

PRO 93-05

NEW BASE METAL EXPLORATION TARGETS IN THE EAST WARD EXTENSION OF THE SOUTHERN ABITIBI VOLCANIC BELTS INTO THE GRENVILLE PROVINCE, EAST OF SENNETERRE, QUEBEC

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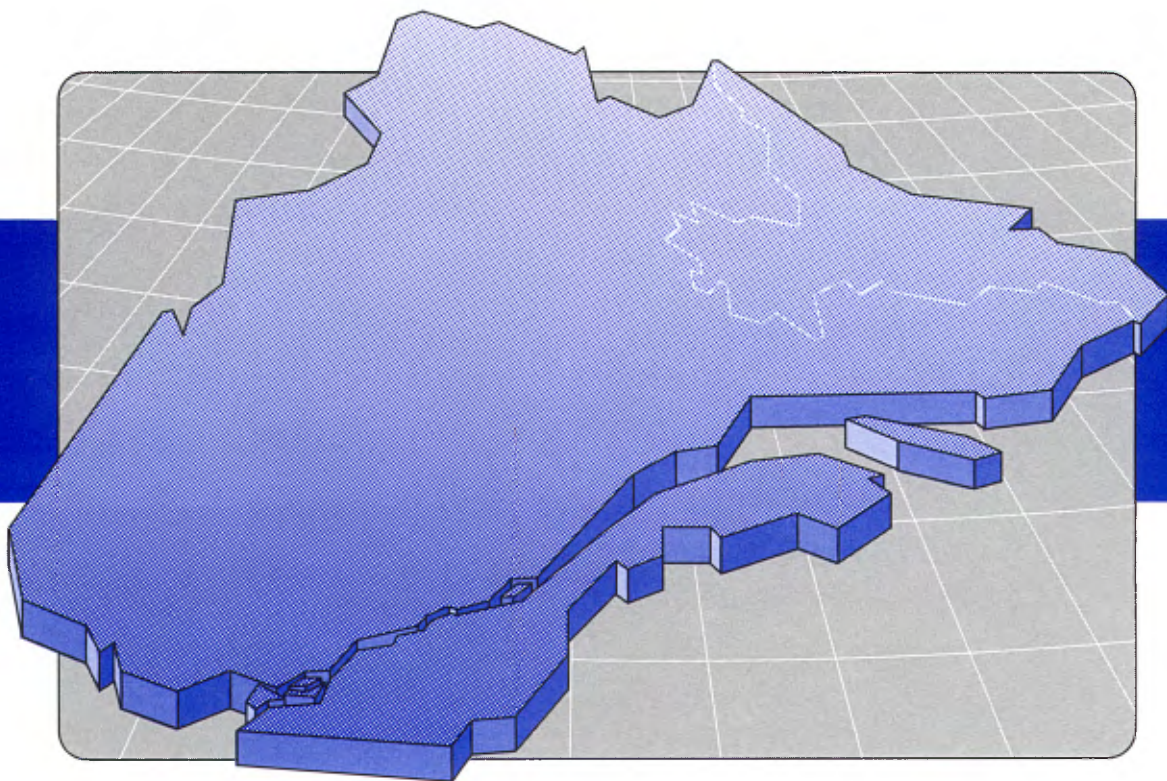
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New base metal exploration targets in the eastward extension of the southern Abitibi volcanic belts into the Grenville Province, east of Senneterre, Quebec

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INTRODUCTION

Volcanic belts in the southern Abitibi Subprovince, well known for base metal mineralization, are truncated by the Grenville Front tectonic zone east of Senneterre. However, the presence of preserved metamorphosed slivers of mafic volcanic rocks in the adjacent Grenville Province (Birkett *et al.*, 1991) suggests that the area could also host base metal deposits.

High-grade metamorphic environments are not well known as hosts for metallic deposits due to their relative lack of fluids and steep thermal gradients. However, a metallic deposit created under supracrustal conditions prior to tectonic burial is unlikely to have been destroyed by metamorphism. The Montauban and Balmat-Edwards mines in the southern Grenville Province are well known examples of preserved deposits. By analogy, the volcanic belts of the Superior Province, buried during the Grenville orogeny, could still retain their primary synvolcanic mineralization.

