

Petroleum Geology of the Giant Elm Coulee Field, Williston Basin

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The Elm Coulee Field of the Williston basin is a giant oil discovery in the middle Bakken Formation (Devonian-Mississippian) discovered in 2000. Horizontal drilling began in the field in 2000 and to date over 600 wells have been drilled. The estimated ultimate recovery for the field is over 200 million barrels (31.8 million m³) of oil.

The Bakken Formation in the field area consists of three members: (1) upper shale, (2) middle silty dolostone, (3) lower siltstone. The total Bakken interval ranges in thickness from 10 to 50 ft (3.1 to 15.3 m) over the field area. The upper shale is dark-gray to black, hard, siliceous, slightly calcareous, pyritic, and fissile. The shale consists of dark organic kerogen, minor clay, silt-sized quartz, and some calcite and dolomite. The upper shale ranges in thickness from 6 to 10 ft (1.8 to 3.1 m) over the field area. The middle member consists of a silty dolostone and ranges in thickness from 10 to 40 ft (3.1 to 12.2 m). The lower member in the Elm Coulee field consists of brownish-gray, argillaceous, organic-rich siltstone. The lower member ranges in thickness from 2 to 6 ft (0.61 to 1.8 m).

The main reservoir in Elm Coulee is the middle member which has low matrix porosity and permeability and is found at depths of 8500 to 10500 ft (2593 to 3203 m). The current field limits cover approximately 450 mi² (1165 km²). The middle Bakken porosities range from 3 to 9% and permeabilities average 0.04 md. Overall, reservoir quality in the middle Bakken improves upward as the amount of clay matrix decreases. The middle Bakken is interpreted to be a dolomitized carbonate-shoal deposit based on subsurface mapping and dolomite lithology. The main production is interpreted to come from matrix permeability in the field area. Occasional vertical and horizontal fractures are noted in cores. The vertical pay ranges in thickness from 8 to 14 ft (2.4 to 4.3 m).

The Elm Coulee field illustrates that the Bakken petroleum system has enormous potential for future oil discoveries in the Williston Basin.