The Basque-Cantabrian Basin: a natural laboratory to study the reactivation of a hyperextended system

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The Basque – Cantabrian Basin (BCB) corresponds to a Mesozoic hyperextended rift basin that was subsequently reactivated from Late Cretaceous to Cenozoic and is at present part of the Pyrenean orogen. Numerous studies have addressed the role of rift inheritance on the formation of orogens, but little consideration has been given to the rift segmentation and the along strike variability. In the BCB, most studies focused on a section at the central part of the basin, despite the amount of geological and geophysical data available on the entire area, which make it a perfect natural laboratory to study the reactivation of a hyperextended basin.

The aim of this study is threefold: (I) reveal the 3D geometry and the along strike variability of the BCB by doing three N-S transversal cross sections from east to west; (II) define the rift domains and their limits; and (III) study the impact of rift inheritance during the compressional reactivation mainly focusing on the former distal rift domains.

Our preliminary results show that the BCB is affected by a multistage and polyphase rift evolution including a first, widespread Permo – Triassic rift phase including Late Triassic salt, a Late Jurassic to Barremian extensional phase and a more prominent Aptian to Middle Cenomanian hyperextension phase. This complex rift template had a major impact on the subsequent reactivation and can explain some of the along strike variabilities observed within the three regional cross sections. To the east, the BCB was completely reactivated and transported to the south over the Late Triassic salt, which acted as a decoupling level. On the contrary, the westernmost section preserves the rift-related structures only weakly reactivated, providing direct insights on the early stages of reactivation. Our observations show that underthrusting/subduction initiates within the exhumed mantle domain, while during initial collision, the necking domains acted as a buttress. Decollement levels during early stages are located in the former rift distal domains and use serpentinized mantle rocks, while during collision they migrate to more external parts and use intra-basement decoupling levels such as the ductile middle crust and/or salt horizons.

Key words: Rift inheritance, Pyrenees, Basque – Cantabrian Basin, hyperextension.