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New Constraints on Pleistocene lateral slip rates across the Dead Sea Transform

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The Dead Sea Transform (DST) accommodates ∼105 km of sinistral motion between the Arabian and African plates since the Miocene. GPS measurements reveal recent slip rates of ∼3-4 mm/yr, geomorphic markers indicate Holocene – late Pleistocene rates of ∼3-9 mm/yr and offset geologic structures and bedrock units suggest ∼5-8 mm/yr since lateral deformation since the Miocene. However, scarce preservation of markers for Pleistocene offsets and dating complications at this age range have resulted so far in limited quantitative constraints for Pleistocene slip rates across the DST. Here, we address this data gap using a combination of field work, geochemistry, geochronology and suite of satellite observations along the Arava segment of the DST, located along the Israel-Jordan border between the Dead Sea and the Gulf of Elat/Aqaba. We demonstrate that ∼85 km of the total 105 km offset along the DST are accumulated along a single fault strand within our study area. We then used spectral data from NASA's Advanced Spaceborne Thermal Emission Radiometer (ASTER) to uniquely correlate between sinistrally offset alluvial surfaces of purported Pleistocene ages. Using a newly established dating approach for desert alluvial surfaces we then used radar data from Japan's Advanced Land Observation Satellite Phased Array type L-band Synthetic Aperture Radar (ALOS-PALSAR) to quantitatively determine the age of these offset units. Our results demonstrate that Pleistocene slip rates across the DST since ∼1 Ma are comparable to previously published slip rates at longer and shorter time-scales and thus support the previously suggested hypothesis that the slip rate of the DST has remained ∼constant since the Miocene.