

What do the Variscan structures in the Central Pyrenees tell us about the Mesozoic Iberian margin and the Pyrenean orogenic prism?

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The formation of the Pyrenean mountain belt since late Variscan times is responsible of the exhumation of the basement in the central part of the belt. This basement is mainly made of Proterozoic to Paleozoic rocks involved in the Variscan orogeny. Following the publication of the ECORS deep seismic profile of the Central Pyrenees in 1989, it has been proposed that the Pyrenees are an asymmetrical double verging belt implying crustal nappe stacking resulting from the inversion of the Iberian margin. Such alpine deformation implies important Meso-Cenozoic bloc rotations and internal deformation, overprinting the earlier Variscan deformations that would define the basement.

In order to constrain how the crust was affected by both Variscan and Alpine orogenies, we present a structural and petrological study along the trace of the ECORS profile in the axial zone. The section is composed of Precambrian to Carboniferous low-grade metasedimentary rocks intruded by large late-Variscan calc-alkaline plutons. We highlight a transpressional event which can be divided into three progressive stages: (1) a N-S folding, producing regional-scale open to southward verging anticlines and synclines, prior to the metamorphic peak; (2) a strong N-S horizontal shortening synchronous to the maximum temperature recorded which increases from 500 °C in the north, to 350 °C in the south (Raman Spectroscopy of Carbonaceous Materials geothermometry combined with a petrological study). This deformation induces vertical stretching, isoclinal folding and formation of a steep pervasive cleavage defined by biotite and chlorite; (3) a strain localization into retrogressive reverse mylonitic shear zones, responsible for limited vertical offset of the sedimentary pile and a maximum offset of the isotherms of 50 °C. The presence of undeformed and unconformable Permian deposits at the top of the pile underlines the Variscan age of, at least, the two first stages of pervasive deformation.

The continuity of Variscan structures, stratigraphy and isotherms all along the cross-section allows us to consider that the Axial Zone (the Iberian north margin) was only moderately affected by Cretaceous rifting, contrary to the European one. For the same reasons, we propose that the Axial Zone was neither affected by an intense pervasive deformation nor by large-scale internal rotation and vertical offset during the Alpine orogeny.