The Elemental Analysis of Glass Beads

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Chapter 13

Inland glass beads in Northeast Tanzania, 8th-17th centuries CE

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1. Introduction

This chapter reports glass bead data from archaeological sites in Northeast Tanzania. The archaeological investigation of areas inland of East Africa’s Swahili Coast has origins decades ago; however, only recently have the scale, funding, and quality of some inland projects begun to match the established trends of coastal archaeology (Kusimba and Walz 2018). During 2001-2006, Walz completed a systematic, regional scale project in inland Northeast Tanzania, which identified settlements and unique evidence of connections to the coast and wider Indian Ocean during the last centuries of the first millennium CE and the first half of the second millennium CE (Walz 2005, 2010, 2013, 2017). Glass beads were among the artifacts documented at archaeological sites in the vicinity of Mombo (Walz and Dussubieux 2016), a present-day town located approximately 100 kilometers from the coastline of the Indian Ocean.

Based on the application of LA-ICP-MS to a sample of 62 glass beads from 11 archaeological sites, this chapter documents glass chemical compositions to address the chronological associations and origin places of the beads. This evidence enhances our understanding of inland-ocean ties and the political economy of communities living in the outer landscapes of contemporaneous Swahili towns along the coast.

The pre-18th century glass beads from the vicinity of Mombo are unique to the interior of East Africa and historically significant. Such glass beads are somewhat common at multiple archaeological sites at the Indian Ocean coast of this and other areas in the ocean basin. However, the inland beads in Northeast Tanzania include early glasses (for East Africa), and they have multiple likely origins, including the Middle East and South Asia, among others. Perhaps most

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importantly, analysis of the glass beads demonstrates the continuity and longevity of coast-inland exchange in Northeast Tanzania over the span of a millennium (8th-17th centuries).

2. Background

The relationship between Swahili coastal and inland African communities has long been denied (for the historiography, see Walz 2010: 35–67; Kusimba and Walz 2018). There remain many questions about the character of the relationship. Inadequate research in inland areas of the coast of eastern Africa enabled the representation that the ‘coast’ and ‘hinterland’ were separated places with distinct rather than entangled relations and pasts. This glass bead project is part of a longer-term effort to test the assumption of separation using systematic material and other evidence retrieved through a regional scale project conducted across Northeast Tanzania.

2.1. Northeast Tanzania

This region lies at the intersection of multiple environments and human communities with distinct livelihoods. The Pangani (Ruvu) River flows from northwest to southeast, entering the Indian Ocean at Pangani Bay. Components of the Eastern Arc Range – East and West Usambara Mountains and South Pare Hills – offer diverse physical and natural resources to communities. The East Usambara Mountains approach the Indian Ocean coast to within 15 kilometers and can be seen by sailors from more than fifteen kilometers offshore. All four language families of Africa are represented in wider northern Tanzania. In addition, hunter-gathers, pastoralists, agriculturalists, and urbanites have all occupied the region during the last few centuries. These geographical factors and the diversity of its communities, coupled with evidence from documents and oral traditions from recent centuries, suggest connectivity among communities and across the coast-interior in the deeper past is a hypothesis to be tested (Walz 2010, 2013, 2017). Archaeological reconnaissance by Soper (1967) provided material evidence for human settlement in the region during the last two millennia. Since Soper’s informal assessment, more systematic survey (Walz 2010) and excavations (e.g., Walz 2010; Biginagwa and Ichumbaki 2018) have been conducted in the region’s lowlands from inland to the marine coast.
2.2. Archaeological field project

The systematic archaeological project conducted in lowland Northeast Tanzania (Walz 2010) employed a survey universe divided into five survey areas around known 19th century caravan halts reported in oral traditions and historical documents. One survey area was at Pangani Town along the Indian Ocean coast. The other survey areas proceeded northwest along a natural inland corridor. The project identified 238 archaeological sites, 210 of which were within the survey universe (Walz 2010, 2013). The Mombo Survey Area – the vicinity of focus in this chapter – yielded 81 archaeological sites (Walz 2010). Fifty-six of the sites at Mombo are characterized by TIW/TT (Triangular Incised Ware-Tana Tradition) and/or Group B ceramics, dating to the second half of the first millennium CE and the first half of the second millennium CE, respectively (Soper 1967; Chami 1994, 1998; Horton 1996). Sites in the Mombo Survey Area cluster along a low ridge west of the seasonal Mkomazi River, in low-lying areas between the Mkomazi River and the West Usambara Mountains, and along the skirt of these mountains. These sites include, but are not limited to, Jamali 3 (Site 189), Kwa Mgogo (Site 177), Kwa Mkomwa (Site 135), and Ulimboni (Site 110) (Figure 13.1).

