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Structural, sedimentary and igneous evidence for the genesis and emplacement of the rifted continental margin of the Southern Neotethys, SE Turkey

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Evidence of the rift, spreading and closure history of the Southern Neotethys is revealed by allochthonous continental margin and ocean-derived units that were emplaced onto the Arabian foreland during latest Cretaceous (Adıyaman area).

The structurally lower Karadut Complex is a broken formation, mainly composed of a fragmented sequence of pelagic/hemipelagic carbonates, radiolarites and redeposited limestones. Sedimentary structures and petrographic work suggest that detrital material was mostly derived from the Arabian margin in the form of gravity flows rich in shallow-water carbonate material. Interbedded siliceous sediments are dated as Early Toarcian and Late Albian using radiolarians, whereas hemipelagic carbonates are dated as Turonian-Santonian using planktic foraminifera. The outcrops of the Karadut Complex are restored as Late Cretaceous slope, to base-of-slope deposits of the Arabian continental margin.

The more widely exposed, generally structurally higher, Koçali Complex comprises variably disrupted thrust sheets that are in places folded on a kilometric scale. Intact successions were measured in several of the volcanic-sedimentary thrust sheets. The successions begin with basaltic volcanic rocks that are interbedded with volcaniclastic, radiolarian and carbonate sediments, and then pass upwards into thin-bedded non-calcareous ribbon radiolarites, shales and thin to medium-bedded redeposited limestones. Previous work documented a relatively intact sequence of ocean island basalt (OIB)-type (intra-plate) basaltic lavas and volcaniclastic sediments, associated with Middle Carnian-Rhaetian radiolarites. Study of several different thrust sheets during this work indicates the presence of widespread OIB and also enriched mid-ocean ridge-type basalt (E-MORB). Associated radiolarites are dated as Early Norian, Early Pliensbachian and Bajocian, extending the known age range of the Koçali Complex succession. Variably dismembered ophiolitic rocks, mostly depleted mantle harzburgite, layered and massive gabbro, diabase and basaltic extrusives, are interleaved with the volcanic-sedimentary units to form a tectonic slice complex.

In our working hypothesis, the Koçali Complex preserves the Late Triassic distal rifted margin of the Arabian continent. During Late Cretaceous accretion, crust that originally formed within the continent-ocean transition zone was preferentially preserved (proximal rifted margin crust is not exposed). The Koçali Complex accreted during Late Cretaceous northwards subduction, whereas MORB-type crust subducted. During subduction against the backstop (Koçali ophiolite), the sedimentary sequence on the incoming plate appears to have detached (delaminated) into a lower part (Triassic-Jurassic) that was sliced, folded and over-ridden, and an upper part that was bulldozed continentwards. Two scenarios are considered: 1. Two different successions are partially preserved, a relatively proximal slope/base-of-slope sequence (Karadat Complex) and a more distal volcanic-sedimentary sequence (Koçali Complex), with only parts of both original successions now being preserved. 2. The stratigraphically higher, Cretaceous levels of the Koçali volcanic-sedimentary sequence are now represented by the Karadut Complex. In this case, the Karadut Complex was emplaced beneath the Koçali Complex by out-sequence thrusting or re-thrusting. In either scenario, ophiolitic rocks, including sheared serpentinite and Mesozoic deep-sea pelagic/redeposited sediments locally advanced furthest to form the southernmost front of the allochthon (∼Besni olistrostrome). The various allochthonous units were emplaced, subaerially exposed and partially eroded during the Maastrichtian, giving a precise timing for the emplacement of the S Neotethyan allochthonous units.