Sub-Phanerozoic Geology of the Reed Lake Area, Flin Flon Belt, West-Central Manitoba (Part of NTS 63K7, 8, 9, 10)

S. Gagné (MGS)

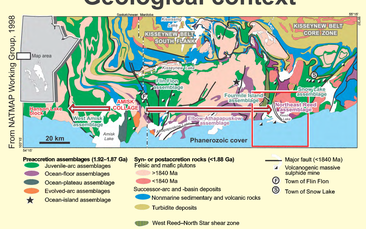
Introduction

The Flin Flon belt in the Reed Lake area, and its extension to the south under Phanerozoic sedimentary rocks, has significant potential to host additional VMS deposits. Despite the presence of several economic deposits, the geological setting of VMS deposits in the Reed Lake area is not well understood. Discovery of the Reed VMS deposit in 2007 deposit has resulted in renewed interest in the geology of tReed Lake area.

In order to gain a better understanding of the geological framework and mineral potential of the Reed Lake area and its sub-Phanerozoic basement, a multiyear field-mapping and compilation project was initiated in 2013. To complement data acquired through geological mapping, a drillcore examination and sampling component was added to the project in 2015. The drillcores provide essential information in areas that lack surface exposure.

A compilation of geological data from surface mapping and drillcore was integrated with regional geochemistry and airborne geophysical surveys to produce **two new preliminary maps**, one for the exposed Flin Flon belt in the Reed Lake area – (**PMAP2017-01**; **poster T7**) and the other for its sub-Phanerozoic extension to the south – (**PMAP2017-02**; **this poster**).

Geological context

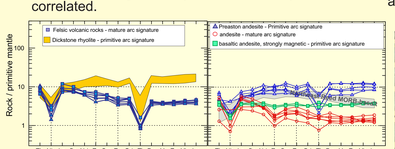


Paleoproterozoic rocks in the Reed Lake area are a component of a larger tectonic collage of volcano-plutonic and sedimentary rocks assembled during the closure of an ancient ocean (ca. 1.9–1.8 Ga) and collectively termed the 'Flin Flon belt' (FFB).

Fourmile Island assemblage

Bimodal volcanic and volcaniclastic rocks of the Reed mine area (**sJ1a, sJ1b, J4, and J8**) represent the sub-Phanerozoic extension of the **Fourmile Island assemblage** (**FIA**). Both the more primitive volcanic arc signature (Dickstone mine horizon; **J9** and **J10** in **PMAP2017-1**) and the more mature arc signature (Fourmile Island area; **J4 - J8** in **PMAP2017-1**), not explicitly subdivided in PMAP 2017-2, are recognized in the sub-Phanerozoic **FIA**.

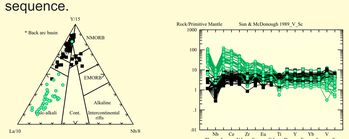
Similar lithofacies and chemical signature are observed between exposed rocks of the **FIA** and their sub-Phanerozoic extension south of the Berry Creek shear zone suggesting that they can reasonnably be correlated.



An interpreted thrust fault that passses through Black Duck Lake marks the eastern limit of the **FIA**. That fault is at the contact with a panel of Burtnwood group sedimentary rocks.

Calc-alkaline and MORB volcanism

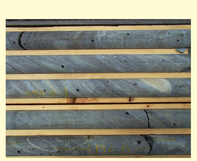
A package of mafic-dominated volcanic and volcaniclastic rocks along the northeast shore of Dolomite Lake (**sJ2, sJ3**) is interpreted to represents a distinct sequence from the **FIA**. Whereas the **FIA** contains no MORB-like rocks, the Dolomite Lake volcanic sequence contains **abundant MORB-basalt**. The sequence also contains abundant **calc-alkaline andesitic rocks**, which are not found in any other sequence in the exposed Reed Lake basement and its sub-Phanerozoic extension to the south. Minor felsic volcanic rocks and sediments are also part of the sequence.



Calc-alkaline andesite (green circles) and MORB-basalt (black squares) represents a unique assemblage for the Reed Lake area.

