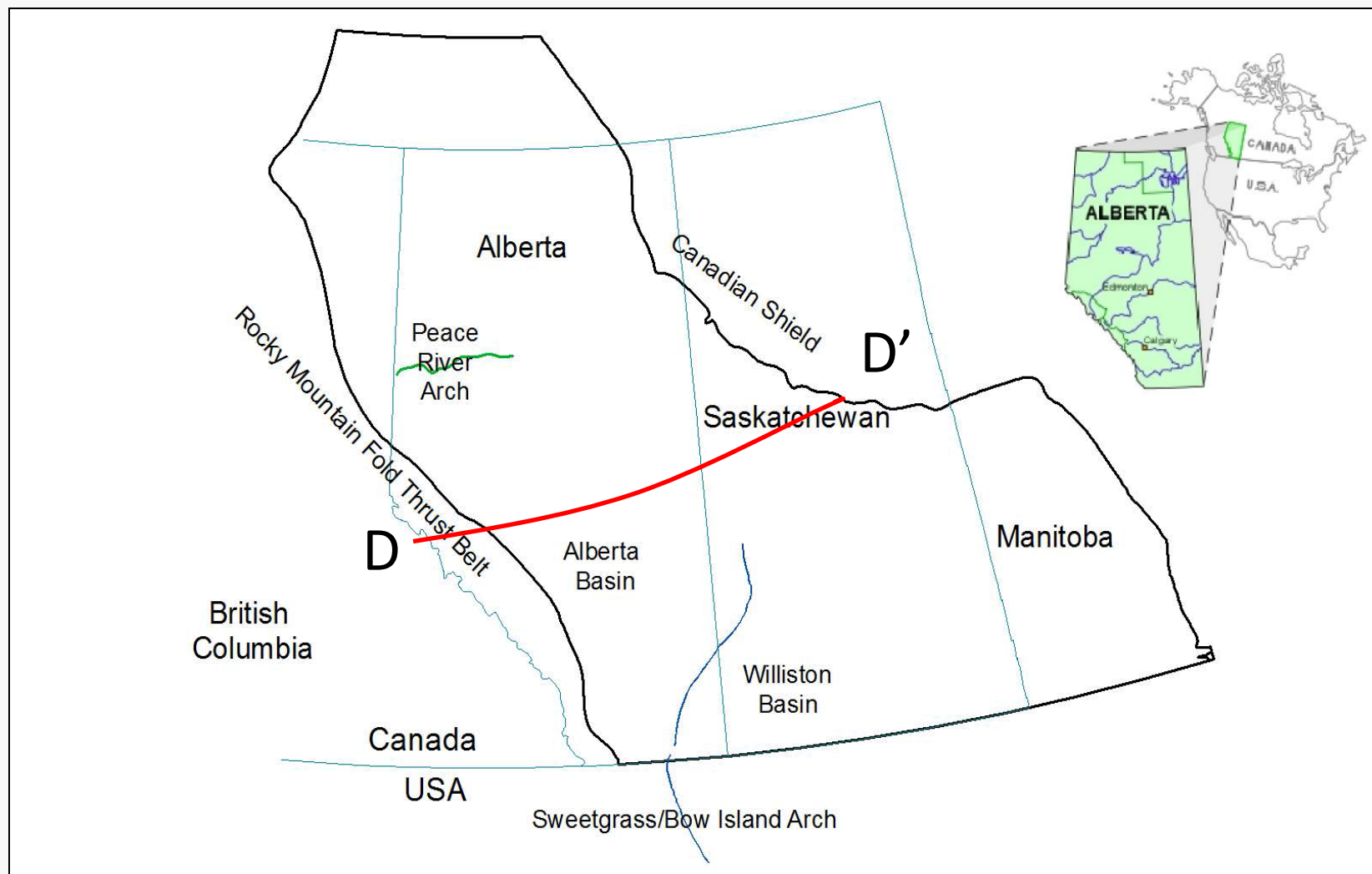


Evolution of Li-enriched oilfield brines in Devonian carbonates of the south- central Alberta Basin, Canada

G.F. Huff, Alberta Geological Survey

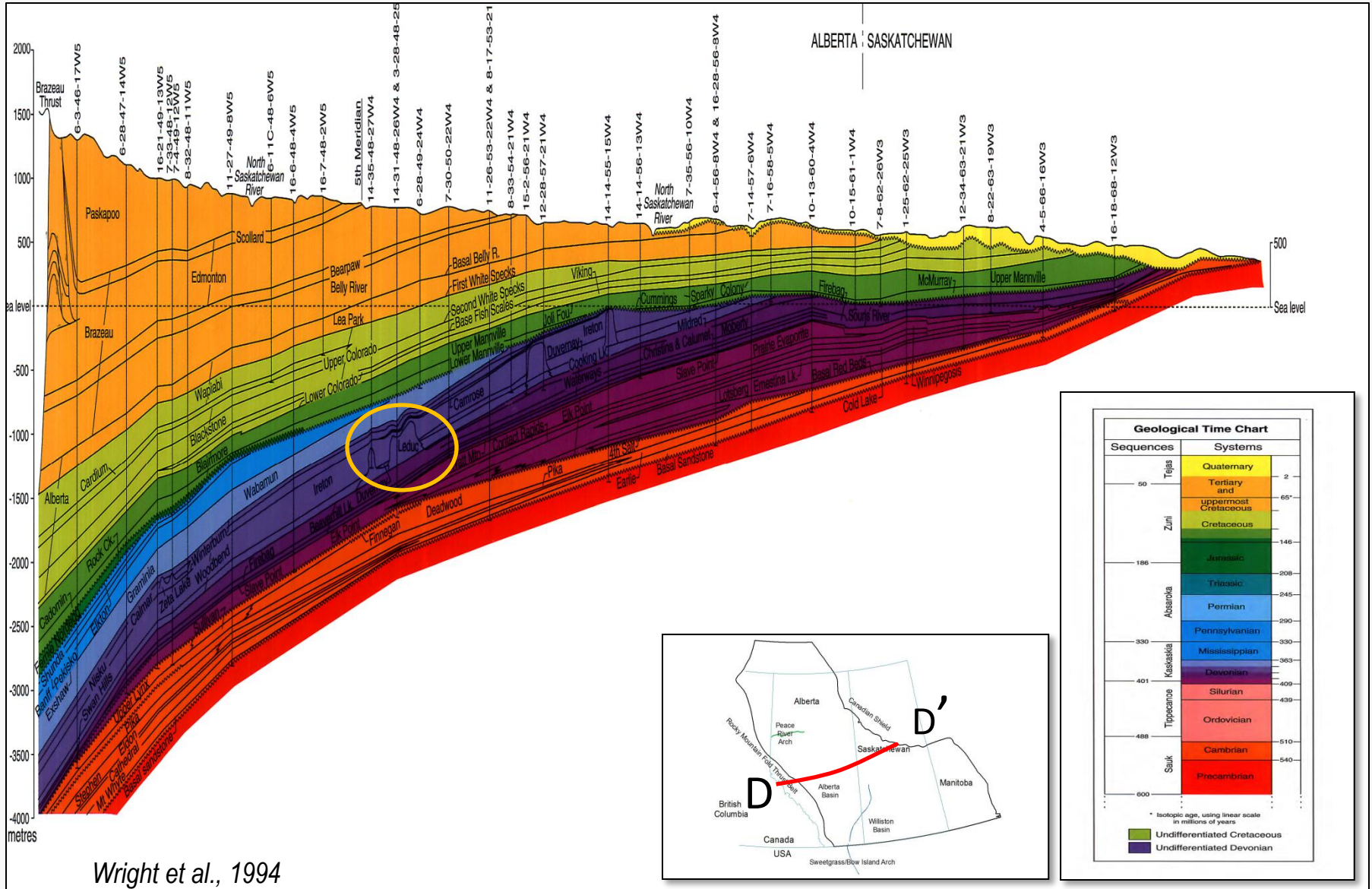


Geologic Setting



D

D'



