

New Québec and Torngat Orogens, Southeastern Churchill Province (core zone), and Ungava Orogen

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Introduction

Composed mainly of Paleoproterozoic rocks, the New Québec (Labrador Trough), Torngat, and Ungava (Cape Smith Belt) orogens cover a significant proportion of northern Québec (figures 1D-1 and 1D-2). The Southeastern Churchill Province includes the New Québec and Torngat orogens and their hinterland (core zone, composed largely of Archean rocks and sometimes referred to as the Rae Province [James *et al.*, 1996; Wardle *et al.*, 2002] [Figure 1D-1]).

The main targeted commodities in the New Québec Orogen and the core zone in 2004 were copper, nickel, platinum group elements (PGE), zinc, and cobalt. The search for diamonds generated some interest in the Torngat Orogen (Figure 1D-1). The Ungava Orogen (Ungava Trough or Cape Smith Belt) once again attracted several exploration companies in the search for nickel, copper, and PGE. All exploration projects reported in 2004 by exploration companies and individual prospectors within the study area are listed in Table 1D-1.

New Québec Orogen

GEOLOGICAL OVERVIEW

Also referred to as the Labrador Trough in Québec, or simply “the Trough”, the New Québec Orogen, with rocks dated from 2.17 to 1.79 Ga, forms a fold and thrust belt along the margin of the Superior Province (Clark and Wares, 2004). The Trough is composed of rocks comprising two volcano-sedimentary cycles and a third cycle of metasedimentary rocks (Clark and Wares, 2004).

MAGMATIC CU-NI (\pm PGE) DEPOSITS

Azimut Exploration Inc. carried out prospecting and sampling on the Retty and Lac Gillet properties (projects 1 and 2, Figure 1D-1). The two properties are associated with strong Ni-Cu-Co lake sediment geochemistry anomalies. **Golden Valley Mines Ltd** reported the results of their 2003 exploration program on the Marymac project (project 3, Figure 1D-1), including assays up to 2.01% Ni, 4.80% Cu, and up to 15.88 g/t PGE from seven historical drillholes in the Island Zone (drillhole AUL-220 yielded grades of 1.41% Ni, 3.07% Cu, and 1.89 g/t PGE over 1.5 m).

Assays up to 0.42% Ni, 3.07% Cu, and 0.95 g/t PGE were obtained from two drillholes in the Redcliff Zone (drillhole AUL-200 yielded 0.42% Ni, 2.23% Cu, and 0.95 g/t PGE over 0.9 m).

ZN-CU-AU-AG \pm PB DEPOSITS

Several Zn-Cu-Au-Ag sulphide deposits are known in the sandy-pelitic sequences of the second cycle in the Baby and Howse zones (Clark and Wares, 2004). In these areas, black shales and iron formations are commonly encountered, and namely host the Kan deposit. Showings are also reported in carbonate sequences of the Abner Formation. Overall, these showings may be related to Besshi-type deposits, a variation on the VMS theme, where the proportion of sedimentary rocks is greater than that of volcanic rocks. Following encouraging results from a soil geochemistry survey performed in 2003 on the Lac La Touche property (project 6, Figure 1D-1) NNE of Schefferville, **Metco Resources Inc.** conducted prospecting, sampling, and surface stripping on mineral occurrences essentially composed of pyrrhotite, in thin beds or conformable laminations of massive sulphides in exhalite, black shale, mudstone, mudslate, and dolomitic sandstone.

Torngat Orogen and Core Zone

GEOLOGICAL OVERVIEW

The Paleoproterozoic Torngat Orogen is bounded to the east by Archean rocks of the Nain Province and to the west by Archean and Paleoproterozoic rocks of the core zone (Figure 1D-1). This orogen is divided into lithotectonic domains and complexes separated by ductile shear zones (*e.g.*, the Abloviak deformation zone, Figure 1D-1).

