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Kinetics of Anhydrite Precipitation from Carbonate Hosted Geothermal Reservoirs

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Summary

Despite the lack of a high geothermal gradient across most of the Western Canadian Sedimentary Basin (WCSB), the possibility of bringing geothermal energy to the basin is supported by the abundance of deep oil and gas wells already in place. If some of these wells could be repurposed to produce deep formation waters, it would eliminate the need to drill new wells to the depths of 3000-4000m required to produce waters with temperatures hot enough for geothermal energy production. To determine the viability of this idea, the geochemistry of deep formation brines must be understood.

Carbonate hosted formation waters within the WCSB are brines often oversaturated with multiple mineral phases at surface conditions. As the target waters for geothermal energy production, this is a cause for concern. Minerals that experience decreasing solubility with decreasing temperature may precipitate out of solution during their transport to, circulation through, or transport from a heat exchanger. Mineral precipitation within infrastructure is referred to as scaling and when abundant can limit water flow and decrease heat exchanger efficiency. The purpose of this project is to look at one possible scaling mineral, anhydrite ($CaSO_4$), and determine (1) its solubility at temperatures from 50-150˚C and (2) its precipitation rate, if oversaturated, over the same temperature range. The solubility of anhydrite across the specified temperature range is modeled using Geochemist's Workbench (GWB). The precipitation rate is determined through experimental methods. Through these methods, the behavior of anhydrite within a geothermal energy production system can be modeled and precautions can be taken to avoid excessive anhydrite scaling in future geothermal energy plants.

Theory / Method / Workflow

Geochemist's workbench is used for equilibrium modelling. Batch reaction experiments are done to determine kinetic rate law parameters. These parameters are used to create kinetic rate laws, which are then used to execute reactive transport models, also with the Geochemist's Workbench.

Results, Observations, Conclusions

A kinetic rate equation will be presented for the precipitation of anhydrite from geothermal brines.

Novel/Additive Information

This information can be used to help developers predict geochemical risks associated with geothermal energy production, which, in turn will help them plan mitigation strategies in their power plants.

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