Deformation of continental blocks within convergent plates: Anatolia as a case study

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Anatolia is part of the west-central Alpide plate-boundary zone, particularly where the deformation is characterized by the westward extrusion of this continental block between the Arabian-Eurasian collision in the east and the Hellenic Subduction in the west. Although, this motion mostly happens along the boundary structures, i.e., the North Anatolian and East Anatolian shear zones, there are multiple studies documenting the active deformation along NE-striking sinistral and NW-striking dextral strike-slip faults within the central and eastern parts of Anatolia. These secondary faults slice Anatolia into several pieces giving formation of the Malatya-Erzincan, Cappadocian and Central Anatolian slices from east to west, where their boundary geometries are strongly controlled by the weak zones, the Tethyan Suture Zones.

We compiled all geological slip-rate and palaeoseismological studies, which point out inhomogeneous magnitude of deformation along different sections of these secondary structures. The Central Anatolian Fault Zone, the westernmost NE-striking sinistral strike-slip structure and the western boundary between the Central Anatolia and Cappadocian slices, has an average horizontal slip-rate of about 1 to 1.5 mm/a for the last few tens of thousands of years. The earthquake recurrence of about 4500 years between two events revealed on the northern sections of the CAFZ also support this rate of deformation. However, the Malatya-Ovacık Fault Zone has a bimodal behaviour in terms of deformation rate, which is 2.5 times higher along its northern member, the Ovacık Fault (OF) than the southern one, the Malatya Fault (MF) (2.5 to 1 mm/a), respectively. This velocity difference between two distinct members of the same fault zone can be explained by the relative westward motion of slices where the OF makes the direct contact between the Central Anatolian and Malatya-Erzincan, and the MF delimits Cappadocian and Malatya-Erzincan slices. Although these structures, which are shallow and probably deform only the upper crust, are of having secondary importance, yet they are still capable of producing infrequent but strong earthquakes within this highly deforming convergent setting. This study is supported by TÜBİTAK projects no. 114Y227 and 114YS80.