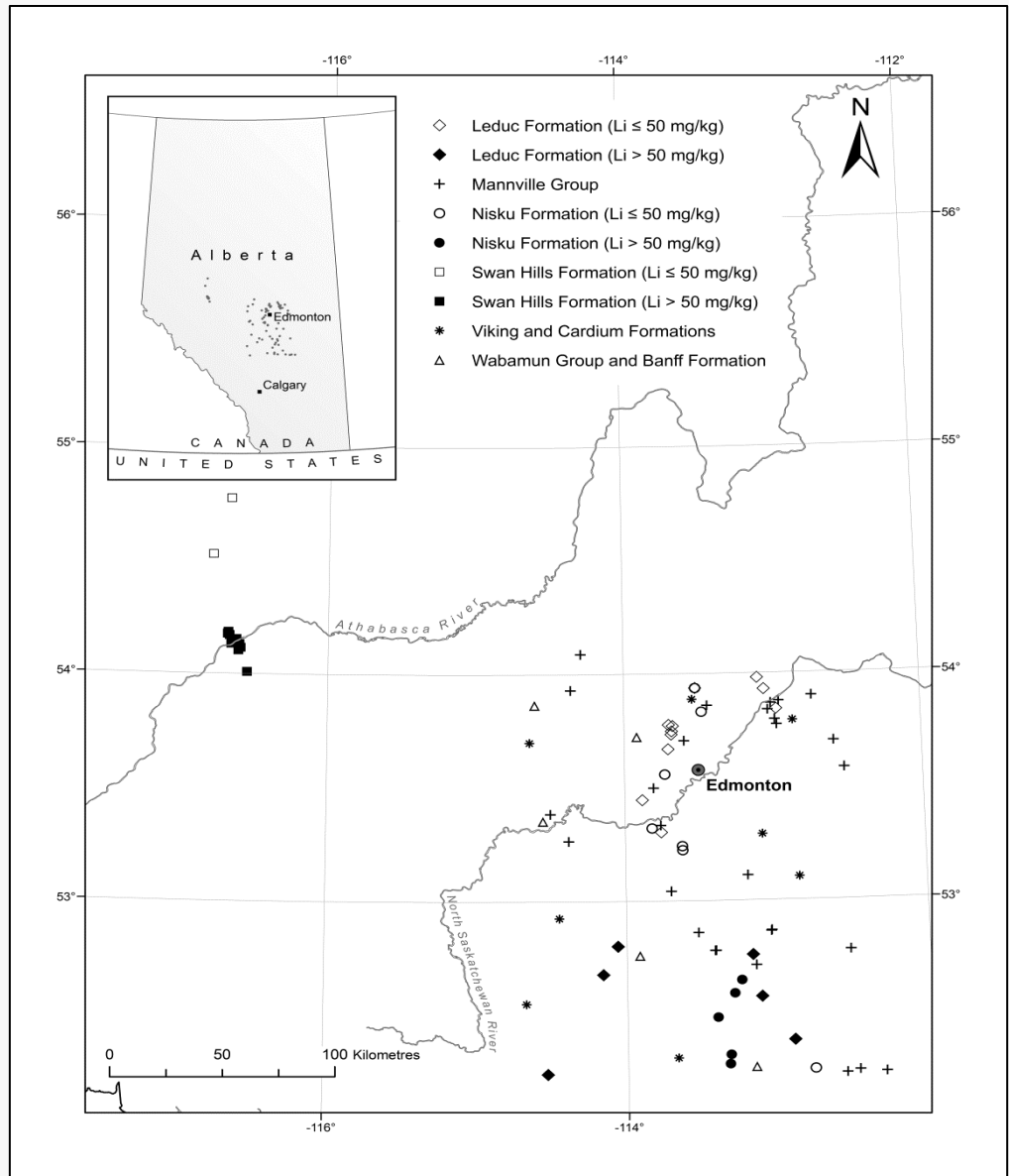
Wright et al., 1994

Purpose

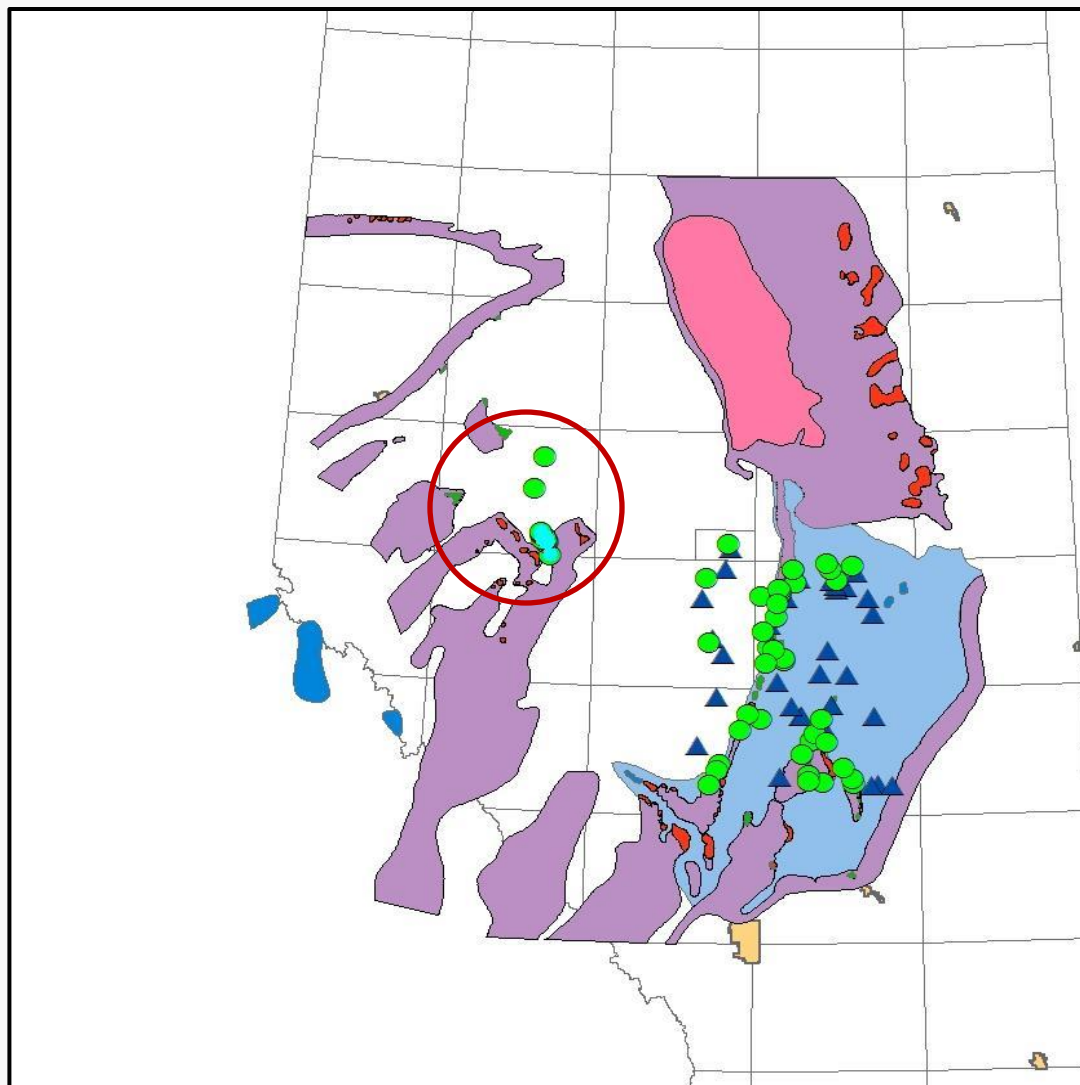
- Understand the origins of Li-enriched oilfield brines found in Devonian carbonates of eastern-central Alberta.
- Definition:

Li-enriched ≥ 50 mg/kg.

