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Late Quaternary dune activity in the Thar Desert, India: an insight from OSL dating

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It is generally accepted that insolation driven changes in monsoon intensity have affected contraction and expansion of the Thar Desert, India during the late Quaternary, impacting on the construction and accumulation of aeolian landforms [1,2]. Observation of dune alignment using remotely sensed imagery has shown that regionally, dunes are closely aligned with the prevailing wind direction of the southwest monsoon system. Therefore, the Thar dune systems potentially provide a rich archive of past climatic and geomorphological change. Whilst a small number of studies have undertaken geochronological investigations of dunes using luminescence dating [2,3], studies have been sporadic and have tended to rely on older dating protocols. As a result, the temporal and spatial analyses of Thar dune accumulation histories and their comparison with growing multiproxy framework of past environmental dynamics become difficult.
To address this, systematic sampling of dune fields was carried out in different regions in the desert. Sites were selected to form a transect across the modern precipitation gradient, and linear and parabolic dune forms, which have a high sediment preservation potential, were targeted. Optically stimulated luminescence (OSL) dating was used to provide a chronological framework, with the aim of inferring dune sensitivity to palaeoenvironmental change, and the time scales over which they register and preserve the palaeoenvironmental record.
This study presents a suite of 60 quartz OSL ages, calculated using the double-SAR protocol [4]. The chronology demonstrates a dynamic aeolian environment in the Thar during the late Quaternary, as well as spatial and temporal variability in aeolian accumulation across the region. The majority of accumulation is recorded after the Last Glacial Maximum, with the early Holocene identified as a phase of intensive and widespread accumulation, indicating that relatively more arid and windy conditions were prevalent during this period. OSL ages also show major phases during the mid-Holocene and within the last millennia, suggesting that potential drivers of dune mobility in the last century include a strong anthropogenic dimension [5]. The study concludes that a strategic approach to sampling coupled with robust dating protocols allow the scope for a more complex chronology to be identified and subsequently enhance our understanding of dunefield development.

References

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