



Preliminary report on the archaeological investigation of the Mara Region, southeast of the Lake Victoria Basin, Tanzania

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ABSTRACT

This study presents findings from archaeological research conducted in the Mara Region between 2023 and 2024 as part of a University of Dar es Salaam field school. It centers on excavations at the Mkirira, Balima, and Nyabekwabi rock shelter sites in the Musoma and Butiama districts within the southeastern Lake Victoria Basin (LVB). Despite its potential for significant discoveries, this area remains one of the most underexplored in the country. The initial survey and excavations uncovered artefacts, including Later Stone Age (LSA) lithics, pottery, beads made from ostrich eggshells, ochre, remains of wild animals, and exotic obsidian. These findings indicate that hunter-gatherers in the basin engaged in hunting and fishing while living in open-air sites and rock shelters. The isolated discovery of a potsherd with a smooth fabric at Nyabekwabi warrants further investigation to determine whether it belongs to the Kansyore tradition or represents a different cultural affiliation. Moreover, the presence of Kansyore and Iron Age pottery traditions such as Urewe and Lanet highlights mobility, technological, and land-use behaviours across the LVB and surrounding regions of Tanzania, Kenya, and Uganda, providing crucial insights into human adaptive strategies.

Keywords: Later Stone Age, Iron Age, human adaptive strategies, Mara Region, Southeast Lake Victoria Basin

1. Introduction

The Later Stone Age (LSA), from ~45 000 years ago, provides an understanding of the complex behavioural shift of *Homo sapiens* (Mehlman 1989; Tryon et al. 2018). This period is characterised by technological innovation towards miniaturisation of lithic artefacts, diverse subsistence strategies – including a focus on aquatic resources – increased symbolic behaviour and material culture, and emerging complex social organisation (Ambrose 1998; Kessy 2005; Seitsonen 2010). Research on the LSA in East Africa has a long history, beginning in the 1920s with pioneering work by Wayland (1924) and Leakey (1929) in Uganda, Kenya and northern Tanzania (Kessy 2005). Early investigations were largely descriptive in nature, but they established a foundation for subsequent explanatory and behavioural approaches (Kessy 2005). Over time, LSA research in East Africa has expanded thematically, particularly in relation to understanding the transition from the Middle Stone Age (MSA) to the LSA. Well-stratified sites such as Kisese II and Mumba rock shelters in Tanzania (Mehlman 1989; Tryon et al. 2018), and Enkapune ya Muto in Kenya (Ambrose 1998), preserve cultural sequences that are central to understanding technological change, behavioural variability, and the Pleistocene hunter-gatherer adaptations within broader regional and interregional contexts (Tryon et al. 2012).

Despite these advances, significant gaps remain in our understanding of the Pleistocene LSA, particularly in the Lake Victoria Basin (LVB). Compared to intensively studied regions such as the East African Rift System (EARS), LSA research in the LVB remains limited, spatially uneven, and poorly

integrated into regional comparative frameworks (Dale & Ashley 2010; Seitsonen 2010). The resulting patchy archaeological record obscures a broader understanding of patterns of human interaction within and beyond the lake basin. Furthermore, many Pleistocene LSA sites in East Africa suffer from inadequate stratigraphic control and limited absolute dating, leading to inconsistent chronological frameworks. These challenges continue to constrain interpretations of Pleistocene LSA cultural dynamics and highlight the need for systematic, well-dated research in underexplored regions such as the LVB.

Human settlement in the LVB dates back to the Pleistocene ~1.7 ma (Finestone et al. 2024), and has been characterised by one or more significant desiccation events that likely influenced patterns of habitation, with a prominent event dated to ~17-18 ka (Tryon et al. 2012; Temoltzin-Loranca et al. 2023; Wienhues et al. 2024). During and following this, the region was occupied mainly by hunter-gatherers with LSA technologies, categorised into Aceramic and Ceramic groups, the latter being noted for the unique Kansyore pottery (Dale & Ashley 2010). Kansyore pottery is one of East Africa's oldest and most enduring traditions. It was first identified in 1967 by Susannah Chapman on Kansyore Island, in western Uganda (Chapman 1967; Kyazike 2019; Jones & Tibesasa 2022). Since then, a plethora of Kansyore sites have been discovered across the region, spanning lake basins and adjoining areas, including inland regions (Prendergast 2010). Prominent lake basin sites with Kansyore pottery include Gogo Falls, Usenge 3, Wadh Lang'o, Kakapel, and Luanda in Kenya (Robertshaw 1991; Lane et al. 2007; Ashley 2008; Prendergast 2010; Goldstein et al. 2025), along with Kansyore Island, Ndali Crater, Lugala A, Namaboni B and Namundiri A in Uganda (Kyazike 2019; Tibesasa 2021; Jones & Tibesasa 2022; Schimdt et al. 2024), along with Chole and Capri Point in Mwanza, Tanzania (Fig. 1) (Soper & Golden 1969; Robertshaw 1991; Lane et al. 2007; Prendergast 2010; Prendergast et al. 2014; Jones & Tibesasa 2022). Furthermore, hinterland sites such as the Mumba and Nasera rock shelters and Seronera in the Serengeti Gol Kopjes also contained communities that utilised Kansyore pottery (Bower 1973, 1991; Bower & Chadderdon 1986; Prendergast et al. 2014). Kansyore is often found among hunter-gatherers and fishers, and most scholars consider Kansyore pottery to be a product of the Ceramic LSA, made by hunter-gatherers whose subsistence strategies primarily relied on wild animals and fishing, in contrast to those who depended on domesticates (Dale & Ashley 2010).

While Kansyore pottery has largely been associated with hunter-forager communities, sites across the LVB have also yielded evidence of Early Iron Age (EIA) ceramics, most notably Urewe pottery, named after a site in Kenya. Urewe or 'dimple-based' pottery is commonly associated with Bantu-speaking people. It is widespread across the Victoria Nyanza at sites such as Gogo Falls in Kenya, across southern and western Uganda, and in Karagwe and the northern Mara areas of Tanzania (Robertshaw 1991; Lane 2004, 2013; Culley et al. 2021; Schmidt et al. 2024; Goldstein et al. 2025). Similar ceramic traditions have been reported in Rwanda and Burundi. The earliest dates for Urewe pottery range between ca. 2550-1000 BP, and this tradition has long been interpreted as marking a transition from LSA hunter-foraging to more sedentary farming, especially for communities in the LVB (Clist 1987; Lane 2004; Lane et al. 2007; Goldstein et al. 2025). At Gogo Falls, for example, the Urewe pottery has been found to co-exist with the historic Luo ceramic tradition, Middle Iron Age (MIA) wares, and the Pastoral Neolithic (PN) pottery traditions, including the Elmenteitan and Akira (Lane 2004, 2013; Schmidt et al. 2024). A subsequent Transitional Urewe phase has been recognised in the East African lake regions (Posnansky et al. 2005; Pawlowicz 2011; Schmidt et al. 2024) and is dated to the late first millennium CE (Posnansky et al. 2005). Transitional Urewe appears to have developed from earlier Urewe traditions, and in some cases, both wares seem to have been produced by the same cultural groups (Pawlowicz 2011).

Subsequently, Iron Age (IA) ceramic traditions linked to iron-using and agricultural communities – commonly referred to as the Pastoral Iron Age (PIA), which spans from 1200 to 300 BP; the Middle Iron Age (MIA), dating approximately from 300 BP to AD 1300; and the Late Iron Age (LIA), covering the period from AD 1000 to 1850 – have been documented in East Africa, including within the Lake Victoria Basin (LVB) (Bandama 2013; Lane 2013; Schmidt et al. 2024; Goldstein et al. 2025). PIA sites, such as Deloraine, Lanet, Hyrax Hill, and Gogo Falls, have been documented in Kenya (Lane 2013; Schmidt 2024). In Uganda, evidence of the PIA occurs at Kabata, Rwanwenzi, and Kyakatama

(Schmidt et al. 2024). Similarly, other PIA artefacts have been documented at Uvinza, Iramba, Chole, and Capri Point in Tanzania (Posnansky 1961, 1967; Soper & Golden 1969; Sutton 1987; Lane 2013; Schmidt et al. 2024). However, most archaeological research in the LVB occurs in Kenya and Uganda, while investigations in Tanzania are notably limited. As a result, the comparative dataset on human adaptive strategies within the LVB remains insufficient, which this study seeks to address.



Figure 1. Selected archaeological sites in the Lake Victoria Basin and its hinterland.

2. Overview of archaeological research in the study area

The Mara Region forms part of the eastern LVB; however, most archaeological research in the area has focused on the PN communities of the interior dry grasslands, particularly the Serengeti National Park (SENAPA). The historical progression of archaeological research within the Mara Region commenced with the endeavours of John Bower in the SENAPA (Fig. 1), who subsequently collaborated with Thomas Chadderdon (Bower 1973; Bower & Chadderdon 1986). Their research meticulously documented PN sites, which revealed substantial evidence of both domestic and wild animal remains, potsherds, lithic artefacts, ochre, and stone enclosures, all of which were dated between 7200 and 4900 years ago. Following this, Fidelis Masao undertook further archaeological investigations to record rock art on Lukuba Island, situated 10 km northeast of Musoma urban. Audax Mabulla also conducted analogous thematic research across the Musoma rural, Musoma urban, and Bunda districts. The former reported parietal art associated with the IA pastoral societies, while the latter documented artistic expressions from hunter-gatherer and PN communities (Masao 1991; Mabulla 2005).

In addition to the excavations conducted in SENAPA, the inaugural excavations in Musoma rural were conducted by Mwitondi in 2012, focusing on the Nyamang'ora and Nyankingi rock shelters within Kasoma village. This research established two LSA assemblages: Aceramic and Ceramic. The Aceramic culture was dated to $23\,251 \pm 86$ BP (Wk-31385) based on a charcoal sample (Mwitondi 2012). The Ceramic LSA was characterised by Kanyore sherds and lithic artefacts. It is noteworthy that no

bone or bead remains were identified within the Aceramic LSA assemblage. The ongoing research initiatives in the Mara Region were started in 2023 by the Department of Archaeology and Heritage Studies at the University of Dar es Salaam as part of a field school. In 2024, these efforts received funding from the Gerda Henkel Stiftung. The primary objective of the fieldwork is to collect data that facilitates the reconstruction of human adaptive strategies in the southeastern LVB and to establish a comparative dataset with other significant sites from the Late Pleistocene and Holocene periods.

