



Unexpected technological heterogeneity in northern Arabia indicates complex Late Pleistocene demography at the gateway to Asia



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ABSTRACT

The role and significance of the Arabian Peninsula in modern human dispersals out of Africa is currently contentious. While qualitative observations of similarities between Arabian Middle Palaeolithic and African Middle Stone Age (MSA) assemblages have been made, these inferences remain untested and often situated within overly broad dichotomies (e.g., 'Africa' versus the 'Levant'), which distort concepts of geographic scale and subsume local variability. Here, we quantitatively test the hypothesis that assemblages from Jubbah, in the Nefud Desert of northern Saudi Arabia are similar to MSA industries from northeast Africa. Based on the quantitative analysis of a suite of metric and morphological data describing lithic reduction sequences, our results show that early and late core reduction at Jubbah is distinct from equivalent northeast African strategies, perhaps as a result of raw material factors. However, specific techniques of core shaping, preparation and preferential flake production at Jubbah draw from a number of methods also present in the northeast African MSA. While two Jubbah lithic assemblages (JKF-1 and JKF-12) display both similarities and differences with the northeast African assemblages, a third locality (JSM-1) was significantly different to both the other Arabian and African assemblages, indicating an unexpected diversity of assemblages in the Jubbah basin during Marine Isotope Stage 5 (MIS 5, ~125–70,000 years ago, or ka). Along with evidence from southern Arabia and the Levant, our results add quantitative support to arguments that MIS 5 hominin demography at the interface between Africa and Asia was complex.

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Introduction

Evidence contributing towards understanding the routes, timing and character of modern human dispersals out of Africa have emphasised increasingly complex scenarios, including multiple human expansions into Eurasia (e.g., Marks, 2009; Petraglia et al., 2010; Rose et al., 2011; Blinkhorn et al., 2013; Boivin et al., 2013). Recent discoveries from the Arabian Peninsula in particular suggest that this region may have played a critically important role in the initial stages of Eurasian colonisation (Groucutt and Petraglia, 2012). Palaeoenvironmental research has demonstrated that Arabia was not an inhospitable desert during several periods of the Middle and Late Pleistocene (Parker, 2009; Vaks et al., 2010; Groucutt and Petraglia, 2012; Rosenberg et al.,

2013). New archaeological finds point towards the presence of a number of separate populations during the critical ~120–40 ka (thousands of years ago) bracket linked to modern human dispersal (Petraglia et al., 2010, 2012; Armitage et al., 2011; Rose et al., 2011; Delagnes et al., 2012; Crassard et al., 2013). However, the definitive assignation of many Arabian Middle Palaeolithic assemblages to *Homo sapiens* or other hominin species has been elusive due to a lack of pre-Holocene hominin skeletal evidence and the absence of detailed, quantitative intra-regional comparative studies of lithic assemblages. These issues have meant that there is a continued lack of consensus on the role of the Arabian Peninsula, both as a frontier between archaic and modern humans, and as a nexus for modern human dispersal into Eurasia. In this paper we provide the first quantitative comparison of Arabian Middle Palaeolithic assemblages with those from a neighbouring region. Specifically, this study compares assemblages from northern Arabia and northeast Africa in the context of testing hypotheses (detailed below) about population dispersals in the Late Pleistocene.

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The Middle Palaeolithic of Arabia

While some role for Arabia as a conduit for modern human dispersals is widely accepted, the possibility of 'archaic' dispersals into Arabia is a more contentious topic. The known southern limit of Neanderthals is a short distance northwest of the Arabian Peninsula, while evolutionary processes to the northeast and east of Arabia are currently very poorly understood. Notwithstanding this continued debate, the number of technologically diverse sites dating to the Middle Palaeolithic in the peninsula is striking and rapidly increasing (Petraglia and Alsharekh, 2003; Petraglia et al., 2010, 2012; Armitage et al., 2011; Rose et al., 2011; Delagnes et al., 2012; Groucutt and Petraglia, 2012; Usik et al., 2013). Nubian Levallois production systems, first defined by Guichard and Guichard (1965) and sometimes described as typical of the north-east African Middle Stone Age (MSA) (see e.g., Van Peer, 1998; Usik et al., 2013), have been identified in a number of regions, including Yemen, the Nejd of central Arabia and in southern Arabia, particularly the Dhofar governorate of Oman, where one instance has been dated to more than ~107 ka (Inizan and Ortlieb, 1987; Rose et al., 2011; Crassard and Hilbert, 2013; Usik et al., 2013). In some cases, these assemblages also appear to have some distinctly Arabian technological characteristics, such as the high frequency of 'dihehedral chapeau de gendarme' striking platforms (see Usik et al., 2013). The presence of this industry in Arabia is widely thought to represent modern human dispersal out of Africa, but its relevance to the successful colonisation of Eurasia is disputed by some (Mellars et al., 2013), owing to the perceived lack of Nubian Levallois reduction elsewhere. However, the recent discoveries of Nubian-like technology in the Nejd (Crassard and Hilbert, 2013), and as far afield as India in the East (Blinkhorn et al., 2013) challenges this view and raises questions regarding the extent and significance of Nubian Levallois methods, both in Arabia and elsewhere.

