Manitoba's Far-North Mapping Initiative: Reconnaissance Bedrock Mapping and Sampling of the Great Island Domain

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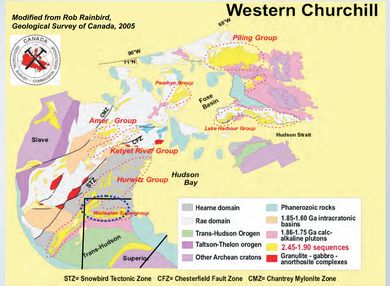
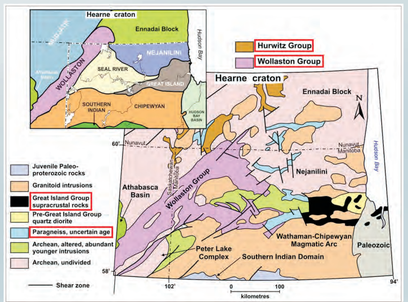
Western Churchill





Regional Geology

The southeast margin of the Hearne craton has been regionally subdivided into six geological domains: the Mudjatik, Peter Lake (present only in Saskatchewan), Wollaston, Seal River, Great Island and Nejanilini domains. The domains are distinguished by their cover rocks, the proportion or absence of basement rocks, and their dominant structural trends.

The Manitoba Geological Survey (MGS) created the

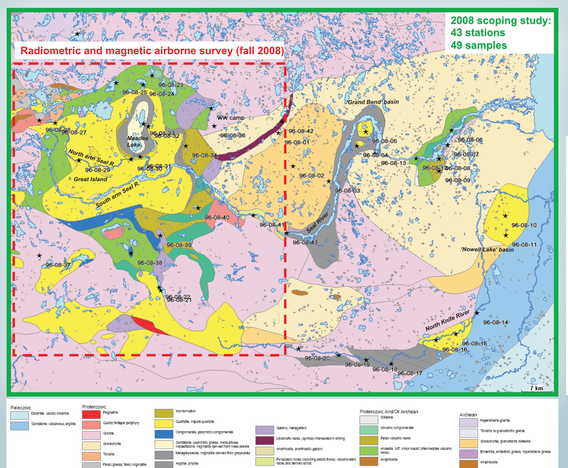
Far North Mapping Initiative

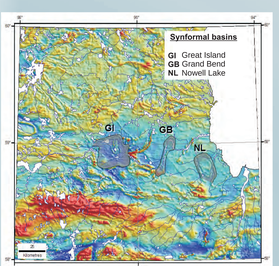
to study the southeast margin of the Archean Hearne craton in Manitoba, with the goal of furthering our understanding of the nature, evolution and mineral potential of one of the principal but least explored geological building blocks of Manitoba's Precambrian shield.

The 2008 fieldwork consisted of reconnaissance bedrock mapping and sampling in the area of the lower Seal and North Knife rivers, which are situated within the Great Island Domain at the southeastern extent of the Hearne craton.

The Great Island Domain, which was last mapped in the 1970s by the MGS (Schledewitz, Weber et al.), includes key exposures of metasedimentary cover rocks, as well as the only known occurrences of metavolcanic rocks in Manitoba's far north, the age and significance of which have yet to be determined.

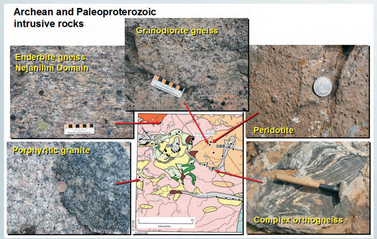
The 2008 reconnaissance bedrock mapping and sampling in the Great Island Domain mainly focused on metavolcanic and metasedimentary outcrops along the lower Seal and North Knife rivers, and included the collection of representative bedrock samples of all the major rock-types previously identified in the Great Island Domain. These samples are being submitted for lithogeochemical (Actlabs), Sm-Nd isotopic (University of Alberta Radiogenic Isotope Facility) and U-Pb geochronological analysis (Geochronology Laboratory of the Geological Survey of Canada), in advance of a more concerted mapping program planned for the 2009 field season as part of the MGS's Far North mapping initiative.

