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A chronological framework connecting the early Upper Palaeolithic across the Central Asian piedmont

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ABSTRACT

Central Asia has delivered significant paleoanthropological discoveries in the past few years. New genetic data indicate that at least two archaic human species met and interbred with anatomically modern humans as they arrived into northern Central Asia. However, data are limited: known archaeological sites with lithic assemblages generally lack human fossils, and consequently identifying the archaeological signatures of different human groups, and the timing of their occupation, remains elusive. Reliable chronologic data from sites in the region, crucial to our understanding of the timing and duration of interactions between different human species, are rare. Here we present chronologies for two open air Middle to Upper Palaeolithic (UP) sequences from the Tien Shan piedmont in southeast Kazakhstan, Maibulak and Valikhanova, which bridge southern and northern Central Asia. The chronologies, based on both quartz optically stimulated luminescence (OSL) and polymineral post-infrared infrared luminescence (pIR-IRSL) protocols, demonstrate that technological developments at the two sites differ substantially over the ~47–19 ka time span. Some of the innovations typically associated with the earliest UP in the Altai or other parts of northeast Asia are also present in the Tien Shan piedmont. We caution against making assumptions about the directionality of spread of these technologies until a larger, better defined database of transitional sites in the region is available. Connections between the timing of occupation of regions, living area setting and paleoenvironmental conditions, while providing hypotheses worth exploring, remain inconclusive. 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 Last Glacial Maximum, despite cooler, and possibly drier, conditions. Our results thus provide additional data to substantiate arguments for occupation of Central Asia.

1. Introduction

Central Asia lies at the core of the largest continent in the Old World, Eurasia. The region has delivered some of the most significant paleoanthropological discoveries in the past few years. Specifically, new genetic data indicate that at least two archaic human

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species, Neandertals and the recently discovered Denisovans (Krause et al., 2010; Reich et al., 2010), met, shared territories and possibly interbred with anatomically modern humans (AMH) as they arrived in the Altai Mountain region of northern Central Asia (Prufer et al., 2014). Despite these exciting glimpses into possible introgression scenarios among various hominin groups, evidence of genetic admixture alone does not inform the spatio-temporal context of these interactions. The small number of early AMH fossils excavated in this region so far lack archaeological context (Kuzmin et al., 2009; Fu et al., 2014). Known archaeological sites with lithic assemblages are more numerous, but lack associated human fossils or reliable chronologies (Glantz, 2010; Rybin, 2014). Therefore, identifying the archaeological signatures of incoming groups against established indigenous populations requires detailed analysis of Middle (MP) and Initial and Early Upper Paleolithic (IUP and EUP) stone tool assemblages, combined with reliable chronologies. Unfortunately, reliable chronological data from available sites in the region, which are crucial to our understanding of the timing and duration of interactions between different human species, are also rare.

Developing a framework for human occupation of, and interaction within, Central Asia is not straightforward due to the sparse and uneven geographic distribution of known sites. In this paper, we define Central Asia as a region encompassing the foothills and steppe north of the Asian high mountains, southern Siberia and Mongolia, and arid western China (west of the Yellow River and Chinese Loess Plateau). The geographic distribution of available sites across this region is strongly biased by political boundaries and historical research activity (Fig. 1). Known Paleolithic sites in this geographically defined 'greater' Central Asia fall into three main geographic clusters, defined here from southwest to northeast as 1) western Tien Shan, including the Ferghana Valley (Uzbekistan), 2) the Russian Gorny Altai (Russia), and 3) Transbaikalia and the eastern Hangay mountains (Russia and Mongolia). The known sites broadly stretch across the Central Asian mountain piedmont. Between clusters 1 and 2 lie the Tien Shan foothills of southern Kazakhstan, Dzhungaria and the Tarim Basin margins (Fig. 1), which contain very few Paleolithic sites. Despite the relative lack of sites, this region is of critical importance to understanding gene flow and cultural interaction since it represents a natural corridor connecting the Central Asian piedmont with China via mountain passes such as Dzhungaria, and between the high mountains to the south and deserts to the north. Our paper presents new data from two sites in this vast bridging region.

