

Magnetic Signatures of Late Archean Intrusions in the Abitibi Greenstone Belt and Implications for Exploration

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Abstract

The Abitibi Subprovince encompasses numerous calc-alkaline to alkaline intrusions (2685 to 2670 Ma) associated with major gold deposits. The highly variable petrology of these plutons, their emplacement dynamics and their magmatic hydrothermal evolution have been the focus of studies in an effort to renew our understanding. The study of geophysical data, particularly the magnetic signature of these intrusions, enables us to attempt an early diagnostic on their metallogenic potential. The zoning of magnetic susceptibility values may indicate the presence of a redox front with, more specifically, the transition from a magnetite zone to a hematite zone. The latter is critical in terms of mineral potential, since the gold potential is particularly influenced by the oxidation state of magmas. The study is done using governmental datasets (MRN, GSC). The aeromagnetic grid is processed in Oasis Montaj software. The main treatment is to apply a filter that cut the high wavelengths and keep the low wavelengths of the magnetic susceptibility signal. This method generates detailed images of the magnetic susceptibility variations in and around the plutons. From these images, field work (Lac Bachelor) and bibliography, correlations between lithology, alterations and magnetic susceptibility are established and lead to a classification of the gold-bearing plutons. Preliminary results show at least two categories: (1) plutons with low magnetic susceptibility of the core and high susceptibility of the edges (e.g.: Lac Bachelor); (2) plutons with high magnetic susceptibility of the core and low susceptibility of the edges (e.g.: Beattie). On top of the regional scale interpretation, the Lac Bachelor example shows that the magnetic susceptibility can be used at the deposit scale to identify targets. This is being tested with a drilling program; first results are really encouraging.

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