Sample locations

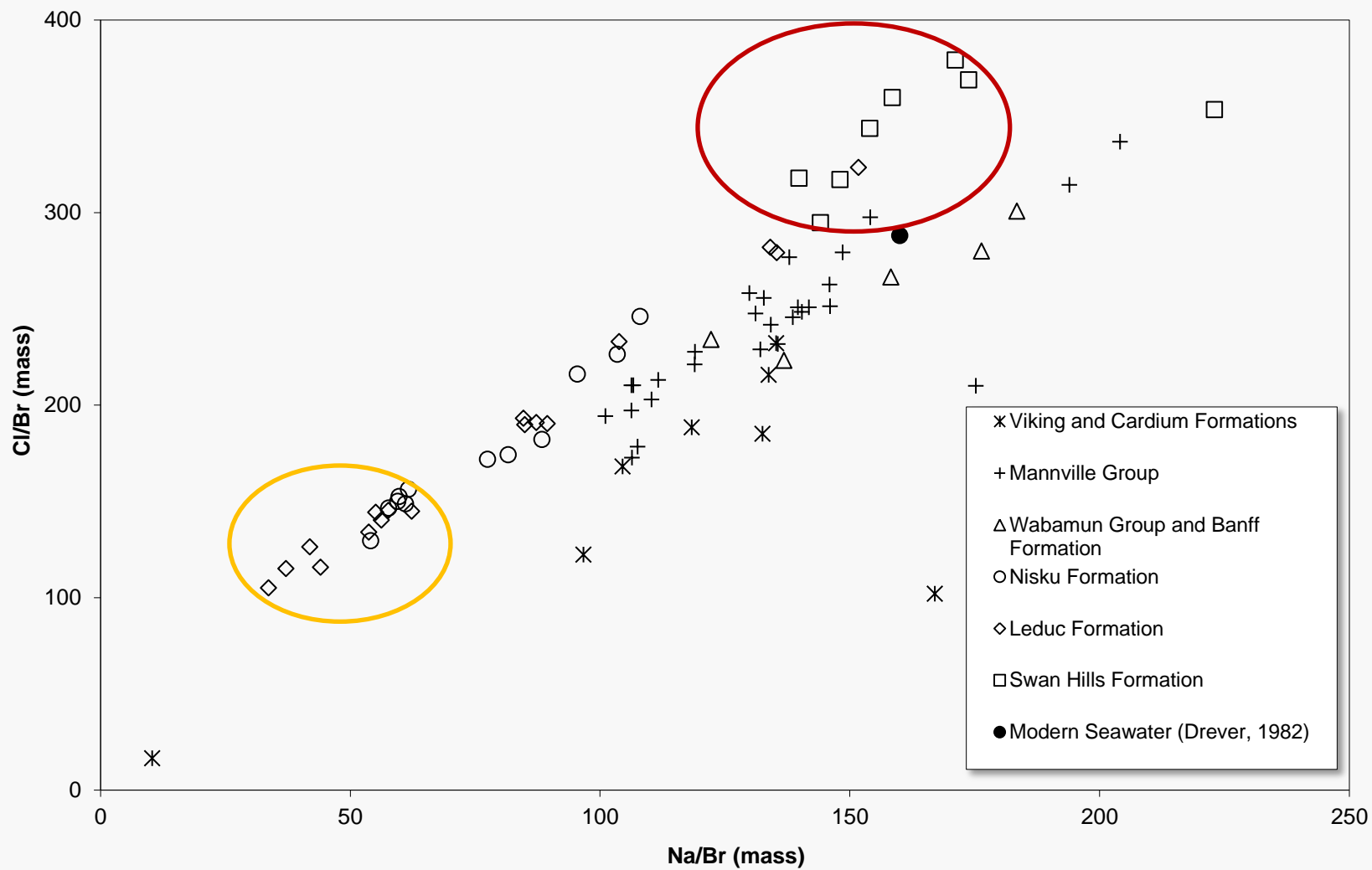


- ▲ Samples from Clastics
- Samples from Carbonates
- Evaporites
- Dolomitized Carbonates
- Non-Dolomitized Carbonates
- Gas Pools
- Oil Pools
- Eccles and Berhane 2011,
AGS OFR 2011-10