McClarty Lake arc rocks

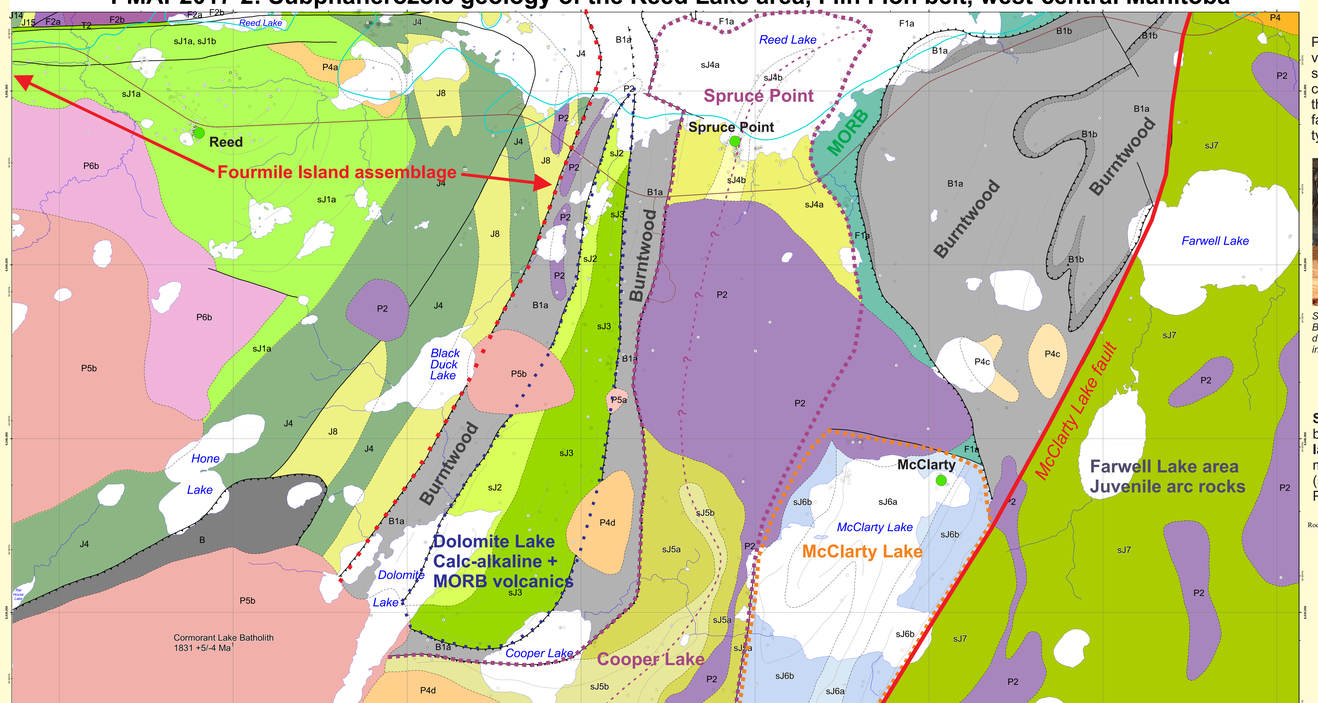
Rocks of the McClarty Lake area (**sJ6a and sJ6b**) displays middle to upper amphibolite facies mineral assemblages in contrast with the middle greenschist facies to lower amphibolite facies mineral assemblages typically found in the Reed Lake area. Due to the higher metamorphic grade confident protolith recognition is difficult, but a combination of textural observation and whole-rock chemistry suggest that bimodal volcanic and volcaniclastic rocks with moderate to strong arc signature form the bulk of the sequence along with abundant granitoid and lesser gabbroic intrusions.



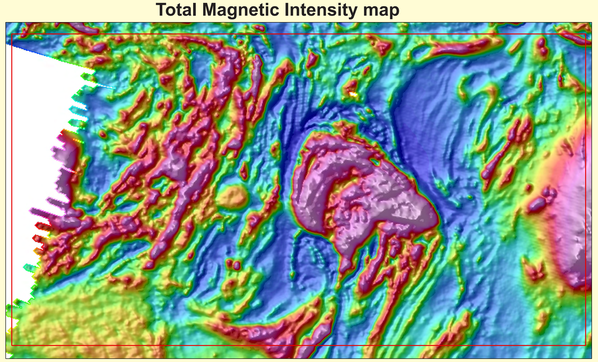
Mafic heterolithic tuff breccia, most fragments have a bleached rim, indicating silica replacement after deposition

strongly foliated biotite-sillimanite quartzofeldspathic gneiss (upper row) and more massive biotite-garnet quartzofeldspathic gneiss (lower row),

PMAP2017-2: Subphanerozoic geology of the Reed Lake area, Flin Flon belt, west-central Manitoba



Total Magnetic Intensity map



Sedimentary Rocks

Burntwood Group

- B1 — Greywacke, mudstone
- B1a — Greywacke, siltstone, mudstone
- B1b — Graphitic, sulfidic mudstone, sulfide facies iron formation, minor greywacke

Tectonites

Berry Creek Shear Zone

- T2 — Mafic tectonite: chlorite schist, ± carbonates, brittle/ductile shears

Intrusive rocks

- P6 — Granite to granodiorite
- P5 — Granodiorite to tonalite
- P5a — Granodiorite
- P5b — Granodiorite to tonalite
- P4 — Tonalite to quartz diorite
- P4a — Tonalite
- P4c — Leucotonalite
- P4d — Tonalite to quartz diorite

