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# Formation and Growth of Smectites in Bentonites: A Case Study from Kimolos Island, Aegean, Greece

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**Abstract:** The low-temperature alteration of a rhyolitic rock from Kimolos Island, Aegean, Greece, yielded an alteration profile characterized by gradual transition from fresh glass to bentonite containing homogeneous Chambers-type montmorillonite and then to a mordenite-bearing bentonite. Both mordenite and smectite were formed from poorly crystalline precursors, which probably had compositions comparable to that of the crystalline end-product. However, their composition may have been modified to some degree after reaction with the fluid phase. Particle length and width measurements of smectite crystals yielded lognormal profiles, which suggest supply-controlled crystal growth in an open system or random ripening in a closed system. The former mechanism is in accordance with the observed sustained supply of Mg and Fe by the fluid phase throughout the alteration profile and is believed to be the dominant formation mechanism of smectites in bentonites in general. In the mordenite-bearing zone, random ripening is expected in domains with low permeability, in which the system was essentially closed, favoring the formation of mordenite. The level of supersaturation with respect to smectite was probably lower in the mordenite-bearing zone. Smectite probably affected pore-fluid chemistry either through ion exchange or via dissolution of initially formed K-bearing smectite. The latter process raised the  $K^+/(Na^+ + Ca^{2+})$  activity ratio of the pore-fluid favoring K-bearing mordenite.

**Key Words:** Bentonite • Crystal Growth • Montmorillonite • Mordenite • Open System • Particle-Size Distribution • Precursor • Random Ripening

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