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The structure of the Middle Stone Age of eastern Africa

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ABSTRACT

The Middle Stone Age (MSA) of eastern Africa has a long history of research and is accompanied by a rich fossil record, which, combined with its geographic location, have led it to play an important role in investigating the origins and expansions of *Homo sapiens*. Recent evidence has suggested an earlier appearance of our species, indicating a more mosaic origin of modern humans, highlighting the importance of regional and inter-regional patterning and bringing into question the role that eastern Africa has played. Previous evaluations of the eastern African MSA have identified substantial variability, only a small proportion of which is explained by chronology and geography. Here, we examine the structure of behavioural, temporal, geographic and environmental variability within and between sites across eastern Africa using a quantitative approach. The application of hierarchical clustering identifies enduring patterns of tool use and site location through the MSA as well as phases of significant behavioural diversification and colonisation of new landscapes, particularly notable during Marine Isotope Stage 5. As the quantity and detail of technological studies from individual sites in eastern Africa gathers pace, the structure of the MSA record highlighted here offers a roadmap for comparative studies.

1. Introduction

Currently, our understanding of the geography of modern human origins is in a state of flux. Until recently, the earliest fossil evidence for *Homo sapiens* was found in eastern Africa dating to ~195 thousand years ago (ka) associated with Middle Stone Age (MSA) technologies (McDougall et al., 2005). Renewed dating of fossil specimens from Jebel Irhoud, North Africa, now present significantly older evidence for the earliest *Homo sapiens* ca 300ka, broadly contemporaneous with the earliest evidence for MSA technologies across Africa (Hublin et al., 2017; Potts et al., 2018). This is supported by genetic studies from southern Africa which indicate the differentiation of modern human populations within the region at a similar time frame (Schlebusch et al., 2017). As a result, eastern Africa no longer presents a discrete source region for the origins of *Homo sapiens*. Nevertheless, due to its pivotal geographic location, eastern Africa remains a potential source region for modern human dispersals out of Africa, offering access to two key routes of expansion into Eurasia via the Bab al Mandeb strait to Arabia or the Nile Valley to the Levant (Groucutt et al., 2015; Lamb et al., 2018). Biological evidence (fossils; genetic studies) increasingly supports a pattern of geographically structured populations amongst early *Homo sapiens* in Africa (Scerri et al., 2018). As a result, eastern Africa may have played a central role mediating interaction between populations split between northern and southern Africa. However, the ability to resolve the nature and configuration of such population structures within Africa is restricted by the sparse fossil record, poor preservation of ancient DNA in the region and limited ability to extrapolate from contemporary populations. Examining the structure of behavioural records offers a complementary approach to understanding the nature of past population structures within Africa (Scerri et al., 2014). Here, we illuminate the structure and variability of MSA stone tool assemblages across eastern Africa using a rigorous quantitative approach, combining data from a newly collated, comprehensive database of stone tool typology and chronology with geographic and environmental datasets.

The MSA of eastern Africa, broadly spanning 30-300ka, has a substantial research history. Clark (1988) reviews the earlier history of research and offers an overview of MSA occupations of the region. Critically, he notes that although certain aspects of technology are commonplace, such as Levallois technology or retouched

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points, they vary across eastern Africa and no feature can be considered ubiquitous. Clark provided an innovative combination of descriptions of sites and stone tool assemblages from across the region with geographic, ecological and environmental maps to illustrate how behavioural diversity was grounded within a diverse physical environment. This perspective on regional variability remains as relevant as ever and has proved robust to the increasing chronological resolution that has since developed.

Two more recent syntheses of the eastern African MSA record have played important roles in establishing the nature of behavioural variability in the region. Twenty years after Clark's review, Basell (2008) presented a synthesis of chronometrically dated MSA assemblages accompanied by a qualitative overview of assemblage composition. This overview clearly illustrated the diversity of stone tool use, highlighting considerable overlap between assemblages, and again stressing the absence of any single *fossil directeur* of the eastern African MSA. Extending Clark's focus on the interactions between ecology and behaviour, Basell (2008) highlights the placement of MSA sites within ecotonal settings, permitting access to wooded ecologies, in contrast to the previously assumed central importance of savannahs. Furthermore, the roles of volcanism and tectonics are also recognised alongside patterns of climate change as affecting the habitability of the region and permitting the identification of potential regional refugia. In conclusion, Basell (2008) hypothesised that following contraction of MSA occupations during the high aridity of Marine Isotope Stage (MIS) 6, regional expansion and movement into new environments in MIS 5 corresponded with increased mobility and changes in stone tool use, promoted by climatic, volcanic and tectonic push and pull factors.

