The Trade, Use, and Circulation of Elephant Ivory in Sub-Saharan Africa over the Longue Durée

Paul J. Lane, Department of Archaeology and Ancient History, Uppsala University and Ashley N. Coutu, University of Oxford

https://doi.org/10.1093/acrefore/9780190854584.013.258
Published online: 19 October 2022

Summary

Humans have utilized and exchanged ivory from different species of elephant living on the African continent for millennia, with ivory from both forest and savannah species being exploited. Starting around 4600 BP, elephant ivory sourced on the African continent also began to be exported to other parts of the world. The ways of working ivory, the uses to which it has been put, and its symbolic and representational meanings have all varied according to context across space and time. Different agents have played diverse and varying roles in its acquisition, crafting, and distribution. From early on, ivory's malleability and comparative strength relative to other raw materials made it particularly sought after. Its color and texture, as well as the variation between species and in its structure at different points on a tusk, have also been critical aspects of its material affordances. Archaeological evidence from sub-Saharan Africa, especially material dating from after the BCE/CE transition, combined with ethnographic and historical data, provides important insights into the deep history of ivory, where it has been sourced on the continent, what is known about how it was worked in the distant past, and the changing history of its trade and exchange both within and beyond the continent. Regional and global shifts in its circulation, along with some of the societal and ecological consequences of these have also been studied, with particular reference to eastern Africa. Despite many advances in recent years, there is still a need for further multidisciplinary and multi-sited research informed by posthumanist perspectives and ethics.

Keywords: Africa, elephant ivory, archaeology, material culture, trade

Subjects: Archaeology

Introduction

There are two extant species of African elephant—the savannah elephant *Loxodonta africana*, and the forest elephant *Loxodonta cyclotis*, representing two divergent lineages, separated by four to seven million years of parallel evolution (Roca et al. 2015). Forest elephants are smaller than, and morphologically distinct from, savannah elephants and in the early 21st century are restricted to parts of West and Central Africa, including northern Congo and southwestern Central African Republic (Maisels et al. 2013), in areas of lowland tropical rainforest. The savannah elephant has a wider distribution, and although mostly restricted in the early 21st century to eastern and southern Africa, small pockets of savannah elephants are present in West Africa and were certainly more numerous there at the turn of the 20th century (De Boer et al. 2013; Parker and Graham 1989a, 1989b). The North African, or Atlas, elephant, now extinct, may have constituted

a third species, being smaller than savannah elephants and more docile than both extant species. Its precise taxonomic and genetic status is uncertain, however, and consequently it is currently regarded as a subspecies (*Loxodonta africana pharaoensis*) of the savannah elephant (Nowak 1999).

Elephants have been valued in a myriad of ways by different African cultures over the millennia (Ross 1992) and may have been exploited for their meat since the Lower/Early Middle Pleistocene, as attested by the finds of *Elephas recki* at the FLKN-6 site in Olduvai Gorge and other Early Stone Age localities (Saegusa and Gilbert 2009; Todd 2005). The presence of *Elephas* and subsequently *Loxodonta* remains on Middle Stone Age sites on the continent, including Sibudu Cave, South Africa, where the remains of *Loxodonta* have been reported (Collins 2016), further indicates a long history of human interest in their exploitation. Interpretation of such archaeological evidence, however, is often plagued by taphonomic issues and uncertainties, as highlighted by the reassessment (Wright et al. 2014) of the remains of a near-complete elephant discovered at Mwanganda's Village, Karonga (Malawi) that was originally interpreted as a butchery site dating to the early Middle Stone Age (Clark and Haynes 1970) but now appears to have been a natural accumulation. Compared with Eurasia, where mammoth and elephant ivory was used to produce tools, ornaments, and even musical instruments from the Late Pleistocene (Pettitt et al. 2014), evidence for the use of elephant ivory as a raw material on the African continent (figure 1) is comparatively scarce prior to the last *c.* 5000 years (Bradfield and Choyke 2016), and instead other biomaterials such as ostrich eggshell and bone seem to have been preferred.

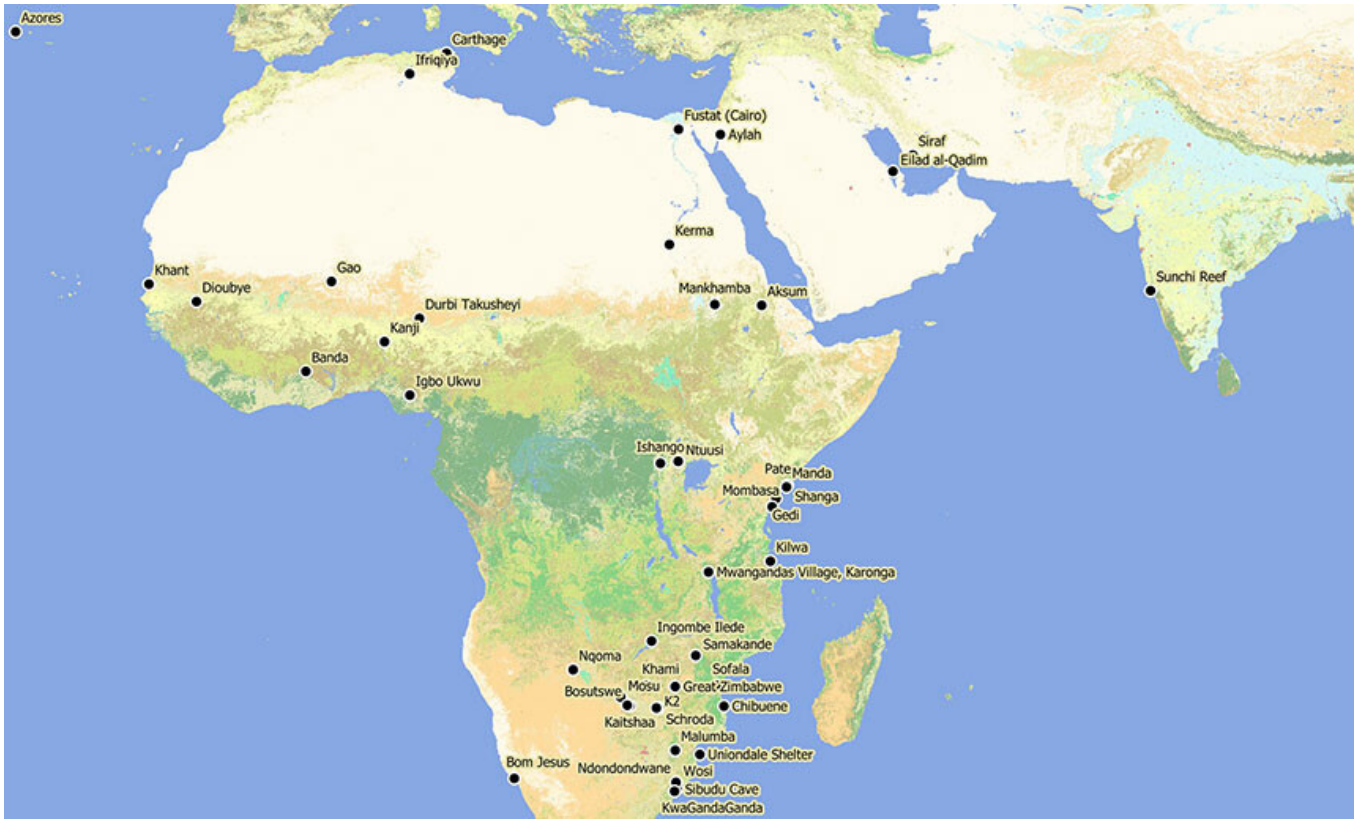

Figure 1. Location of main find spots of archaeological ivory in Africa and beyond mentioned in the text.

Source: Base map of vegetation cover is adapted from the European Space Agency GlobCover 2009 map.

An early instance of the use of ivory as a raw material comes from Ishango 14, eastern Democratic Republic of Congo, an early Late Stone Age (LSA) site dated to between 15,000 and 20,000 BCE, where it was used to produce biserial points (Yellen 1998), although further analysis (e.g., proteomic or DNA) is required to determine if this was derived from *Loxodonta* sp. rather than hippopotamus or warthog, for instance. Ivory points, possibly used as arrow armatures, have been reported from LSA contexts at Uniondale Shelter, Eastern Cape, South Africa, *c.* 4350 BCE–725 CE (Brooker 1989), and a single ivory harpoon is known from a "Neolithic" coastal shell midden at Khant, northern Senegal, dating to between *c.* 3,300 and 2,275 BCE and associated with the remains of elephants and large aquatic animals (Mbow 1998). The widespread depiction of elephants in the continent's diverse rock art traditions (Coulson and Campbell 2001; Thackeray 2019), including in therianthropic forms and their associations with rain-making activities and beliefs (Kinahan 1999; Parkington and De Prada-Samper 2021), is also indicative of deep histories of complex human-elephant relationships that warrant further study.

More extensive archaeological evidence for the exploitation of elephant ivory as a raw material for local production and consumption and as an export commodity (Documenting Precolonial Trade in Africa) is available from *c.* 4,000–5,000 years ago. The earlier evidence relates principally to exploitation on the continent, especially along the Nile Valley in predynastic and dynastic Egypt and associated Red Sea ports (Krzyszkowska and Morkot 2000); in Nubia, where elephant ivory is known from Pre-Kerma (*c.* 3500–2500 BCE) and Kerma (*c.* 2500–1480 BCE) contexts (Choyke 1990; Lobban and de Liedekerke 2000); and across the Maghrib (Camps-Fabrer 2003). In all these localities at least some of the elephant ivory in circulation seems likely to have been sourced from areas south of the Sahara. "The Land of Punt"—now thought to have been in the northern Horn of Africa (Fattovich 2018)—has long been known as a major source of elephant ivory for Pharaonic Egypt, for example. Asian elephant ivory from Syria and other parts of Asia was also imported to North Africa, particularly Carthage and other Phoenician sites (Le Meaux 2013), while ivory from North African elephant populations would have been in circulation until they were hunted to extinction, beginning in Ptolemaic times (Cobb 2016) and continuing into the Roman era (Lobban and de Liedekerke 2000).

Starting around *c.* 2600 BCE with the export of ivory from North African elephants to the Iberian Peninsula (Schuhmacher et al. 2009), African ivory became increasingly desired as a raw material in the wider world, and the flow of elephant ivory from eastern Africa may well have been stimulated by the southward expansion of trade networks as the elephant populations in the Red Sea areas were locally extirpated (Burstein 1996). Moreover, at least since the 1st millennium CE, elephant ivory from sub-Saharan African elephants (*Loxodonta* sp.) has circulated widely alongside ivory from Asian elephants (*Elephas maximus*) and other species, including hippopotamus, dugong, and walrus, within Western Europe, the Mediterranean world, the Persian Gulf, India, and China. Objects carved from walrus and elephant ivory are also known to have circulated within northern Europe and the Baltic region in the medieval period (Barrett et al. 2020). It has also been argued that a shortage of elephant ivory in western and northern European spheres of exchange may have encouraged Viking exploration of Iceland and the west coast of Greenland for exploitation of walrus stocks in the Disko Bay area from the end of the 10th century

to the early 14th century CE, by which time African elephant ivory was once again available in abundance in Europe, along with walrus ivory from northern Russia (Chopin 1978; Gillman 2017; Keighley et al. 2019; Keller 2010; Roesdahl 1998).

The geographical origins of the ivory exported from Africa undoubtedly shifted over time, although data are largely lacking on precisely which locales were the primary suppliers during particular centuries, and why these shifts occurred. Thus, for instance, there is considerable uncertainty as to whether ivory from eastern Africa was the primary source for the various early and later medieval centers of ivory carving in early Christian Europe, al-Andalus under the Spanish Umayyad dynasty (711–1031 CE), and Byzantium. The general consensus, especially among art historians, has long been that while ivory from Asian elephants was likely in circulation in the early 1st millennium CE up to the 6th century, eastern Africa was the primary source after the extinction of North African elephants. After an apparent hiatus in supply, eastern Africa once again became the primary source via Fāṭimid Egypt (910–1171 CE) from the 9th century onward (Cutler 1994; Horton 1987; Shalem 2005).

The evidence is open to alternative interpretations, however. On the one hand, documentary sources certainly suggest that ivory was both rare and expensive during the Carolingian period (750–887 CE), for example, and the limited availability of elephant ivory in western and northern Europe between the 6th and 10th centuries could be explained by the dominance of the Red Sea routes by merchants from the Gulf during this period, who may have redirected ivory supplies to the Arab world. On the other hand, elephant ivory was certainly present in Anglo-Saxon England, most notably in the form of one-piece rings possibly used as a kind of bag or purse opening, found in both inhumation and cremation burials dating between the 5th and 7th centuries at sites such as Spong Hill, Norfolk (Hills et al. 2001). The size and physical characteristics of the rings also suggest they were made from the tusks of African elephants. Similar concentrations of ivory rings are known from 6th- and 7th-century Merovingian contexts in southern Germany and adjacent areas, where they are often associated with other artefact types indicating trade connections with Byzantium (Drauschke 2019). It is interesting to note that the distribution of ivory rings here maps quite closely onto the distribution of cowrie shells (predominantly the Red Sea species *Cypraea pantherina* but including examples of the Indian Ocean species *C. tigris*), and it is tempting to envisage that both materials were sourced from the same geographical area (compare Drauschke 2019, figs. 1.4 and 1.5, pp. 20–21, although these are at different scales). Finds of ivory purse rings dating to the 5th to 7th century are also quite widespread in the Carpathian Basin and were also probably obtained via trade connections with Byzantium (Bollók and Koncz 2020).

