RG 2003-02

GEOLOGY OF THE LAC COUTURE (35B) AND LACS NUVILIK (35G, SOUTHERN HALF) AREAS

Documents complémentaires

Additional Files

Licence

License

Énergie et Ressources naturelles
Québec

RG 2003-02

Geology of the Lac Couture (35B) and Lacs Nuvilik (35G, southern half) areas

Louis Madore
Youcef Larbi
Jean-Yves Labbé
Kamal N.M. Sharma
Pierre Lacoste
Jean David

Arctic plant (Silene acaulis) from the northern Ungava Peninsula.

2004

Québec

Geology of the Lac Couture (35B) and Lacs Nuvilic (35G, southern part) areas

Louis Madore
Youcef Larbi
Jean-Yves Labbé
Kamal N.M. Sharma
Pierrre Lacoste
Jean David

RG 2003-02

Abstract

This geological survey covers the area represented by the Lac Couture map sheet (NTS 35B) as well as the southern part of the Lacs Nuvilic map sheet (NTS 35G, Lac Allemand area). This area is mainly underlain by Archean rocks. Proterozoic gabbro dyke swarms (Klotz Dykes, Payne River Dykes, Pointe Raudot Dykes and Franklin Swarm) cross-cut the rocks in the area. The northern part of the area is overlain by thrust sheets composed of Paleoproterozoic supracrustal sequences of the Ungava Trough. In the northwestern part of the map area bordering the Ungava Trough, two small Proterozoic lamprophyric diatremes (Kuuvvaluk Diatremes) pierce the Archean craton.

Based on lithological assemblages and structural style, the area was subdivided into three informal domains: the *western domain*, the *central domain* and the *eastern domain*. The *western domain* is mainly composed of foliated or gneissic tonalite of the Rochefort Suite. These tonalites enclose volcano-sedimentary rocks, namely the Allemand and Duquet belts. In the *central domain*, migmatitic tonalites of the Lesdiguières Suite are predominant, and enclose the Peltier and Caumartin belts. In the western and central domains, regional metamorphic conditions reached the amphibolite facies. The *eastern domain* mainly consists of foliated pyroxene-bearing granodiorites and granites of the Châtelain Suite. These intrusive rocks enclose the Headwind Belt. In this domain, regional metamorphic conditions are typical of the granulite facies. Weakly deformed, locally porphyritic late Archean granites of the La Chevrotière Suite intrude tonalitic rocks in all three domains.

At least four episodes of deformation have affected the rocks in the area. The first two episodes of deformation (D1 and D2) are ductile and Archean in age. Deformation D1 is represented by a foliation or gneissocity, accompanied by isoclinal and intrafolial folds. Deformation D2 is complex, and corresponds to the development of ductile shear zones and of regional structures with a geometry reminiscent of domes. These Archean episodes of deformation were followed by a Paleoproterozoic event (D3) that corresponds to the Ungava Orogen. Structures associated with this Paleoproterozoic event are observed in the northern part of the area (NTS sheet 35G). They are represented by major thrust faults shallowly dipping to the NNW. They are associated with the SSE tectonic transport of Paleoproterozoic sequences of the Ungava Trough over the Archean basement. A late episode of deformation (D4) postdates the Paleoproterozoic event. It consists of rectilinear brittle faults that transect the entire area.

Exploration carried out in the 1990s has led to the discovery of several showings in the Duquet volcano-sedimentary belt. The latter hosts volcanogenic massive sulphide mineralization associated with anthophyllite-cordierite-garnet-chlorite-biotite alteration zones. It also hosts gold showings associated with shear zones. Two minor showings were discovered in the northern part of the area. A Cu showing occurs in mafic volcanic rocks of the Allemand Belt, and a Ag showing was found in metabasalts of the Peltier Belt. Two other Cu-Co showings were found in a brittle fault oriented NW-SE, which runs across the central part of the area. Finally, the Allemand-Tasiat structural zone hosts a series of small alkaline intrusions, including the Kuuvvaluk Diatremes, composed of ultramafic lamprophyre. This zone warrants more detailed investigations to fully assess its diamond potential.

DOCUMENT PUBLISHED BY GÉOLOGIE QUÉBEC

Director
Alain Simard

Head of the Service géologique du Nord-Ouest
Robert Marquis

Document accepted for publication on the 02/04/02

Critical review
Pierre Brouillette
Abdelali Moukhsil

Translation
Michelle Mainville

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

Computer assisted drawing
Sophie Turcotte
Nathalie Drolet

Technical supervision
Charlotte Grenier

Dépôt légal – Bibliothèque nationale du Québec
ISBN : 2-551-22471-3

CONTENTS

(continues on the following page)

(Table of Contents continued...)

"Mapping thrives on the ambiguity caracteristic of the crossroads between an exact science and an art."
Jean-Claude Groshens

INTRODUCTION

Objectives

Since the summer 1997, the Ministère des Ressources naturelles du Québec (MRN) has devoted, within the scope of the Far North Program, tremendous efforts to develop a vast territory located north of the 55th parallel, by acquiring data and building a geoscience database. These initiatives are designed to help establish new strategies for mineral exploration in Québec's Far North, and contribute to a better understanding of this part of the Superior Province. Mapping conducted during the summer 2001 was carried out within the scope of this program. It consists of a geological survey at 1:250,000 scale, covering some 15,300 km^2. This new survey covers the Lac Couture map sheet (NTS 35B), and the southern part of the Lacs Nuvilic map sheet (NTS 35G, Lac Allemand area).

Location and Access

The area covered by this survey is located in northern Québec, in the Ungava Peninsula (Figure 1). It is bounded to the north by the Ungava Trough (61° 25' latitude) and to the south by the 60th parallel. Its eastern and western limits correspond to longitudes 74° 00' and 76° 00'. The closest Inuit community is Puvirnituk, located 115 km to the southwest of the centre of the area. The area is accessible by ski-equipped aircraft from December to May, and by floatplane during the summer months. The Rivière Puvirnituq is the main watercourse that runs through the area. The largest water bodies are Lac Couture, Lac Duquet, Lac Châtelain, Lac Lesdiguières, Lac Nantais and Lac Allemand. Topographic relief is low overall, and the area consists of gently rolling landscape. The average altitude gradually rises from the south to the north, from 150 to 500 metres above sea level. The area lies north of the tree line. Rock outcrops are large and numerous, but are generally covered with lichen.

Methodology

Fieldwork consisted of geological mapping and sampling of lithodemic units and mineralized occurrences for lithogeochemical analysis. Geological crews were transported in the field via helicopter. Traverses averaging 15 km in length were spaced roughly 8 km apart. The grid spacing was reduced in more interesting areas, namely in volcano-sedimentary sequences and alkaline intrusions. Previously acquired geoscience data was integrated to the newly collected data. This information is available in Québec's spatially referenced geomining information system, SIGÉOM.

Previous Work

In the early 1960s, the Geological Survey of Canada carried out a series of geological observations in the northern part of Nouveau-Québec (Kretz, 1961). This operation was followed by a 1:1,000,000 scale reconnaissance survey (Stevenson, 1968). The latter covers most of the Ungava Peninsula, namely between longitudes 70° 00' and 79° 00' and latitudes 56° 00' and 61° 00'. The Geological Survey of Canada continued with more detailed work, including a 1:250,000 scale geological reconnaissance survey, which includes map sheet 35G (Taylor, 1982). Later on, the Ministère des Ressources naturelles du Québec conducted a series of geological surveys at 1:50,000 scale, focussing on areas underlain by Paleoproterozoic rocks (Moorhead, 1989). In this report, we will focus on describing units within the Superior Province, since the rocks of the Ungava Trough have already been described in fairly recent and detailed publications.

A 1:250,000 scale reconnaissance survey covers the southern part of map sheet 35B (Percival *et al.*, 1996a). A lake sediment geochemistry survey (MRN, 1998), a gravity survey with readings at a 10-km grid spacing (GSC, 1994), and a regional aeromagnetic survey (Dion and Dumont, 1994) complement the geological data.

Acknowledgements

We wish to thank the members of our field crew who were involved in the field work, and who carried out remarkable work: Jonathan Andersen, Jason Annahatak, Valérie Bécu, Julie Bernard, Geneviève Boudrias, Sophie Brochu, Mira Dulude, Patrick Gavaland, David-Yohan Jalbert, David Lalonde, Annie Lavoie, Aurèle Noël, Jonathan O'Neil, Olivier Rabeau, Marie-Noëlle Riverin, and Sophie Turcotte. We also wish to thank Don Francis (McGill University), Michel Hocq (MRN) and Normand Goulet (Université du Québec à Montréal). Their involvement in this project was greatly appreciated. Our gratitude also goes out to the staff of Virginia Gold Mines, more specifically to Paul Archer for allowing us access to unpublished data and to Michel Chapdelaine and Philippe-Alexandre Villeneuve. We wish to acknowledge the excellent services rendered by Barry Ormes, Sylvain Ouellet and Michel Viens of Canadian Helicopters Limited, as well as by Léonard Deraps for the transportation of our equipment by floatplane, and also Aliva Tulugak, our dispatcher based in Puvirnituq. Pierre Brouillette (GSC), Jean-Pierre Lalonde, Charles Maurice and Abdelali Moukhsil (MRN), through their judicious advice, contributed to the quality of this report.

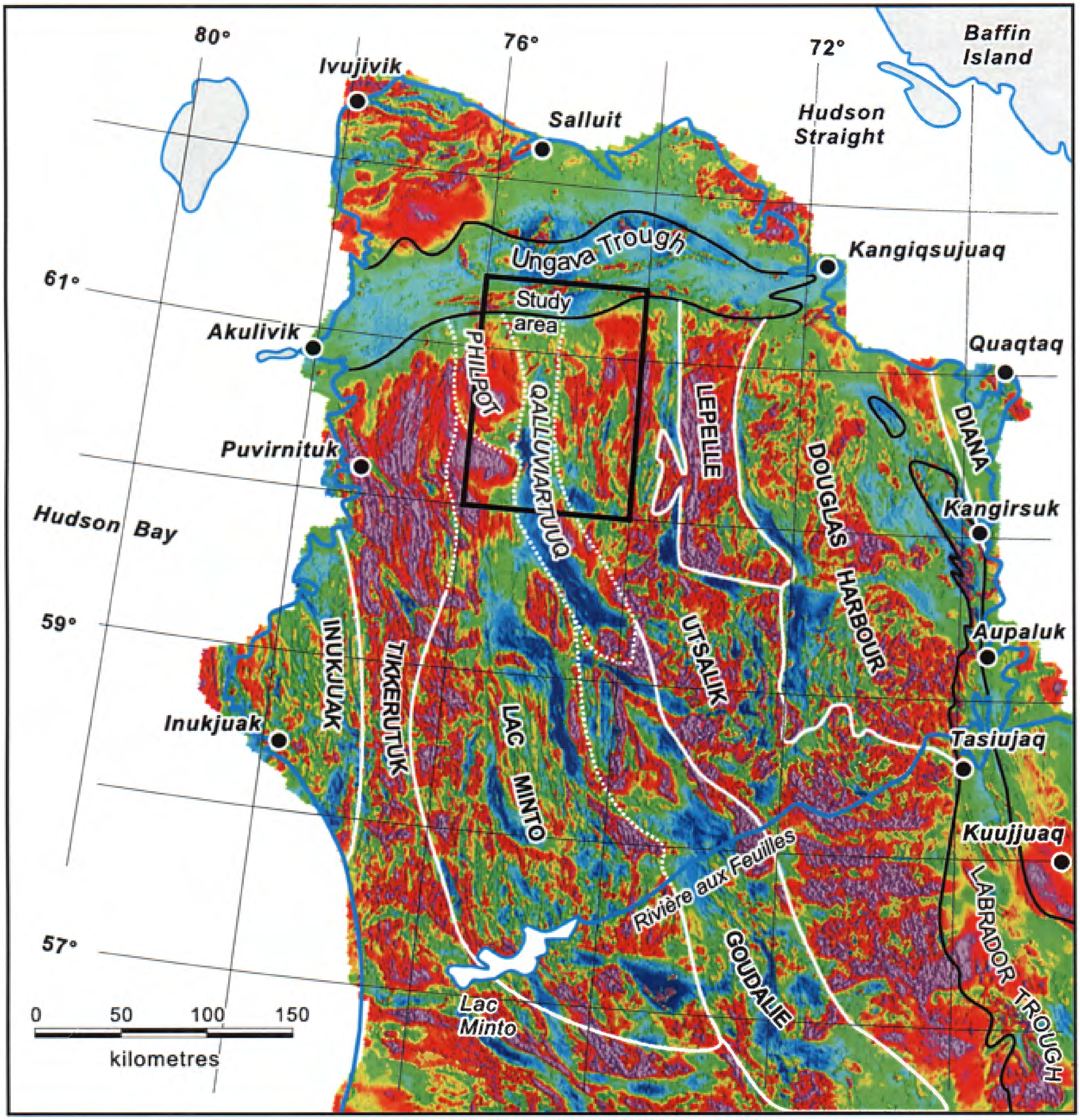


FIGURE 1 - Shaded total magnetic field showing the location of the study area and the boundaries of lithotectonic domains, modified after Percival *et al.* (1991, 1992, 1997). Dashed lines correspond to domain boundaries to be modified as a result of new geological surveys conducted by the MRN within the scope of the Far North Program.

GENERAL GEOLOGY

The northeastern Superior Province is a vast area mainly composed of foliated or gneissic felsic plutonic rocks. These rocks consist of tonalite-trondhjemite-granodiorite (TTG) that formed across a very wide age span (2.8-2.6 Ga). These TTG generally coincide with magnetic troughs. They enclose thin volcano-sedimentary belts (2.9-2.7 Ga) forming a string of scattered bands extending over more than one hundred kilometres in certain cases. Late (2.7 Ga) granodioritic and granitic intrusions cross-cut the TTG. This late potassic magmatism is invasive, and predominates in several areas. The latter coincide with zones characterized by a high magnetic field.

In the northeastern Superior Province, the Archean craton is bounded by Paleoproterozoic sequences assigned to the

Labrador Trough to the east, and to the Ungava Trough to the north. This Paleoproterozoic rock cover is allochthonous, at least along its northern area of exposure, and tectonically overlies the craton (St-Onge *et al.*, 1988; St-Onge and Lucas, 1990; Bouchard *et al.*, 1999). Archean rocks bordering these Paleoproterozoic sequences were remobilized during the Proterozoic (New Québec and Ungava orogens, *ca.* 1.8 Ga).

Percival *et al.* (1991, 1992 and 1997) subdivided the northeastern Superior Province into nine lithotectonic domains broadly trending NNW-SSE. These are, from west to east: the Inukjuak, Tikkerutuk, Lac Minto, Philpot, Qalluviartuuq, Goudalie, Utsalik, Lepelle and Douglas Harbour domains, with the Diana domain added at the easternmost edge (Madore *et al.*, 2001; Madore and Larbi, 2001). The Diana domain is characterized by a Proterozoic penetrative deformation event that affects the Archean bedrock (Figure 1). These lithotectonic domains, largely extrapolated based on the regional magnetic field map, do not always coincide with recent geological data. This is particularly true in the northern part of the area, for the Philpot and Qalluviartuuq domains, as well as for the Goudalie domain.

STRATIGRAPHY

The study area mainly comprises Archean rocks of the Superior Province. According to lithotectonic subdivisions proposed by Percival *et al.* (1991, 1992 and 1997), the map area is centered on the junction between the Philpot, Qalluviartuuq, Lac Minto and Utsalik domains (Figure 1). However, the boundaries of these domains do not coincide perfectly with the geology observed in the field, and will need to be modified as a result of this new geological data acquisition campaign.

In order to outline the lithological and structural characteristics of the major Archean rock assemblages in the area, we have subdivided the area into informal domains: the western, central and eastern domains. The western domain is composed of foliated or gneissic tonalite assigned to the Rochefort Suite. These tonalites enclose volcano-sedimentary rocks, namely the Allemand and Duquet belts. In the central domain, migmatitic tonalites of the Lesdiguières Suite enclose the Peltier and Caumartin belts. The eastern domain is largely dominated by deformed granodiorites and granites of the Châtelain Suite. These intrusive rocks enclose volcano-sedimentary rocks of the Headwind Belt.

The three domains contain late Archean intrusions of the La Chevrotière Suite. Composed of weakly deformed and locally porphyritic granites, these intrusions are somewhat more abundant in the eastern and central domains. All Archean assemblages are intruded by Proterozoic gabbro dyke swarms (Klotz Dykes, Payne River Dykes, Pointe Raudot Dykes and Franklin Swarm). In the northwestern part of the area, bordering the Ungava Trough, two small lamprophyric diatremes, presumably Proterozoic in age, intrude the Archean craton. Paleoproterozoic supracrustal sequences of the Ungava Trough cover the entire northern part of the area. A simplified geological map is shown in Figure 2.

Archean

Western Domain

Duquet Belt (Aduq)

During a reconnaissance mapping program conducted in the early 1960s, the Geological Survey of Canada (GSC) reported the presence of volcano-sedimentary rocks for the first time in the vicinity of lakes Ikirtuuk, Duquet and Couture (Stevenson, 1968). However, it was only in 1995 that a GSC crew conducted sufficiently detailed work to identify the rock types present in these volcano-sedimentary rocks and to delineate their extension (Percival *et al.*, 1996a, 1996b, 1997). The Duquet belt (north of Lac Couture) and the Akuaraaluk belt (west of Lac Couture) were defined by these surveys. In this report, we will group the two belts under the lithodemic term of Duquet Belt (Aduq), to designate all volcano-sedimentary rocks outcropping in the vicinity of lakes Ikirtuuq, Duquet and Couture (Figure 2).

The Duquet Belt is formed of volcano-sedimentary bands ranging from a few hundred metres to over 30 km in length, and less than 5 km wide. These bands occur along the margins of dome-shaped structures that characterize the southwestern part of the map area. The Duquet Belt is enclosed in tonalites-trondhjemites-granodiorites (TTG) of the Rochefort Suite. Rocks in the belt are migmatized and intruded by granitic and tonalitic veins.

Metabasalt and Mafic Gneiss (Aduq1)

Metabasalts and mafic gneisses (Aduq1) constitute the dominant rock types in the Duquet Belt (Figure 2). These lithologies are locally intercalated with ultramafic, intermediate or felsic volcanic rocks. Thin discontinuous metasedimentary horizons are also observed in certain locations. These mainly consist of paragneiss and conglomerate. Minor amounts of marble, calc-silicate rock and iron formation are also present within the volcanic sequences.

On outcrop, metabasalts and mafic gneisses are respectively characterized by a penetrative foliation and cm-scale compositional banding. Along the borders of the unit, near the contact with country rocks, the degree of deformation increases and a mylonitic or straight gneiss fabric develops. Locally, in the core of volcano-sedimentary bands, primary volcanic textures and structures are preserved. These generally consist of plagioclase-phyric lavas and pillowed or brecciated flows.

In thin section, metabasalts and mafic gneisses, mainly composed of amphibole (55 to 75 %) and plagioclase (20 to

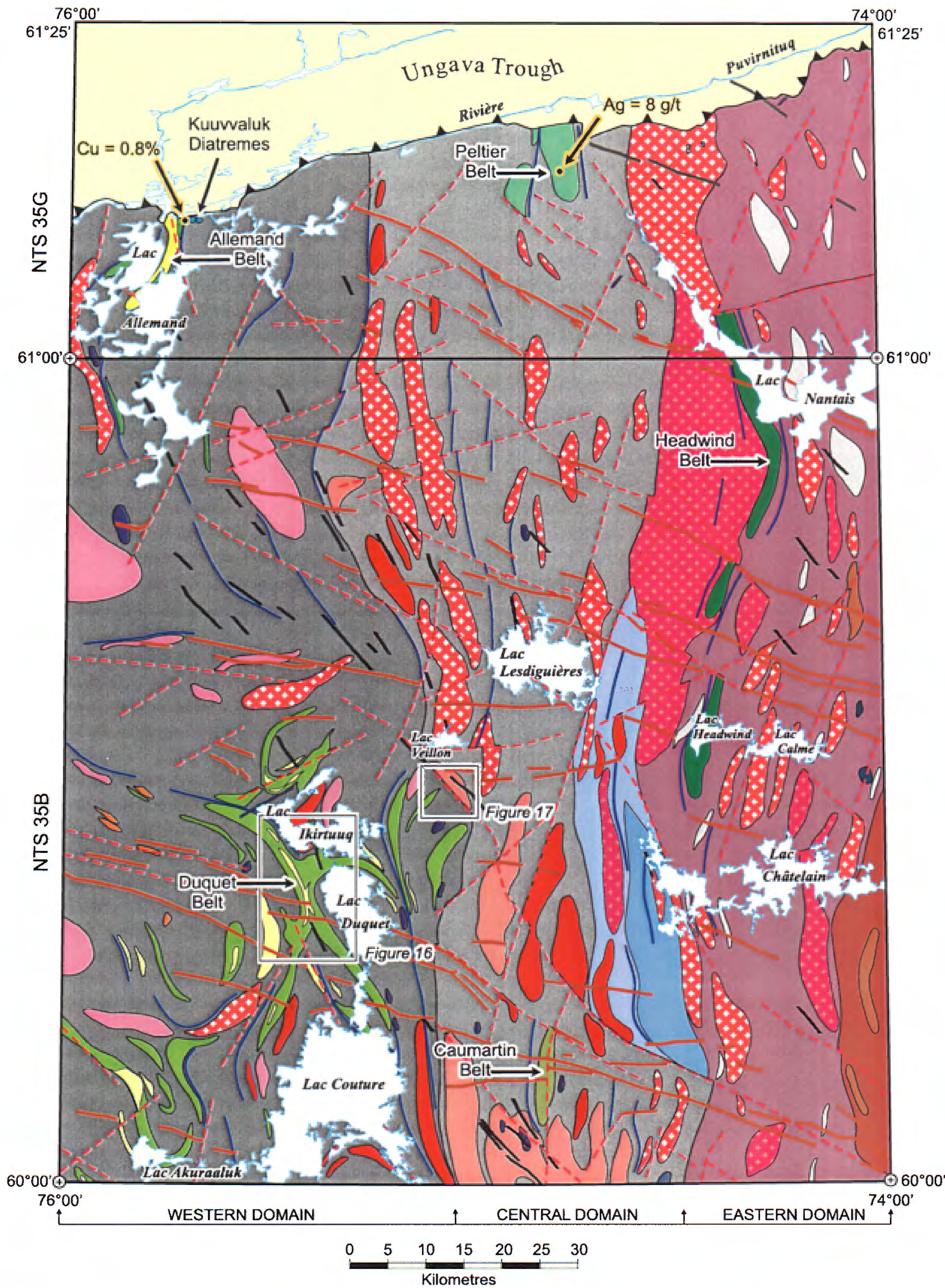


FIGURE 2 - Simplified geology of the Lac Couture and Lac Allemand area (NTS sheets 35B and southern part of 35G).