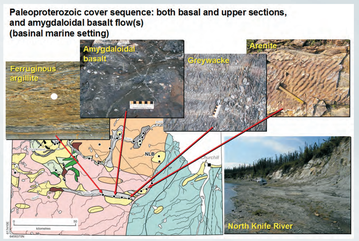


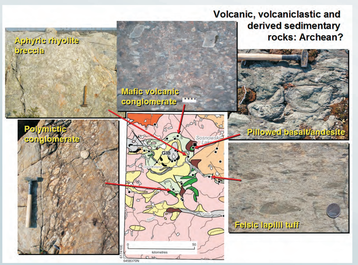


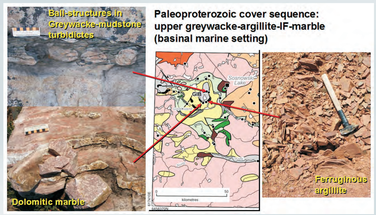
Bedrock exposures examined in 2008

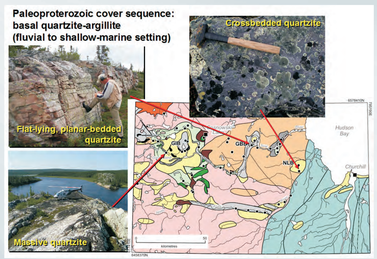
range up to 160 km west of Churchill. The 2008 field studies included detailed petrographic-petrological and structural mapping of bedrock exposures at 43 stations (see map to the left), which were chosen based on previous mapping by Schledewitz et al. to include all of the major rock types in the region. Emphasis was placed on known occurrences of supracrustal rocks. At each station, representative bedrock samples were collected for laboratory analysis; in most cases the quality and volume of the material collected are sufficient for geochemical, isotopic and/or geochronological analysis.

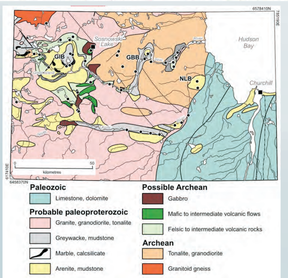












Geology of the Great Island Domain

Metasedimentary rocks throughout Manitoba's Far North are thought to be broadly correlative with the Paleoproterozoic Wollaston Supergroup in Saskatchewan and northwest Manitoba (ca. 2.1-1.9 Ga) and the partially time-equivalent Hurwitz Group in Nunavut (ca. 2.4-1.9 Ga). The age and possible correlation of metavolcanic rocks in the Great Island area, however, remain unknown; samples obtained during the 2008 program will be utilized to resolve outstanding questions regarding the age, provenance and correlation of all the major supracrustal rock types in the Great Island Domain.

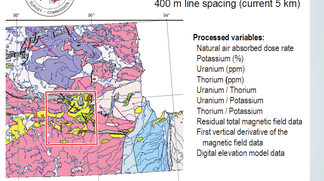
Supracrustal rocks in the Great Island Domain are intruded by syn to late-tectonic granodiorite, quartz monzonite and granite plutons. Similar plutons in the Wollaston Domain in Saskatchewan yielded ages between ca. 1.84 and 1.80 Ga, which corresponds to the main period of Hudson granite emplacement throughout the Western Churchill Province.

