Towards a new geological framework for the Reed Lake area (parts of NTS 63K7, 8, 9, 10)

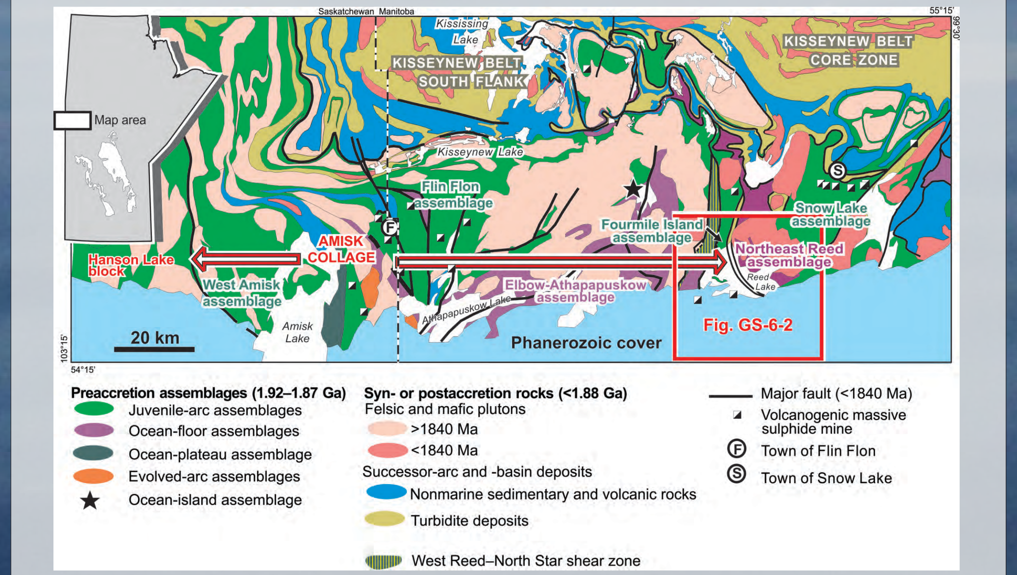
S. Gagné (MGS)

Introduction

The discovery of the Reed VMS deposit in 2007 has resulted in renewed interest in the sub-Phanerozoic geology south of Reed Lake. 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.

Geological context

The Reed Lake area is located in the central part of the Flin Flon belt (FFB) which consists of a collage of distinct Paleoproterozoic (1.92–1.88 Ga) tectonostratigraphic assemblages and minor Archean crustal slices that were juxtaposed during a period of 1.88–1.87 Ga intraoceanic accretion to form the 'Amisk collage' (Lucas et al., 1996). Paleoproterozoic assemblages within the Amisk collage are subdivided into juvenile-arc, ocean-floor, ocean-plateau and evolved-arc (David and Syme, 1994).



From NATMAP Working Group, 1998

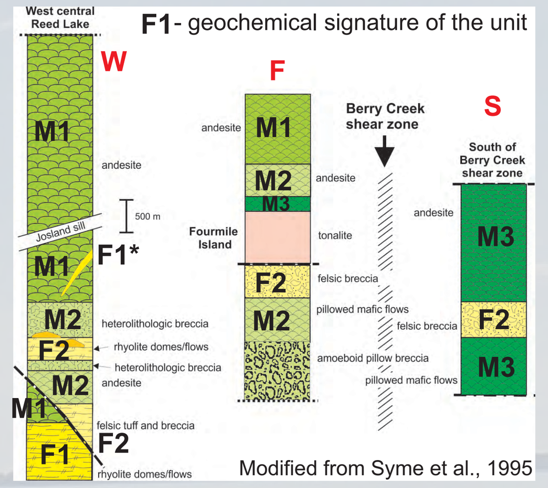
The exposed portion of FFB at Reed Lake contains several distinct panels of juvenile-arc assemblage, which are separated by major faults; some panels also contain ocean-floor assemblage, Burntwood group sedimentary rocks and plutonic rocks. The juvenile-arc assemblages are internally complex due to faulting and folding (e.g., Bailes and Syme, 1989), but are typically bimodal and include a wide range of arc-related volcanic, volcaniclastic and synvolcanic intrusive rocks (Bailes and Syme, 1989; Syme and Bailes, 1993; Lucas et al., 1996; Bailes and Galley, 2007). Ocean-floor assemblages are composed mainly of mid-ocean-ridge–like basalt and related kilometre-scale, turbiditic greywacke, mudstone and rare conglomerate.

