A sequence of two large earthquakes occurred on 4 April 1904 in SW Bulgaria. Epicentral area commonly identified with combined maximum isoseismal of both events is located in the Struma Valley and surrounding mountain terrain close to the SW Rila foothill (Fig. 1; Grigorova, Palieva, 1968). They are assigned a $M_{LH} = 7.33 \pm 0.21$ and $M_{LH} = 7.74 \pm 0.22$ (Christoskov, Grigorova, 1968) or $M_w = 6.84 \pm 0.32$ and $M_w = 7.02 \pm 0.08$ (Dineva et al., 2002) for the first event and the second one respectively. Numerous studies have attempted to recognize their source faults; however acceptable solution has still not been found (synthesis in Ambraseys, 2001 and Ganas et al., 2005). According all accounts, the second earthquake ruptured Kroupnik Fault. Suggested sources of the first earthquake remain questionable. Ambraseys (2001) has concluded that recognition is difficult as a consequence of insufficient contemporary data on damages and indistinguishable effects from the two events. In this study, a new scenario for the disputable problem is suggested. It is based on the latest epicenters re-location assessed by Dineva et al. (2002). It is assumed that some portion of fault projections on the surface should be positioned inside the 68% confidence intervals in instrumental epicenter locations. Re-assessment of old seismograms by modern methods apparently locates epicentral areas more certainly than limited historical data, especially from a few villages northward of Razlog town.

The Kroupnik Fault evidently ruptured in one of 1904 events at least in behalf of reported environmental effects in Struma Valley (Grigorova, Palieva, 1968). Paleoseismological study has proved that it is a surface-rupturing fault, and the last event occurred between AD 1696 and AD 1904 (Meyer et al., 2007). This fault is positioned within area where epicenter of the first event is determined from instrumental data, but it is outside the epicentral area of the second event (Fig. 1). The first event must have occurred along Kroupnik Fault. Previous disagreement between smaller second earthquake size estimated from geological data on the Kroupnik Fault and much larger magnitudes from seismological data comes from assumption that it is a source of the second event. Moment magnitude evaluated from Kroupnik rupture dimensions is 6.9 (Meyer et al., 2002) and 6.7 (Ganas et al., 2005). These values are consistent to the seismological assessment of first event magnitude. A recently published reminiscence of a witness Stoyne Yanev, who was working in the Struma floodplain close to Kroupnik Fault during the 1904 earthquake sequence (Kostov, 2009) provides another strong support to the hypothesis that the Kroupnik Fault was source of the first event. He remembered that a lot of fissures appeared and ground subsided after the first shock. The second shock was felt stronger, but environmental effects did not accompany it. The Yanev’s story clearly points to ground effects at Kroupnik Fault related to the first event.

The epicenter of second event is positioned in an area centered at the middle of SE Rila foothill (Fig. 1; Dineva et al., 2002). There, a fault system passing through the entire SE Rila mountainside consisting from Bachevo and Semkovo Faults and segments northeastward across Rila-West Rhodope batholith is related to a neotectonic structure (Vrablianski, 1975). The fault system has not been a subject of detailed study; and in later maps, it has been shortened to the extent of Semkovo Fault (e.g. Georgiev et al., 2007) or even neglected (e.g. Ganas et al., 2005). Morphotectonic analyses indicate that Rila undergoes fault uplift along its entire SE side in the way it was postulated in earlier maps (e.g. Vrablianski, 1975). For example, a base-level map constructed from 4th-order stream elevation clearly shows uniform linear abrupt base-level fall at SE Rila mountainside (inset in Fig. 1).

Keywords: seismogenic faults, morphotectonics, Kroupnik Fault, Bulgaria.
These environmental effects correspond to intensity X in ESI 2007 scale, and provide indirect evidence for an adjacent source fault.

On the base of revised data from previous studies and identification of morphotectonic features, it may be suggested that the first event ruptured the Kroupnik Fault, and the second event probably occurred along the SE Rila Normal Fault.

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References


