Canada's Athabasca Oil Sands—Geology of the Second Largest Hydrocarbon Accumulation on Earth

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ABSTRACT

The Canadian oil sands are the second largest hydrocarbon accumulation on Earth with bitumen in place of 1.7 trillion barrels. The oil sands occur in three areas in northern Alberta, covering an area of 140,200 km^2 (54,100 mi^2)—larger than the state of Florida. Current production exceeds 1.3 million barrels per day. The oil sands have been extensively drilled and studied, and are undergoing multi-billion dollar developments. The geology of this overall reservoir is well understood in general, but still delivers geological surprises.

One of the oil sand areas contains the Lower Cretaceous McMurray Formation of the Athabasca oil sands, which was deposited on the eastern, low-accommodation side of the foreland basin. Reservoirs, 10-90 m (33-295 ft) thick, occur in tidally-influenced meandering point-bar and tidal-bar deposits. The overall reservoir occurs at depths of 0-400 m (0-1312 ft). Sediment was derived primarily from the exposed craton to the east and northeast. Minimum sediment burial and early oil migration resulted in 30-35% porosity and multi-Darcy permeability. Lateral and vertical variation of reservoir and bitumen parameters is typical. Microbial biodegraded bitumen varies from 6-8° API gravity with viscosity greater than 1,000,000 centipoises. Viscosity can vary by an order of magnitude over 50 m (164 ft) vertically and 1 km (0.62 mi) laterally. Shale layers, either as mud plugs, extensive tidal flats, or muds on laterally accreting point bars, are a manageable challenge to development. The oil source is likely Mississippian shale of the Exshaw Formation from the underlying passive margin succession, which reached maturity during foreland basin compression. Work by others suggest that the Exshaw oil may have been generated and emplaced approximately 112 Ma, just after deposition of the McMurray Formation.

Nexen Inc.'s Long Lake Project upgrades 6-8° API gravity bitumen to 39° API synthetic oil. The project is largely self-sufficient with respect to natural gas. It will export co-generated power to market and produce premium synthetic crude oil that requires no diluents for shipping.

Ed. Note: This abstract is for the GCSSEPM luncheon at the 2008 convention. The abstract was received after the main body of the *Transactions* had been paginated and sequenced. We regret any inconvenience.

Leckie, D., 2008, Canada's Athabasca oil sands—Geology of the second largest hydrocarbon accumulation on Earth: Gulf Coast Association of Geological Societies Transactions, v. 58, p. 947.