Located in the Southeastern Churchill Province, the Trough hinterland and the Torngat foreland were called the “core zone” by James *et al.* (1996). The core zone is composed largely of Archean gneisses with bands of Paleoproterozoic supracrustal rocks. These rocks were subsequently deformed and metamorphosed during the Paleoproterozoic. The core zone is divided into a series of lithotectonic domains separated by wide deformation zones (Figure 1D-1; Wardle *et al.*, 2002).

DIAMONDS

In September 2004, **Diamond Discoveries International Corp.** announced a kimberlite discovery in the first drillhole completed on the St. Pierre dyke on the Torngat project (project 11, Figure 1D-1). The drillhole intersected kimberlite material over a 6.85-m interval, which corresponds to a true dyke thickness of 5.42 m. Indicator minerals such as garnet (pyrope), picroilmenite, and olivine (forsterite) were observed in core samples. In October, the company released the results of caustic fusion analyses from 19 samples (5.1 to 72.95 kg) of various kimberlites and lamprophyre dykes. A sample from the K-25 dyke (#90943, 21.50 kg) yielded a clear microdiamond, weighing 0.026 mg and with dimensions of 0.38 x 0.30 x 0.1 mm. The K-25 dyke, 3 to 5 m

wide on average, was traced on surface over more than 5 km. According to the company, it is the fourth dyke known to contain macro or microdiamonds. The other three diamond-bearing dykes are the A dyke, the B dyke, and the F dyke. The A dyke also contains pink corundum (ruby).

Ungava Orogen

GEOLOGICAL OVERVIEW

The Paleoproterozoic Ungava Orogen (Ungava Trough or Cape Smith Belt) consists of a volcano-sedimentary belt that stretches over some 370 km along an ENE-WSW axis (St-Onge and Lucas, 1990; Figure 1D-2). The area may be divided into four main tectonic units: a) the autochthonous Archean basement of the Superior Province, b) the allochthonous accretionary belt or Ungava Trough *s.s.*, c) the Paleoproterozoic Narsajuaq Terrane, and d) the parautochthonous Archean basement (Lamothe, 1994). The Ungava Orogen comprises seven tectonostratigraphic units that form the Southern and Northern lithotectonic domains, separated by the Bergeron fault. The Southern Domain is composed of three groups: a) the Lamarche Group (sedimentary assemblage intruded by gabbro sills), b) the Povungnituk Group (tholeiitic basalts intercalated with detrital sediments), and c) the Chukotat Group (komatiitic to tholeiitic basalts) thrust onto the Povungnituk. The Northern Domain consists of the Chassé Formation (detrital unit) and of four groups: a) the Watts Group (sedimentary and metavolcanic rocks), b) the Parent Group (tholeiitic basalts and tuffs), c) the Spartan Group (psammites, pelites, semipelites, sandstones, felsic tuffs, and mudstones), and d) the Perrault Group (wackes, conglomerates, sandstones, and mudstones).

MAGMATIC NI-CU-CO-PGE DEPOSITS

Since 1998, the **Société minière Raglan du Québec**, a wholly-owned subsidiary of **Falconbridge Ltd.**, operates an underground and open pit mine, extracting ore from several Ni-Cu-PGE deposits in the Raglan mining camp (project 12, Figure 1D-2). The ore deposit consists of a series of 19 massive sulphide lenses (including the Katinniq deposit). **Falconbridge Ltd.** remains very active in the area, exploring to discover and delineate new lenses (project 13, Figure 1D-2; Table 1D-1).

On the Delta-Kenty property (project 14, Figure 1D-2), located 50 km west of the Raglan mine, **Melkior Resources Inc.**, in partnership with **Falconbridge Ltd.**, detected four electromagnetic anomalies, two of which coincide with weakly mineralized ultramafic rocks separated by a weakly mineralized gabbro unit. The Delta-Kenty property is known for its historical geological reserves estimated at 817,000 tonnes at a grade of 3.05% Ni, 1.26% Cu, and 2.65 g/t PGE, in addition to another 205,800 tonnes of resources at 2.63% Ni, 1.15% Cu and 2.46 g/t PGE.

