Preliminary results from bedrock mapping in the central Sipiwesk Lake area, Manitoba

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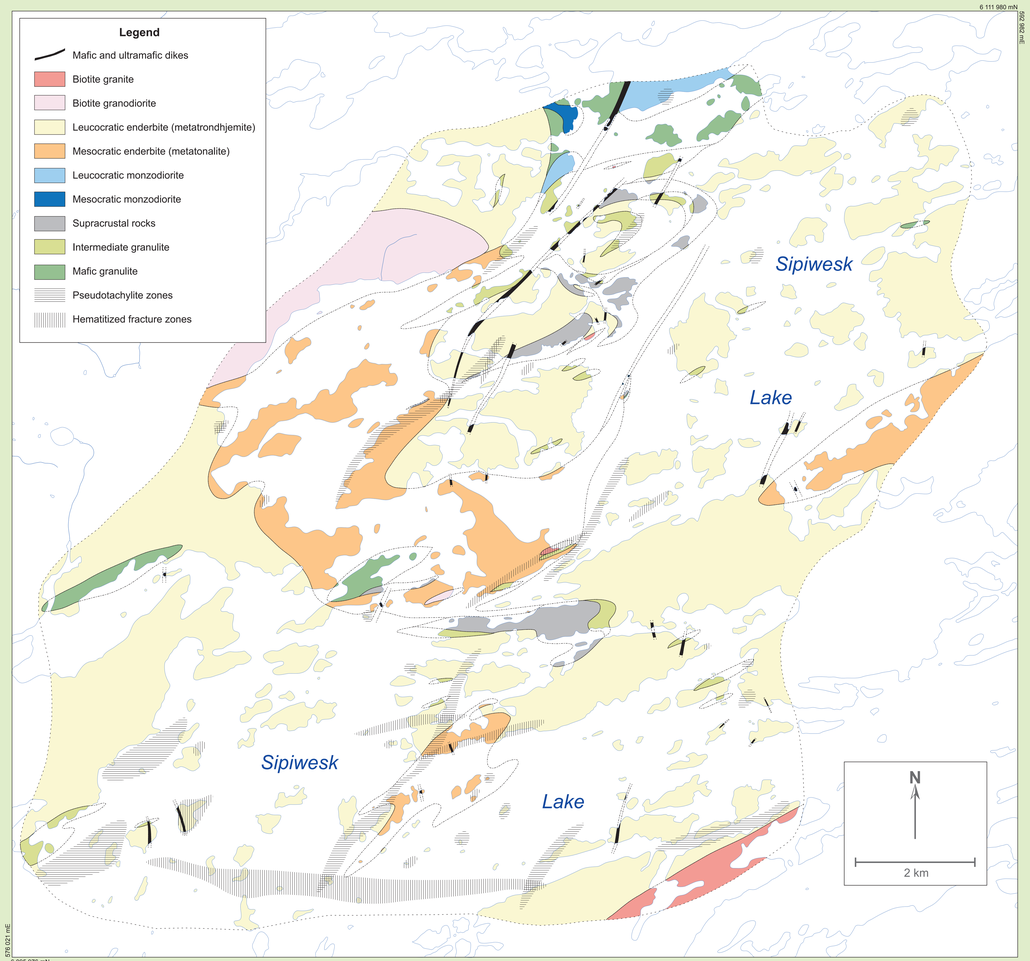
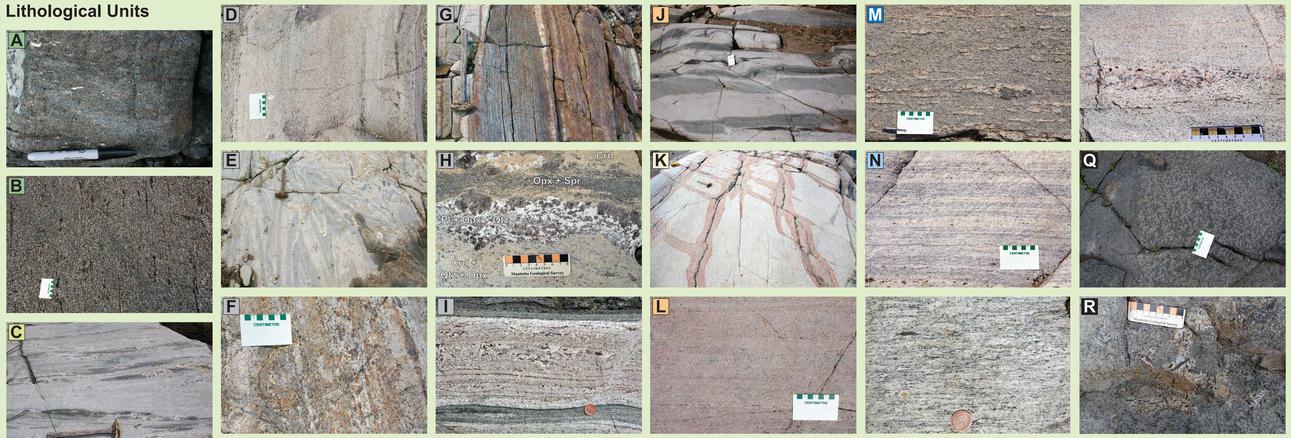
Summary