Mafic gneiss horizons located in the Grenville parautochthonous zone east of Senneterre Quebec, have been identified as a regional metallotect (Birkett *et al.*, 1991; Moorhead *et al.*, 1991). These mafic gneisses form a band that links up with the truncation of the Carpentier-Tavernier volcanic belt of the Superior Province along the Grenville Front (figure 1). The area with the highest proportion of mafic gneisses, the Serpent Complex, seemed to be the most promising region for the discovery of new Cu-Zn mineralization (Moorhead *et al.*, 1991).

In this document, we report on a 1:100 000 scale mapping project, completed in the summer of 1992 (Girard and Moorhead, in preparation), of the area surrounding the Serpent Complex in which several new mineralized zones were discovered.

REGIONAL GEOLOGY

Volcanic belts of the Abitibi Subprovince terminate abruptly at the Grenville Front, 70 kilometres east of Val-d'Or and Senneterre in northwestern Quebec. Rocks immediately to the east of the Grenville Front, generally referred to as the parautochthonous zone, near the towns of Fermont, Chibougamau and Sudbury, are thought to represent metamorphosed and deformed equivalents of the adjacent Superior Province (Rivers *et al.*, 1989). The same type of relationship is thought to be valid for the Grenville adjacent to the southern part of the Abitibi Subprovince.

The Grenville parautochthonous zone east of Val-d'Or and Senneterre has been divided into three main lithotectonic units (Birkett *et al.*, 1992; Girard *et al.*, 1993) (figure 1): the Pascagama and Serpent complexes in the north (N of latitude 48°15') and the lac Témiscamingue Terrain to the south. This terrain extends at least 150 km to the SE (Rive, 1974).

In our study area, the lac Témiscamingue Terrain is composed mainly of garnet-biotite paragneiss (60%) inter-layered with mafic gneiss (15%) and quartzofeldspathic gneiss of tonalitic composition (20%). Minor amounts of ultramafics and granitic intrusions are also present. The Pascagama Complex is composed of quartzofeldspathic gneiss and tonalite (80%) that contain slivers of mafic gneiss (20%). The Serpent Complex is located in between the Grenville Front to the west, the Pascagama Complex to the north and the lac Témiscamingue Terrain to the south. It contains equal amounts of mafic gneiss, paragneiss and quartzofeldspathic gneiss.

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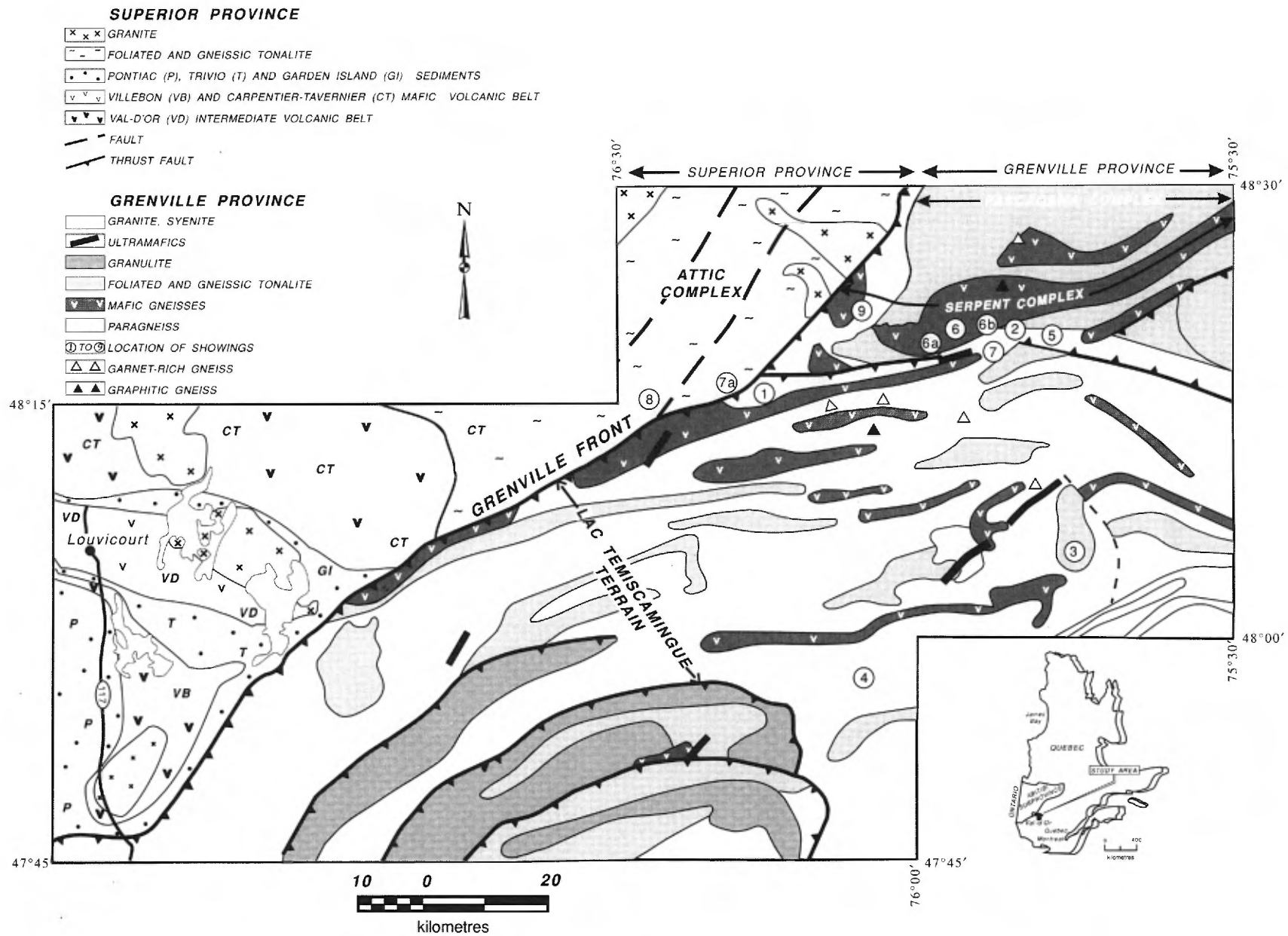


