Journal of Archaeological Science: Reports 11 (2017) 169–188

Contents lists available at ScienceDirect

Journal of Archaeological Science: Reports

journal homepage: www.elsevier.com/locate/jasrep

Research article

Middle Pleistocene lithic raw material foraging strategies at Kathu Pan 1, Northern Cape, South Africa

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ARTICLE INFO

Article history:
Received 28 July 2016
Received in revised form 1 November 2016
Accepted 1 November 2016
Available online xxxx

Keywords:
Middle Stone Age
Fauresmith
Raw material foraging
Lithic analysis
South Africa
Human evolution

ABSTRACT

There is a general trend for increased selectivity and longer transport distances of lithic raw materials for flintknapping in the Middle Stone Age compared to the Earlier Stone Age. The Stratum 4a assemblage at Kathu Pan 1, Northern Cape, South Africa, which dates to ~500 ka, presents a unique opportunity for assessing Pleistocene raw material foraging strategies at the onset of the Middle Stone Age. In this paper, I identify potential primary and secondary sources for the raw materials used for lithic reduction at Kathu Pan 1 (KP1), and quantify raw material variability at nearby secondary sources. Patterns of raw material selection are identified within the KP1 Stratum 4a assemblage and compared to a sample from the underlying Stratum 4b, an Acheulean assemblage, to test for a temporal pattern. Raw material use during the Stratum 4a occupation of Kathu Pan, which is focused on abundant locally available resources for flintknapping, is consistent with the general pattern for Earlier Stone Age foraging strategies, and differs from evidence at some more recent Middle Stone Age sites that show longer transport distances and increased selectivity for certain high-value materials. While many aspects of technology change at KP1 ~500 ka, these technological shifts are not associated with a significant change in the kinds of raw material that were exploited. There are, however, differences in how the raw material was exploited. In Stratum 4a, there is evidence that hominins intentionally exploited the natural banding in banded ironstone formation in order to produce elongated products, and this evidence is lacking in the underlying Acheulean assemblage.

1. Introduction

Lithic raw material studies provide information on hominin and early human selective decisions and foraging strategies. They shed light on the amount of time and energy required to locate and process different raw material types, and on how far and in what direction lithic resources were moved across the landscape. Raw material form and mechanical properties interact with other factors, such as skill, technological style, reduction strategy and intensity, to influence artifact production and use (e.g. Andrefsky, 1994; Archer and Braun, 2010; Bar-Yosef et al., 2012; Brantingham et al., 2000; Braun et al., 2009; Clark, 1980; Eren et al., 2011, 2014; Luedtke, 1992; Lycett and von Cramon-Taubadel, 2015), and lithic artifact manufacture includes making selective decisions about raw material choice. Hominins at some Oldowan sites ~2 Ma selected specific raw materials for the implementation of certain techniques because of the internal structure of these rocks (Braun et al., 2008, 2009; Goldman-Neuman and Hovers, 2012; Stout et al., 2005). There is also clear evidence for raw material selection and differential use at African Acheulean sites (Clark, 2001; Howell et al., 1962; Jones, 1979, 1994; Sharon, 2008; Sheppard and Kleindienst, 1996). Raw material foraging behaviors in the Middle Stone Age (MSA) are generally considered more selective than earlier periods, with more time expended on search, extraction, and processing (Ambrose and Lorenz, 1990; Brown et al., 2009; Brown, 2011; Deacon, 1989; Minichillo, 2006; Vermeersch et al., 1990; Wadley and Mohapi, 2008; Wadley and Prinsloo, 2014). The movement of raw materials across the landscape has important implications for the ranging patterns and resource networks of stone-tool using populations (Feblot-Augustins, 1993; Gamble, 1999). There is evidence from some parts of Africa for raw material transfers that exceed 100 km, and some even extending beyond 300 km, during the MSA (Merrick and Brown, 1984; Merrick et al., 1994; Nash et al., 2013; Negash and Shackley, 2006). Transfers in excess of 100 km during the MSA could have been acquired indirectly, via interaction and trade between groups, or directly, via embedded or targeted acquisition (e.g., Boulanger et al., 2015; Feblot-Augustins, 1993; Speth et al., 2013; Whallon, 2006; Wilkins, 2010). In contrast to the MSA, Acheulean sites do not show evidence for raw material transportation beyond

