

Lithostratigraphy and Depositional Systems of the Bakken Formation in the Williston Basin, North Dakota

Anne Pendleton Steptoe, and Timothy R. Carr, Department of Geology and Geography, West Virginia University, Morgantown, 26506 WV

asteptoe@mix.wvu.edu and tim.carr@mail.wvu.edu

The Late Devonian to Early Mississippian Bakken Formation in the Williston Basin of North Dakota is a large emerging, unconventional oil play. This unconventional gas reservoir is widespread across the intracratonic basin with an estimated 3.7 billion barrels of undiscovered, recoverable oil and has significant economic potential in portions of North Dakota, South Dakota, Montana, Saskatchewan and Manitoba. Although the Bakken interval is being drilled throughout the basin, several uncertainties remain including the environment and distribution of depositional facies, generation and migration of hydrocarbons, and controls on production. The Bakken Formation consists of a middle member bounded by two black, organic-rich shale units. Generally, the upper and lower shale members are considered to have been deposited under relatively deep marine anoxic conditions (>200 meters depth). However, the underlying Sanish sand unit and the middle member of the Bakken have been interpreted as deposited in an epicontinental sea under shallow-water high-energy conditions (< 10 meters depth). The middle member of the Bakken is a complex stacked interval of dolomitic siltstone, and oolitic or calcareous sandstone. To evaluate the inferred rapid changes in base level and the influence on depositional environments and production, log characteristics were statistically tied to core. Isopach maps of units and petrofacies of the Bakken and associated units were used to better define lithostratigraphic boundaries and petrofacies in several hundred wells distributed across a 1,000 square mile study area in northwest North Dakota. The result is an improved understanding of deposition and basin evolution for the Bakken interval.