdates the tonalites. However, a U/Pb zircon age of 2718+11/-8 Ma.[1] was obtained for a Coursolles tonalite, i.e. younger than the age of 2749±4 Ma obtained for a Favard trondhjemite. These data contradict the cross-cutting relationships observed in the field, which implies that several tonalitic intrusive phases may have come into play. Nevertheless, we will consider, for the moment at least, that the major part of the Coursolles Suite is composed of tonalites older than rocks of the Favard Suite, and that the two suites may represent a single diorite-tonalite-trondhjemite evolution series. Finally, these two suites have been migmatized or granitized to variable degrees almost everywhere in the area.

Brésolles Suite (Abre)

The gneisso-tonalitic Brésolles Suite was initially identified in the Gayot area (Gosselin and Simard, 2000a), where it occupies an important surface area. U-Pb zircon dating performed on a sample from this area collected in a dioritic horizon associated with the gneisses, yielded an age of 2803±8 Ma. In Maricourt, another age date was obtained, this time on a sample from a trondhjemite forming homogeneous m-scale layers intercalated in the banded gneisses.

1 Ages are given in million years (Ma) rather than billion years (Ga) when an error margin is provided (±)

An age of 2754+11/-9 Ma was obtained, indicating that these layers are late relative to the gneisses. The sample also contained inherited zircons which yielded an approximate age of 2.79 Ga. These zircons were most likely inherited from the gneisses.

The Brésolles Suite occupies an important surface area in the southeastern and western parts of the area. It also forms a small band NW of the Angilbert North belt (Figure 3). Brésolles gneisses generally display a banded texture produced by alternating dark and light-coloured bands of variable thickness. Overall, leucocratic tonalitic layers are larger and more abundant, although melanocratic dioritic layers are locally dominant. Diorite also occurs as enclaves a few centimetres to a few metres long within tonalitic horizons. In certain areas, the dioritic portion is scarce, and the tonalite in these areas displays a very strong foliation marked by mafic minerals concentrated in mm-scale bands. In thin section, dioritic bands contain between 20 to 35% mafic minerals dominated by green hornblende, with minor quantities of biotite, which is often greenish. Epidote and sphene are practically always associated with the mafic minerals. These minerals often cut across biotite and hornblende grains. Tonalitic bands contain less than 5% mafic minerals, showing up as tabular biotite. In general, plagioclase grains are more altered in these leucocratic bands. Apatite is always present, and allanite is occasionally observed in epidote.

Amphibolite enclaves, centimetric to decimetric in size, as well as more or less continuous m-scale horizons, are frequently observed in this unit. They generally form between 10 to 15% of the rock. They are less abundant in gneisses located in the western half of the area, where they only form between 1 to 5% of the rock. Moreover, in the area NW of the Angilbert North belt, the gneisses contain mostly paragneiss enclaves.

Brésolles gneisses are affected by numerous folds, and are injected by younger tonalites and granites, which often produces fairly complex structural patterns. Injections of trondhjemite, similar to the Favard Suite (Afav2), are particularly abundant in gneisses located in the western half of the area. In the SW quadrant, the Brésolles Suite forms a narrow band in contact with a thrust fault (Figure 3). Here, the unit contains atypical lithological assemblages. Granitic and granodioritic rocks, often porphyritic, occur with the tonalitic rocks. All these lithologies are extremely deformed and display a banded mylonitic fabric. For the moment, these rocks have been assigned, with some caution, to the Brésolles Suite.

Coursolles Suite (new unit, Acou)

The Coursolles Suite is a new lithodemic assemblage identified in the Maricourt area, characterized by an early diorite unit (Acou1) and a main hornblende-biotite tonalite unit (Acou2) for which an age of 2718+11/-8 Ma was obtained. The Coursolles Suite occupies an important surface area in the eastern half and the southwest corner of the area. Further south in the Gayot area, this suite had not been recognized. However, the presence of hornblende-biotite tonalite had been reported in a few locations in the NE part of the Gayot area, in association with dioritic lenses then assigned to the Favard Suite (unit Afav1; Gosselin and Simard, 2000a). These diorites are now included in unit Acou1 of the Coursolles Suite. In several sectors within the study area, Coursolles tonalites are migmatized (unit Acou2a). These sectors are characterized by a heterogeneous aspect produced by a mixture of tonalite with lenses of granodioritic to granitic mobilizate in gradational and diffuse contact with the tonalite.

Dioritic Unit (Acou1)

The dioritic unit (Acou1) is well-exposed in the SE part of the area, and it forms several lenses of restricted extent in the W and NE sectors (Figure 3). This unit appears to represent an early intrusive phase of the Coursolles Suite. Injections of hornblende-biotite tonalite of unit Acou2 were observed cross-cutting the diorites in several locations. Furthermore, dioritic enclaves most likely belonging to unit Acou1 were observed in unit Acou2.

Unit Acou1 is mainly composed of diorite and quartz diorite, with some local gabbro. Hornblende-biotite tonalites typical of unit Acou2 may also be observed in variable proportions within unit Acou1. Gabbro is particularly abundant in the SE part of the area, west of the Moyer belt. In this area, a few horizons of ultramafic rocks, mainly pyroxenites, were also observed with the gabbros and diorites. These different phases occur as enclaves in the more felsic phases, suggesting that the Coursolles Suite may represent an intrusive suite that presumably evolved from early mafic to intermediate phases, to a more felsic phase represented by the hornblende-biotite tonalite of unit Acou2, rich in mafic minerals.

Diorites and quartz diorites are medium grey to dark grey rocks, medium to coarse-grained, and display a massive to foliated aspect. These rocks contain between 25 to 40% mafic minerals, generally aligned parallel to the foliation. Mafic minerals generally form cm-scale pods or glomerocrysts composed of variable proportions of green hornblende and biotite, although hornblende is generally more abundant. They also contain between 1 to 8% quartz, and up to 10% potash feldspar. Sphene and epidote are common and are generally associated with the mafic minerals. The amount of magnetite is highly variable from one sample to the next, whereas apatite and allanite are present in minor quantities.

In the NE part of the area, the biotite in the dioritic unit is brownish and plagioclase grains are fairly fresh. In the SE sector however, these rocks have undergone alteration or late retrograde metamorphism, which has transformed the biotite, and sometimes the hornblende, into chlorite and which has strongly altered the plagioclase to sericite. In the NE sector, this alteration phenomenon was observed within a deformation corridor related to a regional fault.

Hornblende-Biotite Tonalite Unit (Acou2)

The hornblende-biotite tonalite is the principal lithology in the Coursolles Suite. However, it locally contains an important proportion of diorite, quartz diorite and gabbro identical to those in unit Acou1. Coursolles tonalites are medium-grained, medium grey to dark grey rocks, with a well-developed foliation. They contain between 15 to25% green hornblende and biotite in equal proportions which form, as is the case with the diorites, pods or glomerocrysts often elongated paralel to the foliation. The tonalites look very similar to the diorites and quartz diorites. Their constituents are the same, with a higher quartz content and a lower content in mafic minerals for the tonalite.

The alteration of biotite to chlorite and plagioclase to sericite was observed in several samples, and the regional distribution of this alteration phenomenon is similar to that observed for the diorites. The tonalites frequently contain 1 to 2% enclaves of diorite, quartz diorite or gabbro, from a few centimetres to a few decimetres long, most often stretched along the foliation direction. This percentage increases in areas where intermediate to mafic rocks alternate with the tonalites.

Migmatized Tonalite Unit (Acou2a)

Unit Acou2a occupies sectors where Coursolles tonalites were affected by a migmatization process to varying degrees. The granodioritic to granitic mobilizate generally constitutes between 10 to 50% of the total outcrop surface. It occurs as lens-shaped or discontinuous bands between one to ten centimetres thick, with gradational contacts with the tonalite. It also forms pods or pockets of variable dimensions as well as small nodules or cm-scale pods that sometimes give the rock a porphyritic aspect. The mobilizate is distributed very heterogeneously at both the scale of the outcrop and the sample. It is light grey to pinkish grey, has a heterogeneous grain size and contains a small percentage of mafic minerals, mainly biotite. The presence of 5 to 15% discontinuous dark grey bands rich in mafic minerals, and between 1 to 10 cm thick, is often noted. These bands may represent remnants of mafic to intermediate enclaves, or may be the result of segregation due to the migmatization process. In unit Acou2a, the distribution of mafic minerals is often quite variable at the scale of the sample or of the outcrop. All these phenomena give this unit a characteristically heterogeneous aspect.

In several locations, a much more homogeneous granodiorite is observed in more or less gradational contact with heterogeneous zones. This granodiorite appears to represent a more advanced phase of the migmatization process. It then becomes very difficult to differentiate this lithology from the homogeneous granodiorite of the Desbergères Suite (Adeb), described in a later section.

The Favard Suite (Afav)

The Favard Suite was originally defined in the Gayot area (Gosselin and Simard, 2000a), south of our map area. It was divided in the Gayot area into two units: an early, dioritic unit (Afav1) restricted to the northern part of the area, near the southeastern margin of our map area, and a principal unit of biotite leucotonalite (trondhjemite) (Afav2). Results of our field work in the summer of 1999 have prompted us to reconsider the diorites (Afav1) observed in the Gayot area as equivalent to the dioritic unit Acou1 of the Coursolles Suite (Table 2) described above. In the Maricourt area, the Favard Suite is therefore composed of unit Afav1 consisting of trondhjemites, equivalent to those of unit Afav2 of the Gayot area. Certain features observed in the Maricourt area have however enabled us to define two other sub-units within the principal unit: sub-unit Afav1a is characterized by the presence of specific lithologies associated with the trondhjemites, and sub-unit Afav1b corresponds to migmatized portions of the trondhjemite from principal unit Afav1 (Figure 3; Table 2).

The Favard Suite occupies an important surface area in the Maricourt area (Figure 3). Zircon dating performed on a trondhjemite yielded an age of 2742±3 Ma (Table 1). As a reference, this same suite had yielded a preliminary age of 2.73 Ga in the Gayot area (Gosselin and Simard, 2000a).

Trondhjemites (Afav1)

This unit is characteristic of the Favard Suite. It consists of medium-grained whitish to slightly pinkish trondhjemite. The trondhjemite contains less than 10% mafic minerals, which are largely dominated by biotite. The biotite is generally concentrated along poorly-defined cm-scale layers, which give the trondhjemite a more or less banded aspect quite typical of the unit. The rock is most often massive in appearance to weakly foliated. However, the degree of deformation is widely variable even within a single outcrop, and the rock varies from massive to strongly foliated and even gneissic. These variations generally appear to be associated with an increase in deformation near the margins of late plutons, or in the vicinity of fault zones. In the east-central part of the area (Lac Châteauguay, Figure 3), a trondhjemite pluton is affected by a particularly intense foliation, defined by the alignment of biotite and the presence of stretched quartz grains, which give the rock a finely laminated aspect.

Trondhjemites contain cm-scale to m-scale enclaves mainly composed of diorite and amphibolite, generally forming less

TABLE 2 – Preliminary regional stratigraphic correlations essentially based on descriptive data provided for the principal units and sub-units encountered in the Maricourt area (this report), Gayot (Gosselin and Simard, 2000a), and Nedlouc (Parent *et al.*, 2000) areas.

Gayot Area		**Maricourt Area**		**Nedlouc Area**	
Lithostratigraphic unit	**Brief description** (Gosselin and Simard, 2000a)	**Lithostratigraphic unit**	**Brief description** (this report)	**Lithostratigraphic unit**	**Brief description** (Parent *et al.*, 2000)
Tramont Suite	Biotite leucogranite	Tramont Suite	Biotite leucogranite	Morrice Suite (2682±4Ma)	Granite
none	Mafic to ultramafic intrusions	Châteauguay Suite	Mafic to ultramafic intrusions	Bacqueville Suite	Mafic intrusions
Maurel Suite (2.68 Ga)	Megaporphyritic granite to granodiorite	Maurel Suite (2.685 Ga)	Megaporphyritic granite to granodiorite	La Chevrotière Suite (2732 +4/-2 Ma)	Megaporphyritic granite
La Bazinière Suite	Foliated to gneissic, locally porphyritic granodiorite	? Desbergères Suite (2683 +4/-2 Ma)	Homogeneous biotite-hornblende granodiorite	Granodiorite of the Rivière-aux-Feuilles Suite (2724 Ma)	Homogeneous hornblende-biotite granodiorite
				? Monchy Suite	Heterogeneous granodiorite
		Du Gué granulitic Complex, orthopyroxene tonalite (2.729 Ga)	Diatexite	Rivière-aux-Mélèzes Suite (2.67 Ga)	Diatexite
			More or less migmatized orthopyroxene paragneiss	Paragneiss unit in the Minto domain	More or less migmatized orthopyroxene paragneiss
			Megaporphyritic orthopyroxene-bearing tonalitic to granitic rocks	? Lippens and McMahon Suites (2.70-2.71 Ga)	Enderbite and charnockite
			<u>Undivided</u> Orthopyroxene tonalite, enderbite, paragneiss, volcanic rocks, diatexite		
			Red biotite trondhjemite		
Favard Suite (2.73Ga)	Foliated, locally gneissic trondhjemite	Favard Suite, trondhjemite (2749±4 Ma)	Migmatized trondhjemite	Trondhjemite (or leucotonalite) from the Charnière Suite (2.74 Ga)	Foliated, locally gneissic, biotite leucotonalite
			Trondhjemite associated with horizons of gneiss, paragneiss and mafic volcanic rocks		
			Trondhjemite		
		Coursolles Suite	Hornblende tonalite	? Tonalite of the Rivière-aux-Feuilles Suite (2.7-2.71 Ga)	Hornblende tonalite
			Migmatized tonalite	Sullupaugalik Suite (2805 +9/-4 Ma)	Migmatized tonalite
Favard Suite	Diorite and gabbro		Diorite and gabbro		
Brésolles Suite (2803±8 Ma)	Tonalitic gneiss	Brésolles Suite	Tonalitic gneiss		
		Garault Complex, sericite schist (2.786 Ga)	Volcano-sedimentary sequence dominated by metasediments ; calc-alkaline lavas and diorite	? Duvert Complex (2713 ± 6 Ma)	Volcano-sedimentary sequence ; tholeiitic lavas and calc-alkaline andesite unit
Gayot Complex, felsic tuff (2.86 Ga)	Volcano-sedimentary sequence and mafic to ultramafic intrusions	Gayot Complex	Volcano-sedimentary sequence ; tholeiitic lavas	? Dupire Complex (2787 ± 4 Ma)	Volcano-sedimentary sequence ; tholeiitic lavas

? = questionable stratigraphic correlation than 2% of the total outcrop, but locally reaching up to 40%. The abundance of enclaves is often accompanied with an increase in the percentage of mafic minerals, particularly amphiboles, within the trondhjemite itself. Enclaves are often stretched, and exhibit an internal foliation parallel to the regional foliation. However, a few contain an early foliation, crenulated by the regional foliation. Finally, enclaves of tonalitic gneiss, paragneiss and hornblende-biotite tonalite are also observed locally.

In thin section, trondhjemites generally contain less than 5% biotite commonly greenish in colour, which is sometimes partially altered to chlorite. Epidote and sphene are often in contact with biotite grains, and allanite was observed within epidote grains, in a few samples. Quartz grains almost always exhibit a pronounced undulatory extinction. The alteration of plagioclase to sericite varies from one sample to the next, and increases along with the chloritization of biotite. Potash feldspars account for less than 1% of the rock, but are slightly more abundant in certain migmatized zones. Idiomorphic apatite is fairly common.

Trondhjemites Associated with Other Lithologies (Afav1a)

An informal sub-unit (Afav1a) was defined in the northwest part of the area. It is essentially characterized by an abundance of bands and enclaves of decimetric to metric size, composed of paragneiss, tonalitic gneiss, diorite, gabbro and amphibolite, intercalated in Favard trondhjemites. This sub-unit occurs along the extension of the Angilbert North volcano-sedimentary belt, and of a tonalitic gneiss horizon belonging to the Brésolles Suite. It is therefore possible that bands and enclaves encountered in this sub-unit may correspond to preserved remnants of the Garault or Gayot Complex, as well as Brésolles gneisses.

Migmatized Trondhjemites (Afav1b)

Trondhjemites of the Favard Suite have undergone migmatization of variable intensity. This migmatization is observed almost everywhere in the area. However, an informal sub-unit of migmatized trondhjemite (Afav1b) was defined in areas where this migmatization is more intense and regular. The migmatization process translates into the presence of a granodioritic to granitic pinkish grey mobilizate, medium to coarse-grained, which constitutes between 5 to 40% of the rock. This mobilizate forms more or less continuous bands with diffuse contacts, centimetric to decimetric in thickness, which give the trondhjemite a banded aspect. It also occurs as patches, pods or nodules of variable dimensions, heterogeneously distributed at both the scale of the outcrop and the scale of the sample. The migmatization observed in Favard Suite trondhjemites is similar to that observed in tonalites of the Coursolles Suite. It is quite possible that this phenomenon is related to a single metamorphic episode.

