



geoconvention

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Li-enriched oilfield waters in the Woodbend Reef Complexes of the Alberta Basin: A tale of two brines.

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Summary

Known areas of occurrence of Li-enriched oilfield brines exist within the Swan Hills Formation of western-central Alberta and within the Leduc and Nisku Formations of eastern-central Alberta. While both occurrences are hosted within Devonian carbonates of the Woodbend Reef Complex, the brines within each occurrence show distinct geochemical characteristics indicating distinct evolutionary histories. Li-enriched oilfield brines present within the Swan Hills Formation formed primarily by dissolution of halite into (possibly slightly evapoconcentrated) Devonian seawater. Post-formational (possibly Laramide) injection of Li-bearing hydrothermal fluids caused Li enrichment observed within Swan Hills oilfield brines. Li-enriched oilfield brines present within the Leduc and Nisku Formations show a more apparently-complex evolutionary history than oilfield brines present within the Swan Hills Formation. Oilfield brines within the Leduc and Nisku Formations formed through a series of events including evapoconcentration of Devonian seawater, dissolution of potash minerals and dolomitization of Devonian carbonates during long-range gravity-driven westerly subsurface flow. Dissolution of potash minerals into Devonian seawater evapoconcentrated to less than, or diluted below, potash-mineral saturation likely occurred contemporaneously with deposition of the Prairie Evaporite Formation. Dense brines so formed then gravitationally migrated downward into underlying Devonian carbonates. Long-range gravity-driven westerly subsurface flow, accompanied by extensive dolomitization of Devonian carbonates, followed post-Jurassic tectonics which imparted a westerly dip to pre-Cretaceous formations within the Alberta Basin. Partitioning of Li into subsequently redissolved late-stage potash minerals is a plausible explanation for Li enrichment observed within oilfield brines present within the Leduc and Nisku Formations. Li-enriched oilfield brines present within the Swan Hills, Leduc and Nisku Formations have all been affected by varying degrees of dilution with meteoric water and may have been emplaced in their current locations by compressional forces associated with the Laramide Orogeny.