STRATIGRAPHIC LEGEND

UNGAVA TROUGH

PALEOPROTEROZOIC

Unsubdivided: Sedimentary and volcanic rocks, mafic and ultramafic intrusions

PROTEROZOIC

LATE MAFIC AND ULTRAMAFIC INTRUSIONS

Franklin Swarm (~723 Ma)

Ophitic gabbro

Pointe Raudot Dykes

Ophitic gabbro

Payne River Dykes (~2000 Ma)

Ophitic gabbro, locally sheared

Klotz Dykes (~2209 Ma)

Ophitic gabbro, locally sheared

Kuuvvaluk Diatremes

Ultramafic lamprophyre (Akuv)

Ductile shear zone

Thrust fault

Late brittle fault

Showing

SUPERIOR PROVINCE

ARCHEAN

LATE FELSIC INTRUSIONS

La Chevrotière Suite

Porphyritic biotite-hornblende granite (Alcv3)

Porphyritic clinopyroxene granite (Alcv2)

Biotite-hornblende granite (Alcv1)

EASTERN DOMAIN

Châtelain Suite

Foliated two-pyroxene granodiorite, granite (Achl2)

Foliated clinopyroxene granodiorite, granite (Achl1)

Lac Calme Suite

Massive pyroxenite (Aclm2)

Orthopyroxene diorite (Aclm1)

Kapijuq Suite

Gneissic or foliated tonalite (Akpj)

Headwind Belt

Foliated metabasalt, mafic gneiss (Ahea)

CENTRAL DOMAIN

Lesdiguières Suite

Biotite-horblende granodiorite, granite (Alsd4)

Migmatitic two-pyroxene tonalite (Alsd3)

Migmatitic clinopyroxene tonalite (Alsd2)

Migmatitic hornblende-biotite tonalite (Alsd1)

Couture Suite

Pyroxenite, peridotite (Acot2)

Peltier Belt

Foliated metabasalt, mafic gneiss (Aplt)

Caumartin Belt

Foliated or sheared metabasalt, mafic gneiss (Acau)

WESTERN DOMAIN

Rochefort Suite

Foliated granodiorite, granite (Arot2)

Foliated or gneissic tonalite (Arot1)

Couture Suite

Pyroxenite, peridotite (Acot2)

Anorthosite, anorthositic gabbro (Acot1)

Allemand Belt

Muscovite schist (Aale2)

Metabasalt, mafic gneiss (Aale1)

Duquet Belt

Paragneiss, metasedimentary rock (Aduq2)

Metabasalt, mafic gneiss (Aduq1)

FIGURE 2 (continued) - Simplified geological legend.

40 %), exhibit a well-developed granoblastic texture and a fine grain size (0.2 to 1.0 mm). Amphibole crystals are preferentially oriented parallel to the foliation and display a nematoblastic texture. Plagioclase occurs as equigranular polygonal neoblasts. Green hornblende is the dominant amphibole. However, cummingtonite is also observed in a few locations. Biotite and garnet porphyroblasts occur in a few samples. In some locations, clinopyroxene crystals are almost entirely replaced by hornblende. Minor amounts of quartz, epidote (clinozoisite and pistacite) and sphene are present in several metabasalt and mafic gneiss samples. Roughly 1 to 5% opaque minerals, mainly magnetite and pyrite, occur as fine grains scattered throughout the rock. Secondary carbonate and tourmaline, disseminated or in stringers, occur in a few locations. These minerals are the result of hydrothermal activity.

Paragneiss and Other Metasedimentary Rocks (Aduq2)

Metasedimentary rocks occur in many different locations in the Duquet Belt, and form, in a few areas, units sufficiently extensive to appear on the geological map (Figure 2). Paragneisses are the most abundant metasedimentary rocks. Bands of polygenic conglomerate, sandstone, marble, calc-silicate rock and iron formation are also observed, albeit in more modest proportions.

On outcrop, paragneisses exhibit cm-scale compositional banding. They are locally rusty, schistose or intensely deformed and mylonitized. Garnet porphyroblasts (> 1 cm) occur in many different locations. Staurolite and andalusite porphyroblasts are also fairly commonly observed on outcrop. The paragneisses are migmatized, and contain 10 to 75 % felsic mobilizate which forms cm-scale discontinuous veins parallel to the gneissosity. It also forms cross-cutting veins, with ptygmatic folds and pockets that invade the paragneiss in many locations. Conglomerate, sandstone, marble, calc-silicate rock and iron formation horizons, ranging from one metre to a few tens of metres in thickness, are intercalated with the paragneisses.

Mineral assemblages vary from one location to the next in the paragneisses. In thin section, a fine-grained (0.2 to 1.0 mm) groundmass is observed, mainly composed of granoblastic quartz and feldspar. Typically, paragneisses contain biotite flakes oriented parallel to the foliation, and garnet porphyroblasts with a widely variable grain size (from 5 to 50 mm). Several outcrops contain cordierite, sillimanite, andalusite, staurolite, tourmaline and spinel. The most common opaque minerals are magnetite and pyrite. The opaques are fine-grained and disseminated in the rock.

Allemand Belt (Aale)

Moorhead (1989) used the stratigraphic term "Lac Allemand Formation" to describe "a volcano-sedimentary assemblage including micaschists, siltstones, sandstones and conglomerates interbedded with metavolcanic rocks (amphibole-chlorite schists)". He was not able however to determine the facing direction, or to establish a stratigraphic sequence for this supracrustal assemblage. We therefore propose to modify the term introduced by Moorhead (1989), to comply with our lithodemic approach and to group all volcano-sedimentary rocks in the Lac Allemand area under the term Allemand Belt (Aale).

Located in the northwestern part of the study area, the Allemand Belt consists of elongated volcano-sedimentary bands. The main body is 2 km thick on average, and extends for more than 4 km along strike. The entire series of bands that make up the belt extend over more than 45 kilometres along a curved axis broadly trending N-S. These volcano-sedimentary bands are enclosed in tonalites-trondhjemites-granodiorites (TTG) of the Rochefort Suite, previously referred to as the Perron Complex by Lamothe *et al.* (1984) and Moorhead (1989). Volcano-sedimentary rocks of the Allemand Belt are migmatized and injected by granitic and tonalitic veins. As it extends northward, the Allemand Belt disappears underneath the Paleoproterozoic allochthonous cover of the Ungava Trough (Figure 2).

Metabasalt and Mafic Gneiss (Aale1)

Volcanic rocks of the Allemand Belt mainly consist of locally pillowed metabasalts and mafic gneisses. Intercalated with the metabasalts and mafic gneisses, laminated tuffs, formed of alternating mafic and felsic mm-scale bands also occur. A few m-scale horizons of lapilli tuff are also present in the volcanic sequence.

On outcrop, the metabasalts and mafic gneisses are respectively characterized by a penetrative foliation and cm-scale compositional layering. Locally, they are strongly deformed and exhibit a mylonitic or schistose fabric. These rocks are injected by granitic and tonalitic dykes and veins.

In thin section, the metabasalts and mafic gneisses are fine-grained (0.2 to 0.5 mm) and exhibit a nematoblastic texture defined by the alignment of amphibole crystals. This texture gives these rocks a very well developed tectonometamorphic foliation. The metabasalts and mafic gneisses are mainly composed of green hornblende (60 to 80%) and plagioclase (10 to 20%). The presence of garnet and biotite porphyroblasts is observed in many places, as well as small amounts of sphene and magnetite. These rocks are locally altered to chlorite. The secondary minerals such as quartz, carbonate, epidote and tourmaline, related to the hydrothermal alteration, occur as disseminations or in thin veinlets.

Muscovite Schist (Aale2)

Muscovite schists represent the dominant metasedimentary rock. They are an important component of the Allemand Belt. A few m-scale bands of quartzite, conglomerate and iron formation are also interbedded with the schists. On outcrop, these muscovite schists exhibit compositional banding ranging from 1 to 5 mm thick. Greyish porphyroblasts are locally observed. These are difficult to identify with any confidence, even under the microscope. They may represent altered andalusite crystals, now composed of aggregates of quartz + white mica (sericite and muscovite).

In thin section, muscovite schists contain a granoblastic quartz-feldspar groundmass. Muscovite is abundant, and generally occurs as small flakes (0.2 to 2.0 mm) oriented parallel to the foliation, thus defining a lepidoblastic texture. It also occurs as porphyroblasts, not necessarily aligned parallel to the foliation. In certain locations, the muscovite schist contains biotite, sphene and tourmaline. Secondary chlorite and epidote were observed in many samples.

Couture Suite (Acot)

Small (10 km^2) mafic and ultramafic geologic bodies were mapped in the western domain. A few of these also occur in the central domain. These rocks were grouped under the lithodemic term "Couture Suite" (Acot). This suite consists of pyroxenite, peridotite, gabbro and anorthosite, generally occurring in the vicinity of volcano-sedimentary belts. However, a genetic link between the volcanic rocks and these mafic-ultramafic rocks has not yet been established. On the whole, rocks assigned to the Couture Suite are most likely intrusive. These rocks are themselves injected by granitic and tonalitic veins, and are enclosed in gneissic tonalites.

Anorthosite, Anorthositic Gabbro (Acot1)

Small anorthositic bodies are exposed to the west of the Duquet Belt (Figure 2). Gabbroic bands are also observed in these bodies. On outcrop, these rocks exhibit a well-developed foliation. Locally, the presence of tectonic banding (straight gneiss) indicates intense ductile deformation. In more strongly deformed zones, the anorthositic rocks are dismembered and intercalated with tonalitic gneisses.

In thin section, anorthositic rocks least affected by deformation exhibit a mortar texture formed of coarse plagioclase crystals surrounded by a matrix of fine-grained granoblastic plagioclase. Most often, these rocks exhibit an oriented granoblastic texture, where ferromagnesian minerals are broken down into fragments that form trains parallel to the foliation. Green hornblende is the dominant ferromagnesian mineral in these rocks. Minor biotite (< 5%) is also present in certain places. Ferromagnesian minerals are locally replaced by chlorite and epidote.

Pyroxenite, Peridotite (Acot2)

Pyroxenite is the dominant lithology in the Couture Suite. It is generally associated with small volumes of peridotite. Most of these rocks outcrop in the western domain, in the vicinity of the Allemand and Duquet belts. Further east, in the central domain, ultramafic rocks of the Couture Suite are only exposed in a few locations. On outcrop, these rocks are massive and homogeneous, and locally foliated. They are injected by granite and tonalite. Outcrops where the volume of injected material is abundant exhibit a brecciated structure formed of ultramafic enclaves surrounded by a felsic matrix.

In thin section, pyroxenites and peridotites of the Couture Suite are coarse-grained and exhibit a primary granular texture preserved in several locations. Pyroxenites are mainly composed of clinopyroxene and minor amounts of orthopyroxene. Both pyroxenes are partially replaced by acicular actinolite. Certain olivine-rich rocks correspond to peridotite horizons. The olivine is typically replaced by iddingsite, serpentine and talc. Both pyroxenites and peridotites contain minor amounts of phlogopite. They also contain alteration minerals such as chlorite (clinochlore), epidote and calcite. The most commonly observed opaque mineral is magnetite.

Rochefort Suite (Arot)

The lithodemic term "Rochefort Suite" was introduced by Leclair *et al.* (2000) to designate tonalitic intrusive rocks that cover a large surface area (nearly 40% in NTS sheet 34I). We propose to include in this suite the tonalites-trondhjemites-granodiorites-granites (TTG) of the western domain. The tonalitic phase is largely predominant in this unit. It is intercalated with subordinate phases of diorite, trondhjemite, granodiorite and granite. Certain granodiorite and granite bodies are large enough to be represented on the map.

Foliated or Gneissic Tonalite (Arot1)

Tonalites of the Rochefort Suite show widely variable textures and structures from one location to the next. Typically, they are foliated or gneissic, and contain 1 to 20% felsic mobilizate. In certain locations, they are massive and homogeneous, with a granular or porphyritic texture due to the presence of idiomorphic plagioclase phenocrysts. These tonalites generally contain one to ten-metre bands of diorite, trondhjemite or granodiorite. They locally host mafic enclaves composed of metagabbro, amphibolite or diorite. In the vicinity of volcano-sedimentary belts, the enclaves are mostly supracrustal in origin, and consist of metabasalt, mafic gneiss and paragneiss. Ultramafic enclaves are also observed in a few locations.

In thin section, tonalites of the Rochefort Suite and their associated phases are medium-grained and exhibit a granoblastic texture. The degree of deformation is widely variable from one place to the next. Weakly deformed samples contain hypidiomorphic plagioclase crystals and show a foliation defined by the alignment of ferromagnesian minerals. A well-developed mylonitic fabric characterizes strongly deformed rocks. Biotite and hornblende are the most commonly observed ferromagnesian minerals in these rocks. Biotite is locally altered to chlorite, and plagioclase is partially sericitized and epidotized. Secondary calcite is observed in a few samples. The most common accessory minerals are sphene, apatite, allanite and zircon. Opaque minerals, generally occurring in trace amounts, consist of pyrite and rare magnetite.

Foliated Granodiorite and Granite (Arot2)

Granodioritic to granitic intrusive bodies are scattered in the tonalites of the Rochefort Suite. These intrusive bodies show diffuse contacts with the tonalite. Their size is widely variable. They often cover surface areas of less than 1 km^2, but may exceed 100 km^2 in certain cases. On outcrop, these rocks are usually foliated and contain 1 to 20 % felsic mobilizate. They are however massive and homogeneous in many locations.

In thin section, granodiorites and granites of the Rochefort Suite (Arot2) exhibit petrographic features comparable to those observed in the tonalitic unit (Arot1), apart from their greater K-feldspar content. These rocks are generally medium-grained and display an oriented granoblastic texture that partially obliterates the coarse igneous texture. They contain 1 to 15 % ferromagnesian minerals, oriented parallel to the foliation. These ferromagnesian minerals mainly consist of biotite and hornblende.

Central Domain

Caumartin Belt (Acau) and Peltier Belt (Aplt)

The "Caumartin Belt" (Acau) and the "Peltier Belt" (Aplt) are two new lithodemic terms that refer to geological bodies composed of metavolcanic rocks (Figure 2). The Caumartin Belt, located in the southern part of the central domain, occurs in the form of a metavolcanic band about 15 km long and less than 3 km wide. A few metavolcanic bands less than 15 km long and 5 km wide were also identified in the northern part of the central domain. These bands make up the Peltier Belt.

The Caumartin and Peltier belts are essentially composed of metabasalt and mafic gneiss. Ultramafic horizons (volcanic rocks or sills) were also identified in the Caumartin Belt. On outcrop, metabasalts exhibit a penetrative foliation, whereas mafic gneisses show cm-scale compositional banding. More strongly deformed rocks display a mylonitic fabric. Rocks of the Caumartin Belt are generally more strongly deformed than those of the Peltier Belt. In the Caumartin Belt, a mylonitic or straight gneiss fabric is fairly typical, whereas in the Peltier Belt, intense deformation zones are more discrete, and mainly occur along the borders of individual bands.

In thin section, the metabasalts and mafic gneisses are fine-grained (0.2 to 0.5 mm). They contain green hornblende (60 to 80%), aligned in such a way as to define a nematoblastic texture. They also contain granoblastic plagioclase (10 to 20%). Garnet and biotite porphyroblasts are observed in a few locations, mainly in mafic gneiss samples. Biotite is locally altered to chlorite. Minor amounts of sphene and magnetite are also observed in the metabasalts and mafic gneisses, as well as secondary minerals associated with hydrothermal alteration, such as quartz, carbonate and epidote. These secondary minerals are scattered in the rock or make up the material filling the veinlets traversing the rock.

Lesdiguières Suite (Alsd)

The Lesdiguières Suite (Alsd) is a new lithodemic unit introduced to designate intrusive rocks composed of strongly migmatized tonalite-trondhjemite-granodiorite-granite (TTG) that contain a substantial amount of granitic material injected *lit-par-lit*. These rocks represent the most widespread unit in the central domain (Figure 2). The tonalitic phase is largely predominant. It is intercalated with subordinate phases of trondhjemite, granodiorite, granite and diorite. These rocks locally contain mafic enclaves from 1 to 10 m in size.

The Lesdiguières Suite is subdivided into four sub-units, based on mineralogy: 1) hornblende-biotite tonalite (Alsd1), 2) clinopyroxene tonalite (Alsd2), 3) clinopyroxene-orthopyroxene tonalite (Alsd3), and 4) biotite-hornblende granodiorite and granite (Alsd4). On outcrop, rocks of the Lesdiguières Suite exhibit a foliation or gneissosity that is locally overprinted by a mylonitic fabric. Typically, these rocks contain more than 20% felsic mobilizate, which generally forms cm-scale veins injected *lit-par-lit* parallel to the gneissosity.

In thin section, the tonalite and associated phases (TTG) exhibit a granoblastic texture. Weakly deformed rocks locally contain hypidiomorphic antiperthitic plagioclase crystals. Strongly deformed rocks show a mylonitic foliation. Plagioclase crystals are sericitized and contain small grains of secondary epidote. Biotite and hornblende are the most common ferromagnesian minerals in sub-units Alsd1 and Alsd4. Biotite is locally altered and replaced by chlorite. Sub-unit Alsd2 contains, in addition to biotite and hornblende, some clinopyroxene. In several areas, hornblende overgrows on clinopyroxene. Sub-unit Alsd3 is characterized by the presence of clinopyroxene and orthopyroxene. Ortho-pyroxene is usually unstable and is replaced by alteration products such as talc, iddingsite, chlorite, magnetite and calcite. Magnetite, zircon, sphene, apatite and allanite occur in trace amounts.

Eastern Domain

Headwind Belt (Ahea)

The Headwind Belt (Ahea) is a new lithodemic unit that designates a series of volcano-sedimentary bands located within the eastern domain (Figure 2). These bands form very elongated troughs (tight synforms) distributed along a N-S axis, over a distance of more than 70 km. The average thickness of these bands is roughly 2.5 km. The Headwind Belt is enclosed in granodiorites and granites.

The Headwind Belt is almost entirely composed of metabasalt and mafic gneiss. A few rare layers, 1 to 10 m thick, of ultramafic rocks or strongly migmatized paragneiss are however intercalated in the volcano-sedimentary sequence. On outcrop, the metabasalts and mafic gneisses are respectively characterized by a penetrative foliation and cm-scale compositional banding. In certain locations, especially along the borders of the unit, the rocks are intensely deformed. This deformation is outlined by the presence of a mylonitic or straight gneiss fabric. The metabasalts and mafic gneisses contain 5 to 20 % felsic mobilizate, occurring as mm-scale to cm-scale discontinuous veins injected parallel to the gneissosity. Ultramafic horizons are massive or weakly foliated, and generally only weakly migmatized. Paragneisses are strongly migmatized and generally contain more than 20 % granitic mobilizate.

In thin section, the metabasalts and mafic gneisses are fine-grained (0.2 to 0.5 mm) and exhibit a granoblastic texture. The main mineral phases are hornblende (60 to 80 %) and plagioclase (10 to 15 %). Garnet and biotite porphyroblasts are present in many places. Clinopyroxene and orthopyroxene were observed in a few areas. Quartz, epidote and sphene occur as minor phases. Roughly 1 to 5 % opaque minerals (magnetite and pyrite) are disseminated throughout the rock. The textures and mineral assemblages (hornblende + garnet + plagioclase ± epidote and orthopyroxene + clinopyroxene + plagioclase ± hornblende) observed in the mafic volcanic rocks indicate metamorphic conditions ranging from the middle amphibolite facies to the granulite facies.

Kapijuq Suite (Akpj)

The Kapijuq Suite (Akpj) is a lithodemic unit defined to the east of our study area by Madore *et al.* (2001), to designate gneissic tonalite bands several kilometres in length. These bands are enclosed in granodiorites and granites which, in the study area, belong to the Châtelain Suite. These tonalitic bands may correspond to relics of more extensive tonalitic units such as the Lesdiguières Suite or the Rochefort Suite that have been invaded by large volumes of granodiorite and granite.

On outcrop, tonalites of this suite are generally gneissic or foliated, but exhibit a mylonitic fabric in several locations. They are intercalated with subordinate phases of diorite, trondhjemite, granodiorite and granite. These rocks contain 5 to 50% felsic mobilizate, occurring as cm-scale veins parallel to the gneissosity. They locally host one to ten metre-size enclaves of mafic rock and paragneiss.

In thin section, tonalites of the Kapijuq Suite generally display a granoblastic texture, and in more strongly deformed samples, a mylonitic foliation. Biotite and hornblende are the most commonly observed ferromagnesian minerals, whereas clinopyroxene, less abundant, is present in several places. Magnetite, zircon, sphene, apatite and allanite occur in trace amounts.

Lac Calme Suite (Aclm)

A series of mafic and ultramafic intrusions were identified within the eastern domain. These relatively small (< 20 km^2) intrusions are distributed along a N-S axis. They are enclosed in granodiorites and granites of the Châtelain Suite. These rocks were grouped under the new lithodemic term "Lac Calme Suite" (Aclm). This suite is mainly composed of orthopyroxene diorite, but also contains a few pyroxenite intrusions.

Orthopyroxene Diorite (Aclm1)

Orthopyroxene diorites form small elongate bodies that do not exceed 15 km in length and 2 km in width. On outcrop, these rocks appear to be homogeneous. They are generally foliated but may be massive in the core of intrusive bodies. These diorites contain granitic veins from 1 to 10 cm thick, generally injected parallel to the planar fabric. However, some late granitic veins also cut the planar fabric.