Acknowledgements

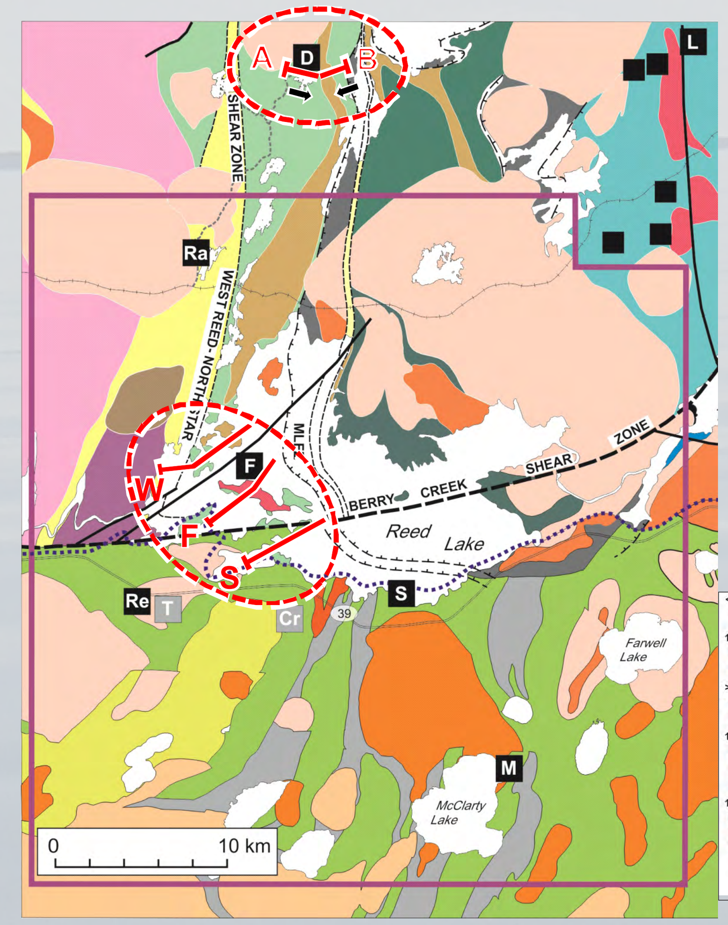
The project has been facilitated by the co-operation of Hudbay Minerals Inc., Royal Nickel Corporation (formerly VMS Ventures Inc.) and Rockcliff Copper Corporation that provided access to recent drillcores, permitted sampling and shared some of their own data. This co-operation has significantly expanded 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.

Stratigraphy & Chemistry

Metavolcanic rocks of the Fourmile Island Assemblage (FIA) are exposed at surface on western Reed Lake where they form a greater than 5.5 km thick sequence of subaqueous bimodal volcanic rocks. Syme et al. (1995) described six main stratigraphic components for the FIA in western Reed Lake. The Fourmile Island Assemblage is currently interpreted (Zwanzig and Bailes, 2010) as a back arc-rift succession formed at about 1.89 Ga during opening of an ocean basin.

