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Cover and Inside Back Cover: A 16th-century Taíno cemí/belt which features a human mask of rhinoceros horn; total height: 31.5 cm (courtesy of Museo delle Civilitá – MPE “L. Pigorini,” Piazzale G. Marconi 14,00144 Rome; acc. no. 4190) (photo: Joanna Ostapkowicz).

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KARLIS KARKLINS, *editor*

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TO PRODUCE “A PLEASING EFFECT:” TAÍNO SHELL AND STONE *CIBAS* AND SPANISH *CUENTAS* IN THE EARLY COLONIAL CARIBBEAN

Joanna Ostapkowicz

This article serves as an introduction to the use of beads – both indigenous and European – in surviving examples of body ornaments from the early colonial Caribbean: a cemí/belt in the collections of Rome’s Museo Nazionale Preistorico Etnografico “L. Pigorini,” a belt from the Weltmuseum Wien, and a cache of beads in a wooden vessel from the collections of the Museo de Historia, Antropología y Arte, Universidad de Puerto Rico. These artifacts offer insights into how the Taíno may have adopted newly introduced foreign goods, aligning them to their own aesthetics and world view. Glass beads, acquired via visitors from foreign lands, entered into a well-established repertoire of indigenous shell, stone, and potentially botanical beads, introducing different colors and finishes, but nevertheless fitting within traditional cultural expressions and value systems.

INTRODUCTION

The Jamaican Taíno greeted Columbus’ first visit to the island in 1494 with the pomp and ceremony such a historic visit demanded: in full regalia, a *cacique* (chief) and his envoys approached the Spanish caravels in canoes, wearing stones of “high value,” with the cacique resplendent in a “garland of small stones, green and red, arranged in order and intermingled with some larger white stones, *producing a pleasing effect,*” together with a matching belt “of the same workmanship” (Bernaldez in Jane 1967:162). These ornaments adorned his otherwise naked body, becoming focal points for the lavish display of beadwork valuables in both stone and shell. Members of his retinue wore caps “ingeniously worked” with green and white parrot feathers (Bernaldez in Jane 1967:162). The visual spectacle clearly made an impression on the Spanish, who quickly identified individuals of status by the quantity and quality of their ornaments, which they described as being made of “fine stones [and shells], very small and pearl-like” (Las Casas 1951, I:272). European glass beads had qualities that echoed indigenous stone and shell beads, quickly entering the Taíno sphere of material wealth and being incorporated into indigenous regalia.

Among the handful of surviving artifacts from this early period of interaction (pre-1550) to physically integrate both indigenous and European beads are a composite sculpture consisting of a belt and top (possibly a headdress in the form of a *cemí* – a representation of a spirit, deity, or ancestor) nailed to a 16th-century European display mount (Figure 1) in the collections of the Museo Nazionale Preistorico Etnografico “L. Pigorini” (henceforth Pigorini) in Rome, and a belt in the Weltmuseum Wien, Vienna (Figure 2) (for detailed histories of each of these artifacts, *see* Ostapkowicz 2013, 2018; Ostapkowicz et al. 2017). Another artifact – a small, ornately carved wooden vessel containing glass and shell beads – is held in the Museo de Historia, Antropología y Arte, Universidad de Puerto Rico (Ostapkowicz et al. 2012). These three objects offer unique insights into the layered meanings of small bead valuables in the Caribbean region in the early colonial period. This paper explores the context within which indigenous beads were used, and how foreign beads were adopted and adapted in the service of shifting power relations post-1492.

INDIGENOUS WEALTH: DISC BEADS

Striking geometric patterns in red, white, and black beads cover the surfaces of the cotton textiles under discussion. The Vienna belt is composed of nearly 11,000 handmade beads while the Pigorini cemí/belt features over 20,000. Each bead is held in place within a fine mesh of cotton, with two threads crisscrossing below each bead, securing each so tightly that if one is damaged, the other beads are unaffected and the textile remains tight. The sheer scale of the labor involved in producing such a shell armature for these wearable works of art can be appreciated when one considers that each small bead (max. 5 mm diameter) was worked down from a shell blank by various manufacturing stages involving cutting, grinding, drilling, and polishing. The 16th-century *chronista* (historian) Las Casas (1967, I:317) commented on the “wonderous”

Figure 1. Three views of the cemí/belt which features a human mask of rhinoceros horn (right) and a bat face of green glass beads (left). Full height is 31.5 cm, with the top (headdress) measuring ca. 21.5 cm and the belt 10.0 cm (courtesy of Museo delle Civilitá – MPE "L. Pigorini," Piazzale G. Marconi 14,00144 Rome; acc. no. 4190) (all photos by author unless otherwise stated).

production: the beads "…being so small [are made]… without iron instruments, without drills, without chisels, but only… with a flint or stone, or with fish spine or bone, drilled with such subtlety and delicacy that it seems an impossible thing." In the 17th century, the neighboring Carib/Kalinago "could not make one [bead] to perfection and pierce it with the tools that they use in less than three days" (de la Borde in Roth 1924:119). Replication studies improve on this estimate, suggesting that a skilled artisan could achieve as many as five beads in a day, with 300 over a period of two months (Carlson 1993:70). At this rate, 11,000 beads would represent more than six months' labor for ten specialists. The 20,000 shell beads woven into the Pigorini cemí/belt in turn suggest a year's full-time work for ten specialists. The creation of either of these pieces required shell "wealth" in quantity – potentially material that was accumulated over some time for such a specific purpose. Such lavish displays of bead wealth reflected the abilities of the owners/wearers to harness the skills of craftspeople within their community or their success (and resources) in tapping into networks that circulated these valuables.

While these artifacts comprised the pinnacle of wealthy displays, indigenous shell beads in the form of barrel or cylindrical discs fulfilled a variety of purposes which were individual and personal – from strands worn at the neck, arms, and/or wrists to adorning women's *naguas* (skirts) (Alegria 1995; Bernaldez in Jane 1967:162). There were

Figure 2. Cotton belt with indigenous shell beads and European jet, brass, and mirror additions, featuring a central cemí figure. Full length: 116.5 cm; strap height: 7.0 cm; cemí head: 10.2 cm (courtesy of KHM-Museumsverband, Weltmuseum Vienna; inv. no. 10.443).

a variety of shell beads in use in the Caribbean, some undecorated and largely retaining their original shape (e.g., *Oliva* sp.) (Figure 3). Others were entirely modified from their original form (and so may have had greater value), potentially by craft specialists, as suggested for site GT-2 on Grand Turk, Turks and Caicos Islands, which appears to be a beadmaking site used by artisans from Hispaniola (Carlson 1993). Material from these large-scale production centers was likely destined for cacical storehouses, for their distribution or in the manufacture of important gift or status items in their service. Small-scale bead production at the household level also appears to have been fairly widespread; the site of Minnis-Ward, San Salvador, Bahamas, for example, shows evidence of multiple households undertaking bead production (Blick, Kim, and Hill 2010), so it is likely that people had access to at least some of these ornaments, perhaps acquiring a small group of beads over the course of their lives (e.g., gifts during major life events or in exchange). Stone beads (*cibas*), more laborious to manufacture than shell, were cacical prerogatives and were considered sacred (Martyr D'Anghera in Arrom 1999:48): a Hispaniolan myth recounts that the ancestress Guabonito first gifted *cibas* to the culture hero Guahayona at the sacred mountain Cauta, where the first people emerged (Colón 1992:155; Oliver 2000:205-213). Beads were thus among the first mythological "gifts," so it is perhaps not surprising that they, and the body ornaments they were made into, were eagerly gifted, traded, and used by the indigenous populations, with later European beads swiftly adopted for these varied purposes.

Figure 3. *Oliva* sp. ornaments from the Bahamas and Turks and Caicos Islands. **Top:** Perforated, but otherwise complete, Abaco; H: 40 mm, W: 18 mm, D: 16 mm (courtesy of Albert Lowe Museum, Green Turtle Cay, Abaco). **Bottom:** A half-shell ornament from MC-32, Middle Caicos; H: 31 mm, W: 15 mm, D: 6 mm (courtesy of Turks and Caicos National Museum, Grand Turk; FS 21).

The disc beads featuring in the cotton artifacts discussed here are 0.6-2.5 mm thick and 3.2-4.8 mm in diameter. A closer inspection of the Pigorini cemí/belt and the Vienna belt suggests that, despite the similarities in color range and beaded designs, there are some minor differences in the selection and placement of beads. The consistent size of the beads used to cover the woven structures of the Pigorini cemí/belt is striking, suggesting that the artisan specifically selected beads of relatively uniform thickness (ca. 2.0-2.5 mm) in order to maintain the alignment of the designs (Figure 4, a). Thinner beads (0.6-1.5 mm) tend to be infrequent in the Pigorini cemí/belt. The Pigorini weaving technique appears to favor securing single beads individually, no matter their thickness. In contrast, the Vienna belt, while superficially looking very similar in design, does feature more very thin beads that are doubled-up in one binding to bring them in line with the thickness of the other beads, and so maintain the precision of the geometric designs (Figure 4, c). This is particularly noticeable in the nose and eye area of the belt's cemí, but is also evident in the beaded waist straps (Figure 4, b). This undoubtedly was due to what beads were available at the time; perhaps access to a larger number of beads enabled the artisan(s) responsible for the Pigorini cemí/belt to be more selective, allowing greater precision and alignment. Equally, the thinner beads may have been particularly difficult to make, making them potentially more desirable to feature in key areas of the artifacts, such as a Vienna belt's cemí face. In both cases, the weaving is so tight that many broken beads have been retained within the underlying mesh of cotton thread. The method of creating this bead "fabric" is largely obscured due to the tightness of the construction, but the staggered sequence of beads suggests that a technique similar to a brick stitch or a one-

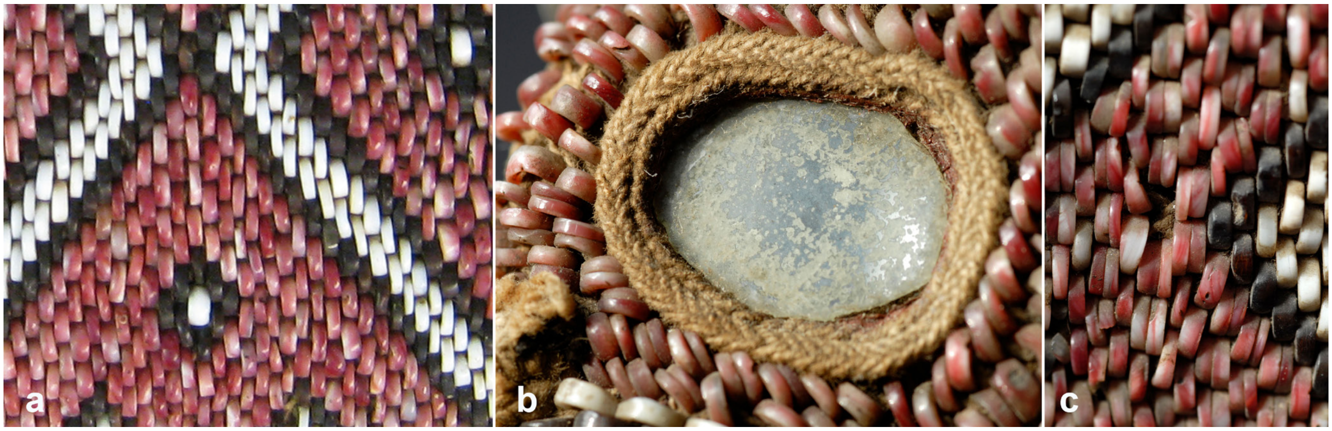

Figure 4. Belt components: a) The Pigorini belt featuring a consistent use of thick disc beads (ca. 2-2.5 mm) (courtesy of Museo delle Civilitá – MPE "L. Pigorini," Piazzale G. Marconi 14,00144 Rome; acc. no. 4190); b) detail of the Vienna belt's cemí face, showing two thin beads stacked together within the cotton mesh; c) detail of the Vienna belt's waist band showing two beads (ca. 0.6-2 mm thick) bound together to maintain the geometric pattern (courtesy of KHM-Museumsverband, Weltmuseum Vienna; inv. no. 10.443).

bead netting method was likely used. Both techniques thread each bead twice for added security and sequencing, as the exposed mesh netting in the damaged areas of the Pigorini cemí/belt and Vienna belt would suggest. It is clear from this treatment that the beads were valued not simply as a way of adding color and pattern to a wearable object, but that they were a contributing valuable to the material (and quite literal) "weight" of something that had deep cultural significance. As noted in the introduction, belts and caps were among the few body ornaments worn by caciques at important political and ritual events (Ostapkowicz 2013). They enclosed the head and central core (below the navel and above the genitals), both critical points of the body and important foci in Taíno myth and art – areas that may have been viewed as significant thresholds for spiritual and physical transcendence (Ostapkowicz 2013).

The vibrant bead colors featured on the two cotton artifacts owe much to the choice of original materials. Cursory examination suggests that *Lobatus gigas* (queen conch) and *Chama sarda* (cherry jewel box clam) were likely used for the white and red beads, respectively, as supported by comparable examples found in the archaeological record (Figure 5, bottom). The source of the dark beads is more difficult to identify. While matte, grey shell beads do appear with some regularity in archaeological contexts (e.g., Blick, Kim, and Hill 2010; Carlson 1995), including some that appear burnt (Figure 5, top), the black beads on the artifacts under discussion potentially suggest another source. Those in the Pigorini and Vienna pieces feature a variety of color tones, incorporating browns and olive greens to deep blacks, some matt but most others having a high sheen. A damaged bead on the Vienna belt appears thickly coated by a grainy black colorant, while its interior is white (Figure 6). This may suggest that some black beads were actually made of white shell darkened with a surface coating. Another possibility – as first proposed by Karl Nowotny (in Schweeger-Hefel 1952:214) – is that many of the black beads were carved from vegetable or fruit seeds, or indeed other organic (e.g., bone) sources (Figure 7, a). Plant-based materials rarely survive in the archaeological record; if beads of a botanical source are featured in the cotton artifacts, they are the only examples currently known. Initial (non-invasive) studies of a broken fragment of one of the Pigorini cemí's black beads does indeed suggest that it is organic (Figure 7, b-c) and further analyses are underway to determine a more definitive identification. A potentially botanical source should not be surprising: indeed, if the corporeal art of the South American mainland cultures is any indication, the possibilities for ornaments derived from botanical sources are as overwhelming as the botanical variety of these regions (e.g., Harding 2003).

While the *chaîne opératoire* of shell artifacts in the circum-Caribbean is coming into greater focus (Carlson 1993, 1995; Falci 2015), we are still some way from understanding the meanings behind material choices, including color symbolism. Looking across the spectrum of ethnographic references to the color of Taíno body ornaments, to the archaeological evidence, and the exceptional cotton artifacts of the early colonial period under discussion here, it is clear that distinct color preferences were made in the creation of body art, whether in the form of a necklace or belt, or, indeed, body painting. Equally, a limited range of colors in suitable materials would have been available in quantity.

Consistently, white, red/pink and black beads recur: whether at an archaeological site in the Bahamas (e.g.,

Figure 5. Top: Five grey beads from Governor's Beach (GT-2, Grand Turk, Turks and Caicos) with 4.26-9.64 mm diameters and averaging about 1.5 mm in thickness (courtesy of Turks and Caicos National Museum; 2-T2 057). **Bottom:** Color range of small shell beads from the Pink Wall site, New Providence, Bahamas (courtesy of The National Museum of the Bahamas [Antiquities, Monuments and Museum Corporation]; NP-12-171-13).

the Pink Wall Site, New Providence – Figure 5, bottom); a *chronista* reference, such as the white and red (and green) "stones"' worn by the Jamaican cacique described in the opening of this paper (Bernaldez in Jane 1967:162); or as clearly seen in the geometrically vibrant beadwork designs featured in the Pigorini cemí/belt and Vienna belt. Looking further afield, the combination of white (*Lobatus gigas*) and red (predominantly *Spondylus* sp.) shells has a long history in South America, going back at minimum to 2500 BC (Claassen 1998:207). The two shells have long been paired in archaeological contexts, as well as iconography; for example, both are depicted in two key obelisks at Chavin de Huantar dating to ca. 800 BC (Lanzón Stela) and ca. 500 BC (Tello Obelisk) – far from the warm coastal waters that are their natural habitat (which itself speaks of people's connections across this vast landscape, and the distances that iconic subject matter and materials may have traveled). The white and red combination, enhanced with black, may have a deep resonance in the wider region. And while it is tempting to step beyond the evidence to more interpretative ground by suggesting possible meanings behind the color

Figure 6. A damaged black bead (inset) showing a white interior and a black outer surface within the context of its surroundings at the top of the cemí's head (courtesy of KHM-Museumsverband, Weltmuseum Vienna; inv. no. 10.443).

choices, this should not be viewed as a literal translation of past understandings. For example, Blick, Kim, and Hill (2010), specifically referencing the Vienna belt, suggest that red and white were complementary opposites. White was associated with peace, the celestial complex, gold and silver, the sun and moon, and elite status; conversely, red was associated with war, the agricultural complex, blood and fertility, the soil and earth, and lower social status (Blick, Kim, and Hill 2010:36). Yet, while such dichotomies may have been held by the Inca (*see* Claassen 1998:208; Mester 1989) their application to the Caribbean is problematic on numerous grounds. The nuances of meaning in the Caribbean are likely to remain far more elusive to us than such concrete opposites would suggest. Similarly, there is probable meaning in the geometric bead designs, but it is impossible to be specific. In a general sense, given their intimate association with the body, they may have had apotropaic qualities. Beads themselves are often given this attribute cross-culturally, but again, whether such was the case in the Caribbean is difficult to establish.

EUROPEAN GLASS BEADS

European glass beads entered into this repertoire of indigenous bead colors and materials, though their integration amidst the indigenous beads in the Pigorini cemí/belt and the Vienna belt suggests that they were understood as equivalents to the traditional bead valuables. In these artifacts they enhanced, and supported, these traditional structures.

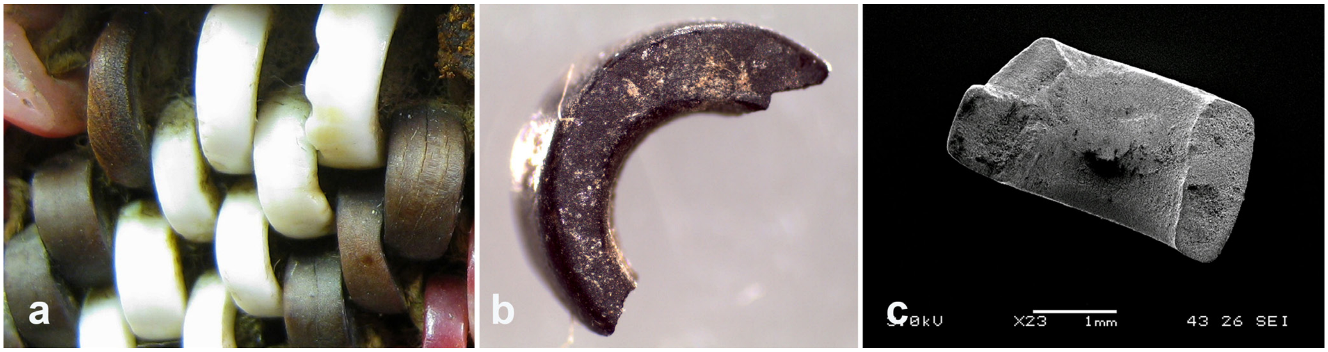

Figure 7. Black beads on the Pigorini cemí/belt: a) the variety of color tones of the belt's "black" beads, some showing natural cracking, suggestive of an organic source; b) the exterior of a broken black bead from the cemí's head area; c) SEM image showing fissures on the surface of the broken bead, suggestive of organic dessication (c photo: Chris Doherty).

No sooner had Columbus offered glass beads as gifts to the Lucayans (inhabitants of the Bahamian archipelago) during his first few days in the "New World" of Guanahani (San Salvador), they were in circulation via indigenous exchange networks to neighboring islands (Dunn and Kelley 1989:85). Perhaps the Lucayans used these exotics goods as material evidence of the curious people from foreign lands, just as Columbus displayed indigenous America's material culture at the Spanish court upon his return – the "foreign" presented in tangible, concrete terms. Equally, beads were desirable in and of themselves – bright, vibrant glass surfaces of unfading color which echoed the shape and qualities of indigenous disc and barrel beads. Columbus noted that the Lucayans "would barter with some pieces of gold hanging from the nose…. which they would willingly give…. for glass beads" (García Arévalo 1990:271). A later historian recounted that "they exchange gold for glass, because nothing is more valuable among them than glass" (Foresti da Bergamo in Symcox 2002:30; *see* Keehnen 2012 for a detailed review of early exchanges). Hence, in his initial trade in *cuentas* (beads) and *abalorios* (small glass beads), Columbus had fortuitously stumbled upon one of the most coveted and appreciated of indigenous valuables; so favorable was the reception to glass beads that it cemented them as an essential commodity for trade in the Americas for centuries to come.

Further, by including green *abalorios* in the initial exchanges, Columbus may have inadvertently connected with another highly desirable quality within indigenous aesthetics and symbolism. Green had a deep resonance in the circum-Caribbean region, a broad referent to water and its fertile potential and linked with widely traded "greenstone" artifacts (Boomert 1987; Rodriguez Ramos 2011). Jadeites, for example, had limited sources (restricted to quarries in the Dominican Republic, Cuba, and Guatemala) and, due to their hardness, were very difficult to work. Vibrantly green glass beads likely echoed these highly coveted stone materials, while their diminuitive size (ca. 3.5 mm diameter) was something almost impossible to achieve in jadeites (for further discussion *see* Ostapkowicz 2018:166-168). Indeed, across the circum-Caribbean region, the scale of jadeite artifacts and their often natural forms (particularly in the Maya region), suggests that there was little desire to reduce this precious material, but rather utilize it in full – hence miniature green beads would have been both novel and highly desirable. Within this context, the exchange of a gold ornament for several green glass beads may have been viewed as very favorable from both the Lucayan/Taíno and Spanish perspectives.

In the early years of the colonial enterprise (1511-1526), over 100,000 green and yellow *abalorios* were sent to Hispaniola (Deagan 1987:110, 157), undoubtedly destined for trade with indigenous communities. Other glass bead styles were also sent, though in lesser numbers. Even at this scale, however, it would appear that glass beads remained relatively scarce at this time – most likely never keeping up with indigenous demand; Spanish imports to Hispaniola focused more on basic necessities for the fledgling colonies than trade. Very few beads have been found in early colonial indigenous sites (Deagan 2004:613; Keehnen 2012:150; Samson 2010:284), suggesting that they were likely highly coveted and curated objects, potentially being passed down through generations. By the early 16th century, *indios* were forced to integrate into Spanish society, and wearing European-style dress, including European ornaments, became the social norm (cf. Valcárcel Rojas 2012): glass beads, accepted in both worlds, facilitated this transition (cf. Panich 2014).

PIGORINI CEMÍ/BELT

The Pigorini cemí/belt (Figure 1), with its rich display of glass beads, emerged at a time of significant cultural and social change on Hispaniola (1492-1550). Its cotton substrate has been dated to AD 1492-1524 (*see* Ostapkowicz et al. 2017), a period when caciques were actively negotiating with the Spanish, and had access to a wealth of European goods as they vied for power in the shifting alliances. This initial influx of trade goods during the earliest years of contact may have spurred an artistic renaissance for those few who made favorable terms with the Spanish, incorporating the new wealth within traditional designs – as the lavish glass beadwork on the cemí suggests. But the early colonial period was also a time of resistance and cultural dislocation: the increasingly exploitative Spanish occupation of the islands – from their slaving raids on indigenous populations to forced assimilation practices – resulted in conflict and rebellions (e.g., the battle of La Vega Real in 1497 Hispaniola and the rebellion of 1511 in Puerto Rico). The period to ca. 1530, and certainly by 1550 (Deagan 2004; Guitar 1998), marked a steep decline in the indigenous power structure and its associated traditional material culture which required the work of skilled artisans to create everything from the varied components (spun cotton, shell beads) to the final elite product (e.g., belts).

This dramatically shifting worldview was the cultural backdrop to the Pigorini cemí and belt, spanning the growing awareness among the Taíno of the escalating power of the Spanish and their own aspirations within this sphere of influence. The only access to glass beads was through negotiation with the Spanish (only until they entered indigenous systems), and the prominent display and sheer quantity of foreign materials within the weave of the Pigorini cemí clearly positioned the individual who commissioned it at the forefront of political maneuvering in the late 15th and early 16th centuries. Choice beads in quantity were selected to highlight specific features on the Pigorini cemí's head and shoulders (notably, only the top incorporates glass beads; the belt is constructed solely of indigenous shell beads). Together with stylistically unusual treatments of the shoulder areas, which potentially suggest the incorporation of 16th-century European fashion elements (e.g., slashed fabrics) into an indigenous creation, the inspiration for this hybrid object was the critical transition point in America's history and Taíno perceptions of their place within it (for further discussion *see* Ostapkowicz 2019).

Three varieties of glass beads are featured: 1) ca. 1,200 small, emerald green *abalorios* covering the bat face and cap of the human head (Figure 8), 2) roughly 450 deep-blue, square-sectioned beads with sharp corner facets at the cemí's shoulders (Figure 9), and 3) one (of potentially 12) faceted three-layer turquoise beads at the top of the head (Figure 10). These bead types were all in circulation pre-1550.