Tryon and Faith (2013) augment the description of patterns of stone tool technology with the introduction of a quantitative appraisal of the presence/absence of a range of artefact types. Again, descriptions of stone tool technologies broadly echo earlier suggestions for considerable diversity across eastern Africa within different artefact types and the absence of a single unifying type. Notably, these authors suggest that the lack of regionally distinct and derived typological traits is likely to hamper efforts to identify human expansions from the region. Tryon and Faith (2013) evaluated the presence and absence of a range of stone tool and other artefact types using correspondence analysis from dated assemblages, differentiating early (MIS 6 and earlier) from later (MIS 5 and later) assemblages. Alongside considerable overlap between early MSA and some later MSA assemblages, they identify a subset of later MSA assemblages that appear distinct, associated with the presence of blades and backed pieces, as well as beads, grindstones, ochre and anvils. These latter categories appear critical in resolving between earlier and later assemblages (Tryon and Faith, 2013: Fig. 4). In addition, Tryon and Faith (2013) demonstrated a weak but significant negative relationship between geographic distance and assemblage similarity, suggesting that geography does have some effect on the observed patterning. Whether this is due to geographic distance per se, or to habitat differences within the region, remains an open question.

These three reviews highlight a number of common themes in their appraisal of eastern African MSA sites, such as the lack of clear intra-regional structure in behaviour, the importance of ecotonal site locations, and the absence of regionally specific stone tool use. Typology remains a key means to evaluate variability across the breadth of the MSA record, although it is not entirely unproblematic. Not only have a wide range of terms been employed to describe stone tools in the MSA of eastern Africa over its extensive research history, but it is broadly acknowledged that significant technological diversity can exist within stone tool types. Elsewhere in Africa, where a comprehensive, technological study of stone tools across a wide area have been conducted within a single analytical system, it has been possible to resolve distinctive, regionalised patterns of behavioural variability within stone tool types (Scerri et al., 2014). To date, no such analysis has been undertaken in eastern Africa.

The use of a broad typological approach may somewhat limit the detail of insight into the precise nature of inter-assemblage relationships, but in advance of a fine-grained systematic appraisal of technological approaches, it provides the ability to objectively compare large numbers of sites and to elucidate generic patterns. Any quantitative archaeological analysis faces a trade-off between resolution at the assemblage scale and the number of assemblages that are available for inclusion. The presence/absence approach developed by Tryon and Faith (2013), and extended considerably below, sacrifices fine-scale resolution in favour of analysing the largest possible number of assemblages. This approach is particularly apposite for the eastern African MSA, as it has been established by numerous authors that there exist no 'typical' assemblages that fully characterise this region and period (such as the Aterian of North Africa or Howieson's Poort of South Africa [e.g. Clark, 1988; Tryon and Faith, 2013]). The goal of this paper is to build upon these previous syntheses of behavioural variability in the MSA of eastern Africa by extending the application of quantitative approaches. In particular, we aim to illuminate the structure of eastern African MSA behaviour, in terms of the typological composition of stone tool assemblages, the variability of site locations with regards to their geographic and environmental features, and how these change through time.

2. Datasets

A broad synthesis of published literature reporting MSA sites was undertaken to compose the dataset for the proposed analyses. Where possible, this involved consulting primary reports on stone tool assemblages, although in rare instances this was not possible. In order to produce as large a database as possible, typological data were also synthesised from secondary sources, principally Basell (2008) and Tryon and Faith (2013), and details of site locations were collected. Chronological data for the assemblages was also collated, but the presence of secure dating was not a prerogative for inclusion within the dataset.

Typological terminology used to report MSA assemblages from eastern Africa has varied considerably over the region's extensive research history. In part, this may have stemmed from theoretical differences underlying the methods and goals of stone tool analysis: whether types represent finished tools for either cultural or functional purposes, or whether they occur as points within a reduction continuum. Other factors include the introduction of formal definitions of key technological systems, such as Levallois methods (Boeda, 1994), post-dating the excavation and reporting of key sites. Finally, there is considerable variation in the level of detail available on MSA assemblages, ranging from very basic typologies simply indicating proportions of cores, flakes, tools and debris, to detailed technological descriptions resulting from chaine opératoire studies (e.g. Douze, 2012).

The goal here is not to present a new composite typology for studying eastern African MSA assemblages, but to homogenize methodologically diverse reports of stone tool assemblages into a single framework for analysis; this is essential for a thorough examination of the structure of behavioural diversity in the region. Rather than using the typology as an immutable representation of past behaviour, we use it to structure our analysis, and note that tensions within and between typological categorisations may offer profitable lines of future enquiry. Typologies reported frequently conflate reduction methods (e.g. blade production), artefact form (e.g. denticulate), and artefact function (e.g. chopper). This mixture