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Reservoir characterization of the Red River Formation, Williston Basin, southeastern Saskatchewan: a revitalized resource opportunity

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Summary

There are two criteria that explain the rationale behind this research: 1) the province of Saskatchewan is striving to increase oil production to 95.4 x 10^3 m^3 (600 000 barrels (bbls)) per day by 2030 (Government of Saskatchewan, 2020) and 2) there is significant interest in diversifying Saskatchewan's natural resource portfolio, particularly in understanding the potential for sustainable energy such as geothermal resource development. In southeastern Saskatchewan, the Ordovician Red River Formation first produced oil in 1958, with the height of exploration and development spanning from the mid 1990's to 2000. It has produced oil from almost exclusively structural traps (Potter and St. Onge, 1991; Kreis and Kent, 2000; Potter, 2006; Pu and Qing, 2003) and since the early 2000's the resource targets have been primarily shallower (e.g., Mississippian-Devonian Bakken Formation). When comparing the theoretical oil generated from potential Red River source rocks (95.4 x 10^6 m^3 (600 x 10^6 bbls); Dow, 1974 or 31.8 x 10^6 m^3 (200 x 10^5 bbls); Osadetz and Haidl; 1989, Osadetz et al., 1989) to the amount of oil produced (4.87 x 10^6 m^3 (30.6 x 10^6 bbls) as of July 2023) from the Red River Formation within the subsurface of Saskatchewan, the data suggests there are significant volumes of oil remaining in the subsurface. This study aims to investigate how and where these hydrocarbons may be trapped for industry exploration.

The Red River Formation is relatively deep, reaching depths greater than 2400 metres subsea (>3000m TVD) near the USA border. If good quality reservoir (higher porosity and permeability) is present, then it has the potential as a geothermal target for direct heating or electrical power. An exciting benefit of being a geothermal energy source is the energy produced would be renewable and sustainable. Operators could extract water to produce heat and offset carbon emissions, and potentially extend the life of existing oil and gas fields. Revisiting the Red River Formation to unlock new resource potential, both hydrocarbons and geothermal, is the motivation for this research.

The proposed study area in southeastern Saskatchewan extends from Township 1, Range 5 west of the Second Meridian (Tp. 1, Rge. 5W2M) to Tp. 18, Rge22W2M in the northwest. Extensive geophysical well log analysis, core description, mapping and petrography will facilitate characterizing reservoir quality and identifying new areas of resource opportunity.

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