



Dating the Exhumation of the Romanian Carpathians: First Results from Apatite (U-Th)/He Thermochronology

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The East Carpathian fold-and-thrust belt and adjacent sedimentary basins are an ideal setting to study the interaction between active tectonics and surface processes in the aftermath of continental collision. Ongoing projects in the East Carpathians foredeep, the Focsani Depression, provide better constraints of its geometry and evolution during Miocene to present-day. These studies reveal strong subsidence in the central parts of the basin and E-ward tilting of its western margin, which requires exhumation and uplift in the mountain belt itself.

An apatite fission-track survey of the Romanian Carpathians (Sanders, 1998; Sanders et al., 1999) showed that up to 4 km of erosion took place during the Miocene, and suggested up to 2 km of erosion during the Pliocene and Quaternary. However, the young apatite fission-track ages and low U-content prevented to sample enough fission-track length measurements to constrain the late stage exhumation with a high enough resolution. A better insight into this late stage exhumation is being reassessed in this research project by analysing the same samples with (U-Th)/He thermochronology. Apatite (U-Th)/He ages have been obtained from samples along two profiles perpendicular to the strike of the East Carpathian orogen. One profile transects the northern/central East Carpathians from SW to NE. Middle Miocene apatite (U-Th)/He ages of around 16 Ma have been obtained for the SW so far. Sanders et al. (1999) reported apatite fission-track ages of around 23 Ma for this area. The other profile transects the southern East Carpathians from NW to SE. Oligocene apatite (U-Th)/He ages have been acquired

for the NW. Interestingly, towards the SE Pliocene apatite (U-Th)/He ages of around 2 to 3 Ma have been obtained, which is much younger than the apatite fission-track ages of around 25 Ma reported by Sanders et al. (1999) and confirms the very recent exhumation in this part of the East Carpathians adjacent to the Focsani Depression.

The results indicate that the (U-Th)/He method is a unique tool to unravel the Pliocene to present exhumation history of the Romanian Carpathians, complementary to the apatite fission-track study of Sanders (1998). Therefore new samples will be collected for (U-Th)/He thermochronology during a fieldwork in spring 2005. At the same time, the fission-track method will be applied to samples from the Molasse series in the south-eastern part of the chain. To constrain in time vertical movements in the sedimentary basins adjacent to the chain, the Focsani Depression and the Transylvania Basin, Ar/Ar and zircon fission-track techniques will be used to date volcanic tuff layers. Furthermore, detrital zircon fission-track analysis will be used to identify regions contributing detritus to the Transylvania Basin and Focsani Depression. In a final stage all low-temperature thermochronology data will be combined to model the vertical motions of the East Carpathians and its adjacent basins in relation to surface processes and tectonic processes in the deeper lithosphere. This will also involve an analysis of drainage patterns of the recent past.

References:

Sanders, C.A.E. (1998). Tectonics and erosion: Competitive forces in a compressive orogen. A fission-track study of the Romanian Carpathians. PhD thesis, Vrije Universiteit, Amsterdam, 204p.

Sanders, C.A.E., Andriessen, P.A.M. & Cloetingh, S.A.P.L. (1999). Life cycle of the East Carpathian orogen: Erosion history of a doubly vergent critical wedge assessed by fission track thermochronology. *Journal of Geophysical Research*, vol. 104, p. 29095-29112.