RG 2000-09

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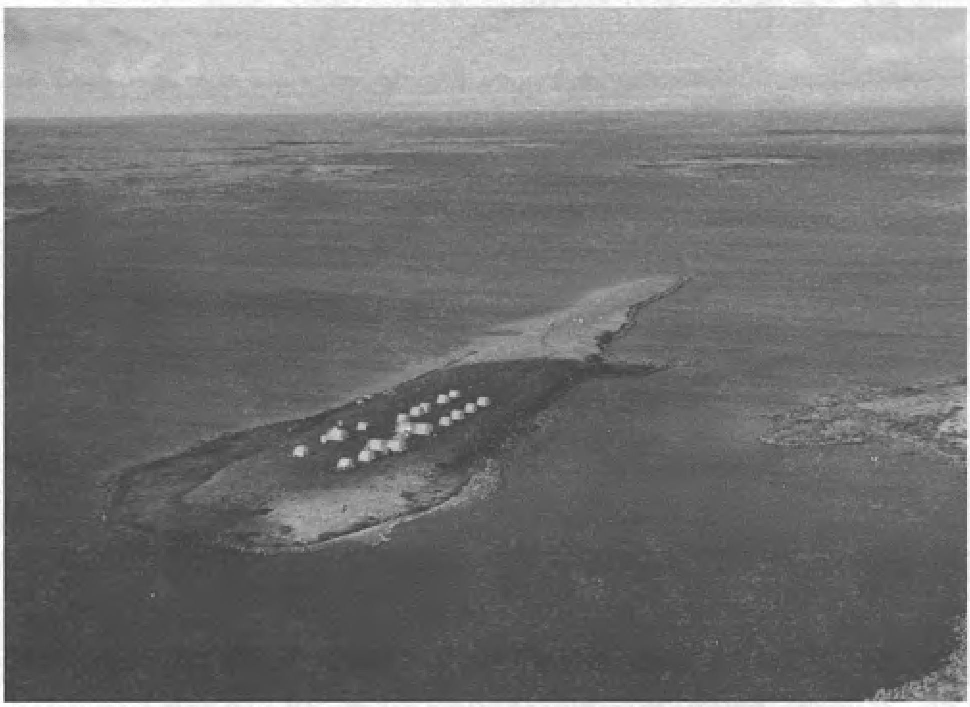
Accompanies maps
SI-34H-C2G-00C and SI-24E-C2G-00C



Lac Nedlouc base camp.

2001

Québec

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ABSTRACT

Fieldwork undertaken during the 1998 summer season in the Lac Nedlouc area was carried out within the framework of the Far North Program, whose main objective is to map the Minto Block in the northeast Superior Province. This work consisted in a geological survey at a scale of 1:250,000 covering NTS sheets 34H and 24E (west part), located between the Rivière aux Feuilles and the Rivière aux Mélèzes, about 250 km southwest of Kuujjuaq.

The Lac Nedlouc area is underlain by Archean rocks belonging to the Tikkerutuk, Lac Minto, Goudalie and Utsalik lithotectonic domains. A lithodemic subdivision is proposed in order to establish the stratigraphy of rocks in the area, while still maintaining the notion of lithotectonic domain. This approach has led to a better definition of the stratigraphic framework and enabled us to make correlations with previous studies. Supracrustal rocks are found within the Duvert and Dupire complexes. The Duvert Complex contains four informal units: basalts, andesites, paragneisses and ultramafic rocks. All four units are strongly metamorphosed. They form dislocated remnants bounded by shear zones and syn- to late tectonic intrusions. Some of these remnants extend over several kilometres; they form the Duvert, Natuak and Morrice belts. The Dupire Complex includes five remnants of volcanic rocks, iron formations and paragneisses that form the Dupire belt. As for intrusive rocks, they form lithodemic suites either restricted to a single domain (Rivière aux Mélèzes (Goudalie), Charnière (Lac Minto), Lippens (Tikkerutuk) and Monchy and Suluppaugalik (Utsalik)), or present in more than one lithotectonic domain (Rivière aux Feuilles, Bacqueville, Morrice, La Chevrotière, MacMahon).

Metamorphosed rocks of the Lac Nedlouc area reflect a complex tectono-metamorphic evolution marked by the presence of numerous pre- to post-tectonic intrusions, in addition to several phases of deformation which resulted in the dismemberment of supracrustal belts. The distribution pattern of lithological units illustrates a complex structural setting that includes five phases of ductile deformation (D_1-D_5), and one phase of brittle deformation (D_6). An episode of granulite-facies metamorphism (M_1) is outlined by the presence of orthopyroxene in certain lithologies. A second metamorphic episode (M_2) is represented in diatexites of the Rivière aux Mélèzes Suite by a metamorphic assemblage composed of andalusite, cordierite, sillimanite and garnet, indicating metamorphic conditions at the amphibolite facies at pressures below 3.5 kbars. Local reactivation to granulitic conditions (M_2+) is suggested by the production of undeformed mobilizate containing orthopyroxene-clinopyroxene-hornblende.

The area shows promising mineral potential outlined by the discovery of several new mineral occurrences in the Duvert, Morrice and Natuak belts. Mineralizations were observed in four different geological settings: silicate and/or oxide-facies iron formations intercalated with paragneisses and metavolcanic rocks (1.3 g/t Au); siliceous horizons associated with mafic metavolcanic rocks (220 ppb Au; 0.85% Cu); horizons located at the interface between ultramafic rocks and mafic metavolcanic rocks (0.18% Cu, 270 ppb Au, 2.6 ppm Ag); late quartz-rich cataclasite zones (130 ppb Au, 0.16% Pb, 0.11% Zn).

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INTRODUCTION

The Archean rocks of the northeast Superior Province cover more than 250,000 km^2 in northern Québec. However, due to their remote location, regional mapping and exploration work has covered only very restricted portions of these rocks. Géologie Québec therefore launched in 1998 an important mapping program of Québec's Far North region (north of the 55th parallel) in order to open up this vast relatively unknown territory to mining exploration. The objectives of the Far North Program are to build a geological framework at a scale of 1:250,000 and to highlight geological settings most favourable to the discovery of new showings. This initiative undoubtedly represents the most ambitious regional geological mapping program undertaken in North America. The work is to be carried out by a multidisciplinary team which groups geologists from Géologie Québec and outside collaborators, specialized in geological mapping, structural geology, metallogeny, geochronology, geochemistry and geophysics. Collected data will be used to define the nature, origin and geological evolution of the Minto Block in the northeast Superior Province, and to outline the most interesting sectors in the search for mineral occurrences.

A geological survey was conducted, during the summer of 1998, in the Lac Nedlouc area within the framework of the Far North Program. The area, located between the Rivière aux Feuilles and the Rivière aux Mélèzes, covers the central part of the Minto Block, in NTS sheets 34H and 24E (Figure 1). It covers portions of the Tikkerutuk, Lac Minto, Goudalie and Utsalik domains (Figure 2), as defined by Percival and Card (1994) based on aeromagnetic and lithological criteria. The 1998 fieldwork allowed a better definition of the nature of these domains and the modification of the lithotectonic subdivision of the Minto Block in the study area.

This report presents the results and interpretations obtained from geological surveys carried out in the Lac Nedlouc area (34H) and in the western part of the Lac Aigneau area (24E). It takes into account the mapping carried out by Percival and Card (1994) in the northwest part of the Lac Nedlouc area and work by Lamothe (1997) in the Lac Dupire area, located in the southeast part of our map area.

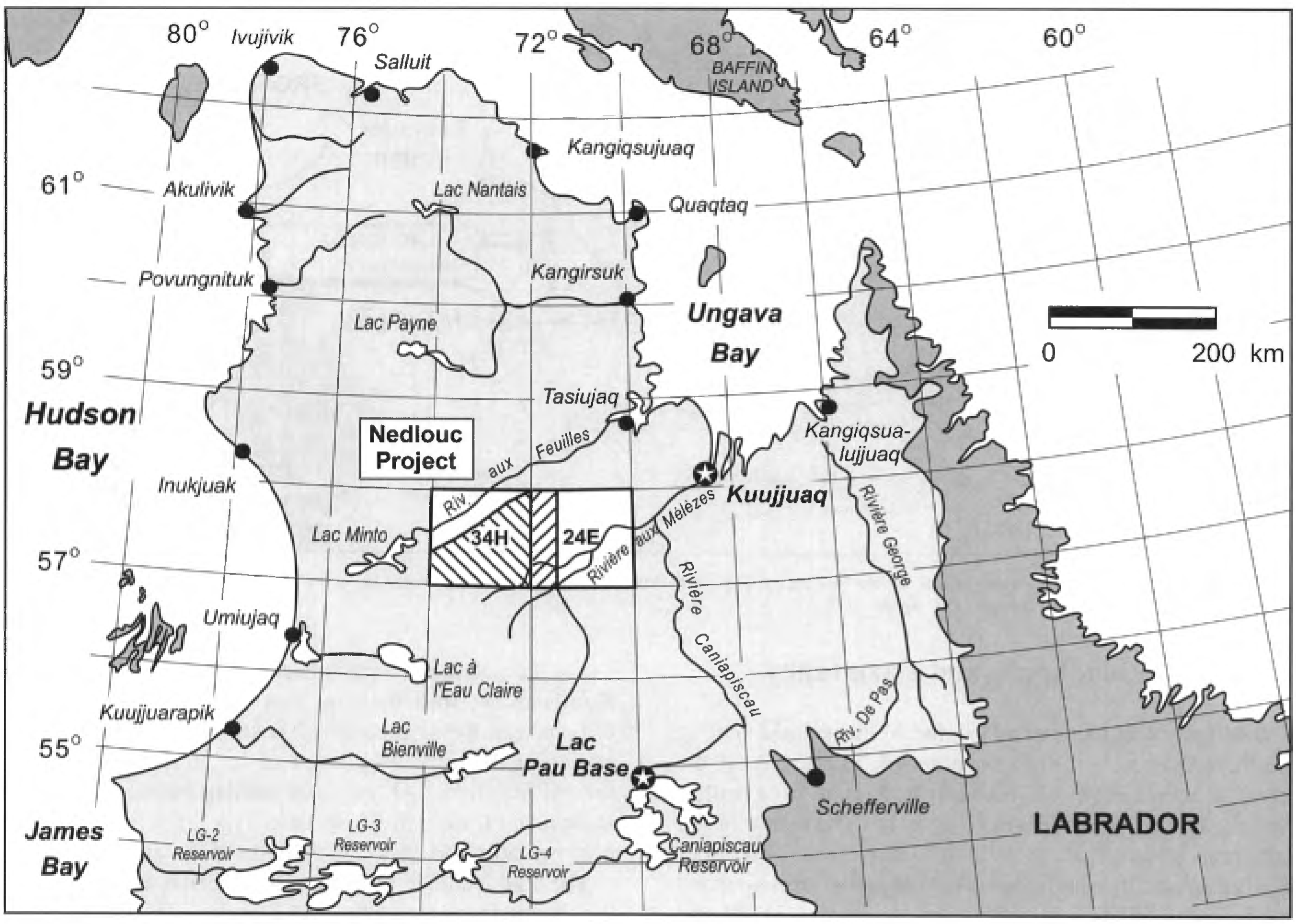

FIGURE 1 - Location of the Lac Nedlouc area.

FIGURE 2 – Lithotectonic subdivision of the northeast Superior Province (modified from Percival *et al.*, 1997b), and location of recent geological mapping projects in the Far North.

Location, Access and Topography

The Lac Nedlouc area is located in an isolated part of northern Québec, in the heart of Nunavik. It is located in the central Ungava Peninsula, between the Rivière aux Feuilles, and the Rivière aux Mélèzes (Figure 1). The centre of the map area is located about 250 km southwest of the town of Kuujjuaq, near the south shore of Ungava Bay. It is bounded by latitudes 57°00' and 58°00' and longitudes 71°30' and 74°00', and covers a total surface area of about 16,600 km^2.

The Lac Nedlouc area is accessible by floatplane from Kuujjuaq or from the Lac Pau base, located near the Caniapiscau Reservoir some 300 km further south. Water bodies in the area are cleared of ice, for water landings around mid-June. At least two landing strips, suitable for short take off aircraft (Twin Otter type), are present in the northernmost and easternmost parts of the area.

The Lac Nedlouc area straddles the boundary between the forested tundra and the arctic tundra. The treeline runs across the area near Lac Nedlouc, and follows the Rivière aux Feuilles towards the northeast. Forests, composed of black spruce and tamarack, are generally open and restricted to valley bottoms. Topographic relief is low to moderate, with altitude variations on the order of 130 to 420 metres above sea level. River valleys along major rivers are fairly deep, producing nearly 300 metres of denivellation. Outcrops are numerous and generally large. They are covered by lichen, which imparts a uniform dark colour regardless of the lithology present. The north-central part of the area is covered by important glacial deposits characterized by *felsenmeers* covering several tens of square kilometres.

Methodology

Fieldwork in the Lac Nedlouc area took place over a period of 11 weeks. The mapping survey was carried out by six geologists during the first half of the field season, and by five geologists during the second half. Mapping teams, each composed of a geologist and an assistant, were transported in the field by a 206-L Long Ranger helicopter from the base camp situated on the shores of Lac Nedlouc, in the centre of the area. Geological mapping was conducted along traverses varying between 8 to 15 km long, spaced every 4 to 10 km depending on the complexity of the geology and the density of outcrops. Particular attention was paid to areas where belts of volcano-sedimentary rocks were present. Helicopter spot checks of nearly 150 sites completed the mapping coverage. The geological interpretation was made using topographic base maps at 1:125,000, and incorporated aeromagnetic and remote sensing data, which was later compiled at 1:250,000. The geological map of the Lac Nedlouc area, as well as the collected field data, are included in the SIGÉOM digital database of the Ministère des Ressources naturelles du Québec.

During the course of the fieldwork, about 1,550 rock samples were collected and cut for more detailed studies. Among the most representative samples, 102 were selected for whole rock analyses and 229 for assays. All the analytical results are available through the SIGÉOM database. A total of 150 samples were used to make thin sections. Ten samples were collected to date major geological events, either through the U-Pb method and/or the Pb-Pb method. The geochronology project of the Far North Program is headed by Jean David at the GÉOTOP laboratory of the Université du Québec à Montréal.

Previous Work

During the 1998 summer season, Géologie Québec carried out three geological surveys at a scale of 1:250,000 in the northeast Superior Province (Figure 2). Before 1998, geological information on the Far North was essentially based on reconnaissance maps dating back to the 1950s and 1960s (Eade, 1966; Stevenson, 1968), as well as geological maps produced during the 1990s in certain restricted areas (Percival and Card, 1994; Percival *et al.*, 1995, 1996, 1997a; Lamothe, 1997). The geological map covering the Lac Nedlouc area includes the map at 1:50,000 scale by Lamothe (1997) of the Lac Dupire area, and the map at 1:500,000 scale by Percival and Card (1994) covering the area along the Rivière aux Feuilles (Figure 2). The remainder of the area is covered by the reconnaissance survey at 1:1,000,000 scale by Stevenson (1968). The latter was based solely on information collected along pre-determined flight lines with observation sites spaced every 10 km or so.

Within the framework of the Far North Program, the Lac Nedlouc area was covered by a lake sediment geochemistry survey (MRN, 1998), conducted by SIAL during the summer of 1997, and funded by the MRN and five industry partners. A total of 1,287 samples were collected in this area, which corresponds to an average spacing of about 3.5 km between each sampling site. The results reveal several interesting anomalies which could represent exploration targets. A few of these coincide with aeromagnetic anomalies and geological assemblages such as volcano-sedimentary belts (Labbé *et al.*, 1999).

Since 1993, the Lac Nedlouc area has been the focus of exploration work conducted by Soquem, Cambior, Cominco and Falconbridge. Reports submitted as assessment work mention the promising mineral potential, namely for gold, base metals and uranium in several locations within the area (Chapdelaine, 1995, 1996; Quirion, 1999). Based on the results obtained last summer, a few companies are continuing their exploration programs in the area.

Acknowledgements

The authors of this report wish to thank the members of the mapping crew, Chantal Bilodeau, Marianne Bonnay, Julien Davy, Éric Gauthier, Jean-Yves Labbé, Edith Martel, Simon Paquet, Patrice Lampron, Pauline Saunders and Bruce Qinuajuak, who proved to be conscientious collaborators and efficient workers. Our chef, Alexandre Bouffard, succeeded in maintaining a good team spirit by providing exceptional meals. Jolyn Hébert demonstrated remarkable talent as our camp manager by carrying out impeccable work throughout the field season. Digital geological maps were integrated into SIGÉOM thanks to the indispensable technical assistance of Christian Garneau, Jacques Fournier and Nelson Leblond. The cooperation of Denis-Jacques Dion and Denis Lefebvre was greatly appreciated in the preparation of aeromagnetic maps for our fieldwork. Les Entreprises Hélicoptères Canadiens provided efficient and safe transportation between the base camp and the field traverses thanks to their pilots Martin Massicotte and Arliss Thivierge, and to their mechanics Serge Blouin and Guy Labelle. Airline companies Johnny May's Air Charter Ltd., Air Saguenay inc. and Air Inuit Ltd. provided prompt

transportation of supplies and materials. The Service des technologies à référence spatiale produced regional spatiomaps from Landsat images, which we used in our fieldwork.

