



## **Paleoearthquakes on the Kelkit Valley segment of the North Anatolian Fault, Turkey: Implications for the surface rupture of the historical 17 August 1668 Anatolian Earthquake**

Cengiz Zabcı (1), H. Serdar Akyuz (1), Volkan Karabacak (2), Taylan Sançar (3), Erhan Altunel (2), Halil Gursoy (4), and Orhan Tatar (4)

(1) Istanbul Teknik Universitesi, Ayazaga Yerleskesi, Jeoloji Muh. Bolumu, 34469, Istanbul, Turkey (zabci@itu.edu.tr), (2) Eskisehir Osmangazi Universitesi, Jeoloji Muh. Bolumu, 26040, Eskisehir, Turkey, (3) Istanbul Teknik Universitesi, Ayazaga Yerleskesi, Avrasya Yerbilimleri Enstitusu 34469, Istanbul, Turkey, (4) Cumhuriyet Universitesi, Jeoloji Muh. Bolumu, 58140, Sivas, Turkey

The North Anatolian Fault Zone is one of the Earth's most important active dextral strike-slip structures, which is extending more than 1500 km from the eastern Turkey to the northern Aegean Sea. This deformation zone is the northern boundary of the westward moving Anatolian block and connects Aegean extensional regime with East Anatolian high plateau. 26 December 1939 Erzincan ( $M_s=7.8$ ) and 20 December 1942 Erbaa-Niksar ( $M_s=7.1$ ) earthquakes created a total surface rupture more than 400 km between Erzincan and Erbaa on the middle to eastern sections of the North Anatolian Fault. These two faulting events are separated by a 10-km-wide releasing step-over, acted like a seismic barrier in the 20th century. In contrast, the historical Anatolian Earthquake of 17 August 1668 is thought to have a probable rupture length of more than 400 km, starts from east of Gerede, crossing the 10-km-wide releasing step-over at Niksar, and stops somewhere close to Koyulhisar. However, some other historical earthquake catalogues do not share the idea of a single very large earthquake and mention a series of events between July and September 1668 at various places. In the framework of T.C. D.P.T. Project to 2006K.120220 we undertook paleoseismological trench investigations on the Kelkit Valley segment to test the multi-cycle earthquake behavior of the North Anatolian Fault at this structural complex section. We found evidences for three surface faulting earthquakes predating the 1939 event during the past millennium in trenches, excavated at Reşadiye (40.38N, 37.35E) and Umurca (40.33N, 37.35E). While Reşadiye trench is excavated on alluvial fan deposits at the east of the Reşadiye town, where sedimentation is modified by a man-made artificial channel after a certain period of time, Umurca trench is located at the distal part of an alluvial fan at 23 km east of Reşadiye trench. In addition to the 1939 Erzincan earthquake, prior earthquake surface ruptures are interpreted as: (a) 17 August 1668, (b) A.D. 1254, and (c) A.D. 1045 events. The 17 August 1668 Anatolia earthquake surface rupture is reported in previous paleoseismological studies on different segments of the North Anatolian Fault, which have created individual earthquakes at 1942, 1943, and 1944 in the 20th century. Taking into account previous studies and our results, we suggest very large 17 August 1668 historical strike-slip earthquake surface rupture jumped the 10-km-wide releasing step-over at Niksar and continued towards east until somewhere close to Koyulhisar. The existence of different magnitude offsets of field boundaries (sets of 4 m, 6.5 m, and 10.8 m) shows the effect of multiple events, in which 1939, 1668, and 1254 surface ruptures have around 4, 2.5, and 4 meters of coseismic horizontal slip on the Kelkit Valley segment, respectively.