Du Gué Granulitic Complex (new unit)

Lithological assemblages metamorphosed to the granulite facies are concentrated in the NW quadrant of the map, and are grouped in a new unit, the Du Gué Complex (Figure 3). This complex occupies a well-constrained surface area corresponding to a well-defined positive magnetic anomaly (Figure 4). It is bounded to the south by reverse faults. Lithological assemblages characteristic of the Du Gué Complex also form large enclaves up to several kilometres in size, within an important pluton of porphyritic granodiorite of the Maurel Suite, located in the western half of the area (Figure 3). Younger, unmetamorphosed, porphyritic intrusions belonging to the Maurel Suite, as well as numerous dykes of fine-grained granite and pegmatite from the Tramont Suite cross-cut the complex in several locations.

The Du Gué granulitic Complex consists of lithological assemblages of various origins. The undivided part of the complex (unit Adug, Figure 3) is mainly composed of tonalitic rocks alternating with bands a few metres to several tens of metres thick, of tonalitic gneiss, migmatized paragneiss, diorite, mafic volcanic rocks and diatexite. In certain areas, informal units were defined based on the predominance of certain lithologies such as: a unit of migmatized paragneiss (Adug1), a unit of red biotite trondhjemite (Adug2), a porphyritic rock unit (Adug3) and a diatexite unit (Adug4; Figure 3). However, the overall composition, distribution and field relations of the various lithological assemblages in the Du Gué Complex suggest that this complex is, at least in part, a metamorphosed equivalent of sub-unit Afav1a of the Favard Suite.

In this complex, the high metamorphic grade, generally granulite facies, is manifested by the presence of orthopyroxene and red biotite, as well by more or less well developed granoblastic textures. Tonalitic and dioritic rocks also display a greenish tinge typical of this metamorphic facies. In the western part of the complex, orthopyroxene is absent but the presence of red biotite and recrystallization textures nevertheless indicate a high metamorphic grade, at least to the upper amphibolite facies. Large, well-crystallized orthopyroxene crystals were observed in certain thin sections of tonalite and tonalitic to granitic porphyritic rocks (Sharma, personal communication). These crystals appear to have a magmatic origin, which suggests the presence of an igneous enderbite-charnockite phase, emplaced among the other metamorphosed lithologies of the Du Gué Complex.

Undivided Portion of the Du Gué Complex (Adug)

The undivided portion of the Du Gué Complex is composed of at least three different types of tonalitic rocks: massive to foliated orthopyroxene trondhjemite, gneissic tonalite and enderbite, possibly intrusive, but which could not be differentiated in the field. Tonalitic rocks possess a characteristic greenish to yellowish green colour. This colour is not as intense however in the trondhjemites. The mineralogy of tonalitic rocks is similar to that of equivalent rocks observed elsewhere in the area, with the addition of red biotite and orthopyroxene. Since the trondhjemite is injected in the gneissic tonalite and remnants of volcano-sedimentary rocks, its timing is considered identical to the Favard Suite trondhjemite.

Paragneisses are relatively abundant in the undivided portion of the Du Gué Complex. They form horizons of a few tens of metres thick, alternating with tonalitic rocks or as enclaves stretched along the foliation direction hosted in the latter. They often occupy more than 20% of the total surface area of outcrops, and are occasionally accompanied by m-scale (or less) horizons of rusty oxide-facies iron formation. Paragneisses are always affected by an intense migmatization, often observed over more than 50% of the rock. A banded aspect is produced by the presence of dark grey to brownish grey paleosome alternating with light grey to whitish neosome. The paragneiss is fine-grained, strongly foliated and displays a characteristic yellowish grey weathered surface. Orthopyroxene was observed in several locations, indicating that the paragneisses were also metamorphosed to the granulite facies. The mobilizate occurs as more or less continuous bands of granodioritic composition, a few centimetres to one metre in thickness, oriented parallel to the foliation. In areas where the migmatization becomes more intense, diatexite horizons several metres in thickness alternate with horizons of migmatized paragneiss.

A few horizons initially identified as strongly magnetic, fine-grained dark grey paragneiss, were observed, intercalated within tonalitic rocks. In thin section, these rocks display an intermediate dioritic composition, and a mineral paragenesis typical of the granulite facies. They are composed of plagioclase and 40 to 50% mafic minerals represented by 5 to 20% red biotite, 10 to 25% green hornblende and 5 to 35% clinopyroxene and orthopyroxene. Quartz is not abundant. The origin of these rocks is uncertain, but they appear to represent diorites rather than paragneisses.

Volcanic rocks were found at a few sites within the Du Gué Complex. These occur as orthopyroxene-bearing amphibolite horizons, a few tens of metres in thickness, alternating with paragneiss horizons. Gossans and rusty oxide-facies iron formations, decimetric to metric in thickness, are sometimes associated with the amphibolites. These volcano-sedimentary sequences rarely exceed 400 m in thickness, and are injected by tonalite. Horizons of coarser-grained mafic rocks, probably gabbros at the onset, 10 to 20 metres in thickness, were also observed locally. One thin section of amphibolite was examined. A well-developed granoblastic texture and the presence of orthopyroxene indicate granulite-facies metamorphic conditions. The rock consists of 50% plagioclase and 50% mafic minerals, represented by 30% green hornblende, 15% orthopyroxene and 5% red biotite.

Migmatized Paragneiss Unit (Adug1)

Unit Adug1 is composed of a few paragneiss horizons large enough to be represented on our map, located in the northwest and south parts of the Du Gué Complex (Figure 3). Horizons of migmatized paragneiss assigned to this unit are similar in all aspects to those observed in the undivided portion of the complex, other than their larger size. The unit also includes a few horizons of iron formation and diatexite bands in more migmatized areas. Two thin sections of paragneiss were examined. These were taken in a small horizon belonging to unit Adug1 located near the western margin of the complex, outside of the orthopyroxene zone. These thin sections contain between 20 to30% elongate prisms of red biotite. Garnet was observed in both samples, and cordierite was identified in one of the two thin sections (Sharma, personal communication).

Red Biotite Trondhjemite Unit (Adug2)

An informal unit of red biotite trondhjemite was identified near the western margin of the Du Gué Complex (unit Adug2). This unit is characterized by a whitish, medium-grained trondhjemite, with a massive homogeneous aspect. This trondhjemite contains a much smaller number of enclaves of other lithologies in the complex than the trondhjemite assigned to the undivided portion of the complex. This trondhjemite contains 5% red biotite, and generally does not contain orthopyroxene, except near the eastern contact, where a few grains were observed. This observation confirms that the metamorphic grade increases eastward. The orthopyroxene isograd in fact roughly corresponds to the eastern limit of this unit.

Orthopyroxene-Bearing Porphyritic Rocks (Adug3)

A unit of orthopyroxene-bearing porphyritic rocks (Adug3) is located in the NE part of the Du Gué Complex (Figure 3). It consists of generally magnetic, porphyritic tonalitic to granitic rocks with a pronounced greenish colour. They are massive to very weakly foliated, except in the vicinity of fault zones where they become intensely foliated and deformed. They contain between 10 to 40% potash feldspar or plagioclase phenocrysts that vary between 1 and 3 cm in length, averaging about 1.5 cm. They contain 10 to 25% mafic minerals represented by variable proportions of red biotite and orthopyroxene. Orthopyroxene generally occurs as well-defined grains, and it is locally recrystallized into small polygonal grains. Porphyritic intrusions similar to those that characterize this unit were also observed in a few rare locations in the undivided portion of the complex.

Diatexite Unit (Adug4)

The diatexite unit is restricted to the NW part of the Du Gué Complex (Figure 3). Paragneiss horizons and enclaves are generally relatively abundant in the diatexites. The latter probably represent the final phase of migmatization of the paragneisses. The diatexites have a granodioritic to granitic composition, are often porphyritic, and display a heterogeneous grain size varying from fine-grained to pegmatitic. They are whitish grey to greenish grey and alter to a brownish grey to yellowish brown colour. Diatexites are generally well-foliated. The foliation is highlighted by the presence of biotite schlieren and stretched enclaves of migmatized paragneiss, which sometimes give the rock a more or less banded aspect. Cm-scale to m-scale paragneiss enclaves generally constitute less than 10% of the surface of outcrops, except for certain layers up to 10 m in size, which may comprise up to 60% of the outcrop. A sample of diatexite collected near the western contact of unit Adug4 was observed in thin section. It is a coarse-grained rock of granitic composition containing 5% large flakes of strongly chloritized dark brown biotite. The chloritization of biotite is probably due to an alteration phenomenon related to the fault that marks the western boundary of the unit (Figure 3).

Archean Late Intrusive Suites

Volcano-sedimentary and tonalitic units are cross-cut by several younger Archean lithological assemblages belonging to four suites. The Desbergères, Maurel and Tramont suites are composed of granodioritic to granitic rocks, whereas the Châteauguay Suite contains a few restricted mafic to ultramafic intrusions.

Desbergères Suite (new unit, Adeb)

The Desbergères Suite is a new unit essentially composed of homogeneous granodiorite. Zircon geochronology yielded a relatively young age of 2683+11/-8 Ma. As we mentioned previously, these granodiorites are similar in composition and texture to the granodioritic fraction observed in heterogeneous units of the Coursolles (Acou2a) and Favard (Afav1b) suites. It is therefore possible that Desbergères granodiorites may be related to the final phase of the migmatization process that has affected these two suites in certain areas.

Desbergères granodiorites occur as homogeneous intrusive bodies several kilometres in size. They are located in the western and northeastern part of the area (Figure 3). In the field, these rocks were often described as homogeneous tonalites given the relatively whitish colour of the potash feldspar component. Feldspar staining however indicates a generally granodioritic composition, confirmed by analytical results (Figure 5). The granodiorite is medium-grained, homogeneous, massive to weakly foliated, generally magnetic, and contains between 5 to25% mafic minerals, averaging about 15%. Potash feldspar phenocrysts between 1 to 2 cm in size are frequently observed. They are often concentrated in horizons of a few metres thick, or disseminated in the granodiorite. In the latter case, they represent 1 to 2% of the total rock. Enclaves between 1 to 50 cm long observed in this unit essentially consist of dark grey strongly magnetic diorite. They are most often stretched along the foliation direction, and occupy 1 to 2% of the total surface area of outcrops.

In thin section, the granodiorite consists of 20 to 30% quartz, 15 to 35% potash feldspar and 30 to 50% plagioclase. Quartz always displays a fairly pronounced undulatory extinction. Perthitic and myrmekitic textures are common and well-developed. The rock contains 10 to 15% hornblende and biotite on average, with biotite as the dominant phase. The biotite, frequently greenish, is partially to completely chloritized. Magnetite and sphene are always present, and are generally aassociated with biotite. Allanite, apatite and epidote are the most common accessory minerals.

Maurel Suite (Amau)

The Maurel Suite was described in 1998 (Gosselin and Simard, 2000a) in the Gayot area to the south. This unit is composed of granodioritic to granitic rocks characterized by a megaporphyritic texture and a strong magnetic susceptibility. Zircon dating performed on a sample from a pluton located in the NW part of the Gayot area yielded a preliminary age of about 2.68 Ga (Gosselin and Simard, 2000a). This result was reproduced on a sample collected during this summer in our area, which yielded an age of 2.685 Ga.

The Maurel Suite consists of intrusive bodies several kilometres in size, the most important being located in the south-central and west-central parts of the area (Figure 3). It also occurs as smaller injections and dykes within older units. This unit is mainly composed of granodioritic to granitic rocks. It contrasts with other intrusive units due to its porphyritic texture, outlined by the presence of potash feldspar phenocrysts between 1 to 3 cm long, but locally reaching up to 5 cm. The percentage of phenocrysts varies from 5 to 50%, but generally averages between 15 and 25%. The rock is medium to coarse-grained, and has a pinkish grey to dark pink colour. It most often displays a massive homogeneous texture, although a weak foliation is frequently visible, and is marked by a poorly-defined preferential orientation of phenocrysts, or by the alignment of mafic minerals. In fault zones however, the foliation becomes very intense.

Enclaves of strongly magnetic diorite are common in granodiorites of the Maurel Suite, however these generally form a low percentage of the total surface area of outcrops. These enclaves are more or less stretched, and they vary from a few centimetres to a few metres in size, but may occasionally reach up to a few tens of metres. The diorite is fine-grained and has a dark grey colour.

In thin section, megaporphyritic rocks of the Maurel Suite display a heterogeneous grain size, and grain boundaries are often dendritic. They are essentially composed of variable proportions of quartz, plagioclase and potash feldspar which produce either a granitic or granodioritic composition. Quartz crystals generally display a fairly pronounced undulatory extinction. Potash feldspar phenocrysts frequently exhibit very well-developed perthitic textures. Myrmekitic textures are also common. The rock contains between 5 to 25% biotite and green hornblende in variable proportions, but generally biotite is the dominant phase. It is either brownish or greenish, and is more or less replaced by chlorite. The rock always contains magnetite in xenomorphic grains associated with biotite, which explains the strongly magnetic natureof this unit. Idiomorphic to hypidiomorphic grains of sphene are also common. The rock also contains minor quantities of apatite, allanite and sometimes epidote.

Châteauguay Suite (new unit, Achg)

The Châteauguay Suite includes mafic to ultramafic dykes that reach up to a few hundred metres wide. These intrusions cross-cut lithological assemblages of the Coursolles and Favard suites, and are themselves injected by pegmatites and granites of the Tramont Suite. Unfortunately, no cross-cutting relationships were observed between these rocks and granodiorites of the Desbergères and Maurel suites.

The Châteauguay Suite is divided into two informal units: unit Achg1 is composed of mafic to ultramafic dykes, and unit Achg2 of pyroxene gabbro dykes. These units are not separated in Figure 3 of this report, but are however identified on the geological map of the area (Gosselin and Simard, 2000b).

Mafic to Ultramafic Dykes (Achg1)

This unit is represented by a few gabbro and/or ultramafic dykes oriented NNE-SSW to N-S located in the east-central, north-central parts and in the NW corner of the area (Figure 3; Gosselin and Simard, 2000b). These dykes vary from a few metres to a few hundred metres in thickness, and some dykes were traced for a few kilometres along strike. Based on field observations, ultramafic phases are early relative to gabbroic phases.

The gabbro is massive to foliated, medium to coarse-grained, dark grey to greenish grey in fresh surface with a brownish grey tinge in weathered surface. The magnetic susceptibility of the rock varies from one intrusive body to the next, and also within the same intrusion. The gabbro is mainly composed of green hornblende forming large xenomorphic grains as well as plagioclase grains of similar size and percentage. Plagioclase grains are strongly altered to sericite. Accessory minerals include chloritized biotite, epidote, magnetite and sphene.

Ultramafic rocks are dark grey to black in fresh surface with a greenish grey to brownish grey weathered crust. They are medium-grained and strongly magnetic. Tonalitic enclaves up to a few metres in size were observed in these rocks, as well as several sulphide-rich rusty zones between 0.3 to 2.0 m wide. The ultramafic rocks vary from a pyroxenitic to peridotitic composition. In thin section, pyroxenites contain about 75% clinopyroxene grains, often twinned, and partially to strongly altered to green hornblende. They also contain xenomorphic grains of biotite and green hornblende distributed between the other mafic minerals. Plagioclase forms patches which are in optical continuity, filling interstices between the other rock constituents. Magnetite and orthopyroxene are also present in minor proportions. Peridotites are composed of equal proportions of entirely serpentinized olivine relics and large grains of green hornblende which may be derived from the alteration of clinopyroxene. They also contain nearly 10% magnetite as small disseminated grains or infilling fractures in olivine grains. A few orthopyroxene relics were also observed.

Pyroxene Gabbros (Achg2)

This unit includes four gabbro dykes oriented NW-SE, a few hundred metres thick, located in the SW part of the area (Figure 3; Gosselin and Simard, 2000b). These gabbros have a dark greenish grey colour in fresh surface and take on a brownish tinge in weathered surfaces. They are massive, medium-grained and possess a strong magnetic susceptibility. They consist of 25 to 40% clinopyroxene grains slightly altered to green hornblende, 10 to 20% dark brown biotite flakes and 40 to 50% plagioclase grains. The rock displays a well-crystallized texture, with weakly altered idiomorphic to hypidiomorphic grains. This contrasts with the gabbro in unit Achg1, which exhibits a texture comprising strongly altered xenomorphic grains. The pyroxene gabbro also contains a little over 1% fine-grained disseminated magnetite. Orthopyroxene, epidote and allanite are also present in minor quantities.

