Hydrocarbons in the Ames Feature: The Oil Creek—Arbuckle (?) Petroleum System, Major County, Oklahoma

A petroleum system includes a mature hydrocarbon source rock, genetically related oil and gas accumulations, and the geologic elements and processes responsible for the formation of the hydrocarbon deposits. This study defines the Oil Creek—Arbuckle (?) petroleum system located within the Ames feature, a Paleozoic structural depression believed to be an astrobleme. The effective source rock is the lower member of the Ordovician Oil Creek Shale, although some researchers suggest a biostratigraphic correlation of this facies with the McLish Shale (Repetski, 1995). The source interval is entirely contained within the depression, consisting of predominantly marine Type II, oil prone organic matter. Average total organic carbon (TOC) is 0.88%, but can locally exceed 2%. Optical and chemical methods indicate that the section has achieved a maturity level equivalent to 1.2%-1.3% vitrinite reflectance. Based on this information, Curtiss and Wavrek (1995) calculated pre-hydrocarbon generation TOC values of 2%-5% and hydrogen index (HI) between 400 and 600 for this interval.

Geochemical analyses indicate a correlation of this source rock to the oils reservoired in the underlying, highly fractured, Cambro-Ordovician Arbuckle Group. They are chemically distinct from the oils produced from shallower horizons, and consist of two genetically related types; one group of oils has an enhanced abundance of low molecular weight (LMW or lower than nC15) compounds, most likely attributable to a higher thermal stress required for hydrocarbon generation and expulsion. A burial history reconstruction for the petroleum system indicates that the “critical moment,” or time of peak hydrocarbon generation and expulsion, occurred at 225 Ma.

The generation accumulation efficiency (GAE) compares the amount of hydrocarbons generated by the source interval to the amount trapped in reservoirs. This petroleum system generated 145MMBO (million barrels of oil), which contrasted with ultimate reserve estimates, establishes a GAE of 37%. The remaining 63% of the hydrocarbons generated were either lost (i.e., not trapped) or represent the potential for future discovery.
References