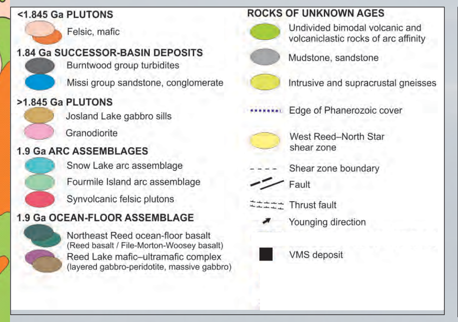


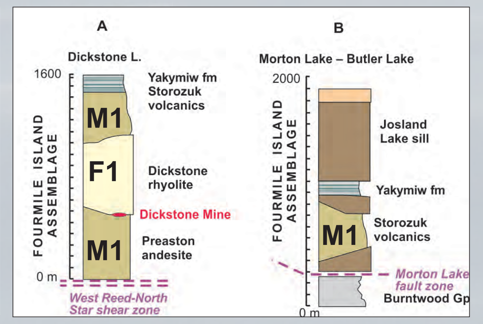
Modified from Syme et al., 1995



From NATMAP Working Group, 1998

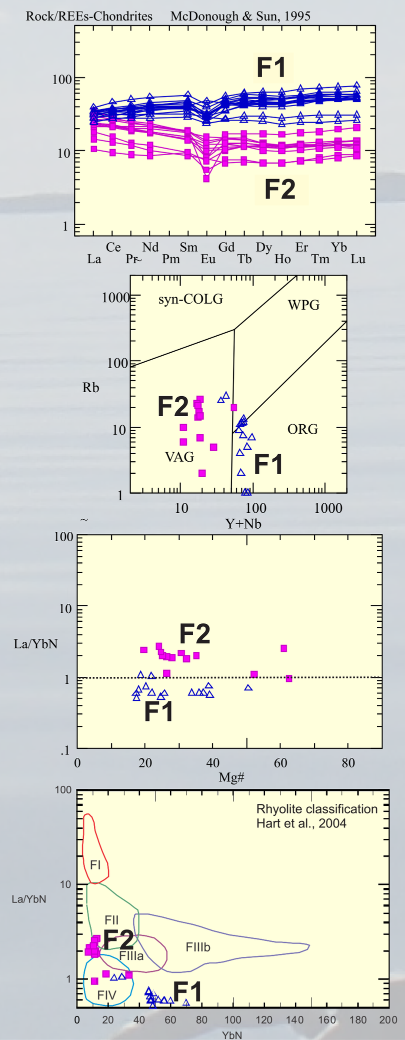
Integration of whole-rock chemistry data with published stratigraphic columns and new field data provides new insight on the internal stratigraphy of the FIA in the western Reed Lake area. Bailes (1980) described a simple sequence for the FIA near Dickstone mine (columns A-B below). Syme et al. (1995) encountered a more complex stratigraphy in the western portion of Reed Lake (Columns W, F and S above). Schematic stratigraphic columns from Syme et al. have been modified according to new data.





Zwanzig & Bailes, 2010

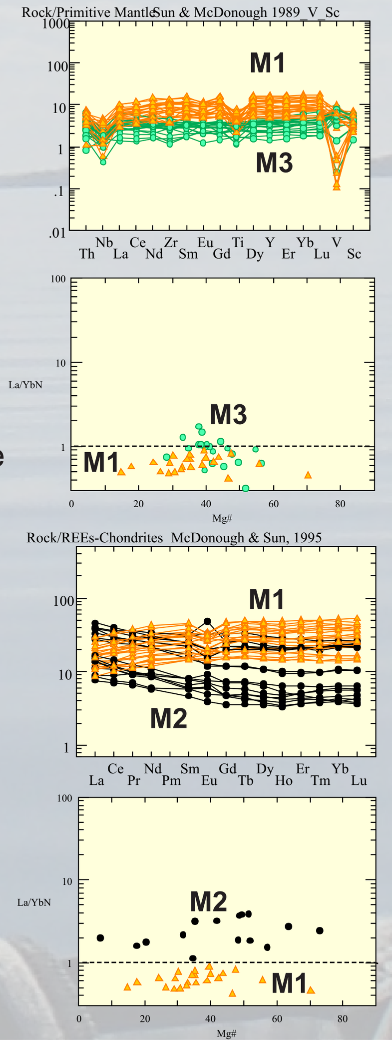
Analysis of whole-rock chemical data has identified five distinct geochemical signatures for the FIA volcanic rocks. The F1-M1 rocks occur mostly along the west shore of Reed Lake, in the Reed Mine area and to the north of Fourmile Island. M2-F2 rocks occur mostly near the Fourmile Island area and M3 rocks, a minor component near Fourmile Island, are abundant in the Cowan River area; M3 also often have a strong positive magnetic signature.



