



New Insight Into Secondary Porosity Generation and Reservoir Rock Characterization of the Heavy Oil Bearing Bakken Formation in the Elbow Basin, West-Central Saskatchewan, Canada

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Abstract

The Devonian-Mississippian Bakken Formation is a prominent marker in the subsurface of the Elbow Basin in west central Saskatchewan. The formation consists of three distinct members: lower black shale, middle sandstone, and upper black shale. The middle unit contains about 12 m of reservoir quality sandy siltstone deposited in a lowstand, progradational environment.

Diagenesis has significantly influenced in the development, preservation and distribution of porosity, permeability, and effective pore network in the reservoir. Rocks exhibit variable amount of porosity, with an average 5% secondary and 1% primary. Primary pores locally exhibit partial pore-filling euhedral carbonate cement, suggesting their primary origin, not formed by carbonate dissolution.

Secondary pores are dominated by micropores (< 0.5 μm pore-throat diameter) within finer grains and matrix, and enlarged intergranular macropores (> 0.5 μm pore-throat). The pore network is generally characterized by several pore types, notably: i) primary and secondary intermatrix/intergranular micropores—very common, ii) primary intergranular macropores—occasional to rare, iii) secondary enlarged intergranular macropores—very common, iv) secondary oversized macropores—common, v) secondary elongate macropores—occasional to rare; and vi) secondary biomoldic macropores—occasional to rare.

This study will improve our understanding of the post-depositional processes that affect reservoir rocks deposited between organic-rich fine grained sediments. The model is an attempt to relate the geological properties to the petrophysical parameters. It would facilitate in identifying and mapping the production zones, so that selection of producing horizons, infill drilling sites, and secondary and tertiary recovery strategies could be planned more accurately and effectively.