Micromorphology of Middle to Later Stone Age sites in northern Malawi

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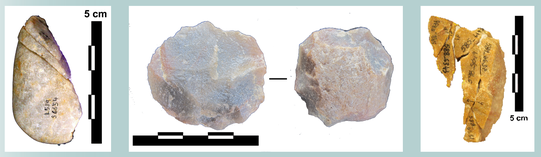
Introduction

Alluvial fan and fluvial deposits along the shores of Lake Malawi are known to be very rich in Middle and Later Stone Age artefacts. In the 1960s, several sites were excavated under the direction of J. D. Clark. Recent excavations by MEMSAP (Malawi Earlier-Middle Stone Age Project) involved reinvestigation of Clark's excavation areas (Mwanganda's Village, Chaminade, see Figure 1) and moved onward with new excavation areas, based on results from test pits and geological trenches. Similarities in the formation processes of artefact-bearing horizons suggest that humans may have preferentially selected certain environments within the landscape. The site of **Mwanganda's Village I** (MGD I) lies on the third of a series of four river terraces dating from the Middle Pleistocene to the Holocene (Fig. 2). The ***in situ* Middle to Later Stone Age deposit** of MGD I dates to **before and during the Last Glacial Maximum**, providing an opportunity to examine **human behavior in light of changing paleoenvironmental conditions**.



Conjoining sets of lithic artefacts from MGD I show that reworking was limited

Methods

We use micromorphology to reconstruct detailed site formation histories for the sites in the Karonga district. Micromorphology is the study of oriented blocks of intact sediment in thin section using a petrographic microscope under plane polarised light (PPL), crossed polarised light (XPL), blue light fluorescence, and oblique incident light (OIL). From the analyses of the composition and fabric of sediments and soils, interpretations can be made about the processes responsible for its formation and post-depositional modification. The method is especially well-suited for the study of features indicative of post-depositional processes such as pedogenesis, groundwater weathering and bioturbation. Identification of microscopic features allows us to assess the impacts of these processes on the deposits and archaeological materials. Mineral and material identifications in thin section are supplemented by Fourier transform infrared (FTIR) spectroscopy.

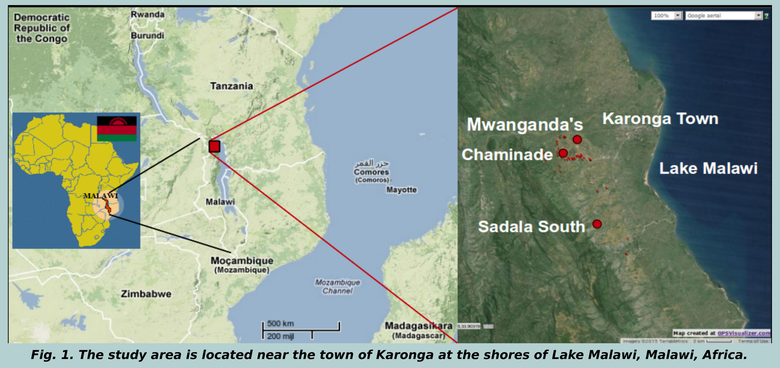


Fig. 1. The study area is located near the town of Karonga at the shores of Lake Malawi, Malawi, Africa.

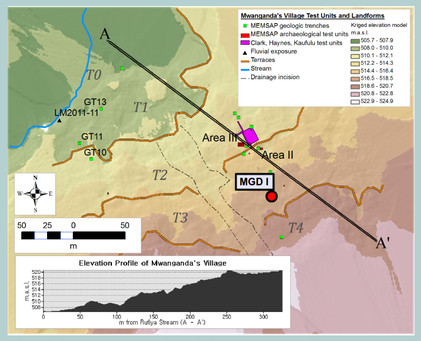
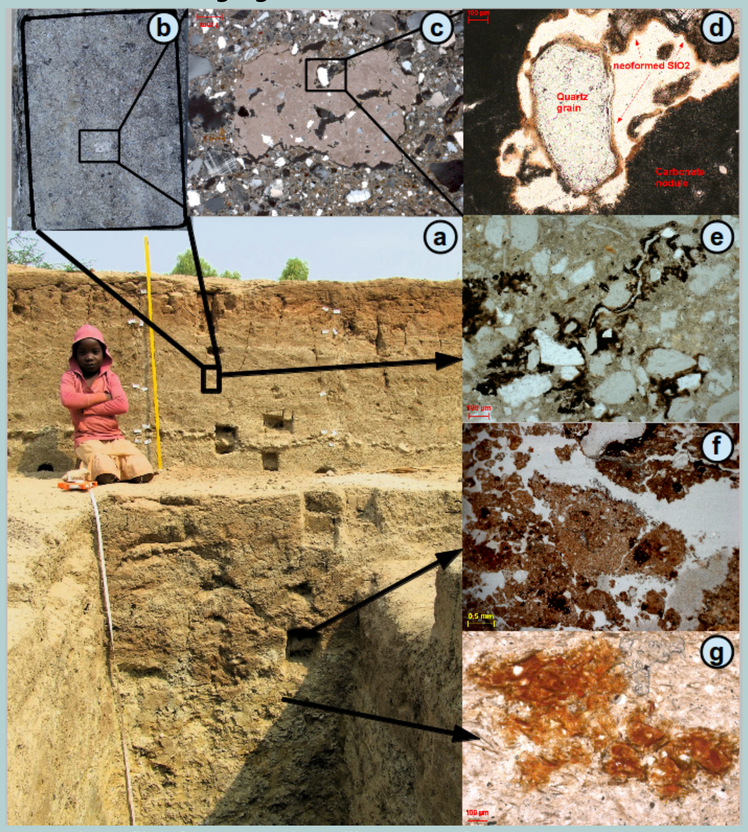


Fig. 2 Elevational model of Mwanganda's Village showing the locations of the excavation areas MGD I and MGD II on the 2nd and 3d terraces of the Chirambiru Creek. Wright et al. 2014.