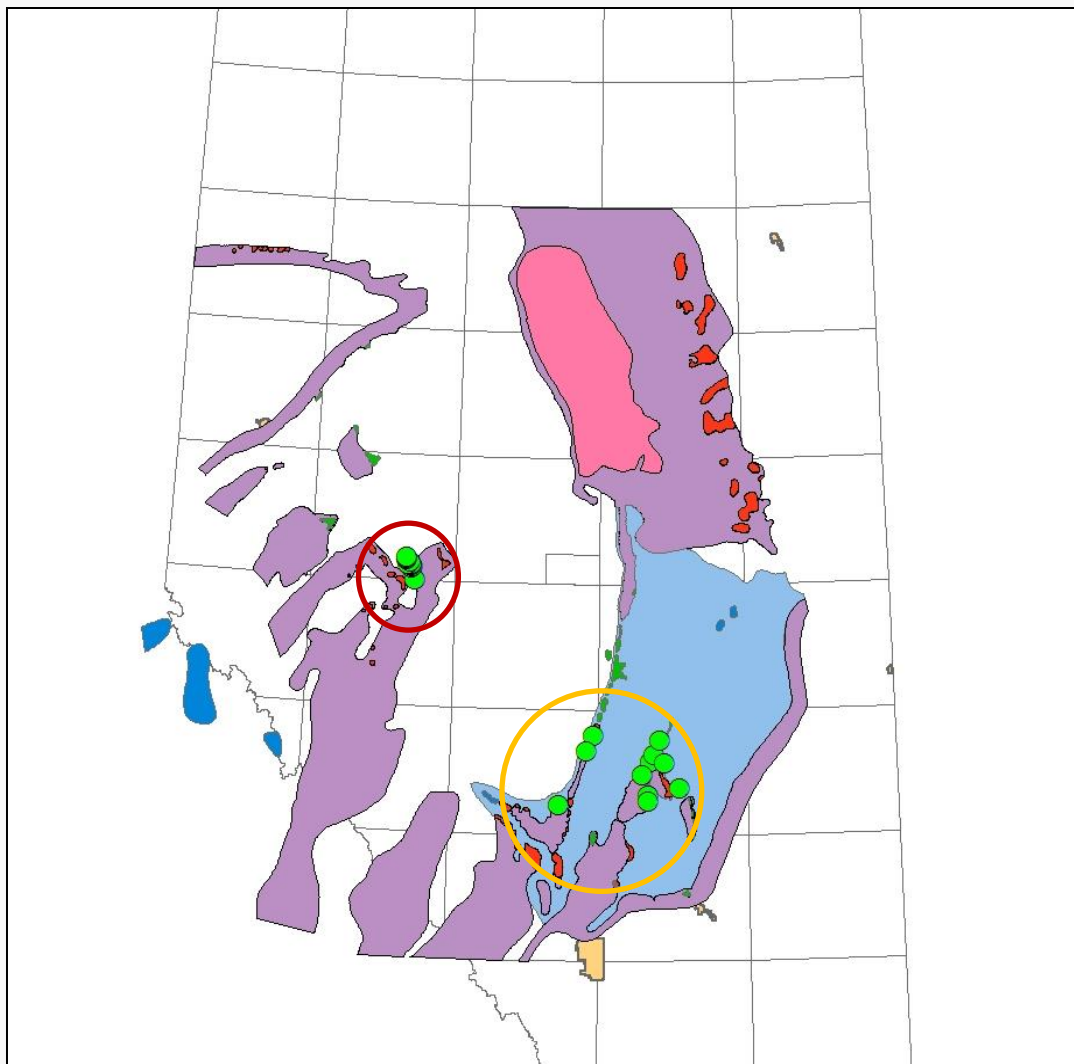
Current Thought

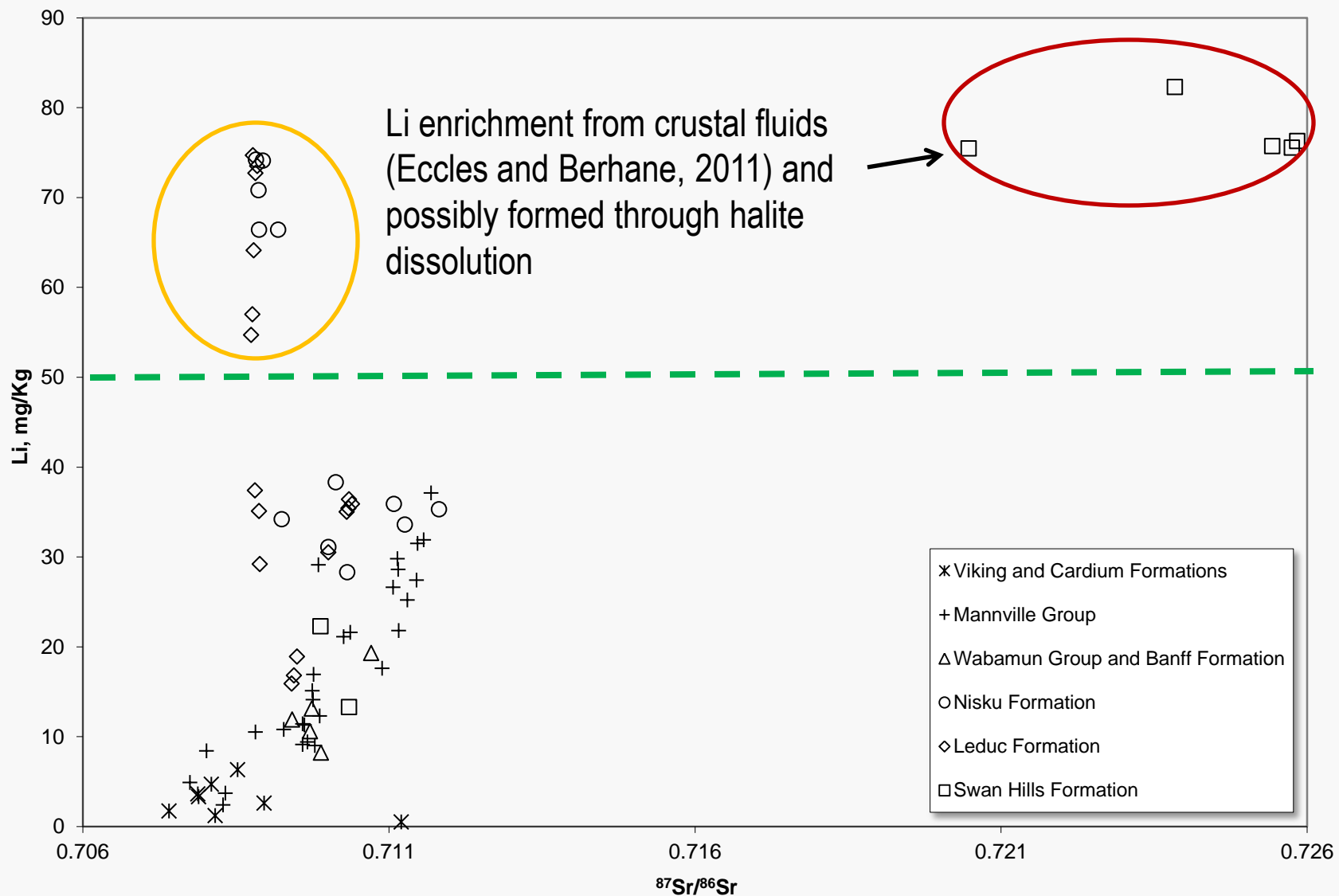
- Brines present in east-central Alberta formed by evaporation of ancient seawater past the point of halite saturation followed by mixing with meteoric water
- Brines present in east-central Alberta formed by halite dissolution
- Both

