Geophysical Research Abstracts
Vol. 13, EGU2011-4787, 2011
EGU General Assembly 2011

The Neogene Evolution of polish Outer Carpathians: relationship between exhumation and deep geodynamic processes as constrained by low temperature thermochronology

Benedetta Andreucci (1), Leszek Jankowski (2), Stefano Mazzoli (3), Peter Reiners (4), Rafal Szaniawski (5), and Massimiliano Zattin (1)

(1) Department of Geosciences, University of Padova, Via Giotto 1, 35137 Padova, Italy (benedetta.andreucci@studenti.unipd.it), (2) Polish Geological Institute-Carpathian Branch, Cracow, Poland, (3) Department of Earth Sciences, University of Naples "Federico II", 80138 Naples, Italy, (4) Department of Geosciences, University of Arizona, Tucson, AZ, (5) Institute of Geophysics, Polish Academy of Science, Warsaw, Poland

The Cenozoic evolution of the Carpathians is characterized by the interplay of different geodynamic processes, such as A-type subduction of the European plate under the north-northeastward moving Alcapa-Tisza Dacia plate, slab roll back, back-arc extension and mantle upwelling in the Pannonian basin.
The response of the chain at shallow crustal levels was therefore marked by different episodes of thrusting and extension that gave rise to the construction and following disruption of the orogenic wedge. Rocks were then moved to the surface through erosion or tectonic exhumation processes according to the prevailing tectonic regime. Hence, modes and timing of burial and exhumation and consequently of heating and cooling of rocks are important parameters to constrain the geodynamic evolution of the orogen.
In this study we applied fission-track (AFT) and (U-Th)/He (AHe) analysis (integrated with structural data from field surveys and other thermal indicators data from literature) to a set of ca. 40 samples belonging to the polish sector of the Outer Carpathians.
The Outer Carpathians accretionary prism is made by Late Jurassic to Early Miocene sediments, formed between the Late Oligocene and the Serravallian-Tortonian, the end of thrusting being progressively younger towards the east (ca. 16-12 Ma in the studied area, Nemcok et al., 2006); in the last 10 Ma thrusting was overlapped by extension (Mazzoli et al., 2010) associated to formation of "intramontane basins" (Zuchiewicz et al., 2002).
The overall distribution of AFT and AHe data shows a decrease of burial conditions toward the outermost tectonic units according to the wedge geometry of the chain. However, the decreasing trend doesn't regularly follow the tectonic structures, suggesting complex exhumation dynamics and interplay of different processes.
Ages of totally reset AFT and AHe samples are comprised in the intervals of respectively 7.0-26.3 Ma and 6.2-20.6 Ma, meaning that exhumation of the studied area occurred between Chattian and Messinian. In particular in the western region both AFT and AHe reset samples give an Early-Middle Miocene signal, whereas younger ages (7-11 Ma) appear confined to the eastern region.
The Early-Middle Miocene ages are coeval to thrusting, suggesting a first exhumation episode driven by erosion of the accretionary wedge during its formation. Our data show therefore that the polish part of the Outer Carpathians underwent, between Chattian and Serravallian, tectonic burial and erosional exhumation, which resulting complex spatial pattern depends on geometry of the thrust sheets and dynamics of thrusting.
The late Miocene ages post-date thrusting and their connection with post thrusting extensional structures is well demonstrated by field survey results, pointing out a tectonic exhumation phase guided by extensional tectonics.
This second exhumation phase is clearly observable in the eastern region, but its less extensive occurrence in the western region cannot be excluded.
Post thrusting crustal extension, reported by both field observation and thermochronological data, is well compatible with two possible triggering processes: (i) gravitational readjustments within the orogenic wedge (MAZZOLI et al., 2010); (ii) back arc processes.
The dependence of Late Miocene exhumation of the Outer Carpathians on deep geodynamic processes that controlled the opening of the Pannonian Basin is supported by the correspondence between timing of extension in the OC and a renewed extensional phase in the Pannonian Basin, although a role of gravitational readjustments within the orogenic wedge cannot be excluded.

REFERENCES

Mazzoli, S., Jankowski, L. and Szaniawski R. and Zattin, M.; (2010) - C. R. Geoscience; 342; 162-169.

Nemcok M., Pogacsas G. and Pospisil L.; (2006) - AAPG Memoirs; 84; 517-540.

Zuchiewicz W., Tokarski A. K., Jarosinski M. and Marton E.; (2002) - EGU Stephan Mueller Special Publication Series; 3, 185–202.