Emerging Model for the Interpretation of the McMurray Formation in the Athabasca Oil Sands

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Abstract
A major deltaic system and its evolution through Lower Mannville time explain the development and distribution of the McMurray Formation, the main reservoir unit of the Athabasca Oil Sands. Preserved in the lower and middle McMurray are at least three regressive packages which accumulated in a narrow, confined, basin. Each regressive package consists of two major facies associations: thick mega-rippled dune sands, interpreted here to be the outer distal element of a tide-dominated delta, and thick interbedded (IHS) point bar systems interpreted as the brackish, proximal or lateral element of the delta. These two facies associations are often interpreted as a single genetic unit of channel fill in an incised valley. However outcrop observation of internal erosional contacts, combined with ichnofossil evidence, clearly demonstrate the inadequacy of an incised valley fill model. If incised valleys are present, they incise into these ubiquitous regressive units. We believe that incised valley deposits have yet to be demonstrated in outcrop, with one debatable exception north of Daphne Island where alluvial deposits, including coal, cap the lowermost regressive systems tract.

An important question is whether these regressive deposits represent normal progradation, or forced regression due to sea level drop. Field evidence indicates progradation as sediment supply outpaced sea level rise.

In the upper McMurray several coarsening-upwards, correlatable units are interpreted as prograding shoreface successions. These indicate that the depositional system evolved from tide- to wave-dominated as the basin filled and its morphology changed. Each shoreface systems tract may be capped by thin coals or carbonaceous mud, and is floored by a regional marine mud on a transgressive surface of erosion.