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# Inter-Basinal Comparison of the Diagenetic Evolution of Illite/Smectite Minerals in Buried Shales on the Basis of K-Ar Systematics

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**Abstract:** The K-Ar systematics of illite/smectite (I/S) mixed layers in deeply buried shales from the Gulf Coast, the North Sea and the Mahakam Delta basins have been compared to provide additional perspectives on the diagenetic evolution of these minerals. Comparison of the results suggests that illitization proceeds similarly in the 3 basins, at least for the increase in the illite-layer and K contents, despite differences in the provenance of the detrital components, the ages of deposition, the depths of burial and the tectonic history of the basins. Analysis of the trends with depth in the illite-layer and K contents of I/S-enriched size fractions of shales in the North Sea and the Mahakam Delta basins shows that these trends represent segments of the more complete trends from I/S minerals of the Gulf Coast area.

The trends with depth in the radiogenic <sup>40</sup>Ar contents and in the K-Ar ages of the I/S-rich fractions in the North Sea and Mahakam Delta basins suggest that, relative to the reference trends of the Gulf Coast area, the K-Ar system of the clay material is more dependent on the behavior of the radiogenic <sup>40</sup>Ar than on the occurrence or non-occurrence of detrital grains in the size fractions. Recasting of the available data suggests that retention of radiogenic <sup>40</sup>Ar by the illite-type minerals occurs in the intense illitization zone and release occurs in the deeper part of the basins. We therefore speculate that the illitization process of the I/S mixed layers of progressively buried shale-type sediments could be controlled by a transformation process integrating dissolution of detrital components in poral rock environments relatively impermeable to radiogenic <sup>40</sup>Ar. These excesses, which might be partly or completely erased in deeper parts of the sedimentary basins, question the application of the K-Ar dating method on clay minerals extracted from shales.

**Key Words:** Burial Diagenesis • Illite/Smectite Mixed Layers • Illitization • K-Ar Data • Sedimentary Basins • Shales

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