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UNIVERSITÄT
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Institut für Geologie

MSc in Earth Sciences, University of Bern

How and how fast deforms the granitoid middle crust?

MSc Project in Geology
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Project description: Granitoids represent the most important rock type of the crystalline crust. Here, deformation is strongly localized in fine-grained polymineralic shear zones. Commonly, it is assumed that deformation rates in these shear zones are constant over long time intervals but is this really the case? The occurrence of shear bands and fractures may indicate that substantial variations in strain rates occur and that deformation might accelerate in certain domains. Such behavior would be important to be detected, since such viscous ductile shear zones often are in charge for "loading" the elastic energy in brittle deforming rocks in shallower crustal levels. It is the instantaneous release of this elastic energy, which induces earthquakes and associated seismic waves. In this project, you will investigate a crustal scale shear zone in the Aar Massif (Central Swiss Alps) by means of structural mapping and microstructural analysis to find evidence for the occurrence of variations in strain rates hinting to episodic deformation.

Project tasks: You will acquire high-resolution mosaics of drone images as a base for detailed structural mapping. You will discriminate different fabric domains being characteristic for specific deformation episodes. The extend and spatial distribution of these fabric domains will be quantified in QGIS. These data serve as a base for selective collection of ultramylonitic samples in the field, which will then be prepared for investigations on the scanning electron microscope. Electron backscatter diffraction mapping will be used to gain information on phase and grain distributions and their changes in transects across the shear zone. Via paleopiezometry estimates on the stress states can be made. Geothermometry will be applied on newly crystallized sheet silicate minerals to quantify deformation temperatures and potential lateral changes. These data, in combination with the geometric constraints of the mapping, are then combined to evaluate the deformation rates in the different fabric domains and their evolution in space and time. In this way, you will be able to unravel episodic deformation stages and to brainstorm on their effect on the elastic loading of tectonic stresses.

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