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A Wide Angle Upper Mantle Reflector in SW Iberia: Some Constraints on its Nature

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Deep and fast wide angle reflection arrivals observed at offsets over 180 km in a seismic experiment shot across SW Iberia as part of the IBERSEIS project, have been modelled from an interface located at around 67 km that features a Vp contrast slightly above 2%. The high frequency and the limited coda of these reflections suggest that the boundary has a relatively sharp nature for a mantle interface, although not sharp enough as to be observed in coincident vertical incidence data. Other reasons that might explain this fact are probably related with the change in the reflection coefficient with incidence angles, and/or the lack of energy at high recording times for the near vertical (vibroseis) data. Although the mantle is acknowledged to be highly heterogeneous and mantle lithologies are capable of giving impedance contrasts high enough as to be observed in seismic data, the mantle is often seen as transparent from a seismic point of view. The short wavelength of mantle compositional heterogeneities is probably what hinders their identification with active source seismic data and only big and sharp discontinuities are imaged in vertical incidence experiments whereas regional transitional boundaries may be also observed at high incidence angles. Accordingly, we propose that the deep reflectivity observed in SW Iberia must correspond to a regional-continental scale feature, not sharp enough as to be seen with vertical incidence energy. This feature, already identified in previous DSS experiments carried out in Iberia, has a depth, a Vp contrast and a relatively transitional nature that match the characteristics proposed for the spinel-lerzholite to garnet-lerzholite phase transition, i.e. the Hales interface. This transition is relatively narrow when the mantle is not depleted, as it is the case in SW Iberia, and occurs along wide intervals when the mantle is depleted, representing then what has been called the Hales transition. In addition, it is a world-wide scale boundary already identified over large areas with different types of datasets. The variability in depth and sharpness of this interface, which is related to the chemistry of the mantle, constrains the possible type of seismic techniques that should be used to identify it.