

## Produced water salinity mapping of the Greater Kaybob Duvernay

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### Summary

A source rock contains all the materials that were present at the time of deposition and have been reorganized through the application of heat and pressure. Initial materials deposited in the Duvernay were principally Quartz, Carbonate, Clay, Bacteria (with Eukaryotes), and Salts. These building blocks were buried and then transformed during the Laramide Orogeny into the source rock we extract oil and gas from today. Matured source rocks have rearranged the organic mass into two parts, one is liquid hydrocarbons, and the other is Amorphous Organic material (AOM). All Duvernay source rocks have an abundance of both parts as liquids (combustible hydrocarbons) and polymers (residual carbon). A simultaneous change occurs with the clays, transforming into an Illite porcelain. This intimate relationship between Hydrocarbon, Illite, and AOM is what is known as an organic porosity system. This system effectively glues the mineral mass together, providing competency and compressive resilience. These properties enable operators to drill to great lengths horizontally in the Duvernay without hole integrity issues.

Salts are an interesting component of the Duvernay source rock. They are concentrated within the organic porosity system. Salt crystals, along with liquid hydrocarbons are observed expelling from fresh cut surfaces of extracted core samples. These salts are found in various concentrations in flowback brines from the Greater Kaybob Basin and mapping of total dissolved solids (TDS) and pH will be presented.

### Workflow

This presentation relies upon flowback data reported to the AER. TDS and pH values for over 100 wells in the Greater Kaybob Basin were input into a Geoscout project and mapped spatially.

### Results, Observations, Conclusions

Both TDS and pH maps show that the Greater Kaybob Basin exhibits a bullseye pattern with highest TDS and lowest (more acidic) pH values at the center of the basin (Figure 1). The explanation for the higher concentrations of salts at the center of the basin is related to the level of evaporation as described by Warren (Figure 2) and the stratification of the water column.

Figure 1: partial mapping output of Duvernay flowback brine TDS values (blue horizontal wells included in study)

