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Epipalaeolithic occupation and palaeoenvironments of the southern Nefud desert, Saudi Arabia, during the Terminal Pleistocene and Early Holocene

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ABSTRACT

The transition from the Terminal Pleistocene to the Early Holocene is poorly represented in the geological and archaeological records of northern Arabia, and the climatic conditions that prevailed in the region during that period are unclear. Here, we present a new record from the site of Al-Rabyah, in the Jubbah basin (southern Nefud desert, Saudi Arabia), where a sequence of fossiliferous lacustrine and palustrine deposits containing an archaeological assemblage is preserved. Sedimentological and palaeoenvironmental investigations, both at Al-Rabyah and elsewhere in the Jubbah area, indicate phases of humid conditions, during which shallow lakes developed in the basin, separated by drier periods. At Al-Rabyah, the end of a Terminal Pleistocene phase of lake expansion has been dated to ~12.2 ka using optically stimulated luminescence (OSL), with a mid-Holocene humid phase dated to after ~6.6 ka. Palaeoecological reconstructions based primarily on non-marine molluscs and ostracods from the younger lacustrine deposits indicate a relatively shallow body of freshwater surrounded by moist, well-vegetated environments. A lithic assemblage characterized by bladelets and geometric microliths was excavated from sediments attributed to a drier climatic phase dated to ~10.1 ka. The lithic artefact types exhibit similarities to Epipalaeolithic industries of the Levant, and their occurrence well beyond the 'core region' of such assemblages (and at a significantly later date) has important implications for understanding interactions between Levantine and Arabian populations during the Terminal Pleistocene–Early Holocene. We suggest that the presence of foraging populations in the southern Nefud during periods of drier climate is due to the prolonged presence of a freshwater oasis in the Jubbah Basin during the Terminal Pleistocene–Early Holocene, which enabled them to subsist in the region when neighbouring areas of northern Arabia and the Levant were increasingly hostile.

1. Introduction

Previous research in the southern Nefud has identified archaeological assemblages of both Middle Palaeolithic and Neolithic age. The former, characterised by Levallois stone tool technologies, have been dated to humid periods during Marine Isotope Stages (MIS) 7 and 5 (Petraglia et al., 2012). Neolithic assemblages similar to the Pre-Pottery Neolithic (PPNA and PPNB), recovered from the surface, have been assigned an age of ~9–8 ka, inferred from proximal Holocene sequences (Crassard et al., 2013). This repeated occupation of the region highlights its importance to human populations over a long period of time, but until now very little evidence for occupation during the intervening period, encompassing the transition from the Pleistocene to the Holocene, has been

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forthcoming (cf. Maher, 2009). The recovery of a lithic assemblage with affinities to the Levantine Epipalaeolithic (EP) from a dated sequence at Al-Rabyah, in the Jubbah basin, has therefore provided an important opportunity to examine human responses to climatically driven landscape change in the southern Nefud at that time.

The Levantine EP is dated to between c. 24 and 11.8 ka and is characterized by a diverse range of lithic industries accompanied by a variety of bone tools, body ornaments, mobile art and other cultural expressions (e.g. Bar-Yosef, 1970; Henry, 1982; Goring-Morris, 1995; Goring-Morris and Belfer-Cohen, 1997; Shea, 2013). EP lithic assemblages are typified by blade and bladelet production, based on pyramidal single platform cores. Blanks are further transformed into microliths, which show great morphological and regional variability through time (e.g. Henry, 1988; Neeley and Barton, 1994; Goring-Morris, 1995; Barton and Neeley, 1996; Belfer-Cohen and Goring-Morris, 2002; Maher et al., 2012; Shea, 2013). The core region for the Levantine EP encompasses the Sinai Peninsula, the eastern Mediterranean and Iraq, with the majority of important sites located in the central part of this region (cf. Shea, 2013). There are also many general similarities between the Levantine EP and lithic assemblages of roughly equivalent age in Mediterranean North Africa, the Nile Valley and montane western Asia (Kozlowski, 1999; Garcea, 2010; Schild and Wendorf, 2010; Düring, 2011; Shea, 2013). In the Arabian Peninsula, evidence for the presence of post-Middle Palaeolithic human groups prior to the Neolithic has so far only been found at a handful of sites in northern and central-southern Saudi Arabia (cf. Maher, 2009; Groucutt and Petraglia, 2012) and in southern Oman (Rose and Usik, 2009; Hilbert, 2014), although the assemblages from the latter exhibit few similarities with the Levantine EP and are instead more characteristic of local lithic industries. This technological and spatial disconnect between the core area of EP industries in the Levant and those from southern Arabia highlights the paucity of sites that can be reliably attributed to this period across much of the Arabian interior, and the resulting lack of understanding of the Terminal Pleistocene–Early Holocene in Arabia.

