Dynamic finite element models for the structural evolution of the Swiss Prealps

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The Swiss Prealps are a stack of allochthonous structural units of Penninic origin, located on the northern front of the present Alpine mountain belt. During Alpine orogeny they were incorporated into the accretionary wedge of the closing Piemont ocean, detached from the basement over a basal evaporite horizon and transported onto the foreland.

We examined the largest and best exposed of these units, the so called Klippen Nappe, to get a detailed idea about the style of deformation and to constrain data for a geometrical reconstruction of the former sedimentary basin. The most common feature in this paleo-basin is a series of synsedimentary normal faults, which led to important thickness and facies changes within the Mesozoic carbonate sequences. Related to this variations, structural observations show a change in the style of deformation: large-scaled fault-induced fold structures in the north pass into several thin thrust sheets in the middle and finally large imbricated thrust slices in the south of the nappe.

We used dynamic finite element models to investigate the influence of an inherited basin geometry on the different styles of deformation observed in the Klippen Nappe. Preliminary model results suggest that mechanics were controlled by (1) changes in basement geometry, (2) the relative thickness and distribution of individual layers (e.g. mechanically strong limestones versus weak marls) and (3) the existence and thickness of a weak detachment horizon.