# Role of the Giudicarie Belt and eastern Southern Alps in Adriatic Indentation

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The Giudicarie Belt (GB) sinistrally offsets the Alpine orogenic edifice by some 70 km, including the front of the Adriatic Indenter as defined at the surface by Periadriatic Fault. The GB is a composite structure, comprising northern and southern segments of the Giudicarie Fault (GF), as well as a ≤50 km wide fold-and-thrust belt that strikes obliquely to ENE-WSW trending thrusts affecting Permo-Mesozoic sediments and basement of the eastern Southern Alps (Fig. 1).

Stratigraphic and thermochronological constraints indicate that sinistral transpression within the GB began at 21-22 Ma and ceased no later than latest Miocene time. Minimum shortening across the GB in the range of 12-35 km was accommodated by thrusts and strike-slip faults that are inferred to reach down to 15-20 km and to link with the GF (Verwater et al. 2021). The GB does not offset the Moho and also does not coincide with observed changes in lithospheric mantle structure imaged by teleseismic $V_p$ tomography. It is therefore not the site of a slab gap or tear, but forms part of an intracrustal fault system that is linked to the north with thrusts and strike-slip faults beneath the Tauern Window.

In the Southern Alps east of the GB, SE-directed folding and thrusting accommodated shortening of 30-50 km. It initiated at 14 Ma (Langhian-Serravalian flysch beneath the Valsugana thrust) and propagated SE-wards to the active Montello thrust along the orogenic front of the Southern Alps (Fig. 1). Thus, thrusting in the eastern Southern Alps began later than within the GB, though deformation within these domains probably overlapped in mid-late Neogene time.

We propose that a 1$^{st}$ phase of Adriatic indentation at 23-14 Ma involving sinistral transpression along the GB was linked to an intracrustal detachment that accommodated rapid exhumation of Penninic units in the Tauern Window and eastward lateral extrusion of orogenic crust in the E. Alps (Fig. 1). A 2$^{nd}$ phase of indentation since 14 Ma involved NNW-SSE-directed shortening that crumpled the leading edge of the Adriatic indenter. Section balancing (McPhee et al., this vol.) indicates that thrusts of this 2$^{nd}$ phase are directly linked to bulging and northward wedging of the Adriatic lower crust, as also indicated by local earthquake tomography obtained from Swath D (Fig. 2, Jozi Najafabadi et al. 2022).

We note that the model above differs from our original interpretation of broadly coeval activity of the GB and the eastern Southern Alps during late Paleogene-Neogene Adria-Europe convergence (Verwater et al., 2021). In our present view, the Trento-Cles strike-slip fault accommodated differential shortening only within the GB and was not linked to the Schio-Vicenza fault system. The latter is marked by only minor (≤ 4 km) sinistral offset and was reactivated as a Mio-Pliocene normal fault in the foreland of the Apennines (Verwater et al. 2021).

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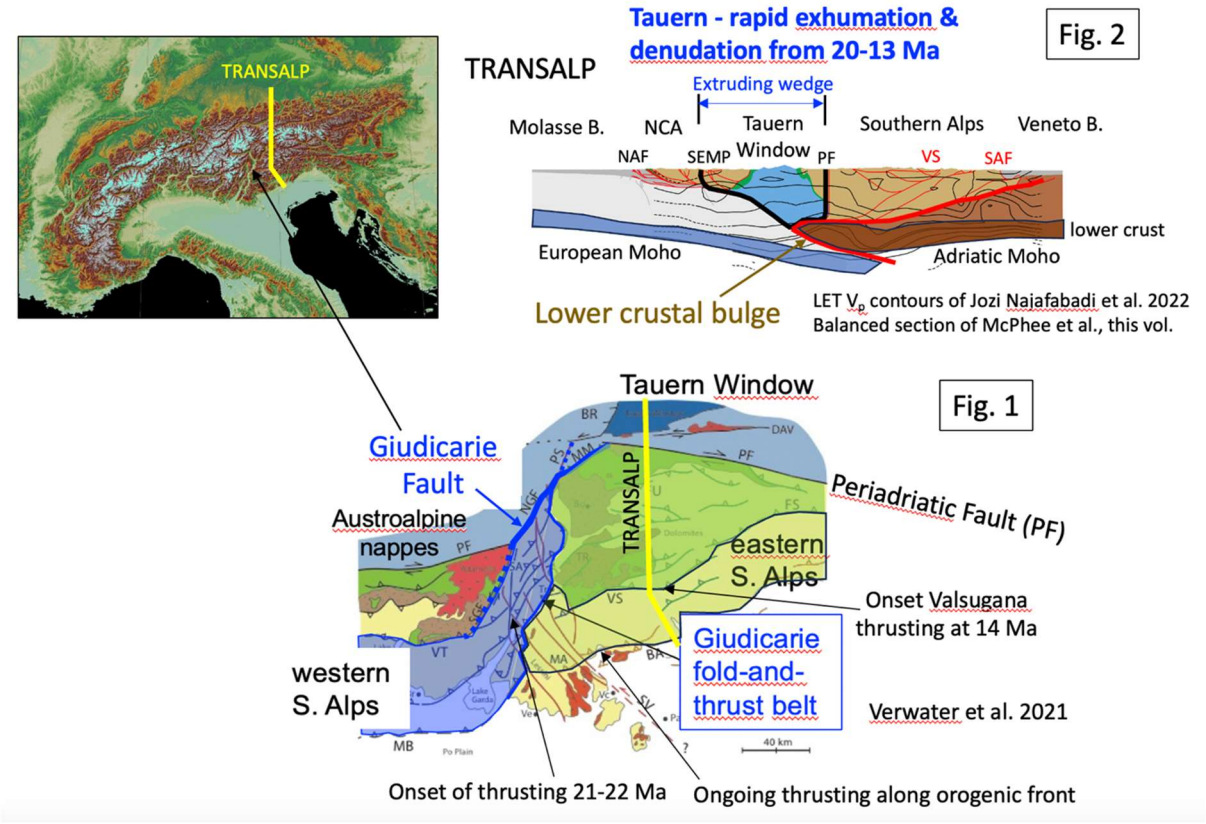


**Figure 1:** Giudicarie Belt and its relationship to Adriatic indenter tectonics: Domains affected by 1st phase (23-14 Ma, blue-shaded area) and 2nd phase (14-0 Ma, green-shaded area) of Adriatic indentation.

**Figure 2:** TRANSALP profile showing 1st phase faults bounding wedge of Tauern exhumation and lateral extrusion (black lines) and 2nd phase faults (red lines) linking Adriatic lower crustal wedge to Miocene thrusting in the eastern Southern Alps.