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Trenton Black River Hydrothermal Dolomite Reservoirs of New York: An Integrated Structural-Stratigraphic-Diagenetic Play

Fourteen new gas fields have been discovered in New York State over the past several years in fault-controlled dolomites of the Ordovician Trenton and Black River Groups. Production from these fields has driven statewide natural gas production to its second highest level in history. Like the Albion-Scipio trend in Michigan, the reservoirs occur in structural lows in patchy matrix dolomite and brecciated zones. Fluid inclusions, stable isotopes, trace elements, strontium isotopes, field relations and petrography all support a hydrothermal origin for the dolomite. The structural lows are visible on seismic and form over dilational parts of strike-slip faults that developed during the Ordovician Taconic Orogeny, soon after deposition of the Trenton and Black River Groups. These wrench faults were conduits for upward migrating high-pressure, high temperature fluids that leached and dolomitized clean, permeable limestones in the highstand and early transgressive parts of sequences. Argillaceous limestones and shales, which occur in the middle and upper transgressive portions of sequences, impeded further upward fluid migration. The high-pressure fluids induced brecciation and fracturing in the uppermost parts of the clean limestone and lowermost portions of the argillaceous limestones. The breccias and fractures are partially cemented with saddle dolomite and calcite. Porosity and permeability occur in matrix dolomite, breccias, fractures, and vugs. Statewide analysis of logs in the Trenton Black River reveals patchy hydrothermal dolomitization occurs in places across much of the western two-thirds of New York. This suggests that current production may represent just the tip of the iceberg. Analysis of various hydrothermal dolomite play types around the world show that hydrothermal dolomite reservoirs occur in a variety of structural settings. These include wrench faults associated with compressional tectonic events (the TBR play as we know it), fault controlled margins, fault intersections, carbonates deposited on newly rifted or tectonically active basement rocks. There are likely to be opportunities in a variety of structural and stratigraphic settings throughout the eastern United States.