
X-ray Diffraction Studies of Illite/Smectite from Rocks, < 1 μm Randomly Oriented Powders, and < 1 μm Oriented Powder Aggregates: The Absence of Laboratory-Induced Artifacts

R. C. Reynolds Jr.

Department of Earth Sciences, Dartmouth College, Hanover, New Hampshire 03755

Abstract: X-ray diffraction patterns were obtained from rock fragments, < 1 μm randomly oriented freeze-dried powders, and < 1 μm oriented aggregates for 11 mixed-layered illite/smectite samples (K-bentonites) that cover the range from 14 to 100 percent expandable. In all cases, $00l$ and hkl comparisons show no evidence of laboratory induced artifacts. Either the laboratory procedures caused no disaggregation of fundamental illite particles, or, if they did, fundamental particle reaggregation during sample preparation duplicated the one and three-dimensional structures of the illite/smectite in the original, untreated rock.

Demodulation of the $20l$, $13l$ reflections into a two-dimensional hand shape occurred with increasing percent expandable layers in illite/smectite. This result strongly supports the contention that turbostratic displacements occur at the expandable interfaces between fundamental particles, and are limited to those sites.

A comparison of the quantities measured by powder X-ray diffraction and high resolution transmission electron microscope (TEM) lattice fringe image techniques for disordered crystals suggests that meaningful comparisons between the two methods can be made only if a sufficient number of images are recorded to define the statistical parameters of the disorder.

Key Words: Artifacts • Illite/smectite • Powder X-ray diffraction • Sample preparation • Turbostratic • X-ray coherence

Clays and Clay Minerals; August 1992 v. 40; no. 4; p. 387-396; DOI: [10.1346/CCMN.1992.0400403](https://doi.org/10.1346/CCMN.1992.0400403)

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