A few kilometres away on the Raglan Project property (project 15, Figure 1D-2), **Novawest Resources Inc.** and **Cascadia International Resources Inc.** reported interesting assays up to 2.89% Ni, 3.99% Cu, and 12.49 g/t PGE over a 15-m interval of massive to disseminated sulphides in drillhole NW04-15.

Since 2001, **Canadian Royalties Inc.** and **Ungava Minerals Corp.** have completed several drill programs on their properties (Expo-Ungava and Phoenix) located about 15 km south of the Raglan mine. In 2004, **Canadian Royalties Inc.** released a revised estimate for the Mesamax deposit (project 16, Figure 1D-2), where indicated resources were increased to 1.84 Mt at a grade of 1.9% Ni, 2.3% Cu, 0.08% Co, 0.3 g/t Au, 0.9 g/t Pt, and 4.3 g/t Pd. At the Mequillon deposit, located about 15 km west of the Expo deposit (project 17, Figure 1D-2), **Canadian Royalties Inc.** also released an inferred resource estimate of 1.4 Mt at a grade of 0.7% Ni, 0.9% Cu, 0.03% Co, 0.2 g/t Au, 0.6 g/t Pt, and 2.1 g/t Pd. On the Expo NE project (project 18, Figure 1D-2), **Canadian Royalties Inc.** confirmed the presence of 24.55 m of massive to disseminated sulphides (drillhole EX-04-71) at an average grade of 1.2% Ni, 1% Cu, 0.06% Co, 0.38 g/t Pt, and 1.23 g/t Pd, including a 5-m interval of massive sulphides grading 3.5% Ni, 3.3% Cu, 0.15% Co, 0.75 g/t Pt, and 2.7 g/t Pd. Another drillhole (EX-04-73) intersected 11 m grading 2.60% Ni, 2.88% Cu, 0.10% Co, 1.81 g/t Pt, and 6.64 g/t Pd. **Golden Valley Mines Ltd.**, in partnership with **Little Mountain Resources Ltd.**, reported drilling results from the India and Alpha zones (projects 19 and 20, Figure 1D-2) on the West Shoot Out project. Grades of 1.1% Ni, 0.74% Cu, and 3.33 g/t PGE over 12.25 m were reported from a deep drillhole on the Alpha zone. In 2003, the best results from several prospecting samples on the India zone were as follows: 1.72% Ni, 1.12% Cu, and 2.66 g/t Pt+Pd+Au.

In 2004, joint venture partners **Anglo American Exploration (Canada) Ltd** and **Knight Resources Ltd** announced the discovery of two new Ni-Cu-PGE zones: the Red Zone and Zone 111 (projects 21 and 22, Figure 1D-2). Assays from the Red Zone went up to 5.75% Ni, 1.35% Cu, 0.21% Co, 0.46 g/t Pt, and 2.97 g/t Pd over 0.55 m (drillhole WR-04-33). Two grab samples from Zone 111 yielded grades of 0.58 to 0.84% Ni, 0.38 to 1.36% Cu, 0.04 to 0.06% Co, and 0.39 to 1.11 g/t PGE. An interesting intercept of 24.5 m grading 1.71% Ni, 0.80% Cu, and 1.33 g/t Pt+Pd was encountered in drillhole WR-04-74 on the Frontier South showing.

Goldbrook Ventures Inc. focussed its efforts on the Bélanger property, and obtained its best results on the Getty zone (project 23, Figure 1D-2). In drillhole BLE 04-21, a 39.35-m interval yielded an average grade of 1.35% Ni, 0.61% Cu, and 2.88 g/t PGE, including 15.90 m of massive sulphides grading 3.27% Ni, 0.99% Cu, and 5.90 g/t PGE. Grab samples from the Sylvie zone, discovered by prospecting, yielded assays up to 0.28% Ni, 0.41% Cu, and 1.45 g/t Pt+Pd (project 24, Figure 1D-2).

