Crustal structure under the Central Iberian Zone (Iberian Massif, Spain): the wide-angle seismic reflection CIMDEF experiment

R. Carbonell[1], I. DeFelipe[1], J. Andrés[1], J. Alcalde[1], P. Ayarza[2], I. Palomeras[2], M. Ruiz[1], D. Martínez Poyatos[3], F. González-Lodeiro[3], J. L. Granja-Bruña[4], M. Torné1, and R. Rodríguez-Fernández[5]

1 Geosciences Barcelona, Geo3BCN-CSIC, Lluís Solé i Sabarís s/n 08028 Barcelona.
2 Dpto. Geología, Universidad de Salamanca, Plaza de la Merced s/n, 37008 Salamanca.
3 Dpto. Geodinámica, Universidad de Granada, av. de la Fuente Nueva s/n, 18071 Granada.
4 Universidad Complutense de Madrid, c/José Antonio Novais, 12, 28040 Madrid.
5 Instituto Geológico y Minero de España, Ríos Rosas 23, 28003 Madrid.

The Iberian Massif is one of the most complete sections of the Variscan orogen and crops out in the western part of the Iberian Peninsula. Since the early 90s it has been the target of a number of geophysical studies to characterize its lithospheric structure. The internal architecture of the Iberian microplate presents critical constraints on the way the Iberian lithosphere responds to the imposed stress regime. This is a compressive tectonic setting resulted from the collision between the Iberian and the European plates. This stress regime is most probably responsible for the deformation patterns that is reflected by the topographic relief of the Iberian Peninsula with few intraplate orogens. The Iberian Central System constitutes a major intraplate orogenic belt conventionally interpreted as a pop-up structure. In order to place geophysical constraints on this relevant topographic feature, crustal structure and deformation style a wide-angle seismic reflection and refraction experiment, CIMDEF (Central Iberian Mechanism of DEFormation), was acquired in 2017 and 2019. It consisted of three NNW-SSE and E-W oriented profiles ranging between 130 and 330 km in length. These profiles run through the Duero basin, the Iberian Central System and the Tajo basin, allowing us to construct a P-wave velocity model in this sector of the Central Iberian Zone. First results based on forward modeling by raytracing show a crust of ~ 32 km thick under the Duero and Tajo basins that thickens to ~ 39 km under the Iberian Central System. A reduction of the lower crust thickness towards the south of the Iberian Central System is also modeled. At far offsets (> 190 km), an upper mantle reflection is observed, modeled as an interface at 58 to 62 km depth with a P-wave velocity contrast of 8.2 to 8.3 km/s. Our preliminary results complement previous models in this area based on Global-Phase Seismic Interferometry and gravity data; provide new constraints to validate the accuracy of passive seismic methods at lithospheric scale in the Variscan orogeny; and contribute with a resolute model of the P-wave velocity in the study area.

This project has been funded by the EIT-RawMaterials 17024_20170331_92304; and MINECO: CGL2016-81964-REDE, CGL2014-56548-P.