

Facies Distribution and Stratigraphic Architecture of the Lower Cretaceous McMurray Formation, Lewis Property, Athabasca Oil Sands Deposit, Northeast Alberta

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ABSTRACT

Within the Lewis study area, McMurray Formation strata comprise 4 facies associations that form a depositional continuum of braided-fluvial (FA1), tidally-influenced braided- to low-accommodation meandering-fluvial and meandering-tidal channel-fills (FA2), associated overbank (FA3), and open-estuarine tidal flat deposits (FA4). The primary reservoir occurs in transgressive FA2 deposits.

Lower-FA2 channels incise older water-wet FA1 sand and consist of medium to locally-coarse, bitumen-saturated sand with rare to locally common pin-stripe laminated and/or 1-5 cm thick mud beds. Channels were initially confined by steep valley walls formed along the sub-Cretaceous unconformity. As a consequence, coeval interchannel sediment (FA3) was cannibalized by lateral channel migration and occur only as common mud-clasts. The net result was the accumulation of a sand-rich, sheet-like deposit with locally-preserved fine-grained interchannel deposits, suggesting a high rate of lateral versus vertical accretion.

With the filling and elimination of the irregular paleotopography along the unconformity, upper-FA2 channels became unconfined and formed thick, areally extensive IHS deposits. Similarly, coeval interchannel deposits are more widely-distributed and thickly preserved compared to underlying strata. The position of upper-FA2 channels was indirectly influenced by paleotopography along the unconformity because IHS strata are thickest and sandiest along trends that overlie earlier channel systems, suggesting that syn-depositional salt dissolution controlled channel position and infilling history. Stratigraphically-upward there is a gradational change toward tidal-flat deposits (FA4), suggesting abandonment of the main north-south channel system and a condition of coarse-grained bedload sediment starvation.