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ORIGINAL ARTICLE

Crafting Swahili Beads: Exploring a New Glass Bead Assemblage from Northern Zanzibar, Tanzania

Henriette Rødland

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Abstract This article presents the discovery and analysis of a new glass bead assemblage from the Swahili site of Mkokotoni, an early second millennium AD settlement in northwestern Zanzibar. It explores the possibilities for local production of glass beads using imported glass cullet or glass tubes at this site. Glass beads are ubiquitous at archaeological sites from the second millennium on the East African coast. They are presumed to have been traded via long-distance networks from South and Southeast Asia, and used locally in personal adornment, barter, and ritual practices. However, the data from Mkokotoni offers a new and unique perspective on glass bead-making traditions, which places the East African coast as an area of production and distribution.

Résumé Cet article présente la découverte et l'analyse d'un nouvel ensemble de perles en verre provenant de Mkokotoni, un site swahili occupé au début du deuxième millénaire au nord-ouest de Zanzibar. Il explore les possibilités d'une production locale des perles de verre à partir de verre importé sous forme de verre brut ou de tube. Les perles de verre sont des artifacts omniprésents sur les sites archéologiques de la côte est-africaine du deuxième millénaire. On considère qu'elles auraient été échangées via des réseaux de longues distances depuis l'Asie du Sud et du Sud-Est et utilisées localement comme parure personnelle, comme objet de troc et dans le cadre de pratiques rituelles. Cependant, les données provenant de Mkokotoni offrent une perspective nouvelle et unique sur le travail des perles en faisant de la côte est-africaine une zone de production et de distribution.

Keywords Zanzibar · Swahili · Glass beads · Craft · Production · Workshop

H. Rødland (✉)
Department of Archaeology and Ancient History, Uppsala University, Thunbergsvägen 3H, Engelska Parken Campus, Uppsala, Sweden
e-mail: Henriette.rodland@arkeologi.uu.se

Introduction

Beads of various materials, shapes, and sizes are ubiquitous at archaeological sites on the East African Swahili coast, reflecting wide use and trade that encompassed the coast and the eastern and southern African interior and Indian Ocean world. They were used in personal adornment, rituals, and barter. From the early second millennium AD, imported glass beads became particularly numerous on the East African coast, believed to reflect increased trade with south and southeast Asia through the Indian Ocean rim. The drawn and monochrome Indo-Pacific beads, produced in South Asia, are perhaps the best known and were circulated widely in the medieval world. They are commonly understood as items of trade, their small size and light weight making them ideal products to carry over long distances, and as evidence

for the intricacies of the Indian Ocean trade networks within eastern and southern Africa. However, a large glass bead assemblage from Mkokotoni, an early second-millennium Swahili site in northwestern Zanzibar (Fig. 1), Tanzania, offers a new perspective on bead-making that places the East African coast as a possible area of production, processing, and distribution of glass beads (see Marilee et al., this volume). The recovery of approximately 25,000 glass beads and associated glass bead waste from Mkokotoni is a unique discovery in sub-Saharan Africa. This discovery allows for a re-evaluation of the role of East Africa in networks of trade, production, and consumption within the Indian Ocean world. It also highlights the significant agency of local African craft workers, who sought to adapt to a growing market for glass beads and changing consumption practices within East Africa. Africa is too often placed on the peripheries of the Indian Ocean and wider medieval worlds, mainly seen as a source for raw materials and a consumer of imported "luxury" goods. Thus, an emphasis on local technologies adds an important perspective that highlights African innovation and practice. It also allows us to start thinking about how glass beads were made and used locally and their role in personal adornment and ritual practice.

The term Swahili is commonly used to describe the long stretch of coastline between Somalia and Mozambique, including its many islands and archipelagos, and the people who have inhabited this area for the past 1400 years. While Swahili settlements were part of the larger East African landscape of trade and contact, they became increasingly differentiated from their hinterland and interior neighbors through growing participation in Indian Ocean trade, the adoption of Islam, and the development of the Swahili language. From the early second millennium AD, many towns dotted the coast, many of which included mosques, tombs, and houses built from coral rag and lime mortar. Some Swahili towns were entrepôts, where raw materials, animal skins, timber, and enslaved individuals were exported to other Indian Ocean port towns. The most common archaeological association with this trade, however, are the imports. These include glazed ceramic and glass vessels, certain types of jewelry, and beads of stone and glass. While such imports have often been understood as symbols of wealth and elite merchant identities (Kusimba & Oka, 2009), their ubiquity in Swahili towns and villages throws this association with elite consumption into question. Glass beads are particularly poorly understood beyond their use as trade goods, but they would also have been common items of personal adornment, which were made into jewelry or sewn onto clothing. My research in Tumbatu also shows they were buried under house floors,

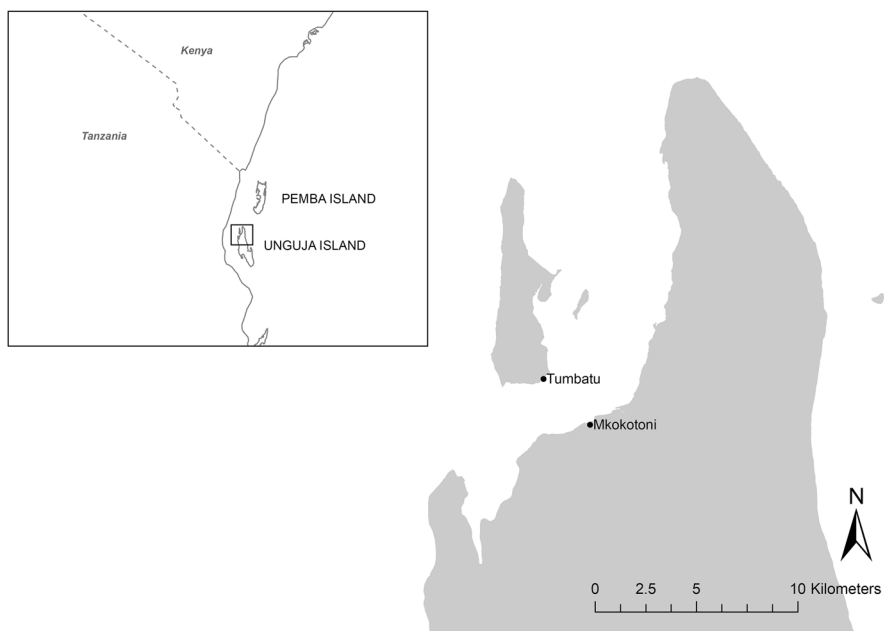


Fig. 1 Map showing northern Zanzibar and the location of Mkokotoni and Tumbatu

suggesting ritual use (Rødland, 2021). Recent excavations of a possible bead workshop in Mkokotoni and the classification of a sample of the glass beads and bead waste recovered from this workshop are now contributing new insights to understanding glass bead sequences and local bead production or processing at Mkokotoni.

Glass Bead Networks Across the Indian Ocean

The vast majority of the beads associated with early second millennium Swahili sites are a type commonly known as Indo-Pacific beads. These are defined as small (below 6 mm in diameter) monochrome glass beads made by the drawing method (Abraham, 2013; Francis, 1990). As their name suggests, they were produced in South Asia and have been in circulation for over two millennia. The Indo-Pacific beads were widely distributed throughout the pre-modern world and found all around the Indian Ocean rim, China, Japan, Korea, South Africa, and Zimbabwe (Abraham, 2016; Francis, 1990). In coastal East Africa, they seem to have become increasingly common after ca AD 1050 (Horton, 2004). However, their ubiquity need not suggest shared value, and their use would have differed across time and space.

Drawn beads, such as the Indo-Pacific types, are produced by drawing molten glass into thin hollow tubes, which are then cut into smaller segments and eventually beads. The process of making the Indo-Pacific beads is known as the *lada* method, a complex process of producing glass beads that seems to be specific to southern Asia (Abraham, 2016; Francis, 1990). After cutting, the ends of the beads were then treated by mixing the beads with ash or sand and heating them while stirring to melt and round off the ends. The longer the beads were heated, the rounder the ends would become (Wood, 2011). The use of the *lada* process allowed the Indo-Pacific bead makers to produce very small beads, some less than 2 mm in diameter, and in great quantities (Kanungo, 2000). This process is known both from ethnographic and archaeological studies, and a growing number of archaeological sites in India are now yielding evidence for bead production (Kanungo, 2004). Bead production involved several different stages, including the production of the raw glass, drawing glass tubes, cutting up tubes into beads, and sorting and stringing beads (Francis, 1990). These different stages of the process may not necessarily take place at one single production center or by the same producers. Identifying the different stages archaeologically can be challenging, and the recovery of glass bead waste, such as broken beads or tube ends, does not necessarily reflect primary bead production. Instead, it may indicate beads imported in bulk, including some of the production waste from the point of origin. Archaeological traces of bead production should therefore ideally include a variety of remains such as glass ingots or cullet, furnaces, metal tools, crucibles, bead waste, and the beads themselves (Carter, 2016; Francis, 1990; Kanungo, 2000), although all such remains may not appear in one single site.

While the Indo-Pacific beads may look similar at first glance, there is much variability within the group in terms of color, shape, size, and to some extent, the chemical composition of the glass. However, these differences can be subtle and not always visible to the naked eye, making morphological distinctions between different Indo-Pacific series difficult. The lack of published illustrations (ideally photographs) from archaeological records and the dearth of archaeological investigations of Indo-Pacific beads in South and Southeast Asia during the second millennium AD (Abraham, 2016; Carter, 2016) further complicate in-depth comparison between different types within the group.