REGIONAL GEOLOGY

The Lac Nedlouc area is located in the heart of the Minto Block, in the northeasternmost part of the Superior Province. The Minto Block is mainly composed of high-grade metamorphic rocks and plutonic rocks. It is characterized by high-relief magnetic anomalies oriented NNW-SSE. It is bounded to the east by Paleoproterozoic rocks of the Labrador Trough (New Québec Orogen) and to the north and west by rocks equivalent to the Ungava Trough (Trans-Hudson Orogen). To the south, plutonic rocks of the Bienville Subprovince are present as well as granulitic rocks of the Ashuanipi Subprovince. The Minto Block may be subdivided into different lithotectonic domains based on lithological, structural and aeromagnetic criteria (Percival *et al.*, 1997b) (Figure 2). These domains, comprised of geological assemblages of various compositions and various ages, may extend over several hundred kilometres. In terms of diversity and scale, most domains are comparable to subprovinces in the southern part of the Superior (Card and Poulsen, 1998). They mainly consist of diverse plutonic rocks, which host numerous well-preserved volcano-sedimentary sequences. Plutonic complexes are essentially composed of tonalite, granodiorite, diatexite and granite, with enclaves and intrusions of diorite, gabbro and pyroxenite. These rocks are massive, foliated or gneissic and form two major intrusive suites: hornblende-biotite granitoids and pyroxene-bearing granitoids. Granitic and charnockitic bodies are generally associated with vast (40-100 km wide) positive aeromagnetic anomalies, whereas volcano-sedimentary sequences are confined to narrow troughs (10-20 km). These sequences are composed of basalt, greywacke, iron formation, tuff, and minor quantities of rhyolite, sandstone, conglomerate and ultramafic rock. Locally, m-scale beds of calcitic and dolomitic marbles may be traced over nearly one kilometre. Metamorphism of the supracrustal sequences varies from the upper greenschist facies to the granulite facies.

Work by Percival *et al.* (1991, 1992) along the Rivière aux Feuilles generated the first subdivision which helped establish boundaries and define the lithological characteristics of the Tikkerutuk, Lac Minto, Goudalie and Utsalik domains. More recent work (Percival *et al.*, 1994, 1996, 1997b) helped identify additional lithotectonic domains, namely the Inukjuak, Philpot, Qalluviartuuq, Lepelle and Douglas Harbour domains. These are defined by distinct magnetic signatures and contrasting lithological, structural and metamorphic features. Although each domain is characterized by its own type-lithologies, the transitions between domains are not clearly understood. The absence of observable tectonic boundaries in the field between the various lithotectonic domains may be due to the emplacement of a large volume of granitoid intrusions at *ca.* 2725 Ma (Machado *et al.*, 1989; Stern *et al.*, 1994), subsequent to the juxtaposition of these domains. Ductile-brittle structures appear to mark the boundaries of the Tikkerutuk and Lac Minto domains, where cataclasite and mylonite zones are observed.

The Minto Block is interpreted as an amalgamation of lithotectonic domains of various origins and ages that were juxtaposed early in their tectonic evolution. Structural relationships between the various lithotectonic domains are difficult to decipher due to the presence of voluminous granitoid intrusions which have largely obliterated contact zones. The regional structural trend, oriented NNW-SSE, reflected by the configuration of aeromagnetic anomalies, is attributed to the distribution of granitic and charnockitic bodies, which were probably emplaced along pre-existing structures. Thematic studies on the age, composition and origin of supracrustal and plutonic rocks were undertaken in order to trace the regional geotectonic evolution and to establish the relationship between the various plutonic complexes and the volcano-sedimentary belts.

STRATIGRAPHY

The nomenclature used to describe the various lithologies is partly based on notions of the North American Stratigraphic Code (DV 86-02, 1986) which may be applied, with more or less success, to metamorphic rocks. The Lac Nedlouc area is underlain by several Archean lithodemic units and one Proterozoic unit. In order to establish valid correlations between our lithodemic legend and previous work by the Geological Survey of Canada, we decided to maintain the notion of lithotectonic domain used by Percival *et al.* (1992). For each of these domains, we generated a lithodemic subdivision for supracrustal rocks and for intrusive suites restricted to a single domain. However, intrusive rocks present within more than one domain were divided into lithodemic units common to several domains. The Rivière aux Feuilles Suite for example, occurs within the Lac Minto, Goudalie and Tikkerutuk domains. It will therefore be described as an intrusive suite that transcends more than one domain. The description of the various lithologies observed in the Lac Nedlouc area will be divided into five sections: the four lithotectonic domains, which are the (1) Goudalie, (2) Lac Minto, (3) Tikkerutuk and (4) Utsalik, and (5) the intrusive suites that transcend more than one domain.

Goudalie Domain

The Goudalie Domain is characterized by a relatively weak magnetic signature containing a series of linear aeromagnetic anomalies oriented NNW-SSE (Figure 3). It is distinguished from other domains by the presence of numerous remnants of supracrustal rocks hosted in a series of plutonic rocks including granodiorites, tonalites, diatexites and granites. In the Lac Nedlouc area, the Goudalie Domain contains three volcano-sedimentary belts: the Duvert, Natuak and Morrice belts. In fact, these belts constitute a group of discontinuous supracrustal rock remnants metamorphosed to the amphibolite and granulite facies. They contain mafic to felsic metavolcanic rocks, iron formations, paragneisses and ultramafic rocks. In our attempt to establish correlations at the scale of the entire Goudalie Domain and to simplify the lithological description of the various units, these volcano-sedimentary belts were grouped within the Duvert Complex (Advt). Consequently, all the supracrustal rocks in the Goudalie Domain are included within this complex. Also, in order to simplify the description of the various units, the prefix "meta" was abandoned, given the fact that all the rocks in the area are metamorphosed to the granulite or amphibolite facies.

The Rivière aux Mélèzes Suite (Aram), composed of diatexite, constitutes the only suite exclusive to the Goudalie. Suites of tonalite, granodiorite, granite and gabbro-diorite, non-exclusive to the Goudalie, will be dealt with in the section describing intrusive suites common to more than one domain.

Duvert Complex (Advt)

The Duvert Complex constitutes a new lithodemic unit named to designate supracrustal rocks of the Goudalie Domain (Figure 4). Rocks belonging to this complex are subdivided into four informal units: basalts, andesites, paragneisses and ultramafic rocks. These units form km-scale remnants bounded by shear zones and late tectonic intrusions.

Basalts (Advt1)

The Duvert Complex is composed of mafic gneisses associated with intermediate gneisses, paragneisses and iron formation units. Lithogeochemistry data and the association of these gneisses with supracrustal rocks such as felsic pyroclastic rocks, paragneisses and iron formations, suggest a volcanic origin. In this report, the term basalt is used to describe mafic gneisses interpreted as having a volcanic origin.

Basalts are composed of ten-metre to one-kilometre thick amphibolite bands that are more or less continuous, which contain m-scale (or smaller) horizons of andesites, felsic rocks, paragneisses, iron formations and ultramafic rocks. Basalts are dark green and fine to medium-grained. They have a granoblastic texture and are mainly composed of olive green to brownish green hornblende, plagioclase, clinopyroxene and orthopyroxene in variable proportions. Plagioclase forms polygonal grains, indicating intense deformation and recrystallization. Hornblende is present as nematoblastic crystals parallel to the regional foliation, whereas certain pyroxenes have a poikiloblastic texture and contain polygonal plagioclase inclusions similar to those found in the basalt groundmass. The presence of these inclusions within pyroxenes suggests that poikiloblastic growth postdates the development of the granoblastic texture. Accessory minerals are magnetite, titanite and apatite.

The basalt unit is composed, on the one hand, of homogeneous massive amphibolite horizons which probably represent massive flows, and on the other hand, of intermediate to mafic horizons with a banded aspect resembling a tuff sequence. However, since the low viscosity of basaltic magma does not allow the production of important volumes of mafic tuffs, these banded horizons are rather interpreted as strongly deformed and metamorphosed sequences of pillowed basalts. The banding is caused by alternating bands of plagioclase+hornblende±clinopyroxene ±orthopyroxene with layers of plagioclase+clinopyroxene+ orthopyroxene. In high-grade metamorphic terrains as well as in shear zones, the transformation from pillowed basalts to this type of banded gneiss is frequently observed. Pillow selvages were observed in a few locations where the basalts are better preserved. The metamorphic grade within the various volcano-sedimentary belts of the Duvert Complex varies from the amphibolite facies to the granulite facies. This variation is indicated by the presence or absence of orthopyroxene in basalts. Where the metamorphic grade reaches the granulite facies, the latter may contain up to 20 % orthopyroxene and clinopyroxene-bearing mobilizate, present as aggregates parallel to the regional foliation. This foliation is also defined by a tectono-metamorphic layering, as well as by the alignment of hornblende and pyroxene grains.

Andesites (Advt2)

The type of information used to determine the volcanic origin of mafic gneisses (basalts), namely the lithological associations and the lithogeochemistry, may also be used for intermediate gneisses. The term andesite is used to designate these intermediate gneisses. These rocks occur within the basaltic unit, but also as km-thick bands that form distinct units. Andesites are mesocratic rocks that contain the following mineral phases: plagioclase, hornblende, brown biotite, clinopyroxene, quartz ± orthopyroxene. The rock is medium greenish grey with a bluish tinge. It is fine to medium-grained and has a granoblastic texture. Andesitic rocks are distinguished from basalts by the predominance of clinopyroxene at the expense of orthopyroxene, a less intense colour, a slightly bluish tinge of the weathered surface, the presence of quartz, as well as a larger quantity of felsic layers. They are composed, on the one hand, of relatively homogeneous horizons without much compositional variation, and on the other hand, of banded horizons formed of intermediate and felsic layers. These layers either represent tuffaceous horizons or tectonic banding. Local plagioclase porphyroclasts suggest the presence of phenocryst relics. Homogeneous intermediate horizons are composed of hornblende, clinopyroxene and orthopyroxene, whereas more felsic layers, dacitic to rhyolitic in composition, contain a matrix formed of quartz, plagioclase and less than 10 % mafic minerals. Andesites contain between 5 and 25 % orthopyroxene and clinopyroxene-bearing mobilizate in the form of migmatitic layers parallel to the main foliation.

Paragneisses (Advt3)

The paragneisses of the Duvert Complex occur as m-scale to km-scale bands that may extend for up to 20 km along strike. They are generally observed within volcano-sedimentary belts, in close association with basalts, andesites and iron formations. Paragneisses are also present in diatexites as enclaves one centimetre to ten metres in size and as remnants several kilometres in length. The paragneiss unit includes all metasediments, migmatized or not, that contain less than 50 % mobilizate. Consequently, metatexites representing the product of the migmatization of sedimentary rocks are included in the paragneiss unit. Transitional contacts, frequently observed between the paragneisses and the diatexites, reflect a gradual increase in the degree of partial melting. Despite the fact that the paragneisses were not subdivided, the percentage of partial melting was noted at each outcrop. Paragneisses are generally greyish brown to rusty brown. Principal mineral components include plagioclase, quartz, biotite, garnet, cordierite (Appendix 1, Photo 1) and in minor quantities, microcline, sillimanite and andalusite. Cordierite often appears altered; it is either slightly sericitized or completely replaced by pinite. Cordierite commonly contains quartz, plagioclase and biotite inclusions whereas poikiloblastic garnets contain inclusions of quartz, plagioclase, biotite, zircon, sillimanite, magnetite and cordierite. Reddish biotite is oriented parallel to the regional foliation. The mineral assemblage sillimanite-andalusite-cordierite indicates low-pressure (< 3.8 kbars) metamorphic conditions at the amphibolite facies. The metamorphic mineral sequence appears to be as follows: biotite, followed by cordierite-andalusite-sillimanite, and garnet. The metamorphism generated granitic composition leucosomes with cordierite, garnet, sillimanite and andalusite. The proportion of leucosomes in the rock may vary between 5 and 50 %. They form mm-scale to cm-scale migmatitic layers, and have a heterogranular texture due to the variable and coarse grain size of quartz, microcline (orthoclase) and plagioclase crystals.

In places, paragneisses form impressive rusty horizons over several tens of metres wide, visible in aerial view. These zones are generally the result of biotite alteration and/or the alteration of disseminated pyrite and pyrrhotite. However, it must be pointed out that some of these rusty horizons are associated with intense deformation zones where the protolith is difficult to identify. Some of these zones were visited in the field, but they did not yield economic grades in precious or base metals. The paragneisses also contain iron formation horizons and a few layers of calc-silicate rocks. These rocks also form rusty horizons, some of which contain anomalous gold values. Iron formation horizons, one to ten metres thick, are generally represented by the silicate and oxide facies. The silicate facies is composed of cm-scale layers of grunerite, garnet-clinopyroxene-orthopyroxene and quartz (metachert). The mineralization, mainly composed of pyrrhotite, pyrite, arsenopyrite and magnetite, is present both as mm-scale to cm-scale massive bands, and as disseminations. The rock has a dark grey-green colour on fresh surface but alters to a rusty brown. The oxide facies is characterized by the presence of mm-scale to cm-scale laminations of magnetite and quartz (metachert). Magnetite horizons are bluish grey to black whereas metachert layers are whitish. The banding observed in this facies probably reflects the primary bedding, albeit largely modified by metamorphism and deformation.

Ultramafic rocks (Advt4)

The ultramafic rocks observed in the Duvert Complex are frequently associated with volcanic rocks. The ultramafic rocks are deformed, and the contacts between basaltic and ultramafic rocks are parallel to the regional foliation. The geochemistry of these ultramafic rocks appears to indicate the presence of both komatiitic flows, which may be genetically related to the basaltic rocks, and distinct sills (see section entitled "Lithogeochemistry"). The ultramafic rock unit (Advt4) contains variable proportions of pyroxenite, peridotite, dunite and hornblendite which occur as horizons, lenticular bodies and dykes. This unit is not shown in Figure 4, given the low volume of rocks of this unit. The degree of deformation, which varies from one location to the other, is responsible for the various textures observed in the ultramafic rocks (Appendix 1, Photo 2). Ultramafic rocks are generally dark green to black on fresh surface, but alter to a buff-brown colour. Pyroxenites are formed of orthopyroxene, clinopyroxene, hornblende, minor interstitial plagioclase and small disseminated crystals of sulphide, magnetite and spinel. The igneous origin of certain pyroxene crystals is illustrated by the presence of well-developed Schiller structures. The deformation of pyroxenites is marked by the presence of recrystallized material containing granoblastic pyroxene and amphibole. Other minerals occur as aggregates composed of talc, carbonate, phlogopite, and disseminated iron oxides. Peridotites are composed of variable proportions of olivine, orthopyroxene and clinopyroxene. Pyroxenes generally occur as large well-preserved crystals, whereas olivine is fractured and is generally serpentinized to varying degrees. Compared to pyroxenites, peridotites contain larger

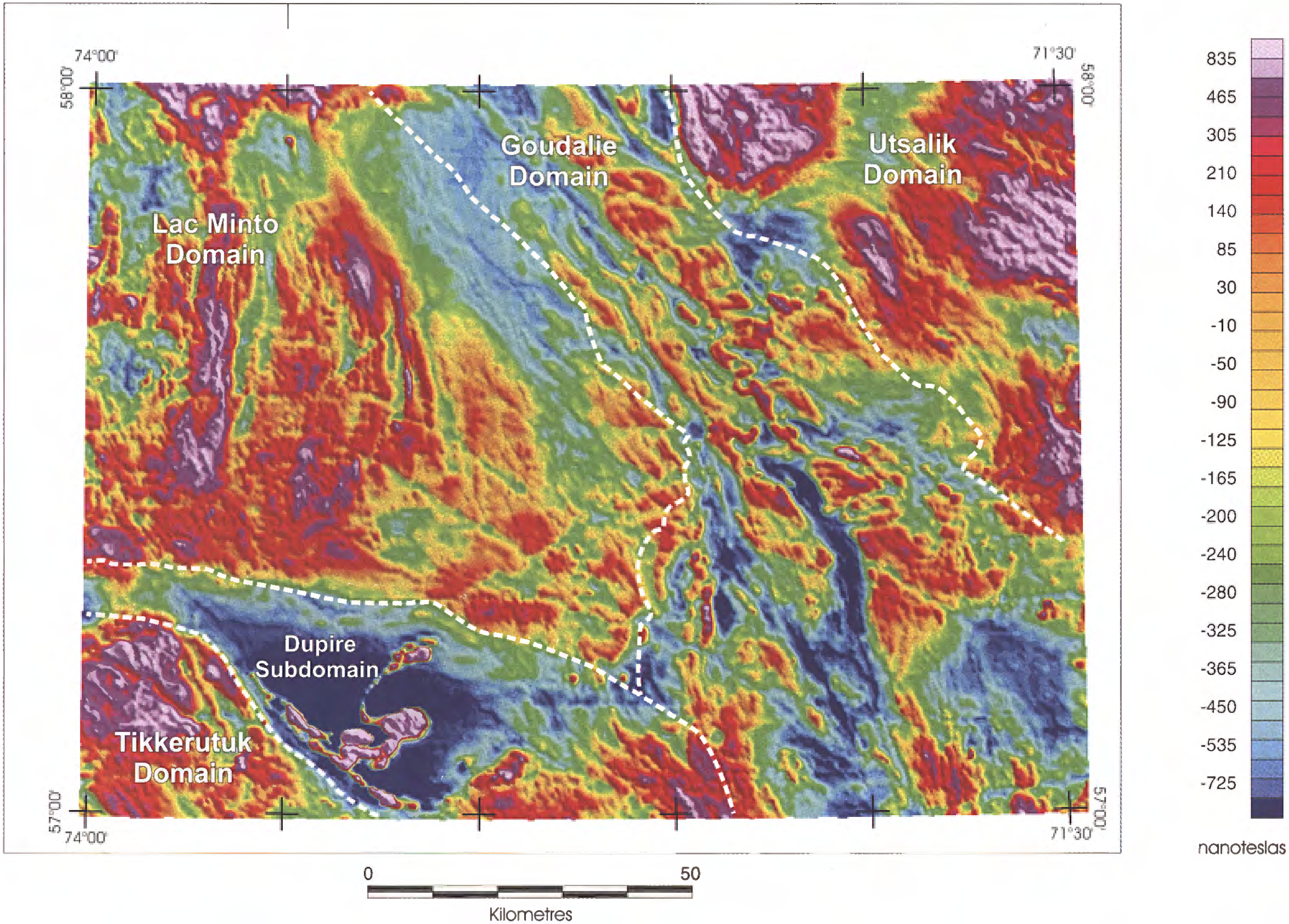

FIGURE 3 – Shaded total residual magnetic field, and boundaries of lithotectonic subdivisions in the Lac Nedlouc area (NTS sheets 34H and 24E, west part).