Tramont Suite (Atra)

The Tramont granitic Suite was originally described in the Gayot area (Gosselin and Simard, 2000a). It corresponds to the youngest Archean suite identified in the Gayot and Maricourt areas. These granites do not contain zircons, which makes it difficult to date them. Nevertheless, the presence of diatexite enclaves belonging to the Opiscotéo Suite, within Tramont granites in the Gayot area, makes it possible to estimate an age of less than 2637±8 Ma, i.e. the

GRANITOID ROCKS

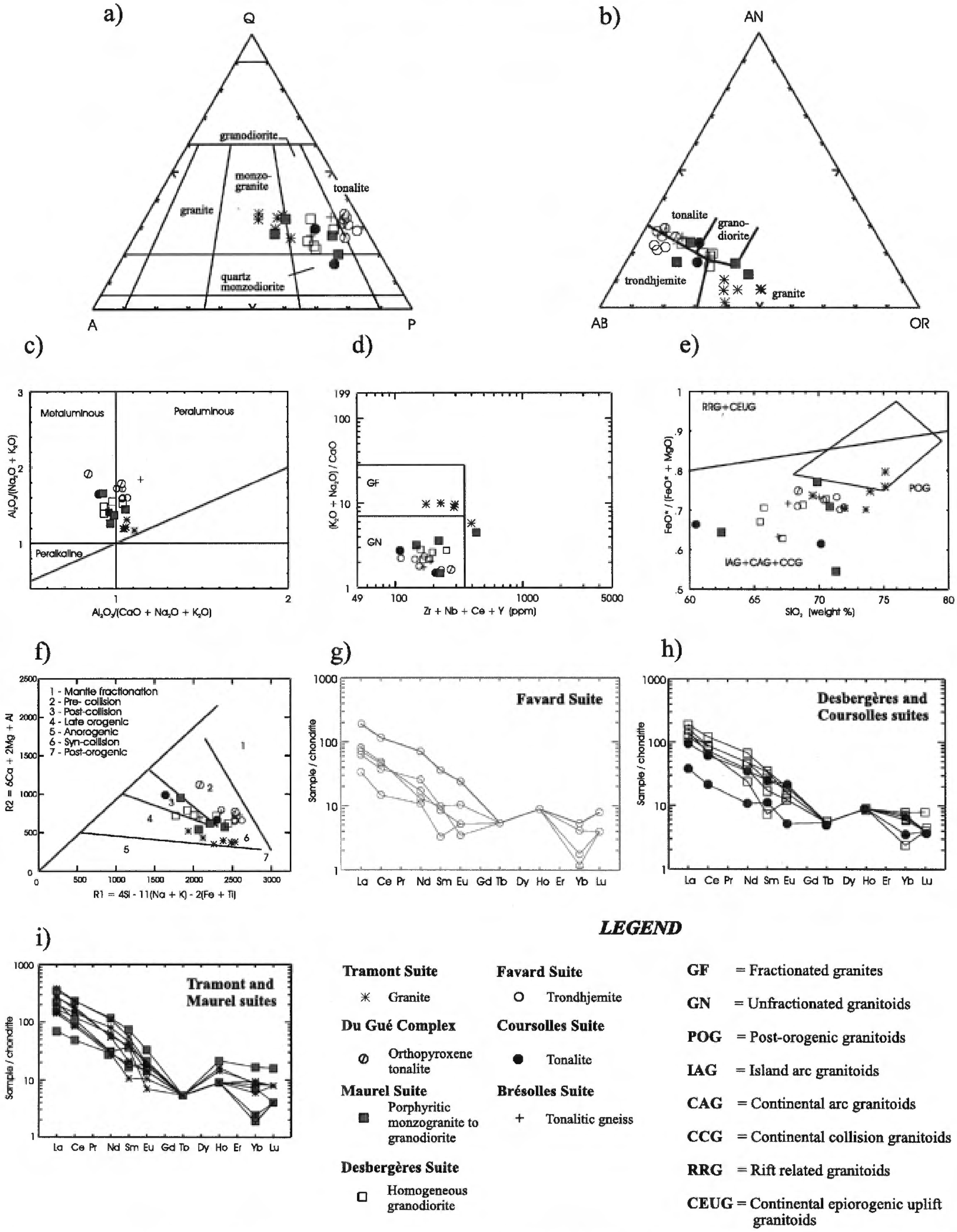


FIGURE 5 – Principal felsic intrusive suites plotted in diagrams by : **a)** Le Maître (1989), **b)** Baker (1979), **c)** Maniar and Piccoli (1989), **d)** Whalen *et al.* (1987), **e)** Maniar and Piccoli (1989), **f)** Bachelor and Bowden (1985), **g)**, **h)** and **i)** chondrite-normalized rare earth diagrams (normative values from Sun and McDonough, 1989).

age of the diatexites, for these rocks (Gosselin and Simard, 2000a).

The Tramont Suite is formed of bodies several kilometres in size, the most important being concentrated in the southeastern part of the area (Figure 3). They also occur as dykes and multiple injections between 1 and 10 m thick, cross-cutting other Archean units throughout the area. Near the boundary of plutonic bodies, this injection phenomenon becomes so important that it isolates numerous enclaves of country rock, and the rock appears more and more like an intrusive megabreccia.

Based on geochemical analyses, rocks of the Tramont Suite have a very homogeneous composition falling in the monzogranite field (Figure 5a). The rock is pale pink, homogeneous, massive to very weakly foliated, except in deformation zones where a nearly gneissic texture may develop. The grain size is generally medium to coarse-grained within large intrusive bodies, and finer-grained in dykes and injections. Pegmatitic dykes are frequently observed, and these appear to correspond to a late phase of the suite. The granite sometimes contains 1 to 3% cm-scale to m-scale enclaves of the surrounding lithologies, mainly diorites, tonalites and paragneisses. The percentage and size of enclaves increases near the margins of the intrusions.

Tramont granites are characterized by a low percentage of mafic minerals, between 1 to 5% and often less than 1%. These mainly consist of brown or green fine-grained biotite flakes, partially to completely chloritized. Small magnetite grains are often associated with the mafic minerals. The magnetic susceptibility, generally fairly weak, seems to vary based on the percentage of mafic minerals. The rock contains equal proportions of quartz, potash feldspar and plagioclase. Potash feldspar crystals are frequently perthitic. Plagioclase has undergone more or less intense sericitization, which increases along with the chloritization of biotite. Muscovite, epidote, allanite and sphene are frequently observed as accessory minerals in these rocks.

Proterozoic Units

Sakami Formation (pPsa)

The Sakami Formation defined by Eade (1966) groups several outliers of Paleoproterozoic sedimentary rocks dated at about 2.0 Ga (Séguin *et al.*, 1981). This formation was the focus of numerous exploration programs targeting uranium deposits during the 1970s. This work led to the discovery of a uraniferous deposit of 50 million metric tonnes at 0.10% U_3O_8 (Marcoux, 1980) immediately south of our area.

In the Maricourt area, the Sakami Formation was observed in only two outcrops: the first is located in the SE corner of the map, and the second is located about 10 km west of Lac Châteauguay (Figure 3). In the SE corner, the Sakami forms a very restricted outlier, the Lac Pons outlier (Figure 2), which for the most part lies outside of the map area. This outlier was investigated for its uranium potential in the late 1970s by the company Uranerz (Orr, 1978; 1979). Orr (1978) mentioned that the sedimentary sequence in the Lac Pons outlier was similar to that observed in other outliers of the Sakami Formation in the region. It consists of a basal conglomerate, overlain by a sequence of feldspathic sandstone then by a unit of quartzose sandstone. The outcrop observed in our area falls in the quartzose sandstone unit.

The presence of the Sakami Formation to the west of Lac Châteauguay was discovered during our field survey, and it appears to cover a very restricted surface area of a few square kilometres at best. In this location, the contact between Proterozoic rocks and Archean rocks is well exposed. The Sakami Formation consists of thick beds of whitish medium-grained massive feldspathic sandstone, in contact with a strongly foliated and deformed Archean quartzose sandstone belonging to the Garault Complex. At the contact itself lies a thin bed of Sakami conglomerate. This conglomerate contains very well-preserved angular fragments of the strongly foliated Archean quartzose sandstone, floating in an arkosic matrix. The fragments vary from a few centimetres to more than 50 cm long. The presence of these fragments may indicate that active faults were present along the basin margins during sedimentation, in this area at least.

Lamprophyre Dykes

Proterozoic lamprophyre dykes were observed in six outcrops in the NE part of the area. These lamprophyres are nearly all located within the Utsalik Domain (Percival *et al.*, 1991; Figure 2). They are restricted in size, and do not constitute a mappable lithological unit. Nevertheless, outcrops where these lamprophyres were observed were identified with a code (I3O) on the geological map (Gosselin and Simard, 2000b) considering their importance for diamond exploration.

Lamprophyre dykes are oriented NW-SE to N-S. They often occur as a network of small parallel injections, more or less continuous, from 1 to 60 cm thick. The lamprophyres are magnetic, very fine-grained, dark grey in fresh surface with a characteristic orange brown weathered crust. A few of these dykes display a brecciated texture. In thin section, the lamprophyres have a finely crystalline carbonate groundmass, with a few idiomorphic olivine relics, completely replaced by carbonates. Relics of small acicular crystals, possibly pyroxenes, sometimes form a trachytic texture. These dykes always contain between 10 to 15% fine-grained disseminated magnetite. A few samples also contain phlogopite.

Diabase Dykes

Diabase dykes were observed in over one hundred outcrops throughout the area. They vary from less than a metre to over 50 m thick. They are generally laterally restricted, and only a few could be traced on the map. These dykes often have a strong magnetic susceptibility, but are rarely visible on regional aeromagnetic maps due to their restricted size. In the northern part of the Gayot area, a diabase dyke cross-cutting sedimentary rocks of the Sakami Formation was dated at 1598 ± 92 Ma using the K-Ar method (Meusy, 1982), i.e. the boundary between the Paleo and Mesoproterozoic.

The diabase dykes observed throughout the area have widely variable orientations, from NE-SW to NW-SE. N-S orientations are common in the eastern half of the area, whereas E-W, ESE-WNW and WSW-ENE orientations are widespread in the western half, and especially in the southwest quadrant. These orientations were also observed in the Nedlouc area by Parent *et al.* (2000). These authors mention that the diabases may belong to three different dyke swarms based on paleomagnetic and geochronological studies performed in the Rivière-aux-Feuilles area (Buchan *et al.*, 1998). Dykes oriented E-W, ESE-WNW and WSW-ENE are similar to the Maguire dykes (2230 Ma), NW-SE dykes may be related to Minto dykes (1998±2 Ma), and finally, NE-SW and N-S dykes may belong to the Ptarmigan dyke swarm (2505±2 Ma).

Diabases have a massive aspect and do not appear to have undergone any type of deformation. They are dark grey to greenish grey with a dark brown weathered crust. They are fine to medium-grained. In thin section, they display an ophitic to subophitic texture, and consist of elongate plagioclase grains, interstitial clinopyroxene and magnetite. They also contain a few partially serpentinized olivine grains, generally surrounded by opaque minerals.

LITHOGEOCHEMISTRY

Major elements, trace elements and rare earth elements were analyzed in 78 rock samples of specific lithologies characterizing the principal lithostratigraphic units in the area. Analytical results are plotted in diagrams shown in figures 5 and 6. They will be briefly discussed in three broad groups, namely: 1- granitoids, 2- volcanic rocks, and 3- intermediate to mafic intrusions.

Granitoids

Granitoids in the area belong to different intrusive and metamorphic suites that were described above (see section entitled "LITHOSTRATIGRAPHY"). Results of lithogeochemical analyses performed on these igneous rocks are plotted in diagrams shown in Figure 5. These diagrams are essentially shown to allow the reader to examine geochemical differences and particular features of the various suites. The interpretation of these results warrants a more detailed study to be performed at a later date.

Mesonormative diagrams by Le Maître (1989) and Barker (1979) (Figures 5a and 5b) help to specify or confirm the nature of rocks identified in the field. In these diagrams, Favard trondhjemites, Brésolles gneisses and orthopyroxene tonalites from the Du Gué Complex form a well-defined group with relatively homogeneous compositions. Samples from the Tramont Suite also form a homogeneous group clearly located in the granite field. Tonalitic and granitic rocks also stand out on the other geochemical diagrams shown in Figures 5c, 5d, 5f, 5g and 5i. The other suites in the area display much more heterogeneous compositions varying from tonalitic to granodioritic (Figures 5a and 5b), although each suite is characterized by a dominant lithology. This heterogeneous nature is also reflected in the other diagrams, resulting in an important scatter of analytical results for each unit.

Volcanic Rocks

From a geochemical standpoint, lavas from the Gayot Complex in the Maricourt area are similar to those described further south, in the Gayot area (Gosselin and Simard, 2000a). These consist of tholeiitic basalts (Figures 6a, 6b and 6d) with a distinctive Zr vs Y ratio of about 2.9, and a typically flat rare earth pattern (Figure 6e). Only one lava sample showed a transitional affinity, with a Zr vs Y ratio of about 6. This sample was taken in a small belt segment located in the NW part of the area, in association with other tholeiitic lavas. However, calc-alkaline lavas had also been identified in the Gayot area, in a few rare locations within the Gayot Complex (Gosselin and Simard, 2000a). A few samples fall in the iron tholeiite field (Figure 6a). These rocks are fairly differentiated, with yttrium concentrations in excess of 30 ppm (Figure 6b). The geotectonic environment discrimination diagram (Figure 6c) indicates an ocean floor setting, or a tholeiitic island arc basalt environment for tholeiitic basalts of the Gayot Complex.

The Gayot Complex also contains ultramafic sills and even flows (Gosselin and Simard, 2000a). Analytical results from a sample taken in a peridotite sill in the Moyer belt indicate that the latter is genetically related to the volcanic sequence. Data plotted on Zr vs Y and Ti vs Zr diagrams (Figures 6b and 6c) coincide with the fractional crystallization line defined by tholeiitic basalt data. Furthermore, the rare earth pattern of this sample (Figure 6g) is comparable to patterns obtained for the ultramafic rocks of the Gayot area.

The Garault Complex contains among other rocks intermediate to mafic lavas (Figure 6d) and dioritic intrusions. These rocks all display a calc-alkaline affinity (Figures 6b and 6c), which suggests that the diorites are synvolcanic. On the Jensen diagram (1976; Figure 6a), one lava sample falls in the tholeiitic field, due to an alteration phenomenon particularly affecting major elements. Another sample falls in the basaltic komatiite field. This sample has an MgO

Volcanic rocks and other units

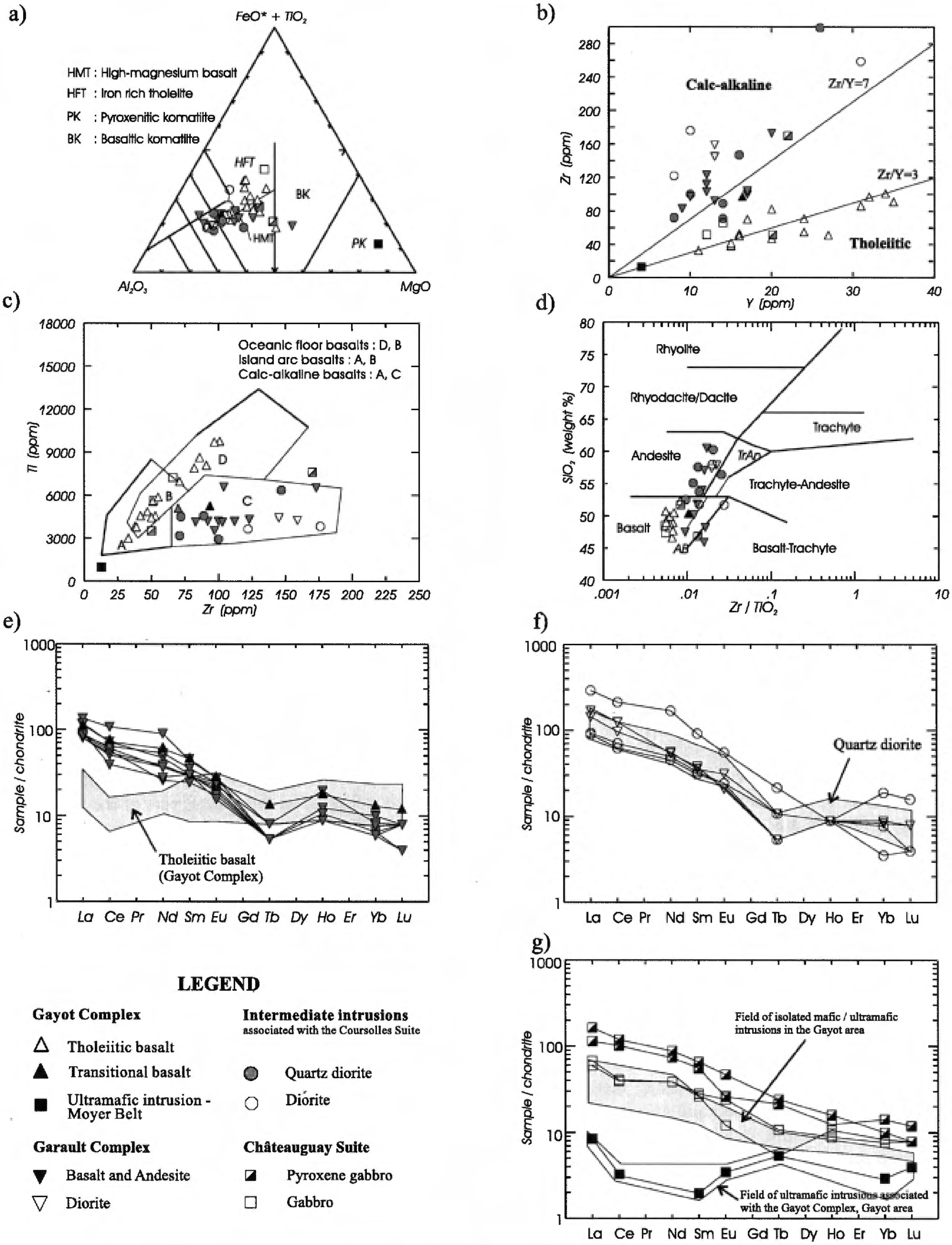


FIGURE 6 – Composition of volcanic rocks and intermediate to ultramafic intrusions associated with various units, plotted in diagrams by : **a)** Jensen (1976), **b)** Zr vs Y, **c)** Pearce and Cann (1973), **d)** Winchester and Floyd (1977), **e), f)** and **g)** chondrite-normalized rare earth diagrams (normative values from Sun and McDonough, 1989).

content of 12.6%. It was taken in a mafic, amphibolitized layer more than 80 metres thick, associated with diorites and paragneisses in the southern part of the Angilbert North belt.