Glass Beads in Coastal East Africa

Most second millennium archaeological sites excavated on the coast of East Africa have produced glass beads, although in variable quantities. This variability is partly due to excavation methods, as fine sieving of all deposits with a 2-mm mesh screen (or less) is required to retrieve many of the smaller beads. While beads made of other materials such as shell, clay, and stone are also common in Swahili sites, glass beads were the most numerous after the turn of the second millennium AD, often numbering in the thousands. Direct comparison between sites is difficult, however, as few site reports give details about volume, such as beads per m^3 of the excavated deposits. Generally, most sites have produced between 200 and 3000 glass beads—one exception is Kilwa in southern Tanzania, where Chittick (1974) recovered nearly 18,000 glass beads. However, only around 2000 of

these came from deposits pre-dating the sixteenth century AD, which marks the start of the Portuguese period (Wood, 2018). A significant number of glass beads have also been recovered from burial contexts in Mayotte and Madagascar (Colomban et al., 2021; Pauly & Ferrandis, 2018). In addition, glass beads have been found at archaeological sites in the hinterland and interior of the East African coast, highlighting a complex network of trade between the coast and the interior (see, for example, Walz & Dussubieux, 2016).

A variety of glass beads from diverse origins have been found at East African archaeological sites, but some of the most common types are the Indo-Pacific beads described in the sections above—while most are drawn, a significant number of wound beads also occur (Wood, 2015). I will only focus on the drawn beads in this article, as they are the most relevant for the current study. Recognizing the variability within bead assemblages, Wood (2011) has divided the Indo-Pacific beads from various southern African sites into sub-groups or series based on their morphology and chemical composition. These include East Coast Indo-Pacific, Khami Indo-Pacific, and K2 Indo-Pacific series beads, all of which are chemically similar, being made from a glass type known as mineral-soda-high-alumina or m-Na-Al, thought to have been produced in South Asia (Dussubieux et al., 2008; García-Heras et al., 2021; Robertshaw et al., 2006; Siu et al., 2021). While most of the East Coast Indo-Pacific beads described in Wood's (2011) article were recovered from southern African sites, they are similar to many of the drawn monochrome beads found on the East African coast. No comprehensive morphological study of East African beads has been carried out. However, a recent publication by Dussubieux and Wood (2021) outlines the chemical analyses of several beads from East African sites, highlighting the diversity within the m-Na-Al chemical group. Six sub-groups of this glass type have so far been identified (Table 1), and at least four of the sub-groups are known to have circulated in sub-Saharan Africa in the first and second millennium. The first, m-Na-Al 1, is associated with beads from first millennium sites in East Africa, such as Unguja Ukuu in Zanzibar, and are some of the earliest glass beads imported into East Africa (McIntosh et al., 2020; Wood, 2018). The m-Na-Al 2 glass beads seem to have been imported from the fourteenth century AD onward (García-Heras et al., 2021; Robertshaw et al., 2010), while a

Table 1 Glass chemical groups associated with beads from East African archaeological sites (data gathered from Dussubieux & Wood, 2021; García-Heras et al., 2021; Siu et al., 2021)

Chemical group	Chemical sub-groups	Possible associated bead series	Associated East African sites	Time period of distribution in East Africa	Glass type	Origin of glass
m-Na-Al	m-Na-Al 1		Unguja Ukuu	Seventh to early-eleventh centuries	Mineral-soda-high-alumina	South Asia
	m-Na-Al 2	Khami Indo-Pacific	Mtwapa, Songo Mnara, Bungule, Takwa, Ungwana, Mahilaka, Antsikara Boira, Manda, Gede	From late fourteenth century		
	m-Na-Al 3		*None*			
	m-Na-Al 4		Musaya	Sixteenth to nineteenth centuries		
	m-Na-Al 5		*None*			
	m-Na-Al 6	East Coast Indo-Pacific, K2 Indo-Pacific	Ibo Island, Mambrui, Antsiraka Boira, Gede, Kisimba Jumbe, Manda	Ninth to thirteenth centuries		

newly identified group, m-Na-Al 6, may have been in circulation between the ninth and thirteenth centuries (Dussubieux & Wood, 2021). Although a relationship between the different chemical sub-groups and the Indo-Pacific bead series outlined above has been suggested by Dussubieux and Wood (2021), further analysis is needed to understand the relationship between bead morphology, bead series, and their chemical composition. There does, however, seem to be a correlation between m-Na-Al 6 beads and the East Coast Indo-Pacific beads of southern Africa.

No chemical analysis has yet been carried out on the beads from Tumbatu and Mkokotoni, and it is therefore not currently possible to determine which chemical group they belong to. Nevertheless, based on morphological studies, many of the beads are similar to Wood's (2011) East Coast Indo-Pacific series. Future chemical analyses may also reveal that they belong to the m-Na-Al 6 chemical group. However, the majority of the beads from Mkokotoni were of a type not currently known from any other East African site, being of different colors and sizes. I have tentatively labeled these beads the Mkokotoni series (Rødland, 2021). However, future chemical analysis of these beads will determine their relationship with other bead series and the composition of the glass. In this article, I will refer to these as Mkokotoni beads.

In addition, a small number of beads seem to be of the Zhizo, Mapungubwe Oblate, and Zimbabwe series, described by Wood (2011). These bead series are more common in southern Africa, where they have been identified as being made from plant-ash glass rather than the m-Na-Al glass of the Indo-Pacific beads. While Wood (2011) has supplied an excellent classification reference, identifying the bead assemblage from Mkokotoni based purely on morphological traits is challenging, and certain features only became apparent when beads of different series were compared directly with each other. Perhaps one of the most interesting aspects of the studies in southern and eastern Africa is the discrepancy between bead assemblages in the two regions. It was previously assumed that glass beads in southern Africa arrived via East African coastal ports. However, more recent studies suggest that southern and eastern Africa may have been connected to different trade networks, and consequently obtained beads from different sources (Wood, 2018).

While stone and shell bead production occurred at several East African sites in the first and second millennium (Flexner et al., 2008; Horton, 2004), evidence for local glass bead production is currently rare. One example of local production comes from Kilwa and Songo Mnara in southern Tanzania, where large bicone beads decorated with trails of yellow, red, or blue glass were produced (Wood, 2018; Wood et al., this volume). Wood (2018) argues that these beads would have been made by reworking imported glass, which can be done at lower temperatures than making raw glass. In addition, Wood et al. (2012) have suggested that some form of glass working may have taken place at Chibuene, a southern port town in Mozambique occupied from the seventh century AD. Chemical analysis confirmed an association between most of the glass beads and the glass bead waste found at the site and revealed that they were made from plant-ash glass. The scale of production seems to have been small in any case, with fewer than 3000 glass beads recovered from the site and only 53 pieces of glass bead waste. Horton (1996, p. 332) has argued for the existence of glass bead production in Shanga, Kenya, where he recovered a small amount of glass bead waste and some glass slag. Similarly, Strandes (1961, p. 89) has stated that "in Mogadishu [Somalia], a complete set of equipment was found for the manufacture of glass beads: crucibles, colored pastes, sticks of glass, and colored beads." Unfortunately, Strandes (1961) does not provide details of who uncovered these artifacts, when they were found, or how they were classified.

The overwhelming majority of glass bead studies from East Africa focus on the origin of beads, their proposed trade routes, and their chemical composition, rather than how they were adopted, adapted, modified, and used in the societies in which they ended up (except Pauly & Ferrandis, 2018; Rødland et al., 2020; also see Robertshaw, 2020). However, their temporal and geographic ubiquity suggests they were an important article of personal adornment, barter, and ritual and religious activity (e.g., Donley-Reid, 1990; Marshall, 2019). Regional and local preferences and availability seem to have played a significant role in the valuation and use of glass beads at different Swahili coastal towns. For example, while drawn beads dominate most coastal assemblages, around half the glass beads from Shanga in Kenya were wound (Horton, 1996, p. 329). Horton (1996)

also reports that yellow and blue were the most common colors in Shanga between the eleventh and thirteenth centuries AD, while in Manda, also in Kenya, blue-green beads seem to have been preferred (Chittick, 1984, p. 188). In Tumbatu, red and black were the preferred colors during the same period (Rødland, 2021).

A Bead Workshop in Zanzibar? Innovation and Adaptation of Bead Technology

The Swahili Coast, Zanzibar, and Mkokotoni

Many archaeological sites dating from the seventh century AD onwards are located in the Zanzibar archipelago, just off the coast of mainland Tanzania (Fleisher, 2003; Horton & Clark, 1985). Zanzibar consists of two large islands, Pemba and Unguja, and several smaller islands dotted around their coasts. The archipelago has played a central role in long-distance trade between coastal East Africa and the wider Indian Ocean world for centuries. Recovery of imported artifacts from the first and second millennium AD contexts, and the mention of Pemba and Unguja in several historical texts by Arab, Chinese, and Portuguese travelers and merchants attest to the centrality of the archipelago in Indian Ocean trade (Foltz, 2018; Gray, 1962; Strandes, 1961). This trade and the subsequent growth of Islam have come to define the East African coast and its inhabitants under the umbrella term Swahili, referring to a particular (material) culture, lifestyle, and language believed to have emerged on this coast from the seventh century AD onward. From around the eleventh century, many coastal settlements grew into larger urban centers with mixed architectural features of timber and daub and stone and lime mortar. The stone houses, mosques, and tombs have received particular attention from many scholars, who have often seen them as symbols of elite merchants' power and increasingly hierarchical settlements (e.g., Kusimba & Oka, 2009; Pawlowicz, 2019).

During my doctoral project at Uppsala University, I set out to question this assumed hierarchical system and explore the social composition of Swahili towns, focusing particularly on the archaeological site Tumbatu and the neighboring site Mkokotoni in northwestern Unguja (Rødland, 2021). Tumbatu was a large (ca 25 ha) town on the southeastern shore of the eponymous island with extensive stone architecture in the form of private houses and mosques. Tumbatu participated in local, regional, and long-distance trade in agricultural products, beads, metals, pottery, and glass vessels. Mkokotoni is located just across the channel from Tumbatu on the main island of Unguja and contains a small number of stone ruins (houses and mosques), and artifact surface scatters covering an area of ca 9 ha. Deep soil deposits probably cover numerous buildings of both stone and daub at this site. Materially, the two sites are similar, attesting to a close relationship between the two settlements and their parallel trade connections. While Tumbatu was a regional entrepôt, providing imported trade goods to northern Unguja, Mkokotoni seems to have been a production area, supplying Tumbatu with various subsistence goods (Rødland, 2021). While they have previously been treated as two separate settlements, my research has shown that they should be understood as belonging to one larger urban landscape tightly connected through commerce and production, and probably also familial relationships between the inhabitants of the two settlement areas. Both sites were occupied simultaneously, from around the eleventh to the fourteenth or fifteenth centuries AD, a period of increased trade and urbanization in Zanzibar and the rest of the East African coast.