A further challenge to understanding the human history of Central Asia is the spatial variability in length and quality of the archaeological record and associated chronologies. The former Soviet republics which comprise southern Central Asia are characterised by very long, yet poorly defined archaeological records extending to the early Pleistocene (Ranov, 1995), which can be compared with those in China further east (Dennell, 2004, 2011, 2013; Dennell and Roebroeks, 2005). By comparison, despite a greater density of known Paleolithic sites, the archaeological record of northeastern Central Asia (including southern Siberia and Mongolia) is shorter, rarely dating beyond the Last Interglacial (Derevianko, 2001, 2006, 2010; Kuzmin, 2007). The large, unknown region which comprises the core of Central Asia strongly suggests that preservation bias plays a significant role in our poor understanding of the area's prehistory. Tectonic instability throughout the Pleistocene and Holocene (Havenith et al., 2015) may have played a role in the physical removal of sites. The problem is further compounded by a political history that isolated the region from focused archaeological surveys aimed at identifying Paleolithic sites. Characterizing the putative differences between the archaeology of the Neandertal-Denisovans, and the nature and timing of transition to AMH dominance across Central Asia, clearly remains a challenging task, hinging on improvements in data density and the quality of the archaeological record. Central to addressing this problem is the generation of reliable chronologies.

This paper presents new chronologies from two open air Paleolithic sequences in Central Asia, located in the key connecting region of southern Kazakhstan. These new data enable us to start exploring the potential geographic link between the southwestern and northeastern extremities of the region. We combine our new chronologies with analysis of chronological and archaeological metadata from published Central Asian piedmont sites in order to explore connections across the region over the earliest part of the Upper Paleolithic.

1.1. Regional context: the Central Asian piedmont

Piedmont loess deposits characterize Central Asia, extending northwards (and westwards) from the Pamir, Alai, Tien Shan, Karatau, Altai and Hangay mountain ranges. These deposits of fine aeolian dust (Pécsi, 1990), assumed to be generated by a combination of glacial grinding in the Asian high mountains, weathering due to active tectonics, and particle abrasion from the desert basins upwind (Smalley et al., 2006), can exceed 100 m in thickness (Ding et al., 2002; Machalett et al., 2008). Central Asian piedmont loess provides near-continuous records of sedimentary accumulation in response to climatic change (Ding et al., 2002; Machalett et al., 2008; Youn et al., 2014; Fitzsimmons et al., in press), in a similar way as do the substantial deposits of the Chinese Loess Plateau to the east (e.g., Liu and Chang, 1964; Liu et al., 2015) and Danube Basin to the west (e.g., Fitzsimmons et al., 2012; Marković et al., 2015). Where open air archaeological sites occur in loess, we are presented with an optimal context for exploring human-environmental-climatic interactions.

The piedmont loess extending from the Pamir and Alai ranges in the west, across the Tien Shan and northwards to the Altai and Mongolian Hangay mountains (Fig. 1), defines a consistent environmental zone across Central Asia (Beeton et al., 2014; Glantz et al., 2016). The landscape is dominated by mountain foothills blanketed by loess, and the vegetation is dominated by steppe species. The location in the rain shadow of the Asian high mountains ensures a consistent continental, semi-arid climate which varies according to latitude, altitude (Glantz et al., 2016) and the relative influences of orographic effects, the mid-latitude westerlies, the polar fronts, and the Asian monsoon subsystems (Machalett et al., 2008). We hereby propose an overarching term encompassing and defining this region, the "Central Asian piedmont".

The Central Asian piedmont has been proposed as a refugium for hominins during more extreme climatic phases, based on the results of ecological niche modeling using the distribution of known sites in the foothills and steppe regions (Beeton et al., 2014; Glantz et al., 2016). Most of the known archaeological sites in the region lie within the Central Asian piedmont, and thus fall within the temperate climatic corridor between the high Asian mountains to the south and mid-latitude deserts to the north (Fig. 1). The Central Asian piedmont may have represented a consistent habitat and potential dispersal route for people between western and eastern Eurasia. However, a larger archaeological, paleoenvironmental and biogeographical dataset – including data from sites in the vacant swath between the Uzbek and Altai clusters of sites – is required to test this hypothesis more thoroughly.

1.2. Archaeological sites

In this paper, we focus on two stratified, open air loess sites, Maibulak and Valikhanova, in southern Kazakhstan. These two sites