



Variscan superimposed folding in the Alpine Bono thrust sheet, Axial Zone of the Pyrenees (Spain)

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The study area covers a small portion of the central part of the Pyrenean Axial Zone, which is the basement of the Pyrenean mountain chain. The Alpine orogeny (Upper Cretaceous – Paleogene), caused that the Axial Zone appears like an antiformal stack of thrust sheets which are made up mostly of Paleozoic rocks and they preserve the Variscan structure inside. One of these sheets is the Bono thrust sheet which is the objective of the study.

The Paleozoic rocks that form the Bono thrust sheet, are basically a group of limestone and shales formations of Lower Devonian age. These rocks were folded and deformed at least in two different Variscan phases of folding (Upper Carboniferous). The study in detail of thin sections, structures at outcrop scale and a new geological map, allowed us to obtain a correct view of the resulting geometry of the Variscan superimposed folding.

In the Bono sheet, the first deformation phase includes close-tight folds with limbs of kilometric scale. The axial plane of these folds trends NE-SW and dips between gently and moderately to the NW. There is no evidence of foliation linked with these folds. These structures were deformed by a second deformation phase with folds which are close-tight and they have different scales. The main foliation in the study area is linked with these second folds. The foliation has an orientation between E-W and ESE-WNW, dips between 15 and 40 degrees to the north and changes from a slaty cleavage to a very fine spaced disjunctive cleavage. Despite of these two deformation phases, locally, the main foliation appears to be folded by different structures which make it difficult of understand the geometry and they could be of Alpine age.

The superposition of both main folds systems led to a complex geometry which can be explained if we keep in mind that the direction of both fold systems is oblique.