The fieldwork for this research was conducted in 2017 and 2019 by me and a team consisting of students and field assistants from Sweden, Tanzania, and Zanzibar, as well as Abdallah Khamis Ali, Faki Othman Haji, and Ali Juma Ameir from the Department of Museums and Antiquities in Zanzibar. Both sites were investigated through shovel test pit (STP) surveys and targeted excavations of specific architectural features. Three trenches covering an area of 10 m^2 were excavated in Mkokotoni, and six trenches were excavated in Tumbatu, covering 52.75 m^2. A total of 12.7 m^3 and 49.9 m^3 volume of soil was excavated, respectively. The excavations in Mkokotoni revealed two structures built with coral stone, daub, and lime mortar or plaster (Figs. 2 and 3). While neither structure was excavated in its entirety, it seems one was a deep, circular feature of unclear function, and the other was a square building, probably a workshop. Both structures contained a variety of artifacts, including local and imported pottery, glass shards, marine shells, and faunal bones, in addition

Fig. 2 View of all trenches in Mkokotoni, circular stone feature/possible furnace in the foreground (scale missing; taken by author 2019)

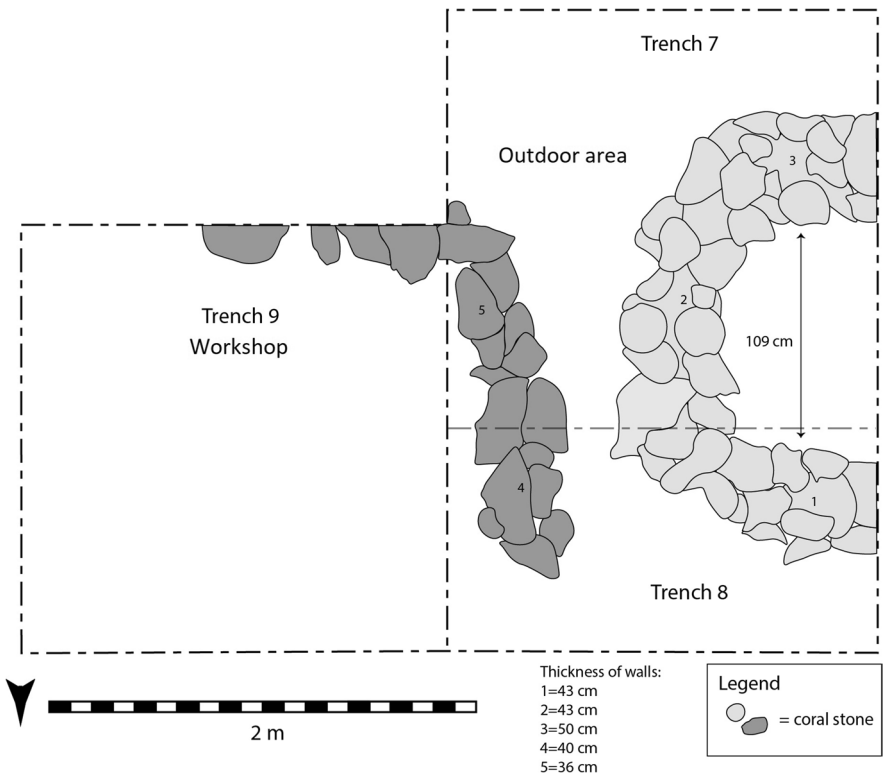


Fig. 3 Plan drawing of all trenches in Mkokotoni (workshop structure on the left and circular stone feature/possible furnace on the right)

to glass bead waste and large numbers of glass beads. The trenches in both Tumbatu and Mkokotoni were stratigraphically challenging to interpret, as many contexts included midden materials, which had been

used as fills for the floors and placed within and on top of structures after they were abandoned. It is therefore difficult to determine which finds relate to the use of the structures, and which were disposed of as waste before or after their use. Nevertheless, some contexts can be more firmly related to the occupation and use of the structures. This includes context 7013 within the circular stone feature, which was the richest of all the contexts in Mkokotoni. It contained a significant amount of the glass beads (19.6% of the total glass bead assemblage from the stone feature), glass bead waste (30.1% of the entire bead waste assemblage from the stone feature), as well as ashy deposits (Fig. 4). This context was radiocarbon-dated to 1019–1154 cal AD—calibrated to 2-sigma, after Reimer et al. (2013)—which corresponds to the date of the floor surface of the workshop structure next to it, dated to 1021–1154 cal AD, indicating context 7013 relates to a period when the workshop was in use. The two contexts directly below, 7015 and 7018, were also very rich in glass beads but were not radiocarbon-dated. For a fuller discussion of the excavations and results, see Rødland (2021).

Based on the large number of glass beads and glass bead waste excavated from both structures at Mkokotoni, the area of the structures can be interpreted as a glass bead production area. The square stone structure may have been the workshop where a variety of activities were carried out, including sorting and stringing beads, an activity observed in more recent bead production locations (Francis, 1990; Kanungo, 2004). While the circular stone feature remains enigmatic and has been difficult to interpret, it may have originally functioned as a furnace used in the production or processing of glass beads. This is supported by the ashy deposits in context 7013 and the ubiquity of glass beads and waste in that context, and within the circular feature more generally (Table 2)—the majority of the glass beads came from this circular feature. It may have been repurposed as a midden when the furnace went out of use. This culture of repurposing may have been the case for the other excavated structures, accounting for the large number of non-glass materials from all contexts.

The bead assemblage from Mkokotoni is remarkable on the Swahili coast, both in terms of the sheer number of beads recovered and the types identified. In total, over 25,000 glass beads were recovered from all three trenches. These numbers equate to an estimated 1986 beads per m^3, compared to just 126 beads per m^3 in Tumbatu (Table 2). Unfortunately, there is no data on volume/m^3 from other Swahili sites for comparison with Mkokotoni. Most of the beads from Mkokotoni are of the drawn variety, which is the most common glass bead type found in East Africa; however, most of the glass beads from Mkokotoni are of a

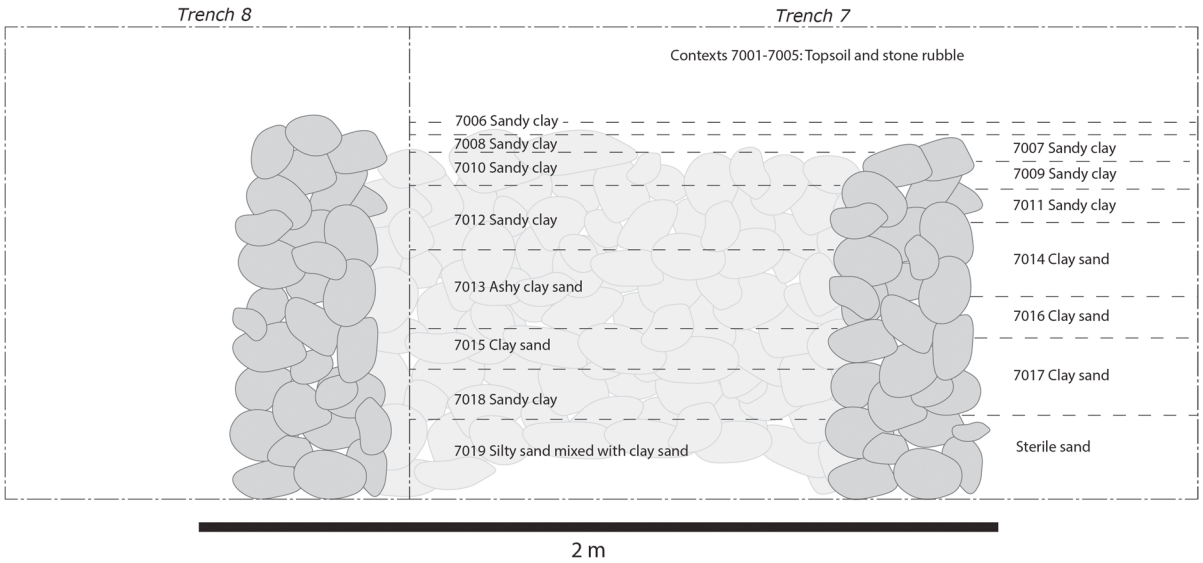


Fig. 4 Section drawing of the possible furnace located within trench 7 (drawing is based on post-excavation data and was not drawn on-site as the contexts were not observable in the section)

Table 2 Quantities of glass beads and bead waste from Mkokotoni (Tumbatu included for comparison)

	Volume (m^3)	No of beads	Bead per m^3	No of waste	Waste per m^3
Deposits inside furnace (excluding topsoil)	0.9	9472	11,014.0	506	588.4
Deposits inside workshop (excluding topsoil)	3.9	5780	1489.7	1137	293.0
Deposits in outdoor area (excluding topsoil)	4.0	1884	468.7	149	37.1
Total space excavated	***12.7***	***25,146***	***1986.3***	***2978***	***235.2***
Tumbatu (all trenches)	49.8	6299	126.5	16	0.3

type not previously reported at any other Swahili site, giving further indication that Mkokotoni was a place of bead-making. I will describe these beads below. In addition, glass bead-making waste is not commonly found in Swahili sites, although its presence may have been under-reported. In those few cases where it has been reported, such as in Chibuene and Shanga, the quantity is low (Horton, 1996, p. 332; Wood et al., 2012). The ubiquity of beads at Mkokotoni has been noted previously by Mark Horton (2004), who excavated test pits at the site during his survey of the Zanzibar archipelago in the late 1980s, and by Mann (2000) during her visit to Zanzibar in 1998.

