

Clay Mineralogy and Chemistry of Cretaceous Shales from Athabasca Oil Sands

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Abstract

Results from mineralogical analysis of clays from Athabasca Oil Sands core, township 84 range 11 west of 4th meridian, has provided additional information about their depositional environment. Cretaceous middle McMurray formation lies unconformably above Devonian Grosmont limestone with some calcareous shale. This complex formation was deposited through incision of fluvial valleys, and subsequent marginal marine transgression during the early Cretaceous. This continuum of sedimentary environments lends itself to a tripartite stratigraphy, from fluvial bars in the lower parts, to estuarine, overlain by marginal marine deposits, strongly supported by the presence of glauconite. The sandier units within this formation are now saturated with heavy bitumen, making them targets for steam assisted hydrocarbon recovery.

Clays in these core were lithified during deposition; their competence is manifest by large sections of angularly broken "rip up" clasts. X-ray diffraction indicates that these silts and clays are rich in quartz, however, further analysis and exchangeable cation techniques show the clays mineralogy varies vertically throughout the core. Kaolinite predominates within the oil sand unit, above which smectite dominates with the exception of the glauconitic deposit. Understanding the chemistry of these clays restricting the sand reservoirs will not only provide additional depositional information, but modify current environmental interpretations to increase future extraction possibilities in this formation.