
Weathering of Basalt: Formation of Iddingsite

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Abstract: The formation of iddingsite by the oxidative weathering of Fo_{80} olivine begins by solution of Mg from planar fissures, 20 Å wide and spaced 200 Å apart, parallel to (001). Oxidation of Fe within the remaining olivine provides nuclei for the topotactic growth of goethite. Cleavage cracks <50 Å in diameter allow Na, Al, and Ca from adjacent minerals, particularly plagioclase, to enter the altering olivine while Mg and Si diffuse away. In the early stages of weathering, strips of Fe-rich smectite (saponite), 20– 50 Å wide and 1– 7 layers thick, form bridges 50– 100 Å long across the planar fissures. Dioctahedral smectite crystallizes on the margins of wider cleavage-controlled fissures; with further weathering halloysite is formed away from the fissure walls. In the ultimate stages of alteration, the saponite and dioctahedral smectite are lost, leaving a porous, oriented aggregate of goethite crystals each measuring about $50 \times 100 \times 200$ Å (X, Y, Z, respectively), with sporadic veins of halloysite crossing the pseudomorph.

Key Words: Goethite • Iddingsite • Iron • Olivine • Scanning electron microscopy • Transmission electron microscopy • Weathering

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