As noted above, Columbus himself gifted and bartered the small green beads, and they were imported in the following decades due to their popularity; they are considered reliable chronological markers up to 1550 (Deagan 1987:169; Smith, in Hoffman 1987:242). The faceted blue and turquoise beads are single and multi-layered Nueva Cadiz beads, respectively, both found at colonial American sites prior to AD 1560 (Deagan 1987:163; Smith and Good 1982:10). Their diminutive size (5-7 mm long) is, however, in stark contrast to the typical length of Nueva Cadiz beads (37-75 mm). These short varieties are an early, poorly documented Nueva Cadiz form, examples of which have been recovered from looted early contact sites in Peru (Deagan 1987:163; Karklins 2018: pers com.).

Figure 8. Green *abalorios* on the Pigorini cemí's bat face (left) and anthropomorph's cap (right). The beads are 1-2 mm thick and 3-3.5 mm in diameter (courtesy of Museo delle Civilitá – MPE "L. Pigorini," Piazzale G. Marconi 14,00144 Rome; acc. no. 4190).

Figure 9. Deep-blue, square-sectioned beads with sharp corner facets featured at the cemí's shoulders. They are 5-6.5 mm long and average ca. 4.5 mm in diameter (courtesy of Museo delle Civilitá – MPE "L. Pigorini," Piazzale G. Marconi 14,00144 Rome; acc. no. 4190).

QUEBRADILLAS VESSEL

While the Pigorini cemí, with its quantity of glass beads woven into the structure, served as a high-profile "advertisement" of Taíno socio-political links to the Spanish, a more intimate picture can be seen in the Quebradillas vessel. This ornately carved wooden vessel, containing over 100 ornaments, including 52 glass beads comingled with 40 indigenous shell disc beads, 12 stone beads with single and double (crossing) perforations, and two drilled dog canines, was recovered from a cave in the Quebradillas region of Puerto Rico in the 1980s (Figure 11, a). The beads were potentially strung together as a single-strand neck ornament prior to being secreted in the cave for safe keeping (Figure 11, b). Alternatively, the comingled beads may have been an offering or ritual deposit. Given the contact-period contents, the vessel was initially thought to date to the early colonial period in Puerto Rico (AD 1508-1520) (Méndez Bonilla 2006:26), but a recent radiocarbon study provided results that were, at minimum, a half century earlier: ca. AD 1337-1446 (Ostapkowicz et al. 2012: Table 1). This would suggest the curation of the vessel for several decades, if not centuries, before access to European beads was possible in Puerto Rico, which was first settled by Spanish colonizers in 1508 (for a full discussion *see* Ostapkowicz et al. 2012:2249). This range of cared-for materials – from the curated wooden vessel to the glass and indigenous beads – suggests an investment that was carefully secreted in the cave.

Of the European beads, three are blue, two yellow, and 47 are a deep emerald green (Figure 11, c). They are ca. 3 mm in maximum diameter, with a somewhat uneven form, one side being slightly thicker than the other, and appear to be wound, some containing numerous air bubbles. They equate to types VID1e-f in the Smith and Good (1982:37, Figure 7, nos. 105-106) typology: a wound (class VI), unmodified (series D) bead of simple construction (Type 1). Very similar yellow and green beads were recovered from the Long Bay site, San Salvador (SS-9), considered by some to be Columbus' first landing site in the New World (Brill and Hoffman 1985:380). The beads, together with other European artifacts found at the site (including a Spanish *blanca* dated no later than 1474), have been assigned to the very earliest period of European contact. These beads have a very high lead content (65-75%), which enabled them to be wound at relatively low temperatures (ca. 750-800°C) (Brill and Hoffman 1985:382).

One of the green beads from the Quebradillas cache was submitted to Robert H. Brill for study at The Corning Museum of Glass, and underwent XRF, density measurement, and Pb isotope analysis. The XRF spectra indicated major levels of lead and silica, with minor levels of alumina, iron, and copper; the density was estimated at 4.10

Figure 10. A turquoise 3-layer Nueva Cadiz bead, one of potentially six to feature on this side of the cemí's cap (note the five damaged areas, exposing a longer strand of cotton). The bead is 7 mm long, 7.6 mm in diameter, and surmounted by an indigenous *Chama* sp. shell bead (courtesy of Museo delle Civilitá – MPE "L. Pigorini," Piazzale G. Marconi 14,00144 Rome; acc. no. 4190).

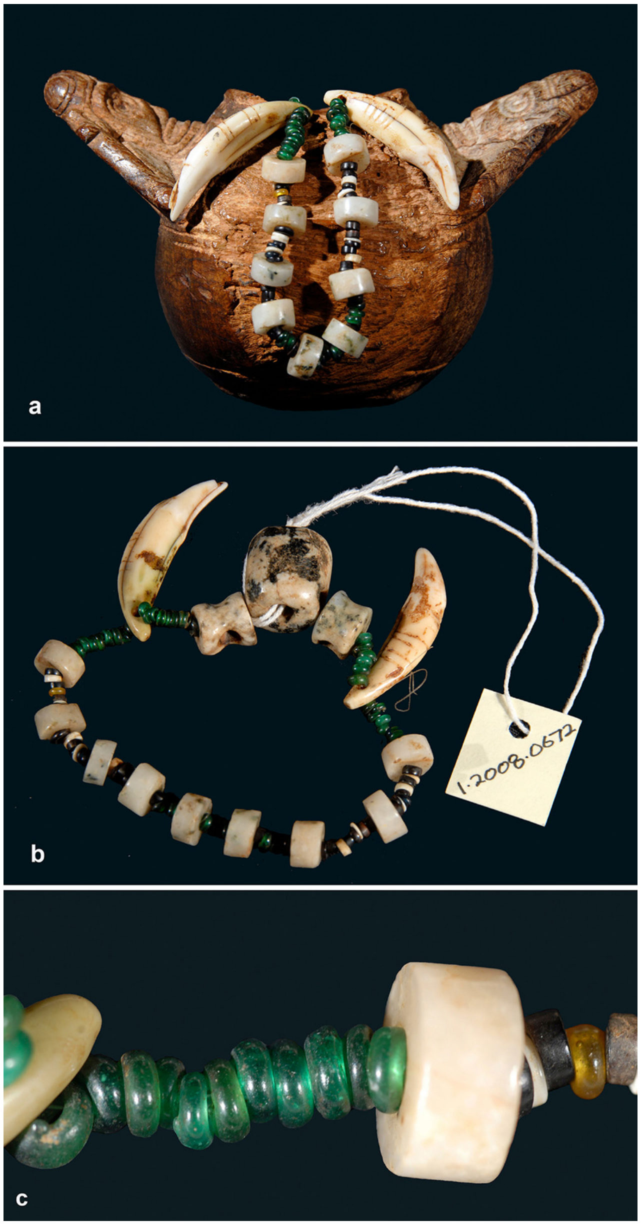

Figure 11. The Quebradillas artifacts: a) the double-headed vessel; L: 122 mm; W: 80 mm; H: 70 mm (max); b) restrung necklace of beads found in the vessel; c) the donut-shaped glass beads (courtesy of Museo de Historia, Antropología y Arte, Universidad de Puerto Rico, San Juan; 1.2008.0671 [vessel], 1.2008.0672 [beads]).

g/cc, corresponding to a $PbO:SiO_2$ glass containing 57-59% PbO (Brill 2012:546). Brill (2012:547) concluded that the high-lead $PbO:SiO_2$ glass – colored by copper and perhaps accidentally by iron – had a composition closely comparable to the San Salvador beads and other early VID1e-f beads sourced for the original San Salvador study. Indeed, of the comparative material for that study, the best match for the Quebradillas bead is a green bead from Nueva Cadiz (CMG 5700), with provenance dating it to 1515-1545 (Brill and Hoffman 1985:381). The results from these beads all fall within a range of ores analyzed from various mining regions in Spain (Brill 2012:546-547), suggesting that a Spanish source – rather than a more commonly attributed Venetian source (e.g., Deagan 1987:158) – remains a possibility for these early beads found on Caribbean shores.

VIENNA BELT JET BEADS

Beads in vibrant hues were not the only imported European goods that had resonance among indigenous groups: black materials were also desirable, such as the jet beads featured on the Vienna belt. Prior to European contact, black ornaments made of fossilized terrestrial plant materials (e.g., lignite and jet) had a deep history in the region, stretching back to the Early Ceramic Age (ca. 400 BC - AD 600) (Ostapkowicz 2018:169-173). They were used in the creation of ornaments depicting transformative creatures, often found in association with exotic imports (Chanlatte Baik and Narganes Storde 1984; Etrich 2003) and paraphernalia used in the ingestion of drugs (Ostapkowicz 2018:169-170). Other elite ceremonial objects, such as *duhos* (wooden or stone seats), were – according to the Spanish – "black as jet" (Helms 1986; Las Casas 1967:174; Martyr D'Anghera 1970:125). If so, they were either selectively chosen for the dark wood (though few woods known to be carved into *duhos* can be identified as "black;" e.g., *see* Ostapkowicz et al. 2012) or, more likely, intentionally darkened. There was undoubtedly significance to black as a material and a colorant, just as there was in Europe; e.g., the use of jet as *veneras* (literarily, items of "veneration," symbols of saints, religious orders, etc.). When these items were imported into the Caribbean as part of rosaries and amulets, the Taíno may have considered them comparable to their own repertoire of black materials used to carve ceremonial items and ornaments (*see* further discussion in Ostapkowicz 2018:169-173). Like the parallels between jadeite ornaments and green *abalorios* noted above, European jet echoed the qualities that were already recognized in the Caribbean. Jet was incorporated into indigenous ornaments worn in colonial contexts – such as the spherical bead strung on a necklace of white coral beads associated with Burial 84 at the site of El Chorro de Maíta, Cuba, dating to the late 16th century (Valcárcel Rojas 2012; *see also* Lambert et al. 1994 for jet beads from the site of Tipu, Belize, ca. 1550-1620). Interestingly, even this late in the early colonial period, both European and indigenous beads were being combined, potentially suggesting the curation of older indigenous beads (or the continuation of their manufacture at the household level) alongside newer jet introductions.

Two styles of jet beads are incorporated into the Vienna belt: 1) a large (12.5 mm x 7.3 mm) rectanguloid bead with beveled sides, fluted corners, and flutes in two of the sides, secured with a brass loop or shank (Figure 12, a), possibly part of a belt buckle or an element from a composite ornament, and 2) a small (4 mm diameter) faceted bead placed in the right earflare (Figure 12, b). These have been cut by hand, making them quite individual in style and hence difficult to match in comparative collections. While the small bead may have been part of a rosary, the larger bead is perhaps carved in the style of a Dominican cross (cf. Deagan 2002:73) or a St Dominic star (St Dominic frequently being depicted with a star above his head in 16th-century European painting). It is intriguing to consider whether the religious significance of jet as a material, and its specific incorporation into religious items such as rosaries and *veneras*, would have resonated with the Taíno (assuming the beads were integrated into the belt within an indigenous context; *see* discussion in Ostapkowicz 2018). Although speculative, there are some grounds for this interpretation given the religious syncretism that was emerging during the early colonial period, when the Taíno adopted certain Christian elements, including saints whose legendary powers may have been comparable to those of their own cemís (Oliver 2009:221-244).

CONCLUSIONS

Beads, as noted by Cristiani and Borić (2017:39), are universally used as "a material strategy par excellence in the construction of the social self;" combined into ornaments they are a "'communication technology,' a visual language through which personal and social information can be broadcast to intimate or distant audiences, thus contributing in creating and maintaining social networks at different levels." To us, as the "distant audience" separated by centuries from the people who originally made these extraordinary creations, the artifacts under discussion offer a tangible means of engaging with the artistry of the early colonial period in the Caribbean, not least the importance of beads within Taíno material culture. The 16th-century Spanish were – despite their physical proximity – also "distant [though colonizing] audiences," and the incorporation of glass and jet beads within the structures perhaps broadcast Taíno interest in binding them into mutually beneficial social networks. Indeed, what higher accolade for the Spanish and their trade goods than to be woven into the body of a cemí? This interest was likely not lost on the immediate audience – the local and neighboring indigenous groups – who themselves vied for access to the new "wealth" of the foreigners in these early years of interaction. The harmonious integration of these foreign elements within structures created from indigenous shell (and potentially botanical) beads, and within a largely

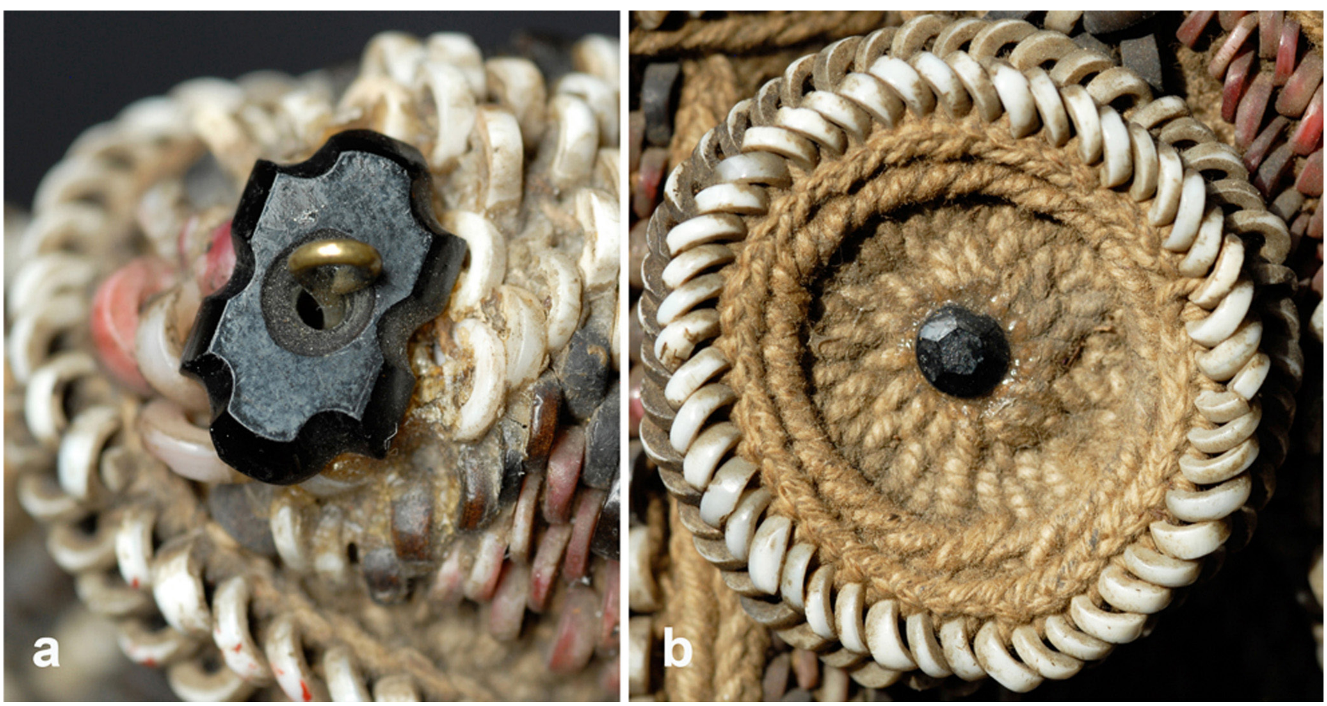

Figure 12. Two jet beads featured on the Vienna belt: a) one of two large, rectanguloid beads (12.5 mm by 7.3 mm) secured with a brass loop at the top of the cemí's head; b) small faceted bead (ca. 4 mm diameter) in the cemí's right earflare (courtesy of KHM-Museumsverband, Weltmuseum Vienna; inv. no. 10.443).

traditional iconography (though *see* Ostapkowicz [2019] for a discussion of the Pigorini's shoulder and neck treatments), speaks of an active engagement in building new histories on familiar foundations, and constructing anew the "self" (the cacique, and by extension, the community). The people who commissioned and used these objects were participants in the shifting power relations of the early colonial period. They were active agents, willing to explore the new possibilities posed by the foreigners on their shores. By incorporating imported glass beads, and by extension the Spanish themselves, into ideologically and socio-politically important objects, they were integrating the foreigners into every future use and display of these creations. In this capacity, the European "other" became intimately entangled with Taíno representations of their own ideology, and ultimately themselves (cf. Gosden 2004), influencing people's understandings of this shifting, transitional period and their place within it. It is an adage worth repeating: beads are not simply pleasing to the eye, but are material expressions of social connections (e.g., Choyke and Bar-Yosef Mayer 2017:3)

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ENDNOTES

1. There is also the possibility that *Spondylus americanus* (atlantic thorny oyster) was used for the red, but this may have been quite rare: only three pieces of unworked *Spondylus* sp. were found at the Governor's Beach site (GT-2), Grand Turk – the largest beadmaking site currently known in the Caribbean (Carlson 1995:99) – yielding a sample of ca. 1,600 complete disc beads, 400 broken beads, 400 bead blanks, 3,000 polished shell fragments, and 13,000 bits of shell debitage.

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BEADS IN IRON-AGE AND EARLY-MODERN TAIWAN: AN INTRODUCTION

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Archaeological research has revealed a long history of glass bead exchange and use in Taiwan, yet it has seldom been discussed in the literature. This paper provides an introduction to this exchange from the Iron Age (ca. late 1st millennium BC - mid-2nd millennium AD) to the early modern period (ca. AD 1600-1900) by revisiting the archaeological and historical records. It is suggested that changes in bead styles and chemical compositions over time reveal the transition of bead supply in Taiwan, which further reflects two broad phases of bead trade: Phase I) the earlier involvement of Taiwan in the Indo-Pacific bead exchange (1st millennium AD) and Phase II) the later cultural and economic contacts between the indigenous people, Chinese merchants, and Europeans (2nd millennium AD).

THE EMERGENCE OF GLASS BEADS IN PREHISTORIC TAIWAN

Taiwan is a small island located off the southeast coast of continental Asia. The earliest glass beads there can be dated to the late 1st millennium BC on the east coast (Lee 2005a, 2007, 2015). This period witnessed the transition from the Late Neolithic period to the Early Iron Age through the presence of metal objects and glass beads which are regarded as evidence of overseas influence on the local material cultures of prehistoric Taiwan.

The background to the appearance of glass beads in Early Iron-Age Taiwan should begin with the nephrite (green jade) trade in the South China Sea interaction network during the Late Neolithic period (ca. 1500 BC - late 1st millennium BC), which connected mainland Southeast Asia, island Southeast Asia, and Taiwan. Eastern Taiwan is known for exporting nephrite objects and raw materials to Southeast Asia in the Neolithic period (Hung and Bellwood 2010; Hung et al. 2007). Research has shown that, in the late 1st millennium BC, ancient Southeast Asian artisans produced nephrite objects using local iconography (so-called *lingling-o* and double-headed animal ear pendants) in local communities using raw nephrite imported from Taiwan (Bellwood et al. 2011; Hung and Bellwood 2010). Within Taiwan, nephrite was also an important raw material for producing tools and weapons, as well as decorative objects during the Neolithic (Liu 2003). The exchange and production of nephrite objects therefore demonstrates the active participation of Taiwan in the South China Sea network since the Neolithic period.

The Iron Age arrived earlier in eastern Taiwan than in the western portion. In eastern Taiwan, iron, bronze, and gold objects (with the continued use of lithic tools) appear as early as the 3rd century BC. In southwestern Taiwan, large quantities of iron artifacts appear in the 2nd century AD, when lithic tools become rare in comparison to the eastern region. Archaeologists in Taiwan generally consider that glass beads and possibly metal objects were imported from Southeast Asia in the Early Iron Age, following the nephrite exchange network established during the Neolithic (e.g., Hung and Chao 2016). This is based on the physical similarity of the Taiwanese specimens to the monochrome Indo-Pacific glass beads in the contemporary South China Sea region. It has been suggested that glass beads may have been used as a new type of ornament and iron objects as tools and weapons during the Iron Age, replacing those of nephrite which were common during the Neolithic period (Liu 2005). It is, however, likely that glass beads and iron artifacts signify the introduction of new material cultures during this period, as nephrite and other lithic artifacts are still found at Iron-Age sites in the eastern region.

PREVIOUS RESEARCH ON TAIWANESE GLASS BEADS

Taiwan is regarded as the homeland of Austronesian peoples who migrated across Southeast Asia beginning around 3000 BC (Bellwood 1995) (Table 1). Several Austronesian indigenous groups in Taiwan were consumers of glass beads. Among them, the Paiwan are famous and the most studied for using heirloom polychrome beads.

Table 1. The Cultural History of Taiwan and Related Developments.

Periods	**Notes**
Paleolithic (25,000 BC - probably 6000 BC)	• Earliest human activities date to around 20,000-30,000 BC. • Chipped pebble tools used. • No evidence of agriculture or pottery making.
Early Neolithic (4000-3000 BC)	• Small scale of settlements distributed along the coast or rivers. • Hunting, gathering, and fishing are the main subsistence strategies, but there is evidence of agriculture development. • Pottery production performed, primarily cord-marked red wares. • Polished lithic tools used, including nephrite. • The connection to the Paleolithic culture is unclear.
Middle Neolithic (3000 BC-1500 BC)	• Localization of Early Neolithic culture in different regions. • Settlements reveal long-term occupation. • The inhabitants practice hunting, fishing, and rice and millet cultivation. • Cord-marked red wares predominate. • Polished stone tools used. • Nephrite used not only for tools but also ornaments. • Nephrite objects exported to Southeast Asia. • The start of Austronesian migration according to the out-of-Taiwan theory (3000 BC).
Late Neolithic (1500 BC-AD 1)	• Diversification of regional cultures. • The scale of settlements is larger than during the Middle Neolithic period. • Inhabitants practice hunting, fishing, and rice and millet cultivation. • Plain red wares predominate, except for midwestern and southwestern regions where grayish-black wares prevail. • The use of stone and nephrite tools/ornaments continues. • A greater amount and diversity of nephrite ornaments, particularly in eastern Taiwan. • Nephrite raw materials begin to be traded to Southeast Asia later in the period. • A few bronze artifacts present in northern Taiwan.
Iron Age (Metal Age) (400 BC-AD 1600)	• Begins earlier in eastern Taiwan than western Taiwan. • Metal artifacts appear in archaeological sites, including iron (predominates), gold, copper, and bronze. • Iron production probably took place in northern and eastern Taiwan. • Glass beads, bracelets, pendants, and agate beads present; the use of nephrite ornaments declines. • Plain red wares predominate, but decorated wares are present in southeastern and southern Taiwan. • New migrants probably arrive from Southeast Asia. • Archaeological sites of the later period reveal interaction with Chinese Han people.
Early Modern Period (AD 1600-1900)	• The Dutch rule the southern part of Taiwan from 1624 to 1662. • The Spanish occupy the northern part of Taiwan from 1626 to 1642. • Qing rule in Taiwan during 1683-1895.

These beads are endowed with social meaning, denoting aristocracy and land ownership, for example (Hsu 2005). Polychrome beads are also seen in Rukai, Beinan, and Tao, but less is known about their social and cultural significance there in comparison with Paiwan. Among some groups, specific bead types are used in ritual events. For example, Kavalan shamen use gold-glass beads to communicate with the spirits (Hu 2012). The social and ritual functions of glass beads among the Atayal, Amis, and Siasiat groups are less known. They do, however, use monochrome glass beads combined with those of shell and agate to create necklaces (Hu 1996:51; Ling 1962; Wong 1996:23).

The exchange of glass beads in the prehistoric period and its relationship with the indigenous bead cultures, the Paiwan group in particular, was researched by archaeologists and ethnographers in the mid-20th century. Early discussion often recorded and compared archaeological and ethnographic materials (Kano 1955; Miyoshi 1932). The style of archaeological (surface finds) and ethnographic glass beads related to Paiwan was recorded and chemical analysis was carried out on a few ethnographic specimens (Chen 1966, 1988:361-365; Sato 1988[1942]:190). This was used to discuss the migration of Paiwan ancestors during the prehistoric period. Tadao Kano (1955:66, 78-80) reported some archaeological finds of gold-glass beads in the northern and northeastern regions (confirmed to be the Kavalan group in later research; Chen 2006) and recorded the style and use of several polychrome glass beads among the indigenous groups (likely Paiwan). Some of the archaeological and ethnographic glass beads were further associated with Southeast Asia based on their physical appearance (Kano 1955:66, 78-80; Miyoshi 1932).

Research on glass beads excavated in Taiwan started in the early 2000s and primarily consisted of the chemical analysis of beads from Shisanhang (Tsang and Liu 2001:93-106), Kiwulan (Chen, Chiu, and Li 2008c:188-200; Cheng 2007), Shenei (Cheng 2007), Xiliao (Chen and Cheng 2011), Chongde (Liou, Wang, and Liu 2014), Jiuxianglan (Yang and Lee 2016), and Huagangshan (Hung and Chao 2016:1543-1544). Stylistic analyses, based on the colors and shapes of mostly monochrome beads, were carried out on beads from Shisanhang and Kiwulan (Cheng 2007; Tsang and Liu 2001:93-106). Some of these analyses, however, are preliminary investigations and have been unable to fully address the archaeological meaning of the analytical data. Only recently, with a greater analytical database, has more integrated and interpretive research been carried out by Wang (2016), in which an interdisciplinary approach was used to study glass beads in Iron-Age Taiwan. This research focused on the 1st millennium AD. Studies of beads of the 2nd millennium are limited by a lack of comparative material and most research has concentrated on European influence during the early modern period (late 2nd millennium) rather than the Late Iron Age (early 2nd millennium) (Wang and Liu 2007).

