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Crossing the Iberian Plate from the Bay of Biscay to the Alboran Sea: a lithospheric geotransect

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A ∼1000-km-long lithospheric transect running from the North-Iberian Margin to the Neogene Alboran Basin (W- Mediterranean) is investigated. The main goal is to image the lateral changes in the crustal and lithospheric structure occurring in: i) the North-Iberian margin, whose deformation in Alpine times gave rise to the uplift of the Cantabrian Mountains related to incipient subduction; ii) the Spanish Meseta, characterized by the presence of Cenozoic basins on top of a Variscan basement with weak Alpine deformation in the Spanish Central System and localized Neogene-Quaternary deep volcanism; and iii) the Betic-Alboran system related to the roll-back of the Ligurian-Tethyan domain. The modeling approach based on the LitMod package combines potential fields, elevation, thermal, seismic and petrological data under a self-consistent scheme. The crustal structure is mainly constrained by active and passive seismic experiments whereas the upper mantle is constrained by tomography models. The results highlight the lateral variations in the topography of the lithosphere-asthenosphere boundary (LAB), suggesting a strong lithospheric mantle strain below the Cantabrian and Betic mountain belts. The LAB depth ranges from 160 km beneath the Cantabrian Mountains to 110-90 km beneath Iberia Meseta deepenly again to values of 190 km beneath Betic Mountain. The Spanish Central System, with elevations higher than 1400 m, has no noticeable signature on the LAB depth. We have considered three lithospheric mantle compositions: a predominantly average Phanerozoic in the continental mainland, and two more fertile PUM (primitive upper mantle) compositions in the oceanic domains of Cantabrian and Mediterranean seas, and in the Calatrava volcanic field. These compositional differences allowed us to reproduce the main trends of the geophysical observables as well as the inferred P-, Pn- and S-wave seismic velocities from tomography models and seismic experiments available in the study transect.