Opportunities for Exploration

Clark and Wares (2004) compiled over 336 mineral occurrences in the New Québec Orogen. We refer the reader to this comprehensive synthesis, which describes the main types of ore deposits in the New Québec Orogen. Among these, we will mention those related to the second cycle, associated with mafic volcanism and mafic to ultramafic sills, which host magmatic Cu-Ni-PGE mineralization. According to these authors, picritic flows and sills hold promising economic potential for this type of mineralization. The Lac Retty and Lac Gerido areas are known for their massive and disseminated sulphide deposits hosted in mafic to ultramafic sills (Clark, 1994). Although known Cu-Ni occurrences in these areas are low-grade, other lenses may be discovered through additional exploration. These areas therefore represent excellent targets to discover new magmatic Cu-Ni-PGE deposits. The Lac Bleu area may also host this type of magmatic copper-nickel mineralization. Here, at the base of the

Willbob Formation, a differentiated sill composed of peridotite and gabbro hosts massive sulphide lenses (Clark and Wares, 2004).

In the Cape Smith Belt, results reported in 2004 by **Canadian Royalties Inc.** and **Goldbrook Ventures Inc.** confirm the excellent potential to discover new Ni-Cu-PGE showings. As is the case at the Raglan mine, this potential is associated with ultramafic sills cogenetic with the Chukotat Group (Raglan trend) and injected in the Povungnituk Group. Until now, exploration has mainly focussed on the Southern Domain of the belt. Various parts of the Northern Domain warrant further exploration and remain very interesting for their Ni, Cu, Co, and PGE potential associated with volcanoclastic rocks of the Parent Group. Mineralization encountered in this formation occurs as stratiform massive sulphide lenses (pyrrhotite-pyrite-chalcopyrite), or is hosted in gabbro sills emplaced in the volcanoclastic rocks (Moorhead, 1996).

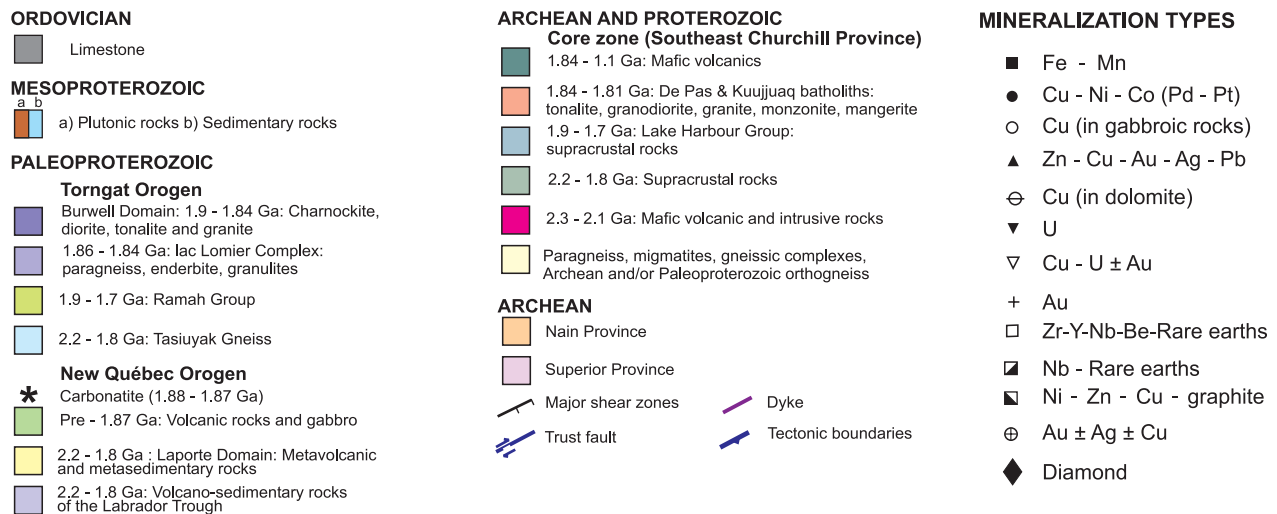


Figure 1D-1. Legend of the mineral exploration projects in the New Québec and Torngat orogens, the core zone and the Ungava Orogen for 2004.