F1 and M1 rocks display a depleted REE pattern relative to chondrite and they consist mostly of coherent facies volcanic rocks with little volcaniclastic component.

Oppositely, M2 and F2 volcanic rocks show an enriched REE pattern relative to chondrite and present more diversity of volcanic facies, including more volcaniclastics rocks. Minor graphitic/ sulphidic argillite is also often associated with the M2/F2 rocks.

The difference in chemistry and volcanic facies, suggest that M1/F1 and M2/F2 rocks represent different stage of the arc evolution.



Structural geology

Geological bedrock mapping (Syme et al., 1995; Gagné and Anderson, 2014) has allowed to establish an initial framework for the deformation history of the Reed Lake area.

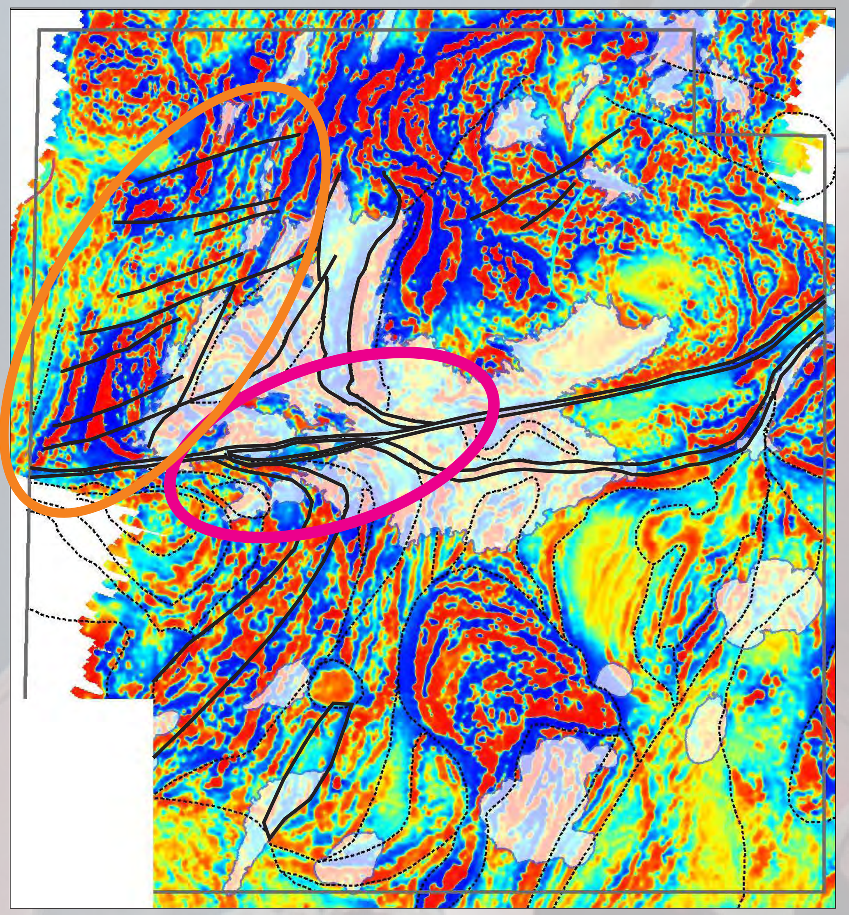
Integration of geological and geochemical data with geophysical surveys is used to interpret large scale structural feature from under Reed Lake and the sub-Phanerozoic basement.