In thin section, orthopyroxene diorites commonly display a granoblastic texture. Despite the recrystallization, these rocks locally preserve a coarse magmatic texture. Orthopyroxene diorites are mainly composed of hornblende and plagioclase, but also contain variable proportions of orthopyroxene, clinopyroxene, biotite and magnetite. Quartz, apatite, sphene and zircon occur in minor proportions.

Pyroxenite (Aclm2)

Pyroxenites of the Lac Calme Suite form very small (< 5 km^2) geologic bodies. On outcrop, these rocks have a massive and homogeneous appearance. They are intruded by granitic pegmatite dykes and veins. In thin section, pyroxenites show a medium to coarse grain size. A primary coarse texture is preserved in several locations, despite the metamorphic recrystallization. These pyroxenites are mainly composed of clinopyroxene and orthopyroxene, in proportions that vary from one outcrop to the next. Both pyroxenes are partially replaced by hornblende. In certain places, orthopyroxene is unstable and is replaced by talc, chlorite, serpentine and calcite. Calcite also occurs in microfractures present inthe rock. Magnetite is observed in all pyroxenites.

Châtelain Suite (Achl)

The Châtelain Suite is a lithodemic term introduced by Madore *et al.* (2001) to designate, just east of the map area, vast composite intrusive bodies mainly composed of pyroxene-bearing granodiorite and granite. The Châtelain

Suite is the most widespread unit of the eastern domain, and it is dominated by granodioritic rocks. On a scale ranging from a few metres to one kilometre, the modal composition gradually varies from that of a granodiorite to a granite. Contacts between these phases are diffuse.

The Châtelain Suite is subdivided into two sub-units, based on mineralogy: 1) foliated clinopyroxene granodiorites and granites (Achl1), and 2) foliated orthopyroxene-clinopyroxene granodiorites and granites (Achl2). On outcrop, granodiorites and granites of the Châtelain Suite appear to be homogeneous. The foliation is generally well developed, and these rocks locally display a porphyritic texture defined by the presence of feldspar phenocrysts oriented parallel to the foliation. These intrusive rocks contain enclaves of tonalitic gneiss, observed in several locations, as well as mafic or ultramafic enclaves. Locally, veins and pockets of granitic pegmatite intrude rocks of the Châtelain Suite.

In thin section, a coarse igneous texture is observed, partially obliterated by metamorphic recrystallization. This recrystallization produces a mortar texture that develops around the feldspar phenocrysts. Rocks of the Châtelain Suite contain 2 to 15 % ferromagnesian minerals, dominated by biotite and hornblende. The presence of clinopyroxene characterizes sub-unit Achl1, whereas the presence of two pyroxenes (orthopyroxene and clinopyroxene) characterizes sub-unit Achl2. In certain areas, the pyroxenes are partially replaced by hornblende. Orthopyroxene is locally unstable and is replaced by alteration minerals such as serpentine, talc, chlorite, magnetite and calcite. Apatite and zircon occur in the two sub-units as accessory minerals. Minor amounts of magnetite (< 5 %) are also observed in these rocks.

Late Felsic Intrusions

La Chevrotière Suite (Alcv)

The La Chevrotière Suite (Alcv) was introduced by Parent *et al.* (2000) to designate alkali feldspar-phyric monzogranite intrusions to the south of our study area. In our map area, cross-cutting relationships observed in the field suggest that rocks of the La Chevrotière Suite are late relative to the vast tonalitic and granodioritic bodies of the Rochefort, Lesdiguières and Châtelain suites. Intrusions assigned to the La Chevrotière Suite are generally elongated parallel to the regional ductile fabric (foliation or gneissosity). They are abundant in the eastern part of the map area, namely in the eastern and central domains. Intrusions of the La Chevrotière Suite do outcrop further west however, in the western domain, where they cover a much more restricted surface area.

The La Chevrotière Suite was subdivided into three sub-units, based on mineralogy and texture: 1) biotite-hornblende granite (Alcv1), 2) porphyritic clinopyroxene granite (Alcv2) and 3) porphyritic biotite-hornblende granite (Alcv3). On outcrop, these granites appear to be homogeneous. They are weakly deformed, but do exhibit a magmatic foliation in several locations. They contain little felsic mobilizate, and less than 5 % mafic enclaves.

In thin section, granites of the La Chevrotière Suite show igneous textures (coarse for Alcv1 and porphyritic for Alcv2 and Alcv3), albeit partially obliterated by metamorphic recrystallization. This recrystallization produces a mortar texture that develops along the periphery of feldspar phenocrysts. This texture is particularly well developed in the porphyritic rocks. Typically, porphyritic intrusions in sub-units Alcv2 and Alcv3 contain subhedral feldspar phenocrysts aligned parallel to the fabric. This texture is typical of synkinematic intrusions. Granites of the La Chevrotière Suite contain 1 to 10% ferromagnesian minerals. Biotite and hornblende are the most commonly observed ferromagnesian minerals; they occur in all three sub-units (Alcv1, Alcv2 and Alcv3). In the eastern part of the map area, a few porphyritic granites also contain clinopyroxene. The presence of this mineral characterizes sub-unit Alcv2. Granites of the La Chevrotière Suite contain trace amounts of apatite, zircon and magnetite.

Proterozoic

Kuuvvaluk Diatremes (Pkuv)

Two diatremes were identified in the northern part of the map area, near the boundary between rocks of the Ungava Trough and the Archean craton (Figure 2). These consist of small circular intrusions about 70 m in diameter. Composed of ultramafic lamprophyre, the diatremes are not deformed and display well-preserved igneous textures. They are inferred to be Proterozoic in age. These rocks were originally described by Moorhead (1989), who included them in the Lamarche Subgroup, Povungnituk Group. The genetic relationship between these diatremes and supracrustal sequences of the Povungnituk Group (Ungava Trough) was not formally established however. We therefore propose to designate these two intrusions under the lithodemic term "Kuuvvaluk Diatremes" (Pkuv).

In the field, the diatremes form circular mounds, easily identified on aerial photographs. These diatremes exhibit, on exposed surfaces, fan-shaped columnar joints that converge towards the centre of the intrusion (Photo 1 in appendix). Sharp intrusive contacts were observed in several locations. Near these contacts, fragments of tonalitic country rock are observed. The diatremes are mainly composed of a greenish, fine-grained, vesicular lamprophyric rock that contains numerous epidotized xenoliths (Photo 2 in appendix). In certain places, the rock shows auto-brecciation structures. Thin discontinuous carbonatite horizons are inserted in the lamprophyre in a few places.

In thin section, ultramafic lamprophyres of the Kuuvvaluk Diatremes exhibit a very fine-grained (< 0.5 mm) felt-like matrix. This ultramafic groundmass is mainly composed of secondary minerals such as acicular actinolite, chlorite, magnetite and leucoxene. Phlogopite phenocrysts as well as relics of olivine and pyroxene phenocrysts are present in the matrix. These rocks also contain amygdules (< 1 mm) filled with calcite and chlorite.

Dyke Swarms

Archean rocks in the area are intruded by four gabbro dyke swarms ranging in age from the NeoProterozoic to the Paleoproterozoic. These are: the Klotz Dykes (pPktz), the Payne River Dykes (pPpay), the Pointe Raudot Dykes (pPrau) and the Franklin Swarm (nPfra). The lithodemic terms "Klotz Dykes" and "Pointe Raudot Dykes" were introduced by Buchan *et al.* (1998). The Klotz Dykes consist of a swarm of gabbro dykes, broadly trending N 310°, with a U-Pb zircon age of 2209±1 Ma (Buchan *et al.*, 1998). The Pointe Raudot Dykes refer to a gabbro dyke swarm oriented at N 40°, which scarcely outcrops in the study area. These dykes are presumably Proterozoic in age, however no geochronology study has been conducted to confirm this. The term "Payne River Dykes" was proposed by Fahrig *et al.* (1985) to designate a gabbro dyke swarm, broadly oriented N 330°. K-Ar isotopic analyses performed on two samples of chilled margin suggest, for the Payne River Dykes, an age of emplacement slightly greater than 2000 Ma (Fahrig *et al.*, 1985). The informal term "Franklin Diabases" was initially introduced by Fahrig *et al.* (1971) to designate a series of mafic dykes that mainly outcrop on Baffin Island and the Melville Peninsula, with an exposure area reaching out to the northern Ungava Peninsula. The term "Franklin Swarm", which we have used, was proposed by Buchan *et al.* (1998) to designate dykes roughly trending 300° N, located in the northern Ungava Peninsula. These dykes intrude units of the Ungava Trough, and their age is estimated at 723 Ma (Heaman *et al.*, 1992).

Proterozoic dykes consist of medium to coarse-grained ophitic gabbro. The rocks are composed of idiomorphic plagioclase crystals embedded in a clinopyroxene groundmass. Fe-Ti oxides, minor quartz and biotite are also present. Dyke margins are chilled over roughly 10 cm. Their mineralogy is characterized by the presence of idiomorphic plagioclase and augite microcrystals, aligned parallel to the dyke contacts. The dykes are generally fresh. They show local evidence of deuteric alteration; clinopyroxene is replaced, to a variable degree, by amphibole and chlorite, and plagioclase is sericitized and saussuritized. In the vicinity of major brittle faults, the dykes are altered and contain chlorite, hematite and epidote veinlets.

Paleozoic

Lac Couture Meteorite Crater

The last geological event to occur in the area is the result of a meteorite impact. The circular Lac Couture, 14 km in diameter, represents the topographic expression of this impact (Figure 2). In 1964, an expedition led by Beals identified the presence of impact breccias near the western part of the lake, and confirmed the presence of a meteorite crater (Kitzes, 1964; Beals *et al.*, 1967). Later studies identified several textures and structures typical of meteorite impacts (Robertson, 1965). Geochronology studies using the ^{40}Ar-^{39}Ar method on impact breccias yielded an age of 425 ± 25 Ma for the time of the impact (Bottomley *et al.*, 1990).

During our field campaign, we noted the presence of impact-melt rocks. These consist of low-density highly vesicular impactites, fallback breccias and brecciated country rocks. These samples were collected in glacial debris deposits in the western part of Lac Couture. They represent material scoured from the bottom of the crater by glaciers and deposited further west. A petrographic study of these samples also revealed several microtextures and microstructures typically associated with a meteorite impact, namely vesicles and feldspar microlites in a glassy matrix, deformation lamellae in quartz crystals and shock deformation in microcline and plagioclase twins (Sharma *et al.*, 2001).

METAMORPHISM

The rocks in the study area contain prograde metamorphic assemblages ranging from the lower amphibolite facies to the granulite facies. Retrograde assemblages marking the transition from the amphibolite facies to the greenschist facies are also recognized in a few locations in the western domain, as well as in Archean sequences bordering thrust sheets of the Ungava Trough. Near major brittle faults, lower pressure and temperature retrograde assemblages are associated with late hydrothermal fluid circulation, which destabilized the primary mineralogy of country rocks.

Rocks in the eastern domain typically contain high-grade metamorphic assemblages (Figure 3). This metamorphism ranges from the middle amphibolite facies to the granulite facies. In granodiorites and granites of the Châtelain Suite, orthopyroxene, clinopyroxene, biotite and hornblende are stable minerals. Furthermore, the pyroxenes exhibit, in several places, a polygonal granoblastic texture, indicating metamorphic recrystallization at high pressure and temperature conditions. Volcano-sedimentary rocks of the Headwind Belt contain the following prograde metamorphic assemblages: hornblende + garnet + plagioclase ± epidote, and orthopyroxene + clinopyroxene + plagioclase ± hornblende, which suggests metamorphic conditions ranging from the middle amphibolite facies to the granulite facies.

The central domain is characterized by prograde metamorphism at the amphibolite facies (Figure 3). In tonalitic rocks of the Lesdiguières Suite, hornblende and biotite are stable phases. Mafic volcanic rocks of the Caumartin and

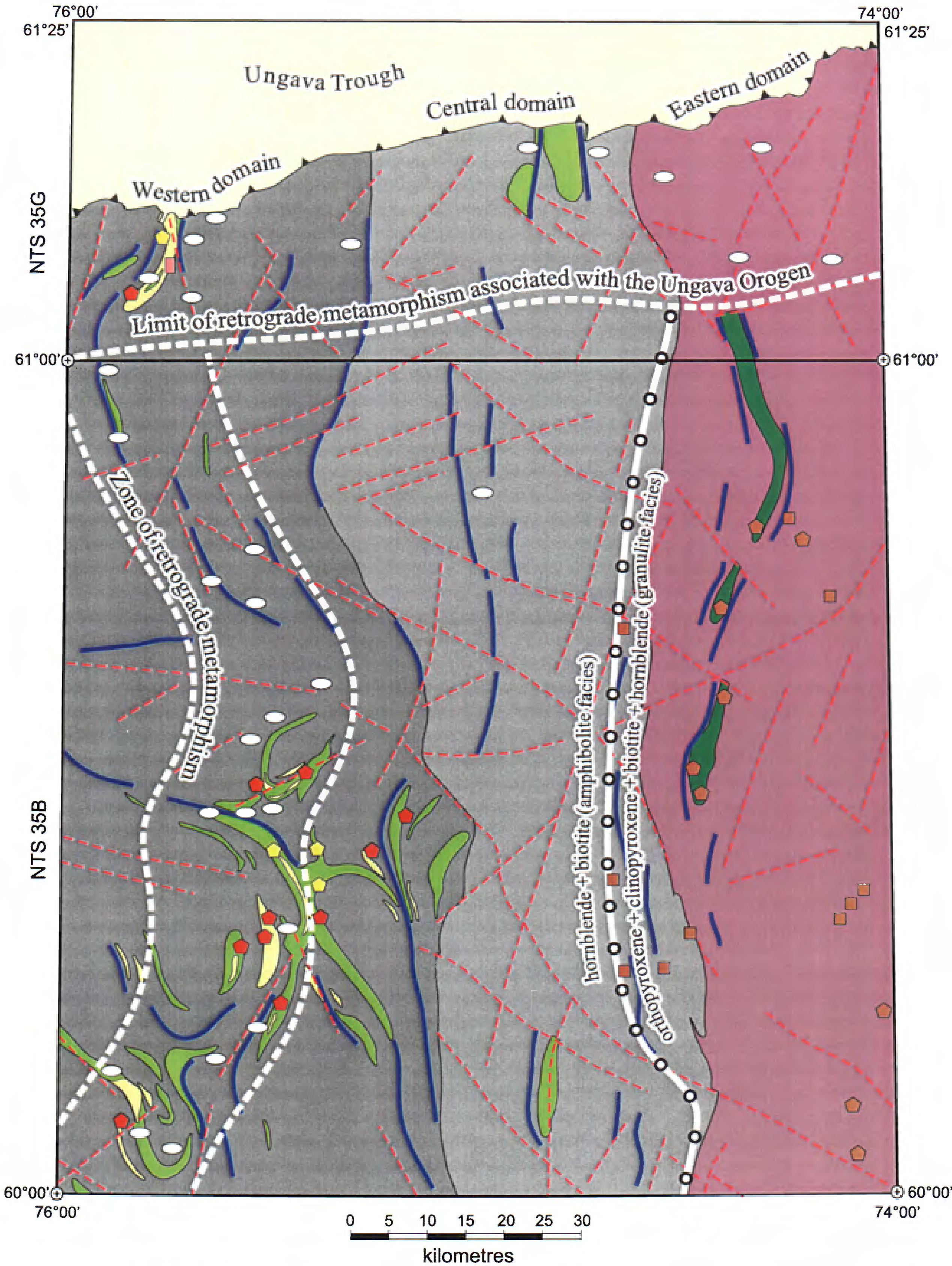


FIGURE 3 - Regional distribution of metamorphism and mineral assemblages observed in thin section.

VOLCANO-SEDIMENTARY ROCKS

Basalts metamorphosed to the granulite facies

Basalts metamorphosed to the amphibolite facies

Paragneisses metamorphosed to the amphibolite facies

MINERAL ASSEMBLAGES OBSERVED IN THIN SECTION

Prograde metamorphism at the granulite facies

Granoblastic orthopyroxene + clinopyroxene + biotite + hornblende odserved in intrusive rocks, metavolcanic rocks and paragneisses

Idiomorphic orthopyroxene + clinopyroxene + biotite + hornblende odserved in intrusive rocks

Prograde metamorphism at the amphibolite faces

Garnet + sillimanite + cordierite observed in paragneisses

Staurolite + andalusite + sillimanite + cordierite observed in paragneisses and muscovite schists

Andalusite relics observed in muscovite schists

Retrograde metamorphism at the greenschist facies

Sericite + chlorite + epidote observed in intrusive rocks, metavolcanic rocks and paragneisses

METAMORPHIC ISOGRAD

Boundary between zones where mineral assemblages "hornblende + biotite + garnet ± epidote" versus "orthopyroxene + clinopyroxene + biotite ± hornblende" are stade

FIGURE 3 (continued) - Legend for metamorphism and mineral assemblages.

Peltier belts contain the metamorphic assemblage hornblende + plagioclase ± biotite ± garnet ± epidote, typical of the amphibolite facies.

The western domain is also characterized by prograde metamorphism at the amphibolite facies (Figure 3). In tonalitic rocks of the Rochefort Suite, hornblende and biotite are stable minerals. Mafic volcanic rocks of the Duquet and Allemand belts contain the metamorphic assemblage hornblende + plagioclase ± biotite ± garnet ± epidote. Paragneisses of the Duquet Belt contain a wide variety of assemblages (Figure 4), including garnet + sillimanite ± cordierite, typical of the upper amphibolite facies (600 to 700 °C and 3.5 to 4.0 kb). Locally, the coexistence of metamorphic minerals such as staurolite + andalusite + sillimanite ± cordierite indicates lower temperature and pressure conditions (roughly 550 °C and 3 kb). The presence of andalusite relics in muscovite schists of the Allemand Belt suggests, much like the latter assemblage, pressure-temperature conditions on the order of 550 °C and 3 kb. Geothermobarometer studies conducted on garnets recovered from paragneisses

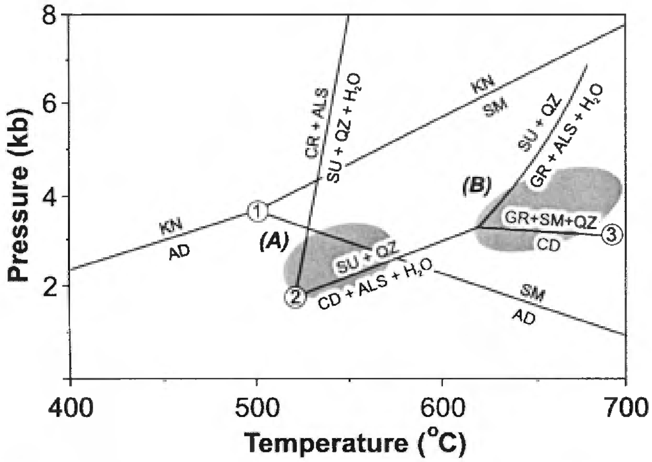


FIGURE 4 - Petrogenetic grid: 1) stability fields of Al_2SiO_5 polymorphs (Holdaway, 1971), 2) limit of staurolite stability (Richardson, 1968), 3) limit of cordierite stability (Holdaway and Lee, 1977). KN = kyanite, AD = andalusite, SM = sillimanite, CR = chloritoid, ALS = aluminosilicate, CD = cordierite, SU = staurolite, GR = garnet, QZ = quartz. Shaded field (A) corresponds to the stability field of the assemblage staurolite + andalusite + cordierite ± sillimanite, and shaded field (B) corresponds to the stability field of the assemblage garnet + sillimanite ± cordierite.

in the Duquet Belt (Percival and Skulski, 2000) yielded comparable results, with temperatures ranging from 600 to 535 °C and pressures of 4.3 to 3.3 kb.

Evidence of greenschist-facies retrograde metamorphism is mainly related to the intense sericitization of plagioclase, and the breakdown of ferromagnesian minerals, replaced by chlorite and epidote. Hydrothermal alteration is also observed in several locations. It translates into the development of quartz, calcite or epidote veins, or the presence of secondary tourmaline. These elements are generally associated with low-temperature brittle-ductile shear zones. Retrograde metamorphism in the northern part of the area is interpreted as evidence of the Ungava Orogen (*ca.* 1.8 Ga) overprinting the Archean craton. This E-W-trending retrograde zone forms a strip a few tens of kilometres wide, parallel to the Ungava Trough (Figure 3). Another N-S trending band, located within the western domain, was also identified (Figure 3). The latter, more than 10 km wide, hosts a series of brittle-ductile faults, the regional extension of which remains to be defined. These late faults may be Proterozoic in age (younger than 2.0 Ga), since isolated observations indicate that they cross-cut Klotz Dykes and Payne River Dykes.

STRUCTURAL GEOLOGY

Cross-cutting relationships, observed both on outcrop and on a regional scale, reveal that at least four episodes of deformation have affected the rocks in the map area. The first two episodes of deformation (D1 and D2) are ductile and Archean in age. These episodes of deformation were followed by a Paleoproterozoic event (D3), which corresponds to the Ungava Orogen. Structures associated with this Paleoproterozoic event are restricted to the northern part of the area (NTS sheet 35G). They are characterized by the development of major thrust faults, shallowly dipping to the north. A SSE-directed tectonic transport of Paleoproterozoic sequences of the Ungava Trough onto the Archean basement is associated with these faults. Finally, an impressive network of brittle faults define the fourth episode of deformation (D4) which affects the entire study area. The regional structural pattern that results from these deformational events is shown in Figure 5.

