2.5D Forward Modelling of Magnetic and Gravity Data in SW-Sudbury, ON: Geological Insights from Different Observation Levels

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The Sudbury basin has been widely explored for mineral deposits from the late 1800s to now. Consequently, many parts of the basin include multiple generations of geoscientific surveying. In the particular case of geophysics, this is normally related to the evolution of surveying equipment (better equipment, improved navigation or, more powerful systems that provide deeper imaging). However, it is rare that the data users have the chance to visualize what each of these datasets can and cannot see, from a geological point of view. The current work focuses in the Drury Township (SW-lobe of the Sudbury basin). Data includes three resolution levels of gravity and magnetic data, which include both airborne and ground. For magnetics, we utilized the Geological Survey of Canada (GSC) regional airborne magnetic database (average 800m line spacing, fixed wing, 200-300m elevation), followed by high-resolution helicopter data (200m line spacing, 50m flying height), as well as two ground profiles over the two main sections being studied. For gravity, we used the GSC ground gravity database (average 2km spacing), a few higher resolution traverses collected by McMaster University in 2009-2010 within the township (average 100-200 m spacing), followed by two ground profiles collected in 2017 at 100 m spacing along the main traverses. The two sections were modelled utilizing the increasing resolution datasets. As expected, the regional surveys provided with some basic locations of contacts and their geometry, however, the ground based surveys gave significantly more detail. The cross sections were linked to bedrock mapping (at 1:20,000 scale) performed by the Ontario Geological Survey (OGS) and Laurentian University in the area. In general, the airborne surveys were able to broadly map regional lithological contacts and dykes, but the ground surveys did consistently show more detail. This study demonstrates that comparing datasets with different resolution power along the same traverses is a powerful tool that can help exploration companies to plan new surveys more effectively based on their exploration goals.