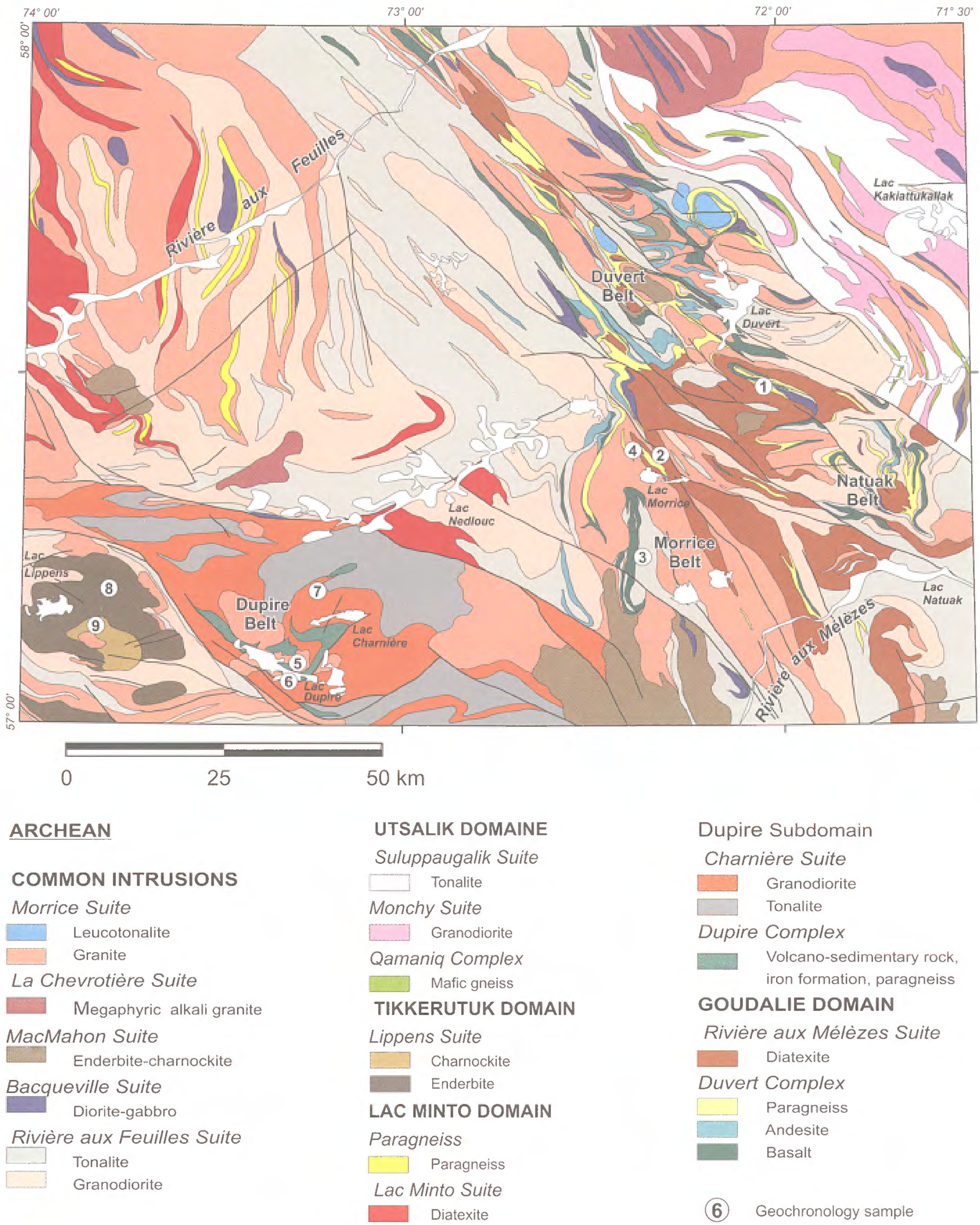

FIGURE 4 – Simplified geological map of the Lac Nedlouc area.

quantities of dark green spinel, sulphide and magnetite. The effects of deformation and recrystallization of peridotitic rocks are shown by the development of a granoblastic texture, the flattening of olivine crystals, the development of serpentinized zones and of magnetite trains, all parallel to the regional foliation. Peridotites locally contain fractures filled with carbonates and prehnite suggesting late hydrothermal activity at low temperatures. Dunites are almost exclusively composed of large olivine crystals, with minor quantities of orthopyroxene, clinopyroxene and amphibole. Dunites are characterized by abundant dark green spinel and magnetite. Deformed dunites feature zones of serpentinization and trains of magnetite grains.

Rivière aux Mélèzes Suite (Aram)

The Rivière aux Mélèzes Suite was established to designate diatexites in the Goudalie Domain. According to the definition proposed by Brown (1973), the term diatexite is used to describe migmatized rocks where the proportion of material derived from partial melting exceeds 50 % of the volume of the rock. Diatexites therefore represent migmatites where a high degree of partial melting has generated important volumes of rock. However, diatexites cannot be defined solely on the proportion of material generated through anatexis. Sawyer (1996) narrowed down the definition of diatexites based on certain textural and structural observations in this lithology. He noted an increase in the grain size, a heterogeneity at a macroscopic scale and the development of flow structures that obliterate pre-migmatization structures (bedding or tectonic fabric). These structures are preserved only in the residual enclaves (Sawyer and Barnes, 1988).

Diatexites of the Rivière aux Mélèzes Suite mainly occur between Lac Duvert and Lac Natuak (Figure 4). The type-locality for this unit is located 12 km SSW of Lac Duvert, at outcrop MP-98-1079 in the SIGÉOM database (UTM coordinates: NAD 83, zone 18; 669377E, 6370749N). Rocks of the Rivière aux Mélèzes Suite display the same overall characteristics as diatexites described in the Ashuanipi Subprovince (Percival *et al.*, 1992; Leclair *et al.*, 1998; Lamothe *et al.*, 1998) and in the Minto Block (Percival *et al.*, 1991). The rock is yellowish grey and takes on a rusty brown colour when the biotite content increases. At a macroscopic scale, the grain size, texture and composition of diatexites is quite variable. The relative proportions of plagioclase, potash feldspar (orthoclase and microcline) and quartz are variable. The presence of large feldspar crystals surrounded by small feldspar and quartz crystals gives the rock a porphyritic texture. Diatexites are generally composed of a neosome, coarse-grained leucocratic phase, and a paleosome, relatively fine-grained mesocratic phase. The coarse grain size of the neosome gives the rock a heterogeneous, disorganized and poorly crystallized aspect. The composition of the neosome varies from monzogranitic to granodioritic. The neosome contains the following metamorphic assemblage: biotite+garnet+cordierite +andalusite+sillimanite (Appendix 1, Photo 3). Greenish spinel is locally observed as inclusions in sillimanite. Poikiloblastic garnets contain quartz, plagioclase, biotite, cordierite, magnetite and sillimanite inclusions. The neosome also contains good quality zircons of variable morphology and colour. Plagioclase is sometimes sericitized, whereas biotite, and locally garnet, are partially retrograded to chlorite. The Rivière aux Mélèzes Suite may be distinguished from diatexites of the Lac Minto Domain (Amin) by the absence of orthopyroxene, clinopyroxene and hornblende.

The neosome contains one-metre to ten-centimetre size enclaves of paragneiss, and more rarely, of mafic to intermediate gneiss. Biotite and sillimanite concentrations form mm-scale schlieren that define an undulating foliation wrapping around garnet porphyroblasts and large feldspar grains. The foliation is generally quite variable on outcrop scale. However, the general trend of this foliation is coherent with the regional foliation observed in non-migmatized rocks. This more or less developed fabric most likely represents flow structures that developed during the generation and emplacement of diatexites.

Field observations lead us to conclude that the diatexite masses have gradual contacts with granite and granodiorite bodies. This gradual transition is observed between heterogeneous diatexites and homogeneous granodioritic or granitic rocks. Based on these observations, at least part of these granites and granodiorites may represent more evolved magmas derived from the diatexites.

Lac Minto Domain

The Lac Minto Domain is characterized by a series of magnetic anomalies oriented N-S to NNW-SSE (Figure 3). These anomalies are related to a heterogeneous lithological assemblage, mainly igneous in origin, which includes paragneiss remnants (Percival et al., 1991). The principal igneous rock types consist of several pre- to late metamorphic intrusive suites including orthopyroxene-biotite granodiorites, hornblende-biotite granodiorites, orthopyroxene-biotite diatexites and biotite-hornblende granites. Results of studies conducted over the past year lead us to propose a new subdivision for the Lac Minto Domain. The most important subdivision is the Dupire Subdomain, which comprises the southern part of the Lac Minto Domain (Figure 3). However, since the relationship between the Dupire Subdomain and adjoining lithotectonic domains remains obscure, we will consider this subdomain as being part of the Lac Minto Domain. The various units that make up the Dupire Subdomain are the Charnière Suite and the Dupire Complex, whereas the Lac Minto Domain is composed of the Lac Minto Suite and of undivided paragneisses.

Dupire Subdomain

Lamothe (1997) considered the supracrustal rocks of the Dupire belt as part of the Lac Minto Domain, based on a lithological comparison with rocks of the Kogaluc belt. However, rocks of the Lac Dupire area differ fundamentally from those of the rest of the Lac Minto Domain, specifically concerning their low and uniform magnetic signature which contrasts with the high and irregular signature of orthopyroxene-bearing granitoids throughout the Lac Minto Domain. The weak magnetic intensity of rocks in this area may be explained by the presence of compositionally distinct granitoids, and by amphibolite-facies metamorphism, as opposed to granulitic conditions that prevail throughout the Lac Minto Domain. Rocks of the Lac Dupire area are bounded to the north by the ductile-brittle Nedlouc structure which marks its limit with the Lac Minto Domain, and to the south by the Dupire ductile-brittle structure which marks its limit with the Tikkerutuk Domain. For these reasons, it is proposed that rocks of the Lac Dupire area form a distinct entity: the Dupire Subdomain. This subdomain is composed of two lithodemic units: the Dupire Complex (Adpr) and the Charnière Suite (Achn).

Dupire Complex (Adpr)

The Lac Dupire area, located in the southeast quadrant of NTS sheet 34H, is composed of weakly foliated intrusive rocks that host well-preserved supracrustal rock remnants. Lamothe (1997) introduced the name Lac Dupire volcano-sedimentary zone (LDVZ) for the supracrustal rock remnants. In order to maintain a certain homogeneity in the nomenclature of these rocks, the term Dupire Complex is used here to describe rocks of volcano-sedimentary origin found within this area. These rocks contrast with the granitoids due to their strong magnetic signature. Given the fact that they had already been mapped at a scale of 1:50,000 (Lamothe, 1997), fieldwork conducted last summer only partly focussed on the volcano-sedimentary rocks. Thus, the description of the various units is largely based on work by Lamothe (1997). In order to reproduce the principal volcano-sedimentary units on the map at a scale of 1:250,000, the various units described by Lamothe (1997) were grouped into four informal units: 1) paragneisses, 2) iron formations, 3) undivided volcanic rocks, and 4) undivided volcano-sedimentary rocks. As opposed to most supracrustal rocks in the Goudalie Domain (Duvert Complex) metamorphosed to the granulite facies, units in the Dupire Complex are metamorphosed to the amphibolite facies.

Paragneisses (Adpr1)

Paragneisses (Adpr1) of the Dupire Complex form two distinct assemblages. The first consists of about 70 % granoblastic quartz with a variable biotite content, 5-15 % porphyroblastic hornblende and 2-5 % poikilitic garnet. The second is characterized by the predominance of biotite and the absence of hornblende (Lamothe, 1997). Lamothe suggested that the hornblende-bearing paragneiss was derived from a lithic wacke, whereas the hornblende-free paragneiss represents a more argillaceous detrital facies. The two paragneiss assemblages are light grey on fresh surface and have a medium grey weathered surface. Lamothe (1997) reports a post-metamorphic hydrothermal alteration episode which transformed the plagioclase into sericite, and the biotite into chlorite.

Iron Formation (Adpr2)

Mapping conducted by Lamothe (1997) had made it possible to subdivide the various facies of iron formations, namely the silicate and oxide facies. However, the 1:250,000 scale of our study makes it impossible to represent the two facies separately. They are therefore grouped into an undivided iron formation unit (Adpr2). The oxide facies is characterized by regular alternating cm-scale bands of metachert, magnetite-quartz, and grunerite-magnetite. The rock is dark grey on fresh surface and has a greyish brown weathered surface. The silicate facies is defined by cm-scale bands composed of grunerite (30-90 %), quartz (3-30 %) and magnetite (10-30 %), alternating with metachert layers. The rock is greenish brown on a fresh surface, and it weathers to a dark green colour. The silicate facies is characterized by the predominance of grunerite relative to the oxide facies.

Undivided Volcanic Rocks (Adpr3)

The Dupire Complex is composed of a considerable quantity of volcanic rocks, which had been subdivided by Lamothe (1997) into basalts (amphibolite), rhyolites and rhyolitic tuffs, and anthophyllite+cordierite-biotite±quartz±chlorite schists. These various lithologies are grouped here into an informal unit of undivided volcanic rocks (Adpr3). Rhyolites and rhyolitic tuffs are yellowish grey on fresh surface, and alter to a greenish grey. This lithology is composed of a recrystallized groundmass of alkali feldspar and biotite with quartz phenocrysts. Lamothe (1997) also described pyroclastic facies with stretched cm-scale lapilli. Basalts are dark grey-green on fresh surface, and have a brownish green weathered surface. They are mainly composed of hornblende and plagioclase, and are generally fine-grained. Lamothe (1997) observed the presence of stretched pillow relics in a few locations. Anthophyllite+cordierite+biotite ±quartz±chlorite schists are generally medium grey-green on fresh surface and alter to a medium brown. They form horizons adjacent to the basalts, and may be traced over a distance of nearly one kilometre. In places, these horizons may reach a thickness of over three metres. The principal mineral phases in these schists are idiomorphic anthophyllite crystals (2-60 %) and cordierite (2-70 %). Lamothe (1997) suggested that the anthophyllite+cordierite+biotite

±quartz±chlorite assemblages represent metamorphosed alteration zones formed in the vicinity of the basaltic lavas. Furthermore, evidence of post-metamorphic hydrothermal circulation (post-amphibolite facies) has been noted, namely in the replacement of biotite by chlorite, anthophyllite by talc, and cordierite by pinite.

Undivided Volcano-Sedimentary Rocks (Adpr4)

A thick cover of Quaternary deposits, mainly in the Lac Charnière area, made it difficult to map the bedrock as outcrops in this area are scarce. However, the magnetic signature of rocks of the Dupire Complex clearly stands out, and outlines km-scale folds. This intense magnetic signature is most likely related to the presence of undivided volcano-sedimentary rocks that are not exposed. This unit may contain one or more of the lithologies previously described, namely: oxide and silicate-facies iron formations, volcanic rocks and paragneisses.

Charnière Suite (Achn)

The Charnière Suite (Figure 4) comprises the intrusive rocks hosting the volcano-sedimentary rocks of the Dupire Complex. These intrusions are characterized by a weak and uniform magnetic signature which contrasts with strong aeromagnetic anomalies associated with charnockitic rocks of the Tikkerutuk Domain to the south, and rocks of the Lac Minto Domain to the north. The Charnière Suite is composed of granodiorite (Achn2) and tonalite (Achn1) units. However, the relative timing of these two units could not be established as no field relationship was observed.

Granodiorite (Achn2) and Tonalite (Achn1)

Granodiorite is the principal unit surrounding the rocks of the Dupire Complex. The rock is grey-pink and displays a pinkish white weathered surface. It is leucocratic, homogeneous, medium-grained, and contains between 2 and 15 % mafic minerals. The granodiorites are locally injected by abundant granitic pegmatites which give the rock a heterogeneous aspect. Granodiorites of the Charnière Suite are generally foliated to weakly foliated, but locally become gneissic where they are involved in shear zones associated with the Dupire structure. The principal mineral phases that characterize this unit are epidote, green biotite, titanite and muscovite, with allanite, apatite and magnetite as accessory phases. Evidence of retrograde metamorphism or hydrothermal alteration were noted in plagioclase (sericitization) and biotite (chloritization). Although epidote is present as idiomorphic to hypidiomorphic crystals, it is superimposed on the sericitized plagioglace and chloritized biotite, thereby suggesting its metamorphic origin. Granodiorites of the Charnière Suite do not contain pyroxene. The absence of orthopyroxene, combined with the presence of green biotite and epidote therefore suggests that these granodiorites were subjected to amphibolite-facies metamorphic conditions.

