The Effect of Provenance on Clay Mineral Diagenesis in Gulf of Mexico Shales

Matthew W. Totten, Sr.[1], Joniell Borges[2], and Iris M. Totten[1]

[1]Department of Geology, Kansas State University, Manhattan, Kansas 66506

[2]Department of Geological Sciences, Northwestern University, Evanston, Illinois 60208

ABSTRACT

This study examines 43 samples from drill cuttings from an offshore well in the Ship Shoal area, Gulf of Mexico. The mudrock samples were taken from a depth interval of 4800-13,600 ft (1463-4146 m), with the deepest sample penetrating the Upper Miocene series. Previously reported work on the same samples (Totten et al., 2002) confirmed diagenetic growth of illite at the expense of smectite with increasing depth. The amount of K_2O varies between 2.5 to 3.6 weight % and also increases with depth. However, only 17% of the increase is depth related ($R^2 = 0.17$). In contrast, none of the other major elements correlate with depth.

Provenance analyses of heavy-mineral suites suggest an increase in the amount of sediment derived from a felsic source in deeper parts of the well. This is also supported by the increase of incompatible trace elements when compared to compatible elements at greater depths. Because felsic rocks contain a higher percentage of potassium-bearing minerals, the K_2O variation may therefore be directly related to changes in provenance. The K_2O required to drive the smectite-illite transformation reaction in these rocks could be acquired from potassium-rich minerals that were originally present in the mud-rock.