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# Pathways of Smectite Illitization

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**Abstract:** Junction probability diagrams show variation in both composition and layer arrangement in mixed-layer clay minerals. These diagrams can represent short-range and long-range ordered, random, and segregated interstratifications. Mineralogical analyses of illite/smectite from shale cuttings, bentonites, and hydrothermally altered tuffs define characteristic reaction pathways through these diagrams. Shale and bentonite analyses fall along pathways joining smectite and illite on diagrams showing nearest-neighbor (R1) layer arrangements. Transition from random to R1-ordered interstratifications occurs in shale samples containing 60–70% illite layers, and in bentonites containing 55–67% illite layers. Analyses of alteration products, however, fall near a line connecting rectorite and illite, which represents the maximum degree of R1 layer ordering. No mineralogical evidence is available to suggest that these alteration samples formed from a smectite precursor. All samples develop next-nearest (R2) and thrice-removed (R3) neighbor ordering along similar pathways. Transition to R2 ordering occurs gradually in samples composed of 65–80% illite layers, and samples containing more than 85% illite layers may show strong R3 ordering.

**Key Words:** Illite/smectite • Illitization • Junction probability diagram • Mixed layer • Ordering • Smectite

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