Guérin (2010, 2013) has argued that while Byzantium and the ivory-carving centers around the eastern Mediterranean are likely to have obtained supplies of elephant ivory from eastern Africa, those in the western Mediterranean, such as the 5th-to-11th-century-CE workshops in Salerno, southern Italy, could have been supplied with ivory from West Africa via the trans-Saharan caravan routes. Archaeological finds, including a large cache of hippopotamus ivory in the medieval town of Gao, northern Mali, dated from the late 9th to 11th century CE (Insoll 1995), attest to this likelihood at least for the later centuries, and different parts of West Africa are

known to have been closely enmeshed in the trans-Saharan trade from the Roman era onward (Magnavita 2009). This trade expanded during the 7th century to meet growing demands for gold, and perhaps also ivory (Phillipson 2017).

That African elephant ivory supplanted Asian elephant ivory in the middle Byzantine period (843–1204 CE) is suggested by changes in the size of ivory plaques, which were used as Christian icons, diptych altarpieces, and later adapted as book covers. Being smaller, tusks from Asian elephants would have limited the maximum dimensions of such plaques to around 110 mm. From the 9th century, however, plaques measuring up to 170 mm tall and 130 mm wide were being produced, implying renewed access to supplies of African elephant ivory (Cutler 1985). This increased supply of African ivory in Europe has also been attributed to geopolitical changes in Egypt in the latter part of the 10th century, following the establishment of the Fāṭimid dynasty there and reorganization of Egyptian commercial networks (Guérin 2013; Horton 1987). Craft workers in Cairo and other parts of the Fāṭimid world clearly benefited from this increased availability of a ready supply of malleable savannah elephant ivory, judging from the large quantity of working debris recovered from excavations in Fusṭāṭ in the early 20th century, as well as the carved boxes, panel work, ivory inlay, and other finely decorated pieces produced in Egypt and Ifrīqiya during the 11th and 12th centuries (Armando 2015).

The following review offers a synopsis of the evidence for these shifting patterns of use, exploitation, and exchange of elephant ivory across the African continent and beyond its shores, as attested both archaeologically and textually for different regions of sub-Saharan Africa, focusing on the last two to three millennia. The article concludes with observations on the potential for future work on these topics.

West Africa

Both savanna and forest elephants are native to habitats across West Africa, with forest elephant tusks being straighter, thinner, and therefore better for intricate carving. Some of the best-known carved tusks from West Africa include the corpus of Afro-Portuguese ivories. These comprise a range of ornately decorated salt cellars (figure 2), oliphants, and other items carved by master West African ivory carvers and sold to Portuguese kings and merchants or exchanged with them for other items, from the 15th to 17th century CE, often in styles oriented toward European tastes and imagery (Afonso 2016; Curnow 1983; Mark 2007). Archaeologically, evidence of ivory production has been found at a handful of sites across the region, dating to the 2nd millennium CE (Coutu and Lane 2021). These sites include the 11th-to-14th-century-CE settlement of Diouboye on the Falémé River (Dueppen and Gokee 2014), where deposits suggest specialized hunting of medium-to-large animals linked to the production of leather hides, furs, and ivory, for local craft production, regional trade to West African states, and long-distance trade through the trans-Saharan trade network. Further south in Ghana, the most significant evidence comes from the region of Banda, where ivory production waste and finished ivory objects (figure 3) have been found (Stahl and Stahl 2004). Interestingly, the ivory evidence from these sites dates from the period of integration within the trans-Saharan trade networks, while the evidence for ivory

production disappears from *c.* 1600 CE, when these communities became more enmeshed in Atlantic Ocean trade networks, possibly suggesting a shift from craft production of finished items to the export of unworked tusks (Logan and Stahl 2017).

Figure 2. Ivory salt cellar made by a West African ivory carver in the late 15th or early 16th century CE. The salt cellar has intricate designs with birds, crocodiles, and a fleur-de-lis.

Source: Courtesy of the Pitt Rivers Museum, University of Oxford (PRM 1884.68.73).

Besides these important sites with evidence of craft production and processing of elephant ivory, there are several sites in West Africa from which ivory finds have been reported. These include items clearly intended for elite display, such as the tusks recovered from the 9th-to-13th-century

complex at Igbo Ukwu, Nigeria (Shaw 1970; Igbo-Ukwu) and the ivory bangles from high-status burials at Durbi Takusheyi (early 14th to early 16th century CE) in northern Nigeria (Gronenborn et al. 2012), whereas other examples include working debris, finished objects (of which wrist bangles are the most common type), and unworked tusks. A distinct cluster of such finds has been reported from various sites on or close to the Middle Niger, from Kanji (Nigeria) in the south to Gourouberi (Niger) in the north, suggestive of the importance of ivory to local communities here during the 1st millennium CE. The presence of ivory on some post-1400-CE shrine sites in the Kanji area, as Guerin (2017) notes, indicates that while clearly an important material for local consumption in a variety of contexts, ivory was already a valuable export commodity for obtaining other, equally desirable goods, especially copper (The Archaeology of Political Complexity in West Africa Through 1450 CE).

Figure 3. Ivory bangle fragments found at the site of Kuulo Kataa, Ghana, from contexts dated from the 14th to 17th century CE (Stahl and Stahl 2004).

Source: Courtesy of Ann Stahl.

Eastern Africa

For eastern Africa, a key early written source is the *Periplus of the Erythrean Sea*, which attests to the export of ivory from a series of ports and landing stages, including Adulis, Avalites, Mundus, and Mosyllum, along the Red Sea coast south of Berenice to Ras Hafun, in the 1st to 2nd century CE, and from several trading centers (Pano, Opone, Sarapion, Nicon, and Rhapta) on the eastern African coast. Rhapta, the farthest south of these, is said to have provided ivory in great quantities, although of inferior quality to that available at Adulis in what is now Eritrea. At the time, Adulis was a five-day journey from Aksum (Casson 1989), the capital of an early Christian kingdom linked through trade to the Mediterranean world for much of its history (Phillipson 2012), and likely able to source ivory from farther into the African interior.

The importance of ivory to Aksum's economy and social life has been further underlined by excavations there, which have uncovered a remarkable collection of finished items including sections of an ivory throne, female figurine, several pyxides (small, turned, cylindrical boxes), over one hundred ivory plaques from a 4th-century-CE structure known as the Tomb of the Brick Arches, and workshop debris from a locality outside the main settlement complex (D. Phillipson 2000; L. Phillipson 2000). Given this evidence for the local working of ivory and diverse historical sources, David Phillipson (2012) has argued that the Aksumite kingdom was a major supplier of ivory to the Mediterranean world from the 3rd century CE up to the second quarter of the 7th century, when its access to maritime routes running north was curtailed by the establishment of Sassanid control over southern Arabia and the Red Sea.

Archaeological and historical sources further suggest that from the 7th century CE there was an increased flow of African ivory toward the Persian Gulf, India, and China, largely because of the expansion of Islamic trade networks. The Chinese author Tuan Ch'eng-Shih noted in the 9th century that eastern Africa was the main source of ivory and ambergris imported into China (Shalem 2005). Writing in the 10th century, the Arab geographer al-Mas'udi recorded ivory, gold, and leopard skins as being the main exports from the Sofala region (i.e., the coastal region south of present-day Tanzania), including "tusks weighing fifty pounds and more" being exported first to Oman (possibly Sohar) and from there on to India and China where they were used, *inter alia*, to make chess pieces, dagger handles, and wrist bangles used as marriage gifts (Freeman-Grenville 1962). Other shipments of ivory may also have been destined for early Islamic (mid-7th to 12th century) entrepôts such as Siraf in the Persian Gulf; Eilad al-Qadim, the early Islamic capital on Bahrain; and the Red Sea port of Aylah, Jordan, as finds of ivory (figure 4) have been recovered from all of these sites (Coutu and Damgaard 2019; Horton 1986). Elephant ivory from eastern and southern Africa might have also reached many of the port cities along the west coast of India from the Indus Delta (e.g., Banbhore, where ivory offcuts and other working debris have been recovered), and south as far as Pattanam (near Kerala) and Mantai on the north coast of Sri Lanka, as transoceanic trade between these areas is well attested by other material evidence (Hawkes and Wynne-Jones 2015; Horton 1986). These ports were also likely to have been supplied with Asian elephant ivory given the well-established regional trade in this commodity (Frenez 2018; Rajan 2011).

Figure 4. Ivory fragments found at the Early Islamic port site of Aylah, Jordan, from deposits dated to the 7th century CE (Coutu and Damgaard 2019).

Source: Image courtesy of Aylah Archaeological Project/Kristoffer Damgaard.

Elephants living in eastern Africa are primarily savanna elephants, although the western forests of Uganda and eastern part of the DRC are habitats for forest elephants, and both species were probably common, widely distributed, and numerous in the 1st to late 2nd millennium CE. However, despite the textual evidence pointing to the importance of elephant ivory as a trade commodity, archaeological evidence for hunting (e.g., butchered elephant bones, tools) and working of elephant ivory among communities in eastern Africa over the last few thousand years is scarce. An exception comes from the Mawogola area of south-western Uganda and the site of Ntuusi, where over two hundred ivory fragments have been recovered from deposits dating from 1200–1500 CE, demonstrating that ivory carving and processing were part of life at the settlement for hundreds of years (Reid 2015). Ntuusi was a complex political center not directly integrated into Indian Ocean trade networks, so it provides important insight into local ivory use in the first half of the 2nd millennium CE.

On the eastern African coast, finished pieces of ivory have been found at several Swahili stone towns dating from the 8th to 15th century CE, including Shanga and Kilwa (The Archaeology of the Swahili World). Remains of ivory working, including pieces of sawn elephant tusk and ivory spindle whorls, were found at the northern Kenyan port of Manda from deposits dated between

the 9th and 13th centuries (Chittick 1984). Several ivory fragments, including an ivory plaque with incised, interlaced geometric designs in a characteristic Islamic style, have also been recovered from Gedi (Kenya) (Pradines 2010). By at least the 17th century, but potentially earlier, large, ornately decorated horns (oliphants), or *siwa* in Swahili, were likely also being produced from complete elephant tusks, with an example known from Pate (Kenya), dated to 1680 CE. Smaller side-blown trumpets were also being produced, with one surviving example known from Sofala, Mozambique (Fagan and Kirkman 1967). Material culture found at Swahili sites includes objects from the Islamic world and China, as these sites were firmly entrenched in Indian Ocean trade networks, and the circulation of both worked and raw ivory would have been part of this trade.

Southern Africa

Following the expansion of Sassanid control over southern Arabia and the Red Sea in the 6th century, which had the effect of displacing Aksumite authority over these areas, there was a redirection of trade in the northern Indian Ocean toward the Arabian Gulf (Seland 2012). This change to the direction of trade may have also drawn southern Africa into Afro-Asiatic Red Sea and northern Indian Ocean exchange networks (Political Complexity North and South of the Zambezi). In this respect, it is notable that from the 7th to mid-10th century CE, imported glass beads (Zhizo and earlier types) of Near Eastern origin occur in considerable quantities on archaeological sites in southern Africa, from Chibuene on the Mozambique coast to Nqoma in western Botswana (Archaeology of Botswana), whereas beads of Zhizo type are relatively scarce on sites in eastern Africa dating to the same period. As Wood (2012) has argued, this discrepancy raises the possibility that although linked through regional exchange networks, eastern and southern Africa were likely tied into different transoceanic trade systems.

Figure 5. Ivory bangle fragments and worked ivory pieces found at the 15th-century capital of Khami, Zimbabwe (Mukwende et al. 2018).

Source: Image courtesy of Tawanda Mukwende.

Archaeological evidence of worked ivory from sites in Botswana (e.g., Nqoma [7th–11th century CE], Kaitshàa [8th–12th century CE], Mosu I [9th–13th century CE], and Bosutswe [13th–15th century CE]) (Reid and Segobye 2000; Denbow et al. 2015); Zimbabwe (e.g., Samakande [5th–9th century CE], Malumba [11th–14th century CE], and Khami [15th–17th century CE]) (Bvocho 2005; Manyanga and Shenjere 2012; Mukwende et al. 2018); and northern and southwestern Zambia (Kubondo Kumbo [8th–10th century CE], Ingombe Ilede [14th–15th century CE]), and the Shashe-Limpopo basin, most notably the early capitals at Schroda [*c.* 900–1020 CE] and nearby

K2 [1020–1220 CE]) indicates that elephant ivory was potentially one of the main items used in exchange for glass beads and other imported goods, including ceramics and metal ware (Chirikure 2020; Forssman et al. 2014; Sinclair et al. 2012).

