

# SEQUENCE-STRATIGRAPHIC AND PALEOENVIRONMENTAL DEVELOPMENT OF THE NE QUADRANT OF THE MCMURRAY SUB-BASIN, ATHABASCA OIL-SANDS REGION, CANADA

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## ABSTRACT

The McMurray Formation of the Western Canada Sedimentary Basin comprises a series of incised-valley fills that were cut and filled during relatively rapid falls and rises in base level superimposed on a longer-term trend of base-level rise. The informal lower McMurray Formation comprises fluvial point-bars and inter-channel dunes, which occupy topographic lows in the underlying Sub-Cretaceous Unconformity (SCU). In the northeastern quadrant of the McMurray Sub-Basin (SE corner: 90-23W3, NW corner: 100-07W4), the lower McMurray Formation is commonly subdivided into two stratal packages by a coal horizon with a maximum thickness of 10 m. The thickness of the coal deposits in localized areas across the region suggest that the coals represent a significant period of time. Hence, the underlying sands either represent an older stage of McMurray-aged deposition, or the coal strata represented a raised mire environment, which significantly altered river flow pathways. In order to assess the stratigraphic significance of the lower McMurray coal deposits, a multidisciplinary approach will be employed. Firstly, coal horizons and the SCU will be spatially mapped in Petrel using their distinctive photoelectric log and neutron-density porosity log characteristics. Log character was ground-truthed through logging 32 cores, including 14 that contained paleosol and/or coal horizons in the lower McMurray strata. An additional 3354 wells in the study area have available LAS files. In Petrel, multi-variant cut-off values are applied to digital well-logs to generate a structure map of the SCU, and an isopach map of the combined coal and paleosol deposits. Secondly, sand samples were taken from above and below a thick coal horizon. The zircon signature and maximum depositional age will be used to help constrain the time interval represented by the coal, and hence, the age of the sands. Within the literature, it has been suggested that the provenance of the McMurray strata shifts throughout its depositional history from the adjacent Canadian Shield to continentally-sourced (Appalachian- and Grenville-derived sediment). Two different stages of lower McMurray deposition may show significantly different detrital zircon suites and therefore provenances. Finally, company-donated coal palynological data will be analyzed to resolve their palynological suite and determine whether the deposits represent raised mires or coastal swamps. Hence, this may restrict the relative position of the ocean. This research project aims to resolve the stratigraphic and paleogeographic significance of lower McMurray coal deposits. Further, detrital zircon analyses will provide valuable information to the ongoing debate on the provenance-development within the McMurray Formation, specifically towards the northeastern subcrop-edge.