The map to the left show the first vertical derivative from a regional airborne magnetic survey flown by Hudbay Minerals (AF73859).

The line work highlights geophysical lineaments or breaks which may represent faults, shear zone, uncomformities, or stratigraphic trends.

Some key structural features are highlighted and briefly described here:

1- Geological mapping identified a series of northeast striking and subvertical discrete dextral shear zones along the west side of Reed Lake (orange ellipse). These ductile shear zones are interpreted to part of the third deformation episode (D3)



of Gagné and Anderson (2014). They can have significant effect on the geology as one of these fault truncates the north end of the Reed lake mafic-uramafic pluton.

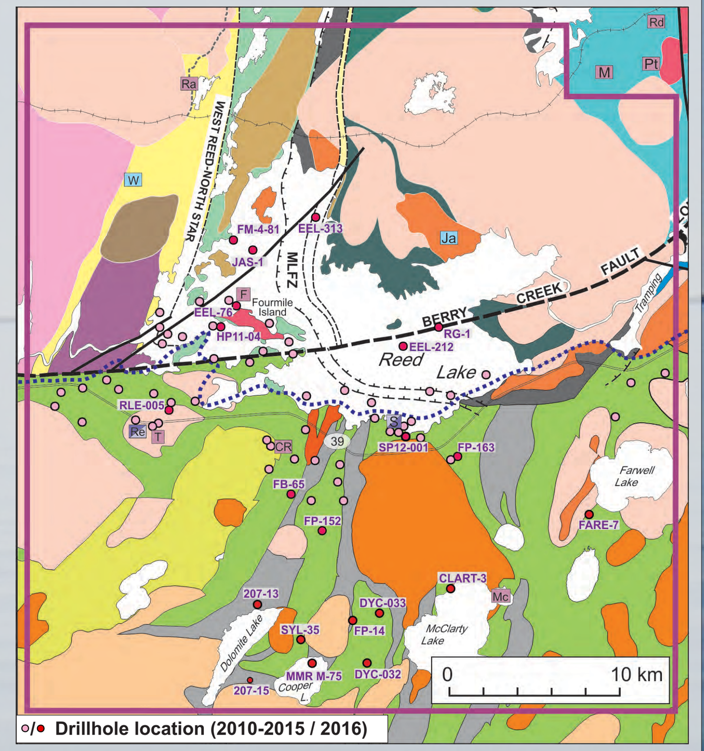
2- The Berry Creek shear zone (BCSZ; main east-west fault cutting accross the lake), a salient feature on any geophysical map of this area has the same orientation has the D3 dextral shear zone from Gagné and Anderson (2014) and was also interpreted to have developed during D3.

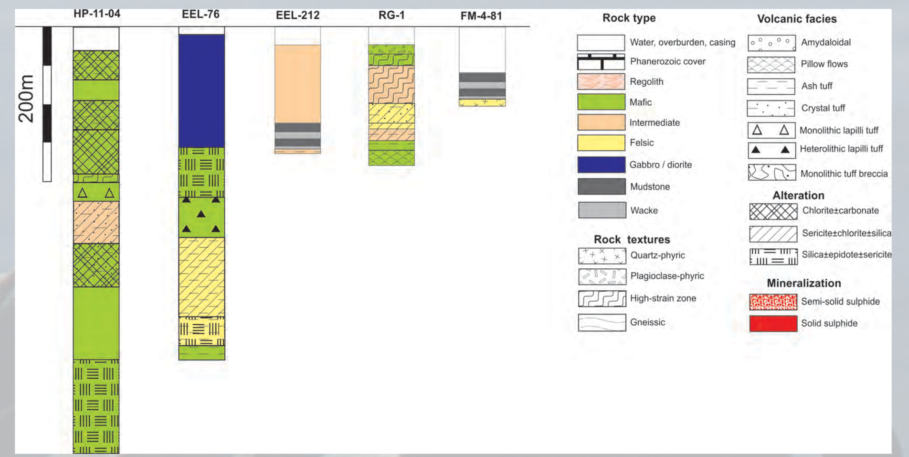
3 - Warping of FIA rocks and Burntwood group rocks (area highlighted in pink ellipse) on opposite side of the BCSZ suggested that the total net displacement on the BCSZ maybe on the order of a few kilometers and correlation accross the shear zone maybe possible. The symmetry of the deflection of the units on both sides of the shear zone could be achieved either by an initial dextral offset followed by late sinistral slip or by an oblique or vertical slip of an inclined marker. Further interpretation of geophysical data combined with drawing of schematic cross-sections and use of chemostratigraphy will help curtail the net displacement along the BCSZ.