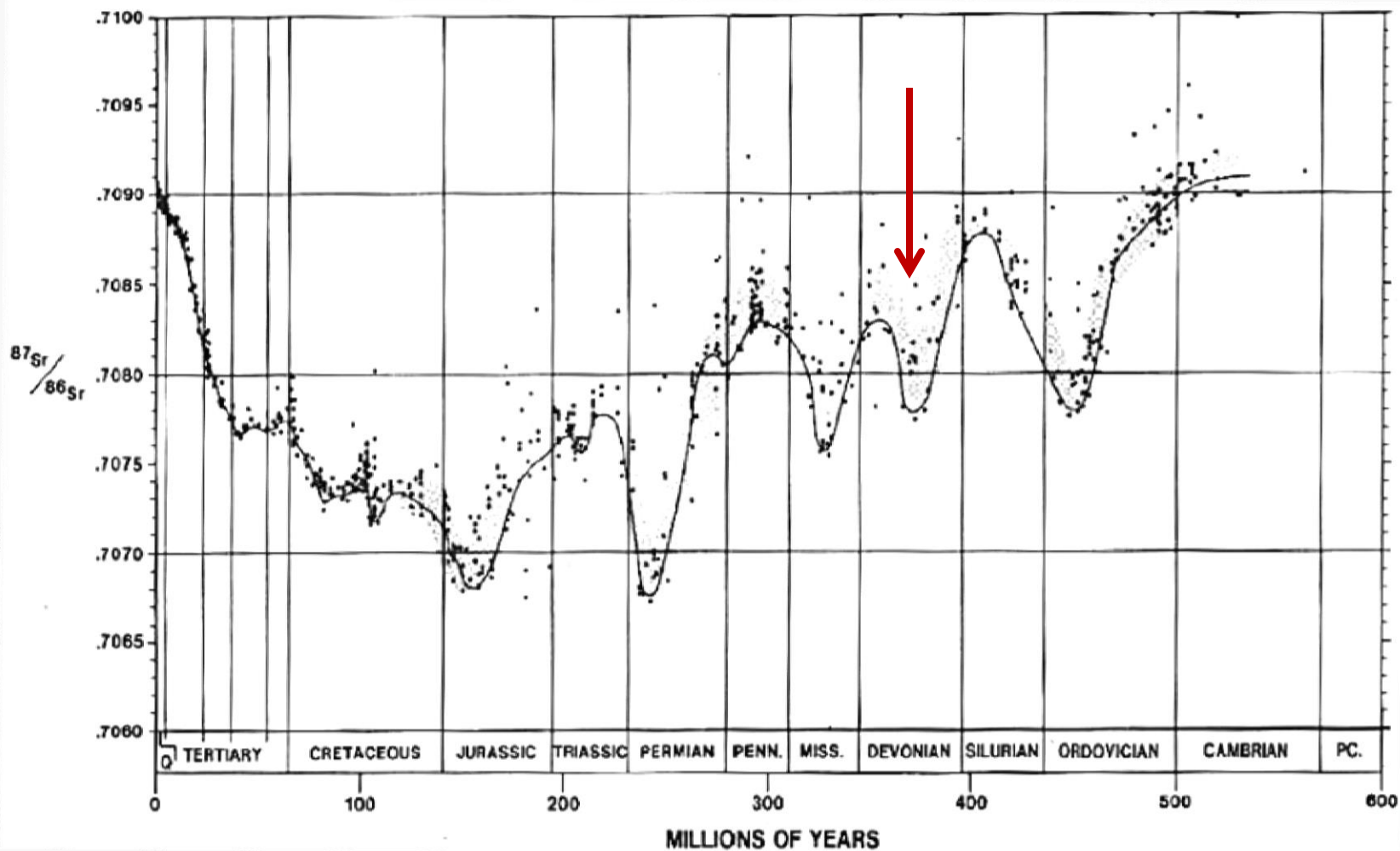


Lithium ≥ 50 mg/kg

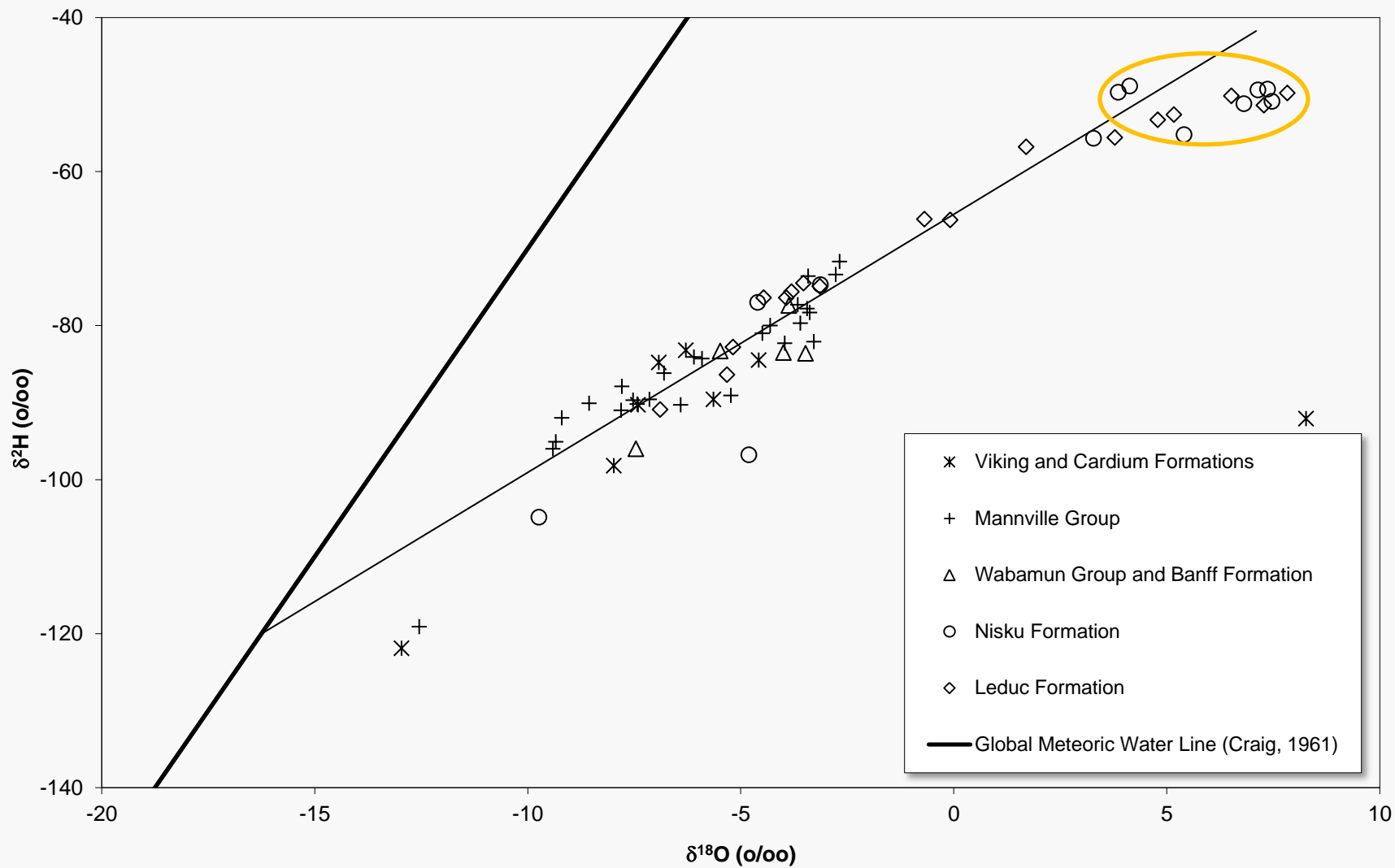
- Samples from Carbonates
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AGS OFR 2011-10

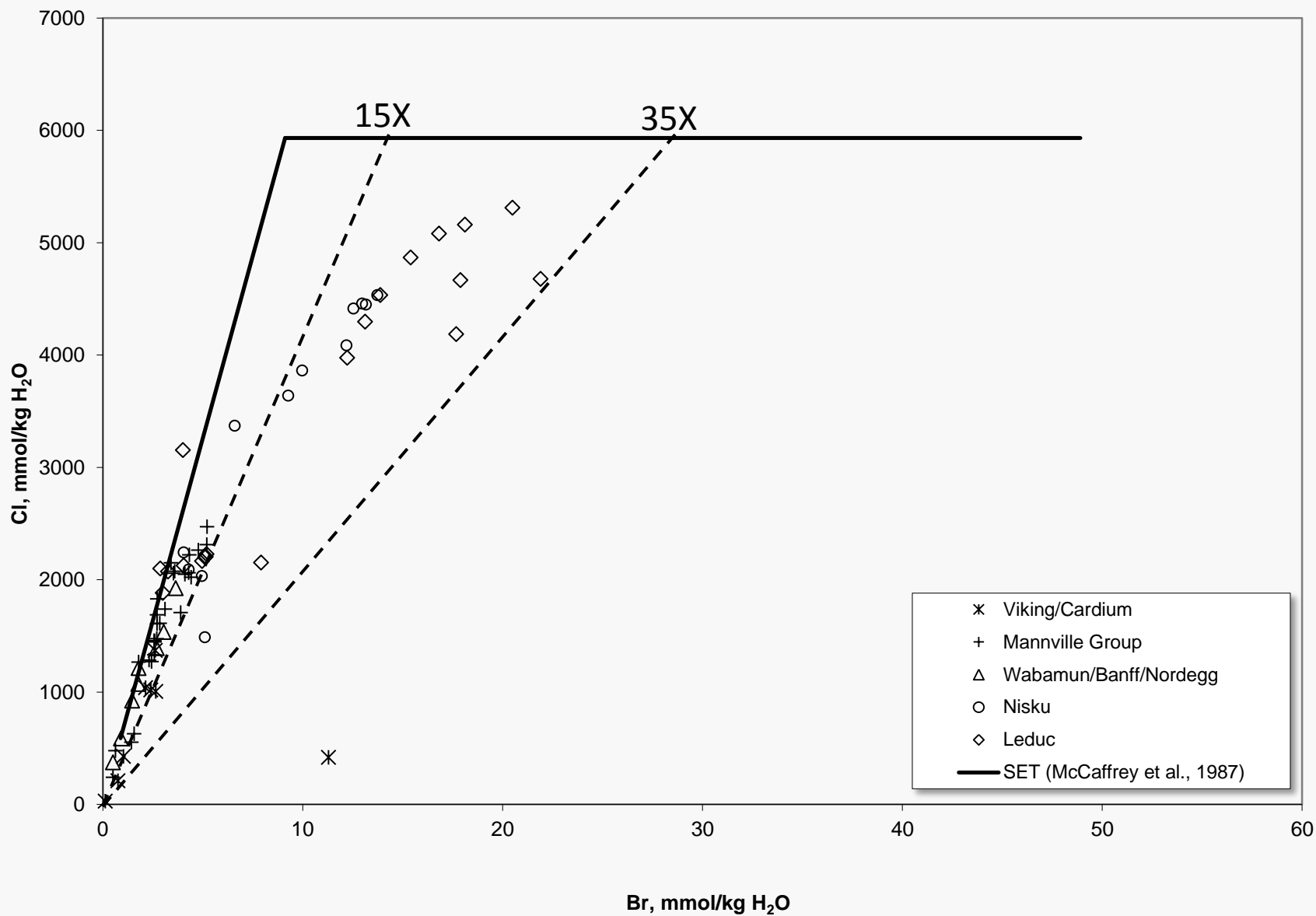






Burke et al., 1982





Problem

How do we explain Li-enrichment in a brine that shows

- No $^{87}\text{Sr}/^{86}\text{Sr}$ evidence of Li derived from silicates,
- Oxygen and hydrogen isotope ratios characteristic of evaporation, and
- Cl/Br ratios indicating a degree (but not enough) evapoconcentration?