Figure 6. Thousands of ivory pieces were found in deposits at the site of KwaGandaGanda, South Africa. The site was occupied from the 7th to 11th century CE. Most of the ivory working waste was found in a deposit dated to the 7th century CE, suggesting the procurement and working of ivory was established from the beginning of the settlement.

Source: Photo by Ashley Coutu; curated by the KwaZulu-Natal Museum, South Africa.

Based on this evidence, ivory was widely used locally and circulating within regional exchange networks, with some locations perhaps specializing in the production of finished items. For example, worked ivory waste and finished ivory bangles (figure 5) were found in multiple deposits at the 15th-century capital of Khami, Zimbabwe (Mukwende et al. 2018; The Archaeology of the Khami and Butua State). Perhaps some of the best examples are the thousands of fragments of ivory from production waste (figure 6) recovered from sites in KwaZulu-Natal (KwaGandaganda, Ndondondwane, Wosi), dating from the 7th to 10th century CE (Coutu et al. 2016). Stable isotope analyses of the ivory fragments confirmed that the ivory originated from multiple sources in southern Africa, which suggests that elephants were hunted elsewhere and their tusks brought to these sites, for the production ivory objects, especially bangles and armlets

(figure 7). Unworked ivory sourced in the interior could have also been incorporated into larger Indian Ocean exchange networks (perhaps through Chibuene on the Mozambique coast), as the sites in KwaZulu-Natal also preserve evidence of trade with other regions in southern Africa (copper, ostrich, eggshell beads) and across the Indian Ocean (glazed ceramics, glass beads). Evidence from Kaitshàa on the edge of Makgadikgadi Pan, Botswana, where ivory was relatively scarce in the pre-900-CE levels, despite the presence of numerous Zhizo-type glass beads, and more common in the upper levels, suggests that ivory may have supplanted salt after this date as the main trade commodity for the communities here (Denbow et al. 2015).

Figure 7. Elephant ivory armband found at the site of KwaGandaGanda, South Africa in a layer dated to the 10th century CE. The armband is 9.5 cm in diameter, 4.5 cm tall, and a maximum of 1 cm thick.

Source: Photo by Ashley Coutu; curated by the KwaZulu-Natal Museum, South Africa.

Transformations in International Trade in Elephant Ivory after 1500

Up to *c.* 1500 CE, some of the major sources of demand for African ivory were in India, China, and the Middle East, and ivory was exported from different ports along the Indian Ocean seaboard, from Lamu in the north (Thorbahn 1979; Ylvisaker 1982) to Mozambique Island and Sofala in the south (Alpers 1975), including the regionally important settlements of Kilwa, Mombasa, and Malindi. However, as Portuguese authority within the Zambezi valley strengthened during the

16th and 17th centuries, Portuguese merchants began to take control of the southern dimensions of this trade. Trade records show, for example, that during the 16th century, on average thirty thousand pounds of ivory were exported from Sofala every year (Beachey 1967). Some of this ivory was probably destined for the large ivory carving centers in Germany and the Low Countries, and some for Asia, including the Portuguese enclave at Goa and to Spanish colonies in the Philippines (Porras 2020). Archaeological evidence for this includes the find of several elephant tusks on the site of a Portuguese shipwreck off Goa (Tripati and Godfrey 2007), and the recovery of an assemblage of over three hundred carved ivory statues in the Hispano-Filipino Christian style from the wreck of the *Santa Margarita* that sank off the Mariana Islands in the Pacific during a voyage from Manila to Mexico in 1601 (Trusted 2013). Despite a Portuguese presence at Kilwa and Mombasa and in other towns to the north, they had much less control over the more northern trade routes, where, as Håkansson (2007, 145) notes, the trade remained "embedded in multiplex social networks, political alliances and intermarriage" and procurement, transport, and marketing of ivory was undertaken and controlled by communities living in the interior of eastern Africa.

These communities included groups of specialized elephant hunters, including Waboni and Wataa who inhabited the areas inland from the Lamu archipelago, northern Kenya, and the lower Tana River valley and central Kenyan coastal zone, respectively, and the Athi in southern Kenya and northern Tanzania (Stiles 1981). Groups such as these probably retained a largely hunting and gathering existence within a broader mosaic of farming and herding populations but over time became increasingly enmeshed in client-patron relationships with neighboring agricultural and pastoralist communities. This certainly seems to have been the case for the Waboni, who from at least *c.* 1500 CE were tied to the more economically and politically powerful pastoralist Oromo and required to supply the latter with tribute payments of a tusk for each elephant they killed (Stiles 1981). Groups of specialized elephant hunters also emerged among nonforager societies, including the Sukuma in western Tanzania and the Kamba—a Bantu-language speaking mixed farming society that traces its origins to the slopes of Kilimanjaro but later settled in the Ulu Hills (near what is now Machakos in Kenya) during the 16th century, before later shifting their focus of settlement to Kitui in the following century (Ambler 1985).

As well as procuring their own ivory, Kamba traders also purchased ivory from other groups, particularly neighboring pastoralists, and by the late 1700s their trading excursions had extended as far north as Lake Turkana (Lamphear 1970). In the 19th century, and perhaps earlier, the more successful traders used the profits from the ivory trade to build up their own cattle herds, allowing them to convert their material wealth into social capital through the use of cattle as bridewealth and in other exchange relationships (Ambler 1985; Håkansson 2007). An elaborate prestige system, marked by the possession and ornamental use of ivory, as epitomized by a type of ivory armband known as *ngotho* and worn by chiefs and other higher-status individuals (Jackson 1977), also developed within Kamba society (Gooding 2020; Steinhart 2000).

In south-eastern Africa, the Yao were especially active as specialized traders, building on an older tradition of more generalized long-distance trading, supplying the Portuguese at Mozambique Island, Kilwa, and Mombasa with both ivory and slaves (Alpers 1976). With the capture of the latter by Omani forces in 1698 and the departure of the Portuguese from Kilwa this precipitated,

the flow of ivory from the interior to the coast was redirected southward. As a result, by the middle of the 18th century, the ivory trade with Gujarat formed the mainstay of the colonial economy of Mozambique (Alpers 1976).

Before the ascendancy of the Yao in the regional ivory trade, the expansion of the Maravi state in the Malawi region was also associated with control over the hunting of elephants and the regional and international trade in ivory from the 15th century. Excavations at the former capital site of Mankhamba at the southern end of Lake Malawi suggest the trade reached its peak in the 17th century. These excavations yielded almost five thousand individual elements of ivory, including pieces of raw ivory, shavings, seventy ivory bangles, and three other worked pieces (Juwayeyi 2010). Imported goods obtained in exchange included Chinese porcelain, glazed ceramics, and numerous glass beads, mostly of the Khami series and others of European origin. Finished copper artefacts were also recovered, including necklaces made from copper wire, earrings, bangles, fishhooks, and part of a copper bowl; these were likely obtained via exchange links with communities to the west. Moreover, while the ivory may have been sourced locally, the Maravi also had ties with the Luangwa Valley, Zambia, well-known for its high density of elephants (Caughley and Goddard 1975).

The volume of ivory exported from West Africa also increased dramatically over the course of the 17th and 18th centuries, often in tandem with the expansion of the transatlantic slave trade (Euro-African Trade Relations and Socioeconomic Development in West Africa, 1450–1900). The Dutch, especially following the founding of the Dutch West India Company (West-Indische Compagnie, or WIC) in 1621, were major importers (Vos 2021), as were the British, Portuguese, and French, with each nation vying for control over different sections of the West African coast. Both savanna and forest elephant could be found in different parts of the region, with forest elephant especially common in the coastal areas of what became known as Ivory Coast. Some of the European archival records of this trade, especially ship manifests and customs registers, have been the focus of detailed study (Feinberg and Johnson 1982), and art historians have researched the history of different traditions of ivory working (Bassani and Fagg 1988), including the aforementioned Afro-Portuguese, or Sapi, ivories that were produced on the continent. There has also been research on ivory carving that developed in Europe, such as in the port of Dieppe, where most ivory from West Africa entered France (and even an actual elephant, which was presented to Henry IV in 1591 [Colace and Maneuvrier 2018]). In marked contrast, research on the archaeological dimensions of this trade remains limited, although some evidence has been recovered from excavations at the coastal trading town of Elmina, Ghana (Coutu and Lane 2021; DeCorse 2001). It is important to note that ivory, along with enslaved individuals, was also exported overland via the central trans-Saharan caravan trade throughout this period at least to the late 19th century (Johnson 1978), although related archaeological evidence is limited to a few finds of ivory from Jagindi and Gandu Shira, Bauchi State, northeast Nigeria (Giade 2016).

The Ivory Commodity Chain in the 19th Century and Its Socioecological Consequences

External demand for African elephant ivory further escalated around the middle of the 19th century, and the focus of this demand shifted from India and the Far East to Europe and North America. Customs records and related archives from Zanzibar, which by then was the main trading center on the East African coast, indicate that the export value of ivory per *frasila* (*c.* 34 lbs.) roughly tripled between the late 1820s and early 1870s, and then almost tripled again over the next twenty years (see Håkansson 2004, 571, fig. 4). The volume of ivory exported from Zanzibar also rose markedly over this period in response to rising demand in the metropolitan centers of Europe and North America. Total ivory imports into the United Kingdom between 1790 and 1875 rose from around 125 tons to 670 tons per annum, with the sharpest increase occurring after 1840 (Sheriff 1987). Not all of this was from eastern Africa; some came from other regions of Africa, and some derived from India, although how much of this was obtained from Asian elephants and how much was re-exported African elephant (*Loxodonta* sp.) is uncertain. By the mid-19th century, however, eastern Africa was the greatest supplier, with exports being channeled to Britain, mainland Europe, and the United States via two main redistribution centers —Zanzibar and Khartoum. Eastern African ivory was desired over ivory from West Africa partly because it is "softer," making it more suitable for use in the manufacture of piano keys, combs, and billiard balls, all increasingly desirable commodities among the burgeoning middle classes in Europe and North America, along with a wide range of other classes of object (figures 8 and 9), from scientific instruments to household decorations and clothing accessories (Kelly 2021).

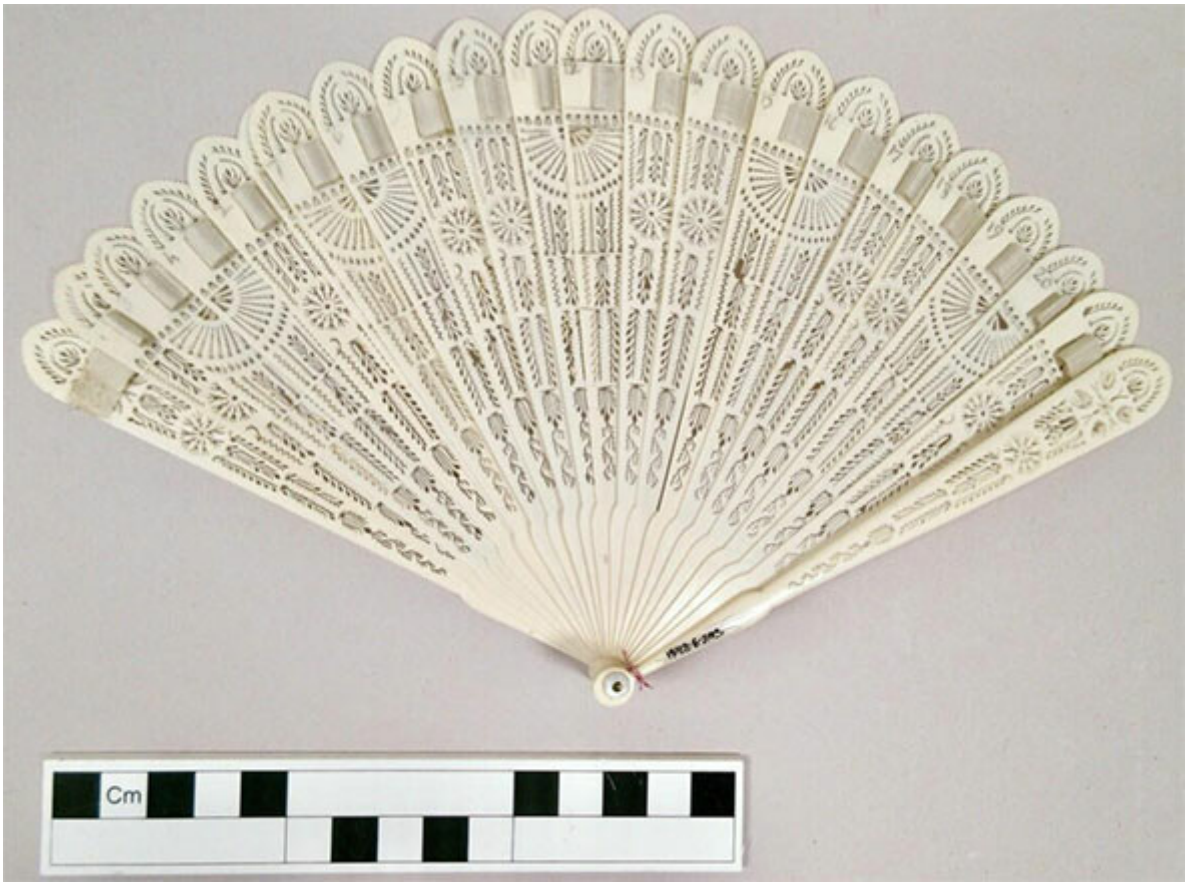

Figure 8. Carved ivory fan made in England in the 19th century CE.

