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Interpretation of K-Ar dates of illitic clays from sedimentary rocks aided by modeling

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ABSTRACT

K-Ar dates of illitic clays from sedimentary rocks may contain "mixed ages," i.e., may have ages that are intermediate between the ages of end-member events. Two phenomena that may cause mixed ages are: (1) long-lasting reaction during the burial illitization of smectite; and (2) physical mixing of detrital and diagenetic components. The first phenomenon was investigated by simulation of illitization reactions using a nucleation and growth mechanism. These calculations indicate that values for mixed ages are related to burial history: for an equivalent length of reaction time, fast burial followed by slow burial produces much older mixed ages than slow burial followed by fast. The type of reaction that occurred in a rock can be determined from the distribution of ages with respect to the thickness of illite crystals. Dating of artificial mixtures confirms a non-linear relation between mixed ages and the proportions of the components. Vertical variation of K-Ar age dates from Gulf Coast shales can be modeled by assuming diagenetic illitization that overprints a subtle vertical trend (presumably of sedimentary origin) in detrital mineral content.