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Plume-induced subduction initiation across the Cretaceous Neotethyan ocean

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Despite the presence of a long-lived, northward dipping subduction zone that had existed below Eurasia since at least Jurassic time, a major, intra-oceanic subduction zone started forming within the Neotethys ocean in the Cretaceous. Relics of the upper plate of this subduction zone are found as ~96-90 Ma supra-subduction zone ophiolites from Pakistan to Oman, Syria, Cyprus, and Turkey. Current models generally assume that intra-oceanic subduction initiated with north-dipping slabs inverting a Cretaceous mid-oceanic ridge, either spontaneously or induced by an Afro-Arabian plate acceleration, or a deceleration at the northern trench due to lower mantle penetration. In this presentation, we will summarize recent paleomagnetic, kinematic, geochronologic, and petrological evidence showing that (1) subduction initiated around 105 Ma, ~10-15 Ma before upper plate extension formed supra-subduction zone ophiolites, thus showing that subduction initiation must have been induced; (2) that subduction initiated (north)westward (Oman) and (south)eastward (Turkey, Syria, Cyprus) requiring E-W compression in the Neotethys, and was associated with ~(N)W-(S)E forearc extension; (3) subduction initiated along ancient fracture zones close to the passive continental margin of Arabia and Adria, and not along a Neotethys ridge that by Cretaceous time had probably long been subducted below Eurasia; (4) a stepped intra-oceanic subduction zone may be traced from western Turkey to the Amirante ridge in the Indian ocean, from where it connects to the Mascarene oceanic basin that separated India from Madagascar. E-W contraction across the Neotethys may be explained by a counterclockwise rotation of India relative to Afro-Arabia around an Euler pole at the western end of the Mascarene basin. The bulk of this rotation post-dates the ~91 Ma arrival of the Morondova large igneous province on Madagascar and SW India. We show evidence from numerical modeling that the rise of a plume may affect plate motions already 10-15 Myr prior to plume arrival below the lithosphere, and subsequent large igneous province emplacement, and thus postulate that subduction initiation across the Neotethys resulted from a minor, 1-2° India-Arabia rotation as a surface response to plume rise.