

South-Central Oklahoma SCOOP Plays:

3D Basin Modeling Support to Select Petroleum System Elements and Processes

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Hydrocarbon zones in the south-central Oklahoma SCOOP plays provide opportunities rivaling those in the Permian Basin at a lower entry / operation cost. This is attributed to a geologic column that provides stacked source rock in the same acreage with opportunities for oil, wet gas, and dry gas production. Major liquid-rich plays are in the Woodford-Meramec and Springer formations, with additional resources in the Sycamore / Osage, and Caney formations. Future activity is forecast in Pennsylvanian black shales and the Ordovician Viola and Oil Creek formations, but these are expected to be niche, geographically limited plays.

Analysis of select petroleum system elements and processes within the SCOOP includes the oil-source rock assignment with geographic-stratigraphic distribution of over 400 oils, with the identification of key source rock variables that impose primary control on reservoir energy. One example includes separation of the Woodford petroleum system into clay-rich and clay-poor (i.e., siliceous or carbonate) organic facies and calculating sample specific thermal stress. This analysis often includes gas isotopes vs. adamantanes vs. biomarkers to identify indigenous vs. migrated charges within a converging interpretation. When compared to the host rock properties, the migration vector can be quantified using 3D basin modeling. Within the Woodford oil phases, the clay-poor organic facies reach peak hydrocarbon generation at a lower degree of thermal stress in a total oil window profile that is narrower, compared to the clay-rich organic facies. This type of input variable is critical to the correct calibration of basin modeling kerogen kinetics. Reservoir energy can also change by secondary alteration mechanisms such as secondary gas charge, phase separation, and top seal leakage. Devolatilization is most common along structural trends and can be investigated using fluid inclusion stratigraphy. Components impacting reservoir energy are analyzed across multiple wellbores using 3D visualization which is beneficial for analysis of unconventional reservoirs. Collectively, petroleum system puzzles can be solved with systematic / converging strategies and interpretation methods.