



Clay Mineral Variations in the Permian Wolfcamp Shale, Crockett County, Texas, using XRD and XRF

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ABSTRACT

The Wolfcamp Formation is a highly targeted unconventional play throughout the Permian Basin, consisting of mixed-siliciclastic carbonate facies that vary both laterally and vertically. The Wolfcamp is estimated to contain 20 billion barrels of oil, 16 trillion cubic feet of natural gas, and 1.6 billion barrels of liquid natural gas within the Midland Basin alone. As these formations are highly heterogeneous, reservoir characteristics need to be assessed in these regional, mixed siliciclastic-carbonate deposits, including the clay mineral contents, in order for more effective exploration.

Clay minerals are difficult to quantitatively analyze with x-ray diffraction (XRD), yet can help with understanding basin formation and diagenesis. The Wolfcamp Formation shale clay fraction typically consists of illite, mixed-layer illite-smectite, chlorite, and kaolinite. Previous studies have shown that determining changes in the polymorph of illite and the relative abundances of minerals can determine heat generation within a basin. Here, XRD was used on six cores to determine clay mineralogy of the Permian Wolfcamp Formation on the carbonate platform, Crockett County, Texas, which consists of the gravity flows within the basal Wolfcamp shale section. XRD was measured on a Bruker D8 ADVANCE, and analyzed with RockJock software from the USGS. The XRD indicates variations of clay mineral abundances with depth; these variations are related to the debris flows observed within the core. Furthermore, these variations demonstrate the highly heterogeneous nature of the formation, even within a single county. These variations are a combination of the debris flows and Milankovitch Cycles controlling small-scale fluctuations in deposition across the region.