1D

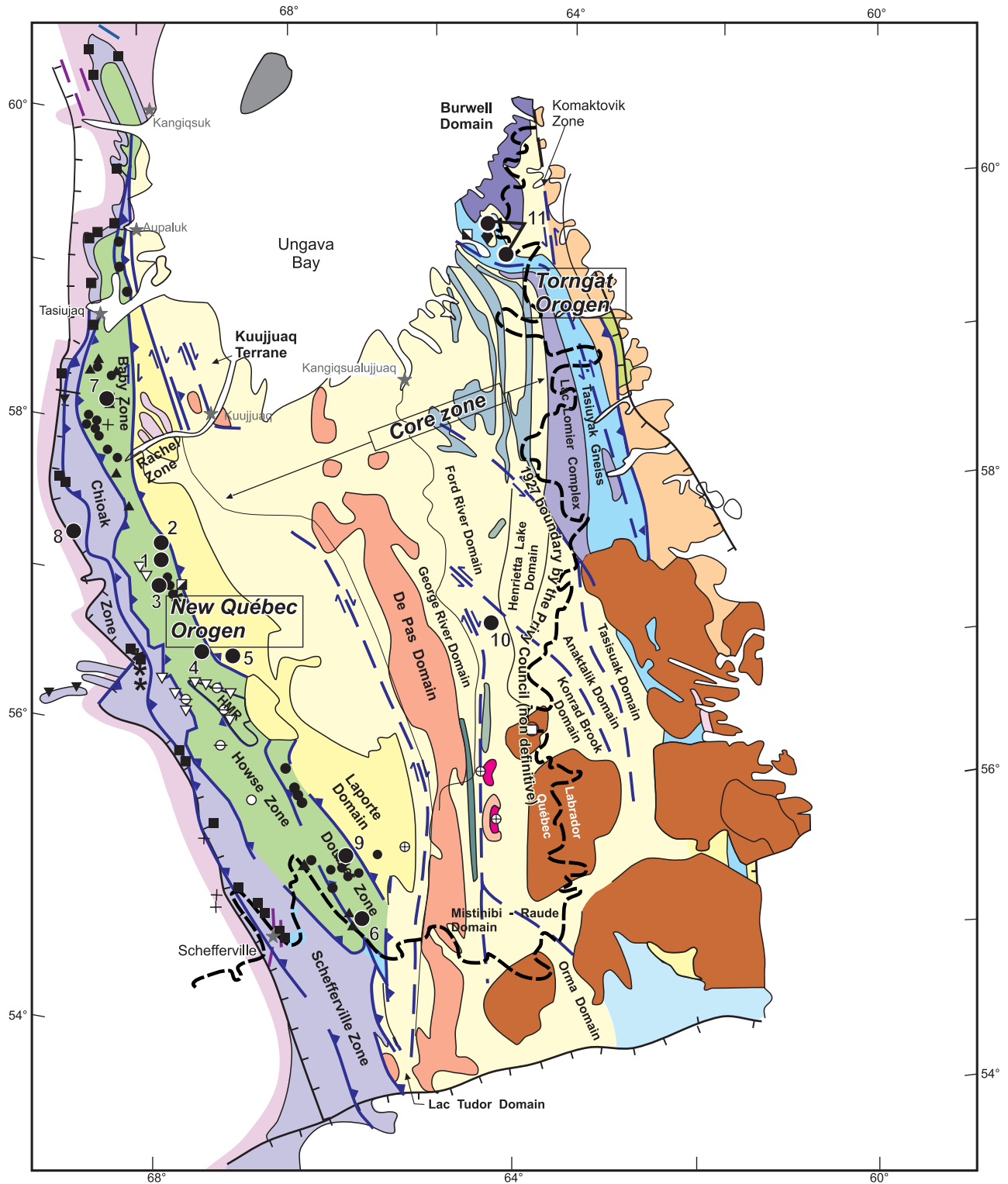


Figure 1D-1. Mineral exploration projects in New Québec and the Torngat orogen, the core zone and the Ungava Orogen for 2004. Modified from Wardle *et al.*, 1990 and 2000.