Source: Courtesy of the Pitt Rivers Museum, University of Oxford (PRM 1942.6.202.1).

Several factors triggered both the increased demand and the geographical shift in the main markets away from Asia. These included technological developments related to the processing and working of ivory, such as, for example, the invention and patenting of a mechanized system for cutting ivory combs by Phineas Pratt, a goldsmith in the small hamlet of Deep River on the lower Connecticut River, United States, in 1797. From this small invention, new ivory processing industries developed, especially the manufacturing of piano keys. Two companies in Connecticut, Pratt, Read in Deep River, and Comstock and Cheney in Ivoryton, were especially influential, fueling local industrialization and labor migration (Chaiklin 2010; Malcarne 2001). The demand for ivory was such that these companies had their own ivory buyers stationed on Zanzibar and helped revive the shipping industry in Salem, Massachusetts, which became the main place of ivory import on the American seaboard. This in turn saw the establishment of the very first steam-powered cotton mill (as opposed to water-powered mills) constructed in the United States. Known as the Naumkeag Steam Cotton Mill, this was built specifically to produce cotton sheeting (known in East Africa as *merikani*) for use as one of the main commodities traded in exchange for raw ivory (Northway 1954).

Figure 9. Examples of 19th-century ivory rule blanks, now in the Hawley Collection, University of Sheffield.

Source: Photo by Ashley Coutu, with kind permission of the Hawley Collection.

Equally significant changes took place in eastern Africa. For example, Håkansson (2007, 143) notes that the system changed over the course of the 19th century from a "decentralized system . . . without any clearly defined exchange nodes to a pattern of well-defined trade routes and nodal points of commerce." As part of this process, new forms of labor relations emerged as individuals and groups differently situated within these exchange networks began to specialize (Rempel 1998; Money and Currency in African History). These new roles, some of which were either seasonal or temporary while others were more long-term, included working as caravan porters (especially Nyamwezi from north-central Tanzania) (Rockel 2006), local middlemen (e.g., Kamba), and specialist elephant hunters (e.g., Waboni, Sukuma). The era also saw the rise in prominence of several local caravan leaders, of whom the most famous was Hamed bin Muhammed el-Murjeb (1832–1905), also known as Tippu Tip (Gooding 2020), whose trading station in the Congo has been located and partially excavated (Arazi et al. 2020).

The large size of the caravans, which by the later 19th century could number over two thousand individuals, meant that opportunities arose for communities along the main caravan routes to produce a surplus to feed passing caravans. Scholars (for synopses, see Håkansson 2007, 2004; Lane 2010) have argued that by intensifying agricultural production through the introduction of terracing, irrigation, and manuring systems, inland villages could obtain access to some of the imported trade goods (most commonly, cloth, brass wire, and glass beads), or use the profits from the exchange of foodstuff as a way of accumulating livestock (for a specific example, see Petek and Lane 2017). On the savannah plains, Maasai herders may have also changed their herd management system to the kind of specialized and exclusive pastoralism for which they are known today (Håkansson 2004).

Strategies aimed at intensifying food production were not without environmental risks, however. In the 1890s, for example, parts of Gikuyuland and Ulu, Central Kenya, were providing hundreds of tons of provisions and faced local food shortages as a result (Ambler 1985). Scholars have also argued that agricultural intensification and the build-up of livestock herds to supply passing trade caravans had the effect of initiating severe soil erosion, such as in Gogoland and Kondoa, Central Tanzania (Christiansson 1981). However, early 21st-century archaeological and geoarchaeological research has highlighted that the correlation between the initiation of

agricultural intensification, severe erosion, and the expansion of the caravan trade is far from straightforward (Heckmann 2014; Iles et al. 2018; Lane 2009). Likewise, archaeological research at former caravan halts has shown that the 19th-century expansion of the caravan trade was accommodated by some communities without significant changes to herd management strategies (Biginagwa and Lane 2021).

The links between the expansion of demand for East African ivory and changes to the nature and scale of enslavement in the region and the trade in enslaved individuals have long been recognized (Alpers 1975; Beachey 1967; Sheriff 1987), and integrated archaeological research in Tsavo, south-eastern Kenya has highlighted the combined impacts on the distribution and structure of settlements, livelihood strategies, and social and political organization (Kusimba 2004). Whereas in the Tsavo area the growth of the trade in ivory and enslaved people appears to have precipitated the collapse of preexisting social structures (Kusimba et al. 2005), the increase in the volume and frequency of trade during the 19th century has also been forwarded as a driver of political centralization in some areas, such as among the Chagga, Mount Kilimanjaro, Tanzania. Although here, more recent assessment has cautioned against such correlations, given the dearth of targeted archaeological studies (Stump and Tagseth 2009).

Shifts in the international demand for ivory and local trade dynamics occurred during the second half of the 19th century, leading to a heightened trade between the East African coast and parts of the interior as far inland as Lake Victoria and Lake Tanganyika, facilitated also by the increased availability of firearms. By the 1890s, 75 percent of the global trade in elephant ivory was passing through Zanzibar (Beachey 1967), for example. Precise estimates of the number of elephants killed each year to sustain this trade are variable, as there are few records that document either when and where elephants were hunted, or the actual number of animals killed on a particular hunting trip. Consequently, ivory tonnage recorded as either exports from different ports or imports into a particular port, or some combination of these, is typically used as a proxy based on estimates of mean tusk mass (Milner-Gulland and Beddington 1993; Milner-Gulland and Mace 1991). Estimates nonetheless vary, with suggestions ranging from around eight thousand to thirty thousand tusks per annum being transported between mainland Tanzania and Zanzibar (Beachey 1967; Håkansson 2004; Spinage 1973; Thorbahn 1979), and hence between four thousand and fifteen thousand elephants potentially being killed each year in this area alone. Based on such figures, over the course of the 19th century, and especially from 1840 onward when the trade escalated (Sheriff 1987), the combined East African elephant population may have been reduced from twenty-four million to just four million. Historical records suggest that this reduction began closest to the East African coast, extending progressively to the interior between *c.* 1840 and 1890 (Håkansson 2004; Thorbahn 1979). Isotopic analyses of ivory pieces known to have been exported from East Africa lend support to these reconstructions, although elephant populations do not appear to have been totally extirpated from the coastal belt, as some scholars have argued previously (Coutu et al. 2016).

As Thorbahn (1979) and Håkansson (2004) have argued, the scale of extraction of elephants, given their role as ecological architects, would have resulted in significant landscape transformations with impacts across most trophic levels. When present in large numbers, for example, elephants help sustain open savannah habitats. Once elephants are removed, all other

factors being equal, such habitats become more wooded (Guldemond and van Aarde 2008). A possible impact on local populations following the large-scale removal of elephants, therefore, may have been an increased prevalence of tsetse fly (which prefers bushy environments) and a corresponding increase in trypanosomiasis—thereby potentially limiting opportunities for cattle herding—and sleeping sickness (Kjekshus 1996). Conversely, where elephants were present in large numbers, their effect of limiting tree growth would have made the same areas attractive for pastoralists, as may have been the case at different times in Amboseli, southern Kenya (Githumbi et al. 2018). It is clear, however, that the interactions between these multiple variables were complex, and many more local studies drawing on archaeological, geoarchaeological, and palaeoecological data are needed that also recognize the agency of the various local actors involved, the selective and changing nature of their consumption practices and desires to access imported trade goods (Pallaver 2009; Money and Currency in African History), and their global repercussions (Prestholdt 2008).

Ivories from Shipwrecks and Urban Contexts in Europe and North America

One obvious consequence of the increased supply of ivory worldwide from *c*. 1500 CE is that pieces of unworked elephant tusks, ivory working debris, and finished objects made from ivory either known to have been derived from Africa or believed to have originated there have been recovered from numerous archaeological contexts in Europe, North America (largely from the late 18th century onward), and elsewhere. No synthesis of these different collections is available, however, and most research has focused on the 19th-century material believed to have derived from East Africa. Many of the discoveries made on European sites come from commercial archaeology projects undertaken in large urban contexts, such as London, Sheffield, Hamburg, Lisbon, and Paris, where ivory markets, workshops, and industries are known to have existed, and finds reports on these materials are typically only available in reports that are not always available in the public domain, or in museum inventories.

An important exception to this rule of thumb is Amsterdam, where an attempt has been made to synthesize information concerning ivory industries in the 17th century recovered from excavations across the city. African elephant ivory became increasingly available in the Dutch Republic during the 17th and 18th centuries, especially following the capture of the West African fort of Elmina by the Dutch West India Company (WIC) in 1637. Between 1676 and 1731, for example, 2,955,533 pounds of ivory are recorded as having been shipped from Elmina by the WIC (Rijkelijkhuizen et al. 2015). This is likely an underestimate of the total quantity entering the Netherlands over this period, as both elephant and hippopotamus ivory (not recorded officially) are known to have been smuggled, and also carried, by private traders. Two categories of elephant tusks were distinguished based on their size and weight—smaller scrivellos (*crevellen*) weighing between 4.6 and 7.9 lb., and larger "teeth" (*tanden*), weighing between 29.6 and 41.4 lb. Some of this ivory was re-exported to Asia and other parts of Europe, with the rest used by diverse groups of crafts including comb, knife, and furniture makers. Excavations across Amsterdam have led to the recovery of a wide range of ivory objects and associated manufacturing debris, among them around two hundred knife handles and four hundred combs, providing important insights into the organization and spatial distribution of these craft industries and the manufacturing

techniques involved in processing different kinds of ivory and other osseous materials (Rijkelijkhuizen 2009). Preliminary efforts have also been made to try to identify the more specific geographical origins of some of this ivory using stable isotope analysis (Rijkelijkhuizen et al. 2015).

There have also been a few studies focusing on specific ivory finds in European contexts. These include the use of aDNA analysis on an ivory chess piece from a site in Belgium dated from the 10th to 13th century CE, which determined it had originated from an elephant from an eastern African savanna (Goffette et al. 2021). Similar research using aDNA undertaken on an elephant molar tooth dated to the 18th century CE found in a riverbed in Portugal indicates it was sourced from an elephant that had lived in either West or West-Central Africa (Psonis et al. 2020).

Aside from urban contexts where ivory from Africa is known to have been worked, shipwreck cargoes are a potentially rich, and underinvestigated, source of information concerning the ebb and flow of ivory exports from the African continent, their global circulation, and changes in the possible geographical origins of ivory entering particular markets. With the expansion of underwater archaeology in the early 21st century, more examples are now known. Some, such as the 17th-century wreck of a Portuguese vessel on Sunchi reef near Goa, India, were carrying hippopotamus ivory as well as complete elephant tusks (Tripati and Godfrey 2007); others appear to have been carrying ivory in bulk, such as the early 18th-century British wreck (BH-001) off Faial Island in the Azores, from which 101 ivory tusks (including some with incised marks) between 0.98 and 6.1 feet in length were recovered (Bettencourt and Carvalho 2011).

Thirteen elephant tusks, presumed to be exported from the Netherlands, and some 103 other pieces of ivory were found in the wreck of the Dutch East Indiaman *Vergulde Draeck*, which struck a reef close to the Southland about 75 miles north of Perth, Australia in 1656 (Green 1977). The largest of the tusks measured 6.2 feet, with others measuring between 5.2 and 5 feet in length. In the 17th century, ivory was the third most important cargo (in terms of weight) carried by Dutch East India Company (VOC) ships to the Indies, and annual requisitions averaged in value around forty thousand *Amsterdamse pondt* between 1634 and 1664, and at times amounted to as much as ninety thousand *Amsterdamse pondt* (Green 1977).

