

## Tracing fluid-rock interactions in active fault zones and hydrothermal systems

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Fluids in active fault zones play a major role in fault zone architecture, earthquake triggering, and the size of the magnitude. Many active fault zones are submerged under aquifers and are influenced by active pumping and changes in water levels. Accumulated aseismic deformation such as micro-cracks, dilation, and creeping, are expected to gradually increase overtime and potentially abruptly prior to or following a major earthquake. Water-rock interactions are therefore likely to be enhanced or induced by these small-scale deformation processes. The goal of this project is to capture such changes. This project will look at isotopic and geochemical changes in fluids composition in various fault zones and hydrothermal systems to provide a real-time monitoring for fluid-rock interactions that is potentially enhanced by accumulated deformation processes. The project involves sampling of water samples from several sites including hydrothermal system in Switzerland and hot springs along the Lower Yarmouk Gorge in Israel, and potentially other sites worldwide. The student will be responsible for isotopes and geochemistry analyses of these water samples and for discussing his new results in the context of existing knowledge.

### Aims and Methods

**Aims:** tracing variations in isotopic and geochemical composition of fluids in hydrothermal and fault systems

**Methods:** field sampling, TIMS and MC-ICPMS analysis at UNIGE

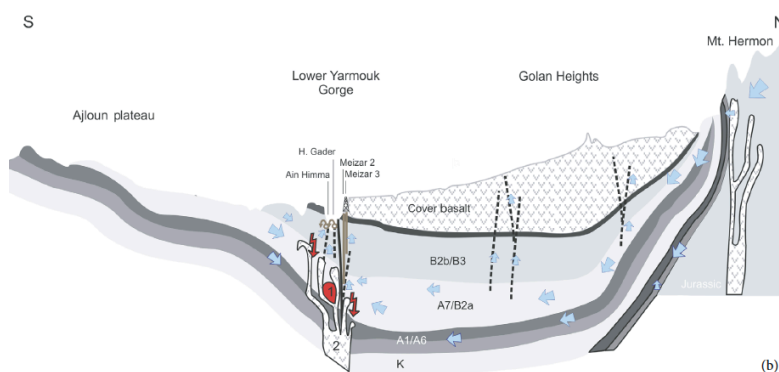
### References

<sup>1</sup> Siebert, Christian, et al. "Applying rare earth elements, uranium, and  $87\text{Sr}/86\text{Sr}$  to disentangle structurally forced confluence of regional groundwater resources: The case of the Lower Yarmouk Gorge." *Geofluids* 2019 (2019).

<sup>2</sup> Skelton, Alasdair, et al. "Changes in groundwater chemistry before two consecutive earthquakes in Iceland." *Nature Geoscience* 7.10 (2014): 752-756.

<sup>3</sup> Craw, Dave. "Gilded by earthquakes." *Nature Geoscience* 6.4 (2013): 248-250.

*The Lower Yarmouk Gorge in Israel (Siebert et al 2019). This site will be sampled by an automated system, and samples will be analyzed following a seismic event (small to medium magnitude are expected frequently in this area along the Dead Sea Transform).*



### Website

<https://www.unige.ch/sciences/terre/en/groups/isotope-geochemistry-geochronology-and-thermochronology/projects/>

<https://www.unige.ch/sciences/terre/en/groups/crustal-deformation-and-fluid-flow/projects/>

### Prerequisite:

Recommended: Methods of isotope analysis - M3, Geochemical cycles and rates of geological processes – M4b