![Map of archaeological survey area near Mombo Town in Northeast Tanzania. Sites marked as numbered dots (see also Table 13.2).](image-url)

**Fig. 13.1:** Map of archaeological survey area near Mombo Town in Northeast Tanzania. Sites marked as numbered dots (see also Table 13.2).
2.3. Bead finds

The larger archaeology project recovered beads (of any type) at 49 of the 210 (23.3%) identified sites. The project bead assemblage includes 194 types, based on raw material, method of manufacture, shape, color, and opacity. One hundred and fifty of the 194 bead types are made of glass. The other 44 are made of non-glass material: semi-precious stone (e.g., carnelian and rock crystal), coral, ivory, ostrich eggshell, mollusk shell (marine or terrestrial), metal (e.g., copper alloy or iron), or ceramic. Beads are distributed across the survey universe but are particularly common at sites on the coast and at some localities more than 40 kilometers inland. As might be expected, beads made of glass dating to the last few centuries are common (Kirkman 1974; Karklins 1992). This chapter emphasizes glass beads from the Mombo Survey Area selected for testing by LA-ICP-MS.

Thirty-one of the 81 (38.3%) identified sites in the Mombo Survey area yielded beads. Of these 31 sites, sixteen (51.6%) produced glass beads only, five (16.1%) had non-glass beads only, and ten (32.3%) had both glass and non-glass beads. The majority of these sites had fewer than five total beads identified during surface investigations. Other sites, like Kwa Mkomwa (Site 135), yielded copious beads. A surface grid survey at Kwa Mkomwa generated 341 glass beads of 23 types. Another site, Kwa Mgogo (Site 177) produced 34 glass beads during excavations of intact archaeological strata associated with TIW/TT, Group B, and other contemporaneous ceramics. In addition, Kwa Mgogo (Site 177) produced other direct indications of coast-interior links (e.g., marine shells as well as a few foreign and coastal ceramics) and evidence of non-glass beads, such as copper alloy cones, carnelian spheres, ostrich eggshell discs, and more than 500 perforated land snail shell discs. These last beads were made on-site (Walz 2010, 2013, 2017; Kusimba and Walz 2018: 435-437).

3. Materials and methods

For the 62 glass beads analyzed from the Mombo Survey Area, LA-ICP-MS was conducted in two batches: Batch 1 (24 beads in 2015-16, only 18 of which produced results and are reported in this chapter) and Batch 2 (44 beads in 2017-18). These legally exported artifacts were analyzed at the Elemental Analysis Facility at The Field Museum of Natural History in Chicago, Illinois, USA.

All Batch 1 beads were retrieved from intact strata at Kwa Mgogo (Site 177) dated to the late first millennium and early to middle second millennium CE. The uniqueness of these early inland finds motivated tests of all 34 excavated glass beads from Kwa Mgogo (Site 177). The chemical compositions of the glasses suggested their origins in time and space (Walz and Dussubieux 2016).
This chapter presents new compositional data from the 44 glass beads tested in Batch 2. The new data builds on previously reported data from Batch 1 (Walz and Dussubieux 2016) in two ways. Batch 2 includes ten additional glass beads excavated from Kwa Mgogo (not previously run in Batch 1) and 34 additional glass beads from ten other archaeological sites in the Mombo Survey Area (see Discussion). The 34 additional glass beads were sampled randomly from the site bead assemblages, most of which included less than five total beads. Some emphasis was placed on Kwa Mkomwa (Site 135), with nine beads selected for LA-ICP-MS tests, because of the large number of glass beads documented there (see above).

See Annex A for a description of the analytical equipment, procedures, and methods used to conduct LA-ICP-MS of the glass beads at the Elemental Analysis Facility at The Field Museum of Natural History.

