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Kinematic restoration of the Mediterranean region since the Triassic

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The Mediterranean region is one of the most complexly deformed areas in the world and its tectonic evolution has been instrumental in the development of numerous fundamental geological principles and geodynamic concepts. Reconstructions of the Mediterranean region invariably demonstrated that the area had a complex paleogeography with ribbon continents or micro-plates and narrow, elongated ocean basins systems in Mesozoic time. A western and northern ocean basin system was genetically related to the Atlantic Ocean, opened in Jurassic time and is known as the Alpine Tethys Ocean. A southern and eastern basin system was genetically related to the Neotethys domain located between Gondwana and Eurasia and – in the Mediterranean realm – opened in Triassic to Jurassic times. Continental domains of variable size within and between these ocean systems rifted away from Eurasia or Africa. This mosaic of pieces of continental and oceanic lithosphere became consumed by a complex configuration of subduction zones that accommodated convergence between the African and Eurasian plates since middle Jurassic times. Since Oligocene time, the overriding plate above subduction zones throughout the Mediterranean region became extended, locally leading to formation of new ocean floor, as a result of roll-back of subducted slab segments, culminating in todays complex and strongly curved configuration of subduction zones and slab segments. An area such as the tectonically complex Mediterranean invites attempt to kinematic restoration, and various reconstructions are already available. However, by now such reconstructions are no more merely a translation of – frequently qualitative – geological data into a quantitative description of surface evolution: with the advent of 3-dimensional numerical modeling tools that can be kinematically driven by plate reconstructions, they become critical input for attempts to integrate surface evolution into mantle dynamics. An increasingly widely used platform for kinematic reconstructions is the freely available GPlates plate kinematic reconstruction software (http://www.gplates.org). We provide the first fully quantitatively described GPlates-based kinematic reconstruction of the Mediterranean region back to Triassic time. Classic plate reconstructions assume plate rigidity, and motion concentrated along discrete plate boundaries. Convergence between Africa-Europe plate boundary in the Mediterranean region is, however, associated with regionally distributed deformation. In this reconstruction, we attempt to restore this distributed deformation, which in practice means that we allow for polygons to change shape and area over time. This reconstruction may (i) be used as input for numerical models that aim to constrain the geodynamic evolution of (parts of) the Mediterranean history, (ii) allow comparing relative tectonic motions of the Mediterranean region to the mantle using mantle reference frames, and (iii) provide regional kinematic context for future geological studies. Upon final publication, all shape and rotation files of this reconstruction will be made publically available, which may serve as a platform for further improvement when new constraints demand so, or when the reader wishes to test different tectonic scenarios.