Ductile deformation D1 is mainly represented by an Archean S1 foliation or gneissosity, accompanied by isoclinal and intrafolial F1 folds (Figure 5). In the central and eastern domains, planar fabrics (S1) and associated intrafolial folds (F1) form a steeply dipping regional structural trend oriented N-S (Figure 6b and c). Regional-scale SZ2 ductile shear zones overprint earlier fabrics (S1 and F1). These shear zones, reaching up to 10 m in width, locally show a slight angle with S1 and F1 fabrics. They are characterized by a mylonitic texture, accompanied by a reduction in grain size. Within the central and eastern domains, SZ2 shear zones are generally rectilinear and trend N-S. In the western domain, they are curved, and appear to follow the trend of large open folds or dome structures, which we attribute to episode of deformation D2'. In fact, these second-generation structures (F2') cause considerable scatter in the orientation of regional S1 and F1 fabrics, especially in the southern part of the western domain (Figure 6a), as well as a reorientation of SZ2 shear zones (Figure 5). Phase of deformation D2' appears to be responsible for the development of regional structures geometrically akin to domes, attributable to superimposed folds (dome and basin interference pattern), or to tectonic movements with a vertical component (gneissic dome, diapir). These structures are very obvious in the southern part of the western domain, especially in the vicinity of the Duquet Belt (Figure 5).

The large majority of mineral and stretching lineations observed in the field come from the ductile shear zones (SZ2) in the western domain. These tectono-metamorphic linear fabrics are defined by the preferential orientation of ferromagnesian minerals, essentially biotite and hornblende, and the development of ribbon quartz. In the western domain, lineations plunge steeply towards the SSE (Figure 6d). This attitude, particularly well developed in the southwestern part of the area, suggests that important vertical movements may be responsible for the development of dome structures. In the central and eastern domains, where the effects of the D2' deformational event are practically non-existent, lineations are poorly developed, and where observed, plunge weakly to moderately towards the NNW or the SSE (Figures 6e and f).

Along the northern edge of the study area, a Paleoproterozoic ductile deformation event (D3) related to the Ungava

Orogen (*ca.* 1.8 Ga) is recognized. During this orogenic event, Paleoproterozoic sequences of the Ungava Trough were thrust onto the Archean rocks of the Superior Province. Structures associated with this thrusting event are characterized by shear zones shallowly dipping north, ranging from 5 to 10 m in thickness. They affect both Paleoproterozoic rocks and the Archean basement. In detachment zones, numerous kinematic indicators as well as stretching lineations shallowly plunging to the NNW suggest a tectonic transport of Ungava Trough sequences from the NNW towards the SSE. Certain authors (Lucas, 1989; St-Onge and Lucas, 1990) have already documented this tectonic transport in greater detail.

The entire area is crossed by major rectilinear lineaments, many of which exceed 50 km in length (Figure 5). These lineaments reveal a late brittle deformation event (D4), superimposed upon Archean (D1 and D2) and Paleoproterozoic (D3) fabrics. Epidotization, sericitization and hematitization as well as quartz veining are observed in the vicinity of these major brittle faults. Despite the scale of these structures, apparent horizontal movements observed along these brittle faults are generally not significant.

LITHOGEOCHEMISTRY

About 60 rock samples were collected and analyzed for major and trace elements. These samples are representative of the main lithologies present in the study area. Felsic intrusive rock samples consist of tonalite and granite-granodiorite. Mafic intrusive rock samples consist of Archean diorite, gabbro and amphibolite as well as Proterozoic gabbro dykes. Ultramafic intrusive rock samples essentially consist of pyroxenite and a few lamprophyres. Mafic and felsic volcanic rocks were also sampled. Chemical analyses were conducted at the Consortium de Recherche minérale (COREM). Major and trace elements Rb, Sr, Nb, Ta, Y and Zr were analyzed by X-ray fluorescence (XRF), and trace elements Ba, Th, Sc, Cs, Sb and U by neutron activation. A summary of analytical results is listed in Table 1, in appendix. All analytical results are available in the SIGÉOM database.

Felsic Rocks

The results of lithogeochemical analyses conducted on felsic intrusive rock samples are plotted on a series of classification diagrams. On the normative diagram proposed by O'Connor (1965), the felsic rocks are distributed from the granite to the tonalite field (Figure 7a). In fact, the majorité of samples plot in the granodiorite field. The classification diagram by De La Roche *et al.* (1980) shows compositions spanning the granodiorite field and the tonalite field (Figure 7b). On this diagram, a few felsic rock samples plot in the fields of monzogranites and syenogranites (Figure 7b). However, the modal composition of these rocks for the most part indicates tonalitic and granitic compositions.

All felsic plutonic rocks in the area are peraluminous to metaluminous (Al_2O_3 > CaO + Na_2O + K_2O), I-type (Figure 7c) and alumina-saturated (0.95 < Al_2O_3/CaO + Na_2O + K_2O < 1.14; Zen, 1988). The parent magmas were probably derived from the anatexis of peraluminous to metaluminous crustal rocks (White and Chappell, 1977). These felsic plutonic rocks are rich in Al_2O_3 (13 to 17%) and SiO_2 (65 to 75%) but depleted in MgO (0.1 to 1.8%). Their Na_2O/K_2O ratios are high for tonalites (up to 12.9) but low for granites (0.6 to 2.1). Binary diagrams of major elements Al_2O_3, CaO, Fe_2O_3t, TiO_2 and MgO versus SiO_2 show negative correlations (Figures 8a, b, c, d, e). The high SiO_2 content (65 to 75%) as well as the negative correlation observed between SiO_2 and the other major elements suggest that the felsic intrusive rocks in the study area constitute highly differentiated phases. Overall, these felsic intrusive rocks are even more differentiated than those occurring to the east of the study area, in the Rivière Arnaud and Lac Klotz areas (Madore and Larbi, 2000; Madore *et al.*, 2001).

The K_2O versus SiO_2 diagram (Rickwood, 1989) shows fields for the low-K tholeiitic series, low-K calc-alkaline series, high-K calc-alkaline series and shoshonitic series (Figure 8f). Granite samples with up to 70% SiO_2 are enriched in potassium. However, tonalite samples with the same SiO_2 content are depleted in potassium. A number of processes may be considered to explain these variations in K_2O content. On the one hand, fractional crystallization from a single parent magma could have generated the extensive composite intrusive bodies assigned to the Rochefort (Arot), Lesdiguières (Alsd) and Châtelain (Achl) suites. It could also have generated late intrusions of the La Chevrotière Suite (Alcv). On the other hand, the differentiation of tonalites to more evolved phases could potentially have produced the tonalite-granodiorite-granite series observed in the central and western domains.

Intrusive suites in the area show distinct trace element geochemical signatures. Granite-granodiorite intrusions show geochemical characteristics similar to those of the upper continental crust (Figure 9), whereas gneissic tonalites have characteristics akin to those of the lower continental crust (Figure 9). The trace element geochemical signature is, for a given lithology, identical from one lithodemic unit to the next. Consequently, these units cannot be distinguished solely on the basis of their trace element geochemistry.

On the diagram in Figure 9, trace element patterns show that these rocks are fractionated and enriched in Rb and Ba (LILE, large ion lithophile elements). Depletion in Ti (HFSE, high field strength elements), combined with a weak positive Sr anomaly, suggests that the felsic plutonic rocks underwent magmatic differentiation during their emplacement. Low Ti and Nb values, outlined by negative anomalies on the spiderdiagram (Figure 9), are probably indicative

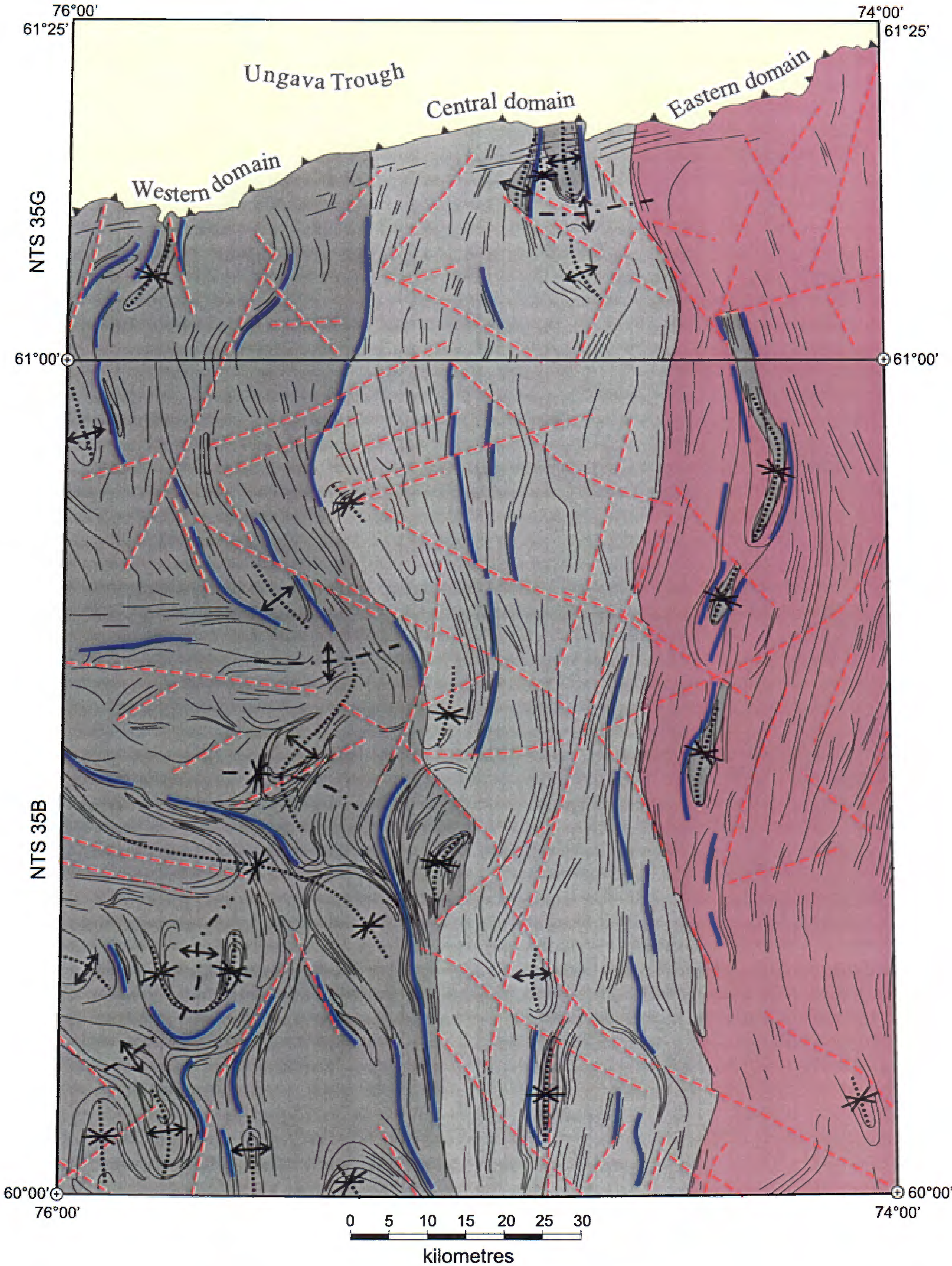
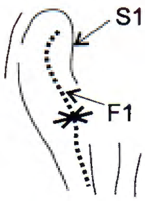


FIGURE 5 - Distribution pattern of regional structures.

Volcano-sedimentary bands. These bands serve as markers to trace the regional deformation.

D1

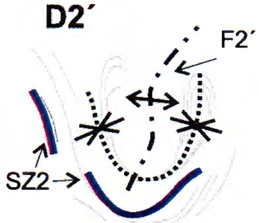


Deformation D1: Archean foliation or gneissosity (S1), accompanied by isoclinal and intrafolial folds (F1).

D2

Deformation D2: Ductile shear zones (SZ2) that overprint earlier S1 and F1 fabrics. Mineral and stretching lineations are associated with these shear zones.

D2′

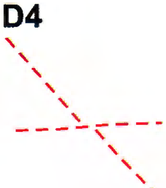


Deformation D2′: Second generation folds (F2′) that affect S1 planar structures and axial traces of F1 folds. F2′ folds are coeval with or consecutive to SZ2 shear zones.

D3

Deformation D3′: Thrust faults associated with the tectonic transport of Paleoproterozoic sequences of the Ungava Trough towards the SSE over the Archean basement.

D4



Deformation D4′: Late brittle faults that overprint both Archean and Proterozoic fabrics.

FIGURE 5 (continued) - Legend for map of regional structures.

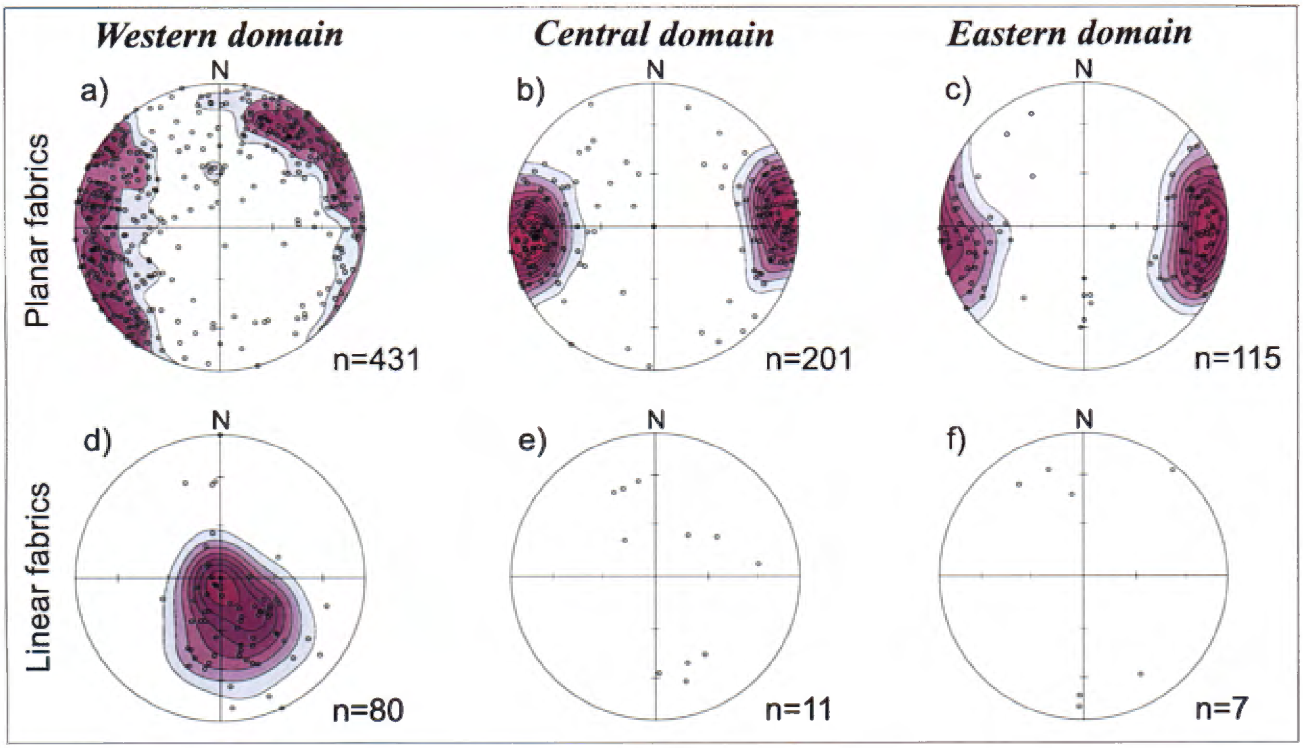


FIGURE 6 - Equal-area stereographic projections. Contours were drawn using the method of Robin and Jowett (1986). n = number of measurements. Stereograms **a**, **b** and **c** show pole projections of planes. Stereograms **d**, **e** and **f** show projections of lineations.

of fractionation of minerals such as sphene, rutile or ilmenite. Relatively high Zr and Th grades lead us to suggest that the parent magma of these felsic plutonic rocks assimilated felsic crustal material with Zr-rich minerals such as zircon or monazite. The diagram Rb versus Y+Nb (Pearce *et al.*, 1984) suggests that the felsic plutonic rocks in the map area formed in a volcanic arc setting (Figure 10).

In the study area, felsic volcanic rocks are rare and represent very restricted volumes of rock. A single felsic volcanic sample was analyzed. It consists of an aphanitic rock, probably a tuff, collected in the Duquet Belt. This volcanic rock has a rhyolitic composition (Figure 11a). It is characterized by a SiO_2 content greater than 80%, Al_2O_3 content greater than 12% and K_2O of roughly 4% (Table 1 in appendix).

Mafic Rocks

Analyzed mafic rock samples mainly represent metavolcanic rocks from the Allemand (Aale), Duquet (Aduq), Peltier (Aplt), Caumartin (Acau) and Headwind (Ahea) belts. A few mafic rock samples were also collected in other units. These samples come from small intrusive bodies assigned to the Couture (Acot) and Lac Calme (Aclm) suites, as well as Proterozoic gabbro dykes.

Based on major element analytical results, mafic rock samples (gabbro and mafic lava) plot in the tholeiitic field (figures 11b and 12a), with MgO values ranging from 2 to 8% (Table 1 in appendix). On Figure 11a, most mafic rock samples appear to be subalkaline, with a small number of samples scattered in the alkali basalt and the andesite field. On a Jensen diagram (1976), the mafic rock samples show high-Fe tholeiite compositions (Figure 11b). The Ti-Zr-Sr paleotectonic diagram by Pearce and Cann (1973) shows that overall, the mafic rocks in the area exhibit characteristics typical of oceanic floor basalts (Figure 12b). On the same diagram, a few mafic intrusive rock samples show characteristics of island arc tholeiites or continental arc basalts. These compositional variations are probably due to contamination of parent magmas or to metasomatic processes that occurred after the emplacement of these rocks.

Trace element contents in mafic lavas (Figure 13) are enriched relative to the primitive mantle. Trace element patterns for these rocks are similar to those of OIBs (oceanic island basalts; Sun, 1980), with enriched Rb (mobile element – LILE) and Y (immobile element – HFSE). These variations suggest that the mafic rocks formed in a tectonic setting similar to OIBs. During their ascent, the magmas underwent contamination from a LILE-depleted mantle (Pearce, 1983) and assimilated heavy minerals such as zircon and garnet. Mafic intrusive rocks, like mafic lavas, are similar to OIBs. This is probably due to magmatic differentiation, or, as in the case of gabbro dykes, to crustal contamination during their emplacement in an early crust.

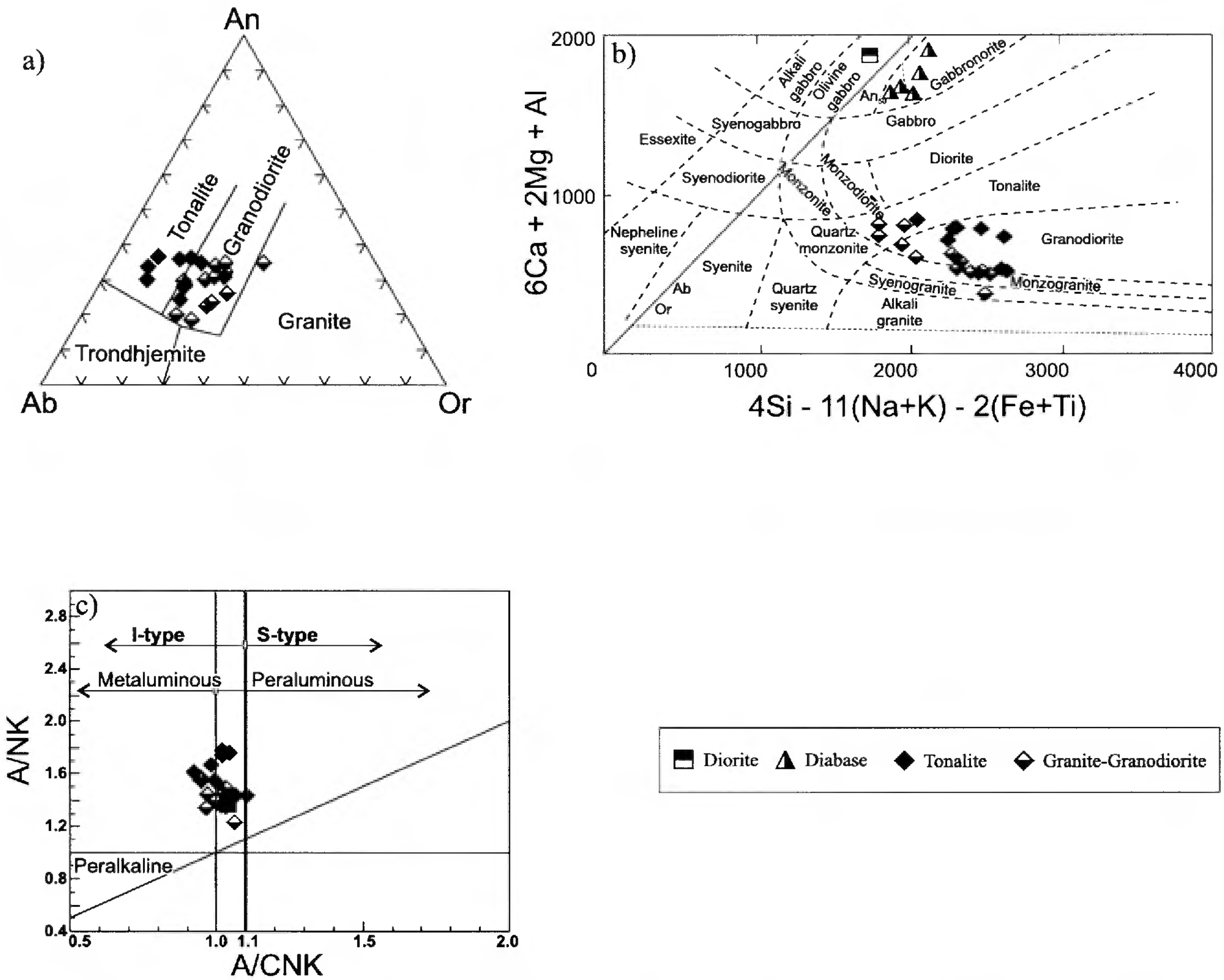


FIGURE 7 - a) Normative anorthite-albite-orthoclase diagram (O'Connor, 1965) for felsic plutonic rocks. **b)** Cationic classification of plutonic rocks after De La Roche *et al.* (1980). **c)** A/NK versus A/CNK discrimination diagram for felsic plutonic rocks. The boundaries of metaluminous, peraluminous and peralkaline fields are from Maniar and Piccoli (1989), and the boundaries of I-type and S-type fields are from Chappell and White (1974).

