



The seismic gap of the Marmara Sea: Paleoseismic and seismotectonic constraints from multi-segment ruptures along the North Anatolian Fault

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Recent studies in paleoseismology along the 1999 Izmit earthquake surface faulting and the 1912 Ganos fault trace provide new data and constraint on the earthquake ruptures of the North Anatolian Fault (NAF). The numerous trenches (> 50 trenches) excavated across the fault segments exhibit late Holocene alluvial units with fault off-sets, liquefaction features, and flexured superficial sedimentary units. At Nehirkent near the Sakarya River, combined trenches and GPR investigations reveal 18.5 ± 0.5 m cumulative offset of a terrace line and 4 to 5 large earthquakes during the last 1020 years. Considering that there was 3.5 - 4 m lateral coseismic offset at this site in 1999, this terrace line may reflect at least 5 events including the 1999 earthquake. Between Sapanca Lake and the Izmit Bay, there is evidence from trenching of at least two and possibly three large surface rupturing events after 1591 (after the Ottoman Canal). These ruptures and related multi-segment faulting may correspond to the large earthquakes of 1719, 1754 and possibly moderate-sized events in 1854, 1878 and 1894 (Rockwell et al., 2001; Akyuz et al., 2005). The 1912 earthquake ruptures and paleoseismic studies along the Ganos fault section provide with a consistent 4 m \pm 0.5 m average right-lateral coseismic slip. Dated fault offsets in trenches can be correlated with the large earthquakes of 1343, 1659 or 1766 and 1912. The 18 mm/yr slip rate obtained from trenches in the Saros bay (Rockwell et al., 2001) are comparable with 17.5-20.0 mm/yr obtained from our trenches near Guzelkoy. The 200-250 years recurrence interval of large earthquakes obtained from paleoseismic studies and the historical seismicity catalogue point to the existence of a seismic gap in the Marmara Sea. The possible offshore continuation of the 1912 fault segment is about 40 km in

the Saros bay and about 30 km in the Tekirdag basin, based on the seismicity in the Marmara region and Saros bay (Karabulut et al. 2006). The probable seismic source of the future large earthquake in the Marmara Sea is poorly known but the 1999 and 1912 coseismic ruptures and earthquake history, east and west of the sea, may resolve its maximum rupture propagation and slip. Within the seismotectonic framework of the Marmara Sea, paleoseismic results restrict the amount of slip deficit in the gap from the Central Basin to the Cinarcik Basin.