THE FIRST MILLENNIUM AD: TAIWAN IN THE INDO-PACIFIC GLASS BEAD EXCHANGE

Glass beads of the 1st millennium AD have been found at several archaeological sites in different regions of Taiwan with varying temporal placements (Figure 1). Beads appear earlier in the eastern coastal regions than the western. This corresponds to the earlier start of the Iron Age in the east as opposed to the west. In eastern Taiwan, beads appear earlier on the southeastern coast rather than the northeastern one. Generally, from the southeast to northeast, glass beads have been found at Jiuxianglan (ca. 3rd century BC - 8th century AD; Lee 2005a, 2007, 2015), Xiaduoliang (possibly 7th century AD; Lee 2009), Balan (6th-14th centuries AD; Fu and Chen 2004), Huagangshan (the Upper Layer Culture, ca. 100 BC - AD 400; Chao, Liu, and Chung 2013), Chongde (ca. early 1st millennium AD; Liu, Wang, and Chung 2007), Blihun Hanben (ca. late 1st millennium AD; Liu 2014), and Kiwulan (the Lower Cultural Layer, ca. 4th-12th centuries AD; Chen, Chiu, and Li 2008c:17-30).

In northern Taiwan, glass beads have been found at Shisanhang where ^{14}C dating suggests a very long occupation (2nd-15th centuries AD; Tsang and Liu 2001). Guishan, at the southern end of the Hengchun peninsula, is the only site where glass beads of the 1st millennium AD have been recovered (Li 1993, 1995), and the artifacts show a cultural affinity to southeastern Taiwan during the Iron Age.

In southwestern Taiwan, our current understanding of the types and chronology of glass beads comes primarily from the Tainan region where the majority were reported at archaeological sites dating later than the 2nd century AD, such as Daoye (ca. 2nd-6th centuries AD; Tsang and Li 2010), Litzuwei (ca. 1st-8th centuries AD; Chen and Chen 2017), Wujiancuo (ca. 6th-10th centuries AD; Nanke Archaeological Team 2005), and Xiliao (ca. 6th-14th centuries AD; Liu et al. 2011).

In the 1st millennium AD, bead colors are predominantly monochrome red, orange, yellow, green, and blue (Figure 2, a-e), with occasional black specimens. The majority resemble the well-known Indo-Pacific beads, and are widely distributed in the southeastern, southwestern, and southernmost regions. Most of the beads were grave goods, while some were recovered from contexts where beadmaking may have taken place (e.g., Jiuxianglan). The beads are of drawn manufacture, based on the longitudinal striae on the surface. They are all made of mineral-soda alumina (m-Na-Al) glass and belong to subtype 1, with an elevated level of barium (1040 ppm on average) and low uranium (< 8 ppm) (Wang 2016). The production of m-Na-Al glass originated

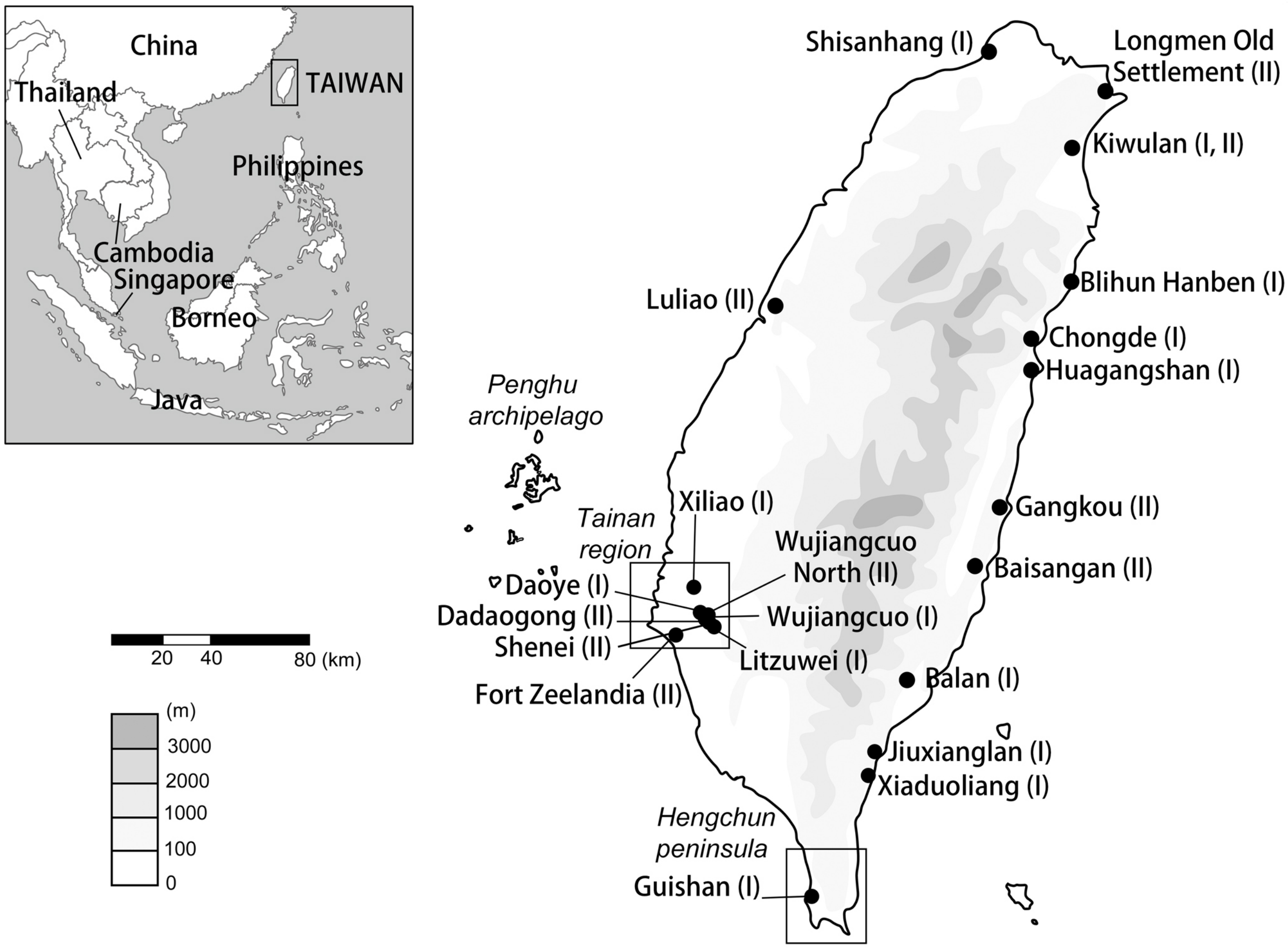

Figure 1. Taiwan showing the location of sites mentioned in text. I: Phase I, the 1st millennium AD; II: Phase II, the 2nd millennium AD (drawing: Kuan-Wen Wang).

in South Asia, where beads of this composition were traded to Southeast Asia between 400 BC and the 1st millennium AD (Dussubieux, Gratuze, and Blet-Lemarquand 2010). The presence of Indo-Pacific beads with this composition matches glass beads from the South China Sea region (Carter 2016; Dussubieux and Gratuze 2010), suggesting that bead exchange during this period in Taiwan was associated with the South China Sea interaction network.

Indo-Pacific beads have also been excavated from burials in the northern and northeastern regions, although they are not as dominant as in the southern areas. Some of the bead styles differ from those of other regions. In particular, the long tubular beads (ca. 6-10 mm in length) covered with orange glass (Figure 2, f) are only found in the northern and northeastern regions (e.g., Shisanhang and Kiwulan). The compositions of the core seem to differ; some are glass while others are of an undetermined earthen material (pers. obs.). The orange glass is m-Na-Al and the glass core is plant-ash glass (Wang 2016).

Other unique bead types from the northern and northeastern regions include long tubular dark-blue beads (ca. 10 mm in length) (Tsang and Liu 2001:95), shorter tubular light-blue beads (ca. 3-5 mm in length) (Figure 2, g), and small oblate yellow beads (ca. 3 mm in diameter) (Figure 2, h), all with a plant-ash composition (Wang 2016:102-111). These bead types are seldom encountered in other regions of Taiwan, and some are also uncommon in Southeast Asia. Both glass compositions are, however, frequently seen in Southeast Asia (Carter 2016; Dussubieux and Gratuze 2010; Wang and Jackson 2014), suggesting they are related to glass from the South China Sea region. These unique bead types suggest the possibility of glass bead reworking in Taiwan or Southeast Asia.

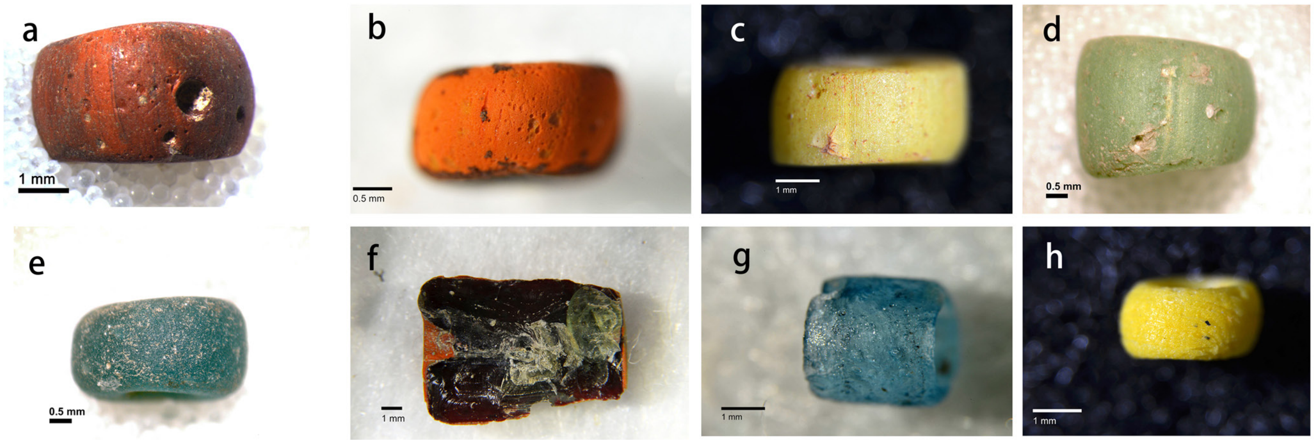

Figure 2. Drawn glass beads of the 1st millennium AD excavated on Taiwan: a) red, Jiuxianglan; b) orange, Kiwulan, Lower Cultural Layer; c) yellow, Guishan; d) green, Daoye; e) blue, Daoye; f) orange outer layer, Kiwulan; g) long, tubular, light blue, Kiwulan; h) yellow, Kiwulan (photo: Kuan-Wen Wang).

The finds of Indo-Pacific beads – with their wide regional distribution and temporal span – indicate the continuous participation of Taiwan in glass bead exchange over at least a millennium in the South China Sea region. The presence of uncommon bead types in northern and northeastern Taiwan also suggests diverse bead exchange during this period. This may be associated with various external exchange networks between these regions and the South China Sea, or may be the result of controlled bead exchange within this particular area.

On the other hand, archaeological evidence of glass bead production has been found in southeastern Taiwan. The presence of a glass bead on a mandrel at Jiuxianglan, together with glass rods, glass wasters, and thousands of glass beads, suggests that this site was a center of wound beadmaking and bead exchange during the Iron Age (Lee 2005b). Recent research, however, has revealed that most of the recovered beads are of drawn manufacture and not wound. The chemical composition and microstructure of the beads and the beadmaking waste also do not match (Wang et al. 2018). It is now suggested that most of the glass beads at Jiuxianglan may be imports from Southeast Asia and, based upon the archaeological find contexts and chronological differences, beadmaking may be a later development at Jiuxianglan. Thus, there is no current evidence for bead production in Taiwan before the mid-1st millennium.

Despite glass beads occurring commonly at Iron Age sites, they are not found until the 10th century in the midwestern region, where the first known occurrence is at Luliao. Their appearance and chemical composition, however, are not similar to the Indo-Pacific beads found at other Iron Age sites during the 1st millennium.

THE SECOND MILLENNIUM: A TRANSITION IN GLASS BEAD SOURCES?

At the turn of the 2nd millennium, different styles and chemical compositions of glass beads occur. Most are wound or folded, as indicated by wind marks that encircle the bead in many cases (Ho and Liu 2005). A greater variety of bead shapes are present, compared to the 1st millennium. In addition to oblate and tubular forms, there are long bicones, long ovals, and faceted forms (Figure 3). Although the majority are still monochrome, the hue of most beads differs from those of the 1st millennium. The colors include opaque white, milky blue, translucent pale blue, and ruby red (Chen, Chiu, and Li 2008c:18-26; Ho and Liu 2005). There are also a few polychrome specimens, mostly with a combed design. The lead-silicate glass (high-lead glass) composition with or without potash predominates during this period, while soda-lime-silicate glass and potash-lime-silicate glass are encountered occasionally (Cheng 2007; Cui et al. 2008). The varied bead styles and chemical compositions may indicate a change in bead origin(s) in Taiwan, which matches what was happening in Southeast Asia as well.

The Late Iron Age: Glass Beads of Chinese Origin?

At present, Luliao (ca. 10th-16th centuries) in midwestern Taiwan is the earliest site where wound beads with a high-lead composition have been excavated, and both lead-silicate glass and potash-lead-silicate glass have been reported (Cui et al. 2008; Ho and Liu 2005). Glass beads have also been recovered from sites such as Dadaogong, Wujiancuo North, Shenei (all ca. 15th-17th centuries) (Cheng 2007; Nanke Archaeological Team 2005), and Fort

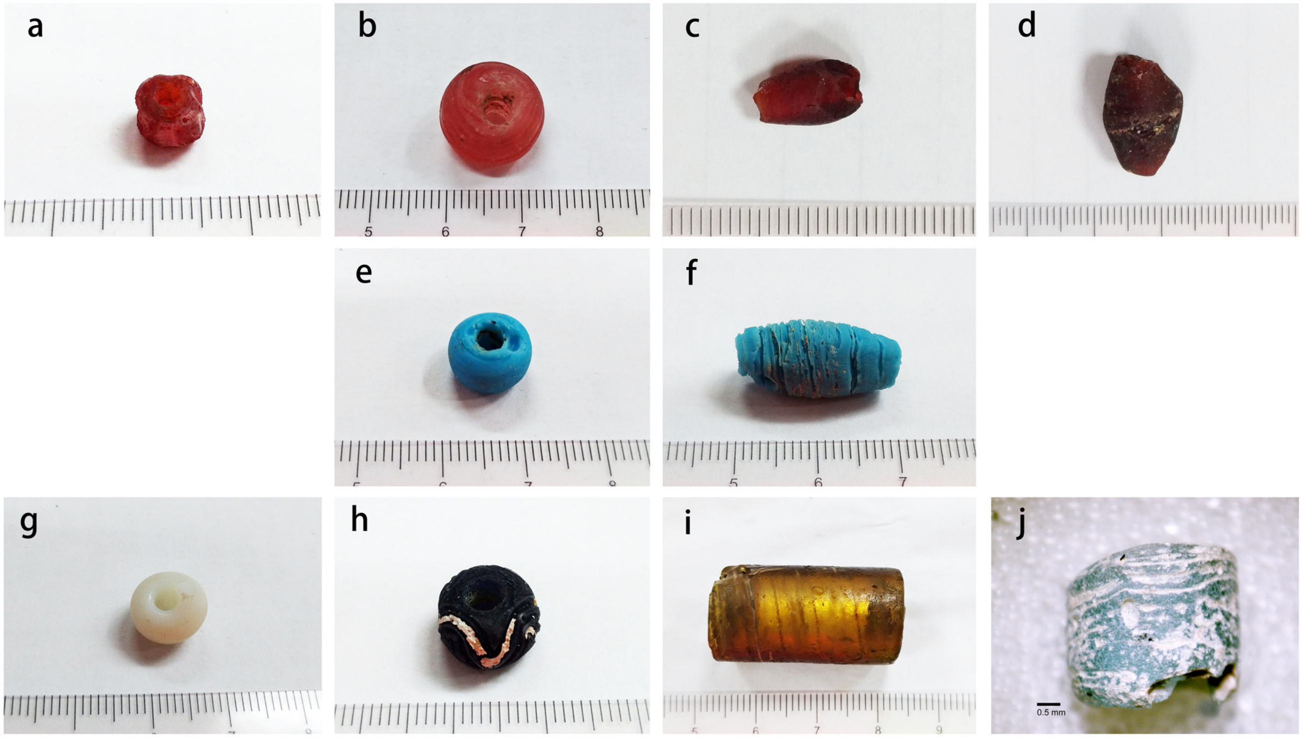

Figure 3. Taiwan glass beads of the 2nd millennium AD: a-d) ruby red; e-f) milky blue; g) white coil; h) dark blue with wavy decoration; i) gold-foil; j) tubular with unaltered ends (a-i, from the Upper Cultural Layer at Kiwulan; j from Wujiancuo North) (photo: Kuan-Wen Wang).

Zeelandia (17th century; Lee, Liu, and Fu 2006:2/117-2/121) in southwestern Taiwan, from Kiwulan (the Upper Cultural Layer, 15th-19th centuries; Chen, Chiu, and Li 2008c:17-30) in northeastern Taiwan, and from Baisangan (ca. 10th-15th centuries; Yeh 1993) and Gangkou (ca. 13th-19th centuries; Yeh 2005) in eastern Taiwan. Chemical analyses carried out on glass beads from Kiwulan (Cheng 2007) and Dadaogong and Shenei (Kuang-Ti Li 2015: pers. comm.) reveal they are composed of potash-lead-silicate glass. The presence of lead-silicate and potash-lead-silicate glass in this period clearly suggests a different tradition of glassmaking, possibly Chinese, in comparison to the m-Na-Al glass and plant-ash glass of the 1st millennium AD. Lead-silicate glass and potash-lead-silicate glass were also found in contemporary Singapore (Dussubieux 2010) and Cambodia (Carter, Dussubieux, and Beaven 2016), suggesting that the transition of glass composition was a regional phenomenon around the South China Sea.

A preliminary investigation of the glass beads reveals the presence of different styles and beadmaking methods. For example, at Luliao and Kiwulan, styles include ruby-red beads with biconical, long tubular, long oval, and round forms (Figure 3, a-d), opaque white coil beads (Figure 3, g), and dark-blue oblate beads with white wavy lines around the middle (Figure 3, h) (*see also* Chen, Chiu, and Li 2008c; Ho and Liu 2005). These styles are rare in the earlier period. Swirls that encircle the coil beads indicate they were wound, while seams on the long tubular ruby-red specimens suggest the use of the folding method. Considering the dates of Luliao and Kiwulan, the similarity of their beads does not necessarily imply direct exchange between the two but rather may indicate the sharing or participation in similar exchange networks over hundreds of years.

It should also be noted that white/black biconical beads seem to be present only at Luliao (Ho and Liu 2005), while large quantities of "golden beads" (long tubular beads with gold foil sandwiched between two glass layers; hereafter gold-foil beads) were excavated at Kiwulan (Figure 3, i) and other sites in northeastern Taiwan, such as Longmen Old Settlement (Pan 2005), but not in other regions. In addition, the light-blue beads with a tubular shape and unaltered ends (Figure 3, j) predominate at Dadaogong in southwestern Taiwan. Similar styles have also been found at Wujiancuo North and Shenei in the same region.

There are obvious differences between the beads of the 1st and 2nd millennia in terms of their chemical composition (soda-fluxed-silicate glass to high-lead glass), beadmaking technology (drawn to wound/folded), and styles (typical Indo-Pacific beads to varied styles including coil beads, long ovals, etc.). Taken together, this suggests a possible change in where the raw glasses were made and the beads produced. Here, the presence of high-lead glass suggests a Chinese tradition of glassmaking, as lead-silicate glass and potash-lead-silicate glass were produced in China no later than the Tang dynasty (618-907) (Brill, Tong, and Dohrenwend 1991; Gan 2007). The winding technique (coil beads) and ruby-red beads are also thought to be associated with China (Francis 2002:75-78). A Chinese-related origin thus is possible for glass beads in the early 2nd millennium, which suggests an extension of the trading partners in the South China Sea network.

For Chinese contact in Taiwan, the archaeological record reveals the temporary settlement of Chinese Han people on the Penghu archipelago, off midwestern Taiwan, since the late Tang dynasty (ca. 8th century), but not the main island of Taiwan (Tsang 1995:66-68). From the 8th century onwards, trade/exchange activities, direct or indirect, between the Han people and the inhabitants of Taiwan are exhibited by other artifacts such as Chinese coins, ceramic wares, and porcelains (Hung and Chao 2016; Liu 2011:262-264). During the Song (960-1279) and Yuan (1271-1368) dynasties, the Han people from southeastern China fished off the coast of southwestern Taiwan, which may have facilitated economic interaction between the Han people and the local population (Tsao 1979:119-120, 154).

The likely change in the source(s) of glass beads during the 2nd millennium does not, however, mean that Taiwan ceased to engage in the South China Sea interaction network. The archaeological record reveals that the ceramic wares and porcelain probably imported from China became common in Taiwan in the early 2nd millennium (Liu 2002:70). Chinese ceramics are also present in Southeast Asia during this period; e.g., the Philippines (Junker 1999:189-194) and Borneo (Harrisson 1970), as well as countries on mainland Southeast Asia, including Thailand and Cambodia (Miksic 2006). The trade/exchange of objects (including glass beads) with communities in Southeast Asia is recorded in a few Chinese archives. In *Zhu Fan Zhi* ("Description of Barbarians"), written by Rugua Zhao in the early 13th century, it is mentioned that glass beads and other objects (such as metal, ceramics, and silk) were traded to the Philippines and Borneo. In the 1330s, the trade in glass beads, ceramics, porcelain, metal, and silk in Southeast Asia was more widely noted in *Dao Yi Zhi Lue* ("A Brief Account of Island Barbarians"), written by Dayuan Wang. Neither document mentions the inter-island exchange of glass beads to Taiwan. It is only in *Dao Yi Zhi Lue* where "soil beads [possibly glass or clay beads], agate, gold beads, coarse [ceramic] bowls and Chuzhou wares" are noted as trade items.

An expansion of maritime trade with the participation of Chinese merchants in the broader South China Sea region is supported by the archaeological finds of new Chinese-type glass beads in Taiwan and the historical literature documenting glass bead exchange in Southeast Asia during the 2nd millennium. The presence of Chinese-type beads at Luliao during the early 2nd millennium may represent the early reach of Chinese mercantile activities. The beads found at other sites later than Luliao suggest Taiwan's continuous acquisition of these items with the supply changing to Chinese-related sources in the broader South China Sea exchange network during the Late Iron Age.

The Early Modern Period: Complex Exchange Activities Between Peoples

The early modern period in Taiwan was initiated by the arrival of Europeans in the 1620s. The Dutch settled in southwestern Taiwan in 1624 and the Spanish occupied northern Taiwan in 1626. During this period, Taiwan was a hub of the Dutch East India Company (VOC) and the Spanish Empire for the trade between Southeast Asia, China, and Japan. A discussion of glass bead exchange during this period is rather difficult and challenging. This is partly due to the lack of research and partly because of the complex economic interaction between the Europeans, their exchange partners in Southeast Asia, and the local people of Taiwan. Within Taiwan, the Europeans might have brought "new" glass beads to establish relationships with local communities, but currently there is no strong evidence to support a European origin of raw glass. Wang and Liu (2007) tried to explore potential European sources based on the stylistic similarities and relevant artifactual evidence of a blue glass bead found at Fort Zeelandia (a fortress built by the Dutch at Tainan between 1624 and 1634) and the gold-foil beads recovered from Kiwulan, but were unable to reach solid conclusions due to the lack of compositional data and other comparative information.

Some glass beads which are still used by current indigenous groups in Taiwan may also have been acquired during this period. This may be inferred from archaeological excavations and the ethnographic and anthropological studies conducted during the second half of the 20th century, during which similar glass beads were recovered and recorded. Current debates regarding indigenous glass beads have focused on their origin. Both European and Southeast Asian origins have been considered, as well as the Chinese contribution of glass beadmaking around the South China Sea (de Beauclair 1970; Chen 1966; Chen et al. 1994:79; Chiu 2001:96; Miyoshi 1932). The regional variation in glass bead styles used by the indigenous groups suggests that bead exchange during the early modern period cannot be attributed to a single model of exchange activity but should take into consideration the multi-scalar interaction between peoples. Several examples are provided below.

Glass Bead Exchange in Northern and Northeastern Taiwan

During the Spanish stay in Taiwan (1626-1642), a few written records were left in the Spanish archives concerning the local bead trade. In northern and northeastern Taiwan, the acquisition of beads from *sangleys* (traveling Chinese merchants or middlemen) is noted in the archives on Isla Hermosa (the Spanish name for Formosa Taiwan). In reports written in 1632, Jacinto Esquivel, a Spanish missionary (Borao Mateo 2001:162-189), recorded the villages in northeastern Taiwan, including:

> Turoban: one village. It has many rich gold mines. The taparris [local population from northern coastal Taiwan] collect gold in huge quantities and sell them to the sangleys [Chinese traveling merchants] who pay in stone money and *cuentas* [small colored stones] (Borao Mateo 2001:163).

The *cuentas* may be "small colored stones strung together in the manner of a necklace or a rosary" (Borao Mateo 2001:163) and it is likely that the term refers to glass beads. Based on his observations, Esquivel suggested that the Spanish could also purchase *cuentas*, brass bracelets, and small stones (likely carnelian beads), possibly from the *sangleys*, to exchange for sulphur with the local population. The (re-)exchange of *cuentas* by local people in northern coastal Taiwan was also noted by Esquivel who mentioned that the Qimaurri people traveled among villages in the northern and northeastern regions, exchanging their physical labors, as well as *cuentas* and stones.

It therefore seems that Chinese merchants were the dominant suppliers of glass beads to the local people in the northern and northeastern regions during the early modern period. The inhabitants, such as the Qimaurri, may have acted as middlemen to trade beads to other communities. The Spanish may also have used glass beads, purchased from the Chinese merchants, to exchange for local resources.

