Maghemite lag: Formation and implication for mineral exploration

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Maghemite is the cubic form of Fe_2O_3 and isostructural with magnetite. It is a common mineral in weathered profiles in arid, semi arid, subtropical and tropical environments but more rare in cooler humid regions (Eagleton, 1988).

The formation of maghemite has been attributed to aerial oxidation of magnetite, dehydration of lepidocrocite (-FeOOH) or goethite and transformation of goethite to maghemite under arid climatic conditions. It is concentrated in the course grains of bed rock remnants or grains formed at weathering profiles by accumulating surface material classified as lag. Lag" was defined by Bates and Jackson (1980) as a general term applied to coarse grained (> 2 mm), hard, but partially weathered rock fragments which concentrated at surface through attrition of finer materials. Studies shove that ferruginized and maghematized lag can attract elements from subtle anomalies and reveal the metal sources with elevated contrast compared to ill nature soil and aeolian materials (Alipour *et al*., 1994 and 1995; Robertson, 1989 and 1995).

Therefore, its unique characteristics such as abundance in arid regions, covered deserts or cultivated lands, converts it to an excellent sampling media. Comparing geochemical behavior of maghematized and non-maghematized materials, maghematized lag can be sampled at first stage of regional exploration to delineate potential targets and non or weakly maghematized lag could be used in follow up stages to locate the source of the anomalies.

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Geochemistry of REE and trace elements and their application in exploration of Qolqoleh orogenic gold deposit, northwestern Iran

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Qolqoleh gold deposit is located in northwestern part of the Sanandaj-Sirjan zone, northwest of Iran. Gold mineralization in the Qolqoleh deposit is almost entirely confined to a series of steeply dipping ductile to brittle shear zones generated during late Cretaceous-Tertiary continental collision between the Afro-Arabian and the Iranian microcontinent of Mesozoic volcano-sedimentary sequences.

Rare earth elements (REE), along with Sc, Th, Zr, Al_2O_3 and TiO_2 are used to identify two volume-important protoliths for alteration and mineralization at the Qolqoleh gold deposit. Aluminum, P, Ti, Y and Zr ratios are relatively constant, suggesting that these elements were the least mobile during hydrothermal alteration associated with ore genesis. Using Al_2O_3 as the immobile component, there is evidence for mobility of REE, particularly of light REE (LREE), TiO_2, and Zr in different styles of alteration. The altered host rock units (metavolcanic and metasedimentary rocks) show a LREE depletion, which clearly correlates with the grades of gold mineralization. Extended element patterns normalized to chondrite indicate the systematic changes of REE abundances according to intensity of deformation and subsequent hydrothermal alteration. Depletion of LREE, as measured by a decrease in $(La/Yb)_N$, increases with increase in Au content for gold ores derived from both mafic to felsic volcanics and sedimentary protoliths. However, depletion of REE in ore-bearing zone, and distinct differences in REE pattern between mineralized metavolcanic and metasedimentary host rocks and unaltered footwall and hanging-wall rocks could be used as a suitable primary tool for lithogeochemical exploration of Qolqoleh-type gold deposits.