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Geometry of the Turkey-Arabia and Africa-Arabia plate boundaries in the latest Miocene to Mid-Pliocene: the role of the Malatya-Ovacık Fault Zone in eastern Turkey

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Abstract. We suggest a working hypothesis for the geometry of the strike-slip faults that formed the boundaries between the Turkish, African and Arabian plates in the latest Miocene to Mid-Pliocene (LMMP), between ~7–6 Ma and ~3.5 Ma. This geometry differed significantly from the modern geometry; the northern Dead Sea Fault Zone (DSFZ) was located east of its present line and the TR-AR boundary was formed by the Malatya-Ovacık Fault Zone (MOFZ), located well north of the modern East Anatolian Fault Zone (EAFZ). The MOFZ is potentially the most problematic aspect of such a scheme, given the dramatically different interpretations of it that have been proposed. However, the presently-available evidence, albeit limited, is consistent with our proposed interpretation. Significant differences between the proposed LMMP fault geometry and the modern geometry include, first, the transtensional geometry of the MOFZ, the modern EAFZ being typically a left-lateral transform fault zone but with localized transpression. Second, the MOFZ slip rate was much lower than the ~9–10 mm a^{-1} EAFZ slip rate; it is estimated as ~2–3 mm a^{-1}, having produced no more than ~8 km of slip during its approximately three million year long activity. Third, unlike at present, there was no throughgoing linkage of left-lateral faulting between the LMMP DSFZ and the MOFZ; instead, the DSFZ terminated northward, and the MOFZ terminated southward, in a zone of localised crustal shortening adjoining the suture of the former Neotethys Ocean in the Kahramanmaraç-Pazarcık region of SE Turkey. The different motion of the Turkish plate relative to Arabia, and, thus, relative to Eurasia, means that senses and rates of crustal deformation can be expected to have been different during the LMMP phase from at present, throughout the eastern Mediterranean region.

Discussion Paper (PDF, 719 KB) Supplement (4871 KB) Interactive Discussion (Closed, 3 Comments) Final Revised Paper (eE)

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