The possibility of a non-European origin for the beads, in terms of raw materials, should be considered, and can probably be deduced from the chemical analysis of a few samples. For example, the polychrome and gold-foil beads from the Upper Cultural Layer at Kiwulan are potash-lead-silicate glass (Cheng 2007; Cheng, Iizuka, and Chen 2008). This composition differs from that of European glass beads which are mostly soda-lime-silica or potash-lime-silica glass (Burgess and Dussubieux 2007; Dussubieux and Karklins 2016; Walder 2013), suggesting a Chinese origin for the Kiwulan specimens (Brill, Tong, and Dohrenwend 1991; Gan 2007). Where the workshop(s) were located remains undetermined.

Gold-Foil Beads in Northeastern Taiwan

Gold-foil beads have been excavated from the Upper Cultural Layer (15th-19th centuries) at Kiwulan in northeastern Taiwan. Wang and Liu (2007) suggest that, based on the stylistic forms of other overseas goods in the same burials, the import of gold-foil beads may have begun during the late 16th or early 17th century. The archaeological evidence suggests that this site may be an old settlement of the indigenous Kavalan people during the early modern period (Chen 2006). Tadao Kano's (1955:79) ethnographic research in the 1920s and 1930s noted that gold-foil beads (*pagao*) were still common in Kavalan societies then. Hu (2012:112) adds that, according to a Kavalan female shaman, this bead type was used to practice shamanic divination, although other interviews suggest that agate beads were also used. Thus the evidence suggests that gold-foil beads were present in northeastern Taiwan as early as the 17th century and remained in continuous use among the indigenous Kavalan group.

Based on the archaeological finds at Kiwulan and the exchange activities noted in Esquivel's report, the Kavalan people may have participated in the exchange network operated by the Taparris, the Qimaurris, the *sangleys*, and the Spanish during the 17th century. It has been suggested that the Kavalan people, who practiced rice cultivation, may have bartered rice and other resources to obtain craft items from the Basay people (i.e., the Taparris and the Qimaurris), the *sangleys*, or the Europeans (Chen 2012). On the other hand, the recovered artifacts suggest direct or indirect exchange with the Chinese (based on the ceramic wares) and Europeans (based on the tobacco pipes) (Chen, Chiu, and Li 2008a:64-125, 2008b:92-109, 2008c:108-109; Wang and Liu 2007). Thus the acquisition of gold-foil beads may be associated with this exchange network, although it is not clear whether the Kavalan people obtained their beads from the Basay people, the Chinese *sangleys*, or the Spanish.

Gold-foil beads have not only been found in northeastern Taiwan, but also in Southeast Asia. It is noteworthy that ethnographic research by Tadao Kano (1955:79) in the Philippines noted gold-foil beads at Ifugao. Based on the presence of similar styles of Chinese and Southeast Asian ceramic wares at Kiwulan and on a Spanish shipwreck off the Philippines, a possible exchange route for gold-foil beads via the Philippines during the 17th century has been hypothesized (Wang and Liu 2007). The presence of gold-foil beads therefore may not only reflect the interaction between peoples in northeastern Taiwan, but may also be associated with the economic activities of the Spanish in the South China Sea region.

Polychrome Glass Beads in Southeastern Taiwan

The Paiwan people of southeastern Taiwan are another example. They are famous for using heirloom polychrome glass beads as ornaments, although monochrome glass beads are also used for decoration (Figure 4). The heirloom beads are linked to the social status and kinship of Paiwan societies (Hsu 2005) and are called *ata* or *qkata* (Lin 2018; Umass 2005). The excavation of Iron-Age sites of the 1st millennium AD in southeastern and southern Taiwan (e.g., Jiuxianglan, Xiaduoliang, and Guishan) has unearthed Indo-Pacific beads and pottery with anthropomorphic and hundred-pace snake designs (Lee 2005b, 2007, 2009; Li 1993, 1995). The designs are similar to the decorative elements used by current Paiwan groups, although the physical appearance and chemical composition of Iron-Age beads differs from that of the heirloom glass beads. Excavations at Jiuxianglan (3rd century BC - 8th century AD) in southeastern Taiwan have led to the supposition among Taiwan archaeologists that there may have been local glass beadmaking in Paiwan since the prehistoric period (Lee 2005b, 2007), although recent research does not fully support this assumption. Wang et al. (2018) suggest that the beads recovered from Jiuxianglan may be imports rather than local products. While wound beadmaking technology was used at the site, the recovered beads are drawn. Furthermore, the chemical compositions of the glass debris and the beads do not match. The beadmaking waste also does not indicate the production of polychrome beads, only monochrome specimens. Questions still remain regarding the origin of the Paiwan polychrome heirloom beads and the possible connection of this bead culture to beads dating to the Iron Age. At present, in terms of style and chemical composition, there is little evidence that suggests a direct relationship of the heirloom beads to prehistoric Indo-Pacific beads. The acquisition of polychrome beads may, however, be linked to bead exchange during the early modern period, while their use during this period is obscure.

Previous research has proposed that the Paiwan polychrome beads originated in Southeast Asia (Borneo in particular) or Europe. Regarding a Southeast Asian origin, Tomokazu Miyoshi (1932) noted similar polychrome bead styles among the Kayan and Kelabit tribes in Borneo and suggested that this might be the homeland of the Paiwan. Chen (1966) and Chen et al. (1994:79) have made a similar argument for a Southeast Asian origin, but with a different chronology. Chen (1966) suggests an "upper time limit" of the early 1st millennium (Iron Age) in terms of the import of Paiwan polychrome beads and the migration of the Paiwan from Southeast Asia to Taiwan. Considering that few polychrome glass beads have been excavated at Iron-Age sites, the "upper time limit" proposed by Chen (1966) requires reconsideration. Chen et al. (1994) associate the polychrome beads with Borneo but with a later date, around the 17th century. It is further indicated by Chen et al. (1994) that a Chinese workshop in Java may be the place where the polychrome beads were made, and they were probably exchanged and circulated in island Southeast Asia and Taiwan.

Despite the hypothesis of a Southeast Asia origin, previous chemical analyses of polychrome glass beads among the indigenous Paiwan groups suggest a Chinese source. This was first reported by Sato (1988[1942]:190) and later by Chen (1988:364). These analyses revealed a high-lead content in the glass and the beads were initially misinterpreted as a Southeast Asian import based on the absence of barium oxide which is indicative of local Chinese glass of the pre-Han and Han periods (Chen 1966, 1988:361-365). This chemical composition was regarded as evidence by Chen (1988:366) that the polychrome beads were precious items brought into Taiwan from Southeast Asia during the early 1st millennium AD (Iron Age) by the ancestors of the Paiwan group. This argument was, however, based on an insufficient understanding of glass bead exchange in Taiwan and beyond during the mid-20th century. Subsequent archaeometric analysis of Chinese and Southeast Asian glass has revealed that the high-lead glass beads used by the Paiwan group may be associated with a Chinese origin during a period later than the early 1st millennium AD (Wang and Jackson 2014). The results of the analysis of Chinese glass have therefore cast doubt on a Southeast Asian "origin" – in terms of glass production – of the polychrome beads. In fact, there is no solid evidence for local production of this type of polychrome bead in China. Similar styles of beads were reported principally in Southeast Asia (e.g., Borneo), but with unknown chemical compositions. This raises questions regarding the circulation of Chinese glass materials, production knowledge, or glassworkers around the South China Sea, questions which unfortunately cannot be fully answered based on current research. It is therefore important that future research consider the possibility of knowledge transmission regarding Chinese glass production or the migration of Chinese craftspeople, as well as the likely reworking of Chinese glass into beads, in the South China Sea region.

Figure 4. Paiwan heirloom glass beads (photo: courtesy of Department of Anthropology, National Taiwan University; cat. no. 1181).

As for a possible European origin, de Beauclair (1970) suggested a Dutch origin for the Paiwan heirloom beads based on archival records regarding Dutch activities in the early modern period, as well as her field observations in eastern Taiwan. Similarly, during fieldwork on a Paiwan tribe, Chiu (2001:96) noted that the glass beads were said to have been acquired from the Dutch. A few 17th-century Dutch archives also record that (glass) beads were given as gifts, rather than exchange objects, to local communities in Taiwan. Written in the 1640s, *De Dagregisters van het Kastell Zeelandia, Taiwan* ("Diary of Fort Zeelandia") mentions that the gold expeditions of the Dutch VOC gave *corales* (beads which could be made of glass or other materials) to villages in eastern Taiwan, including the southeastern region, to establish friendly relations, and these *corales* were regarded as luxury goods by the local societies (Kang 1999:116-127). The Dutch may therefore be one of the sources from whom the indigenous people of southeastern Taiwan acquired glass beads as symbols of social status. It is unclear whether the beads the Dutch brought were produced in Southeast Asia or Europe.

The hypothesis of a Southeast Asian origin concentrates on the overseas exchange and circulation of glass beads, and the inter-island re-exchange or redistribution of glass beads by middlemen or Europeans has not been investigated. This reveals the complexity of glass bead exchange on Taiwan. A comprehensive understanding should take into consideration the long-distance exchange and movement of objects, ideas, and peoples in the broader South China Sea region during the early modern period. Unfortunately certain research is limited in terms of glass beadmaking during this period and bead exchange between the Europeans, the beadmaking workshops, and the bead traders in Southeast Asia. Similar to the case in northeastern Taiwan, it is apparent that the acquisition of glass beads in southeastern Taiwan comprises different scales and contexts of people interaction and the movement of materials within Taiwan and between it and Southeast Asia. Therefore, future research should not simply focus on the origin of glass beads in indigenous societies but explore multi-scalar interaction during the early modern period.

CONCLUDING REMARKS: CHANGES AND CONTINUITIES

Clearly, there is a long tradition of glass bead exchange and use in Taiwan since the 1st millennium AD. These small glass objects reflect the changing interaction between peoples during different periods. The Early Iron Age witnesses the presence of Indo-Pacific glass beads during the 1st millennium AD, demonstrating the continuous participation of Taiwan in the South China Sea network since the Neolithic period. During the Late Iron Age, the dominance of Chinese-type glass beads suggests the growing involvement of Chinese merchants. The transition from the Early to Late Iron Age is revealed in the various styles and chemical compositions of the beads. For the early modern period, an integration of archaeological finds and historical literature reveals complex economic interaction between Europeans, Chinese merchants, and local communities. Indigenous glass beads connect the bead culture of the indigenous peoples to the early modern period, although less is known about the consumption of glass beads in local societies during this period.

While research in recent decades has increased our knowledge of glass bead exchange and consumption on Taiwan from the prehistoric to the historic era, it is hoped that future research will uncover more information about bead exchange on Taiwan and beyond from multi-scalar perspectives.

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BEYOND THE NUBIAN GOLD: MEROITIC BEADS BETWEEN THE FIFTH AND SIXTH NILE CATARACTS

Joanna Then-Obłuska

More than 2,300 beads and pendants were excavated from 16 graves at the Berber Meroitic cemetery (BMC) during the 2009-2013 seasons. The site lies between the Fifth and Sixth Cataracts, some 150 km north of the kingdom's capital, Meroe. The cemetery has been dated to between the 2nd century BC and the 3rd century AD. Next to some ostrich-eggshell, stone, and silver beads and pendants, the bead assemblage is dominated by faience, glass, and metal-in-glass, with the latter type (gold-in-glass and silver-in-glass beads) constituting a quarter of the finds. Some of the metal-in-glass specimens belong to one of the most sophisticated bead types, being decorated with an impressed lozenge motif on one side and the figurative motif of Harpocrates on the other. In general, the diversity of the bead types makes the Berber assemblage comparable to other Meroitic collections from Lower Nubia to the north and from the Meroe royal cemetery to the south. It also contributes new bead types to Meroitic beadwork.

INTRODUCTION

Nubia had the ancient world's richest supply of gold and the ancient Egyptian word for gold, *nub*, might be the origin for the name (Fisher 2012). Nubia encompasses the southern end of Egypt and northern Sudan where it is divided into Lower Nubia and Upper Nubia. Different regions within Nubia are separated by a series of cataracts with the First Cataract being south of Aswan and the Sixth Cataract north of modern Khartoum. From the 3d century BC until the 3rd century AD, the Meroe Kingdom probably extended as far south as the confluence of the Blue and White Nile and beyond, while in the north Lower Nubia became the intermediary with Egypt. Meroe was the center of a kingdom whose elites participated in the religious, political, and economic life of Egypt and the greater Mediterranean world (Yellin 2012:258).

Berber lies between the Fifth and Sixth Cataracts, some 150 km north of Meroe (Figure 1). The Meroitic cemetery at Berber (BMC) has been the object of systematic rescue operations since 2009 by the National Corporation for Antiquities and Museums (NCAM), with logistic support from the Section Française de la Direction des Antiquités du Soudan (SFDAS) (Bashir 2010, 2014, 2015; Bashir and David 2011, 2015). ^{14}C dates and an important review of the ceramic material have revealed a development of the necropolis from around the 2nd century BC to the 3rd century AD (Bashir 2015; Bashir and David 2011, 2014, 2015) (Table 1). The cemetery thus dates to about 2,000 years ago, a period when the Meroitic (Kushite) Kingdom controlled a large territory and exerted a great deal of power there. Although the Kushites often built pyramids to bury their dead (Dunham 1957, 1963), the Berber graves are mostly underground. It is, however, likely that some tombs were covered by a low mound of gravel, a common feature in some Meroitic cemeteries (Bashir and David 2015). The Berber graves contain impressive artifacts, comparable with finds in Meroe cemeteries (Bashir 2015). The presence of such items stems from the important geographical location of the Berber region which served as a corridor linking the Nile and the Red Sea and the southern part of the kingdom of Kush with its northern part, making it a crossroad for trade caravans. This is supported by archaeological evidence which includes ancient routes passing by Berber and some way stations located along the desert route to Berber (Bashir 2015).

About 2,320 beads and pendants, including some fragments, were collected from 15 of the tombs excavated between 2009 and 2013. The beads were mostly found dispersed in the graves. Some were found around the necks (BMC 16-267) or forearms (BMC 31-260) of the deceased. In a few cases, beads and pendants were found threaded on string fragments (BMC 02-20, BMC 12-96, BMC 31-258, BMC 32-254) or attached to each other (BMC 01-12). An overview of the bead materials and types is provided below, as well as the arrangement of beads on preserved strands.

BEADS: Journal of the Society of Bead Researchers 30:31-43 (2018)

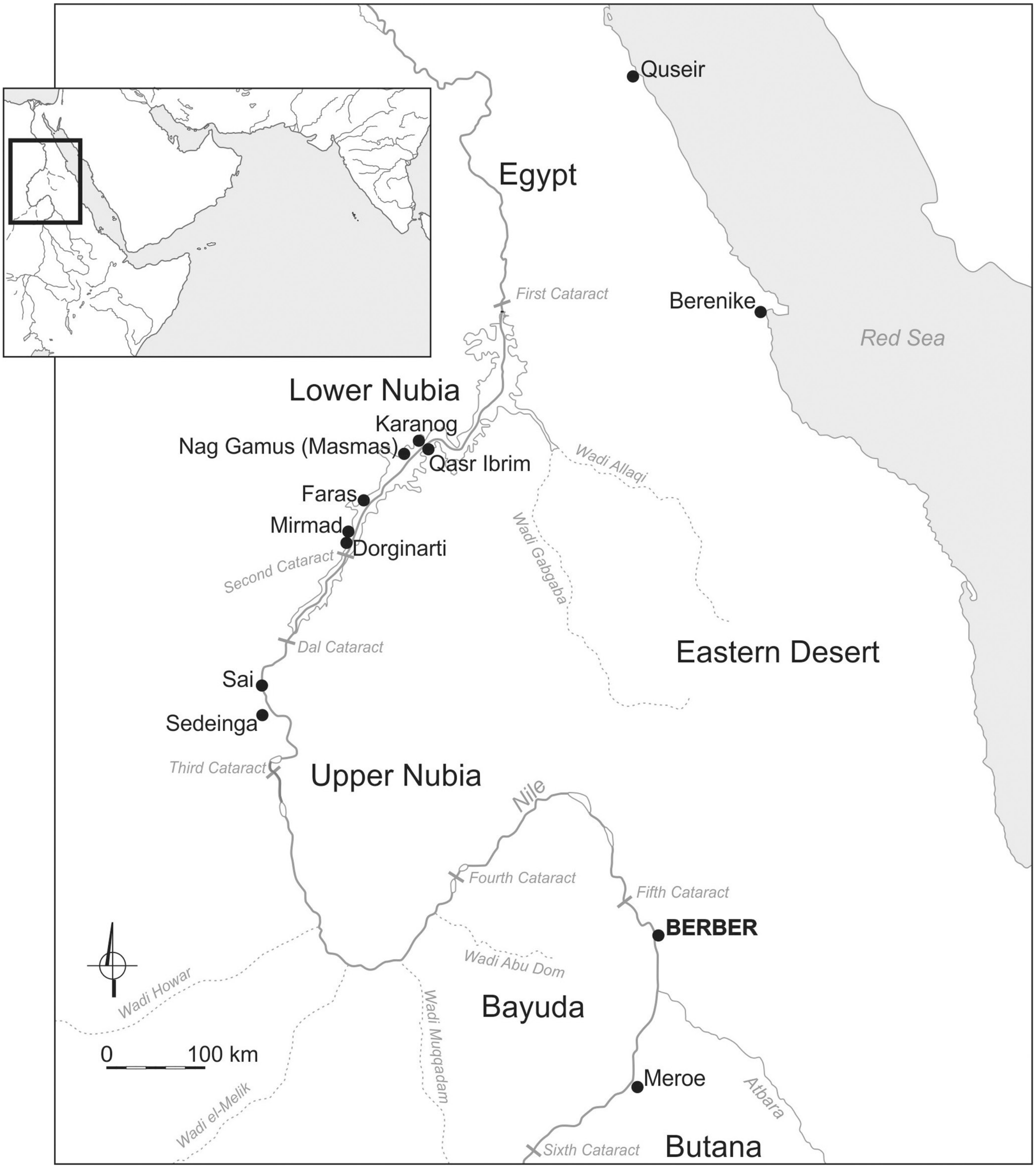

Figure 1. Nubia showing the locations of the sites mentioned in the text (drawing: Szymon Maślak).

THE BERBER BEADS AND PENDANTS

The recovered beads (central perforation) and pendants (off-center perforation) are made of organics (ostrich eggshell, bone), stone (carnelian, quartz), metal (silver), and man-made materials (glazed composition/faience, glass, and metal-in-glass).

Table 1. Berber Tomb Chronology.

Chronological Sequence	Tombs with Beads	BMC Bead Numbers
Second half of 1st c. - beginning of 2nd c. AD / 2nd c. - beginning of 3rd c. AD	BMC23	BMC23-268
Second half of 1st c. - beginning of 2nd c. AD	BMC01, BMC10, BMC31	BMC01-12, BMC10-97, BMC31-258, BMC31-259, BMC31-260
2nd c. - beginning of 3rd c. AD	BMC04, BMC16, BMC27, BMC32, BMC33	BMC4-35, BMC16-267, BMC27-266, BMC32-254, BMC32-255, BMC33-256
3rd c. AD	BMC12	BMC12-20p, BMC12-22, BMC12-23p, BMC12-96, BMC12-144p
Undated	BMC02, BMC05, BMC09, BMC17, BMC30	BMC02-20, BMC02', BMC05-39, BMC9-87, BMC17-253, BMC30-263
Based on Bashir and David (2011: Figure 6, 2015:99).		

Organic Materials

The Berber collection contains four ostrich-eggshell beads found in Tomb T05 (Figure 2: BMC 05-39 b) and six tiny wedge-shaped pendants made of the same material (Figure 3: BMC 33-256f; Figure 4: BMC 33-256 a; Figure 5: BMC 33-256 l). This shape was usually reserved for glass or stone materials. The use of ostrich eggshell in the manufacture of these tiny pendants is rather surprising and there are no parallels as yet.

In contrast to the Napatan period, ostrich-eggshell beads are rare finds in Meroitic bead assemblages. Still, they were recorded at some Meroitic sites in Lower Nubia (Griffith 1924: Plate LXIII:19; Then-Obłuska 2016), in the region between the Second and Third Cataracts (Then-Obłuska 2015a, 2016), and in the Fourth Cataract region (Then-Obłuska 2014: Plate 2.138, cat. 144).

One long tubular bead is made of bone (Figure 2: BMC 05-39 a), possibly the phalanx of an animal.

BMC 04-35 ***BMC 05-39***

Figure 2. Beads from graves T04 (BMC 04-35) and T05 (BMC 05-39) (modern stringing) (all photos by author).

Figure 3. Beads from grave T33 (BMC 33-256) (modern stringing).

Stone

The 63 stone beads and pendants are made mainly of carnelian. There are tiny, highly polished carnelian beads drilled from one end (Figure 5: BMC 33-256 d; Figure 6: BMC 02-20 a; Figure 7: BMC 17-253 e; Figure 8: BMC 27-266 c; Figure 9: BMC 32-255 e), as well as wedge-shaped pendants made of carnelian and steatite (Figure 4: BMC 33-256 e, f). While stone beads are present at many Meroitic sites, pendants of this material were found at Faras in Lower Nubia (Griffith 1924: Plate LXX:7). Another stone pendant, of a shape usually described as "poppy" (Reisner 1910, I: Plate 70) or "lotus seed-vessel" (Beck 1928), is smaller than its slender New Kingdom forerunners (Figure 4: BMC 33-256 g).

The ends of a long cylinder fashioned from carnelian were simply cut off and left unpolished (Figure 3: BMC 33-256 a). Drilled from one end, the perforation has a truncated-cone shape. Carnelian cylinders are a well-recognized type during the Meroitic period (Then-Obłuska 2015a: Figure 4: T293 c1 – Sedeinga; OIM E24324 – Dorginarti; Museo Arqueológico Nacional, Madrid 1980.98.59 – Nag Gamus). The Berenike port site on the Red Sea is another find site (BE00/33/019#21).

Teardrop pendants with globular bases are made of carnelian, white quartz, and black stone (Figure 9: BMC 32-255 k-m). They are among the most characteristic features of the Meroitic assemblages. When found strung, they alternate with a few tiny beads of glass, metal-in-glass, faience, or carnelian (Then-Obłuska 2015a: Figure 10 T196 d1 – Sedeinga; Then-Obłuska 2016: Figure 9.1, 10.1 – Saï).

Metal

Almost 60 beads and pendants are made of sheet silver. Tiny pendants are made of two soldered metal sheets (Figure 4: BMC 33-256 h; Figure 5: BMC 33-256 j), each of which was shaped on a form to produce a convex surface, leaving the interior hollow. The threading holes run horizontally through the non-soldered upper part. Objects of a similar shape from the Meroitic site at Faras are said to be made of shell. They are described as flower beads suspended through the upper hole (Griffith 1924: Plate LXX:5, object 564).

Six long fusiform beads are made of folded sheet metal, most probably silver (Figure 6: BMC 02-20 e).

Faience

Faience beads, numbering almost 1,130, constitute half of the Berber assemblage. A few types can be distinguished. Small blue and green cylinder discs predominate (Figure 3: BMC 33-256 e; Figure 5: BMC 33-256 f; Figure 7: BMC 17-253 a; Figure 9: BMC 32-255 g; Figure 10: BMC 09-87 a; Figure 11: BMC10-97; Figure 12: BMC 12-20 d, BMC 12-96 a; Figure 13: BMC 16-267 f; Figure 14: BMC 31-258 b). Some faience beads are similar in size, although they are more oblate in shape. These are green (Figure 5: BMC 33-256 g) or blue in color (Figure 8: BMC 27: 266 b; Figure 14: BMC 31-258 h).

Blue short cylinders appear to have been glazed resting on one end (Figure 6: BMC 02-20 b); while one end is flat and lacks glaze, the other is rounded. The round end and the sides are covered with a thick layer of blue glaze. Large, long, blue cylinders were found in Tombs T05, 30, and 27 (Figure 2: BMC 05-39 c; Figure 8: BMC 27-266 a, BMC 30-263).

