

Source and Reservoir Characteristics of the Bakken Petroleum System in the Billings Nose Area, Williston Basin

Stephen A. Sonnenberg

Geology and Geological Engineering, Colorado School of Mines, Golden, CO.

The Bakken Petroleum system in the Billings Nose area of North Dakota (Bicentennial to Elkhorn Ranch fields) consists of source beds in the Bakken and lower Lodgepole (“False Bakken”) and reservoirs in the lower Lodgepole (Scallion), upper Bakken shale, middle Bakken siltstone\carbonate, and upper Three Forks silty dolostones. Residual oil saturations, mud log shows, pressure, and completion data indicate the multi-reservoir interval. All reservoirs have low porosity and permeability and fracturing plays a key role in reservoir development.

The main cycle of activity in this area was in the 1970s-1980s with vertical and horizontal completions mainly in the upper Bakken shale. Cumulative production from this area is 28.7 million barrels and 59.5 BCFG from approximately 300 wells.

Source beds in the lower Lodgepole (“False Bakken”) have TOC contents around 1-7 wt%; whereas, the upper Bakken shale has a TOC which averages 11 wt%. Source beds in this area are thermally mature and hydrocarbon generation has resulted in original reservoir pressures as high as 7200 psi (0.7 psi/ft gradient). Fracturing, in part, is caused by hydrocarbon generation and the related overpressuring.

An understanding of source rock maturity, overpressuring, reservoir characteristics, and natural fracture development in the Billings Nose area may help in the discovery and development of new Bakken producing areas in the Williston Basin.