

MIDDLE ORDOVICIAN FAULT-FRACTURE PETROLEUM RESERVOIRS OF THE SOUTHERN MICHIGAN BASIN

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Abstract

Considerable production in the Southern Michigan Basin comes from dolomitized portions of the Middle Ordovician Trenton and Black River limestones. Stratigraphic traps, such as found in the Albion-Scipio Field, are caused by reduction in porosity and permeability of non-dolomitized limestones surrounding reservoirs. Extensive fault-fracture networks provided flow conduits for dolomitizing diagenetic fluids and petroleum migration. Understanding the processes involved in creating these reservoirs is key to future exploration and development of this basin. Studies of petrographic and geochemical differences within Trenton and Black River dolomites suggest multiple fluid flow events. However, understanding of the timing and sources of these events is limited. This study seeks to determine the fluid compositions and sources responsible for dolomitization and emplacement of hydrocarbons and to determine if hydrogeological communication existed among the separate fields. Petrographic and geochemical analysis of carbonate cements and other minerals, including standard and cathodoluminescence petrography, fluid inclusion microthermometry, and carbon, oxygen, and strontium isotope geochemistry will be used to characterize diagenetic fluids. Petrography will determine compositional variation in cements that can be correlated within and between oil fields leading to determine timing of diagenetic events. Fluid inclusion analysis will be used to determine diagenetic temperatures and salinities of fluids as well as timing of hydrocarbon emplacement. Isotope geochemistry will further characterize diagenetic fluids and may indicate basement involvement. A mixing of multiple fluids and underlying basement structures similar to Mississippi Valley-type base metal systems ultimately may be responsible for this and other similar petroleum systems.

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