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Contextual approaches to studying unretouched bladelets: A late Pleistocene case study at Sehonghong Rockshelter, Lesotho

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A B S T R A C T

Unretouched bladelets are widely considered archetypes of 'microlithic' assemblages. These small tools are regarded as significant for understanding broader processes of technological miniaturization, especially when they occur in large numbers. However, a major obstacle to comparative analyses of unretouched bladelets is a lack of standardized methods to define and quantify them. Here, we use cluster analyses to test traditional typo-metric definitions for unretouched bladelets and asymmetry quotients to examine diachronic changes in their morphology. Lithic samples were taken from 5 layers dating to MIS 2 (c. 29–12 ka) at Sehonghong rockshelter in highland Lesotho. Our results show that typo-metric size cut-offs 'misclassify' the actual (cluster analysis) frequencies of unretouched bladelets in our samples by as much as 36%. The asymmetry quotients show wide-variation in bladelet morphologies driven more by changes in length and width than thickness. This wide variability in bladelet morphology matches the variability in bladelet cores seen in ongoing technological analyses at Sehonghong, indicating that the 'high-costs' of bladelet production were spread across a range of reduction strategies during MIS 2. Our results have important implications for considerations of technological homogeneity and heterogeneity during MIS 2, and in explanations for the decline of bladelet production at the end of MIS 2 in southern Africa. These results show the merits of contextual, statistical, and size-based approaches to defining and quantifying unretouched bladelets and for understanding their role within broader processes of technological miniaturization.

1. Introduction

The late Pleistocene (~126–10 ka) was one of the most dynamic periods in the technological evolution of Pleistocene foraging populations. During this period, *Homo sapiens* populations entrenched technologically assisted behavior through a series of major innovations, including the use of fire as an engineering tool, the possible development of mechanically projected weaponry, and the use of pressure flaking for the fine manipulation of artefact morphologies (Brown et al., 2009; Lombard and Phillipson, 2010; Mourre et al., 2010). Some of these technological accomplishments (e.g. mechanically projected weapons) may have accompanied late Pleistocene *Homo sapiens* populations in their dispersals out of Africa (Shea and Sisk, 2010). All of these innovations are markers of the high degree of behavioral variability in human populations living during the late Pleistocene (Shea, 2011).

Toolkit miniaturization is one of the most widespread and economically consequential technological processes in the late Pleistocene lithic record (Elston and Kuhn, 2002; Hiscock, 2014). Of all Pleistocene lithic technologies, the vast and rapid spread of lithic miniaturization during the late Pleistocene most resembles the patterning of modern industrial technologies, such as the proliferation of the portable radio (Schiffer, 1991). Miniature technologies enabled our ancestors to surpass size thresholds in core reduction, to exploit a wider range of raw materials more effectively, and to produce more maintainable and reliable composite toolkits (e.g. Mitchell, 2000; Hiscock, 2014). All of these qualities would have been advantageous to foraging societies living through the climatically hyper-variable late Pleistocene (Shakun and Carlson, 2010).

Microliths are the most generally accepted evidence for Pleistocene technological miniaturization. Microliths are variably

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defined as retouched geometric tools, bladelets, and small flakes made from small cores (Leplongeon, 2013). Microlithic technologies' vast latitudinal spread (from Cape Town to the Arctic) shows that their fabrication is an extremely versatile technological strategy (Groucutt et al., 2015; Roberts et al., 2015). Microliths are often found in archaeological sites from cold climates, habitats with low and/or highly variable rainfall, and with subsistence strategies focused on large migratory mammals (e.g. Elston and Brantingham, 2002; Goebel, 2002; Doelman, 2008). In these contexts, the exploitation of sparse and patchy resources, necessarily high residential group mobility, and logistical foraging might have increased selective pressure for lighter, more reliable, multifunctional microlithic toolkits with low discard thresholds (Hiscock, 2006).

Microliths are also associated with contexts of reduced mobility and increased diet width, such as in the Epipaleolithic of SW Asia (Neeley, 2002), or where non-ecological factors, such as conflict in Holocene Australia, encouraged the production of more reliable weapons (McDonald et al., 2007). Potential reasons for the uptake of microlithic technologies in these contexts include an increased necessity for resource maximization (as in SW Asia), reliability in resource procurement (as with large mammal procurement), or increased human mobility (as with sparsely distributed resources). That microlith production proliferates during late Pleistocene times suggests efforts at intensification in many parts of the world, both in areas that led to agriculture and urbanism (SW Asia) and in places where it did not (sub-Saharan Africa and northern Asia). However, because of the variable definitions for microliths, little comparative work has been done to directly and formally compare processes of microlithization in these diverse contexts (but see Torrence, 2002; Lewis et al., 2014).

