

Beneath the Oil Sands: Stratigraphy and Structural Features of the Devonian of Northeast Alberta, Canada

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Abstract

Devonian limestone and shale subcrops beneath the McMurray Formation oil sand in northeastern Alberta. The Beaverhill Lake Group and the Watt Mountain Formation of the Elk Point Group underwent structural deformation and karstification related to the dissolution of subsurface Prairie Formation halite. We reconstructed four scales of folds, ranging from a wavelength of 50m to the width of the study area, and encountered small normal faults in outcrops and abundant offset fractures in cores. Throughout the area, karst is a common feature, primarily occurring as active and relict sinkholes, enlarged joints and to a lesser extent, caves.

Our reconstruction of the pre-Cretaceous unconformity surface reveals a channel system roughly paralleling the present-day Athabasca River north of Fort McMurray. Abundant lineaments related to erosional and salt dissolution processes and circular structures attributed to sinkholes or other collapse from halite dissolution occur on the Devonian surface.