Preliminary results from mapping of west-central Paint Lake, Manitoba

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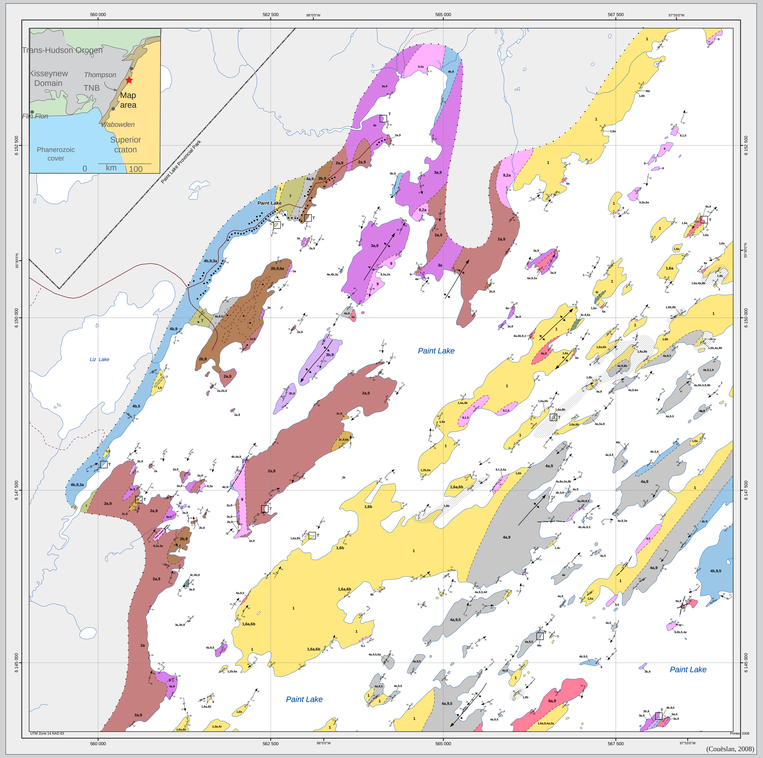


I Summary

This mapping project was initiated with the purpose of improving the understanding of the Archean basement to the Thompson Nickel Belt (TNB). Three major groups of Archean rocks are identified: (1) multicomponent migmatite, (2) retrogressed enderbitic gneisses, and (3) layered mafic rocks.

1) The multicomponent migmatite consists of varying proportions of hornblende gneiss, biotite gneiss, plagioclase amphibolite, leucogranite, granodiorite, pegmatite, and assorted ultramafic blocks and boudins. The various phases occur as intermixed, often highly attenuated, cm- to m-scale bands.

2) Three varieties of enderbitic gneiss were observed: (a) retrogressed enderbitic biotite gneiss, (b) retrogressed enderbitic hornblende gneiss, and (c) two pyroxene enderbitic gneiss.

3) The layered mafic rocks consist of two units: (a) layered metagabbro and (b) layered leucocratic metagabbro. Both units are compositionally and texturally heterogeneous, and layered on a cm- to m-scale.

A variety of rocks of uncertain age were also identified including (4) metasedimentary rocks, (5) plagioclase amphibolite, and (6) granitoid rocks.

4) Metasedimentary rocks consist dominantly of (a) metagreywacke and (b) metapsammite with subordinate (c) metamorphosed iron formation and rare (d) marble. The presence of orthopyroxene-bearing leucosome in the metagreywacke suggests the metasediments are Archean.

5) The plagioclase amphibolite occurs as large masses, discontinuous bands, or boudins throughout the map area. The plagioclase amphibolite is likely derived from mafic rocks of various ages, perhaps including Paleoproterozoic Molson dykes.

6) Two varieties of granitoid rocks of uncertain age are present at Paint Lake: (a) granodiorite and (b) leucogranite. These rocks are tentatively interpreted as Proterozoic; however, they have not been observed intruding known Proterozoic rocks.

Three main groups of Proterozoic rocks were observed: (7) Ospwagan Group metasedimentary rocks, (8) an alkaline igneous suite, and (9) pink pegmatite.

7) Several outcrops of lower Ospwagan Group metasediments were observed along the western margin of the map area that had been previously identified by Macek et al. (2006).

8) Two rocks of possible alkaline affinity were recognized: (a) white pegmatite dykes lacking quartz and (b) carbonatite-like dykes. These rock units are typically associated with alkaline metasomatism of the country rock.

9) Simple quartz-feldspar pink pegmatite occurs in almost every outcrop on Paint Lake. It forms cm- to m-scale dykes and larger elongate bodies greater than 1 km long.

Dominant structures in the area consist of upright, shallow to moderately plunging folds that have deformed the regional foliation. From east to west, Archean granulite-grade assemblages were progressively overprinted by Hudsonian retrogression/hydration.

