Ichnofossil Evidence from the Estuarine Facies of the McMurray Formation, Northeast Alberta: Facies Interpretation and Production Enhancement

Chad R. Harris[1], Murray K. Gingras[2], and S. George Pemberton[1]

[1]Ichnology Research Group, Department of Earth and Atmospheric Science, University of Alberta, Edmonton, Alberta, T6G 2E3
[2]Department of Geology, University of New Brunswick, Fredericton, New Brunswick, E3B 1J7

ABSTRACT

Northeast Alberta plays host to extensive heavy oil and bitumen deposits the largest of which, the Athabasca Oil Sands, contains approximately 1.3 trillion barrels of bitumen in-place, trapped in the non-lithified, surface-exposed, sand of the McMurray Formation. Given the size of this resource and its proven recoverability, this deposit is unquestionably the future of the oil industry in western Canada. Comprehension of the geology of this deposit and effective production techniques will ensure the longevity of this industry in Alberta. Ichnological criteria have long been key to understanding the inherent and complex mosaic of fluvial to shallow marine facies and environments. These ichnofossils may now have an impact on in-situ production.

The conventional fossil data in the McMurray Formation is rare and limited to marine bivalves and common wood fragments. Ichnofossils are readily recognizable in the rock record and their interpretation allows for better understanding of the paleo-environments of distinct facies through several factors. Many ichnofossils have been identified in the McMurray Formation, notably *Skolithos*, *Cylindrichnus*, *Gyrolithes*, *Conichnus*, *Monocraterion*, *Planolites*, and *Palaeophycus*.

Steam Assisted Gravity Drainage in-situ techniques are undoubtedly the future of the oil sands industry. This production method requires good vertical continuity in the defined pay zones of the deposit. Commonly these zones comprise the inclined beds known as Inclined Heterolithic Stratification that contain alternating beds of sand and mud of variable thickness. The sand-filled vertical burrows of *Skolithos*, *Cylindrichnus*, and others generate vertical permeability through these beds that can enhance in-situ production.