



Surface Faulting from Historical Earthquakes and Late Quaternary Slip Rate in the Jordan Valley

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We investigate the late Quaternary active deformation along the Jordan Valley section of the Dead Sea Fault. The 130-km-long trace is most conspicuous ~30 km north of the Dead Sea at the Ghor Kabed area where two pull-apart basins illustrate the young transtensional tectonics along the southern section of the fault segment. The pull-aparts have similar geometry and dimensions, and their relationships to the fault segment imply a tectonic process that involve 170 \pm 5 m of left-lateral offset also visible in a nearby river incision. The fault trace is also exposed in the ~60-m-deep river incision and the natural cross-section displays the Lisan and Damya late Quaternary lacustrine formations. The fault zone shows 17.5 \pm 1.5 m cumulative vertical separation of the "White cliff" unit (uppermost Lisan deposits) and 26.5 \pm 0.5 m for the lower-middle Lisan transition. The age of the incision suggests that the total 170 m left-lateral river offset is younger than 42 ka and older than 27 ka. Paleoseismic trenching dug across the fault trace of the northern pull-apart expose the fault zone. Radiocarbon dating of sedimentary units show that the most recent fault movements have occurred between A.D. 560 and A.D. 1800 (2 sigma calibration) and are consistent with the historical seismicity catalogue. Fault movements may include the A.D. 749 and AD 1033 large earthquakes ($M > 7$) that struck the Jordan Valley. The late Pleistocene-Holocene fault movements across the river incision and at the pull-apart area yield an estimated slip rate of 4 to 6.3 mm/yr and suggest 3.9 to 6.1 m of present-day slip deficit along the Jordan Valley fault segment.