Ultramafic Rocks

Ultramafic rock samples mainly come from small geologic bodies assigned to the Couture (Acot) and Lac Calme (Aclm) suites. A few ultramafic rocks were also sampled in different locations within the volcano-sedimentary belts. On the Jensen diagram (1976), the composition of ultramafic rocks ranges from the basaltic komatiite field to the peridotitic komatiite field (Figure 11b). As opposed to the mafic rocks which are very rich in iron, the ultramafic rocks are highly magnesian (figures 11b and 12a), with up to 40% MgO (pyroxenite and ultramafic lava), and generally depleted in K_2O (Table 1 in appendix). These characteristics are typical of ultramafic rocks that formed in a passive oceanic crust setting. On the Nb-Zr-Y ternary diagram by Meschede (1986), analytical results from ultramafic samples mainly plot in the field of P-MORBs (primitive mid-oceanic ridge basalts), with a few samples in the field of N-MORBs (normal mid-oceanic ridge basalts; Figure 12c). Samples that plot in the calc-alkaline basalt field appear to have undergone crustal contamination or hydrothermal alteration (metasomatism).

Analytical results from ultramafic lavas and intrusive rocks in the area show trace element patterns similar to MORBs (Saunders and Tarney, 1984; Figure 13). However, Sr, K, Rb and Ba (LILE, the most mobile elements) are enriched relative to MORBs. This is probably the result of LILE remobilization, or of assimilation of minerals such as plagioclase and K-feldspar by the magma.

Geochemical Characteristics of Lithodemic Units

Allemand (Aale), Duquet (Aduq), Peltier (Aplt), Caumartin (Acau) and Headwind (Ahea) Belts

Mafic rocks of the Allemand, Duquet, Peltier, Caumartin and Headwind belts show similar geochemical signatures. Based on their trace element contents (Figure 13), most

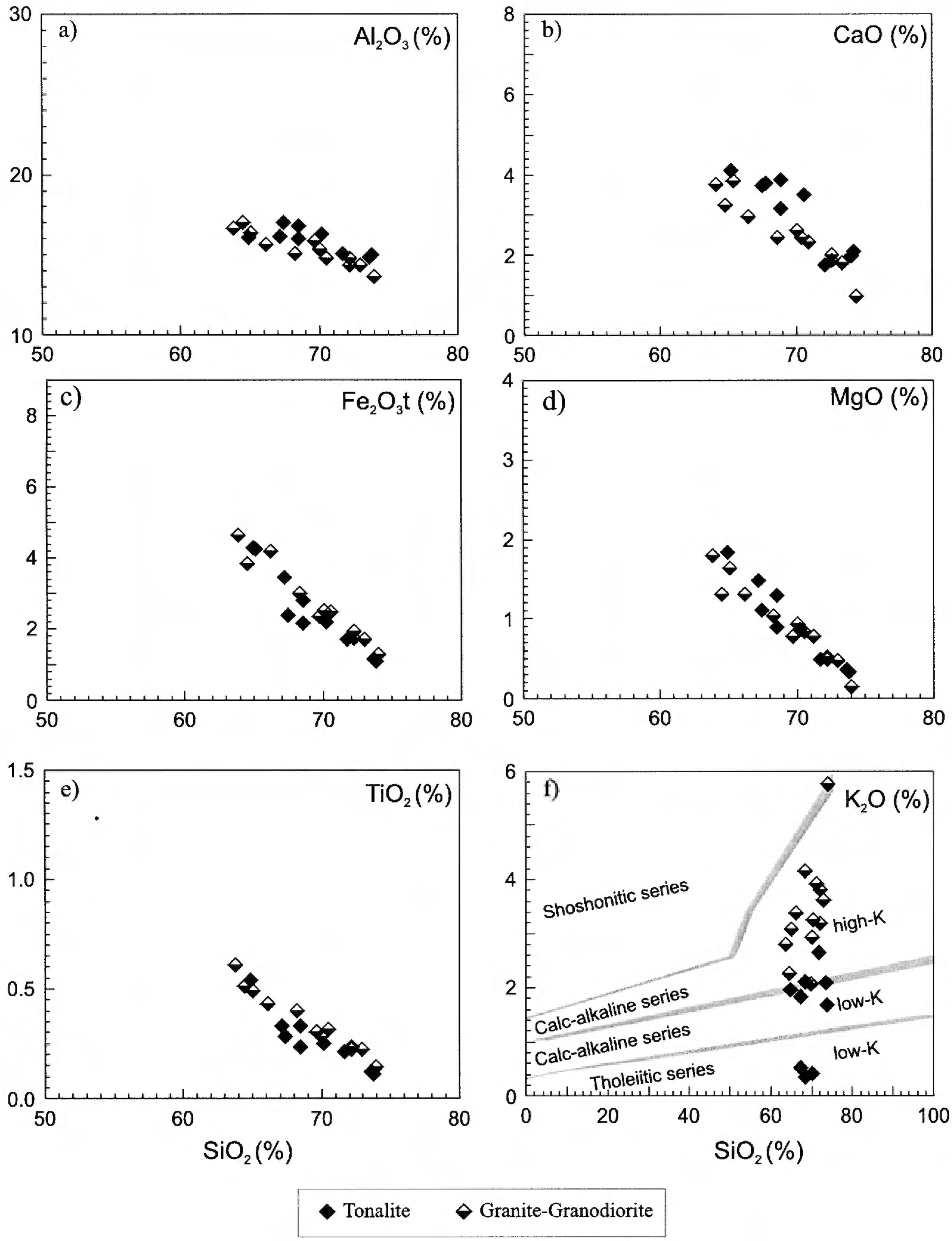


FIGURE 8 - a), b), c), d) and **e)** Binary diagrams Al_2O_3, CaO, Fe_2O_3t, MgO and TiO_2 (weight %) versus SiO_2 (weight %), showing the magmatic evolution of felsic plutonic rocks. **f)** K_2O versus SiO_2 binary diagram by Rickwood (1989).

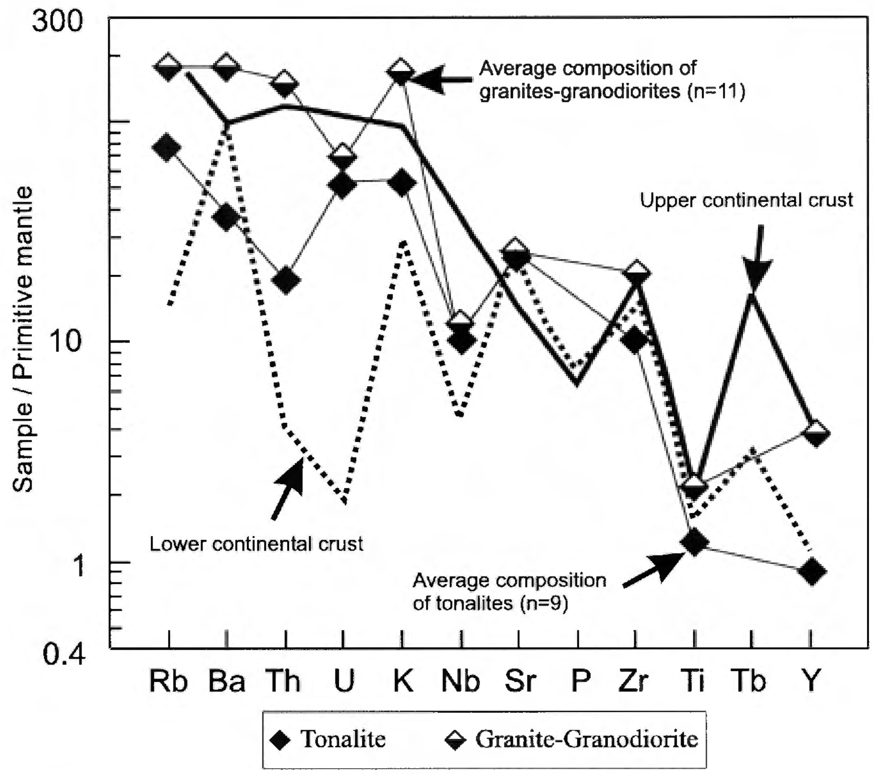


FIGURE 9 - Spiderdiagram normalized to the primitive mantle (Sun and McDonough, 1989), to characterize granites/granodiorites and tonalites. Patterns associated with the lower and upper continental crust are taken from Weaver and Tarney (1984).

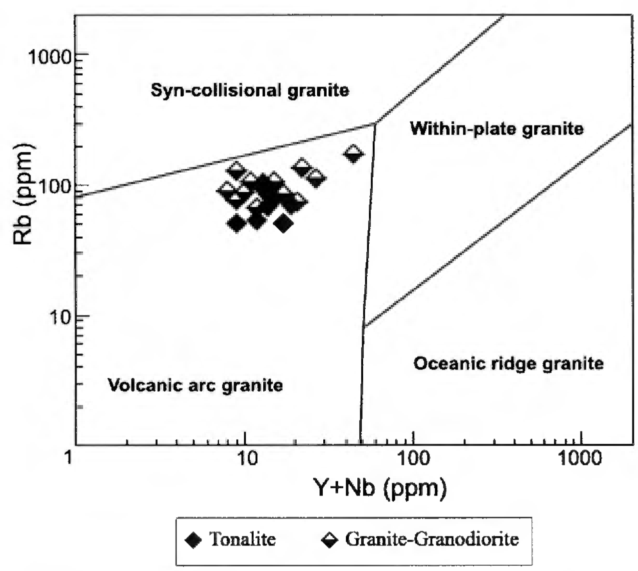


FIGURE 10 - Rb (ppm) versus Y+Nb (ppm) paleotectonic diagram by Pearce *et al.* (1984) for felsic plutonic rocks.

of these rocks are geochemically comparable to OIBs. Overall, mafic rocks encountered in these belts are weakly magnesian (4 to 6% MgO, Table 1 in appendix), and enriched in Ti (up to 5% TiO_2) and Zr (60 to 170 ppm). The presence of mafic lavas, the lack of intermediate to felsic lavas, and the high Ti content are typical of volcanic sequences in the Ungava Peninsula. These observations suggest that these rocks represent the base of a large volcanic edifice, the upper portion of which has presumably been eroded.

Couture (Acot) and Lac Calme (Aclm) Suites

Rocks assigned to the Couture (Acot) and Lac Calme (Aclm) suites form small geologic bodies, the vast majority of which are most likely intrusive. In the Couture Suite, these bodies are composed of anorthositic rocks (Acot1) and pyroxenites (Acot2), whereas the Lac Calme Suite consists of orthopyroxene diorites (Aclm1) and pyroxenites (Aclm2). The morphology, petrography and geochemistry of pyroxenites from the two suites are similar. These pyroxenites are characterized by exceptionally high MgO concentrations, reaching up to 35% MgO.

Rochefort (Arot), Lesdiguières (Alsd) and Kapijuq (Akpj) Suites

The Rochefort (Arot), Lesdiguières (Alsd) and Kapijuq (Akpj) suites are mainly composed of tonalite. The trace element patterns of these tonalites are typical of lower continental crust, with negative Nb and Th anomalies (Figure 9). The tonalites are weakly differentiated, just like those encountered to the east of the study area and assigned to the Pélican-Nantais, Faribault-Thury and Diana complexes

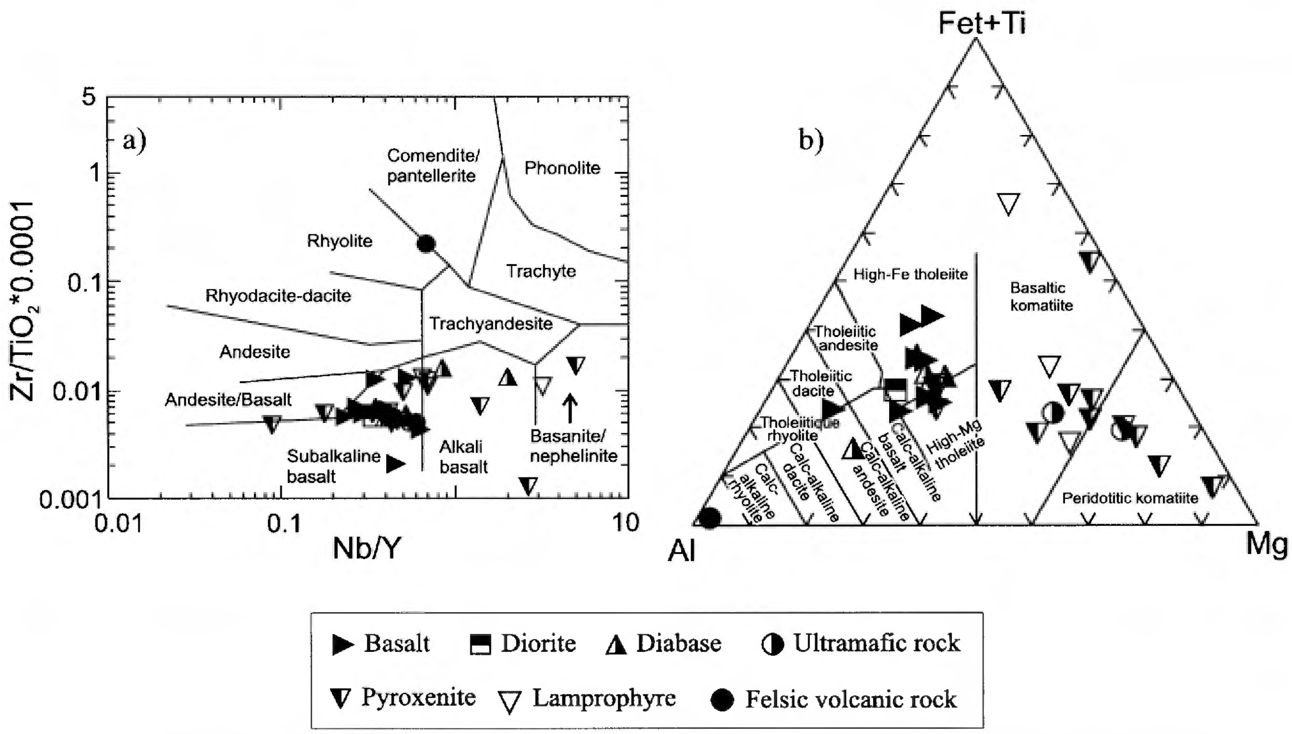


FIGURE 11 - **a)** Nb/Y versus Zr/TiO_2 classification diagram (Winchester and Floyd, 1977). **b)** Jensen cation plot (1976).

(Madore and Larbi, 2000; Madore *et al.*, 2001). The geochemical characteristics of these tonalitic rocks are different from those of granites and granodiorites. Their geochemistry leads us to suggest that the tonalites represent a deep segment of early crust that has been exhumed.

Châtelain (Achl) and La Chevrotière (Alcv) Suites

The Châtelain and La Chevrotière suites are composed of granodiorite and granite. These rocks are highly differentiated. They are probably derived from the differentiation of weakly differentiated rocks located at the base of the crust, or from the melting of rocks in the upper continental crust. The latter hypothesis is preferred, since the trace element patterns are similar to those of upper continental crust (Figure 9).

Analytical results for major and trace elements of granodiorite and granite samples do not allow us to distinguish rocks of the Châtelain Suite from those of the La Chevrotière Suite. Furthermore, these analytical results are comparable to those of other granites and granodiorites encountered to the east of the map area, from rocks assigned to the Leridon Suite (Alrd) and the Lepelle Suite (Alep) (Madore *et al.*, 2001).

Kuuvvaluk (Pkuv) Diatremes

The Kuuvvaluk Diatremes mainly consist of ultramafic lamprophyre and carbonatite. The major element geochemistry of these rocks confirms their alkaline nature (Figure 14a), albeit sometimes close to the sub-alkaline field, and the carbonatite affiliation of a few samples (Figure 14b). Samples from the different mafic and ultramafic phases show Na_2O+K_2O values ranging from 0.1 to 3.0%, and SiO_2 values from 0.1 (carbonatite) to 39% (Table 1 in appendix). These major element analyses show that alkali ratios are inversely proportional to SiO_2, that a few samples are strongly enriched in CaO (up to 60%), that certain samples are strongly depleted in Na_2O+K_2O, and that these rocks are mafic to ultramafic in composition. These observations suggest that these intrusive bodies were contaminated by surrounding country rocks. They are enriched in LILE and slightly depleted in HFSE relative to the mantle (Figure 14b). The LILE enrichment is probably the result of crustal contamination during emplacement, but the HFSE depletion, especially Ti versus Y, is a mantle characteristic.

Summary of Lithogeochemistry

The geochemical composition of felsic intrusive rocks in the map area appears to be homogeneous, with only subtle differences from one unit to the next. These felsic intrusive rocks occur as gneisses (Kapijuq Suite), migmatitic intrusive rocks (Lesdiguières Suite), foliated intrusive rocks (Châtelain and Rochefort suites) and late, more massive intrusive rocks (La Chevrotière Suite).

All of these felsic intrusive rocks probably formed in an active tectonic setting, either along an active margin,

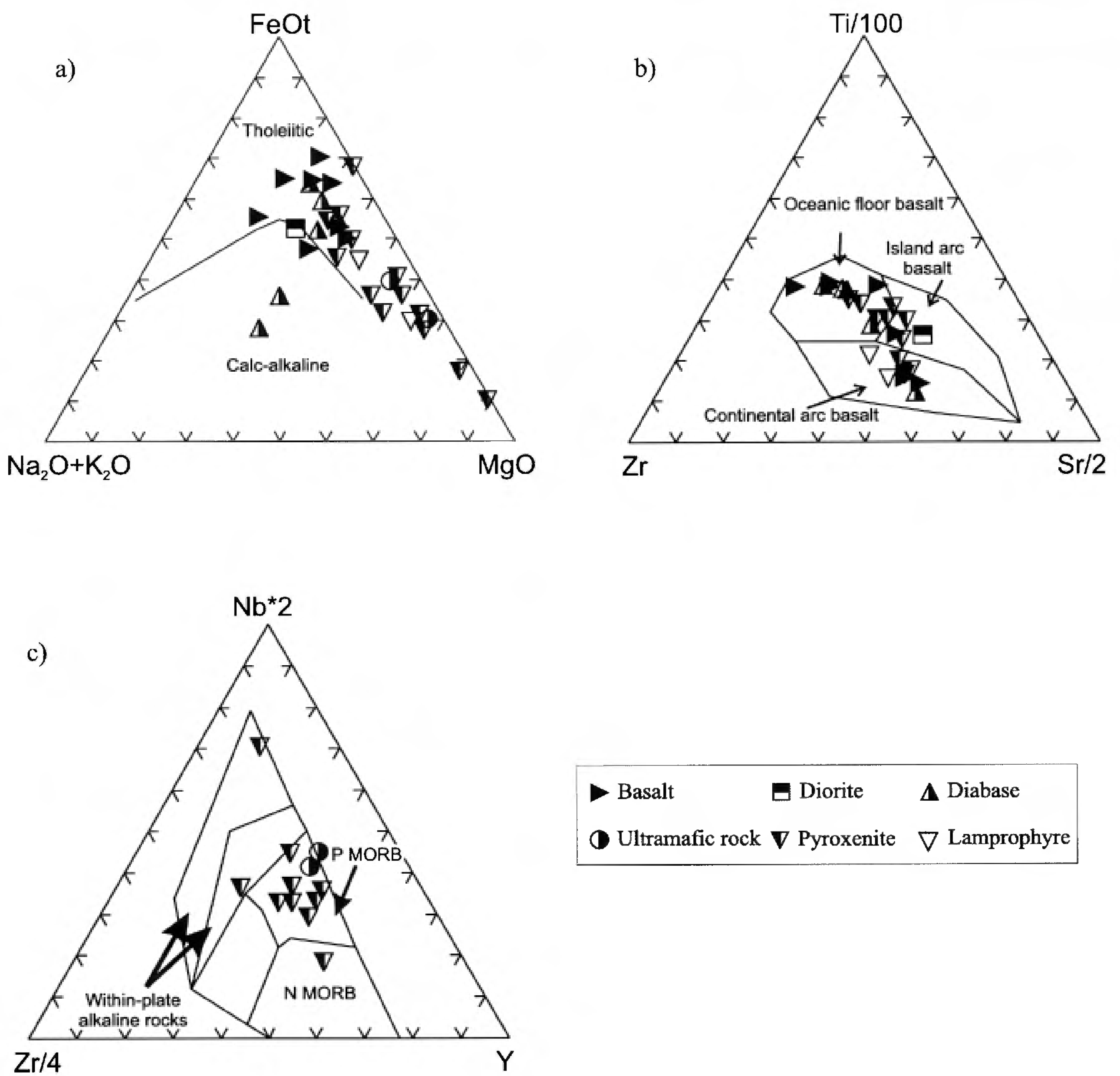


FIGURE 12 - a) AFM ternary diagram by Irvine and Baragar (1971) for mafic and ultramafic rocks. **b)** Ti-Zr-Sr paleotectonic diagram for mafic and ultramafic rocks (Pearce and Cann, 1973). **c)** Zr-Y-Nb paleotectonic diagram for ultramafic rocks (Meschede, 1986).

or during the collision of island arcs or microcontinents. The diagram by Batchelor and Bowden (1985) suggests that tonalitic rocks evolved in a pre-collisional tectonic setting, whereas granites and granodiorites evolved in a syn- to post-collisional tectonic environment (Figure 15). Based on trace element patterns (Figure 9), we propose that, in this part of the Superior Province, tonalites are derived from partial melting in the lower part of the crust, whereas granites and granodiorites are the product of partial melting in the upper continental crust.

Mafic and ultramafic rocks, essentially found in the volcano-sedimentary belts in the area (Allemand, Duquet, Peltier, Caumartin and Headwind belts), share many geochemical similarities with MORBs. Their lithogeochemistry indicates that Archean basalts in the eastern Superior Province are strongly enriched in iron and depleted in trace elements (Zr, Y) relative to modern MORBs (Bryan, 1979; Francheteau *et al.*, 1977; Le-Roex *et al.*, 1981). The same observations were made in adjacent areas to the east (Maurice, 2001; Madore and Larbi, 2000; Madore *et al.*, 2001). According to these observations, it appears that the Archean upper mantle beneath the northeastern Superior Province was enriched in iron, and was chemically closer to chondrites than the modern mantle.

