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OSL chronology and palaeoenvironmental implications of palaeodunes intercalated in loess stratum from Lanzhou, western Chinese Loess Plateau

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Dune systems represent important palaeoenvironmental archives and therefore provide valuable information on past climate conditions of dryland regions. In this study we report on OSL chronologies and palaeoenvironmental implications of several palaeodunes (thickness ca. 10-20 m) intercalated in thick loess accumulations of the western Chinese Loess Plateau, near Lanzhou. The intercalated dune sands are characterized by a well-sorted grain size and a typical aeolian dune structure, with distinct cross-bedded sand layers, with an angle of up to 34°. The chronology for these palaeodunes was established by optically stimulated luminescence (OSL) dating of quartz. The results indicate that sand dune accumulation occurred at two periods, i.e. ca. 35-25 ka and ca. 11-5.1 ka. Dune-building phases are most often interpreted as 'arid' periods, although direct evidence of causality is scarce. Most records from ice cores, lakes, stalagmites, and peats in China indicate that the climate was warm and humid with enhanced Asian summer monsoon during both periods of early marine isotope stage 3 (MIS 3a) (40-25 ka) and the first half of the Holocene (11-5.0 ka). However, our results show that during these two periods the dune-building activity was enhanced in the study area. The conventional interpretation that sand dune accumulation was treated as an indicator of dry event is thus questionable. It is possible that a combination of factors may lead to dune formation (e.g. less rain and lower temperatures; no rainfall reduction and higher temperatures; reduced soil moisture; greater sediment availability and greater frequency of sand transporting winds, etc.). Therefore, the structure of these sand dunes (indicating wind regimes in the past) and the relationship between palaeodune deposits and fluvial/alluvial sediments (indicating sand dune origin) in the study area must be further examined, which will help to understand the mechanism of palaeodune accumulation.