Changing environmental conditions



a: South profile of Mwanganda's Village I. Artefacts are concentrated just on top of the cobble layer. b: an impregnated slice from a block sample with a carbonate nodule. c: micrograph of the same micritic carbonate nodule (xpl). d: quartz grain inside carbonate nodule with a coating of amorphous silica. e: iron/manganese hypocoating. f: micrograph showing secondary carbonate, coating Fe/Mn stained material, indicating changing environments.

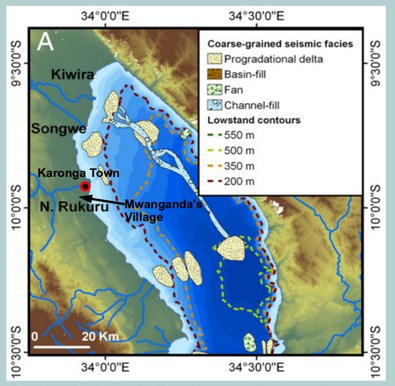


Fig.3 Key bathymetric lowstand contours (meters below modern lake level) illustrate how megadroughts reduced the water balance to ca. 5% of its present level as recently as 90 ka. Lyons et al. 2011.

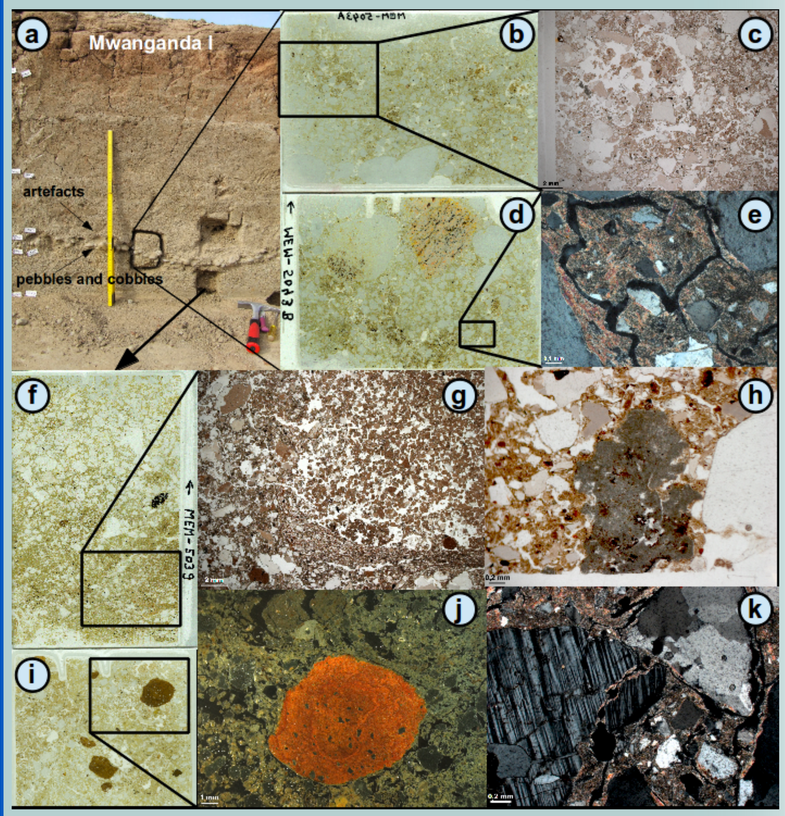
Human response to extreme climate change

Data from sediment cores collected in Lake Malawi indicate a series of **megadroughts** during the Late Pleistocene (Scholz et al. 2007, 2011) (Fig. 3). Our goal is to compare the available paleoenvironmental sequence from the drills with data obtained directly from the terrestrial record at archaeological sites. Post-depositional features observed in thin section are especially informative about the paleoenvironment, as they are associated with an ancient water table and soil formation. This study will allow us to investigate the role that **dramatic shifts in past local and regional environments played in the behavioral evolution of humans in the MSA.**

Conclusions

Mwanganda Area I shows a complex relation of **soil formation and groundwater processes**, reflected in **carbonate formation** and **redoximorphic features**. Field observations and micromorphological analyses lead to the conclusion that the pebble and cobble layer at Mwanganda I represents an **abandoned streambed**, likely frequented by Stone Age people who exploited this type of location for lithic raw material and riparian resources.

Artefacts on a streambed deposit



a: The upper part of the profile at MGD I in which many lithic artefacts were found. b: Scan of a thin section (6x9 cm) from the artefact horizon with some pebbles in the lower part. Loamy sand deposits above and below the streambed are similarly affected by bioturbation (c, g), pedogenic carbonate dissolution and precipitation (h), as well as by translocation of iron oxides and clays. Below the streambed (d), a clay-rich subangular blocky microstructure, formed by repeated wetting and drying (e), is preserved where soil faunal activity has been restricted. Iron stained disorthic nodules of fine clay derive from lagoonal deposits similar to units underneath and indicate local erosion and redeposition.

Literature:
Lyons, R. P. et al. (2011). Late Quaternary stratigraphic analysis of the Lake Malawi Rift, East Africa: An interpretation of drill-core and seismic-reflection data. *Palaeogeography, Palaeoclimatology, Palaeoecology* 303:20-37.
Scholz, C. A. et al. (2007). East African megadroughts between 135 and 75 thousand years ago and bearing on early- modern human origins. *Proceedings of the National Academy of Science* 104:16416-21.
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