Lithological and Structural Setting of the Komatiite-Associated Cubric Ni-Cu-PGE Showing, Southern Manneville Fault Zone, Southern Abitibi Subprovince, Québec

D. Shirriff[1], C.M. Lesher[1], X. Zhou[1], B. Lafrance[1]

[1]Harquail School of Earth Sciences, Laurentian University, Sudbury, Ontario

Introduction

The Abitibi greenstone belt contains abundant small-medium stratiform (Type I) komatiite-associated Ni-Cu-(PGE) deposits. The Marbridge deposit and Cubric nickel showing (CNS) occur in the 2714 ± 2 Ma La Motte-Vassan Formation of the Malartic Group ~25 km north of Malartic, QC (Pilote *et al*. 1998). The La Motte-Vassan Formation consists predominantly of komatiites, basalts, and minor felsic volcanoclastic rocks which were later intruded by gabbroic and granitic dikes. This study is part of the Malartic transect mapping component of the Metal Earth project. The goal of this study is to examine the stratigraphic, structural, and geochemical setting of the mineralization in the CNS. Core logging and petrographic, textural, mineralogical, mineral chemical, and whole-rock geochemical studies are in progress to better constrain the structural history, timing of deformation with respect to metamorphism (i.e., as high-temperature MSS or lower-temperature pyrrhotite-pentlandite-chalcopyrite), metal fractionation during deformation, and – if possible – to place constraints on some of the mechanisms of magmatic ore genesis.

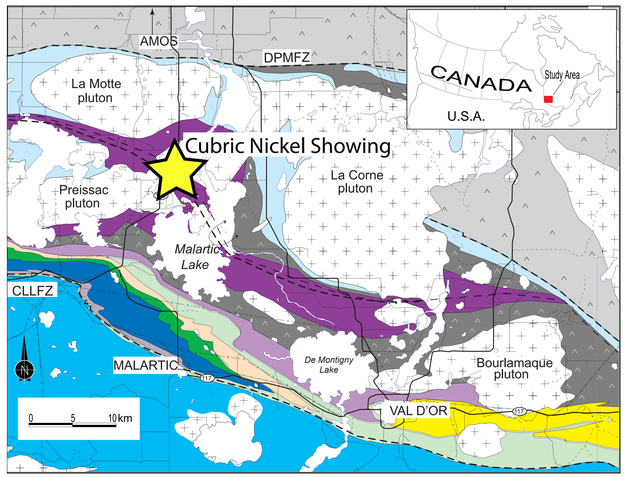

Figure 1 A simplified geological map of the Malartic transect area. The location of the Cubric outcrop is indicated. Modified from Muller *et al.*, (2008).

Regional Geology

The supracrustal rocks of the La Motte-Vassan formation consist predominantly of komatiites, basalts and minor felsic volcaniclastic rocks, which are intruded by gabbroic and granitic dikes. The komatiites show steam vents and spinifex texture, and the basalts exhibit pillow structures, both of which are indicative of submarine extrusion (Champagne, 2004; Lafrance, 2015). The La Motte anticline is the main regional structure with the CNS located in the fold hinge (Imreh, 1984). The regional metamorphic grade is greenschist to amphibolite facies (Champagne, 2004).

