

Multiphase Solution Removal of the Prairie Evaporite Formation in Northeast Alberta (Implications for the Oil Sands Mining Community)

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Abstract

The Middle Devonian Prairie Evaporite section in northeast Alberta is comprised of a thick, up to 270 metre, succession of dolomites, anhydrites and halites. These were deposited as chemically precipitated sediments in the middle reaches of the pre-existing Keg River-Winnipegosis basin. The geologic section thins rapidly towards the basin margin to the east because of subsurface dissolution and because of its inherently soluble nature, the unit does not occur in outcrop.

Dissolution of the Prairie Evaporite section took place because of the influx of fresh waters primarily introduced along the eroding basin margin. This type of dissolution is often referred to as hypogenic karst, as it takes place beneath a relatively intact overlying section. Based on stratigraphic studies undertaken on the Middle Devonian and overlying Cretaceous McMurray section, at least three phases of dissolution collapse are recognized:

- Phase 1: Middle Jurassic to Early Cretaceous accompanying uplift and erosion associated with the Laramide Orogeny and the formation of the pre-Cretaceous unconformity.
- Phase 2: Early Cretaceous during deposition of the Lower McMurray.
- Phase 3: Latest Tertiary during the latest cycle of uplift and erosion when glacial waters entered along the basin margin.

The three phases outlined above reduced the overall Prairie Evaporite section from 270 metres to less than 18 metres in thickness through the progressive and systematic removal of the soluble elements.