Applying a Sequence Stratigraphic Model to Explain Stratigraphic Architecture and the Spatial Distribution of Reservoir Facies in the Mississippian Limestone

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ABSTRACT

When high-resolution correlations are constructed in densely drilled areas, the boundaries of higher-frequency cycles can be recognized and the influence of accommodation on clinoform geometry becomes apparent. In the Star-Lacey field, Kingfisher and Blaine counties, the subaerial exposure of grain-rich depositional facies in the upper regressive section of a probable 3rd-oder depositional sequence resulted in reservoir development. In this case, reservoir genesis was controlled by primary depositional facies and sequence stratigraphic hierarchy. The reservoir formed as the result of subaerial exposure of dissolution prone facies during regression associated with the sequence boundary. Where other facies are exposed along the sequence boundary or the grain-rich facies of higher-frequency cycles are not, the rock remained low porosity/permeability. Furthermore, the apparent change in depth to the reservoir relative to the contacts of the carbonate-dominated interval with the Woodford Shale at the base and the Mississippian shale at the top can be explained by following the sequence boundary. In the southern part of the field, the top of the proposed 3rd–order sequence containing the reservoir is approximately two-hundred (200) feet above the contact with the Woodford Shale. Approximately three (3) miles to the north, the sequence boundary and reservoir are more than three-hundred (300) feet above the Woodford Shale while the thickness of the carbonate interval remains the same. This example illustrates how core-defined, high frequency cyclicity can be used to improve production-scale predictability of oil and gas reservoirs in the Mississippian limestone and enhance exploration strategies.