CO₂-rich springs in Iceland: natural analogues for geologic CO₂ sequestration

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MOTIVATION

- Geologic sequestration of CO₂ via mineral carbonation may be a way to store billions of tons of CO₂ for the long-term.
- In this process, CO₂ is injected into the subsurface either as a separate supercritical fluid or as a single phase fluid mixed with water.
- The CO₂-H₂O dissociates, releasing H⁺ ions and decreasing pH (equation 1). The silicate minerals in basalts are destabilized at lower pH and release their divalent cations, which form carbonate minerals such as calcite (CaCO₃) and magnesite (MgCO₃) with the carbonate ions (equations 2-3). In addition, plagioclase dissolution can consume H⁺ ions, or form carbonates (equations 4-5).
- Basalt carbonation experiments have yielded varied mineralogical results, making predictions difficult.
- Potential environmental harm from CO₂ leakage requires investigation.

OBJECTIVE

- CO₂-rich fluids in Iceland and the basalts through which they circulate serve as natural analogues of the fluid-rock interactions and geochemical reactions that occur upon injection of CO₂-charged water into basalts.
- Fluids at the surface and in the shallow subsurface represent the result of contamination from potential CO₂ leakage.
- Drill cuttings of altered basalt from wells HE-07, KH-11, ÖL-05 and ÖL-10 are used to identify the expected petrologic suite, while fluid analyses help to characterize trace element mobilization and saturation state of the fluids.

REFERENCES


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FUTURE WORK

- Identify phases in which trace elements are hosted.
- Determine divalent cation uptake by secondary phyllosilicates vs. carbonates vs. oxides.
- Use mineral phases to quantify conditions at depth.

REFERENCES