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http://dx.doi.org/10.1016/j.jasrep.2016.11.002

100 km; most raw material is transferred from <10 km away (Merrick et al., 1994), consistent with the daily foraging radius of hunter-gatherers and direct embedded or targeted acquisition from nearby locations. In summary, there is evidence for predominately local use of raw materials in the Earlier Stone Age (ESA), with increased selectivity and increased transport distances in the MSA. However, because Middle Pleistocene sites with chronometrically dated late ESA or early MSA sites are rare, the timing and nature of these behavioral shifts remain largely unknown.

For early MSA and 'transitional' assemblages, there is evidence for an increased reliance on fine-grained raw material compared to Acheulean assemblages at some sites. In the Kapthurin Formation, a single raw material, phonolitic lava, is used for stone tool manufacture at the Acheulean sites of the Leakey Handaxe Area and the Factory Site, and in contrast, a range of fine-grained lavas are used at the early MSA (i.e., 'transitional') site of Koimilot (Tryon et al., 2005). Tryon et al. (2005) suggest that the shift to fine-grained raw materials in the MSA could be related to suitability of these materials for Levallois reduction (but cf., Eren et al., 2011), or a functional emphasis on tools with sharper but potentially less durable edges in the MSA. At Kalambo Falls, there are increases in the frequencies of fine-grained raw materials in the Sangoan (i.e. 'transitional' ESA-MSA) horizons compared to the ESA horizons (Sheppard and Kleindienst, 1996). At Kudu Koppie, there is also increased use of locally available fine-grained raw materials like chert, chalcedony, and BIF when comparing the MSA deposit to the Late ESA assemblage with handaxes and Levallois technology (Wilkins et al., 2010).

Less is known about distance of transfer for the early MSA or 'transitional' assemblages, but some evidence indicates longer distances compared to the ESA. In the Fauresmith-designated assemblage at Canteen Koppie some jaspelite artifacts contain round white macrofossils similar to jaspelite exploited at the Late Acheulean quarry site of Kathu Townlands ~175 km to the NW (Beaumont and McNabb, 2000; Watts et al., 2016). The closest primary outcrops of this Formation are ~90 km west. Specularite, which is a type of hematite known for its glittery visual display properties, outcrops ~190 km to the west of Canteen Koppie; two specularite pieces were recovered from Fauresmith-designated assemblages, but there is no known alluvial system that could have transported the material east towards Canteen Koppie (Watts et al., 2016).

Some researchers have suggested that the characteristics that distinguish Fauresmith-designated assemblages from Acheulean ones are a consequence of different raw materials. Humphreys (1970) argued that the Fauresmith is not an entity distinct from the Acheulean, but appears to be distinct because of raw material factors. The potential influence of raw material on Fauresmith handaxe form and the production of larger flakes was also recognized by other workers and early on (Van Riet Lowe, 1927). Humphreys (1970) argued that most Fauresmith-designated sites near Kimberley were located away from the Vaal River Valley and associated with Ecca Beaufort geology, where hornfels outcrops and is abundant on the landscape. The Acheulean sites are located mainly in the Vaal River Valley, where Ventersdorp Lava (andesite) and dolerite is available. Humphreys (1970) argued that raw material either determined the nature of or produced an 'advanced' appearance for the Fauresmith-designated assemblages. Hornfels is considered easier to knap and it was argued that it may lend itself to improvements in knapping technique. Humphreys also cites evidence from the stratified Acheulean/Fauresmith/MSA site at Sheppard Island (Goodwin and Van Riet Lowe, 1929:235–243) where both Ventersdorp and Ecca deposits are found. The Acheulean at this site was manufactured on gravel materials (quartzite, 'amygdaloidal lavas', and dolerite), whereas the Fauresmith-designated assemblage was manufactured almost exclusively on hornfels.