4. Results

Sixty-two compositions were obtained from the glass beads tested from inland Northeast Tanzania in 2015 (Walz and Dussubieux 2016) and 2017 at the Elemental Analysis Facility at The Field Museum. Like in Batch 1, several beads (JW02, JW10, and JW42) in Batch 2 had low alkali contents reflecting a high state of corrosion of the analyzed glass and will not be discussed further.

The remaining 59 glass samples were separated into five groups:

- 17 soda glass samples with magnesia < 1.5% and high alumina (> 4%) manufactured from a mineral soda – high alumina glass;
- 16 soda glass samples with magnesia > 1.5% and high alumina (> 4%) manufactured from a soda plant ash – high alumina glass;
- 16 soda glass samples with magnesia > 1.5% and low alumina (< 4%) manufactured from a soda plant ash – low alumina glass;
- 8 glass beads with a soda composition of variable magnesia and potash concentrations but generally low alumina (< 3%); and
- 2 glass beads with low soda concentrations (0.3%), but containing significant concentrations of potash (6%) and high concentrations of lead (48%).
See Annex B for elaborations about the glass compositions discussed in this chapter and the volume.

4.1. Mineral soda – high alumina glass

Seventeen samples belong to the mineral soda – high alumina or m-Na-Al glass that in addition to low magnesia (< 1.5%) and high alumina (> 4%) concentrations also is characterized by high trace element concentrations. This glass, manufactured from a natural mix of an immature granite sand and soda-rich efflorescence, was
produced in South Asia (Brill 1987). Five different sub-groups have been identified based on concentrations of the following constituents: MgO, CaO, Sr, Zr, Cs, Ba, and U (Dussubieux et al. 2008; Dussubieux et al. 2010; Dussubieux and Wood 2021). Additional sub-groups identified at the medieval site of Indor (Rajasthan, India) recently were recognized by Trivedi and Dussubieux (this volume; in preparation). See Annex B for more background on m-Na-Al sub-groups.

Based on the seven listed constituents, a comparison of the m-Na-Al compositions from Northeast Tanzania with the compositions of the five initial sub-groups was conducted with principal component analysis (PCA). Figure 13.3 shows that most of the samples from Tanzania fall in the m-Na-Al 6 glass group.

![PCA of m-Na-Al groups against Northeast Tanzania glass beads.](image)

One bead, sample JW48, fits the m-Na-Al 2 glass group. Four samples do not match any m-Na-Al sub-groups on the graph. Two samples (JW27 and JW46) have particularly high uranium concentrations (179 and 189 ppm) whereas two others (JW09 and JW44) have concentrations for the same element intermediary between the values usually found in the m-Na-Al 1 and 6 glasses (19 and 32 ppm). The four outlier samples are likely to be part of recently identified new groups (Trivedi and Dussubieux, this volume; in preparation).

4.2. Soda plant ash – high alumina glass

Sixteen samples are manufactured from a soda glass with high magnesia (> 1.5%) and high alumina (> 4%) concentrations. On average, lime concentrations are
5.4%. This glass likely was manufactured from soda plant ash and a high alumina sand, vegetable soda – high alumina or v-Na-Al glass. Its trace elements are generally lower when compared to m-Na-Al glass. Soda plant ash – high alumina glass is found in Central Asia (Dussubieux and Kusimba 2012; Then-Obłuska and Dussubieux 2016; Carter et al. 2019; Siu et al. 2020). The glass for the v-Na-Al beads found in Northeast Tanzania might have been produced in Central Asia (i.e. between eastern Iran and central India), but there is no certainty about where the beads themselves were manufactured.

Robertshaw et al. (2010) identified two v-Na-Al glass sub-groups in southern Africa: the Mapungubwe Oblate (MO) bead series dating 13th-14th century and the Zimbabwe (Z) bead series dating 14th-15th century, with higher soda, phosphorus, and barium but lower magnesia compared to the former. Siu et al. (2020) distinguished four different sub-groups: types A, B, C and D. Types C and D only include glass vessels and therefore are not relevant for this study. Siu et al. (2020) placed the MO bead series in type A glass and the Z bead series in type B glass. Also in type A are the glass beads found at Mambrui, Kenya (15th-16th century), that form the core of the glass material in the study by Siu et al. (2020). The compositions of the v-Na-Al beads from Northeast Tanzania are very close to the compositions of the beads from Mambrui (Table 13.1). Trombetta et al. (this volume) showed that glass beads with compositions indistinguishable from those in Northeast Tanzania and Mambrui occurred in Ethiopia dated from the middle 14th century.