1D

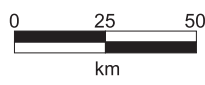
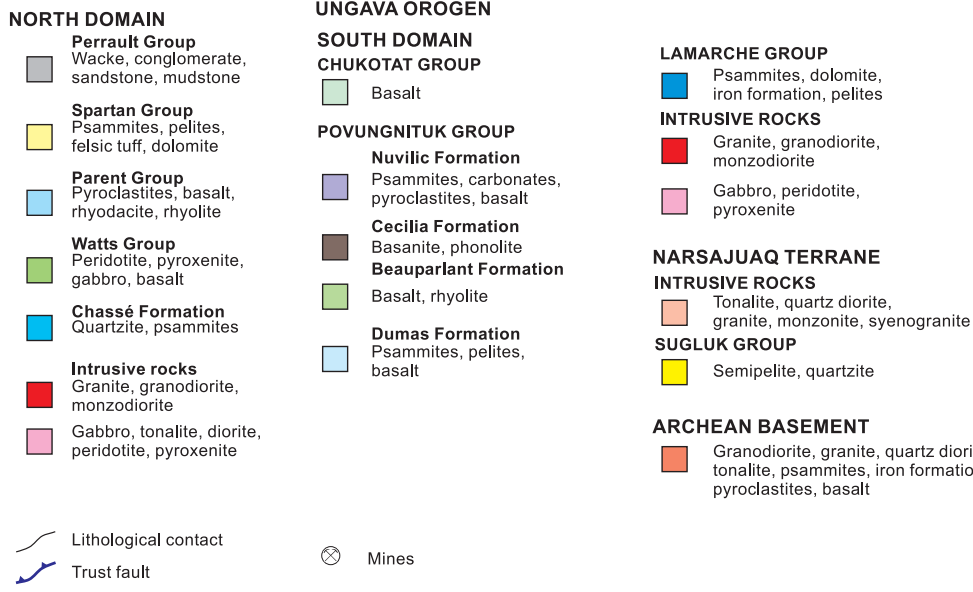
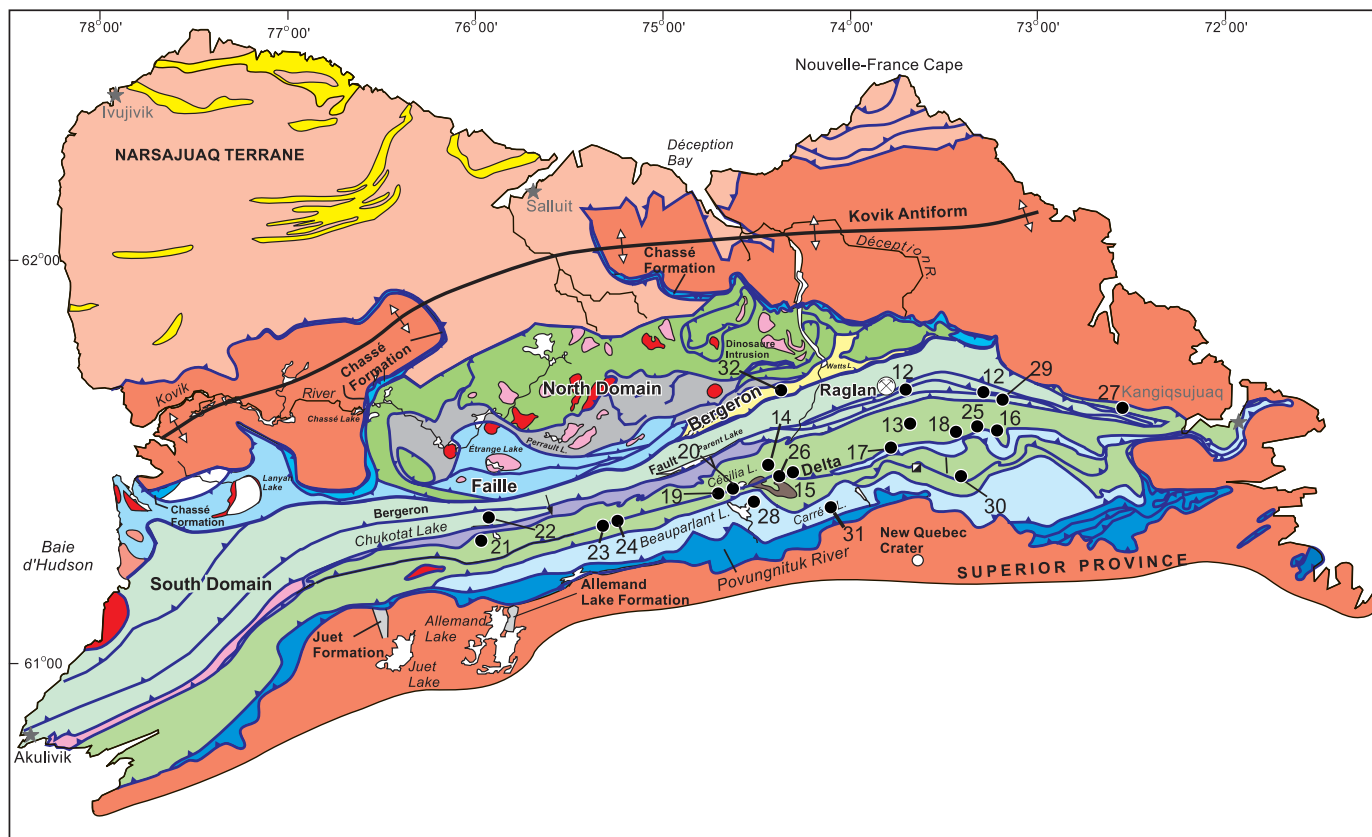


