The Source and Fate of Oils in the Lawton Oilfield, Southwestern Oklahoma

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Abstract

The Lawton oilfield is located east of the Wichita Mountain Uplift in the Anadarko Basin, southwestern Oklahoma. This study focuses on three problems related to this oilfield: (a) what is the source(s) of the oils; (b) have the oils been altered since emplacement; (c) what is the filling history of the Lawton oil field? 18 Oils and one seep sample were characterized by a variety of geochemical techniques including bulk composition, biomarkers, and stable isotopes.

Source rocks in this region are absent following the Pennsylvanian Orogeny but biomarkers and stable isotopic data suggest the source of these oils is probably the Woodford Shale. Despite these oils being recovered from reservoirs at depths between 200 and 900ft, none appeared to be biodegraded as manifested by the abundance of the complete range of n-alkanes. The presence of 25-norhopanes in all 18 samples suggests these oils are mixtures of various proportions of degraded and non-degraded oils. The seep sample and some oils have a high abundance of the C32 ββ22R hopanoic acid, suggesting oils are degraded aerobically to differing degrees.

A hydrocarbon accumulation model has been proposed based on two main charging periods. The initial charge was biodegraded, probably anaerobically, followed by paleopasturization at temperatures exceeding approximately 80℃. The second charging period took place after the uplift of the Wichita Mountains and subsidence of the southern part of the Anadarko Basin leading to deeper burial of the source rock and production of higher maturity oil, which subsequently filled the reservoir containing the degraded oil.