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Approaches to Middle Stone Age landscape archaeology in tropical Africa

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ABSTRACT

The Southern Montane Forest-Grassland mosaic ecosystem in the humid subtropics southern Rift Valley of Africa comprised the environmental context for a large area in which modern human evolution and dispersal occurred. Variable climatic conditions during the Late Pleistocene have ranged between humid and hyperarid, changing the character of the ecosystem and transforming it at different points in time into a barrier, a refuge, and a corridor between southern and eastern African populations. Alluvial fans presently blanket the areas adjacent to major river systems, which were key areas of prehistoric human habitation. These sets of variables have created conditions that are both challenging and advantageous to conduct archaeological research. Lateritic soil development has resulted in poor organic preservation and facilitated insect bioturbation, which has demanded an integrated micro-macro scale approach to building a reliable geochronology. An integrated field and analytical methodology has also been employed to identify the nature and degree of post-depositional movement in alluvial deposits, which preserve a wide range of spatial integrity levels in buried stone artifact assemblages between 47 and 30 ka in Karonga, northern Malawi. This paper describes the methodological advances taken toward understanding open-air Middle Stone Age archaeology in sub-tropical Africa, and explores the inferential potential for understanding Pleistocene human ecology in the important southern Rift Valley region.

1. Introduction

The Middle Stone Age (MSA) of Africa shows some of the earliest clear archaeological evidence for many behaviors that are either unique to or especially well developed in modern humans (d'Errico and Stringer, 2011; McBrearty and Brooks, 2000). As a typo-technological unit, the MSA is defined by the significant presence of prepared core technology, nascent forms of symbolic expression and the absence of large bifacial tools such as handaxes, spanning

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from ca. 285 thousand years ago (ka) to ca. 20 ka (Conard, 2015; Sahle et al., 2014; Tryon and Faith, 2013). Much of the evidence for the MSA comes from more temperate parts of Africa, both in the southern (Brown et al., 2012; Henshilwood et al., 2011; Lombard, 2011; Porraz et al., 2013) and northern parts of the continent (d'Errico et al., 2009; Linstädter et al., 2012). This record is also heavily biased toward the long archives of human behavior that are found in cave or rock shelter sites.

There is a need to advance methods to understand the depositional and taphonomic context for open-air MSA sites in tropical and subtropical ecosystems. New geoarchaeological approaches are tailored for these situations and have equipped researchers with tools to investigate the environmental backdrop of cultural diversifications by MSA people that were critical in defining the trajectory of Pleistocene human evolution. Herein, we present a multi-tiered approach to the interpretation of open-air MSA archaeological sites in alluvial settings in Karonga, northern Malawi, which draws from well-vetted techniques but combines them in novel ways. High-resolution spatial analysis using 3-dimensional (3D) Geographical Information Systems (GIS) and refitting from piece-plotted archaeological excavations reveal whether archaeological deposits have been disturbed by secondary processes. Micromorphological data provide information about modes of deposition, pedogenesis and bioturbation, contextualizing their potential to alter the Optically Stimulated Luminescence (OSL) dosing environment used to estimate the ages of the sites. Integration of data from phytoliths allows for cross-referencing of macro- and micro-scale sedimentary environment observations, and developing terrestrial vegetation histories. Finally, by comparing data from archaeological contexts with a nearby high-resolution lacustrine paleoenvironmental record from Lake Malawi and adjacent regions, a model can be developed that explains human behavioral patterns in response to climatic changes throughout the Late Pleistocene. We describe these approaches to MSA sites in the tropics with specific reference to Chaminade II (CHA-II), which is typical of many archaeological sites in the Karonga District in its depositional context and artifactual composition.

2. Background

The southern Rift Valley of Africa is a critical, yet little-explored geographic transition zone for understanding the evolution and diversification of MSA populations across Africa. Near the modern town of Karonga, Malawi (Fig. 1), pioneering research by Desmond Clark and Vance Haynes in the 1960s (Clark and Haynes, 1970; Clark et al., 1970, 1966), followed by more intensive geoarchaeological investigations by Zefe Kaufulu (1983, 1990), demonstrated the high potential of the region's archaeological record to reveal information about the MSA in tropical and subtropical ecosystems. However, the lack of absolute ages made it difficult to tie the human behavioral record to the significant paleoenvironmental changes the area experienced over the course of the Late Pleistocene (Cohen et al., 2007; Lane et al., 2013; Scholz et al., 2011, 2007). More recently, work by the Malawi Earlier-Middle Stone Age Project (MEMSAP) has revised interpretations of sites first studied by Clark and colleagues (Clark and Haynes, 1970; Clark et al., 1970, 1966) describing the spatial-temporal distribution and attributes of artifactual assemblages and artifact raw material sources near Karonga (Thompson et al., 2014, 2012, 2013; Wright et al., 2014; Zipkin et al., 2015).