In general, all the faience bead types are well known in Nubian Meroitic assemblages (Then-Obłuska 2015a, 2016). Still, large long cylinders are almost absent at Meroitic sites in the region between the First and Third Cataracts. A few long faience beads are, however, illustrated from graves at Sedeinga (Then-Obłuska 2015a: Figure 6:T255 d1, T238 c17) and some were observed in Faras (Griffith 1924: Plate

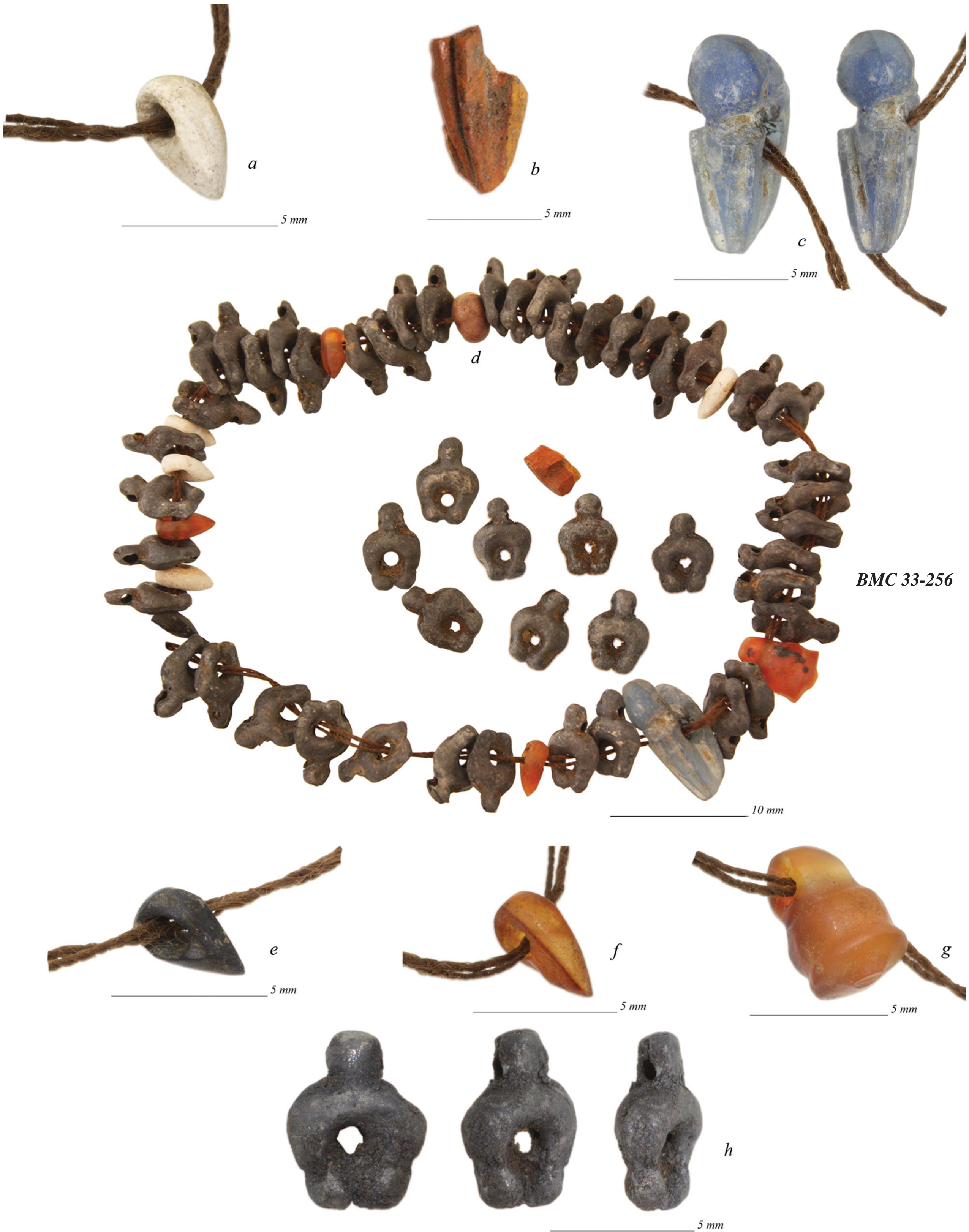

Figure 4. Beads from grave T33 (BMC 33-256) (modern stringing).

Figure 5. Beads from grave T33 (BMC 33-256) (modern stringing).

LXIII:21). There, several such beads were found strung together on the left arm of a burial (Griffith 1924:174). Long blue cylinders were recovered from the Meroe Cemetery W at Begrawiyya; e.g., they were found in Tomb 179, but associated with a subsidiary burial (Dunham 1963:178, Beg. W 179, object 22-2-564c, d, MFA 22-2-564). Others were

Figure 6. Beads from grave T02 (BMC 02-20) (original and modern stringing).

Figure 7. Beads from grave T17 (BMC 17-253).

found in thieves' debris (Dunham 1963:155, Beg. W 453, MFA 23-2-303f) and in the completely plundered Grave Beg. W 464 (Dunham 1963:280, MFA 23-2-329a).

Drawn Glass

Almost 450 beads are made of glass. The majority of the drawn specimens consist of single- and multiple-segment beads which are usually small and oblate. They are monochrome, mostly translucent dark blue (Figure 5: BMC 33-256 h; Figure 8: BMC 27-266 d; Figure 9: BMC-255 j; Figure 14: BMC 31-258 d; Figure 15: BMC 01-12 e, BMC 12-20 b, BMC 12-23 a, BMC 12-96 c, BMC 12-144p c, BMC 16-267 c), opaque red (Figure 4: BMC 33-256 d; Figure 5: BMC 33-256 a; Figure 9: BMC-255 f; Figure 12: BMC 12-20 c, BMC 12-23 c, BMC 12-96 b, BMC 12-144p a; Figure 14: BMC 31-258 b) and translucent green (Figure 5: BMC 33-256 m; Figure 9: BMC-255 h; Figure 12: BMC 12-20 a; Figure 14: BMC 31-258 e; Figure 16: BMC 23-268 b). Others are yellow (Figure 8: BMC 27-266 h) and translucent red and amber (Figure 13, BMC 16-267 a). A few are slightly larger and opaque orange (Figure 5: BMC 33-256 b; Figure 14: BMC 31-258 a). Monochrome segmented beads are well known at other Meroitic sites in Nubia and

Figure 8. Beads from grave T27 (BMC 27-266) and T30 (BMC 30-263).

Early Roman sites in Egypt (Then-Obłuska 2015a, 2015b, 2016). Some yellow beads are cone shaped (Figure 14 BMC 31-258 f) with parallels in Nubia (Silverman 1997:302-303; Penn Museum, Inv. E7925).

Other beads are compound, made of two layers, usually red over colorless glass (Figure 5: BMC 33-256 k; Figure 8: BMC 27-266 e; Figure 9: BMC-255 d). Such beads have been found at the Early Roman Red Sea port site in Berenike (Then-Obłuska 2015b: Figure 4.18; Zych 2011, cat. no. 72, figures 12-69) and at Meroitic burial sites of the 1st-3rd centuries in Nubia (Then-Obłuska 2015a: Figure 13: S041/l – Sedeinga; Then-Obłuska 2016 – Saï). Some larger drawn beads have applied decoration in the form of "eyes" (Figure 10: BMC 09-87 b, d). The eyes are made of mosaic glass cane sections. One bead is made of striped glass (Figure 5: BMC 33-256 e). A few beads were made by cutting a drawn glass tube. The ends of some blue beads appear to have been fire polished (Figure 13: BMC 17-253 b).

Drawn Metal-in-Glass

About 600 drawn metal-in-glass beads were found at Berber. Also called sandwich beads, they are made of two layers of glass with gold or silver foil in between. While some production tubes were straight, others were segmented on grooved open-face molds after being heated to facilitate their being snapped into single or multi-segment beads.

Some large globular (Figure 10: BMC 09-87 e) and barrel-shaped (Figure 7: BMC 17-253 d) gold-in-glass beads have fire-polished ends, as do small, globular silver-in-glass beads (Figure 7: BMC 17-253 c). Silver-in-glass tubes were simply cut into long cylinders (Figure 15: BMC 01-12 b). Gold-in-glass beads consisting of single and multiple globular segments are small (Figure 5: BMC 33-256 c; Figure 8: BMC 27-266 g; Figure 9: BMC 32-255 c; Figure 13: BMC 16-267 d, e; Figure 14: BMC 31-258 g; Figure 15: BMC 01-12 c, BMC 02-20 d, e; Figure 16: BMC 23-268 c;) and large (Figure 3: BMC 33-256 b; Figure 8: BMC 27-266 j; Figure 12: BMC 12-23 b; Figure 14: BMC 31-259; Figure 15: BMC 01-12 a). Some segmented gold-in-glass beads are long tubes (Figure 12: BMC 12-22 a, BMC 12-23 e) or spindle-shaped with collars at both ends. The latter beads come in both long (ca. 20 mm) (Figure 3: BMC 33-256 c; Figure 14: BMC 31-260) and short (ca. 10 mm) forms (Figure 12: BMC 12-23 d). Tabular beads were made of gold- and silver-in-glass (Figure 8: BMC 27-266 f; Figure 9: BMC 32-255 a; Figure 12: BMC 12-23 b, BMC 12-96 d).

Whereas the metal-in-glass beads described above are common finds at other Meroitic sites, Tomb 32 yielded several that are exceptionally rare. These include tabular gold-in-glass beads that exhibit a pressed decoration in the form of a lozenge pattern on both sides (Figure 9: BMC 32-255 b). A similar bead with a lozenge pattern on one side and protruding dots on the other was found in Tomb 75 at the Lower Nubian site of Mirmad (Presedo Velo et al. 1970: Type 169; MAN T75.1980.96.431.169).

Larger, long, tabular gold-in-glass beads found in the same tomb have a lozenge net pattern on one side and a figurative motif on the other (Figure 9: BMC 32-254). The figure that appears on at least 12 specimens and their fragments represents the deity Harpocrates, a boy with a finger to his mouth and a horn of plenty at his side, wearing a crown over the lunar disk. Luxurious gold-in-glass beads with diverse figurative motifs and dotted or lozenge patterns are rare on the whole. They have been found primarily in Nubia (Dunham 1957:108, Figure 73, Plate 66F – Meroe; Shinnie and Bradley 1980: Item 2515, Figure 68 – Meroe; Woolley and Randall-McIver 1910:75 – Karanog; Egyptian Museum in Cairo, JE 40103; Pamela Rose 2016: pers. comm.; British Museum object 86.2.5/20 – Ibrim), but also in Egypt, southern Russia, and Iran (Spaer 1993:16, 2001: cat. no. 234-5; Whitehouse 2005: cat. 72; Metropolitan Museum, NY, MET 10.130.2479_EGDP017279, MET 10.130.2476, 10.130.2477). Beads decorated with figurative

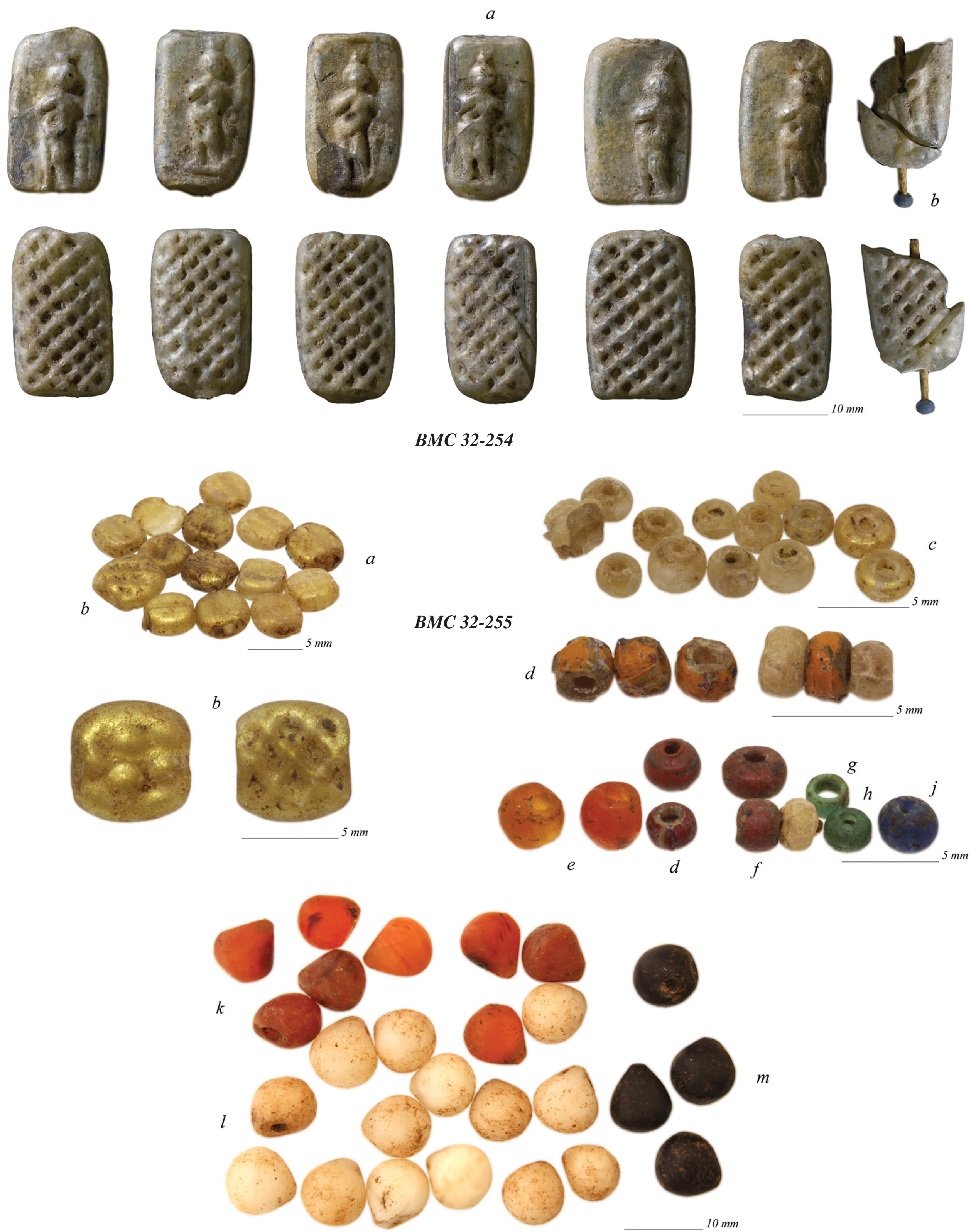

Figure 9. Beads from grave T32 (BMC 32-254, -255) (original stringing).

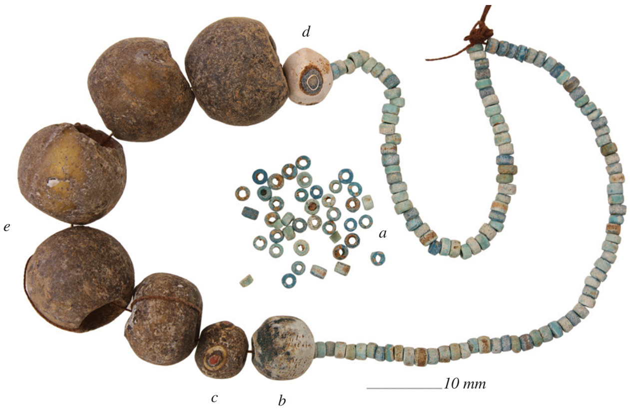

Figure 10. Beads from grave T09 (BMC 09-87) (modern stringing).

motifs are found in contexts dated between the second half of the 1st century BC to the middle of the 1st century AD (Lankton 2003:55, Figure 6.2; Spaer 1993:20).

Wound Glass

Several white globular beads appear to be of wound construction (Figure 16: BMC 23-268 a). Discernible seams next to some perforations may represent traces of a tool that facilitated removing the bead from the mandrel.

Other Glass Bead Manufacturing Types

In one case lapidary technology was used to manufacture beads in the shape of self-shank buttons. They are perforated through a narrow longitudinal projection on the back. Contrary to their modern function of fastening textiles, in Meroitic Nubia shank buttons were threaded on strings together with beads and pendants. The Berber finds are made of blue and orange glass. The single blue specimen represents an *Uraeus* amulet with sun disk (Figure 4: BMC 33-256 c). A decorated piece made of opaque orange glass is a fragment of a similar amulet (Figure 5: BMC 33-256 b). Self-shank buttons of blue glass in the shape of a ram's head with sun disk have recently been recorded in the treasure at Qasr Ibrim (Rose, Then-Obłuska, and Pyke 2019). At Qasr Ibrim, a scorpion bead made of nacre features a similar projection on its undecorated side (Rose, Then-Obłuska, and Pyke 2019). Nevertheless, *Ureaus* amulets made of stone and metal and perforated in a similar way have been recorded within the Saï Meroitic assemblage (Then-Obłuska 2016: Plate 2:13), in Nag Gamus (Almagro 1965: Figure 226.2, MAN 1980.98.335), and Meroe (Dunham 1963:228-229, Figures 159:3, W 120, 163, Figure 118e, W 125).

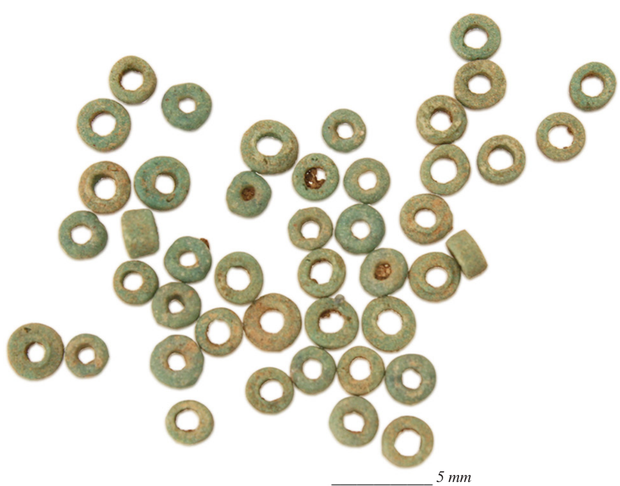

Figure 11. Beads from grave T10 (BMC 10-97).

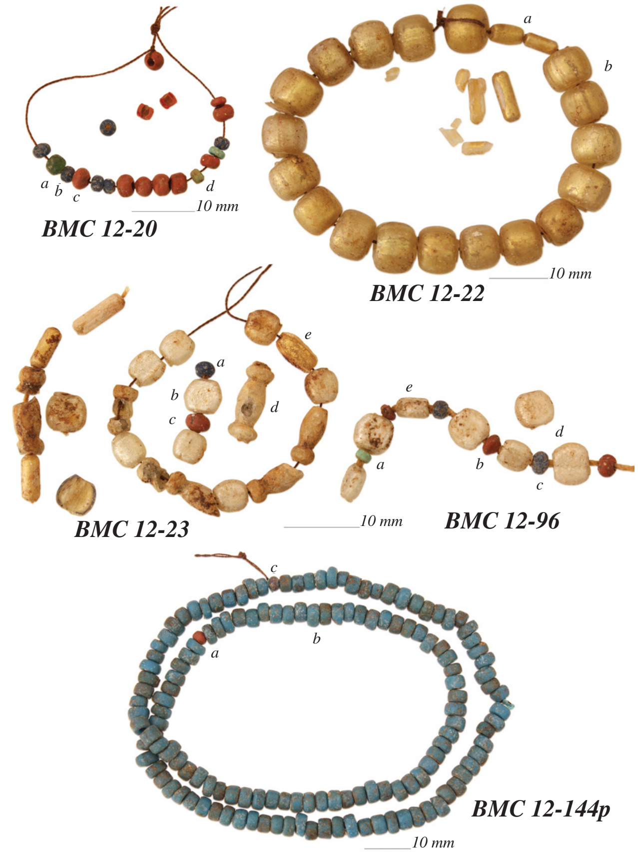

Figure 12. Beads from grave T12 (BMC 12-20, -22, -23, -96, -144p) (modern and original stringing).

Recovered from BMC 04, 97 beads lack a whitish core which is usually discernible in faience beads (Figure 2: BMC 04-35). Therefore these tiny beads, ca. 2 mm in diameter, must have been be made of a vitreous material, but the technique of manufacture remains undetermined.

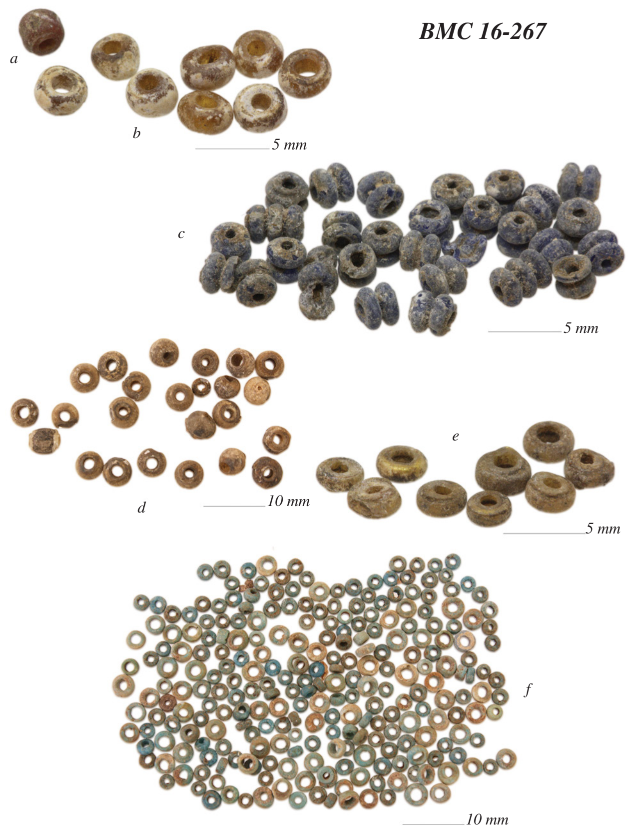

Figure 13. Beads from grave T16 (BMC 16-267).

Figure 14. Beads from grave T31 (BMC 31-258, -259, -260) (original stringing).

BEAD-STRAND PATTERNS

Many short fragments of strung beads have survived at Berber. There are two main patterns: small beads forming a uniform string and larger beads alternating with one or a few smaller ones.

The first pattern has faience beads threaded together (Figure 14: BMC 31-258h) or small tubular gold-in-glass beads alternating with collared ones (Figure 12: BMC 12-23, left).

Examples of the second pattern are diverse. On one specimen, cone-shaped glass beads alternate with smaller faience, glass, and gold-in-glass ones (Figure 14: BMC 31-258). A gold-in-glass figurative bead and a tiny blue glass bead are strung together (Figure 9: BMC 32-254, right), as are tabular silver-in-glass beads alternating with green faience and red and blue glass beads (Figure 12: BMC 12-23 a-c, BMC 12-96). Another specimen consists of three tiny beads made of gold-in-glass and red-on-colorless glass (Figure 9: BMC 32-255 c-d). The latter, however, were found together with larger tabular beads (Figure 9: BMC 32-255 a-b) and it is possible they alternated with the small ones. In yet another case, long cylindrical metal-in-glass beads are attached to tiny glass and probable metal-in-glass beads (Figure 15: BMC 01-12 b-d).

Beads made of sheet metal have also been found threaded together with tiny metal-in-glass, carnelian, and other bead types (Figure 6: BMC 02-20). It is also possible

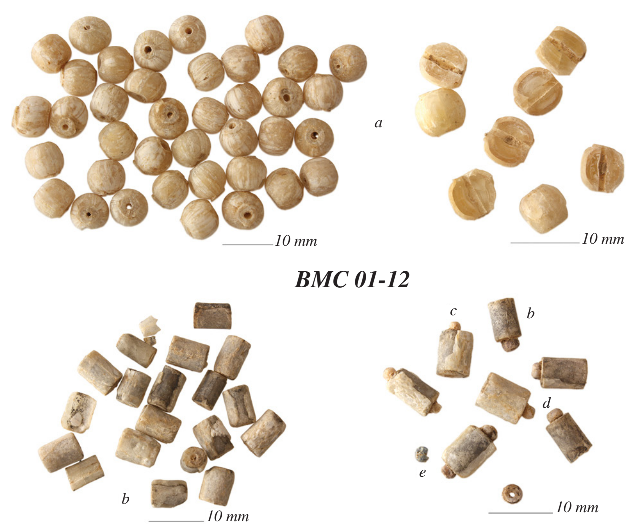

Figure 15. Beads from grave T01 (BMC 01-12).

Figure 16. Beads from grave T23 (BMC 23-268).

that stone teardrop pendants and small glass and gold-in-glass beads (Figure 9: BMC32-255) found together in grave BMC 32 originally alternated on one string.

Patterns similar to all the above-mentioned ones have been recorded at Meroitic Saï (Then-Obłuska 2016: Figures 9-10).

CONCLUSION

Lying between the Fifth and Sixth Cataracts, not far from the center of the Meroitic Kingdom at Meroe to the south and close to the Red Sea coast through the Eastern Desert wadi system, the Berber site with its cemetery is perceived as a crossroad of trade routes. Although this paper provides an overview of the beads from 15 of the graves excavated between 2009 and 2013, some comparative observations can be made. In general, manmade materials (i.e., faience, glass, metal-in-glass, and metal) dominate the Berber assemblage, with only some beads and pendants of ostrich eggshell and stone being recorded.

Many bead types found at Berber have correlatives in other regions of Meroitic Nubia. While ostrich-eggshell beads are almost absent in Meroitic graves in Lower Nubia, the region neighboring Egypt, they are present to the south, between the Second and Third Nile Cataracts, at the Meroitic cemetery of Saï. At Berber, none of the graves in which ostrich-eggshell disc beads were found could be dated. A surprising use of ostrich eggshell at Meroitic Berber was to form unusual wedge-shaped pendants. A small number of beads were made of stone, usually carnelian and red agate, and their shapes are well represented at other Meroitic sites in many parts of Nubia. These include tiny beads, long cylinders, and wedge-shaped beads, as well as teardrop and "poppy" pendants.

Interestingly, in contrast to Nubian cemeteries located below the Third Nile Cataract (Then-Obłuska 2015a; 2016) and in Meroe (Dunham 1957; 1963), no faience amulets or decorated faience beads have so far been recorded at Berber. The same holds true for mosaic glass that is practically absent in the Berber bead repertoire. The exceptions are mosaic cane sections applied as eyes on two beads from Tomb BMC 09. Still, amulets of Uraeus found at Berber are made of glass in the shape of self-shank buttons already known in Nubia.

Next to the many drawn monochrome beads, well recognized in all of Nubia, the variety and quantity of metal-in-glass beads (collared, tabular, tubular, globular, and molded) are notably high at Berber. The ones found in BMC 09 and 17 have fire-polished ends. The manufacture of gold-in-glass beads, either as short tubes or spheres, with fire-polished ends occurred at Rhodes between the 3rd and the 2nd century BC (Spaer 2001:133-134; Weinberg 1971: Plate 79d). It may be that undated graves BMC 09 and 17 belong to the earliest phase of the Berber cemetery.

A dozen or so figurative, tabular gold-in-glass beads with a Harpocrates motif on one side and lozenge-shaped decoration on the other are paralleled at Ibrim, another Meroitic site in Lower Nubia. Luxurious beads with figurative motifs and dotted or lozenge pattern are usually dated to the 1st century BC to the 1st century AD. Those from Berber, however, were found in Tomb BMC 32 which is attributed to the 2nd and beginning of the 3rd centuries AD. Thus, the Berber find appears to be one of the most numerous and latest occurrences of the figurative gold-in-glass bead type in the ancient world.

