Avalonia, get bent! Paleomagnetism from SW Iberia confirms the Greater Cantabrian Orocline

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The amalgamation of Pangea formed the contorted Variscan-Alleghanian orogen suturing Gondwana and Laurussia during Carboniferous. From all swirls of this orogen, a double curve stands out in Iberia, the coupled Cantabrian Orocline and Central Iberian Curve. The Cantabrian Orocline formed subsequent to Variscan orogeny (ca. 315-295 Ma). The mechanisms of formation for this orocline are disputed being the most prominent: 1) An Avalonian (Laurussia) indenter at SW Iberia, that would form the Cantabrian Orocline in a sinistral transpressive orogenic phase. 2) A change in the stress field that buckled the orogen. This change in stress would be potentially far-field and linked to subduction of the Paleo-tethys and/or diachronous collision in the Variscan belt.
In contrast, the geometry and kinematics of the Central Iberian curve are largely unknown. Whereas some authors defend both curvatures are genetically linked, others support they are distinct and formed at different times. Such uncertainty adds an extra layer of complexity into our understanding of the final stages of Pangea amalgamation. We have performed a paleomagnetic analysis of several tectonostratigraphic units in SW Iberiat to solve the late Carboniferous Variscan kinematics. Our results show differential counterclockwise rotations, ranging from 20 degrees and up to 70 degrees at late Carboniferous. These results are coincident with the kinematics expected in the southern limb of the Cantabrian Orocline and discard a concomitant formation of both Cantabrian and Central Iberian curvature. The Avalonian portion of Laurussia rotated with the Cantabrian Orocline at both limbs: the northern one (Ireland, Pastor-Galán et al., 2015) and the southern one (South Portugese Zone, this study). The coherent rotation of Avalonia confirms the Greater Cantabrian Orocline hypothesis and discards the Avalonian indenter as a mechanism of formation for the Cantabrian Orocline. The Greater Cantabrian Orocline extended beyond the Rheic Ocean suture affecting both Laurussia and Gondwana margins and probably formed by a late Carboniferous change in the stress field, due to a still unidentified cause.

Keywords: Orocline, Paleomagnetism, Rock magnetism, Pangea

