Sedimentology and Ichnology of Estuarine Point Bar Deposits, McMurray Formation, Northeastern Alberta

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ABSTRACT

The Athabasca Oil Sands deposit of northeastern Alberta is the largest known accumulation of hydrocarbons in the world, the majority of which is contained within the Lower Cretaceous McMurray Formation. Inclined Heterolithic Stratification (IHS) composes a major portion of the McMurray Formation, commonly reflecting a repetitious alternation between sand-dominated and mud-dominated deposition on a large-scale inclined surface. Over several decades, the favored interpretation for these IHS deposits has become lateral accretion of estuarine channel point bars. Key to the development of this interpretation has been the recognition of brackish water ichnological character. While the IHS deposits have received cursory attention in many broad studies of the McMurray Formation, little is known of their fine-scale aspects.

Patterns of the ichnological and sedimentological variation in McMurray Formation IHS are presented and discussed in the depositional context of an estuarine system. Special attention is paid to the role variable fluvial inflow and migration of the turbidity maximum may have played in the fluctuation of sediment character.

Considerable variation in sedimentological and ichnological characteristics occurs between sets of IHS, which in turn leads to great variability in the reservoir potential of these sediments. In some cases the IHS is dominated by beds of clean, well-sorted sand, with high bitumen saturation and very good lateral continuity, while in other cases the sediment is mud-dominated and may provide an effective barrier to flow. As in-situ techniques of bitumen extraction are refined and become more heavily employed, a detailed understanding of heterogeneous reservoir elements, such as the IHS-bearing intervals, will prove to be invaluable for modeling production dynamics and optimizing recovery.