The Mkokotoni Glass Bead Assemblage: An Overview

Here I will discuss the glass bead assemblage from Mkokotoni, focusing on the procedures employed for classification. This classification allows for comparison with other glass bead assemblages and highlights the uniqueness of the glass beads from Mkokotoni. Due to the volume of the bead assemblage, only a sample was studied in detail. Recorded variables include production method, color, size, shape, diaphaneity, end treatment, and surface condition. These criteria were modeled on those outlined by Wood (2011). This model will permit future comparative studies across different glass bead assemblages from eastern and southern Africa. In total, 500 beads were selected for classification. Two hundred of these came from contexts just below the topsoil, while the remaining 300 came from contexts related to the occupation period of the workshop and the circular stone feature (including context 7013). There was little observable variability between beads from these upper and lower contexts. The same number of beads were studied from the neighboring site, Tumbatu. Although details of the classification of the glass beads from Tumbatu are not discussed here, the assemblage provides useful comparative data that highlights the uniqueness of the Mkokotoni assemblage.

Bead series Where possible, the studied beads were assigned to a bead series using Wood's sequence developed for beads excavated in southern Africa (Wood, 2011), although the lack of beads from East Africa in Wood's analysis and the absence of chemical analysis on the beads from Mkokotoni limit comparability. Because Wood's beads categorized as East Coast Indo-Pacific were mainly recovered from southern African sites, they may not reflect the wide spectrum of beads (and their colors) within the studied assemblage. For example, beads of green or blue colors in the Mkokotoni and Tumbatu assemblages had a wide variety of shades. Examining the beads under a microscope allowed me to detect differences in texture, color, and shade. Most of the glass beads from Mkokotoni are of the drawn, monochrome kind. Only 18 wound beads were recorded. Wood (2011) suggests we should include wound beads within the Indo-Pacific group based on their chemical composition, although I prefer to keep this type separate, as little is known about them. Also, their shape and appearance differ significantly from the drawn types.

Of the beads that could be identified according to Wood's (2011) series, East Coast Indo-Pacific beads were the most common in Mkokotoni and Tumbatu (Fig. 5). In addition, one Mapungubwe Oblate (large, translucent plum-colored cylinder, pitting on the surface), one Zimbabwe (small, opaque green–blue cylinder, no pitting), and two Zhizo series beads (medium, opaque green cylinder, not heat-treated and with striations) were recovered. Seventy-two beads could not be identified according to a specific series. Of the studied samples, 304 beads were classified as Mkokotoni beads (described below). Comparative data from other East African sites are hard to come

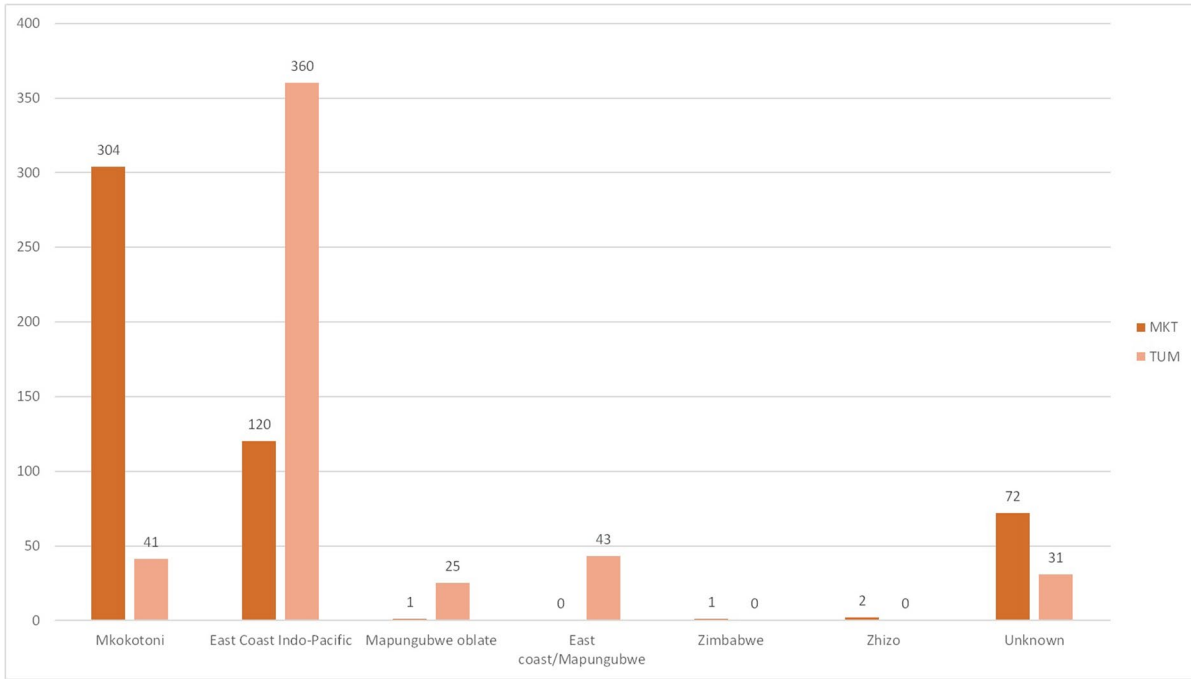


Fig. 5 Distribution of bead series/types at Mkokotoni (MKT) and Tumbatu (TUM) by count

by, as beads are rarely recorded with the same detail as Wood (2011). This lack of published data makes it impossible to determine the distribution and quantity of different types of beads at other contemporary Swahili sites. Comparative studies of all coastal bead assemblages, both morphological and chemical, are needed to better understand the East African glass beads.

Color Figure 6 shows the color groups recorded for the drawn beads according to the series. These were kept relatively simple to allow for comparison with other sites, and to understand the variations within different color groups. Red is the most common color. These are invariably opaque and rarely differ in shade, even across different bead series. Red beads may sometimes appear slightly brown, probably due to the presence of thin black lines or swirls within the red glass of some beads. This difference in shades of red was observable under a microscope. Some beads also have distinct black lines parallel to the perforation on a red surface; it is unclear whether this was done intentionally for decoration or not. While red, black, and (to an extent) yellow are easy to recognize and contain little variability, different shades within the blue and green color groups made identification more difficult and may relate to different bead types and series. Diaphaneity, the level of transparency of the glass, was included to help distinguish between different colors and bead types.

Size Size and length were recorded according to Wood's (2011) recommendations. The size was measured as the maximum diameter around the perforation (Table 3). Small and medium beads were the most common in Mkokotoni (Fig. 7), while the most common length was short (Fig. 8). During the excavations, it was also noted that some beads would slip through the mesh of the sieves, which measured 2 mm, skewing the recovery of these very small beads.

Shape and End Treatment The most common shapes for the drawn beads are cylinder and oblate (Fig. 9). These shapes seem to reflect the production method and end treatment. Most of the beads in Mkokotoni were medium rounded (Fig. 10). This end treatment technique involves mixing glass beads with sharp edges with ash or sand in a tray and reheating them

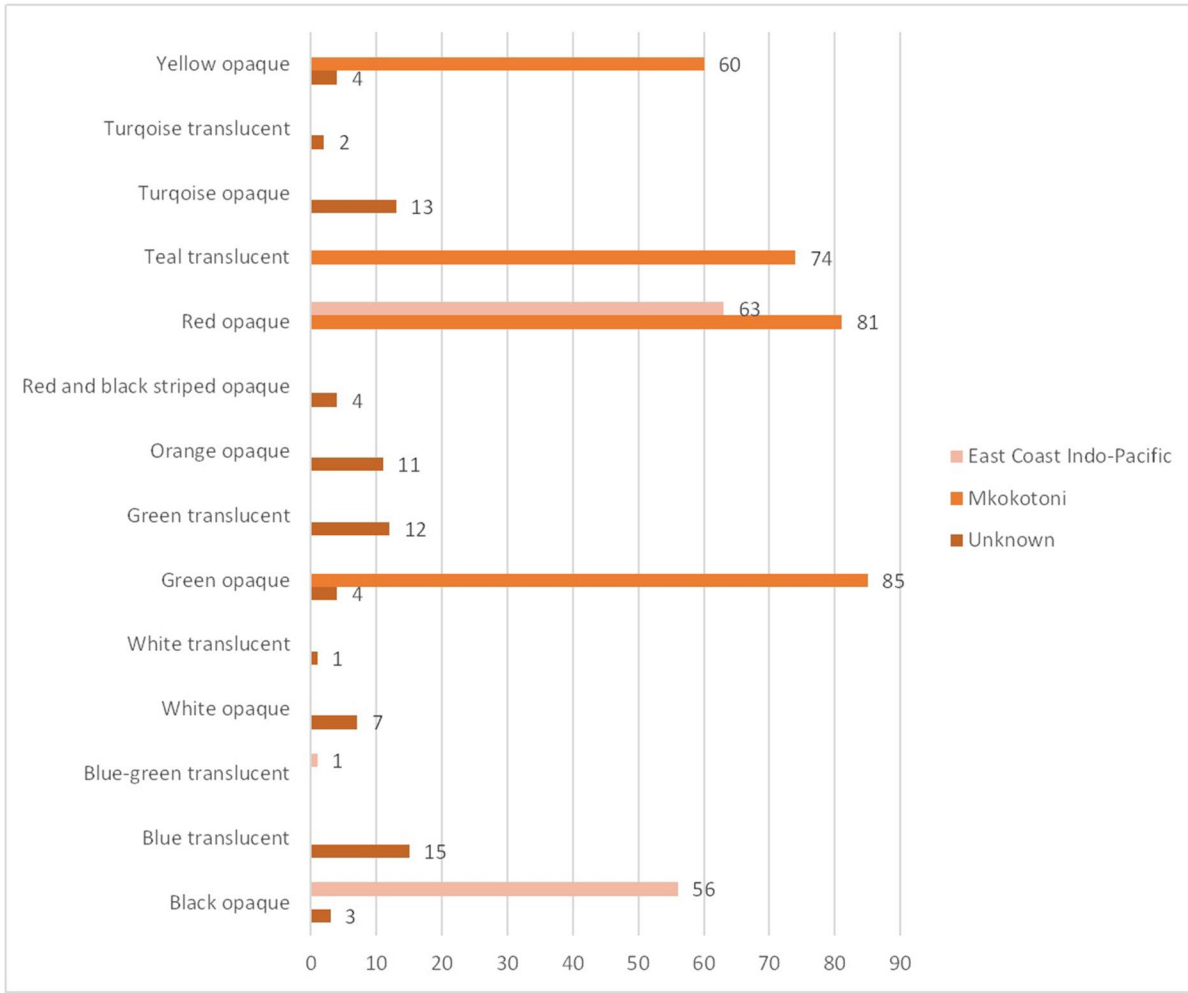


Fig. 6 Main color groups of drawn beads from Mkokotoni by count

Table 3 Size and length ratio calculations based on Wood (2011)

