The architecture and the multi-stage evolution of the North Iberian margin (Bay of Biscay)

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In this work, we address the problem of the formation and reactivation of multi-stage rifting based on the study of the central North Iberian margin, located at the southern Bay of Biscay triangular oceanic domain. This magma-poor rifted margin registered three major Mesozoic rift events and a subsequent Alpine compressional reactivation, representing a unique setting to study the architecture of a multi-stage rift system and its control on subsequent reactivation. Based on a dense dataset of high quality 2D seismic reflection profiles, boreholes and published velocity models, we define, describe and map structural domains, major extensional and compressional structures, and the depth and thickness of syn-rift units. We provide new structural maps showing the geometry and spatial distribution of major rift basins and bounding structures.

The analysis of the tectono-stratigraphic architecture led us to define three rift systems. A diffuse and widespread of Triassic age, with classical fault-bounded half-graben basins, a second, narrow, deep and localised Late Jurassic to Barremian transtensional system, and a third, widely distributed Aptian to Cenomanian hyperextended system, including two distinctive domains. Our results show that each rift system controlled successive rift events, and that the stacking and overlap of the three rift systems resulted in a complex and segmented 3D template that guided subsequent compressional reactivation. Compression affected on a distinctive way the three rift systems, leading to an amplification of the margin segmentation.

This work shows that unravelling the tectono-stratigraphic architecture and evolution of multi-stage rift systems can provide key insights not only to decipher the spatial and temporal evolution of divergent plate boundaries, but also to set up present-day kinematic templates to test dynamic plate deformable models of conjugate rifted margins. It will also be a keystone to constrain early stages of margin reactivation and the architecture of reactivated rifted margins now incorporated in orogenic systems.