Josland sills

- P2 — Gabbro, melagabbro, diorite

Volcanic rocks, sub-Phanerozoic

- sJ7 — Undivided bimodal juvenile-arc volcanic rocks, not exposed
- sJ6 — Volcanic-derived gneisses (juvenile-arc affinity) and metasediments, middle- to upper amphibolite facies
  - sJ6a — Volcanic-derived mafic and felsic gneisses, amphibolite, late granitic intrusions
  - sJ6b — Mixed volcanic and sedimentary mafic, intermediate gneisses, minor granitic intrusions
- sJ5 — Juvenile-arc basalt, andesite, and rhyolite volcanic and volcaniclastic rocks, minor MORB basalt
  - sJ5a — Oceanic-arc mafic and intermediate volcaniclastic rocksks, minor mudstone-sandstone sequences
  - sJ5b — Oceanic-arc basaltic andesite, andesite, MORB basalt, felsic volcanic rocks
- sJ4 — MORB basalt, rhyolite, and andesite with weak arc signature
  - sJ4a — MORB basalt, and andesite with weak arc signature: massive flows and pillows, subordinate autoclastic facies, minor sulphidic mudstone
  - sJ4b — MORB basalt, weak-arc andesite, rhyolite flow and felsic volcaniclastic rocks
- sJ3 — Calc-alkali mafic flows, minor felsic rocks, rare MORB mafic flows
- sJ2 — MORB basalt, andesite, intermediate volcaniclastic rocks, and mudstone-sandstone intervals
- sJ1 — Fourmile Island Assemblage
  - sJ1a — Basaltic andesite, andesite, minor rhyolite and quartz porphyry
  - sJ1b — Intermediate to mafic volcaniclastic rock, minor felsic volcaniclastic rocks and sulfidic argillites

Juvenile-Arc rocks, exposed basement

West Reed volcanic package

- J15 — Felsic crystal tuff, lapilli tuff and tuff breccia; minor quartz-plagioclase–phyric dacitic to rhyolitic flows
- J14 — Mafic volcaniclastic rocks (tuff breccia, lapilli tuff and tuff); minor basalt; massive flows and pillows

Fourmile Island assemblage

- J8 — Porphyritic and aphyric felsic breccia, felsic dikes
- J4 — Aphyric and porphyritic pillowed and massive basalt, basaltic andesite, andesite

Ocean Floor rocks, exposed basement

Reed Lake mafic-ultramafic complex

- F2 — Layered mafic-ultramafic complex
  - F2a — Layered gabbro, leucogabbro, anorthosite
  - F2b — Layered melagabbro, gabbro, pyroxenite
- F1 — N-type basalts
  - F1a — Northeast Reed pillowed and massive MORB basalt

Burntwood group

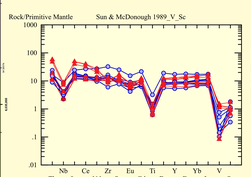
Panels of Burntwood sediments (**B1a, B1b**) typically separate volcanic asemblages. Southwest of Tramping Lake the graphitic sulphide-rich argillite (**B1b**) is present. Its strong magnetic and conductance properties allow to define fold and thrust panels on the map. Based on observation at Reed Lake, **B1b** represents a favorable horizon within Burtnwood group sediments for Sedex-type mineralization.

Sheared graphitic mudstone from the Burtnwood group rocks showing effects of ductile deformation along one of the interpreted thrust fault SE of Reed Lake

Planar bedded greywacke and minor argilite from sub-Phanerozoic drillcore of the Burntwood group southeast of Reed Lake.

Spruce Point & Cooper Lake

Similar chemistry of felsic volcanic rocks, **presence of MORB**-basalt in both areas, and **apparent continuation of the same large-scale fold structure** (see purple dashed fold axial trace on map) suggest that the volcanic rocks of the Cooper Lake area (**sJ5a** and **sJ5b**) maybe part of the same sequence as the Spruce Point deposit (**sJ4a** and **sJ4b**).



Primitive mantle - normalized trace element diagram showing the similarity between the patterns of felsic volcanic rocks from the Spruce Point Mine area (blue circles) and felsic volcanic rocks from the Cooper Lake area (red triangles)

McClarty Lake fault

The McClarty Lake fault is a late fault that juxtaposes Burtnwood sediments and low metamorphic grade juvenile arc rocks. It also brought together high-grade volcanic rocks from the McClarty area with low-grade arc rocks from the Farewell Lake area. The fault can be traced northeastward over a distance of 30 km through Tramping Lake and through Herb Bay at Wekusko Lake.

Acknowledgements

The project has been facilitated by the co-operation of Hudbay Minerals Inc., Royal Nickel Corporation (formerly VMS Ventures Inc.) and Rockcliff Metals Corporation that provided access to recent drillcores, permitted sampling and shared some of their own data. This co-operation has significantly expanded the scope of the drillcore examination program and will contribute to our better understanding of the geology of the sub-Phanerozoic basement of Reed Lake.