Geophysical Research Abstracts
Vol. 15, EGU2013-11725, 2013
EGU General Assembly 2013

Alpine re-activation of pre-Alpine structures: details from a large-scale shear zone in the Aar massif (Central Alps)

Philip Wehrens (1), Roland Baumberger (1,2), and Marco Herwegh (1)

(1) University of Bern, Institute of geological sciences, Bern, Switzerland (philip.wehrens@geo.unibe.ch), (2) Federal Office of Topography, Swiss Geological Survey, Wabern, Switzerland

Alpine re-activation of pre-Alpine structures: details from a large-scale shear zone in the Aar massif (Central Alps)

Wehrens Philip1, Baumberger Baumberger Roland1,2 and Herwegh Marco1

1 Institut für Geologie, University of Bern, Baltzerstrasse 1+3, CH-3012 Bern (philip.wehrens@geo.unibe.ch)
2 Federal Office of Topography, Swiss Geological Survey, Seftigenstrasse 264, CH-3084 Wabern

The Aar massif belongs to the external massifs of the Alps and is mainly composed of granitoids and gneisses. Post-Variscan granitoid rocks have intruded old gneisses belonging to the pre-Variscan basement. 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 detailed study was conducted along a major shear zone located at the southern margin of the Aar massif (running from Furka to Grimsel Pass and Oberaar Glacier), where the Grimsel Granodiorite (GrGr) is juxtapositioned to strongly foliated gneisses.
Preliminary results show that a crenulation of these gneisses predates the age of the granitoid intrusion, meaning they must be older than 298 Ma. The crenulation and a related axial plane foliation (145/80°) define mechanical anisotropies within these Pre-Variscan rocks. The intruding granite has exploited these anisotropies a first time during its emplacement in post-Variscan times. The lithological boundary between the intruded GrGr and Pre-Variscan rocks causes strain again to localize during Alpine deformation and results in a 40 m wide large-scale shear zone. The older part of the shear zone shows cm-scale shear zones with vertical lineations shearing off the aforementioned pre-Alpine axial plane foliation. Hence the contact is reactivated, now as Alpine normal/ reverse fault, a second time. Towards the youngest parts of the shear zone the stretching lineation on the shear surfaces turns from vertical towards a subhorizontal position, indicating a change from initial vertical movement towards strike-slip shearing during a late stage of the shear zone activity. This highest strain event clearly shows a 160/80° orientation of mylonitic and ultramylonitic foliations. In more competent boudins-shaped rocks open fissures developed within the high strain domain. Shear sense indicators related to the subhorizontal lineations, i.e. C' structures, sheared boudins and asymmetric folds, indicate a dextral shear sense. This dextral shearing is coeval with dextral faulting along the Simplon line and represents the third reactivation of the pre-Alpine anisotropies. In sum, this shear zone illustrates the importance of mechanical anisotropies and pre-existing structures for strain distribution, localization and shear zone kinematics in case of the basement rocks.