Figure 1D-2. Exploration projects in the Ungava Orogen for 2004. Modified from Lamothe (1996).

TABLEAU 1D-1 - Mineral exploration projects in New Québec and Tornatg Orogens, core zone and Ungava Orogen for 2004.

NO	FIG.	NTS	COMPANIES / PROSPECTORS	PROJECTS	SUBSTANCES	WORK ⁽¹⁾
New Quebec Orogen						
1	1D-1	24 F/02, 07	Azimut Exploration Inc.	Retty	Cu-Ni-PGE	Pr, S
2	1D-1	24 F/02, 07	Azimut Exploration Inc.	Lac Gillet	Cu-Ni-PGE	Pr, S
3	1D-2	24 F/02, 24 C/15,16	Golden Valley Mines Ltd	Marymac (Island, Redcliff projects)	Ni-Cu-PGE	AEROTEM, Pr, S
4	1D-1	24 C/09	Inco Ltd	Cordier	Ni	Pr
5	1D-1	24 B/05, 12	Inco Ltd	Graham	Ni	Pr
6	1D-1	23 I/13	Metco Resources Inc.	Lac La Touche	Zn-Cu-Au-Ag	G, Gp, Gs(sl), S, T,
7	1D-1	24 K/04	Azimut Exploration Inc.	De Romer	Cu-Ni-PGE	Pr, S
8	1D-1	24 F/04, 05	Uranor Inc.	Labrador-Tornatg	U	Pr
9	1D-2	23 O/01, 08	E. D. Black \ Pacific North West Capital Corp.	Retty Lake	Cu-Ni-Pt	Pr, S
Core zone and Tornatg Orogen						
10	1D-1	24 A/15	Inco Ltd	Terriault	Ni	Pr
11	1D-1	24 P/07, 11	Diamond Discoveries International Corp / Tandem Resources Ltd	Monts Tornatg	Diamond	B, D(1:43), S
Ungava Orogen						
12	1D-2	35 H/11, 12	Société Minière Raglan du Québec / Falconbridge Ltd	Raglan	Cu-Ni-Co-PGE	D(238:6400), G, Mag-EM(A), Pr, S
13	1D-2	35 F, G, H	Falconbridge Ltd	Ungava Regional	Ni-Cu-PGE	D(16:2600), G, Gp, Gs(sl),Mag, Mag-EM(A), Pr
14	1D-2	35 G/07, 08	Falconbridges Ltd / Melkior Resources Inc.	Delta-Kenty	Cu-Ni-Co-PGE	D(2:450), DPEM, EM, S
15	1D-2	35 G/08	Novawest Resources Inc. / Cascadia International Resources Inc.	Raglan (Bravo)	Ni-Cu-Co-PGE	D(9:1305), DPEM, G, Gp, Pr,
16	1D-2	35 H/11	Canadian Royalties Inc.	Mesamax	Ni-Cu-PGE	D(?:?), Re
17	1D-2	35 H/11, 12	Canadian Royalties Inc. / Ungava Minerals Corporation	Mequillon	Ni-Cu-PGE	D(75:?), G, Mag, Pr, Re, S, TDEM
18	1D-2	35 H/11	Canadian Royalties Inc.	Expo NE	Ni-Cu-PGE	E, D(?:?), G, Pr
19	1D-2	35 G/07, 08	Golden Valley Mines Ltd / Little Mountain Resources Ltd	West Shoot out (India)	Ni-Cu-Au-PGE	D(30:4299), Mag, Pr, S, TDEM
20	1D-2	35 G/07, 08	Golden Valley Mines Ltd / Little Mountain Resources Ltd	West Shoot out (Alpha)	Ni-Cu-Au-PGE	D(30:4299), Mag, Pr, S, TDEM