Intermediate and Mafic Intrusions

Field observations prompt us to consider diorites and quartz diorites of the Coursolles Suite as members of an intrusive phase that preceded the emplacement of tonalites. These intermediate intrusive rocks (Figure 6d) have a calc-alkaline affinity (Figures 6a, 6b, 6c) and are enriched in light rare earths (Figure 6f). The composition of these rocks is comparable, in many respects, to that of calc-alkaline volcanic rocks of the Garault Complex.

Gabbros from the Châteauguay mafic-ultramafic Suite were also analyzed. The results indicate that these intrusions have a tholeiitic affinity (Figures 6a, 6b and 6c) except for one particularly altered and deformed sample of pyroxene gabbro that falls in the calc-alkaline field (Figures 6b and 6c). Despite their tholeiitic affinity, these gabbros contrast with the mafic rocks of the Gayot Complex given their clearly enriched light rare earth concentrations (Figure 6g). Small mafic-ultramafic intrusions with similar geochemical features had also been identified in the Gayot area (Gosselin and Simard, 2000a). The latter are probably equivalents of the Châteauguay Suite.

GEOCHRONOLOGY

A geochronological study was undertaken, and analyses were performed at the GÉOTOP laboratories of the Université du Québec à Montréal. A section of this study focuses on 7 samples (A to G, Figure 3) taken from the different lithostratigraphic units in the area. Results of U-Pb isotopic analyses (isotopic dilution and thermal ionization mass spectrometry: *TIMS*) and of ^{207}Pb and ^{206}Pb isotopic analyses (in situ analysis by laser ablation and inductively coupled plasma mass spectrometry: *LA-ICP-MS*) help define emplacement and metamorphic ages, as well as inherited ages. These results will also be discussed in a more detailed report dealing with the geochronological study. The latter will discuss analytical methods and their respective precision, statistical processing methods used and results obtained for all geochronological samples collected under the Far North Project during the 1999 summer mapping program.

Tonalitic Gneiss – Brésolles Suite

One sample was collected in the SE part of the area, within an important tonalitic gneiss unit assigned to the Brésolles Suite (site A, Figure 3). This sample corresponds to a leucotonalite or a trondhjemite, forming m-scale homogeneous conformable horizons intercalated within a banded gneiss sequence. It must be indicated that the gneisso-tonalitic Brésolles Suite was initially proposed in the Gayot area, where zircon dating performed on a dioritic horizon associated with the gneisses had yielded an age of 2803±8 Ma (Gosselin and Simard, 2000a).

Zircons recovered from the sample taken in the Maricourt area form a population of euhedral to subhedral crystals consisting of stubby prisms (proportions of 1:1:4), with moderately dulled edges. It was not possible to establish with any certainty the presence of cores or overgrowths. Statistical processing of $^{207}Pb/^{206}Pb$ analytical results from 24 grains produced a principal mode corresponding to an age of 2742±6 Ma, and a second, less clearly defined mode representing an approximate age of 2.790 – 2.800 Ga. Preliminary U-Pb analyses, performed on individual prisms with identical morphological characteristics yielded minimum ages of 2.739 and 2.762 Ga. Despite the fact that these U-Pb results are discordant, they are distributed along a regression line whose upper intercept corresponds to an age of 2754+11/-9 Ma. The latter age is interpreted as the age of emplacement for trondhjemite injections within the gneisses, an age that is equivalent, within error margins, to the $^{207}Pb/^{206}Pb$ age, over which it takes precedence. Finally, the 2.79-2.80 Ga age represented by the second mode of Pb/Pb analyses corresponds to zircons inherited from the gneisses representing the northern extension of the Brésolles Suite.

Trondhjemite – Favard Suite

A sample of trondhjemite characteristic of the Favard Suite was collected in the central part of the area (site B, Figure 3). The purpose of this analysis was to establish the relative timing of trondhjemites in the Gayot area, dated at 2.730 Ga, compared to those in the Maricourt area. Recovered zircons are prismatic, stubby and uncoloured; some have square sections, while a second population is characterized by euhedral to subhedral prisms with an hexagonal section. Statistical processing of results from 24 analyzed crystals yielded a principal mode representing an age of 2.724 Ga. Two other modes were also identified; these represent ages of 2.844 Ga and 2.652 Ga. In this sample, it was not possible to establish a direct correlation between a morphological type and a particular age. U-Pb analyses performed on square-sectioned prisms yielded identical, weakly discordant (<0.9%) results which correspond to an age of 2749±4 Ma. This age is interpreted as the emplacement age for the trondhjemite, and is comparable to that obtained for the same lithology in the Gayot area (2.730 Ga). Furthermore, this age also corresponds to the age of 2754+11/-9 Ma associated with the late phase of trondhjemite injections within gneisses of the Brésolles Suite.

Tonalite – Coursolles Suite

One sample of hornblende tonalite assigned to the Coursolles Suite (site C, Figure 3) was analyzed. Recovered zircons class into two morphologically distinct populations, one of rectangular stubby uncoloured prisms, and another of square elongate brownish prisms. Analytical results obtained from a selection of crystals of each population yielded three statistically distinct modes, two of which may confidently be related to one population or another. A principal mode with an age of 2.723 Ga is associated with the stubby prisms, whereas a second mode associated with elongate prisms represents an age of 2.760 Ga. The third mode, which reflects an age of 2.616 Ga, could not be related to a particular population. Results of U-Pb analyses obtained from stubby prismatic crystals are associated with an age of 2718+11/-8 Ma (upper intercept), which corresponds to the age of crystallization of the tonalite. The age of 2.760 Ga obtained from $^{207}Pb/^{206}Pb$ analyses of elongate prisms, most likely represents a crystallization age disturbed by a loss of lead. The youngest age is similar to other dates already obtained on zircons and titanites, and which are associated with a late hydrothermal event (Parent *et al.*, 2000).

For the moment, the age of 2718+11/-8 Ma poses a problem with regards to the general interpretation that Coursolles tonalites are older than Favard trondhjemites (2749±4 Ma). It is however possible that the sampled tonalite belongs to a younger tonalitic phase that was not identified.

Granodiorite – Desbergères Suite

One sample of coarse-grained, homogeneous, massive to weakly foliated granodiorite was collected in the central part of the area (site D, Figure 3). The sample contains alternating bands of different composition (hornblende vs clinopyroxene). Zircons form a single population of euhedral, stubby uncoloured crystals possessing a rectangular section with truncated edges. $^{207}Pb/^{206}Pb$ analyses produce a single statistically significant mode representing an age of 2.683 Ga, interpreted as the age of crystallization for the granodiorite. Four fragments of xenocrysts yielded an age with a poor precision at ca. 2.810 Ga. U-Pb analyses performed on five unique crystals that did not present any morphological differences yielded different results. The first three analyses are distributed along a single line with an upper intercept at 2683+4/-2 Ma. This is interpreted as the age of the zircons, and is related to the crystallization of the granodiorite. It is identical to results from reconnaissance $^{207}Pb/^{206}Pb$ analyses. The other two analyses yielded concordant results, namely an age of 2715±2 Ma and an age of 2656+2 Ma. These respectively correspond to an inherited zircon, and to an age associated with a metamorphic episode. U-Pb analyses currently underway, performed on titanite fractions from the same sample, appear to corroborate the latter interpretation.

Porphyritic Granite – Maurel Suite

A granite with potash feldspar phenocrysts assigned to the Maurel Suite (2.680 Ga) was sampled (site E, Figure 3) in order to corroborate its affinity with lithologies of this suite dated in the Lac Gayot area, at 2.680 Ga (Gosselin and Simard, 2000a). Zircons form a single population of very dark brown prisms that are both large and elongate. They are characterized by a well-developed internal zonation produced during magmatic crystallization. Moreover, two types of older zircon inclusions are observed, namely pale brown cores filled with inclusions present in several prisms, and less common, small uncoloured clear zircon cores. Statistical processing of $^{207}Pb/^{206}Pb$ analyses has outlined three distinct modes that represent ages of 2.685 Ga, 2.724 Ga and 2.860 Ga. The first age is interpreted as the age of crystallization of the granodiorite; it corresponds to dark brown magmatic zircons. The other two ages are respectively associated with the two types of cores representing the principal host rock lithologies. U-Pb analyses performed on prism terminations yielded identical ages of 2.690 Ga. Despite the fact that these results are about 1% discordant, they still confirm the validity of the $^{207}Pb/^{206}Pb$ age of 2.685 Ga, recognized as a good estimate for the age of emplacement. This age will be more accurately defined with the addition of two new U-Pb analyses.

Sericite Schist – Garault Complex

One sample was collected within a thick sequence of sericite schists belonging to the Garault Complex and associated with the Angilbert North belt (site F, Figure 3). The association of these schists with the volcano-sedimentary sequence suggests that they may represent a felsic tuff assemblage or a sedimentary sequence. We must mention however that the exact origin of this lithology remains uncertain. Regardless of these questions, zircons recovered from this sample belong to several morphological populations: stubby dark brown prisms, equidimensional uncoloured prisms as well as uncoloured xenocrysts. However, no zircon grains displayed a truly clastic aspect, namely a frosty, subrounded xenomorphic grain. The frosty texture at the surface of rounded grains is the result of mechanical abrasion during transport in a turbulent suspension, or in saltation in a fluviatile environment. Consequently, one could submit the hypothesis that the schist has a pyroclastic origin.

Statistical processing of $^{207}Pb/^{206}Pb$ analytical results from 24 grains outlined a principal mode corresponding to an age of 2.786 Ga. A few grains, probably mixed, helped outline a second mode at 2.827 Ga, whereas the uncoloured xenocrysts are represented by a mode associated with an age of 3.170 Ga. The age of emplacement, if the schist indeed represents a pyroclastic rock, is interpreted as being 2.786 Ga. This age is similar to those obtained for felsic volcanic rocks in the Dupire and Vizien supracrustal sequences in the Lac Nedlouc area, directly to the northwest of our map area (Table 1; Parent *et al.*, 2000).

Orthopyroxene Tonalite – Du Gué Complex

A sample of enderbite or orthopyroxene leucotonalite was collected in the NW part of the area, within the Du Gué Complex (site G, Figure 3). As we mentioned previously, the igneous or metamorphic origin of these rocks could not be determined in the field. The sample is homogeneous and has undergone important penetrative deformation. Zircons are for the most part mixed and composed of prisms which exhibit several overgrowths. Only $^{207}Pb/^{206}Pb$ analytical results are currently available for these zircons. The results yielded, after statistical processing, three significant modes, namely a principal mode representing an age of 2.803 Ga, a secondary mode associated with an age of 2.729 Ga and finally a younger age at 2.675 Ga. The first age, the oldest and most abundant, is interpreted as being related to a remobilized lithology and possibly related to tonalitic gneiss horizons observed within the Du Gué Complex. The second age is comparable to the period corresponding to the age of emplacement of the Favard Suite, dated in the Lac Gayot area at 2.73 Ga and in the present map area at 2749±4 Ma. This result corroborates the interpretation that a major portion of the Du Gué Complex may in fact represent a metamorphosed equivalent of unit Afav1a of the Favard Suite. In fact, a number of igneous charnockitic units yielded ages of 2.700-2.710 Ga. As for the youngest age of 2.675 Ga, it is contemporaneous with a metamorphic episode already recognized in adjacent areas. Field observations support the idea that the Du Gué granulitic Complex, which is crosscut by the Maurel Suite, is therefore older than 2.683 Ga.

REGIONAL STRATIGRAPHIC CORRELATIONS

This chapter is devoted to the regional stratigraphic correlations that may be established between the principal units observed in our area and those defined in the Nedlouc (Parent *et al.*, 2000) and Gayot (Gosselin and Simard, 2000a; Figure 1) areas. This is a preliminary effort to interpret and synthesize the results of these surveys. Correlations were proposed based mainly on the descriptions of the various units (Table 2), also taking into account available chronological data (Table 1). Units are grouped into six assemblages, namely: 1- volcanic and sedimentary assemblages, 2- tonalitic units, 3- granodioritic units, 4- granulitic units, 5- late granitic units and 6- late mafic to ultramafic units.

Volcanic and Sedimentary Assemblages

The principal volcano-sedimentary assemblages in the Gayot, Maricourt and Nedlouc areas were divided into complexes, namely the Gayot, Garault, Dupire and Duvert complexes (Tables 1 and 2). These complexes are distributed throughout the territory within belts of variable dimensions, most frequently isolated from one another. Furthermore, the volcano-sedimentary sequences that make up the belts are subject to important lateral and sequential variations that cannot be defined in a satisfactory manner during mapping at a scale of 1:250,000. Links which could be established between the various mapped belts and their relation to one or the other of the volcano-sedimentary complexes are therefore mainly based on very broad considerations.

The Gayot, Dupire and Duvert complexes are comparable in many respects (Table 2). They are mainly composed of tholeiitic basalts, with a minor proportion of metasedimentary rocks, iron formation, and intrusive and sometimes effusive ultramafic rocks. However, the Duvert Complex contains an important unit of calc-alkaline andesite (Parent *et al.*, 2000). Such a unit was not recognized in the Dupire Complex (Lamothe, 1997) or in the Gayot Complex, where andesites are fairly rare (Gosselin and Simard, 2000a). In the Maricourt area, calc-alkaline lavas are restricted to the Garault Complex, which is composed for the most part of metasedimentary rocks. Correlations between these different assemblages therefore appear difficult to establish. Furthermore, available chronological data (Table 1) do not allow us to clearly differentiate the complexes. However, we must take into account that these results correspond to isolated samples collected within relatively poorly known volcanic sequences that display important variations. Regardless of these considerations, the ages obtained until now suggest that the Gayot Complex is the oldest with an age of 2.86 Ga (Table 1). The Garault and Dupire complexes have similar ages, of 2.786 Ga and 2787±4 Ma respectively. Finally, a sample from the Duvert Complex yielded the youngest age at 2713±6 Ma.

Tonalitic Units

Possible correlations between the tonalitic Brésolles, Coursolles, Favard, Sullupaugalik, Rivière-aux-Feuilles and Charnière suites are shown in Table 2. Strictly on a descriptive basis, hornblende tonalites of the Coursolles Suite are comparable to those of the Rivière-aux-Feuilles Suite, and migmatized tonalites of the Sullupaugalik Suite appear similar to the migmatized sub-unit of the Coursolles Suite. Also, trondhjemites of the Favard Suite appear to be equivalent to those observed in the Charnière Suite. However, these correlations are not always corroborated by chronological data (Table 1). For example, the relative timing of tonalites of the Rivière-aux-Feuilles Suite dated at 2.70 – 2.71 Ga (Parent *et al.*, 2000) and those of the Coursolles Suite, where cross-cutting relationships suggest an age older than the Favard Suite (> 2.74 Ga) makes it difficult, for the moment, to establish a link between these units. The correlation between the Coursolles and Sullupaugalik suites is also uncertain given the age of 2805+9/-4 Ma obtained for the Sullupaugalik Suite in the Aigneau area (Table 1; Berclaz *et al.*, 2000).