FIGURE 1 – Simplified regional geology.

The nature and geographical distribution of the three main lithotectonic units represents a mirror image of the main lithotectonic subdivisions of the adjacent Superior Province. This portion of the Superior Province comprises the sedimentary Pontiac Subprovince to the south, the Villebon, Val-d'Or and Carpentier-Tavernier volcanic belts in the center and the tonalitic Attic Complex to the north.

The mafic gneisses are concentrated in a band, roughly parallel to the Grenville Front, that originates at the truncation of the Carpentier-Tavernier volcanic belt and splays out to the NE into the Serpent Complex. These mafic gneisses are considered metamorphic equivalents of the mafic volcanics of the Superior Province on the basis of:

- 1) the gneisses are continuous with the Archean volcanic rocks at map scale.
- 2) numerous relic pillow textures are preserved in the gneisses.
- 3) they have similar geochemical signatures (Lafliche and Birkett, in preparation).

In addition, the ultramafic rocks of the study area also have geochemical characteristics similar to the komatiites of the Villebon and Val-d'Or volcanic belts (Lafliche and Birkett, in preparation).

Given the heterogeneous nature of the quartzofeldspathic gneisses, they are thought to have originated from several different protoliths, which could have included metagreywacke, felsic to intermediate volcanics, hypabyssal intrusions, tectonic slivers of batholiths, and late-stage intrusions and metamorphic segregations.

RECOGNITION OF PRE-METAMORPHIC HYDROTHERMAL ALTERATION

Synvolcanic base metal deposits of Archean volcanic belts are typically underlain or surrounded by highly altered rocks. These altered rocks are likely to be preserved through tectonic burial, although their mineralogy would be very different under higher metamorphic grades. The recognition of these rocks is a critical component for an exploration program in highly metamorphosed supracrustal terrains, such as this portion of the Grenville Province.

Contact zones between quartzofeldspathic gneiss (felsic metavolcanics?) and intermediate to mafic gneiss are commonly delineated by the presence of thin siliceous gneiss with disseminated pyrrhotite, graphitic schist or abnormally garnet-rich gneiss (>50% for a mafic gneiss and >25% for a biotite-free quartzofeldspathic gneiss). These lithologies, thought to be similar to the exhalites, sediments and altered rocks that mark breaks in the volcanic sequences of the Superior volcanic belts, represent marker horizons for the accumulation of volcanogenic massive sulphides. The presence of any of these three gneisses or schists would discriminate stratigraphic from tectonic contacts between quartzofeldspathic gneisses and intermediate to mafic gneisses.

