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Upper mantle discontinuity beneath the SW-Iberia peninsula: A multidisciplinary view.

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Evidence for an upper mantle discontinuity located between 60 and 70 km depth have been provided by different seismic data sets acquired in the Southern Iberian peninsula. First indications of such a discontinuity were obtained by the very long offsets seismic refraction shot gathers acquired within the DSS ILIHA project in the early 90's. Clear seismic events recoded by the dense wide-angle seismic reflection shot gathers of the IBERSEIS experiment (2003) provided further constraints on the depth of the discontinuity and first-order estimates of its physical properties beneath the Ossa Morena Zone. Furthermore, the normal incidence Vibroseis deep seismic reflection images of the ALCUDIA transect (2007) extends this structure to the northeast beneath the Central Iberian Zone. This transect images deep laterally discontinuous reflections at upper mantle travel times (19 s) that roughly correspond to depths within the range of 60-70 km. Receiver function studies of the passive seismic recordings acquired by the IBERARRAY (TOPOIBERIA projects) provides additional support for the existence of this upper mantle structure and suggests that this is a relatively large scale regional feature. Two major scenarios need to be addressed when discussing the origin and nature of this deep structure. One is the tectonic scenario in which the structure maybe be related to a major tectonic event such as an old subduction process and therefore represent an ancient slab. A second hypothesis, would relate this feature to a phase change in the mantle. This latter assumption requires this feature ought to be a broader scale boundary which could be identified by different seismic techniques. Reflectivity modeling carried out over the IBERSEIS wide angle reflection data concludes that the observed phase is consistent with an heterogeneous gradient zone located at, approximately, 61-72 km depth. A layered structure with alternating velocities within ranges 8.1 to 8.3 km/s is necessary in order to achieve constructive interferences that model the observed high amplitudes. Independet velocity modelling done under the assumption that the mantle in SW Iberia is only slightly depleted suggests that the characteristics of the observed feature are consistent with the characteristics of the spinel-lherzolite to garnet-lherzolite phase transition, i.e. the Hales interface or gradient zone.