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Kinematics of Late Cretaceous subduction initiation in the Neo-Tethys Ocean reconstructed from ophiolites of Turkey, Cyprus, and Syria

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Formation of new subduction zones represents one of the cornerstones of plate tectonics, yet both the kinematics and geodynamics governing this process remain enigmatic. A major subduction initiation event occurred in the Late Cretaceous, within the Neo-Tethys Ocean between Gondwana and Eurasia. Supra-subduction zone (SSZ) ophiolites (i.e. emerged fragments of ancient oceanic lithosphere accreted at supra-subduction spreading centers) were generated during this subduction event, and are today distributed in the eastern Mediterranean region along three ∼E-W trending ophiolitic belts. Current models associate these ophiolite belts to simultaneous initiation of multiple, ∼E-W trending subduction zones at ∼95 Ma.
Here we report paleospreading direction data obtained from paleomagnetic analysis of sheeted dyke sections from seven Neo-Tethyan ophiolites of Turkey, Cyprus, and Syria, demonstrating that these ophiolites formed at ∼NNE-SSW striking ridges parallel to the newly formed subduction zones. This subduction system was step-shaped and composed of ∼NNE-SSW and ∼ESE-WNW segments. The eastern subduction segment invaded the SW Mediterranean, leading to a radial obduction pattern similar to the Banda arc. Emplacement age constraints indicate that this subduction system formed close to the Triassic passive and paleo-transform margins of the Anatolide-Tauride continental block. Because the original Triassic-Jurassic Neo-Tethyan spreading ridge must have already subducted below the Pontides before the Late Cretaceous, we infer that the Late Cretaceous Neo-Tethyan subduction system started within ancient lithosphere, along ∼NNE-SSW oriented fracture zones and faults parallel to the ∼E-W trending passive margins. This challenges current concepts suggesting that subduction initiation occurs along active intra-oceanic plate boundaries.