1D and 3D Inversion and Modelling of Airborne Transient Electromagnetic and Magnetic Data From Over a Potential Volcanogenic Massive Sulphide Deposit, Cripple Creek, Newfoundland

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SUMMARY

Electromagnetic (EM) methods, including transient electromagnetics (TEM), and magnetic methods are commonly used in mineral exploration. In this study, airborne TEM, ground-based frequency-domain EM and magnetic data are used to investigate possible mineralization zones suggested by the airborne TEM data on the Cripple Creek Property, in the Gander area, Newfoundland, Canada. This study's main goal is to invert the airborne TEM data in 1D to recover the conductive structures that are possible mineralization zones. Airborne magnetic and ground-based frequency-domain EM data are also considered. The ground-based frequency-domain EM data, which are available for just a limited area, and the TEM responses are compared and their respective responses shown to be mostly consistent. A 3D inversion of the magnetic data not only helps better define the physical properties of the targets identified from the EM data-sets but also helps define the background regional geology. The geometry of a mineralized zone suggested by the TEM inversion is then refined by further forward modelling (using the software "Maxwell"). The resulting models are compared and discussed in terms of reliability of the inversion. The results show that the 3D models of the conductivity generated from the stitched together 1D TEM inversion results recover the near-surface structures quite well but become inaccurate at depth. It is shown that the models resulting from the 3D magnetic inversion are partially consistent with the TEM results. This is possible because of the physical property of the structure of interest, which means that the area of interest does not show the same magnetic properties everywhere. Both magnetic and conductive features are only coincident on one of the flight lines. However, when the magnetic inversion result is considered separately, it helps to reveal the magnetic properties reasonably well around the structure of interest.

Keywords: Airborne Transient EM, Magnetic, Inversion