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Petrographic and Microfacies Analysis of the Shublik Formation, Northern Alaska: Implications for an Unconventional Resource System.

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ABSTRACT

The North Slope of Alaska includes a world-class conventional petroleum system, one of the most prolific in the United States, that has been producing for approximately 40 years. The decline in conventional hydrocarbon production and the presence of high quality source rocks inspire the evaluation of an unconventional petroleum system where oil or gas are produced directly from source rocks. The regional stratigraphy includes multiple proven source and reservoir rocks including the Middle to Upper Triassic Shublik Formation (Fm.). The Shublik Fm. is heterogeneous, and has been interpreted to indicate deposition influenced by marine upwelling. Lithofacies include phosphatic siltstone, nodular phosphorites, organic-rich carbonate mudstones, packstones, grainstones, and glauconitic and non-glauconitic sandstones. Lithofacies observed in outcrop comprise intervals of non-resistant organic-rich packages juxtaposed with resistant phosphatic and carbonate packages that exhibit coarsening upward rhythmic depositional successions. Pore space and networks provide potential storage and migration pathways within unconventional resource systems. Pore types were imaged and quantified at a high resolution using electron microscopy. Pore types that are present within the Shublik Fm. include interparticle, intraparticle, moldic, and microfracture. The data collected from high resolution pore imaging is used to estimate the storage capacity of the Shublik Fm. as an unconventional resource system. Building upon previous work, utilizing sequence stratigraphic models and connecting the genetically related units with observed microfacies will permit the identification of the intervals that have the greatest storage potential. Facies stacking patterns identified through core, outcrop, and petrographic analysis are calibrated to well logs to map relevant stratigraphic intervals on a regional scale. The phosphatic limestone and flat clam facies will be the focus for pore types and the abundance. The phosphatic limestone facies contains the greatest amount of porosity including interparticle, intraparticle, and moldic within the phosphate nodules and matrix and fractures surrounding phosphate nodules. Fracture and intraparticle porosity are the primary pore types within the flat clam facies. Combining the proposed methods provides an important component to evaluating the Shublik Fm. as a potential unconventional resource system.