Tropical and subtropical regions of Africa are located within the most productive biotic environments in the world (Grace et al., 2006), and, as such, present a unique cluster of opportunities and pitfalls for archaeological research. In addition to intensive and sustained agriculture and other land use practices that involve movement of sediment, bioturbation from termites (e.g., Crossley, 1986; McBrearty, 1990; Mercader et al., 2003), burrowing mammals and lizards, and fluvial winnowing (Schick, 1987; Yellen, 1996) all provide opportunity for disturbance of primary archaeological deposits. In addition, groundwater percolation (Schick, 1987; Sitzia et al., 2012; Stewart et al., 2012; Yellen, 1996), biomantle formation ("soil upbuilding"; Ahr et al., 2012; Araujo, 2013; Johnson et al., 2005; Phillips and Lorz, 2008; Van Nest, 2002) and pedogenic processes translocating minerals down the solum (Eren et al., 2014; Feathers, 2002; Gliganic et al., 2012) have been identified as potential factors affecting site taphonomy.

In northern Malawi, downwarping and fault-trough sedimentation during the Middle to Late Pleistocene (Betzler and Ring, 1995; Ebinger et al., 1993) in combination with variable climatic conditions (Crossley, 1984; Stone et al., 2011) activated alluvial fans and streams, which created riparian environments attractive to MSA people (Thompson et al., 2014, 2012; Wright et al., 2014). The remains of MSA activities in the Karonga region are embedded in remnants of an alluvial fan system known as the Chitimwe Beds (Clark and Haynes, 1970; Clark et al., 1970; Kaufulu, 1990; Wright et al., 2014). Alluvial fans can rapidly bury occupation surfaces and rework older deposits. Because many of the sediments have been subsequently modified through pedogenesis and bioturbation, artifacts can change their stratigraphic position and are often found in association with paleosols that formed at a later date. The materials and methods employed by MEMSAP were tailored to address these specific taphonomic conditions of the Karonga sites, which fall within an equatorial savanna with a dry winter (Aw) of the Köppen-Geiger classification system (Kottek et al., 2006).

3. Materials and methods

3.1. Landscape-scale geomorphology and site-scale sedimentology

The focus of the geomorphologic, sedimentologic and pedologic investigation concentrated on the identification of source-to-sink processes and areas of sustained landform stability in which human activity would have been plausibly preserved. Archaeological surveys and test pitting were conducted across an alluvial fan west of the modern-day town of Karonga, Malawi, which resulted in the identification of CHA-II (Fig. 1). Recording of sedimentary lithofacies involved description of sorting, bedding features, particle sizes, inclusions, rounding properties, hardness, plasticity and unit boundaries. Pedologic recording accounted for relative degrees of weathering by recording soil color, structure and the presence of authigenic and translocated minerals in the solum. Geomorphologic reconstruction of landform evolution was made by combining sedimentologic and pedologic analyses from numerous test units in combination with topographic maps. Sampling for OSL dating, micromorphology and phytolith analyses was performed to constrain environmental conditions within a dated context.

3.2. Excavation and artifact analysis

The CHA-II site (9.955° S, 33.892° E) was excavated in 2011 and 2012. A large eroded surface to the west of CHA-II contained 100,000s of artifacts in a series of drainage gullies that incise the Chitimwe Beds. CHA-II was mechanically excavated as a 4 × 50 m trench to a depth of 2 m, and then excavated by hand within a central 2 × 32 m area. The mechanically excavated sediments were placed in ten piles of 40 m^3 each, sieved, and found to confirm an average artifact density of 1 per m^3. The center trench was excavated in natural stratigraphic units and 1 × 1 m squares to a maximum total depth of 4.6 m, producing in total more than 10,000

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