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# The deep structure of the Western Pyrenees: constraints from tomographic imaging, field and marine geological observations

Julie Tugend (1,2), Gianreto Manatschal (2), Sébastien Chevrot (3), and Geoffroy Mohn (4)

(1) Laboratoire de Géologie, Ecole normale supérieure, Paris, France (tugend@geologie.ens.fr), (2) IPGS, Université de Strasbourg, EOST, Strasbourg, France, (3) Observatoire Midi Pyrénées, IRAP, Université Paul Sabatier, Toulouse, France, (4) Département Géosciences et Environnement, Université Cergy-Pontoise, Cergy-Pontoise, France

Knowledge of magma-poor rifted margin architecture has significantly evolved over the past decades. Refraction seismic data combined with drill-hole observations unravelled the velocity structure and lithological assemblages of the most distal part of continental rifted margins. Present-day models of continental rifted margins include the occurrence of hyperextended domains consisting in extremely thinned continental crust and/or exhumed subcontinental mantle as described at many rifted margins. Studies in mountain belts revealed that remnants of hyperextended domains could also be identified in internal parts of collisional orogens. Integrating recent developments in the understanding of rifted margins in the study of mountain building processes, in particular the importance of the reactivation of inherited rift structures is therefore essential and may result in alternative interpretations of the lithospheric scale structure of collisional orogens.

In this contribution, we focus on the western part of the Pyrenean orogen that resulted from the inversion of a complex Late Jurassic to Mid Cretaceous rift system. The transition from preserved oceanic and rift domains to the west (in the offshore Bay of Biscay) to their complete inversion in the east provides simultaneous access to seismically imaged and exposed parts of a hyperextended rift system. Based on a multi-scale dataset that combines sub-surface data (field and drill-hole observations) with tomographic imaging (PYROPE experiment) and integrating new concepts derived from the study of present-day rifted margins, we investigate the lithospheric-scale architecture of the Western Pyrenees.

Our results suggest that the imaged north-dipping crustal root may correspond to the former exhumed mantle and hyperthinned domains that have been subducted/underthrust at the onset of convergence. This interpretation contrasts with the classical assumption that the crustal root is made of lower crustal rocks. This alternative interpretation can not only explain the progressive attenuation of the velocity anomaly at depth that is observed on tomographic images, but also the occurrence of hyperthinned crust and mantle in the internal parts of the orogen. Moreover, this interpretation suggests that the final stage of collision was controlled by the former European margin acting as an indentor, illustrating the complex role of rift architecture in structuring the Pyrenean orogen.

This new interpretation of the deep structure of the Western Pyrenees results in (1) different restorations of the total amount of shortening accommodated in the Pyrenean domain and (2) new insights on the evolution and architecture of Alpine-type collisional orogens.