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Resource Assessment and Regional Geology of the Athabasca Oil Sands Deposit, McMurray Formation, Northeastern Alberta: A Synthesis

Alberta houses an immense bitumen resource with an initial in-place crude bitumen volume of 1.6 trillion barrels. Remaining established reserves for Alberta bitumen are 176 billion barrels compared with 252 billion barrels for Saudi Arabian conventional oil. The Athabasca Oil Sands Deposit (AOSD) is the largest of its kind in Alberta (OBIP of 1.3 trillion barrels), mostly derived from the Cretaceous McMurray-Wabiskaw interval (881 billion barrels). Of this, 86% occurs in in-situ areas and 14% in mining areas.

This study focused on the comprehension of depositional environments, regional correlations and geological history of the bituminous McMurray Formation. Rapid lateral facies variations make for complicated correlations. A statistical approach was adopted to determine the proportion of depositional environments comprising the entire McMurray Formation, and for its various intra-stratigraphic intervals. This information may serve to improve predictions of reservoir quality trends within the AOSD of Alberta.

Four main lithofacies associations (LA) were recognised and interpreted from cores; fluvial channels (LA I), estuarine channels (LA II), tidal creeks (LA III) and bay fills (LA IV). Relative proportions of these LA's are plotted spatially and temporally. Results show that the ratio of argillaceous bay-fills to sandier estuarine and fluvial channels becomes higher in the northern AOSD area and towards the top of the McMurray Formation. A southward regional transgression of the Boreal Sea caused the southward retrogradation of depositional environments, increase in net-to-gross and continuous pay. A detailed understanding of the McMurray regional geology could lead to improved selection of SAGD site selection.