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Geophysical-petrological model for bidirectional mantle delamination of the Adria microplate beneath the Apennines and Dinarides orogenic systems

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In this study we present a geophysical-geochemical integrated model of the thermochemical structure of the lithosphere and uppermost mantle of the Adria and Tisza microplates along two transects running from the Northern Apennines to the Pannonian Basin, and from the Southern Apennines to the Balkanides, respectively. The objectives are to image crustal thickness variations and characterize the different mantle domains. In addition, we evaluate the topographic response of opposed subductions and discuss their implications in the evolution of the region. Results show a more complex structure and slightly higher average crustal density of Adria compared to Tisza microplate. Below the Tyrrhenian Sea and Western Apennines, Moho is much shallower (< 25 km) than along the Eastern Apennines, where it can reach depths of 50-55 km. The LAB depth shows significant lateral variations, from the shallow LAB of the Tyrrhenian Sea and Western Apennines (< 80 km) to the thick LAB underneath the eastern Apennines and Adriatic Sea (150 and 125 km, respectively). Our results are consistent with the presence of two mantle wedges, resulting from the rollback of the Ligurian-Tethys and Vardar-NeoTethys oceanic slabs followed by continental mantle delamination of the eastern and western distal margins of Adria. These two opposed slabs beneath the Apennines and Dinarides are modelled as two thermal sublithospheric anomalies of -200°C. A Tecton garnet lherzolite (Tc_2 of Griffin et al., 2009) for the whole lithospheric mantle allows fitting geoid height and long-wavelength Bouguer anomalies. Most of the elevation along the profile is under thermal isostasy and departures can be explained by regional isostasy with an elastic thickness between 10 and 20 km.

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