The only distinctive feature of the tonalite unit (Achn1) relative to the granodiorite unit (Achn2) concerns the relative proportions of potassic and sodic feldspar. Tonalites have a grey colour, and alter to a white-grey colour. The grain size, intensity of deformation, alteration and mineralogy of mafic phases are similar to those observed in the granodiorite unit (Achn2).

Lac Minto Suite (Amin)

Diatexites in the Lac Minto Domain were originally described by Percival *et al.* (1990) in the Lac Minto area (NTS sheet 34G). Subsequently, Percival *et al.* (1991) recognized that the presence of important masses of diatexite was one of the principal distinctive features of the Lac Minto lithotectonic Domain. The Lac Minto Suite designates diatexites found within the Lac Minto Domain. These diatexites may be distinguished from those of the Goudalie Domain (Rivière aux Mélèzes Suite – Aram) by the presence of orthopyroxene. Since diatexites of the Lac Minto Suite mainly outcrop in the northwest quadrant of NTS sheet 34H, an area previously mapped by Percival *et al.* (1990, 1991), the description of this suite will be mainly based on the observations of these authors. A U/Pb zircon age obtained from a diatexite of this suite yielded an age of 2702 ± 2 Ma (Percival and Card, 1994).

The principal characteristics of diatexites of the Rivière aux Mélèzes Suite (Aram) also apply to the Lac Minto Suite. Diatexites of the Lac Minto Suite occur as plutons and sheets injected in the granodiorites and tonalites of the Rivière aux Feuilles Suite (Arfe1 and Arfe2). Diatexites have a yellowish grey colour but take on a rusty brown tinge when the biotite content increases. They are composed of a heterogeneous neosome, generally coarse-grained and granodioritic in composition, which constitutes 50 to 95 % of the volume of the rock. This neosome may contain between 5 and 50 % enclaves of paragneiss, iron formation and fine to medium-grained mafic to intermediate gneiss. Diatexites of the Lac Minto Suite contain the following mineral assemblage: quartz-plagioclase-microcline-biotite-orthopyroxene and locally cordierite. The presence of orthopyroxene suggests that the diatexites formed in conditions corresponding to the granulite facies. Moreover, the presence of hornblende coronas around certain orthopyroxene crystals (Percival *et al.*, 1990) as well as the local occurrence of cordierite indicates that the diatexites of the Lac Minto Suite probably underwent partial retrograde metamorphism at the amphibolite facies.

Paragneisses (AMNT1)

The paragneiss unit (AMNT1) includes all sedimentary rocks of the Lac Minto Domain, with the exception of those included in the Dupire Complex, which were described in the

Dupire Subdomain. In our map area, paragneisses of the Lac Minto Domain (AMNT1), as opposed to those of the Goudalie (Advt3), are rarely associated with mafic rocks that could be related to volcanic sequences. Furthermore, iron formations, except for enclaves in diatexites or granodiorites, are rarely observed in the AMNT1 paragneiss unit. These paragneisses occur as discontinuous km-scale remnants, as well as enclaves 10 cm to 10 m in size within diatexites of the Lac Minto Suite (Amin) and granodiorites of the Rivière aux Feuilles Suite (Arfe1). The remnants may reach up to ten kilometres long by a few kilometres wide. The rock is medium grey and alters to a rusty brown. The paragneiss unit is characterized by fine to medium-grained rocks composed of plagioclase, quartz, biotite, garnet (±orthopyroxene, ± potash feldspar). It is often migmatized and contains one to ten-cm thick bands of granodioritic to granitic composition. A well-developed gneissocity and a migmatitic layering are observed in these rocks; they define the regional foliation. The paragneiss unit includes metatexites, since the maximum percentage of neosome in the paragneiss has been established at 50%, i.e. the limit with diatexites. The gradual transition observed between paragneisses and diatexites reflects the gradual increase in the degree of partial melting.

Tikkerutuk Domain

The Tikkerutuk Domain, located in the southwest quadrant of the map area, is characterized by a strong, uniform magnetic signature associated with enderbite and charnockite intrusions. These intrusions are injected into biotite and magnetite-bearing (± hornblende) granodiorites, and are cross-cut by biotite (±hornblende) granitic plutons. The boundary between the Tikkerutuk Domain and the Dupire Subdomain is marked by the Dupire ductile-brittle structure, which corresponds to a sharp break of aeromagnetic anomalies. In the field, this structure is represented by protomylonites, cataclasites and by an increase of migmatization phenomena. The similarity of lithologies and magnetic signatures suggests a continuity between the Tikkerutuk Domain and the Bienville Subprovince. In fact, the boundary between the Tikkerutuk Domain and the Bienville Subprovince was never clearly established. The age of Tikkerutuk granodiorites (2702 ± 2 Ma) and Bienville granodiorites (2710 ± 2 Ma) suggest that these rocks may be associated with a magmatic arc younger than the Rivière aux Feuilles Suite, dated at *ca.* 2725 Ma (Percival *et al.*, 1998; Skulski *et al.*, 1998). However, this interpretation should be considered with some caution as geochronological data and field relationships are still poorly constrained. In this report, granodiorites mapped within the Tikkerutuk Domain were included in the Rivière aux Feuilles Suite (Arfe1).

Lippens Suite (Allp)

The lithodemic unit represented by the Lippens Suite was introduced to describe charnockitic intrusions emplaced to the west and south of the Dupire structure. These intrusions cross-cut hornblende-biotite granodiorites of the Rivière aux Feuilles Suite (Arfe1). They have an intense and uniform magnetic signature. The Lippens Suite includes enderbitic and charnockitic intrusions.

Enderbite (Allp1)

Enderbite constitutes the principal lithology of the Lippens Suite. It covers a surface area of about 450 km^2 in the southwesternmost part of the map area. The type-locality for this lithology is located 7.5 km northeast of Lac Lippens, on outcrop MP-98-1323 of the SIGÉOM database (UTM coordinates: NAD 83; 574771E, 6339610N). On fresh surface, the rock is greenish brown, whereas the weathered surface is white with brown spots. The greenish colour on fresh surface, which is due to the colour of plagioclase, is characteristic of charnockitic rocks. Enderbites are weakly foliated, homogeneous, equigranular and strongly magnetic. They are coarse to medium-grained. They are generally leucocratic, and contain between 10 and 25% orthopyroxene, clinopyroxene, red biotite and magnetite. Orthopyroxene is more common than clinopyroxene, whereas biotite is superimposed upon orthopyroxene. Enderbites are injected by undeformed granitic veins and pegmatites where the only mafic phase is biotite. The effect of deformation is outlined by a mortar texture, by bent plagioclase twins and by the alignment of biotite and pyroxene grains parallel to the regional foliation. The various constituent minerals are very rarely affected by retrograde phenomena. In fact, pyroxene, biotite and plagioclase grains are generally unaltered.

Charnockite (Allp2)

The charnockite unit forms a pluton covering a surface area of about 50 km^2 which cross-cuts the enderbite unit (Allp1). The type-locality of this lithology is located southeast of Lac Lippens, on outcrop MP-98-1260 of the SIGÉOM database (UTM coordinates: NAD 83; 572480E, 6333457N). The rock is greenish brown with a slight pinkish tinge on fresh surface, and alters to a pale pink-grey colour. The charnockite is strongly magnetic, homogeneous, and medium to coarse-grained. It is leucocratic, and contains about 15% orthopyroxene, clinopyroxene, red biotite and magnetite. Locally, partial clinopyroxene coronas are present around orthopyroxene grains. Accessory phases are zircon and allanite. The charnockite is massive to weakly foliated; where present, the foliation is defined by the alignment of biotite. Orthopyroxene-free granitic pegmatite injections are frequently observed in the charnockite.

Utsalik Domain

The Utsalik Domain, located in the easternmost part of the area, shows a positive magnetic signature and a particularly complex lithological framework. Its lithologically heterogeneous nature contrasts with other domains. The Utsalik Domain is composed of heterogeneous tonalitic to granodioritic plutonic rocks intruded by granitic sheets. Remnants and enclaves of mafic rocks of uncertain origin are present within these heterogeneous plutonic rocks. Field observations suggest that the heterogeneity is the result of a migmatization process. Given the fact that these rocks are fundamentally different from the definition of the Utsalik Domain established by Percival *et al.* (1992) along the Rivière aux Feuilles, it was deemed preferable to propose two new intrusive suites (Monchy and Suluppaugalik) in order to separate these heterogeneous rocks from the Rivière aux Feuilles Suite (Arfe1 and Arfe2). These two suites may however represent a migmatization front separating the Goudalie and Utsalik domains. In addition to these two intrusive suites, a complex of uncertain origin (Qamaniq Complex) was also introduced in order to fully represent the lithological variations in the Utsalik Domain.

Qamaniq Complex (Aqmq)

The Utsalik Domain contains a few remnants of mafic to ultramafic rocks within the heterogeneous tonalites and granodiorites of the Monchy (Amcy) and Suluppaugalik (Aspk) suites. These mafic to ultramafic rocks may be distinguished from supracrustal rocks in the Duvert Complex (Goudalie Domain) by the absence of felsic volcanic rocks, paragneisses and iron formations. In fact, we found no evidence to suggest that these rocks are volcanic in origin. Since the nature of these rocks remains uncertain, the term Qamaniq Complex is used to describe the mafic and ultramafic rocks present within the Utsalik Domain. The mafic rocks are generally dark green to black and fine to medium-grained. The principal minerals that make up these mafic rocks are green hornblende, plagioclase, biotite and more rarely orthopyroxene and clinopyroxene. Ultramafic rocks display similar colours on fresh surface but their weathered surfaces take on a buff-brown colour, typical of ultramafic rocks. They are composed of variable proportions of clinopyroxene, orthopyroxene, olivine and spinel. The mineral composition of ultramafic rocks varies from pyroxenitic to dunitic. All the lithologies present in the Qamaniq Complex are foliated or gneissic, and metamorphosed to the granulite and amphibolite facies. These rocks are injected by late granitic dykes and plutons.

Monchy Suite (Amcy)

The Monchy Suite designates heterogeneous plutonic rocks of granodioritic composition mapped within the Utsalik Domain. These granodiorites, medium grey on fresh surface with a pinkish white weathered surface, are heterogeneous both at the scale of the sample and at the scale of the outcrop. They are generally heterogranular given the grain size of quartz, microcline (orthoclase) and plagioclase crystals which varies from medium to coarse-grained. Other essential minerals include olive green hornblende, brownish biotite and epidote. Locally, clinopyroxene is observed in the core of certain hornblende crystals. Accessory minerals are: magnetite, titanite, apatite and zircon. One of the principal features of the Monchy Suite is the presence of tonalitic material, which occurs in diffuse contact within the granodiorite. The tonalitic material constitutes between 20 and 50% of the volume of this unit. These granodiorites probably represent the products of an important migmatization process affecting the tonalites. This migmatization may define the boundary between the Utsalik and Goudalie domains. Granodiorites of the Monchy Suite contain amphibolite enclaves one centimetre to ten metres in size whose origin remains uncertain (Appendix 1, Photo 4). The regional foliation is defined by schlieren formed of mafic minerals, by the alignment of biotite and hornblende grains, as well as by diffuse horizons of tonalitic material. The foliation is commonly undulating and is difficult to measure. The deformation is also outlined by the development of mortar textures along certain preferential planes parallel to the foliation.

Suluppaugalik Suite (Aspk)

The Suluppaugalik Suite was established to identify rocks of tonalitic composition present along the boundary between the Utsalik and Goudalie domains. Tonalites in this suite are very heterogeneous, and display a wide variety of lithologies, structures and textures even within a single outcrop. They contain amphibolite and diorite enclaves of variable dimensions. They are generally medium grey on fresh surface and alter to a grey-white colour. The main constituents of tonalites of the Suluppaugalik Suite are plagioclase and quartz in variable proportions. Mafic minerals observed in these tonalites include olive green hornblende, reddish brown biotite and epidote. Biotite is superimposed upon hornblende crystals, whereas epidote superimposes upon both biotite and hornblende. Epidote occurs as poikilitic, idiomorphic and xenomorphic crystals, and the presence of allanite in the core of certain epidote crystals has been noted. Accessory minerals include microcline, apatite, titanite, zircon and chlorite. Microcline occurs as small isolated crystals, and in the interstices between quartz and plagioclase crystals.

Intrusions that transcend several lithotectonic domains

The Minto Block is largely composed of pre- to late tectonic intrusive rocks. Several of these intrusions form distinct suites which are characteristic of a particular lithotectonic domain. However, given their degree of metamorphism and deformation, mapping at a scale of 1 : 250,000 is not always successful in setting them apart. Despite the fact that the various lithotectonic domains are defined based on lithological and structural criteria as well as their distinctive magnetic signatures, certain intrusive suites are present within several lithotectonic domains. Regardless of the domain where they are observed, rocks in these suites display the same petrographic features.

The presence of these intrusive rocks in several domains probably reflects the emplacement of an important volume of granitoid rock after the juxtaposition of the various lithotectonic domains. These granitoids may explain the absence of visible tectonic boundaries between these domains. However, such preliminary interpretations should be considered with caution since geochronological data and field relationships are still poorly constrained. Five of these suites, observed within more than one lithotectonic domain and herein described are : the Rivière aux Feuilles, Bacqueville, MacMahon, La Chevrotière and Morrice suites.

Rivière aux Feuilles Suite (Arfe)

The Rivière aux Feuilles Suite, as defined in the work of the Geological Survey of Canada (Percival and Card, 1994; Stern *et al.*, 1994), essentially designates I-type calc-alkaline intrusions, including pyroxene-hornblende granodiorites, tonalites, granites, diorites, gabbros-pyroxenites and synplutonic mafic dykes. Age constraints concerning the emplacement of the Rivière aux Feuilles Suite were established at *ca.* 2724 Ma, based on a few ages obtained from granodiorites (Machado *et al.*, 1989; Stern *et al.*, 1994).

Results of our fieldwork, carried out in the Lac Nedlouc area in the summer of 1998, led us to slightly modify the description of the lithodemic unit known as the Rivière aux Feuilles Suite. The term "Rivière aux Feuilles Suite" is used herein to identify granodioritic and tonalitic intrusive rocks that transcend the boundaries of the Lac Minto, Tikkerutuk and Goudalie domains. This suite is composed of homogeneous, weakly foliated to strongly deformed granodiorites and tonalites. Moreover, rocks in the Utsalik Domain, which are highly heterogeneous, do not meet established criteria and are therefore not included in the Rivière aux Feuilles Suite. These rocks were described in the Monchy and Suluppaugalik suites of the Utsalik Domain.

Granodiorites (Arfe1) and Tonalites (Arfe2)

Previous work (Percival *et al.*, 1994; Stern *et al.*, 1994) identified two phases of granodiorite within the Rivière aux Feuilles Suite, i.e. hornblende-bearing and pyroxene-bearing. These two phases were observed during our field mapping program in the Lac Nedlouc area, however they did not constitute distinct mappable units. Thus, granodiorites of the Rivière aux Feuilles Suite (Arfe1) include both hornblende and pyroxene-bearing phases. The rock is pale grey to pinkish grey on fresh surface and alters to a white-pink colour. The rock is generally medium-grained. The principal mafic minerals, which account for 5 to 25% of the rock are either 1) biotite, hornblende and magnetite, or 2) biotite, orthopyroxene, clinopyroxene and magnetite. The alignment of these minerals defines a weak to strongly developed foliation. In certain cases, the presence of clinopyroxene cores retrograded to hornblende was noted.

The tonalite unit (Arfe2) designates all the tonalitic rocks in the Goudalie, Lac Minto and Tikkerutuk domains, with the exception of tonalites within the Dupire Subdomain (Achn1). These rocks are generally medium grey and contain between 5 and 30% mafic minerals. The principal mafic minerals are hornblende, biotite and magnetite. The tonalites are homogeneous, foliated to locally gneissic. It is difficult to establish the presence of different tonalitic suites based on the degree of deformation, since gneissic rocks are generally the result of a transposition associated with a phase of deformation that postdates the regional foliation. It is impossible to recognize with any confidence tonalitic gneisses that could represent a basement, as identified by Percival and Card (1994).

Bacqueville Suite (Abcv)

Dioritic and gabbroic rocks were observed by Percival *et al.* (1991) in the Lac Minto, Goudalie and Utsalik lithotectonic domains. They are particularly well preserved in the Lac Bacqueville area (NTS 34I). The Bacqueville Suite was therefore established to designate units of hornblende-plagioclase (± clinopyroxene) diorites and gabbros. These lithologies are homogeneous and medium to coarse-grained. They occur as dismembered dykes and remnants within diatexites of the Lac Minto Suite (Amin) and granodiorites of the Rivière aux Feuilles Suite (Arfe1). The Bacqueville Suite was intruded by rocks of the Morrice Suite (Agdm). Percival and Card (1994) noted the presence of rare pyroxenites and lamproites.

