

3D structural model and kinematic interpretation of the Panixer Pass Transverse Fold (Infrahelvetic Complex, eastern Switzerland)

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The Panixer Pass Transverse Fold in the eastern Swiss Alps (Glarus-Flims area) is a peculiar SSE-trending structure oriented approximately perpendicular to most alpine structures. It represents a plunging fold with Permian Verrucano in its core, which is cut by the Glarus Thrust. Hence Verrucano can be found below the Glarus Thrust in the Infrahelvetic Complex. Across the Panixer Pass Transverse Fold the structural buildup of the Infrahelvetic Complex changes considerably. Multiple theories of the structural evolution have been published (Oberholzer, 1933; Wyssling, 1950; Pfiffner, 1978); however, none of those is satisfying particularly because traditional 2D geological cross-sections have not been sufficient to fully understand the 3D complexity of the structure.

The main result and product of our study therefore is a 3D structural model of the Panixer Pass Transverse Fold to get a better insight into its geometry. As input for the model creation, we first produced a detailed litho-stratigraphic map and collected structural orientation data during two geological field seasons. The final 3D structural model honors the observed surface geology and the expected 3D subsurface geometry. Our field data indicates that the shearing and transport direction was continuously NNW-directed, except for a phase of north-directed shearing during the early movement along the Glarus Thrust (i.e., late Calanda Phase) and related foliation development in the Helvetic Nappes.

The Panixer Pass Transverse Fold developed prior to the penetrative foliation during a thrust-dominated deformation phase (i.e., Cavistrau Phase), for which we created a kinematic block model. According to this model, the Panixer Pass Transverse Fold is the result of multiple lateral ramps and related lateral fault-bend folds that all developed in a similar position amplifying each other. In particular, we do not propose ENE-WSW-directed shortening to form the Panixer Pass Transverse Fold.

Our kinematic model reproduces the 3D structural model, but challenges some previously proposed sequences of deformation phases (Schmid, 1975; Milnes and Pfiffner, 1977; Gasser and den Brok, 2008). However, after a reinterpretation the deformation phases of Gasser and den Brok (2008) actually correlate quite well with our own interpretation and the proposed deformation phases of Schmid (1975) and Milnes and Pfiffner (1977).

References:

- Gasser D. and den Brok B., 2008: Tectonic evolution of the Engi Slates, Glarus Alps, Switzerland, *Swiss Journal of Geosciences* 101, 311–322.
- Milnes A.G. and Pfiffner O.A., 1977: Structural development of the infrahelvetic complex, eastern Switzerland, *Eclogae Geologicae Helvetiae* 70, 83–95.
- Oberholzer J., 1933: *Geologie der Glarneralpen*, A. Francke AG.
- Pfiffner O.A., 1978: Der Falten- und Kleindeckenbau im Infrahelvetikum der Ostschweiz, *Eclogae Geologicae Helvetiae* 71, 61–84.
- Schmid S.M., 1975: The Glarus overthrust: Field evidence and mechanical model, *Eclogae Geologicae Helvetiae* 68, 247–280.
- Wyssling L.E., 1950: *Zur Geologie der Vorabgruppe*, PhD Dissertation No. 1807, ETH Zurich, Switzerland.