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FLORIDA CUT-CRYSTAL BEADS IN ONTARIO

Karlis Karklins, Alicia Hawkins, Heather Walder, and Scott Fairgrieve

Faceted rock-crystal beads attributed to ca. 1550-1630 have been found at a number of North American archaeological sites, principally in the southeastern United Sates where they are generally termed Florida Cut-Crystal. Finds further to the north are rare. It was, therefore, of great interest to discover three different examples in the bead collections of two 17th-century Huron-Wendat sites in southern Ontario: Le Caron (BeGx-15) and Warminster (BdGv-1). The beads are investigated using a multi-disciplinary approach in an effort to determine how and where they were produced.

INTRODUCTION

European trade beads are ubiquitous on contact-period Iroquoian archaeological sites in Ontario, with those of glass being the most common. Beads of other materials, such as lathe-turned bone, are comparatively scarce. While stone beads presumed to have been produced by Indigenous peoples exist in small numbers, those made of hard minerals such as quartz are absent in the archaeological artifact inventories. It was therefore of more than passing interest to encounter three different forms of rock-crystal beads while examining legacy collections from a number of 17th-century Huron-Wendat sites in southern Ontario; especially so since the beads clearly belong to a group of lapidary beads found principally in the southeastern United States. The three beads were recovered from two sites: Warminster (BdGv-1) and Le Caron (BeGx-15).

THE SITES

The Warminster site is a Huron-Wendat village in eastern Huronia within the territory usually attributed to the Arendaronnon or Rock Nation (Heidenriech 1971). It has been famously debated as a possible location of the village of Cahaigué visited by Samuel de Champlain in 1615 (Fitzgerald 1986; Skyes 1983). The site was excavated as part of three different campaigns from the University of Toronto starting in 1946 and terminating in 1979. The settlement consisted of two palisaded sections with an ossuary in the center. The excavations from the settlement area recovered a total of 452 glass beads, the majority of them being white or cobalt blue varieties. On this basis, the villages can be safely assigned to Glass Bead Period II (ca. 1600-1625/30) (Fitzgerald et al. 1995). The single cut-crystal bead does not appear to be discussed in Skyes' (1983) analysis or inventory of beads, and it is likely that it was one of seven beads assigned to an "indeterminate" category. While the bead has a catalog number, provenience information is not available.

Located on the Penetang peninsula further to the west, Le Caron is also a Huron-Wendat village. It is considered to have been occupied by the Attignawantan or Bear Nation. Excavations at Le Caron were carried out in the 1970s under the auspices of Trent University field schools (Johnston and Jackson 1980). The fieldwork resulted in the partial exposure of five longhouses and a palisade. There is no evidence that the site consists of more than one section, but most of the site remains unexcavated. The glass bead assemblage consists of 447 beads, of which 57% are round red beads and 3% are red tubular beads (Evans 1998). Faceted 7-layer chevrons and several varieties of Nueva Cadiz beads are also present. Le Caron would have been occupied during Glass Bead Period IIIa (ca. 1625/30-1640) (Fitzgerald et al. 1995; Kenyon and Kenyon 1983). The two cut-crystal beads originated from the northeast midden, which lies outside the palisade. Slightly more than 15% of the glass beads from Le Caron were found in this midden (Evans 1998).

THE CUT-CRYSTAL BEADS

The three cut-crystal beads are all multi-faceted though they differ in both form and the number of facets. The Warminster specimen (WAR 706) is globular and exhibits 5 rows of 10 hexagonal facets each that encircle the bead for a total of 50 facets (Figure 1, a). The ends are ground flat. The perforation has a distinct taper which is atypical of the cut-crystal group, suggesting a different drill configuration and possibly a different source than the others. There are a couple of tiny chips out at the narrow end where the drill broke through. This reveals that the bead was faceted before the hole was drilled. The specimen is 8.4 mm long, 9.6 mm in diameter, and the perforation measures 2.1 mm at the intact wide end.

The two Le Caron beads have parallel-sided perforations drilled from one end that are a uniform 2.0-2.1 mm in diameter. The first example (J18bl-4) is oblate with five rows of facets (Figure 1, b). There are 21 diamond-shaped facets around the middle and 6 pentagonal ones at the ends for a total of 33. The ends are severely battered, suggesting that the bead had been shaped by pecking prior to the grinding of the facets (Francis 2002:113). Apparently it was not deemed necessary to polish the ends. There is a large chip out of one end. The bead is 6.1 mm long and 8.7 mm in diameter.

The second specimen (J18hl-30) is oblong with a hexagonal cross section (Figure 1, c). The surface exhibits 12 triangular facets. The ends are flat but exhibit a pebbled surface indicating that this bead had also been shaped by pecking. The bead measures 12.0 mm in length and 7.6 mm in diameter.

LA-ICP-MS ANALYSIS

The two Le Caron beads were included in a broader study of glass trade beads from early to mid-17th-century Wendat archaeological sites in Ontario (Walder and Hawkins 2018). Their composition was analyzed using Laser Ablation – Inductively Coupled Plasma – Mass Spectrometry (LA-ICP-MS) at the Elemental Analysis Facility of the Chicago Field Museum.[1] Both Le Caron beads were found to contain >99% silicon dioxide by weight, which is consistent with the makeup of quartz. Identifying the geologic source of the quartz based on its chemical composition is challenging, since trace elements are present in very small quantities. Variations in trace elements caused by geologic source environments of mineral formation have been identified for quartz, especially for the elements titanium (Ti) and aluminum (Al) (Rusk et al. 2011; Thomas et al. 2010). There are compositional differences between the two beads, with more trace elements recorded in higher quantities in LC J18h1-30 (LC 29) than in LC J18b1-4 (LC 28), which is 99.85% silicon dioxide (Table 1). Unfortunately, without a larger overall sample size, and samples from a variety of quartz sources used to produce 17th-century beads, it is not possible to determine if these compositional differences between the two beads indicate differences in sources of raw material or merely variations within a single geologic source.

This problem of intra-source variation relates to the "provenience postulate:" if the sources of raw material are to be distinguished, the compositional differences *within* a single source must be less than differences among sources (Price and Burton 2011:214). As discussed below, at the time that the Warminster and Le Caron sites were occupied, cut-crystal bead production may have been taking place in both Europe and Asia. Geologic sources of quartz used for beadmaking in those areas in the 17th century are not well documented archaeologically or historically. A way to identify possible compositional variations within single production batches of cut-crystal beads, which presumably might be produced in a workshop using material from the same source, would be to analyze the composition of beads with a known point of origin. For example, the Tortugas shipwreck, which sank in the Florida Keys in 1622, was a Spanish vessel carrying cargo for colonial trade (Stemm et al. 2013). Along with glass beads, cut-crystal beads were recovered from archaeological investigations, and the excavators propose that these beads were produced in Spain. Compositional analysis of cut-crystal beads from that assemblage could provide information on the range of variation in trace elements present in the quartz source used to produce those beads. Other samples of undetermined place of manufacture, such as those recovered in Ontario, could then be compared to the known quartz compositions.

SEM EXAMINATION OF PERFORATION CASTS

To further examine the production technology of the Ontario cut-crystal beads, casts of the perforations of all three Ontario specimens as well as three beads from a contemporary site in central Florida (Karklins 1974) were made using Mikrosil® (Kjell Carlsson, Sweden), a casting material designed for forensic applications. Once mixed, the Mikrosil was placed in a large-gauge syringe and injected directly into the perforation of each bead. The hardened cast was extracted using forceps and the excess trimmed off. A 12-mm carbon adhesive disk on an aluminum stud was used to attach each specimen perpendicular to the long access. As the adhesive disk was not sufficient for long-term mounting, white PVA glue was used to secure the cast. Each specimen was then coated in ca. 8-10 nm of gold using a Cressington Sputter Coater (Ted Pella, Inc. Redding, CA) to produce a conductive surface. The specimens were examined using a Cambridge Stereoscan 120 scanning electron microscope (SEM). The resulting images were captured in TIFF format.

The SEM images of the tapered Warminster bead's perforation reveal that it is decidedly conical. The perforation surface exhibits a number of distinct diagonal cracks, including some in a spiral configuration (Figure 2, a). The conical configuration resembles one described by Mark Kenoyer (1992:501) as having been produced using

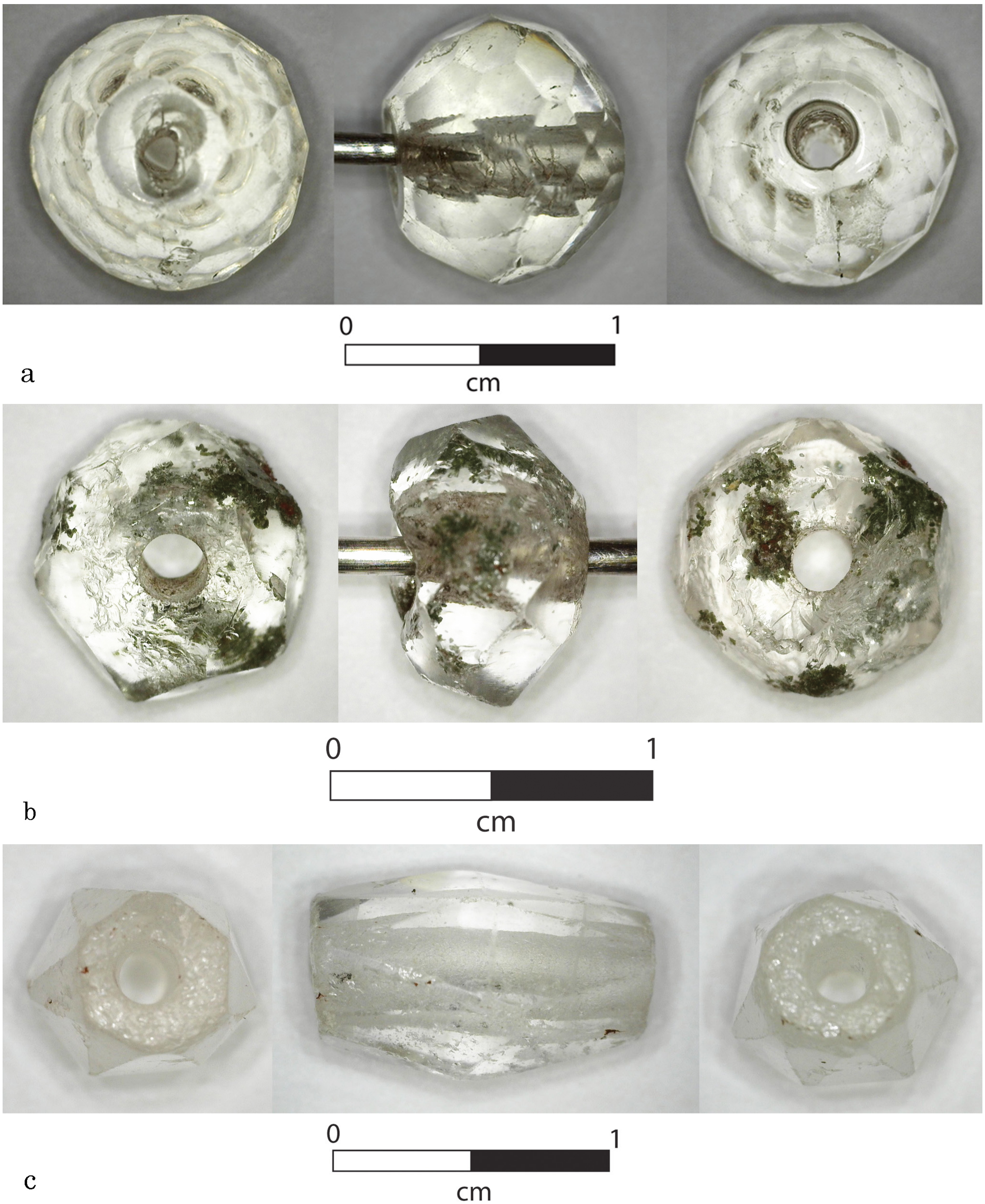

Figure 1. The Ontario Cut-Crystal beads: a) Warminster (WAR 706); b) oblate Le Caron (J18bl-4); c) oblong Le Caron (J18hl-30) (photos: Alicia Hawkins).

Table 1. Results of LA-ICP-MS Analyses of Two Ontario Cut-Crystal Beads.

ID	**SiO_2**	**Na**	**Mg**	**Al**	**P**	**K**	**Ca**	**Mn**	**Fe**	**Cu**	**Sn**	**Pb**
LC_28	99.85%	217	20	55	38	68	314	15	49	39	93	197
LC_29	99.01%	2734	586	347	174	775	1285	42	290	153	165	513
	Li	**Be**	**B**	**Sc**	**Ti**	**V**	**Cr**	**Ni**	**Co**	**Zn**	**As**	**Rb**
LC_28	3	0	0	4	16	0	3	1	1	1	8	1
LC_29	4	0	3	4	20	0	6	4	8	4	21	2
	Cs	**Ba**	**La**	**Ce**	**Pr**	**Ta**	**Au**	**Y**	**Bi**	**U**	**W**	**Mo**
LC_28	0	1	0	0	0	0	0	0	1	0	0	0
LC_29	0	3	0	0	0	0	0	0	4	0	0	0
	Sr	**Zr**	**Nb**	**Ag**	**In**	**Sb**	**Cs**	**Ba**	**La**	**Ce**	**Pr**	**Ta**
LC_28	0	0	0	0	0	0	0	1	0	0	0	0
LC_29	4	0	0	0	1	1	0	3	0	0	0	0
	Au	**Y**	**Bi**	**U**	**W**	**Mo**	**Nd**	**Sm**	**Eu**	**Gd**	**Tb**	**Dy**
LC_28	0	0	1	0	0	0	0	0	0	0	0	0
LC_29	0	0	4	0	0	0	0	0	0	0	0	0
	Ho	**Er**	**Tm**	**Yb**	**Lu**	**Hf**	**Th**	**Ho**				
LC_28	0	0	0	0	0	0	0	0				
LC_29	0	0	0	0	0	0	0	0				

Note: Silica is reported in weight percent of oxide; the other elements are reported in parts per million.

an unidentified type of drill with an abrasive, something that was not used in India or elsewhere in South Asia.

The parallel-sided perforation of the oblong Le Caron bead is covered with micro cracks and pits (Figure 2, b) which are a close match for one of the Florida Cut-Crystal beads (Figure 2, c) recovered from a burial mound in central Florida. The oblate specimen exhibits faint spiral grooves (Figure 2, d). Kenoyer (2017: pers. comm.) has opined that these perforations may have been made using double-diamond drills.

COMPARATIVE SITE DATA

The rock-crystal beads described above belong to a group of lapidary beads called Florida Cut Crystal. As the name suggests, sites yielding these beads are concentrated in Florida (Fairbanks 1968), but find sites are also located in coastal and interior Georgia (Blair et al. 2009; Worth 1988), Louisiana (Brain 1979), eastern Tennessee (Badger and Clayton 1985), coastal Virginia (Bushnell 1937; Lapham 2001), east-central New York (Rumrill 1991), and eastern Quebec (Turgeon 2001). There are few reported sites outside North America: three specimens were excavated in Paris (Turgeon 2001), several were found in a 16th-century midden at the Montmorin Castle in central France (Boudriot 1998), while the Diakhité burial site in Senegal, West Africa, yielded over a thousand examples (Opper and Opper 1989). It is not clear whether the paucity of quartz beads of the Florida Cut-Crystal group at European sites of the 16th-17th centuries reflects an actual scarcity of such beads, or just a lessened interest in sites and beads of the post-medieval period (A. Bonneau 2018: pers. comm.).

Fairbanks (1968:3) assigned the majority of the Florida specimens to the 16th and early 17th centuries. Marvin T. Smith (1983:155) subsequently revised the dates to 1550-1600, though the presence of substantial numbers of cut-crystal beads on the wrecks of three Spanish galleons which sank off Key West in 1622 (Francis 2009:118; Stemm et al. 2013:27) suggests that they were still a viable commodity

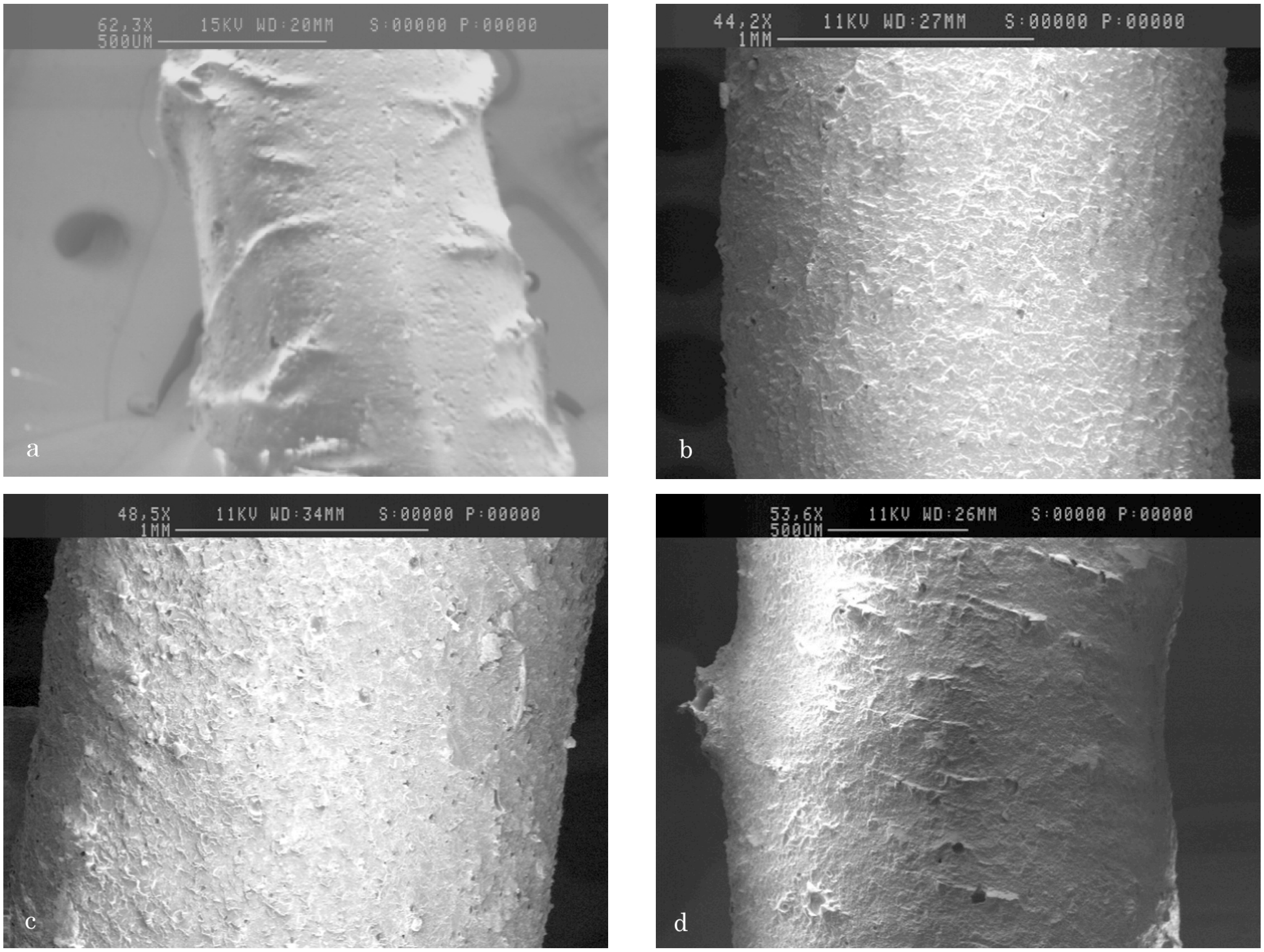

Figure 2. SEM images of bead perforation casts: a) Warminster; b) oblong Le Caron; c) Florida; and d) oblate Le Caron (photos: Scott Fairgrieve).

at that time, and likely even somewhat later. The Ontario specimens fit in comfortably at the tail end of this revised time frame.

It should, however, be mentioned that cut-crystal beads have also been recovered from late 17th- and 18th-century contexts in North America, including Mission San Luis Talimali, Florida, 1656-1704 (Mitchem 1993); the Trudeau site, Louisiana, 1731-1764 (Brain 1979); and Leedstown, Virginia, early 18th century (Francis 2009:122). In these instances it is unclear if the beads were still being circulated at the time or represent heirloom pieces. In the case of the beads found in Senegal, they clearly are heirlooms, being found with glass beads indicative of the 18th and first half of the 19th century (Opper and Opper 1989:18).

All three Ontario specimens have correlatives among the large and varied collection of Florida Cut-Crystal beads recovered from Mound Key in southwestern Florida which was occupied from ca. 1550 to 1763 (Wheeler 2000:89-91). The Warminster specimen is equivalent to Mound Key Style 5a, while the oblong Le Caron bead correlates with Style 2 and the oblate one is similar to Style 4, though with several more body facets.

SOURCING

The source of the cut-crystal beads remains problematic. Francis (2009:118) initially proposed India – long known as a source of stone beads – as the likely production center but later concluded that this was not likely due to the low quality of the stone and the rather primitive drilling technology. The technology used to drill the Warminster bead also refutes an Indian origin for at least that bead. Francis excluded Venice and Paris[2] – which also worked rock crystal into beads and other adornments – for the same reasons.

Considering that the beads were introduced into North America by the Spaniards, Spain might be a possibility, with the area around Castile being suggested by Francis (2009a:118; 2009b:180) as the likeliest place. Another potential source is the famous stone-bead emporium of Idar-Oberstein in west-central Germany which has been in operation since around A.D. 1500 (Frazier et al. 1998-1999:35). While it is best known for its agate beads, Idar-Oberstein also worked crystalline quartz to some degree. It is important to note that this industry employed bow-drills using abrasives with such skill that they were able to drill straight holes up to 20 cm in length from one end while other beadmaking centers generally drilled the hole from either end (Frazier et al. 1998-1999:44-45). This is certainly in keeping with the Le Caron beads. The Germans also utilized double-diamond drills, but it is not known if they were in use as early as the 16th-17th centuries. So, until conclusive historical, archaeological, and/or archaeometric data are forthcoming, the place (or places) where the cut-crystal beads were produced remains conjectural. That the Warminster bead and the Le Caron beads were drilled using two different techniques suggests that they may have come from two different production workshops, if not two different production centers.

CONCLUSION

Concentrated in the southeastern United States, Florida Cut-Crystal beads are scarce north of Virginia. Until now only two such find sites were known – one in eastern New York state (Rumrill 1991) and another on the Gulf of the St. Lawrence in eastern Quebec (Turgeon 2001). The Ontario beads bring the number of northern sites to four and the bead count to nine. While a study of these beads has provided information about how they were manufactured, it has yet to be determined where they were made, or what particular significance – if any – they had among the aboriginal population. Quartz crystals were believed to possess mystical powers by many Indigenous peoples (e.g., Hamell 1983; Hoffman 2004). With all their sparkling facets, were cut-crystal beads held in the same regard? In the Southeast they were generally distributed by the Spanish, though the French and British also traded them. In Ontario, the French are the likeliest source.

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ENDNOTES

1. For a technical summary of this minimally invasive analytical method, see Gratuze (2013).

2. Although three cut-crystal beads similar in form to those from Ontario were recovered from 16th-century contexts in Paris and a search of post-mortem records of Parisian beadmakers revealed that rock-crystal beads comprised 4.4% of the inventories, no evidence was found for their production in the workshops (Turgeon 2001). The inventories did list tools for the production of a variety of glass beads and lathe-turned beads of organic materials such as shell and bone, but no tools that could be attributed to the working of hard stone were listed.

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MORE PIPECLAY BEADS FROM NORTON ST PHILIP, ENGLAND

Marek Lewcun

During the 17th century, Norton St Philip was a major production center for clay tobacco pipes. As a sideline, they also made such items as wig curlers, gaming pieces, and beads. A previous article discussed six beads recovered from pipe-making wasters in fields adjoining the village. Here are described an additional five specimens, each with different decoration.

Since the publication of the initial article on pipeclay beads in this journal (Lewcun 2015), five more decorated specimens have been found in Norton St Philip, an ancient village on the eastern edge of the county of Somerset, southwest England. The six previously reported beads were found over a period of 13 years, a find rate of roughly one every two years. The most recent batch, however, was found over a period of just two years, three of them in a single month in 2018. This increase in numbers is a reflection of the recent prolonged dry weather in the United Kingdom which afforded the repeated and more detailed search of the arable fields which surround the hub of the village.

The five new beads are all made from the same pipeclay as those discussed in the 2015 article. Two are spherical, another slightly ovoid, while the remaining two are cylindrical. The boreholes range from 2.4 mm to 3.4 mm, typical of the holes in pipes of the latter part of the 17th century in Somerset. Each bead is decorated with designs and motifs similar to those previously reported. The decoration consists primarily of wheel spokes, crosses, milling, squares, and "staples" (design elements composed of two small indentations connected by a shallow groove). The stamps used to impart the individual motifs were probably fashioned from pipe stems. An example of these stamps – used to decorate not only beads but various other pipeclay objects found in the village – was recently found in one of the fields. It is 32 mm long and 9 mm in diameter at the working end (Figure 1).

Figure 1. Stamp with wheel-spoke design (all photos by author).

