

## **Northern Indiana and Vicinity Jointing, Fracturing, Faulting and Structural Patterns: Implications for Regional and Local Fractured Reservoirs and Tectonics in the Southern Michigan Basin and Adjacent Arches**

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Fractured reservoir targets in the southern Michigan Basin and the Kankakee, Cincinnati and Findlay arches include the Antrim and Maquoketa (Utica) shales, the Trenton-Black River carbonate sequence, and potentially other units with low or no original porosity and permeability, as well as more conventional targets, all potentially enhanced via local and regional jointing, fracturing and faulting. Extensive literature reviews and proprietary research has resulted in the review of widely published to fairly obscure data sets, geologic maps, geophysical, and tectonic interpretations.

When viewed at an appropriate scale in context with geologic bedrock and structure maps, trends depicted in fracture trace and lineament maps, regional and local fault maps, rose diagrams of joints from outcrops and quarries, and aero-magnetic and gravity interpretations suggest possible exploration and production fairways and also allow for the interpretation of local and regional tectonics. These trends are related to both older and modern stress fields with interpreted, or apparent, tectonic, organic, erosional and glacial origins. Direct exploration and production application to shale, hydrothermal dolomite and other carbonate reservoirs is possible and will be reviewed. The reef-influenced Traverse Formation and associated fractured Antrim Shale have been tested and produced in a few areas, with testing and scattered production of the Utica-Trenton-Black River intervals.