The Organic Geochemical Variability of Soft and Hard Beds within a Stratigraphic Sequence of the Woodford Shale in the Ardmore Basin, Oklahoma.

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Abstract

The Devonian-Early Mississippian Woodford Shale, underlying the subsurface of Carter and Murray Counties in the Ardmore Basin, Oklahoma, USA, has attracted growing interest as an unconventional reservoir. Heterogeneity has always been assumed within samples collected from different locations, while uniformity is often assumed in a stratigraphic sequence of the shale both in chemical and physical properties. However, the Woodford Shale is composed of characteristically different layers, a soft bed comprising of higher TOC, higher ductility and clay content, as well as a hard layer that is lower in TOC, higher in brittleness and in silica content. The bulk of the interval shows pristane/n-C17 vs. phytane/n-C18 ratios, C27-C28-C29 ratios, diasterane/sterane ratios, and Ts/Tm ratios indicating a depositional environment of a reduced, marine environment, with low immaturity and high biodegradation, probably as a result of contemporary weathering. The variations between the soft and hard beds are responsible for the variability of the biomarkers rather than solely depth. Variations within the relative C30 hopane concentrations show higher values within the harder beds and lower values in the softer beds that have a higher TOC percentage. Samples have been taken at 6” intervals over a 40ft. outcrop of the Woodford shale to investigate variability in organic facies, source input, and depositional environment conditions. Shale samples have been characterized by Rock Eval to determine TOC and hydrocarbon potential. Additionally, shale extracts were characterized by

gas chromatography and gas chromatography-mass spectrometry to acquire biomarker distributions that aid in the construction of paleoenvironmental conditions. Variations in the biomarker distributions indicate the heterogeneity of the shale over this 40ft interval, which in turn will yield fundamental information related to fine differences that affect reservoir quality in exploration and production of unconventional reservoirs.