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PROGRESSIVE INVERSION OF A HYPER-EXTENDED RIFTED MARGIN: THE CENTRAL NORTH PYRENEAN ZONE, FRANCE

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The Aquitaine Basin is the retro-foreland basin associated with the Pyrenean orogen. It developed from Campanian to Mid-Miocene by flexure of the upper (European) plate. To the south the orogen comprises the North Pyrenean Zone, the Axial Zone, the South Pyrenean Zone and the Ebro basin on the lower (Iberian) plate. The North Pyrenean Zone is a narrow thrust belt comprising both non-metamorphic and metamorphic Triassic to mid-Cretaceous strata that record both Pyrenean shortening and Aptian-Cenomanian extension locally associated with HT/LP metamorphism. This latter zone is separated from the underlying non-metamorphic series by a basal tectonic contact along which lherzolite massifs and breccias represent remnants of a zone of exhumed mantle.

This study aims to understand the relationship between the deformation history of the central North Pyrenean Zone and the evolution of the Aquitaine foreland basin, from the initial rift architecture to the present-day structure. Based on geophysical, structural, seismic, borehole and paleotemperature data (RSCM) a new crustal cross-section of the retro-foreland system constrains the structure of the North Pyrenean Zone and the central Aquitaine Basin. The detailed foreland basin evolution is constrained by chrono- and litho-statigraphy and subsidence analyses from the literature. The section is sequentially restored to an Early Cretaceous rift template allowing us to correlate the timing of deformation and distribution of loads with foreland basin evolution.

We propose a kinematic model for the progressive inversion of the rift system. During early convergence (Campanian-Maastrichtian) the closing of the exhumed mantle domain is associated with the thrusting of the metamorphic unit over the distal European margin to the north. This episode generated the first tectonic loading of the European lithosphere, from Campanian to Late Maastrichtian, contemporaneous with post-rift thermal subsidence. The major continental collision, from Thanetian to Mid-Miocene, associated with the emplacement of a mantle body at depth, generated a second phase of tectonic subsidence. These two events are recorded as two distinct tectonic phases in the tectonic subsidence of the Aquitaine foreland basin, separated by a quiet phase. We propose that the rift architecture has a strong influence on the deformation style of the retro-wedge and that major normal faults that delimit the rift domain are inverted during the compression.