



Apatite fission-track data for the Miocene Arabia-Eurasia collision

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The collision between the Eurasian and Arabian plates along the 2400-km-long Bitlis-Zagros thrust zone isolated the Mediterranean from the Indian Ocean and has been linked to extension of the Aegean, rifting of the Red Sea, and the formation of the North and East Anatolian fault systems. However, the timing of the collision is poorly constrained, and estimates range from Late Cretaceous to late Miocene. Here, we report the first apatite fission track (AFT) ages from the Bitlis-Zagros thrust zone. The AFT samples are distributed over the 450 km length of the Bitlis thrust zone in southeast Turkey and include metamorphic rocks and Eocene sandstones. Despite the disparate lithology and large distance, the AFT ages point consistently to exhumation in the Early to Mid Miocene between 18 and 13 Ma.

Tectonostratigraphic analysis of sedimentary successions along the facing converging margins of the Arabian and Eurasian plates can provide additional constraints on the timing of collision. Along the northern margin of the Arabian plate in southeast Anatolia, widespread shallow-marine carbonate deposition during the Eocene was followed by an Oligocene regression, and Oligocene deposits are missing over much of the region. A marine transgression at the beginning of the Miocene led to the deposition of Lower Miocene (Aquitania-Burdigalian) reefal carbonates, which crop out close to the Bitlis thrust zone. The carbonates pass upward and northward to siliciclastic marine turbidites, again of Lower Miocene age. The turbidites, which are 800 m thick, were deposited in a peripheral foreland basin during its phase of underfilling and are at present partly overthrust by the Bitlis Massif and the Eocene series. The Lower Miocene series represent the last marine sequence on the northern margin of the Arabian plate and are followed by the deposition of continental conglomerate, sandstone and evaporites of late Miocene–Pliocene age.

North of the Bitlis suture in the eastern Anatolia on the Eurasian plate, a thick succession of Oligocene turbidites crops out north of Muş; these are overlain by shallow marine sandstone, shale, and limestone of early Miocene (Aquitania-Burdigalian) age. The Oligocene-Miocene succession was deposited in a retroarc foreland basin associated with northward subduction of the Arabian plate. Lower Miocene (Lower Burdigalian) shallow-marine limestones also crop out widely west of Lake Van, where they are unconformably overlain by Pliocene to Holocene volcanic rocks.

The AFT ages, along with an appraisal of regional stratigraphy, indicate that the last oceanic lithosphere between the Arabian and Eurasian plates was consumed by the early Miocene (ca. 20 Ma). The early to mid-Miocene Arabia-Eurasia collision supports a temporal link between collision and the formation of the late Miocene North Anatolian fault. However, extension in the Aegean domain, related to the slab retreat, dates back to the Oligocene. This and the recent recognition of major Oligocene dextral strike-slip faults in Anatolia suggest that the westward translation of Anatolia started in the Oligocene and predated the Miocene Arabia-Eurasia collision.