

## Mapping Lithium Recovery Potential of Devonian Aquifers in the Western Canadian Sedimentary Basin (Alberta)

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### Summary

Devonian aquifer brines are currently a primary target for lithium (Li) exploration in western Canada. However, only limited water analysis datasets with Li concentration measurements are publicly available for these brines, challenging the assessment of Li recovery potential. This study addresses a significant information shortfall by developing a new workflow for indirect estimation of Li concentration in (deep) saline aquifers using ubiquitous water analysis data. Statistical analysis of produced brines from 2,454 Devonian oilfield wells demonstrated that anomalies in Li concentrations across Alberta can be predicted (max.  $\pm 15\%$  error) using total dissolved solids and pH as inputs. The predictions improved significantly (max.  $\pm 10\%$  error) by incorporating the concentration of a major element, potassium, as an input, due to its correlation with Li in Devonian brines in western Canada. The developed workflow enabled mapping of the spatial distribution of Li concentrations across Alberta with a significantly higher resolution and extent (3,942 datasets;  $\sim 147,000 \text{ km}^2$ ) than achieved previously (271 datasets;  $26,393 \text{ km}^2$ ), facilitating more confident Li exploration in Canada.