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Morphotectonic analysis of seismically active Tuzla Fault near İzmir city, Western Anatolia, Turkey

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The Tuzla Fault that forms the eastern border of Seferihisar High is one of the main strike-slip fault zones around İzmir city and separates the Upper Cretaceous-Paleoecene Bornova mélange from the Miocene Volcano-sedimentary succession. Total lengths of fault segments lying in N10-60E direction are about 50 km long and shows strike-slip fault geometry. In the literature chronologically referred to by various names such as Cumaovası lineament, Cumalı reverse fault, Tuzla fault and Orhanlı fault zone. The hitherto conducted structural studies suggest that it represents a reactivated structure formed in two phases: (1) during the left-lateral strike-slip motion active in the Miocene, followed by (2) as a right-lateral, brittle shear active in Plio-Quaternary. To show evidence of fault reactivation and seismic hazards assessment of faulting we conducted morphotectonic studies on the fault zone and surroundings.

Seismic hazard assessment of strike-slip faults is based on the identification and mapping of morphotectonic features which are powerful tools to infer parameters such as segmentation, slip-rate, slip per event, and recurrence of earthquakes. Geographic Information Systems (GIS) and Digital Elevation Models(DEM) have been extensively used in morphological and tectonic studies and give good results, especially where strike slip faulting has a dominant role in the formation of landforms. We apply this methodology to the Tuzla Fault where we identify a number of offset features that we mapped on a high-resolution Digital Elevation Model (DEM). Based on the offset measurements, we calculate the Cumulative offset (CO) for each fault segment. The CO value suggest that the slip rate varies from one segment to the other.

Our results include a) a series of maps displaying the spatial variation of morphotectonic indices (sinuosity, asymmetry factor, valley-floor-to-height-ratio etc), b) drainage basins is shaped by the interference between an old drainage network of sinistral strike-slip fault and the younger one controlled by the dextral strike slip motion, and c) map of active fault segments associated with fault-slip data. The morphotectonic analysis indicates that Tuzla fault in this area is active, it is capable of generating earthquakes with M >=7.0 in the near feature. This study is supported by TUBİTAK-ÇAYDAG Project No: 117Y190.