SEQUENCE MODEL FOR THE SIMPSON GROUP OF THE SOUTHERN MID-CONTINENT: A TOOL FOR STRATIGRAPHIC TRAP PREDICTION

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ABSTRACT

Preliminary investigations indicate that the Middle Ordovician Simpson Group of the southern Mid-continent has significant reservoir potential, which can be predicted and exploited through the application of sequence stratigraphic principles. Exploration for Simpson limestone and sandstone reservoirs historically has been structurally driven. As a consequence, there has been very little exploratory drilling for stratigraphic traps that may exist between structures or along the flanks of paleostructures. Stratigraphic traps may have been set up by deposition of time-transgressive or retrogradational sand bodies which are now segregated vertically from each other as separate reservoirs. This stratigraphic architecture is likely more commonplace than is recognized in the Simpson Group. When incorporated in a well-log based exploration strategy, this architecture could aid the detection of subtle stratigraphic traps that typically escape seismic detection.

Within a sequence stratigraphic interpretation, the major sandstone units (Oil Creek, McLish, and Bromide) of the Simpson Group represent local lowstand to widespread transgressive deposits. These sandstones were transported across an exposed shelf during a relative lowstand and deposited at the strandline. During an ensuing transgression, the shoreline retreated and left in its wake, a series of backstepping, or retrogradational, shoreface complexes that overlie the 3rd-order sequence boundary. Thick basal Oil Creek sandstone, for example, may represent the lowstand systems tract deposited along the edge of the rapidly-subsiding southern Oklahoma aulacogen. The relatively thinner sandstones on the slowly-subsiding craton represent the more-widespread transgressive systems tract. The upward gradation of basal sandstone to open-marine shale represents continued transgression to a maximum flooding interval. Shallow-marine (subtidal to supratidal?) carbonates overlie the shales and represent the highstand systems tract. Highstand deposition concluded with a relative fall of sea level and development of a subaerial surface (sequence boundary) across which siliciclastic sands of the following sequence were transported basinward by fluvial and eolian processes.

The stratigraphic model can help delineate internal heterogeneities and stratigraphic geometries favorable to entrapment of oil and gas within the Simpson Group. Stratigraphic traps may exist within laterally-discontinuous retrogradational shoreface complexes and within prograding carbonate banks which may have reservoir potential in porous grainstone-rich facies adjacent to porosity pinchouts. This regional model can be a tool for renewed Simpson Group exploration in the southern mid-continent area that has few purely structural trap-oriented exploration opportunities remaining.

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