

Lithium in Oil Field Brines: More Questions than Answers?

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Abstract

The main objective of this proposed study is to investigate whether the elevated lithium concentrations found in oil field brines in the Williston Basin are sourced by upward advection of hot basement brines through deep-seated fracture systems. Even though the data is sparse, the distribution of elevated lithium concentrations in the Black Slough and Beaver Lodge fields appears to be local as opposed to regional in scale. Adopting a model developed in Canada we suggest evaluating these lithium occurrences with regard to being sourced by advecting crystalline basement fluids. Features consistent with this include structural curvature maps of the Beaver Lodge that exhibit abnormally high degrees of structural curvature, cores with large (2" wide) anhydrite filled fractures, vertical stylolites, high heat flow and highly altered crystalline basement rocks. Adding to this is an age date from the crystalline basement that indicates that these rocks were hydrothermally (?) altered sometime after the late Precambrian and before the Quaternary. Given this set of circumstances, future work to either support or refute this should be considered. For example, hydrothermally formed dolomite is frequently found forming xenotopic textures, baroque or saddle shaped crystal faces and isotopic signatures that are distinctly different than those formed in sedimentary environments. Therefore, evaluating core, thin sections and obtaining samples for carbon and oxygen isotopes should be helpful in working out the geologic parameters that influence the distribution of lithium in the oil field waters of the Williston Basin.