Diagenesis of Mixed-Layer Clay Minerals in the South Timbalier Area, Gulf of Mexico

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ABSTRACT

Although the distribution of mixed-layer clay minerals is geologically important for understanding the development of the Gulf of Mexico Basin and technologically useful in preventing drilling and completion problems associated with expandable clays, there are few studies documenting clay mineral distribution in the subsurface Gulf of Mexico.

Shale sections from nine wells within the South Timbalier area were sampled at depths near known paleontological markers. The bulk clay mineralogy of each sample was determined by x-ray diffraction, and is dominantly mixed-layer smectite and illite with minor kaolinite. The less than 10-micron fraction was further separated into four fractions by density. The mineralogies of these four fractions are end-member smectite, smectite-rich mixed layer, illite-rich mixed layer, and end-member illite.

The relative amounts of these fractions do not vary systematically with age. However, the percentage of the illite-rich mixed layer fraction does increase with depth. The correlation of the illite-rich mixed layer fraction with depth, however, is not as strong in this multi-well study as the correlation reported from a single well in Ship Shoal using identical methods. This is likely due to the fact that each well has a unique time-temperature history that controls the conversion to illite from mixed-layer clays. The amount of time rocks are exposed to increasing temperature is an important factor in the diagenesis of clay minerals. In addition, the presence of mixed-layer kaolinite in many of the smectite-rich fractions indicates a significant mineralogical variation not seen in the single well study.

Totten, M. T., M. Dixon, and M. Hanan, 2006, Diagenesis of mixed-layer clay minerals in the South Timbalier area, Gulf of Mexico: Gulf Coast Association of Geological Societies Transactions, v. 56, p. 819. A full-length manuscript is available as part of the 2005 GCAGS Transactions, v. 55 (New Orleans), p. 821-829.