

Neotectonics and seismicity of Erzurum pull-apart basin, East Turkey

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Abstract

The study area is the Erzurum pull-apart basin located in the East Anatolian Tectonic Block (EATB), which is under the control of a strike-slip neotectonic regime since the beginning of Quaternary. The Quaternary Erzurum pull-apart basin is an about 1–30 km wide, 90 km long and actively growing strike-slip depression. It is bounded by the Erzurum–Dumlu sinistral strike-slip fault zone to the east-southeast, by the Askale sinistral strike-slip fault zone to the north-northwest, and by the Basköy–Kandilli reverse fault zone and the N–S-trending Ilica oblique-slip normal fault set to the west. The Erzurum pull-apart basin was evolved by the deformation and subdivision of an E–W-trending older intermontane basin. The new basin has a 0.5 km thick, flat-lying (undeformed) and unconsolidated fill, which overlies, with an angular unconformity, the deformed (folded and faulted) basement rocks of pre-Quaternary age. Basin fill consists of coarser-grained marginal facies (fault terrace, fan, fan-apron and superimposed fan deposits) and finer-grained depocentral facies represented by flood plain to organic material-rich marsh deposits. All gradations are seen among these lithofacies.

The seismicity of the Erzurum pull-apart basin is quite high. The magnitude of the peak earthquake to be sourced from the active faults (e.g., the Erzurum fault) is about $M_w = 7.0$. This was proved by both the historical and recent earthquakes. Numerous settlements in the size of a large city (e.g., Erzurum), county, town and small villages with a total population of over 766,000 are located in and along the active fault-bounded margins of the Erzurum pull-apart basin. They are under the threat of destructive earthquakes to be sourced from the margin-boundary faults. Therefore, based on both the active fault parameters and the water-saturated basin fill, a large-scale earthquake hazard map has to be prepared. This map has to be used in both the earthquake hazard to risk analyses and the redesign of city planning and all type of constructions in Erzurum and other settlements in this region.

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Keywords: Erzurum; pull-apart basin; strike-slip neotectonic regime; active fault, East Anatolian tectonic block

1. Introduction

The study area is the city of Erzurum and its near environ included in the East Anatolian tectonic block (EATB), which comprises the western section of the East Anatolian–Iranian Plateau (Fig. 1). The study area is located outside and approximately 70 km away from the Karliova junction, where the North Anatolian Fault System (NAFS) and the East Anatolian Fault System (EAFS) meet each other.

Approximately 766,000 people are living in Erzurum region, under threat of earthquake hazard. Although the seismicity of Erzurum and its near environ is very high, its source such as major strike-slip structures (e.g., dextral to sinistral strike-slip faults, oblique-slip normal and thrust to reverse faults) exposing in and adjacent to the study area have

not been well-identified until the present study. A number of strike-slip basins are also exposed well in the EATB. However they were not mapped at 1/25,000 scale and examined in detail. One of the well-developed strike-slip basins is the Erzurum pull-apart basin. Its evolutionary history and margin-boundary faults have not been well identified. Whereas actual sites of active faults and their various parameters (e.g., strike, dip amount to direction, length, type, slip rate, the return period and magnitude of peak earthquake to be sourced from the active faults) have a critical importance in the preparation of earthquake hazard map for the city of Erzurum and its near environ. In addition, the Erzurum pull-apart basin is also a geothermal field but this aspect of the basin has not been studied yet. A number of relatively local geological works were carried out for different purposes in the EATB (Aksoy and Tatar, 1990; Bozkus, 1992, 1993, 1994; Bozkus and Yilmaz, 1993; Ketin, 1950, 1977; Koçyigit, 2013; Koçyigit et al., 1985; Öztürk and Bayrak, 2005; Rathur, 1969; Temiz et al., 2002; Üner et al., 2010; Yarbasi and Bayraktutan, 2003;