1.1. *A microlith is not a monolith*

The variable definitions of microliths are major obstacles to comparative research on global processes of technological miniaturization. Many archaeologists view the modification of small flakes and bladelets into geometric forms as a clear example of microlithization (e.g. Kuhn and Elston, 2002). In East Africa, microliths >41 ka are identified by retouch (backed tools), and their production is sometimes explained as an adaptation to changing raw material acquisition practices and the increased micro-economics of human social networks (Ambrose, 2002). Although these backed tools are sufficiently larger than those of the southern African Holocene Later Stone Age (LSA) (c. 10 ka onwards) (see Brown et al., 2012), archaeologists consider their modification via backing enough to signal a microlithic strategy. Some southern African Pleistocene LSA assemblages (c. 40–12 ka) are labeled ‘microlithic’ by virtue of the systematic production of small (<3 cm) unretouched flakes, bladelets and flake-bladelets made from ‘flat bladelet cores’ and single platform cores (Wadley, 1993; McCall and Thomas, 2009: 256). This broader definition of a microlith is widely employed in other parts of equatorial and eastern Africa where microlithic assemblages are commonly identified as small, unretouched, flake assemblages made on locally available quartz using bipolar techniques (Brooks and Robertshaw, 1990; Eren et al., 2012). These examples make clear that the term ‘microlith’ means at least three different things: small retouched pieces, small-unretouched flakes and bladelets. Are unretouched Pleistocene LSA assemblages therefore not microlithic, or just not microlithic in the same way?

When it is employed, the term ‘microlith’ has clearly become a catch-all category for a wide range of miniature tool production strategies (e.g. Burdukiewicz, 2005; Leplongeon, 2013). Understanding broader variability and longevity in processes of toolkit miniaturization is especially complex when small-unretouched flakes are considered as a legitimate manifestation of lithic miniaturization (e.g. Eren et al., 2012). In order to navigate through the complex issue of microlith production variability, we focus on one specific aspect of small tool manufacture, the making of unretouched bladelets. We do this because bladelet production is one of the defining features of the southern African late Pleistocene LSA (Wadley, 1993), yet little is known about bladelet production in this region and time period. Moreover, comparative studies of bladelet technologies in southern Africa are plagued by many of the same issues of definition as are studies of microlithization (see Kaufman, 1986 for a general discussion; also see Section 1.4).

1.2. *The big deal about bladelets*

Bladelets maintain a particularly prominent position in discussions about lithic miniaturization and microliths (e.g. Owen, 1988; Close, 2002; Boëda and Bonilauri, 2006). They are also a defining feature of well-known microlithic stone tool industries such as the Iberomaurusian in North Africa (e.g. Barton et al., 2013; Sari, 2014), and the Robberg in southern Africa (e.g. Klein, 1972; Deacon, 1984; Mitchell, 1995; Wadley, 1996). For some authors, the presence of bladelets is a discriminating factor between major analytical units in the Stone Age, such as the Middle and Later Stone Ages in Africa, and the Middle and Upper Paleolithic in Eurasia (Bar-Yosef and Kuhn, 1999; Le Brun-Ricalens et al., 2009; Mitchell, 2013). In the latter case, the frequency of bladelet production is considered a behavioral feature distinguishing anatomically modern humans from Neanderthals in Western Europe (Faivre, 2012; Benazzi et al., 2015). Higher frequencies of bladelet production (>5% of an assemblage) are said to be characteristic of the behaviors of skeletally modern humans as opposed to Neanderthals (Villa and Roebroeks, 2014). The frequent and systematic production of bladelets is therefore considered a manifestation of ‘modern human behavior’ (Brown et al., 2012). Yet, bladelet production is no more consistent a feature of late Pleistocene assemblages than bead production, rock art or engraved ochre. Bladelet production was one of many strategic options for our Pleistocene ancestors. This variable late Pleistocene record for bladelet production shows why bladelets should not be used as a major evolutionary behavioral marker (see de la Peña and Wadley, 2014 for a similar discussion).

Many of the assumed behavioral differences between makers of blades and bladelets arise from arguments about their economic value. Blades are perceived as being more efficient than flakes in terms of the number of tools per unit of tool stone and the amount of cutting edge produced (e.g. Sheets and Motu, 1972; Bar-Yosef and Kuhn, 1999). However, experimental work has shown that in terms of retouch potential, flakes are more economical than blades (Eren et al., 2008). However, small blade, or bladelet, production increases the efficiency of raw material use by reducing the mass and target surface area of end products (Eren et al., 2008). In southern Africa, bladelets are frequently found unretouched in archaeological assemblages, leaving most of their volume as usable tool edge suggesting a further economizing of raw material (Cochrane, 2008). Bladelets are generally thinner and narrower than blades, and because they can be produced using narrow core faces, they enable knappers to deal with challenging rock types and morphologies (e.g. Doelman, 2008). Although bladelet production takes many different forms, it generally allows knappers to work with different core shapes using little changes in debitage strategy (e.g. platforms, overall morphology, platform angles) (Doelman, 2008). Bladelet production is also commonly thought to produce more standardized end products than flake production (e.g. Chazan, 2001). These combined factors make bladelet technologies a remarkably flexible and economically efficient set of tool production strategies.