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The Kerkini-Sidirokastro (northern Strymon valley, Greece) active fault and its seismic potential

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The E-W trending Kerkini – Sidirokastro fault is located in northern Greece, near the border with Bulgaria. It is an impressive structure dividing the northern mountainous area (Beles-Balassitsa 2031m) from the southern Strymon valley. Its total length is more than 40 km, but its definitive active length is about 10 km. This fault has been active at least during Quaternary and especially Holocene, accommodating part of the N-S extensional regime of the broader region. Composite Quaternary alluvial fans, which belong to four successive generations, are associated with active tectonism. Strymon valley is filled up with fluvioterrestrial and lacustrine Neogene and Quaternary sediments.

This fault is not associated with any instrumentally recorded or historical earthquakes. However, based on detailed geological mapping, field observations and Landsat images interpretation, it has typical characteristics of an active fault and it can be divided into some smaller segments on the basis of its geometry, morphotectonics and fan development. These segments show different degree of active behaviour, with the most active being the easternmost one, which is probably associated to the deflection of Strymon (Struma) river. Taking into account that the 1904 Cresna (Krupnic fault) earthquake (estimated magnitude 7.1-7.2) has taken place in a relatively short distance to the north (50-60 km), as well as other large (M = 6.5 to 6.9) earthquakes not far to the south (e.g. Assiros 1902, Stivos-Thessaloniki 1978 and Stratoni-Ierissos 1932) with similar morphotectonic features, seismic potential seems to be quite high for this fault. This is further supported by its strike and striation measurements, which confirm that the fault is favorably oriented in respect to the active regional stress field.

Regarding seismic hazard for this fault, the following table summarizes the results of the empirical relationships developed by Pavlides and Caputo (2004), Pavlides et al. (2000), Ambraseys and Jackson (1992) and Wells and Coppersmith (1994) regarding the maximum expected earthquakes and displacements, in three scenarios involving different reactivation fault length:

Table 1. Summarized results from different equations used for the Kerkini-Sidirokastro fault. (1) Pavlides and Caputo, 2004; (2) Pavlides et al., 2000; (3) Ambraseys and Jackson, 1992; (4) Wells and Coppersmith, 1994; MD: maximum expected displacement.

Fault length	1, 2			3		4
	M_s	M_s	MD (cm)	M_s	M_s	M_w
3 km	5.8	5.9	0-3	5.7	5.6	5.5
6 km	6.1	6.2	11	6.0	5.8	5.9
10 km	6.4	6.4	25	6.3	6.0	6.2

Additionally, in case of the total length activation, the expected maximum magnitude (worst case scenario) is of the order of 7.0. Based on seismological data of the broader area (55km around the fault), the probabilities for an earthquake of given magnitudes have also been calculated:

Table 2. Earthquake probability distribution for the broader area of the fault (distance up to 75 km). Maximum expected earthquake magnitude in the broader area is 7.2. (a = 3.15, b = 0.75).

Magnitude	Mean recurrence interval (years)	10-year probability	50-year probability	100-year probability
5.8	15.8	0.468	0.957	0.998
6.0	22.4	0.36	0.88	0.98
6.4	44.7	0.20	0.67	0.89
6.6	63.1	0.14	0.54	0.79
7.2	168.8	0.12	0.26	0.44

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