Low thermal constraints on the Alpine evolution of the Gemer Belt (Western Carpathians)

RASTISLAV VOJTKO[1], PETR JEŘÁBEK[2], SILVIA KRÁLIKOVÁ[1], MARTIN REISER[3] and ONDREJ LEXA[2]

1 – Department of Geology and Palaeontology, Faculty of Natural Sciences, Comenius University Bratislava, Mlynská dolina, Ilkovičova 6, 842 15 Bratislava, Slovakia, rastislav.vojtko@uniba.sk, kralikova.silvia@gmail.com
2 – Institute of Petrology and Structural Geology, Faculty of Science, Charles University, Albertov 6, 128 43 Praha, Czech Republic, jerabek1@natur.cuni.cz, lexa@natur.cuni.cz
3 – Geological Survey of Austria, Neulinggasse 38, 1030 Vienna, Austria, martin.reiser@uibk.ac.at

The Western Carpathians represent the northernmost part of the Alpine orogen in Central Europe. The research was focussed to study the late stages of the Carpathian orogen evolution covering mainly its internal parts. Zircon and apatite fission track (ZFT and AFT) thermochronology has been used in order to derive quantitative constraints on the low-thermal evolution of basement and sedimentary rocks in the Gemer Belt. In the Gemer Unit, the Alpine metamorphic peak is considered to be Early Cretaceous (~140–115 Ma) and is related to Cretaceous N–S convergence in the Inner Western Carpathians (IWC) orogenic wedge. After the metamorphic peak, which was caused by the Alpine nappe stacking, a tectonic collapse is evidenced by cooling of the Gemeric Unit and the overlying Meliata subduction-accretionary complex.

Basement samples from the Gemeric Unit of the IWC yielded cooling ZFT ages in the range from 108.2 ± 7.0 to 73.0 ± 4.5 Ma and apparent AFT ages between 62.5 ± 7.3 and 59.3 ± 6.1 Ma. The Upper Permian to Lower Triassic siliciclastic sediments of the Stratená Nappe, belonging to the Silica Unit, yielded cooling ZFT ages from 121.1 ± 21.9 to 72.5 ± 14.7 Ma apparent AFT ages between 72.8 ± 8.0 and 61.3 ± 7.3 Ma. The same siliciclastic rocks of the Vernár Nappe provided ZFT ages at 115.3 ± 20.1 and AFT ages 66.8 ± 10.5 Ma, respectively. Both nappes were heated to a temperature approximately 300°C or slightly more during the Alpine metamorphism. In any case, our data support the hypothesis that the Silica-related nappes system was at least partly incorporated into the Mesozoic accretionary wedge and contradict the widely accepted assumption that this nappe system lacks an Alpine metamorphic overprint. However, the Muráň Nappe gave ZFT ages from 259.4 ± 20.9 – 253.1 ± 18.4 Ma, which reflects the cooling of source rocks of the Lower Triassic siliciclastic deposits without any Alpine thermal overprint. The samples from the Muráň Nappe yielded Alpine cooling AFT ages between 107.8 ± 20.3 and 92.7 ± 9.3 Ma. According to ZFT and AFT data, the Gemeric Unit, an uppermost thick-skinned thrust sheet, cooled from depth levels of ~10 up to 6.0 km (temperature interval of ~300–200°C) about 108–73 Ma ago. This cooling began immediately after the collapse of overlying Meliata-Turňa Mesozoic accretionary prism with the cooling ages of the Silica-related nappes approximately (121 – 72 Ma).

Acknowledgement: This research was supported by the Slovak Research and Development Agency under contracts No. APVV-17-0170.