<table>
<thead>
<tr>
<th>Type A</th>
<th>Type B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tanzania</td>
<td>Mambrui</td>
</tr>
<tr>
<td>Na₂O (%)</td>
<td>15.4±1.7</td>
</tr>
<tr>
<td>MgO (%)</td>
<td>4.2±0.5</td>
</tr>
<tr>
<td>Al₂O₃ (%)</td>
<td>5.6±0.3%</td>
</tr>
<tr>
<td>K₂O (%)</td>
<td>3.2±0.3%</td>
</tr>
<tr>
<td>CaO (%)</td>
<td>5.4±0.7%</td>
</tr>
<tr>
<td>Ti (ppm)</td>
<td>1095±252</td>
</tr>
<tr>
<td>Sr (ppm)</td>
<td>371±33</td>
</tr>
<tr>
<td>Zr (ppm)</td>
<td>67±11</td>
</tr>
<tr>
<td>Ba (ppm)</td>
<td>375±21</td>
</tr>
</tbody>
</table>

Table 13.1: Comparison of v-Na-Al compositions of glass beads from Northeast Tanzania against glass beads of Type A [found at Mambrui, Kenya and Mapungubwe, South Africa] and Type B [found in Zimbabwe] (Siu et al. 2020).
4.3. Soda plant ash – low alumina glass

Sixteen glass samples have a soda-rich composition with magnesia and potash concentrations higher than 1.5% and alumina concentrations lower than 4%. On average, lime in this glass measures 6.5%. These glass samples were manufactured from soda plant ashes rich in sodium but also calcium, and with magnesia, potash, and a relatively pure silica with low alumina concentrations. These beads are considered vegetable soda – lime or v-Na-Ca glass. Since at least the middle of the 2nd millennium BCE (during the Late Bronze Age), the Middle East has served as a soda plant ash – low alumina producing region. This trend continued through the Sasanian period and later during the Islamic period (e.g., Mirti et al. 2008, 2009; Schibille et al. 2018; Shortland et al. 2018), although this type of recipe also might have been used in Egypt and/or the Levant.

To understand the similarities and differences between the v-Na-Ca beads from Northeast Tanzania and other soda plant ash glasses, the Tanzania beads were compared with four glasses using principal component analysis and the concentrations of MgO, P$_2$O$_5$, CaO, Cr, Rb, and La (Figure 13.4). The four glasses against which the Tanzania beads were compared include a v-Na-Ca glass thought to be manufactured in Egypt in the 14th century (Dussubieux, 2017) and three different v-Na-Ca glasses identified at Chibuene, Mozambique (Wood et al. 2012):

— v-Na-Ca 1: the most abundant v-Na-Ca glass type at Chibuene and associated with the 8th-10th century CE;
— v-Na-Ca 2: significantly high amount of chromium correlated with the presence of nickel; found at Chibuene in samples of glass sherds or wastes associated with the 8th-10th century CE; and
— v-Na-Ca 3: in the form of bluish or greenish drawn glass beads it contains higher trace elements, such as Rb, Ce, Cs, Ba, La and U and is associated with the earliest context of 7th-9th century CE.

Most of the samples from Northeast Tanzania fall into the v-Na-Ca 1 group although these samples do not form a tight cluster. Some of the Tanzania beads were affected by corrosion which might have slightly impacted the concentrations of some elements. One sample (KMT23), with a higher concentration of Cr (137 ppm, while the average for the remainder of the v-Na-Ca glass was 35 ppm), was manufactured using a sand with different proportions of trace elements. Sample JW24 has a composition similar to that of Egyptian glass samples.
The v-Na-Ca 1 glass group was used to manufacture Zhizo beads recognized in southern Africa (Robertshaw et al. 2010). These are drawn beads with marked longitudinal striations on their surface that are similar to the v-Na-Ca 1 beads found in Northeast Tanzania. Sample JW24, with an Egyptian glass composition, does not match the description of Zhizo beads. It is a large roundish bead with a smooth surface which confirms a difference in origin and perhaps in date.

