TESTING A BUCKLE FOLD MODEL IN THE THRUST BELT OF THE WESTERN NORTHERN CALCAREOUS ALPS

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Northern Calcareous Alps, thrust sequence, buckle fold model, Tirol, Allgäu

The Northern Calcareous Alps (NCA) are a typical thin-skinned fold-and-thrust belt in which thrusting was accompanied by sedimentation. Synorogenic sediments below a thrust allow to date the age of thrusting. Applying this concept shows that thrusting generally propagates from S(E) to N(W): the Aptian/Albian Lechtal thrust is followed by the Cenomanian, out-of-sequence Inntal thrust. The Allgäu- and Lechtal thrust sheets were emplaced onto the Cenoman-Randschuppe in Turonian. Finally, the NCA nappe stack reached the South Penninic Units in Turonian/Coniacian. However, growth strata in thrust-sheet-top deposits depict that shortening persisted after thrust sheet emplacement well into Cenozoic times.

Ramp-flat models are often used to visualize large scale thrust belt geometries. According to this model, upper-footwall deposits should accompany a thrust continuously. In fact these deposits are restricted to synclines in the footwall that do not affect the thrust, both the in-sequence Lechtal thrust as well as the out-of-sequence Inntal thrust. Therefore, the ramp-flat model is probably not appropriate.
Folds observed in the NCA typically show rounded hinges and are floored and cored by evaporites, which favours folding by buckling. Therefore we propose the structural evolution of the NCA thrust sheets in the following sequence:

(1) buckle folding with amplitudes decreasing toward external folds

(2) locking of internal folds that have reached a minimum opening angle

(3) nucleation of a new thrust across locked folds

(4) thrust propagation through existing and probably still growing folds.

This model could explain many peculiarities of the NCA thrust belt, such as truncation of folds by a thrust on top or at the base, pieces of hanging-wall units below thrusts and footwall folding also below in-sequence thrusts. We test the applicability of the buckle fold model within the work of two master theses located in an internal (Lechtal thrust) and an external part (Falkensteinklippe, Cenoman-Randschuppe) of the NCA thrust sheet by:

- extensive structural field analysis to elaborate a better understanding of structure evolution in time,

- retro-deformation of cross sections to demonstrate that unfolding of the thrusts does not eliminate entire folding,

- measuring and comparing fold amplitudes to corroborate decreasing amplitudes toward external folds.