

Seismic modeling of Lower Cretaceous flow units observed in outcrops and drill holes near Ft. McMurray, Alberta, Canada

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Most of the bitumen resources in the Athabasca Oil Sands Area are contained in estuarine and fluvial channel deposits of the Lower Cretaceous McMurray Formation. Stratigraphic sections were measured in detail along a 5 km stretch of the Steepbank River. Synthetic sonic logs were constructed for these outcrops with the help of logs of nearby wells. Core in the area correlates log responses with lithologies observed in outcrop. Three structural cross sections with 6 times vertical exaggeration were constructed through this area. At least 4 flow units are outlined by dipping surfaces of lateral accretion stratification in the largely estuarine middle McMurray Formation. The lower parts of these flow units are characterized by trough cross beds, which generally contain the highest bitumen contents. A steep NE trending normal fault can be interpreted from the NW trending cross section. The seismic response along these 3 cross section lines through these data points was modeled by ray-tracing.

The seismic lines obtained from this modeling were compared with four high-quality seismic lines, which the Alberta Geological Survey obtained from Mobil Oil Canada in the Clarke Creek area, 20 km southeast of the Steepbank River area. In this area flow units are well-defined on the seismic lines. Our modeling confirms that these flow units can be seismically imaged. From such seismic lines the bitumen contents may possibly be predicted. This prediction will be of high importance in areas of in-situ production, where the best production could be obtained from cross-bedded flow units.