Reconciling mutually incompatible models for the tectonostratigraphic zonation of the Variscan orogen in western Europe

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The Late Paleozoic Variscan orogen in Europe is widely acknowledged to be the result of convergence and collision between Laurussia and Gondwana during closure of the Rheic Ocean. The orogen is classically divided into a number of tectonostratigraphic zones that have a distinctive curvature (Ibero-Armorican Arc, IAA) and record different aspects of the Late Cambrian-Early Ordovician opening of the Rheic Ocean and the migration of terranes from the Gondwanan margin towards Laurussia, as well as the tectonothermal events that accompanied the closure of that ocean and the development of the IAA. Although there is a general consensus that the curvature originated at some stage during the development of the Variscan orogen two models have emerged to explain the distribution of tectonostratigraphic zones: (1) a consequence of indentation tectonics due to collision with Laurussia by a (Ibero-Aquitanian) promontory of Gondwana during the Devonian; (2) development of the Cantabrian orocline at ca. 295 Ma at the inner core of the IAA, an interpretation supported by a wealth of paleomagnetic, structural and geochronological data. These models have been viewed to be mutually incompatible because the former requires curvature along the Gondwanan margin prior to its ca. 400 Ma collision with Laurussia, whereas the latter requires that the tectonostratigraphic zones were linear prior to bending at ca. 295 Ma.

Recent sedimentological and structural data have rekindled the hypothesis that the Cantabrian Orocline is connected to a second orocline to the south (Central Iberian Orocline), highlighting the possibility that inner (Gondwanan) and outer (Laurussian) zones of the IberoArmorican arc may be structurally discordant with respect to each other, implying that the geographic limits of orocline formation are presently unclear.

The two models can be simply reconciled if the geography of Gondwana's leading edge was irregular, but the tectonostratigraphic zones remained approximately linear within the inner zones of the putative Ibero-Aquitanian indenter and deformation associated with initial collision was largely accommodated by sinistral (SW Iberia) and dextral (Armorican Massif) motion along shear zones on either side of the promontory).

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