



Margin segmentation, double subduction polarity and twisted slab roll-back as triggering mechanisms for the formation of the Betic-Rif orogenic system

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Several geodynamic models have been proposed to explain the origin and evolution of the Betic-Rif arcuate orogen and the inner Alboran back-arc basin. Many of these models propose that the Alboran domain underwent a large westward drifting (> 600 km) driven by a subduction rollback. Alternative models with a more autochthonous component assume that the Oligocene subduction trench extended continuously along the whole Iberian Mediterranean margin from the present Gibraltar arc to the Alps. Common assumptions to all these models are: i) the initial time is about 35 Ma (Eocene-Oligocene), ii) the plate boundary is continuous and non-segmented, iii) the initial subduction polarity is NW-dipping, and iv) the slab must undergo a twisted roll-back to explain the present position of the HP-LT metamorphic rocks involving slab rupture, detachment and tearing. Recent geophysical models based on seismic data, tomography and potential fields draw an arcuate mantle slab restricted below the Betic-Rif orogen, dipping towards the E below the Gibraltar Strait and turning to the SE and S beneath the Betics. In addition, the crust beneath the northern Moroccan margin shows a smooth thinning toward the Alboran basin whereas the southern Iberian margin presents a much sharper thinning. To fulfill these crustal and mantle asymmetries and other available geological data we propose an alternative and simpler kinematic model acting in the westernmost Mediterranean region. The model is based on the following considerations: i) the reconstruction starts in Late Cretaceous times at the onset of northern Africa convergence, ii) displacements and initial configuration are based on plate reconstructions of the Atlantic-Ligurian-Tethys region, and iii) the model assumes that subduction polarity changes laterally from NW-dipping in the Algerian segment to SE-dipping in the Betic-Rif segment. Apart from its simplicity, this model requires a moderate NW to W drifting of the HP-LT metamorphic complexes formed by limited subduction and exhumation and is compatible with the main geological structures in the region.