

McMurray Formation Type Section Outcrop: Part 1 - A World Class Learning Lab for Fluvio-Tidal Sedimentology, Petroleum Systems and Reservoir Characterization and Part 2 - An Unparalleled Portal for SAGD Risk Assessment, Well-Placement Planning and Production Optimization Studies

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Abstract

McMurray Formation Type Section (defined by Carrigy, 1959) is located 5km downstream from the confluence of the Athabasca and Clearwater rivers and extends 2 km along the east bank of the Athabasca River. This outstanding, up to 80 m thick exposure has been described, logged and visited by many geologists. Since the first documentation of oil sands along the Athabasca River by Peter Pond in 1778, literature review documents early qualitative geological descriptions of this outcrop by Bell (1884), McConnell (1893), Ells, (1914), followed by descriptive logging by Carrigy (1959). Carrigy's (1959) outcrop log included (i) contact between McMurray (named by McLearn, 1917) and Clearwater Fm., (ii) McMurray subdivision into middle and upper member, and (iii) sand description based on grain size, sand mineralogy, cement type, induration, and bitumen saturation. Although regularly visited by many geologists in recent decades, the Type Section have not been documented in literature with the exception of Hein et al., (2001), who did detailed outcrop logs including description of sedimentary facies and provided depositional environment interpretation.

In the first part, this report builds on previous works (particularly on Hein et al. 2001) and aims to (i) document detailed reservoir architecture; (ii) reconstruct depositional processes characterized by the dynamic interplay of deposition and erosion on various time scale; and (iii) understand the impact of vertical and lateral compartmentalization and facies heterogeneities on reservoir oil-charge, in-reservoir biodegradation, and fluid (oil, water, and gas) migration and mixing processes which cumulatively control the geometry of high Sw geobodies in present day outcrops and subsurface. In the second part, a detailed geological outcrop map is used as a portal to qualitatively compare the impact of the spatial distribution of various reservoir heterogeneities and lean zones on a range of SAGD well-placement configurations and production optimization strategies.

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