

Extensional faulting, paleodrainage patterns and impact on hydrocarbon reservoir quality and distribution during foreland basin subsidence: A case study from the L. Mannville Fm.

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ABSTRACT

Lithospheric flexure during tectonic loading and subsidence of the Cretaceous-Tertiary foreland basin in western Canada resulted in intermittent local extensional faulting and rotation of Paleozoic “basement” blocks. The resulting half-grabens and variations in accommodation space localized both marine shoreface and fluvial/estuarine sand fairways during Lower Mannville deposition. Results from an evaluation of the Lower Mannville in twenty townships in south-central Alberta illustrate the impact of extensional faulting and relative sea level changes on the thickness, maturity and geographic distribution of reservoir facies, seals and stratigraphic traps in one of these half-grabens.

2-D seismic data from the area support the geological model developed from core and well log data. Regional seismic and deep well data indicate that intermittent Cretaceous extensional faulting occurred on a regional scale and that the faults commonly cut basement and Lower Paleozoic strata. However, seismic data also suggest that where Devonian evaporites are present at depth, brittle extensional faulting in the upper part of the section was accommodated at depth by ductile strain within the weaker evaporites.