Geo-Mapping Frontiers' Chantrey project: Reconnaissance geology and economic potential of a transect across the Thelon tectonic zone, Queen Maud block, and adjacent Rae craton

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INTRODUCTION

Geo-Mapping Frontiers' Chantrey project: Reconnaissance geology and economic potential of a transect across the Thelon tectonic zone, Queen Maud block, and adjacent Rae craton

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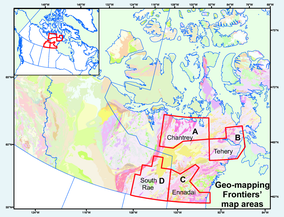
[1] Geological Survey of Canada, Ottawa (rberman@nrcan.gc.ca)
[2] McGill University, Montreal
[3] Geological Survey of Canada, Quebec City
[4] University of Manitoba, Winnipeg
[5] University of Saskatchewan, Regina

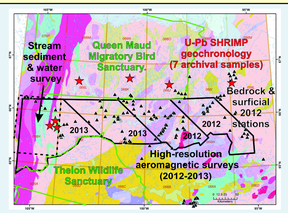
Geo-Mapping Frontiers was initiated under the Geo-mapping for Energy and Minerals (GEM) Program in order to upgrade understanding and help evaluate the economic potential of regions with little pre-existing information. Acquisition of new data, including fieldwork in the summer of 2012, was prioritized for four large regions of the Rae craton that had been previously mapped only at 1:1 million scale by helicopter surveys in the 1950s and early 1960s.



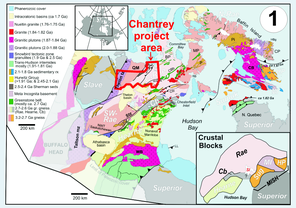
This poster summarizes the progress to date for the Chantrey project area in the northwestern Rae craton. Results presented here include:

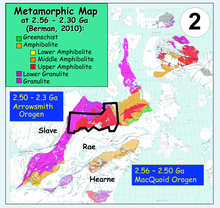
1) Compilation of legacy field data from the 1950s and 1960s
2) A high-resolution airborne magnetic survey
3) A Remote Predictive Map (RPM) of the region
4) Highlights of 2012 bedrock & surficial fieldwork along an ~500 km east-west transect located between the Queen Maud Migratory Bird Sanctuary and the Thelon Wildlife Sanctuary
5) Geochronology of 8 archival bedrock samples
6) Geochemical results of till samples, a stream survey across the western part of the area, and rock assays

These data sets, scheduled for release by March 31, 2013, permit significant improvement of the existing geological compilation map for the Chantrey region shown below (Wheeler et al., 1996).



REGIONAL SETTING



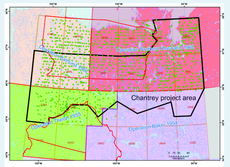


The Chantrey project area extends ~500 km across the 2.0-1.9 Ga Thelon tectonic zone, Queen Maud block (QM), and into the adjacent Rae craton which hosts highly prospective ca. 2.9-2.7 Ga greenstone belts and 2.1-1.9 Ga sedimentary cover.

The region has been reworked extensively at high grade during the ca. 2.5-2.3 Ga Arrowsmith orogeny (see metamorphic zones on the northwest side of Fig. 2). The extent of reworking of the project area during the 2.0-1.9 Ga Thelon and 1.9-1.8 Ga Hudsonian orogenies is poorly constrained by available data.

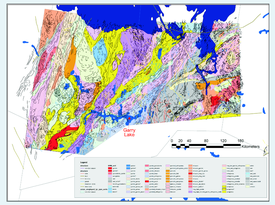
Fundamental questions impacting metallogenic models for the region are:
a) did the 2.45-2.40 Ga Sherman basin form in a continental rift (Schultz et al., 2007) or continental arc (rifted arc, back-arc? Berman et al., 2012) setting?
b) did ca. 2.0-1.9 Ga Thelon magmatism/tectonism form in an interior mountain belt (Chacko et al., 2000) or at a plate boundary (Hoffman, 1988)?

RPM ACTIVITIES



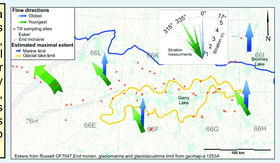
Legacy Data
A major component of the Operation GEM project involves the integration of legacy field data collected for 400 localities during the helicopter reconnaissance operations of the 1950s-1960s. These data are being used to help calibrate predictions of bedrock lithology based on geophysical and remotely sensed data. Work in is in progress to obtain the following from all archived materials: photographs, magnetic susceptibility, and composition via portable XRF. Zircon geochronology on six archival samples are presented in this poster. All data will be released within FY 2013/2014.

