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A review of the arcuate structures in the Iberian Variscides; constraints and genetic models

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ABSTRACT

In the Iberian Variscides several first order arcuate structures have been considered. In spite of being highly studied their characterization, formation mechanisms and even existence is still debatable.
The main Ibero-Armorican Arc (IAA) is essentially defined by a predominant NW–SE trend in the Iberian branch and an E–W trend in the Brittany one. However, in northern Spain it presents a 180° rotation, sometimes known as the Cantabrian Arc (CA). The relation between both arcs is controversial, being considered either as a single arc due to one tectonic event, or as the result of a polyphasic process. According to the last assumption, there is a later arcuate structure (CA), overlapping a previous major one (IAA). Whatever the models, they must be able to explain the presence of a Variscan sinistral transpression in Iberia and a dextral one in Armorica, and a deformation spanning from the Devonian to the Upper Carboniferous. Another arcuate structure, in continuity with the CA, the Central-Iberian Arc (CIA) was recently proposed mainly based upon on magnetic anomalies, geometry of major folds and Ordovician paleocurrents.
The critical review of the structural, stratigraphic and geophysical data supports both the IAA and the CA, but as independent structures. However, the presence of a CIA is highly questionable and could not be supported.
The complex strain pattern of the IAA and the CA could be explained by a Devonian — Carboniferous polyphasic indentation of a Gondwana promontory. In this model the CA is essentially a thin-skinned arc, while the IAA has a more complex and longer evolution that has led to a thick-skinned first order structure. Nevertheless, both arcs are essentially the result of a lithospheric bending process during the Iberian Variscides.
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1. Introduction

First order arcuate structures are a common feature in orogenic belts (Argand, 1924; Carey, 1955). Their understanding is an important issue in Plate Tectonics, because similar shapes could result from different processes. Primary arcs are induced by the formation of the fold belt, as happens when moulding the orogen around a promontory. When the curved shape is not a pre-orogenic feature but the result of an impressed strain on a previous linear belt, it is known as an orocline (Carey, 1955). Curved arcuations could also be considered as thick skinned or thin skinned: in the formers ones the strain pattern was developed both in the cover and the basement of the orogen, while the strain pattern in thin skinned arcs is restricted to the cover.

The understanding of orogenic arcs is usually easier in active orogens because the continuity of major structures between both branches is often visible. In such young tectonic environments, major arcuations are common in convergent settings, either related to ocean–ocean (*e.g.* Scotia Arc, Dalziel, 1971; De Wit, 1977), ocean–continent (*e.g.* the Central Andean orocline, Eichelberger and McQuarrie, 2014 or the Banda Arc, Vroon et al., 1995; Harris, 2011) or continent–continent (*e.g.* western and eastern syntaxis of Himalayas; Tapponier and Molnar, 1976; Matte, 1986) collisions.

In old orogens major arcs are more difficult to emphasize because the original continuity is often:

- disrupted by the superposition of younger structures or magmatic batholiths;
- hidden below younger sediments;
- dismembered by the opening of new oceans.

Nevertheless, since the early works several major arcs have been described in the Variscan Belt, not only at the orogen scale but also in Iberia (*e.g.* Du Toit, 1937; Carey, 1955). However, at this moment there is still a lack of understanding concerning the formation of the

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