Overall, tonalitic units may be divided into three distinct phases. The first "early" phase corresponds to the gneisso-tonalitic Brésolles Suite mapped over a distance of more than 300 kilometres from the Lac Hurault area (Thériault and Chevé, 2000) immediately south of Gayot, to the northern margin of Maricourt. This suite, dated at 2803±8 Ma, was not observed further north. However, tonalites with comparable ages (between 2.78 and 2.80 Ga) were identified by Skulski *et al.* (1996) and by Jean David in the La Potherie area (Rochefort Suite, Leclair *et al.*, 2000b) and Aigneau area (Sullupaugalik Suite, Berclaz *et al.*, 2000; Table 1).

A second tonalitic phase seems to have occurred at about 2.73-2.75 Ga. This phase is interpreted from four ages derived from leucotonalite samples. Two of these were collected within the Favard Suite (2.73 Ga and 2749±4 Ma), another comes from the Charnière Suite in the Nedlouc area (2.74 Ga, Parent *et al.*, 2000) and the last corresponds to trondhjemitic injections (2754+11/-9 Ma) within gneisses of the Brésolles Suite, in the Maricourt area (Table 1). As we mentioned previously, observed cross-cutting relationships suggest that Coursolles tonalites are older than Favard trondhjemites. Finally, the youngest tonalitic phase corresponds to tonalites of the Rivière-aux-Feuilles Suite, dated at 2.70-2.71 Ga. In the Maricourt area, a hornblende tonalite dated at 2718+11/-8 Ma, temporarily assigned to the Coursolles Suite may also be considered in this phase.

Granulitic Units

The Du Gué granulitic Complex is a unit specific to the Maricourt area. It consists of various lithologies metamorphosed to the granulite facies. Some of these lithologies appear to represent more metamorphosed equivalents of units observed elsewhere in the area. For example, the undivided unit of this complex (Adug; Figure 3) contains roughly the same lithological assemblages as sub-unit Afav1a of the Favard Suite. The sub-unit of red biotite trondhjemite (Adug2) seems equivalent to sub-unit Afav1, and finally orthopyroxene paragneisses (Adug1) are interpreted as lateral equivalents to those of the Garault Complex, or to paragneisses mapped further north in the Minto Domain (Table 2; Parent *et al.*, 2000). Zircon dating performed on a greenish orthopyroxene tonalite yielded an age of 2.729 Ga, which corroborates its probable correlation with trondhjemites of the Favard Suite. In the Nedlouc area however, granulitic rocks belonging to the Lippens and McMahon suites are considered as charnockitic intrusions, and an age of 2.70-2.71 Ga was obtained on a sample of enderbite (Tables 1 and 2; Parent *et al.*, 2000). Such intrusions could be present in the Du Gué Complex. However, they could not be identified in the field. Finally, the Du Gué Complex appears to be comparable to the Troie and Qimussinguat complexes described by Madore *et al.* (1999) in the Peters area, located about 200 km north of Maricourt. An age of 2740 Ma was obtained from a tonalitic gneiss at the granulite facies belonging to the Troie Complex.

The Du Gué Complex also contains orthopyroxene-free diatexites (sub-unit Adug4) which are fairly similar to those of the Rivière-aux-Mélèzes Suite mapped in the Nedlouc area (Tables 1 and 2), and which were dated at 2.67 Ga (Parent *et al.*, 2000). However, diatexites of the Du Gué Complex were observed as enclaves in intrusions of the Maurel Suite, dated at 2.685 Ga. This suggests that these diatexites are therefore older than those of the Rivière-aux-Mélèzes Suite.

Granodioritic Units

The principal granodioritic suites are: the Desbergères and La Bazinière suites in the Gayot and Maricourt areas, and the Monchy and Rivière-aux-Feuilles suites in the Nedlouc area (Table 2). The age of 2683+4/-2 Ma (site D, Figure 3) obtained for the Desbergères Suite, indicates that there is no possible correlation between the latter and the Rivière-aux-Feuilles Suite (2724 Ma, Percival *et al.*, 1992; Parent *et al.*, 2000); it rather appears to be associated with the same intrusive period as the Maurel Suite (see below). Furthermore, we cannot establish for the moment any correlation between the Desbergères Suite and other granodioritic suites. As for the La Bazinière Suite, this unit was defined with a certain amount of caution, to group a few scattered outcrops located in the far NW corner of the Gayot area (Gosselin and Simard, 2000a). This unit does not appear to extend into the SW part of the Maricourt area. The few rare outcrops that were observed in this sector mainly correspond to migmatized tonalites that were included in the Coursolles Suite.

Late Granitic Units

Important intrusions belonging to the Maurel Suite are present in the Gayot and Maricourt areas. These granitic to granodioritic rocks display a characteristic megaporphyritic texture. Zircon dating performed on samples from these two areas yielded similar ages of 2.68 Ga (Table 2). Megaporphyritic granites were also identified in the northern part of the Nedlouc area (La Chevrotière Suite, Parent *et al.*, 2000) as well as in the La Potherie area located to its north. Zircon dating performed on a sample from an intrusion in the La Potherie area yielded an age of 2735 Ma (Leclair *et al.*, 2000b; Table 1). This age difference when compared to the Maurel porphyritic suite indicates that these represent two distinct generations, despite their lithological and textural similarities.

The Tramont Suite is also a distinct unit of biotite leucogranite that cuts across all other Archean units observed in the Gayot and Maricourt areas. This unit could not be dated given the absence of zircons in the rock. Based on field observations, granites of the Tramont Suite intrude porphyritic rocks of the Maurel Suite, and are therefore younger than 2.68 Ga. In this context, the relationship between the granitic Morrice Suite dated at 2682±4 Ma (Table 1), and the granitic Tramont Suite remains uncertain. However, Tramont granites could be the same age or younger than those of the Morrice Suite.

Late Mafic to Ultramafic Units

Late mafic and ultramafic intrusions of the Châteauguay Suite display the same lithological and geochemical features as those observed in certain isolated intrusions encountered in the Gayot area (Figure 6; Gosselin and Simard, 2000a). In the Nedlouc area, late mafic intrusions are also described and are assigned to the Bacqueville Suite (Table 2; Parent *et al.*, 2000).

METAMORPHISM

Based on observed mineral assemblages, most of the rocks in the area have undergone prograde metamorphism at the middle amphibolite facies, with the exception of rocks in the Du Gué Complex, which contains granulite-facies assemblages. Evidence of higher grade metamorphism, probably upper amphibolite facies, was also observed in a few locations in the westernmost part of the area. Massive tonalites, diorites and granodiorites in this sector sometimes exhibit a slightly greenish tinge and a smoky aspect. Recrystallization textures, red biotite and clinopyroxene were also observed in a few samples. This metamorphism, however, has not affected the late intrusive Maurel, Châteauguay and Tramont suites.

The most indicative paragenesis pointing to a middle amphibolite regional metamorphic grade was identified in paragneisses and mafic volcanic rocks. In paragneisses, the mineral assemblage is composed of garnet + biotite ± sillimanite ± muscovite, whereas mafic volcanic rocks consist of hornblende + plagioclase ± quartz ± garnet. In the NW sector of the area, lithological assemblages of the Du Gué Complex display recrystallization textures and paragenetic assemblages characteristic of high-grade metamorphism, generally at the granulite facies (orthopyroxene + red biotite ± clinopyroxene). Within the complex, the metamorphic grade appears to increase from the west to the east. This translates into the progressive appearance of orthopyroxene. The orthopyroxene isograd roughly corresponds to the eastern contact of the red biotite trondhjemite unit (Adug2) (Figure 3). Beyond this isograd, orthopyroxene is ubiquitous in all lithologies. The presence of intrusions belonging to an enderbite-charnockite suite, which presumably intruded granulitic rocks, is suggested by the presence of large well-crystallized orthopyroxene grains observed in certain samples and which appear to be magmatic in origin. These grains are sometimes partially recrystallized into small polygonal grains, which may indicate that granulitic conditions persisted for a certain period of time after the emplacement of charnockitic intrusions, leading to the recrystallization of orthopyroxene.

A regression phenomenon of biotite into chlorite, accompanied by a pronounced alteration of plagioclase into sericite, has affected a fair portion of the rocks in the area. This regression phenomenon appears to be less widespread in the northeast and western parts of the area, and has not affected the Du Gué Complex. It is possible, however, that it is more difficult to observe in the various lithologies of the complex given the higher metamorphic grade at the onset. This mineral transformation is widespread but not systematic. Although it has been observed in all lithological assemblages, the volcano-sedimentary rocks and tonalitic gneisses are the most affected. The mineral retrogression phenomenon is particularly intense along late fault zones which could have served as conduits for hydrothermal fluid circulation. A similar retrograde metamorphism was reported in the Nedlouc area, to the NW of our study area (Parent *et al.*, 2000), and in the Aigneau area to the north of it. In the latter case, it appears to be restricted to late fault zones (Berclaz, pers. comm.).

STRUCTURAL GEOLOGY

From a structural standpoint, the Maricourt area is comparable in many respects to the Gayot area further south (Figure 7; Gosselin and Simard, 2000a) as well as to the Nedlouc area located to the northwest (Table 3; Parent *et al.*, 2000). The dominant structural trend in these regions is oriented NW-SE to NNW-SSE, an orientation that characterizes the entire Minto Subprovince (Percival *et al.*, 1992). Table 3 shows the tectonic events observed in the Maricourt and Gayot areas, and outlines possible correlations with those in the Nedlouc area.

Structural Elements and Phases of Deformation

In the Maricourt area, several phases of deformation successively took place. A few amphibolite or mafic volcanic enclaves observed in Brésolles gneisses contain relics of an early S1, foliation at an angle, sometimes low sometimes high, relative to the regional S2 foliation. This primitive

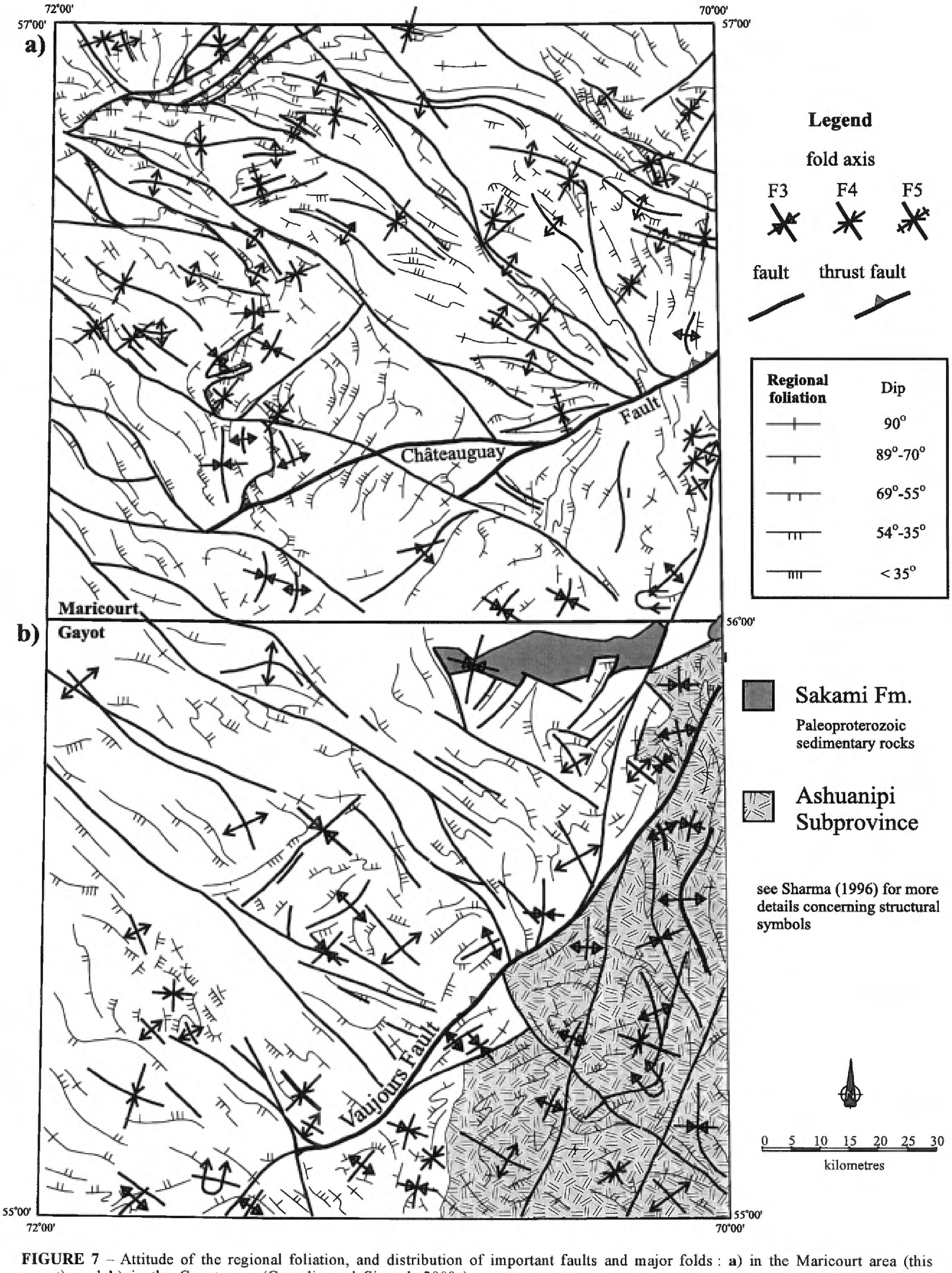


FIGURE 7 – Attitude of the regional foliation, and distribution of important faults and major folds : **a)** in the Maricourt area (this report), and **b)** in the Gayot area (Gosselin and Simard, 2000a).

TABLE 3 – Preliminary interpretation of deformation phases that have affected the Gayot and Maricourt areas, and their possible correlation with those described in the Nedlouc area (Parent *et al.*, 2000).

Gayot Area (RG 99-06) Descriptions	Maricourt Area Descriptions	Phase	Correlations and Comments	Phase	Nedlouc Area (RG 99-13) Descriptions
Late readjustments, hematitization, injection of Proterozoic dykes in fracture zones		D6	Probabe correlation	D6	Late brittle faults
Late faults, NE-SW to NNE-SSW, reverse movement to the SE (Vaujours fault)	-Late faults ENE-WSW to NE-SW, thrusting to the NW (north part) or to the SE (Châteauguay fault) -A few related ENE-WSW folds?	D5	Undetermined correlation	D5	Sporadic open to tight F5 folds oriented ENE-WSW, without associated foliation.
-Network of NW-SE faults (apparent movement varies from dextral to sinistral), local development of a crenulation cleavage, transposition of earlier structures. -F4 folds, WNW-ESE to NW-SE, open to tight, without associated foliation, transposed along NW-SE faults.		D4	Phases D3 and D4 of the Nedlouc area are considered in the Maricourt and Gayot area as belonging to a single D4 phase of deformation.	D4	NW-SE (dextral) shearing, mylonitic fabric, F4 drag folds.
F3 folds, NE-SW to NNE-SSW, tight to isoclinal, without associated foliation, locally N-S to NNW-SSE (Reoriented by the D4 phase of deformation?)		D3	There appears to be no equivalent in the Nedlouc area for the D3 phase observed in the Maricourt and Gayot areas. However, it may be possible to establish a certain correlation between ENE-WSW F3 folds in the Dupire sector of the Nedlouc area, with this phase.	D3	-F3 fold, tight to isoclinal, without associated foliation, reoriented by D4 shearing. -WNW-ESE orientation in Goudalie Domain and ENE-WSW in Dupire sector.
Regional foliation (S2)		D2	Regional foliations probaly correspond. F2 folds not observed (obliterated) in Maricourt and Gayot.	D2	Penetrative S2 foliation and isoclinal F2 folds oriented parallel to NNW-SSE contacts.
Relics of an early foliation in enclaves. This foliation predates the regional foliation.		D1	Probable correlation	D1	Foliation in enclaves discordant relative to regional foliation (S2).

foliation is the only remnant of an early D1 phase of deformation. The principal S2 regional foliation, associated with phase of deformation D2 (Table 3), later obliterated or almost entirely reoriented all structures associated to deformation D1. Relationships between early D1 and D2 deformation phases remain poorly understood, largely due to the parallel nature of the two fabrics.

The regional foliation (S2) affects all the Archean rocks in the area. It takes on diverse forms, from a simple discrete mineral alignment to a strong gneissosity. These variations essentially appear to be controlled by the intensity of deformation or by the age and type of lithological assemblages affected. Late units are much less foliated.

