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Opening stages of tension fractures upon the western margin of the Dead Sea Rift based on OSL age estimates of their sediment fill

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Open tension fractures attaining depths of over 10 m in horizontally-bedded hard carbonate strata along the western plateau margins of the Dead Sea Rift, and west of the Rift fault escarpment, form unique geomorphic expressions. The fractures strike parallel to sub-parallel to the fault escarpment and were mapped, classified, and their propagation and dilation stages were relatively dated. Geomorphic relative age indicators include open fracture cross-section geometry, surface edge sharpness, wall morpho-matching, pitting profile, fill accumulation morphologies and pedogenic development, and perennial shrubs cover. These initially suggest that the fractures are quite recent.

Some of the open fracture segments are active and fossilized endoreic depressions filled with fine-grained sediment displaying weak pedogenic development. These sediments were profiled and found to display a tri-modal particle-size distribution dominated by fine silts, with carbonate contents usually averaging 30-40%, as found for modern dust. The sediments, understood to be of an aeolian source and locally eroded and weathered chalk, gradually accumulated by local surface flow, following fracture formation stages.

The sediment fill of three open fracture classes was dated by optically-stimulated luminescence (OSL). Large scatter of equivalent doses of the OSL samples is explained by the dynamic depositional nature of the sediments. Based on OSL age estimates and geomorphic analysis of the development stages of open fracture classes, it seems that fracture propagation and dilation began before ∼30 ka while later main opening stages occurred around ∼10 ka and ∼3 ka. Additional opening stages of fracture segments may have occurred where the fracture fill is unsuitable for OSL dating.