The mid-crustal seismic discontinuity in the Iberian Massif

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A number of deep vertical incidence seismic experiments have been conducted in the Iberian Massif (SW Spain) since the 1990's, in order to unravel the architecture of the crust. The images obtained revealed an outstanding seismic signature change in the different sub-domains of the Iberian Massif and a conspicuous boundary separating the upper and lower crust. In this work we present the most complete and homogeneous image of all the vertical incidence seismic data acquired up to date, and use it to unravel the characteristics of this mid crustal feature, in order to shed light on the evolution of this portion of the Variscan Orogen. We use the depth and geometry of the mid-crustal boundary to estimate the amount of crustal thickening, later extension and partial melting underwent by the Gondwanan crust during the Variscan collision with the peri-Godwanan terranes and Laurussia. In the South Portuguese Zone (SW Iberia), the discontinuity divides the crust into two layers with similar thickness but featuring opposite vergence reflectivity, probably related to Variscan deformation. To the north, the mid-crustal discontinuity becomes shallower while the crustal thickness stays remains relatively constant in the Ossa Morena and Central Iberian zones. This could be an indication of that either the upper crust was originally thinner or that the whole crust thickened and was later isostatically re-equilibrated through erosion and uplift processes. The northwestern part of the Iberian Massif, in the Central Iberian and Galicia-Trás-os-Montes zones, show little remnants of the mid-crustal discontinuity or it is located very deep, resulting in a very thin lower crust. These areas were generally affected by the late Variscan crustal melting, while in the Central Iberian Zone, melting seems to be limited to the upper crust. The conspicuous mid-crustal feature divides an upper and a lower crust exhibiting contrasting reflectivity and geometry, and provide evidences of the different mechanisms to accommodate deformation, and may represent the Iberian equivalent to what in other areas worldwide are interpreted as Conrad Discontinuity.

Funding resources: EU EIT-RawMaterials Ref: 17024_20170331_92304; MINECO: CGL2016-81964-REDE CGL2014-56548-P: JCYL: SA065P17)