Bead 1 (Figure 2) is incomplete but was spherical originally. The design consists of seven bands of milling which stretch from end to end, interspaced with "staples," all produced by the same stamps as those used on Beads 3 and 4. Some of the staples form crosses, while on one side three staples have been combined to form the letter H which may represent the surname initial of Jeffry Hunt, its probable maker. The bead is 19 mm in diameter with a hole diameter of 2.6 mm. It was found in the same field as Beads 2 and 4 in this paper and Bead 1 in the 2015 article.

Bead 2 (Figure 3) is also roughly spherical. Paired bands of milling are spiraled along the axis, and are interspaced with small squares with serrated edges. This bead differs from all the others, the milling being of a toothed form rather than the traditional style found on pipes of the period and as seen on Beads 3 and 4. It is 16 mm long and 18 mm in diameter with a bore that is 3.0 mm wide. It was found in the same field as Bead 3.

Bead 3 (Figure 4) is slightly ovoid in shape. Although battered by the plow, the design elements are discernible. They include three bands of milling, one around either end and one encircling the middle. Between each band of milling, and at each end, is a series of staple-like indentations identical to those which feature on Beads 1 and 2 in the 2015 article. The bead is 20 mm long and 16 mm in diameter with a hole diameter of 2.4 mm. It was found in the same field as Bead 5.

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Figure 2. Bead 1, side and end views.

Bead 4 (Figure 5), the largest one to date, is cylindrical with slightly rounded ends and decorated with a combination of milling and staple designs from the same tools used to decorate Bead 3. The eight lines of milling gently spiral about the bead. Between each line is a series of three or four lines of parallel staples. Additional staples spiral around the ends, while five staples are arranged across the axis on one side. The bead is 32 mm long, 13 mm in diameter with a hole diameter of 2.8 mm. It was found in a part of what was once the medieval South Field, where the softer soil has been kinder to its condition.

Bead 5 (Figure 6) is broken at one end, but would have been cylindrical in form originally. Battered by the plow over the years, the design consists of crosses within circles, with an indentation central to the edge of each quadrant. The bead is 19 mm long and 15 mm in diameter with a 3.4 mm hole. It was found on the northwest side of the village, in the same field as Bead 3 in *Beads* 27.

Bead 2 was found close to a deposit of pipes by Richard Greenland (1633/1640-1710), and although it could theoretically date from anytime between 1660 and 1710, it is more likely to be of a similar date to the other three. Beads 3 and 5 were associated with pipes made by Jeffry Hunt of

Figure 3. Bead 2, side and end views.

Figure 4. Bead 3, side and end views.

Figure 5. Bead 4, side and end views.

Figure 6. Bead 5, side and end views.

Norton St Philip (1599-1690), and can be dated to between 1670 and 1690. Bead 4 was associated with pipes made by both Jeffry Hunt and Richard Greenland and is probably also of the 1670-1690 period.

Whereas the vast majority of the clay tobacco pipes with which the beads were found were workshop waste, discarded due to accidental breakage or over-firing of the kilns, four of the beads are perfectly fired and complete or almost complete, while the other was probably broken by a harrow or plowshare at some point in the last 300 years.

These, and the beads previously published, remain the only examples known in Britain, and are thus nationally unique as a group. Milling was typically used on most tobacco pipes between 1620 and 1670, but very rarely thereafter, and not at all in Norton St Philip after 1670. The 1670-1690 date of the beads is reliable, and their decoration might represent the continued use of the milling tools used on pipes but put to a different purpose. More beads must still lie buried and await discovery in the village soils, and they will be reported in due course.

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MORE ON FRIT-CORE BEADS IN NORTH AMERICA

Karlis Karklins and Adelphine Bonneau

This article publishes new findings on frit-core beads in North America, including an initial assessment of their chemical composition. Two new find sites have been added to the inventory, bringing the total to 19. In addition, two new types have been recorded, each with variants. Two beads from contexts later than the date range attributed to this bead category suggest that frit-core beads continued in use, possibly as heirlooms, well into the 17th century.

INTRODUCTION

Frit-core beads are distinct from glass beads in that, while the exterior is vitreous, the core is composed of sintered quartz sand or crushed quartz. Likely made in France, in North America they are only found in the northeastern states and provinces. In that they have relatively short temporal ranges, they are ideal chronological indicators for the latter part of the 16th century and the early 17th century. The base color of most of the beads is dark blue and the decorative elements are white, though there are examples where the color scheme is reversed. For additional details, *see* Karklins (2016).

Since the publication of the 2016 article, two more find sites have come to light; one in southeastern Quebec and the other in western New York state. Both are of interest as one replicates a rare style found only at one other site and the second is from an archaeological context significantly later than the date range proposed for frit-core beads. In addition, two previously unrecorded types were discovered in an unprovenienced collection of trade beads in Quebec City.

NEW SITES / NEW TYPES

Regarding the new find sites, the first specimen (Figure 1) was recovered from a pit at the Abenaki village of Odonak (site CaFe-7) near Pierreville on the north side of the Saint-François River in southeastern Quebec. It is Type 6 and 9 mm in length and diameter. The perforation is 2.5 mm wide.

While Odanak is recorded as having been founded around 1670, archaeological investigation has determined that the earliest occupation date for the site is 1571 (Musée des Abénakis 2017a, b). Radiocarbon dating attributes the pit fill to 1570 ±25 cal AD (Geneviève Treyvaud 2017: pers. comm.).

Figure 1. Type 6 from Odonak, Quebec (photo: Andre Gill).

The second specimen was recovered from the Seneca Power House site near Lima in western New York (Rochester Museum and Science Center/Rock Foundation # 5264/24). It is Type 2 with four longitudinal stripes and four rows of four dots each alternating around the body (Figure 2). It measures 13 mm in length and 11 mm in diameter.

Power House is attributed to the period ca. 1640-1655 (Sempowski and Saunders 2001:6) which is well outside the 1560-1610 date range posited for frit-core beads (Karklins 2016:64). In this instance, it is highly likely that this is an heirloom piece.

A comparatively large group (8 specimens) of frit-core beads was discovered in an unprovenienced bead collection held by the Laboratoire et Réserve d'archéologie du Québec (LRAQ) in Quebec City. Of the eight beads, three are Type 1. They measure 13.3-14.3 mm in length and 9.2-10.3 mm in diameter. Another bead is a variant of Type 2. Instead of four or six longitudinal white stripes, this one has only three (Figure 3). It measures 12.8 mm by 9.8 mm.

Figure 2. Type 2 from the Power House site, western New York (photo: Michael J. Galban; courtesy of the Rock Foundation, Rochester Museum and Science Center).

The four remaining beads represent two new types. Continuing the type number sequence presented in Karklins (2016), Type 7 (Figure 4) has an oval configuration with three or five short longitudinal white stripes with a small blob at the medial end around either end. Three white rosettes composed of six dots around a central dot encircle the middle. The beads are 9.0 mm (fragmentary) to 12.3 mm in length and 8.7 mm to 9.6 mm in diameter.

Type 8 is oval and represented by two variations. One, with a unique indigo hue, exhibits six longitudinal, slightly raised, white stripes, each of which is decorated with three blue dots (Figure 5). On the other, the six stripes are represented by raised ridges which exhibit four white dots (Figure 6). The beads measure 12.8-14.8 mm by 10.8-10.9 mm.

Unlike most frit-core beads where the blue glass covers the entire surface, the core is visible at the ends of several of the LRAQ specimens. Broken surfaces further reveal that the core consists of what appears to be crushed quartz with angular edges. The particles are ca. 50-100µm in size and set in a beige-colored matrix (Figure 7).

Figure 3. Type 2 with three sets of stripes and rows of dots (photo: Adelphine Bonneau).

Figure 4. New Type 7 (photo: Adelphine Bonneau).

Figure 5. New Type 8 (photo: Adelphine Bonneau).

It is unfortunate that the provenance of the beads in the LRAQ collection is unknown. The beads are strung together with shell and glass beads, some of which are of 19th-century origin, so the associated material does nothing to help determine where they were found or their age.

Updated type descriptions are presented in Table 1 and all the types are illustrated in Figure 8.

COMPOSITIONAL ANALYSIS

To obtain an initial chemical profile of a frit-core bead which might indicate a place of origin, the Type 5A specimen (BjFj-101-4B43-560) (Figure 9) from Pointe-à-Callière,

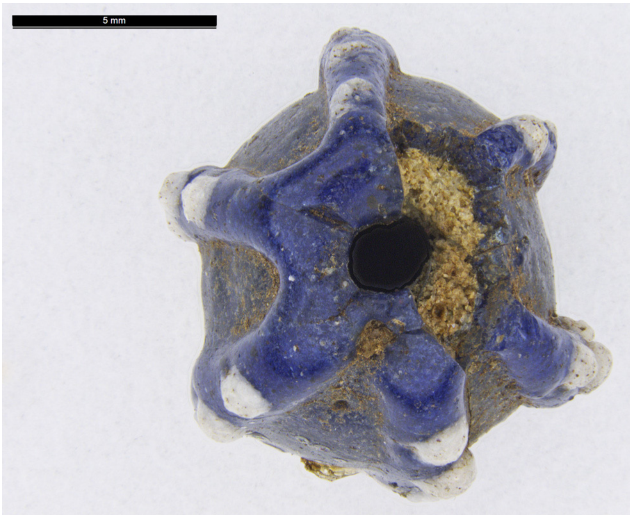

Figure 6. Type 8 variant with raised stripe ridges (photo: Adelphine Bonneau).

Montreal, Quebec, was subjected to microscopic, Raman spectroscopic, and micro X-ray fluorescence analysis at Laval University, Quebec City (Bonneau and Auger 2018). This revealed that the dark blue component is a potash-lime glass with 5.6% potash, 3.1% soda, 8.0% lime, 0.8% magnesia, and elevated alumina (7.9%). It is colored with a high concentration of cobalt (0.3%), compared to what can be expected for cobalt-colored glass from the 17th-18th centuries. Conversely, the white part is composed of soda-lime glass with 7.9% soda, 4.9% potash, 5.8% lime, 1.7% magnesia, 1.2% alumina, and 0.1% titanium. It was opacified with a high concentration of tin (11.5%) and lead (11.2%) which is consistent with the use of a lead-tin calx,

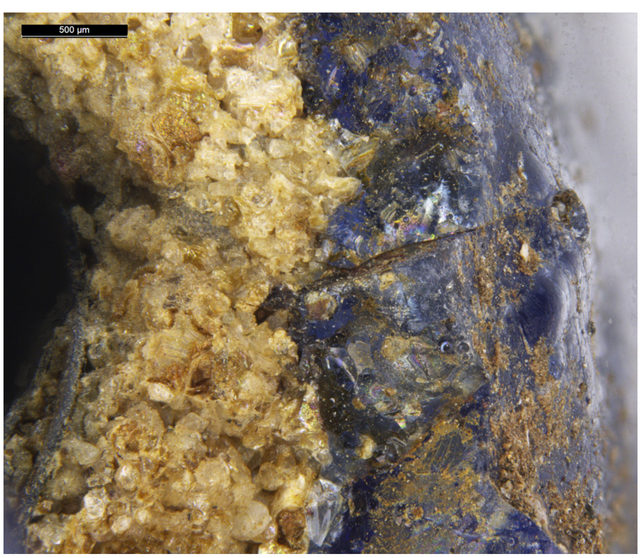

Figure 7. The sintered crushed-quartz core of a Type 8 bead (photo: Adelphine Bonneau).

Table 1. Frit-Core Bead Types.

Type 1. A loop with 6 dots around a single dot in its center is situated on opposite sides of the bead. The space between the two loops contains a longitudinal row of 4-5 dots on either side.
Type 2. This type exhibits 3, 4, or 6 longitudinal stripes between each pair of which is a row of 3-5 dots.
Type 3. No decoration.
Type 4. A configuration of 6 "petals" encircles either end of the perforation; a line encircles the middle. There are examples where the surface is covered with white glaze and the design elements are blue. These are designated with the suffix A (Type 4A).
Type 5. There are three or more longitudinal stripes, between each pair of which is a configuration of 5-6 dots around a single dot with a short stripe at either opening of the perforation. As with the previous type, there are examples where the color scheme is reversed (Type 5A).
Type 6. An undulating line encircles the middle. In each of the 4 undulations is a dot encircled by 5 dots.[1]
Type 7. Exhibits 3 or 5 short, longitudinal, petal-like stripes around either end. Three rosettes composed of 6 dots around a central dot encircle the middle.
Type 8. There are two variations. One, with a unique indigo hue, exhibits 6 longitudinal slightly raised, white stripes, each of which is decorated with 3 blue dots. On the other, the 6 stripes are represented by raised ridges which exhibit 4 white dots.

a recipe used by Venetian glassmakers (Biron and Verità 2012).

The compositions of the two glasses point to two different European production centers. The components of the white glass suggest an origin in southern Europe, but the high levels of potash, alumina, and titanium tend to reject a Venetian provenance, although it is possible that the core of the bead may have influenced the µXRF analysis. The constituents of the blue glass are indicative of an origin in northern or northeastern Europe. Further analysis using Laser Ablation-Inductively Coupled Plasma-Mass Spectrometry (LA-ICP-MS) is necessary to make a final determination. One can, however, postulate that the bead was made from imported glass.

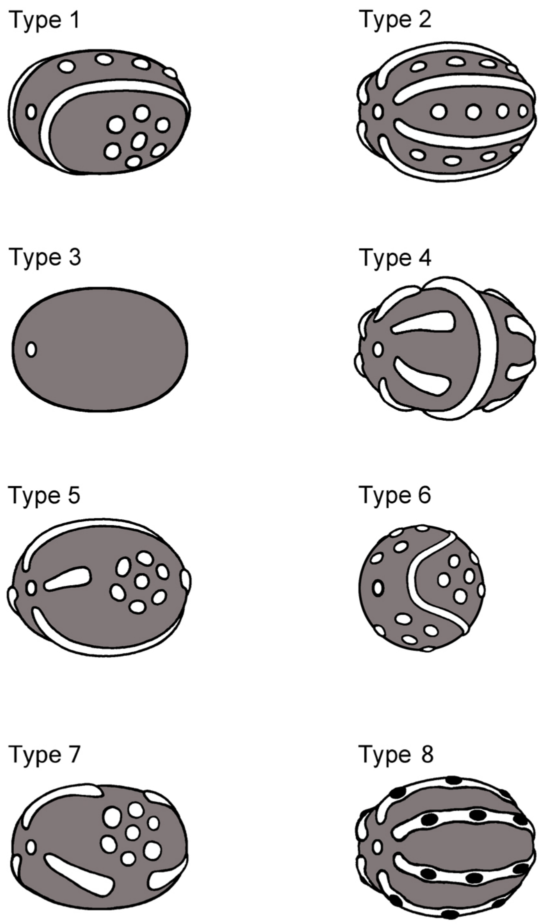

Figure 8. Frit-core bead types (drawing: Dorothea Larsen).

Figure 9. Type 5A bead from Pointe-à-Callière, Montreal, Quebec (photo: Alain Vandal; courtesy of Musée Pointe-à-Callière).

CONCLUSION

The number of find sites for frit-core beads has increased to 19 and there are now eight style types, several of which have color variants. Their temporal range has also increased significantly. They were originally considered to be type fossils for the latter part of the 16th century in southern Ontario (Kenyon and Kenyon 1983:60). Based on new finds, the date range was subsequently expanded to 1560-1610 for the Northeast in general (Karklins 2016:63-64). The Power House specimen discussed above suggests that frit-core beads may still have been in use as late as 1640-1655, though likely as heirlooms. The Type 5A bead from Fort Ville-Marie at Pointe à Callière, Quebec, may also be added to this later period. Previously attributed to the 1580-1600(?) period (Karklins 2016:62), the occupation of the fort actually only began in 1642 and the site was gradually abandoned beginning in 1665 (Conciatori 2000:38-39). This being the case, care must be taken to not automatically assign all frit-core beads to the 16th century or slightly later, especially if only one example is found. There may well be other instances where these beads are heirlooms, either handed down from one generation to another or possibly found eroding from the ground at an earlier village site in the region and put to use by the finder. It will be interesting to see if other specimens are recovered from 17th-century contexts.

As to their place of origin, it is hoped that planned LA-ICP-MS analysis of frit-core beads from the archaeological contexts in Quebec mentioned above and those found in France will provide the required information.

ACKNOWLEDGEMENTS

Our thanks to Geneviève Treyvaud of the Eau Terre Environnement Research Centre in Quebec City and to Michael Jason Galban of Ganondagan State Historic Site at Victor, New York, for bringing the respective beads to our attention, as well as to Aurélie Desgens and Claudine Giroux at the Laboratoire et Réserve d'archéologie du Québec, Quebec City, for providing access to their collections.

ENDNOTE

1. In the 2016 article, this type was described as having five undulations and dot rosettes. This was based on sketchy notes, coupled with a 3-D reconstruction that showed it was possible for a bead ca. 10 mm in diameter to have that many undulations. The Odonak specimen clearly shows that only four are possible. The description of Type 6 has, therefore, been revised.

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SOURCING A UNIQUE MAN-IN-THE-MOON BEAD

Thomas Stricker, Karlis Karklins, Mark Mangus, and Thaddeus Watts

Chemical analysis of a unique black bead found in southeastern Turkey that depicts the four phases of the moon reveals it most likely originated in the Fichtelgebirge region of Bavaria at some time prior to the early 19th century.

INTRODUCTION

About 40 years ago, a young girl dug for beads on the beach adjacent to the ancient Girl Fortress at Kızkalesi, Mersin Province, Turkey (Figure 1). She came back with more than 20 beads representing a wide range of cultures and time periods: Greek, Roman, Islamic, and others (Figure 2). Among these beads – which now belong to the senior author – was an unusual "man-in-the-moon" bead which forms the basis of this article.

Figure 1. The Girl Fortress at Kızkalesi, Turkey. The "bead beach" is visible directly behind the ruins (courtesy of Mersin Directorate of Culture and Tourism).

THE BEAD

Likely of furnace-wound manufacture, the bead is round, 12.4 mm in diameter, and its opaque black body exhibits four phases of the moon: new, waxing crescent, full, and waning crescent (Figure 3). Each phase is separated from its neighbor by two stars. The new moon is represented by a circle enclosing four dashes that form the features of a human face. The full moon is a solid circle. The two crescent phases have human features. The designs are not trailed but were produced by painting on a suspension of pulverized yellow glass in water, possibly with the addition of gum arabic, then fired in the furnace to fuse the material.

Figure 2. The beads from the beach adjacent to the fortress at Kızkalesi (photo: Thomas Stricker).

Both the crescent moons and stars are very similar to those found on classic man-in-the-moon beads which have been found at a number of archaeological sites in eastern North America (Figure 4) (Lorenzini and Karklins 2000-2001), as well as in France, Mali, Morocco, and Jerusalem. Unlike the Turkish specimen, they are tabular in form and generally blue or amber colored. While many Islamic nations have espoused the crescent and star as a heraldic device, the crescent never has human features. This is apparently a uniquely European configuration.

SOURCING AND DATING

In an attempt to determine the possible origin of the bead, it was investigated using ED-XRF analysis at the Ion Beam Analysis of Material Laboratory, Arizona State University, Phoenix (Thaddeus Watts 2018). The bead was

Figure 3. The four phases of the moon on the Turkish bead (photo: strickerphotograph.com).

Figure 4. A typical blue tabular man-in-the-moon bead found at Fort Michilimackinac, Michigan (photo: strickerphotograph.com).

found to contain low percentages of potash and soda, and high levels of iron, alumina, and lime. This composition is somewhat unusual for traditional glass and seems to be a better match for Proterobas, an igneous rock found in the Fichtelgebirge region of Bavaria that was used locally to make a truly opaque black glass without the use of any additives (Karklins et al. 2016:16). It served in the production of ball buttons, spindle whorls, and beads. While there are notable discrepancies, such as elevated levels of iron, potash, and lead, the other constituents generally match quite well (Table 1). The indication is, therefore, that the Turkish bead is composed of Proterobas and originated in one of the Fichtelgebirge glassworks.

Dating the bead is difficult in that it is a surface find with no know counterparts in dated contexts. While it is not known exactly when the production of Proterobas beads and buttons began and ended, in the eastern United States, Proterobas ball buttons are restricted to sites occupied during the 16th and 17th centuries, though historical documentation reveals that Proterobas buttons and beads were still being made in the Fichtelgebirge in 1811 (Karklins et al. 2016:23). It is therefore probable that the Turkish man-in-the-moon bead was produced at some point in this time range. It is

Table 1. Compositional Analysis of the Turkish Man-in-the-Moon Bead and Proterobas Objects from the Fichtelgebirge Region of Bavaria.

Elements	Turkish Bead (% weight)*	Values Converted to % of Oxides**	Proterobas Objects (% of oxides)***
Si	34.8	45.0	48.8-53.8
Fe	22.4	19.4	6.6-11.0
Al	11.4	13.0	13.6-16.9
Ca	9.4	8.0	9.5-13.1
K	7.3	5.3	1.2-4.1
Mg	5.2	5.2	7.0-9.2
Pb	2.6	1.7	> 1.0
Na	2.5	2.0	2.1-3.2
Mn	0.5	0.4	0.2-0.5

*ED-XRF analysis (Watts 2018); **Turkish bead values converted to % of oxides and normalized to 100% by Laure Dussubieux, Field Museum, Chicago; ***LA-ICP-MS analysis (Dussubieux 2016).

interesting to note that Turkey was a major destination of Fichtelgebirge products during this time period (Karklins et al. 2016:17).

CONCLUSION

This is the first Proterobas bead to be identified from a context outside the Fichtelgebirge region. It is hoped that the compositional analysis of other opaque black beads from sites around the world will identify more of them and allow their temporal range to be determined.

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STONE BEADS IN OMAN DURING THE 3RD TO 2ND MILLENNIA BCE: NEW APPROACHES TO THE STUDY OF TRADE AND TECHNOLOGY

Jonathan Mark Kenoyer and Dennys Frenez

This paper focuses primarily on ancient stone beads found in Oman at sites dating to the 3rd to 2nd millennium BCE, generally dated to the Umm an-Nar and Wadi Suq periods. Archaeological collections were documented to determine the range of variation in the finished objects and if there is evidence for local production of carnelian and other hard-stone beads. A comparative analysis with published materials from other regions was also undertaken to document the bead types in Oman that might have been obtained through trade networks that linked this region to Mesopotamia, Iran, the Indus Valley region, Afghanistan, Egypt, and Anatolia. The overall outcome of this study is a more comprehensive understanding of the types of interactions that were carried out between communities in Oman and adjacent regions during the prehistoric period.

INTRODUCTION

Archaeological studies of early civilizations in the Old World have identified core areas and numerous interlinked regions that were the setting for early developments of technology, trade, and eventually, urban society. Four main core areas – Mesopotamia, Egypt, the Indus Valley, and China – have been the focus of intense archaeological research, but new studies are beginning to show that the peripheral regions also played an important role in the development of early urban civilizations (Azzara and Cattani 2018; Cleuziou 1992; Potts 1990). Since the early 1960s, archaeological investigation at sites on the Arabian Peninsula and the Makran Coast have demonstrated that there were numerous land and maritime routes that linked cities of the Indus Valley to trading posts and urban centers in eastern Arabia, Iran, and Mesopotamia (Figure 1) (Dales 1962, 1971, 1976; During-Caspers 1971; Edens 1993; Frenez 2011; Højlund 1989; Lamberg-Karlovsky 1979, 2009; Laursen 2010). In ancient Mesopotamian texts (Sumerian and Akkadian), several major regions to the east were specifically mentioned as being important trading partners: Elam (western Iran; Potts 1999), Aratta (eastern Iran/Afghanistan; Moorey 1994), Marhashi (southeastern Iran; Potts 2004), Dilmun (modern Bahrain; Potts 1983), Magan (eastern Arabia and the Makran Coast of Iran and Pakistan; Moorey 1994), and Meluhha (the Indus Valley of Pakistan and western India; Moorey 1994; Sollberger 1970). The main stimulus for long-distance interaction may have been the needs of elite consumers in the major urban centers in Mesopotamia and the Indus Valley, but communities in the intervening regions also benefitted from this trade and played a significant role in shaping the interactions.

The study of technology and the trade in raw materials and finished commodities provides important information about these communities since we have no textual documentation for the earliest periods and only limited references from Mesopotamia beginning in the mid-3rd millennium BCE. The Southeastern Arabian Peninsula, which includes the present-day Sultanate of Oman (Oman) and the United Arab Emirates (UAE), is strategically positioned along the major maritime trade network that linked the Indus Valley with Mesopotamia. Excavations at coastal as well as inland sites in Oman and the UAE have provided considerable evidence for the presence of Indus artifacts as well as Indus-style goods, but it is possible that trade between these regions may have begun much earlier than the mid-3rd millennium BCE (Kenoyer 2008).

In this paper we present the preliminary results of a long-term and multifaceted study of the role of craft specialists and traders who were present in ancient Magan during the 5th-1st millennia BCE (Table 1), with a specific focus on beads found at sites in modern Oman, and their relationship with the Indus Valley or Meluhha. This study expands on the important research begun by earlier scholars by using new methods of analysis for artifacts that were excavated in the past, and by studying new sets of data from more recent excavations. The study of stone beads includes the microscopic examination of bead drill holes using scanning electron microscopy (SEM) to gain a more precise understanding of bead production.

