Targeted investigation of base metal mineralization beneath glacial cover using magnetic field methods, petrophysics, and petrology

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Magnetic anomalies near areas of known base metal sulphide mineralization were seen in regional airborne data from the Bay of Chaleur in northern New Brunswick, Canada. A ground magnetic investigation was performed over this area to better characterize the source of these regional anomalies and to investigate their relation to the sulphide mineralization. The mineralization is hosted in Late Silurian to Early Devonian volcano-sedimentary stratigraphy and has been identified in several boreholes. The local geology consists of highly magnetic basalts, volcanic breccias, rhyolites, tuffs, siltstones, and limestones. This volcano-sedimentary stratigraphy was deposited in a half-graben shallow marine setting, where hydrothermal fluids transported sulphide mineralization through a fault network. The mineralization has been identified as strata-bound replacement style and vein mineralization. Chlorite and ankerite alteration are observed in core and are closely related to the occurrence of sulphide mineralization. The ground magnetic surveys show that anomalous regions are characterized by a total magnetic field of approximately 54,100 nanotesla, whereas the shallow alteration associated with mineralized zones are approximately 53,450 nanotesla. These magnetic anomalies are significant, being close to 700 nT greater than the surrounding area. The ground magnetic data were upward continued to a height of 100 metres and was successfully compared to the airborne magnetic data. While the airborne magnetic data was downward continued and all details matched the ground magnetic features. The few occurrences of bedrock outcrops on the property confirm the occurrence of rhyolites and tuffs, as well as the presence of sulphide mineralization. However, much of the study area is densely vegetated and covered by glacial sediments up to 25 metres thick. Thus, to better interpret the geology and occurrence of the sulphide mineralization, several boreholes were examined based on magnetic susceptibility and further correlated with the borehole logs and observations of lithologies in core. It was found that individual basalt flows have higher magnetic susceptibility, by several orders of magnitude, than the alteration zones and felsic tuffs where mineralization occurs. This finding indicates that the magnetic anomaly identified, both in the regional magnetic survey and the ground survey, is likely caused by the occurrence of basalts. Further characterization of the host rocks of the sulphide mineralization and the alteration will be accomplished by incorporating historic petrophysical studies of density and conductivity.