Other, apparently more geographically restricted Arabian assemblage types have also been hypothesised to reflect African origins. For example, Jebel Faya Assemblage C, with its small handaxes and forms described as 'foliates', is argued to strongly resemble assemblages from northeast and East Africa (Armitage et al., 2011). However, this interpretation has been questioned (Petraglia, 2011). The use of foliates in an Arabian Middle Palaeolithic context has not yet been conclusively documented elsewhere in the region, and other Arabian Middle Palaeolithic localities are culturally ambiguous. Purported typological similarities between southern Arabian assemblages and the Aterian of North Africa have been discounted (Scerri, 2012). At the Jubbah palaeolake sites in the Nefud Desert of northern Saudi Arabia, assemblage affinities both with the African MSA and the Levantine Middle Palaeolithic have been suggested, indicating that technologies present may potentially derive from different source populations (Petraglia et al., 2012). This hypothesis is also reinforced by discoveries at Wadi Surdud in Yemen, where blade and point dominated assemblages may possibly reflect methods descended from those of Levantine hominins (Delagnes et al., 2012). Crassard (2009) likewise sees possible Levantine influences in the Middle Palaeolithic of the Hadramaut region, as well as at Jubbah (Crassard and Hilbert, 2013). While the cultural and biological background of the MIS 3 hominins occupying Wadi Surdud are currently unclear, the key point is that their material culture represents a distinctive localised technology (Delagnes et al., 2012).

Two recent studies further highlight the diversity of the Arabian Middle Palaeolithic (see also extensive background reviews in Petraglia and Alsharekh, 2003; Petraglia and Rose, 2009; Groucutt and Petraglia, 2012). Firstly, a series of systematic surveys in the Huqf region of Oman have revealed a rich Pleistocene

archaeological record (e.g., Jagher, 2009). All material comes from the surface, so there is very weak chronological control. The area seems to primarily feature a long tradition of blade and biface manufacture. It is interesting to note that Nubian cores, so abundant a few hundred kilometres west in Dhofar, are not found in the Huqf area. Indeed Levallois technology as a whole seems to not form a strong component of the Palaeolithic in the Huqf area. These features may suggest that southeastern Arabia did not form a primary Late Pleistocene dispersal route.

The second important discovery relates to a number of Middle Palaeolithic sites at the Mundafan palaeolake in southwestern Saudi Arabia (Crassard et al., 2013). Here a series of technologically similar Middle Palaeolithic assemblages were identified on the surface. These assemblages reflect a combination of preferential and recurrent (particularly centripetal) Levallois reduction. Retouched forms focus on side retouched flakes and blades. The Mundafan sites appear to reflect a similar technology to that seen in contexts such as the East African MSA and the Levantine MIS 5 Middle Palaeolithic (e.g., Qafzeh).

To summarise the emerging state of knowledge of the Arabian Middle Palaeolithic, we can distinguish between lithic assemblages that have been dated to MIS 5 and have been hypothesised to reflect dispersal into Arabia, and those which post-date MIS 5 and represent autochthonous developments within the peninsula.

Testing hypotheses of demographic change

The lithic variability discussed above has suggested to some researchers that the organisation of the technology being used in different geographic areas of Arabia in the Middle Palaeolithic is complex and may reflect different population histories, whose origins potentially include East Africa, northeast Africa, the Levant and Iran (e.g., Crassard, 2009; Rose, 2010; Armitage et al., 2011; Groucutt and Petraglia, 2012). Long-term population continuity is also possible, particularly in southern Arabia (e.g., Armitage et al., 2011; Delagnes et al., 2012). If the latter is the case, there are important implications, both for the nature of the role of archaic and modern human interaction in the region, and for the timing and character of modern human dispersal. However, the different observations described above have not been formulated into testable hypotheses. Thus the detailed, quantifiable comparisons of Arabian assemblages with those from other regions is likely to provide critically needed new insights into the role of the Arabian Peninsula in modern human dispersal out of Africa. In particular, quantified, multivariate analyses allow consideration of the relationship between constellations of features including the presence of various technological methods and concepts without giving typological bias to named industries or techniques. Terms such as 'Levallois' and 'Nubian' have utility in describing a combination of attributes, but an approach based on the comparison of individual attribute states allows features to be compared in a quantified fashion rather than subsuming variability into typological categories.

We present the first assemblage-focused quantitative comparative study for Arabia. The premise underlying such a comparison is that technological similarities, particularly where recurring through several domains of analysis, can be hypothesised to represent shared population histories. Such a notion is consistent with the recognition that various factors (e.g., raw material, contextual ecology), not just demographic ones, influence lithic variability. A body of literature explores the extent to which lithic data can inform studies of prehistoric demography (e.g., Shennan, 2001; Henrich, 2004; Tostevin, 2012; Scerri, 2013a, b). To test the hypothesis that north Arabian assemblages from Jubbah have 'African' technological origins (see Petraglia et al., 2012 for a

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