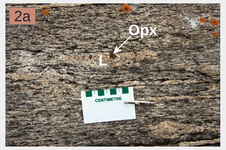
The recognition of an Archean metasedimentary sequence that exhibits some similarities to the Ospwagan Group has major implications for exploration in the belt. Specifically, it could allow for the mistaken identification of Ospwagan Group metasedimentary rocks in areas of low nickel potential. The possible suite of alkaline igneous rocks, which may include carbonatite, suggests potential for additional magmatic or hydrothermal deposit types in the area.

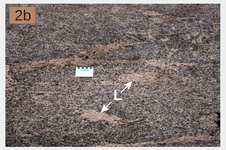
II Archean Rocks

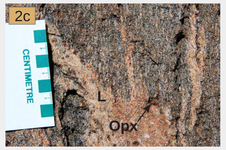
1) Multicomponent Migmatite

Unit 1: Multicomponent migmatite consisting of intermixed bands of hornblende gneiss, plagioclase amphibolite, leucocratic granite, and pegmatite with boudins of clinopyroxenite (top). Highly strained multicomponent migmatite with boudins of plagioclase amphibolite and pyroxenite and dykes of pink pegmatite (middle). Multicomponent migmatite that has been strongly overprinted by Hudsonian hydration, metamorphism, and deformation (bottom).

2) Retrogressed Enderbitic Gneisses

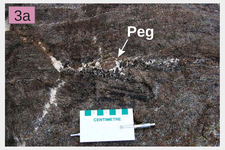


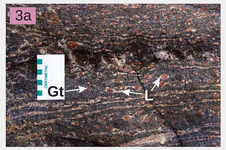


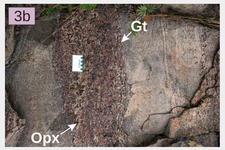


Unit 2: Retrogressed enderbitic biotite gneiss with Archean leucosome containing relict orthopyroxene (top). Retrogressed enderbitic hornblende gneiss with Archean leucosome. The leucosome contains poikiloblastic hornblende which may be pseudomorphs of orthopyroxene (middle). Two pyroxene enderbitic gneiss with orthopyroxene-bearing leucosome. The groundmass consists of biotite, brown orthopyroxene, green clinopyroxene, plagioclase, and quartz (bottom). L = leucosome, Opx = orthopyroxene.

3) Layered Mafic Rocks



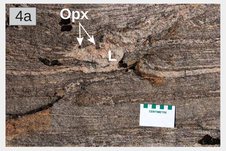




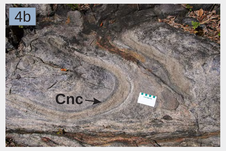
Unit 3: Pyroxenite horizon within the layered metagabbro. The pyroxenite contains a pegmatitic segregation (top). Layered metagabbro with abundant poikiloblastic garnet. The garnet is enclosed by quartz-plagioclase leucosome (middle). A coarse-grained, garnet-rich horizon in the layered leucocratic metagabbro. The garnet-rich horizon also contains coarse-grained orthopyroxene (bottom). Gt = garnet, L = leucosome, Opx = orthopyroxene, Peg = pegmatitic segregation.

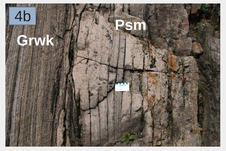
III Rocks of Uncertain Age

4) Metasedimentary Rocks



Unit 4a: Metagreywacke with orthopyroxene-bearing leucosome suggesting the metasediments may be Archean (top). Detail of garnet-bearing metagreywacke (bottom). Orthopyroxene, rather than garnet, is generally more abundant towards the east of the map area. L = leucosome, Opx = orthopyroxene.

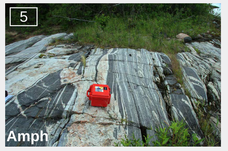




Unit 4b: Metapsammite with garnet-rich concretions (top). Garnet-rich concretions also characterize Setting Formation of the Ospwagan Group. Metapsammite interbedded with metagreywacke (bottom). Cnc = concretion, Grwk = metagreywacke, Psm = metapsammite.

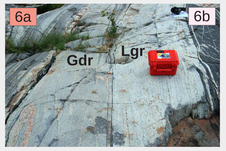
5) Plagioclase Amphibolite

Units 4c,d: Silicate facies iron formation with alternating quartz-rich and iron-rich layers (top). Marble containing abundant serpentinized olivine and minor amounts of a red mineral, likely clinohumite (bottom). The marble is similar to the Ospwagan Group, Thompson Formation, T3 Member.



Unit 5: Plagioclase amphibolite band in multicomponent migmatite (top). Discontinuous bands of plagioclase amphibolite in multicomponent migmatite. The amphibolite has been disrupted by injections of pink pegmatite (bottom). Amph = plagioclase amphibolite.