TABLEAU 1D-1 - Mineral exploration projects in New Québec, Torngat Orogens, core zone and Ungava Orogen for 2004.

NO	FIG.	NTS	COMPANIES / PROSPECTORS	PROJECTS	SUBSTANCES	WORK ⁽¹⁾
Ungava Orogen						
21	1D-2	35 G/05, 05, 35 F/08	Anglo American Exploration (Canada) Ltd / Knight Resources Ltd	West Raglan (Red Zone)	Ni-Cu-PGE	AEROTEM, D(60:7241), DPEM, EM, G, Gs, Mag, Pr, S
22	1D-2	35 G/05, 05, 35 F/08	Anglo American Exploration (Canada) Ltd / Knight Resources Ltd	West Raglan (Zone 111)	Ni-Cu-PGE	AEROTEM, D(60:7241), DPEM, EM, G, Gs, Mag, Pr, S
23	1D-2	35 G/06	Goldbrook Ventures Inc.	Bélanger (Cetty zone)	Ni-Cu-PGE	D(15:?), EM, Pr, S
24	1D-2	35 G/06	Goldbrook Ventures Inc.	Bélanger (Sylvie zone)	Ni-Cu-PGE	D(4:?), EM, Pr, S
25	1D-2	35 H/11, 12	Canadian Royalties Inc. / Ungava Minerals Corporation	Tk Area	Ni-Cu-PGE	D, Pr, S
26	1D-2	35 G/08	Novawest Resources Ltd / Cascadia International Resources Inc.	Raglan (Echo)	Cu-Ni-Co-PGE	D(6:1247), Pr
27	1D-2	35 H/10	Goldbrook Ventures Inc. / Inlet Resources Ltd	Wakeham	Ni-Cu-PGE	D(?:?), G, Pr, S
28	1D-2	35 G/07, 08	Golden Valley Mines Ltd / Resolve Ventures Inc.	Shoot out East	Ni-Cu-Au-PGE	Pr, S
29	1D-2	35 H/11	Boulder Mining Corporation / Canadian Royalties Inc.	Colts	Cu-Ni-PGE	AEROTEM, D(?:?) EM, Pr, S
30	1D-2	35 H/06	Boulder Mining Corporation / Canadian Royalties Inc.	Breakaway	Cu-Ni-PGE	AEROTEM, D(?:?) Mag-EM, Pr, S
31	1D-2	35 G/08	Montoro Resources Inc. / Canadian Royalties Inc.	South Trend Prospect	Cu-Ni-PGE	G, Gp, Pr, S
32	1D-2	35 G/09	Novawest Resources Ltd / Cascadia International Resources Inc. / Minera Capital Corp.	True North	Cu-Ni-PGE	G, Pr, S

1 = See abbreviation list in appendix II.

