

## Sedimentology and Depositional History of the McLaren Formation (Lower Cretaceous), North Bodo Pool, East-Central Alberta – A Compound Incised Valley Fill

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Recent advances in sequence stratigraphy have profoundly improved our ability to interpret and make predictions in the sedimentary record. Of particular note is the significant progress made in understanding the spatial and temporal relationships of strata that fill incised valleys. The North Bodo Pool in east-central Alberta (T 38; R1; W4) is interpreted to represent an incised valley fill. Heavy-oil production is from the Lower Cretaceous McLaren Formation (Mannville Group), with reserves estimated at  $(24 \times 10^6 \text{ m}^3 \text{ OOIP})$ . Based on framework-grain mineralogy, interpreted stratal discontinuities, and geophysical-log attributes McLaren strata in the study area have been subdivided into four distinct stratigraphic units. The first unit consists of two stacked, upward-shoaling shallow-marine successions that were deposited following a transgression that flooded coastal plain strata of the underlying Waseca Formation. These strata are comparatively mineralogically mature (subarkose to sublitharenite) but because of their relatively fine grain size are non-reservoir. Subsequently, as a result of a relative sea level fall, a major fluvial channel system incised into the older marine deposits and formed a northward-flowing valley that entered into the North Bodo area from the south and exited toward the west. As relative sea level rose thick meandering-fluvial point bar deposits were emplaced. Commonly these strata are more than 20 metres thick and represent the primary reservoir strata in the North Bodo Pool. Mineralogically these strata are classified mostly as sublitharenites. Later, a second relative sea level fall caused a second fluvial system to be incised. This system, however, entered into the study area from the east and in many places cross-cuts the older (reservoir) fluvial deposits as it flowed toward the west. As relative sea level rose this system filled with several-metre-thick, upward-fining meandering fluvial deposits. Significantly, these younger strata consist of mineralogically immature volcano-feldspathic sand (feldspathic litharenite) and because of extensive diagenetic alteration are non-reservoir. This marked compositional change suggests a fundamental change in sediment provenance, which in turn may be related to a major tectono-eustatic event. As relative sea level continued to rise marginal-marine tidal conditions developed. Tidal deposits consist of upward-fining tidal channel fills and mud-rich tidal flat deposits. Mud-rich tidal flat deposits are non-reservoir whereas tidal channel deposits form areally-restricted several-metre-thick reservoirs consisting mostly of relatively mature, quartz-rich sand. Subsequently, relative sea level fell again and subaerially exposed the study area. A regionally-extensive paleosol accumulated at this time. This unit, in turn, is overlain by lithic-rich coastal plain deposits of the overlying Colony Formation.