



Characterizing, identifying and mapping structural domains at rifted continental margins: insights from the Bay of Biscay margins and its Pyrenean fossil analogue

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The occurrence of hyperextended domains at rifted continental margins consisting of extremely thinned crust and/or exhumed mantle has been increasingly recognized over the past decades, both at present-day rifted margins and in deformed remnants preserved in collisional orogens. At present, most studies aiming to characterize rifted continental margin structure and the extreme thinning of the continental crust and lithosphere are either focused offshore using geophysical methods, or onshore on fossil analogues relying on geological field observations. Marine and onland examples provide complementary datasets, but their different scale and resolution of observations prevent straightforward correlations to be done.

In this contribution, we use the Bay of Biscay and Western Pyrenees to develop and apply a geological/geophysical approach to characterize and identify distinctive rifted margin domains both in offshore and onshore settings. The Bay of Biscay and Western Pyrenees represent a unique natural laboratory that offer the possibility to have access to seismically imaged, drilled and exposed parts of one and the same hyperextended rift system.

Quantitative techniques (gravity inversion and flexural backstripping) are used on offshore examples (Western Approach margin and Parentis basin) to estimate accommodation space, crustal thickness and lithosphere thinning while seismic interpretations enable the recognition of extensional settings (low- and high- β settings). Field observations (Mauléon basin) and drill-hole data (Parentis basin) focused on key outcrops enables the description of the nature of sediment and basement rocks and of the structures forming fossil remnants of rifted margins.

This qualitative and quantitative characterisation provides diagnostic elements to identify and map structural domains at magma-poor rifted margins and their fossil analogues. We name these 5 domains proximal, necking, hyperthinned, exhumed mantle and oceanic.

This new geological/geophysical approach can be further used as an interface between onshore and offshore observations. Offshore seismic interpretations can take advantage of onshore observations on the nature of sediment, basement and of their interface. The large scale geometry and stratigraphic architecture imaged offshore can be used to restore onshore fossil remnants back into a rifted margin context.

The application of this multidisciplinary approach to the Bay of Biscay margins and their onshore Pyrenean fossils remnants enables us to propose a new map of the different rift systems preserved at the transition between the European and Iberian plates. The approach underlying this mapping has general global application to unravelling the spatial and temporal complexity of rifted margin structural domains.