A project has been initiated to re-map portions of the Archean Pikwitonei Granulite Domain in central Manitoba, with emphasis on interpretation of pre-granulite protoliths; this report summarizes the findings from the first summer of field mapping at central Sipiwesk Lake. The mapped area has been subjected to relatively uniform, high-grade Neoarchean metamorphism accompanied by intense deformation. Exposures in the central Sipiwesk Lake area include: 1) mafic and intermediate granulite, which likely represent a variety of protoliths, including intrusive and volcanic rocks; 2) newly recognized suites of supracrustal rocks, including metapelite to semipelite, metapsammite, metawacke, meta-iron formation, layers of Mg-Al rock interpreted as the products of seafloor alteration, and layers of Ca-Al rock of uncertain origin; 3) vast amounts of metaplutonic rocks, including mesocratic and leucocratic enderbite to opdalite, and minor mesocratic to leucocratic monzodiorite; 4) a suite of later granitoid intrusions, including granitic pegmatite and aplite dikes, and sheets of granite and tonalite/granodiorite; and 5) unmetamorphosed mafic dikes ranging from diabasic to gabbroic to ultramafic, some of which are more than 50 m wide. Exposures are typically high strain and characterized by an early gneissosity, which is locally folded and pervasively transposed by later ductile deformation. Late, likely Paleoproterozoic, brittle structures are common and include zones of pervasive fracturing and hematitization, discrete faults with fault gouge, and zones of intense pseudotachylite veining. The metamorphic grade appears to be relatively constant across the map area. Mafic, intermediate and enderbitic gneiss are characterized by orthopyroxene+clinopyroxene metamorphic assemblages; metapelite contains orthopyroxene+garnet+sillimanite+rutile±cordierite assemblages; and quartz-free Mg-Al rocks are characterized by sapphirine+ orthopyroxene+cordierite assemblages. Peak metamorphic conditions are estimated to have been 810–930 °C and 6.9–8.3 kbar, based on preliminary phase-equilibria modelling.



Lithological Units



A) Ultramafic granulite, occurs as local bands within B) mafic granulite, and C) intermediate granulite. The mafic granulite and intermediate granulite are commonly transposed and interbanded as visible in C). The granulites are likely derived from a combination of both plutonic and volcanic rocks.

D) Metapsammite containing varying proportions of garnet. E) Metawacke with conformable bands of leucosome, folded by F_2. F) Metapelite with abundant garnet and orthopyroxene.

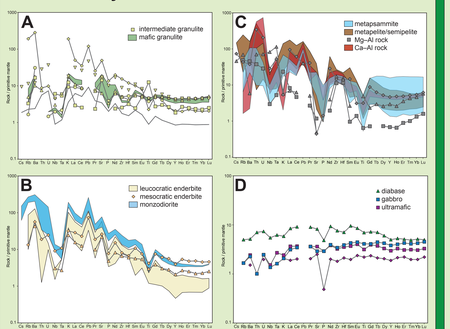
G) Metamorphosed iron formation with chert laminations. H) Mg–Al rock, possibly the product of seafloor alteration, is characterized by bands enriched in cordierite, orthopyroxene, and sapphirine. (I) Ca–Al rocks, of uncertain origin, consist of calcic plagioclase, andraditic garnet, and clinopyroxene, and local scapolite. Abbreviations: Crd = cordierite, Opx = orthopyroxene, Pl = plagioclase, Qtz = quartz, Spr = sapphirine.