Study area

The Mara Region is bordered to the north by Kenya and to the south by the Mwanza, Simiyu, and Shinyanga regions, with the Arusha Region to the east, and the Kagera Region to the west, across the waters of Lake Victoria. The region spans $2^{\circ}30'2.86''\text{S}$ and $35^{\circ}15'39.21''\text{E}$. It comprises seven districts: Musoma Municipal, Musoma, Bunda, Rorya, Butiama, Tarime, and Serengeti Districts (DCs) (Fig. 1). Surveys and archaeological excavations were conducted in Musoma, Bunda and Butiama districts, focused on three granite rock shelters: Balima, Mkirira, and Nyabekwabi (Fig. 2). The Balima site is administratively found in the Buhare Ward in Musoma Municipal, approximately 2 km west of the Musoma-Majita main road and the Buhare Community Development Training Institute (CDTI), and about 4 km north of Lake Victoria. It lies 5 km southeast of the town of Musoma, at $01^{\circ}31'45.1''\text{S}$, $33^{\circ}45'14.1''\text{E}$, with an elevation of 1219 m. The Mkirira rock shelter situated in Nyegina Ward, Musoma District, lies approximately 4 km southwest of the Balima at $01^{\circ}54'22''\text{S}$, $33^{\circ}54'11''\text{E}$, with an altitude of 1226 m. Meanwhile, the Nyabekwabi site is situated in Nyakatende Ward in the Butiama District. It lies 12 km from Buhare CDTI, at $01^{\circ}35'49.812''\text{S}$, $33^{\circ}46'15.06''\text{E}$, with an altitude of 1302 m.

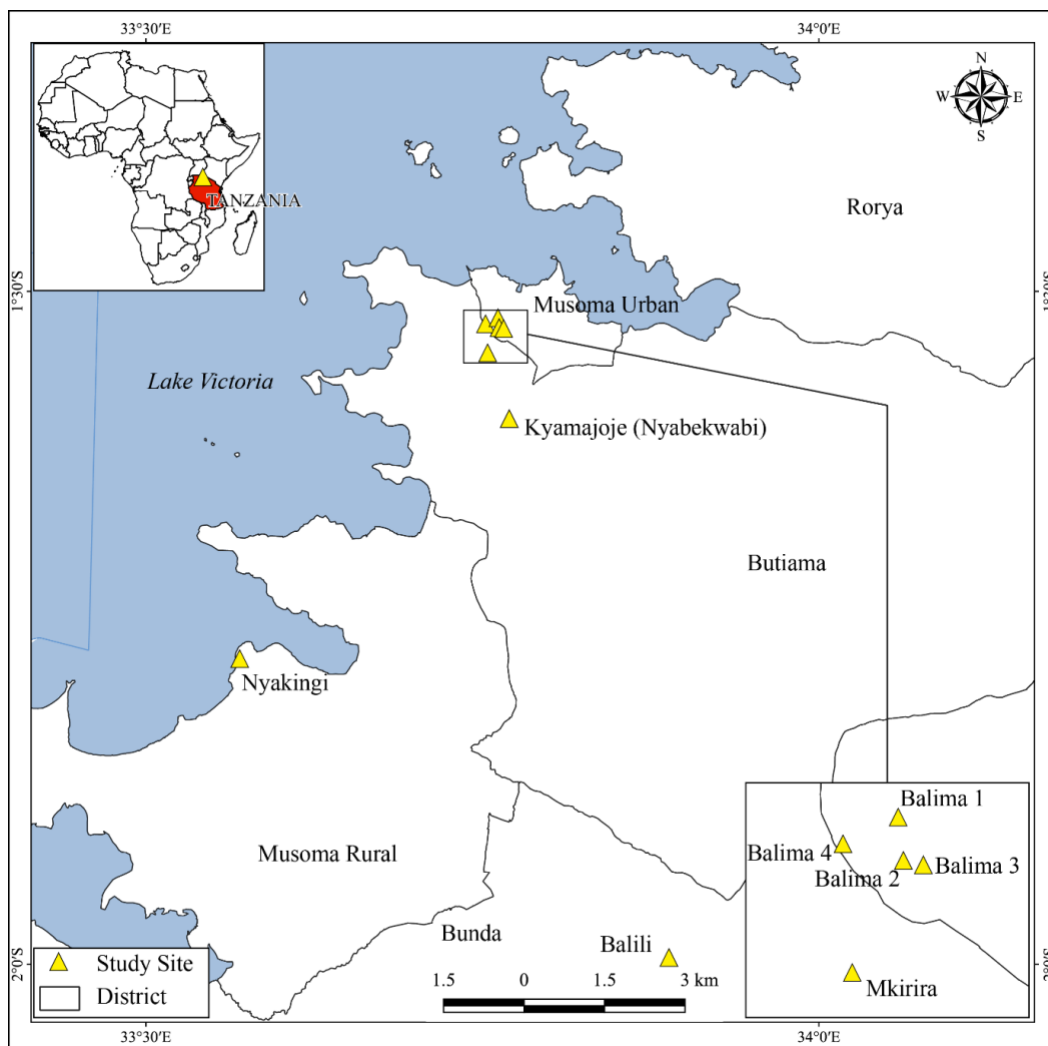


Figure 2. Map of the Mara Region showing the study sites.

The expansive landscapes surrounding the Balima, Nyakatende, and Mkirira rock shelters are sparsely populated, primarily by the Wakwaya ethnic group, whereas the Wajita community predominates in the Musoma and Bunda districts. Other ethnic groups, including the Waluri, Wakurya, and various minorities, also inhabit the region. Historically, the first settlements in Musoma emerged along the shores of Lake Victoria, where access to aquatic resources was easier, and where the sandy soils were more suitable for cultivation using hand tools (National Bureau of Statistics [NBS] 2003); the heavier soils found further inland are challenging for farming. The lake's proximity also facilitated fishing, which supplemented local diets and, through the development of canoes, provided convenient transport over long distances. Oral histories suggest that inland areas were perceived as perilous due to the prevalence of wild animals, particularly predatory species such as lions and leopards, which ultimately influenced their later settlement (Jackson 1970; NBS 2003). Today, the principal economic activities include agriculture, livestock rearing, gold mining, and fishing. Recently, increased quarrying activities (sand, gravel, and stone), such as near the Balima rock shelters, serve to jeopardise the preservation of archaeological sites.

Geology, climate and soils of the study area

The Archaean Tanzania Craton forms the foundational layer of East Africa's crust, extending from central Tanzania to western Kenya and southeastern Uganda (Manya et al. 2007). It consists of two primary terranes: a high-grade metamorphic terrane located in central Tanzania and a low-grade granite-greenstone terrane found in northern Tanzania, southwestern Kenya, and southeastern Uganda (Manya et al. 2006; Mshiu & Maboko 2012). In Tanzania, the area characterised by high-grade metamorphic rocks is the Dodoman Belt, which includes granite, granodiorite, granitic gneisses, and migmatites. The low-grade granite-greenstone terrane includes the Nyanzian and Kavirondian Supergroups, mainly situated south and east of Lake Victoria. The Nyanzian Supergroup comprises two main units: a lower unit of mafic metavolcanic rocks and an upper unit of chemical metasediments, featuring chert, banded iron formation, felsic tuffs and flows, agglomerates, and graphitic shales. Together, the Nyanzian and Kavirondian rocks define the geology of the study area (Manya et al. 2007; Mshiu & Maboko 2012).

The study area features broad, flat valleys that drain gradually into Lake Victoria, interspersed with undulating hills that rise between 1000 and 1500 m above sea level (Jackson 1970; NBS 2003; Mwitondi 2012). The locations are primarily within gently hilly landscapes without deep incisions that might serve as natural sediment traps (Fig. 3). The terrain comprises rugged, often wooded granite hills, which often contain rock art sites, in contrast to the smooth, elongated grassy hills formed by the Nyanzian Supergroup rocks (Manya et al. 2007; Mtoro et al. 2009; Mshiu & Maboko 2012). Today, the Mara Region exhibits climate variations from highland-central to lowland zones, with the Musoma districts situated in the lowlands receiving approximately 700-900 mm of rainfall annually. Rainfall typically occurs in a single season, from November or December to late April or May. The average annual temperature is 28.5°C, with a recorded peak temperature of 32.5°C (NBS 2003). The weathering processes of granite rock have contributed to the formation of diverse soils in both open areas and rock shelters, ranging from gravel and red sandy soils to light sandy loams and grey clay. The soils found in the open areas of Mkirira and parts of the eastern Balima rock shelter are predominantly black cotton soils (Mshiu & Maboko 2012).

3. Methods

Archaeological surveys

Survey work commenced in the summer of 2023, involving researchers and students from the University of Dar es Salaam. The primary aim of the reconnaissance surveys was to identify and document rock art and the spatial distribution of archaeological materials. Before undertaking these archaeological surveys, our research team engaged with local communities to discuss our research objectives. Informants were selected through a snowball sampling technique, which proved effective as it allowed us to identify sites and enhance our understanding of archaeological locations throughout the study area in a relatively short timeframe. Following this initial engagement, sites identified via the snowball technique were sampled using a purposeful approach, informed by existing knowledge of the region's archaeology (see Mabulla 2005).

Surveyed sites were assigned names, numbers, and abbreviations for identification purposes. For example, at the Balima area, four sites were identified: Balima 1 (BM 1), Balima 2 (BM 2), Balima 3 (BM 3), and Balima 4 (BM 4). Additional sites include Mkirira 1 (MK 1), Nyabekwabi 1 (NBK 1), Mgungumalo (MGM), Nyankingi (NYK), Balili (BL), and Nyabherangi (NRG) (Table 1). We conducted surface walkovers to assess the archaeological significance of the area. The randomly organised walkovers involved a crew of 10 individuals, who were distributed across the landscape. This technique was particularly effective in navigating the challenging terrain characterised by hillsides and shrubs within the Lake Victoria Basin. To document our findings, we utilised recording tools, including a Sony Alpha 1 for capturing images of the paintings. Garmin GPS devices were employed to map find locations, survey areas, and delineate potential site boundaries. Diagnostic archaeological materials, such as sherds, lithics, and beads, were collected for further examination. At the same time, rock paintings were documented with the aid of DStretch (Fig. 3). Ultimately, the results from the surveys and the methods discussed in this paper were shared with the local community of the study area through an organised community workshop (see Bigambo et al. 2025).

