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Architecture and segmentation along the Northern Bay of Biscay passive margin (offshore France)

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Studies on magma-poor rifted margin structure provide a set of architectural diagnostic criteria that enable the identification of distinct structural domains formed during successive phases of deformation controlled by the evolution of rheological proprieties during rifting. Most studies define rifted margin structure based on observations made along one profile, considered as representative of the entire margin. However, the mapping of structural domains may reveal significant along strike, lateral morpho-structural variations within different segments of the same passive margin. Transfer faults often mark the limit between two segments, but in many cases, the linkage between margin segments is difficult to identify and map precisely, representing a large zone of deformation.
Here, we document the morpho-structural lateral evolution observed along the northern Bay of Biscay margin (offshore France) that formed subsequently to a Late Jurassic to Early Cretaceous oblique rifting and Aptian-Albian oceanic spreading onset. There, significant changes in architecture were previously reported and used to define different margin segments (Western Approach and Armorican). We use a series of reflection seismic sections and complementary marine geophysical data to characterize and map the structural pattern evolution, focusing notably on the characterization of this segment transition. Our seismic interpretations combined with mapping results reveal a progressive change in architecture between margin segments, defining a relatively loose segment transition. Lateral morpho-structural variations are quite noticeable over the necking domain. In the Western Approach segment, the thinning of the crust is progressive, partitioned between two main extensional fault systems controlling syn-rift sediment distribution within two conjugate V-shape sub-basins. In contrast, in the Armorican segment, the thinning of the crust is localized within one fault system, defining a shaper crustal neck architecture.
Results of this work reveal a complex 3D structural pattern of rift structures associated to significant changes in structural style within and between passive margin segments. The parameters controlling this segmentation need to be further investigated, such as the role pre-existing structures, but this 3D variability needs to be integrated to understand the partitioning of the deformation and syn-rift sediment distribution during passive margin formation.