Vallée MA, Morris WA, Perrouty S, Lee RG, Wasyliuk K, King JJ, Ansdell K, Mir R, Shamsipour P, Farquharson CG, Chouteau M, Enkin RJ, Smith RS, 2019, Constrained geophysical inversion contribution to mineral exploration: lessons from the Footprints project, Abstract, GAC-MAC, Québec, QC

Geophysical inversions are techniques used to create geophysical models from geophysical data. Constrained geophysical methods integrate geological information in the inversion process to produce more meaningful results. This study analyses the validity of this assertion using real data sets. In the context of the NSERC-CMIC Mineral Exploration Footprints project, constrained geophysical inversions were applied to three mining sites: a gold site (Canadian Malartic), a copper site (Highland Valley) and a uranium site (Millennium-McArthur). The same methodology was applied at the three sites: after unconstrained inversions of magnetics (and gravity for the copper site) for each site, constrained inversions were developed based on physical property measurement and analysis, which provided the relationship between the geology and the geophysics, and on geological boundaries developed from surface and borehole geological control. In some cases, the geological model was improved using iterative geophysical forward modeling. At the gold and copper sites, the geology is mainly interpreted from airborne magnetic grid, using sparse outcrops as constraints; therefore, the geological model is consistent with the geophysical inversion. The gold site contains units with high magnetic susceptibility that mask the more subtle magnetic signature of the deposit. At the copper site, the contrast in physical properties (density and magnetic susceptibility) in the different units was subtle, and the variations in the geophysical signature were mainly explained by intraformational differences. At the U site, the main susceptible units are buried below a thick sedimentary cover and extend at great depth and the magnetic signal is weaker. Consequently, the geophysical interpretation was more challenging. However, the final interpretation is achieved within the limitations of the method.

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