Acquisition and processing of gravity data for the Metal Earth project

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INTRODUCTION

The Metal Earth project aims to understand the underlying geological mechanisms that differentiates highly mineralized zones from poorly mineralized ones in Precambrian Rocks in the Canadian Shield. Geophysical prospecting methods such as reflection seismology, magnetotellurics, and gravity, as well as geological observations, have been or will be acquired along selected transects perpendicular to the geological strikes directions in the Abitibi and Wabigon areas. The Metal Earth project contains a total number of 13 transects. So far, we have contributed to the Metal Earth project via collecting and processing of gravity data across the Rouyn-Noranda (~93 line km), Amos-Malartic (~88 line km) ,and Chibougamau (~128 line km) transects.

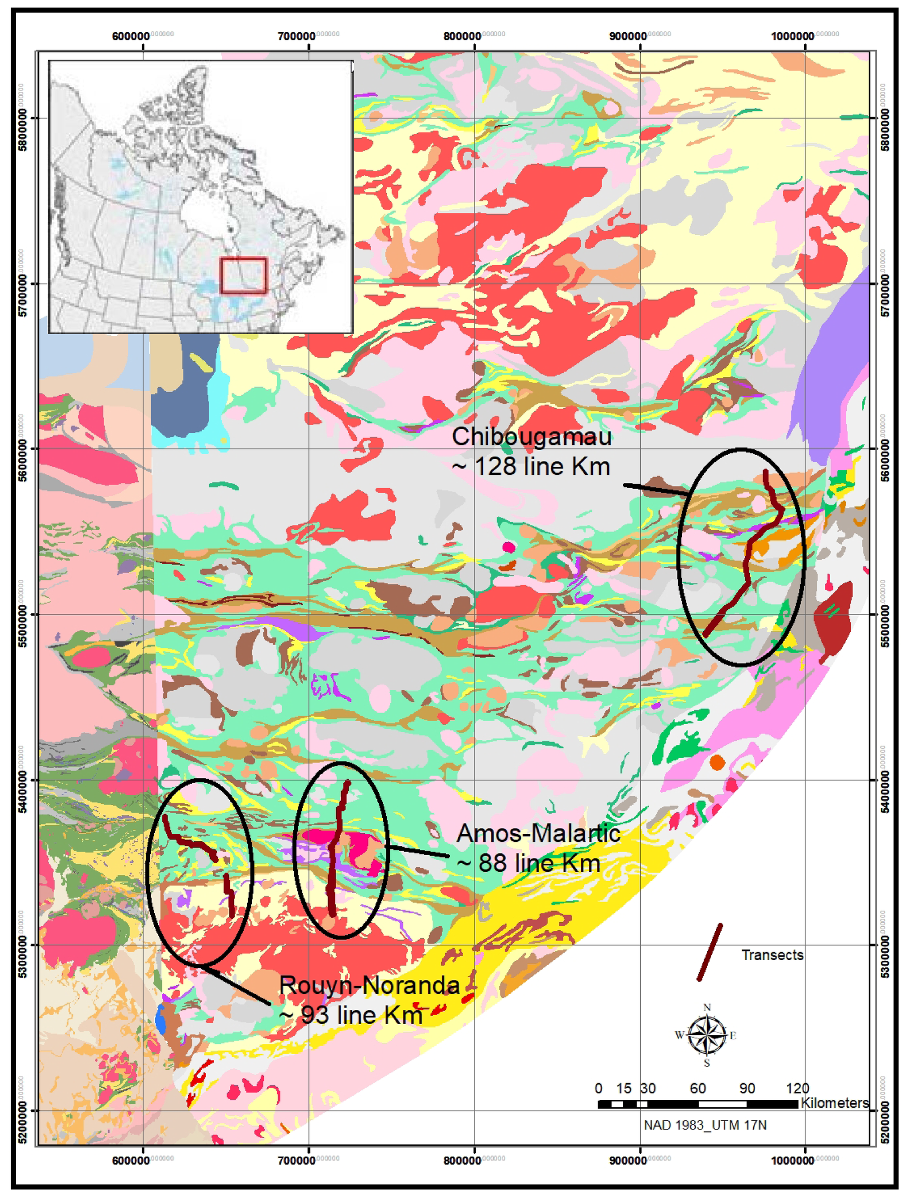

Fig.1. Three acquired transects displayed on geology map (Wheeler et al., 1996)

DATA ACQUISITION

The two geophysical crews acquired a total number of 1066 gravity observations during the first field season of the project, along the above three measured gravity transects from 23rd of June to 25th of August 2017.

The average spacing between observations is ~300m. The stations were mostly chosen alongside roads or within walking distance of roads. However, where the acquired data values appeared angular on plotted profiles, with sharp changes, infill data with 150 m spacing from adjacent stations were selected and additional data was acquired. Also, in order to have off-profile (three dimensional data), data were also collected on short traverses perpendicular to the main traverses when there was side-road access. These short profiles comprised three stations with 300 m spacing. All gravity readings were taken using two geophysics crews equipped with two Scintrex CG6 gravity meter instruments. Seven new base stations (control points) were established at strategic locations. The control point values were refined by tying them to existing base stations at the first day of data collection for each area.