MacMahon Suite (Acmm)

The MacMahon Suite was introduced to describe charnockitic rocks common to all domains, with the exception of granulitic rocks in the Tikkerutuk domain, located south of the Dupire structure. It consists of intrusive rocks that vary in composition from granitic to tonalitic, generally weakly deformed with a weak foliation. They are medium-grained, however megaphenocrysts of potash feldspar are sometimes observed. The greenish colour of plagioclase gives the rock, on fresh surface, a greenish-brown colour typical of granulitic rocks. The principal mafic minerals are orthopyroxene, clinopyroxene, magnetite and green biotite. Intrusions of the MacMahon Suite are, for the most part, associated with well-circumscribed positive anomalies.

La Chevrotière Suite (Alcv)

The lithodemic unit known as the La Chevrotière Suite was named to describe alkali feldspar-phyric monzogranites. These rocks are present in two sectors of our map area, namely north of the Nedlouc structure, in the northeasternmost part of NTS sheet 34H and in the area east of Lac La Chevrotière (NTS sheet 34I) swhich constitutes the best location to observe these rocks. They cross-cut tonalites and granodiorites of the Rivière aux Feuilles Suite (Arfe1 and Arfe2) as well as those of the Monchy (Amcy) and Suluppaugalik (Aspk) suites. The rock is grey-pink on fresh surface and alters to a yellowish pink colour. Monzogranites of the La Chevrotière Suite are characterized by the presence of microcline and orthoclase megaphenocrysts reaching up to five centimetres long. Potash feldspar phenocrysts often contain inclusions of quartz, plagioclase and biotite. The groundmass is formed of plagioclase, quartz, olive green hornblende, brown biotite, titanite, magnetite and apatite. Titanite is very abundant and forms coronas around certain magnetite grains. In the field, the monzogranite appears massive to weakly foliated. Petrographic studies reveal a foliated aspect defined by the alignment of biotite and by an intergranular deformation (mortar texture). Several minerals display evidence of post-metamorphic alteration : plagioclase is sericitized whereas hornblende and biotite are partially altered to chlorite. The transformation of these minerals may be due either to retrograde metamorphism at the greenschist facies, or to a late hydrothermal episode.

Morrice Suite (Agdm)

The lithodemic Morrice Suite designates all rocks of granitic composition (Agdm1), with the exception of megaphyric rocks (La Chevrotière Suite-Alcv) and charnockitic rocks (MacMahon Suite-Acmm and Lippens Suite-Allp2). Since the granites present in the various lithotectonic domains display the same features at a scale of 1:250,000, it is impossible to differentiate them. This suite will eventually be subdivided based on petrographic, geochemical and geochronological criteria. But for now, the Morrice Suite includes all intrusions, dykes and pegmatites of granitic composition (with the exception of the La Chevrotière, MacMahon and Lippens suites), regardless of the domain where they outcrop. It also includes three small intrusions of late leucotonalite occurring in the Lac Duvert area (Agdm2). The granites are generally pinkish, medium to coarse-grained and sometimes pegmatitic. They are weakly deformed and weakly foliated. The principal mineral phases are: quartz, microcline, plagioclase, green biotite and minor hornblende. The granites cross-cut most other units in the Lac Nedlouc area. In certain locations, field observations suggest the presence of transitional contacts between diatexites and granites. Based on these contacts, it appears that the granites may be derived from the crystallization of a melt fractionated from the diatexites. However, the lack of geochemical data makes it impossible for us to confirm or refute this interpretation.

Proterozoic Diabase Dykes

All the units in the area are cross-cut by diabase dykes that are post-orogenic relative to the Archean deformation and regional metamorphism. Some of these dykes are affected by a fracture pattern associated with a late brittle deformation episode. They display a homogeneous texture and well-developed chilled margins. Most dykes are discontinuous and are less than 50 metres thick. Consequently, they are not represented on the geological map. The diabase is generally fresh and commonly displays a subophitic texture.

The overall orientation of dykes is variable. However, they appear to form three groups with common orientations. The most abundant dykes are oriented WNW-ESE to WSW-ENE. The second most common group contains dykes oriented N-S to NE-SW. The remaining dykes are generally oriented NW-SE. The age of these three groups of dykes is uncertain. Nevertheless, based on paleomagnetic and geochronological studies conducted on dykes of the Rivière aux Feuilles area (Buchan *et al.*, 1998), dykes in our map area may be related to three distinct dyke swarms. The first and third groups have orientations similar to the Maguire dykes (*ca.* 2230 Ma) and Minto dykes (1998 ± 2 Ma), whereas the orientation of the second group is comparable to the Ptarmigan dykes (2505 ± 2 Ma) (Buchan *et al.*, 1998). However, more detailed studies are necessary in order to properly characterize the dykes in our map area and to establish better correlations.

STRUCTURE

The Minto Block is characterized by a regional structural pattern oriented NNW-SSE. This trend is outlined by the configuration of aeromagnetic anomalies (Figure 4). In certain areas, the magnetic pattern shows regional sigmoidal structures with an amplitude of several kilometres. Also worth noting is the fact that aeromagnetic and gravity anomalies are truncated in several sectors by major east-west trending lineaments. These lineaments are interpreted as ductile-brittle structures.

The outcrop distribution pattern of units in the Lac Nedlouc area reflects a complex structural setting resulting from at least five phases of ductile deformation and one phase of brittle deformation. The structural evolution of the area is punctuated by pre- to post-tectonic intrusive events that significantly modify or mask the general structural aspect. The absence of stratigraphic marker horizons, the high degree of metamorphism and the lack of primary structures restrict our ability to carry out detailed structural analysis. Nevertheless, observed mesoscopic and km-scale structures, responsible for the outcrop pattern, help model a structural interpretation coherent with our regional mapping at a scale of 1:250,000. In order to make the description of the various structural elements easier, the nomenclature D_1 to D_6 is used for the phases of deformation. Please note that this terminology does not necessarily imply that there were six distinct episodes of deformation. Associated structures such as foliations and folds, are identified in the corresponding manner: S_1, S_2, etc.; F_1, F_2, F_3, etc.) (Table 1).

Structural Elements and Phases of Deformation

Primary volcanic and sedimentary structures and textures have been largely obliterated in the Lac Nedlouc area by the intense deformation and regional metamorphism. Nevertheless, certain primary structures and textures were identified in supracrustal rocks in better preserved areas. In certain locations, mafic volcanic rocks display relics of flattened pillows with recrystallized selvages, whereas it is still possible to identify felsic volcanic rocks formed of tuff and pyroclastic horizons. Moreover, the compositional banding of iron formations and paragneisses most likely represents a primary sedimentary bedding albeit largely transposed by deformation and recrystallized during metamorphism. Consequently, it is impossible to conduct a coherent structural analysis of S_0 surfaces and stratigraphic facing directions.

The main foliation in the study area is defined by the preferential orientation of biotite, hornblende and orthopyroxene. It is also represented in several sectors by a gneissosity and locally by migmatitic layering. Gneissosity in metasedimentary and metavolcanic rocks is probably derived from the primary bedding, strongly modified by metamorphism. However, the gneissosity in plutonic rocks is marked by an increase in the mineral foliation intensity, caused by an increase in the degree of deformation. Migmatitic layering, on the other hand, is defined by the presence of irregularly alternating leucosome and paleosome phases in rocks affected by partial melting.

From a regional standpoint, the main foliation in the Lac Nedlouc area may be correlated with that observed in the Vizien and Kogaluc belts located further north (Percival *et al.*, 1995; Lin *et al.*, 1996). In these belts, the main foliation is interpreted as being related to the D_2 phase of deformation, thus an S_2 foliation. The latter is preceded by S_1 fabric, locally preserved in conglomeratic boulders and deformed by F_2 folds. The S_1 foliation is associated with a first phase of deformation D_1 marking an early episode of thrusting (Percival *et al.*, 1995; Lin *et al.*, 1996). Thus, the principal foliation in the Lac Nedlouc area is identified as S_2 fabric in accordance with the structural framework already proposed in the Vizien and Kogaluc areas.

In the Lac Nedlouc area, the D_1 deformation phase is illustrated by a fabric (S_1) locally preserved in supracrustal rock enclaves. This fabric forms an angle relative to the principal foliation (S_2) observed in intrusive rocks. However, the principal foliation (S_2) in supracrustal belts overprints the S_1 fabric and completely obliterates the latter. It is therefore impossible to establish a structural interpretation of the D_1 phase of deformation, since the associated fabric (S_1) is masked by the principal S_2 fabric. The principal foliation (S_2), which is steeply dipping, is conformable with lithological contacts and lithotectonic domain boundaries. This implies a transposition of geological contacts. The variation in the orientation of the main foliation (S_2) is used to subdivide the area into five structural domains. Stereograms for structural domains 1 and 4 outline an orientation that varies from N-S to NNW-SSE for the S_2 foliation, whereas those of domains 3 and 5 indicate a NW-SE orientation for this same foliation (Figure 5). However, the stereogram for domain 2 clearly marks a radical change in the foliation, which takes on an E-W orientation. Results of a detailed structural study carried out by Lamothe (1997) in the Lac Dupire area (structural domain 2, Figure 5) suggest that the development of the main foliation S_2 is contemporaneous with the development of a network of thrust faults. This event is associated with a mineral lineation that plunges steeply along the thrust plane.

The D_2 phase of deformation also generated L_2 lineations and F_2 isoclinal folds. Lineations are defined by the elongate nature of minerals and mineral aggregates in the foliation plane (S_2). They have moderate to steep plunges (Figure 5). Mesoscopic F_2 folds, observed in a few locations, are intrafolial folds, dismembered and tight to isoclinal. These folds were identified in the Dupire belt (Lamothe, 1997) (structural domain 2, Figure 5), as well as in the Morrice belt. In the latter, the supracrustal rocks form a N-S oriented F_2 isoclinal synform (structural domain 4).

The D_3 phase of deformation generated tight to isoclinal F_3 folds oriented WNW-ESE to NNE-SSW with a m-scale to km-scale amplitude. These folds affect the main S_2 foliation. Consequently, phase D_3 is responsible for the change in orientation and plunge of F_2 fold axes. As opposed to F_2 folds, F_3 folds generally do not display any foliation. The geometry of F_3 fold hinges, which varies from rounded to angular, may be explained by a rheology difference between volcano-sedimentary and granitic units. In the Goudalie Domain, the distribution of these units appears to be partly controlled by F_3 macrofolds (structural domain 3, Figure 5). Lamothe (1997) mentioned that F_3 folds with NE-SW oriented axial planes are responsible for the orientation of magnetic anomalies in the Lac Dupire area.

Structural domain 2, which includes the Dupire Complex, contrasts with other domains due to the different orientations of the axial planes of F_2 and F_3 folds as well as the main

TABLE 1 – Preliminary interpretation of tectono-metamorphic events in the Lac Nedlouc area.

← Metamorphism →			← Structure →	
episode	facies	evidence	phase	characteristics
M3	Greenschist	retrogression: GR and BO --> CL PG and CD --> SR presence of CL and EP hydrothermal zircons at *ca.* 2,6 Ga	D6	late brittle faults, conjugate network
M2 ↑	amphibolite	HB superimposed on D4 shearing	D5	sporadic open to tight F5 folds oriented ENE-WSW, no associated foliation
M 2+	granulite	-late charnockites -OX-CX mobilizate (undeformed)	D4	NW-SE shearing (dextral) (Goudalie), mylonitic fabric, F4 drag folds
↓ M2	amphibolite	HB, BO granitoids HB superimposed on primary OX diatexite (Goudalie) AD, SM, CD, GR	D3 ↑	tight to isoclinal F3 folds oriented ENE-WSW, reoriented by D4 shearing (no associated foliation)
			D2	penetrative S2 foliation and isoclinal F2 folds oriented parallel to contacts (NNW-SSE)
M1	granulite	-OX-GR diatexite (Lac Minto) -OX paragneiss -volcanic rocks (OX) -early intrusions	↓ D1(?) ↓	foliation within enclaves at an angle relative to regional S2 foliation

S_2 foliation. This particular feature of domain 2 is also outlined by the general E-W orientation of magnetic anomalies as opposed to a NW-SE orientation in other domains. It therefore appears that units in domain 2 may have undergone a reorientation that postdates the D_3 phase of deformation. A possible interpretation concerning the mechanism responsible for this reorientation is that it may have been caused by a strike-slip movement along the Nedlouc and Dupire structures. The Nedlouc structure corresponds to the northern boundary of domain 2, whereas the Dupire structure transects the domain in a NW-SE orientation. The deviation of the main foliation in the immediate vicinity of each of these two ductile-brittle structures suggests a sinistral movement along the Nedlouc structure and a sinistral movement along the Dupire structure. A systematic study of kinematic indicators will eventually corroborate this interpretation.

The D_4 phase of deformation is associated with important shear zones oriented NW-SE. These zones are expressed in the field by the presence of a mylonitic fabric (S_4) and drag folds (F_4). Along the shear zones, which do not exceed a few metres in width, the mylonitic fabric has completely transposed the S_2 foliation (Appendix 1, Photo 5), and reoriented F_2 and F_3 folds. Structures associated with the D_4 phase are mainly concentrated in structural domain 3, in the central part of the area (Figure 5). These structures, observed within the Duvert belt, are probably responsible for the dismemberment of volcano-sedimentary rock units in this belt. The asymmetry of F_4 drag folds generated by the shear zones suggests a dextral movement. Finally, the variation in the orientation of the main foliation between the Goudalie (NW-SE) and Lac Minto (N-S) lithotectonic domains is attributed to phase D_4.

Structures associated with phase D_5 were only observed locally in volcano-sedimentary sequences of the Goudalie Domain, i.e. mostly to the north of Lac Natuak (structural domain 4, Figure 5). They correspond to upright, open to tight F_5 folds, oriented ENE-WSW. This folding did not generate an axial fabric, but the folds are generally associated with small shear zones parallel to the axial planes.

The D_6 phase of deformation is responsible for the network of late brittle faults observed both on outcrop scale and on a regional scale. These faults define topographic lineaments associated with 10-metre wide cataclasite zones. They are mainly oriented E-W, and have also developed a network of conjugate fractures oriented NW-SE and NE-SW. In certain locations, D_4 shear zones are reactivated by D_6 brittle structures. The results of a petrographic study of lithologies that lie within certain D_6 brittle structures reveal that fragments contained in the cataclasites display mylonitic

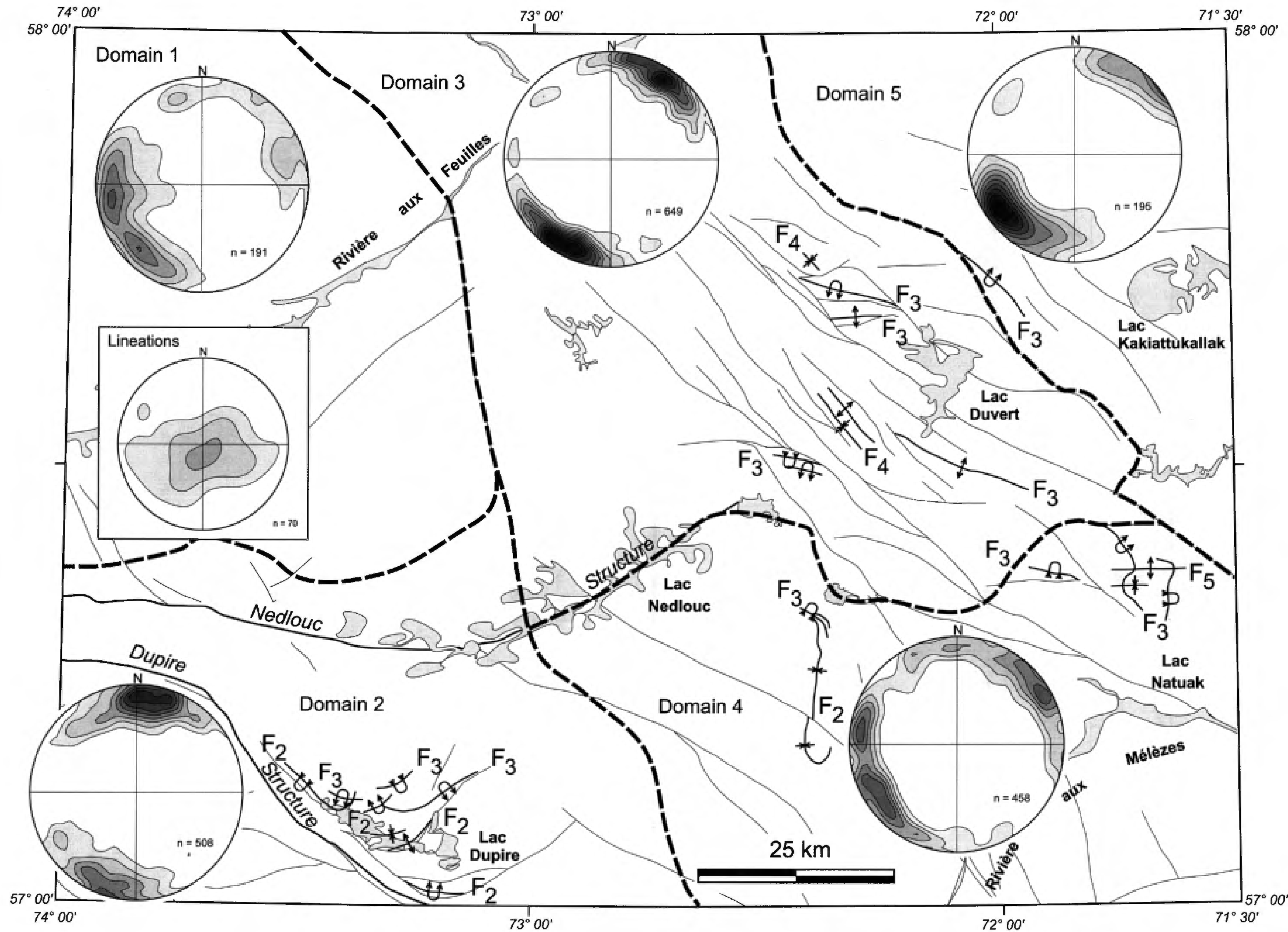

FIGURE 5 – Principal structural elements in the Lac Nedlouc area, and stereographic projection of the principal foliation and tectono-metamorphic lineations. (n = number of measurements)

fabrics. This fact implies a ductile deformation episode predating the cataclasite zones. D_6 zones are commonly associated with hematite, chlorite and epidote rich alteration zones. It is possible that these structures were active during the Archean, and that they were reactivated subsequently, serving as conduits for hydrothermal fluids. Certain of these D_6 zones also cross-cut Proterozoic diabase dykes.

