Understanding fluid-rock interactions in hydrothermally altered rocks of the Hengill Volcano, Iceland: implications for geothermal energy and CO_2 storage

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The evolution of permeability in geothermal reservoirs is strongly affected by interactions between the host rock and the fluids flowing through the rock's permeable pathways. Precipitation of secondary mineral phases within the fracture network can significantly reduce the permeability of the overall system, whereas mineral dissolution can enhance reservoir permeability. The coupling between these two competing processes dictates the long-term productivity and lifetime of geothermal reservoirs. Furthermore, understanding the physico-chemical controls on dissolution-precipitation proceses in the Hengill system are fundamental to enhance, maintain, and extend inovative methods of CO_2 storage, such as, mineral carbonation through the CarbFix method [1].

In this study, we perform measurements on servocontrolled hydrostatic pressure vessels to achieve in-situ reservoir preassures. We report a full characterization of the mineralogy, microstructures, porosity and permeability of cores extracted from the Hengill geothermal system by Reykavik Energy to understand fluid flow in the system. Finally, we investigate the permeability evolution of a single fracture during injection of CO_2-saturated water under controlled CO_2 inlet and outlet volume, preassure and temperature conditions. This experimental design aims to constrain the rate of permeability changes of the system in both injection and carbonation areas.

[1] Snæbjörnsdóttir, S.Ó., Sigfússon, B., Marieni, C. *et al*. Carbon dioxide storage through mineral carbonation. *Nat Rev Earth Environ* **1,** 90–102 (2020). https://doi.org/10.1038/s43017-019-0011-8