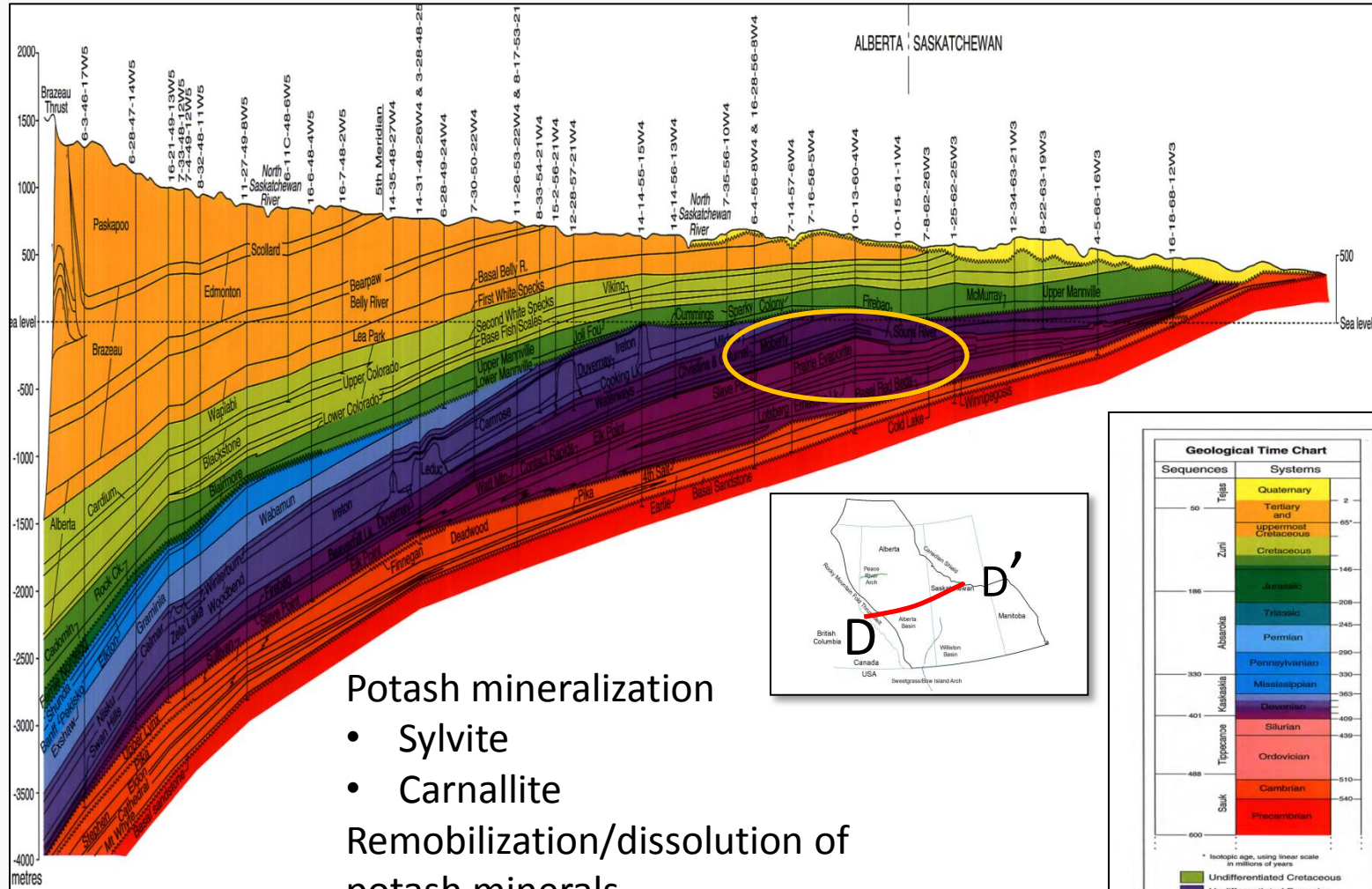
Proposed Solution:

- Concentrate Br and Li,
- Mobilize them into evaporated seawater, and
- Get the brines from where they formed to where we found them.

Step 1 – Concentrate Br and Li

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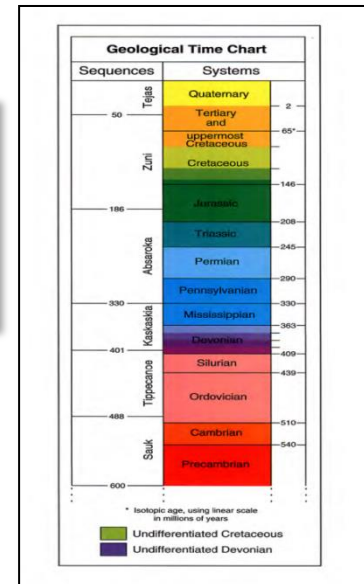


