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The Wilson cycle in Pyrenees: the role of Triassic evaporites on structural styles and crustal architecture

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As a matter of fact, a complete Wilson cycle is recorded in the Pyrenees. Indeed, the extensional cycle is documented there by 1) distributed continental rifting during Triassic times, 2) localized hyper-extension during the Early Cretaceous leading ultimately to locale mantle exhumation. The convergent cycle initiated by Late Cretaceous led to the reactivation of the former hyper-extended rifts followed by collision and foreland basins dynamics.

Most of present-day research focuses on the role of crustal/lithospheric scale structure on the present-day orogenic architecture. This is particularly true for the role of rift inheritances (structural, compositional and thermal) recently highlighted in the Alps and Pyrenees. However from a basin perspective, the key role of salt as a first order parameter at each stage of deformation is often under-estimated. Indeed, salt not only plays a key role as a detachment level, which allows developing a coulomb-like wedge of deformed foreland sediments (i.e. Sierras Marginales, Sierras Exteriores), but its unique capability of flowing enables for salt tectonic structures, likely diapirs (i.e. Basco-Cantabrian), minibasins (i.e. Corbières), and welds to form. Additionally, at a larger scale, salt levels during mantle exhumation and passive margin development promote both gravitational sliding and spreading of sediments (i.e. Chaînons Béarnais). At every stage of basin evolution, salt may also control petroleum systems evolution by enhancing locally thermal gradients and by strongly modifying fluid flow.

In this study, we propose a regional (i.e. Pyrenean-scale) review of the role of salt during both extension and compression. By combining mapping and critical review of published literature this work addresses the role of salt in a time perspective, by analyzing the type of salt structures developed during post Hercynian evolution, Early Cretaceous hyper-extension, Late Cretaceous early orogeny (i.e. margin inversion stage) and collision (i.e. foreland basin stage). In addition, along strike variability also matches with salt distribution. This reinforces the link between Triassic palaeogeography and the final orogenic structure. We further speculate that two non-exclusive possibilities may explain all those observations: 1) Either Late Triassic palaeogeography is the main cause for the final architecture, or 2) Triassic salt distribution and the final orogenic architecture are both consequences of pre-Wilson cycle inheritances (i.e. Late Hercynian orogenic collapse).