GEOLOGY OF AN IN SITU PILOT PROJECT, WABASCA OIL SANDS DEPOSIT, ALBERTA

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ABSTRACT

The Wabasca Oil Sands Deposit, north-central Alberta, contains 24 billion barrels of the bitumen in place within two sand members in the Lower Cretaceous (Albian) Grand Rapids Formation, uppermost Mannville Group. The 6-8° API bitumen has a viscosity at reservoir temperature (65°F) of 2 million centipoises and a sulphur content of 4.6 weight percent. Since 1974 Gulf Canada has been experimenting with in situ fireflood, cyclic steam stimulation, steam flood and solvent related processes in the uppermost 'A' Member of the formation.

Regional structure is a gentle southwestward - dipping homocline locally complicated by differential compaction of Mannville sediments over paleotopographic relief on the Paleozoic erosion surface. In the pilot area, low amplitude (3 m), northwest-southeast oriented, plunging folds may represent compactional features, or wrinkles produced by the down-dip creep and buckling of the unconsolidated, oil-saturated sand.

The (Grand Rapids "A") reservoir is composed entirely of sand, 13.5-15 m thick, which is divisible into three members on the basis of grain size and sedimentary structures. Grain size increases upwards from very fine at the base of the Lower Member to fine sand in the Middle Member. In the Upper Member, the grain size decreases upwards from granuliferous, coarse sand at the erosional base to fine sand at the top.

Oil Saturation varies from 0 to 14 wt. % with an average saturation of 8.5 wt. %. The oil saturation is zero within: 1) Calcite cemented beds, 2) A basal water zone varying from 4.5 to 11.5 ft. in thickness, and 3) A thin water zone at the top of

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the reservoir.

Log porosity of bitumen-saturated sand ranges up to 36 percent and permeability reaches 25 millidarcies. Permeability of extracted sand reaches several darcies. The reservoir contains seven thin (.15 m - .55 m) beds tightly cemented with calcite that form permeability barriers. Permeability of oil sand is highly directional and is correlative with grain fabric. Oil saturation is controlled by grain size, quantity of intergranular fines, sorting, roundness and authigenic clay.

Pilot experiments have been disappointing and inconclusive for reasons attributable to physical and chemical characteristics of the reservoir. Major difficulties involve achieving injection into oil-saturated sand and preventing injected steam and air from escaping into the water zones. Laboratory experiments simulating steam and fireflood conditions resulted in marked chemical and physical changes on reservoir material.