4.4. Soda glass with variable potash and magnesia and low alumina
A group of eight beads are made from a soda glass with low alumina concentrations (< 3%) but highly variable potash (1.1 to 8.5%) and magnesia (0.05 to 2.8%) concentrations when compared to the three glass groups described above (Figure 13.5).

Those soda glass beads have a composition and distinctive typologies that link them to European production. The various compositions might indicate the beads derive from different regions in Europe and/or that they were manufactured during different periods. Beads JW19 to JW23, JW40, JW50, and JW52 are drawn beads with a dark blue color produced by the presence of cobalt in concentrations between 323 and 562 ppm. The presence of cobalt is associated with higher concentrations of Ni, As, and Bi, which is the signature of cobalt ore extracted from the mines in Schneeberg (Erzgebirge), Germany, from the 15th-18th century (Gratuze et al. 1996).
4.5. Lead-potash glass

JW06 and JW07 are wound blue beads that contain 48% of PbO. The other elements present in significant quantities include silica (41%), potash (6%), and lime (2%). All of the other elements appear in concentrations less than 1%. Potash lead silicate glass has a long tradition in China that starts in the 2nd century (Fuxi, 2009) and continues until very recently (Burgess and Dussubieux, 2007).

The blue color of the beads is quite likely due to the addition of ~2000 ppm of copper. This glass also contains arsenic (~4000 ppm). Arsenic might have been added to the glass as an opacifying agent. This element can be used to produce a white opacifier. Arsenic white has been used in Chinese enamels at least since the second quarter of the 17th century (Kerr and Wood 2004: 647).

5. Discussion

The glass beads from Northeast Tanzania and glass composition results produced using LA-ICP-MS provide new information about the human past in Northeast Tanzania, especially about connectivity to broader networks over a millennium. The data contribute to knowledge about the long-term history of this area and East Africa, in general, and further challenge the tired representation that a ‘coast’-‘hinterland’ dichotomy prevailed in pre-colonial East Africa. This and other archaeological evidence detailed elsewhere (Walz 2010) replace such assumptions and representations with evidence of dynamism, exchange, and the integration...
of external items into the practices of inland African communities from the 8th century to the 17th century.

5.1. Contributions of glass compositional analysis

Compositional analysis of 62 glass beads selected from 11 sites in the Mombo Survey Area has aided interpretation of Northeast Tanzania in three basic ways (Table 13.2):

— confirmation of multiple glass groups (and their chronological span of manufacture), including beads of the earliest glass known in East Africa, i.e., v-Na-Ca;

— clarity about places of glass origin: Iraq/Iran (e.g., v-Na-Ca), South Asia (m-Na-Al 1), (likely) Central Asia (v-Na-Al), Europe (soda glass with variable potash and magnesia and low alumina), and China (lead-potash glass) [although it is not certain that select glasses were made into beads in these specific regions, see Annex B]; and

— clarity that coast-inland exchange occurred over the span of a millennium (8th-17th century CE) with representative and overlapping glass groups throughout this extended period.

<table>
<thead>
<tr>
<th>Site Number (Name, if any)</th>
<th>Number of Bead Samples</th>
<th>Glass Composition Type or Origin (Number of Samples)</th>
<th>Date of Glass (CE)</th>
<th>Site Chronology based on Tested Samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>105</td>
<td>2</td>
<td>m-Na-Al 2 (1), v-Na-Al (1)</td>
<td>14th c. or later</td>
<td>13th-16th c. or later</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>110 (Ulimboni)</td>
<td>1</td>
<td>v-Na-Ca 1 (1)</td>
<td>8th-mid-10th c.</td>
<td>8th-10th c.</td>
</tr>
<tr>
<td>127</td>
<td>1</td>
<td>Europe (1)</td>
<td>15th-18th c.</td>
<td>15th-18th c.</td>
</tr>
<tr>
<td>135 (Kwa Mkomwa)</td>
<td>9</td>
<td>m-Na-Al (1), m-Na-Al 6 (2), v-Na-Al (4), v-Na-Ca 1 (1), v-Na-Ca [Egypt] (1)</td>
<td>?</td>
<td>8th-16th c.</td>
</tr>
<tr>
<td>162</td>
<td>1</td>
<td>Europe (1)</td>
<td>15th-18th c.</td>
<td>15th-18th c.</td>
</tr>
<tr>
<td>180</td>
<td>1</td>
<td>m-Na-Al (1)</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>181</td>
<td>3</td>
<td>Europe (3)</td>
<td>15th-18th c.</td>
<td>15th-18th c.</td>
</tr>
<tr>
<td>183</td>
<td>1</td>
<td>m-Na-Al (1)</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>185</td>
<td>11</td>
<td>v-Na-Al (11)</td>
<td>13th-16th c.</td>
<td>13th-16th c.</td>
</tr>
</tbody>
</table>
Table 13.2: Summary of archaeological sites, glass bead samples, glass compositions, and chronology in Northeast Tanzania.