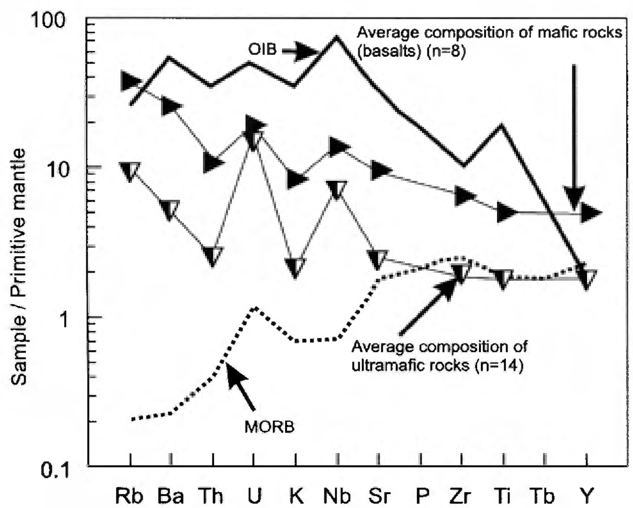


FIGURE 13 - Spiderdiagram normalized to the primitive mantle (Sun and McDonough, 1989) to characterize mafic (basalts) and ultramafic rocks. OIB and MORB patterns are taken from Saunders and Tarney (1984).

ECONOMIC GEOLOGY

Exploration

The Lac Couture and Lac Allemand area was one of the most active in the Far North in terms of exploration in the 1990s, especially the Lac Duquet area. The discovery of the Vizien belt, in the Rivière-aux-Feuilles area, by geologists of the Geological Survey of Canada (Percival and Card, 1992; 1994) opened up a new dimension for the mineral potential of Québec's Far North. In 1992, Cominco and SOQUEM joined forces to conduct a regional reconnaissance program. Several new volcano-sedimentary belts were discovered north of Lac Minto, including the Duquet Belt. Exploration in the following years was mainly focussed on the Lac Qalluviartuuq and Lac Payne areas (NTS 34O), as well as in the vicinity of the Rivière Kogaluk (NTS 34J). Finally, in 1997, attracted by the promising potential for gold-rich volcanogenic massive sulphide deposits, SOQUEM and Virginia Gold Mines acquired an exploration licence in the Lac Duquet area.

Fieldwork conducted in 1997 led to the discovery of several showings in four segments of the Duquet Belt (Cuerrier, 1997; St-Hilaire, 1997). The following year, only a few days of mapping and prospecting were carried out on the Duquet property (Chapdelaine, 1999). Reconnaissance work (Francoeur and Chapdelaine, 1999) was also carried out on other licences acquired on the basis of regional lake sediment geochemistry results (MRN, 1998). No significant results came out of this reconnaissance program.

More detailed investigations began on the Duquet property in 1999, when Cambiex Exploration Inc., now Hope Bay Gold Corp. Inc., joined SOQUEM and Virginia Gold Mines. Detailed mapping and sampling (Chapdelaine and Villeneuve, 2000) as well as ground geophysics (Dubois, 1999) helped constrain the main mineralized zones. Regional reconnaissance surveys also led to the discovery of new Cu-Co showings, and a new exploration licence was acquired in the Lac Veillon area (M. Chapdelaine, personal communication). Finally, in the summer 2000, a few drillholes were completed to test the most promising targets on the Duquet property (Villeneuve, 2000). Given the lack of encouraging results from this drill program and the lacklustre economic setting, no additional exploration work has been carried out on the property since then.

We will briefly describe the main showings encountered in the Lac Couture and Lac Allemand area. We will first review occurrences associated with the Duquet Belt, and follow up with the mineral potential of other volcano-sedimentary belts and Cu-Co mineralization in the Lac Veillon area. The diamond potential will also be briefly discussed.

Duquet Belt

The Duquet Belt (Figure 2) is among the most extensive and well-exposed volcano-sedimentary belts known in Québec's Far North. Several showings were discovered in this belt in the late 1990s, and the characteristics of the main showings will be summarized below. Thirteen of these showings are described in mineral deposit files, available on GM-type digital maps in SIGÉOM. A summary of these descriptions is provided in Table 2, in appendix.

For the sake of clarity in the following paragraphs, we have subdivided the Duquet Belt into four distinct segments. These are the southern, central and northern Lac Duquet segments, as well as the Lac Akuaraaluk segment. Most of the showings associated with the Duquet Belt occur in the southern, central and northern Lac Duquet segments, and their location is shown in Figure 16.

Southern Lac Duquet Segment

The southern Lac Duquet segment is mainly characterized by mafic metavolcanic rocks that have undergone intense hydrothermal alteration. This alteration translates into the presence of anthophyllite, chlorite, garnet, cordierite, and locally, talc and serpentine. These mafic rocks are in contact with a tonalitic intrusion to the east, considered as a synvolcanic intrusion (Chapdelaine and Villeneuve, 2000). A few horizons of ultramafic rock, felsic to intermediate volcanic rock and iron formation are locally inserted in the mafic volcanic sequence. Four polymetallic showings were identified in the southern segment. These are, from north to south: the Scrap Yard, Havre Sigouin, Francoeur and Veines showings. A minor gold showing (showing 810091) was also discovered within a tonalite-hosted shear zone (Figure 16).

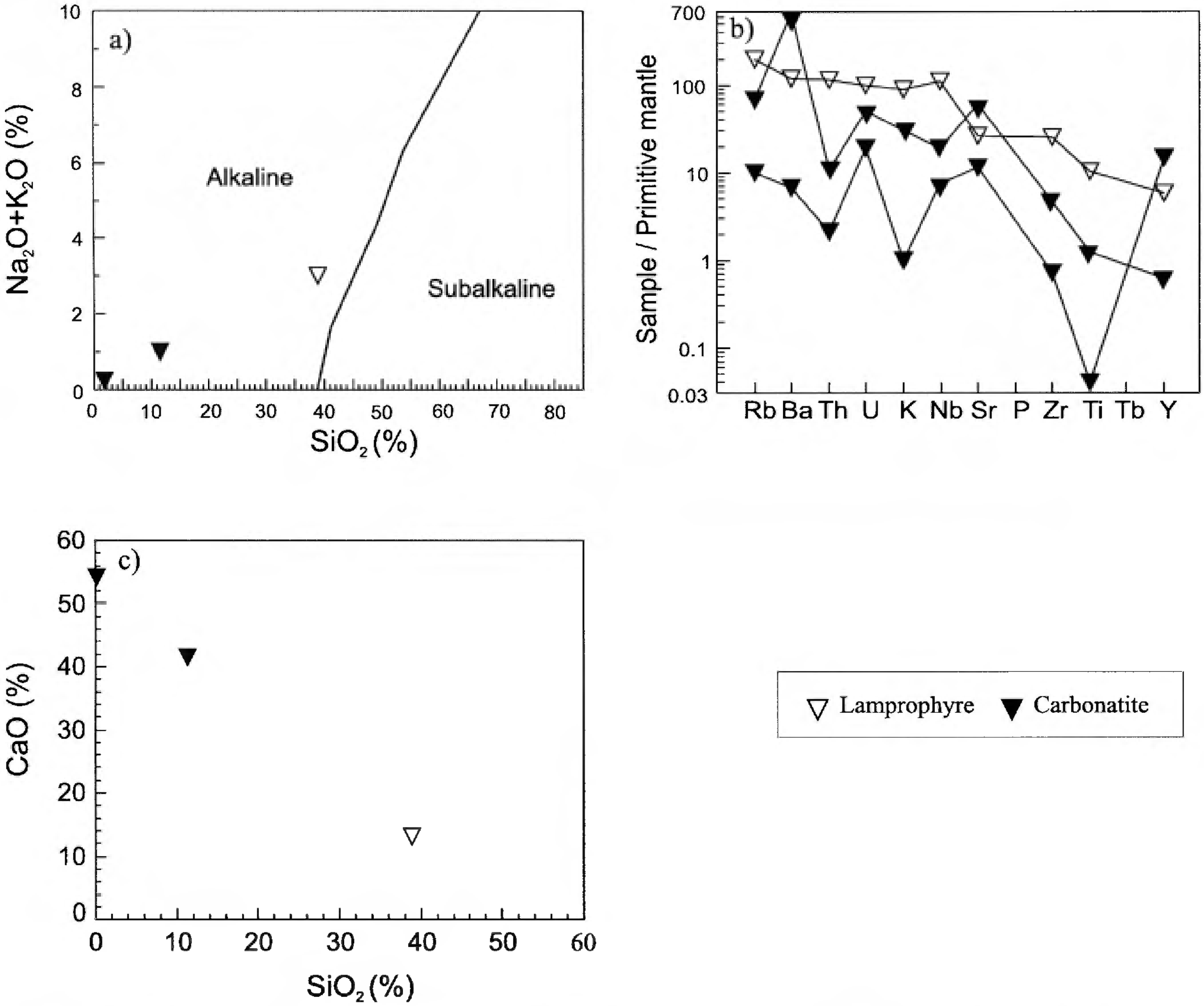


FIGURE 14 - a) Diagram by Irvine and Baragar (1971) to characterize alkaline rocks. **b)** Spiderdiagram normalized to the primitive mantle (Sun and McDonough, 1989) showing the same alkaline rocks. **c)** CaO versus SiO_2 binary diagram, showing the magmatic evolution of lamprophyres and carbonatites.

The Scrap Yard showing (file 35B06-0003) consists of massive to semi-massive sphalerite veins from 1 to 10 cm wide, hosted in mafic volcanic rocks. The sphalerite is accompanied by magnetite (up to 20%) and local traces of pyrrhotite, chalcopyrite and chromite. Overall, the veins appear to be subparallel to the regional foliation. The mafic host rock is strongly affected by hydrothermal alteration, as indicated by the presence of anthophyllite, chlorite, garnet and cordierite. An ultramafic horizon is observed near the mineralized zone. It is completely serpentinized and altered to talc. It contains a 10-cm fuchsite layer and a steatite zone. The steatite zone may constitute an interesting albeit small deposit of carving stone (soapstone); it forms a hill about 5 to 6 metres high by roughly 10 metres wide and 20 metres long. Samples from the sphalerite veins yield up to 29.9% Zn and 1.0% Cu, along with trace amounts of Ag and Cd (Chapdelaine, 1999). A 2.3-m long channel sample yielded an average grade of 4.6% Zn (press release, Virginia Gold Mines, February 10, 2000).

The Havre Sigouin showing (file 35B06-0002), located about 1,000 metres south of the Scrap Yard showing (Figure 16), is characterized by strongly altered mafic volcanic rocks. These volcanic rocks contain garnet, anthophyllite and chlorite. The mineralization consists of a few quartz-chalcopyrite cm-scale veins (stringers). The abundance and the large size of garnet porphyroblasts is spectacular in this alteration zone. The best grades obtained from grab samples collected on this showing are on the order of 10.4% Cu, 12.6 g/t Au and 46.3 g/t Ag (press release, Virginia Gold Mines, February 10, 2000). About 500 metres to the west of the Havre Sigouin showing, the Francoeur showing (file 35B06-0001) consists of massive sulphide lenses 0.1 to 1.0 m in size, hosted in volcanic units ranging from mafic to felsic in composition (Figure 16). An iron formation

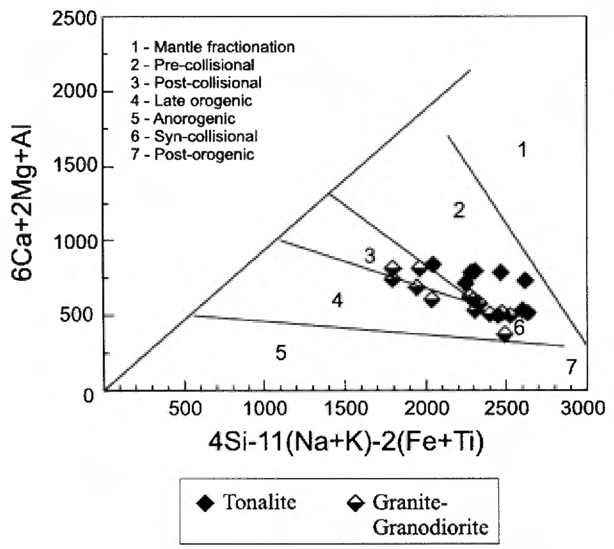


FIGURE 15 - Petrogenetic and paleotectonic diagram (Batchelor and Bowden, 1985) for felsic plutonic rocks.

horizon is observed directly to the west of this showing. Once again, the volcanic rocks are strongly altered, as indicated by the presence of anthophyllite, garnet and biotite, especially in mafic units. The sulphides mainly consist of pyrrhotite, sphalerite and chalcopyrite. A grab sample yielded grades of 1.5% Cu, 4.95% Zn, 18.8 g/t Ag and 0.02% Cd (Chapdelaine, 1999), whereas a channel sample yielded 6.4% Cu, 3.4% Zn and 64 g/t Ag over 1.5 m (press release, Virginia Gold Mines, February 10, 2000).

Finally, near the southernmost part of this segment, the Veines showing (file 35B03-0001) is somewhat different from the three previous showings (Figure 16). The mineralization consists of 1 to 10-cm quartz veins that cross-cut the main foliation. The mineralization is mainly auriferous, associated with disseminated pyrite (up to 40%) along the vein margins. Traces of chalcopyrite and sphalerite were also observed associated with the pyrite. A few coarse gold grains were also observed in the quartz. The quartz veins occur in a muscovite-chlorite schist that marks the sheared contact between the tonalitic intrusion and mafic volcanic units located to the west. A serpentinized ultramafic horizon is also present in this zone. Assays from a grab sample yielded up to 74.75 g/t Au (visible gold), whereas a channel sample graded 7.24 g/t Au over 2.1 m (press release, Virginia Gold Mines, February 10, 2000).

Showings in the southern Lac Duquet segment show many characteristics typically associated with volcanogenic massive sulphide deposits (Labbé and Lacoste, 2001), among which a mafic to felsic volcanic setting, the presence of a synvolcanic tonalitic intrusion, typical anthophyllite + cordierite + garnet + chlorite + biotite alteration and the presence of copper-zinc sulphides. It is interesting to note the high gold content in mineralized samples from this area. This segment shows promising potential for Bousquet-LaRonde-type polymetallic deposits.

Central Lac Duquet Segment

Much like the southern segment, the central Lac Duquet segment hosts polymetallic showings that appear to be related to a volcanogenic system, with the difference that hydrothermal alteration is not as obvious. Anthophyllite-cordierite-garnet units, typical of the southern Lac Duquet segment, are generally very rare, if not altogether absent. However, the central segment is characterized by the presence of highly siliceous massive rhyolite units that most likely correspond to rhyolitic domes. These rhyolites occur within a sequence of felsic to intermediate breccias and tuffs, in contact with mafic metavolcanic rocks. The rhyolitic horizons are relatively well preserved and locally weakly deformed. They are moderately altered, as indicated by sericite and silica enrichment. Compared to the rest of the Duquet Belt, the metamorphic grade in the central segment appears to be somewhat less intense. Three main showings are reported in the central segment.

The COM showing (file 35B06-0007) is directly associated with a rhyolite horizon slightly altered to sericite and quartz (Figure 16). It consists of massive sulphide lenses from 0.1 to 1.0 m in size, as well as sulphide veins. The main sulphide phase is pyrite, with a few pods of sphalerite, galena and chalcopyrite. The "Arsenic" zone, located about 250 m east of the massive sulphide lenses, consists of veins essentially composed of arsenopyrite. A grab sample from the COM showing yielded grades on the order of 34.3 g/t Au, 553 g/t Ag, 1.46% Pb, 7.4% Zn and 0.46% Cu (Cuerrier, 1997). A grab sample from the "Arsenic" zone yielded 1.6% Zn, 0.1% Cu, 0.73 g/t Au and 5.4 g/t Ag (Chapdelaine, 1999).

The Plozin showing (file 35B06-0006), located less than one kilometre northwest of the COM showing (Figure 16), is similar in many ways to the latter. The mineralization occurs as 10-cm lenses of massive to semi-massive sulphides, along with mm-scale sulphide stringers. The sulphides mainly consist of pyrite, with minor amounts of galena and sphalerite. A grab sample yielded 4.26 g/t Au, 370 g/t Ag, 4.55% Pb and 0.6% Zn (Cuerrier, 1997). Assays up to 10.3% Zn were obtained in samples collected further west.

The "Secteur 3-Nord" showing (file 35B06-0005), also called the "Y" showing, is located northwest of the Plozin showing (Figure 16). This showing is hosted in chloritized and silicified mafic volcanic rocks. The mineralization consists of disseminated pyrite, sphalerite and arsenopyrite, associated with quartz injections in a mafic tuff unit. A channel sample graded 7.2% Zn, 0.68% Cu and 9.3 g/t Ag over 0.5 metre (press release, Virginia Gold Mines, February 10, 2000), whereas one of the grab samples yielded up to 6.5% Cu (Villeneuve, 2000).

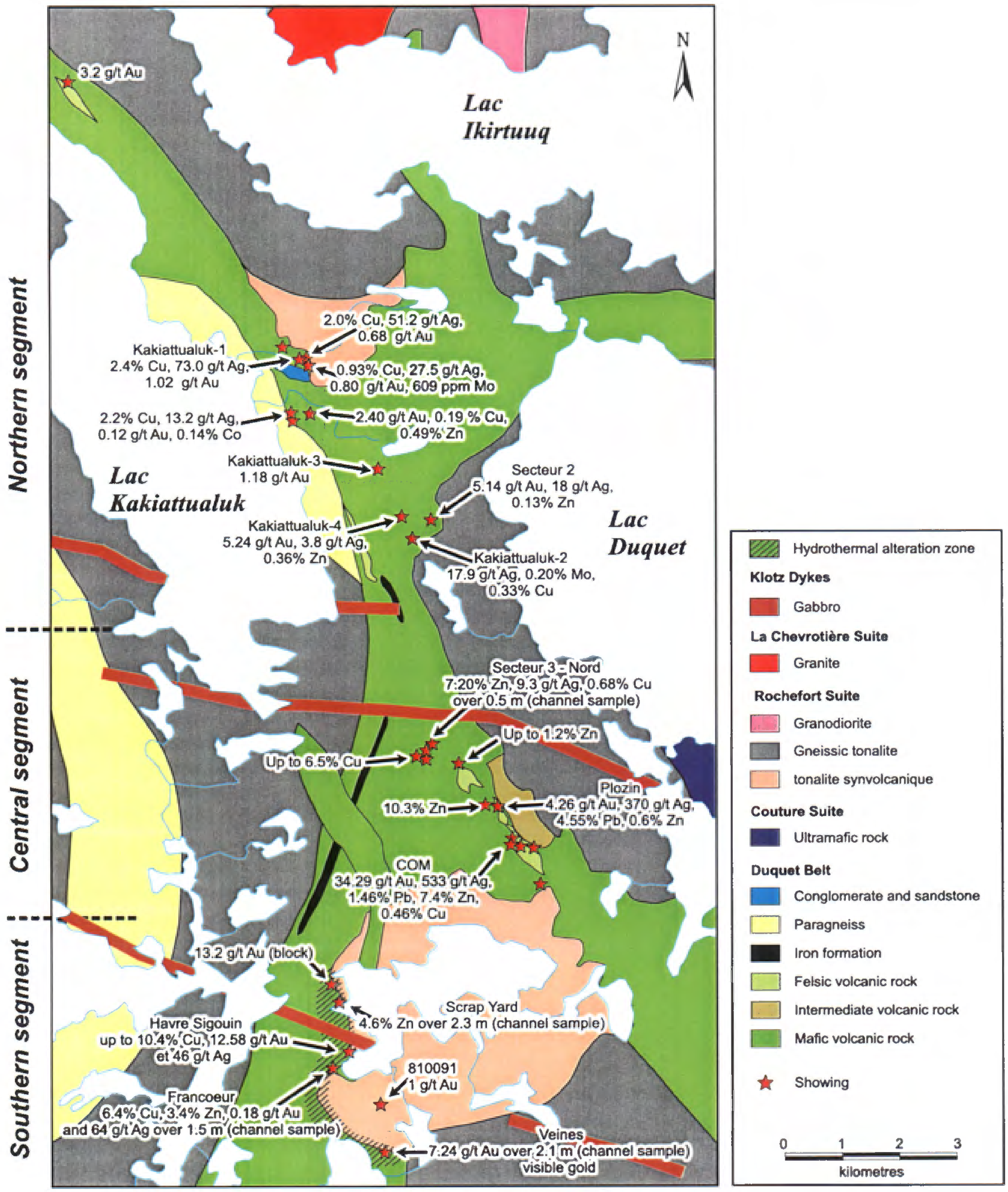


FIGURE 16 - Geology of the NE part of the Duquet Belt, and location of the main showings. The detailed geology of the Duquet Belt is modified after Chapdelaine (2000).

Northern Lac Duquet Segment

The metallogenic setting in the northern Lac Duquet segment is different from those in the central and southern segments. Felsic volcanic rocks are absent in this segment. Furthermore, other characteristics typically associated with volcanogenic massive sulphide deposits, for example, anthophyllite-garnet alteration zones exposed further south, are not observed either. Mineral occurrences in the northern Lac Duquet segment mainly correspond to gold showings associated with shear zones. They generally consist of discontinuous zones where disseminated sulphides occur associated with shear zones. Quartz veins are present in certain cases. These showings were for the most part discovered during reconnaissance surveys (Cuerrier, 1997; Chapdelaine, 1999; Chapdelaine and Villeneuve, 2000; Villeneuve, 2000), and very little work has been conducted since then, such that their characteristics are not well known. Their association with shear zones suggests a mesothermal origin. However, the presence of copper, silver and locally molybdenum may indicate a porphyry-type mineralization.

Data on the five showings located in the northern Lac Duquet segment are available on the mineral deposit map (GM) in SIGÉOM. The characteristics of these showings are summarized in Table 2 in appendix. The most significant results were obtained on the Kakiattualuk-1 and Secteur 2 showings (Figure 16); these two showings respectively yielded 2.4% Cu, 1 g/t Au, 73 g/t Ag, and 5.14 g/t Au, 18 g/t Ag, 0.10% Pb, 0.13% Zn. The Kakiattualuk-2 showing (Figure 16), which contains up to 0.20% Mo, may be related to a porphyry-type mineralisation.