The apparent absence of Late Pleistocene–Early Holocene sites in the Arabian Peninsula has been attributed to the harsh, arid environmental conditions that prevailed across much of the region during the last glacial period, making Pre-Neolithic human incursions into the interior extremely difficult (e.g. Uerpmann et al., 2009; Bretzke et al., 2013). Although it is reasonable to assume that the timing of any demographic expansions into the Arabian desert belt would have coincided with periods of increasingly humid climate, it is important to consider the spatial and temporal variability of these climatic phases across Arabia during the Terminal Pleistocene–Early Holocene. Palaeoclimatic evidence from the Levant suggests that the Early Holocene period remained relatively dry (e.g. Vaks et al., 2010; Enzel et al., 2008; Petit-Maire et al., 2010), whereas regions of Yemen and southern Oman, located closer to the Intertropical Convergence Zone (ITCZ) and associated monsoon rain belt, became increasingly humid at ~11 ka (Radies et al., 2005; Davies, 2006; Lézine et al., 2007; Fleitmann et al., 2007). It has therefore been suggested that the onset of wetter conditions occurred earlier in southern Arabia than in the central desert regions (Parker, 2009). To the north, in the southern Nefud desert, Holocene lake formation has been dated to ~10 ka (Whitney and Gettings, 1982; Whitney, 1983; Whitney et al., 1983; Engel et al., 2012). Most recently, evidence from a locality at Jebel Qatar (JQ-200) has indicated humid conditions in the Jubbah basin between ~9 and 8 ka (Crassard et al., 2013). These findings are at odds with a broader analysis of the timing of late Quaternary lake formation across the Nefud (Rosenberg et al., 2013), which reported no Holocene lake formation; similarly, no evidence for lake formation during the Early Holocene has been reported from neighbouring regions such as Jordan (Petit-Maire et al., 2010; Cordova et al., 2013).

These contradictions illustrate the complexity of the climatic and environmental conditions that prevailed in northern Arabia at the Pleistocene–Holocene transition. Not only are significant differences in the timing of humid conditions apparent, but also variations in regional responses to increased rainfall, driven primarily by geomorphology. These have important implications for the availability of food and water supplies across northern Arabia, which are in turn critical to understanding the demographic complexity of the period. The Al-Rabyah site represents the first well-dated sequence from which archaeological and palaeoenvironmental evidence can be integrated, and contributes to a growing corpus of data suggesting that the Jubbah basin was a critical freshwater oasis in the southern Nefud during the transition from the Terminal Pleistocene to the Early Holocene.

2. Site location and description

The site of Al-Rabyah is located at the western end of a large basin near the town of Jubbah, in the southern Nefud desert of northern Saudi Arabia (Fig. 1). The area is bounded to the north and south by extensive fields of barchan dunes, some of which attain heights of up to 60 m, and to the east and west by a belt of sandstone jebels. The site is situated approximately 300 m from the eastern flank of Jebel Umm Sanman (Fig. 2), which attains a height of ~400 m above the basin floor and has sheltered the adjacent basin from infilling by the eastward transport of aeolian material. Consequently, preserved Terminal Pleistocene–Early Holocene sediment sequences are exposed across the basin floor.

The site is one of several mounds of lacustrine and palustrine sediments, predominantly marls and silty sands, capped by highly indurated calcretes. These crop out up to ~2 m above the surrounding partially deflated land surface, which dips gently to the SSW and is primarily composed of pale, fine–medium aeolian sands of mixed lithologies and iron-rich quartzitic coarse sands. The cemented calcrete capping the Al-Rabyah mound has protected a sequence of 16 sedimentary units (Fig. 2), one of which preserved a stratified archaeological assemblage. Similar inverted relief features armoured by calcrete crusts have been observed in other arid regions, such as Egypt (Aref, 2003) and Kuwait (Al Shuaibi and Khalaf, 2011).

Archaeological material was also found scattered over a discrete area of the deflated surface in the vicinity of the Al-Rabyah mound. Importantly, no archaeological material could be found on top of this feature. This, taken together with typological similarities to the excavated material, indicates that the surface artefacts were eroded from lateral extensions of the preserved deposits (Fig. 1). Similar situations have been observed elsewhere in the southern Nefud, such as at the Middle Palaeolithic site at Jebel Katefeh (Petraglia et al., 2012).

3. Materials and methods

3.1. Excavation

An 8 m long trench was excavated by hand in the Al-Rabyah mound, exposing *in situ* sediments to a depth of 2.5 m. Sediment removed from the trench was sieved through a 3 mm mesh to ensure full recovery of smaller artefacts. Surface collections of lithic material were also undertaken, covering an area of ~500 m^2 (Fig. 1). Samples were taken from the exposed sections for dating and palaeoenvironmental analyses (see below).