These outcomes help to enhance understandings of the region’s history and political economy, including Indian Ocean exchange networks and trends in African consumption across time. No inland site in Tanzania greater than 50 kilometers from the marine coastline had yielded glass beads confirmed by LA-ICP-MS to pre-date the 16th century CE. Thus, the Mombo Survey Area now has the earliest glass known in inland East Africa: v-Na-Ca 1 beads from the 8th-10th century CE. Three sites – Kwa Mgogo (Site 177), Kwa Mkomwa (Site 135), and Ulimboni (Site 110) – produced at least one bead and as many as 14 beads of this glass. Interestingly, only a few sites at the coast of Tanzania have yielded these early glass beads (e.g., Unguja Ukuu in Zanzibar, see Wood et al. 2017; Sarathi et al., this volume). Beads of v-Na-Ca 1 glass are somewhat more common in southern Africa, including at sites in the Kalahari Desert and at Great Zimbabwe (e.g., Denbow et al. 2015; Wood 2016; Wood et al. 2016; Klehm and Dussubieux, this volume).

Partially overlapping or subsequent to the beads of v-Na-Ca glass are the beads of m-Na-Al 6 (9th-13th century CE) and v-Na-Al (13th-16th century CE) glasses, respectively. The former likely are made of glasses from South Asia and the latter have Central Asian compositions strikingly similar to MO beads, common in southern Africa (Robertshaw et al. 2010) and at Mambrui, Kenya (Siu et al. 2020), but...
and in Ethiopia (Trombetta et al., this volume). The m-Na-Al 6 glass was used to make beads also called Indo-Pacific K2 and East Coast varieties (Robertshaw et al. 2010; Wood 2011). In general, it appears that during the first half of the second millennium CE, glass beads in Northeast Tanzania shift from an exclusive origin in Iraq/Iran to include glass origins in Central Asia and northern India. This trend may be characteristic of wider East and Northeast Africa. All 11 of the tested beads from Site 185 (located near the Zimui River at the base of the West Usambaraa Mountains, Figure 13.1) are of v-Na-Al glass. This site may have facilitated exchange between communities in the lowlands and highlands. In the middle of the second millennium CE (starting as early as the 15th century CE) beads from Europe and, somewhat later, China appear in inland Northeast Tanzania, in recent centuries becoming very common (see Background). From LA-ICP-MS tests, the earliest European beads vary in their glass compositions in space and time. Included among European beads from the project (but untested by LA-ICP-MS) are moulded beads from Venice and Bohemia (e.g., Karklins 1992; Walz 2010). Overall, the results from Northeast Tanzania suggest a remarkable longevity of bead exchange inland over the span of more than a millennium (8th-17th centuries and beyond).

5.2. Political economy and beads

People in Northeast Tanzania secured and remade their livelihoods by producing, exchanging, and consuming goods. A political economic perspective on these activities, conscious of the limitations and opportunities of the setting, achieves scalar integration by considering contemporaneous societies and residues of interaction and power. Connectivity viewed through an interactionist perspective emphasizes “how societies structure their interactions through material culture that is used to send social signals…. [It is] simultaneously alert to the historically specific and the processual…. [and] it pays attention to underlying spatial and geographical structures” (Mitchell 2005:24-25). In this perspective, mutually constitutive interactions among the region’s communities formed a system of value [see Prestholdt (2008) for an instructive example from 19th century East Africa relevant to glass beads].

