

Hydrothermal alteration investigation of selected rock samples from the Odenwald area, Germany: a contribution towards the site selection for the GeoLaB underground infrastructure

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Research background

- Sustainable geothermal use of the crystalline bedrock for the energy transition requires scientific investigations in an underground laboratory.
- Make a significant contribution to secure the energy supply and the heat transition.
- As a holistic research platform, GeoLaB (a Helmholtz initiative) offers cutting-edge research beyond geothermal energy and creates synergies for the development of geotechnologies that are economically relevant today. The mineral investigation targets to detect **hydrothermal alteration** and to create a solid baseline for further analyses of the rock properties essential for the plan-construction of this research infrastructure.

1) Sampling area, Odenwald

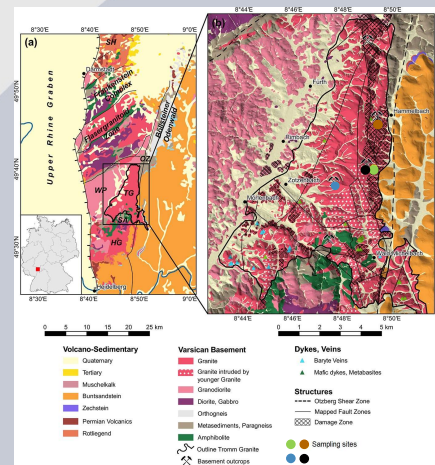
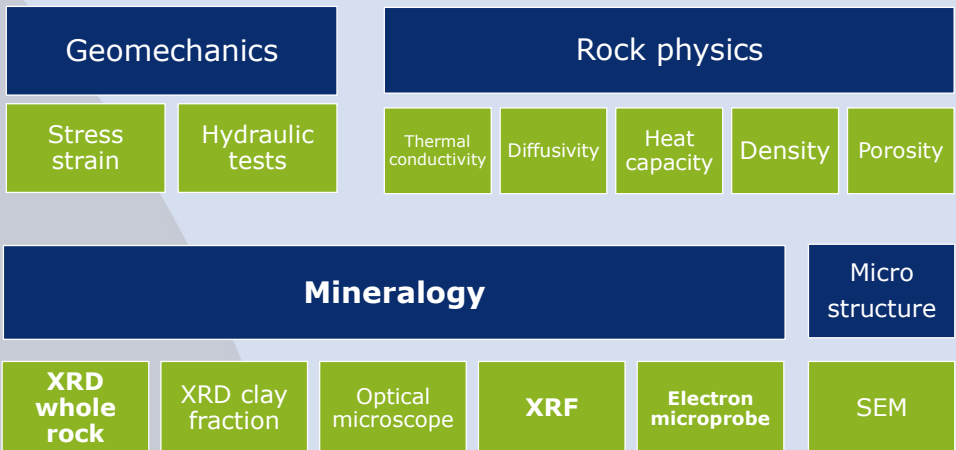


Figure 1. Fieldwork area in the Tromm Odenwald with the lithologies and the sampling locations. Modified after Frey et al. (2022).

2) Experimental workflow GeoLaB



3) Geochemistry results

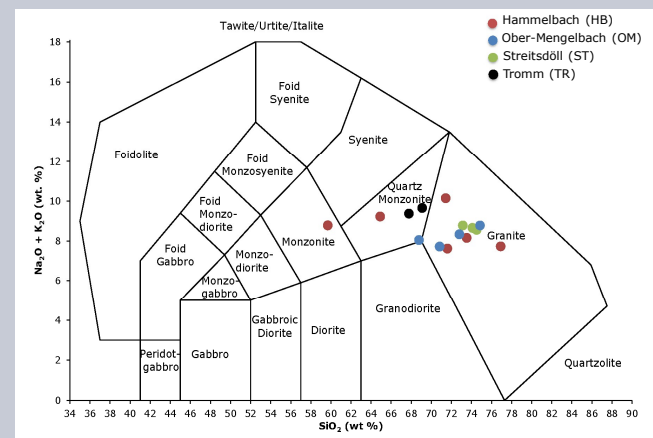


Figure 2. Total SiO_2 versus the sum of Na_2O and K_2O after le Bas. The analysed samples have a geochemical signature ranging from granite to monzonite. This classification was confirmed with the XRD measured which revealed a granite mineral assemblage mostly with quartz, plagioclase and mica (biotite and/or muscovite).

4) Electron microprobe results

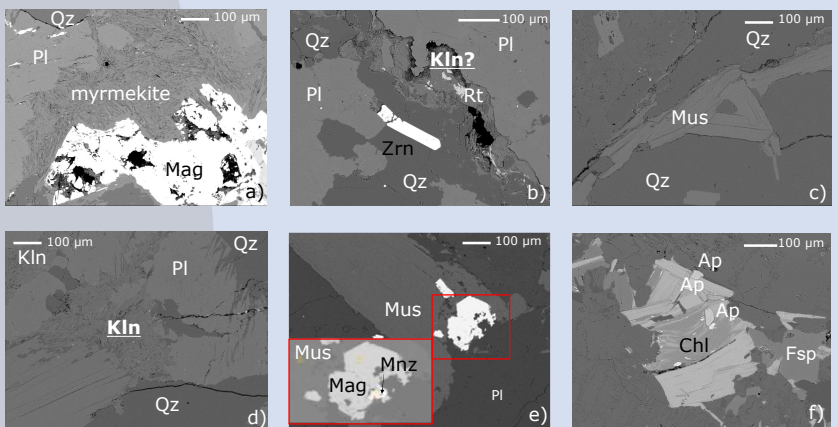


Figure 3. A selection of SE (Secondary Electron) images acquired with the electron microprobe. a) ST001: myrmekite structures, i.e. inclusion of quartz in plagioclase (Pl) indicating tectonic induced metasomatism. The structures follow a the magnetite (Mag) rims big magnetite. b) HB002: well formed zircon (Zrn) embedded in quartz (Qz). Kaolinite (Kln) occurring in the fracture would indicate the occurrence of hydrothermal alteration. Rutile (Rt) is an accessory phase. c) ST002: a triangular muscovite (Mus) embedded in quartz. d) ST002: small kaolinite (Kln) grains likely formed from the alteration of plagioclase (Pl). e) ST002: muscovite (Mus) grain including a magnetite (Mag) and monazite (Mnz). The latter offers the possibility to perform in-situ geochemical dating and investigate REEs concentration. f) OM001: Chlorite (Chl) with large apatite (Ap) grains.

5) Outlook

- Pilot seismic campaign : the first seismic survey was carried out in September 2024.
- Potential geophysics: on-going.
- Exploration drilling: start planned for the beginning of 2025.

Acknowledgements

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References

Frey, M., Bossennec, C., Seib, L., Bär, K., Schill, E., & Sass, I. (2022). Interdisciplinary fracture network characterization in the crystalline basement: a case study from the Southern Odenwald, SW Germany. *Solid Earth*, 13(6), 935-955

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Figure 4. GFZ Vibroruck deployed during the recent pilot seismic campaign.