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### **Subsurface Sequence Architecture of the Cromwell Sandstone (Morrowan), Oklahoma**

The Cromwell Sandstone is a prolific gas-producing reservoir in the Kinta field, of the Arkoma basin. The predictability, however, of Cromwell reservoirs has been elusive based on the published literature. The study area encompasses four townships in Haskell County, Oklahoma and includes two cores, which in turn were used to calibrate well-log responses to stratigraphic elements. High-resolution sequence stratigraphy was applied to delineate the geometry and distribution of Cromwell reservoirs and offer insight to production strategy.

The Cromwell Sandstone is the lower member of the Morrowan age Union Valley Formation. The Union Valley Limestone overlies the Cromwell Sandstone and is the upper member of the Union Valley Formation. The Union Valley Formation rests on the sub-Pennsylvanian disconformity and is succeeded conformably by shale and limestone of the Wapanucka Formation.

The investigation revealed that the Cromwell is marine in origin and formed under the dominant influence of sea-level transgression. Five Parasequence sets are identified within the Cromwell Sandstone, two to seven parasequences are associated with each parasequence set. Cromwell reservoirs are regarded as having been deposited as shore-oblique to shore-parallel offshore ridges. An important finding of this study is the recognition of two intra-Cromwell 4th-order sequence boundaries. From parasequence-based correlation, Cromwell reservoirs develop into retrogradational parasequence sets. Correlation within the Cromwell using sequence architecture provides a better understanding of the distribution of gas production; however, diagenesis is a contributing factor to porosity formation.