



Fault characteristics, segmentation and paleoseismology along the 9 August 1912 Ganos earthquake-rupture (North Anatolian Fault, Turkey)

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The Ganos fault is the most western segment of the North Anatolian fault that experienced the $M_s = 7.4$ earthquake of 9 August 1912 (Ambraseys and Finkel, 1987). The earthquake revealed 45-km-long of surface ruptures inland, trending $N70^\circ E$, and 5.5 m of maximum right lateral offset near Gaziköy. The earthquake size requires about 100-km-long faulting but the offshore extension of the fault is problematic. We measured co-seismic displacements of roads, paths, streams, man-made buildings and field limits using Differential GPS surveys and total station at 39 sites. Dextral displacements range from 2.5 to 5.5 m from Gaziköy to Yeniköy. In addition, we used 1/10 000 and 1/ 35 000 scaled aerial photographs, Landsat TM images, SPOT 5 images and digital elevation models (SRTM) to analyze the geomorphology of the region. Offset distribution, fault geometry and geomorphology have been used to identify 4 sub-segments with variable orientations ($N72^\circ E$ to $N66^\circ E$) and length (7 to 15 km). The Yörgüç, Gölcük and Kavak basins are major step-overs along the fault and limit the sub-segments. The long term deformation of the fault is clearly expressed by several small pull-aparts and sag ponds, pressure and shutter ridges and offset streams. Selected sites are studied with microtopographic surveys and seven paleoseismic trenches to characterize 3 past earthquakes and 8.3 m and 19.4 m cumulative and successive lateral offsets on present-day streams at Güzelköy. Radiocarbon dating of successive colluvial wedges in trench 1, and the fresh scarplet above (probably 1912 surface rupture) indicate the occurrence of three faulting events since the 11th

century. Parallel trenches (3, 5, 6 and 7) expose paleo-channels and show a cumulative right-lateral offset of 12.5 m next to the fault, and a total stream deflection of 23.6 m. Radiocarbon dating of older channel units imply a minimum 17.5 - 20 mm/year slip rate along this section of the North Anatolian Fault. This slip rate is comparable with the 22 - 24 mm/yr. GPS measurements for the Ganos region (Mc Clusky et al., 2000, Meade et al., 2002) and the 18 mm/yr obtained from paleoseismic analysis in the Saros bay (Rockwell et al., 2001). Three events likely associated with the 1343, 1659 or 1766 and 1912 earthquakes have been identified from the trenches from which we infer 200 to 250 years recurrence of large earthquakes along the Ganos fault segment.