

Geochemistry of natural IOH in supergene ore deposits by TEM analyses.

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Iron –oxy(hydr)oxides (IOH) commonly occur in the top residual part of Supergene Ore Deposits (SOD), in duricrusts, gossan, ferricrete or “limonite” zones. IOH are seldom chemically pure; in fact, they generally hosts a wide range of metal cations, isovalent (e.g. Al³⁺, Co³⁺, Sc³⁺) or heterovalent (e.g. Ni²⁺, Zn²⁺, Cd²⁺) with Fe³⁺ in its structure, largely as a consequence of the high specific surface areas of its particles and strong affinities for the surface binding heavy metals.

For this study, several specimens from different SOD were selected: 2 samples from Çaldağ and 2 from Karaçam Ni-laterite deposits (Turkey); 2 samples from the Zn-nonsulphide deposit of Hakkari (Turkey) and 2 samples from the bauxite deposits of Dragoni and Maiorano (Italy). Preliminary mineralogical, geochemical and petrographic analyses had already been carried out using standard techniques (ICP-AES, XRD, SEM-EDS, EPMA, LA-ICPMS). The analytical results were used as background to the new analyses and the ubiquitous presence of silicon is striking. It was suspected that Ferrihydrite would be the host for silicon, however these samples are shown to be crystalline goethite and hematite.

Here, we present the results of more detailed study using TEM analysis (EDX, EDX mapping, EELS/EDX, HR-TEM, SAD, BF and DF), with the aim of resolving the nature of silicon in the minerals studied. Combined TEM analyses reveal that nano-to-microcrystalline goethite and hematite host silicon that is not resolvable as discrete quartz and hence appears to substitute in the structure of the IOH. Further study is planned to resolve the nature of the silicon coordination.