



Fault geometry and deformation at the SW lobe of the Sudbury Basin, Canada: Insights from potential field modelling

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The 1.85 Ga Sudbury Igneous Complex, Ontario, Canada represents an impact melt sheet that has been distorted by post-impact deformation into a basin shape, the Sudbury Basin. Major faulting was achieved on ENE-WSW striking fault planes, parallel to the long axis of the Basin. The SW-lobe of the Basin shows substantial magnitudes of strike separation of lithological contacts. The geometry of the impact melt sheet and fault surfaces at depth is essential in reconstructing the complex deformation history of the Sudbury Basin.

The area of the project has been surveyed by a wealth of airborne geophysical data (high resolution magnetic, gridded at 20 m cell size, new 20 m resolution digital elevation data, regional radiometrics). Existing ground gravity from the Geological Survey of Canada (~1000 m between stations) was merged with new data collected during September 2009. The new profiles had an average spacing of 200 m between stations. Both the magnetic and gravity data exhibit major anomalies west of the SIC-footwall contact, on an area mapped as Neoproterozoic basement.

Multiscale edge detection algorithms over the entire area were combined with standard 2D modelling of a number of 2D sections both across and parallel to the SIC-footwall contact. The sections were subsequently integrated in 3D, which allowed a valuable definition of lithological contacts and mostly the NE-SW striking fault system predominant in the area.

The 3D model shows major fault systems crosscutting the SW-lobe of the Sudbury Impact Structure. Based upon the geometry and distribution of lithologies at depth, it is proposed that movement on fault surfaces was predominantly top to the north reverse faulting and only a limited amount of strike-slip kinematics.

This integrated model constrains fault geometry and deformation history of the SW lobe of the Sudbury Basin, and will constitute the basis of further 3D modelling over the entire Basin.