Lac Akuaraaluk Segment

The Duquet Belt extends to the southwest part of our study area, in the Lac Akuaraaluk area (Figure 2). In this segment, the supracrustal belt mainly consists of metabasalts and mafic gneisses. Bands of paragneiss, medium to coarse-grained arenaceous sandstone and polygenic conglomerate are also observed. Very little exploration has been conducted in this area. Reconnaissance surveys did however identify a few anomalies in gold and zinc (M. Chapdelaine, personal communication). A longitudinal traverse conducted in the southern part of the Duquet Belt, near Lac Akuaraaluk, came across a few disseminated sulphide zones, which failed to yield any interesting assays however. A mafic metavolcanic rock sample from the northwestern part of this segment, near the westernmost limit of our map area, did however yield an anomalous gold grade, at 0.33 g/t Au.

Allemand, Peltier, Caumartin and Headwind Belts

Four other volcano-sedimentary belts are identified in the map area (Figure 2). The Peltier, Caumartin and Headwind belts are mainly composed of mafic metavolcanic rocks, whereas the Allemand Belt is dominated by metasedimentary rocks. No evidence of rhyolitic volcanism was observed in these belts. Furthermore, mapping did not encounter any evidence of volcanogenic alteration within these belts. A few ultramafic horizons were recognized in the Headwind and Peltier belts, but no significant mineralization was observed in these rocks.

The only results worth mentioning, obtained from samples collected during the regional mapping of these belts, are those obtained from a mafic volcanic sample of the Allemand Belt, which yielded 0.8% Cu, and from a metabasalt sample of the Peltier Belt, which contains 8 g/t Ag (Figure 2). To the best of our knowledge, no prospecting or mineral exploration has been conducted in these volcano-sedimentary belts.

Brittle Structures

Copper and cobalt showings were discovered by Virginia Gold Mines geologists to the southwest of Lac Veillon (figures 2 and 17), during a reconnaissance survey conducted in 1999 (M. Chapdelaine, personal communication). We sampled the rocks in this area, in order to better define the setting in which these new showings occur.

Several Cu-Co showings or anomalies were identified over a roughly 2-km long segment of a NW-SE-trending brittle structure (Figure 17). The most spectacular mineralizations occur at both ends of this segment. They are described in two mineral deposit files in SIGÉOM. They are known as the Cipmyluk-1 and Cipmyluk-2 showings. To the best of our knowledge, the northwestern and southeastern extensions of these mineralized zones have yet to be investigated.

These mineral occurrences are hosted in a strongly deformed granodiorite that also contains numerous enclaves of amphibolite and paragneiss. It shows local evidence of migmatization, and is cross-cut by pegmatite injections. Near the fault zone, a minor distal epidote alteration zone is noted, followed by strong hematitization and silicification within the fault zone itself. The granodiorite is fractured and injected with magnetite (photos 3 and 5 in appendix) and quartz. Locally, a breccia with a magnetite matrix is even observed (Photo 4 in appendix). The mineralization appears to be mainly associated with the silicification phase. Several hematitized zones injected with magnetite veins do not contain any sulphides.

At the Cipmyluk-1 showing (Figure 17), the mineralization mainly consists of chalcopyrite-pyrite pods hosted in quartz veins and in silicified surrounding rock. A grab sample yielded assays of 2.20% Cu and 125 ppm Co (Virginia Gold Mines, unpublished data). However, at Cipmyluk-2, magnetite is predominant, and very few quartz injections are observed. Pyrite and chalcopyrite are associated with the magnetite, in veins and breccia zones (Photo 6 in appendix),

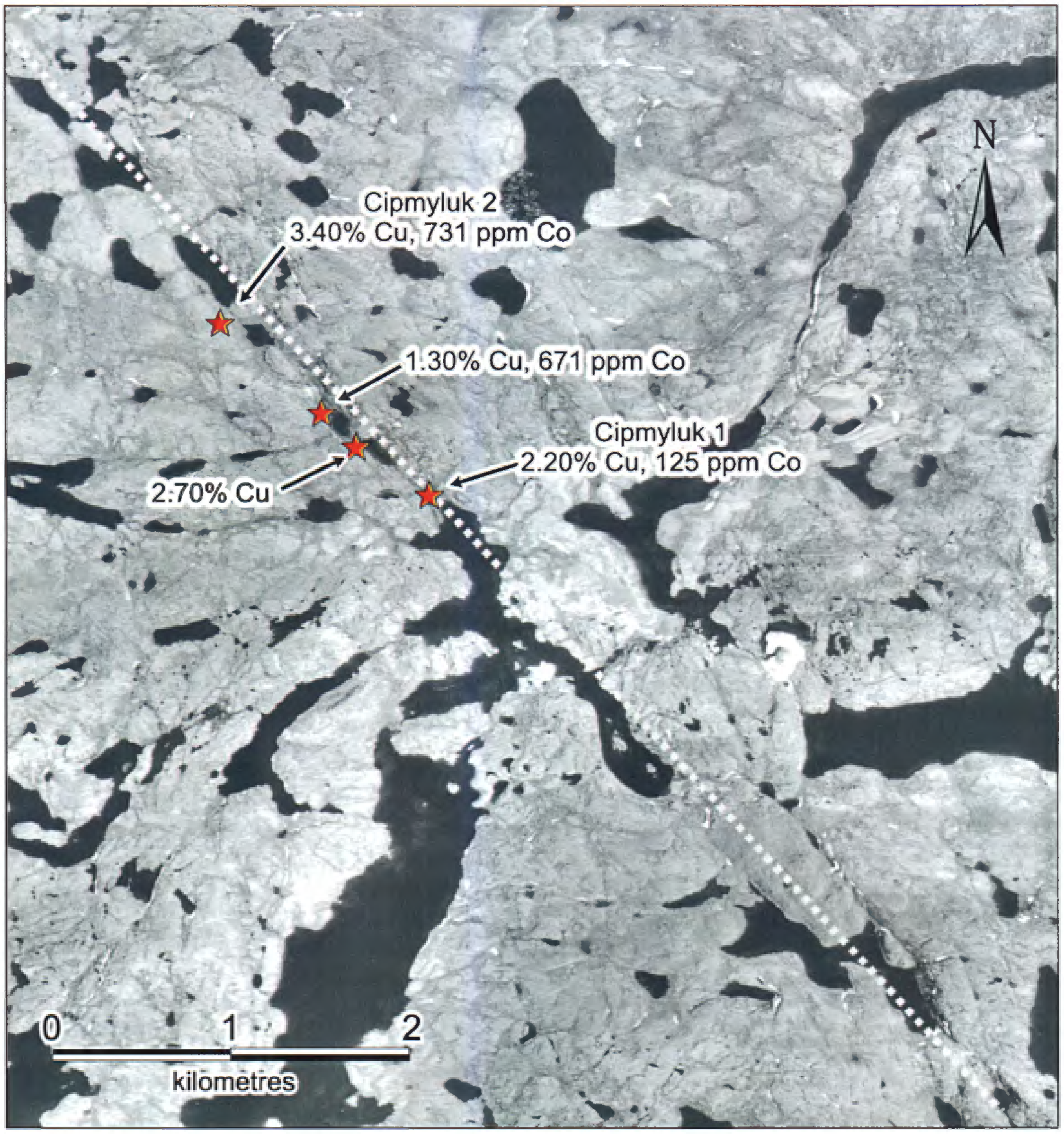


FIGURE 17 - Aerial photograph of the area south of Lac Veillon, showing the location of the NW-SE trending brittle fault, and the location of copper-cobalt showings.

and very little disseminated mineralization is observed. A grab sample from this zone yielded 3.40% Cu and 731 ppm Co (Virginia Gold Mines, unpublished data).

Mineralized zones in the Lac Veillon area are associated with a late brittle structure that cuts the regional tectonic fabric. At first glance, the presence of copper mineralization in breccias with a magnetite matrix may be similar to Olympic Dam-type mineralization. These types of deposits are commonly Proterozoic or younger (Oreskes and Hitzman, 1993; Gandhi and Bell, 1996). It is not impossible that the NW-SE-trending brittle fault that hosts these occurrences may be Proterozoic in age, or that it was reactivated at that time. However, a major distinction exists between the Lac Veillon occurrences and Olympic Dam-type deposits. They are both associated with fracture zones, but in the case of Olympic Dam-type mineralization, the fracture zones affect continental supracrustal rocks, commonly felsic in composition and formed in late orogenic to post-orogenic settings (Gandhi and Bell, 1996). The granodioritic country rocks that host the Cipmyluk showings represent deep-seated intrusions that are in no way comparable to volcano-plutonic suites typically hosting Olympic Dam-type iron oxide deposits. It is not impossible however, that these granodiorites were once unconformably overlain by Proterozoic units of this nature, and that what we see today are the roots of a former system related to Olympic Dam-type mineralization.

Several other NW-SE-trending brittle faults are observed in the area (figures 2 and 5). However, despite the presence of a few hematite alteration zones, no other occurrences of this type were encountered during our mapping survey.

Diamond Potential

The Lac Couture and Lac Allemand area may be considered prospective for diamond exploration. The western part of the area corresponds to the Allemand-Tasiat Structural Zone defined by Moorhead *et al.* (1999 and 2000). This corridor, more than 50 km wide, is defined by the alignment of several alkaline intrusions, namely a nepheline syenite in the Lac Tasiat area (Percival *et al.*, 1995), the Lac Couture carbonatite (Percival *et al.*, 1996a) and the Kuuvvaluk Diatremes (Figure 2). The Lac Couture carbonatite corresponds to a carbonatite dyke with ultramafic fragments that is roughly 3 metres wide by 500 metres long, located 30 km southwest of Lac Duquet. These lithologies were not investigated during our mapping survey. However, the Kuuvvaluk Diatremes were examined in the northwesternmost part of the map area, near the Allemand Belt. They consist of circular intrusions of ultramafic lamprophyre. Their nature warrants more detailed work, in order to better define their potential for diamond exploration.

CONCLUSION

Recent mapping (Moorhead, 1989; Percival *et al.*, 1996a) has provided some insight on the nature of intrusive rocks and has identified volcano-sedimentary bands, namely the Allemand, Duquet and Akuaraaluk belts. This new survey has detailed the nature and distribution of felsic intrusive rocks, predominant in the area, and has uncovered new volcano-sedimentary bands, namely the Peltier and Headwind belts. This work has also led to a subdivision of the area into three informal domains: the western domain, the central domain and the eastern domain.

The western domain is mainly composed of foliated or gneissic tonalite (Rochefort Suite) that encloses bands of volcano-sedimentary rocks (Allemand and Duquet belts). Lithological assemblages mapped in the western domain are comparable to those described in the Goudalie domain (Percival *et al.*, 1991, 1992, 1997) or in the Faribault-Thury Complex (Madore *et al.*, 1999, 2001; Madore and Larbi, 2000). The eastern domain mainly contains granodiorites and granites (Châtelain Suite) that enclose thin bands of volcano-sedimentary rocks (Headwind Belt). Lithological assemblages observed in this domain resemble rocks assigned to the Lepelle and Utsalik domains, as defined by Percival *et al.* (1991, 1992, 1997). The central domain mainly consists of migmatitic tonalite with abundant granitic injections (Lesdiguières Suite). These intrusive rocks host a few small bands of volcano-sedimentary rocks (Peltier and Caumartin belts). Lithological assemblages in the central domain represent a hybrid combination of assemblages from the western and eastern domains. The central domain therefore probably corresponds to a wide transition zone between two major Archean terrains that make up the northeastern Superior Province.

Granitic plutons (La Chevrotière Suite) intrude lithologies in all three domains. Cross-cutting relationships observed in the field suggest that these intrusions are relatively late. They are particularly abundant in the eastern part of the area, namely in the eastern and central domains. The area of exposure of these intrusive rocks extends much further west however, into the western domain, where they are much more restricted. The tabular shape of these intrusions, aligned with the regional fabric, as well as the presence of hypidiomorphic feldspar phenocrysts parallel to the foliation, suggest that these rocks were emplaced during or towards the end of an episode of deformation (synkinematic intrusions).

Apart from two minor Cu and Ag showings respectively discovered in the Allemand Belt and the Peltier Belt, no new significant mineralization was uncovered during our field campaign. Nevertheless, between 1997 and 2000, mineral exploration companies identified many different types of mineral occurrences in the map area, especially in the Lac Duquet area. Showings discovered during these exploration programs were revisited and studied in order to characterize regional metallogenic settings.

Within the Duquet Belt, volcanogenic massive sulphide-type polymetallic showings occur, in combination with anthophyllite-cordierite-garnet-chlorite-biotite alteration zones. Gold showings associated with shear zones were also uncovered. Another series of Cu-Co showings were discovered in a NW-SE-trending brittle fault that runs across the central part of the area. An interesting setting for diamond exploration was also identified, in the Allemand-Tasiat structural zone defined by Moorhead *et al.* (1999 and 2000). This structural corridor hosts a series of small alkaline intrusions, including the Kuuvvaluk Diatremes, which consist of ultramafic lamprophyre.

REFERENCES

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

BEALS, C.S. - DENCE, M.R. - COHEN, A.J., 1967 - Evidence for impact origin of Lac Couture. Publication of the Dominion Observatory, Ottawa; volume 31.

BOTTOMLEY, R.J. - YORK, D. - GRIEVE, R.A.F., 1990 - ^{40}Ar-^{39}Ar dating of impact craters. Proceedings-20th Lunar and Planetary Sciences Conference; pages 421-431.

BOUCHARD, N. - MADORE, L. - GOULET, N., 1999 – Le chevauchement des roches de la Fosse du Labrador et de ses équivalents stratigraphiques : l'exemple de la séquence supracrustale de la région du lac Nagvaraaluk. *Dans:* Explorer au Québec : Le défi de la connaissance, Programme et résumés. Ministère des Ressources naturelles, Québec; DV 99-03, page 41.

BRYAN, W.B., 1979 - Regional variation and petrogenesis of basalt glasses from the FAMOUS area, Mid-Atlantic Ridge. Journal of Petrology; volume 20, pages 293-325.

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

CHAPDELAINE, M., 1999 - Rapport des travaux de cartographic et de prospection 1998, projet Minto, propriété Duquet. Ministère des Ressources naturelles, Québec; GM 56484.

CHAPDELAINE, M. - VILLENEUVE, P.-A., 2000 - Rapport des travaux de cartographie et de prospection, été 1999, projet Duquet. Ministère des Ressources naturelles, Québec; GM 57834.

CHAPPELL, B.W. - WHITE, A.J.R., 1974 - Two contrasting granite types. Pacific Geology; volume 8, pages 173-174.

CUERRIER, G., 1997 - Propriété Duquet (1205), rapport des travaux, été 1997. Ministère des Ressources naturelles, Québec; GM 55596.

DE LA ROCHE, H. - LETERRIER, J. - GRANDE CLAUDE, P. - MARCHAL, M., 1980 - A classification of volcanic and plutonic rocks using R1-R2 diagrams and major element analyses – its relationships and current nomenclature. Chemical Geology; volume 29, pages 183-210.

DION, D.J. - DUMONT, R., 1994 - Diffusion des données numériques (maille du champ magnétique total résiduel), territoire du Québec. Ministère des Ressources naturelles, Québec; MB 94-08X.

DUBOIS, M., 1999 - Rapport sur des levés géophysiques au sol, projet Duquet. Ministère des Ressources naturelles, Québec; GM 57835.

FAHRIG, W.F. - IRVING, E. - JACKSON, G.D., 1971 - Paleomagnetism of Franklin Diabases. Canadian Journal of Earth Sciences; volume 8, pages 455-467.

FAHRIG, W.F. - CHRISTIE, K.W. - CHOWN, E.H. - MACHADO, N., 1985 - The tectonic significance of some basic dyke swarms in the Canadian Superior Province with special reference to the geochemistry and paleomagnetism of the Mistassini swarm, Quebec, Canada. Canadian Journal of Earth Sciences; volume 23, pages 238-253.

FRANCHETEAU, J. - HEKINIAN, R. - NEEDHAM, D. – LE PICHON, X. - CHOUKROUNE, P. - TAPPONNIER, P. - BELLAICHE, G. - CHEMINEE, J.L., 1977 - Rocks collected by bathyscaph and diving in the FAMOUS area of the Mid-Atlantic Rift Valley; petrological diversity and structural setting. Deep-Sea Research; volume 24, pages 565-589.

FRANCOEUR, G - CHAPDELAINE, M., 1999 - Rapport des travaux 1998, projet Grand-Nord. Ministère des Ressources naturelles, Québec; GM 56437.

GANDHI, S.S. - BELL, R.T., 1996 – Kiruna/Olympic Dam-type iron, copper, uranium, gold, silver. In: Geology of Canadian Mineral Deposit Types. Eckstrand, O.R., Sinclair, W.D. and Thorpe, R.I. *(editors)*. Geological Survey of Canada, Geology of Canada; number 8, pages 569-579.

GSC, 1994 – Gravity database. Geological Survey of Canada, Ottawa: digital data.

HEAMAN, L.M. - LECHEMINANT, A.N. - RAINBIRD, R.H., 1992 - Nature and timing of Franklin igneous events, Canada: Implications for a late Proterozoic mantle plume and the break-up of Laurentia. Earth and Planetary Sciences Letters; volume 109, pages 117-131.

HOLDAWAY, M.J., 1971 - Stability of andalusite and the aluminium silicate phase diagram. American Journal of Sciences; volume 271, pages 97-131.

HOLDAWAY, M.J. - LEE, S.M., 1977 - Fe-Mg cordierite stability in high grade pelitic rocks based on experimental, theoretical and natural observations. Contributions to Mineralogy and Petrology; volume 63, pages 175-198.

IRVINE, T.N. - BARAGAR, W.R.A., 1971 - A guide to the chemical classification of the common volcanic rocks. Canadian Journal of Earth Sciences; volume 8, pages 523-545.

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

KITZES, E., 1964 - Exploring craters in the Earth. Nature and Science; volume 1, pages 10-12.

KRETZ, R., 1961 – Geological Observations in Northern New Québec, 34 and 35. Geological Survey of Canada, Ottawa; Paper 60-12, 17 pages (accompanies map number 13-1960).

LABBÉ, J.-Y. - LACOSTE, P., 2001 - Environnements propices aux minéralisations polymétalliques de type volcanogène dans le Grand-Nord québécois. Ministère des Ressources naturelles, Québec; MB 2001-07, 82 pages.

LE-ROEX, A.P. - ERLANK, A.J. - NEEDHAM, D., 1981 – Geochemical and mineralogical evidence of the occurrence of at least three distinct magma types in the 'FAMOUS' region. Contributions to Mineralogy and Petrology; volume 77, pages 24-37.

LAMOTHE, D. - PICARD, C. - MOORHEAD, J., 1984 – Bande de Cap Smith-Maricourt, région du lac Beauparlant. Ministère des Ressources naturelles, Québec; DP 84-39, annotated map.

LECLAIR, A. - PARENT, M. - DAVID, J. - SHARMA, K.N.M. - DION, D.J., 2000 – Geology of the Lac La Potherie Area (34I). Ministère des Ressources naturelles, Québec; RG 2001-04, 43 pages.

LUCAS, S.B., 1989 - Structural evolution of the Cape Smith thrust belt and the role of out-of-sequence faulting in the thickening of mountain belts. Tectonics; volume 8, pages 655-676.

MADORE, L. - BANDYAYERA, D. - BÉDARD, J.H. - BROUILLETTE, P. - SHARMA, K.N.M. - BEAUMIER, M. - DAVID, J., 1999 – Geology of the Lac Peters Area (NTS 24M). Ministère des Ressources naturelles, Québec; RG 99-16, 43 pages.

MADORE, L. - LARBI, Y., 2000 – Geology of the Rivière Arnaud area (25D) and adjacent coastal areas (25C, 25E and 25F). Ministère des Ressources naturelles, Québec; RG 2001-06, 35 pages.

MADORE, L. - LARBI, Y. - SHARMA, K.N.M. - LABBÉ, J.-Y. - LACOSTE, P. - DAVID, J. - BROUSSEAU, K. - HOCQ, M., 2001 – Geology of the Lac Klotz (35A) and the Cratère du Nouveau-Québec (southern half of 35H) areas. Ministère des Ressources naturelles, Québec; RG 2002-05, 45 pages.

MADORE, L. - LARBI, Y., 2001 - Regional structural character of the northeastern Ungava Peninsula: Connection between the Rae and Superior Provinces. In: GAC/MAC, St. John's 2001 Abstracts Volume 26. Memorial University of Newfoundland, St. John's; page 93.

MAURICE, C., 2001 - The Archean Mafic Volcanism of the Eastern Ungava Peninsula, Northern Québec. McGill University; M.Sc. Thesis, 87 pages.

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

MESCHEDE, M., 1986 - A method of discriminating between different types of mid-ocean ridge basalts and continental tholeiites with the Nb-Zr-Y diagram. Chemical Geology; volume 56, pages 207-218.

MOORHEAD, J, 1989 - Géologie de la région du lac Chukotat (Fosse de l'Ungava). Ministère des Ressources naturelles, Québec; ET 87-10, 56 pages (accompanies map number 2059-B).

MOORHEAD, J. - BEAUMIER, M. - LEFEBVRE, D. - BERNIER, L. - MARTEL, D., 1999 - Kimberlites, linéaments et rifts crustaux au Québec. Ministère des Ressources naturelles, Québec; MB 99-35.

MOORHEAD, J. - PERREAULT, S. - BERCLAZ, A. - SHARMA, K.N.M. - BEAUMIER, M. - CADIEUX, A.-M., 2000 – Kimberlites and Diamonds in Northern Québec. Ministère des Ressources naturelles, Québec; PRO 99-09.

MRN, 1998 - Résultats d'analyses de sédiments de fond de lacs, Grand-Nord du Québec. Ministère des Ressources naturelles, Québec; DP 98-01 (digital data).

O'CONNOR, J.T., 1965 - Classification of quartz-rich igneous rocks based on feldspar ratios. United States Geological Survey; Professional Paper 525-B, pages 79-84.

