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A 220,000-year-long continuous large earthquake record from the central Dead Sea Fault

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Large earthquakes (magnitude ≥ 7.0) are rare, especially along slow-slipping plate boundaries. Lack of large earthquakes in the instrumental record enlarges uncertainty of the recurrence time; the recurrence of large earthquakes is generally determined by extrapolation according to a magnitude-frequency relation. We enhance the seismological catalog of the Dead Sea Fault Zone by including a 220,000-year-long continuous large earthquake record based on seismites from the Dead Sea center (ICDP Core 5017-1). We constrain seismic shaking intensities via computational fluid dynamics modeling and invert them for earthquake magnitude. Our analysis shows that the recurrence time of large earthquakes follows a power-law distribution, with a mean of ≤ 1400±160 years. This mean recurrence is significantly shorter than the previous estimate of 11,000 years for the past 40,000 years. Our unique record confirms a clustered earthquake recurrence pattern and a group-fault temporal clustering model, and reveals an unexpectedly high seismicity rate on a slow-slipping plate boundary.

Our results suggest that researchers may underestimate the seismic hazard potential of similar slow-slipping faults with irregular rupture. Our study highlights the potential of *in situ* deformed sediment layers in a subaqueous environment as a strong-motion paleo-seismometer to record long seismic sequences covering multiple recurrence intervals of large earthquakes. Long records are vital for accurate hazard assessment. Our quantitative method of seismic record reconstruction, with paleo-earthquake intensity (ground acceleration) and magnitude estimation, may also prove suitable for similar subaqueous environments along other faults.