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Middle to Late Pleistocene human habitation in the western Nefud Desert, Saudi Arabia

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ABSTRACT

The Nefud Desert is crucial for resolving debates concerning hominin demography and behaviour in the Saharo-Arabian belt. Situated at the interface between the Mediterranean Westerlies and African Monsoonal climate systems, the Nefud lies at the centre of the arid zone crossed by *Homo sapiens* dispersing into Eurasia and the edges of the southernmost known extent of the Neanderthal range. In 2013, the Palaeodeserts Project conducted an intensive survey of the western Nefud, to: (1) evaluate Pleistocene population dynamics in this important region of the Saharo-Arabian belt and (2) contribute towards understanding early modern human range expansions and interactions between different hominin species. Thirteen Lower and Middle Palaeolithic sites were discovered in association with palaeolake basins. One of the sites, T'is al Ghadah, may feature the earliest Middle Palaeolithic assemblage of Arabia. Preliminary analyses show that the Lower and Middle Palaeolithic sites discovered display diverse technological characteristics, indicating that the Nefud was important for population turnovers and exchanges throughout the Pleistocene. Periodic environmental amelioration appears to have attracted hominin incursions into the region, and subsequent ephemeral occupations structured around lakes and, to a lesser extent, raw material sources. However, differences between the Lower and Middle Palaeolithic sites are indicative of greater mobility during the later Pleistocene. A rarity of formal tools, but strong similarities in lithic production techniques, are also suggestive of demographic affinities across the Nefud during the Pleistocene, and perhaps beyond. These preliminary results support the view that the Arabian Peninsula was a critically important region of southwest Asia during the Late Pleistocene, in which demographic responses to climatic amelioration may have structured connectivity across the Saharo-Arabian belt, the Levant and as far as India.

1. Introduction

Southwest Asia is a critical locus for understanding dispersals out of Africa during the Pleistocene, as well as the interactions between different hominin populations precipitated by these processes (e.g., Shea, 2003, 2013; Rose and Petraglia, 2009; Green et al., 2010). The Levant in particular has yielded a rich array of Palaeolithic sites and fossil remains (see e.g., Shea, 2003, 2013; Hovers, 2009 for recent summaries) which have played a central role in constraining the chronology of hominin dispersals and the southern spatial extent of the Neanderthal range. However, because these data still represent information from an extremely small area of Southwest Asia, the extent of population continuity, exchange and replacement in this region during the Middle and Late Pleistocene is difficult to ascertain.

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Recent research conducted in the Arabian Peninsula has significant potential to investigate the degree of demographic complexity in the Palaeolithic of Southwest Asia (Rose and Petraglia, 2009; Groucutt and Petraglia, 2012, 2014; Groucutt et al., 2015). Stratified sites found in northern Arabia may represent a southerly incursion of Neanderthals from the Levant and/or further evidence for dispersing modern humans during periods such as Marine Isotope Stage 5 (MIS 5, ~130–75 thousand years ago or ka) (Petraglia et al., 2011, 2012; Scerri et al., in press). In southern Arabia, the site of Jebel Faya has been argued to reflect a 'southern route' dispersal out of East Africa (Armitage et al., 2011), while a series of 'Nubian Complex' sites across the Peninsula may represent a dispersal of northeast Africans into the Peninsula, also during MIS 5 (e.g. Crassard and Hilbert, 2013).

While these discoveries have catalysed interest in the Arabian Palaeolithic, its characterization is in its early stages. Many new sites discovered have yielded new technological characteristics, which may represent dispersals from elsewhere and a subsequent variety of autochthonous developments (see Groucutt and Petraglia, 2012; Scerri et al., in press for reviews). Verifying and linking such demographic processes are hampered by low chronological control due to current low numbers of stratified, dateable primary contexts. The current lack of pre-Holocene hominin fossils from the region also makes it impossible to make any definitive statements as to the taxonomic nature of the hominins responsible for the archaeological sites discovered, particularly during the Late Pleistocene. Pleistocene sites in the Arabian Peninsula are widely dispersed across a land mass stretching over three million square kilometres, which has significantly problematized the provision of a framework for understanding technological variation across the Arabian Palaeolithic and its relationship with Africa and the rest of Southwest Asia.