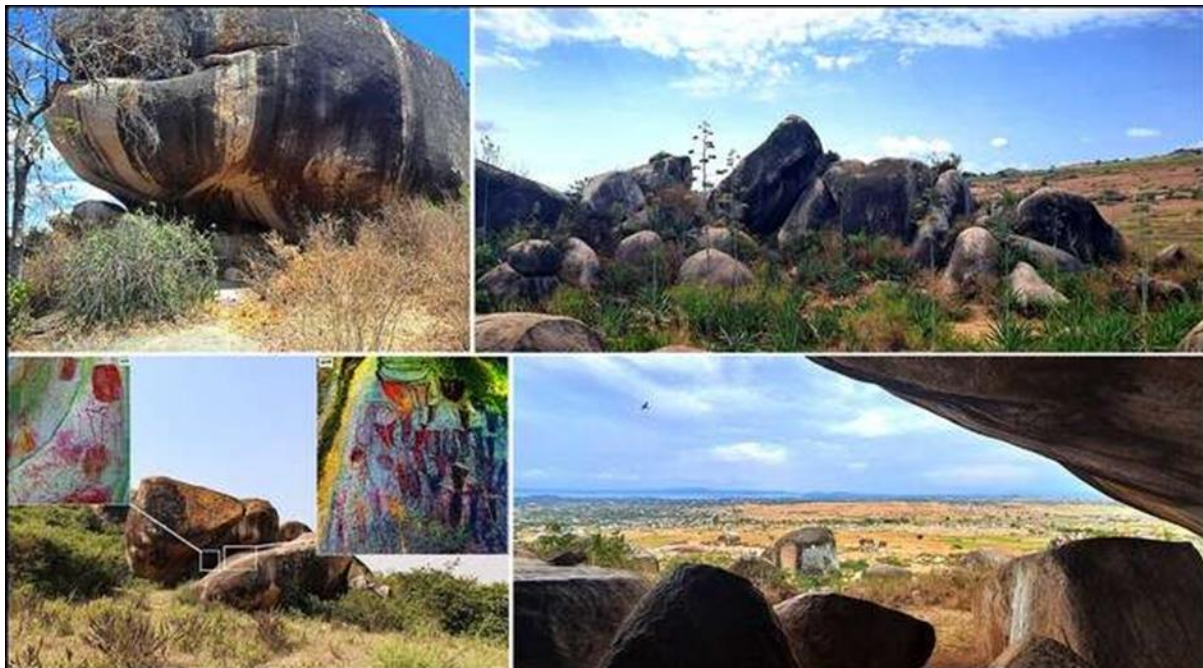


Figure 3. MK 1 (top left), BM 4 (top right), NBK 1 with rock paintings enhanced by DStretch (bottom left), and LVB view from BM 1 (bottom right).

Excavation protocols

The archaeological excavations sought to clarify the relationship between the painters of rock art and the subsurface archaeological evidence. The subsurface data were vital in revealing the adaptive strategies used by those who lived in the BM 4, MK 1, and NBK 1 rock shelters. Following the purposeful sampling approach described earlier, we set up three excavation units at these sites. BM 4 is situated 3 km southwest of the BM 1 site, which is known for the rock art documented by Mabulla (2005), and approximately 4 km northwest of the shore of Lake Victoria. A 1x2 m excavation unit was established using a Leica Total Station with four control points serving as reference markers at each site. The total station also facilitated mapping the artefacts' context and spatial distribution, enabling their later digitisation in GIS (Fig. 4). Stratigraphic layers were defined based on soil hue (using the Munsell Colour Chart) and on dry and wet soil consistency, which distinguished soil textures ranging from fine and medium to coarse and very coarse.



Figure 4. Excavation processes at BM 4 (left) and NBK 1 (right).

The soil in all three excavated sites comprises organic matter, roots, and inorganic materials, including stones from the parent rock. Root limitations in the soil extend to depths of approximately 60 cm. Based on estimations, rock fragments represent approximately 0-3% of the soil deposits, while bedrock constitutes nearly 5-10% of the excavation unit. The soil tends to be dry, particularly during the dry season. Collected materials were assigned unique identification numbers, recorded, and stored separately by category: charcoal, shells, bones, lithics, and beads. Soil samples and sediments intended for phytolith analysis were gathered independently. Excavation protocols for the handling of human remains were meticulously observed, ensuring that all significant attributes – including burial type, skeleton orientation, soil features, body position, bone condition, associated tissues, artefacts, context, completeness, dentition, and taphonomic characteristics – were documented in accordance with standard human burial protocols. While human remains from the excavation are referenced here, their analysis has yet to be undertaken and the results will be published separately.

Faunal analysis was completed at the University of Dar es Salaam under the supervision of Ipyana Mwakyoma, a palaeoanthropology PhD student at Instituto de Historia, Madrid, Spain, who went through all the anatomical size classes and taxonomically classified groups of bones, looking for pieces that could be refitted across excavation levels/trenches, following established practices (Bunn 1986; Klein et al. 1999; Lyman 2008). Lithic analysis followed Mehlman's (1989) typological scheme, while pottery attribute analysis incorporated Wandibba's scheme (Wandibba 1980; Mehlman 1989). Ochre analysis was conducted by consulting the work of Hodgskiss (2013), whereby samples were subjected to the Dino-Lite digital microscope, version 2.0. The analysis of shells followed a scheme by Cuenca-Solana (2011). The ostrich eggshell (OES) beads were analysed according to previously established schemes for sub-Saharan contexts, utilising attribute analysis that included shape (e.g., circular, roughly

circular), size (diameters, thickness), patina (post-depositional analysis), heating (present or absent), and staining (residue), with methodologies adopted from Miller (2019). The bead production stages followed Orton's (2008) pathways 1 and 2, along with the production value schemes developed by Kandel and Conard (2005).

Survey results

At Musoma Municipal, archaeological surveys were conducted at the Balima site, encompassing four hills with rock shelters and the surrounding landscapes (Table 1). For clarity and reference, each rock shelter was assigned a number and corresponding geographic coordinates, designated as Balima 1 to 4. BM 1 is notable for its rock art, originally recorded by Mabulla (2005). A random survey of the rock shelter talus, which faces east, noted significant vandalism on the site. The floor of the rock shelter exhibits a substantial excavation that has removed nearly a quarter of the shelter's surface. This clandestine excavation has revealed sub-surface soils containing LSA artefacts. According to our local informant, the damage was caused by a team of 'treasure hunters'. The deteriorating condition of the rock paintings is evident. Ongoing stone quarrying at the center of Balima Hill also threatens the preservation of archaeological materials and rock art.

Further south and west of the BM 1 hill escarpments, the frequency of surface scatters becomes even rarer, with little LSA and early second-millennium pottery (Lanet cord-roulette) (Fig. 5) known from Hyrax Hill, Iramba, and Uvinza, dating from the 9th century to the second millennium (Posnansky 1967; Odner 1971; Sutton 1987). The notable potsherds in this zone comprise thick-walled sherds featuring a Sirikwa hole, characteristic of early second-millennium IA sherds associated with pastoral societies (Sutton 1987). At the summit of BM 1 hill, we also observed several stone cairns and burial structures (rounded graves) with either grinding stones or iron implements placed atop (Fig. 6). These burial structures are ubiquitous in the Balima area, and according to our local informant, the stones placed on top of the graves vary between female and male graves. The term '*olubhui*', loosely translated as stone, is commonly used on female graves, while '*libhenjo*' is employed for males. The burial practices include placing the deceased seated in a rounded grave reserved for elders, while the stone cairns are used to designate the remaining age groups. Meanwhile, the northern foothills of BM 1 hill contain dense IA pottery remains and LSA surface scatters of quartz and obsidian that warrant excavation. An attempt to survey rock shelters located approximately 200 m north of BM1 hill was halted because the area was under the jurisdiction of the Tanzania People's Defence Forces (TPDF). Efforts have been made to request access.

At BM 2 and BM 3, several artefacts were recorded, including potsherds primarily dating to the early second millennium CE (Fig. 7, Table 1). These were similar to those found at BM 1 and were associated with glass beads. Other artefacts observed on the hilltop surface included grinding stones, cup marks, ochre, and LSA lithic artefacts. Rounded graves similar to those at BM 1 were also noted. Moreover, Kansyore traditions linked with LSA lithic artefacts were identified only at BM 4 and at the MK 1 site in Musoma District. The assemblages comprised scrapers, cores, flakes, and backed pieces made from quartz and exotic obsidian. At NBK 1 hill in Butiama District, the MGM Rock shelter yielded cord-roulette pottery, ochre, grinding stones, and rock art motifs located atop the hill (Table 1).

In Bunda District, particularly in the BL hills, a brief visit to the site revealed dozens of grinding stones, an unidentified tradition of EIA sherds with a thickened rim, and cord-roulette sherds evident on the hilltop (Fig. 5). On the other hand, a site visit to NRG rock shelter, located in Bulamba village, Bunda District, reveals paintings that depict hunter-forager and pastoral traditions (Mabulla 2005), while the surface is littered with typical and Transitional Urewe sherds (Fig. 8, Table 1). The site is currently used by several families around the rock shelter who continue to perform ritual activities there. Local taboos prohibit cutting trees around the shelter, and access requires the removal of shoes and all metallic objects, such as silver coins. Due to time constraints and other considerations communicated by a local informant, including the need to obtain permission from the families who use the shelter before any research activities, we did not collect the sherds. Instead, the materials were photographed and left *in situ*, pending future visits once consent is granted by the relevant families.

Table 1. Surveyed sites in the Mara Region.

Site name	Site type	Location	Lithics	Ceramic	Beads	Bones	Miscellaneous
BM 1	Rock shelter, hunter-forager paintings, open-air	01°31'14.9" S, 33°45'36.4" E, 1263 m	Microliths, grinding stones, hammerstones	Kansyore Lanet and other IA Wares		Bovids Human femur	Cairns, ochre, shells, and graves
BM 2	Rock shelter, open-air	01°31'38.2" S, 33°45'53.4" E, 1282 m	Microliths, grinding stones, hammerstones	Lanet	Modern glass	Bovids	Cairns, ochre, shells, graves, cup marks, and smoking pipes
BM 3	Rock shelter, open-air	01° 31' 39.6" S, 33°45'57.4" E, 1278 m	Microliths, grinding stones, hammerstones	Lanet	Modern glass	Bovids	Cairns, ochre, shells, graves, and smoking pipes
BM 4	Rock shelter, open-air	01°31'45.1" S, 33°45'14.1" E, 1219 m	Microliths	Kansyore	Modern glass	Bovids	Slag, shells, and ochre
MK 1	Rock shelter, hunter-forager art, open-air	01°54'22.0" S, 33°54'11.0" E, 1226 m.	Microliths	Kansyore		Bovids	
NBK 1	Rock shelter, hunter-forager/pastoral art	01°35'26.6" S, 33°46'04.2" E, 1342 m	Microliths	Lanet		Bovids	
MGM	Rock shelter, hunter-forager/pastoral art	S 1°35'26.6", E 33°46'04.2", 1342m.	Microliths	Lanet			
NYK	Rock shelter, hunter-forager art, open-air	01°46'33.0" S, 33°34'15.0" E, 1161 m	Microliths, grinding stones	Kansyore	Complete OES bead	Bovids	Modern graves
BL	Open-air on granite hills	02°01'26.26" S, 33°52'51.85" E, 1402 m	Grinding stones	Unidentified EIA tradition		Bovids	
NRG	Rock shelter, hunter-forager/pastoral art, open-air	02°07'52.98" S, 33°36'20.35" E, 1249 m	Microliths	Urewe			

At NYK in Musoma District, the rock art at this site was first reported and documented by Mabulla (2005), while Mwitondi (2012) later excavated the site. The surrounding landscape contains numerous LSA lithic artefacts and Kansyore potsherds, extending over a 1 km radius from the shelter. Approximately 50 m northwest of the NYK rock shelter are the remains of stone enclosures beside ancient and modern graves (Table 1). Locals regard these stone enclosures as part of a defensive strategy employed in the past against invasions by pastoral societies, such as the Maasai, who aimed to steal their cattle.

