Electron Microscopic Investigations of Iron Oxyhydroxides and Accompanying Phases in Lateritic Iron-crust Pisolites

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Abstract: Pisolites from an iron crust in western Senegal were studied by conventional and high-resolution electron microscopy to determine their internal structure and the genetic processes that led to their formation. Each pisolite consisted of a concentric structure of hematite rimmed by goethite. Two types of goethite were distinguished: (1) large (≈0.6 μm long and 0.06 μm wide), euhedral laths arranged in fibrous aggregates of slightly misoriented grains devoid of internal defects as shown by their two-dimensional lattice images, and (2) a matrix of smaller (≈400 Å), anhedral grains surrounded by the larger laths. Based upon the crystal habit and the presence or absence of internal alveoles, the large goethite laths probably grew at the expense of the matrix goethite. Poorly crystalline kaolinite, presumably formed from well-crystalline precursor kaolinite, and clusters of partially dissolved quartz grains were also imaged. In addition, two uncommon phases were found—maghemite in topotactic relationship with hematite and a layered, Fe-rich, mica-like mineral with a 2*M* superstructure. Unlike kaolinite, this latter phase was likely in equilibrium with iron oxyhydroxides. Substituted Al probably was released during goethite recrystallization, and mass transfers probably took place through the heterogeneous porosity (i.e., large voids and cracks coupled with fine pores) revealed by transmission electron microscopy.

Key Words: Goethite • Hematite • Iron • Kaolinite • Laterite • Lattice fringe image • Pisolite • Transmission electron microscopy

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