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Salt of the Earth: The Lithium Potential of NE BC

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The NEBC Lithium Formation Water Database joint study, conducted by Canadian Discovery Ltd. and Matrix Solutions Inc. for Geoscience BC, strives to deliver a lithium and other dissolved minerals and metals brine database through a large-scale sampling program undertaken in northeastern British Columbia (figure 1.1). No such research has previously been conducted in NEBC despite similar, and in some respects more favourable, geologic conditions for the emplacement of lithium-enriched brines than in neighbouring Alberta and Saskatchewan.

Lithium is on Canada's list of 31 critical minerals that are essential to the green and digital economies. It is used in a wide range of industries and applications including renewable energy production and storage, EV batteries and motors, defence and security technologies, consumer electronics, critical infrastructure, and medical applications. Extracting lithium from oilfield brines provides BC an opportunity to use its extensive oil and gas industry database and workforce to acquire this critical mineral.

This project expands upon discoveries of elevated concentrations of dissolved metals (specifically lithium) in multiple geological formations in both Alberta and Saskatchewan in the Western Canada Sedimentary Basin. Despite ample historical oil and gas industry sampling of formation water for routine analyses, the publicly available datasets for brine chemistries and associated lithium concentrations remain relatively limited. This is because samples were not routinely analyzed for lithium and other metals. At present, Alberta has recorded over 1,600 formation water samples with lithium concentrations (Eccles and Berhane, 2011; Lopez et al., 2020) and Saskatchewan over 200 (Jensen, 2012, 2016; Jensen et al., 2017). Northeastern BC, prior to this project, had only recorded five samples with lithium concentrations (Eccles and Berhane, 2011). This data scarcity presents a significant challenge for operators looking to develop lithium resources in BC. Adding data is complicated by the fact that formation water can only be sampled from existing oil and gas infrastructure, that is, from wells that are on production and can bring associated water to surface.

The study was conducted in three phases: an initial sample collection phase where operators in NEBC were asked to obtain water (brine) samples from currently producing wells; a second phase to analyze the samples for a full suite of physical and chemical parameters to produce a preliminary brine characterization dataset; and a third phase of integrating the analyzed data into existing water chemistry datasets and the reservoir geology of NEBC. These public, peer-reviewed results will help the natural resource sectors, governments, communities, Indigenous groups and academia to further understand the potential for lithium production in the region.

At this time, it is generally accepted in industry and in literature that lithium brine concentrations need to be above 50 mg/L to be considered economic (Standard Lithium, 2021; LithiumBank, 2023). This study found that northeastern BC could host potentially economic or near-economic concentrations of lithium in brines within the pore spaces of several formations. Brine-hosted in-situ lithium potential was estimated for the Triassic Montney Formation, which is not an aquifer in northeastern BC, but a very fine-grained unconventional reservoir that must be hydraulically fractured to produce hydrocarbons, and also to co-produce lithium from the frac and formation water.

The lack of analyzed lithium samples was the greatest challenge in this study. Relatively few samples were collected over the vast expanse of NEBC; sampling is sparse, not only areally, but also stratigraphically. Specific areas are recommended for further sampling, but in general more samples should be collected in all formations. It is recommended that sampling occur away from waterflood schemes where true formation water chemistry has been diluted or altered by injected water.

Because there is a limited number of samples in each formation, and the geographical extent of those samples is limited, the total dissolved solids (TDS) to lithium concentration correlation developed for this study was used as a proxy to high-grade or low-grade formations for lithium development potential. However, while higher lithium concentrations are often associated with higher TDS concentrations, high TDS concentrations do not necessarily imply high lithium concentrations.

Figures

1.1 | Study Area Sample Distribution and Transportation Infrastructure Map

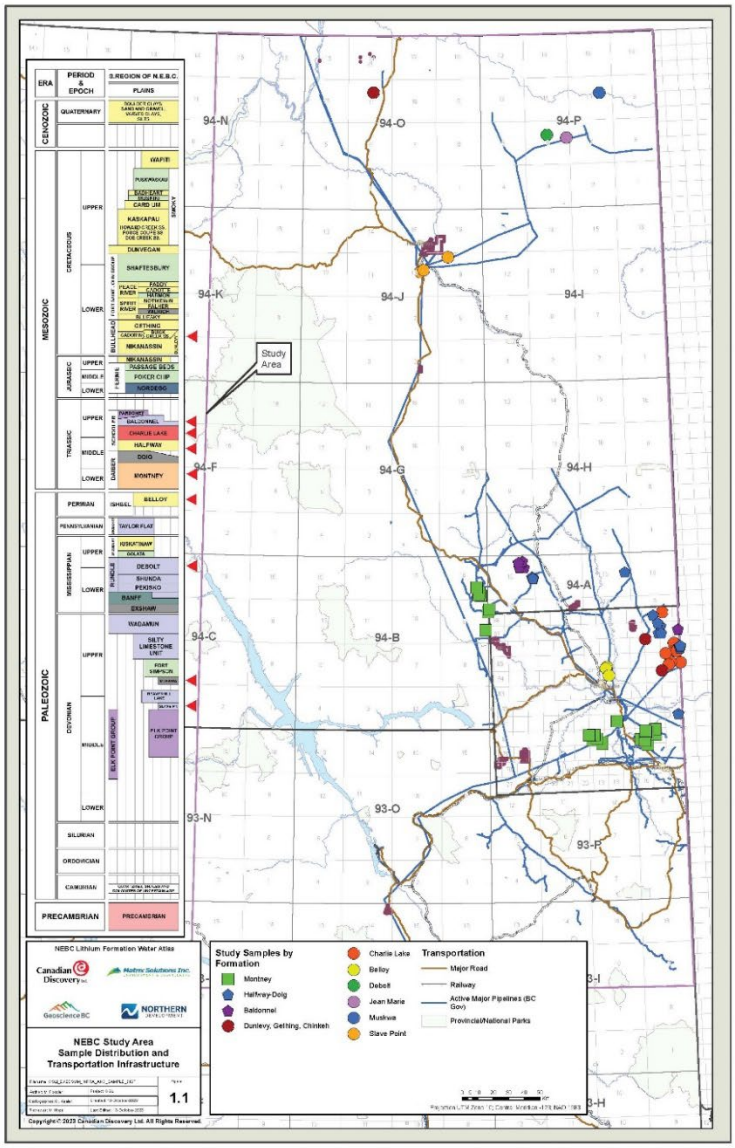

Figure 1.1

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