Several elephant tusks have also been recovered from the seabed around Half Moon Reef in the Pelsaert Group of the Houtman Abrolhos Island, Western Australia (Green 2015). These may have come from the *Zeewijk*, a VOC *retourschip* that left Middelburg in November 1726 bound for Batavia in the Dutch East Indies but was wrecked on Half Moon Reef in June 1727. However, between 1720 and 1729, the VOC was not exporting ivory from the Netherlands, so if the tusks do derive from the *Zeewijk* then they were being carried illegally. Determining which vessel was carrying the ivory is further complicated by the presence of several other wrecks in the vicinity. Hence, it is possible these tusks were from another vessel, possibly the *Aagtekerke*, another VOC ship that is known to have been officially authorized to carry ivory from East Africa (Mozambique) via the Cape to the Indies during this period. The *Aagtekerke* left the Cape of Good Hope on January 27, 1726, bound for Batavia, but never arrived. It is known from archival records to have been loaded with ivory, most probably a consignment brought from Mozambique on the brigantine *Feynoord* in October 1725. It is possible that the *Aagtekerke* was also wrecked on Half

Moon Reef, and the recovered tusks were part of this legal consignment. However, since other European ships are believed to have been wrecked in the vicinity, possibly including another VOC vessel, the *Fortuin*, which left the Cape in January 1724 for Batavia but never arrived, the tusks may derive from one of these vessels (Green 2018). Early 21st-century ancient DNA analyses of samples taken from some of the tusks recovered here and those known to have come from the *Vergulde Draeck* could provide further insights to determine the origins of these cargos.

Other reported shipwrecks with ivory include a 16th-century Portuguese *nãu*, or carrack, located off Ras Ngomeni, *c*. 17 miles north of Malindi, Kenya (Bita 2018); IDM3, a 17th-century Portuguese vessel that sank off Mozambique Island (Mirabal 2007); and the British ship *Child Harold*, sailing from Bombay to London and carrying 1,336 pieces of ivory, cotton, deer horns, pearl shells, and cardamom, which was wrecked off Dassen Island, South Africa, in February 1850 (Tripati and Godfrey 2007; Turner 1988). Another example is the Danish-Norwegian ship *Fredensborg*, which was involved in the triangular trade between Europe, West Africa, and the Caribbean, and was wrecked off the Island of Arendal in Norway in 1768 carrying slaves, from which at least 2044 lbs. of elephant tusks and an unspecified quantity of hippopotamus ivory were recovered during excavations (Svalesen 2000).

Ivory fragments and even whole tusks are reported to have been dragged up by fishermen in their nets during the 1930s off the Saint Quay Islands in Brittany (France), and it seems probable these came from the wreck of an early 18th-century vessel subsequently located and investigated between 1987 and 2003. While no further traces of ivory apart from a piece of medical equipment have been recovered, other finds (including a brass manilla) point to trade connections with West Africa (Herry 2004). Ivory that might have originally been on board the ship could have either been disturbed by currents or could have substantially decayed. Organic materials such as bone and ivory are often attacked by bacteria and other marine organisms in the underwater environment, which can lead to complete decay (Albéric et al. 2014).

Elsewhere, ninety elephant tusks were found on the remains of the VOC ship *Risdam*, wrecked in 1727 near Mersing on the east coast of Malaysia, although these may have been of southeast Asian origin (Green 1986). Another Dutch ship, the *Aanloop Molengat*, sank between 1635 and *c*. 1648 off Texel on the Dutch coast carrying a rich cargo including woolen textiles, leather, lead ingots, barrels of rolled tin, wrought-iron bars, and elephant ivory. The wreck was excavated between 1985 and 1999, and three tusks were recovered, one of which had a diameter of 5.1 inches, likely indicating it derived from an African rather than an Asian elephant (Maarleveld and Overmeer 2012).

By far the most significant early 21st-century discovery is that of the remains of the wreck of the *Bom Jesus*, a Portuguese ship that sank off the coast of Namibia in 1533 carrying over one hundred elephant tusks (Chirikure et al. 2010; Werz 2010). This wreck is remarkable not only due to the forty tons of cargo preserved (Hauptmann et al. 2016; Werz 2015), from copper ingots to gold coins, but also in the way that it was discovered, during offshore diamond mining operations on the southern coast of Namibia. The *Bom Jesus* was a Portuguese *nãu* designed for carrying goods to India, and this example was recorded as lost at sea before rounding the Cape of Good Hope in 1533 (Xavier 1989). Using a combination of ancient DNA and stable isotope analyses, de Flamingh

et al. (2020) found that the tusks (figure 10) on board the *Bom Jesus* were from at least seventeen different herds of forest elephants from two regions in West Africa, with genetic diversity not present in today's populations. Additionally, some of the elephants lived in mixed savannah habitats outside of deep tropical forests, similar to how West African forest elephants roam into savannah habitats today. Information such as this on past patterns of movement provides insights that can be used to inform contemporary conservation strategies for the remaining elephant populations in these regions (Mondol et al. 2015).

Figure 10. Elephant tusks excavated from deposits in Oranjemund, Namibia, containing the remains of the Portuguese ship *Bom Jesus*, which vanished in 1533 CE. One hundred tusks from elephants hunted in multiple regions of West Africa were part of the cargo of the ship, when it sank en route to India.

Source: Photo courtesy of the National Museum of Namibia.

As a final note, most of the other shipwreck ivories listed here have not been verified as to whether they originated from African or Asian elephants, and we should be mindful that ivory of all three species of elephant (*Loxodonta africana*, *Loxodonta cyclotis*, and *Elephas maximus*) was in circulation, and thus all three species might be represented in these shipwreck finds along with ivory from other species. Two hippopotamus tusks, for example, were recovered from the wreck of the *Santo Antonio de Tanna*, a Portuguese *nãu* that sank in 1697 during an engagement with the Turkish Ottoman navy opposite Fort Jesus, Mombasa, Kenya (Piercy 1981).

Big Game Hunting, Natural History Collections, and Elephant Conservation

With the expansion of European colonization on the African continent, further transformations in the value and significance of elephant ivory—and elephants themselves—began to occur. As big game hunting became widespread, elephant tusks and skulls came to be prized as hunting trophies to be displayed proudly, sometimes alongside other elephant body parts, on the walls of homes, private clubs, and municipal buildings in Europe, North America, and in European settings in Africa. Living elephants became sources of education as well as entertainment (Cowie 2012), featuring in zoos and international exhibitions (Bondeson 2014), and their representation in the form of chryselephantine sculpture was even used to celebrate Belgium's imperial project (Flynn 1997). Businesses involved in the manufacture of goods using ivory also sometimes displayed complete tusks (and visual representations of these) as a way of expressing an aspect of their corporate identity, as in the case of the Sheffield cutlery firm of Joseph Rodgers and Sons, which displayed several large, complete tusks on their main office stairway (Rodgers n.d.). Broadly concurrently, with the growth in public interest in natural history and the popularization of science during the Victorian era (Yanni 2005), museums across Europe and America sought to acquire both tusks and complete elephant skeletons for display. Perhaps the most iconic example is the famous Kilimanjaro tusks, now in the Natural History Museum in London and believed to be the largest pair of elephant tusks still in existence (Hill 1957). In the early 21st century these kinds of natural history specimens are valued less as curios and objects of wonderment and more for their inherent information value about the lives of elephants (Coutu 2015), their genetic histories (Wandeler et al. 2007), and potential contributions to education, conservation, science, and addressing wildlife crime (Dorfman 2018; Good et al. 2019; Poumie et al. 2021), among other themes.

While the legitimate trade in African elephant ivory continued throughout the colonial period and beyond, until international bans on its sale began to be introduced from 1989 under CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora), the future of Africa's elephants had already become a matter of ecological anxiety by the late 19th century (Lane 2019). As part of these anxieties, new legislation governing wildlife was introduced, often criminalizing indigenous people who relied on hunting for their livelihoods (Steinhart 1989), and large areas of land were gazetted as national parks and game reserves from which indigenous communities were evicted and forcibly excluded (MacKenzie 1988; Colonial Wildlife Conservation and National Parks in Sub-Saharan Africa). Ivory's value once again began to shift, no longer something to be desired in itself but rather something to be left attached to elephants and integral to the survival of their species. While restrictions on the legitimate movement of ivory have intensified following additional agreements under CITES, this has not halted the illicit trade in ivory, however, with new hubs, actors, and networks emerging in response (Gossmann 2009; Huang et al. 2020). At the same time, different state actors have responded differently to how to deal with their vast stockpiles of confiscated and collected ivory, with some, such as Kenya, opting for high profile acts of deliberate destruction and others, such as Botswana, choosing more creative repurposing of ivory in the form of public works of art (Walker 2009; Somerville 2016).

Conclusion

Humans have utilized and exchanged ivory from different species of elephant living on the African continent for millennia, and since at least 4,500 years ago ivory sourced on the continent has been steadily acquired through long-distance trade and exchange by people living in other parts of the world. The ways of working ivory, the uses to which it has been put, and its symbolic and representational meanings have all varied according to context across space and time. Different agents have played diverse and varying roles in its acquisition, crafting, and distribution. Archaeological records of this deep history are also highly variable, partly owing to preservation factors and challenges associated with the correct identification of worked pieces purely by visual examination. The earliest evidence for the use of ivory, although elusive and comparatively rare, suggests that our immediate ancestors recognized its malleability and comparative strength, and both aspects of ivory's materiality have continued to be important factors behind its acquisition and transformation. Ivory's color and texture, as well as variations in its structure along the length of a tusk and between species, have been similarly critical aspects of its material affordances, attracting and sustaining human interest in ivory and making it highly desirable. Such desires have found expression across the continent and beyond in diverse ways, with ivory at times shaped to serve overtly utilitarian goals, such as points used in hunting, but also decorative roles in the form of bangles and other kinds of body ornaments, and as sacred and ritual objects and elite symbols. Unworked tusks have at times also served some of these roles, and it seems unlikely that African elephant ivory has ever (or only rarely so) been considered as simply another "raw material." It is the material properties of ivory that have made it so amenable to aesthetic and symbolic elaboration, to the undoubted pleasure of countless humans over the course of history and the equally undoubted misfortune of elephants themselves. At least one sub-species of elephant on the continent has been hunted to extinction within the last two millennia, and the future of both extant species seems increasingly precarious.

As explored in this article, researching ivory, whether from African elephants or other species, can never be just about the material and the different artefact types and artefact components it has been used to produce, although these provide the obvious starting point. From its very first exploitation, ivory has been embedded in operational chains connecting different actors and agents in diverse and variable ways with each other and with the original providers of ivory—elephants. Over time, such networks of connection have become increasingly entangled, with ivory touching the lives of individuals in very different ways and with different material and emotional consequences. Archaeological research on the African continent can play a critical role in expanding understanding of the shifting nature of these connections and their spatial and temporal extents. Emerging bioarchaeological research, especially in the fields of ancient DNA and paleo-proteomics (Archaeozoology: Methods), is also transforming understanding of the identification and provenance of ivory recovered from archaeological sites in Africa and elsewhere around the world. Yet, as highlighted here, other disciplines bring additional insights to bear and enrich our understanding of these histories. Multiple spatial and temporal gaps in current knowledge of the scale and nature of the exploitation and circulation of elephant ivory on the continent and its trade with the wider world remain to be filled, and multi-sited and multidisciplinary efforts to achieve this are called for. Ultimately, such approaches also need to

return to consideration of the consequences of millennia of exploitation and increasingly overexploitation of ivory for the continent's two surviving species, through the adoption of posthumanist perspectives and ethics that recognize their rights as "unruly beasts" (Donaldson and Kymlicka 2011), as well as ours, in a shared universe.

Acknowledgments

We thank Ann Stahl, Tawanda Mukwende, Shadreck Chirikure, Kristoffer Damgaard, Mark Dickerson, and Gavin Whitelaw for sending images to enhance this article. We would also like to thank two anonymous reviewers for their helpful comments on an earlier draft.

Further Reading

da Silva Horta, José, and Carlos Almeida, eds. 2021. *African Ivories in the Atlantic World*. Lisbon, Portugal: University of Lisbon (CH-ULisboa), Lisbon Historical Studies.

Håkansson, N. Thomas. 2004. "The Human Ecology of World Systems in East Africa: The Impact of the Ivory Trade." *Human Ecology* 32: 561–591.

Kelly, Alexandra. 2021. *Consuming Ivory: Mercantile Legacies of East Africa and New England*. Seattle: University of Washington Press.

Ross, Doran H., ed. 1992. *Elephant: The Animal and Its Ivory in African Culture*. Los Angeles: Fowler Museum of Cultural History, University of California.

Somerville, Keith. 2016. *Ivory: Power and Poaching in Africa*. London: Hirst.

Walker, John Frederick. 2009. *Ivory's Ghosts: The White Gold of History and the Fate of Elephants*. New York: Atlantic Monthly Press.

References

Afonso, Luís U. 2016. "Patterns of Artistic Hybridization in the Early Protoglobalization Period." *Journal of World History* 27 (2): 215–253.

Albéric, Marie, Aurélien Gourrier, Katharina Müller, Ivo Zizak, Wolfgang Wagermaier, Peter Fratzl, and Ina Reiche. 2014. "Early Diagenesis of Elephant Tusk in Marine Environment." *Palaeogeography, Palaeoclimatology, Palaeoecology* 416 (December): 120–132.

Alpers, Edward A. 1975. *Ivory and Slaves in East Central Africa: Changing Patterns of International Trade to the Later Nineteenth Century*. London: Heinemann.

Alpers, Edward A. 1976. "Gujarat and the Trade of East Africa, c. 1500–1800." *International Journal of African Historical Studies* 9 (1): 22–44.

