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Evolution of Middle to Late Pleistocene Sandy Calcareous Palaeosols Underlying the Northwestern Negev Desert Dunefield (Israel)

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Calcareous palaeosols in the northwestern (NW) Negev Desert dunefield, Israel, at the eastern end of the Sinai-Negev erg were studied in relation to their overlying stabilized dunes and downwind loess deposits, using sedimentological analyses, spectroscopy, and optically stimulated luminescence (OSL) dating. During the Middle to Late Pleistocene, between around MIS 7 and through MIS 3, several cycles of sand veneer (sheet) deposition, stabilization, pedogenesis, and erosion formed a spatially variable sequence of sandy calcareous palaeosols in the NW Negev. Periods of stability on the order of several thousand years to over ten thousand years, characterized by post-depositional illuviation of aeolian silts, clays, and salts, enabled the formation of diagnostic, often-indurated, calcareous, Bk horizons (stages I-III), with orthic carbonate nodules. The primary particle-size mode of the palaeosol (127 μm) is intermediate between the modes of the overlying (MIS 2) dune sand and the mode of primary northern Negev ($\sim$MIS 6 through MIS 2) loess deposits in the dunefield periphery. The sand fraction of the palaeosols is slightly finer than the dune sand, and its spatial sedimentation pattern correlates with the pattern of the subsequent dune incursions. These observations suggest that (1) Bk palaeosol horizons were resistant to (MIS 6 – MIS 3) sand veneer aeolian erosion and formed chronologically differentiated and durable surfaces; (2) these surfaces remained in equilibrium for extensive periods, being intermittently covered and preserved by shifting sand veneers; (3) the MIS 2 dune incursion episodes followed the same transport routes of the underlying palaeosol sand substrate while producing a limited amount of aeolian erosion on the Bk horizons, and; (4) the similar sedimentological and chronological framework of the palaeosols and loess deposits suggests a partial genetic connection. As for the overlying dunes, aeolian sand supply to the parent material of the palaeosols was initially controlled by sediment availability originating in the Nile Delta and probably linked to glacial-interglacial eustatic cycles and glacial and cold-event windiness. The NW Negev sand deposition episodes that markedly differ from the ages of a nearby sandy palaeosol sequence of coastal origin exemplify the role of sand supply on the development of palaeosol sequences in a similar palaeoclimate.