Slip deficit along the Jordan Valley segment of the Dead Sea Fault from paleoseismology, historical seismology and archeoseismology

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The 110-km-long fault rupture of the Jordan Valley section of the Dead Sea Fault exhibits a significant late Quaternary active deformation. We document repeated earthquake ruptures from geomorphological and paleoseismic investigations at three sites along the fault combined with the historical seismicity catalogue and previous studies in archeology. At Ghor Katar, offset stream gullies display increasing cumulative displacements that may be sorted into six distinct classes. Climatic record of Lake Lisan ¦ƒ¢¦¢â€¦Ъ¢â‚¬¦'a precursor to the Dead Sea- reveals that three intense drops in lake level followed by three strong rainfall episodes are responsible for the onset of gullies. We establish a chronology of the six displacement classes using climatic events and obtain a 5 $\pm$ 0.2 mm/yr left-lateral slip-rate for the last 47 ka, in agreement with the 4 to 6 mm/yr measured on neighboring fault segments. At Ghor Kabed, paleoseismic trenches dug across the bounding faults of a pull-apart basin show that at least two fault movements have occurred between A.D. 560 and A.D. 1800 (2σ-calibration) and can be attributed with the A.D. 749 and A.D. 1033 large earthquakes (M>7) that struck the Jordan Valley. Further north, at the archeological site of Tell Es-Saidiyeh, ~ 7 m and ~ 114 m cumulative left-lateral offsets of a drainage pattern indicate the succession of fault movements and related past large earthquakes. Paleoseismic trenches evidence up to 8 surface-rupturing events during the last 14 ka, of which the most recent is radiocarbon dated and may be correlated to the historical A.D. 1033 earthquake. Archeoseismic data from previous investigations indicate levels of destruction possibly due to past earthquakes at ~ 2900 B.C. and ~ 1130 B.C.. Considering the Jordan Valley Fault has accumulated 5 $\pm$ 0.2 mm/yr since the last large earthquake of A.D. 1033, a total of ~ 5 m of slip is yet to be released along the fault segment. The paleoseismic record along the Jordan Valley fault spans several seismic cycles and suggests 1000 to 1400 year recurrence interval for large earthquakes in the last 14 ka.