



Morphotectonics evidence of the 1755 historical earthquake of Fez-Meknes, Morocco

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The Southern Rif Front (SRF) is located at the southernmost frontal part of the Rif Cordillera (Morocco) and overthrusts the foreland basins of Saiss and Gharb. Extending over a length of ~ 150 km between Fez, Meknes and Rabat cities, the SRF stands out as a major active structure. It represents an important seismic hazard for these highly-populated cities as evidenced by their historical seismicity records. The last larger historical earthquake in the area occurred on the 27 November 1755 (almost a month after the large “Lisbon” earthquake of the 1st November 1755), striking the region of Meknes and Fez and causing many casualties. Its intensity is reported to be VIII on the MSK scale. Using satellite imagery, aerial photographs and field investigations, we carried out a morphotectonics study between Fez and Meknes to identify the most recent traces of tectonic activity. Few kilometres westwards Fez city, we identified evidence for a very recent reverse fault scarp at the foothills of the Jebel Thrat massif. High resolution Digital Elevation Model of the fault scarp allowed determining a coseismic vertical displacement of ~ 0.75 -1 m, which yields a reverse slip along the fault of 1.8-2.5 m for a dip estimated at 24° towards the North. According to Wells and Coppersmith’s regressive laws (1994), this amount of displacement yields a Moment Magnitude comprised between 6.5 and 7, which would correspond to a surface thrust rupture length of ~ 20 -40 km. ^{14}C dating of the affected stream terrace yields an age of 1769 ± 50 cal AD. These results suggest that the observed features correspond to the 27 November 1755 historical earthquake. Cumulative deformations are also observed within the studied area with uplifted, tilted and folded fluvial deposits. In order to estimate the Holocene long term slip rate along the fault, we mapped an alluvial terrace showing a 12 m vertical offset, and we sampled its sandy deposits for Optical Stimulated Luminescence dating.