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Human occupation of the Central Asian loess piedmont: new chronologies and perspectives on past climates

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Central Asia lies at the intersection between the major northern hemisphere climatic subsystems, and at the centre of some of the most significant recent paleoanthropological discoveries in the past few years, including new genetic data indicating that archaic human species met and interbred with anatomically modern humans as they arrived into the region. However, data enabling us to understand the human history of this area and its palaeoenvironmental backdrop are limited. Reliable chronologic data from sites in the region, crucial to our understanding of the timing and duration of interactions between different human species as well as of palaeoenvironmental change, are rare.

Here we present chronostratigraphies for three loess-paleosol profiles from the Tien Shan mountain piedmont in southeast Kazakhstan bridging southern and northern Central Asia, two of which represent open air Palaeolithic sequences, coupled with archaeological metadata analysis. The chronological, stratigraphic and archaeological data respectively provide insights into loess accumulation rates and processes, palaeoenvironmental change, and variability in human technological developments between sites over ∼47-19 ka. All three sites record increased loess accumulation during marine oxygen isotope stage (MIS) 3 and into the last glacial maximum (LGM), which we hypothesise to represent two climate-driven processes. Firstly, loess accumulation coeval with MIS 3 glacial advance in the Tien Shan was likely facilitated by northward expansion of the Asian monsoon and associated precipitation increase, with compression of the temperate zone westerlies causing increased wind strength. Second, peak loess accumulation during the LGM occurred under drier, colder climates with persistent westerly winds and sustained, if reduced, glaciation in the high mountains. We cautiously suggest a trend towards increasing occupation of open air sites across the Central Asian piedmont after ∼40 ka, corresponding to more humid climatic conditions which nevertheless included pulses of dust deposition. Human occupation persisted into the LGM, despite cooler, drier, conditions. Our data set the scene for future integrated research based on quantitative palaeoclimate reconstruction and archaeological prospection in the Central Asian loess piedmont.