

Paleoseismologic investigation of the fault rupture of the 14 April 1928 Chirpan earthquake (M 6.8), southern Bulgaria

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Seventy-five years after the destructive Chirpan earthquake of 14 April 1928, we conducted a paleoseismologic study of the causative fault combining a review of contemporary literature, geomorphology, geophysical prospecting, and trenching. We reidentified the fault scarp in the field, and mapped it over a distance of 12.5 km. Geophysical profiles and boreholes demonstrate that Chirpan scarp is the surface expression of a normal fault that was active throughout the Pleistocene and Holocene. In 2002, we excavated a paleoseismologic trench to study the faulting history. A narrow fault zone separates Plio-Pleistocene alluvial sand in the footwall from Holocene alluvial and colluvial silt in the hanging wall. The 1928 earthquake is recorded by 0.45 m vertical offset of the topsoil, in accordance with contemporary descriptions. We identified three colluvial wedge-like units in the hanging wall sediments next to the fault, evidencing at least three surface-rupturing paleoearthquakes since the Atlantic. Their timing could only be loosely constrained using pollen. The penultimate event had an offset of 0.40–0.45 m and occurred after circa 2600 calibrated years before present (cal years B.P.). Event 3 displaced a subboreal semiarid calcic soil 0.55–0.70 m between circa 5750 and 2600 cal years B.P. The fourth event had a minimal offset of 0.50–0.70 m and occurred between circa 8900 cal years B.P. and 4900 B.C., when the region was first settled. We obtain a Holocene fault slip rate of 0.22 ± 0.12 mm/yr and an average recurrence interval of 2350 ± 643 years for earthquakes comparable to or larger than the 1928 event.