Size designation	Diameter (mm)	Length ratio designation	Formula
Minute	< = 2.5	Disc	Length = < 1/5 diameter
Small	> 2.5–3.5	Short	Length = > 1/5 diameter and < 4/5 diameter
Medium	> 3.5–4.5	Standard	Length = > 4/5 diameter and < 1 1/5 diameter
Large	> 4.5–5.5	Long	Length = > 1 1/5 diameter and < 2 diameter
Very large	> 5.5	Very long	Length = > 2 diameter

in bulk while stirring. The duration of this reheating treatment would consequently impact the shape. For example, oblate beads are more irregular in shape, probably a result of prolonged heat treatment.

Surface I examined the surface of the bead with a handheld magnifier and under a microscope and recorded the surface as smooth, pitted, heavily pitted, or with striations (Fig. 11). These variables are usually a result of the glass composition and quality, or post-

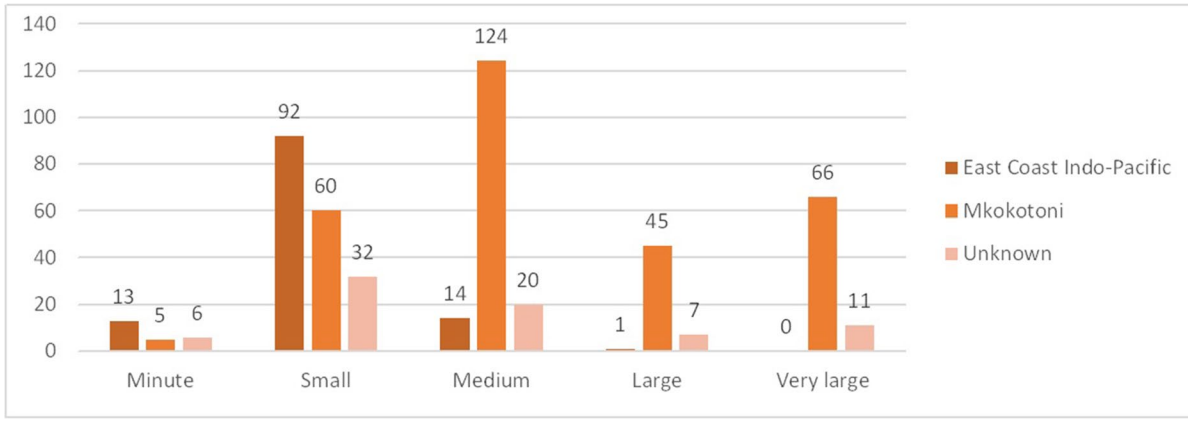
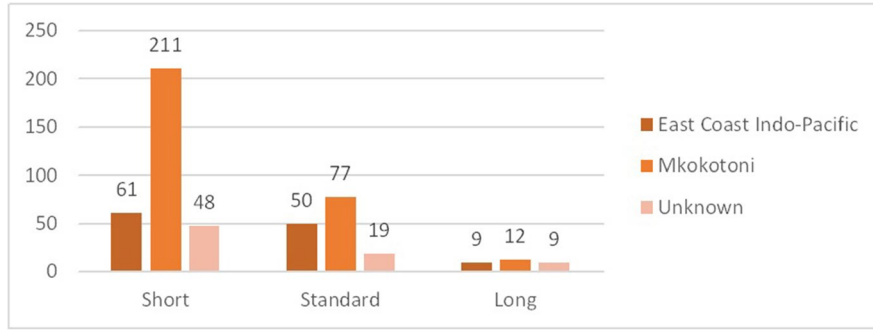


Fig. 7 Bead size by series in Mkokotoni

Fig. 8 Length ratio by series in Mkokotoni



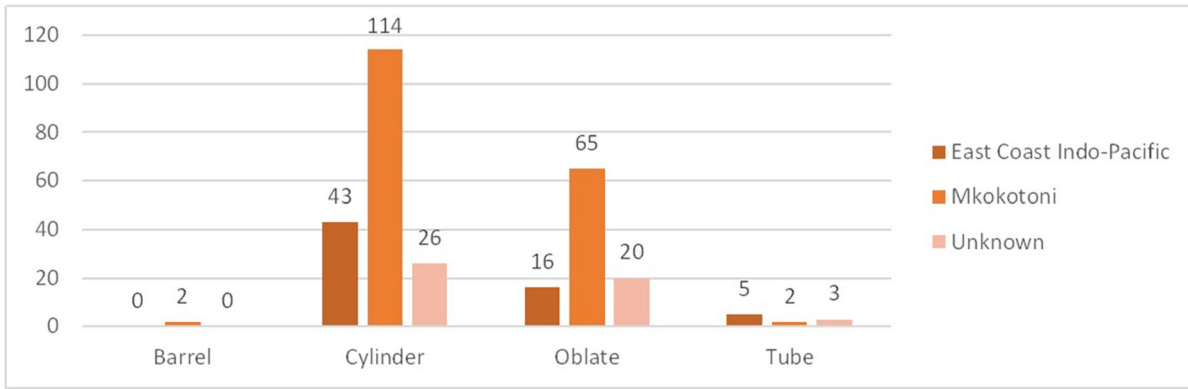


Fig. 9 Shape by series in Mkokotoni

depositional processes, and smooth glass tends to be of a higher quality and shows little to no degradation. Heavily pitted beads were difficult to classify due to the high degree of degradation.

Identifying Mkokotoni Beads

The most significant result of the study is the identification of four types of beads currently only associated with Tumbatu and Mkokotoni—here called

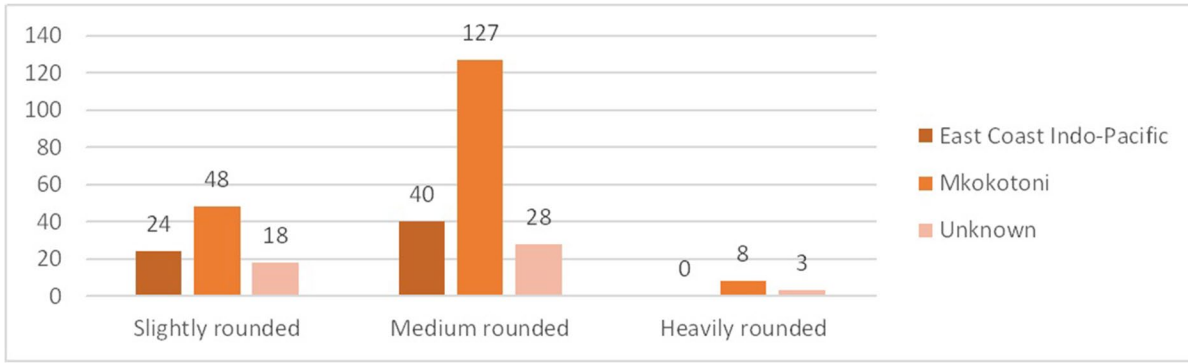


Fig. 10 End treatment by series in Mkokotoni

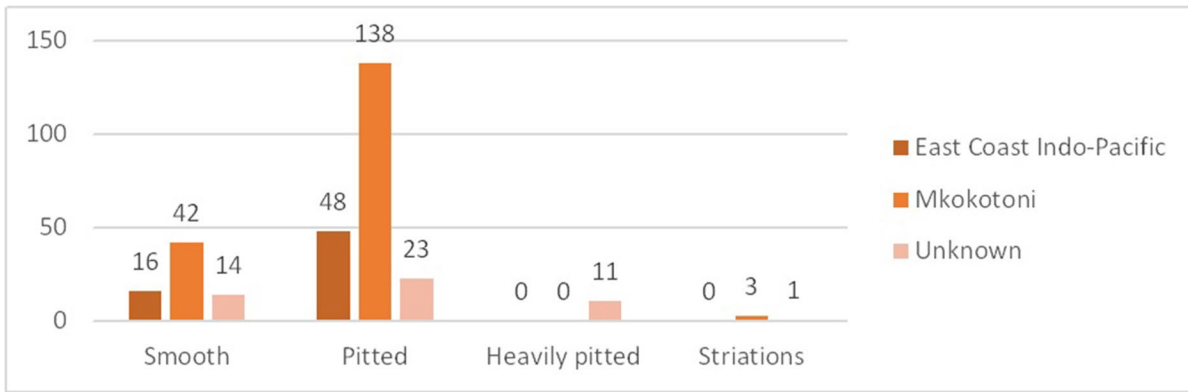


Fig. 11 Surface condition by series in Mkokotoni

Mkokotoni beads. These beads stand out when compared to the East Coast Indo-Pacific beads in terms of their color, surface texture, and size (Fig. 12), and probably belong to a different yet currently unknown bead series (or several bead series). The precise nature of the production of these beads is unclear, as will be discussed below, although some form of processing or modification of these beads is likely to have occurred in Mkokotoni.

