A Deepwater Gulf of Mexico Source Rock Penetration: Applications to Mesozoic Source Rocks and Depositional Systems

Teerman, Stan C.[1]; Howe, R. W.[3]; Hwang, Rong [2]; Lytton, Rome [3] (1) North America Upstream, Chevron Corp, Houston, TX. (2) ETC, Chevron Corp, San Ramon, CA. (3) ETC, Chevron Corp, Houston, TX.

The Atwater Valley (AT) 182 ST1 Sturgis exploratory well penetrated the basal Cenozoic, and a Cretaceous and Upper Jurassic section that contains some organic-bearing intervals. Biostratigraphic analyses, although challenging, partly due to possible unconformities, indicate the occurrence of marine source rocks primarily in Tithonian to Oxfordian sediments, and some Mid/Lower Cretaceous intervals. The northern Gulf of Mexico shelf and deepwater represent a world class petroleum province, consisting of multiple source rocks. However, limited Cretaceous and Jurassic source rock penetrations restrict: 1) characterization of the hydrocarbon generative system, 2) defining petroleum system dynamics, and 3) investigating how depositional processes formed these organic-rich intervals, and influenced bulk and molecular properties of the oil. Selected core pieces and continuous sample cuttings collected over the source rock section were characterized by bulk and molecular geochemistry, organic petrology, and inorganic analyses. Obtaining geochemically correct samples by removal of drilling additives was an essential objective of this study.

Geochemical characterization of this thermally immature to marginally mature, suboxic to anoxic, oil-prone section confirms the historical perception of significant potential for hydrocarbon charge. Integrated geochemical results document that this section consists of a temporally heterogeneous source interval. Organic accumulation was the product of dynamic mechanisms driven by a variety of primary sedimentary processes and post-depositional effects. Comparison of artificially generated hydrocarbons from pyrolysis experiments with nearby and sub-regional occurring oils help define oil-to-source correlations, and their relationship to specific source facies. This provides better calibration to oil geochemical studies that are used to reconstruct source rock properties. Geological and geochemical reconstruction of the deposition of this source rock section contributes to a better understanding of the Mesozoic in the deepwater Gulf of Mexico. Geological challenges exist in extending concepts defined from a single-well study to developing models that explain source rock formation and properties in a larger basin-wide depositional system.