



Neogene tectonics in the Swiss Subalpine Molasse basin: Preliminary results from apatite (U-Th)/He ages and fault slip analyses in the Rigi area (Switzerland)

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Apatite fission-track (AFT) data from wells within the Swiss Subalpine Molasse basin suggest tectonic reactivation and km-scale thrusting in a triangle zone during Plio-Pleistocene times (Cederbom et al., in preparation). An offset in the AFT age/depth trend within and between wells penetrating the triangle zone suggest thrusting during or after major exhumation and basin erosion. The aims of this reconnaissance study were to test if: (1) the suggested erosion and thrusting can be verified by an independent low-temperature dating technique and if; (2) the exact location of reactivated faults can be identified.

We applied apatite (U-Th)/He dating to a vertical profile of the Rigi Mountain (the hanging wall), and a horizontal transect across the Rigi thrust into the triangle zone. Additionally, detailed structural mapping was conducted in order to understand the local tectonic configuration and to document the paleo-stress. In total, 10 apatite samples from seven different locations were successfully dated with the (U-Th)/He technique. Granitic boulders were collected from the conglomeratic units in order to minimize the detrital age spread and to maximize the amount of crystal-shaped apatite grains. However, inclusions and defects were common in the apatites, so triplicates were picked and analysed for each sample. For the structural analysis, stereonet and stress inversion software were used to evaluate the collected fault slip data (mainly growth fibre and slicken-side lineations). Unfortunately, a comprehensive identification and mapping of individual faults were not possible in this densely populated and vegetated area.

Single apatite (U-Th)/He ages vary between 3 and 84 Ma, probably due to unidentified inclusions or zonations. However, several sample aliquots replicate well and provide reasonable ages. In general, Pliocene ages are obtained on both sides of the Rigi thrust and the apatite ages increase with elevation along the vertical transect of the hanging wall. Moreover, two different sets of maximum horizontal stress orientations have been discerned from the fault slip analysis so far (N-S and NNW-SSE, respectively). Both represent a compression dominated stress regime for the Rigi region.

The preliminary data confirm late Neogene km-scale erosion of the Subalpine Molasse (cf. Cederbom et al, 2004), but do not support more recent thrusting along the Rigi thrust. Nevertheless, thrusting further north cannot be excluded due to ambiguous results within the triangle zone. Additionally, the huge spread in single grain (U-Th)/He ages for some of the granitic boulders emphasizes the importance of analysing triplicates or more when applying the technique to crystalline apatites in this area.

Cederbom, C.E. and Sinclair, H.D., Schlunegger, F., Rahn, M.K. (2004) Climate-induced rebound and exhumation of the European Alps. *Geology*, 32:709-712

Cederbom, C.E., Schlunegger, F., van der Beek, P., Sinclair, H., Oncken, O., Foreland basin erosion at 5-4 Ma reveals climatic, tectonic and geodynamic forcing on the European Alps (in preparation)