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Deformation zones in convergence tectonic settings: The Anatolian Block as a case study

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Since the introduction of the plate tectonics theory, plate boundaries are suggested to host intense deformation that is localized within narrow zones. These boundaries are loaded by a constant rate of relative motion of plates and are characterized by high seismic activity. Convergence plate boundaries show a different behaviour, which is defined by distribution of deformation within wide zones of continental crust. In these zones, the earthquakes distribution is irregular and temporally less frequent than in narrow plate boundaries. These wide zones of continental deformation still attract less attention and, therefore, it is important to analyze them looking at the whole system, where individual faults geometry and kinematics depends on complexity of deforming media.

Anatolia presents us one of the best polygons for such studies providing an example of the post-collisional convergence along the Bitlis-Zagros Suture and back arc extension of the Hellenic subduction at its western part. In this tectonic frame, the deformation along the boundaries of the Anatolian Block is mostly represented by strike-slip motions along the North Anatolian (NASZ) and East Anatolian (EASZ) shear zones. The westward extrusion of the Anatolian Block with respect to Eurasia is accommodated along these boundary faults, whereas the interior of the block also reveals intense deformation of variable kinematic types. In summary, the deformation of the Anatolia's interior has been explained by various models, such as (a) the Prandtl cell model, (b) rotational motions of rigid blocks as in shape of a 'fishbone', (c) the effect of difference in velocity anomalies in the upper mantle, (d) or combinations of these. In this study, we try to test these hypotheses with the perspective of palaeoseismology and field observations focusing on the Malatya-Ovacık (MOFZ), Central Anatolia (CAFZ), and the Tuz Gölü (TFZ) fault zones. First, we divide Anatolia into two parts; the eastern part lies between the Karlıova triple junction in the east and a provisional N-S oriented boundary located at the 31.5°E longitude, and the western part that is also known as the Aegean Extensional System. The Hellenic subduction governs kinematics of the western part. On the other hand, the decreasing deformation rates of active faults from east to west ($\sim$2.5 mm/yr for the MOFZ, $\sim$1 mm/yr for the CAFZ and < 1mm/yr for the TFZ), support the effect of post-collisional conditions for the deformation pattern in the eastern central Anatolia. Moreover, the earthquake interval of the easternmost strike-slip fault (the MOFZ) shows a more frequent pattern ($\sim$2650 years) than the western ones (e.g. about 4500 years for the CAFZ and TFZ). Therefore, these correlation helps to understand the crustal deformation of the Anatolia's interior and is also important to develop a better understanding of the diffused deformation zones of collisional systems. This study is supported by the TÜBİTAK project no. 114Y227.