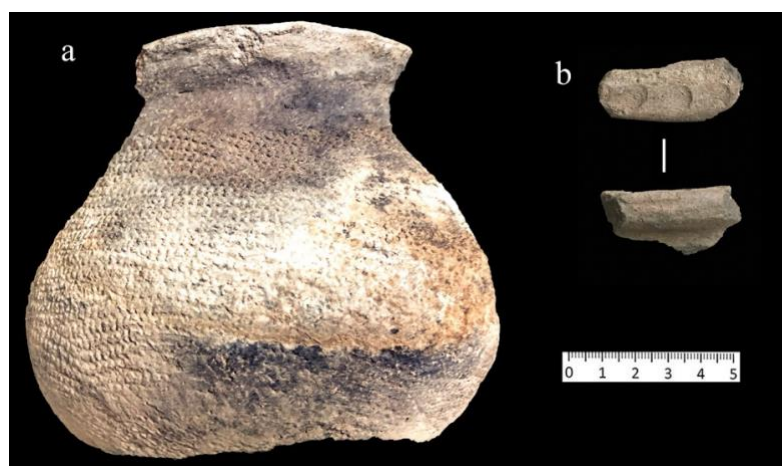


Figure 5. Roulette-decorated sherd from BM 1 (a); EIA sherd with finger impressions on the rim from BL (b).

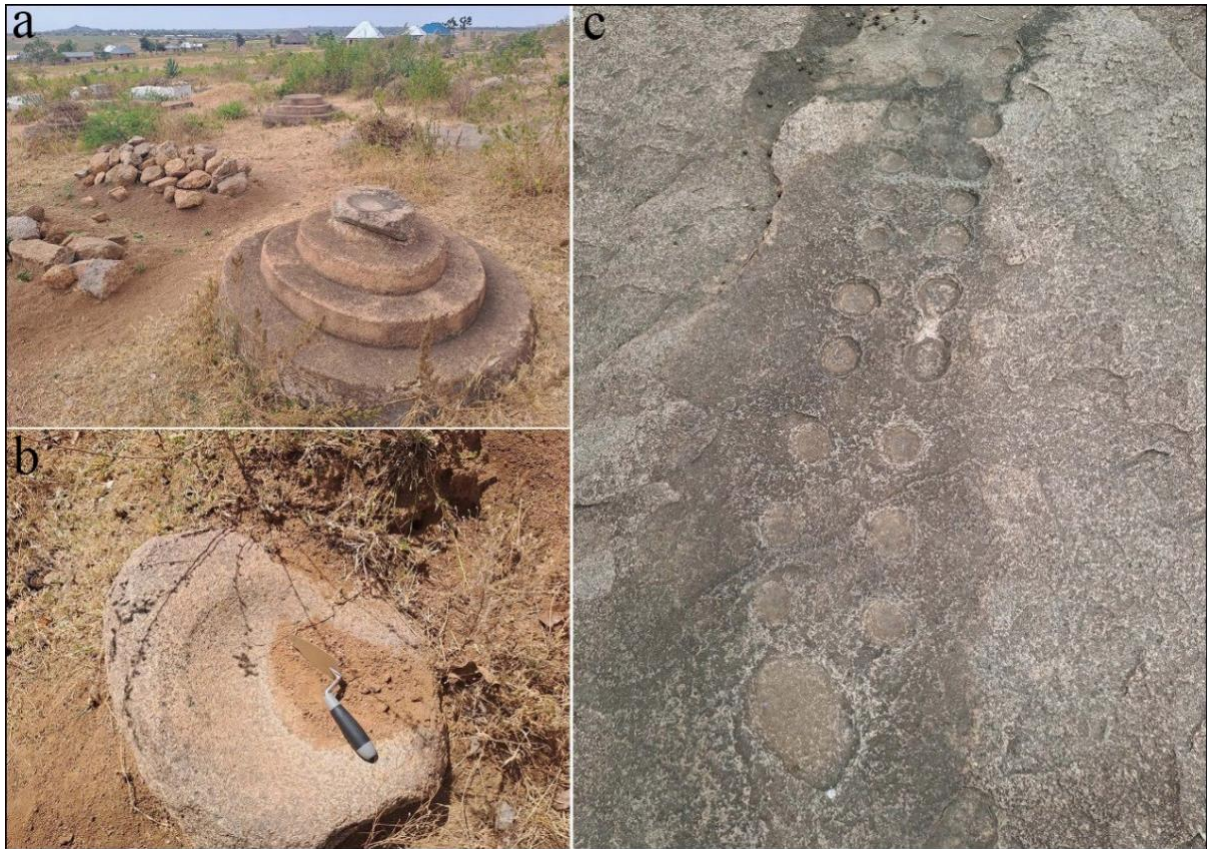


Figure 6. Traditional rounded grave at BM 3 (a); grinding stone (metate) at BM 3 (b); cup marks at BM 1 (c).

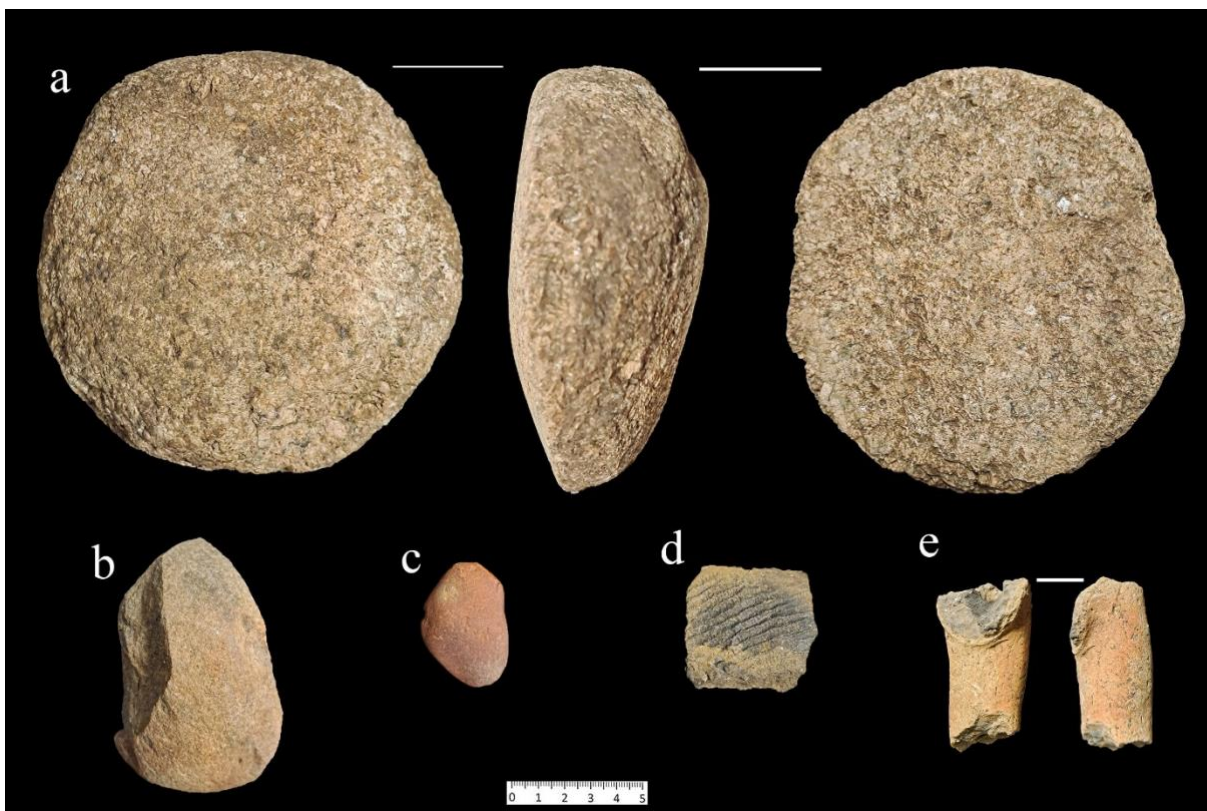


Figure 7. Grinding stone (mano) (a); broken hammerstone (b); ochre (c); roulette-decorated sherd (d); broken smoking pipe from the BM 2 and BM 3 sites (e).



Figure 8. Transitional Urewe sherds (a & b); Urewe sherd from the NRG site (c).

4. Excavation results

Site descriptions and stratigraphy

BM 4: The site where the excavation was conducted is well-protected by two granite rocks stacked in a triangular formation with an opening between them. No rock art has been found at this location. The shelter's entrance faces north-south and is 12 m in length, 1.12 m in width, and 5.1 m in height. The BM 4 site lies approximately 100 metres from swamps, seasonal water tributaries, and sand and gravel quarries. It borders modern farms that cultivate cassava and rice. The rice fields are noted for their black cotton soils, which contrast with the sand and loam found inside the shelter. The surrounding landscape, featuring rice farms, *matete*, and sand quarries, suggests a riverine or semi-perennial habitat. The overall terrain at BM 4 consists of rolling hills interspersed with *oldupai*, short grasses, and prominent shrubs. Sandy soils (7.5YR and 10YR) predominate layers I, VII, and VIII, while the other layers (II, III, IV, V, and VI) contain fine to medium-grained loamy soils, also showing colours from 7.5YR to 10YR (Fig. 9). Layers I to VI contain ash remains from fires, with the sterile layer marked at 100 cm. The vertical orientation of layers VII and VIII may reflect the shape of bedrock or be the result of disturbances from human burial/s.

MK 1: The MK 1 rock shelter, composed of granitic rocks, is located on the Nyegina/Lyamguna/Mkirira hills, about 70 m from a natural spring surrounded by *matete* plants, sugar cane, and horticultural farms. The spring is a watering spot for various animals, including cattle, goats, and cows. The rock shelter features faded rock paintings. The areas surrounding the shelter are characterised by rocky terrain and a thorny environment. The shelter measures 20 m in length, width, and height, with a painted surface area of 2 m (both length and width). The soil inside the shelter has a mix of sandy and loamy textures, while black cotton soil predominates outside. At the MK 1 site, four layers were identified during

excavation, with the first layer composed of loam soils (10YR 2/2) and layers II to IV consisting of sandy soils ranging from 7.5YR 3/2 to 10YR 3/4 (Fig. 10). The artefact assemblage is divided into Ceramic and Aceramic LSA, with pottery primarily found in the upper sections of layer II. Ochre remains were plentiful across all levels, along with lithics and bones. Layer IV marked the sterile zone at 90 cm. Artefact typological classes are presented in the ensuing sections.