METAMORPHISM

The various metamorphic assemblages observed indicate that the Lac Nedlouc area underwent several episodes of prograde metamorphism at the granulite and amphibolite facies, and possibly a retrograde episode at the greenschist facies. Correlations were established between the metamorphic assemblages and the different phases of deformation in order to decipher the tectono-metamorphic evolution of the Minto Block in the Lac Nedlouc area (Table 1).

Episode M_1 is marked by the presence of orthopyroxene in certain early intrusions, in diatexites and paragneisses of the Lac Minto Domain, as well as in the mobilizate of certain volcanic rocks. The orthopyroxene in these rocks is deformed by the S_2 regional foliation, indicating pre- to syn-D_2 granulitic conditions. Episode M_2, on the other hand, is represented in Goudalie diatexites by the following metamorphic assemblage: andalusite-cordierite-sillimanite-garnet. This assemblage indicates metamorphic conditions at the amphibolite facies, at pressures below 3.5 kbars. Goudalie diatexites are affected by the S_2 foliation, suggesting that these rocks were emplaced during the D_2 episode of deformation. M_2 metamorphism also translates into the presence of hornblende porphyroblasts, oriented parallel to the S_2 foliation, superimposed upon primary orthopyroxene crystals. Episode $M_{2'}$ appears to coincide with a local reactivation of granulitic conditions. The production of undeformed orthopyroxene-clinopyroxene-hornblende mobilizate (Appendix 1, Photo 6) may be attributed to this event, along with the emplacement of late charnockitic intrusions.

Regionally, an important retrogression of certain minerals to chlorite (biotite and garnet) and sericite (plagioclase and cordierite) is observed. This may correspond either to an episode of retrograde metamorphism (M_3), or to post-metamorphic hydrothermal circulation. Late brittle structures (D_6) associated with alteration zones may have served as channels for fluid circulation. In certain locations, diabase dykes interpreted as Proterozoic in age are locally affected by these alteration zones. This influence suggests that at least part of this alteration is Proterozoic or younger. A more detailed study of assemblages associated with these alteration zones is required in order to fully understand the mechanisms which prevailed.

GEOCHRONOLOGY

A geochronological study was undertaken on specific representative lithologies present in the various domains of the Lac Nedlouc area. Preliminary results of U-Pb isotopic analyses (isotopic dilution and thermal ionization mass spectrometry – TIMS) and ^{207}Pb-^{206}Pb isotopic analyses (in situ analysis by laser ablation – inductively coupled plasma mass spectrometry – LA-ICP-MS) are presented in order to establish the ages of emplacement and metamorphism, as well as inherited ages for nine samples. U-Pb analytical results are presented in million years (Ma) with a confidence interval of 2 standard deviations, whereas Pb-Pb analytical results are presented in billion years (Ga) with an interval of 1 standard deviation. In the latter case, unless otherwise specified, the precision is estimated at *ca.* ±1 %. U-Pb analyses currently under way will eventually reveal other dates, mainly emplacement ages. Samples from the Goudalie, Lac Minto (Dupire Subdomain) and Tikkerutuk domains were selected in order to better characterize lithostratigraphic and lithodemic units that make up these domains and to determine their relative timing.

Four samples were collected in the southeast part of the Goudalie Domain (sites 1 to 4; Figure 4). Two of these samples were taken in lithologies specific to this domain: a felsic tuff from the Duvert Complex and a garnet-biotite-cordierite diatexite from the Rivière aux Mélèzes Suite. This suite is interpreted as a syn- to late tectonic event that characterizes the area. The other two samples were taken in intrusive suites present in several domains, namely a massive to foliated tonalite collected in a homogeneous unit of the Rivière aux Feuilles Suite, and a biotite-garnet granite of the Morrice Suite that cross-cuts the tonalites. Two samples were also collected in felsic volcanic horizons in the south part of the Lac Minto Domain (Dupire Subdomain) (sites 5 and 6; Figure 4). A third sample was collected in the Charnière Suite (site 7; Figure 4), an intrusive suite of foliated granodiorite-tonalite which contains volcano-sedimentary remnants of the Dupire Complex. Finally, two lithologies were sampled in the southwest part of the area, in charnockitic intrusions of the Lippens Suite, principal constituent of the Tikkerutuk Domain. In this area, the massive to weakly foliated intrusions cross-cut foliated to gneissic granodiorites of the Rivière aux Feuilles Suite.

Tuff (Advt2) from the Duvert Complex and diatexite (Aram) from the Rivière aux Mélèzes Suite (Goudalie Domain)

The felsic tuff sample (98-MP-1373; site 1 Figure 4; UTM coordinates: NAD 83; 677547E, 6375597N), most likely volcaniclastic in origin, yielded two populations of zircons. The first and most important population comprises stubby dark brown prisms with a marked magmatic zoning. The second population occurs either as overgrowths of uncoloured zircon on crystals of the first population, or as small neoformed uncoloured zircon prisms. Statistical processing of $^{207}Pb/^{206}Pb$ analytical results of about twenty crystals of both populations helped define a principal mode at 2.68-2.69 Ga associated to zircons of the first population. Two other secondary modes are observed; they represent both younger ages at *ca.* 2.63 Ga, most likely related to the second generation of zircon, and older ages at *ca.* 2.72 Ga, associated in this case with older zircon inclusions. Three preliminary U-Pb ages, carried out on zircon fractions of the first population, yielded ages between 2683 and 2691 Ma, for which a linear regression analysis established an age of 2713 ± 6 Ma, the best estimate for the age of emplacement.

A diatexite sample (98-AL-127; site 2 Figure 4; UTM coordinates: NAD 83; 660957E, 6368723N) was collected in the central part of the Goudalie Domain, where the unit is homogeneous and free of enclaves. However, from a regional standpoint, the diatexite unit, which cross-cuts the Duvert Complex and the Rivière aux Feuilles Suite at least in part, is generally heterogeneous as it contains a fair proportion of paragneiss enclaves. Three types of zircons were identified in the accessory mineral fraction: 1) xenomorphic, equidimensional very dark brown crystals with visible cores, 2) stubby prisms with dulled edges, 3) uncoloured elongate prisms with a central portion exhibiting a diffuse brownish zone. $^{207}Pb/^{206}Pb$ analyses did not give coherent results for each of these populations. This fact suggests that the formation of these crystals must be associated with multiple episodes of crystallization. However, statistical processing of all the results outlines three distinct modes that may be interpreted as: 1) the presence of cores older than 2.75 Ga, 2) the age of emplacement of the diatexite, with a principal mode at 2.66-2.67 Ga, 3) evidence of a late thermal event at *ca.* 2.61 Ga. Finally, two U-Pb analyses were made on monazite crystals; these yielded practically identical results at *ca.* 2671 Ma. These results confirm the age of emplacement of the diatexites, represented by the principal mode derived from the statistical processing of zircon analytical results.

Tonalite from the Rivière aux Feuilles Suite (Arfe2) and granite from the Morrice Suite (Agdm)

A massive to weakly foliated tonalite (98-AL-367; site 3 Figure 4; UTM coordinates: NAD 83; 658525E, 6347037N) was sampled along the southern margin of the Goudalie Domain, where it is cross-cut by a biotite-garnet granite (98-AL-316; site 4 Figure 4; UTM coordinates: NAD 83; 656165E, 6364710N). Zircons recovered from the tonalite form two populations. The first population consists of medium brown stubby crystals with well-defined edges, along with a few subhedral dark brown crystals. The second population corresponds to a second generation of limpid uncoloured zircon present either as overgrowths or as prismatic crystals. Preliminary $^{207}Pb/^{206}Pb$ analyses yielded several ages among which four modes are distinguished: two generations of older cores produced modes at *ca.* 2.75 Ga and between 2.78 and 2.84 Ga, a principal mode at 2.70-2.71 Ga is associated with crystals of the first population, and a final mode corresponds to a younger age at *ca.* 2.60-2.61 Ga.

As opposed to the tonalite, the granite (98-AL-316) contains a single homogeneous population of reddish brown short hexagonal zircon prisms showing diffuse magmatic zoning. $^{207}Pb/^{206}Pb$ analytical results from some fifteen crystals provided ages between 2.69 and 2.72 Ga. These define a single mode at *ca.* 2.70 Ga, thus providing a preliminary age for the emplacement of the granitic suite. U-Pb analyses on monazite crystals from both samples yielded results varying between 2668 and 2675 Ma. These results confirm that the intrusive suites were affected by a metamorphic event most likely contemporaneous with the emplacement of diatexites of the Rivière aux Mélèzes Suite.

Felsic tuffs from the Dupire Complex (Adpr3) and tonalite from the Charnière Suite (Achn1)

The southern part of the Lac Minto Domain (Dupire Subdomain) is characterized by the presence of the Dupire Complex volcano-sedimentary sequence, from which two samples were collected in felsic horizons: a quartz-phyric tuff (98-MP-1436; site 5 Figure 4; UTM coordinates: NAD 83; 604475E, 6328112N) and a volcaniclastic rock (98-MP-1372; site 6 Figure 4; UTM coordinates: NAD 83; 602930E, 6325922N). A third sample of biotite-epidote tonalite (98-MP-1438; site 7 Figure 4; UTM coordinates: NAD 83; 607007E, 6340301N) was taken in the vicinity of the felsic tuffs. The quartz-phyric tuff sample contains medium brown stubby prismatic zircons. They form a single population of highly fractured crystals. Preliminary $^{207}Pb/^{206}Pb$ zircon ages hover around 2.79-2.80 Ga, but a mode at *ca.* 2.9 Ga is also present, characteristic of small inclusions of older zircons. Preliminary results from U-Pb analyses form a regression line with an upper intercept at 2787 ± 4 Ma. The latter is interpreted as the age of emplacement for the quartz-phyric tuff (98-MP-1436).

Zircons from the volcaniclastic sample are divided into two distinct populations : 1) euhedral elongate uncoloured prisms, and 2) dark brown stubby prisms with magmatic zoning and overgrowths. Preliminary $^{207}Pb/^{206}Pb$ ages indicate that crystals of the first population represent older inherited zircons with ages between 2.92 and 2.94 Ga. Analytical results from a series of crystals of the second population indicate that the overgrowths have ages of *ca.* 2.81-2.82 Ga whereas the cores are slightly older at *ca.* 2.85 Ga.

Zircons from the tonalite sample form a homogeneous population of dark brown rectangular prisms containing visible zircon inclusions. $^{207}Pb/^{206}Pb$ analyses performed on some fifteen crystals produced ages between 2.72 and 2.76 Ga. Statistical processing of these results confirms the presence of a principal mode at *ca.* 2.74-2.75 Ga. This mode is interpreted as representing the age of crystallization of the granodiorite, an age which should however be more accurately defined. Statistical processing also reveals a second mode between 2.63 and 2.65 Ga. The latter could again represent a late thermal event. This age is confirmed by analyses of titanite, present as an accessory mineral, for which a U-Pb age of 2637 ± 7 Ma was obtained.

Enderbite and charnockite from the Lippens Suite (Allp) (Tikkerutuk Domain)

Samples of enderbite (MP-1323; site 8 Figure 4) and charnockite (MP-1260; site 9 Figure 4) from the Lippens Suite were respectively collected in the type-localities identified for each lithology (see section entitled "Stratigraphy"). Zircons recovered from the enderbite form two morphologically distinct populations: 1) short simple uncoloured prisms, and 2) small brownish prismatic to equidimensional crystals, with a thin overgrowth. Preliminary results from U-Pb analyses for three crystals of the first population indicate an age of 2757 ± 9 Ma. U-Pb analyses from two equidimensional crystals of the second population yielded ages of 2704 Ma and 2708 Ma, for which the discordance is estimated at *ca.* 2%. Results from $^{207}Pb/^{206}Pb$ analyses carried out on crystals of the same population yielded ages between 2.69 and 2.70 Ga. The age of emplacement of the enderbite is interpreted as sometime between 2.70 Ga and 2.71 Ga. Zircons from the charnockite are heterogeneous, highly fractured and display important metamict zones. $^{207}Pb/^{206}Pb$ ages obtained from the analysis of numerous crystals are grouped into four modes, namely 2.64-2.65 Ga, 2.69-2.70 Ga, 2.75 Ga and 2.82-2.84 Ga. These crystals illustrate a complex crystallization history, and were affected by late remobilization. At the present time, it is difficult to establish the age of emplacement of this intrusion given the ambiguous results obtained.

LITHOGEOCHEMISTRY

In order to characterize the principal lithodemic units mapped in the Lac Nedlouc area, 110 rock samples, including 71 granitoid rocks, 28 volcanic rocks and 11 ultramafic rocks, were selected to conduct a lithogeochemistry study. All samples were analyzed for major and trace elements, and 39 of these were also analyzed for rare earth elements. Analyses were performed at the Centre de Recherche Minérale du Québec (CRM), using the different analytical methods listed below. Major elements and certain trace elements (Nd, Rb, Sr, Y and Zr) were analyzed by X-ray fluorescence, trace elements such as Ni, V, Cu, Zn and Li were measured by plasma induced atomic emission spectroscopy (ICE-AES) whereas rare earth elements were analyzed by neutron activation. Results discussed in this section are limited to those obtained for mafic to felsic volcanic rocks, as well as for ultramafic rocks. Geochemical data from volcanic rocks of the Lac Dupire area are from Lamothe (1997), and were extracted from the SIGÉOM database. Please note that the results obtained for granitoids are not discussed herein, but will be the subject of a later study.

Greenstone belts, in addition to their economic interest, are essential in helping us understand the geotectonic history of the entire Minto Block. Consequently, the objectives of the lithogeochemical study of rocks from the Lac Nedlouc area are: 1) to identify the various environments of emplacement of these volcanic rocks, and 2) to establish possible lithological correlations between the different volcano-sedimentary belts of the Duvert and Dupire complexes.

The proposed stratigraphy based on the mapping of the different supracrustal remnants groups supracrustal rocks in the Duvert and Dupire complexes (see section entitled "Stratigraphy"). Four sectors of the Nedlouc area are characterized by an important concentration of supracrustal rock remnants. These sectors are interpreted as relics of metamorphosed and dismembered greenstone belts. They are: the Duvert, Natuak, Morrice and Dupire belts, from which the samples discussed below were collected. All the samples under study were collected in areas where the volcanic origin is confirmed by the presence of pillowed basalt relics, or by the association with paragneiss, iron formation or felsic pyroclastic rocks.

Results

Major and Trace Elements

Analytical results for major and trace elements are plotted in Figures 6 and 7. The classification diagram by Winchester and Floyd (1977) shows that volcanic rocks of the Nedlouc area form a subalkaline suite composed of basalts, andesites and rhyodacites (Figure 6a). These analyses are also plotted on the AFM magmatic discrimination diagram (Figure 6b) as proposed by Irvine and Baragar (1971). This diagram shows that the compositional variation of Nedlouc basalts is related to that of tholeiitic suites characterized by an enrichment in Fe_2O_3t. Intermediate and felsic samples on, the other hand, follow the same alkali enrichment trend as calc-alkaline suites. Diagrams shown in Figures 6c to 6f display some major element concentrations for all the basalt, andesite and rhyodacite-dacite samples.

