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Fracture-Enhanced Porosity and Permeability Trends in Bakken Formation, Williston Basin, Western North Dakota

Fractures play a critical role in oil production from the Bakken Formation (Devonian and Mississippian) in the North Dakota portion of the Williston Basin. The Bakken Formation in the study area is known for its low matrix porosity and permeability, high organic content, thermal maturity, and relative lateral homogeneity. Core analysis has shown the effective porosity and permeability development within the Bakken Formation to be related primarily to fracturing.

In theory, lineaments mapped on the surface reflect the geometry of basement blocks and the zones of fracturing propagated upward from them. Fracturing in the Williston Basin is thought to have occurred along reactivated basement-block boundaries in response to varying tectonic stresses and crustal flexure throughout the Phanerozoic. Landsat-derived lineament maps were examined for the area between 47 and 48 degrees north latitude and 103 and 104 degrees west longitude (northern Billings and Golden Valley Counties, and western McKenzie County, North Dakota) in an attempt to identify large-scale fracture trends. In the absence of major tectonic deformation in the craton, a subtle pattern of fracturing has propagated upward through the sedimentary cover and emerged as linear topographic features visible on these large-scale, remote-sensed images.