Remote Predictive Map
The predictive map shows units based on interpretation of enhanced magnetic, gamma ray spectrometer and LANDSAT data. Overlaid are structural form lines digitized from interpretation of magnetic and LANDSAT data. This map was produced in the Spring, 2012 in order to provide a detailed map that could be used both for ground-truthing during 2012 fieldwork and for improving the next generation of geological maps for the Chantrey region. This map was produced by J. Harris,C. Wagner and P. Behnia.

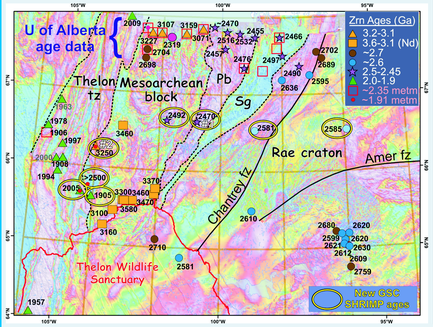


SURFICIAL GEOLOGY

Landforms and striations on polished surfaces show a dominant northerly flow direction. Youngest striations indicate a later north-northwesterly flow direction, resulting in palimpsest dispersal trains with a maximal 60° offset. Till offering a fresh C horizon within 20 cm or less and/or mudboils were readily available. Clay sediment cover was observed on a single occasion, near Bromley Lake. The presence of km-scale areas of outwash sediment related to the numerous segmented esker systems will need to be taken into account in the design of detailed till surveys.



GEOCHRONOLOGY

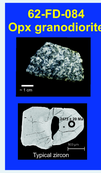


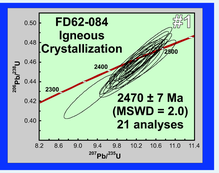
Recently acquired U-Pb zircon data (Tersmette, 2012; Schultz et al., 2007; this poster), combined with Nd model ages (Theriault et al., 1994) and regional aeromagnetic data, indicate five distinct domains. From west to east, these include:

1) 2.0-1.9 Ga Thelon tectonic zone
2) 3.2-3.0 Ga Mesoarchean block, dominated by granitoid gneisses hosting the Ni-Cu prospective Perry River ultramafic-mafic rocks
3) 2.53-2.46 Ga largely Opx-Mt-bearing, granitoid plutonic belt (Pb)
4) 2.45-2.40 Ga Sherman group (Sg; Schultz et al., 2007) metapelite and metagreywacke
5) 2.7-2.6 Ga granitoid gneiss of the Rae craton, cut by the Chantrey and Amer fault zones

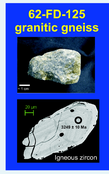
The regional continuity of these five domains highlights new understanding of the "Queen Maud block", originally defined as the region between the Thelon magmatic zone and the Chantrey fault (Heywood and Schau, 1978).

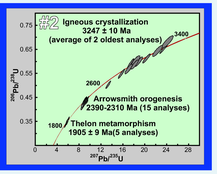
62-FD-084 Opx granodiorite



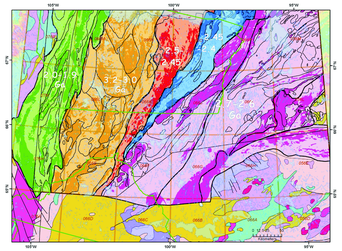


62-FD-125 granitic gneiss





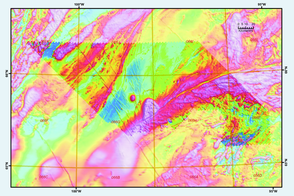
IMPROVED GEOLOGICAL MAP



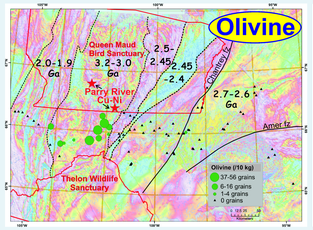
Work in progress to improve the geological map for the Chantrey region integrates interpretations of enhanced airborne magnetic data (including the new high-resolution survey below) with available geochronology and lithological information from the extensive archival collection and 2012 field observations. The five main crustal domains are defined by pronounced age differences. Coloured internal boundaries reflect significant contrasts in the magnetic data within each domain, with highs correlating with magnetite-bearing granitoid rocks and lows with granite, migmatite, and paragneiss. Further subdivisions within the Mesoarchean block reflect domains with variable structural grain.