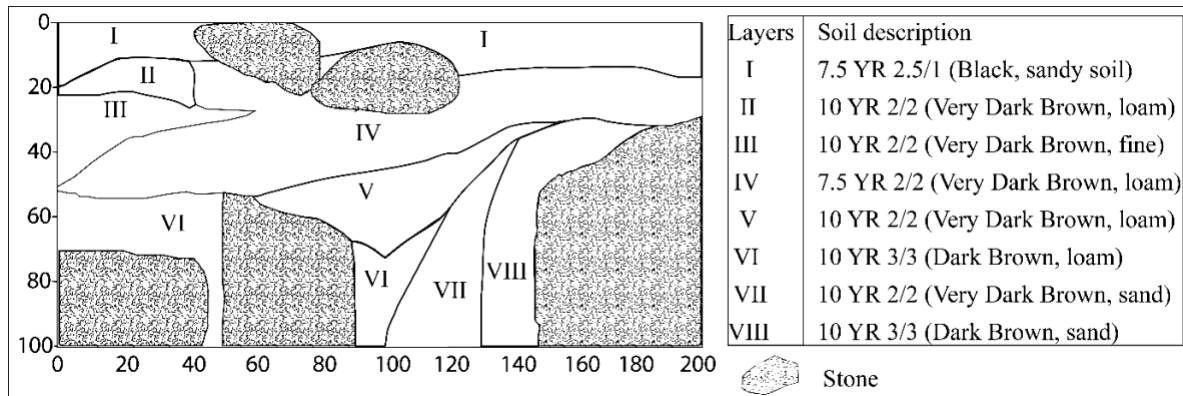


Figure 9. Southern wall profile at BM 4.

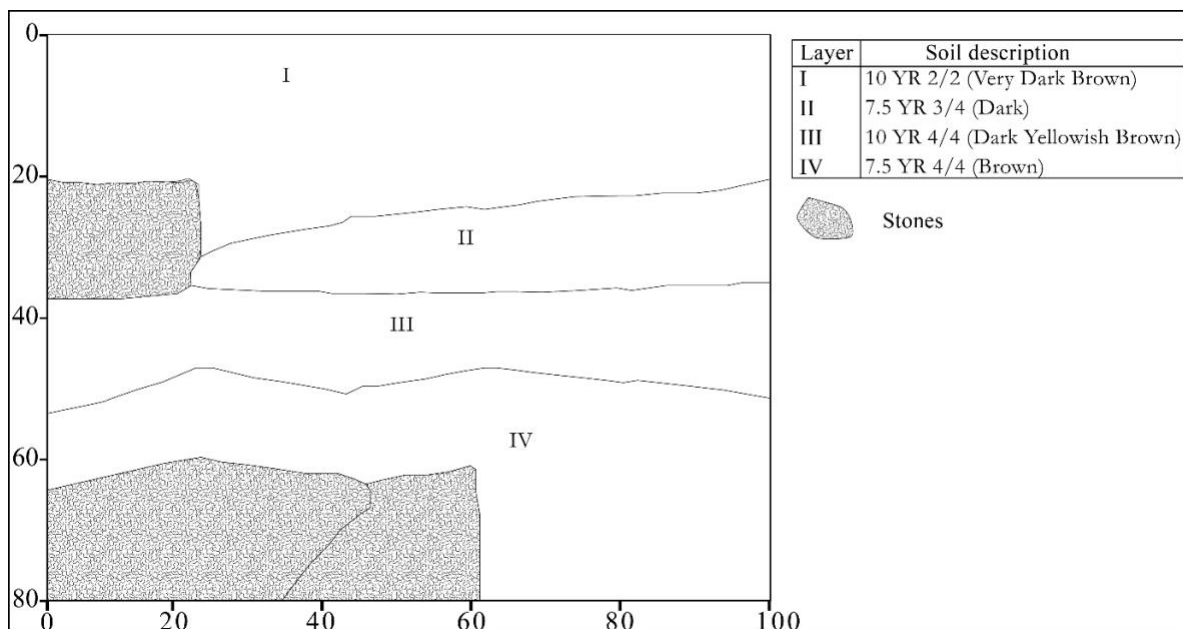


Figure 10. Southern wall profile at MK 1.

NBK 1: NBK 1 is a rock art site at the Kyamajoje village, which is public property in the Butiama District of the Mara Region. The site features granite outcrops surrounded by bushy and thorny vegetation. The site sits approximately 7 km southeast of the MK 1 site. The shelter where the paintings are found measures 8 m in length, 8 m in width, and 7 m in height. The surface area of the shelter containing the rock paintings is 6 m and includes 13 painted figures. The paintings are shielded from sunlight exposure, given the rock overhang. An excavation unit designated as NBK 1 was established in a north-south orientation at the lee side of the shelter to retrieve the subsurface materials. The excavated soils contain approximately 0-5% rock fragments, clasts and stream pebbles. Organic remains, such as roots, were found between 0 and 50 cm in depth.

Based on variable soil colours, content and texture, three distinct layers were identified at NBK 1 (Fig. 11). The sterile area at NBK 1 was located at a depth of 120 cm. Layer I consists of coarse, sandy soil (7.5 YR 4/2), and layer II is characterised by fine, loamy soil (10YR 5/3). Layer III (7.5 YR 4/5) contain silty, sandy soil, with a texture ranging from medium to coarse when dry. Artefacts such as lithic, pottery, bones, ochre, and beads were retrieved throughout all layers.

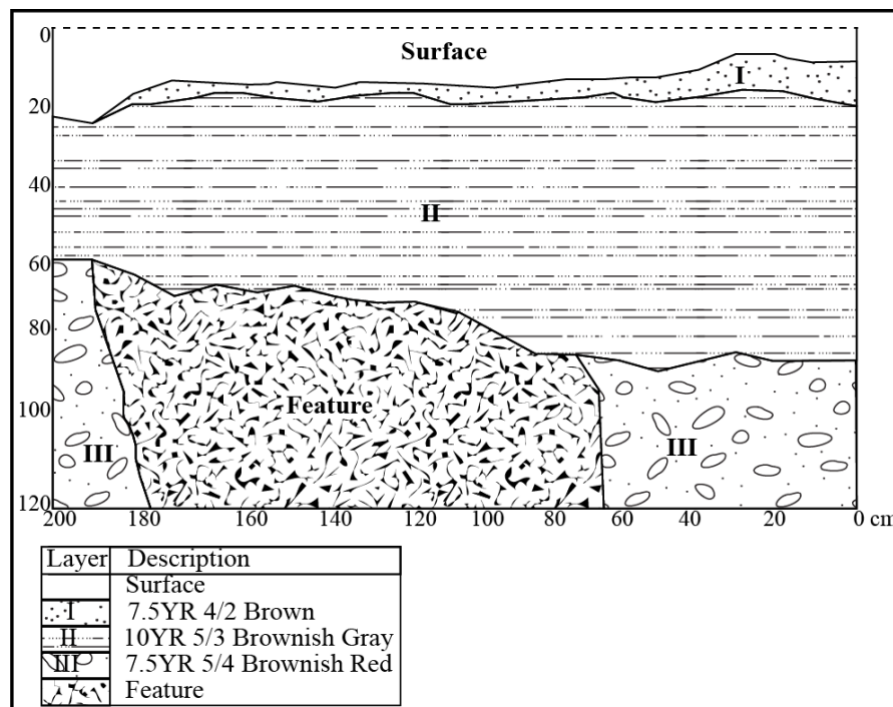


Figure 11. Western wall profile at NBK 1.

Lithics

The lithic assemblage at BM 4 belongs exclusively to the Ceramic LSA (Fig. 12). Our analysis identified 195 lithic artefacts within the BM 4 assemblage, consisting of core fragments (11.8%), backed fragments (9.2%), diverse cores (19.4%), and angular fragments (8.7%). Additionally, whole flakes and various pieces each make up 4.1%. Other tool types like scrapers, burins, cores, *percoir* (borer), and blades represent less than 1% each, while the rest comprises debris. Regarding lithic raw materials, quartz is predominant, constituting 74.4% from BM 4, while basalt accounts for 14.4%. Obsidian accounts for 6.2% of the raw materials, while other sedimentary and metamorphic rocks comprise less than 1%. At MK 1, 293 lithics were analysed, and the results indicate that core fragments are the most prevalent, making up 18.4%, followed by scraper fragments at 6.5%, flakes at 1%, bipolar cores at 3.8%, and blades at 2.4% (Figs 12 & 13). The rest of the lithics comprise debris and pebbles (manuports). These lithic artefacts are made predominantly of quartz, accounting for 77.6%. Basalt contributes 13.9%, sedimentary rocks comprise 5%, and obsidian represents 1.9%. Other rocks make up less than 1% of the lithic raw materials. On the other hand, the NBK 1 site yielded 1879 lithic artefacts culturally assigned to the LSA (Fig. 14). Most lithic remains (33.8%) were angular fragments, followed by 12.2% core fragments, 16% whole flakes, 5.9% whole blades, and 5.1% bipolar cores. Other tool categories accounted for less than 4%. The rest of the lithic assemblage consisted of debris and manuports. Several lithic manufacturing techniques were employed, including bipolar, blade, backing, and pressure flaking. These techniques typically characterise the LSA lithic artefacts found at most PN sites within the East African context. The lithic raw materials at NBK 1 are primarily composed of 77% quartz, 11.5% basalt, and 7.6% quartzite. Other materials, such as obsidian and various sedimentary and metamorphic rocks, comprise less than 2% each.

Pottery

The BM 4 pottery collection comprised 106 sherds linked to the Kansyore tradition (Fig. 15). The most common rim types featured round, pointed, and flattened shapes. Notably, 93.4% of the rim profiles were either inverted or neutral, with the rest indeterminate. Various decorative techniques were employed, favouring impression, stamping, and stab/drag. Other methods observed included rocker stamp, cutting/incision, and *appliqué* (Fig. 15).

