

Petrophysics revealing alteration zones of ore deposits

S. MERTANEN^{1*} AND F. KARELL¹

¹*Geological Survey of Finland, P.O. Box 96, 02151 Espoo, FINLAND (*correspondence: satu.mertanen@gtk.fi)*

Circulation of hydrothermal fluids and consequent fluid–rock interaction can significantly modify the physical properties of ore-bearing deposits. These processes typically also produce changes in ferromagnetic minerals. Detailed petrophysical investigations (density, magnetic susceptibility, remanence and AMS) at outcrop scale can identify and characterize differences between the barren host rock and ore-bearing alteration zone. Rock magnetic tests give information about magnetic minerals and their grain sizes which have relevance in investigating the relation of induced and remanent magnetization, an important factor for interpretation of magnetic anomalies and for 3D modelling.

We have studied orogenic gold or porphyry copper type Cu-Au deposits in Satulinmäki, Kedonojankulma and Uunimäki of the Häme Belt, in Jokisivu of the Pirkanmaa Belt, in Saattopora, Sinerjärvi and Pahtavaara in the Central Lapland Greenstone Belt (Airo and Mertanen 2008, Mertanen and Karell, 2011, 2012, 2015) and in Pampalo in the Hattu greenstone belt (Mertanen and Karell, 2014). In all studied formations the magnetic properties have altered due to fluid infiltration. In Häme and Pirkanmaa deposits the auriferous shear zones show higher magnetizations than the host rocks due to formation of pyrrhotite. In Pampalo the auriferous rocks have partly lost their magnetization when pyrrhotite was formed at the expense of magnetite.

Remanence directions coupled with AMS directions suggest that in most cases tectonic movements post-date the mineralization event. However, in the deposits of the Central Lapland Greenstone Belt and in part of the Uunimäki deposit, preservation of a late Svecofennian (ca. 1.8 Ga) remanence direction implies that the mineralization occurred after the last ductile tectonic movements.

References:

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