2016 Drillcore examination program

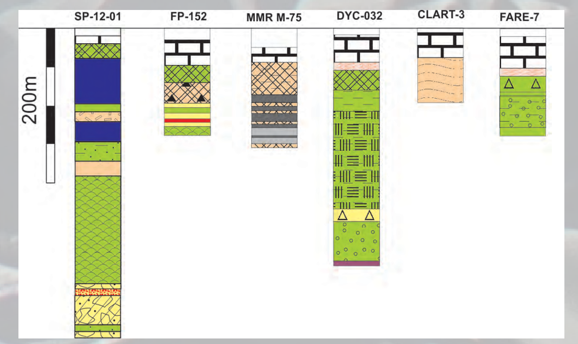
IN 2016, two weeks were spent examining recent and historical exploration drillcore from the Reed Lake area and the sub-Phanerozoic basement immediately to the south. A total of 21 drillcores were examined, documented and sampled to complement a set of 53 drillcores examined previously (2010–2015).

Key observations from this summer include recognition of intense pervasive silica alteration and narrow graphite-sulphide–bearing sedimentary intervals within the volcanic-arc sequence in the northern part of Reed Lake. Intrusive and extrusive rocks of intermediate and felsic composition, of possible arc to arc-rift origin, were identified in what was previously interpreted as a homogeneous ocean-floor sequence in eastern Reed Lake, and may indicate tectonic interleaving of the ocean-floor and volcanic-arc sequences in this area. Drillcores from the Fourmile Island area confirmed the presence of altered felsic volcanic and volcaniclastic rocks on both flanks of the island.





The presence of felsic and intermediate volcanic and volcaniclastic rocks in the eastern bay of Reed Lake was also confirmed. The bimodal composition and volcaniclastic character of rocks encountered in RG-01 and EEL-212 suggest an arc/arc-rift setting (geochemical results pending). These lithological units contrast with the monotonous pillowed basalt observed



along the northeastern shoreline of Reed Lake, which has an ocean-floor trace-element signature (Syme et al., 1995a). The pillowed basalt directly overlying Spruce Point deposit has an ocean-floor trace-element geochemical signature (S. Gagné, unpublished data, 2016). The presence of arc/arc-rift rocks in direct contact with ocean-floor rocks can be explained by the presence of an early discrete fault that predates the Morton Lake fault zone.

JAS-1; massive andesitic flow show a progression from moderate (medium grey-green at bottom) to strong silica alteration (light grey colour at top; BQ core; 225–280 ft)

RG-1, quartz-phyric felsic lapilli tuff with weak to moderate sericite alteration (BQ core, 333–348 ft);

SP-12-01, basaltic amoeboid pillow breccia with narrow dark selvages on clasts and a fine matrix of biotite and chlorite (HQ core; 35.6 m).

HP-11-04, quartz-phyric intermediate crystal tuff with moderate sericite alteration (NQ core, 234 m)

DYC-033,pillowed andesitic flows with thick dark selvage (3–6 mm) and minor interpillow material (NQ core, 80–84 m);

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