



Particle-size fractionation of aeolian sand along a climatic and geomorphic gradient of the Sinai-Negev erg

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This study examines changes in the aeolian sand fractions along the west-east aeolian transport path of the northern Sinai Peninsula – northwestern (NW) Negev erg of Egypt and Israel. This erg originates from the Nile Delta and is composed of currently active linear (seif) dunes in northern Sinai (its western part), and currently stabilized vegetated linear dunes (VLDs) in the NW Negev dunefield (its eastern part). Sand samples from the Nile Delta, northern Sinai and NW Negev were analyzed for particle-size distribution and sand grain morphology in accordance to their Eastern Mediterranean INQUA Dunes Atlas luminescence and radiocarbon chronologies. Linear seif dunes differ from VLDs in their vegetation cover, linearity, and dynamics. Although both are continuous landforms with similar orientations and sand-grain roundness values, the linear dunes of Sinai are coarser-grained than the Negev VLDs. The VLDs have a significantly higher proportion of very fine sand (125-50 μm) content and a varying but lower sand fining ratio defined as the ratio of fine sand percentage to very fine sand percentage. Very fine sands are suggested to have been winnowed by saltation and low suspension from source deposits and sand sheets. Detailed semi-quantitative examinations of sand grains by a SEM of a Negev VLD shows that most grains do not exhibit features that can be attributed to aeolian abrasion by sand grain-grain collisions. From these observations we infer that fractionation of sand was a major process leading to downwind fining along the studied aeolian transport path.

We suggest that the very fine sand fraction of Nile Delta and Sinai sands has been transported downwind since the late middle Pleistocene. In the late Pleistocene, sand reached the NW Negev in the form of VLDs due to last-glacial period windiness of intensities unprecedented today and probably larger sediment supply. Generally current and inferred past decreasing wind velocities and increasing precipitation along the dune transport path enhanced vegetative and biogenic soil crust cover in the NE Sinai and NW Negev and enabled deposition of the very fine sand component within VLDs that was probably transported by low suspension. We hypothesize that very fine sands also probably compose a partial coarse fraction of the late Pleistocene northern Negev loess deposits, adjacently downwind of the NW Negev dunefield.

Our results suggest that particle-size distribution can elucidate much about erg and dunefield history especially where a climatic gradient exists, over timescales of a glacial-interglacial cycle.