

# Eo-Alpine metamorphism and the “mid-Miocene thermal event” in the Branisko Mts. (Western Carpathians, Slovakia) as revealed by multi-system low-temperature thermochronology

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A number of fundamental questions regarding the Carpathian orogenesis, such as timing and grade of metamorphism, thermal histories of crystalline and sedimentary rocks, or the timing and nature of exhumation processes, remain open or controversial due to a lack of empirical data and the sparse geological record. In this study we apply a combination of zircon (U-Th)/He (ZHe), apatite fission track (AFT) and apatite (U-Th)/He (AHe) dating methods to constrain the metamorphic and exhumation history of the Tatric part of the Branisko Mts. in the Western Carpathians.

Latest Cretaceous-Eocene ZHe ages from the basement samples prove that the basement was heated to temperatures between ~180 and 250 °C and did experience a very low-grade to low-grade Alpine metamorphic overprint. The ZHe ages are interpreted as cooling ages recording the exhumation of the Branisko Mts. basement related to the extensional collapse of the Carpathian orogenic wedge after the mid-Cretaceous (Eo-Alpine) collision and thrusting. Miocene AFT and AHe ages found in the basement and in the Paleogene sediments conclusively demonstrate that the Branisko Mts. experienced a “mid-Miocene thermal event”. This event had a regional character and was related to magmatic and/or burial heating. According to AFT, AHe and thermal modelling results, the sediments of the Central Carpathian Paleogene Basin and the basement were heated to

~120–130 °C and ~110–190 °C, respectively, during “mid-Miocene thermal event”. Final exhumation of the Branisko Mts. occurred in the Early-Late Miocene according to the thermal modelling. This conclusion is in good agreement with the sedimentary record in the adjacent Eastern Slovakian Basin and fits well with the general exhumation pattern of crystalline bodies in the Western Carpathians with well-defined spatial AFT age patterns. However, the exhumation is not directly corroborated by the evidence from the geological record. Detecting the mid-Miocene thermal event in the Western Carpathians by AFT and AHe systems has proved to be a viable tool for reconstructing the original extent of Neogene sediments with application to paleogeographical reconstructions. Further details of this study can be found in Danišík et al. (2012).

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## References

- DANIŠÍK, M., KOHÚT, M., EVANS, N. J., & McDONALD, B. J., 2012: Eo-Alpine metamorphism and the “mid-Miocene thermal event” in the Western Carpathians (Slovakia): New evidence from multiple thermochronology. *Bratislava, Slovak Geol. Mag.*, 149, 158 – 171.