Slip rate determination and paleo-earthquakes dating along the Southern Dead Sea fault: optically stimulated luminescence, ^{10}Be cosmogenic radionuclide, and ^{14}C ages brought face to face

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Active tectonics studies are often limited by accurate and precise dating of Late Quaternary alluvial deposits. This is illustrated at 2 sites along the Wadi Araba Fault (WAF), which were targeted for fault slip rate determination and paleo-seismology.

Geodetic, geomorphic and geologic studies converge to a fault slip rate of 5 ± 2 mm/a. Yet, Late Pleistocene slip rate determined at the site of Fidan cover a wide range due to large uncertainties, mostly related to the dispersion of ^{10}Be cosmogenic radionuclide (CRN) ages. The maximum slip rate since ~100 ka is up to 11 mm/a, possibly suggesting significant variations in fault activity with time. In order to reduce uncertainty and draw further conclusions regarding the WAF seismic behavior, we applied optically stimulated luminescence (OSL) dating on quartz and K-feldspar minerals from fan levels F2 and F4, previously dated at 37 ± 5 ka and 87 ± 26 ka using ^{10}Be CRN. Quartz OSL ages from F2 are 9.0 ± 1.5 ka and 15.2 ± 1.2 ka, consistent with a ^{14}C age of 13.0 ± 0.2 ka from a landsnail shell. Four quartz OSL ages from F4 are comprised between 34 ± 7 ka and 39 ± 6 ka; a 5th age is older, with 53 ± 6 ka. All ages are younger than the average ^{10}Be exposure age. Only the oldest OSL age of F4 overlaps the ^{10}Be exposure age of the youngest cobbles (~50 ± 5 ka). Infra-red stimulated luminescence (IRSL) on K-feldspars from F4 yielded high fading rates (= loss of luminescence signal with time) with g-values of 9% per decade and more, considered to be too high to provide reliable fading correction. Future work includes investigation of the saturating behavior of quartz and post-IR IRSL dating of K-feldspar, which is not affected by fading.

At the second study site, Qatar, a paleo-seismic trench revealed alternating sandy and silty layers ruptured by up to 8 earthquakes during the last 5 ka. The chronology is supported by more than 30 ^{14}C ages from charcoal, most of them in stratigraphic order. OSL measurements on quartz from 5 samples show asymmetric paleo-dose (De) distribution, commonly interpreted as evidence for partial bleaching of the grains during the most recent transport episode. Preliminary estimates show that, depending on the chosen age model, the OSL ages are in agreement with ^{14}C ages.