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A numerical model of the Western Mediterranean

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In this study, we present a 3D numerical model of the Western Mediterranean subduction system based on the interaction of two subducting plates retreating in opposite directions. The objective of this work is to reproduce the main features of the evolution of the Gibraltar arc system in terms of: 1) a plausible model set-up corresponding to 83.5 Ma; 2) the time-evolution of the two adjacent plate segments retreating in opposite directions; and 3) the formation of the arcuate trench associated with the Betic-Rif orogen. The 3D numerical model is carried out with the Underworld code and consists of two oceanic plates with a visco-plastic rheology subducting into a viscous upper mantle. Three continental plate segments with linear viscous rheology are also included in the model. In the Betic-Rif Tethyan segment, the plate dips to the southeast and is fixed to the Iberian margin. A continental African plate segment west to the plate is also included in this region. In the Algerian segment, the plate dips to the northwest and the trailing edge is fixed to the African margin. Our results show that the progressive curvature of the Betic-Rif trench is due to its connection with the Atlantic oceanic to the West and the segmentation of the African margin, which acts as a passive continental indenter. Moreover, we study the evolution of the trench retreat velocity of both plates correlating our results with geological data. Mantle flow, plate deformation and stress state produced by this subduction process are analyzed identifying the linking mechanisms coupling the behavior of the retreating plates.

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