Subsequent phases of deformation, D3, D4 and D5, have reoriented, folded and accentuated the regional foliation (S2). Phase D3 produced tight to isoclinal folds oriented N-S to NE-SW, without an axial plane schistosity. F3 folds, up to m-scale, were observed in outcrop in a few locations. The attitude of the regional foliation also allows to detect the presence of km-scale regional folds related to this phase.

Phase of deformation D4 produced the structural trend oriented NW-SE, which is dominant throughout the area. It is characterized by the development of a network of NW-SE oriented faults that delineate corridors a few tens of kilometres wide, within which are distributed important F4 folds without associated schistosity, oriented WNW-ESE to NW-SE. Faults related to the D4 phase are associated with apparent movements that are sometimes dextral, sometimes sinistral. Most of these were interpreted from lineaments observed on aeromagnetic maps. In the field, their effect is rarely observed, but generally corresponds to sheared and strongly foliated zones, or to quartz breccia zones. A crenulation cleavage affecting the regional S2 foliation was noted in a few locations in the vicinity of important fault zones, indicating that these deformation zones locally generated their own fabric.

A phase of deformation D5 was also interpreted. It is essentially represented by late faults oriented ENE-WSW to NE-SW. These faults are generally poorly exposed and their presence essentially translates into a strong hematitization of the surrounding rocks. It is possible that a few folds oriented ENE-WSW, located in the vicinity of these faults, could be associated with this phase (Figure 7). However, there are no specific indications to confirm this for the moment, and these folds could just as well belong to phase D3. In the NW part of the area, a system of ENE-WSW faults delimiting the Du Gué granulitic Complex is particularly well exposed. Several observations suggest that these faults accommodated a thrusting movement towards the NW. Deformation zones related to these faults are a few hundred metres wide, and are characterized by the presence of well-developed mylonitic zones. These thrust faults affect, among others, the megaporphyritic granites of the Maurel Suite; this is a good indication of the late nature of these structures.

Further south, the Châteauguay fault represents a major regional structure (Figure 7a) similar to the Vaujours fault, observed in the Gayot area (Figure 7b). The Châteauguay fault, however, is only poorly exposed. A few rare indications, observed near the eastern margin of the area, lead us to suggest a reverse or thrusting movement towards the SE, similar to that of the Vaujours fault (N'Dah and Goulet, personal communication). Furthermore, the Châteauguay and Vaujours faults delimit, in a similar manner, contrasting structural environments. Areas to the NW of these faults show a well-defined NW-SE structural trend (phase D4) whereas to the SE, the structural trend is oriented N-S to NE-SW (phase D3).

Statistical Compilation

Variations in the attitude of the regional foliation were used to divide the area into eight structural domains (Figure 8). Phase of deformation D3 is particularly well represented in structural domains 1, 2 and 6a. A statistical compilation of planar and linear elements in these domains confirms the presence of F3 folds oriented N-S to NE-SW in these sectors (Figure 9). However, the influence of phase D4 is important, particularly in domain 6a. It translates into the reorientation of planar structures and F3 fold axes along NW-SE faults associated to D4. Furthermore, stretching lineations and fold axes measured in these domains generally appear to be related to phase D4.

In the other domains, the compilation of structural elements clearly reflects the dominant WNW-ESE to NW-SE orientation related to phase D4 (Figure 9). Usually, linear structures, mainly represented by stretching lineations, moderately plunge to the NW (domains 4 and 5, Figure 9) or sometimes very shallowly to the NW or SE (domains 3 and 6a, Figure 9). However, several lineations measured in domain 4 are steeply plunging to the WSW. These lineations are associated with intense deformation zones oriented NW-SE, which particularly affect volcano-sedimentary rocks of the Garault Complex. Statistical data from domain 3 do not highlight the presence of a few folds oriented N-S to NNE-SSW interpreted near the eastern boundary of this domain. Although a major portion of the area is clearly under the influence of phase D4, these folds are considered for the moment, although with some caution, as F3 folds reoriented by phase D4. They form part of a particularly complex N-S corridor that extends into domain 6a. This corridor corresponds to a mylonitized lithological suite that was traced for over 50 kilometres, and is interpreted as being related to a thrust fault that has apparently been folded.

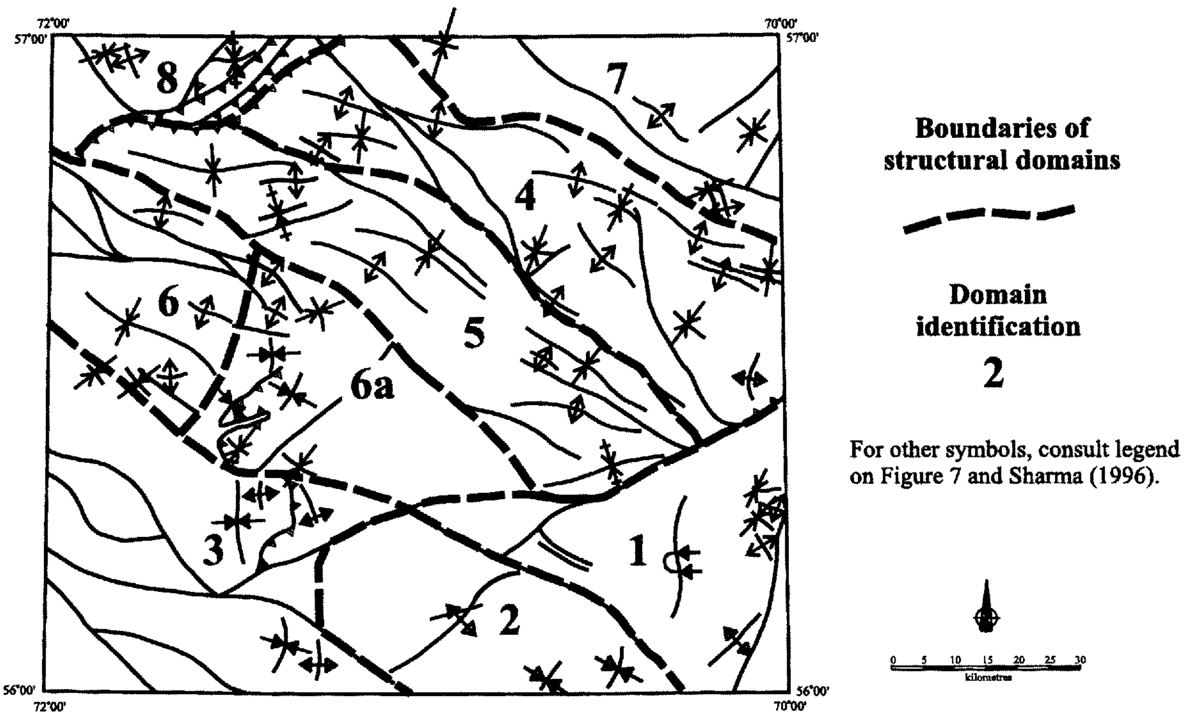


FIGURE 8 – Boundaries of structural domains in the Maricourt area.

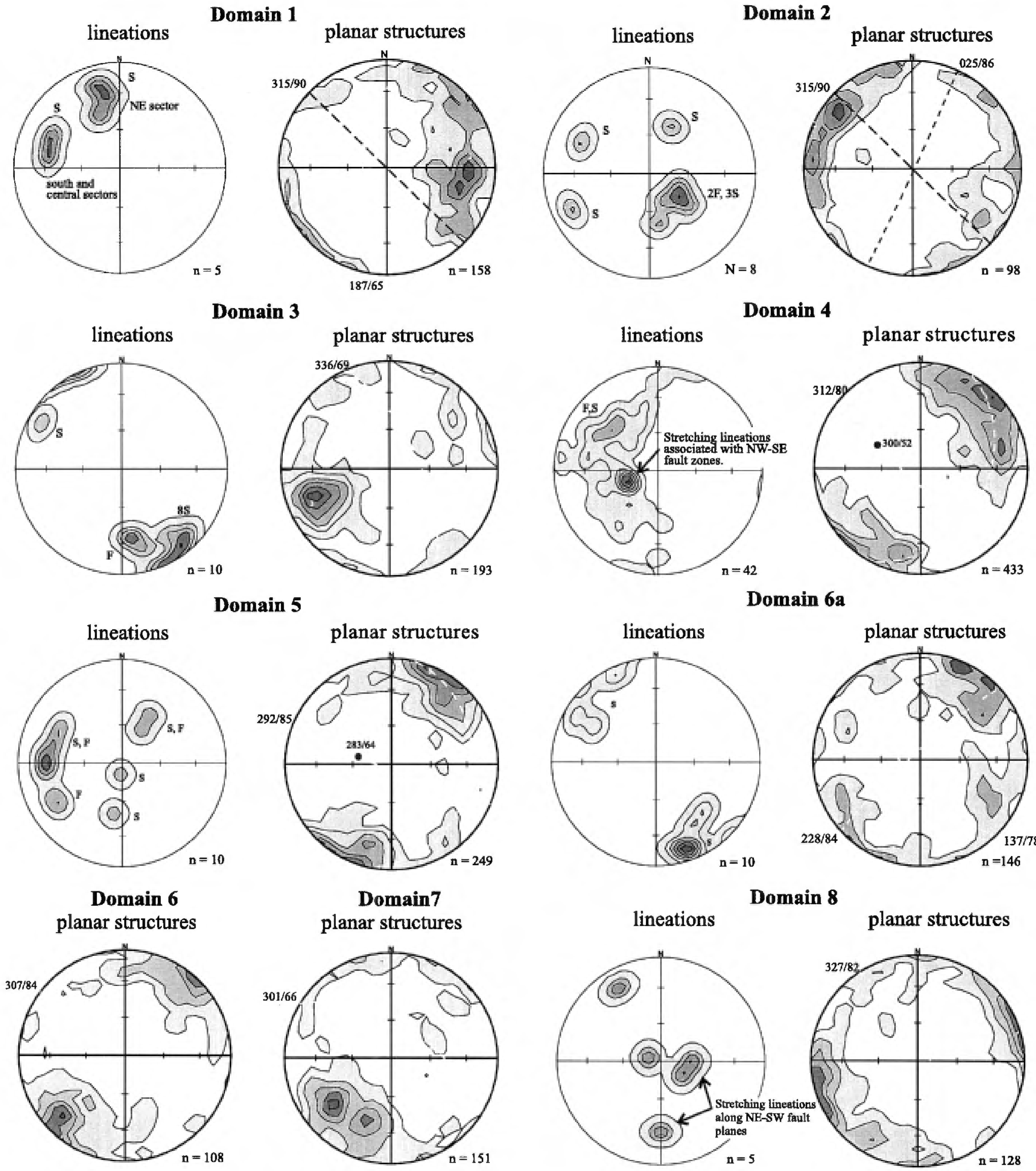


FIGURE 9 – Statistical compilation of regional foliation and lineation measurements plotted on stereograms. Abbreviations: S = stretching lineations, F = fold hinges, and n = number of measurements.

ECONOMIC GEOLOGY

Previous Work

Important exploration programs were carried out during the 1970s essentially targeting potential uranium deposits in Paleoproterozoic sedimentary rocks of the Sakami Formation. This work, carried out by companies Eldorado Nuclear and Uranerz, led to the discovery of a uranium deposit located in the northern part of the Gayot area, immediately south of our area. Estimated reserves (1980) for this deposit amounted to 50 million metric tonnes at 0.10% U_3O_8, or 10 to 15 million tonnes at 0.25% U_3O_8 (Marcoux, 1980). Uranerz also investigated the Lac Pons outlier (Orr, 1978; 1979) which touches the SE corner of the area (Figure 2).

An important lake sediment geochemistry survey (Géologie Québec, 1998), performed by SIAL in 1997 under the Far North Project, covers the entire Maricourt area. This survey, funded by the MRN and five partners, prompted exploration companies to take exploration permits in the area. Other than these programs, no other exploration campaign had been carried out in the area, and no mineral occurrence had been reported before our survey.

Results of our Field Survey

Our work has revealed the economic potential of the Maricourt area, through the discovery of several mineralized zones, and the discovery of additional new volcano-sedimentary belts, with several associated mineral occurrences (Figure 10a, Table 4). The principal mineralizations are associated with volcanic rocks, metasediments or ultramafic rocks.

Mineralization Associated with Volcanic Rocks

Mineralizations associated with volcanic rocks correspond to disseminated or semi-massive sulphide zones, or oxide-facies iron formations (Figure 10). Sulphide zones vary from less than a metre to 1 or 2 metres thick; they are intercalated within basaltic sequences or associated with felsic horizons. These zones contain pyrite and pyrrhotite, with occasional minor chalcopyrite. Iron formations vary from 1 to 3 metres thick. They consist of alternating cm-scale layers of chert and magnetite, which give the rock a banded aspect. They are often very rusty, due to the presence of sulphides.

Most of the samples collected in these mineralized zones contain clearly anomalous copper values, above 500 ppm (Figure 10a). The best results come from sulphide zones, where grades between 0.1 to 0.26% Cu were obtained. A few anomalous zinc values, between 500 to 810 ppm, were also obtained. One particular sulphide zone, located in the NW part of the area, is associated with a gold grade of 820 ppb Au accompanied by an anomalous concentration of 360 ppm As (site 29, Figure 10a and Table 4).

Mineralization Associated with Metasediments

Mineral occurrences associated with metasediments also correspond to sulphide zones and oxide-facies iron formations, between 0.5 to 1.5 metres thick. They are found mainly in the Angilbert South belt, as well as in the NW part of the area, in the Du Gué Complex (Figure 10a). These sites frequently contain anomalous copper grades above 500 ppm, reaching up to 0.19% Cu. A few anomalous zinc (0.11%), gold (160 to 290 ppb), silver (29 g/t) and cobalt (0.20%) values were also obtained.

Mineralization Associated with Ultramafic Rocks

Mineral occurrences associated with ultramafic rocks (Figure 10a) correspond to zones that contain between 2 to 5 % disseminated sulphides over thicknesses of a few metres. Those observed in the south part of the Moyer belt are intercalated within the volcanic sequence. In the NW sector, however, this type of association with volcanic rocks could not be established. The mineralizations are found in isolated ultramafic intrusions that vary from 40 to over 400 metres thick. Most of these were interpreted as late intrusions belonging to the Châteauguay Suite. In both regions however, similar grades on the order of 0.31 to 0.37% Cu and about 0.24 to 0.37% Ni were obtained.

The Maricourt and Gayot Areas; A Comparable Economic Potential

The Maricourt and Gayot areas are characterized by the presence of fair-sized volcanic belts, in which several mineral occurrences were discovered. In both areas, mineralized zones are associated with similar geological settings. Furthermore, anomalous concentrations of precious metals and base metals are comparable in both areas. Mineralizations associated with paragneisses are much more abundant in Maricourt, if we the exclude iron formations of the Ashuanipi Subprovince (Figure 10; Gosselin and Simard, 2000a). Sulphide mineralization and iron formations associated with volcanic rocks display roughly the same features and contain comparable base metal concentrations in the two areas (Figure 10). It is worth mentioning, however, that the company Virginia Gold Mines (Chapdelaine, 1999) obtained gold values between 0.4 and 5.6 g/t Au in an iron formation associated with volcanic rocks in the Venus belt, located in the Gayot area.

Over the course of the 1999 summer season, Virginia Gold Mines discovered four new zones mineralized in Ni-Cu and PGE, associated with ultramafic rocks in the Venus belt (Savard and Chapdelaine, 1999). These zones are located along the extension of the Loup showing, discovered in 1998 (Figure 10) during our survey in the Gayot area

TABLE 4 – Brief description of mineral occurrences observed in the Maricourt area, and best assay results obtained from grab samples. The numbers refer to site locations shown in Figure 10a.