The abnormally garnet-rich gneisses are locally characterized by gradational contacts with the surrounding gneisses, heterogeneous and brecciated textures, intense silicification, and a stockwork of quartz veins. Similarly, the Montauban deposit (Bernier *et al.*, 1987) and Dussault showing (Bernier, 1992) in the southern Grenville possess some of the same features and also have a halo of rocks containing variable amounts of ortho-amphibole, spinel, cordierite, staurolite, kyanite and/or sillimanite along with small amounts of disseminated sulphide. The presence of these minerals in a rock other than a paragneiss, along with abnormally high concentrations of garnet, are considered as evidence for pre- metamorphic, possibly synvolcanic, alteration zones.

NEW SHOWINGS

During the 1992 field season the Serpent Complex and surrounding areas were mapped at a 1:100 000 scale. Several mineralized zones were discovered during this campaign, and are briefly described below and on table 1.

1) Bolger showing

A pyrrhotite, graphite- and garnet-bearing horizon, a few metres in thickness, is located between mafic and quartzofeldspathic gneiss near the locality of Bolger on the CN railway. In this vicinity, numerous smaller rusty horizons can also be found in a similar geological context. Grab samples yielded 0,86% zinc, 0,07% copper and 0,03% nickel.

TABLE 1 – Metal content of the various showings

Showing	UTM east	UTM north	Au	Ba	Cu	Ni	V	Zn
			g/t	%	%	%	%	%
Bolger	403850	5345850	–	–	0,07	0,03	–	0,86
Délaissé	440000	5354500	–	0,20	–	–	0,09	0,08
Choiseul	436950	5331400	0,10	–	0,04	0,02	0,05	–
Paradis	420200	5310000	–	0,08	0,06	–	0,04	–
Bongard	443900	5352450	–	0,09	–	–	–	0,03
Serpent	424200	5355300	–	–	0,07	–	–	–
Kekek	436450	5354400	–	0,30	0,06	–	–	–
Forsythe	394700	5343400	–	–	–	–	–	–
Normick	415600	5354300	–	–	–	–	–	–
5371	427450	5363450	–	–	0,05	–	–	–
5950	423700	5353250	–	–	0,09	–	–	–

2) Délaissé showing

Rusty outcrops, east of the bridge over the Kekek River, have mafic and quartzofeldspathic gneiss associated with ultramafic rocks and garnetiferous gneiss. A graphite and disseminated sulphide horizon yielded 0,08% zinc, 0,2% barium and 0,09% vanadium.

3) Choiseul showing

This showing, south of Choiseul Lake, is essentially composed of abnormally (30-70%) garnetiferous mafic gneiss. Grab samples indicate values of 0,1 g/t gold, along with 0,05% vanadium and 0,04% copper.

4) Paradis showing

A thin horizon of graphitic schist intercalated between mafic and quartzofeldspathic gneiss is present in the southern part of the region. Values up to 0,06% copper have been detected.

5) Bongard showing

An extensive gossan occurs at the intersection of a logging road and a creek that drains into Bongard Lake. Nearby biotite- and sulphide-rich quartzofeldspathic gneisses yielded 0,03% zinc.

6) Serpent showing

A rusty mafic gneiss horizon intercalated within quartzofeldspathic gneisses along a road in the Serpent Complex yielded 0,07% copper. Other outcrops of similar gneisses in the vicinity [no 5371 (6a) and no 5950 (6b)] yielded values of up to 0,09% copper.

7) Kekek showing

Veins of quartz, feldspar, carbonate, pyrite, pyrrhotite and white mica, together with an area of intense epidotization, are reported along a kilometre-long stretch in the bed of the Kekek River. These veins are hosted by quartzofeldspathic gneiss. Values up to 0,3% barium and 0,06% copper are present. A second occurrence of similar veins is present north of Rochambeau Lake (7a).

8) Forsythe showing

Located along the CN railway in a trenched outcrop near the locality of Forsythe, this showing consists of quartz and pyrite veins hosted by mylonites associated with the Grenville Front. Only a very small (0,01 g/t) gold value was reported.

9) Sauvageau showing

Traces of chalcopyrite and malachite staining were observed at various locations along a diatextitic paragneiss horizon in the Serpent Complex. No significant metal content was detected.

CONCLUSION

These subeconomic mineralized zones occur within a very particular geological environment, characterized by the presence of graphite, sulphides and abnormally garnet-rich rocks along the contact between quartzofeldspathic and intermediate to mafic gneiss. This leads us to believe that they could represent the distal portions of pre-metamorphic, possibly synvolcanic, alteration zones related to massive sulphide mineralization.

Therefore, the paraautochthonous zone of the Grenville Province east of Senneterre, particularly the Serpent Complex, represents a good exploration target for metamorphosed base metal deposits that merits further work.

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