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Formation and exhumation of Permian granulites: case study from the polyphase Campo Unit (Central Alps)

B. Petri (1,2), G. Mohn (1), G. Manatschal (1), J. Wijbrans (2), and K. Schulmann (1)

(1) EOST-IPGS, Université de Strasbourg, Strasbourg, France (bpetri@unistra.fr), (2) Department of Petrology, Vrije Universiteit, Amsterdam, The Netherlands

Studies on Wilson cycles usually focused on the formation, destruction and final integration of oceanic domains in orogens whereas the subsequent dismantling of mountain ranges and its importance for rift-systems is yet less understood. How orogenic inheritance influences the crustal thinning during rifting and the final architecture of rifted margins remains poorly depicted. To answer this question, we initiated a multidisciplinary research project coupling structural geology, igneous and metamorphic petrology and geochronology in selected areas of the Austroalpine nappes in SE-Switzerland and N-Italy, where remnants of a Jurassic continental margin have been previously described.

We chose to focus on the Campo unit, due to a complete record of events from at least the Variscan orogeny to middle-Jurassic rifting, and a low-grade Alpine metamorphism. The Campo basement is composed of metamorphic rocks (metasediments and metabasites) of unknown age (probably Variscan), equilibrated in amphibolite-facies conditions. A gabbroic plutonic complex (the Sondalo gabbro), composed of gabbro-norites, quartz-diorites, olivine-gabbros was set in place in late-Carboniferous and early-Permian times between 280 and 300 Ma. This intrusion produced a metamorphic contact aureole. In its vicinity, surrounding crust was melted (as indicated by muscovite decomposition, abundant garnet and sillimanite crystallization). As consequence, granulitic rocks can be found in intra-plutonic positions. Interactions between mafic liquids and metapelites-derived liquids lead to complex magmatic patterns, including magma mingling and hybridization. The connection of acid melts produced by the partial melting of the crust causes the intrusion of granitoids (e.g. Val Ferrata granite). These structures are cross-cut by the Eita shear zone, which exhumed the Campo unit during the Jurassic rifting phase near to the seafloor. This exhumation is responsible for 40Ar/39Ar ages on muscovite and biotite, which are ranging between 180 and 200 Ma.

Studying the Permian intrusions and their relation to the host rocks enables to establish a snapshot of the crust in Permian time and consequently to determine the pre-rift crustal structure and conditions. In order to get better constrains on P-T-t conditions before and during the rifting, we will use thermodynamic modeling and 40Ar/39Ar dating. This study will enable us to characterize more precisely the crustal evolution between the collapse of the Variscan orogen and the Mesozoic rifting, which is a prerequisite to understand and model the evolution of hyper-extended rifted margins.