DESCRIPTION OF MINERAL OCCURRENCES (Location shown in Figure 10a)

1	Oxide- and sulphide-facies iron formations in volcanic rocks (5 m thick)	***910 ppm Cu***
2	Sulphide zone associated with mafic to ultramafic intrusions	***0.37 % Cu*** ***0.32 % Ni***
3	50-cm thick sulphide zones with magnetite and garnet, in mafic to ultramafic rocks	***800 ppm Cu*** ***0.24 % Ni***
4	Magnetite-bearing sulphide zone associated with mafic to ultramafic rocks	***530 ppm Cu*** ***570 ppm Ni***
5	10 to 15-cm thick sulphide zones in volcanic rocks associated with ultramafic rocks	
6	Disseminated (10%) sulphide zones (<1 m) in basalts	***870 ppm Cu*** ***490 ppm Ni***
7	Sulphide zone (<1 m) in volcanic rocks and iron formations associated with paragneisses	
8	20-cm thick sulphide zone containing 5 to 10% pyrrhotite in amphibolites	***540 ppm Cu***
9	10-cm thick sulphide zone containing 10% pyrrhotite at the contact between mafic and felsic lavas	***850 ppm Cu***
10	10 to 40-cm thick iron formation horizons intercalated with basalts, sulphide zones in felsic tuffs	***840 ppm Cu***
11	10 to 20-cm thick disseminated sulphide horizons in felsic tuffs	***0.14 % Cu***
12	30 - cm thick disseminated sulphide horizons in felsic tuffs	
13	Laterally restricted, lens-shaped iron formation, 10 to 80 cm thick	
14	10 - cm thick sulphide-bearing amphibolite horizons in banded gneiss sequences	***0.15 % Cu***
15	2 to 3-m thick sulphide zone in amphibolite horizon	***970 ppm Cu***
16	Oxide- and sulphide-facies iron formations (1 m thick) in amphibolite and paragneiss sequences	
17	1-m thick iron formation horizon in mafic volcanic rocks	
18	Oxide- and sulphide-facies iron formation horizons (0.2 to 3.0 m thick) in amphibolites	***720 ppm Cu***
19	1-m thick massive to semi-massive sulphide zones in paragneiss and amphibolite sequence	***29 g/t Ag*** ***160 ppb Au*** ***860 ppm Cu*** ***0.2 % Co***
20	3 sulphide bands (<1 m thick) in paragneiss and amphibolite sequence	
21	Sulphide zones (<1 m thick) in paragneisses	
22	Massive and disseminated sulphide zones in a paragneiss sequence	
23	10 to 20 -cm thick sulphide-rich horizon in basalts	***130 ppb Au*** ***0.26 % Cu*** ***180 ppb Pb*** ***500 ppm Zn***
24	Blocks with sulphide mineralization, derived from volcanic rocks	***0.65 % Cu*** ***0.17 % Ni***
25	10 to 30 -cm thick iron formations with 10 to 20 -cm thick sulphide zones in lavas	
26	Sheared and altered sulphide-bearing gabbro or ultramafic intrusion (<1 m thick), near a diabase dyke	***0.31 % Cu*** ***0.30 % Ni***
27	m-scale oxide- and sulphide-facies iron formation horizons in volcanic rocks	
28	Sulphide-bearing iron formations (30 cm thick) in paragneiss	***420 ppm Cu***
29	5 sulphide bands between 0.1 to 1.0 m thick, associated with felsic volcanic rocks	***360 ppm As*** ***820 ppb Au*** ***310 ppm Cu***
30	3 sulphide-bearing silicified zones from 0.2 to 1.0 m thick in basalts	***810 ppm Zn***
31	Iron formations in a paragneiss horizon	***0.11 % Cu***
32	Pyroxenite with thick (several metres) sulphide zones	***920 ppm Cu*** ***670 ppm Ni***
33	Massive pyroxenite with 2-3% sulphides	
34	30-cm thick disseminated sulphide zones in a 400-m thick pyroxenite	***0.37 % Cu*** ***0.32 % Ni***
35	Sulphide zones from 0.1 to 1.0 m thick in amphibolites	***780 ppm Ni***
36	Sulphide zones from 0.1 to 1.0 m thick in amphibolites	***570 ppm Cu***
37	Sulphide-magnetite zones from 0.5 to 1.0 m thick in paragneisses	
38	30-cm thick sulphide zones intercalated in paragneisses	***0.19 % Cu*** ***0.11 % Zn***
39	Enclaves of iron formations (20 to 50 cm thick) associated with paragneiss enclaves in diatexites	***290 ppb Au***
40	Enclaves of iron formation (20 to 50 cm thick) associated with amphibolite enclaves in diatexites	
41	30-cm thick iron formation horizons intercalated in paragneisses	***590 ppm Cu***
42	10-cm thick iron formation horizons in paragneisses	
43	Enclaves of iron formation (0.1 to 3.0 m thick) associated with paragneiss enclaves in diatexites	***450 ppm Cu***

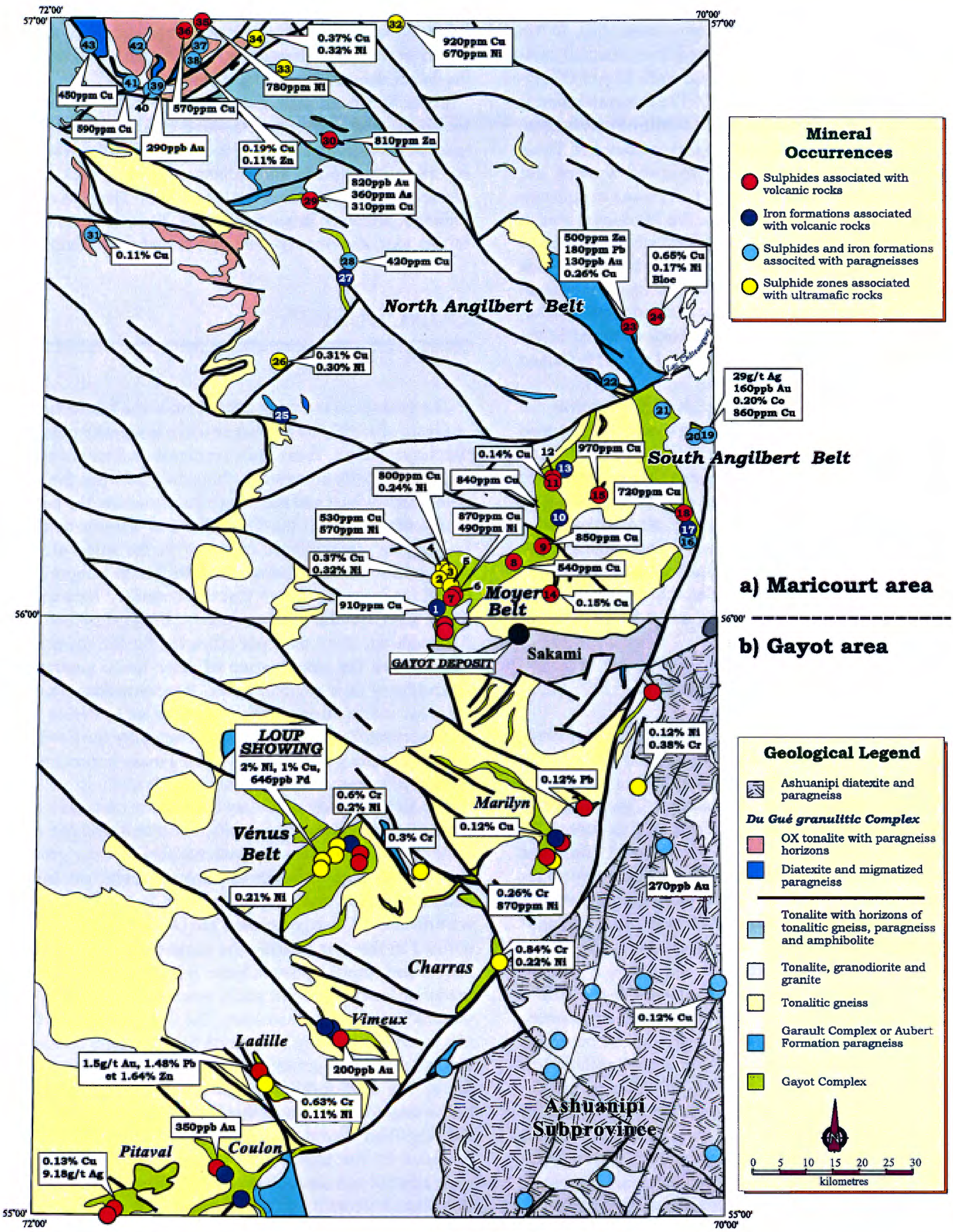


FIGURE 10 – Location of the principal mineral occurrences, and presentation of best assay results : **a)** for the Maricourt area (this report), and **b)** for the Gayot area (Gosselin and Simard, 2000a).

(Gosselin and Simard, 2000a). The four new showings define a favourable horizon that extends over more than 15 km along strike. The best grades obtained from channel samples are: 2.54% Ni, 0.49% Cu, 0.06% Co and 2.93 g/t PGE (Pt-Pd) over 3.85 metres (press release). The mineralization is hosted in ultramafic intrusions and komatiitic lavas intercalated in the volcanic sequence of the Gayot Complex. These new discoveries have generated renewed interest for mineralization associated with ultramafic rocks in volcano-sedimentary belts in this region. In the Maricourt area, a similar geological setting was identified in the south part of the Moyer and Angilbert South belts, where ultramafic rock horizons are included in the volcanic sequence of the Gayot Complex. Observed mineralizations and copper and nickel grades are comparable overall with those obtained in the Gayot area. These grades vary between 0.1 to 0.37% Cu and between 0.2 to 0.3% Ni.

Finally, Ressources Vaujours Inc. developed, during the summer of 1999, a vein-type Cu-Au-Ag showing discovered in 1998 by Makamikex in the Charras belt, Gayot area (Figure 10b). Ressources Vaujours obtained encouraging results of 2.4% Cu, 2.52 g/t Ag and 0.93 g/t Au on the Isabel showing (De Corta *et al.*, 1999). This company also uncovered a stratiform massive sulphide zone associated with a metamorphosed marble horizon (Gino-Laurent showing). This horizon is 0.5 to 5.0 metres thick. Relatively constant anomalous grades of 0.14% Cu, 1.9 g/t Ag and 0.13 g/t Au were obtained.

Lake Sediment Survey

Geological surveys carried out under the Far North Project help define the geological setting used to interpret the results of the lake sediment survey carried out in 1997 by the MRN, in partnership with the private sector. Figure 11 shows the principal anomalous zones defined by this survey for copper, nickel, chromium and gold. Zones 1 to 5, identified on this figure, correspond to multi-element anomaly zones (Cu-Ni-Cr). Zone 1 coincides with Cu-Ni mineralization hosted in ultramafic rocks associated with the volcano-sedimentary Gayot Complex, in the south part of the Moyer belt (Figures 10a and 11). Zones 3 and 4 also constitute interesting exploration targets as they seem to be related to a geological setting similar to Zone 1. It is worth mentioning that a particularly interesting group of outcrops occurs in the south part of the Angilbert South belt (Zone 3, Figure 11). It contains ultramafic rocks, possibly effusive, intimately associated with a horizon of oxide-facies iron formation (Gosselin and Simard, 2000b).

Zone 4 also coincides with the presence of Cu-Ni mineralizations, in this case associated with ultramafic intrusions considered as belonging to the Châteauguay Suite. Finally, another multi-element anomaly (Cu-Ni-Cr) (Zone 5, Figure 11) is located along the southern margin of the area. The copper anomaly in this sector (between 240 to 310 ppm) is the highest in the area, which makes it another interesting exploration target. However, we have very little geological information in this location given the paucity of outcrops. On the other hand, ultramafic rocks mapped further south in the Gayot area may explain this anomaly.

In the Maricourt area, gold anomalies in lake sediments are scarce and correspond to weak concentrations on the order of 13 to 20 ppb. One of these occurs to the NW of an outcrop with sulphide mineralization, where a rock sample yielded a grade of 0.82 g/t Au (Figure 11). The highest lake sediment anomaly in gold (between 30 to 40 ppb) occurs further east, and overlaps an important regional fault.

CONCLUSION

The geological mapping carried out in the Maricourt area at a scale of 1:250,000 made it possible to identify numerous lithological units. These units are distributed within an area which reportedly contains the boundary between the Bienville Subprovince and the Minto Subprovince; the latter is represented here by the Goudalie and Utsalik domains. Lithological assemblages observed in the study area are similar to those that characterize the Minto Subprovince, which leads us to believe that the boundary between the Minto and Bienville is located outside of the Maricourt area. Although our work does not allow us, for the moment, to elaborate on the exact nature of these broad geotectonic assemblages on a regional scale, it nevertheless provides essential information which will allow us to define them more accurately and even redefine them once the Far North Project is more advanced, and when a more important proportion of the territory has been investigated.

The area is mostly underlain by Archean units, as well as a few restricted Proterozoic units. The oldest Archean rocks (2.78 to 2.86 Ga) belong to supracrustal sequences, grouped for the most part within three important belts: the Moyer, Angilbert North and Angilbert South belts. These rocks were divided into two complexes. The Gayot Complex, initially defined in the area bearing the same name, occurs in the Moyer and Angilbert South belts. It is characterized by the predominance of tholeiitic mafic volcanic rocks and mafic to ultramafic syngenetic intrusions. The Garault Complex (new unit) occurs in the Angilbert North belt. It mainly consists of diverse metasedimentary rocks and calc-alkaline volcanic rocks. The relationship between the two complexes could not be established. On the other hand, the boundary between the Angilbert North and South belts is marked by the presence of the regional Châteauguay fault. This fault separates the two complexes, which undoubtedly represent two distinct geotectonic environments.

Intrusive units are by far dominant in the study area. Tonalitic gneisses of the Brésolles Suite, Favard trondhjemites, Maurel porphyritic granites and Tramont granites, which had been defined in the Gayot area, are also found in

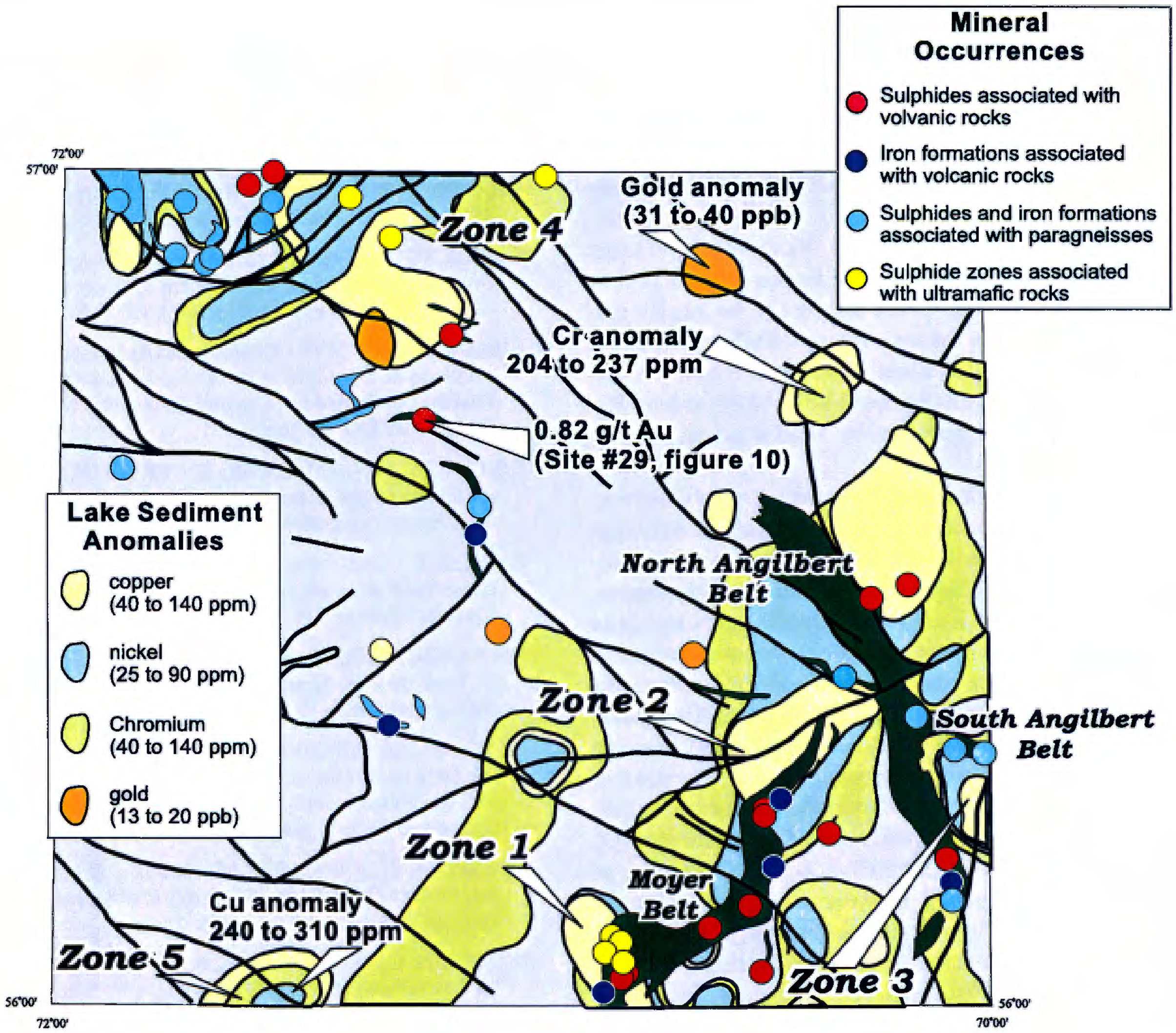


FIGURE 11 – Principal lake sediment geochemistry anomalies and their relation to observed mineralizations.