High-resolution Aeromagnetic Survey
Early in 2012 approximately 63,000 line kilometres were flown in order to extend high-resolution data obtained to the south across the Amer fault zone and further west. An additional 92,000 line km will be flown in 2013 in order to form a continuous transect across the Queen Maud block and adjacent Thelon magmatic zone.

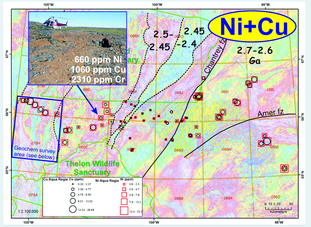
The new data help delineate regional and local structures including heterogeneities within the Chantrey fault zone, Paleoproterozoic supracrustal belts, a previously unrecognized north-striking dyke swarm north of the Amer fault zone, and supracrustal rocks thought to be high-grade equivalents of the Woodburn Lake Group south of the Amer fault zone.

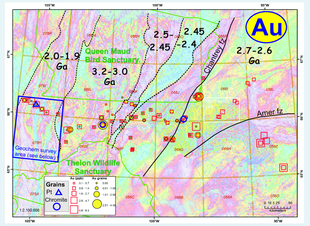


ECONOMIC POTENTIAL

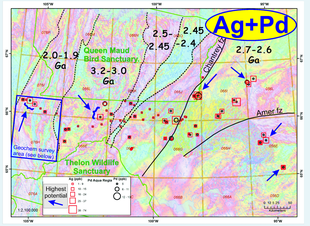


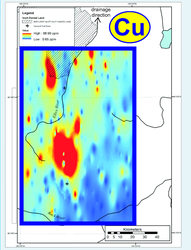
Base metal potential
Till heavy mineral analyses show a strong correlation between olivine and Mesoarchean block samples, but without other mantle xenolith indicators. Proximity to the Perry River Cu-Ni showings and N-directed glacial transport, indicate that potential mafic-ultramafic host rocks are more abundant than previously recognized. Base metals are elevated in this region, as well as to the west and east.





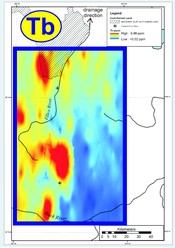
Precious metal potential
Till heavy mineral analyses show a number of locations with reshaped gold as well as one with native Pt (Thelon tz) and two with chromite. Till analyses indicate six main areas with elevated potential for precious metals. These areas generally correspond with areas of highest base metal potential as well.





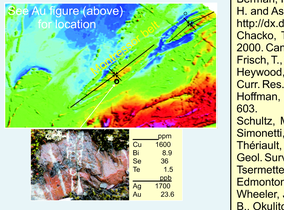
Stream sediment survey across the Thelon magmatic zone
A stream sediment and water survey completed in August, 2012 will provide a range of regional baseline geochemical and mineralogical data to mineral exploration companies considering new projects in under-explored areas of Nunavut. During the last two weeks in August, a contractor, Noble Exploration Services Ltd., collected 114 bulk stream sediment samples, 244 stream silt samples and 244 stream water samples in an area drained by the Ellice River and Back River. Analytical and mineralogical data for will be made available in the form of a GSC Open File on CD-ROM within FY 2013/2014.

Preliminary results shown here indicate fairly coincident regions with elevated Cu and the REE, Tb. Other elements such as Zn, Mo, and Ag show similar enrichment patterns.



Montressor Belt
Low-grade sedimentary rocks of the Montresor belt likely correlate with the ca. 2.1 Ga Amer belt 50 km to the south (Frisch, 2000). A moderately deformed supracrustal package lies structurally beneath the northeastern end of the belt. Recognized by Frisch (2000) to be older, possibly Archean, the sequence consists of siltstone, thin basalt flows and gabbro sills, and appears to be in structural contact with granitoid rocks to the north. Work is underway to better define the age of the sequence.

Near the southern margin of the belt, west of the Back River, a wide, quartz-hematite-epidote breccia zone forms a prominent ridge. Assays indicate low-grade hydrothermal mineralization, including anomalies in Cu, Ag, Au, Bi, Se and Te.



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