

EGU2020-637

<https://doi.org/10.5194/egusphere-egu2020-637>

EGU General Assembly 2020

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The seismic structure of the West Iberian continent-ocean transition

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The West Iberian margin has been studied since the 1980 to mid 1990's when some of the most emblematic geophysical cross-sections and borehole samples were collected in the area. Despite of this wealth of information, there is little understanding on how the transitional domain, commonly interpreted as exhumed mantle, transitions into oceanic crust. The lack of appropriate geophysical data makes the nature of the basement, and thus the origin of the structures, still debated. Also, the mechanisms of thinning occurring in the continental-ocean transition are poorly constrained due to data quality or methodological limitations.

Here, we present spatially coincident multichannel seismic (MCS) and wide angle seismic (WAS) data collected during the FRAME-2018 survey across the Tagus Abyssal Plain, South-West the Iberian margin. The MCS data were recorded with a 6-km-long streamer, while 17 Ocean Bottom Seismometers and 18 Ocean Bottom Hydrophones were deployed each 10 km and used to record the WAS data, both along a 350 km-long, E-W trending profile located at 38° N, and crossing the Tagus Abyssal Plain.

The MCS time-migrated seismic section provides a high-quality image from which we interpret the tectono-stratigraphic structure from the continent to the ocean, ~180 km eastwards from the J-anomaly. The seismic image shows three main domains: a first domain closest to the continent with tilted fault blocks with possible syn-rift sediments and a possibly continental basement. In this domain, there is high-reflectivity reflections at 1-2 s TWT from the top of the basement. Then, westwards, a domain displays gentle basement-top topography, high intra-basement complex reflectivity and deep-penetrating landward dipping reflections. No clear Moho reflection occurs. A third domain to the west correspond to a very smooth and highly reflective top of basement coincident with the magnetic J-anomaly. Further west top basement shows an irregular topography with comparatively numerous short tilted blocks.

We use refracted and reflected travel-times (TT) WAS and MCS field data to jointly invert for P-wave velocity (V_p) and the geometry of interfaces in the sediment, the top of the basement, and

Moho. Combining MCS TT with WAS TT allows retrieving the Vp structure of the shallow part of the model and the geometry of seismic interfaces with a level of resolution that is beyond what can be obtained with WAS TT alone. The result of this joint WAS-MCS tomography is a Vp model of the margin that is fully consistent with the MCS image along the whole profile. The preliminary models show that the crustal structure is laterally more complex than previously modelled, presenting sharp boundaries between at least 5 different domains from the base of the continental slope to the ocean basin.