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Geodynamics of the northern Adriatic plate

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The northern Adriatic plate underwent Permian-Mesozoic rifting and was later shortened by three orogenic belts (i.e., Apennines, Alps and Dinarides) developed along three independent subduction zones. The inherited Mesozoic horst and graben grain determined structural undulations of the three thrust belts. Salients developed in grabens or more shaly basins, whereas recesses formed regularly around horsts.

A new interpretation of seismic reflection profiles, subsidence rates from stratigraphic analysis, and GPS data prove that the three orogens surrounding the northern Adriatic plate are still active. The NE-ward migration of the Apennines subduction hinge determines the present-day faster subsidence rate in the western side of the northern Adriatic ([1 mm/year). This is recorded also by the SW-ward dip of the foreland regional monocline, and the SW-ward increase of the depth of the Tyrrhenian sedimentary layer, as well as the increase in thickness of the Pliocene and Pleistocene sediments. These data indicate the dominant influence of the Apennines subduction, which controls the asymmetric subsidence in the northern Adriatic realm. The Dinarides front has been tilted by the Apennines subduction hinge, as shown by the eroded Dalmatian anticlines subsiding in the eastern Adriatic Sea. GPS data suggest that southward tilting of the western and central Southern Alps, whereas the eastern Southern Alps are uplifting. The obtained strain rates are on average within 20 nstrain/year.

The horizontal shortening obtained from GPS velocities at the front of the three belts surrounding the northern Adriatic plate are about 2–3 mm/year (Northern Apennines), 1–2 mm/year (Southern Alps), and\1 mm/year (Dinarides). The shortening directions tend to be perpendicular to the thrust belt fronts. The areas where the strain rate sharply decreases along a tectonic feature (e.g., the Ferrara salient, the Venetian foothills front) are proposed to be occupied by locked structures where stress is accumulating in the brittle layer and thus seismically prone. Finally, we speculate that, since the effects of three independent subduction zones coexist and overlap in the same area, plate boundaries are passive features.