

Electrolyte ion binding at iron oxyhydroxide surfaces

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Electrolyte ion loadings at the surfaces of synthetic goethite (α -FeOOH) and lepidocrocite (γ -FeOOH) nano-sized particles that were pre-equilibrated in aqueous solutions of 10 mM NaCl and NaClO₄ were investigated by means of cryogenic X-ray photoelectron spectroscopy (XPS) [1]. Atomic concentrations of Cl⁻ and ClO₄⁻ in acidic pH regions and of Na⁺ cations [2] in alkaline pH regions were correlated to potential determining ion (*p.d.i.*; H⁺, OH⁻) adsorption obtained by potentiometric titrations. (Fig. 1)

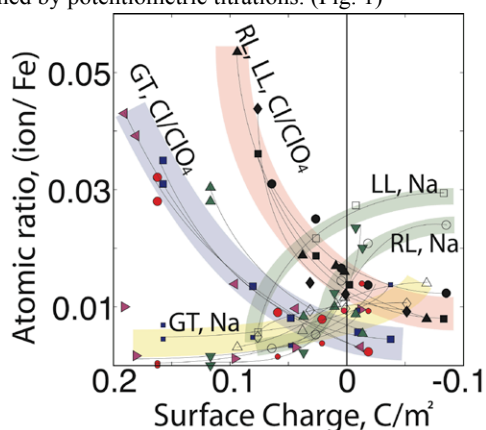


Figure 1. Ionic surface loadings as a function of surface charge developed on rod- (RL) and lath-shaped (LL) lepidocrocite, as well as in two different goethite with specific surface area of 69 (GT69) and 122 (GT122) m²/g.

The data revealed a strong dependency of *p.d.i.* and electrolyte ion adsorption on mineral particle morphology, as seen by comparison of rod- (RL) and lath-shaped (LL) lepidocrocite particles, as well as on surface roughness, as in case of samples with different surface porosity (Fig. 1). LL particles with a predominantly proton-inactive (010) surface acquired greater sodium but lower anion loadings. GT122 particles contained greater surface roughness and thereby acquired greater *p.d.i.* and anion loadings than GT69.

[1] Shchukarev (2010), *Journal of Electron Spectroscopy and Related Phenomena* **176**, 13–17. [2] Shimizu, Shchukarev, Kozin and Boily (2012), *Surface Science* **606**, 1005-1009.

Petrogenesis of mafic-ultramafic rocks from the Berit metaophiolite massif: implications for REE, PGE, base metal and Al-rich chromitite composition

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Mantle heterogeneity in terms of corundum bearing mafic rocks, as including eclogite and/or pyroxenite within peridotite is observed in Berit massif. The bulk chemical analytical results of the patterns from mafic and ultramafic rocks indicate that they relatively enriched in the REE-PGE and base metals. The refertilized and inhomogeneous mantle is capable of yielding more voluminous and compositionally diverse magma than normal. The REE and PGE distribution of high-Al chromitite patterns and mafic layers in Berit peridotite are, therefore, very important geochemical tool for determining the upper mantle heterogeneity. REE values of mafic rocks are between (La/Ce: 0.40-0.69, Ce/Yb: 1.05-16.29, La/Yb: 0.44-7.62, La/Sm: 0.88-6, La/Lu: 2.8-55) 12-165 ppm. The LREE-enrichment in peridotites are explained by interaction of the peridotites with LREE-enriched melts. The REE and PGE are generally considered to be relatively immobile during low-temperature alteration. However some elements, such as Eu, can be modified some what by hydrothermal processes. It has been determined the positive Eu anomalies in the normalised diagram for some chromitites and ultramafic mafic rock samples (dunite-pyroxenite-gabbro-diabase) from Berit metaophiolite. A relative enrichment in siderophile elements (as ppm) in the both of mafic and ultramafic rocks and in the high-Al chromitites for base metals (Ag: 0.3-0.9, Bi: 0.03-0.11, Cu: 13-2626, Ni: 134-7172, and Te: 0.1-3 ppm) is also determined. It is noteworthy that especially Pt (2.5 ppm) and Pd (4 ppm) enrichments are encountered in the high-Al chromitites.

Two chromite generations are determined in Berit: 1) primary spinel component-rich (Al₂O₃- and MgO-rich compositions); 2) developed on the boundary of grains of chromite I – chromite and II enriched by chromite and magnetite minerals (in Fe, Cr and Ti). The association of base metals (Cu, Ni, Bi, Se, Te, Au, Ag) and Ti as well as Pd and Pt itself in composition of accessory minerals has been suggested that they may be brought into chromitites by fluids in basic composition.