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From large to small scale for reducing uncertainty in the structure and evolution of the Western Iberia margin

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Western Iberia is considered an archetypal example of a hyper-extended Atlantic margin that has been studied by multiple authors, who have defined its regional-scale structure and mapped out the different tectonic domains. However, to date, there is no detailed mapping of faults, depocenters and other structures at the scale of the entire margin that is fully consistent with the magnitude and temporality of Mesozoic extension and Cenozoic inversion experienced by this margin. Limitations in the data (quality of reflection seismic, ambiguity in interpretation of potential field and seismic refraction data, ...) mean that their interpretation is non-unique, making it difficult to converge on a single detailed interpretation without incorporating further constraints.

The present study describes the tectonic evolution of the western Iberia margin based on three different sectors; Galicia, Peniche-Alentejo and Algarve-Gulf of Cadiz. Our interpretation indicates that estimates of beta factor (crustal extension) based on fault heaves can be a factor of two less than estimates from crustal thickness derived from refraction seismic or isostatic equilibrium methods. The resulting interpretation has been sequentially restored to identify the structural elements that give rise to the extension discrepancy. These observations have in turn been used to iteratively improve the seismic-based interpretationand reduce the differences between discrepancies in extension measurements.

The Mesozoic extensional structure of this margin is further complicated by Cenozoic inversion. Some inversion features elevate features that were already highs during the extensional stage, making it difficult to separate the impact of both tectonic events and being a possible source of the extension discrepancy. We have tried to discriminate the syn-rift structure from post-rift margin inversion along the margin based on gravimetric and magnetic data, seismic and well data.

The final result is an interpretation that is our best attempt at honoring all sources of information (geophysical and well data as well as tectonic evolution, structural constraints, subsidence history . . .) with the ultimate goal of reducing the uncertainty derived from the non-unique interpretation of the different data sources.