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Tethys-Atlantic Interaction along the Iberia-Africa Plate Boundary: the Betic-Gibraltar-Rif System

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A large variety of different geodynamic models coexist for the Betic-Rif orogenic system along the southern margin of Iberia, some of them mutually exclusive. Notwithstanding this disparity of interpretations, the prevailing scenario consists of a long-distance southwest to west tectonic transport of the Alboran crustal domain subsequent to the onset of the western Alboran basin formation in late Oligocene times. The Betic-Rif orogenic system has been shaped through a large number of crustal and subcrustal processes that have been extensively studied by many research groups. However it has not been yet presented an evolutionary model combininig the different scales of work and the different processes that coexisted in the External Betics, the Internal Betics and the Alboran domain. In this paper we present a kinematic model integrating simultaneous tectonic, sedimentary, metamorphic and volcanic processes occurring along the outer External Betics fold-and-thrust belt, the inner metamorphic Internal Betics and the back-arc Alboran basin. An extensive review of the timing at which these processes occurred provided important constraints on the presented reconstruction that initiates at Late Cretaceous times with a slow convergence rate between Africa and Iberia becoming more vigorous after mid Oligocene times when the Pyrenean orogenic phase abruptly declined. The proposed model is based on a SE-dipping subduction from Late Cretaceous to mid Oligocene times twisting to an E-directed subduction up to the late Miocene, which explains straightforwardly the time and spatial distribution of the buried and exhumed HP/LT Alpujarride and Nevado-Filabride metamorphic complexes. The SE-dipping subduction along the Betic-Rif segment of the Ligurian-Tethys domain was independent of the NW-dipping subduction of the Algerian segment and separated by a roughly NW-SE trending transform fault. The NW retreat of the Ligurian-Tethys subducting slab together with changes in their paleogeographic distribution triggered the fast advance of the outer fold-and-thrust belt and the coeval formation of western back-arc Alboran basin. The final westwards retreat of the Ligurian-Tethys slab during middle-late Miocene coexisted with, and possibly initiated, the lateral tear of the already steeply subducted Ligurian-Tethys lithosphere beneath the Betic Cordillera.