New insights into the northeastern edge of Adria plate (Gulf of Trieste) by 3D velocity-depth models from reflection tomography and depth imaging of multichannel seismic data

Dal Cin M.[1], Busetti M.[1], Böhm G.[1], Picotti S.[1], Zgur F.[1], A. Camerlenghi[1]

[1] Istituto Nazionale di Oceanografia e di Geofisica Sperimentale - OGS, Italy
(*corresponding author: mdalcin@inogs.it*).

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Abstract

The NE edge of the Adria plate, over the N Adriatic Sea and the Venetian-Friulian plain, lies at the junction of the Meso-Cenozoic SW-verging External Dinarides and S-verging Southeastern Alps, originated by Adria-Eurasia collision. In the Gulf of Trieste (GT, NE Adriatic), double-polarity foredeep and distal foreland for both the chains, a multichannel seismic reflection dataset acquired by OGS revealed the present-day structural style due to the rheological contrast between the ductile Eocene turbiditic flysch deposits and their rigid NE-ward flexured Mesozoic-Paleogene Friuli-Dinaric Carbonate Platform (FDCP) bedrock. The FDCP aggraded thanks to Mesozoic NE-SW extensional regime, E-ward deflected by the Late Cretaceous-Paleogene External Dinaric orogeny, then filled by the flysch and dissected by the SW-ward verging Karst Thrust, outermost Dinaric ramp that separates the gulf from the Karst Plateau. The Oligo-Miocene Alpine orogeny produced N-ward tilting of the FDCP. The Messinian unconformity, covered by Quaternary sediments, is cut by transpression faults due to the ongoing NNW-ward Adria motion (Busetti et al., 2010, 2013).

We adopted two advanced tomographic techniques, to construct the first well-constrained 3D P-wave velocity-depth model and imaging of flysch and carbonates units and their top surfaces in the eastern GT: 1- traveltime reflection tomography (Böhm et al., 1999), that allowed resolution of vertical and lateral velocity gradients by a procedure based on ray tracing and simultaneous iterative reconstruction technique (Carrion et al., 1993) and 2- depth seismic imaging, that refined the velocity field through an iterative imaging procedure including pre-stack depth migration, residual move-out analysis and grid tomography (Picotti et al., 2018). The results provide 1450 m as maximum flysch thickness. The top FDCP lies at about 1600 m, 2 km offshore the city of Trieste. This indicates that Karst Thrust is responsible for a vertical displacement of at least 1600-1800 m. This throw is comparable to those of the SW-verging thrusts of the eastern Friulian plain, where geological setting is analogous.

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