Induced barite scaling in porous geothermal reservoir rocks during core-flooding experiments

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In geothermal utilization scaling is often caused by extracting heat from a geothermal fluid. As observed in Soultz-sous-Forêts (France) barite is the dominant scaling mineral that deposits downstream the heat exchanger [1] and can potentially lead to clogging of the near-wellbore environment in the reservoir formation.

This research focuses on the coupling between barite scaling and hydraulics in core-flooding experiments mimicking the reinjection environment. In these laboratory experiments, a defined degree of supersaturation with respect to barite is attained by mixing two parent solutions before the bulk fluid enters the core sample. Resembling the geothermal fluid from Soultz-sous-Forêts, these contain a Na-Ca-Cl background electrolyte and defined concentrations of Na_2SO_4 and $BaCl_2$, respectively. The geochemical calculations are computed with the geochemical code PHREEQC [2] and its default database (Pitzer/LLNL). The effluent is frequently analyzed to keep track of the precipitation process.

Preliminary results show that barite precipitates subsequently while the fluid percolates through the accessible pore space, decreasing the permeability substantially. SEM/EDX analyses show newly-formed barite crystals in the pore space of sandstone samples. Further research will include investigating the dependence of pressure, temperature, saturation index, and flow rate on the clogging process. The experimentally determined kinetic and thermodynamic parameters will serve as a dataset for a thermo-chemical-hydraulic model of the reinjection process thereby establishing a better predictability for the long-term well performance.

[1] Scheiber et al. (2014), "Barite scale control at the Soultz-sous-Forets (France) EGS Site." *Proceedings Workshop on Geothermal Reservoir Engineering*, Stanford. [2] Parkhurst & Appelo (1999), *U.S. Geol. Survey Water-Resources Investigations Report* 99-4259, 310 pp.