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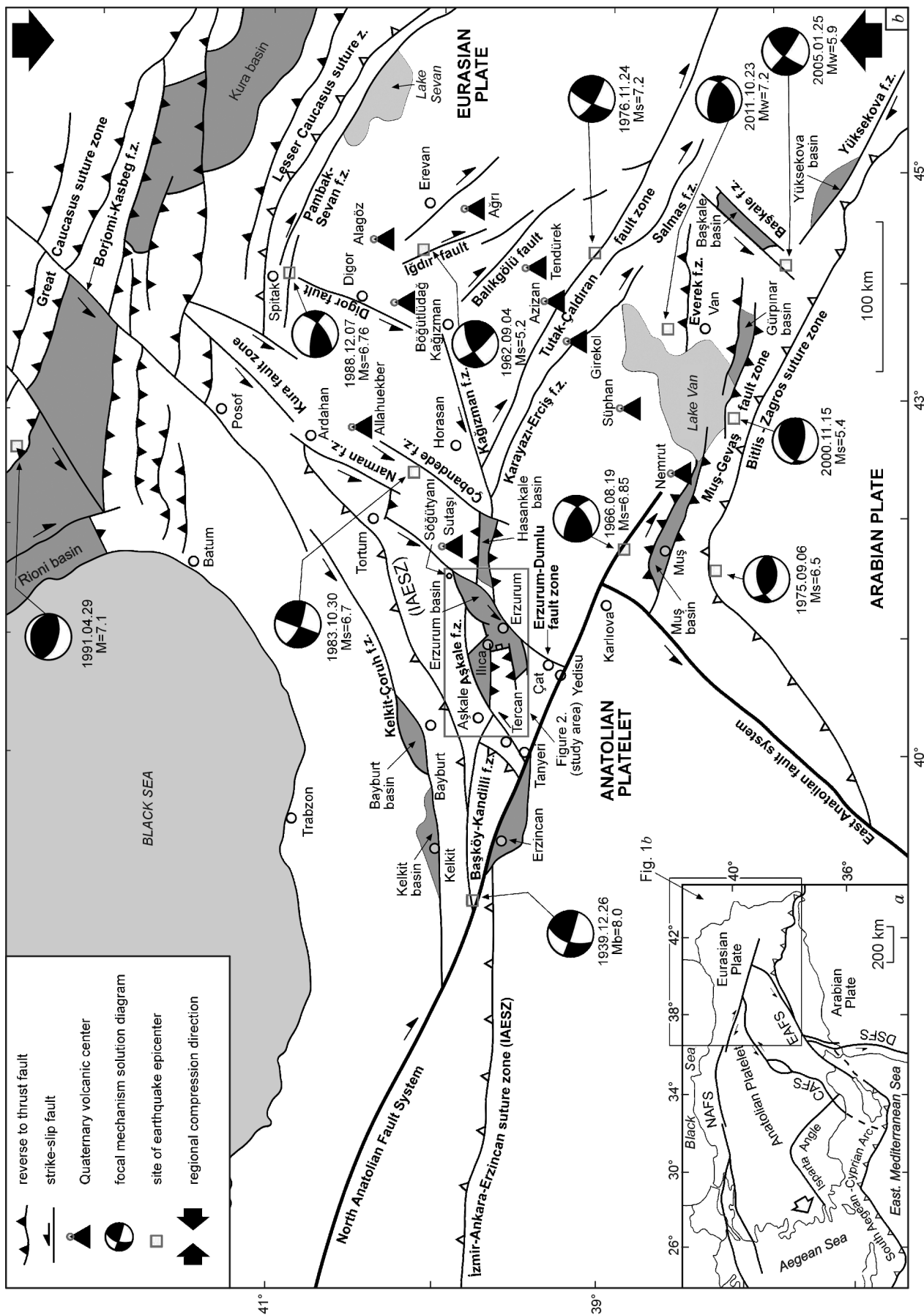


Fig. 1. a, Simplified map showing the plate tectonic configuration of Turkey and its near environ. CAFS, Central Anatolian Fault System; DSFS, Dead Sea Fault System; EAFS, East Anatolian Fault System. b, Simplified seismotectonic map of the East Anatolian Tectonic Block (EATB) and adjacent area (numbers in circles correspond to the numbers of earthquakes listed on Table 2).

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