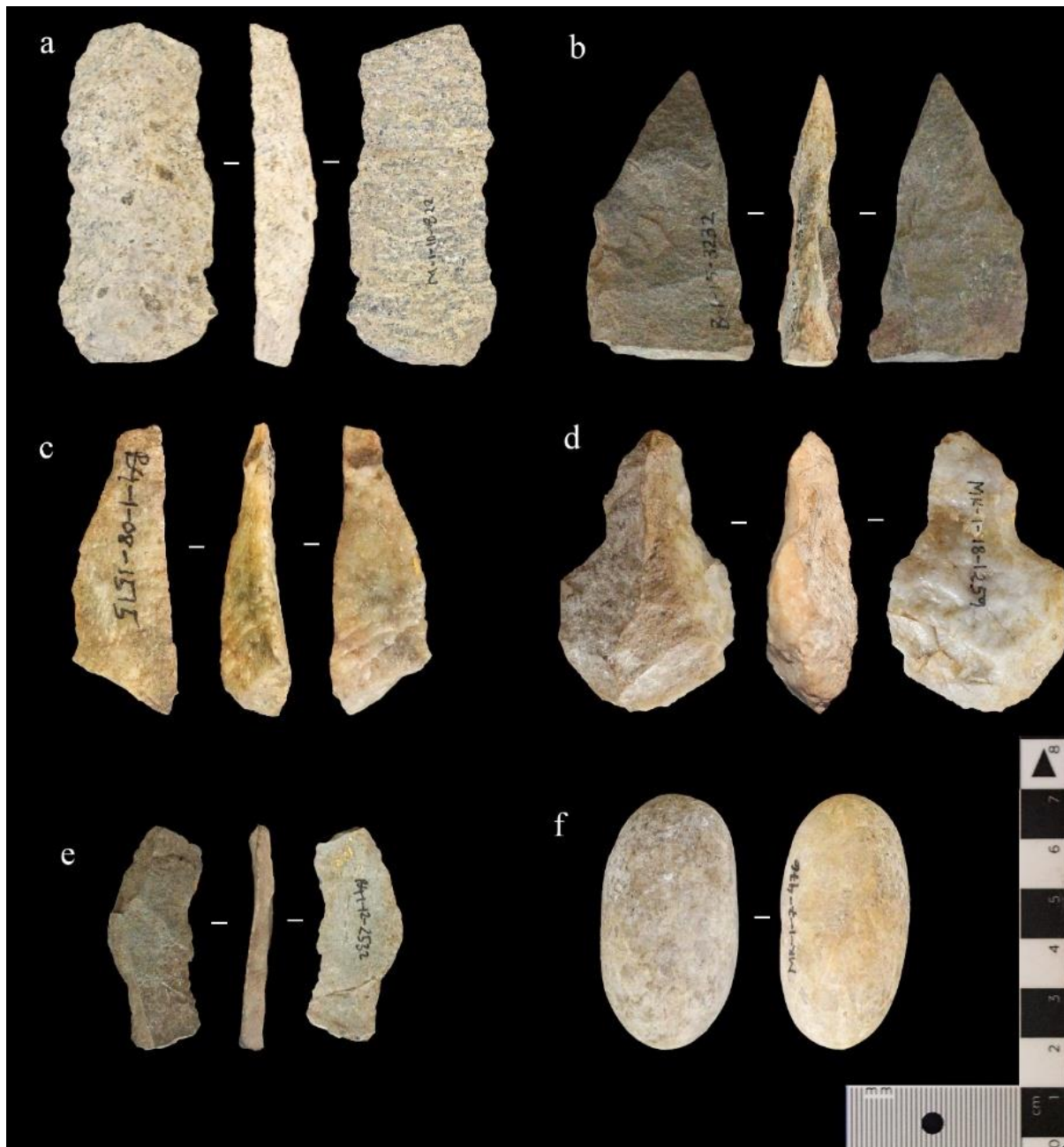


Figure 12. Lithics from the BM 4 and MK 1 sites: blades (a, c & e); flakes (b & d); manuport (f).

On the other hand, the pottery assemblage at MK 1 consists of 12 sherds with a single everted and milled rim, while the rest are body parts. Milled rims have been documented in Kansyore deposits across East Africa. A well-known example is the Gogo Falls site in Kenya, where milled rims were identified as part of the Kansyore pottery tradition by Robertshaw (1991). Sherds at the MK 1 site are exclusively Kansyore, and the sherds demonstrate evidence of a slipping technique at 83.3%, with the remainder consisting of graphiting. It is worth noting that the slipping occurs on the exterior, while graphiting is found on the interior of the sherds. Decorative techniques are predominated by impressions (83.3%), while incision accounts for the remainder. Bands of alternating comb impressions, vertically and horizontally, dominate the decorative motifs at MK 1.

At NBK 1, 16 sherds were analysed, and all sherds originated from the base or body parts and were handcrafted. Three sherds displayed decorative elements associated with the Kansyore hunter-foragers, including wavy and horizontal lines of impressions (Fig. 16). These Kansyore sherds are found between 70 and 100 cm in depth. On the other hand, a thin-walled sherd with no decoration (30 cm in depth)

overlies the Kansyore sherds, suggesting a possible IA sherd with a burnished surface. In a similar context where IA pottery is found, six other broken, undecorated sherds from a single pot indicate evidence of coil breakage (Fig. 16). Interestingly, a single sherd from the same context (30 cm) exhibited a soft, thin-walled structure, decorated with a band of incisions bordered by a single incised line, followed by a plain surface and a burnished finish (Fig. 16) (Robertshaw 1991).

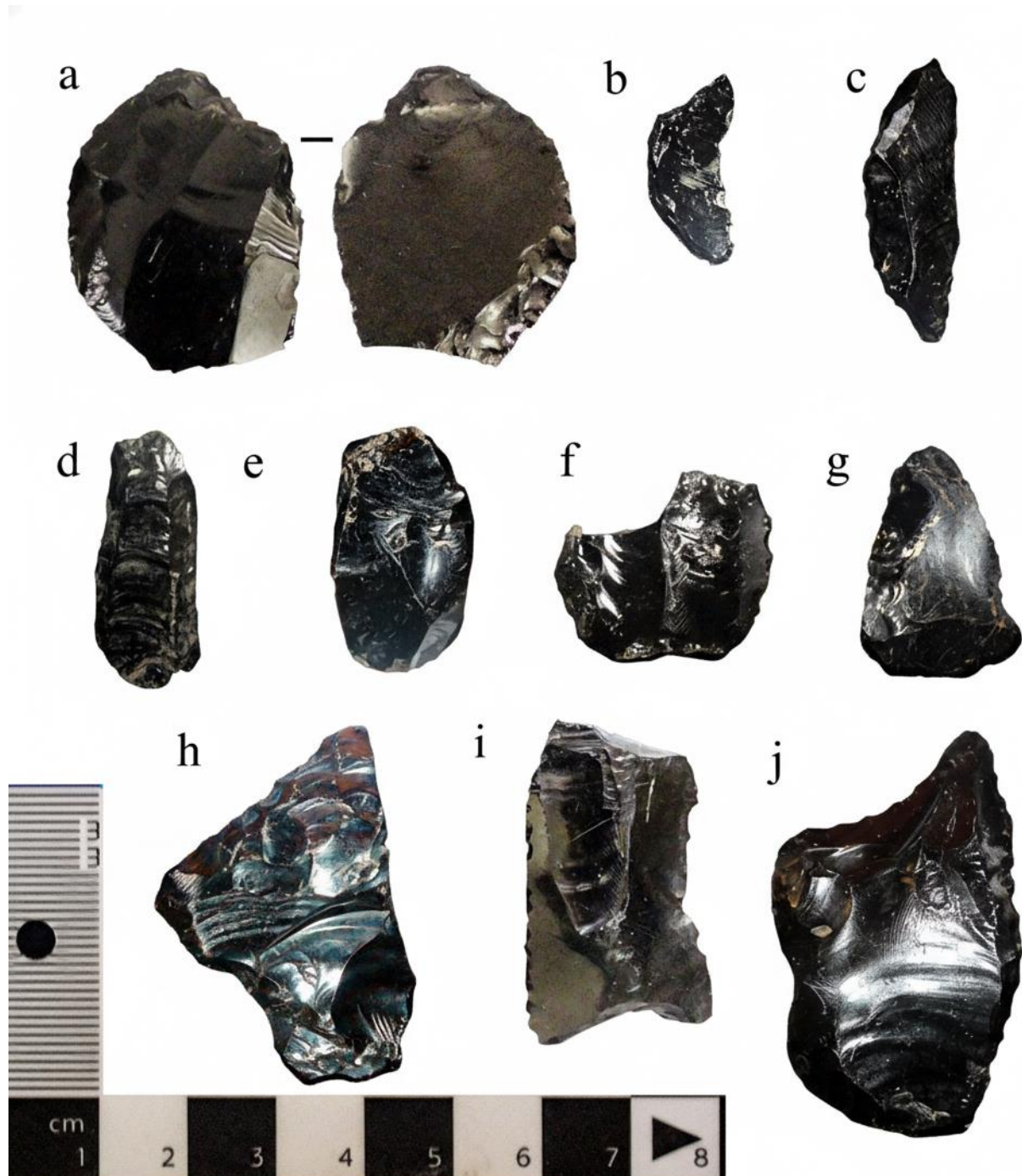


Figure 13. Lithics from the BM 4 and MK 1 sites: scrapers (a, g, h); crescent (b); crescent+*percoir* (c); bipolar cores (d-e); utilised core fragment (f); utilised blade (i); scraper+*percoir* (j).

Beads

The bead assemblage at BM 4 consists of 19 beads that were made from ostrich eggshells (OES), with the majority (52.6%) exhibiting a circular shape and the rest being roughly circular (Fig. 17). Most OES beads (57.9%) showed no surface patina, while 15.8% had a slight patina; the remaining were indeterminate due to surface carbonate concretion. The BM 4 bead collection contained only complete,

finished beads, while the lack of OES production debris implies that they were made elsewhere (Fig. 17). At MK 1, 25 beads were analysed, and only one was fashioned from animal bone, with the rest made of OES. Most bead shapes were circular (56%), with 32% being roughly circular, and the rest being indeterminate. The bead surface patina varied: 64% had no patina, 24% exhibited surface patina, and 4% showed slight patina. Interestingly, 84% of the beads were finished pieces, 8% were complete but broken, and 4% were distributed among rounded blanks, broken, perforated, and slightly formed beads. At NBK 1, 19 beads were recovered, with layer III producing the highest number of beads among the various levels. Most of the bead assemblage is made from ostrich eggshell (OES). The remaining shells were deemed indeterminate due to surface carbonate concretion obscuring identification. The analysis of the bead shapes shows that 97% were roughly circular rather than perfectly round. All beads were determined to be finished products at the time of recovery.



Figure 14. Lithics from the NBK 1 site: manuports (a); cores (b-c).

