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Contrasting cooling and exhumation histories of tectonic blocks in the eastern part of the Eastern Alps and its possible relationships with lithospheric dynamics

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In the European Alps two fundamental changes in the lithospheric structure controlled the geodynamic evolution of the orogen: (1) Late Eocene to Early Oligocene rupturing of the European slab and (2) Early Miocene change in subduction polarity between the Western and Eastern Alps. In particular, the eastern part of the Eastern Alps is a key area which will provide both, information about the surface response to the Eocene/Oligocene slab breakoff and the response to a proposed isostatic rebound due to slab detachment of the European lithosphere in the Miocene (Handy et al., 2015). The eastern part of the Eastern Alps is characterized by fault-bounded blocks with different thermochronological ages, mean elevations and hillslope angles, indicating a variable spatial and temporal evolution throughout the Cenozoic era. The topographic pattern of the study area can be described in terms of (1) high relief with a rugged surface and steep slopes in the Niedere Tauern and (2) lower relief and distinctly smoother topography in the Seckauer Tauern, the Gurktal, Saualpe and Koralpe blocks. Generally, tectonic blocks with higher relief and rugged topography display the youngest apatite fission track (AFT) and apatite (U-Th)/He data (AHe); the Niedere Tauern concurs with middle Miocene AFT and late Miocene/Pliocene AHe ages (Wölfler et al., 2016). The other tectonic blocks generally show Eocene to Oligocene AFT ages (Wölfler et al., 2016 and references therein) and Oligocene to early Miocene AHe ages (Legrain et al., 2014, own preliminary work). New AFT and AHe data from the Gurktal block and Seckauer Tauern indicate that substantial parts of the study area where at near-surface conditions since the Eocene and Oligocene. Thermal history models suggest fast cooling through the AFT and AHe closure temperatures in the Oligocene as a possible response to slab breakoff that was followed by thermal stagnation until the present. In contrast, the neighboring Niedere Tauern experienced enhanced cooling and exhumation in the middle Miocene and again at the late Miocene and Pliocene (Wölfler et al., 2016). Middle Miocene exhumation is interpreted as a result of tectonic escape and convergence that operated simultaneously during lateral extrusion of the Eastern Alps. As the higher late Miocene/Pliocene exhumation rates are restricted to a single tectonic block, namely the Niedere Tauern, we infer a tectonic trigger that is probably related to a change in the external stress field that affected the Alps during this time.

References

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