The Beads The Mkokotoni beads are all monochrome and drawn, and although they vary in size, they are generally bigger than East Coast Indo-Pacific beads. Size is the only variable that depends significantly on color, although minute beads are rare among all Mkokotoni bead colors. Most Mkokotoni beads are short, and the most common shapes are cylinders and oblate. All beads have been heat-treated to round the ends, and the majority have medium rounded ends. The surface is usually pitted (Fig. 13). The Mkokotoni beads come in four colors: red opaque, yellow opaque, green opaque, and teal translucent (Fig. 14). The teal beads are easily recognizable from other beads due to their unique color; many are also very large and of an irregular shape. Similarly, although green colors occur in other bead series, the Mkokotoni green is easily recognizable due to its opaque grassy color. Red beads are indistinguishable from East Coast Indo-Pacific red beads in color, although they are generally larger and some are more irregular in shape. The distinction was therefore made based on size alone: all minute and small red beads were characterized as East Coast Indo-Pacific, while medium to very large beads belonged to Mkokotoni beads, but some overlap may exist (Wood, 2011, p. 71). Red is uncommon in other bead series from this time period.

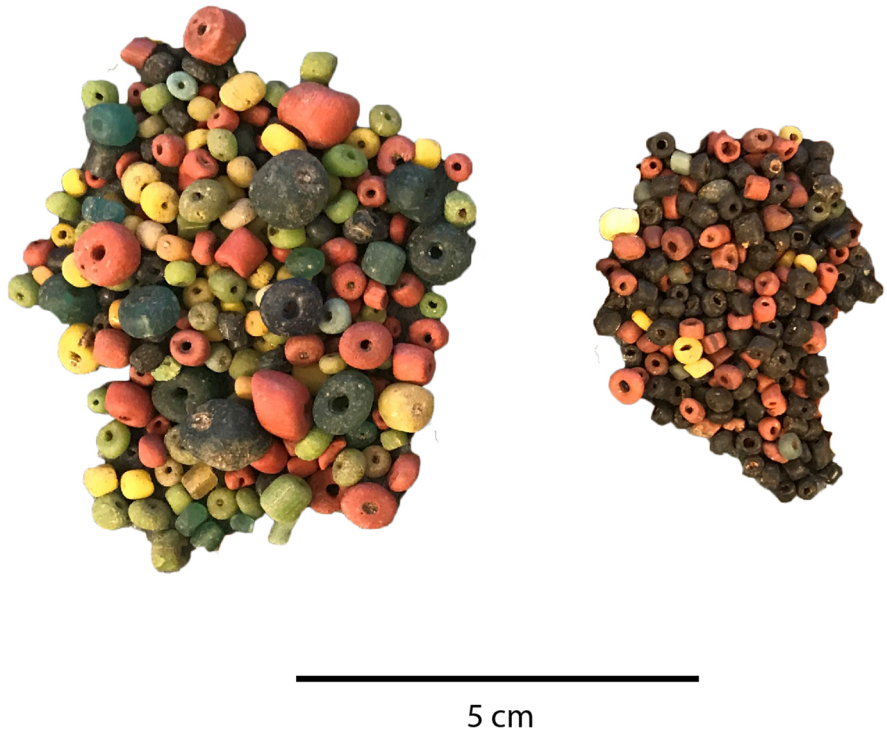


Fig. 12 A sample of beads from Mkokotoni (left) and Tumbatu (right)

Although medium-sized red beads occur in the Khami bead series, the Khami series is associated with the early fifteenth to seventeenth century AD. This period was after the final occupation phase of Tumbatu and Mkokotoni. The similarity between the red bead types may reflect a similar source for the glass or for the beads themselves. The yellow opaque beads can also be difficult to distinguish from East Coast Indo-Pacific yellow. However, when observed under a microscope, the Mkokotoni yellow is slightly greener and more pitted, giving it a grainier appearance (Fig. 15). The East Coast Indo-Pacific yellow also appears to be slightly translucent.

The Bead Waste In addition to these previously unknown types of beads, glass bead waste was also recovered in some quantity: almost 3000 pieces were found in Mkokotoni. In total, 659 of these were studied and recorded in detail (including color, waste type, diaphaneity, and surface). The colors associated with this waste match the colors of the Mkokotoni beads to a significant extent; that is, the most common waste colors are yellow opaque, teal translucent, and red opaque (Fig. 16—opaque green is relatively rare compared to the other colors), another indicator that the Mkokotoni beads were produced or modified in Mkokotoni. Several different types of waste were identified, the majority of which consisted of broken beads or small lumps of glass of various shapes (Table 4 and Fig. 17). Most of these seem to have been heat-treated after breaking. To my knowledge, the only comparable glass bead waste assemblage comes from medieval Gao Saney in Mali, West Africa. Some of the waste from Gao Saney is similar to the Mkokotoni waste assemblage, such as joined beads and heat-treated broken beads (Cissé et al., 2013). McIntosh et al., (2020, p. 3, 15) suggest that the waste could indicate beads imported in bulk. It is entirely possible this was the case at Mkokotoni as well, where crafters or traders may have imported glass beads in bulk and sorted them on site. I will discuss this and other possibilities below.

Discussion

Possibilities for Bead Production in Mkokotoni

The archaeological evidence presented above strongly suggests that some form of glass bead production or

Fig. 13 Morphological traits of the Mkokotoni beads according to color (by count)

Fig. 14 Mkokotoni bead colors (image on the right shows teal bead under bright light)

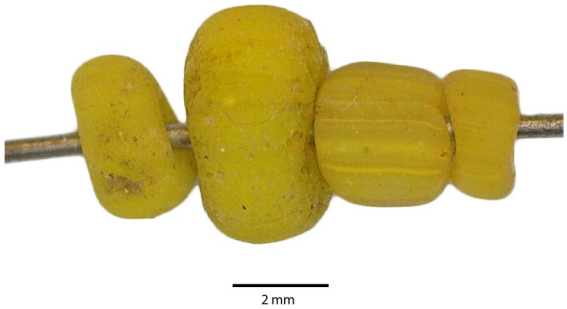


Fig. 15 Mkokotoni (left) and East Coast Indo-Pacific (right) yellow beads

processing occurred in Mkokotoni, and there are several ways we might imagine this labor:

1) As there is currently no evidence for indigenous glass production anywhere on the East African coast, we can assume the Mkokotoni beads were made from the imported glass if they were made locally. One possibility is the re-melting of imported glass shards (cullet). These occurred frequently in all three trenches, and a total of 153 glass shards were recovered in Mkokotoni. Although we did not recover crucibles or glass slag that would suggest possible primary glass making (e.g., Babalola et al., 2018, 2020), glass shards are a common find at contemporary Swahili sites, including Tumbatu, where they are assumed to be the remains of imported glass vessels (also see Wood et al., 2012; Wood et al., this volume). It is also possible they re-melted imported glass beads or glass bead waste.
2) A second possibility is that Mkokotoni bead workers imported ready-made glass tubes, which were then cut into beads of the desired length, and subsequently heat-treated. This proposition has been put forward by Horton (2004) and Wood (2016) as the most likely scenario for local bead production. If this were the case in Mkokotoni, we should expect to find large glass tubes to fit with the larger Mkokotoni type beads, but this was not the case.
3) The final scenario involves the import of beads and waste in bulk from a currently unknown location elsewhere in the Indian Ocean to be sorted and distributed from Mkokotoni for local redistribution and sale. They may also have been heat-treated on-site in Mkokotoni.

While I currently cannot determine the nature of bead production at Mkokotoni, I plan to explore the above possibilities in the future. The absence of crucibles and tools in relation to the workshop renders scenario 3 the most plausible. However, only a portion of this workshop was excavated, and future excavations may reveal the full extent of the space and associated production remains. In addition, chemical analysis may help shed light on the relationship

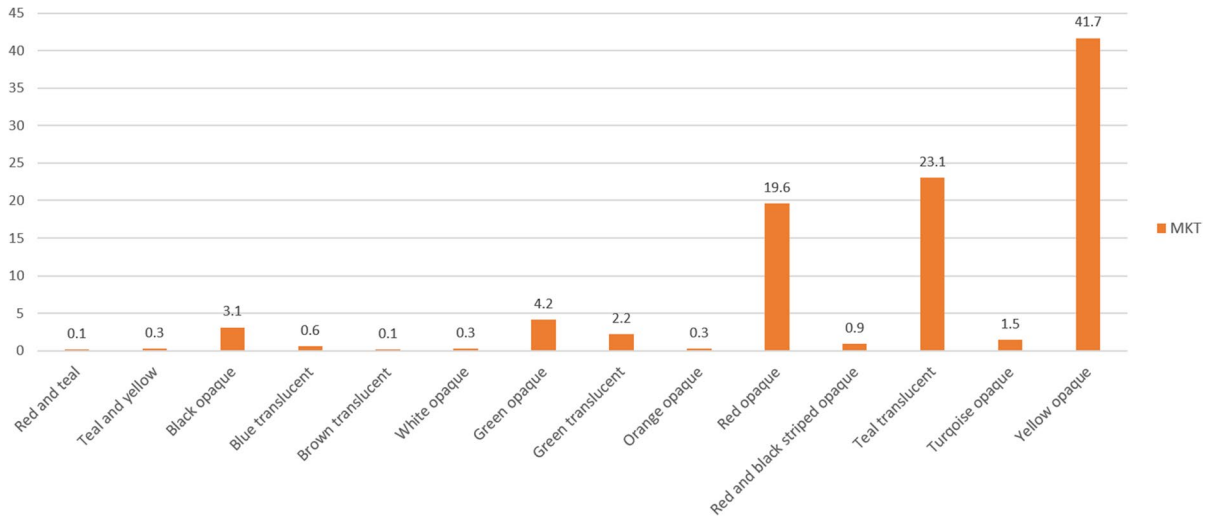


Fig. 16 Occurrence of glass waste colors in Mkokotoni (presented as % of total)

Table 4 Glass bead waste types in Mkokotoni

Waste type	Count
Bead fragment	411
Joined beads	17
Deformed beads	17
Worn beads	16
Glass lump	161
Joined glass	3
Tube	11
Tube fragment	14
Unclear	9
Total	***659***

between the beads, bead waste, and glass shards and between the Mkokotoni beads and other bead series. Regardless of the exact nature of the beadwork at Mkokotoni, the uniqueness of the Mkokotoni beads suggests they may have been produced or modified to fit local esthetics and preferences. Glass beads were a popular item of adornment, and the presence of a local bead workshop would have made it easier for the inhabitants of Mkokotoni and the surrounding areas to access these beads. The fact that most of the East Coast Indo-Pacific beads from both Mkokotoni and Tumbatu were either black or red (91.5%) could indicate a limited supply of other colors via the Indian Ocean trade routes. Therefore, the Mkokotoni beads offered new and different colors that aligned better with local needs. The Mkokotoni beads seem to have been less popular in Tumbatu, where they only made up 8.2% of the studied beads versus 60.8% in Mkokotoni. It is possible the larger Mkokotoni beads were not preferred in Tumbatu (and perhaps elsewhere on the coast) and were therefore removed during sorting before the beads were exchanged from Mkokotoni. Few sites of comparable dates have been excavated (and published) on the island of Unguja, and future research may reveal more about the local and regional distribution of Mkokotoni beads and consumption practices. It is intriguing that Fleisher (2003) reported few glass beads from contemporary sites in Pemba, which may indicate limited exchange of beads between Mkokotoni/Tumbatu and Pemba.

