Tectonic evolution of the Mediterranean region from a global plate kinematics perspective: insights from a new deformable tectonic model

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The tectonic evolution of the Mediterranean is well studied, but the models often cover a limited period of geological time and are not always placed in a wider context. Its evolution is linked to the surrounding African and Eurasian continents and their relative movements.

A new fully deformable tectonic model of the Mediterranean has been created as part of a proprietary plate model. This work has led to the identification of key global tectonic events influencing the development of the Mediterranean from the Early Permian to the present day. This first fully-deformable plate model of the Mediterranean enables to account for the shortening and extension that occurred in the area at a temporal resolution of 1 Ma. In most available plate models, plates are rigidly rotated back to their paleo-position, meaning they preserve their present-day size and shape. In some recent papers, the extent of deformation has been illustrated for selected time-slices, but these models cannot be considered to be ‘deformable’ because the deformation is not modelled in a continuous manner.

Following Hercynian orogenesis and until the break-up of Pangea, the Mediterranean was dominated by extensional tectonics along its southern margin, as a series small continental blocks rifted from the northern margin of Gondwana. The opening of the Central Atlantic in the Late Triassic-Early Jurassic led to displacement between Eurasia and Africa south of Iberia and the development of the Alpine Tethys, as the Atlantic initially propagated northwards to the east of Iberia. Rotation of Africa caused by the opening of the South Atlantic in the Late Jurassic-Early Cretaceous led to a ‘jump’ in spreading to the west, at the Iberia-Newfoundland margin. These larger scale plate motions overprinted the more local impacts of continued extension along the northern margin of Africa (e.g. Pindos Ocean). Opening of the North Atlantic once again changed the relative motion of Eurasia and Africa, and initiated a period of oceanic subduction and collision that culminated in the Alpine orogeny. Crucial to this story is the paleo-position of Apulia/Adria, which remained attached to Africa and was able to act as an indenter into Eurasia during the Alpine compression. Evidence for this connection will be presented and discussed.