



Plate kinematic consequences of double in-line subduction in Anatolia

Derya Gürer (1), Douwe J.J. van Hinsbergen (1), and Claudio Faccenna (2)

(1) Department of Earth Sciences, Utrecht University, Utrecht, Netherlands, (2) Laboratory of Experimental Tectonics, Department of Sciences, Università degli Studi Roma Tre, Rome, Italy

The onset and arrest of double subduction in which two plates are subducting synchronously along two subduction zones with similar polarity have been attributed to major accelerations and decelerations in plate convergence. Such a setting characterizes the modern Philippine Sea Plate surrounded by the Izu-Bonin-Mariana and Ryukyu trenches. Such geometry has also been invoked to explain major India-Asia convergence rate fluctuations in the past. Neotethyan ophiolites found throughout the Anatolian orogen, on Cyprus, and on northern Arabia are relicts of the oceanic 'Anadolu' plate that intervened a double subduction setting. Geological data were previously interpreted to show that the northern trench was stationary and active from Early Jurassic to Paleogene time, whereas the southern trench was mobile (retreating/advancing) and active from the Late Cretaceous to at least Neogene time. Here, we reconstruct the kinematic evolution of the double subduction zone to assess the influence of the onset, evolution and demise of the simultaneous activity of two in-line subduction zones on plate motions. We find that the arrest of double subduction around 70 Ma along the eastern 50% of the plate boundary correlates with a sharp decrease in convergence rate of 1.5-4 cm/yr, whereas arrest of double subduction in the remaining 10-20% of the plate boundary in Anatolia, in two steps at ~60 and ~25 Ma, does not correlate with major plate convergence fluctuations. Effects of initiation of double subduction around 100 Ma cannot be correlated to convergence rate fluctuations in absence of magnetic anomalies between ~125 and 83 Ma. We conclude that double subduction evolution in Anatolia may have influenced Africa-Europe convergence rates by several cm/yr, and may have contributed to the counterclockwise rotation of Africa/Arabia relative to Eurasia. Furthermore, the variation in the style of subduction (stationary vs. mobile) had a first-order effect on the geometry and rates of subduction in the upper mantle, as well as on magmatism and the first-order geological architecture of the Anatolian orogen.