

Prediction of Petrophysical Properties of Trenton-Black River (Ordovician) Reservoirs by Comparing Pore Architecture and Permeability to Sonic Velocity, Michigan Basin, USA

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Reservoir characterization of carbonate rocks is complicated by heterogeneous pore architecture related to primary depositional facies and subsequent diagenesis; this is especially true in diagenetically-altered and structurally-influenced Trenton-Black River reservoirs of the Michigan Basin. Accurate and reliable prediction of reservoir properties within hydrothermal dolomite reservoirs through the use of seismic imaging would aid exploration and characterization both within and outside of the Michigan Basin.

Permeability is the primary factor responsible for the deliverability of hydrocarbons in carbonate reservoirs and is related to the three-dimensional pore architecture. Diagenetically-altered depositional facies are the primary control on three-dimensional pore architecture, and pore architecture exerts a strong control on elastic properties and acoustic response. Due to these relationships, it should be possible to predict permeability from acoustic response. In order to test this hypothesis, pore types and pore architecture will be characterized from petrophysically significant facies which will then be measured in the laboratory for acoustic response. This data will be correlated to geophysical well logs and ultimately three-dimensional seismic in order to test the applicability of this method. Results of this study should aid in establishing predictability of permeability in carbonates from seismic surveys and petrophysical logs.

Methods utilized will include traditional high-resolution core examination, two-dimensional image analysis of thin sections, three-dimensional X-ray computed tomography analyses of core plugs and laboratory sonic velocity analysis of core plugs.