

Timing of high-grade metamorphic overprints in the basement of the Aar massif (Central Alps)

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Context

The pre-Alpine basement of the Aar massif (central Alps) hosts high-grade metamorphic gneisses and migmatites that were intruded by the Aar Batholith between 348 and 300 million years ago. The high-grade metamorphic overprint is therefore either of Carboniferous (early Variscan) or of Ordovician age, or likely multi-phased, showing overprints of both Ordovician-age and Variscan orogenic cycles. The primary textures and mineral parageneses have been overprinted by Alpine tectonics, which may render mapping of structures and relative age relationships in the field difficult. This proposed Master thesis should test the hypothesis that two high-grade metamorphic cycles exist in the basement of the Aar massif using U-Pb age determinations of accessory minerals.

The outcrops are partly along roadside, but in part at high elevations up to 2900 meters a.s.l. No mapping is necessary since the area is mapped in detail. The work area will be along the northern border of the Aar massif, in between Lauterbrunnen, Guttannen, Innertkirchen and Susten pass. This project is financially supported by swisstopo and suitable for a student, who wants to get some insight into analytical methods. The topic is independent of the sanitary situation with COVID-19, and has excellent touristic infrastructure in the field area, including a large number of mountain huts for overnight stays!

Objectives and Methods

The planned work will consist of the following tasks: 1) Recognition and documentation of different types and generations of leucosomes in gneisses and migmatites in different basement units; 2) sampling of leucosomes and gneisses for geochronology; 3) separation of accessory minerals for U-Pb geochronology (zircon, monazite, titanite); 4) cathodo-luminescence and backscattered electron imaging of selected grains; 5) U-Pb dating, possibly trace element analysis and Hf isotope analysis of zircon using laser-ablation ICP-MS; 6) isotope-dilution TIMS U-Pb dating of individual grains of monazite, titanite and apatite.

Literature

Schaltegger & Corfu (1992), *Contrib. Mineral. Petrol.* 111, 329-344 ; Schaltegger U. (1993) *Contrib. Mineral. Petrol.* 113, 466-478; Berger, A., Mercolli, I., Herwegh, M., Gnos, E (2017) Geological map of the Aar Massif, Tavetsch and Gotthard Nappes. *Geol. spec. Map 1:100'000*, explanatory notes 129. Federal Office of Topography swisstopo.



Websites to visit :

<https://www.unige.ch/sciences/terre/en/research/isotope-geochemistry-geochronology-and-thermochronology/u-pb-geochronology/>

Choice of orientation and modules:

Orientation GATO (Geochemistry, Alpine tectonics and Ore Deposits)