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Structural Evolution in the Aar Massif (Central Alps): First attempts of linking the micron- to the kilometer-scale

P. Wehrens, R. Baumberger, and M. Herwegh
Institute for geological sciences, University of Bern, Switzerland (philip.wehrens@geo.unibe.ch)

The Aar massif belongs to the external massifs of the Alps and is mainly composed of granitoids and gneisses. Despite numerous detailed studies in the past decades, the overall exhumation history and the associated massif internal deformation (internal strain distribution and its evolution in time, kinematics etc.) are largely unknown at present. In this project, we aim to investigate the role of shear zones in the deformation history at a variety of scales. In this context it is important to understand their microstructural evolution, the involved deformation processes, kinematics and relative ages as well as the associated changes in rheology.

A GIS-based remote-sensing structural map, verified by fieldwork, (see Baumberger et al., this volume) served as base for our investigations. Lithological differences between the units (Central Aare granite, ZAGr; Grimsel granodiorte, GrGr and gneisses) cause strain to localize along these contacts. Furthermore, the initial magmatic differentiation in the granitoids locally controls the Alpine deformational overprint because of differences in effective viscosity during solid-state deformation. This behavior is illustrated by the increase of foliation intensity and the number of shear zones per rock volume from ZAGr to GrGr.
Preliminary results show that deformation at the N boundary of the Aar massif has to be distinguished from the central and the southern part. In the North steep NE-SW trending foliations and shear zones with subvertical lineations represent the major structures. The shear zones acted both as normal faults and as reverse faults, which mostly used pre-existing lithological boundaries between the different gneiss units. In a later stage, E-W trending shear zones and shear bands with moderate dipping angles cross cut the earlier structures. They always show a top to the North component and might be related to the late north directed movements of the Aar massif. Yet, no absolute age dating has been performed on such structures.
The central and southern part have NE-SW (dip azimuth 130°-180°) and NW-SE trending shear zones dissecting the Central Aar granite (ZAGr). The shear zones, mostly with steep lineations, are of ductile origin sometimes overprinted in a brittle manner. Again shear sense indicators of NE-SW structures show south block up and down movements for individual shear zones. In addition some of these strike-slip shear zones have both subhorizontal and subvertical lineations. They may represent a late strike-slip reactivation of earlier vertical movements.
Crosscutting relationships indicate that the NW-SE shear zones are younger than the NE-SW ones, and acted as dextral strike slip zones (subhorizontal lineations).