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Orthogonal geometrics of lower McMurray Formation sand complexes: effects of salt dissolution collapse-subsidence across the northern Athabasca oil sands deposit

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Abstract

Lower McMurray strata distributed across the northern one-third of the Athabasca oil sands deposit filled cross-cutting troughs that formed a giant orthogonal lattice. This pattern of lineament pair bound troughs on the sub-Cretaceous paleotopography was configured by underlying Middle Devonian salt dissolution-collapses. The western segment of the giant 50 km long V-shaped Bitumont trough overlies the 5-10 km wide Middle Devonian salt scarp, which was further dissected by continued dissolution along lineament pairs during the lower McMurray period. There was a more complete removal of at least 100 m of salt beds underlying the eastern trough. Salt removals during the pre-Cretaceous and lower McMurray periods fragmented the overlying Upper Devonian strata into fault blocks that floored these giant cross-cutting troughs and resulted in Devonian block containers that differentially subsided and compartmentalized the lower McMurray deposits. These container fills were mostly coarser sand aggradations across the western trough in contrast to structurally lower heterolithic flood plain deposits to the east. The container fills inherited orthogonal geometrics contiguous with the underlying salt dissolution lattice pattern.