
Weathering of Enstatite to Talc Through a Sequence of Transitional Phases

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Abstract: Orthopyroxene (En₈₅) weathers initially by vacancy diffusion, and through this process hydration occurs and a sequence of biopyriboles develops, culminating in a talc-like layer silicate whose structure joins coherently to the orthopyroxene structure. Oxidation of Fe²⁺ to Fe³⁺ colors the altering pyroxene yellow. The 'talc' does not remain in structural coherence with the pyroxene after it has exceeded a few tens of nanometers in size; it is replaced by a mixture of talc and smectite. In some areas the mixture has an epitactic relation to the pyroxene, but commonly it fills faceted solution holes without crystallographic relation to the parent structure. Continued weathering extends the yellow zone at the periphery of the orthopyroxene, and the alteration product increases in smectite and decreases in 'talc.' During this stage of the reaction, MgO and SiO₂ are released to form colorless true talc around the altering pyroxene. Eventually, the yellow alteration may become a smectite pseudomorph after orthopyroxene or it may be changed entirely to a mixture of vein talc and iron oxides. The complete conversion of orthopyroxene to talc plus oxides thus takes place through three sequential mineral reactions without the development of a noncrystalline phase.

Key Words: Biopyribole • Enstatite • Smectite • Talc • Transmission electron microscopy • Weathering

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