ORESKES, N. - HITZMAN, M.W., 1993 - A model for the origin of Olympic Dam-type deposits. In: Mineral Deposit Modeling. Kirkham, R.V., Sinclair, W.D., Thorpe, R.I. and Duke, J.M. *(editors)*. Geological Association of Canada; Special Paper 40, pages 615-633.

PARENT, M. - LECLAIR, A. - DAVID, J. - SHARMA, K.N.M., 2000 – Geology of the Lac Nedlouc Area (NTS 34H and 24E). Ministère des Ressources naturelles, Québec; RG 2000-09, 41 pages.

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

PEARCE, J.A., 1983 - Role of the sub-continental lithosphere in magma genesis at active continental margins. In: Continental basalts and mantle xenoliths. C.J. Hawkesworth and M.J. Norry *(editors)*, pages 230-249.

PEARCE, J.A. - HARRIS, N.B.W. - TINDLE, A.G., 1984 – Trace elements discrimination diagrams for the tectonic interpretation of granitic rocks. Journal of Petrology; volume 25, pages 956- 983.

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

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

PERCIVAL, J.A. - CARD, K.D., 1992 - Vizien greenstone belt and adjacent high-grade domains of the Minto block, Ungava Peninsula, Quebec. In: Current Research, Part C, Geological Survey of Canada; Paper 92-1C, pages 69-80.

PERCIVAL, J.A. - CARD, K.D., 1994 - Geology Lac Minto – Rivière aux Feuilles, Québec. Geological Survey of Canada; map 1854A.

PERCIVAL, J.A. - SKULSKI, T. - CARD, K.D. - LIN, S., 1995 – Geology of the Rivière Kogaluc-Lac Qalluviartuuq (parts of 34J and 34O), Québec. Geological Survey of Canada; Open File 3112.

PERCIVAL, J.A. - SKULSKI, T. - NADEAU, L., 1996a - Geology, Lac Couture, Québec. Geological Survey of Canada; Open File 3315, scale 1:250,000.

PERCIVAL, J.A. - SKULSKI, T. - NADEAU, L., 1996b - Granite-greenstone terranes of the northern Minto block, northeastern Superior Province, Quebec. In: Current Research 1996-C. Geological Survey of Canada; pages 157-167.

PERCIVAL, J.A. - SKULSKI, T. - NADEAU, L., 1997 - Granite-greenstone terranes of the northern Minto Block, northeastern Québec: Pélican-Nantais, Faribault-Leridon and Duquet belts. *In:* Current Research, 1997-C. Geological Survey of Canada; pages 211-221.

PERCIVAL, J.A. - SKULSKI, T., 2000 - Tectonothermal evolution of the northern Minto Block, Superior Province, Quebec, Canada. The Canadian Mineralogist; volume 38, pages 345-378.

RICHARDSON, S.W., 1968 - Staurolite stability in a part of the system Fe-Al-Si-O-H. Journal of Petrology; volume 9, pages 467-488.

RICKWOOD, P.C., 1989 - Boundary lines within petrologic diagrams which use oxides of major and minor elements. Lithos; volume 22, pages 247-263.

ROBERTSON, P.B., 1965 - Petrography of the bedrock and breccia erratics in the region of Lac Couture, Québec. Pennsylvania State University; M.Sc. Thesis.

ROBIN, P.Y. - JOWETT, E., 1986 - Computerized density contouring and statistical evaluation of orientation data using counting circles and continuous weighting functions. Tectonophysics; volume 121, pages 207-223.

SAUNDERS, A.D. - TARNEY, J., 1984 - Geochemical characteristics of basaltic volcanism within back-arc basins. In: Marginal Basin Geology. B.P. Kokelarr and M.F. Howella *(editors)*, Geological Society of London, London; Special Publication 16, pages 59-76.

SHARMA, K.N.M. - MARQUIS, R. - DULUDE, M. - LARBI, Y. - MADORE, L. - NOËL, A. - STEVENSON, R., 2001 - Cratère météoritique du lac Couture : de nouvelles évidences. In: L'exploration minérale au Québec, de brillantes perspectives. Programme et résumés. Ministère des Ressources naturelles, Québec; page 40.

STEVENSON, I.M., 1968 - Geology, Leaf River, Quebec. Geological Survey of Canada; map 1229A, scale 1:1,000,000.

ST-HILAIRE, C., 1997 - Levé électromagnétique et magnétique héliporté, projet Minto-Vizien. Ministère des Ressources naturelles, Québec; GM 55595.

ST-ONGE, M.R. - LUCAS, S.B. - SCOTT, D.J. - BÉGIN, N.J. - HELMSTEADT, H. - CARMICHAEL, D., 1988 - Thin-skinned imbrication and subsequent thick-skinned folding of rift-fill, transitional-crust and ophiolite suites in the 1.9 Ga Cape Smith Belt, northern Quebec. In: Current Research, Part C. Paper 88-1C. Geological Survey of Canada; pages 1-18.

ST-ONGE, M.R. - LUCAS, S.B., 1990 - Evolution of the Cape Smith Belt: Early Proterozoic continental underthrusting, ophiolite obduction and thick-skinned folding. In: The Early Proterozoic Trans-Hudson Orogen: Lithotectonic Correlations and Evolution. J.F. Lewry and M.R. Stauffer *(editors)*, Geological Association of Canada; Special Paper 37, pages 313-351.

SUN, S.S., 1980 - Lead isotopic study of young volcanic rocks from mid-ocean ridges, ocean islands and island arcs. Philosophical Transactions Royal Society; volume A297, pages 409- 445.

SUN, S.S. - MCDONOUGH, W.F., 1989 - Chemical and isotopic systematics of oceanic basalts: implication for mantle compositions and process. In: Magmatism in the Ocean Basins. A.D. Saunders and M.J. Norry *(editors)*, Geological Society Special Publication; volume 42, pages 313-345.

TAYLOR, F.C., 1982 - Reconnaissance geology of a part of the Canadian Shield, northern Quebec and Northwest Territories. Geological Survey of Canada; Memoir 399, 32 pages.

VILLENEUVE, P.-A., 2000 - Rapport des travaux de forage et de reconnaissance 2000, propriété Duquet. Ministère des Ressources naturelles, Québec; GM 58641.

WEAVER, B. - TARNEY, J., 1984 - Empirical approach to estimating the composition of the continental crust. Nature; volume 310, pages 575-577.

WHITE, A.J.R. - CHAPPELL, B.W., 1977 – Ultrametamorphism and granitoid genesis. Tectonophysics; volume 43, pages 21-51.

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

ZEN, E.A., 1988 - Phase relations of peraluminous granite rocks and their petrogenetic implications. Annual Review of Earth and Planetary Sciences; volume 16, pages 21-51.

TABLE 1 - Results of geochemical analyses of representative rock samples from the Lac Couture and Lac Allemand area.

	Duquet Belt	Headwind Belt		Allemand Belt		Peltier Belt		Rochefort Suite	Lesdiguières Suite		Châtelain Suite	La Chevrotière Suite
Lithology	V1	I4B	V4	I3O	V3	I4B	V3	I1D	I1D	I2J	I1B	I1B
SiO_2 %	80.60	51.90	46.70	38.90	48.20	49.20	36.00	67.40	47.00	48.80	70.00	73.00
Al_2O_3 %	12.60	4.02	9.04	7.32	13.30	5.88	14.00	17.00	15.60	15.00	15.40	14.40
Fe_2O_3t %	0.27	8.55	12.60	15.40	18.60	10.10	21.60	2.38	13.20	11.90	2.51	1.70
MgO %	0.21	17.30	14.90	13.00	4.64	14.60	6.39	1.11	7.61	5.13	0.93	0.48
CaO %	0.02	14.80	12.30	13.20	8.80	16.60	7.49	3.80	12.00	12.40	2.43	1.81
Na_2O %	0.10	0.96	1.21	0.33	3.51	0.94	1.48	5.00	1.97	2.45	4.20	3.81
K_2O %	3.75	0.43	0.53	2.68	0.47	0.53	0.11	1.44	0.20	1.36	3.43	4.02
TiO_2 %	0.04	0.27	0.36	2.59	2.34	0.47	4.32	0.28	0.95	1.00	0.28	0.22
MnO %	0.01	0.18	0.21	0.23	0.25	0.18	0.27	0.02	0.21	0.22	0.04	0.02
P_2O_5 %	0.01	0.01	0.01	0.67	0.25	0.04	0.10	0.05	0.02	0.02	0.09	0.05
Cr_2O_3 %	0.01	0.14	0.09	0.05	0.02	0.12	0.01	0.01	0.04	0.02	0.01	0.01
LOI %	1.82	1.78	1.54	4.98	0.19	1.43	8.38	0.61	1.22	1.18	0.61	0.43
Total %	99.44	100.34	99.49	99.35	100.57	100.09	100.15	99.10	100.02	99.48	99.93	99.95
Nb ppm	19.00	7.00	6.00	89.00	12.00	5.00	10.00	6.00	7.00	7.00	8.00	6.00
Rb ppm	93.00	14.00	20.00	136.00	11.00	11.00	8.00	50.00	10.00	55.00	85.00	127.00
Sc ppm	2.10	57.00	45.00	23.00	47.00	70.00	34.00	4.10	37.00	42.00	4.20	0.80
Sr ppm	7.00	94.00	9.00	596.00	121.00	74.00	86.00	480.00	100.00	227.00	544.00	378.00
Ta ppm	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
Th ppm	9.50	0.40	0.20	11.00	1.50	0.40	0.40	2.50	0.30	0.40	8.40	7.80
U ppm	1.90	0.50	0.50	2.60	0.50	0.50	0.50	1.6	0.50	0.50	0.50	0.50
Y ppm	28.00	10.00	10.00	28.00	44.00	13.00	22.00	3.00	11.00	21.00	9.00	3.00
Zr ppm	88.00	29.00	18.00	280.00	167.00	28.00	89.00	86.00	41.00	56.00	140.00	108.00
Ba ppm	740.00	50.00	50.00	910.00	50.00	70.00	50.00	390.00	90.00	240.00	910.00	1100.00
Cs ppm	2.70	0.50	0.50	14.00	0.50	0.50	0.50	2.10	0.50	0.50	0.60	0.80
Sb ppm	0.70	0.10	0.10	0.10	0.30	0.10	0.10	0.10	0.10	0.10	0.10	0.10

Fe_2O_3t = total iron oxides expressed as Fe_2O_3.

Lithology codes :

I1B = granite, I1D = tonalite, V1 = felsic volcanic rock, I2J = diorite, I3O = lamprophyre

V3 = mafic volcanic rock, V4 = ultramafic volcanic rock, I4B = pyroxenite

TABLE 2 - Characteristics of the main showings in the Lac Couture and Lac Allemand area.

Name	Area	UTM 18 NAD 83	Substances	Mineralization	Host rock	Alteration	Grade	Mineral deposit file
Kakiattualuk-1	Duquet North	476228 E 6694475 N	Cu, Au, Ag	Disseminated CP hosted in 10 cm QZ veins	Shear zone at the contact between a tonalite and mafic volcanic rocks	Local carbonate alteration	2.4% Cu - 1.02 g/t Au - 73 g/t Ag	35B06 - 0008
Kakiattualuk-2	Duquet North	478230 E 6691136 N	Ag +/- (Mo, Cu)	Disseminated sulphides; mainly PY with CP and AS	Shear zone at the contact between a tonalite and mafic volcanic rocks	None reported	17.9 g/t Ag - 0.20% Mo - 0.33% Cu	35B06 - 0009
Kakiattualuk-3	Duquet North	477630 E 6692436 N	Au +/- Ag	Disseminated PY and AS in QZ vein	Mafic volcanic rock	Chloritization (?)	1.18 g/t Au - 3.1 g/t Ag	35B06 - 0011
Kakiattualuk-4	Duquet North	478005 E 6691536 N	Au +/- (Ag, Zn)	Disseminated PY	Mafic volcanic rock	None reported	5.24 g/t Au - 3.8 g/t Ag - 0.36% Zn	35B06 - 0012
Secteur 2	Duquet North	478640 E 6691456 N	Au, Ag +/- (Pb, Zn)	Disseminated PY (1-2%) in QZ vein	Intermediate volcanic rock with an m-scale shear zone	Sericite alteration in shear zone	5.14 g/t Au - 18.1 g/t Ag - 0.10% Pb - 0.13% Zn	35B06 - 0010
Secteur 3 - Nord	Duquet Centre	478490 E 6686816 N	Zn, Cu, Ag	Disseminated (?) sulphides, probably associated with QZ veins	Mafic volcanic rock	Chlorite and silica alteration with minor epidote	7.2% Zn - 0.68% Cu - 9.3 g/t Ag over 0.5 m (channel sample), up to 6.5% Cu	35B06 - 0005
Plozin	Duquet Centre	479950 E 6685916 N	Zn, Pb, Au, Ag +/- Cu	10 cm pods and mm-scale stringers of PY-GL-SP	Massive meta-rhyolite in a felsic to mafic sequence	Sericite and quartz alteration	4.26 g/t Au - 370 g/t Ag - 4.55% Pb - 0.6% Zn (east) 10.3% Zn (west)	35B06 - 0006
COM	Duquet Centre	480279 E 6685205 N	Au, Ag, Zn, Pb +/- Cu	Massive PY lenses (dm to m) and PY veins. Local SP-GL-CP-AS	Massive meta-rhyolite in a felsic to mafic sequence	Sericite and quartz alteration	34.29 g/t Au - 553 g/t Ag - 1.46% Pb - 7.4% Zn - 0.46% Cu	35B06 - 0007
Scrap Yard	Duquet South	476869 E 6681966 N	Zn, Cu +/- (Ag, Cd)	Massive to semi-massive SP veins (cm to dm) with MG and traces of PO, CP and CM	Mafic volcanic rock near the contact with an ultramafic rock	Strong AT-CL-GR-CD alteration typical of VMS settings	4.6% Zn over 2.3 m (channel sample); up to 29.9% Zn and 1% Cu (grab sample)	35B06 - 0003
Havre Sigouin	Duquet South	477069 E 6681005 N	Cu, Au, Ag	Veins of CP-QZ (cm-scale) with traces of PO and MG	Mafic volcanic rock	Strong GR-AT-CL alteration typical of VMS settings	Up to 10.38% Cu, 12.58 g/t Au and 46.3 g/t Ag	35B06 - 0002
Francoeur	Duquet South	476754 E 6680785 N	Cu, Zn, Ag +/- (Au, Cd)	Massive sulphide pods (10 cm), with (PO-SP-CP)	Mafic vocanic rock in contact with a felsic volcanic rock and iron formations	Strong AT-GR-BO alteration typical of VMS settings	6.4% Cu - 3.4% Zn - 64 g/t Ag over 1.5 m (channel sample); 1.5% Cu - 4.95% Zn - 18.8 g/t Ag (grab sample)	35B06 - 0001
810091	Duquet South	477659 E 6680004 N	Au	Disseminated pyrite	Shear zone within a tonalitic intrusion	None reported	1.09 g/t Au	35B06 - 0004
Veines	Duquet South	477487 E 6679085 N	Au +/- (Ag, Zn, Cu)	Disseminated PY along the edges of quartz veins. Local visible gold.	MV-CL schist in a contact zone between a tonalite and mafic volcanic rocks	MV-CL-TC alteration	7.24 g/t Au over 2.1 m (channel sample); 74.75 g/t Au - 1.9 g/t Ag (grab sample)	35B03 - 0001
Cipmyluk-1	Lac Veillon	496418 E 6705357 N	Cu +/- Co	PY and CP in veins with QZ-MG, disseminated PY and CP	Migmatitic granodiorite intruded by pegmatite	Hematitization and silicification + distal epidotization	2.20% Cu - 125 ppm Co	35B06 - 0013
Cipmyluk-2	Lac Veillon	495186 E 6706331 N	Cu +/- Co	MG veins with PY and CP	Migmatitic granodiorite intruded by pegmatite	Hematitization and silicification	3.40% Cu - 731 ppm Co	35B06 - 0014

Mineralogy codes : AS, arsenopyrite; AT, anthophyllite; CL, chlorite; CM, chromite; CP, chalcopyrite; Gl, galena; GR, garnet; Mg, magnetite; MV, muscovite; PO, pyrrhotite; PY, pyrite, QZ; quartz; SP, sphalerite; TC, talc.

APPENDIX 2 - PHOTOGRAPHS

PHOTO 1 - Aerial view of a radial fracture pattern in ultramafic lamprophyres of the Kuuvvaluk Diatreme. The field of view is roughly 150 metres wide.

PHOTO 2 - Epidotized fragment in negative relief in ultramafic lamprophyre of the Kuuvvaluk Diatreme.

PHOTO 3 - Magnetite injections in a hematitized granodiorite, area south of Lac Veillon. Vertical surface about 2 metres high.

PHOTO 4 - Breccia with magnetite matrix, Cipmyluk-2 showing, area south of Lac Veillon.

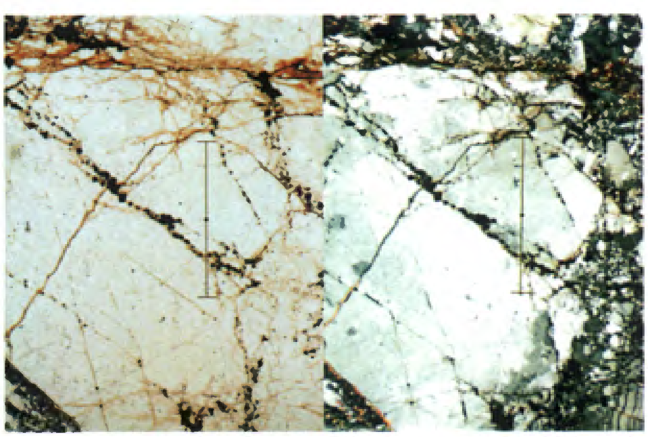


PHOTO 5 - Photomicrograph of brecciation and hematitization in granodiorite, as well as magnetite infiltration, area south of Lac Veillon. Natural light (left), polarized light (right). Scale = 1.25 mm.

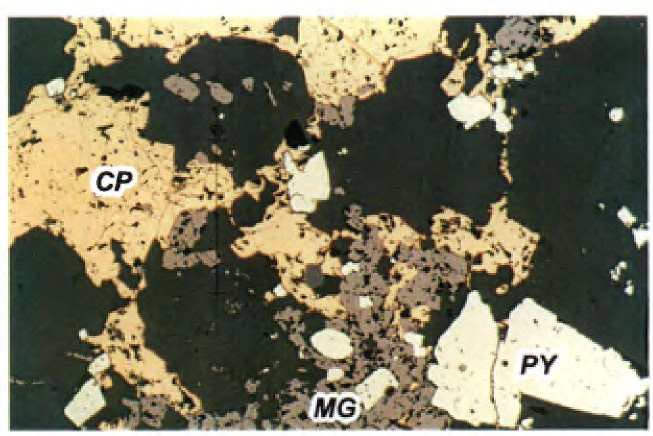


PHOTO 6 - Photomicrograph, in reflected light, of mineralization at Cipmyluk-2 showing, area south of Lac Veillon. Scale = 0.8 mm.

Abstract

This geological survey covers the area represented by the Lac Couture map sheet (NTS 35B) as well as the southern part of the Lacs Nuvilik map sheet (NTS 35G, Lac Allemand area). This area is mainly underlain by Archean rocks. Proterozoic gabbro dyke swarms (Klotz Dykes, Payne River Dykes, Pointe Raudot Dykes and Franklin Swarm) cross-cut the rocks in the area. The northern part of the craton is overlain by thrust sheets composed of Paleoproterozoic supracrustal sequences of the Ungava Trough. In the northwestern part of the map area bordering the Ungava Trough, two small Proterozoic lamprophyric diatremes (Kuuvvaluk Diatremes) pierce the Archean craton.

Based on lithological assemblages and structural style, the area was subdivided into three informal domains: the western domain, the central domain and the eastern domain. The western domain is mainly composed of foliated or gneissic tonalite of the Rochefort Suite. These tonalites enclose volcano-sedimentary rocks, namely the Allemand and Duquet belts. In the central domain, migmatitic tonalites of the Lesdiguières Suite are predominant, and enclose the Peltier and Caumartin belts. In the eastern and central domains, regional metamorphic conditions reached the amphibolite facies. The eastern domain mainly consists of foliated pyroxene-bearing granodiorites and granites of the Châtelain Suite. These intrusive rocks enclose the Headwind Belt. In this domain, regional metamorphic conditions are typical of the granulite facies. Weakly deformed, locally porphyritic late Archean granites of the La Chevrotière Suite intrude tonalitic rocks in all three domains.

At least four episodes of deformation have affected the rocks in the area. The first two episodes of deformation (D1 and D2) are ductile and Archean in age. Deformation D1 is represented by a foliation or gneissocity, accompanied by isoclinal and intrafolial folds. Deformation D2 is complex, and corresponds to the formation of ductile shear zones and the development of regional structures with a geometry reminiscent of domes. These Archean episodes of deformation were followed by a Paleoproterozoic event (D3) that corresponds to the Ungava Orogen. Structures associated with this Paleoproterozoic event are observed in the northern part of the area (NTS sheet 35G). They are represented by major thrust faults shallowly dipping to the NNW. They are associated with the SSE-verging tectonic transport of Paleoproterozoic sequences of the Ungava Trough over the Archean basement. A late episode of deformation (D4) postdates the Paleoproterozoic event. It consists of rectilinear brittle faults that transect the entire area.

Exploration carried out in the 1990s has led to the discovery of several showings in the Duquet volcano-sedimentary belt. The latter hosts volcanogenic massive sulphide mineralization associated with anthophyllite-cordierite-garnet-chlorite-biotite alteration zones. It also hosts gold showings associated with shear zones. Two minor showings were discovered in the northern part of the area. A Cu showing occurs in mafic volcanic rocks of the Allemand Belt, and a Ag showing was found in metabasalts of the Peltier Belt. Two other Cu-Co showings were uncovered in a brittle fault oriented NW-SE, which runs across the central part of the area. Finally, the Allemand-Tasiat structural zone hosts a series of small alkaline intrusions, including the Kuuvvaluk Diatremes, composed of ultramafic lamprophyre. This zone warrants more detailed investigations to fully assess its diamond potential.

Ressources naturelles, Faune et Parcs
Québec