Physical rock property collection and characterization of the Abitibi greenstone belt

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Introduction

Metal Earth aims to better understand metal endowment in Canadian greenstone belts. This includes the Abitibi and Wabigoon greenstone belts located in Quebec and Ontario. In order to study these geologic regions, 13 transects have been placed throughout the two greenstone belts with a combination of geological and geophysical investigations. The resulting data is being augmented with petrophysical data both collected during the project and compiled from government organisations, namely magnetic susceptibility and density. Petrophysics is an important link when considering geophysical results in context with geology and geochemistry. Density measurements are valuable when fitting near-surface anomalies while modelling gravity data. Magnetic susceptibility is important to linking the magnetic information to mineralogy and geochemistry; however, values for this property vary on the centimeter scale, requiring the average of a large amount of data to understand the distribution of susceptibility values in specific lithologies (Smith et al., 2012). These physical rock propoerties will assist in future Metal Earth tasks such as inversion of potential field data.

Petrophysical data from the Rouyn-Noranda, Amos-Malartic, and Chibougamau transect were collected over the 2017 field season by 14 crews. Acquired petrophysical properties will be incoroporated with existing petrophysical databases in the Abitibi and Wabigoon.

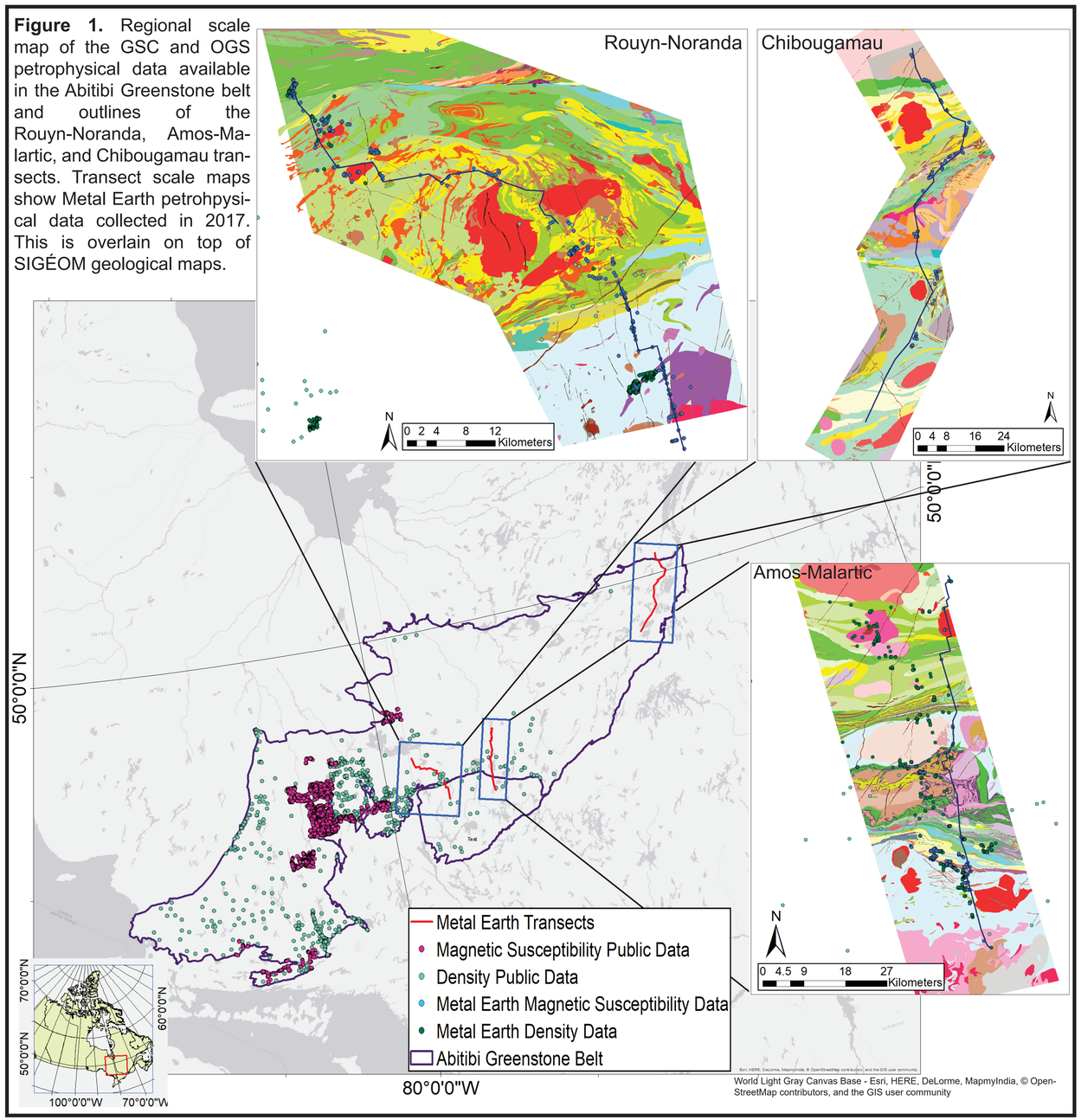
Data Collection: Density

Density measurements are being acquired through ALS Global and an in-house scale from samples collected from the field season. In both cases, a bulk sample density is measured using a direct measurement method in which samples were first weighed dry and then when submerged in water. Using the formula:

$$Density = \frac{m_a}{(m_a - m_w)}$$

Where m_a is the weight measured in the air and m_w is the weight measured when immersed in the water (ASTM International, 2009). Approximately 400 samples are to be measured by ALS Global. An additional, 200 samples were measured in-house. In-house, pure samples of barite, pyrite, quartz and calcite were measured initially and every 20 measurements there after to ensure consistency and accuracy across all of the measurements.

Figure 1. Regional scale map of the GSC and OGS petrophysical data available in the Abitibi Greenstone belt and outlines of the Rouyn-Noranda, Amos-Malartic, and Chibougamau transects. Transect scale maps show Metal Earth petrohpysical data collected in 2017. This is overlain on top of SIGÉOM geological maps.



Data Collection: Magnetic Susceptibility

Magnetic susceptibility measurements were acquired using 14 Terraplus KT-10 devices. At each outcrop, 10 measurements were taken to give a distribution of data representative of the outcrop. This includes taking readings of dykes crosscutting any outcrops. In total, 5105 readings were collected over 370 outcrops. These readings were then incorporated into UTM zone 17N and 18N databases that also includes mean, standard deviation, and the maximum and minimum range of magnetic susceptibility.

Figure 2a. Scale used to measure the density of rock samples in-house. **Figure 2b.** KT-10 magnetic susceptibility meter taking a measurement.

Future Work

In future field seasons, Metal Earth will increase the coverage of magnetic susceptibility and density measurements along the transects that are currently being mapped. Adittionally, 10 more transects will be geologically surveyed, and magnetic susceptibility and density measurements will be collected and combined with existing measurements from the public domain to better improve characterization of geological features for future gravity and magnetic modelling.

Acknowledgements

Special thanks to all Metal Earth geology field crews who helped collect magnetic susceptibility data and samples for density data

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