Who were the bead-workers in Mkokotoni? Horton (2004) suggested they may have been immigrant crafters from South or Southeast Asia who brought glass bead production technologies from their homelands. Resident immigrants from the Indian Ocean world were present in many second millennium Swahili towns, and some may have brought productive technologies with them. If this were the case in Mkokotoni, we might expect the material culture associated with the bead workshop to reflect the foreign origin of the bead crafters. This was not the case, however, and the overall material assemblage from the workshop was similar to that found in domestic contexts at Tumbatu and other excavated Swahili sites (Rødland, 2021). It is, therefore, plausible to argue

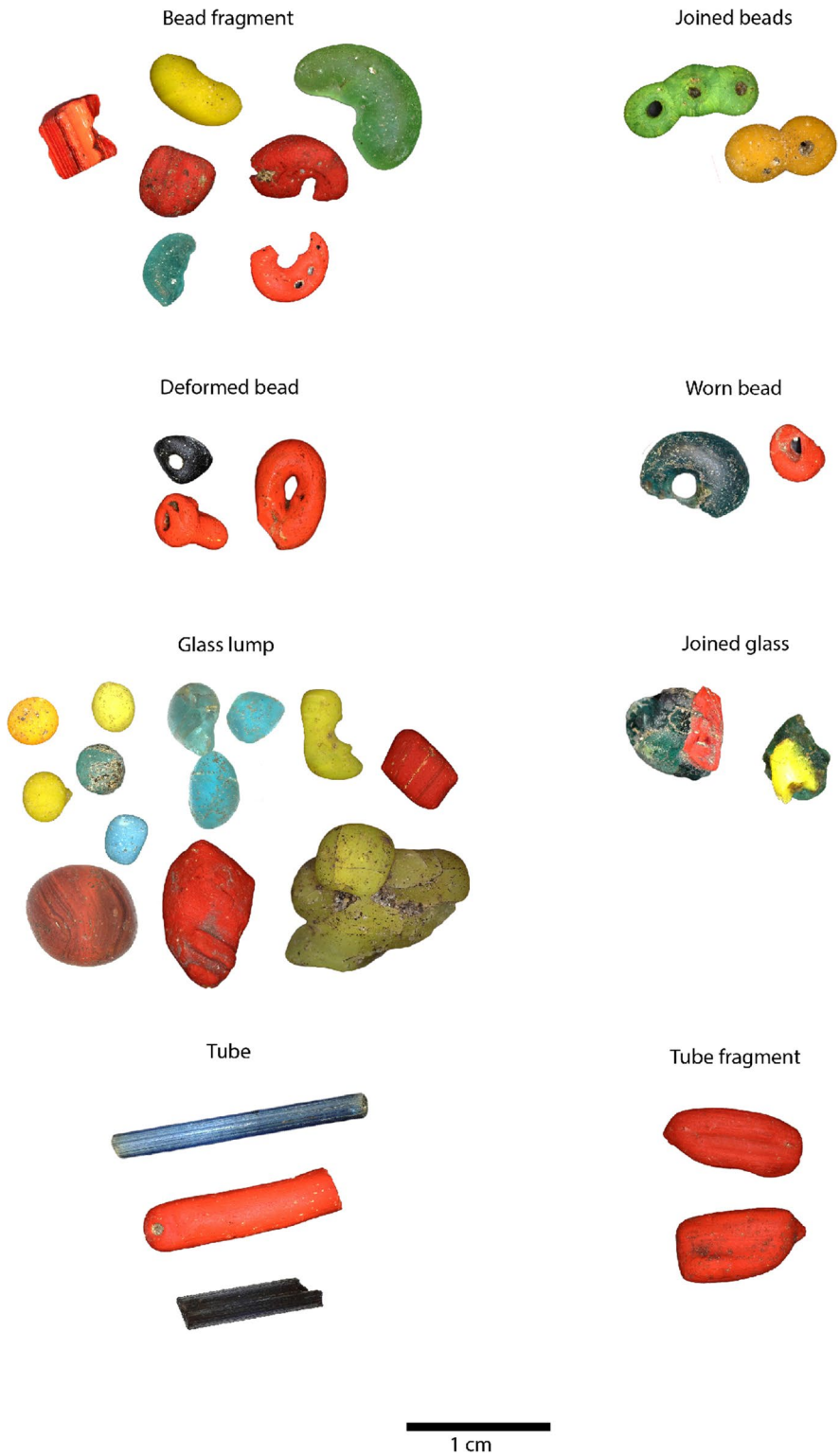


Fig. 17 Glass bead waste types from Mkokotoni

that the bead crafters would have been local Zanzibari people who gained knowledge of these technologies through trade relationships and adapted them to fit local resources and their social, cultural, and economic needs. If the Mkokotoni beads were manufactured locally, their larger size and uneven shape could indicate such adapted technologies.

Beads in the Swahili World: New Insights and Future Directions

Considering the unusually large number of glass beads recovered from Mkokotoni, there is little doubt that glass beads played a significant role in Mkokotoni's culture and economy. The discovery of a workshop area is also extraordinary on the Swahili coast, as evidence of such specialized production structures is generally rare. The local adaptation of glass bead production technologies shows the creativity of the Mkokotoni crafters in utilizing the regional demand for glass beads to their own economic and social benefit. Glass beads became more common on the coast from the eleventh century onwards, a date which coincides with the construction of the Mkokotoni bead workshop, whose foundation layers have been radiocarbon-dated to 994–1153 cal AD (Rødland, 2021).

The social role of beads in Swahili societies is still poorly understood, as much scholarly effort has gone into studying the composition of glass and the trade routes of the beads. However, we can expect that beads were an important part of personal adornment and identity display, whereby different types of beads and their colors carried meaning beyond the esthetic. The presence of a bead workshop producing thousands of beads in Mkokotoni hints at the importance of the beads and the collective consumption power of the people who wore and used them. Some of the early Portuguese seafarers who arrived in East Africa reported that they could not sell their European glass beads to local inhabitants, who instead wanted the Indian beads they were already accustomed to (Wood, 2016), suggesting strong preferences for certain types of beads.

The dearth of published bead assemblages from East Africa has rendered comparison challenging. This lack of scholarship impaired my ability to securely identify sites with Mkokotoni beads. However, the significant output of the workshop in Mkokotoni would suggest trade beyond this site and into other Swahili towns of the same period. I have identified some glass beads from Vohemar in Madagascar that show similarities with the Mkokotoni beads, based only on superficial comparison with published photos of some of the beads from Vohemar (accessed via Musée du Quai Branly: https://www.quaibranly.fr/en/explore-collections, item numbers 71.1947.80.27 and 71.1947.80.7). The beads from Vohemar were excavated from a large necropolis dating to the thirteenth to eighteenth centuries AD in northwestern Madagascar (Colomban et al., 2021). In addition, Pearce (1920, p. 335) has described an unusual type of bead found at Ndagoni/Ras Mkumbuu in Pemba:

> The most common bead found at Ndagoni is a large, irregularly shaped, bluish-green glass bead of a distinctive character. After heavy rain they may be picked up on the sea-beach by the hundreds. That they are somewhat archaic in manufacture is evident from the irregularity of their shape and size. Many of them appear to have become distorted in the process of being made.

While I have been unable to find any photos of this bead type, the description fits the translucent teal Mkokotoni bead, and the date of Ndagoni/Ras Mkumbuu settlement is estimated to be around the tenth to sixteenth centuries. Finally, some large red glass beads similar in shape and size to Mkokotoni beads were excavated from Ibo Island, a site in Mozambique dated to the eleventh to twelfth centuries AD (García-Heras et al., 2021).

Conclusion

Four new types of glass beads previously unknown on the East African coast have been uncovered during excavations at Mkokotoni in north-western Zanzibar, in association with a workshop structure and corpus of waste, suggesting that Mkokotoni was a center where these glass beads were produced or modified for redistribution. It is currently not possible to determine with certainty whether primary production or re-melting of imported cullet took place at the site as no crucibles, tools, or semi-finished glass

was recovered from the site. Such production remains may be uncovered in the future if a larger area is excavated. However, a possible furnace shows that some glass working was done at Mkokotoni. The Mkokotoni glass beads are characterized by their large size and irregular shape, slightly grainy surface, and the unique color of two sub-types: translucent teal and opaque (grassy) green. The two other colors, opaque yellow and opaque red, share similarities with beads of the same color in other bead series, such as the East Coast Indo-Pacific series, but differ in surface texture and size. Future chemical analysis and comparative morphological classification can shed further light on the production and distribution of the Mkokotoni beads across East Africa and the Indian Ocean world. Archaeological evidence of the workshop at Mkokotoni and its associated bead assemblage offers the first substantial data for local glass bead processing in East Africa. As such, this article has contributed to our growing understanding and appreciation of crafting labors and the significance of glass beads on the Swahili Coast in the second millennium AD. Mkokotoni glass beads were not just trade items, but also objects of personal adornment, identity display, ritual performance, and consumption power.