Ultramafic rocks have compositions corresponding to komatiitic basalts and komatiites, because their SiO_2 contents vary between 41.2 and 50.6 %. They are characterized by moderate to high Fe_2O_3t (10-18 %) and MgO (6.3-31.3 %)

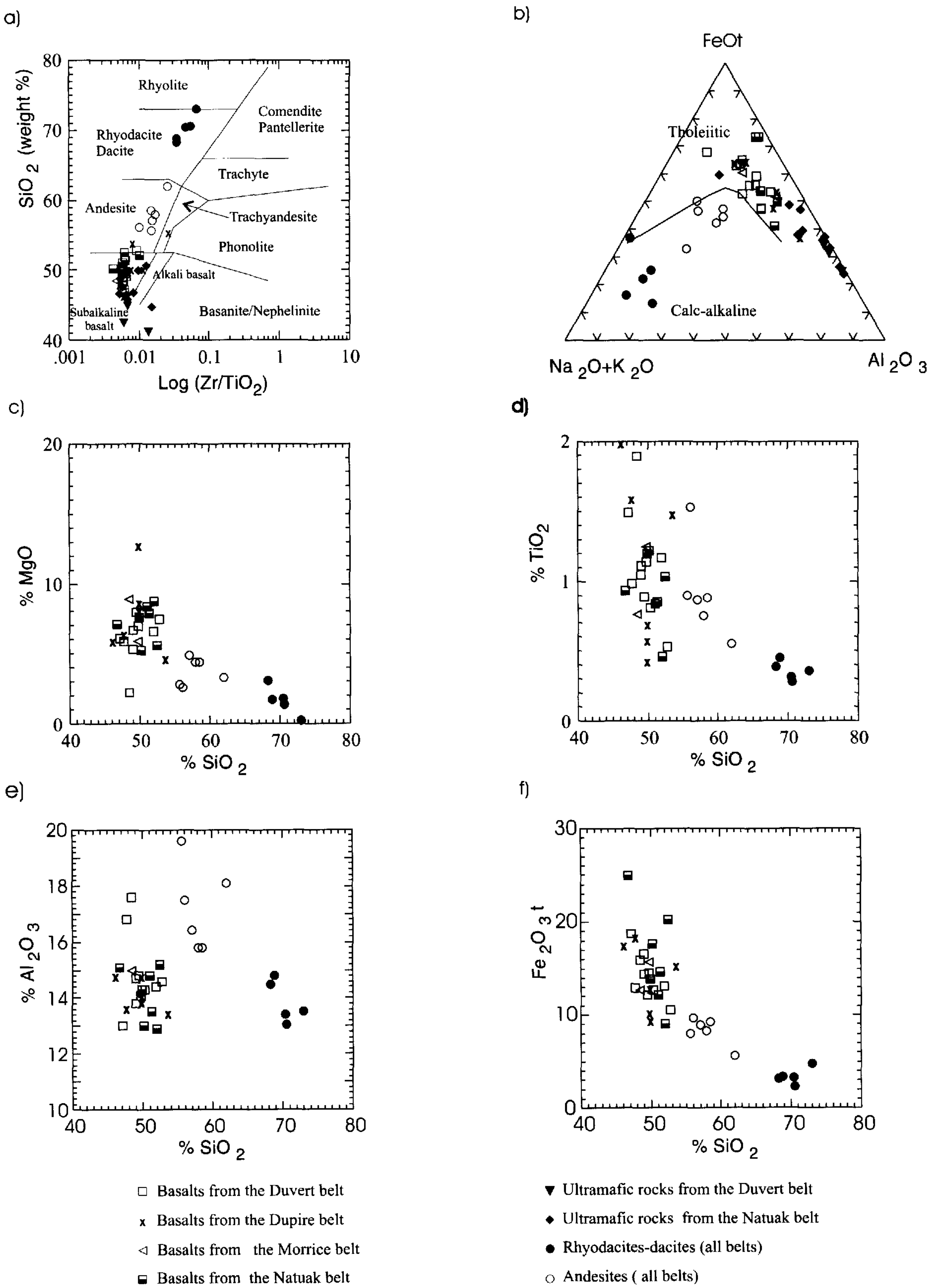

FIGURE 6 – Geochemical diagrams showing results of major element analyses of volcanic rocks and ultramafic rocks in the Lac Nedlouc area : **a)** SiO_2 vs Zr/TiO_2 classification diagram (Winchester and Floyd, 1977); **b)** AFM diagram (Irvine and Baragar, 1971); Binary diagrams **c)** MgO vs SiO_2; **d)** TiO_2 vs SiO_2, **e)** Al_2O_3 vs SiO_2, **f)** total Fe_2O_3 vs SiO_2.

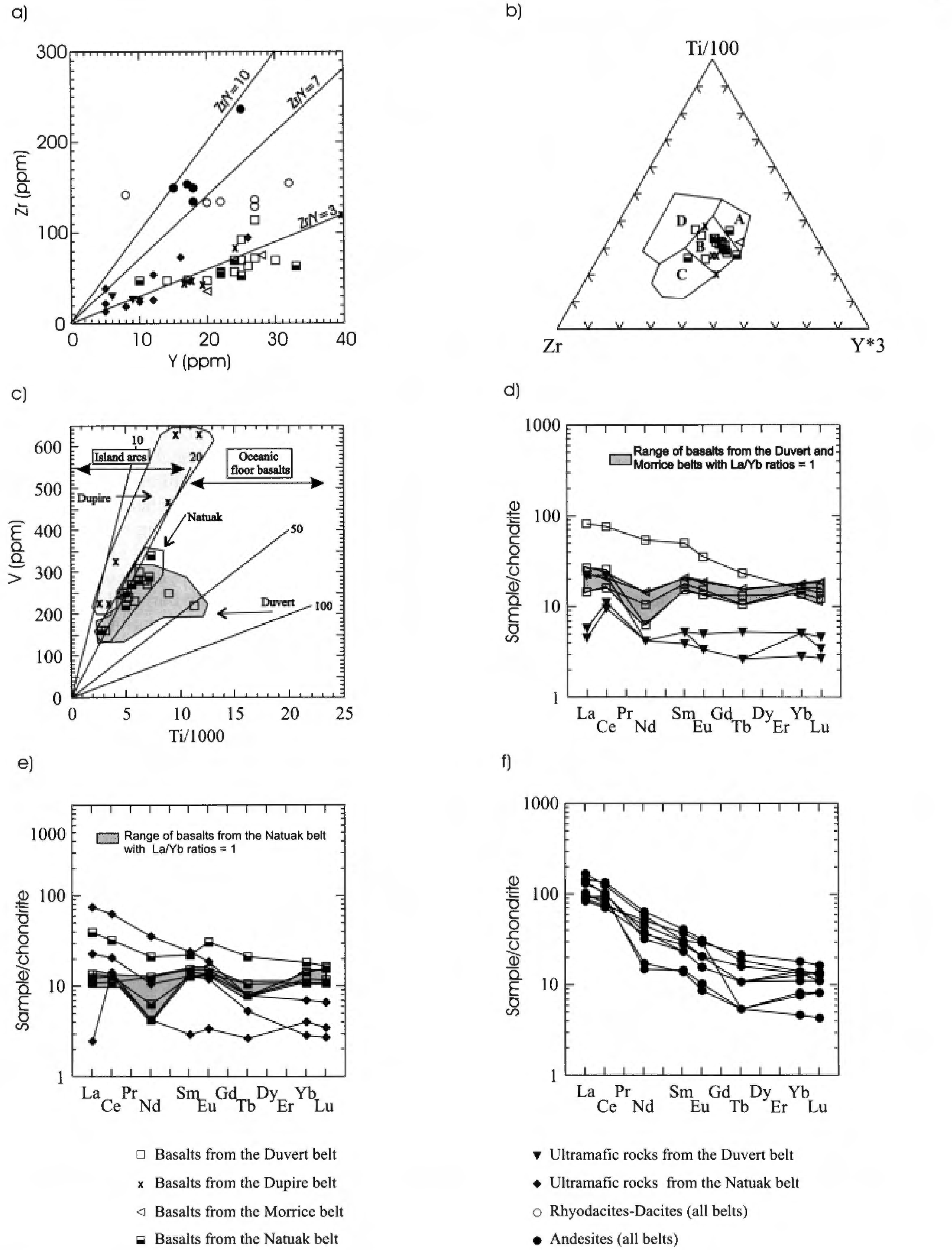

FIGURE 7 – Geochemical diagrams showing results of trace and rare earth element analyses of volcanic rocks and ultramafic rocks in the Lac Nedlouc area : **a)** Zr/Y diagram; **b)** Zr-Ti-Y paleotectonic diagram (Pearce and Cann, 1973); fields A and B : K_2O-poor island arc tholeiitic basalts; field B : oceanic floor basalts; fields B and C : calc-alkaline basalts; field D : intraplate basalts; ; **c)** Ti/V paleotectonic diagram (Shervais, 1982); Chondrite-normalized rare earth element diagrams; **d)** Mafic volcanic and ultramafic rocks from the Duvert belt; **e)** Mafic volcanic and ultramafic rocks from the Natuak belt; **f)** Intermediate to felsic volcanic rocks from all belts.

contents. Compatible minor elements such as Cr and Ni show concentrations between 300 and 5,100 ppm, and between 67 and 1,500 ppm respectively. Major element concentrations in basalts fall between 2.3 and 12 % MgO (Figure 6c), between 0.4 and 2.0% TiO_2 (Figure 6d), between 13 and 15 % Al_2O_3 (Figure 6e) and between 10.6 and 24.0 % Fe_2O_3t (Figure 6f). Minor elements such as chromium varies between 20 and 400 ppm and nickel between 33 and 457 ppm. These concentrations indicate that none of the basalt samples appears to have the composition of a primitive magma. It is worth mentioning that major element concentrations are essentially identical for samples from all belts. Consequently, the results of major element analyses are not useful in distinguishing basalts from one belt relative to basalts from other belts. As opposed to ultramafic-mafic rocks, andesitic to dacitic-rhyodacitic composition intermediate rocks have moderate to low Fe_2O_3t contents, which respectively vary between 5.6 and 9.73 %, and between 2.2 and 4.7 %. These rocks also display low MgO contents between 2.6 and 4.9 % and between 0.2 and 3.1 %. Intermediate rocks have Al_2O_3 concentrations greater than 16 % indicating a sharp increase in Al_2O_3 content relative to mafic samples. This increase in aluminium is interpreted as an indication that the two compositional suites are not related. Felsic to intermediate rocks are characterized by a systematic decrease in the concentration of most major elements as a function of increasing differentiation represented by the increasing SiO_2 content. This type of geochemical relationship is characteristic of a petrological evolution largely controlled by fractional crystallization processes of minerals such as clinopyroxene, hornblende, plagioclase and titano-magnetite.

With regards to immobile trace elements such as Zr and Y (Figure 7a), all ultramafic rocks and basalts, with the exception of a few rare samples, have Zr/Y ratios below 3. This low ratio indicates that all the rocks sampled, although they come from different complexes, behave as a single syngenetic suite. However, intermediate to felsic rocks have higher Zr/Y ratios varying between 5 and 10.

Using elements such as Ti, Zr and Y, which are usually immobile during episodes of regional metamorphism, it is possible to compare the basaltic suite of the Nedlouc area with those from modern paleotectonic environments (Pearce and Cann, 1973; Figure 7b). Nedlouc basalts mainly fall in field B, which corresponds to oceanic floor basalts (MORB), island arc tholeiites and calc-alkaline basalts. Since we know that basalts in our area belong to a tholeiitic suite, the calc-alkaline basalt environment may be eliminated. Moreover, the V/Ti diagram (Shervais, 1982) shown in Figure 7c separates rocks of the Dupire belt from those of the Duvert, Natuak and Morrice belts. Rocks from the Dupire belt have V/Ti ratios below 20. These values correspond to those of rocks from modern island arc environments, whereas rocks from other belts have ratios above 20. The latter fall in the field defined by oceanic floor basalts (MORB) and back-arc basalts.

Rare Earth Elements

Over twenty samples, selected among the ultramafic and basaltic rocks of the Duvert, Morrice and Natuak belts, and certain felsic rocks were analyzed for rare earth elements. These elements are generally used to illustrate magmatic differentiation processes responsible for the petrologic evolution of a suite of rocks, and thereby establish genetic links between different rock types. Chondrite-normalized analytical results are plotted in diagrams shown in Figures 7d, 7e and 7f.

Three ultramafic rock samples from the Duvert belt are represented (Figure 7d) by flat, less evolved rare earth element patterns, with a La/Yb ratio of 1 to 3 and lanthanum contents three times that of chondrites. Basalts are characterized by two types of patterns; the first type is flat with a La/Yb ratio of 1 and lanthanum values about twenty times chondrites, whereas the second type is evolved, showing an enrichment in light rare earth elements with a La/Yb ratio of 7 and a lanthanum value at ninety times that of chondrites. With the exception of a slight negative neodymium anomaly, the first of these two types of patterns is parallel to that of ultramafic rocks, but with an overall enrichment in rare earth elements. The similarity of ultramafic rock patterns and basalt patterns suggests that these basalts may have been derived from the fractional crystallization of olivine and hornblende, the latter being the only mineral that may explain the neodymium anomaly. This fractional crystallization process would have taken place in a komatiitic parent magma. As for the more evolved pattern, two hypotheses may be considered to explain its presence; either the production of magma from a very low rate of partial melting, or the production of a basalt of calc-alkaline affinity resulting from fractional crystallization and crustal contamination processes. In the latter case, the basalt could reflect a drastic change in the tectonic regime allowing the emplacement of magmas. This change could also be associated with the transformation from an oceanic basalt environment to that of a basalt associated with an active compressional tectonic regime.

Ultramafic rocks of the Natuak belt show more diverse rare earth element patterns than those of the Duvert belt (Figure 7e). One sample has a relatively flat pattern with a La/Yb ratio of 1.5 and a lanthanum content of one to two times chondrites. Two other samples have more evolved patterns characterized by an enrichment in light rare earths, with La/Yb ratios of 11 and 15 and lanthanum values at twenty to one hundred times chondrites. As for basalts, they show patterns similar to those of basalts from the Duvert belt. Three samples have flat yet slightly enriched patterns, typical of N-MORBs, with lanthanum values at ten times chondrites, and La/Yb ratios of 1.6. Another basalt sample displays a pattern enriched in light rare earth elements, with a La/Yb ratio of 3 and a lanthanum content at twenty times chondrites. As in the Duvert belt, basalts of the Natuak belt may have been derived from fractional crystallization processes. The composition of the parent magma could resemble that of the most primitive ultramafic rock sample, and the tectonic environment could also be similar. However, at this point in our study, it is difficult to explain what the two light rare earth-enriched ultramafic rock samples represent.

All felsic samples indicate an enrichment in light rare earth elements. La/Yb ratios are typical of evolved patterns. These ratios vary between 10 and 15, with lanthanum values around one hundred times chondrites. The patterns obtained are similar to those of calc-alkaline intermediate to felsic rock samples. In these suites, fractional crystallization and crustal contamination mechanisms play an essential role in the petrological evolution of these rocks. These processes are generally responsible for the generation of magmas associated with a compressional tectonic regime related to continental volcanic arcs.

ECONOMIC GEOLOGY

The discovery of Archean greenstone belts by the Geological Survey of Canada in the early 1990s generated increasing interest for gold and base metal exploration in the Minto Block. Early exploration programs focussing on the mineral potential of the Minto Block were conducted by Soquem and Cominco (Chapdelaine, 1995; 1996) and by the Ministère des Ressources naturelles du Québec (Lamothe, 1997) in the Lac Dupire area. This work led to the discovery of gold showings in iron formations. Subsequent work by Soquem, Cominco and Virginia Gold Mines, among others, resulted in the discovery of numerous gold and base metal mineral occurrences in the Kogaluc belt (Francoeur, 1996), the Qalluviartuuq-Payne belt (Cattalani and Heidema, 1993; Cuerrier, 1998) and the Duquet belt (Cuerrier, 1997). This work outlined the volcanogenic nature of mineralization in the Qalluviartuuq-Payne and Duquet belts, in addition to uncovering evidence of porphyry-type polymetallic mineralization associated with tonalites in the Duquet belt (Cuerrier, 1997; see Labbé *et al.*, 1998).

The lake sediment survey conducted by the MRN in 1997 over the entire territory covered by the Far North Project (MRN, 1998), revived mining exploration interest in Québec's Far North. Following this survey, a joint venture involving Soquem, Virginia Gold Mines and Cambior took two exploration permits in the Lac Nedlouc area (NTS sheet 34H), the Morrice and Vernot licences, based on anomalies indicating a uranium potential. Uranium values in lake sediments in these areas reached up to 1,900 ppm.

Mapping carried out in the summer of 1998 led to the discovery of several new mineralized zones in the Morrice, Natuak and Duvert belts, thus illustrating the promising mineral potential of the area. No metallogenic study has been carried out yet on these mineralized zones. Nevertheless, the principal sites of economic interest (sites 1 to 20), which yielded anomalous values in Au, Ag and base metals, are briefly described in Table 2. The location of these sites is noted in GC-type geological maps in the SIGÉOM system. Sites 1 to 20 are located on the map showing lake sediment anomalies in the Lac Nedlouc area (Figure 8). This map also shows the contacts between lithological units (Figure 4), overlain by anomalous concentrations exceeding that of the 95th percentile for Au, As, Cu, Zn, Ni, Cr and Co. This presentation illustrates the difficulty in directly correlating lake sediment anomalies with mapped mineralized zones. It is therefore essential to follow through with the interpretation of lake sediment data beyond an intuitive level. On the other hand, the presence of anomalous As values at site 3 (0.28% As) coincides with several lake sediment anomalies. In a few locations, the presence of ultramafic rocks appears to explain other Ni and Cr anomalies. Mineralizations observed in the various belts in the area are associated with the following metallotects : iron formations, siliceous horizons, mineralized horizons associated with basalts and ultramafic rocks, and late quartz-rich cataclasite zones.

Iron Formations

Iron formations were observed exclusively in the Duvert (Advt) and Dupire (Adpr) complexes. They form one to ten-metre thick banded horizons associated with volcanic rocks and garnetiferous paragneiss. Previous work by Chapdelaine (1995; 1996) and Lamothe (1997) in the Lac Dupire area, revealed the presence of iron formations reaching up to 30 metres thick. These authors mention that the structural setting of this area is conducive to the secondary concentration of gold in fold hinges and shear zones. The mineralization occurs as disseminated PY-PO-AS±CP, and PY-AS veinlets parallel to the banding and the foliation. Furthermore, the presence of PY-QZ veinlets cross-cutting the iron formation at an angle indicates that at least part of the mineralization is epigenetic, and could reflect the remobilization of a primary concentration of gold and sulphides. However, since the discovery of interesting gold concentrations (6.4 g/t) in 1993-1994 (Chapdelaine, 1995; 1996; Lamothe, 1997), exploration work in this area was unsuccessful in identifying economically viable zones.

