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Geophysical and geological characterization of a hyper-extended domain: a point of view from Iberia

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The domain that lies between the continent and the oceanic crust has been intensely surveyed and studied in the last decades. However, this region is not yet well constrained and the nature of the basement is almost unknown. The research community identified numerous questions that remain unanswered concerning the structural and thermal history and the nature of its crust. Despite the progress made, especially from the academic community on the Iberia and Newfoundland conjugate margins, the access to geological information is scarce and interpretations remain challenging. The available geological models still cannot account for the observed complexity, restricting the interpretations from the potential field methods and modeling, which depend on the geology to be reliable
From this point of view, the aim of this study was to characterize the hyper-extended domain along the Iberia margin, i.e, the region that lies between the necking zone and the first true oceanic crust, using geophysical data. Along this margin, important geological and potential field datasets are available and decades of research provide good constrains for a variety of studies. We attempted to define the limits of this marginal system, identifying the main geophysical characteristics related to the different tectonic domains. Map transformations were used in order to enhance the lateral contrasts in the density and/or magnetization pattern, along with forward modeling, providing information about crustal composition/thickness variations. Our results suggest that the zone of exhumed mantle may extend far beyond what has been previously inferred based on the magnetic anomaly modeling. Our interpretations suggest the existence of a region characterized by an embryonic-type of crust to the west of the J magnetic anomaly, which structure and composition does not fit the expected “classical” oceanic crust. The lithospheric structure which is associated to this anomaly seems to constitute a key feature and its origin may be related to a profound change in the magmatic (and geodynamic?) history of this margin. However, it may not mark the continent-ocean boundary, once there is no geophysical evidence of a compositional change related to this feature. If this statement is true, one important remaining question is how the breakup is documented and when it occurred?