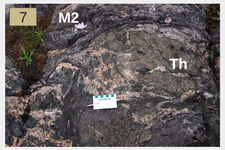
6) Granitoids



Unit 6: Adjacent bands of granodiorite and leucogranite in multicomponent migmatite (top). Local bodies of granodiorite contain rounded phenocrysts of potassium feldspar (bottom). Gdr = granodiorite, Lgr = leucogranite.

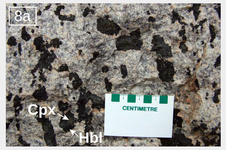
IV Paleoproterozoic

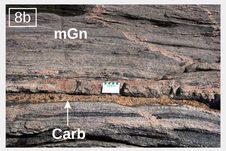
7) Ospwagan Group

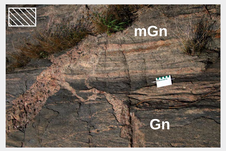


Unit 7: Unconformity between Ospwagan Group metasediments and Archean multicomponent migmatite. Manasan Formation M1 Member quartzite lies directly on the unconformity contact (top). The quartzite is overlain by the M2 Member semipelite (middle). Boudins of Thompson Formation calcsilicate hosted in M2 semipelite (bottom). Arch = Archean multicomponent migmatite, Th = Thompson Formation.

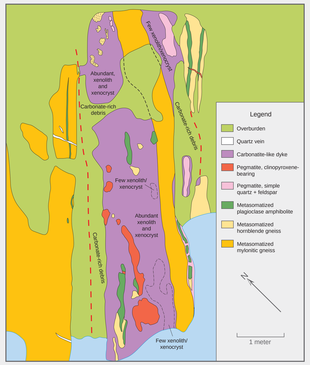
8) Alkaline Igneous Suite





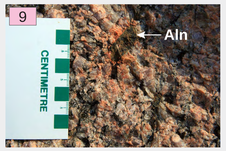


Unit 8: Clinopyroxene with hornblende rims observed in quartz-free white pegmatite. The white pegmatite locally contains up to 5 % apatite (top). A thin carbonatite-like dyke hosted in metasomatized hornblende gneiss. The dyke consists dominantly of pink carbonate that weathers to a pale rusty-orange (middle). Contact between relatively unaltered hornblende gneiss and metasomatized gneiss (bottom). Carb = carbonatite-like dyke, Cpx = clinopyroxene, Gn = hornblende gneiss, Hbl = hornblende, mGn = metasomatized gneiss.



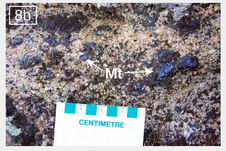
Unit 8b: Detail outcrop sketch of the largest carbonatite-like dyke found to date (above). A photograph of the outcrop is shown to the right with field assistant J. Duku for scale. The dyke contains abundant xenocryst and randomly oriented xenolith of country rock. The approximate margins of the dyke are indicated by the red dashed line in the map and photograph.

9) Pink Pegmatite



Unit 9: Pink pegmatite dykes that intruded retrogressed enderbitic biotite gneiss (top). A brownish metamict mineral, likely allanite, is locally present as subhedral to euhedral grains (middle). Pink pegmatite dykes spatially associated with carbonatite-like dykes and metasomatized gneiss are typically clinopyroxene-bearing and contain relatively lower modal amounts of quartz (bottom). It is unclear if the clinopyroxene-bearing dykes are a purely igneous phase, or the result of metasomatism. Aln = allanite, Cpx = clinopyroxene, Peg = pegmatite.

V Economic Considerations



Molybdenite lens in Archean multicomponent migmatite (top). Magnetite- and apatite-rich margin of a carbonatite-like dyke. The yellowish grains in the groundmass are apatite, the pinkish grains are carbonate (bottom). Mo = molybdenite, Mt = magnetite.

The largest nickel deposits of the TNB are hosted by Ospwagan Group metasediments; therefore, the recognition of Archean metasediments with characteristics similar to the Ospwagan Group has important implications for exploration. Ultramafic bodies which have intruded Ospwagan Group metasediments have a much greater potential of forming magmatic nickel deposits than ultramafic bodies hosted by Archean gneisses. The recognition of a possibly Archean metasedimentary sequence including quartzites with garnet-rich concretions, iron formations, and olivine marbles, presents an additional complicating factor in an area already made challenging for mineral exploration by intense deformation and high metamorphic grades.

Molybdenite flakes occur as rare isolated lenses up to 3 cm long. Isolated knots of molybdenite were observed in Archean multicomponent migmatite, metapsammite, and metagreywacke. No associated alteration or trends were identified.

The possible presence of alkaline igneous rocks including carbonatite suggests additional potential for mineral deposits in the region, including iron, Nb, REE, and other commodities.

Acknowledgements

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References

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