New Exploration Concepts for the Lacustrine Moncton Basin, Onshore New Brunswick

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Exploration History

The Moncton Basin of Atlantic Canada has long been known to contain significant hydrocarbon potential within the lacustrine Albert Formation of the Horton Group. Exploration began in 1859, and culminated with discovery of the Stoney Creek Field in 1909, one of the first producing fields in Canada. The Stoney Creek Field produced 28 bcf (8 x 10^8 m^3) of gas and 800,000 barrels (130,000 m^3) of oil from the Albert Formation, although a large percentage of the oil (22 mmbls) was left in the ground due to the poor production practices of that time.

Basinal Setting

The Moncton Basin is part of the larger Maritimes Basin, a Devono-Carboniferous feature that extends from New Brunswick to Newfoundland and from the Gulf of St. Lawrence to the Scotian Shelf. The Horton Group rocks were deposited within Late Devonian/Early Carboniferous *en echelon* asymmetrical basins. There were soon after folded and unconformably overlain by continental conglomerates and marine evaporates and limestones of the Windsor Group.

Source Rock

The source rocks in the Moncton Basin are the lacustrine Frederick's Brook Member oil shales of the Albert Formation. These extremely organic-rich, dolomitic shales were deposited during a regional episode of basin subsidence. Hydrologically-restricted basins created salinity stratification and anoxic bottom conditions that facilitated the preservation of abundant algal material.

Reservoir Rock

Unlike some lacustrine basins where reservoir rock is a concern (such as the under-filled East African Rift basins), the Moncton Basin contains abundant sandstone reservoir rock. Reservoir was best developed during prograding shoreline episodes where the lakes shallowed and wave activity cleaned, sorted and redistributed fluvial and deltaic sands into laterally extensive shoreline beaches and bars. Due to the shallow and sand-rich nature of the basin, these sands were deposited on both the ramp and master fault sides of the asymmetrical basins. Individual wave-reworked sandstones are up to 15 m thick (generally 5-10 m) and laterally continuous. Stacking of these sandstones is common, with some areas (e.g. Stoney Creek) having 45 m of sandstone development, all within organic black shales.

Trapping Mechanisms

Hydrocarbons were trapped within the Stoney Creek field by stratigraphic pinchout and fault offset. Similar fault/pinchout plays were mapped during this study. Other types of plays include a combination of structural and sub-unconformity/sub-salt plays, where the unconformity is overlain by laterally continuous Windsor Group marine limestones and evaporites. There is evidence from exhumed fields that the unconformity acts as a seal. Reasonable reservoir parameters indicate traps with recoverable reserved in the order of 100 bcf or 25 million barrels.

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Exploration Strategy

Most wells drilled into the Albert Formation were spotted on surface shows and commonly intersected exhumed, but biodegraded pools. The thick Windsor Group marine evaporite sequence prevented seismic imaging of the underlying Albert Formation structure and stratigraphy until the early 1980's, when Chevron acquired 570 km of seismic reflection data in southern New Brunswick. Only four wildcats were drilled based on that data, one of which occurs within Corridor licence areas.

Our exploration strategy focuses on mapping the location of the organic-rich shales across the basin. The low velocity oil shales are readily mapped using modern seismic inversion techniques. Shoreline sandstones associated with these oil shales form strong and moderately continuous seismic reflections that fade into the deeper portions of the basin. The nearby oil shales provide organic acids that enhance the (secondary) porosity of the sandstones and also provide a local hydrocarbon charge.