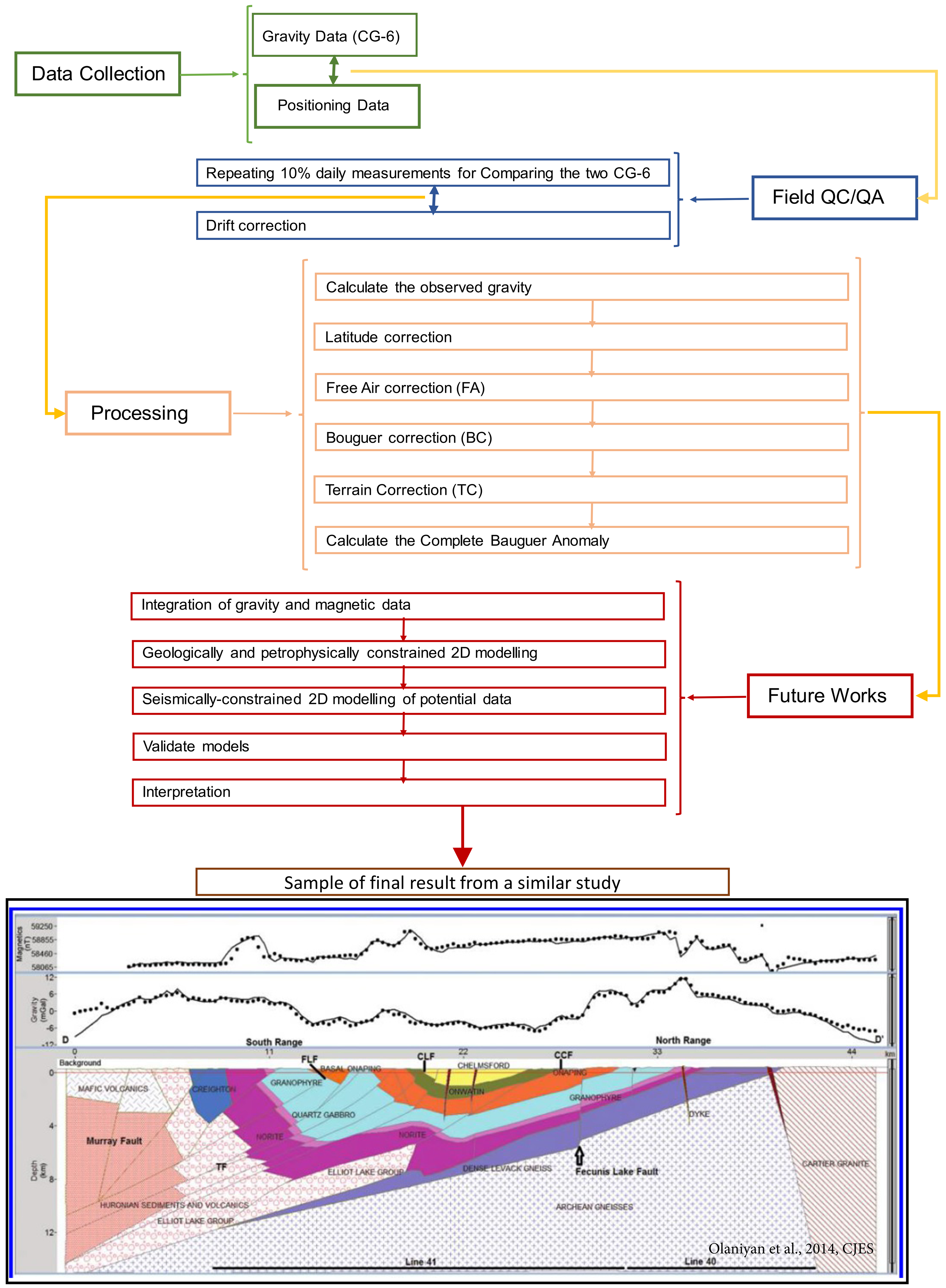

Fig.2. Flowchart displaying data acquisition, processing, and modelling in this study

DATA PROCESSING

The first step in field processing of the gravity data was to check for drift errors. Drift has been defined as the difference between the readings at the control points at the start and end of the day. These drifts were interpolated to the time that data was acquired at each station and used to correct for the drift of the instrument at that station.

The positional data from the differential GPS processing was then associated with each gravity reading.Therefore, each record consisted of station number, easting, northing, height and difference from the gravity at the base station.

The CG6 gravity meter uses the position and time from an internal GPS system to calculate an earth-tide correction. Subsequent field processing of the gravity data at each station follows the flowchart in Fig. 2, and the complete Bauguer anomaly calculated as follows (Nowell, 1999):

$BA = G_{obs} – FA – BC + TC - G_{theo}$

Fig.3. The CG-6 Gravimeter and Juniper system Geode collecting data on Chibougamau base station

SUMMARY

In the gravity data acquisition, a total number of 1066 gravity observations have been acquired, controlled and the complete Bouguer Anomaly has been calculated to compile an initial database. In addition, acquired gravity data will be combined with existed magnetic grids to perform seismically-geologically constrained 2D integrated modelling.

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