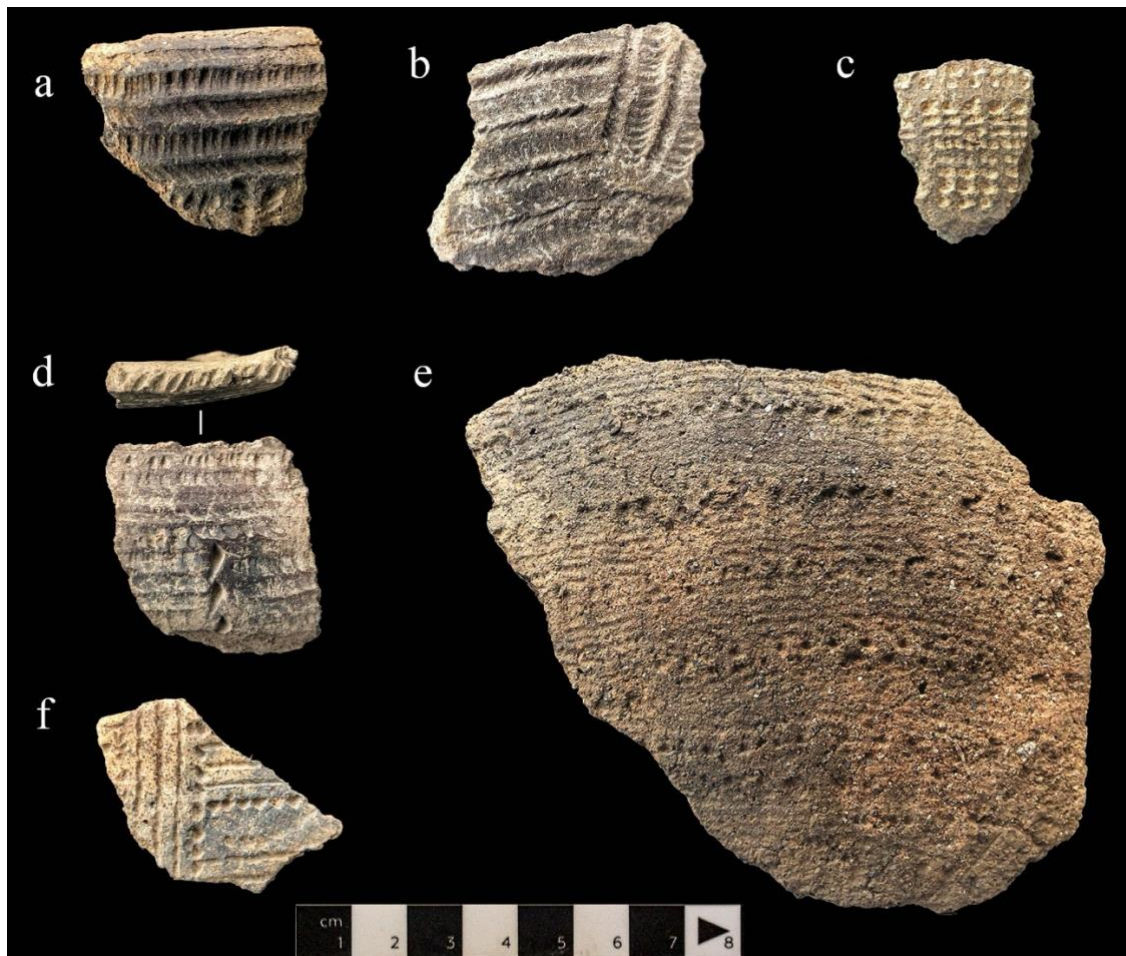


Figure 15. Kansyore sherds from BM 4 and MK 1 sites (a-e). Note the milled rim on sherd (d).

Ochre

Twenty-four ochre pieces were identified at BM 4, comprising 75% clayey material, 20.8% hematite, and 4.2% shale, spanning all layers. Although shale is found in the area, surveys did not detect any clayey or hematite deposits in the landscape. Among the ochre assemblage, 58.3% exhibited surface modifications, 33.3% showed no modifications, and the remaining pieces were indeterminate. No metallic lustre was observed; however, the smoothing results indicated that 62.5% of the samples had non-uniform surfaces, while 37.5% had uniform surfaces. Residue analysis revealed that 75% of the samples contained non-ochre materials, while the remaining samples either lacked residue or were obscured by calcium carbonate formations. Most of the ochre (62.5%) from BM 4 shows likely signs of use, with 12% providing substantial evidence of utilisation while the rest were either unused or use could not be confirmed (indeterminate).

At MK 1, 147 ochre pieces consisted mainly of shale (71.4%) and clayey materials (23.1%), with hematite making up 4.8%, and the rest being indeterminate. A significant portion of the ochre pieces (83%) showed no evidence of surface modification, while 15.6% had scratches. The MK 1 ochre assemblage lacked metallic lustre; smoothing analysis indicated that 75.5% of the ochre was uniform, 19.7% was non-uniform, and the rest was indeterminate. Non-ochre residue was found in 6.1% of the samples, while the majority (61.9%) were absent, and the remaining samples were covered in calcium carbonate. Despite the large volume of ochre, only 8.8% showed potential signs of use, with the remainder appearing unused. On the other hand, the NBK 1 unit yielded nine pieces of ochre, largely clayey, with seven pieces showing surface scratches, which may indicate prior use (Hodgskiss 2013). The most prevalent colour is red hematite, but there are also instances of brown and grey (Fig. 18). This colour distribution aligns with the paintings found at the NBK 1 site, where most of the art is in red monochrome, with a few pieces featuring shades of brown or dark grey. The chemical analysis of ochre at NBK 1 is necessary to confirm this alignment.



Figure 16. Kansyore sherds: with coil break (a), smooth fabric (b), from the NBK 1 site (c-d).

Fauna

Fauna from two levels (layer VIII and layer I) at BM 4 were studied to provide an initial assessment of bone preservation and the potential for future analysis. Two hundred and thirty-five specimens were studied, with an NISP of 84, 36 of which could be identified to taxon and family level (Tables 2 & 3). The sample was predominated by bovids, although equids, suids, and siluriform fish were also present (Fig. 19). The sample analysed here is too small to support any representations of skeletal parts and subsequent cultural inferences, but it suggests the use of terrestrial and aquatic resources.



Figure 17. Beads from the MK 1 and BM 4 sites.



Figure 18. Ochre remains at the NBK 1 site.

Table 2. Taxonomic composition (Family) at the Balima site (n=235, NISP=36).

Family	Frequency	Distribution
Bovidae	27	75.00%
Equidae	5	13.89%
Suidae	4	11.11%
NISP	36	100.00%

Table 3. Frequency and distribution of higher taxonomic groups at the Balima site (n=235).

Taxa groups	Frequency	Distribution
Indet.	197	83.83%
Artiodactyla	31	13.19%
Perissodactyla	5	2.13%
Siluriformes	2	0.85%
Grand total	235	100.00%

Other miscellaneous materials

This category includes materials such as daub (burnt clay) and mollusc shells. Three samples of daub were recorded at BM 4. Under this category, we include the remains of 40 shells. The shell assemblage predominantly consists of bivalve mollusc shells (24), followed by Achatinid snails (7) and *Achatina fulica* (2), with the remainder being indeterminate. The shell remains suggest evidence of being used for human consumption or used as tools. Assessing the age at consumption was complicated by the fragmentation of shells, where the majority (31) were indeterminate. However, the adult, sub-adult, and juvenile shells ranged between two and four per taxon. At MK 1, 11 shell remains, consisting of bivalves (7) and Achatinid (4), were documented. No signs of use or surface alteration were found, with four categorised as subadults and the remainder as indeterminate. Nine daubs were collected from excavation unit 1 at NBK 1, while shells amounted to 31 (Fig. 20). The assemblage reveals predominantly bivalve mollusc shells (18), followed by four Achatinid snails, and three fragmented indeterminate shells. The assemblage also includes remains of six *Achatina fulica*. The NBK 1 shell assemblage indicates that juveniles (6) were more prevalent than adults (2), while the remaining shells were indeterminate.

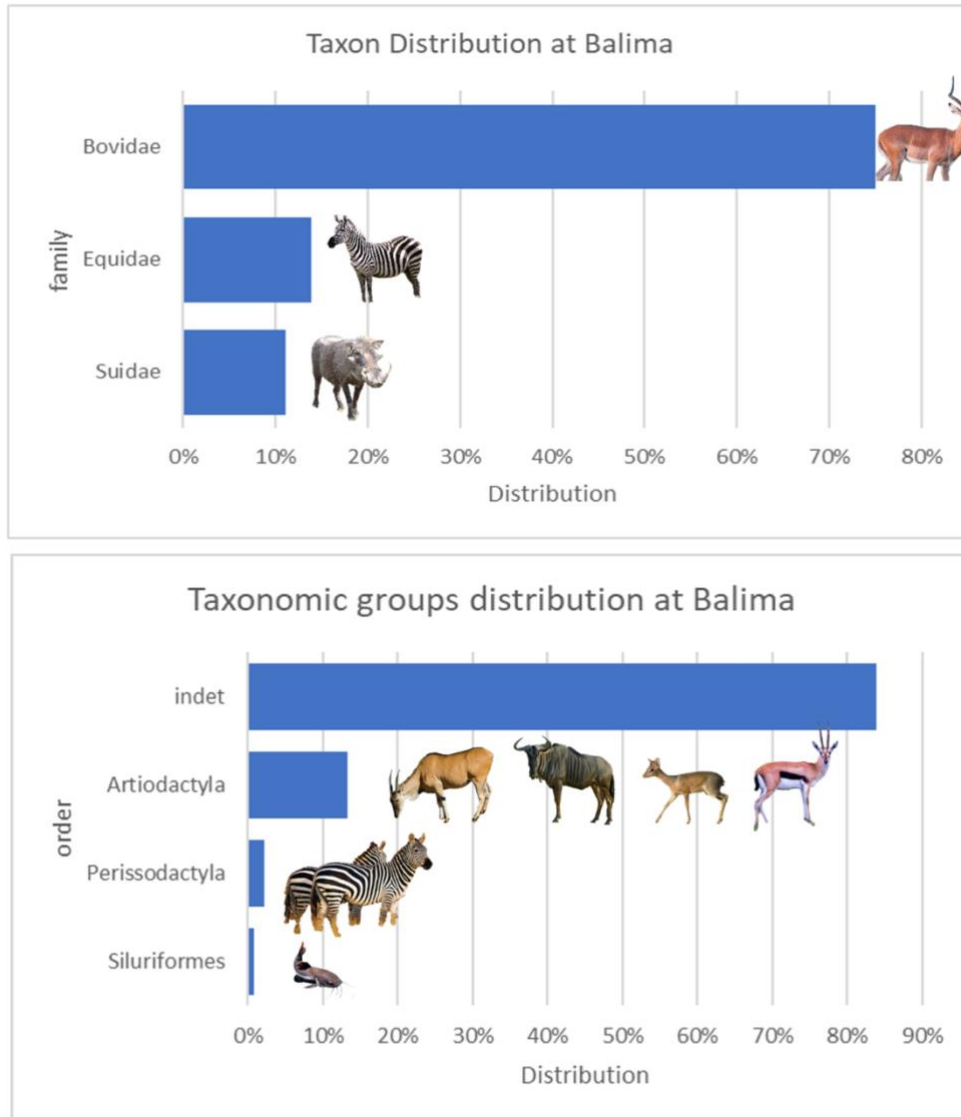


Figure 19. Taxonomic composition of the BM 4 assemblage (n=235).

