Paleozoic Sequence Boundaries and Petroleum Accumulations in Oklahoma

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Significant petroleum accumulations in Oklahoma occur in reservoirs formed along sequence boundaries. Some oil- and gas-bearing reservoirs are associated with the Sloss sequences, whereas others are related to 3rd and 4th order boundaries generated by Milankovitch glacioeustatic cycles.

The Sauk-Tippecanoe (SK) sequence boundary separates the Ordovician Arbuckle and Simpson Groups, but does not host large petroleum accumulations. On the other hand, the boundary between the Tippecanoe and Kaskaskia (TK) sequences hosts large oil and gas accumulations in the Hunton Group. Dissolution, erosion and deposition along the Kaskaskia-Absaroka (KA) boundary separating the Pennsylvanian and Mississippian subsystems enhanced petroleum-trapping capabilities on the shelf. Fourth-order cycles or cyclothems in the middle Pennsylvanian "Cherokee" Group contain major channel-filling sandstones and "hot" shales. On the platform, each 4th order cycle typically contains a thin, but persistent limestone. Sea-level lowstand and low accommodation associated with 4th order cycle boundaries generated valleys that were conduits that delivered sediment across the shelf to basinal settings. These Type 1 sequence boundary valleys supplied the sand that became reservoirs in a Skinner lowstand delta and Red Fork submarine fans. During the subsequent transgressions, these valleys trapped sand to form major valley-filling reservoirs. In some cases, evolution of reservoirs in post-boundary rocks was influenced by the composition of strata subjacent to the sequence boundary. The integration of paleogeomorphology, lithofacies and structural attitude can be used to enhance exploration and development strategies for reservoirs associated with sequence boundaries.