The Wabiskaw B Reservoir of the Kirby-Primrose Area; Depositional and Diagenetic Controls on Reservoir Properties

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Abstract

The Wabiskaw B of northeastern Alberta is a falling stage systems tract delta, intermediate between undifferentiated Wabiskaw highstand sediments to the south and lowstand Wabiskaw A sediments to the north. Sediment was supplied to the delta by an incised valley that focused sediment at a point source. Frictional forces dominated sediment dispersal processes resulting in a sand rich reservoir body. Distribution of mudstone interbeds, sedimentary structures and ichnofossils indicate an energy gradient decreasing away from the point of sediment input. Mudstone interbeds increase in thickness and number away from the sediment source. Current formed sedimentary structures are replaced by wave formed structures distally. A sparse low diversity proximal fauna is replaced by a mixed Cruziana-Skolithos fauna distally.

Post-depositional exposure of the reservoir to influx of meteoric fluids (i.e. due to continued fall of relative sea level fall and lowstand depositon) resulted in neoformation of kaolinite cements and conversion of original depositional clays to kaolinite. Calcite from shell material was dissolved and reprecipitated as strata-bound concretions and layers.

Poor performance of the Wabiskaw B upon steam stimulation , relative to ostensibly similar Cold Lake reservoirs, can be attributed to high clay content resulting in high irreducible water saturation/low bitumen saturation and low permeability due small pore throat size. Kaolinite is susceptible to mineralogical transformation to illite and mixed layer clays upon steaming and in the presence of potassium from the dissolution of potassium feldspar, transformation to smectite. Segmentation of the reservoir into multiple flow units by continuously cemented horizon was evident in both pilot projects attempted in the reservoir.