

and lower plates and their absolute velocity with respect to the underlying mantle) of subduction zones. We obtain that, although the state of stress in slabs and overriding plates is controlled also by other processes, down-dip compression in the subducting slab and extension in the overriding plate are enhanced by mantle flow opposing the direction of the dip of the slab, whereas down-dip extension in the slab and contraction in the overriding plate are favoured by mantle flow in the same direction of the slab dip (i.e., sustaining it). We conclude that the asymmetry of Alps and Apennines is primarily controlled by the slab polarity with respect to the westward drift of the lithosphere.

### **Structure and kinematics of the northern Adula nappe (Central Alps, Switzerland) and its emplacement in the Lower Penninic nappe stack**

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The Adula nappe belongs to the Lower Penninic domain of the Central Alps. It consists mostly of pre-Triassic basement rocks containing also numerous eclogites. The Adula nappe has the peculiarity to comprise several cover occurrences within the basement. The nature of the deformation experienced by the nappe reveals a complex history with several deformation phases.

The purpose of our study is a better understanding of the Alpine kinematics of the northern Adula nappe with a special focus on the early deformation phases responsible for the nappe emplacement. This study is mainly based on a detailed geologic mapping of several representative key-areas in the Northern Adula nappe. It has been also extended to a multi-scale structural analysis of the nappe at a broader scale.

We recognized that the nappe emplacement is associated with two phases of deformation. The early Ursprung ductile deformation phase is characterized by folds that are compatible with a top-to-the-south shearing. The Zapport phase is partially contemporaneous with the Ursprung phase. It produces the main structural features of the nappe by ductile north directed shear and forms two generations of isoclinal nappe-scale folds. These folds are revealed by a detailed mapping in areas preserved by later deformation. The Zapport phase folds are complex synclines cored by the sedimentary cover at the front of the nappe.

In the Eastern transect of the Central Alps, the Adula nappe and the nappes derived from paleogeographic domains located south of the Adula domain (hyper-extended margin) are mostly emplaced by detachment and basal accretion in the Alpine accretionary prism. In contrast, the Adula nappe and the other nappes located northward in the paleogeography are derived from a coherent European slab and form fold-nappes. The specific paleogeographic position of the Adula domain at the leading edge of a coherent European slab explains why this unit was subducted to depth sufficient to form eclogites. This leads the Adula nappe to act as a major shear zone during the nappe emplacement.

Two later deformation phases postdate mainly the nappe emplacement. The Leis and the Carassino deformation phases are principally characterized by NW-vergent folds. These deformations affect the nappe front formed during the previous nappe emplacement phases.