In order to make sense of the technological variability apparent in the Arabian Palaeolithic and address its place in the Palaeolithic of Southwest Asia, the Palaeodeserts Project developed a programme of interdisciplinary research in the southwestern Nefud Desert. The programme of research had two key aims: to (1) understand the technological characteristics of the Lower and Middle Palaeolithic and their relation to the landscape in a geomorphologically and ecologically bounded region, and (2) strategically extend fieldwork southwards from the borders of the relatively well investigated Levant. Due to its geographic situation, the Nefud Desert shares a number of ecological features with the southern Levant, such as flora, fauna and other biogeographic features (Harrison and Bates, 1991; Stimpson et al., 2015). Research indicates that this may also have been the case in the Pleistocene, with significant water bodies such as the Mudawwara palaeolake (Petit-Maire et al., 2010) spanning what is presently southern Jordan and northern Saudi Arabia. Critically, the Nefud Desert also provides important information regarding the nature and extent of climatic variability within the Arabian interior, where stratified, dated Middle Palaeolithic sites have been found (Petraglia et al., 2012).

Here, we present the discoveries and preliminary analyses of our southwestern Nefud Desert survey. The survey was conducted in 2013 and led to the identification of new lithic assemblages at two sites which have chronometric age estimates (Rosenberg et al., 2013) and the discovery of several new Lower and Middle Palaeolithic sites. We report descriptions of the techno-typological assignations for two dated Middle Palaeolithic sites, including one very early Middle Palaeolithic site, together with descriptions of the further 11 sites located, which are considered in the light of their similarities to the dated sites. A discussion of the associated multiproxy studies of both local and regional geomorphology and sedimentary records is subsequently presented, contributing towards some preliminary interpretations of landscape use in the Middle and Late Pleistocene of the Nefud Desert.

2. The Nefud Desert

The Nefud Desert is located north of the Arabian shield at ~27°–30°N, ~38°–44°E and is the northernmost sand sea, or erg in Arabia. The Nefud covers an area of ~72,000 km^2 (Goudie, 2002) and is mainly comprised of high (~120 m) east–west longitudinal dunes and barchanoid dunes overlain by smaller traverse and branching dunes. Despite the current, hyperarid conditions, relict lacustrine sediments are exposed in numerous interdunal areas, in particular those nearer the western and southern peripheries of the sand sea. Such deposits are indicative of wetter periods in Arabia's history, when rainfall incursions transformed the arid desert interior into savannah grasslands featuring many large freshwater lakes. Understanding the timing and character of these climatic amelioration events is critical for determining the context of Palaeolithic archaeology in the Arabian Peninsula.

Numerous palaeoenvironmental studies have demonstrated several periods of past environmental amelioration in the Nefud during the Pleistocene. These periods of environmental amelioration are typically associated with interglacial periods. Early palaeoclimatic studies (i.e. Whitney and Gettings, 1982; Whitney, 1983; Whitney et al., 1983) suggested that lake formation within the Nefud occurred during the latter part of Marine Isotope Stage 3 (MIS 3, ca. 40–25 ka, although as discussed below, this is based on problematic radiocarbon dates) and during the early Holocene wet phase (ca. 10–6 ka). More recent studies now suggest that lake formation occurred during interglacial periods associated with MIS 11 (ca. 410 ka), MIS 9 (ca. 320 ka), MIS 7 (ca. 200 ka) and MIS 5e (ca. 125 ka) (Petraglia et al., 2011; Rosenberg et al., 2013). Utilising a detailed suite of optically stimulated luminescence (OSL) dates from a number of lacustrine archives in the eastern and western Nefud, Rosenberg et al. (2013) suggested that a single perennial lake covered the entire southwestern Nefud during MIS 9 (~320 ka) and that during MIS 7 and MIS 5, lake formation was restricted to smaller interdunal water bodies. The discrepancy between ages of lake formation in recent and earlier studies (the latter being based on radiocarbon chronologies) is explained as the result of contamination with younger ^{14}C from the precipitation of CO_2 dissolved in meteoric waters, which has produced younger age ranges (Rosenberg et al., 2013). Palaeohydrological analyses from multispectral satellite data also indicate the presence of hundreds of palaeolakes across the southwestern Nefud, in both interdune depressions and structurally defined closed basins (Breeze et al., 2015).

Taken at face value, these findings indicate a predominantly arid climate, punctuated by brief but dramatic landscape changes every ~100 ka. However, recent studies have demonstrated that the climate of Arabia is more complex than what simplistic wet/dry indicators suggest (Parton et al., 2015). Findings from central and southern Arabia (Mclaren et al., 2009; Parton et al., 2013) have shown that humid periods in Arabia may also occur during mid-high latitude glacial periods, while the overall timing of pluvials exhibits a periodicity in line with insolation maxima every ~23 ka (Parton et al., 2015). This is demonstrated by recent findings from southern Arabia, which provide evidence of Middle Palaeolithic assemblages dated to ca. 55 ka (Delagnes et al., 2012), and indicates that dispersals and refugial population continuity/expansions may not be limited to interglacials. Indeed, prior to the onset of intensified agriculture, large oasis basins in the southern Nefud such as