Maricourt. New suites were also defined. These are the tonalites of the Coursolles Suite, granulites of various origins of the Du Gué Complex, and finally, granodiorites of the Desbergères Suite.

Cross-cutting relationships and zircon ages indicate that the Brésolles (2.803 Ga), Coursolles and Favard (2.730 to 2.749 Ga) suites occur in chronological order, respectively from the oldest to the youngest. However, this situation often appears quite complex, as indicated by an age of 2718+11/-8 Ma obtained for a tonalite assigned to the Coursolles Suite. The hypothesis that is nevertheless proposed for the moment is that the Coursolles and Favard suites belong to a single diorite-tonalite-trondhjemite evolution series.

Phenomena interpreted for the moment as being associated to migmatization have affected vast expanses of the Coursolles and Favard suites. In these areas, a granodioritic material has invaded the host rock. This material takes on considerable proportions in certain locations; in these cases, compositional and textural features appear similar to those observed in the Desbergères Suite. This is why we propose, as a working hypothesis, that the Desbergères Suite may represent the ultimate phase of the migmatization of older suites.

The Du Gué granulitic Complex is a singular assemblage observed only in the Maricourt area. In areas further north, the only complexes that appear to be comparable are the Troie and Qimussinguat complexes described by Madore *et al.* (1999) in the Lac Peters area. This area is located about 200 km further north, in the Douglas Harbour Domain. An age of 2.740 Ga was obtained from an orthopyroxene-bearing gneissic tonalite sampled in the Troie Complex. This age is close to one obtained for a similar lithology in the Du Gué Complex (2.729 Ga). It is also worth mentioning that, based on our observations, an important part of this complex is presumably equivalent to the Favard Suite, dated in Maricourt at 2749±4 Ma.

The regional metamorphic grade in the Maricourt area reached the amphibolite facies, except for lithological assemblages of the Du Gué Complex which have undergone granulite-facies metamorphism. A mineral retrogression phenomenon associated with hydrothermal alteration or late greenschist-facies metamorphism particularly affected volcano-sedimentary rocks, Brésolles gneisses and late fault zones. Finally, from a structural standpoint, five phases of deformation were interpreted. Phase D1 was detected only in enclaves found in the Brésolles and Favard suites, whereas phase D2 is responsible for the regional foliation. Phase D3 has folded the regional foliation along a N-S to NE-SW orientation. This phase appears to be largely restricted to the SE part of the area. Phase D4 affects the entire area. It is characterized by a well-developed system of NW-SE faults, as well as folds oriented WNW-ESE to NW-SE. Finally, phase D5 is represented by NE-SW oriented thrust faults.

Concerning economic mineral occurrences, the discovery of several anomalous occurrences and mineralized showings indicates that the area holds an interesting potential for base metals within volcanic and sedimentary sequences, and in ultramafic rocks. Zones of ultramafic rocks, and more specifically those associated with the volcano-sedimentary Gayot Complex attract our attention, especially since the recent discovery of important Cu-Ni-PGE mineralization by Virginia Gold Mines in the Venus belt (Gayot area). This is a good example of the favourable geological setting present in the Gayot Complex. In Maricourt, the Moyer and Angilbert South belts are fairly extensive and offer similar settings, and therefore possess an interesting potential. Finally, as we mentioned previously, Ressources Vaujours inc. is developing in the Charras belt a vein-type Cu-Au-Ag showing as well as a stratiform massive sulphide zone mineralized in Cu-Ag-Au which is associated with a marble horizon. Thus, mineralizations discovered within volcano-sedimentary sequences have diverse origins and contain a variety of economic substances. It is important however that more detailed exploration work be performed to fully assess the economic potential of these regions.

REFERENCES

BACHELOR, R.A. - BOWDEN, P., 1985 - Petrogenetic interpretation of granitoid rock series using multicationic parameters. Chemical Geology; volume 48, pages 43-55.

BARKER, F. (editor), 1979 - Trondhjemites, dacites and related rocks. *In:* Developments in Petrology 6. U.S. Geological Survey, Denver, Colorado, U.S.A.; pages 1-12.

BERCLAZ, A.- CADIEUX, A.M., - DAVID, J., 2000 - Géologie de la région du lac Aigneau (SNRC 24 E). Ministère des Ressources naturelles, Québec; RG 2000-? (in preparation).

BUCHAN, K.L. - MORTENSEN, J.K.- CARD, K.D. - PERCIVAL, J.A., 1998 - Paleomagnetism and U-Pb geochronology of diabase dyke swarms of Minto block, Superior Province, Quebec, Canada. Canadian Journal of Earth Sciences; volume 35, pages 1054-1069.

CARD, K.D. - CIESIELSKI, A., 1986 - DNAG No 1 Subdivisions of the Superior Province of the Canadian Shield. Geoscience Canada; volume 13, pages 5-13.

CHAPDELAINE, M., 1999 - Rapport technique des travaux, été-1998. Ministère des Ressources naturelles, Québec; GM 56177.

CIESIELSKI, A., 1998 - Compilation géologique de la partie orientale de la Province du Supérieur, Québec. Geological Survey of Canada; Open File 3580, scale 1:1,000,000.

CIESIELSKI, A., 1999 - Géologie et lithogéochimie de la Sous-province de Bienville et des zones adjacentes dans l'est de la Province du Supérieur, Québec. Geological Survey of Canada; Open File 3550, 90 pages.

DE CORTA, H. - SAULNIER, I. - PETIT, N., 1999 - Rapport d'une campagne de prospection, propriété Vaujours. Ministère des Ressources naturelles, Québec; GM 57411, 94 pages.

EADE, K.E., 1966 - Fort George River and Kaniapiskau River (west half) map-areas, New Quebec. Geological Survey of Canada; Memoir 339 (map 1155A), 84 pages.

GÉOLOGIE QUÉBEC, 1998 - Résultats d'analyses de sédiments de fond de lacs, Grand-nord du Québec. Ministère des Ressources naturelles, Québec; DP 98-01.

GOSSELIN, C. - SIMARD, M. - CHALIFOUR, S., 1999 - Géologie de la région du lac Maricourt. *In:* Explorer au Québec: Le défi de la connaissance. Ministère des Ressources naturelles, Québec; DV 99-03, page 43.

GOSSELIN, C. - SIMARD, M., 2000a - Geology of the Lac Gayot Area (NTS 23M). Ministère des Ressources naturelles, Québec; RG 2000-03, 28 pages.

GOSSELIN, C. - SIMARD, M., 2000b - Géologie de la région du lac Maricourt (SNRC 24D). Géologie Québec; SIGÉOM map SI-24D-C2G-00K.

GOUTIER, J. - DION, C. - LAFRANCE, I. - DAVID, J. - PARENT, M. - DION, D.J., 1998 - Géologie de la région des lacs Langelier et Threefold (SNRC 33F/03 et 33F/04). Ministère des Ressources naturelles, Québec; RG 98-18, 52 pages.

HOCQ, M., 1994 - La province du Supérieur. *In:* La Géologie du Québec. Ministère des Ressources naturelles, Québec; MM 94-01, pages 7-20.

JENSEN, L. S., 1976 - A new cation plot for classifying subalkalic volcanic rocks. Ontario Department of Mines; Miscellaneous paper 66.

LAMOTHE, D., 1997 - Géologie de la région du lac Dupire. Ministère des Ressources naturelles, Québec; RG 96-01, 17 pages.

LECLAIR, A. - PARENT, M. - BERCLAZ, A. - CADIEUX, A.M. - SHARMA, K. N. M., 2000a - Compilation géoscientifique, géologie 1: 250 000, 24E, Lac Aigneau. Ministère des Resssources naturelles, Québec; map SI-24E-C2G-00C.

LECLAIR, A. - PARENT, M.- DAVID, J. - SHARMA, K.N.M. - DION, D.-J., 2000b - Géologie de la région du lac La Potherie (SNRC 34I). Ministère des Ressources naturelles, Québec; RG 2000-12.

LE MAITRE, R.W. (editor), 1989 - A Classification of Igneous Rocks and a Glossary of Terms. Blackwell, Oxford; 193 pages.

MADORE, L. - BANDYAYERA, D. - BÉDARD, J.H. - BROUILLETTE, P. - SHARMA, K.N.M. - BEAUMIER, M. - DAVID, J., 1999 - Geology of the Lac Peters Area (24M). Ministère des Ressources naturelles, Québec; RG 99-16, 41 pages.

MANIAR, P.D. - PICCOLI, P.M., 1989 - Tectonic discrimination of granitoids. Bulletin of the Geological Society of America; volume 101, pages 635-643.

MARCOUX, P., 1979 - Rapport des géologues résidents sur l'activité minière régionale. Ministère de l'Énergie et des Ressources, Québec; DPV-737.

MARCOUX, P., 1980 - Rapports des géologues résidents. Ministère de l'Énergie et des Ressources, Québec; DPV-814, pages 103-115.

MEUSY, G.X., 1982 - Projet 523 Villemure, Québec, permis 651 et 652, rapport de synthèse SNRC 23M, 24D. Ministère de l'Énergie et des Ressources, Québec; GM 38502.

MORTENSEN, J.K. - CIESIELSKI, A., 1987 - U-Pb zircon and sphene geochronology of Archean plutonic and orthogneissic rocks of the James Bay region and Bienville Domain, Quebec. *In:* Radiogenic Age and Isotopic Studies: Report 1. Geological Survey of Canada; Paper 87-2, pages 129-134.

ORR, R., 1978 - Assessment report 1978, project no. 71-86, Gayot Lake permit areas. Ministère des Richesses naturelles, Québec; GM-34390.

ORR, R., 1979 - Gayot Lake area, project no. 71-86, Assessment report 1979. Ministère de l'Énergie et des Ressources, Québec; GM-36171.

PARENT, M. - LECLAIR, A. - DAVID, J. - SHARMA, K.N.M., 2000 - Geology of the Lac Nedlouc Area (NTS 34H and 24E). Ministère des Ressources naturelles, Québec; RG 2000-09, 40 pages.

PEARCE, J.A. - CANN, J.R., 1973 - Tectonic setting of basic volcanic rocks determined using trace element analyses. Earth and Planetary Science Letters; volume 19, pages 290-300.

PERCIVAL, J.A. - CARD, K.D. - STERN, R.A. - BÉGIN, N.J., 1991 - A geological transect of the Leaf River area, northwestern Superior Province, Ungava Peninsula, Quebec. *In:* Current Research, Part C, Geological Survey of Canada; paper 91-1C, pages 55-63.

PERCIVAL, J.A. - MORTENSEN, J.K. - STERN, R.A. - CARD, K.D. - BÉGIN, N.J., 1992 - Giant granulite terranes of northeastern Superior Province: the Ashuanipi Complex and Minto block. Canadian Journal of Earth Sciences; volume 29, number 10, pages 2287-2308.

SAVARD, M. - CHAPDELAINE, M., 1999 - Rapport technique des travaux, été 1999. Ministère des Ressources naturelles, Québec; GM 57115.

SEGUIN, M.K. - SHARMA, K.N.M. - WOUSSEN, G., 1981 - Étude paléomagnétique des roches protérozoïques de la Formation de Sakami, région de la Grande Rivière, Territoire du Nouveau-Québec, Canada. Canadian Journal of Earth Sciences; volume 18, pages 1893-1899.

SHARMA, K.N.M., 1996 - Légende générale de la carte géologique – édition revue et augmentée. Ministère des Ressources naturelles, Québec; MB 96-28.

SKULSKI, T. - PERCIVAL, J.A. - STERN, R.A., 1996 - Archean crustal evolution in the central Minto block, northern Quebec. *In:* Radiogenic Age and Isotopic Studies: Report 9. Geological Survey of Canada; Current Research 1995-F, pages 17-31.

STEVENSON, I.M., 1968 - A geological reconnaissance of Leaf River map-area, New Quebec and Northwest Territories. Geological Survey of Canada; Memoir 356 (map 1229A), 112 pages.

SUN, S.S.- McDONOUGH, W.F., 1989 - Chemical and isotopic systematics of oceanic basalts. *In:* Magmatism in the ocean basins. Geological Society of America, Special Publication 42, pages 313-345.

THÉRIAULT, R. - CHEVÉ, S., 2000 - Géologie de la région du lac Hurault (SNRC 23L). Géologie Québec; RG- 2000-11.

WHALEN, J.B. - CURRIE, K.L. - CHAPPELL, B.W., 1987 - A-type granites: geochemical characteristics, discrimination and petrogenesis. Contributions to Mineralogy and Petrology; volume 95, pages 407-419.

WINCHESTER, J.A. - FLOYD, P.A., 1977 - Geochemical discrimination of different magma series and their differentiation products using immobile elements. Chemical Geology; volume 20, pages 325-343.

Abstract

This report contains the results of a geological survey carried out during the 1999 summer season at a scale of 1:250,000. It covers the area represented by NTS sheet 24D (Lac Maricourt), located about 250 kilometres southwest of Kuujjuaq. The Maricourt area is transected by the boundary between the Bienville Subprovince and the Minto Subprovince. The latter is represented in our area by the Goudalie and Utsalik domains. The results of our studies lead us to include the entire area in the Minto Subprovince, and thus reconsider the location of the boundary of the Bienville.

The bedrock in the area is Archean in age, with the exception of a few outcrops of Paleoproterozoic sedimentary rocks of the Sakami Formation, and a few Proterozoic diabase and lamprophyre dykes. Volcano-sedimentary rocks belong to the two oldest units in the area, namely: the Gayot Complex (2.86 Ga) mainly composed of volcanic rocks, and the Garault Complex dominated by sedimentary rocks. Tonalitic rocks belong to three lithodemic suites. The Brésolles Suite (2803 ± 8 Ma) is composed of tonalitic gneiss, the Coursolles Suite mainly consists of hornblende-biotite tonalite and the Favard Suite (2.74 Ga) is essentially composed of massive to foliated trondhjemite. The last two units may be related and form a single continuous suite. Granulitic assemblages located in the northwest and western parts of the area were included in the Du Gué Complex. This unit appears to be a metamorphosed equivalent of a part of the Favard Suite. It also includes younger intrusions belonging to an enderbite-charnockite suite.

Late plutonic suites were also defined. These include the granodioritic and granitic Desbergères, Maurel and Tramont suites, as well as a volumetrically restricted suite of mafic-ultramafic intrusions named the Châteauguay Suite. The Desbergères Suite ($2683 + 4/-2$ Ma), composed of massive granodiorite, may represent the final phase of migmatization of the Coursolles and Favard tonalitic suites. The Maurel Suite (2.68 Ga) is characterized by granodiorites with a megaporphyritic texture and a strong magnetic susceptibility. The granitic Tramont Suite is the youngest Archean unit in the area. It forms plutons and injections that cross-cut all other Archean units. The Châteauguay Suite is younger than tonalitic units, but older than Tramont granites. Its relationship with other late suites could not be established.

The regional metamorphic grade reached the amphibolite facies, except for lithological assemblages in the Du Gué Complex, where metamorphic conditions reached the granulite facies. A mineral retrogression phenomenon, either associated with hydrothermal alteration or with greenschist-facies retrograde metamorphism, has particularly affected volcano-sedimentary rocks, gneisses of the Brésolles Suite and late fault zones.

In the Maricourt area, several phases of deformation successively occurred. Relics of an early D1 phase of deformation are detected in enclaves hosted in Brésolles gneisses and Favard tonalites. Phase D2 is responsible for the regional S2 foliation, which is the most penetrative structural element in the area. This foliation was reoriented and folded by three subsequent phases of deformation. Phase D3 produced N-S to NE-SW folds without schistosity. Phase D4 is characterized by folds oriented WNW-ESE to NW-SE along with a well-developed system of NW-SE faults. Finally, phase D5 is represented by NE-SW thrust faults.

Regional mapping has led to the discovery of several mineral occurrences and showings associated with volcanic rocks, metasediments or ultramafic rocks. Showings associated with volcanic or metasedimentary rocks correspond to disseminated or semi-massive sulphide zones as well as oxide or sulphide-facies iron formations, reaching from a few decimetres to a few metres in thickness. Most of these zones yield anomalous copper values, and more rarely, zinc, cobalt, silver, tungsten or gold values. Mineralized zones associated with ultramafic rocks, and more specifically those encountered in the Gayot volcano-sedimentary Complex, attract our attention. The recent discovery of important Cu-Ni-PGE mineralization by Virginia Gold Mines in the Venus Belt (Gayot area) has outlined the economic importance of this complex. In the Maricourt area, the Moyer and Angilbert South belts consist of sequences assigned to the Gayot Complex. More detailed exploration work is however necessary to fully assess the potential of these newly identified belts that extend for a few tens of kilometres along strike.

Ressources naturelles
Québec