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Cemented ash as a receptacle or work surface for ochre powder production at Sibudu, South Africa, 58,000 years ago

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ABSTRACT

The white ash of Sibudu hearths sometimes became cemented and, when this was the case, some of these crusts were used as work surfaces or receptacles, particularly in occupations dating about 58,000 years ago. Substantial deposits of red and yellow ochre powder have been found on these crusts. This suggests that the ochre was not associated with hearths for heat treatment because yellow ochre readily transforms to red even at low temperatures. XRF readings suggest that the ochre used at the site derives from different geological sources. Micromorphological studies imply that phosphatization caused the cementation of the ashes in some hearths, while gypsum growth hardened one of the hearths described here.

1. Introduction

The presence of ochre in Middle Stone Age (MSA) sites excites archaeologists for several reasons. First, the iron-rich minerals and colloids that are loosely called ochre (the term is explained below) have a long history of use. More than 70 pieces of red ochre were found at GnJh-03 in the Kapthurin Formation of East Africa, a site that dates to almost 300 ka ago (McBrearty, 2001:92). At a similarly aged site, Twin Rivers, in Zambia, five different colors of minerals show traces of use (Barham, 2002). Secondly, ochre seems to have had universal appeal in early sites in Africa, the Near East and Europe. Worked red ochre occurs commonly in the Near East at early sites like Qafzeh (Hovers et al., 2003), but manganese dioxide, a black mineral, was more often used by Neanderthals in Europe and red ochre, although present, is uncommon at these sites (D'Errico, 2008). Red is the most frequently recorded color of ochre pieces recovered from southern African MSA sites, even at sites older than ~160 ka, such as Pinnacle Point (Marean et al., 2007). Thirdly, many archaeologists use ochre (specifically red ochre) as a proxy for symbolic behaviour, both among modern humans and Neanderthals (Zilhao et al., 2010). Red ochre is popular as body paint today and it is also used for other means of decoration for ritual occasions (see, for example, Marshall, 1976; Robbins et al., 1998), but it seems to have been used for a wide-range of other purposes in the past. Whether or not all of these had symbolic intent as a common denominator is a topic open for debate, but this issue is not dealt with further here. Red ochre became trapped in some Blombos (South Africa) and Taforalt (Morocco) perforated seashells from rubbing against ochre that was on thread or some other material (D'Errico et al., 2005, 2009) and pigment seems to have been deliberately painted on marine shells from the Iberian Peninsula (Zilhao et al., 2010). Red ochre found on bone awls at Blombos suggests that the mineral may additionally have been involved in the processing of hides at this site (Henshilwood et al., 2001). At Blombos, and also at Klein Kliphuis, ochre was scored so that crosshatching and other geometric patterns formed, usually on a surface that became polished from grinding (Henshilwood et al., 2009; Mackay and Welz, 2008). Unexpectedly, iron oxide nodules were themselves used as hammerstones at Sibudu and ochre deposits were observed on the platforms of some Still Bay Industry flakes associated with the production of bifacial points (Soriano et al., 2009). Ochre powder is, moreover, an ingredient in some, though not all, adhesives used for attaching stone tools to their hafts (Wadley et al., 2009). No doubt other uses of ochre in antiquity remain to be discovered.

Ferruginous rocks that contain iron oxide or iron hydroxide are colloquially called 'ochre'. Hematite (α-Fe_2O_3) is an iron oxide with a hexagonal crystal system and a red to red-brown streak, while yellow ochre - goethite (α-FeOOH) – is a hydrated iron oxy-hydroxide with an orthorhombic crystal system and a yellow to orange-brown streak (Cornell and Schwertmann, 2003; Schwertmann and Cornell, 1991). Replications demonstrate that

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yellow ochre can be successfully transformed to red or shades of red when it is buried in sand under a fire (Wadley, 2009). Temperatures of 300 to 400 degrees C can routinely be obtained 5 cm below a small camp fire and temperatures of close to 300 degrees C can even be achieved 10 cm below the center of a fire. Such conditions are ideal for dehydroxylating iron oxyhydroxides and changing their colors. In one of my experiments an underground temperature of 270 degrees C, maintained for three hours, was sufficient to alter ochre color from yellow to red (Wadley, 2009). In the past, this transformation may sometimes have been deliberate, but on other occasions ochre nodules or ochre residues present on artifacts may have been heated by chance through unintentional proximity to heat; thus fires lit above ancient camp sites can cause post-depositional change to colloids or minerals thousands of years after they were used at a site.

Methods for processing ochre in the MSA have not yet been extensively explored, although I have ground ochre pieces on coarse sandstone slabs to produce ochre powder. The striations and polish produced in this way mimic those on many ochre pieces recovered from archaeological sites. Striations and polish on worked ochre pieces from MSA sites imply that these iron oxides and oxyhydroxides were often rubbed on coarse slabs such as sandstone to extract ochre powder (Wadley, 2005a). Scoring ochre nodules with a sharp stone or piece of bone or wood after they have been ground helps to extract the last available powder. This method leaves incisions on the ochre face. My experiments produced markings that mimic those found archaeologically (Wadley, 2005b). Crushing ochre with rocks produces powder, too, but this product contains coarse particles that might be undesirable, depending on the purpose intended for the powder. The ochre listed in archaeological reports is invariably in the form of modified or unmodified chunks. However, in Sibudu, South Africa, patches of ochre powder are commonplace in the MSA, particularly in association with hearths. An aspect of the powder production is the focus of this paper.

