



## **Tectonic evolution of the Northern Pyrenees. Results of the PYRAMID project**

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The aims of the PYRAMID project funded by the Agence Nationale de la Recherche of France, were to investigate and constrain the 3D structural style and architecture of the North Pyrenean retrowedge and foreland basin, their evolution through time, to define the character and role of inherited crustal geometries, to investigate the interactions between deformation, fluids and thermicity in the different structural units, and to carry out source to sink studies

In this talk we present a series of restored cross sections through the central and eastern Pyrenean retrowedge to illustrate structural style, amount and type of deformation and how it was accommodated within the upper crust along the orogen. The total amount of convergence appears to have been constant and the timing of onset of convergence was synchronous. However, in the retrowedge the complexity of the Cretaceous oblique rift system has led to high lateral structural variability. Inherited vertical late Variscan faults trending NE-SW to ENE-WSW segment the European crust and have strongly compartmentalised both retrowedge and foreland basin evolution along the orogen. Crustal scale restorations provide new evolutionary models for the geometry and style of inversion of the pre-orogenic hyper-extended rift system where mantle was exhumed in the most distal domain. Numerical models provide insight into retrowedge inversion.

A new stratigraphic scheme has been developed for the eastern and central foreland. Subsidence analyses and foreland basin reconstructions document two pulses of convergence (Late Santonian to Early Paleocene and Eocene to Oligocene) separated by a quiet phase during the Paleocene. These phases can be linked to deformation in the North Pyrenean Zone thrust belt. The first phase was caused mainly by inversion and emplacement of the Metamorphic Internal Zone onto external zones associated with subduction of the exhumed mantle domain. Little or no relief was created during this phase although thermochronological data records the beginning of inversion in the eastern retrowedge. Full collision began in Early Eocene, distributed between the pro- and retro wedges, with only about 30% of convergence accommodated in the retrowedge. Low temperature thermochronology data records southward migrating exhumation of the axial zone while external basement massifs were being exhumed in the North Pyrenean Zone. The Cretaceous rift system was inverted by a combined thin-skinned-thick-skinned style with a decoupling level in the Keuper evaporites. The North Pyrenean Frontal thrust consists of a series of inverted Cretaceous rift margin faults, which in the east represent the main breakaway fault system.