Archaeological deposits at Kathu Pan 1 (KP1) in the Northern Cape preserve an ESA to MSA sequence that can be used to evaluate and further examine changes in raw material use in the Middle Pleistocene. In particular, a consideration of raw material foraging strategies represented by Stratum 4a at KP1, which has been chronometrically dated to ~500 ka (Porat et al., 2010) and yields a Fauresmith or early MSA lithic assemblage (Beaumont, 1990, 2004; Wilkins and Chazan, 2012; Wilkins et al., 2012; Wilkins, 2013), permits an assessment of whether there was a significant change compared to the underlying Acheulean (ESA) assemblage, and whether the foraging strategies are most similar to a typical ESA or MSA pattern. The latter is pertinent because the Fauresmith is described as an industry transitional between the ESA and MSA based on the presence of elements diagnostic of both periods (Herries, 2011; Underhill, 2011; Wilkins and Chazan, 2012; Wilkins, 2013). It is also important to identify the raw materials utilized at Kathu Pan to address the question of the raw material and the Fauresmith. If the Fauresmith-designated assemblage was manufactured on different raw materials than the underlying Acheulean, then one could hypothesize that raw material explains the difference between the Fauresmith and Acheulean technology (sensu Humphreys, 1970). If there is little difference between the raw materials, then raw material does not explain the difference.

In this paper, I identify potential primary and secondary sources for the raw materials used for lithic reduction at Kathu Pan 1 (KP1), and quantify raw material variability at nearby secondary sources. Patterns of raw material selection are identified within the KP1 Stratum 4a assemblage and compared to a sample from the underlying stratum (4b) to test for a temporal pattern. The KP1 lithic assemblages are among the first in this region of the Northern Cape that have been subjected to a detailed program of raw material identification and availability, and these data serve as a starting point for future comparative analyses.

1.1. Kathu Pan 1

KP1 is located about 4.5 km northwest of the town of Kathu, in the Northern Cape Province, South Africa (27°39′59 S, 23°00′26 E, Fig. 1). This part of the Northern Cape is located on South Africa's inland plateau, which consists of expansive grasslands, and geologically and ecologically contrasts with the Kalahari Basin to the north and the Great Escarpment to the west, south, and east. There are two prominent hill ranges on this part of the inland plateau that run in a north south direction and about 400 m high; the Langeberg and the Kuruman Hills. Pans and springs are major sources of water in the Northern Cape. These features are abundant around the Kuruman Hills and important determinants of human land use and settlement patterns.

The site of KP1 is located in Kathu Pan, which is situated between the Langeberg Hills ~30 km to the west, and the Kuruman Hills ~7 km to the east (Fig. 1). The Gamagara River is located about 11 km west of Kathu Pan, though minor tributaries run within 4 km of the pan today and the pan itself is part of the Gamagara drainage system. The Gamagara drainage system runs northward until it meets the Kuruman River, which is a tributary of the Molopo River that forms part of the border between South Africa and Botswana. These rivers are dry except after flash floods. About 7 km south is Sishen Mine that is exploiting the extensive iron and manganese deposits located there. The pan is ~0.3 km^2 in area and is perennially flooded by high water table levels and artesian seepage (i.e., springs). Sinkholes into the underlying karstic system have formed and are still forming in and around the pan, and in some of these sinkholes, including KP1, stratified Stone Age deposits have accumulated.

The Kathu Pan complex of sites was first investigated by Peter Beaumont beginning in 1974, and initial excavations at KP1 were carried out between 1979 and 1982 (Beaumont, 1990). These excavations revealed a long, but punctuated ESA-LSA sequence across 5 Strata (Beaumont, 1990, 2004). The uppermost deposits, Strata 1 and 2 contained sparse lithic artifacts consistent with a LSA designation. Stratum 3 contained artifacts consistent with an MSA designation, such as points and prepared cores. Stratum 4a, which yielded large bifaces, points, and prepared cores, was designated as a