



Origin and preservation of the late contractional relief of an intraplate thrust-belt: the NE Iberian Chain (Iberian Peninsula)

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The Iberian Chain is an intraplate thrust-belt produced by the Cenozoic contractional inversion of the Mesozoic extensional basins within Iberia. NE of it, the Cenozoic Ebro basin is the common foreland basin of both the Iberian Chain and the Pyrenees. The Ebro basin was endorheic from the latest Eocene-earliest Oligocene to the late Miocene, when it was captured by rivers flowing to the Mediterranean (the major one is the Ebro). The Bouguer anomalies depict a regional gravity low under the Iberian Chain. These anomalies are both large and negative (reaching -110 mGal), and therefore they are consistent with a thickened crust. The topography of the chain exceeds 1000 m in most of its area and 2000 m in several places. Both the crustal thickening and the topography of the Iberian Chain are likely to be the result of the Cenozoic contraction.

In the NE part of the chain, a wedge-shaped, north-vergent thrust-system developed between the Middle Eocene (?) and the Lower Miocene, involving the Mesozoic rocks of the Maestrat basin (one of the Iberian Mesozoic basins) and also the Cenozoic rocks of the Ebro basin. To the hinterland the thrust-system also involved the Variscan basement and, as a result, a high area of about 35 km per 50 km developed, ranging its elevation from 1400 to 2000 m. The total shortening of the thrust-system is about 20 km (19%) in a NNE-SSW transect from the Ebro basin and across the high area.

The high area is mainly constituted by the Upper Cretaceous marine rocks and locally even basal Paleogene lateritic clays (the last preserved pre-contractional rocks), indicating a very low erosion of the area. These rocks have been uplifted to about 1500 m above sea level at the core of the synclines. A topographic step separates the high area from the areas to the north. In some places, where the topographic step has not been eroded, it appears as a well preserved erosional escarpment, facing to the NE.

A widespread and flat erosional surface is preserved on top of the thrust-system NE of the topographic step. This erosional surface is covered by Lower Miocene rocks, mainly conglomerates, sedimented by N-directed alluvial-systems. These rocks still experienced a slight contractional deformation, thus indicating that the erosional surface formed when the thrust-system was still active. The present height of the base of these Lower Miocene rocks exceeds 1200 m in the proximal areas, in the S, at the foot of the previously described erosional escarpment, and about 300 m in the more distal areas, in the center of the foreland Ebro basin, more than 100 km to the N, defining a mean slope of this surface of about 0.5°. This slope points to the preservation of the primary relative elevation between both areas.

The present day fluvial system is downcutting into the previously described features. This system flows to the Ebro and appeared when the Cenozoic Ebro basin was captured by the Mediterranean rivers and the erosion of the basin and the orogens around it started. Knick points of this erosional event can be recognized in many places. They do not reach most of the high area in the hinterland of the NE Iberian Chain and, in some places, spare pieces North of it: in these places, the erosional escarpment previously mentioned is preserved. Uphill of the knick points the landscape have a smooth relief: the early Miocene landscape is still preserved.

The high area in the hinterland of the NE Iberian Chain should be a crustal feature, taking into account its dimensions and its elevation. Calculating a moving average of its elevation with a search radius of 15 km, all the

area is above 1300 m and almost one third of it is above 1500 m. A crustal thickening of at least 6 km has been calculated to support this topography, and a 16.4% of shortening is deduced from it, assuming a plane strain in the NNE-SSW direction and a conservation of the area. This crustal thickening is interpreted to be the result of the Cenozoic contraction.

From the previous we conclude: 1) By the end of the Cenozoic contraction a near flat erosional surface developed over the orogenic wedge in the NE Iberian Chain, being lately covered by alluvial sediments. 2) These alluvial rocks were sedimented by alluvial systems which eroded the elevated hinterland. The erosional escarpment of this is still preserved. 3) The present height of the NE Iberian Chain was reached by the end of the Tertiary contraction, and was a result of the crustal thickening produced by this contraction. 4) The erosion coming from the Ebro river have not still reached the high area in the hinterland of the NE Iberian Chain.