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Palaeoenvironmental expression of humid phases in the western Nefud Desert over the past c. 500,000 years

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Orbitally-driven humid phases in arid regions such as the Arabian and Saharan Deserts have played an important biogeographic role in ancient human dispersals, range expansions/contractions and population structure. The timing and regional climatic pattern of humid phases has been shown by multiple long-term continuous palaeoenvironmental records from both marine and terrestrial (speleothems and long palaeolake cores) archives. These attest to episodic humid phases across this region in line with peak interglacial periods over the Pleistocene. However, these records lack detailed information at the scale at which humans interact with the environment, meaning these interactions are poorly understood. To address this, we apply multi-proxy palaeoenvironmental analysis to interdunal carbonate/siliceous sediment beds that formed during episodic humid phases over the past c. 500,000 years in the western Nefud Desert, Saudi Arabia. While such deposits are short relative to many marine, speleothem and palaeolake records, they provide “snapshots” of the palaeoenvironmental conditions experienced by ancient humans. Importantly, these deposits are often directly associated with Lower and Middle Palaeolithic archaeology, demonstrating they were an important locus for ancient human activity during humid phases.

Our analysis demonstrates that humid intervals related to MIS 11, 9, 5e and 5a follow a simple environmental pattern where relatively stable interdunal lake bodies existed through a single humid phase. In contrast, MIS 7 is climatically complex as the sediment record demonstrates a dynamic hydrological system fluctuating between lacustrine and palustrine conditions within a single humid interval. Where available, diatom or invertebrate palaeoecology data consistently indicate predominantly fresh waters across multiple humid intervals, and this is supported by a lack of evaporitic minerals (i.e. gypsum and halite) through all sequences. We therefore argue that the western Nefud Desert has repeatedly provided vital freshwater resources for ancient humans and other fauna over the past c. 500,000 years.