In eastern and southern Africa, bead studies slowly are shifting to integrate beads of African origin (e.g., Miller et al. 2018; Insoll 2021) into overall interpretations of assemblages and the political economy. Beads of local origin are often most common at sites. At Kwa Mgogo (Site 197), for instance, glass beads comprise less than 5% of the bead assemblage, which is dominated by locally-made land snail shell beads. In addition, there is a tendency for archaeologists working in the region to study the presence, quantities, and origins of beads, but not integrate
them into understandings of the region’s history, or to engage ways foreign beads were (re)made, combined with local beads, or consumed alongside them to meet African purposes (e.g., Ogundiran 2002; Walz 2015; Moffett and Chirikure 2016). Such efforts begin to better address Africa-Indian Ocean entanglements, as with the example below: a brief overarching narrative about Northeast Tanzania.

5.3. Regional narrative

In the late first millennium CE and during subsequent centuries, the lower Pangani Basin experienced population growth, semi-specialized craft production, the beginnings of political differentiation among sedentary communities, and elaborations of ritual tied to consumption (Walz 2010, 2017). The material signatures of these developments include comparatively large settlement clusters in the Mkomazi River Valley near Mombo, Swahili architecture of coral at the coast, greater frequencies of non-local (including foreign) items, increased shell bead and iron production, and, eventually, specialized pastoralism and terraced cultivation in and around the Eastern Arc Mountains (e.g., Walz 2010, 2013; Biginagwa and Ichumbaki 2018). Excavated burials with burned shell disc beads at Kwa Mgogo and a massive ash mound with discarded land snail shell beads at Gonja Maore (in the lowlands west of Mombo) are indicative of ritual practice at a scale that treats beads as social symbols. A recovered sequence of beads of carnelian and glass at Kwa Mgogo (Site 177) indicates that foreign beads were being integrated alongside non-glass beads for personal adornment.

In the lower Pangani Basin, there were “pulses” of connectivity and at least partial integration into global commercial networks from the late first millennium CE to recent centuries. The quantity and diversity of external items increased circa 1000 CE and again circa 1500 CE. The earliest group of non-local artifacts at inland sites included copper alloy ornaments (likely from further inland) and shells and glass beads from the wider Indian Ocean. Evidence of substantial iron production to the west (along the skirt of the South Pare Hills) also surged circa 1000 CE (Walz 2010). While beads made of glass from South Asia and Central Asia show that early objects from Indian Ocean networks reached into Northeast Tanzania, this occurred alongside an increased production of beads of marine shell along the coast 750-1100 CE. The Swahili site of Shanga in the Lamu Archipelago (northern Kenya) exemplified this trend (Horton 1996). The early simultaneous interest in both marine shell beads and beads of glass along the coast may have been driven by the desire to signal associations with and/or differentiations from other communities on the African mainland (see above for interactionist perspective). The multiple origins and aesthetic characteristics of beads and their mobility and endless (re)combinations better enabled social signaling (in life and by discard or
adornment at burial).

By the 12th century, the production of marine shell disc beads at the coast declined dramatically (e.g., Sarathi et al., this volume), followed by a brief surge in the production of tubular beads of marine shell (e.g., Horton 1996:323). At Kwa Mgogo (Site 177), the excavation of strata dated to this period identified beads of v-Na-Ca 1, m-Na-Al 6, and v-Na-Al glasses but also a few finely made marine shell disc beads (of *Anadara* sp.) and, in the immediately subsequent excavation levels, 16 tube beads of marine shell (of *Strombus* spp.). These marine shell beads recovered from an inland site are the same sizes and forms as the beads identified at Shanga in Kenya. Thus, patterns in the material assemblage at Kwa Mgogo mirrored coastal trends of this period. Overall, the material evidence from across the region bolsters arguments for connectivity among contemporaneous communities living in different regional settings and suggests that the production, exchange, and consumption of glass and shell beads played an important role in intergroup relations across Northeast Tanzania since the middle to late first millennium CE.

