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Evidencing a prominent Moho topography beneath the Iberian-Western Mediterranean Region, compiled from controlled-source and natural seismic surveys

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The complex tectonic interaction processes between the European and African plates at the Western Mediterranean since Mesozoic times have left marked imprints in the present-day crustal architecture of this area, particularly as regarding the lateral variations in crustal and lithospheric thicknesses. The detailed mapping of such variations is essential to understand the regional geodynamics, as it provides major constraints for different seismological, geophysical and geodynamic modeling methods both at lithospheric and asthenospheric scales.

Since the 1970s, the lithospheric structure beneath the Iberian Peninsula and its continental margins has been extensively investigated using deep multichannel seismic reflection and refraction/wide-angle reflection profiling experiments. Diaz and Gallart (2009) presented a compilation of the results then available beneath the Iberian Peninsula. In order to improve the picture of the whole region, we have now extended the geographical area to include northern Morocco and surrounding waters. We have also included in the compilation the results arising from all the seismic surveys performed in the area and documented in the last few years.

The availability of broad-band sensors and data-loggers equipped with large storage capabilities has allowed in the last decade to boost the investigations on crustal and lithospheric structure using natural seismicity, providing a spatial resolution never achieved before. The TopoIberia-Iberarray network, deployed over Iberia and northern Morocco, has provided a good example of those new generation seismic experiments. The data base holds $\sim$300 sites, including the permanent networks in the area and hence forming a unique seismic database in Europe. In this contribution, we retrieve the results on crustal thickness presented by Mancilla and Diaz (2015) using data from the TopoIberia and associated experiments and we complement them with additional estimations beneath the Rif Cordillera arising from more recent deployments. We have now included also the sparse results in the region previously published, with the aim of checking the consistency of the results, hence giving more strength to the retained features.

Combining the Moho depth values coming from controlled source and natural seismicity experiments has finally allowed us to build up a high quality grid of the region at crustal scale, which is completed in the non-sampled areas by the wide-scale CRUST1.0 model. The final picture evidences the geodynamic diversity of the area, including crustal imbrication in the Pyrenean range, a large and relatively undisturbed Variscan Massif in the center of Iberia and a probable delamination process beneath the Gibraltar Arc. Crustal thicknesses range from values around 15 km in continental margins (Cantabrian margin and Valencia Trough) to depths exceeding 50 km beneath the Pyrenees and the Rif Cordillera. A new 3D model of those variations is presented here to illustrate and summarize such large variations