High- and ultrahigh-pressure rock exhumation and tectonic structure of the southeastern Austroalpine crust

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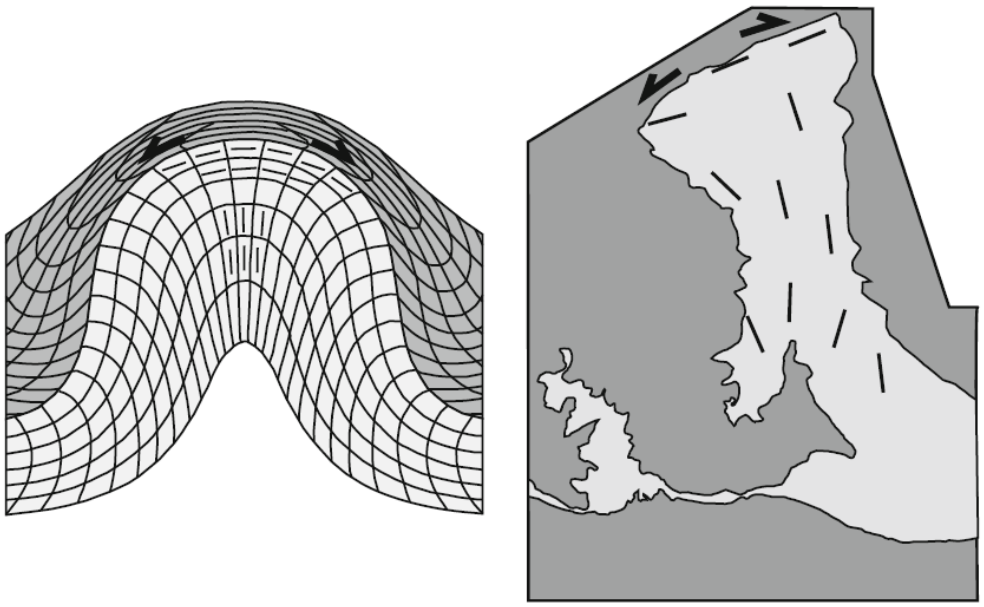
Goals:
We intend to reconstruct the deformational history of the Saualpe-Koralpe-Pohorje Complex (SKPC) in the Austroalpine Nappes during its exhumation. For that we investigate the deformation microstructures of the rocks with respect to the macroscopic fabrics and the related deformation phases. We will further analyze the synkinematic mineral assemblages and shear sense indicators of the related deformation. An important tool to gain this information is a microstructural and crystallographic preferred orientation (CPO) analysis of the investigated rock units. Determined by the operation of at least five independent slip systems, strain can be fully accommodated through dynamic recrystallization. The emerging CPO may provide information on strain and strain intensity, the strain path, shear sense and deformation mechanisms.

New results and interpretations:
Our working hypothesis is that the SKPC was extruded by non-cylindrical, localized flow from the subduction zone, driven by a pressure gradient resulting from slab extraction ("vacuum-cleaner model"). Such a process leads to a complex pattern of strain in the extruded unit, characterized by a wide variety of prolate to ablate strain ellipsoids, different orientations of the stretching direction, and shear-sense reversals along strike of a shear zone, as previously shown for the Adula Nappe (Kossak-Glowczewski et al., 2017).



Left: Analog-material experiment of diapiric rise (Dixon, 1975); right: Stretching lineations and shear sense in the Adula Nappe; note similar arrangement of stretching lineation and shear sense in the experiment and in nature. From Kossak-Glowczewski et al., 2017, Swiss Journal of Geosciences).

Relevance for the AlpArray Experiment and for research theme 1 (Large-scale reorganizations of the lithosphere) and 3 (Rock trajectories and deformation during mountain building):

One of the central questions addressed by the AlpArray Exoeriment and Priority Programme 4D-MB is related to the subsurface of the Eastern Alps: Does the steeply dipping high-velocity anomaly under the Eastern Alps that can be imaged down to 250 km depth represent the southward subducted European slab or the northward-subducted Adriatic slab? The latter interpretation would imply a subduction-polarity reversal under the western end of the Eastern Alps, with strong implications for the tectonic evolution and kinematics of crust and mantle. The Eastern Alps are distinct from the central and western parts of the orogen not only by this hypothetical subduction polarity reversal but also in another important respect: They are largely covered by an allochthonous thrust mass that does not occur in the Central and Western Alps: The Austroalpine Superunit. The tectonic history of the Austroalpine is still enigmatic because it experienced orogenic metamorphism up to ultrahigh pressures (documented by diamond-bearing rocks in Pohorje) and nappe stacking already in the Cretaceous (100 to 90 Ma), in the hanging wall of and apparently unrelated to the Paleogene subduction zone that consumed the Penninic Ocean(s) between Europe and Adria, leading to continent collision at 40 to 35 Ma. In this project, we plan to study the exhumation of the most deeply subducted part of the Austroalpine after its subduction. This will allow to better understand the tectonic evolution and structural geometry of the Austroalpine and help to unravel also the deep lithospheric structure under the Eastern Alps.