Metamorphic mineral assemblages indicate that the metamorphic grade in the Great Island Domain generally ranges from low in the southeast to high in the northwest. Lower greenschist facies metasedimentary rocks are exposed in the deeply incised banks of the lower North Knife River, whereas upper amphibolite or granulite facies metaplutonic rocks are exposed in extensive outcrop fields north of Great Island, at the south margin of the Nejanilini Domain.
Finite strain varies from moderate to intense in the examined outcrops. Structural trends in the south are generally east-west and mesoscopic deformation structures indicate at least two generations of tight to isoclinal folds, the latter of which is associated with the development of a penetrative, generally east-trending, transposition fabric. In the north, structural trends are much more variable and reflect the presence of macroscopic dome and basin-style folds, the most prominent example of which is centred on Meades Lake, north of Great Island. Observed bed forms and younging criteria indicate that metasedimentary rocks in this portion of the study area occupy synclinal keels, whereas metaplutonic and minor metavolcanic rocks occupy the intervening anticlinal culminations. Other prominent synclinal basins occur along the north-trending section of the lower Seal River ~30-40 km west of Hudson Bay (herein termed the 'Grand Bend' basin) and to the west of the north-trending section of the lower North Knife River (herein termed the 'Nowell Lake' basin).

Geomapping for Energy and Minerals (GEM) national program (2008-2013):

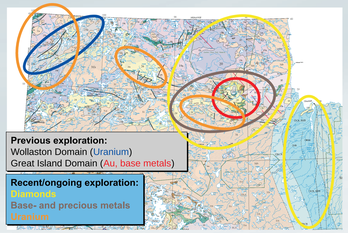
Far north project 2008: High Sensitivity Airborne Geophysical Survey

- Flown fall 2008
- Magnetic total field
- Gamma-ray spectrometric
- Survey specs:
  ~17,000 line-kilometres
  125 m nominal terrain clearance
  400 m line spacing (current 5 km)



Processed variables:
Natural air absorbed dose rate
Potassium (%)
Uranium (ppm)
Thorium (ppm)
Uranium / Thorium
Uranium / Potassium
Thorium / Potassium
Residual total magnetic field data
First vertical derivative of the magnetic field data
Digital elevation model data

Mineral Potential of Manitoba's Far North: A Brief Overview

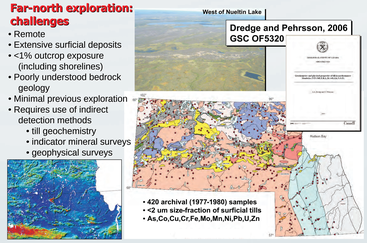


Previous exploration:
Wollaston Domain (Uranium)
Great Island Domain (Au, base metals)

Recent/ongoing exploration:
Diamond
Base- and precious metals
Uranium

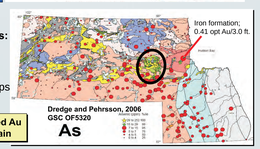
Far-north exploration: challenges

- Remote
- Extensive surficial deposits
- <1% outcrop exposure (including shorelines)
- Poorly understood bedrock geology
- Minimal previous exploration
- Requires use of indirect detection methods
  - till geochemistry
  - indicator mineral surveys
  - geophysical surveys



Orogenic gold

Exploration parameters:
- Accretionary orogens
- Greenstone terranes
- Major shear zones
- Chemical/structural traps

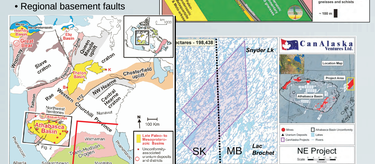


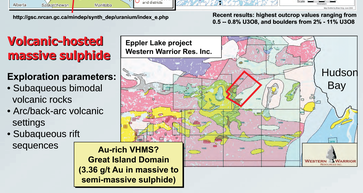
Iron formation hosted Au Great Island Domain

Uranium

Exploration parameters:
- Post-orogenic siliciclastic basins
- Graphitic metapelites in basement
- Regional basement faults

Wollaston Domain in Manitoba: How far below the basal unconformity?





