

## **Quantifying Pore Architecture by Facies for Enhanced Prediction of Reservoir Distribution in Silurian Pinnacle Reefs of the Michigan Basin**

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Reservoir quality in carbonates is dependent on the complex relationship of rock fabric, porosity, and permeability. Simple porosity/permeability transforms do not provide sufficient information to estimate reservoir deliverability because permeability is dependent on pore architecture. As a result, Middle Silurian (Niagaran) Reef reservoirs in the Michigan Basin were evaluated to better understand this relationship. Additionally, pore types and associated geometries are thought to have a direct correlation with sonic velocity values. To confirm this relationship, Niagaran reef wells with both core and petrophysically measured sonic log values were used. Petrophysically significant facies and related pore types were identified through core analysis. Key facies were made into thin sections and photomicrographs were imported into an image analysis program where pore abundance and geometries were determined. Facies and related pore geometries were compared to sonic velocity values to identify the relationship of velocity and pore architecture. Facies with greater rigidity contain more rounded pores and have higher velocities whereas facies with less rigidity contain more irregular shaped pores and have slower velocities. Permeability can then be determined by integrating the relationship between pore types and facies with the effect of pore geometry on rock acoustics. As a result, quantifying rock and well log data relationships allows for better prediction of reservoir quality with logs in the absence of rock data.