Ambler, Charles H. 1985. “Population Movement, Social Formation and Exchange: Central Kenya in the Nineteenth Century.” *International Journal of African Historical Studies* 18 (2): 201–222.

Arazi, Noemie, Suzanne Bigohe, Olivier Mulumbwa Luna, Clément Mambu, Igor Matonda, Georges Senga, and Alexandre Livingstone Smith. 2020. “History, Archaeology and Memory of the Swahili-Arab in the Maniema, Democratic Republic of Congo.” *Antiquity* 94 (375): E18.

Armando, Silvia. 2015. “Fatimid Ivories in Ifriqiya: The Madrid and Mantua Caskets between Construction and Decoration.” *Journal of Islamic Archaeology* 2 (2): 195–228.

Barrett, James H., Sanne Boessenkool, Catherine J. Kneale, Tamsin C. O’Connell, and Bastiaan Star. 2020. “Ecological Globalisation, Serial Depletion and the Medieval Trade of Walrus Rostra.” *Quaternary Science Reviews* 229 (February): 106–122.

Bassani, Ezio, and William Fagg. 1988. *Africa and the Renaissance: Art in Ivory*. New York: Center for African Art.

Beachey, Raymond Wendell. 1967. “The East African Ivory Trade in the Nineteenth Century.” *Journal of African History* 8 (2): 269–290.

Bettencourt, José, and Patrícia Carvalho. 2011. “A história submersa na baìa da Horta: Resultados preliminares dos trabalhos arqueológicos no ‘naufrágio do marfim’ (primeiro quartel do sèculo XVIII).” In *Actas do V Colóquio, realizado em Maio de 2010 nas ilhas do Faial e de São Jorge*, 139–153. Horta, Portugal: Núcleo Cultural da Horta.

Biginagwa, Thomas J., and Paul J. Lane. 2021. “Local Animal Economies during the Nineteenth-Century Caravan Trade along the Lower Pangani, Northeastern Tanzania: A Zooarchaeological Perspective.” *Azania: Archaeological Research in Africa* 56 (2): 219–249.

Bita, Caesar. 2018. “The Ngomeni Shipwreck.” *Kenya Past and Present* 45: 33–44.

Bollók, Ádám, and István Koncz. 2020. “Sixth- and Seventh-Century Elephant Ivory Finds from the Carpathian Basin: The Sources, Circulation and Value of Ivory in Late Antiquity and the Early Middle Ages.” *Archaeologiai Értesítő* 145 (1): 39–68.

Bondeson, Jan. 2014. *The Feejee Mermaid and Other Essays in Natural and Unnatural History*. Cornell, NY: Cornell University Press.

Bradfield, Justin, and Alice M. Choyke. 2016. “Bone Technology in Africa.” In *Encyclopaedia of the History of Science, Technology, and Medicine in Non-Western Cultures*. Part 2. 954–961.

Breternitz, David A. 1975. “Rescue Archaeology in the Kainji Reservoir Area, 1968.” *West African Journal of Archaeology* 5: 91–151.

Brooker, Mary Leslie. 1989. “The Holocene Sequence from Uniondale Rock Shelter in the Eastern Cape.” *Goodwin Series* 6: 17–32.

Burstein, Stanley M. 1996. “Ivory and Ptolemaic Exploration of the Red Sea: The Missing Factor.” *Topoi Orient Occident* 6 (2): 799–807.

Bvocho, Godhi. 2005. “Ornaments as Social and Chronological Icons: A Case Study of Southeastern Zimbabwe.” *Journal of Social Archaeology* 5 (3): 409–424.

Camps-Fabrer, Henriette. 2003. “Ivoire.” *Encyclopédie berbère* 25 (September): 3813–3817.

Casson, Lionel. 1989. *The Periplus Maris Erythraei: Text with Introduction, Translation, and Commentary*. Princeton, NJ: Princeton University Press.

Caughley, Graeme, and John Goddard. 1975. “Abundance and Distribution of Elephants in the Luangwa Valley, Zambia.” *African Journal of Ecology* 13 (1): 39–48.

Chaiklin, Martha. 2010. “Ivory in World History: Early Modern Trade in Context.” *History Compass* 8 (6): 530–542.

Chirikure, Shadreck. 2020. “New Perspectives on the Political Economy of Great Zimbabwe.” *Journal of Archaeological Research* 28 (2): 139–186.

Chirikure, Shadreck, Ashton Sinamai, Esther Goagoses, Marina Mubusisi, and Weber Ndoro. 2010. “Maritime Archaeology and Trans-Oceanic Trade: A Case Study of the Oranjemund Shipwreck Cargo, Namibia.” *Journal of Maritime Archaeology* 5 (1): 37–55.

Chittick, Neville H. 1984. *Manda: Excavations at an Island Port on the Kenya Coast*. Memoir 9. Nairobi, Kenya: British Institute in Eastern Africa.

Chopin, Danielle Gaborit. 1978. *Ivoires du Moyen Age*. Office du livre.

Choyke, Alice. 1990. “Travail de l’os et de l’ivoire á Kerma.” In *Kerma, royaume de Nubie*, edited by Charles Bonnet, 140–141. Geneva, Switzerland: Mission archéologique de l’Université de Genéve au Soudan.

Christiansson, Carl. 1981. *Soil Erosion and Sedimentation in Semi-Arid Tanzania: Studies of Environmental Change and Ecological Imbalance*. Stockholm: Nordic Africa Institute.

Clark, J. Desmond, and C. Vance Haynes. 1970. “An Elephant Butchery Site at Mwanganda’s Village, Karonga, Malawi, and Its Relevance for Palaeolithic Archaeology.” *World Archaeology* 1 (3): 390–411.

Cobb, Matthew. 2016. “The Decline of Ptolemaic Elephant Hunting: An Analysis of the Contributory Factors.” *Greece and Rome* 63 (2): 192–204.

Colace, Marie-Pascale, and Christophe Maneuvrier. 2018. “L’éléphant africain offert à Henri IV par des marins de Dieppe (1591).” *Annales de Normandie* 68 (2): 61–76.

Collins, Ben. 2016. “Foraging Strategies during the Final Middle Stone Age Occupation at Sibudu Cave, South Africa.” *Journal of Archaeological Science: Reports* 5 (February): 61–70.

Coulson, David, and Alec Campbell. 2001. *African Rock Art: Paintings and Engravings on Stone*. New York: Abrams.

Coutu, Ashley N. 2015. “The Elephant in the Room: Mapping the Footsteps of Historic Elephants with Big Game Hunting Collections.” *World Archaeology* 47 (3): 486–503.

Coutu, Ashley, and Kristoffer Damgaard. 2019. “From Tusk to Town.” *Studies in Late Antiquity* 3 (4): 508–546.

Coutu, Ashley, and Paul Lane. 2021. “Ivory in West Africa, c. 100 to 1900 CE: Archaeological Evidence and Future Research Priorities.” In *African Ivories in the Atlantic World*, edited by José da Silva Horta and Carlos Almeida, 341–374. Lisbon Historical Studies, University of Lisbon.

Coutu, Ashley N., Julia Lee-Thorp, Matthew J. Collins, and Paul J. Lane. 2016. “Mapping the Elephants of the 19th Century East African Ivory Trade with a Multi-Isotope Approach.” *PloS One* 11 (10): e0163606.

Coutu, Ashley N., Gavin Whitelaw, Petrus le Roux, and Judith Sealy. 2016. “Earliest Evidence for the Ivory Trade in Southern Africa: Isotopic and ZooMS Analysis of Seventh–Tenth Century AD Ivory from KwaZulu-Natal.” *African Archaeological Review* 33 (4): 411–435.

Cowie, Helen. 2012. “Elephants, Education and Entertainment: Travelling Menageries in Nineteenth-Century Britain.” *Journal of the History of Collections* 25 (1): 103–117.

Curnow, Kathy. 1983. “The Afro-Portuguese Ivories: Classification and Stylistic Analysis of a Hybrid Art Form.” PhD diss., Indiana University.

Cutler, Anthony. 1985. *The Craft of Ivory: Sources, Techniques, and Uses in the Mediterranean World, A.D. 200–1400*. Washington, DC: Dumbarton Oaks, Research Library and Collection.

Cutler, Anthony. 1994. *The Hand of the Master: Craftsmanship, Ivory, and Society in Byzantium (9th–11th Centuries)*. Princeton, NJ: Princeton University Press.

De Boer, Willem F., Frank van Langevelde, Herbert H. T. Prins, Peter C. De Ruiter, Julian Blanc, Marc J. P. Vis, Kevin J. Gaston, and Iain D. Hamilton. 2013. “Understanding Spatial Differences in African Elephant Densities and Occurrence: A Continent-Wide Analysis.” *Biological Conservation* 159 (March): 468–476.

DeCorse, Christopher R. 2001. *An Archaeology of Elmina: Africans and Europeans on the Gold Coast, 1400–1900*. Washington, DC: Smithsonian Institution Press.

Denbow, James, Carla Klehm, and Laura Dussubieux. 2015. “The Glass Beads of Kaitshàa and Early Indian Ocean Trade into the Far Interior of Southern Africa.” *Antiquity* 89 (344): 361–377.

Donaldson, Sue, and Will Kymlicka. 2011. *Zoopolis: A Political Theory of Animal Rights*. Oxford: Oxford University Press.

Dorfman, Eric J. 2018. “Elephants and Ivory: Coordinating Natural History Museum Action to Address Wildlife Crime.” *Curator: A Quarterly Publication of the American Museum of Natural History* 61 (1): 133–145.

Drauschke, Jörg. 2019. “Archaeological Perspectives on Communication and Exchange between the Merovingians and the Eastern Mediterranean.” In *East and West in the Early Middle Ages: The Merovingian Kingdoms in Mediterranean Perspective*, edited by Stefan Esders, Yaniv Fox, Yitzhak Hen, and Laury Sarti, 9–31. Cambridge, UK: Cambridge University Press.

Dueppen, Stephen, and Cameron Gokee. 2014. “Hunting on the Margins of Medieval West African States: A Preliminary Study of the Zooarchaeological Record at Diouboye, Senegal.” *Azania: Archaeological Research in Africa* 49 (3): 354–385.

Fagan, Brian M., and James Kirkman. 1967. “An Ivory Trumpet from Sofala, Mozambique.” *Ethnomusicology* 11 (3): 368–374.

Fattovich, Rodolfo. 2018. “The Archaeology of Punt.” *Journal of Egyptian Archaeology* 104 (2): 205–209.

Feinberg, Harvey M., and Marion Johnson. 1982. “The West African Ivory Trade during the Eighteenth Century: The ‘ . . . and Ivory’ Complex.” *International Journal of African Historical Studies* 15 (3): 435–453.

Flamingh, Alida de, Ashley Coutu, Judith Sealy, Shadreck Chirikure, Armanda D. S. Bastos, Nzila M. Libanda-Mubusisi, Ripan S. Malhi, and Alfred L. Roca. 2020. “Sourcing Elephant Ivory from a Sixteenth-Century Portuguese Shipwreck.” *Current Biology: CB* 31 (3): 621–628.

Flynn, Tom. 1997. “Taming the Tusk: The Revival of Chryselephantine Sculpture in Belgium during the 1890s.” In *Colonialism and the Object: Empire, Material Culture and the Museum*, edited by T. B. A. Flynn, 188–204. London: Routledge.

Forssman, Tim, Bruce Page, and Jeanetta Selier. 2014. “How Important Was the Presence of Elephants as a Determinant of the Zhizo Settlement of the Greater Mapungubwe Landscape?” *Journal of African Archaeology* 12 (1): 75–87.

Freeman-Grenville, Greville. 1962. *The East African Coast*. Oxford: Clarendon Press.

Frenez, Dennys. 2018. “Manufacturing and Trade of Asian Elephant Ivory in Bronze Age Middle Asia: Evidence from Gonur Depe (Margiana, Turkmenistan).” *Archaeological Research in Asia* 15 (September): 13–33.

Giade, Ahmed A. 2016. “An Archaeological Investigation in Shira Region, Bauchi, Northeast Nigeria.” PhD diss., University of East Anglia.

Gillman, Matthew Elliott. 2017. “A Tale of Two Ivories: Elephant and Walrus.” *Espacio Tiempo Y Forma: Serie VII, Historia Del Arte* 5: 81–105.

Githumbi, Esther N., Rebecca Kariuki, Anna Shoemaker, Colin J. Courtney-Mustaphi, Maxmillian Chuhilla, Suzi Richer, Paul Lane, and Rob Marchant. 2018. “Pollen, People and Place: Multidisciplinary Perspectives on Ecosystem Change at Amboseli, Kenya.” *Frontiers of Earth Science in China* 5: 113.

Goffette, Quentin, Nathalie Suarez Gonzalez, Raphaël Vanmechelen, Erik Verheyen, and Gontran Sonet. 2021. “Tracking the Origin of Worked Elephant Ivory of a Medieval Chess Piece from Belgium through Analysis of Ancient DNA <http://doi.org/10.1002/oa.3041>.” *International Journal of Osteoarchaeology*.