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Declarations

Competing Interests The author declares no competing interests.

References

Abraham, S. A. (2013). In search of craft and society: The glass beads of early historic Tamil South India. In S. A. Abraham, P. Gullapalli, T. P. Raczek, & U. Z. Rizvi (Eds.), *Connections and complexity: New approaches to the archaeology of South Asia* (pp. 239–261). Left Coast Press.

Abraham, S. A. (2016). Glass beads and glass production in early South India: Contextualizing Indo-Pacific bead manufacture. *Archaeological Research in Asia, 6*, 4–15. https://doi.org/10.1016/j.ara.2016.02.003

Babalola, A. B., Rehren, T., Ige, A., & McIntosh, S. (2018). The glass making crucibles from Ile-Ife, SW Nigeria. *Journal of African Archaeology, 16*, 31–59.

Babalola, A. B., Ogunfolakan, A. B., & Rehren, T. (2020). Semi-finished glass from Ile-Ife, Nigeria: Implications for the archaeology of glass in sub-Saharan Africa. *Antiquity, 94*(375), 1–6.

Carter, A. K. (2016). The production and exchange of glass and stone deads in Southeast Asia from 500 BCE to the early second millennium CE: An assessment of the work of Peter Francis in light of recent research. *Archaeological Research in Asia, 6*, 16–29. https://doi.org/10.1016/j.ara.2016.02.004

Chittick, N. (1974). *Kilwa: An Islamic trading city on the East African Coast* (Vol. 2). The British Institute in Eastern Africa.

Chittick, N. (1984). *Manda: Excavations at an island port on the Kenya coast*. British Institute in Eastern Africa.

Cissé, M., McIntosh, S. K., Dussubieux, L., Fenn, T., Gallagher, D., & Smith, A. C. (2013). Excavations at Gao Saney: New evidence for settlement growth, trade, and interaction on the Niger Bend in the first millennium CE. *Journal of African Archaeology, 11*(1), 9–37. https://doi.org/10.3213/2191-5784-10233

Colomban, P., Franci, G. S., & Koleini, F. (2021). On-site Raman spectroscopic study of beads from the Necropolis of Vohemar, Northern Madagascar (>13th C.). *Heritage, 4*, 524–540. https://doi.org/10.3390/heritage4010031

Donley-Reid, L. (1990). The power of Swahili porcelain, beads and pottery. *Archaeological Papers of the American Anthropological Association, 2*(1), 47–59.

Dussubieux, L., & Wood, M. (2021). Indian glass: Chronology and distribution in Eastern Africa. In A. K. Kanungo & L. Dussubieux (Eds.), *Ancient glass of South Asia: Archaeology, ethnography and global connections* (pp. 511–532). Springer.

Dussubieux, L., Kusimba, C. M., Gogte, V., Kusimba, S. B., Gratuze, B., & Oka, R. (2008). The trading of ancient glass beads: New analytical data from South Asian and East African soda-alumina glass beads. *Archaeometry, 50*(5), 797–821. https://doi.org/10.1111/j.1475-4754.2007.00350.x

Fleisher, J. (2003). *Viewing stonetowns from the countryside: An archaeological approach to Swahili regional systems, AD 800–1500*. Ph.D. dissertation. University of Virginia.

Flexner, J. L., Fleisher, J., & LaViolette, A. (2008). Bead grinders and early Swahili household economy: Analysis of an assemblage from Tumbe, Pemba Island, Tanzania, 7th-10th centuries AD. *Journal of African Archaeology, 6*(2), 161–181.

Foltz, R. (2018). From Zanzibar to Zaytun: Iranian merchants across the Indian Ocean Basin. *Iran and the Caucasus, 22*, 139–154. https://doi.org/10.1163/1573384X-20180203

Francis, P. (1990). Glass beads in Asia, part two. Indo-Pacific Beads. *Asian Perspectives, 29*(1), 1–23.

García-Heras, M., Agua, F., Madiquida, H., Fernández, V. M., de Torres, J., Villegas, M. -Á., & Ruiz-Gálvez, M. (2021). Characterization of glass, shell, and fishbone beads on Ibo Island (Northern Mozambique) in the context of the Indian Ocean trade. *African Archaeological Review, 38*, 297–318. https://doi.org/10.1007/s10437-021-09430-0

Gray, J. M. (1962). *History of Zanzibar from the Middle Ages to 1856*. Oxford University Press.

Horton, M. (1996). *Shanga: The archaeology of a Muslim trading community on the coast of East Africa*. British Institute in Eastern Africa.

Horton, M. (2004). Artisans, communities, and commodities: Medieval exchanges between Northwestern India and East Africa. *Ars Orientalis, 34*, 62–80.

Horton, M., & Clark, C. (1985). Archaeological survey of Zanzibar. *Azania: Archaeological Research in Africa, 20*(1), 167–171.

Kanungo, A. K. (2000). Glass beads in Indian archaeology: An ethnoarchaeological approach. *Bulletin of the Decan College Research Institute, 60*(61), 337–353.

Kanungo, A. K. (2004). Glass beads in ancient India and furnace-wound beads at Purdalpur: An ethnoarchaeological approach. *Asian Perspectives, 43*(1), 123–150. https://doi.org/10.1353/asi.2004.0009

Kusimba, C. M., & Oka, R. (2009). Trade and polity in East Africa: Re-examining elite strategies for acquiring power. In T. Falola & M. D. Childs (Eds.), *The changing worlds of Atlantic Africa* (pp. 39–60). Carolina Academic Press.

Mann, R. (2000). The history of beads in East Africa. *Kenya past and Present, 31*, 36–47.

Marshall, L. (2019). Consumer choice and beads in fugitive slave villages in nineteenth-century Kenya. *International Journal of Historical Archaeology, 23*, 103–108.

McIntosh, S. K., Wood, M., Dussubieux, L., Robertshaw, P., Insoll, T., & Cissé, M. (2020). Glass beads from Medieval Gao (Mali): New analytical data on chronology, sources, and trade. *Journal of African Archaeology, 18*, 1–23. https://doi.org/10.1163/21915784-20200009

Pauly, M., & Ferrandis, M. (2018). Le site funéraire d'Antsiraka Boira (Acoua, Grande Terre): Islamisation et syncrétisme culturel à Mayotte au XIIe siècle. *Afriques, 9*, 1–39.

Pawlowicz, M. (2019). Beyond commoner and elite in Swahili society: Re-examination of archaeological materials from Gede, Kenya. *African Archaeological Review, 36*, 213–248. https://doi.org/10.1007/s10437-019-09326-0

Pearce, F. B. (1920). *Zanzibar: The Island metropolis of Eastern Africa*. T. Fisher Unwin.

Reimer, P. J., Bard, E., Bayliss, A., Beck, W. J., Blackwell, P. G., Ramset, C. B., Buck, C. E., et al. (2013). IntCal13 and Marine13 radiocarbon age calibration curves 0–50,000 years cal BP. *Radiocarbon, 55*(4), 1869–1887.

Robertshaw, P. (2020). Glass beads in African society: Beyond chemistry and provenience. In C. N. Duckworth, N. Cuénod, & D. Mattingly (Eds.), *Mobile technologies in the Ancient Sahara and beyond* (pp. 385–422). Cambridge University Press.

Robertshaw, P., Rasoarifetra, B., Wood, M., Melchiorre, E., Popelka-Filcoff, R. S., & Glascock, M. D. (2006). Chemical analysis of glass beads from Madagascar. *Journal of African Archaeology, 4*(1), 91–109. https://doi.org/10.3213/1612-1651-10064

Robertshaw, P., Wood, M., Melchiorre, E., Popelka-Filcoff, R. S., & Glascock, M. D. (2010). Southern African glass beads: Chemistry, glass sources and patterns of trade. *Journal of Archaeological Science, 37*, 1898–1912.

Rødland, H. (2021). *Swahili social landscapes: Material expressions of identity, agency, and labour in Zanzibar, 1000–1400 CE*. Uppsala University.

Rødland, H., Wynne-Jones, S., Wood, M., & Fleisher, J. (2020). No such thing as invisible people: Toward an archaeology of slavery at the fifteenth-century Swahili site of Songo Mnara. *Azania: Archaeological Research in Africa, 55*(4), 439–457.

Siu, I., Henderson, J., Qin, D., Ding, Y., & Cui, J. (2021). A study of 11th–15th centuries AD glass beads from Mambrui, Kenya: An archaeological and chemical approach. *Journal of Archaeological Science: Reports, 36*.https://doi.org/10.1016/j.jasrep.2020.102750

Strandes, J. (1961). *The Portuguese period in East Africa*. The Kenya History Society.

Walz, J., & Dussubieux, L. (2016). Zhizo series glass beads at Kwa Mgogo, Inland NE Tanzania. *Journal of African Archaeology, 14*(1), 99–101. https://doi.org/10.3213/2191-5784-10284

Wood, M. (2011). A glass bead sequence for southern Africa from the 8th to the 16th century AD. *Journal of*

African Archaeology, 9(1), 67–84. https://doi.org/10.3213/1612-1651-10184

Wood, M. (2016). Glass beads from pre-European contact sub-Saharan Africa: Peter Francis's work revisited and updated. *Archaeological Research in Asia, 6*, 65–80. https://doi.org/10.1016/j.ara.2016.02.007

Wood, M. (2018). Glass beads and Indian Ocean trade. In S. Wynne-Jones & A. LaViolette (Eds.), *The Swahili World* (pp. 458–471). Routledge.

Wood, M., Dussubieux, L., & Robertshaw, P. (2012). The glass of Chibuene, Mozambique: New insights into early Indian Ocean trade. *The South African Archaeological Bulletin, 67*(195), 59–74.

Wood, M. (2015). Divergent patterns in Indian Ocean trade to East Africa and southern Africa between the 7th and 17th centuries CE: The glass bead evidence. *Afriques, 6*.https://doi.org/10.4000/afriques.1782