Weathering of Hornblende to Ferruginous Products by a Dissolution-Reprecipitation Mechanism: Petrography and Stoichiometry

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Abstract: Hornblende of the Carrol Knob mafic complex (southern Blue Ridge Mountains, North Carolina) has weathered under humid, temperate conditions. Hornblende weathering appears to have been a dissolution-reprecipitation reaction, in which hornblende dissolved stoichiometrically, and the ferruginous and aluminous weathering products (goethite, gibbsite, and kaolinite) precipitated from solution (neoformation). During the earliest stage of alteration, ferruginous weathering products formed as linings of fractures within and around crystals and cleavage fragments of hornblende. Side-by-side coalescence of lenticular etch pits during more advanced weathering produced characteristic "denticulated" terminations on hornblende remnants in dissolution cavities bounded by ferruginous boxworks. Dissolution cavities are devoid of weathering products. Small "pendants" of ferruginous material project from the boxwork into void spaces. Because these products are separated from the hornblende remnants by void space, they must have been produced by dissolution-reprecipitation reactions. Complete removal of the parent hornblende left a ferruginous microboxwork or "negative pseudomorph." Only Al and Fe were conserved over microscopic distances; alkali and alkaline-earth elements were stoichiometrically removed from the weathering microenvironment during the weathering process.

Key Words: Gibbsite • Goethite • Hornblende • Iron • Kaolinite • Neoformation • Petrography • Scanning electron microscopy • Weathering

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