At first, glass beads from Asia reinforced previously established bonds developed through food exchange and the exchange of other objects where communities with different life-ways intersected. From 750-1100 CE, coastal and inland communities tended to make shell disc beads from different materials: primarily marine shell at the coast and land snail shell at inland sites. The simultaneous timing of disc bead production across these settings is unlikely to be coincidental. Smith (1999:117) highlights the role of “raw-material substitution” in sending social signals that forge intergroup ties. Shell disc beads in this region had a value beyond simple use, namely as “sign vehicles” that maintained and reinforced socio-economic relationships on a mosaic landscape with diverse societies. By participating in bead making, emulation, and consumption (public display, ritual acts, and ancestor veneration), communities negotiated their positions in a wider social network, benefitting from links to webs that buoyed them during periods of downturn or calamity.

The relatively swift halt to local bead production in particular at the coast during the earliest century of the Swahili “Golden Age” (CE 1250/1350-1550) indicates a partial interruption to the regional economy. Inland groups were now predominantly receiving MO v-Na-Al beads, as evidenced by the many glass beads at Kwa Mkomwa (Site 135) and Site 185. Whereas shell discs of land snail had been made almost exclusively at sites along the ridge opposite the Mkomazi River, glass beads during the 13th-16th centuries concentrate in lowland areas nearer to the mountains. It may be that exchange between coastal and inland communities could no longer depend on balanced input from coastal communities,
coastal people being increasingly ingrained in new systems of value enabled by new objects of importance for display and consumption (e.g., including beads of v-Na-Al glass and, even later, the lead potash glasses of China and European beads). Thus, it appears balanced coast-inland ties grew leading up to the Swahili “Golden Age,” based on the importance of shell disc beads as common goods that could be produced and their distributions controlled by local communities. By 1200-1350 CE and in the following centuries, however, glass beads and other far-flung objects became the focus of residents at the littoral, drawing them away from more balanced and holistic engagements. The relationship of coastal settlements with inland groups thereby became increasingly imbalanced. Glass beads during this time increased in prominence at inland sites to facilitate social differentiation (access and display of prestige items). However, this did not always prove to be the case, as beads were sometimes used for inland purposes other than differentiation, putatively including as items in healing practice (Walz 2015).

The unique character of resources (elephant ivory, minerals, and dense human population in the proximal mountains exploited by slavers) in Northeast Tanzania may have insulated it against some uncertainties. Inland, exchange and alliances (cooperation) served as alternatives to violence (conflict) in times of resource depletion or local instability. Kin ties, blood brotherhoods, and systems of reciprocity reinforced mutual connections. Developing moral economies supported by narratives that stressed balance and decried instability provided insurance in an attempt to diminish vulnerability. In late Swahili and early Portuguese times (especially through the 16th century CE), raids became more pronounced because the social meaning of pan-regional symbols and exchange systems faded. Rotating markets at geographical intersections arose during this period that enabled territorial linkages among newly fragmented groups. More stable food production resulting from terracing, irrigation strategies and, later, the arrival of specialized pastoralists eventually led to greater accumulations of social wealth and new political forms (Walz 2010). Millions of glass beads flooded East Africa in these more recent centuries, serving as a mark of significance in power plays.

6. Conclusion

This chapter articulates the significance of LA-ICP-MS analysis of 62 glass beads from 11 archaeological sites in the Mombo Survey Area of Northeast Tanzania. Results show five glass groups and many glass sub-groups, which provide information about the beads’ origins and chronology and have further implications for understanding the region’s political economy. Northeast Tanzania has a rich
past. Glass origins include different areas of Asia through time, the earliest of which dates to the 8th-10th century CE. The tested beads provide a chronology of a millennium that goes through the 17th century CE. Glass beads later than the 17th century CE already were known from the area and can be easily identified macroscopically. Compared with other contemporaneous areas in Tanzania’s hinterland, glass beads at Mombo are unique.

This glass bead evidence enhances understandings of inland-ocean connectivity and the political economy of communities in the region, including those living in the outer landscapes of urban Swahili settlements. Early and substantial coast-hinterland interactions occurred. The identified chronology of bead origins and use provides new insights into this little-studied inland area. Connectivity across a mosaic of environments and among people of different lifeways forged social bonds and ameliorated uncertainties. The outcomes of global exchange and local production and consumption in Northeast Tanzania reverberate up to the present. Glass beads and knowledge about their compositions help archaeologists to (re-)make African history.

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