

EXHUMATION OF THE HIGH TATRA MOUNTAINS AND IMPLICATIONS FOR THE WESTERN CARPATHIANS (SLOVAKIA)

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ABSTRACT

The Carpathian Mountains are a large (~1500 km) collisional orocline stretching from Vienna, Austria to Bucharest, Romania. The Western and Inner Carpathians include the High Tatra mountains, which exhibit the highest elevation peaks of the entire mountain belt. Here we studied the exhumation history of Gerlachovský štít, the topographically highest point of the High Tatra Mountains. Granitoid samples from different elevations were collected and analyzed for apatite (U-Th)/He (n=12; 5-6 aliquot ages each) and zircon (U-Th)/He ages (n=22; 2-4 aliquot ages each). In addition, apatite U-Pb dating was conducted to complement existing zircon U-Pb dates to track the evolution of the High Tatra Mountains from the onset of magmatism during the Variscan orogeny. The (U-Th)/He apatite ages increase systematically from 28.8 ± 1.8 Ma to 9.6 ± 0.6 Ma from lower to higher elevations. Zircon (U-Th)/He ages from the same samples, however, are scattered and range from 15.5 ± 1.1 Ma to 47.8 ± 3.9 Ma. The ages agree with some published low-T thermochronometric results. However, the apparent average exhumation rates for zircon and apatite (U-Th)/He data derived from the age-to-elevation profiles are inconsistent with a proposed rapid early Miocene exhumation pulse. Apatite U-Pb ages obtained in this study are between 344.2 ± 2.0 Ma and 354.2 ± 1.8 Ma, and are similar to ~350 Ma zircon dates from the same or nearby samples. This observation is indicative of rapid cooling of the granitoids following crystallization. The results of the (U-Th)/He ages captures both pre- and post-Miocene slow cooling interrupted by early Miocene tectonic unroofing. Overall, the results are used to outline the earliest tectonic history of the High Tatra Mountains until the onset of more recent exhumation and impacts our understanding of the origin and development of the arcuate mountain belt.

(U-Th)/He Thermochronology, U-Pb Geochronology, High Tatras, Western Carpathians, Gerlachovský štít

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