2. Background to Sibudu

2.1. General

Sibudu is a large rock shelter situated on the Tongati River, north of Durban in KwaZulu-Natal, South Africa (Fig. 1). The Middle Stone Age (MSA) is represented by a long and detailed cultural sequence. The MSA sequence at Sibudu includes pre-Still Bay, Still Bay and Howiesons Poort industries with ages of ∼77 ka, ∼70 ka and ∼64–62 ka, respectively, derived from single-grain optically stimulated luminescence (OSL) analysis of sedimentary quartz grains (Jacobs et al., 2008b) (Table 1). Younger MSA assemblages are represented by pulses of occupation with weighted mean ages of 58.5 ± 1.4 ka, 47.7 ± 1.4 ka and 38.6 ± 1.9 ka; the three phases were separated by long hiatuses of 10.8 ± 1.3 ka and 9.1 ± 3.6 ka (Jacobs et al., 2008a,b) (Table 1). No Later Stone Age occupation is present at the site.

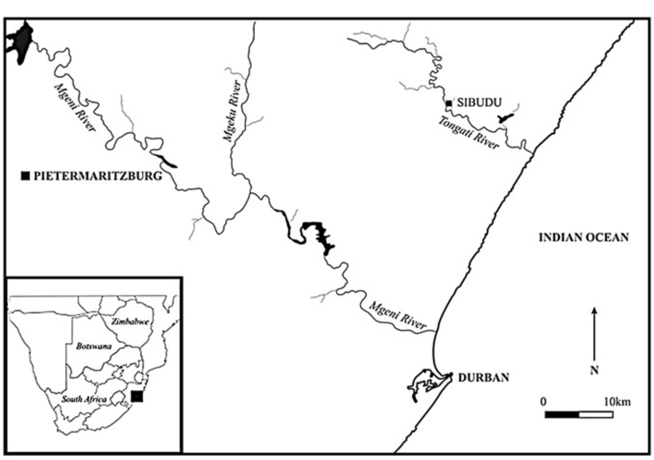

Fig. 1. The location of Sibudu.

Recent multidisciplinary archaeological research has enabled reconstruction of the site's environmental conditions, its cultural succession and its chronology (Allott, 2006; Backwell et al., 2008; Cain, 2004, 2005, 2006; Clark and Plug, 2008; Cochrane, 2006, 2008; Delagnes et al., 2006; D'Errico et al., 2008; Glenny, 2006; Herries, 2006; Jacobs et al., 2008a,b; Lombard, 2004, 2005, 2006a, b; Pickering, 2006; Plug, 2004, 2006; Renaut and Bamford, 2006; Reynolds, 2006; Schiegl et al., 2004; Schiegl and Conard, 2006; Sievers, 2006; Sievers and Wadley, 2008; Villa et al., 2005; Villa and Lenoir, 2006; Wadley, 2004, 2005c, 2006, 2007; Wadley and Jacobs, 2006; Wadley and Mohapi, 2008; Wadley et al., 2009; Wells, 2006).

Sibudu is important not only because of its long, well-dated cultural sequence and its good organic preservation, but also because it provides a cultural depository far from the Cape where most other MSA research is being conducted at coastal or near-coastal sites.

The emphasis here is on the ∼58 ka layers and these post-Howiesons Poort strata incorporate members of sediments that

Table 1
Sibudu pre-Still Bay, Still Bay, Howiesons Poort and post-Howiesons Poort stratigraphic layers, age in ka (from single grain optically stimulated luminescence dating) (Jacobs et al., 2008a,b) and industrial designation.

Layers	Age (ka)	Industry
Co (Coffee)	38.0 ± 2.6	late and final MSA
Bu (Buff)	39.1 ± 2.5	
LBMOD (Light Brown MOD)	49.9 ± 2.5	
MOD (Mottled deposits)	49.1 ± 2.1	
OMOD (Orange MOD)	46.6 ± 2.3	
OMOD-BL (OMOD black lens)	47.6 ± 1.9	
RSp (Red speckled)	46.0 ± 1.9	
RD (Red decomposed)	49.4 ± 2.3	
BSp (Brown Speckled)	57.6 ± 2.1	post-Howiesons Poort MSA1
SPCA		
Bl, Or, Mi		
SS (Speckled Sunrise)	59.6 ± 2.3	
Eb (Ebony)		
Ma, MY, BO		
P (Pox)	59.0 ± 2.2	
BP (Brown Pox)		
Iv, BM, Ch,		
Su, Su2, P1		
G1 (Grey 1)		post-Howiesons Poort MSA2
Ch2 (Chocolate 2)	58.3 ± 2.0	
Y1 (Yellow 1)	58.6 ± 2.1	
B/Gmix (Brown/Grey Mix)	58.2 ± 2.4	
YA (Yellow Ash)		
YA2, YA2(i)		
Brown under YA2(i)		
GR		Howiesons Poort
GR2 (Grey Rocky 2)	61.7 ± 1.5	
GS		
GS2 (Grey Sand 2)	63.8 ± 2.5	
PGS (Pinkish Grey Sand)	64.7 ± 1.9	
RGS (Reddish Grey Sand)	70.5 ± 2.0	Still Bay
RGS2		
LBG (Light Brownish Grey)	72.5 ± 2.0	Pre-Still Bay
LBG2	73.2 ± 2.3	
LBG3		
BS (Brown Sand)	77.2 ± 2.1	