

# Bakken and Three Forks Logging Acquisition for Reservoir Characterization and Completion Optimization

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*The Bakken and Three Fork formations of North Dakota are characterized by highly variable lithologies that result in heterogeneous petrophysical and mechanical rock properties. Additionally in the Bakken, fractures may be important for production in some areas. Proper placement of laterals in higher porosity dolomitic or clastic intervals can play a critical role in completion design. Traditionally operators have not acquired the necessary log measurements to properly characterize and complete these complex reservoirs. To address these complexities a program of higher tier logging measurements calibrated to core was employed as part of the Bakken Research Consortium (Consortium) to better define lithology, porosity, permeability and mechanical rock properties.*

*In the Consortium area (Section 36 T156N R95W), results from the Combinable Magnetic Resonance (CMR) and the Elemental Capture Spectroscopy (ECS) logs indicate that better matrix porosity and permeability occur in dolomitic sediments. Cleaner (low gamma ray) intervals are tighter, characterized by higher limestone content, and are more prone to natural fracturing. Fractures are bed bounded, and have low intensity and porosity based on the Formation MicroImager (FMI). Hence the effect of fractures on productivity appears to be limited in this area. The Sonic Scanner (SSR), which measures 3-D rock properties, confirmed that the Upper and Lower Bakken shales vertically provide good hydraulic fracture containment. Additionally, changes in stress, both vertically and horizontally, can be observed within the Middle Bakken.*

*These log measurements were integrated in a hydraulic fracture model that was then used to optimize the completion design and packer placement.*

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