



## **Style decoupling within the Gibraltar Arc external wedge: a record of strain in a divergent thrusting setting**

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The external orogenic wedge around the Western Gibraltar Arc (WGA, SW Spain) acquired its foreland fold-and-thrust belt deformation style during the Miocene, as a result of the W-directed thrusting (Gibraltar Thrust) of a previously deformed continental block, i.e. the Alboran Domain, and the subsequent westward Arc migration. The rocks outcropping beneath the Gibraltar Thrust belong to two different domains: a) *The South Iberian Paleomargin internal units* mainly represented in the studied area from bottom to top by Triassic Mulschelkalk and Keuper facies rocks, Jurassic massive dolostones and limestones and alternating layers of late Cretaceous-early Paleogene pelagic marls and marly limestones, b) *The Flysch Trough units*, thrustured onto the Paleomargin Domain units, made up of Cretaceous to Early Miocene deep water turbidite sequences.

The most conspicuous structures deforming the Paleomargin units are metric to decametric Lower to Middle Miocene NW-verging chevron folds, throughout present on the marly rocks and only locally described on the Jurassic rocks. The fold axes are roughly parallel to the Alboran Domain front, the transport sense being near normal to axes trend. The interlimb angle varies between 55° and 75° and the folded layer developed a well defined pressure-solution foliation. It is remarkable that neither the interlimb angle, nor the foliation spacing increase along the transport direction toward more external positions. Nevertheless, the decreasing fold frequency toward the

foreland and the occurrence of structures favour hinge thickening mechanisms only detected in the most internal positions suggest the strain rate diminishes toward the foreland. The contact between the marly multilayer formation and the underlying massive calcareous rocks seems to be the detachment surface of these structures, although the Jurassic rocks seem to be involved locally near the Alboran Domain contact, also suggesting an increasing strain toward the hinterland.

Of the same age that the asymmetric folds described above are the NNE-SSW-directed thrust systems defining the internal structure of the Flysch Trough units, being their vergence towards the W in the eastern part and toward the E in the western part. No foliation has been related to these systems which are connected downwards with a regional detachment on the top of the Paleomargin units. The deformation features suggest that the outcropping Flysch Through units were displaced and shortened under rather brittle conditions and therefore were never sheared below the Alboran Domain.

Superimposed on the Flysch thrust imbricate and below the main Alboran Domain units, other tectonic slices evidence high strained zones. This is the case of a duplex structure made up by Dorsal Units. Internal structure of each horse consists of plurikilometric, west vergent recumbent folds, lower Miocene in age. Folds have associated pervasive foliation.

This distribution in terms of deformation style and strain rate depicts a multiple decollement setting during westward Arc migration where ductile deformation is concentrated within alternating shear bands promoted by differences in primary rheological properties and structural position. In this scenery, asymmetric folds developed on the Paleomargin units and Dorsal units as the result of shear overthrusting, whereas coeval thrust systems were essentially induced by a *push-from-behind* mechanism, the Alboran Domain acting as a relatively rigid backstop.