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Integrated Characterization of Hydrothermal Dolomite Reservoirs in Trenton-Black River Carbonates of New York

Twelve 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. 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 and petrography all support a hydrothermal origin for the dolomite.

The structural lows are visible on seismic and form over extensional pull-aparts that developed during the Ordovician Taconic Orogeny, soon after deposition of the Trenton and Black River Groups. The pull-aparts formed when sinistral shear along pre-existing northwest-southeast trending basement faults led to development of east-west trending extensional faults.

The extensional 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, smeared along the faults and 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. The matrix dolomite, breccias and some vugs can be porous.

This play went undetected for many years because of its unintuitive structural expression (lows vs. highs) and complex diagenesis. Similar untested reservoirs in the Appalachian Basin and around the world may be found with the appropriate integrated structural-diagenetic-stratigraphic model.