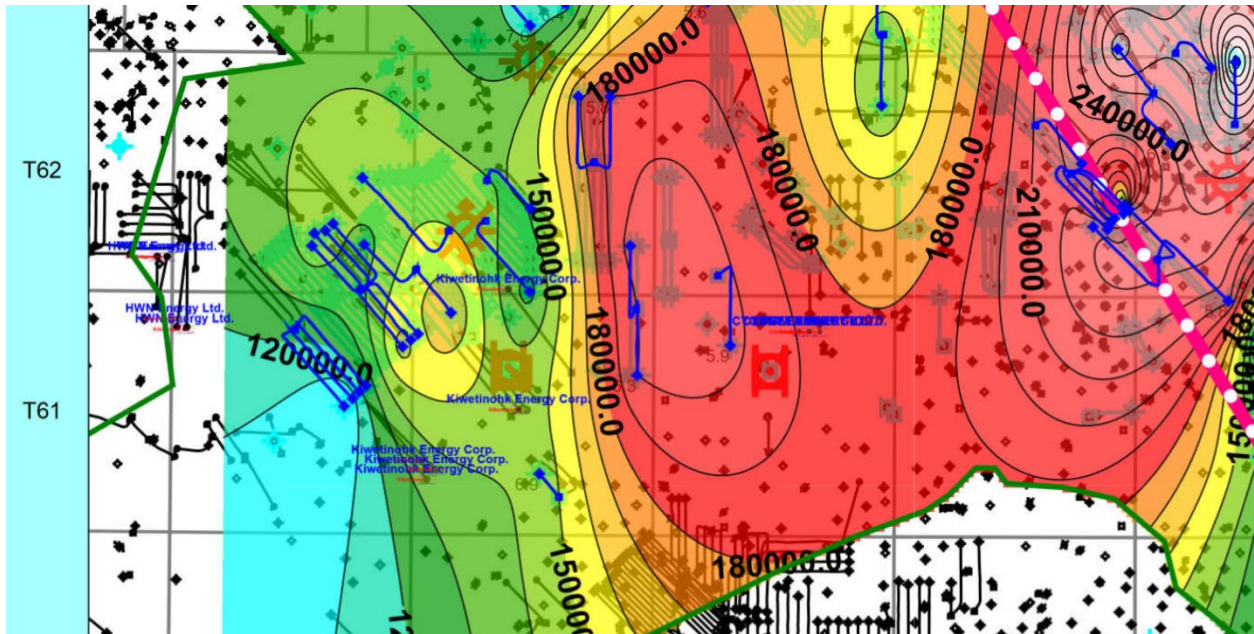
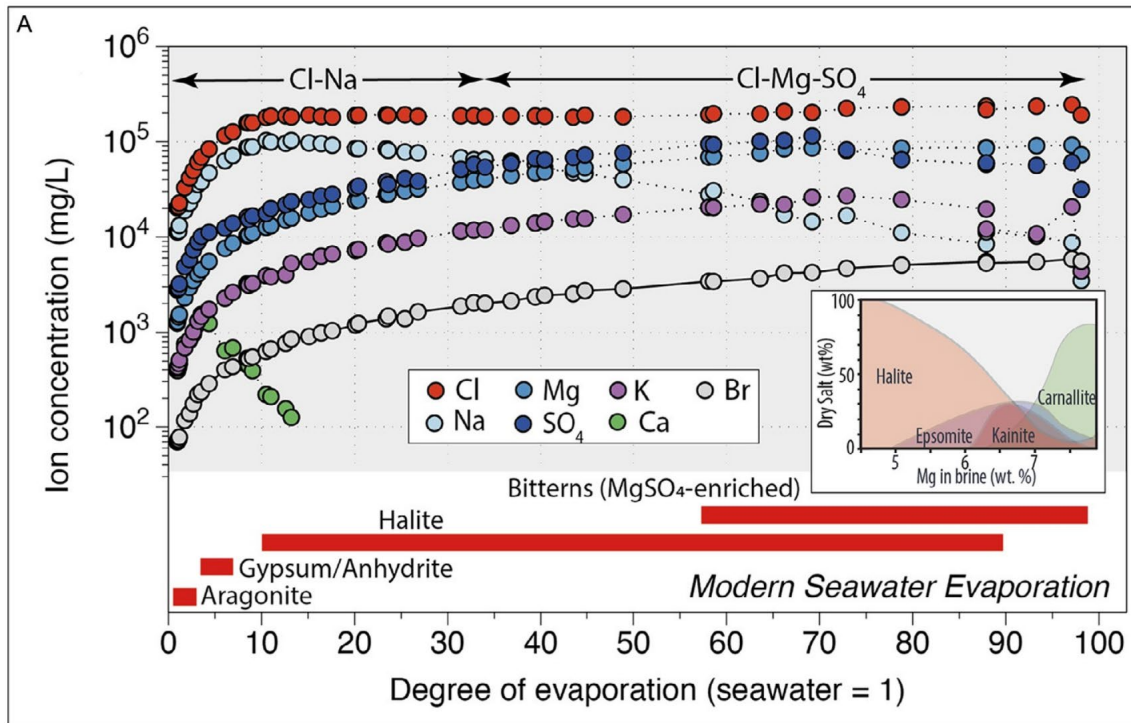


Figure 2: Mesohaline water chemistry changes with evaporation (Warren 2021)



## References

Evaporite Deposits John K Warren, International Graduate Program in Petroleum Geoscience, Department of Geology, Chulalongkorn University, Bangkok, Thailand; Saltwork Consultants, Adelaide, SA, Australia © 2021

Evaporitic source rocks: mesohaline responses to cycles of “famine or feast” in layered brines JOHN K. WARREN Int. Assoc. Sedimentol. Spec. Publ. (2011) 43, 315–392

Chemical compositions of flowback and produced water from the Duvernay shale and Montney tight reservoir developments in Western Canada: potential for lithium resources from wastewater A. Kingston<sup>1</sup>, C. Jiang<sup>1</sup>, X. Wang<sup>2</sup>, and T. Hobbs<sup>3</sup> GEOLOGICAL SURVEY OF CANADA OPEN FILE 8974 (2023)

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