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# Slip-deficit on the Levant fault estimated by paleoseismological investigations

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The Levant fault is a major tectonic structure located east of the Mediterranean Sea. It is a 1200 km-long left-lateral strike-slip fault, which accommodates the northward movement of the Arabic plate relatively to the Sinai micro-plate, with a $\sim$ 5mm/year slip-rate. This slip-rate has been estimated over a large range of time scales, from a few years (gps) to several hundred thousands of years (geomorphology). The geometry of the southern part of the Levant fault, the Wadi Araba fault, is linear with only a few bends and steps. The Middle-East is a region where there is an important and complete historical record of past earthquakes. Nevertheless, due to the arid and unpopulated nature of the Wadi Araba, to constrain location and lateral extent of those past earthquake with accuracy remains challenging.

We excavated a trench $\sim$ 100 km north of Aqaba in the wadi Musa alluvial fan, next to the largest compressional jog of the Wadi Araba. The stratigraphy contains three main units. Two units are coarse and channelized, and sandy flat layers form the third unit. In the trench the deformation is distributed over 15m, and is more pronounced in the eastern part. We can identify at least 12 earthquakes, based on upward terminations of ground ruptures. $^{14}$C dating of 28 charcoals distributed over the three documented trench walls, shows a 7000 year-long record and it allows us to match some events with historical earthquakes in AD1458, AD1293, AD748, AD114, BC31. For other dated events, matching with historical events remains more speculative considering the limited testimonies in old ages. As the last earthquake in the Wadi Araba occurred in AD1458, with an average slip rate of 5 mm/yr, about 2.7 m of slip-deficit have already accumulated, suggesting that this area might be ripe for a large earthquake. Some of the events recognized in our trench are attested north of the Dead Sea as well, such as the AD749 earthquake, suggesting that long sections of the Levant Fault might also rupture together, or in a short period, during earthquake series. Combining our results with previous paleaoseismological studies in the region, we estimated lateral extent of earthquakes and we built regional rupture scenarios. The lateral extent of earthquake ruptures was also used to estimate the average co-seismic slip, using classical scaling laws, thus to assess the cumulated slip related to each rupture scenarios.

Eventually, we tried to balance long-term tectonic loading with the computed cumulated slip to estimate the accumulated slip deficit for the Levant fault, from Aqaba to the south of Lebanon, over the documented period. The seismic-moment budget shows that levels of slip deficit, both north and south of the Dead Sea basin, are similarly high, which could suggest that a seismic crisis could happen over the entire region in a near future.