

## **Tectonics and sedimentation in the Swiss Molasse basin: Insights and lessons from analogue modelling.**

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In order to investigate the interplay between tectonics, basin evolution and erosion, we performed a series of analogue tapered wedge models. To maintain the critical wedge the modelled foreland basins tectonically deformed by folding and thrusting while surface processes were active. After each incremental step of convergence the ideal wedge geometry was maintained by eroding and sedimenting in areas which were in a super- or sub-critical stages, respectively. The geometric and kinematic evolution of the wedge is strongly dependent on the amounts of sediments shed into the foreland basin as well as the volumes eroded, both in the growing wedge and the basin. We performed different sets of models which show the differing basin evolutions as a function of basin infill: large amounts of sediments produced large and deep basins with few tectonic structures, whereas smaller basins with more folding and thrusting develop with lower sedimentation. Punctuated thrusting in the foreland fold-and-thrust part of the orogenic wedge model is governed by the mechanics of the wedge. The novelty of our approach is that the analogue model takes into account both the tectonic and lithological heritages based on an Alpine paleogeographic setting.

Insights from analogue modelling show that:

- Basin width is constant after reaching a threshold width
- Basin evolution is mainly towards the front of the orogenic wedge
- The basin evolves into sub-basins due to the punctuated formation of thrust-related folds. During the course of evolution some of these basins may completely disappear. These units are subsequently unaccounted for in the sedimentary record. A corollary is that the Molasse basin may in some cases be detached from its substratum. A consequence is that the total length of the basin may significantly be underestimated, and hence line balancing techniques may be inappropriate to make balanced sections of the original basin width and/or substratum width
- Sedimentation and erosion show an inherent cyclicity that is caused by the wedge mechanics
- The punctuated cycles in sedimentation/erosion are related to the forward propagation of the thrusts, which in turn are related to the growth of the orogenic wedge.

Comparisons with the Alpine Molasse basin and orogen show striking similarities in the pattern of evolution of the basin and in the development of tectonics. Three cross-sections through the western Alps are compared with models results from different experimental runs (Figure 1).

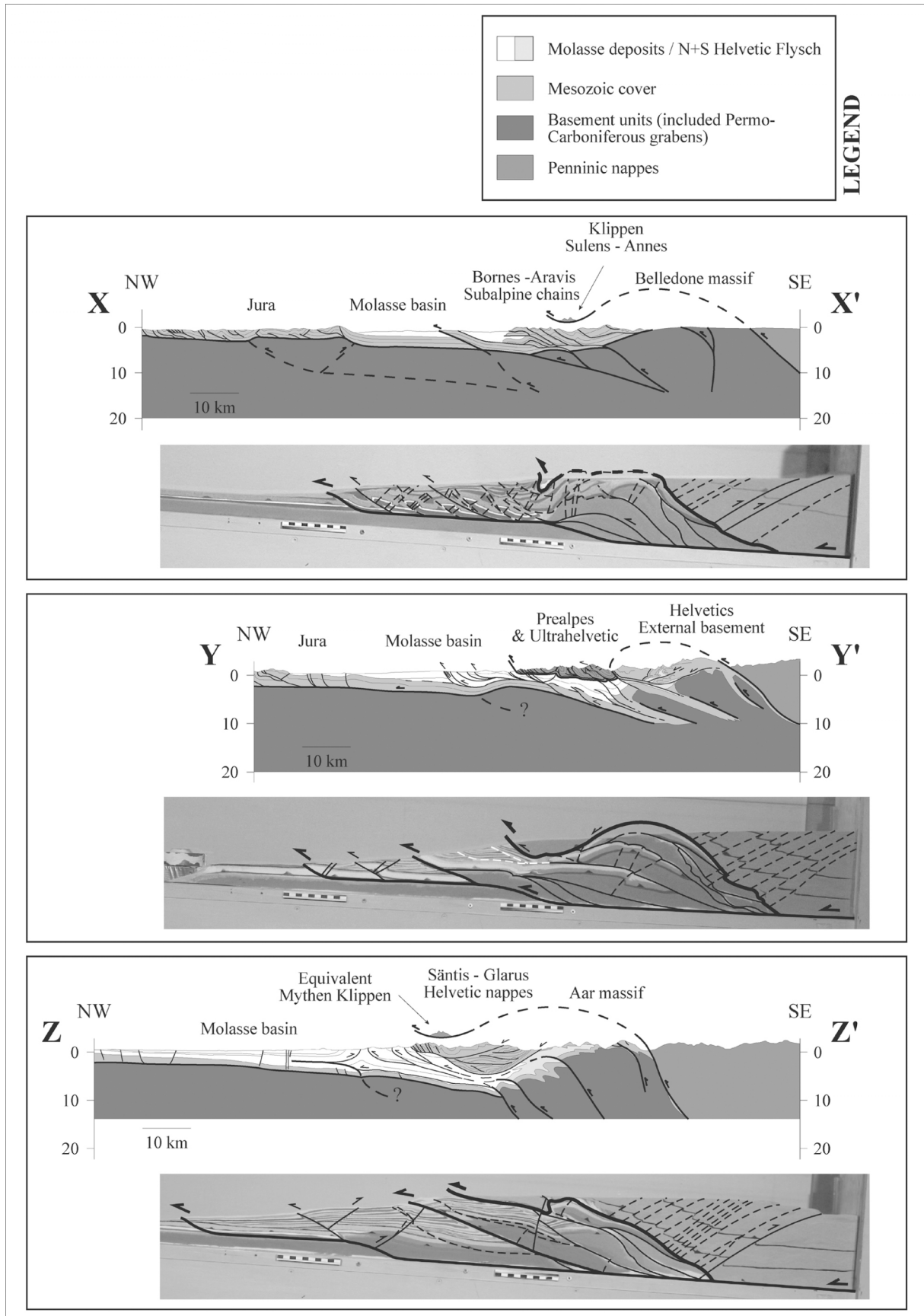


Figure 1. Comparison of geometrical structures between three simplified cross-sections of the central-western Alps (based on data from literature) and three analogue experiments we performed with variable rates of erosion and sedimentation.