



Syn- to post-orogenic topography and sedimentary flux of mountain systems: application from the Northern Pyrenees

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Development of a doubly-vergent mountain range by thrust activity and internal deformation during mountain building leads to the subsidence of the continental lithosphere. Resulting marginal depressions are filled with sediments to form foreland basins. During active orogenesis, it is expected that a significant portion of sediment eroded from the orogen is trapped in the foreland basin. However, as tectonic shortening slows, the mountain range transitions to a post-orogenic state with reductions in width and elevation of mountain topography and the isostatic rebound of the foreland basins. Studies have broadly quantified the post-orogenic rebound in the North Alpine Foreland Basin of Switzerland and resulting sedimentary fluxes. However, the physical controls on the interactions between a decaying range and a rebounding basin in terms of the signals of evolving topography and sedimentary flux remain uncertain.

One particular feature of the Southern Pyrenees and its pro-foreland basin is the important accumulation of thick continental deposits (i.e. Late Eocene-Oligocene conglomeratic sedimentation), which buried and draped the Southern Pyrenees relief up to at least 1700m. This accumulation of continental conglomerates caused by the closure of the Ebro basin has been used to explain the presence of recurrent high-elevation and low-relief surfaces in the morphology of the Pyrenees. It has been proposed that the Northern Pyrenees experienced the same evolution based on the recurrence of low-slope surfaces on both side of the range and the presence of Eocene to Lower Oligocene conglomerates (Carcassonne group) in the Aquitaine basin. Furthermore, post-orogenic sedimentation is recorded in the Aquitaine basin (upper Miocene) sealing Northern Pyrenean thrust structures up to ~600m elevation. The exact nature of sediment accumulation and the topography of the Northern Pyrenees at the end of orogenesis have yet to be constrained in order to fully understand its evolution.

In this study we use a synthesis of stratigraphic/sedimentological and topographic data to reconstruct the late to post-orogenic evolution of the Northern Pyrenees and Aquitaine basin and its associated sediment dispersal. We use a box-model that approximates orogenic topography, basin flexure, erosion and sediment flux to explore the evolution of topography and sediment flux to distant continental margins during the transition from syn- to post-orogenesis. We use values from the Pyrenean system to consider the presence of post-orogenic sediment drapes and changes in sediment flux to the Atlantic margin. This study is part of the “Orogen” project - an academic-industrial collaboration (CNRS-BRGM-TOTAL).