



## **The Sophades (Thessaly) earthquake revisited: morphotectonic analysis of the Ekkara fault system and seismic risk assessment of SW Thessaly**

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The construction of the new high-speed Athens-Thessaloniki train line required the reevaluation of the seismic potential of the marginal fault systems in the southern and south-western flanks of the Thessaly plain. This need was augmented by the fact that the existing train line was severed in the Sophades earthquake of 30 April 1954 ( $M=6.8$ ). Based on the existing field descriptions, we re-traced the 1954 earthquake surficial ruptures and associated them with the mapped segments of the marginal faults zones of SW Thessaly. High-resolution colour aerial photographs and Digital Elevation Model were also used for the morphotectonic analysis of the delineated structures and fault-related landforms. The results of these localized studies were placed in the seismotectonic setting of SW Thessaly, evidenced by the analysis of earthquake source parameters, regional neotectonic mapping and geophysical investigation of the Sophades – Karditsa plain. The two main fault strikes are E-W and NW-SE, with the latter showing clearer indications of recent activity. However, recent studies have shown that both fault systems are active, albeit in different and alternating time periods, a result of earthquake clustering, which is related to neighbouring fault systems triggering one another; these seismic clusters may be followed by relatively long quiescent periods.

The Ekkara fault (EF) forms the SE segment of the Sophades Fault Zone, with average NW-SE strike and oblique-normal kinematics. The reported co-seismic displacement in the 1954 event was as much as 90 and 20 cm, dip-slip and strike-slip, respectively (in soft sediments). The present-day morphology of the earthquake fractures does not reveal much, as the terrain has undergone modifications by road crossings and farming. However at some sites indications of the recent activity are still discernible, es-

pecially in the hilly area south of the village of Ekkara. The morphotectonic analysis also suggested the occurrence of a fault segment parallel to the EF, lying to the east and parallel to it. This notion is corroborated by the fact that south of the village of Velessiotes, earthquake fractures were also detected after the 1954 event and these cannot be related to the EF, which lies more than 2 km to the west. This NW-SE fault (Velessiotes Fault) may be the southern-most segment of the Sophades Fault Zone, which appears to terminate between the villages of Ekkara and Thaumakos.