Determining the 3D structure of the Bathurst Mining Camp: results from the TGI 3 Appalachians Project

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The Geological Survey of Canada's 2005–10 TGI 3 program was devised to help sustain base metals reserves in existing mining communities. For the Bathurst Mining Camp (BMC) the primary aim was to reduce the inherent risk in exploration by improving the understanding of the 3D geological structure to provide a framework to vector in on mineralization.

The BMC is host to numerous known base metal deposits, the great majority of which occur at or very near the surface. As with many mature mining camps, the likelihood is that if there are significant deposits awaiting discovery, then they will be hidden or deeply buried. Although the distribution of units at the surface of the BMC is reasonably well established, prior to this study, the trace of these units to depth has been highly speculative. The prevalence of steeply dipping fabrics and poly-phase deformation of the BMC hampers structural interpretation and precludes accurate projections of deeply buried mineralized horizons. Integration of multiple geophysical sources with geologic data has constrained inversions to provide a realistic 3D model for the region.

The data used for the modelling are the 1994 EXTECH II airborne geophysical survey for total field magnetic field, resistivity and gamma spectrometry, TGI 3 2006–2008 ground gravity surveys, and the Government of New Brunswick's digital elevation model. These data are reprocessed and combined to produce a series of transects across major structural and/or economically significant parts of the BMC.

Significant implications from the 3D geological model include that: (i) the Flat Landing Brook Formation extends to below 10 km in the central portion of the BMC, and the Nine Mile Synform amplitude in excess of 5 km; (ii) a hidden ophiolite underlies the southeast portion of the BMC with the Tomogonops Formation its cover, and these units are thrust beneath the Tetagouche and Sheephouse Brook groups; and (iii) the Miramichi Group is tectonically emplaced as a thin sheet over the younger Sheephouse Brook felsic volcanic rocks and associated Chester ore horizon, effectively increasing the area of high mineral prospectivity by approximately 35%.

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