

Mapping rift domains within an inverted hyperextended rift system: The role of rift inheritance in controlling the present-day structure of the North Iberian margin (Bay of Biscay)

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This study presents a new rift domain map in the central and western North Iberian margin, in the southern Bay of Biscay. This margin was structured during polyphase Triassic to Lower Cretaceous rifting events which led to hyperextension and exhumation and the formation of oceanic crust during a short-lived seafloor spreading period. Extension was halted due to the Alpine convergence between the Iberian and the European plates which led to the formation of the Cantabrian-Pyrenean orogen during the Cenozoic. In the Bay of Biscay, while the northern Biscay margin was slightly inverted, the North Iberian margin, which is at present-day part of the western branch of the Alpine belt together with the Cantabrian Mountains, exhibits several degrees of compressional reactivation. This makes this area a natural laboratory to study the influence of rift inheritance into the inversion of a passive margin.

Relying on the interpretation of geological and geophysical data and the integration of wide-angle results, we have mapped five rift domains, corresponding to the proximal, necking, hyperthinned, exhumed mantle, and oceanic domains. One of the main outcomes of this work is the identification of the Asturian Basin as part of a hyperthinned domain bounded to the north by the Le Danois basement high. We interpret Le Danois High as a rift-related crustal block inherited from the margin structure.

Our results suggest that the inherited rift architecture controlled the subsequent compressional reactivation. The hyperextended domains within the abyssal plain focused most of the compression resulting in the development of an accretionary wedge and the underthrusting of part of these distal domains beneath the margin. The presence of the Le Danois continental block added complexity, conditioning the inversion undergone by the Asturian Basin. This residual block of less thinned continental crust acted as a local buttress hampering further compressional reactivation within the platform and the inner basin, which were only slightly inverted and uplifted passively due to the underthrusting of the hyperextended domains beneath Le Danois High.

The new inverted rift domain map adds some constraints to support kinematic reconstructions and confine palinspatic restorations of the inverted rifted margin. Furthermore, it provides more insights to comprehend the strain partitioning within the Bay of Biscay-Pyrenean inverted hyperextended rift and the broad structural variability observed in such a reduced area, arising from the strong segmentation and the obliquity between the NW-SE and WNW-ESE trending rift structures and the E-W compressional front.