
Three Zones for Illite Formation during Burial Diagenesis and Metamorphism

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Abstract: Reinterpretation of published data for shale cuttings from the Gulf of Mexico sedimentary basin identifies three reaction zones for illite formation with increasing depth for well CWRU6. In a shallow zone (1.85 to 3 km), non-expanding illite-like layers formed primarily by the coalescence of smectite 2:1 layers around interlayer K^+ . In a middle zone (3 to 4 km), illite crystals neofomed from solution as coarser K-bearing phases and smectite were dissolved by organic acids. In the deepest zone (>4 km), illite recrystallized as less stable illite crystals dissolved, and more stable illite crystals grew during mineral ripening. The progressive loss of radiogenic argon in the deepest zone yielded a constant apparent age for the clays with depth, an effect previously attributed to "punctuated diagenesis." The above hypothesis for illite formation emphasizes the need to establish the zone (i.e., the reaction mechanism) from which shales were derived before making detailed geologic interpretations based on illite mineralogy.

Key Words: Age dating • Burial diagenesis • Gulf Coast basin • Illite • Illite/smectite • Ostwald ripening • Potassium/argon • Punctuated diagenesis • Sedimentary basins • Shale • Smectites

Clays and Clay Minerals; February 1993 v. 41; no. 1; p. 26-37; DOI: [10.1346/CCMN.1993.0410103](https://doi.org/10.1346/CCMN.1993.0410103)
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