

## **Source and Reservoir Potential of the Lower Lodgepole Formation Within the Bakken Petroleum System in the Billings Nose Area, Williston Basin**

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The Bakken petroleum system in the Billings Nose region of North Dakota consists of source beds in the upper Bakken shale and lower Lodgepole (“False Bakken”) and reservoirs in the upper Three Forks, middle Bakken, upper Bakken shale, and lower Lodgepole (Scallion) limestone. Source rock analyses indicate that the False Bakken is organic rich and thermally mature with a TOC up to 6 wt% and a  $T_{\max}$  around 445° C, while the upper Bakken has an average TOC of 11 wt% and a  $T_{\max}$  around 450 °C. Residual oil saturations, mud-log shows, and completion and production data indicate the multi-reservoir nature of the system. Each reservoir has low porosity and permeability and is enhanced by natural fractures.

Development of the area began in the 1970s with vertical wells that were perforated in the Scallion limestone, the upper Bakken shale, the middle Bakken, and the upper Three Forks. When the upper Bakken shale became the target of horizontal drilling in 1987, the adjacent carbonates were also considered pay. The natural fracture networks within the reservoirs are attributed in part to overpressuring related to hydrocarbon generation in the source beds. The presence of the False Bakken source bed may be responsible for fractures found in the lower Lodgepole limestone. The dynamic stratigraphy of the area, which displays a thickening of the lower Lodgepole, including the False Bakken, may cause the fractures to extend beyond the Bakken edge. In this way, the Scallion may hold additional reserves which could be produced from horizontal wellbores drilled and completed outside of the depositional edge of the upper Bakken shale.