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Seismic structure of the main geological provinces off the SW Iberian margin: first results from the NEAREST-SEIS wide-angle seismic survey

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The region offshore the SW Iberian margin hosts the present-day NW-SE plate convergence between the European and African Plates at a rate of 4.5 mm/yr, fact that causes continuous seismic activity of moderate magnitude. In autumn 2008 a Spanish-French team carried out a refraction and wide-angle reflection seismic survey in the area (NEAREST-SEIS cruise), in the framework of the EU, FP6-funded NEAREST project. During the survey two long seismic profiles were acquired using a pool of 36 Ocean Bottom Seismometers (OBS), with the objectives of providing information about the geometry of the crust-mantle boundary and the physical properties of the crust, revealing the deep geometry of the main fault interfaces, and identifying the nature of the basement and the limits of the different geological provinces in the region.

A total of 30 OBS were deployed along profile P1, which is 356 km long and trends NW-SE from the Tagus abyssal plain (TAP), crossing the Gorringe bank (GB), the Horseshoe abyssal plain (HAP) and the Coral Patch Ridge (CPR), up to the thrust-and-fold belt of the Seine abyssal plain (SAP). The acquired data were modeled by joint refraction and reflection travel time inversion, following a layer-stripping strategy. The inverted model show four well-differentiated domains in terms of its seismic structure: In the TAP a 3-4 km-thick, low velocity sedimentary layer covers the basement, which shows a remarkably high velocity (>7 km/s), similar to that of the basement outcropping in the Gorringe bank. In the HAP the sedimentary cover is thicker, showing an upper unit with low velocity corresponding to the Horseshoe gravitational unit, on top of a higher velocity lower unit, which may represent the highly consolidated Mesozoic sedimentary sequence. The thickness of the two units together exceeds 5 km. The basement shows the same velocity distribution as in TAP and GB, suggesting a common nature and origin. According to its seismic structure, and considering that there is no evidence for the presence of a basal reflector (e.g. Moho) in the record sections, we interpret this basement as highly serpentinized, exhumed mantle. In contrast, the CPR and SAP show evidences for the presence of a well-developed, 6-7 km-thick oceanic crust, underlying the 2-3 km-thick, moderate velocity, Mesozoic sedimentary sequence.

Profile P2 is 256 km long, and trends S-N from the easternmost SAP beyond the NW Moroccan margin, crossing the Gulf of Cadiz imbricated wedge and the Portimao bank ending at the Iberian margin shelf. 15 OBS and 7 land-stations were deployed along this profile, and the recorded data were modeled following the same approach and strategy as for P1. The inverted model shows two main domains: In the southern half, there is a 3-4 km-thick cover of low velocity sediments, which represents the western edge of the sedimentary wedge that covers the internal Gulf of Cadiz, overlying a 7-8 km-thick oceanic crust. According to recent tectonic reconstructions, this crustal segment should have been emplaced there during the early phase of continental spreading between Iberia and Africa, in the context of Mesozoic Atlantic spreading. The northern part of P2 displays a relatively sharp ocean-continent transition zone concentrated in a $\sim$50 km-wide band, that ends with the $\sim$30 km-thick continental crust of the SW Iberian shelf.