Potash mineralization

- Sylvite
- Carnallite

Remobilization/dissolution of
potash minerals

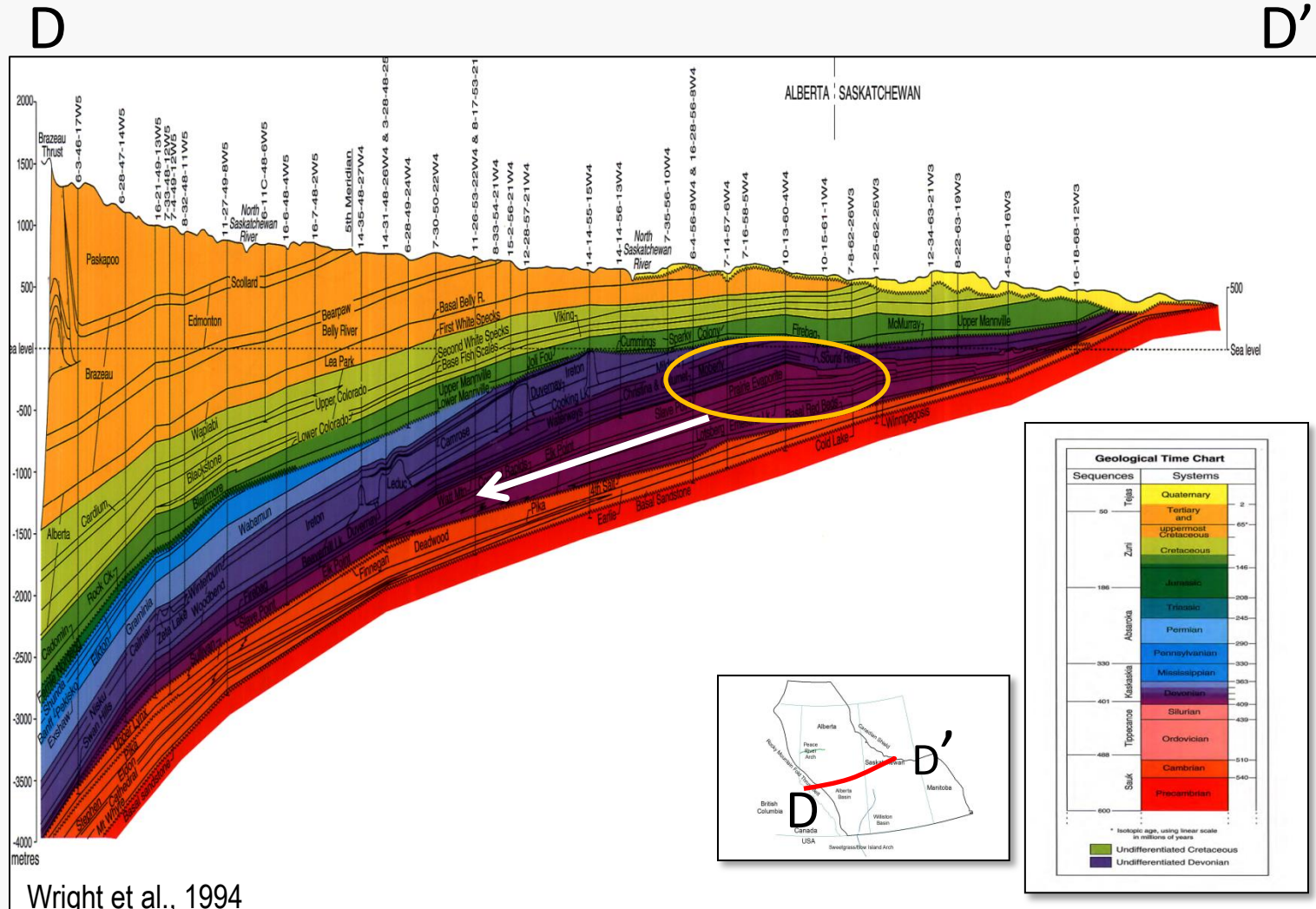
Wright et al., 1994



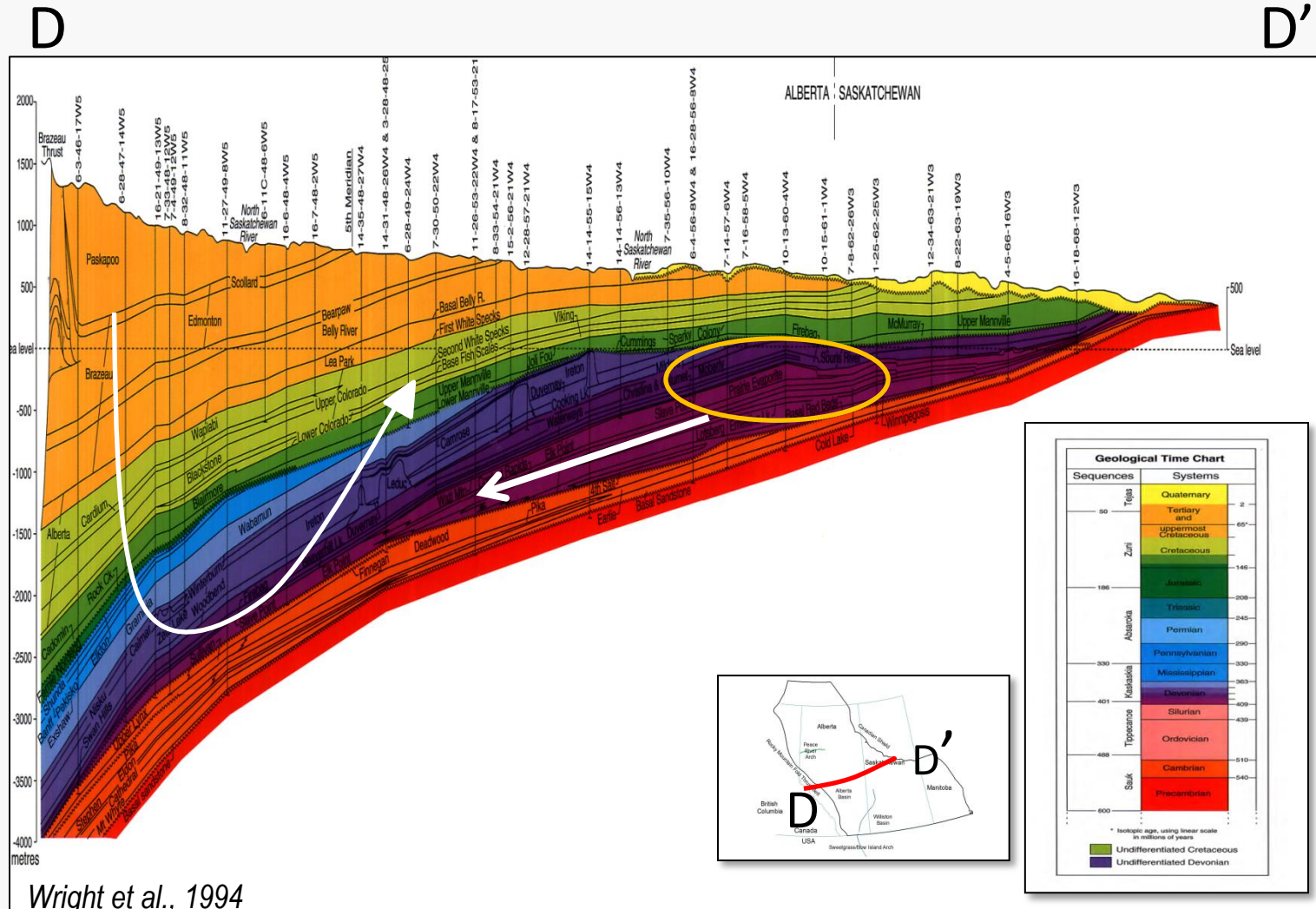
Step 2 – Remobilize late-stage evaporites into evaporated middle Devonian seawater

- Remobilizing brine saturated with regard to halite but undersaturated with regard to potash minerals?
 - Storm events?
- Collect the Li and Br enriched brines in underlying permeable carbonate (Winnipegosis/Contact Rapids)

Step 3 – Tip the carbonates westward and allow the dense Li-enriched brines to flow west

