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The thermotectonic evolution in front of the Dolomites Indenter

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The Adriatic Indenter is subdivided into a western and an eastern domain termed Canavese-Insubric Indenter and Dolomites Indenter, respectively, and offset for ~75 km from late Oligocene onwards by the NNE-SSW-trending sinistral-transpressive Giudicarie fault system (GFS). The N(NW)-directed movement of the Dolomites Indenter (DI) modifies the early Cenozoic nappe structure of the Alpine orogen as the accommodated shortening changes substantially, depending on the oblique shape of the indenter and its counter-clockwise rotation. The Austroalpine basement units northwest of the GFS experienced open folding of the Cretaceous nappe stack and preserved Cretaceous metamorphic ages. In contrast, the previously deep-seated Neoalpine metamorphic Subpenninic and Penninic units of the Tauern Window in front of the DI's tip are exhumed and the Austroalpine units adjacent to the DI are brought into a subvertical or even overturned position.

The combination of several thermochronological methods and structural field work allows for constraining time on this tectonic evolution: The Austroalpine units directly adjacent to the DI belong to the uppermost nappe system of the Eoalpine orogeny (Drauzug-Gurktal Nappe System) and experienced an anchizonal to lowermost greenschist-facies metamorphic overprint during the Alpine orogeny resulting in an only partial reset of Variscan Rb/Sr Biotite ages (Pomella et al., 2022). Fission track data from the western Tauern Window and the Austroalpine units adjacent to the north-western corner of the DI, indicate cooling below 180-200 °C (Zircon Fission track data) in the Early Miocene and below the 100-120 °C (Apatite Fission track data) in the Late Miocene (Klotz et al., 2019). (U-Th)/He on Apatite data, derived from a horizontal section of the Brenner Base Tunnel and reaching from the DI into the Austroalpine nappe stack, indicate continuous differential uplifting of the northern block along the, in this area, approximately E-W striking Periadriatic fault system until the Pliocene (Klotz et al., 2019).

Earthquake focal solutions and satellite-based geodetic studies show, that indentation is ongoing today. The significant present-day seismotectonic activity concentrates in the Friuli area in the southeast, whereas there is currently no significant seismicity along the western and northern boundaries of the DI or in the northerly adjacent Austroalpine basement and the Tauern Window. Increased seismic activity can only be detected north of the Tauern Window, along, and north of the Inn Valley (Reiter et al., 2018). Based on field evidence and the thermochronological record, the recent seismic distribution indicates an important change in style and localisation of deformation compared to what is documented from the past.

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