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Contribution ID: **77** Type: **Oral Presentation**

Evolution of fracture permeability induced by THMC-coupled processes

Tuesday, 1 June 2021 11:15 (15 minutes)

Coupled thermal-hydrological-mechanical-chemical (THMC) processes can significantly impact fracture permeability, immediately influencing the productivity/injectivity of fracture-dominated reservoirs, associated with geothermal energy extraction, hydrocarbon production, nuclear waste disposal, and geologic storage of carbon dioxide (CO2). It is, therefore, necessary to investigate the THMC coupling processes in natural fractures to develop well-calibrated models and predict the changes in hydraulic and transport properties of deep geological reservoirs.

In this presentation, results of flow-through experiments on fracture granite samples were reported to examine permeability evolution induced by THMC-coupled processes. We used two types of granite samples, naturally fractured granodiorite cores from the Deep Underground Geothermal Lab at the Grimsel Test Site (GTS) in Switzerland, and hydrothermally-altered fractured granite from Borehole EPS1 of the Soultz geothermal system and power plant site in France.

The GTS granite samples were subjected to flow-through experiments using DI water at temperatures varying 25-140 ℃ to characterize the evolution of fracture permeability. Periodic measurements of the efflux of dissolved minerals yield the net removal mass, which is correlated to the observed rates of fracture closure. Changes measured in hydraulic aperture are significant, exhibiting reductions of 20-75 % over the heating/cooling cycles.

The Soultz granite sample was first opened along the calcite-filled fracture, and then subjected to flow-through experiments using HCl solution at a temperature of 100 ℃ to evaluate the the evolution of fracture permeability and the fracture shear displacements due to calcite dissolution. Periodic fluid samples were also taken to infer the efflux of dissolved minerals. A strong correlation can be observed between permeability and shear displacement of the fracture.

Our experimental observations in this study should certainly contribute to the interpretations on coupled THMC evolutions during processes such as chemical/thermal stimulation of enhanced geothermal systems and carbon capture, utilization, and storage.

Time Block Preference

Time Block A (09:00-12:00 CET)

References

Lima, M.G., Vogler, D., Querci, L. et al. Thermally driven fracture aperture variation in naturally fractured granites. Geotherm Energy 7, 23 (2019).

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Student Poster Award

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