Migmatites of the southern Aar Massif and their petrogenetic relationship to the Aar Granite Suite

Hannes Hartung-Hofmann

Master thesis in Earth Science

The petrogenetic relationship of migmatites in the pre-Variscan basement along the Massa gorge north of Naters (Aar Massif, Central Swiss Alps, Valais) and the adjacent Aar Granite suite (AGS) was investigated using field mapping, petrology, whole rock geochemistry, and U – Pb zircon dating.

Four deformation events could be recorded during field mapping, including a late Variscan anatectic event, which could be dated between ~320 and 306 Ma. Migmatites, ranging from biotite-plagioclase bearing metatexites to amphibole diatexites, formed during anatexis from metasediments. The amphibole diatexites were interpreted as the result of water fluxed melting of the assemblage biotite-quartz-plagioclase under upper amphibolite facies conditions.

New U-Pb zircon ages of the outcropping migmatites as well as small granite stocks were achieved by in situ LA-ICP-MS. The data indicate that protolith of the migmatites has a maximum sedimentation age of 471 ± 15 Ma and is most likely derived from Pan-African / Cadomian igneous source rocks. Small scale granite stocks in- and outside the migmatite complex are coeval within the errors and have intrusion ages of 306 ± 3,2 Ma and 303,1 ± 3,2 Ma. Inherited cores in the zircons of the granitoids exhibit ages ranging from Paleoproterozoic to Paleozoic, and were interpreted to reflect reworking of older crustal units during melt generation.

Results of whole rock geochemistry of leucosomes and granitoids point to a mixed origin of the granitic melts expressed by A/CNK values ~ 1. Additionally, compositional trends of the samples from the Massa gorge indicate a relationship due to partial melting, as well as chemical modification due to mixing of either hydrothermal fluids or primary melts with the anatectic melts during partial melting.

A comparison of the geochemistry of the migmatites with reference data from the Aar Granite Suite by Schaltegger (1990) and Schaltegger et al. (1990) exclude the migmatites from the Massa gorge as feeder zones of the Aar Granite Suite. However, an indirect genetic relationship, which is represented by a deeper magma serving as heat source as well as source of magmatic fluids is suggested.

Supervisor: Prof. Bernard Grobéty