Good, Caroline, Peter Tyrrell, Zhaomin Zhou, and David W. Macdonald. 2019. “Elephants Never Forget, Should Art Museums Remember Too? Historic Ivory Collections as Ambassadors for Conservation Education.” *Biodiversity and Conservation* 28 (6): 1331–1342.

Gooding, Philip. 2020. “The Ivory Trade and Political Power in Nineteenth-Century East Africa.” In *Animal Trade Histories in the Indian Ocean World*, edited by Martha Chaiklin, Philip Gooding, and Gwyn Campbell, 247–275. Cham: Springer International.

Gossmann, Anita. 2009. “Tusks and Trinkets: An Overview of Illicit Ivory Trafficking in Africa.” *African Security Review* 18 (4): 50–69.

Green, Jeremy. 1977. *The Loss of the Verengide Oostindische Compagnie Jacht Vergulde Draeck, Western Australia 1656. 36 (i)*. Oxford: British Archaeological Reports.

Green, Jeremy. 1986. “The Survey of the VOC Fluit Risdam (1727), Malaysia.” *International Journal of Nautical Archaeology* 15 (2): 93–104.

Green, Jeremy. 2015. “The Wreck of the VOC ‘Retourschip Zeewijk’: An Archaeological and Historical Puzzle.” *Journal of the Australasian Institute for Maritime Archaeology* 39: 9–26.

Green, Jeremy. 2018. *The Mystery of the Missing VOC Shipwreck in the Houtman Abrolhos Islands, Western Australia*. Special Publication 20. Freemantle, Australia: Western Australia Maritime Museum.

Gronenborn, Detlef, Paul Adderley, James Ameje, Arun Banerjee, Thomas Fenn, Gerhard Liesegang, Claus-Peter Haase, Yusuf Abdallah Usman, and Stephan Patscher. 2012. “Durbi Takusheyi: A High-Status Burial Site in the Western Central bilād al-sūdān.” *Azania: Archaeological Research in Africa* 47 (3): 256–271.

Guérin, Sarah M. 2010. “Avorio d’ogni ragione: The Supply of Elephant Ivory to Northern Europe in the Gothic Era.” *Journal of Medieval History* 36 (2): 156–174.

Guérin, Sarah M. 2013. “Forgotten Routes? Italy, Ifrīqiya and the Trans-Saharan Ivory Trade.” *Al-Masaq* 25 (1): 70–91.

Guerin, Sarah M. 2017. “Exchange of Sacrifices: West Africa in the Medieval World of Goods.” *The Medieval Globe* 3 (2): 97–124.

Guldemond, Robert, and Rudi van Aarde. 2008. “A Meta-Analysis of the Impact of African Elephants on Savanna Vegetation.” *Journal of Wildlife Management* 72 (4): 892–899.

Håkansson, Thomas N. 2004. “The Human Ecology of World Systems in East Africa: The Impact of the Ivory Trade.” *Human Ecology* 32: 561–591.

Håkansson, Thomas N. 2007. “Trade, Trinkets, and Environmental Change at the Edge of World Systems: Political Ecology and the East African Ivory Trade.” In *Rethinking Environmental History: World-System History and Global Environmental Change*, edited by A. Hornborg, J. Martinez-Alier, and J. R. McNeill, 143–162. Walnut Creek, CA: AltaMira.

Hauptmann, Andreas, Gabi Schneider, and Christoph Bartels. 2016. “The Shipwreck of Bom Jesus, AD 1533: Fugger Copper in Namibia.” *Journal of African Archaeology* 14 (2): 184–207.

Hawkes, Jason D., and Stephanie Wynne-Jones. 2015. “India in Africa: Trade Goods and Connections of the Late First Millennium.” *Afriques* 6 (December).

Heckmann, Matthias. 2014. “Farmers, Smelters and Caravans: Two Thousand Years of Land Use and Soil Erosion in North Pare, NE Tanzania.” *Catena* 113 (Supplement C): 187–201.

Herry, Nolwenn. 2004. “Report on Finds from the Saint-Quay-Portrieux Wreck, France.” *International Journal of Nautical Archaeology* 33 (1): 96–105.

Hill, J. E. 1957. “Record Ivory in the Collection of the British Museum (Natural History).” *Tanganyika Notes and Records* 46: 29–31.

Hills, Catherine. 2001. “From Isidore to Isotopes: Ivory Rings in Early Medieval Graves.” In *Image and Power in the Archaeology of Early Medieval Britain: Essays in Honour of Rosemary Cramp*, edited by Helena Hamerow and Arthur MacGregor, 131–146. Oxford: Oxbow.

Horton, Mark. 1986. “Asiatic Colonization of the East African Coast: The Manda Evidence.” *Journal of the Royal Asiatic Society of Great Britain and Ireland* 118 (2): 201–213.

Horton, Mark C. 1987. “Early Muslim Trading Settlements on the East African Coast: New Evidence from Shanga.” *Antiquaries Journal* 67 (2): 290–323.

Huang, Wenyang, Huiwen Wang, and Yigang Wei. 2020. “Mapping the Illegal International Ivory Trading Network to Identify Key Hubs and Smuggling Routes.” *EcoHealth* 17 (4): 523–539.

Iles, Louise, Daryl Stump, Matthias Heckmann, Carol Lang, and Paul J. Lane. 2018. “Iron Production in North Pare, Tanzania: Archaeometallurgical and Geoarchaeological Perspectives on Landscape Change.” *African Archaeological Review* 35: 507–530.

Insoll, Timothy. 1995. “A Cache of Hippopotamus Ivory at Gao, Mali, and a Hypothesis of Its Use.” *Antiquity* 69 (263): 327–337.

Jackson, Kennell A., Jr. 1977. “Ngotho (the Ivory Armlet): An Emblem of Upper Tier Status among the 19th Century Akamba of Kenya ca. 1830–1880.” *Kenya Historical Review* 5 (1): 35–69.

Johnson, Marion. 1978. “By Ship or by Camel: The Struggle for the Cameroons Ivory Trade in the Nineteenth Century.” *Journal of African History* 19 (4): 539–549.

Juwayeyi, Yusuf M. 2010. “Archaeological Excavations at Mankhamba, Malawi: An Early Settlement Site of the Maravi.” *Azania: Archaeological Research in Africa* 45 (2): 175–202.

Keighley, Xénia, Snæbjörn Pálsson, Bjarni F. Einarsson, Aevar Petersen, Meritxell Fernández-Coll, Peter Jordan, Morten Tange Olsen, and Hilmar J. Malmquist. 2019. “Disappearance of Icelandic Walruses Coincided with Norse Settlement.” *Molecular Biology and Evolution* 36 (12): 2656–2667.

Keller, Christian. 2010. “Furs, Fish, and Ivory: Medieval Norsemen at the Arctic Fringe.” *Journal of the North Atlantic* 3 (1): 1–23.

Kelly, Alexandra C. 2021. *Consuming Ivory: Mercantile Legacies of East Africa and New England*. Seattle: University of Washington Press.

Kinahan, John. 1999. “Towards an Archaeology of Mimesis and Rain-Making in Namibian Rock Art.” In *The Archaeology and Anthropology of Landscape*. Edited by P. J. Ucko and R. Layton, 336–357. London: Routledge.

Kjekshus, Helge. 1996. *Ecology Control and Economic Development in East African History: Case of Tanganyika*, *1850–1950*. Eastern African Studies. London: James Currey.

Krzyszkowska, Olga, and Robert Morkot. 2000. “Ivory and Related Materials.” In *Ancient Egyptian Materials and Technology*, edited by P. T. Nicholson and I. Shaw, 320–331. Cambridge, UK: Cambridge University Press.

Kusimba, Chapurukha M. 2004. “Archaeology of Slavery in East Africa.” *African Archaeological Review* 21 (2): 59–88.

Kusimba, Chapurukha M., Sibel B. Kusimba, and David K. Wright. 2005. “The Development and Collapse of Precolonial Ethnic Mosaics in Tsavo, Kenya.” *Journal of African Archaeology* 3 (2): 243–265.

Lamphear, John. 1970. “The Kamba and the Northern Mrirna Coast.” In *Precolonial African Trade*, edited by Richard Gray and David Birmingham, 75–86. London: Oxford University Press.

Lane, Paul. 2009. “Environmental Narratives and the History of Soil Erosion in Kondoa District, Tanzania: An Archaeological Perspective.” *International Journal of African Historical Studies* 42 (3): 457–483.

Lane, Paul J. 2010. “Developing Landscape Historical Ecologies in Eastern and Southern Africa: Opportunities and Challenges.” *African Studies* 69: 299–322.

Lane, Paul J. 2019. “Material Desires, Ecological Anxieties, and East African Elephant Ivory in a Long-Term Perspective.” *Environmental History*: 688–694.

Laws, Richard M. 1970. “Elephants as Agents of Habitat and Landscape Change in East Africa.” *Oikos* 21 (1): 1–15.

Le Meaux, Hélène. 2013. “Des ivoires et des œufs: Réflexions sur l’interaction art/technologie dans le contexte orientalisant de la première moitié du Ier millénaire avant J.-C. en péninsule Ibérique.” *Melanges de la Casa de Velazquez* 43 (1): 85–110.

Lobban, Richard A., and Valerie de Liedekerke. 2000. “Elephants in Ancient Egypt and Nubia.” *Anthrozoös* 13 (4): 232–244.

Logan, Amanda L., and Ann B. Stahl. 2017. “Genealogies of Practice in and of the Environment in Banda, Ghana.” *Journal of Archaeological Method and Theory* 24 (4): 1356–1399.

Maarleveld, Thijs J., and Alice Overmeer. 2012. “Aanloop Molengat: Maritime Archaeology and Intermediate Trade during the Thirty Years’ War.” *Journal of Archaeology in the Low Countries* 4 (1): 95–149.

MacKenzie, John M. 1988. *The Empire of Nature: Hunting, Conservation and British Imperialism*. Manchester, UK: Manchester University Press.

Magnavita, Sonja. 2009. “Sahelian Crossroads: Some Aspects on the Iron Age Sites of Kissi, Burkina Faso.” In *Crossroads/Carrefour Sahel: Cultural and Technological Developments in First Millennium BC/AD West Africa*. Edited by Sonja. Magnavita, Lassina Koté, Peter Breunig, and Oumarou A. Idé, 79–104. Journal of African Archaeology Monograph Series 2. Frankfurt am Main: Africa Magna Verlag.

Maisels, Fiona, Samantha Strindberg, Stephen Blake, George Wittemyer, John Hart, Elizabeth A. Williamson, Rostand Aba’a, Gaspard Abitsi, Ruffin D. Ambahe, Fidèl Amsini, Parfait C. Bakabana, Thurston Cleveland Hicks, Rosine E. Bayogo, Martha Bechem, Rene L. Beyers, Anicet N. Bezangoye, Patrick Boundja, Nicolas Bout, Marc Ella Akou et al. 2013. “Devastating Decline of Forest Elephants in Central Africa.” *PloS One* 8 (3): e59469.

Malcarne, Donald L. 2001. “Ivoryton, Connecticut: The Ivory Industry and Voluntary and Involuntary Migration in the Late Nineteenth Century.” *North American Archaeologist* 22 (3): 283–295.

Manyanga, Munyaradzi, and Plan Shenjere. 2012. “The Archaeology of the Northern Nyanga Lowlands and the Unfolding Farming Community Sequence in Northeastern Zimbabwe.” *South African Archaeological Bulletin* 67 (196): 244–255.

Mark, Peter. 2007. “Towards a Reassessment of the Dating and the Geographical Origins of the Luso-African Ivories, Fifteenth to Seventeenth Centuries.” *History in Africa* 34: 189–211.

Mbow, Mary Amy. 1998. “Le site archéologique du Khant (région de Saint-Louis du Sénégal): Nouveaux éléments.” *Presence Africaine* 158 (2): 5–22.

Milner-Gulland, E. J., and J. R. Beddington. 1993. “The Exploitation of Elephants for the Ivory Trade: An Historical Perspective.” *Proceedings of the Royal Society of London, Series B: Biological Sciences* 252 (1333): 29–37.

Milner-Gulland, E. J., and Ruth Mace. 1991. “The Impact of the Ivory Trade on the African Elephant Loxodonta africana Population as Assessed by Data from the Trade.” *Biological Conservation* 55 (2): 215–229.

Mirabal, Alejandro. 2007. *Interim Report on Underwater Archaeological Excavations off the Island of Mozambique and Mogincual, from March to November 2006*. Arqueonautas S.A.

Mondol, Samrat, Ida Moltke, John Hart, Michael Keigwin, Lisa Brown, Matthew Stephens, and Samuel K. Wasser. 2015. “New Evidence for Hybrid Zones of Forest and Savanna Elephants in Central and West Africa.” *Molecular Ecology* 24 (24): 6134–6147.

Mukwende, Tawanda, Foreman Bandama, Shadreck Chirikure, and Robert T. Nyamushosho. 2018. “The Chronology, Craft Production and Economy of the Butua Capital of Khami, Southwestern Zimbabwe.” *Azania: Archaeological Research in Africa* 53 (4): 477–506.

