

High-Resolution Sequence Stratigraphy of the Woodford Shale, Kansas

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ABSTRACT

The Chattanooga (Woodford) Formation is an organic-rich, black shale that was deposited in Kansas and Oklahoma during the late Devonian and the upper part of the early Mississippian as a result of a transgressive sequence. It is both a source rock and unconventional hydrocarbon reservoir. This research aims to produce a high-resolution, sequence stratigraphic framework based on the identification of key stratigraphic surfaces, systems tracts and depositional sequences. The framework will be used to infer the processes that controlled sediment accumulation and produced this mudrock succession. The analyses will include a centimeter to millimeter scale sedimentological description, aided by petrography and X-ray diffraction (XRD), and the generation of chemostratigraphic profiles using both hand-held XRF (HHXRF) and gamma ray spectrometers. Core and HHXRF data will be collected in a core from Douglas County, Kansas, with an available gamma-ray log. Chemostratigraphic data will be used to detect variations in the concentration of specific elements that can provide information on sediment source at the time of deposition and on bottom water conditions (anoxic vs. oxygenated). These conditions are important for the preservation of the organic material necessary to produce hydrocarbons. The three members of the Chattanooga Shale have distinct gamma ray signatures. A cross-correlation analysis will be applied to the HHXRF and gamma-ray data to evaluate if there are any relationships between the gamma-ray signature and the concentrations of proxy elements in the core. The same methodology will be applied to an outcrop of the Chattanooga Shale in Oklahoma, and a core-outcrop correlation will be carried out. The establishment of a stratigraphic framework for this formation will allow its use as a predictive tool for determining potentially productive zones in areas where cores are not available.