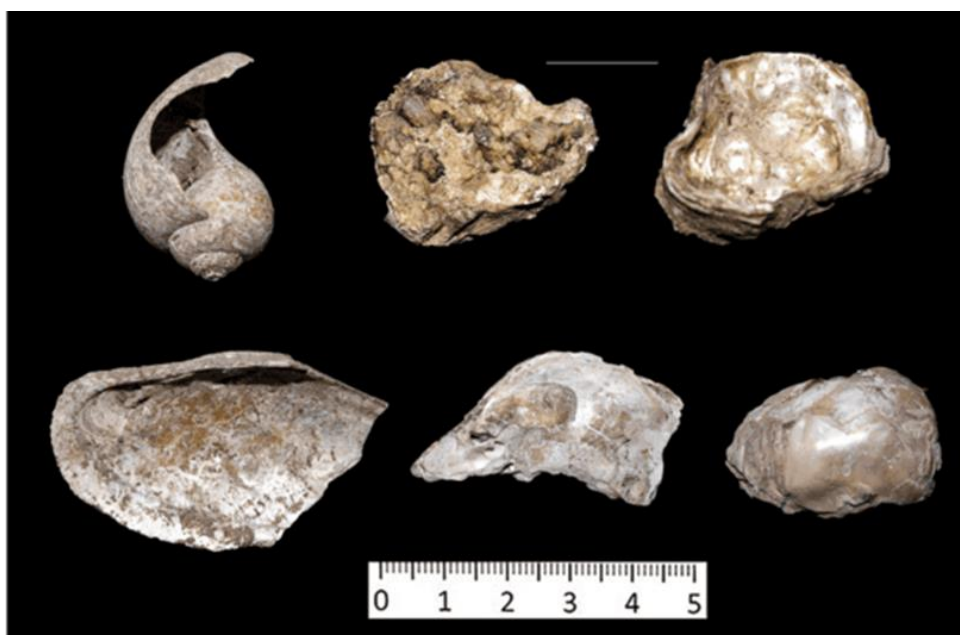


Figure 20. Shell remains at the BM 4 site.

5. Discussion

Archaeological surveys conducted in the Mara Region documented sites containing remains of LSA lithics, pottery, faunal remains, OES beads, land snail shells, and ochre. The survey also revealed remains of IA ceramics, including Urewe and cord-rouletted Lanet. Urewe pottery, the earliest IA ceramic tradition in the region, is widely distributed across the lake regions and is divided into two phases: Early and Transitional. The Early phase marks the onset of farming, with the earliest dates from Victoria Nyanza extending to the sixth century BCE, although sites east of Lake Victoria are up to a thousand years younger (Schmidt 1980; Pawlowicz 2011). This phase is associated with Bantu-speaking farming communities. The Transitional phase, sometimes referred to as devolved or Transitional Urewe, dates to the late first millennium CE (Posnansky et al. 2005) and is thought to have been produced by the same cultural groups (Pawlowicz 2011). In contrast, PIA pottery traditions are commonly reported from sites such as Hyrax Hill, Iramba, Uvinza, and the LVB (Posnansky 1967; Odnor 1971; Sutton 1987). The notable Lanet cord roulettes found at these locations consist of thick-walled sherds exhibiting a Sirikwa hole, a characteristic feature of PIA sherds associated with pastoral societies (Sutton 1987; Lane 2013).

The archaeology of the Mara Region, as presented here through the survey and excavation of sites BM 4, MK 1, and NBK 1, indicates that the region was once occupied by people who utilised LSA lithic tools, ceramics – of various pottery traditions such as the Kansyore, EIA (Urewe) and PIA – consumed animals and fish, made beads from OES, used mollusc shells, engaged in rock art production at NBK 1 and MK 1 sites, and utilised rock shelters for settlement (temporarily or long term), as indicated by the remains of daub at the BM 4 and NBK 1 sites. However, it is worth noting that there are inter-site variations. For instance, the MK 1 site indicates a clear separation of two LSA lithic assemblages, an Aceramic that underlies the Ceramic. At the BM 4 site, the LSA lithic assemblage is primarily Ceramic, as is also the case at NBK 1. However, differences between the BM 4 and NBK 1 sites are evident in the recorded pottery manufacturing techniques. At the NBK 1 site, a single sherd with a smooth fabric and surface finish was recovered. Similar manufacturing techniques have been documented at other Kansyore sites (Dale 2007; Tibesasa 2021), although this find may also indicate a ceramic tradition not yet fully confirmed at the study site. Further investigation of the NBK 1 site is needed to broaden our understanding of pottery traditions in the area.

No significant typological or technological differences exist in the lithic assemblages between sites. The bipolar, blade, backing, and pressure flaking techniques used at BM 4, MK 1, and NBK 1 sites reflect lithic manufacturing techniques commonly documented at various Holocene sites in East Africa. The MK 1 and BM 4 lithic assemblages retain little evidence of core reduction techniques. Quartz is the predominant lithic raw material found at MK 1, BM 4, and NBK 1, surpassing other materials. At all sites, stream pebbles appear to have been utilised as manuports, transported to the locations for the purpose of tool manufacturing. Overall, except for obsidian, other raw materials are found locally. The presence of obsidian within the assemblage signifies regional connectivity, as this raw material is considered exotic in the Mara Region (Mwitondi 2012). The recognised sources for obsidian in northern Tanzania (particularly the study area) are Lake Naivasha and Mount Eburru in Kenya (Gliganic et al. 2012), located over 480 km from the excavated sites.

The existence of exotic materials, such as obsidian, in the study area indicates a complex phenomenon related to material exchange and mobility theories. Ideas, knowledge, and technologies were likely shared (Kador & Leary 2016). In the LVB and the EARS, we observe a product of these social interactions that have formed over a lengthy period (Blumenschine et al. 2008; Nash et al. 2011; Ndiema et al. 2011). Obsidian has appeared in the lithic industries of the Earlier, Middle, and Later Stone Ages and remains in use in later ethnographic periods. The use of OSL or AMS dating can provide accurate context about the period when these raw materials were utilised at MK 1, BM 4, and NBK 1 sites. This, in turn, will enrich our understanding of the rock art authorship era and the known ethnographic use of the rock shelter.

The symbolic objects, such as beads, were determined to be finished products during recovery. However, unperforated OES at the MK and BM sites suggests that beads were manufactured there.

Conversely, all beads found at NBK 1 were classified as complete, indicating that they were produced elsewhere and subsequently transported to the site from their manufacturing locations. The OES beads found at MK 1, BM 4, and NBK 1 have not yet undergone absolute dating. However, they can be placed within the temporal framework of OES bead manufacturing. According to Miller & Wang (2022), this tradition in East Africa dates back 50 000 years, continues into the ethnographic period, and has been associated with hunter-gatherer, farmer, and pastoralist cultures. Other materials, such as ochre remains, are ubiquitous across sites and may have played multiple functions. For instance, ochre powder is directly associated with human remains and other lithic artefacts at the MK 1 site. Ochre may have been used in funerary practices, as evidenced by the Njoro River Cave (Leakey & Leakey 1950; Shoemaker & Davies 2019). It is also possible that the ochre excavated from the MK and NBK sites can be linked to the site's rock art. Absolute dating and chemical analyses of ochre remains are essential to substantiate this conclusion.

Pieces of daub have been linked to the PN settlements in Narosura and Luxmanda (Odner 1972; Fitton et al. 2022). At the NBK 1 site, the daub may suggest that the shelter's occupation is connected with the PN people. This interpretation aligns with the well-established narrative regarding the NBK 1 rock shelter, which locals assert was occupied by the '*Wekwabhi*', loosely translated as the Maasai people, during their cattle raids in the region. The presence of shields, arrows, and fighting tools in the NBK 1 paintings supports this narrative (Fig. 21). Land snails and bivalves are common in archaeological sites (Mehlman 1989). Bivalves are likely to have been brought to the sites (rock shelters), as there is no other way they could have reached there. Mollusc remains either indicate a diet preference, or that they were used as tools, such as knives or spoons (Mehlman 1989; Cuenca-Solana 2011). Therefore, age preference is crucial for understanding the consumption or utilisation phase, as demonstrated by the shell remains at the BM 4 site, where the preference for adults surpasses that for juveniles and sub-adults. Conversely, at the NBK 1 site, juveniles were predominantly preferred.

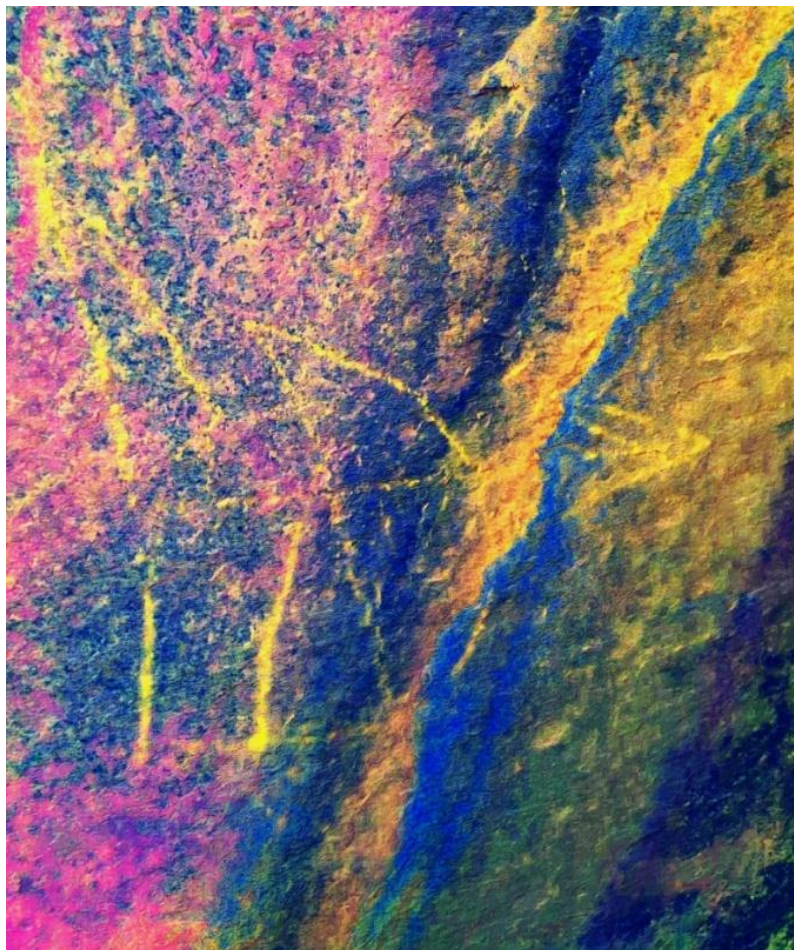


Figure 21. Bow and arrow at NBK 1 site (after Dstretch image enhancement).

6. Conclusion

Preliminary analysis of materials from the Musoma and Butiama districts in the Mara Region demonstrates that the area is archaeologically rich, with evidence for human occupation from the LSA through the early second millennium IA and into recent periods. The assemblages include abundant symbolic materials such as ostrich eggshell beads and ochre alongside hunter-gatherer (notably Kansyore) and pastoralist pottery, mollusc shells, daub, and substantial faunal remains of wild animals, fish, and humans. These findings indicate diverse adaptive strategies and align closely with cultural traditions documented across the Lake Victoria Basin and its hinterland, including sites in Tanzania, Uganda, and Kenya. However, the regional chronology currently relies on a single radiocarbon date from Nyamang'ora rock shelter, with most interpretations based on relative typologies. Establishing a robust AMS radiocarbon chronology is therefore essential for situating Musoma within the broader LSA framework of the Lake Victoria Basin. Additionally, the presence of exotic obsidian highlights the need for provenance studies to clarify patterns of mobility and interaction within and beyond the basin.

Acknowledgements

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