Our mapping program uncovered several mineralized iron formations in the Duvert and Natuak belts (Appendix 2, Photo 1). In these belts, silicate iron formations composed of grunerite, clinopyroxene, garnet, quartz and magnetite

TABLE 2 – Principal sites with anomalous concentrations in Au, Ag and base metals.

site	SIGÉOM NUMBER	LOCATION:UTM NAD 83	SETTING	GRADES
			Duvert Belt	
1	1348	670305E 6400131N	Silicifed felsic horizon with PY-PO-CP±AS mineralization, 1 to 2 m thick, associated with iron formation and andesites.	220 ppb Au, 0.85% Cu, 960 ppm Zn
2	1303	669297E 6399716N	Completely carbonatized ultramafic rocks, with PY-PO-AS mineralization, associated with oxide and silicate-facies iron formations, basalts and andesites.	23 ppb Au, 0.14% As
3	281	658391E 6406665N	Siliceous horizons with a mylonitic texture,assoiated with ultramafic rocks. The mineralisation consists of PY-AS-TL-TM.	270 ppb Au, 0.28% As, 0.25% Ni, 0.12% Co, 0.13% Cr
4	282	661623E 6401585N	Bands of ultramafic rocks associated with basalts and QZ-PY siliceous horizons.	220 ppb Au, 670 ppb Ag 0.12 % Ni, 0.12 % Co
5	1310	667614E 6396749N	PO-PY-CP mineralized zone about 1 m thick at the contact between ultramafic rocks and basalts.	190 ppb Au, 0.49 % Cr 0.18 % Ni
6	1312	667715E 6397092N	Oxide-facies iron formation horizon, 2 to 3 m thick, with PY-PO mineralization, assoated with migmatized paragneiss.	556 ppb Au
7	3279	668017E 6388967N	Cataclastic and/or brecciated basalts with mylonitic quartz fragments in a PY-PO matrix.	130 ppb Au, 0.16 % Pb, 0.11% Zn, 700 ppm Cu
8	3285	667155E 6388367N	Cataclastic and/or brecciated basalts with mylonitic quartz fragments in a PY-PO matrix.	0.20 % Cu
9	1029	663226E 6381217N	Oxide and silicate-facies iron formation, mineralized in PY-PO-AS, 15 to 20 m thick and associated with paragneiss.	1.3 ppm Au
10	9079	678629E 6375953N	Oxide and silicate-facies iron formation, mineralized in PY-PO-AS, associated with a bimodal volcanic sequence and paragneiss.	270 ppb Au, 590 ppm As
11	61	663974E 6398493N	Discontinuous horizons with PY-CP-AS mineralization hosted in a basalt sequence.	78 ppb Au, 0.94 % As, 0.12 % Cu
			Natuak Belt	
12	1196	336830E 6361259N	Silicate-facies iron formation associated with andesites.	110 ppb Au, 0.12 % Cr
13	1210	336880E 6361726N	Felsic horizon with PO-PY-FC mineralization, associated with basalts, andesites, ultramafic rocks, paragneisses and thin carbonate horizons.	67 ppb Au, 290 ppm Zn 0.25 % Ni, 0.39 % Cr
14	4539	337113E 6360202N	Silicate-facies iron formation with PY-PO-AS mineralization, associated with basalts.	0.20 % Pb, 6 ppm Ag 0.78 % Zn
15	90	333510E 6357749N	Siliceous QZ-PY horizons about 6 m wide associated with basalts.	220 ppb Au, 8 ppm Ag 0.14 % Pb, 0.31 % Zn
16	178	340941E 6364355N	PY-bearing quartz veins cross-cutting a sequence of pillowed metabasalts.	0.16 % Cu, 8 ppb Au
17	1156	334784E 6360186N	Oxide-facies iron formation horizon, 2 to 3 m thick, with PY-PO mineralization, assoated with migmatized paragneiss.	556 ppb Au
			Morrice Belt	
18	1193	656883E 6357706N	Discontinuous horizons with disseminated PO-PY-CP mineralization located within a basalt sequence.	0.18 % Cu, 2.6 ppm Ag 170 ppb Au, 290 ppm Zn 290 ppm Ni
19	1165	655927E 6357968N	1 to 2 m thick horizon with disseminated PO-PY-CP within a homogeneous basalt sequence.	0.24 % Cu, 2.3 ppm Ag, 26 ppb Au
20	1164	656260E 6357889N	Magnetic horizon (MG-QZ-HB) with PO-PY-CP mineralization in basalts.	0.19 % Cu, 1 ppm Ag, 100 ppb Au, 310 ppm Zn, 0.13 % Cr

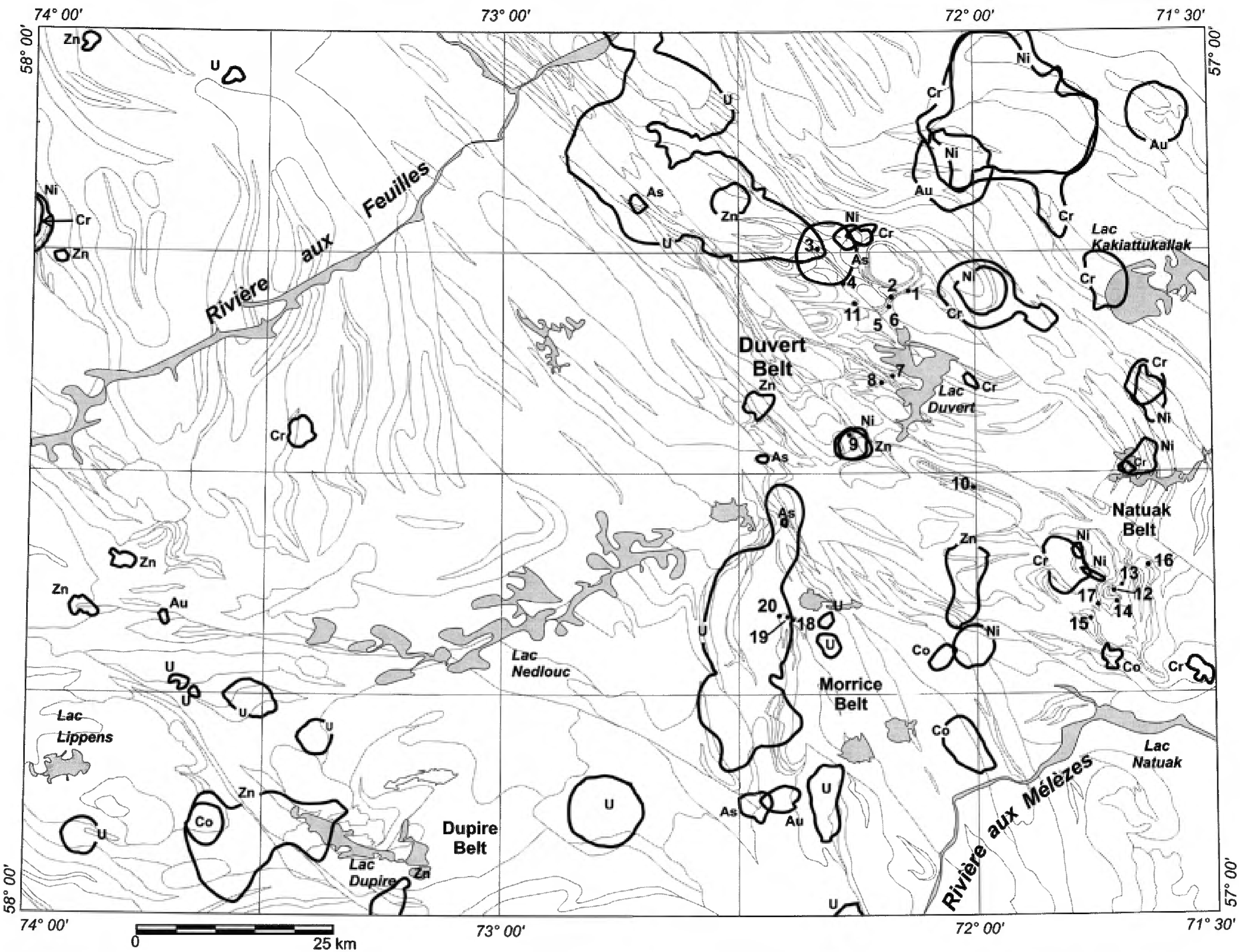

FIGURE 8 – Geochemical areas containing one or more anomalous lake sediment samples, and location of principal sites of economic interest (1 to 20) associated with anomalous values in the bedrock. Lake sediment anomalies exceeding the value of the 95th percentile are outlined on a diagram showing the contacts between the various lithological units (Figure 4).

bands generally show better potential for gold than oxide-facies iron formations. The mineralization occurs as disseminated PY-PO-AS, or in mm-scale bands parallel to the S_2 foliation. The best grade obtained in these iron formations is 1.3 g/t Au (site 9, Figure 8; Table 2).

Siliceous Horizons

Several siliceous horizons were mapped in the Duvert and Natuak belts. These horizons are one to ten metres thick, and are commonly associated with basalts and ultramafic rocks (Appendix 2, Photo 2). The quartz displays well-developed mylonitic, granoblastic or cataclastic textures, characteristic of rocks that have undergone intense deformation. The mineralization present within these horizons is generally composed of PY-AS-PO±CP. Tourmaline and tremolite are also present in certain mineralized zones. The best grades obtained from samples collected in these horizons were taken at site 1, associated with an iron formation horizon (Appendix 2, Photo 3; 220 ppb Au; 0.85 % Cu; 960 ppm Zn), and site 3 (270 ppb Au; 0.28 % As; 0.25 % Ni; 0.12 % Co; 0.13 % Cr), associated with ultramafic rocks (Figure 8, Table 2).

Horizons Located at the Interface between Ultramafic Rocks and Basalts

The Morrice, Duvert and Natuak belts contain several mineralized zones located within basalt sequences, as well as at the contact between basalts and ultramafic rocks. Within basalt sequences, mineralized zones occur as small one to ten-centimetre thick veinlets of PY-PO±CP, disseminated and parallel to the regional foliation, or as cm-scale veinlets that cross-cut the foliation. In certain locations (Lac Dupire and north of Lac Duvert), these mineralizations are associated with cordierite and anthophyllite-rich layers. Such occurrences are frequently interpreted in the literature as representing hydrothermal alteration zones associated with volcanogenic sulphide mineralization. However, in the case of the Lac Duvert area, a more detailed study is necessary to establish the relationship of these minerals with surrounding lithologies. The best results were obtained from samples collected at site 18 (Morrice belt). Maximum grades are: 0.18% Cu, 170 ppb Au, 2.6 ppm Ag (Figure 8, Table 2). As for mineralized zones present at the interface between basalts and ultramafic rocks, the mineralization occurs as disseminated PO-PY±CP along m-scale horizons. Best results are: 270 ppb Au, 670 ppb Ag, 0.12% Ni and 0.12% Co at site 5 (Figure 8, Table 2, Appendix 2; Photo 4).

Quartz-Rich Late Cataclasite Zones

Numerous late brittle deformation zones are represented in the field by cataclasites oriented E-W, NE-SW and NW-SE. These zones are interpreted as being associated with deformation phase D_6. The cataclasites may result from the reactivation of older ductile structures. Cataclastic zones generally display strong hematization, epidotization and chloritization (Appendix 2, Photo 5). They constitute good contexts for the remobilization of gold, base metals and uranium. In the Duvert belt, a brittle structure defined by a NNW-SSE oriented lineament that extends over several tens of kilometres affects a granodiorite of the Rivière aux Feuilles Suite. The latter has suffered cataclasis and is injected with quartz-hematite veins. This zone was also observed in basalts, where fragments of granoblastic quartz were found in a matrix of pyrite and pyrrhotite (sites 7 and 8). These sites yielded anomalous values of 130 ppb Au, 0.16 % Pb, 0.11 % Zn and 700 ppm Cu (site 7) and 0.20 % Cu (site 8).

DISCUSSION AND CONCLUSION

Our work in the Lac Nedlouc area has enabled us to build a new geological framework at a scale of 1:250,000 and to establish a stratigraphy for supracrustal rocks and intrusive suites. Supracrustal rocks in the map area are grouped in the Duvert and Dupire complexes, each complex comprising one or more volcano-sedimentary belts (Duvert, Morrice, Natuak and Dupire). Intrusive rocks are subdivided into lithodemic suites, based on their spatial distribution relative to known lithotectonic domains. Consequently, certain suites are present in several of these domains. The stratigraphy used in this report maintains the notion of lithotectonic domain in order to facilitate correlations with previous work (Percival and Card, 1994). However, this type of approach raises numerous questions concerning the proposed lithotectonic subdivision. The most important questions raised are:

1) Given the absence of visible tectonic sutures, and the distribution of certain intrusive suites, the boundaries of lithotectonic domains sometimes become obscure and arbitrary. What is the relationship between these lithotectonic domains? Do the domains truly correspond to distinct geotectonic entities?

2) What is the significance of the presence of intrusive suites within several lithotectonic domains (the Rivière aux Feuilles Suite, for example)? Do these intrusive suites have the same tectono-metamorphic history as the supracrustal rocks? What is the relationship between these intrusive rocks and the supracrustal rocks? Is there a link between the emplacement of the intrusive rocks and the degree of metamorphism affecting supracrustal rocks?

More detailed work focussing on stratigraphic correlations, geochronology and the lithogeochemistry of supracrustal and intrusive rocks, as well as on the various tectono-metamorphic events is required before we attempt to answer these questions and understand the different terrains that make up the Minto Block. As a first step, the stratigraphy established in this report will be useful in making correlations on a regional scale, and will contribute in deciphering the relationships between these terrains.

Our mapping also helped outline the sectors most favourable to the discovery of new mineral occurrences in the Duvert, Morrice and Natuak belts. The geological settings observed in these volcano-sedimentary belts are comparable to those in belts in the northwest Minto Block (Qalluviartuuq-Payne, Kogaluc and Duquet), where numerous showings were discovered in recent years. Most of these volcano-sedimentary belts display many features similar to other Archean greenstone belts renowned for their gold and base metal ore deposits, such as the Abitibi, or more strongly metamorphosed belts in the Yilgarn Craton of Australia. These similarities indicate that the Lac Nedlouc area, despite the restricted extent of its volcano-sedimentary belts, warrants further attention for precious metals (Au, Ag) and base metals (Cu, Zn, Ni, Co). Furthermore, evidence of alteration associated with ductile-brittle structures indicates that the latter may have played a significant role in the remobilization and the secondary enrichment of gold and uranium through hydrothermal circulation processes.

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APPENDIX 1 : PHOTOGRAPHS

1- Garnet-biotite-cordierite paragneiss from the Duvert Complex (Advt3). Garnet is syn- to late-S_2.

2- Sheared ultramafic rock from the Duvert Complex (Advt4) exhibiting well-developed C/S type fabrics.

3- Garnet-biotite-cordierite-andalusite-sillimanite diatexite from the Rivière aux Mélèzes Suite (Aram).

4- Heterogeneous granodiorite from the Monchy Suite (Amcy) containing tonalitic phases and mafic gneiss enclaves.

5- Heterogeneous tonalite from the Suluppaugalik Suite, where the S_2 foliation is transposed by a shear zone associated with deformation phase D_4.

6- Metabasalts from the Duvert Complex (Advt1) containing undeformed leucosomes with orthopyroxene, clinopyroxene and hornblende, which represent M2+ metamorphism.

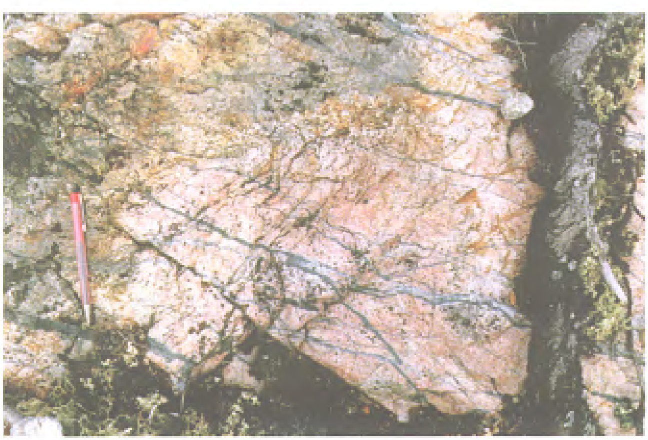
APPENDIX 2 : PHOTOGRAPHS

1- Rusty zone associated with ultramafic rocks, iron formations and mafic to intermediate volcanic rocks. This zone is located in the Natuak belt (sites 13 and 14, Figure 8).

2- Rusty zone associated with a siliceous horizon within a basalt sequence (site 15, Figure 8).

3- Rusty zone representing an iron formation and a mineralized siliceous horizon (site 1, Figure 8). This zone is located in the Duvert belt.

4- One to two-metre thick mineralized horizon located at the interface between basalts and ultramafic rocks in the Duvert Complex (sites 5 and 6, Figure 8).



5- Fractured granodiorite injected by quartz and hematite veins. The fracture pattern is interpreted as a product of deformation phase D_6.

6- Completely carbonatized ultramafic rocks intruded by pegmatite containing abundant diopside (site 2, Figure 8).

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