Northway, Philip H. 1954. “Salem and the Zanzibar-East African Trade, 1825–1845.” *Essex Institute Historical Collections* 90: 123–153.

Nowak, Ronald M. and Ernest Pillsbury Walker. 1999. *Walker’s Mammals of the World*. 6th ed. Baltimore: Johns Hopkins University Press.

Pallaver, Karin. 2009. “‘A Recognized Currency in Beads’: Glass Beads as Money in Nineteenth-Century East Africa; The Central Caravan Road.” In *Money in Africa*, edited by C. Eagleton, H. Fuller, and J. Perkins, 20–29. London: British Museum Research Publications.

Parker, Ian S. C., and Alistair D. Graham. 1989a. “Elephant Decline (Part I): Downward Trends in African Elephant Distribution and Numbers.” *International Journal of Environmental Studies* 34 (4): 287–305.

Parker, Ian S. C., and Alistair D. Graham. 1989b. “Elephant Decline: Downward Trends in African Elephant Distribution and Numbers (Part II).” *International Journal of Environmental Studies* 35 (1–2): 13–26.

Parkington, John, and José M. De Prada-Samper. 2021. “When Elephants Were People.” In *Ontologies of Rock Art: Images, Relational Approaches, and Indigenous Knowledges*, edited by Oscar Moro Abadía and Martin Porr. New York: Routledge.

Petek, Nik, and Paul Lane. 2017. “Ethnogenesis and Surplus Food Production: Communitas and Identity Building among Nineteenth- and Early Twentieth-Century Ilchamus, Lake Baringo, Kenya.” *World Archaeology* 49 (1): 40–60.

Pettitt, Paul. 2014. “The European Upper Palaeolithic.” In *The Oxford Handbook of the Archaeology and Anthropology of Hunter-Gatherers*, edited by Vicki Cummings, Peter Jordan, and Marek Zvelebil, 279–309. Oxford: Oxford University Press.

Phillipson, David W. 2000. *Archaeology at Aksum, Ethiopia, 1993–7*. London: British Institute in Eastern Africa and Society of Antiquaries.

Phillipson, David W. 2012. *Foundations of an African Civilisation: Aksum and the Northern Horn, 1000 BC–AD 1300*. Eastern African Studies. Woodbridge, UK: James Currey.

Phillipson, David W. 2017. “Trans-Saharan Gold Trade and Byzantine Coinage.” *Antiquaries Journal* 97 (September): 145–169.

Phillipson, Laurel 2000. “Ivory-Working Techniques.” In *Archaeology at Aksum, Ethiopia, 1993–7*, edited by D. Phillipson, 460–468. London: British Institute in Eastern Africa and Society of Antiquaries.

Piercy, Robin C. M. 1981. “Mombasa Wreck Excavation Fourth Preliminary Report, 1980.” *International Journal of Nautical Archaeology* 10 (2): 109–118.

Porras, Stephanie. 2020. “Locating Hispano-Philippine Ivories.” *Colonial Latin American Review* 29 (2): 256–291.

Poumie, Mohamed Mounir Mfonden, Peter Coals, Félix Meutchieye, and Olivier Miantsia Fokam. 2021. “Wildlife Collections of Royal Palace Museums in the West Region of Cameroon with a Focus on Wildlife Conservation.” *Journal of the Cameroon Academy of Sciences* 16 (3): 249–261.

Pradines, Stéphane. 2010. *Gedi, Une Cite Portuaire Swahilie: Islam medieval en Afrique orientale*. Cairo, Egypt: Institut Français d’Archéologie Orientale FIFAO 60.

Prestholdt, Jeremy. 2008. *Domesticating the World: African Consumerism and the Genealogies of Globalization*. Berkeley: University of California Press.

Psonis, Nikolaos, Carlos Neto de Carvalho, Silvério Figueiredo, Eugenia Tabakaki, Despoina Vassou, Nikos Poulakakis, and Dimitris Kafetzopoulos. 2020. “Molecular Identification and Geographic Origin of a Post-Medieval Elephant Finding from Southwestern Portugal Using High-Throughput Sequencing.” *Scientific Reports* 10 (1): 19252.

Rajan, K. 2011. “Emergence of Early Historic Trade in Peninsular India.” In *Early Interactions between South and Southeast Asia*, edited by A. Mani, Geoff Wade, and Pierre-Yves Manguin, 177–196. Singapore: ISEAS.

Reid, Andrew. 2015. “Archaeological Ivory and the Impact of the Elephant in Mawogola.” *World Archaeology* 47 (3): 467–485.

Reid, Andrew, and Aline K. Segobye. 2000. “An Ivory Cache from Botswana and Its Implications for Trade.” *Antiquity* 74 (January): 326–31.

Rempel, R. 1998. “Trade and Transformation: Participation in the Ivory Trade in Late 19th-Century East and Central Africa.” *Revue Canadienne d’Etudes du Peveloppement/Canadian Journal of Development Studies* 19 (3): 529–552.

Rijkelijkhuizen, Marloes. 2009. “Whales, Walruses, and Elephants: Artisans in Ivory, Baleen, and Other Skeletal Materials in Seventeenth- and Eighteenth-Century Amsterdam.” *International Journal of Historical Archaeology* 13 (4): 409–429.

Rijkelijkhuizen, Marloes J., Lisette M. Kootker, and Gareth R. Davies. 2015. “Multi-Isotope Analysis of Elephant Ivory Artefacts from Amsterdam: A Preliminary Provenance Study.” *World Archaeology* (June): 1–21.

Roca, Alfred L., Yasuko Ishida, Adam L. Brandt, Neal R. Benjamin, Kai Zhao, and Nicholas J. Georgiadis. 2015. “Elephant Natural History: A Genomic Perspective.” *Annual Review of Animal Biosciences* 3: 139–67.

Rockel, Stephen J. 2006. *Carriers of Culture: Labor on the Road in Nineteenth-Century East Africa*. Portsmouth, NH: Heinemann.

Rodgers, Joseph. N.d. *Under Five Sovereigns*. Sheffield: Joseph Rodgers and Sons.

Roesdahl, Elsa. 1998. *L' Ivoire de morse et les colonies norroises du Groenland*. Paris: Société des Études Nordiques.

Ross, Doran H., ed. 1992. *Elephant: The Animal and Its Ivory in African Culture*. Los Angeles: Fowler Museum of Cultural History, University of California.

Saegusa, Haruo, and W. Henry Gilbert. 2009. "Elephantidae." In *Homo erectus: Pleistocene Evidence from the Middle Awash, Ethiopia*, edited by W. Henry Gilbert and Berhane Asfaw, 193–226. University of California Press.

Schuhmacher, Thomas X., João L. Cardoso, and Arun Banerjee. 2009. "Sourcing African Ivory in Chalcolithic Portugal." *Antiquity* 83 (322): 983–997.

Seland, Eivind H. 2012. "Trade and Christianity in the Indian Ocean during Late Antiquity." *Journal of Late Antiquity* 5 (1): 72–86.

Shalem, Avinoam. 2004. *The Oliphant: Islamic Objects in Historical Context*. Leiden, The Netherlands: Brill.

Shalem, Avinoam. 2005. "Trade in and the Availability of Ivory: The Picture Given by the Medieval Sources." In *The Ivories of Muslim Spain: Papers from a Symposium Held in Copenhagen from the 18th to the 20th of November 2003*, edited by Kjeld von Folsach, and Joachim Meyer II: 25–36. Copenhagen: The David Collection.

Shaw, Thurstan. 1970. *Igbo-Ukwu: An Account of Archaeological Discoveries in Eastern Nigeria*. London: Faber.

Sheriff, Abdul. 1987. *Slaves, Spices and Ivory in Zanzibar*. London: James Currey.

Sinclair, Paul, Anneli Ekblom, and Marilee Wood. 2012. "Trade and Society on the South-East African Coast in the Later First Millennium AD: The Case of Chibuene." *Antiquity* 86 (333): 723–737.

Somerville, Keith. 2016. *Ivory: Power and Poaching in Africa*. London: Hirst.

Spinage, Clive. A. 1973. "A Review of Ivory Exploitation and Elephant Population Trends in Africa." *African Journal of Ecology* 11: 281–289.

Stahl, Ann B., and Peter W. Stahl. 2004. "Ivory Production and Consumption in Ghana in the Early Second Millennium AD." *Antiquity* 78 (299): 86–101.

Steinhart, Edward I. 1989. "Hunters, Poachers and Gamekeepers: Towards a Social History of Hunting in Colonial Kenya." *Journal of African History* 30 (2): 247–264.

Steinhart, Edward I. 2000. "Elephant Hunting in 19th-Century Kenya: Kamba Society and Ecology in Transformation." *International Journal of African Historical Studies* 33 (2): 335–349.

Stiles, Daniel. 1981. "Hunters of the Northern East African Coast: Origins and Historical Processes." *Africa, Quaderni* 51 (4): 848–862.

Stump, Daryl, and Mattias Tagseth. 2009. “The History of Precolonial and Early Colonial Agriculture on Kilimanjaro: A Review.” In *Culture, History and Identity: Landscapes of Inhabitation in the Mount Kilimanjaro Area*, edited by Timothy Clack, 107–124. BAR International Series, Archaeopress.

Svalesen, Leif. 2000. *The Slave Ship Fredensborg*. Indiana University Press.

Thackeray, J. Francis 2019. “African Elephants, Roan Antelope, Language and Rock Art.” *Afrique Archeologie et Arts* 15 (December): 17–22.

Thorbahn, Peter F. 1979. “The Precolonial Ivory Trade of East Africa: Reconstruction of a Human-Elephant Ecosystem.” PhD diss., University of Massachusetts Amherst.

Todd, Nancy E. 2005. “Reanalysis of African Elephas recki: Implications for Time, Space and Taxonomy.” *Quaternary International* 126–128 (January): 65–72.

Tripati, Sila, and Ian Godfrey. 2007. “Studies on Elephant Tusks and Hippopotamus Teeth Collected from the Early 17th Century Portuguese Shipwreck off Goa, West Coast of India: Evidence of Maritime Trade between Goa, Portugal and African Countries.” *Current Science* 92 (3): 332–339.

Trusted, Marjorie. 2013. “Survivors of a Shipwreck: Ivories from a Manila Galleon of 1601.” *Hispanic Research Journal* 14 (5): 446–462.

Turner, Malcolm. 1988. *Shipwrecks and Salvage*. Cape Town: C. Struik.

Vos, Jelmer. 2021. “Back to the Ivory Coast: Dutch Commodity Trading in West Africa, 1740–1809. In *African Ivories in the Atlantic World*, edited by José da Silva Horta, Carlos Almeida, and Peter Mark, 401–416. Lisbon, Portugal: Centre for History of the University of Lisbon.

Walker, John Frederick 2009. *Ivory’s Ghosts: The White Gold of History and the Fate of Elephants*. New York: Atlantic Monthly Press.

Wandeler, Peter, Paquita E. A. Hoeck, and Lukas F. Keller. 2007. “Back to the Future: Museum Specimens in Population Genetics.” *Trends in Ecology and Evolution* 22 (12): 634–642.

Werz, Bruno. 2010. “Sub-Saharan Africa’s Oldest Shipwreck: Historical-Archaeological Research of an Early Modern-Era Portuguese Merchantman on the Namibian Coast.” *Mariner’s Mirror* 96 (4): 430–442.

Werz, Bruno. 2015. “Some Methodological Aspects Related to the Study of Historical Shipwrecks, Based on Two Decades Maritime Archaeological Research in Southern Africa.” In *Shipwrecks Around the World: Revelations of the Past*, edited by Silas Tripati, 308–334. New Delhi: Delta Book World.

Wood, Marilee. 2012. *Interconnections: Glass Beads and Trade in Southern and Eastern Africa and the Indian Ocean: 7th to 16th Centuries AD*. Uppsala, Sweden: Uppsala University, Studies in Global Archaeology.

Wright, David K., Jessica Thompson, Alex Mackay, Menno Welling, Steven L. Forman, Gilbert Price, Jian-xin Zhao, Andrew S. Cohen, Oris Malijani, and Elizabeth Gomani-Chindebvu. 2014. “Renewed Geoarchaeological Investigations of Mwanganda’s Village (Elephant Butchery Site), Karonga, Malawi.” *Geoarchaeology* 29 (2): 98–120.

Xavier, Manuel. 1989. *Relações Da Carreira Da Índia: Navios Da Carreira Da Índia (1497–1653)*. Lisbon, Portugal: Publicações Alfa.

Yanni, Carla. 2005. *Nature's Museums: Victorian Sciences and the Architecture of Display*. Princeton, NJ: Princeton Architectural Press.

Yellen, John E. 1998. "Barbed Bone Points: Tradition and Continuity in Saharan and Sub-Saharan Africa." *African Archaeological Review* 15 (3): 173–198.

Ylvisaker, Margeurite. 1982. "The Ivory Trade in the Lamu Area." *Paideuma* 28: 221–232.