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Low temperature thermochronology in the Easter Alps. New data, interpretations and perspectives.

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The aim of this study is to evaluate new and published low temperature thermochronological data of the Eastern Alps in terms of its Mesozoic and Cenozoic tectonic evolution and the possible connection with deep seated lithospheric processes.
In the Eastern Alps, the tectonic units that originate from the Penninic domain are buried beneath the Austroalpine nappe stack. Overthrusting of the Austroalpine nappes over the Penninic units occurred throughout the Cretaceous and lasted until the Eocene. During lateral tectonic extrusion in Oligocene to Miocene times the footwall penninic units exposed in the Tauern Window, were tectonically exhumed from below the Austroalpine hanging wall. This is well documented by Miocene to Pliocene zircon- and apatite fission track (ZFT, AFT) and (U-Th)/He data.
However, the Austroalpine hanging wall shows a more complex age pattern. Late Cretaceous ZFT data reflect post-metamorphic exhumational cooling after Eo-Alpine metamorphism that goes along with an extensional phase that affected large parts of the Eastern Alps. Paleogene AFT and apatite (U-Th)/He data of the Austroalpine units to the east of the Tauern Window reflect exhumation of this area that supplied clastic material, the so-called Augenstein formation. Exhumation and erosion of the area left a probably hilly surface in Early Miocene times that was only moderately uplifted since then. These areas are well known for paleosurfaces exposed in the Gurktal-Kor- and Seckauer Alps to the east of the Tauern Window and in the central and eastern Northern Calcareous Alps. However, distinct parts of the Austroalpine hanging wall experienced substantial exhumation and surface uplift in the Miocene, contemporaneous to the exhumation of Penninic units and lateral extrusion of the Eastern Alps. These areas are restricted to the south and northeast of the Tauern Window and are characterized by steep and rugged reliefs that contrast the hilly and moderately shaped reliefs of the paleosurfaces. To summarize, low temperature thermochronological data of the Eastern Alps display at least three different exhumation scenarios during Cretaceous, Paleogene and Neogene times. Recent studies suggest that these time frames mark substantial changes in the lithosphere beneath the European Alps. Therefore exhumation in the Eastern Alps may reflect processes like lithsopheric thinning, changes in slab polarities and the formation of slab gaps.