# Incised Valleys vs. Channels: Implications for McMurray Formation Bitumen Mapping and Exploration

Y. Greg Hu and Derek G. Lee
Petro-Canada, P.O. Box 2844, Calgary, AB, T2P 3E3

Incised valleys form when there is a relative sea level drop accompanied by incision of rivers into pre-existing sediments. The maximum depth of an incised valley is equivalent to the magnitude of the relative sea level drop that caused the incision.

Athabasca oil sands are present in an immense incised valley on the Sub-Cretaceous Unconformity. The paleovalley system had a south-to-north gradient and was over hundred kilometers wide and 50 to 100 metres deep. This paleovalley was far away from the active thrusting belt along the western margin of the Western Canada Sedimentary Basin, and overall subsidence rates of its basement were slow. The formation and filling of this huge paleovalley may have been controlled mainly by eustatic sea level fluctuations.

The filling of this incised valley took place during the overall transgression of the Cretaceous seaway during the McMurray time. This overall trend, however, was interrupted several times by higher frequency of relative sea level drops, which resulted in formation of smaller scale incised valleys and their associated channel systems. These smaller-scale incised valleys could be a few kilometers wide (compared to the over 100 km wide in the major incised valley system) and tens of meters deep. They were subsequently filled rapidly with sediments during the accompanying relative sea level rise. These sediments are predominantly fluvial-estuarine channel sandstones and their associated facies. These channel sandstones are the most important reservoir host to bitumen.

Constrained by well control, correlation of individual channels is virtually impossible. Thick and widespread bitumen sandstones seen over much of the Athabasca area may be a result of multiple incisions of smaller scale incised valleys. Low basement subsidence rates over the region may have caused multiple incised valleys at different times to stack together, laterally and vertically, to form thick and widespread sandstones. As a result, incised valley trends, which are easier to map than individual channel sandstones, are indicative of where commercial size bitumen deposits are found.