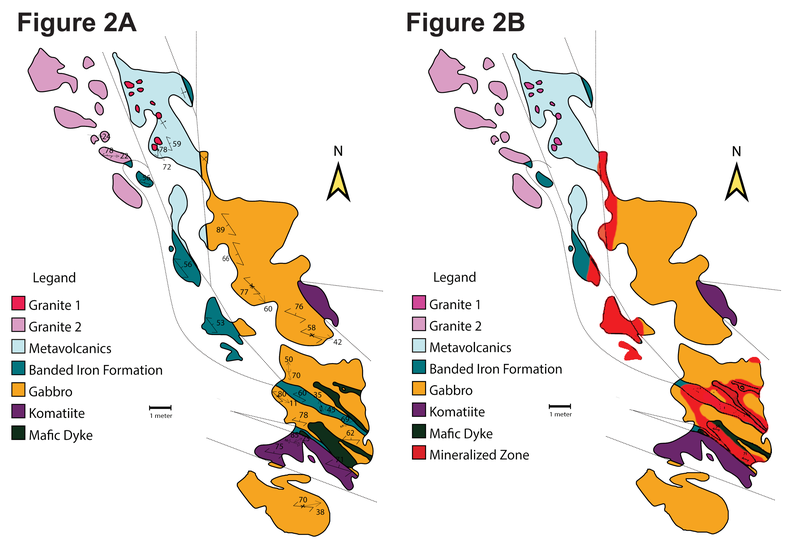

Figure 2 Two outcrop maps of the Cubric showing. **Figure 2A** shows the lithologic distributions and structural measurements. **Figure 2B** shows the distribution of sulfide mineralization at the CNS.

Mineralization

The mineralization occurs in the banded iron formation and along the banded iron formation-gabbro contact. It consists mainly of pyrite, chalcopyrite, and pentlandite. In the banded iron formation, the sulfides occur within folded bedding planes. Sulfides near or in the late mafic dikes are disseminated. The sulfides at the iron formation-gabbro contact are semi-massive. On the east side of the outcrop, there is a small (~30 cm) isolated massive sulfide lens with a sharp contact against the gabbro. Figure 2B shows the spatial distribution of the mineralization and the host rocks. The sulfides were mobilized from the komatiite into the iron formation prior to the emplacement of the gabbro. The gabbro is pegmatitic in texture, which makes it a candidate for U-Pb zircon dating, which will constrain the absolute timing for the mobilization of sulfides.

Structural History

Four episodes of deformation have been recognized at CNS and in nearby outcrops: D1 pre-dates gabbro emplacement and is observed in metavolcanic xenoliths hosted in gabbro, is manifested as foliation that likely accompanied regional thrust faulting, and mobilized ductile sulfides from the komatiites into adjacent banded iron formation (Figure 3A). D2 post-dated emplacement of the gabbro and granite dikes and intrusions, is manifested by tight-isoclinal F2 folds and with principal S2 cleavage (Figure 3B). The D2 is responsible for shearing Fe-Ni-Cu sulfides into the chilled margin of the gabbro. D3 and D4 did not mobilize sulfides and are expressed as a discrete and isolated crenulation cleavage (Figure 3C) and S-C fabrics (Figure 3D) throughout the CNS.

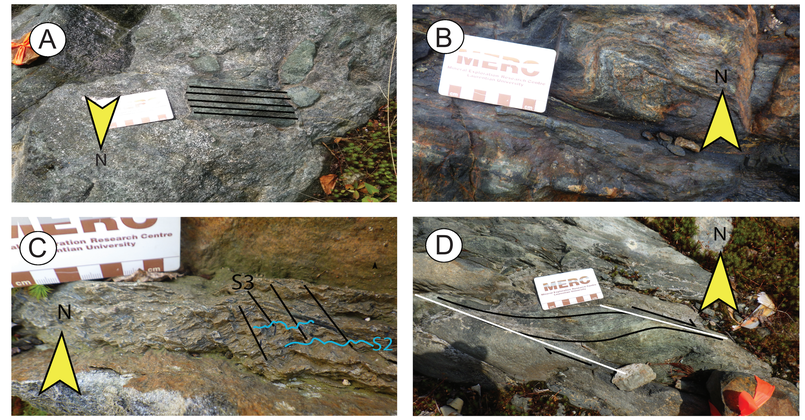

Figure 3. A photo plate of the four deformational events at the CNS and surrounding area. A) mafic volcanic xenolith within the gabbro dyke, B) an F2 fold within the banded iron formation. C) crenulation clevage along the komatiite-banded iron formation contact. D) the S-C fabric within the talc altered komatiite.

Conclusions

The Ni-rich, Cu-poor assemblage suggests a komatiitic rather than sedimentary-exhalative or gabbroic origin, and the interior of the dike is barren, suggesting a mobilized primary komatiitic origin rather than a primary gabbroic origin.

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