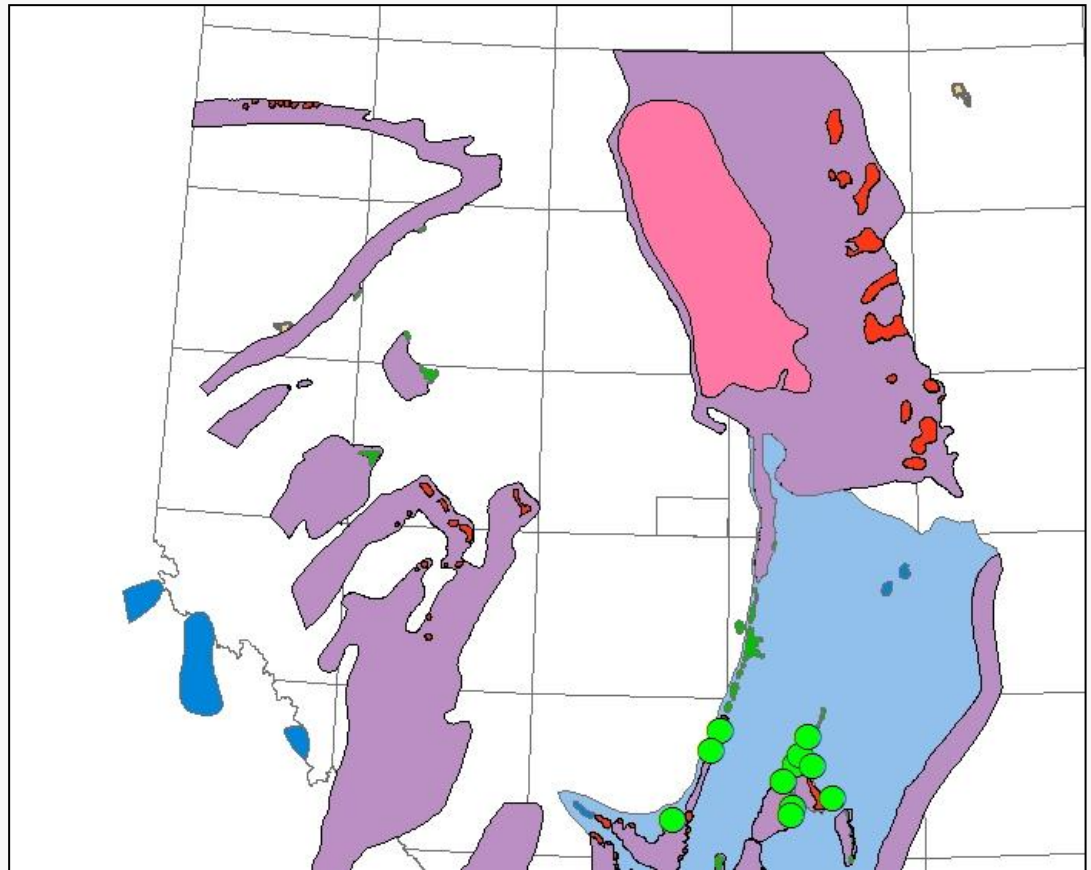


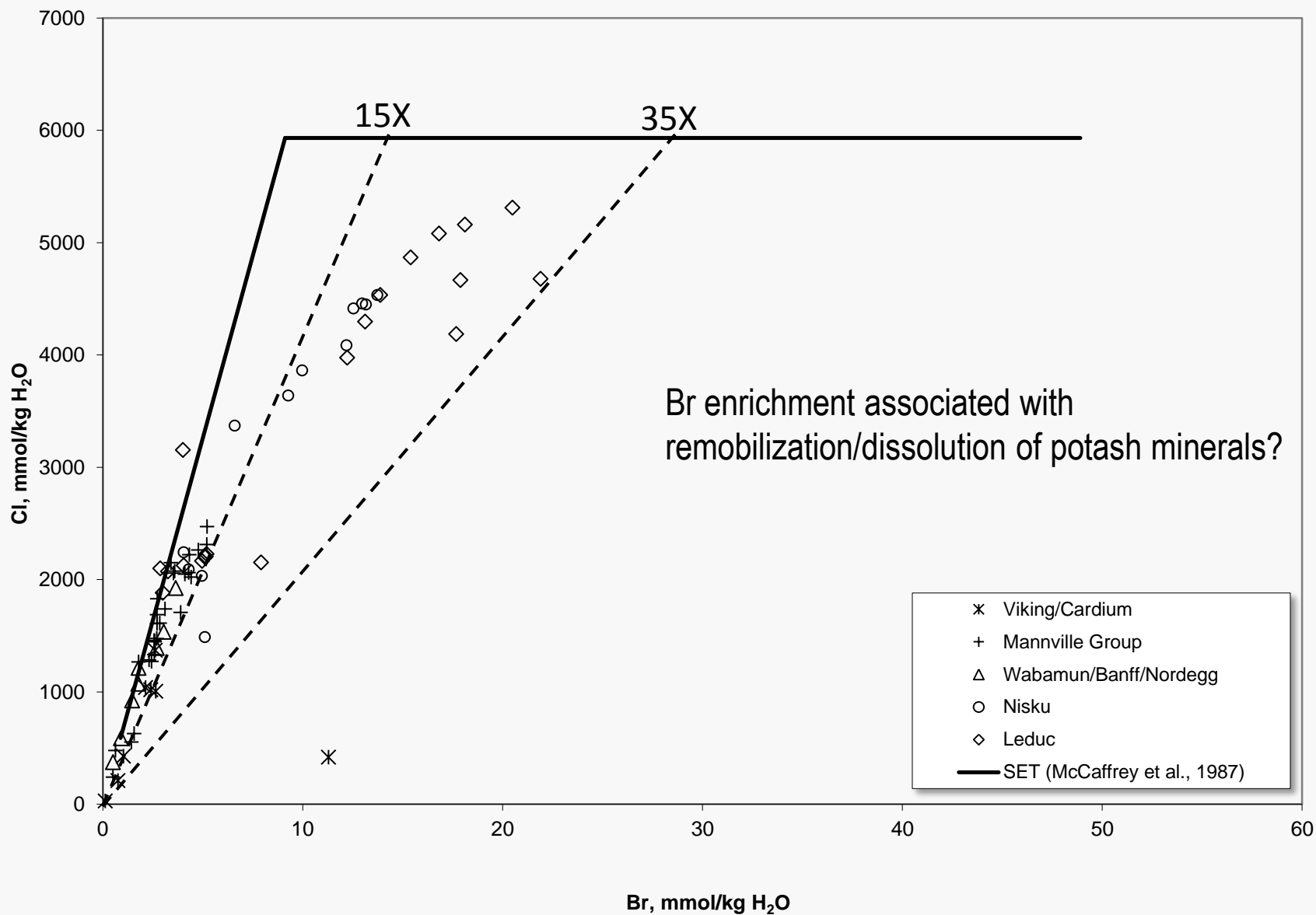
Step 4 – Establish deep penetration of meteoric water due to topography caused by Laramide Orogeny

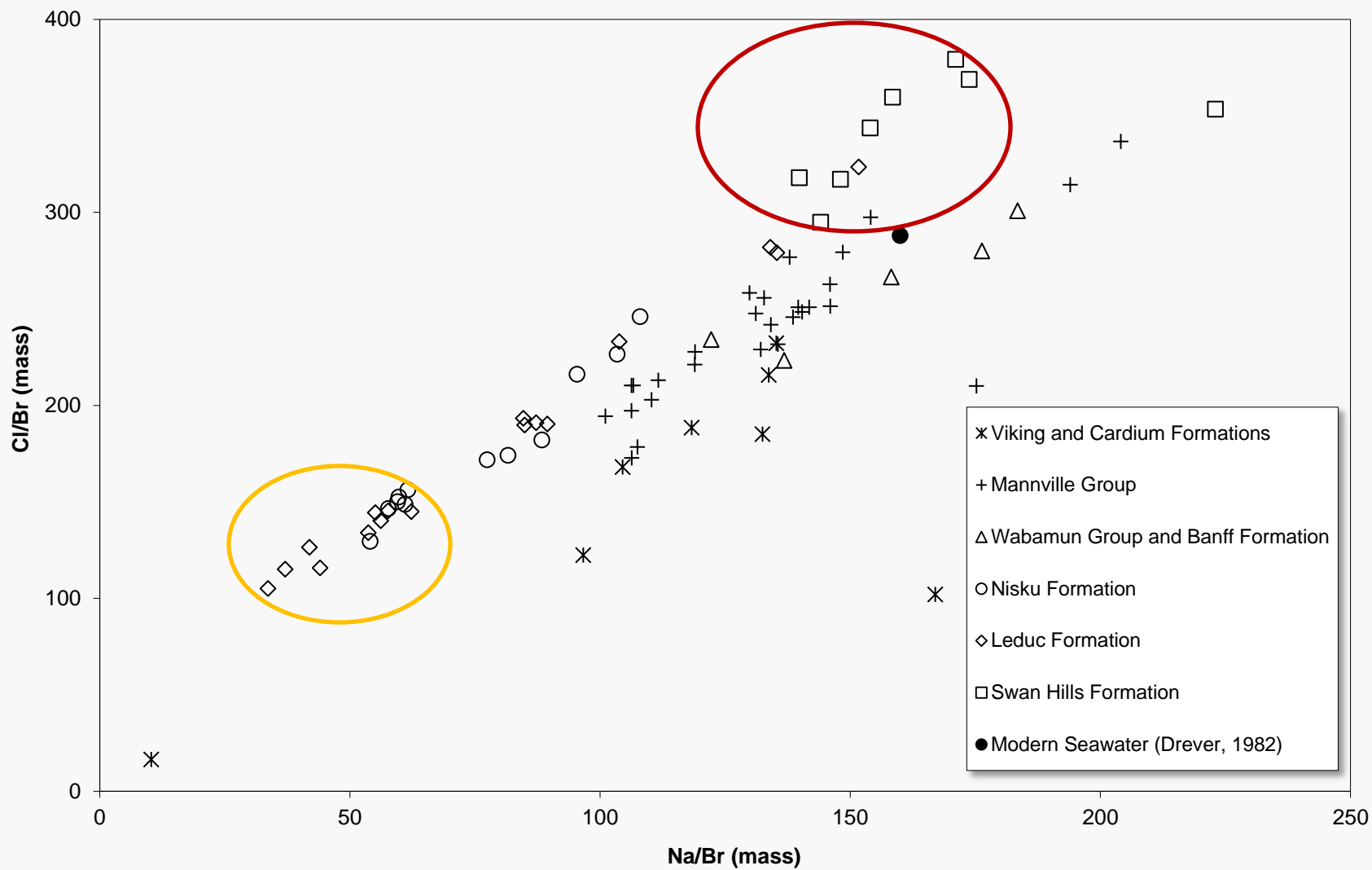


Lithium ≥ 50 mg/kg in Leduc reefs and overlying Nisku carbonates

- Samples from Carbonates
- Evaporites
- Dolomitized Carbonates
- Non-Dolomitized Carbonates
- Gas Pools
- Oil Pools









Thank you