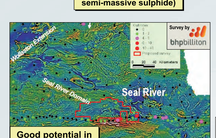
Volcanic-hosted massive sulphide

Exploration parameters:
- Subaqueous bimodal volcanic rocks
- Arc/back-arc volcanic settings
- Subaqueous rift sequences

Au-rich VHMS? Great Island Domain (3.36 g/t Au in massive to semi-massive sulphide)

Sediment-hosted base metals

Exploration parameters:
- Platform/rift sequences
- Restricted rift-basins
- High heat-flow
- Exhalative activity

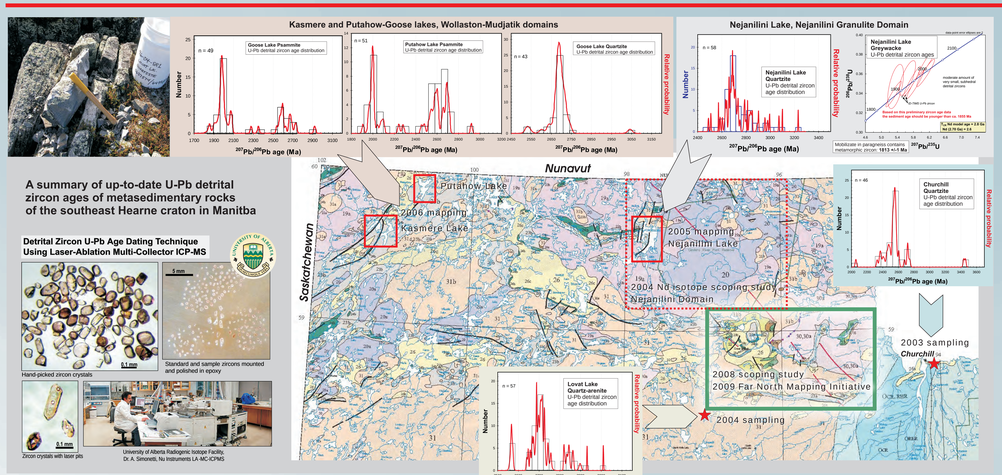


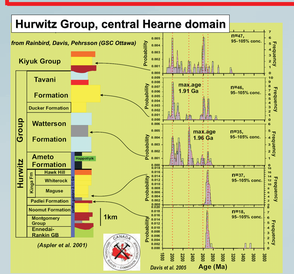
Good potential in Wollaston & Great Island domains

- Regional heavy mineral sampling
- Significant numbers of gahnite grains
- BHT or SHMS prospectivity

The MGS Far North Mapping Initiative

commenced in 2004 with a Sm-Nd isotopic study of archival granitoid samples collected by D. Schledewitz from throughout the NTS 64P map sheet, and was followed up with targeted bedrock and surficial mapping and sampling at Nejanilini Lake in 2005 and in the Kasmere and Putahow lakes area in 2006. From a bedrock geological perspective, the Nejanilini Lake study provides detailed insight into the tectonothermal evolution of plutonic and subordinate sedimentary cover rocks inboard of the Hearne craton margin, whereas the Kasmere-Putahow lakes studies provide insight into evolution of the mainly sedimentary cover rocks at the craton margin.





The Paleoproterozoic cover sequences

to the Archean Hearne craton in Manitoba bridge the areas where similar sequences have been defined separately: the Hurwitz Group of the central Hearne craton in Nunavut and the Wollaston Supergroup of the south Hearne craton in northeast Saskatchewan. These sequences record rifting, basin opening and basin closure during the breakup of 'Kenorland' and the assembly of Laurentia.

In Manitoba, the cover sequences consist of thick successions of quartzite, arkose, calc-silicate, psammite, semipelite and pelite (from base to top), which are intruded by younger, Paleoproterozoic, granitoid plutons, and were deposited as a passive-margin sequence along the rifted southeast margin of the Hearne craton, and/or within restricted extensional sub-basins inboard from the craton margin. U-Pb detrital zircon age data presented here are comparable to similar rocks from both the Hurwitz Group in Nunavut and the Wollaston Supergroup in Saskatchewan.

<u>The Bottom Line</u>: The Manitoba Geological Survey is ramping up for its 2009-2011 Far North Mapping Initiative. Main foci are the detailed mapping and mineral potential assessment of the supracrustal sequences partly coeval to the Wollaston and Hurwitz groups. In the Great Island area, these supracrustal rocks, together with their basement and younger intrusions, have excellent exploration potential particularly for uranium and gold.