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ORIGINAL PAPER

Evidence of surface rupture associated with historical earthquakes on the Gülbahçe Fault Zone (İzmir, Türkiye) and its application for determination of the surface fault-rupture hazard zone

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Abstract

In order to decipher the late Pleistocene-Holocene seismotectonic behavior of the Gülbahçe Fault Zone (GBFZ), trench-based palaeoseismological analyses were performed for the first time using optically stimulated luminescence and radiocarbon (^{14}C) dating. The paleoseismic data from this study shows that (i) GBFZ has been responsible for four surface rupturing earthquakes since the late Pleistocene-Holocene, which occurred at 34.6 ± 8.6 ka (E1), 14.4 ± 4.4 ka (E2), 4.3 ± 2.0 ka (E3), and 0.5 ± 0.4 ka (E4), (ii) the recurrence interval of destructive earthquakes on GBFZ were found between 1.4 kyr and 6.2 kyr for the Holocene which signifies irregular recurrence interval, (iii) the elapsed time since the most recent surface rupturing earthquake on the GBFZ is 633 year, (iv) the predicted dextral slip rate ranges from 1.37 mm/yr to 4.27 mm/yr for the western splay of the GBFZ. These results show that the GBFZ has completed approximately half of the destructive earthquakes that ruptured the ground surface corresponding to the narrowest time and should be evaluated within the scope of its potential to produce a destructive earthquake in the near future. GIS-based modeling of the surface rupture zone on the GBFZ ranging in width from 40 to 50 m was defined to reduce the risks that may occur in the future on the fault zone.

Keywords Palaeoseismology · Active tectonics · Gülbahçe Fault Zone · Surface fault-rupture hazard zone · Western Anatolia

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