J) Mesocratic enderbite (metatonalite) with discontinuous bands of mafic and intermediate granulite. K) Leucocratic enderbite (metatrondhjemite) with locallized hematite staining along joints. L) Pink enderbite, the color appears to be caused by the presence of pink, antiperthitic plagioclase.

M) Mesocratic monzodiorite, the mafic minerals consist of biotite and clinopyroxene. N) Leucocratic monzodiorite, the mafic mineral in the grey bands consist of hornblende, while orthopyroxene and clinopyroxene are dominant in the light pink bands. O) Biotite granodiorite from the northwest margin of the map area.

P) Biotite granite with a pegmatitic segregation from the southeast margin of the map area. Q) Mafic to ultramafic dyke with a layer characterized by dendritic plagioclase. R) Pod of gabbroic pegmatite with coarse-grained hornblende. Pegmatitic pods typically occur towards the cores of larger mafic and ultramafic dykes.

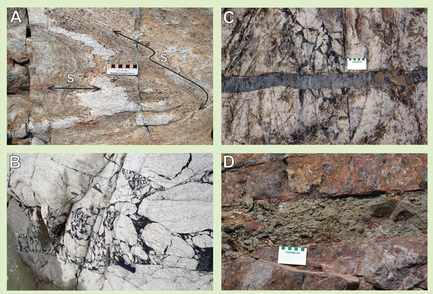
Geochemistry



Primative mantle-normalized multi-element diagrams for A) mafic and intermediate granulites, and B) meta-intrusive rocks. The large spread of data, coupled with the lack of a coherent pattern, for the the intermediate granulite supports the interpetation that it may be derived from a variety of protoliths.

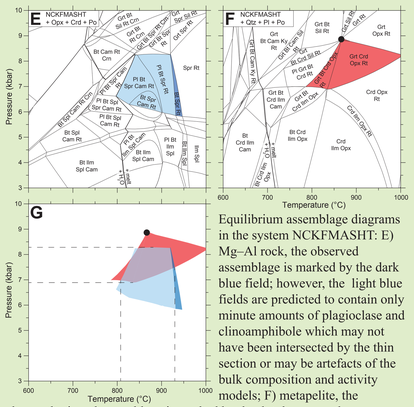
Primitive mantle-normalized multi-elment diagrams for C) supracrustal rocks, and D) mafic and ultramafic dikes. The range of values for the Mg–Al rocks, could suggest that they were derived from the seafloor alteration of more than one rock type.

Deformation and metamorphism



A) S_1 gneissosity folded by F_2, the S_2 foliation is developed parallel to the axial plane. B) Zone of brecciation and pseudotachylite veining within enderbite.

C) Zone of brecciation and pseudotahylite veining cut by a mafic dyke. The antithetic relationship was also observed elsewhere on the lake and may suggest that the timing of pseudotachylite formation and mafic magmatism was contemporaneous. D) Fractured and hematitized enderbite cut by a discrete fault with fault gouge.



Equilibrium assemblage diagrams in the system NCKFMASHT: E) Mg–Al rock, the observed assemblage is marked by the dark blue field; however, the light blue fields are predicted to contain only minute amounts of plagioclase and clinoamphibole which may not have been intersected by the thin section or may be artefacts of the bulk composition and activity models; F) metapelite, the observed mineral assemblage is marked by the dot; however, the possibility that sillimanite and biotite may be relict and/or retrograde suggests that the broader field of coexisting garnet + orthopyroxene + cordierite + rutile, marked in red, could be a more realistic estimate of the P–T conditions; G) the overlapping fields yield a best estimate for the peak metamorphic conditions of 810–930°C and 6.9–8.3 kbar.

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