
Transformation of Iron-Bearing Kaolinite to Iron-Free Kaolinite, Goethite, and Hematite

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Abstract: Ferruginous clay partings in limestones of the marine, largely evaporitic, Upper Triassic Mohila Formation (Makhtesh Ramon, Israel) contain hexagonal plates and cube-like bodies up to one millimeter across. Analyses by electron microscopy, infrared and Mössbauer spectroscopy, and X-ray powder diffraction indicate that the matrix contains Fe-rich anhedral kaolinite, up to 100 μm in size; the hexagonal plates are composed of euhedral, Fe-free kaolinite covered with well-developed acicular goethite and platy hematite (0.5 to 2 μm in size), and the cubes consist of fine-grained goethite with minor amounts of kaolinite. The anhedral kaolinite appears to be detrital, the hexagonal plates to be authigenic, and the cubes to be pseudomorphs after pyrite. Oxidation appears to have altered Fe-rich kaolinite and pyrite to Fe-free kaolinite, goethite, and hematite and was accompanied by recrystallization and pseudomorphic replacement. The alteration process was slow and was probably induced by a small increase in pH and in the Al/Fe ratio, resulting from oxidation of reduced components (pyrite, ferrous carbonate, organic matter) in a semiclosed, sediment-mud system. Overlying kaolinitic flint clay deposits may be the final product of a similar process.

Key Words: Goethite • Hematite • Iron • Kaolinite • Mössbauer spectroscopy • Oxidation • Pseudomorphism

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