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Regional uplift and erosional denudation vs. footwall exhumation along the Shkoder-Peja Normal Fault at the Dinarides-Hellenides transition

Joerg Giese (1), Marc Grund (1), Sascha Zertani (1), Mark R. Handy (1), Stefan M. Schmid (2), Jan Pleuger (1), and Kujtim Onuzi (3)

(1) Institute of Geological Sciences, Freie Universität Berlin, Berlin, Germany (joerg.giese@fu-berlin.de), (2) Institute of Geophysics, ETH-Zürich, Zürich, Switzerland, (3) Institute of Geosciences, Polytechnic University of Tirana, Tirana, Albania

The Shkoder-Peja Normal Fault (SPNF) is an orogen-perpendicular structure at the transition of the Dinarides and Hellenides that accommodated clockwise rotation of its hanging wall around a vertical axis near the city of Shkoder in northern Albania. The exact timing of faulting and footwall motion remain poorly constrained; so far, Mid-Miocene clastic sediments in the fault-bounded western Kosovo basin in the hangingwall of the SPNF [1] yield the best indication for the onset of extension [2].
In this study, we conducted apatite fission-track (AFT) analysis on 8 samples from two profiles across the SPNF close to the cities of Shkoder and near Peja, and one additional sample from the distant footwall of the SPNF to better constrain the timing and differential throw along the SPNF. All samples from both foot- and hanging walls of the SPNF are (partially) annealed and yield apparent AFT ages between 57 $\pm$ 17 Ma and 21 $\pm$ 6 Ma, thus predating the assumed onset of faulting in Mid-Miocene time. The apparent AFT ages of eight samples close to the fault overlap within 1 sigma uncertainty and have comparable single-grain age distributions; these feature (I) large spreads in single-grain ages and (II) a significant number of single-grain ages ranging between 25 and 10 Ma. We interpret the Early- to Mid-Miocene range of single-grain ages to date cooling below the lower limit (60°C) of the partial annealing zone for apatite; the apparent AFT ages probably represent mixed ages that document an inherited component of earlier cooling, perhaps due to nappe stacking and/or a provenance signal.
These results are puzzling in light of recently investigated microstructures of a calc-mylonite from the central part of the SPNF near Bajram Curri indicating a syn-mylonitic temperature of $\geq$200°C, temperatures which are expected to completely reset any inherited signal in the fission track data from the footwall. A possible explanation of this dilemma is that the AFT samples in the Peja section come from a relatively higher position in the Dinaric nappe stack compared to the calc-mylonite, whereas AFT samples from the Shkoder section are located in a much lower level of the same nappe stack.
The overlap in AFT ages from the hanging- and footwalls of the SPNF suggests contemporaneous cooling (within precision of the method) in the footwall and proximal hanging wall of a distributed normal fault system, possibly masking the thermal effect of differential exhumation during normal faulting. In any case, this overlap indicates that regional uplift and erosional denudation – possibly starting prior to and outlasting extension along the SPNF – affected the nappe stack at the Dinarides-Hellenides transition. This corroborated by river incision in sediments of the western Kosovo and Tropoja basins in the hanging wall of the SPNF.

[1] Elezaj, Z (2009) Cenozoic molasses basins in Kosovo and their geodynamic evolution. Ştiinţele Naturii. Craiova, v. 25, p. 343-350.
[2] Handy, MR, Giese, J, Schmid, SM (2017) Slab rollback and Neogene deformation at the Dinarides-Hellenides junction. 13th Workshop on Alpine Geological Studies. Zlatibor, Serbia.