PETROPHYSICAL CHARACTERIZATION AND SEQUENCE STRATIGRAPHY OF MISSISSIPPIAN CARBONATES, NORTH-CENTRAL OKLAHOMA

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The Mississippian Limestone play in the northern Oklahoma has been productive for more than 50 yr. It has recently become a significant unconventional play for horizontal development. Improvements in completion techniques and horizontal drilling have increased hydrocarbon production relative to vertical wells. However, understanding the geological control on heterogeneity is still a primary challenge in this carbonate play.

The Mississippian interval consists of four high-frequency transgressive-regressive cycles with shallowing-upward character. The cycles are often capped by unconformable surfaces related to subaerial exposure resulting from relative sea-level fall and/or regional uplifting. The Mississippian interval exhibits a variety of alteration types, including silicification, dissolution, compaction, and brecciation. The dominant lithologies include chert-breccia, bedded chert-breccia, grainstone and mudstone, with significant alterations occurring near the top of the Mississippian interval.

This research explores relationships between core- and well-log properties using petrophysical and statistical classification methods to distinguish distinct petrofacies in the Mississippian Limestone. The results of the detailed core analysis and estimation methods will be used to identify stratigraphic cycles and estimate lithofacies in non-cored wells in order to interpret a sequence-stratigraphic framework for the Mississippian in the study area. In addition, statistical measures of heterogeneity will be used to relate lithological and petrophysical variability to the established sequence framework. Detailed three-dimensional reservoir models will be constructed that integrate the sequence-stratigraphic framework, lithofacies architecture, and the associated petrophysical property distributions. The three-dimensional models will be useful to further investigate the geological controls on reservoir heterogeneity and the impact on reservoir connectivity and productivity.

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