**Integrating Depositional Facies and Stratigraphy in Characterizing Hydrothermal Dolomite Reservoirs: Trenton Group of the Albion-Scipio Trend, Michigan Basin**

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Late Middle Ordovician Trenton-Black River carbonates are prolific hydrocarbon producers in the Michigan Basin, and the Albion-Scipio trend/Stoney Point Field are considered classic examples of production from hydrothermally dolomitized intervals. The current reservoir model for these two trends suggests that magnesium-rich hydrothermal fluids flowed vertically along basement seated wrench faults and developed reservoirs through emplacement of hydrothermal dolomite (HTD) along the faults. Structural HTD emplacement models address linear, reservoir scale dolomite distribution coincident with left-lateral *en echelon* faults, but are inadequate in modeling tens/hundreds of meter-scale variability in dolomitization laterally away from primary fractures/faults. Renewed exploration for these reservoirs in the Michigan Basin suggests the need for a better understanding of the controlling mechanisms and resulting distribution of reservoir HTD laterally away from the main fault-zones.

Recently completed research on the Black River Group has shown that primary depositional facies control the development of secondary HTD reservoirs laterally from primary fault-zones, with *Cruziana*-type (*Thalassinoides*) burrowed facies within high-frequency ($4^{th}$ order) sequences correlating with higher reservoir quality. These burrow facies provided higher permeability relative to adjacent depositional facies and afforded pathways for lateral fluid migration away from main faults, resulting in reservoir quality development away from seismically resolvable structures.

The primary goal of this investigation is to create a sub-regional depositional model, quantitatively delineate preferentially dolomitized facies, and to geostatistically model the three-dimensional distribution of reservoir facies within the Trenton Group of the Albion-Scipio trend area. Subsurface core description, analysis, and wire-line log data establish depositional facies, a sequence stratigraphic framework, and reservoir facies when compared with whole core analysis, well engineering, and production data. Regionally continuous volcanic ash beds provide markers for construction of temporally constrained depositional facies models, and when combined with depositional facies analysis and cyclic sedimentation patterns, provide the basis of Trenton group depositional modeling. Facies relationships and geometrical attributes are further constrained by modern depositional analogs. Model validity will be tested by direct comparison with recently drilled Albion-Scipio Trend control-well data. The resulting model aims to improve visualization and understanding of reservoir geometries and distributions to reduce close step-out dry holes when targeting secondary burrow-facies reservoirs. Methods of identifying, evaluating, and modeling relationships between depositional and reservoir facies distributions and geometries will likely provide enhanced insight into controls on HTD reservoir

formation mechanisms in the Southern Michigan Basin, as well as to aid in exploration and reservoir development and management strategies in globally distributed HTD reservoirs.