Layer Charge of the Expandable Component of Illite/Smectite in K-Bentonite as Determined by Alkylammonium Ion Exchange

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Abstract: The charge of the expandable interlayers in a series of fourteen diagenetic illite/smectites (I/S) from lower Paleozoic K-bentonites was determined by the alkylammonium ion exchange method. The magnitude (<0.50 equivalents per half formula unit) and characteristic heterogeneous distribution of interlayer charges in eight samples with expandabilities from 70% to about 15% confirm the smectitic character of the expandable interlayers in this range. This result coupled with the lack of a correlation between expandability and interlayer charge is consistent with the hypothesis of a layer-by-layer transformation from a precursor smectite to highly illitic I/S clays during K-bentonite diagenesis. The charge of the expandable interlayers in I/S samples with about 10% or less expandabilities have been inferred to be vermiculitic rather than smectitic. The K-fixed interlayers and expandable interlayers in these samples appear to be similar in charge. The significantly higher charges inferred for the highly illitic samples can be consistent both with a layer-by-layer transformation and the neoformation mechanisms proposed in the literature for the formation of illite.

Key Words: Alkylammonium • Bentonite • Clays • Diagenesis • Illite • Illite/smectite • Layer charge • Smectite

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