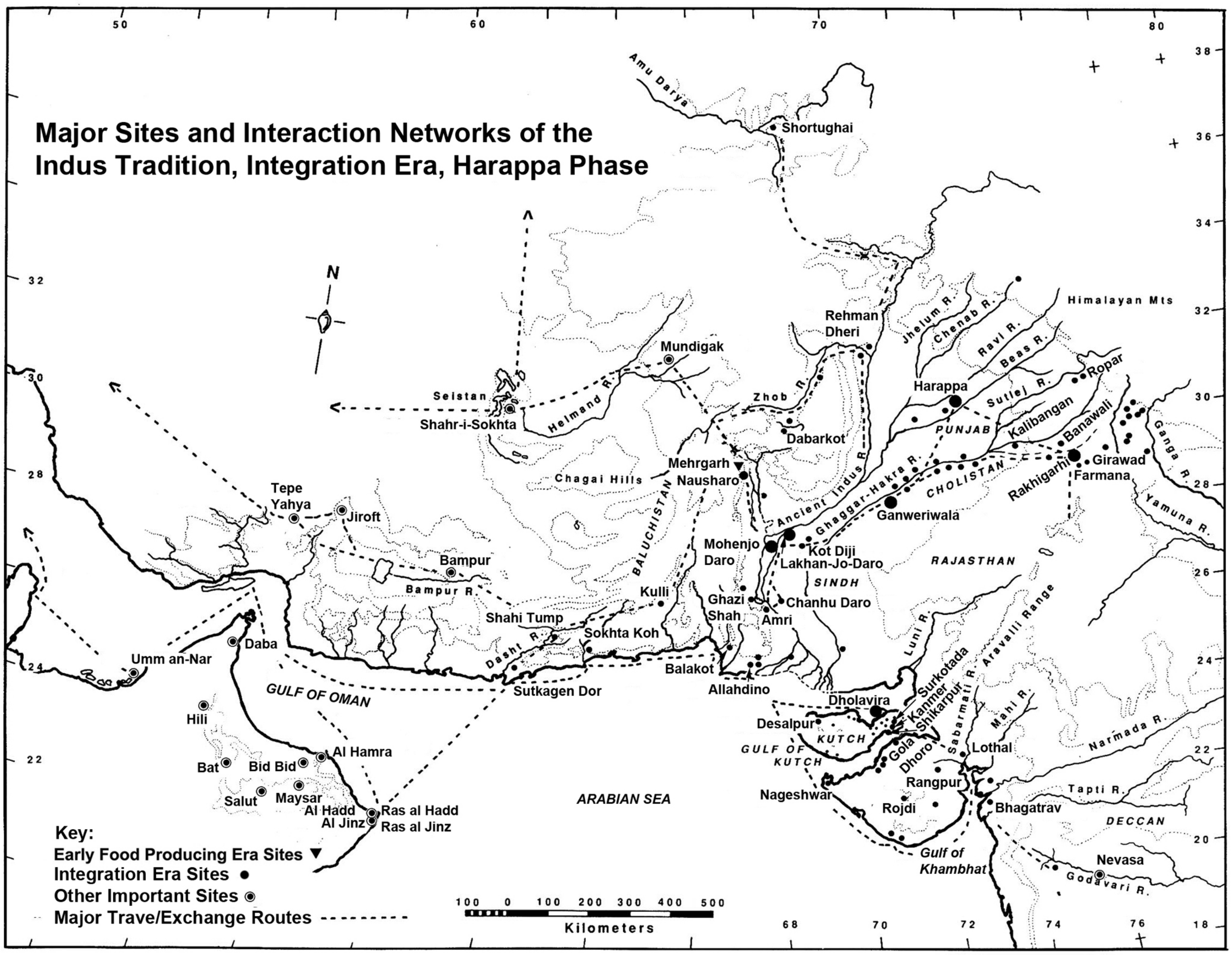

Figure 1. Major sites in Oman and the Indus (all images by the authors unless otherwise indicated).

Stone beads from archaeological excavations (Table 2) were studied at various locations of the Ministry of Heritage and Culture's Department of Excavations and Archaeological Studies, Oman, at the Faisal Bin Ali Museum Storage Lab for the National Museum, and at the Office of the Adviser to His Majesty the Sultan for Cultural Affairs (Diwan) (*see* acknowledgements below).

This paper focuses on the stone beads of the mid-3rd to late 2nd millennium BCE from the sites of Bat (Schmidt and Döpper 2014), Salut (Frenez et al. 2016), and a collection of beads from Bid Bid in order to better understand the possible development of local bead production and the trade connections that linked Oman to surrounding regions. In addition, some beads from later periods will be presented to show the major differences in bead types and drilling technology over time. These collections provide an excellent overview of the types of information that are available through the study of the beads from sites in Oman and will provide a framework for future work in this region.

Methodology of Stone Bead Analysis

Each of the beads under study was measured using a digital caliper to record the length, width, and internal hole diameter (Figure 2). The external surfaces of the beads, and particularly their ends, were examined using a 10x hand lens in order to document the raw material and to study the shape, external manufacture, and use indicators. In addition, specific features of surface modification were documented using a digital microscope (Dinolite ™) that can be linked through a USB port directly to a computer. These details of manufacture are critical for differentiating beads that look

Table 1. General Chronology (Kenoyer 2014; Moorey 1994; Weeks 2014).

Indus Tradition	Oman/UAE	Mesopotamia
Localization Era		
	Iron Age II: 1000-600 BC	
	Iron Age I: 1300-1100 BC	
Late Harappa Phase: 1900-1300 BCE	Wadi Suq Period: 2000-1300 BCE	Isin-Larsa Dynasties: 2000-1600 BCE
Integration Era		
Harappa Phase: 2600-1900 BCE	Umm an-Nar Period: 2700-2000 BCE	Ur III Period: 2100-2000 BCE
		Akkadian Period: 2350-2100 BCE
		Early Dynastic Period: 3000-2350 BCE
Regionalization Era		
Early Harappa Phase: 5000-2600 BCE	Hafit Period: 3200-2700 BCE	Jemdet Nasr Period: 3500-3000 BCE
		Uruk Period: 4000-3500 BCE
Early Food Producing Era		
Mehrgarh Phase: circa + 7000-5000 BCE	Foraging-Agro/Pastoral: 6000-3200 BCE	Ubaid Period: 5500-4000 BCE

the same but may have been made in different workshops by different craftspeople (Kenoyer 2003). The wear on the ends and the exterior of the beads provides information about their actual use. If a freshly manufactured bead is deposited in a burial or lost, it has very sharp drill-hole edges and the surface shows traces of the final polish. If a bead has been worn on a string next to other beads or metal objects, the ends are worn, the edge of the drill hole is worn and polished, and the exterior of the bead can show various types of wear and abrasion. These details provide a general idea of the relative use life of a bead and if it was used for a short or long period of time prior to being buried or discarded.

Drill-hole impressions were studied using a 10x hand lens and also a standard binocular microscope to determine the nature of the technology and the specific patterns of production. For example, some beads are drilled only from one end and when the drill pops out at the other end, it leaves a conical flake scar. Other beads are drilled half way from one end and then turned around and drilled from the opposite end. If the driller is highly skilled, the drill holes usually meet perfectly at the center of the bead. In many cases, the drilling was not done very carefully so the holes do not meet properly. This causes sharp edges that can cut the suspension string. These special features of drilling are

Table 2. Oman Bead Collections Discussed in this Report.

Site	No. of Beads	Material	Major Periods	Project/Institution
Bid Bid	80	Carnelian, agate	4th millennium to Iron Age	National Museum
Bat RTF1	94	Carnelian, agate, shell, ostrich eggshell	Umm an-Nar to Iron Age	American Mission to Bat
Salut ST 1	3	Carnelian	Umm an-Nar	Italian Mission to Oman
Dhank	29	Carnelian, agate, etc.	Hafit and Umm an-Nar, not studied	SoBO Dhank, Temple University
Bat - German Project	1	Carnelian	Umm an-Nar	German Expedition to Bat, Tübingen University

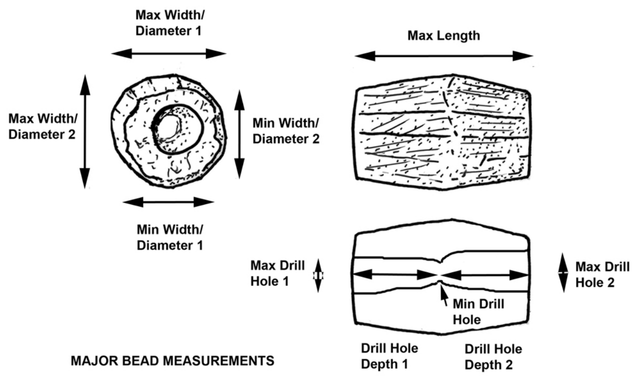

Figure 2. Major bead measurements.

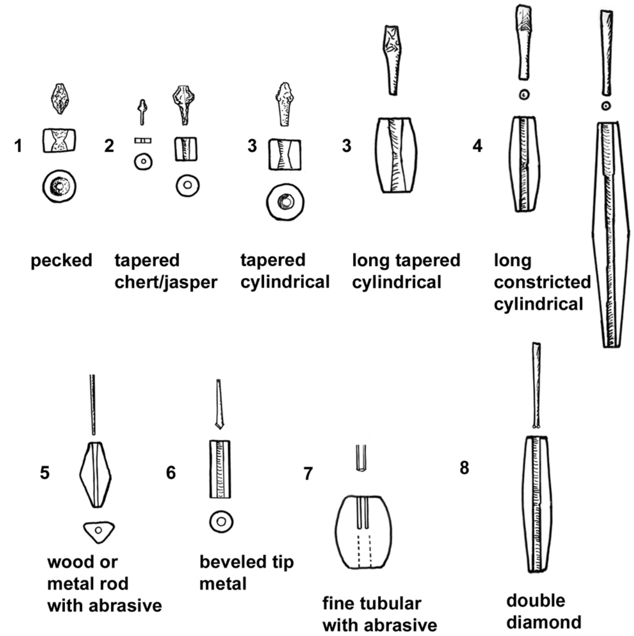

Figure 3. Major bead drill types and drill-hole sections.

Figure 4. Indus ernestite drills and long biconical carnelian beads from Chanhudaro (courtesy of the Museum of Fine Arts, Boston).

indicative of different workshops and production traditions. Beads produced in major workshops of the Indus Valley region tend to have drill holes that are exceptionally well centered, while beads drilled in other regions tend to be quite irregular and are often not centered.

Selected drill-hole impressions were studied under the higher-power SEM at the Department of Animal Sciences Microscopy Laboratories of the University of Wisconsin to document the nature of the drilled surfaces to confirm the type of drilling. Due to limited time, only a few samples have been studied at this level and further reports will include more details regarding the SEM study.

Bead Drilling

The type of drill used to perforate a bead also provides important information on the details of the manufacturing process (Figure 3). Most of the hard-stone beads in the collections were made from microcrystalline silicates, such as carnelian and jasper. The only drill that can perforate this type of stone is one made from a harder silicate stone (e.g., chert or ernestite) (Figure 4) (Kenoyer and Vidale 1992), or from corundum/emery (hardness 9 on Mohs scale) or diamond (hardness 10) (Kenoyer 2003). The type of drill used to perforate a stone can be determined based on the nature of the abraded surface of the drill hole. The most effective way to determine this information is to take an impression of the hole using fine-quality vinyl polysiloxane dental impression material (3M Express, light body, regular set) and then studying the impression using high-power magnification (Kenoyer 1997, 2017a). Two or more sets of impressions are made of each bead drill hole. The first impression usually has traces of sand and dust on it so the second or third impression is used for the high-magnification study using SEM (Kenoyer 2017b).

OMAN STONE-BEAD TECHNOLOGY

Beads from Bid Bid

Over the course of many years, a large quantity of ancient beads was collected from the area of the modern town of Bid Bid (Figure 1), southeast of Muscat. The collection was donated to the Ministry of Heritage and Culture's Department of Excavations and Archaeological Studies in 2012 and is currently in the holdings of the Oman National Museum. The beads were not recovered during proper archaeological excavations, but appear to have been collected from disturbed sites and tombs dating from one or more chronological periods. After an initial sorting of the larger collection, a smaller sample of 80 stone beads was selected for further study at the Faisal Bin Ali

Museum Storage Lab in Muscat. Although the beads were not recovered in a primary archaeological context, they represent a wide variety of bead styles and manufacturing techniques, and provide an excellent collection for study that can be linked to beads from excavated sites. The value of this collection is that it covers a long period of the history of Oman and can help to demonstrate the many links between Oman and other regions throughout its long history.

Preliminary analysis of the drill-hole impressions and the general shapes of the beads suggests that they come from many different time periods and represent production from many different regions of West Asia, South Asia, and possibly Arabia itself. Some of the beads were made using soft stone such as steatite. This type of raw material can be shaped with stone or metal tools and is easily perforated to create beads or pendants. In contrast to the soft steatite ornaments, hard-stone beads such as carnelian require specialized technologies to produce, beginning with chipping and grinding, then drilling, and finally polishing. While chipping, grinding, and polishing are generally the same for all carnelian and agate beads, the technology associated with perforation or drilling is quite distinct. By determining the nature of drilling, it is possible to determine some aspects of the chronology, as well as the types of workshops in which a bead was produced.

Some of the beads were made using a pecking technique (Figure 3, 1) that is known from very early Neolithic times, circa 6000 BCE in Mesopotamia (Chevalier, Inizan, and Tixier 1982), and from slightly later times in Arabia, Egypt, and the Indus Valley regions (Kenoyer 2003). These may be beads that have been passed down for thousands of years and used by many different people before their final burial. Other beads have been drilled using a constricted cylindrical ernestite drill (Kenoyer and Vidale 1992), a technology that was only found in the Indus Valley region and dates to around 2600-1900 BCE (Figure 4). This means that some of the beads were brought to Oman from the Indus Valley region. Other beads have been drilled using a solid or tubular metal drill with some form of abrasive. Based on Kenoyer's current studies of Indus beads, drilling with abrasives is documented at sites in the Indus Valley such as Harappa and Dholavira between 2500-1900 BC, but the type of abrasive is not known.

Drilling with abrasives is also known from prehistoric sites in the Mediterranean and Anatolian regions to the west, but comprehensive studies have not been conducted to understand the origin or distribution of this technique. It is possible that some of the beads from Bid Bid were made in the Indus Valley or in Anatolia (modern Turkey), or somewhere in Mesopotamia (modern Iraq, Kuwait, Syria) or Egypt. A few of the beads were made using a double-diamond drilling technique that is only known from ancient India starting around 1000-600 BC. These beads may have been brought to Oman directly from South Asia or indirectly through trade networks passing through Baluchistan, Iran, or Yemen. A selection of the beads will be discussed below according to their drilling technology and also their shape, as these features help to define the workshops and general cultural associations of the beads.

Carved Steatite Beads, Metal Drill

Two examples of carved steatite beads were examined to determine the nature of the drilling and carving techniques (Figure 5). Such beads with carved surfaces could have been used as seals and are often called button seals, but these examples do not have any evidence for such use. Made from a soft grey-colored steatite (hardness 1 on the Mohs scale), the beads have not been fired to harden the stone. They were perforated using what appears to be a metal drill with possibly a beveled cutting edge (Figure 3, 6). The carving on the surface of the beads appears to have been done with a sharp metal blade. The type of metal has not been determined, but it could have been copper, bronze, or iron, depending on the actual period during which these beads were made. The dot-in-circle motif is found on stone beads as well as seals and other decorative objects of the mid-3rd millennium BCE.

Figure 5. Carved steatite beads, Bid Bid collection.

This design was made with a special type of compass drill featuring two or three sharp points where one is slightly longer than the others. The drill turns on the longer point and engraves a perfect circle with the second point. Some drills have three points and are used to make dot-in-double-circle motifs. This decorative motif is widespread in the Indus Valley region as well as in many areas of the ancient world. Even today the motif is carved on stone vessels or wooden tools throughout the region. Shihuh craftsmen from the Musandam Peninsula of northern Oman carve the motif using a stone tool called a *ma'z*, and more recently an iron compass drill called a *zahrah* (Ziolkowski and Al-Sharqi 2006). Stylistic studies of the carved beads from Bid Bid need to be undertaken to compare them with beads from sites with better chronological control, but an example recently discovered in Tomb 156 by the German Archaeological Project at Bat suggest that they may date to the Iron Age (Schmidt and Döpper 2014:11, Figure 8).

Short Barrel and Short Biconical Carnelian Beads, Pecked Drilling

The technology of pecking is generally associated with short cylindrical, barrel, or biconical stone beads. This technique has been documented at sites in Arabia, Egypt, Mesopotamia, the Indus Valley, and even China (Kenoyer, ongoing studies). All of the pecked beads in this collection are carnelian and have a short barrel or biconical shape. Three of the beads have a lot of wear on the narrowest part of the hole that is the result of wear from a string. These beads may have been passed down over many generations before they were buried.

The beads are pecked from both ends resulting in an inverted biconical hole (Figure 6). This type of drilling is common for short biconical and short barrel-shaped beads at sites throughout Oman and also is common in the Indus region at sites such as Mohenjo-daro, Chanhudaro, Dholavira, and Harappa (Figure 7). The pecking technology involves the use of a pointed stone tool that is struck against the bead and gradually fractures tiny conical points that eventually break off to create a wide hole with a narrow tip that can be clearly seen when examined using SEM (Figure 8). The bead was turned over and the same process was repeated from the opposite side. In some cases, the final percussion from the first side resulted in a large cone of percussion that broke

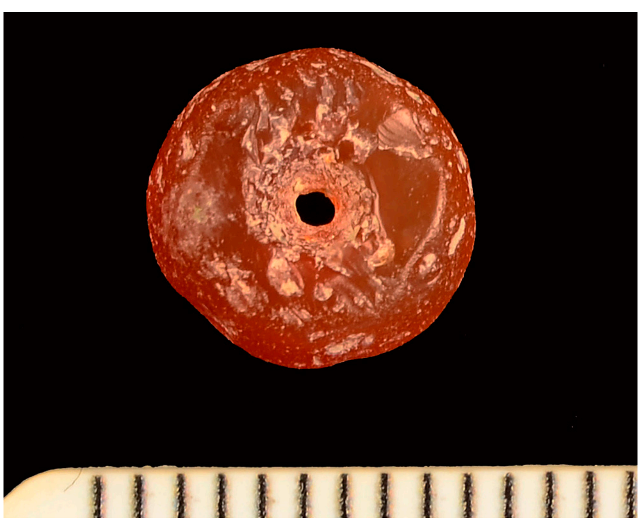

Figure 6. Carnelian bead with pecked perforation, Bid Bid.

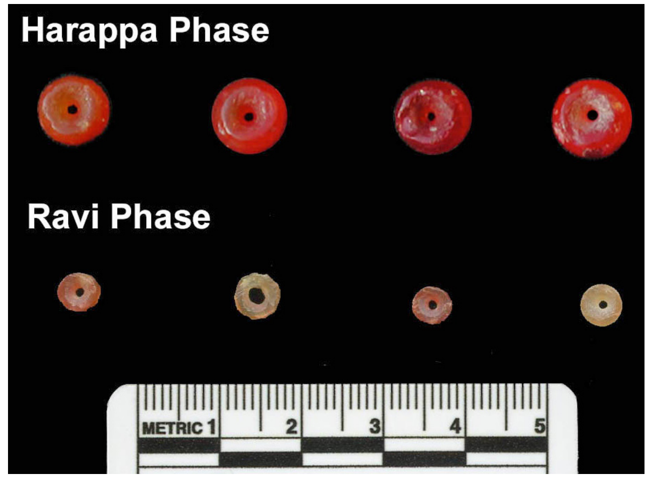

Figure 7. Carnelian beads with pecked perforation from Harappa.

through the bead, resulting in a pecked conical depression on one side and a single conical flake scar on the other. No examples of this type of hole were found in the sample from Bid Bid, but an example of this type of bead was discovered in recent excavations by the authors at the site of Ras al-Hadd, HD1 in 2018.

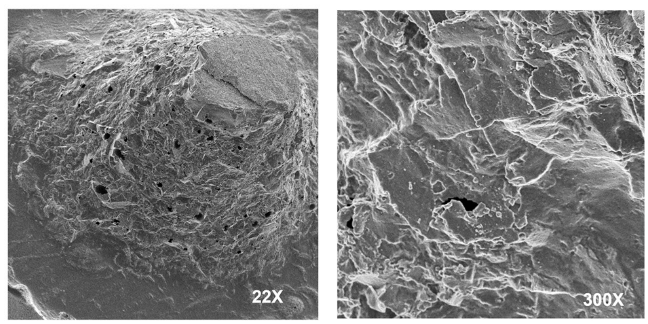

Figure 8. SEM image of pecked drill hole, DA 12772.1 Salut.

Biconical and Barrel-Shaped Beads

While many beads look the same on the outside, the drilling technique used for perforation can be quite different. The differences in drilling technology can sometimes be determined at low magnification, but the final identification should be done using SEM analysis. The Bid Bid beads in Figure 9 include those that were drilled using stone as well as abrasives. The use of stone drills results in a highly polished surface of the carnelian (Figure 10, a) since the stone drill is only slightly harder than the bead itself. Other beads were drilled using a solid metal drill with abrasive (Figure 10, b), or with a tubular metal drill with abrasive (Figure 10, c).

The collection also has examples of carnelian beads that have been drilled from one end with the closed end popping

Figure 9. Long barrel and biconical beads, Bid Bid collection; nos. 24, 25, and 26 have Indus-style stone drilling.

out due to pressure from drilling. Other beads have been drilled from both ends and meet in the center of the bead.

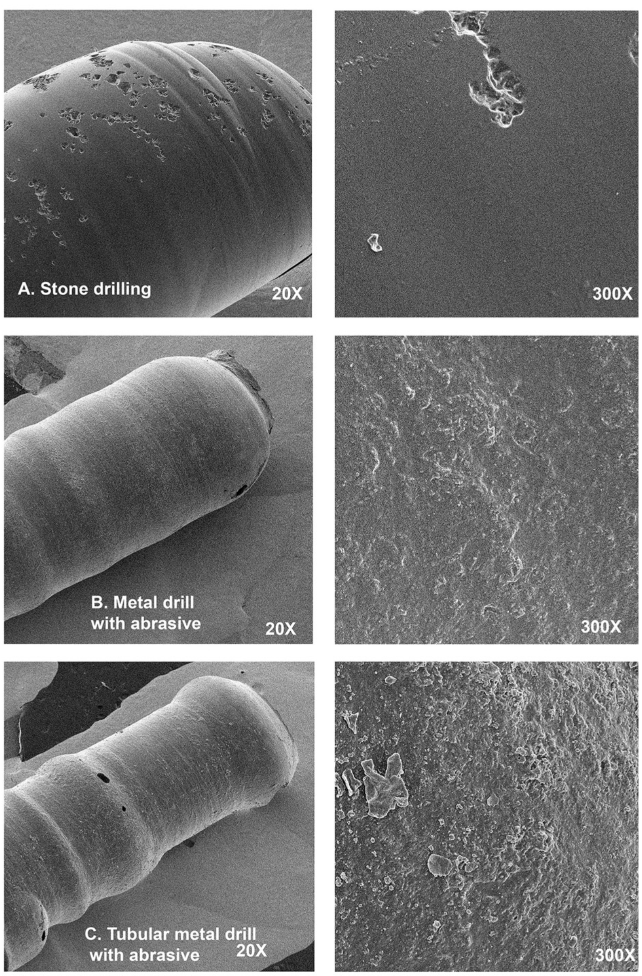

Figure 10. SEM image of Bid Bid bead perforation drilling.

Sometimes the drilling is done to equal depths from both ends and meets precisely in the center with careful alignment of the holes. In other instances, the drilling is primarily done from one end and a shorter drilling is done from the other to complete the hole. In some cases the same drill sizes are used for both ends, but in others two or more sizes are used. This creates stepping or distinct drilling striae. The patterns of drilling – from one or both ends, the numbers of steps, and the distance drilled between each change of drill – can help to determine the precise workshop in which the beads were produced. This study is still ongoing, but promises to help clarify distinctive workshop styles of carnelian bead production. Recent studies of carnelian beads from the Levant by Geoffrey Ludvik (2018) have demonstrated that it is possible to define distinctive workshop styles related to Indus bead production that was taking place either in Mesopotamia or the Indus Valley region.

Long Barrel and Biconical Beads, Constricted Cylindrical Stone Drill – Indus Style

The use of constricted cylindrical stone drills (Figure 3, 4) made from the hard stone called ernestite is a technology that is directly linked to the Indus civilization (Figure 4) (Kenoyer and Vidale 1992; Prabhakar et al. 2012). The bead shapes associated with Indus-style drilling are also typical of beads produced in the Indus workshops (Kenoyer 1998, 2005, 2017a). The Bid Bid collection contains seven beads that appear to have been made using Indus shapes and drilling techniques, and three are illustrated in Figure 9 (nos. 24-26). This size and shape of bead is commonly found at Indus sites and appears to have been an important trade item that reached even into the interior of Oman at sites such as Salut, Bat, and Hili (in the UAE). Ongoing studies are being carried out to quantify the precise shapes and drilling techniques used for this type of bead to determine if they were all made in similar workshops or if they were made at many different locations. The technique of perforation and the distinctive shapes suggest that the craftspeople that were making them were from the Indus region or were trained in Indus workshops. It is also possible that some of these beads may have been made in workshops in Oman using raw materials from the Indus or other sources. So far, however, no conclusive evidence for local production has been reported.

Salut ST1 – Carnelian Beads

One of the most important aspects of our study of stone beads has been to confirm the presence of carnelian beads that appear to have been made in the Indus and traded to Oman. Three carnelian, long biconical bead fragments (Figure 11, a) were discovered in the excavations at the 3rd-millennium stone tower site at Salut ST1 (Frenez et al. 2016). These beads are technically long bicones, but in the classification developed for these types there are three sub-types: long biconical, very long biconical, and very, very long biconical (Kenoyer 2017a: Figure 6). The shape and finishing of the beads is identical to beads studied by Kenoyer from the site of Dholavira, Gujarat. The drill hole perforation is also identical to the perforation technique using constricted cylindrical drills and this has been confirmed using SEM (Figure 11, b).

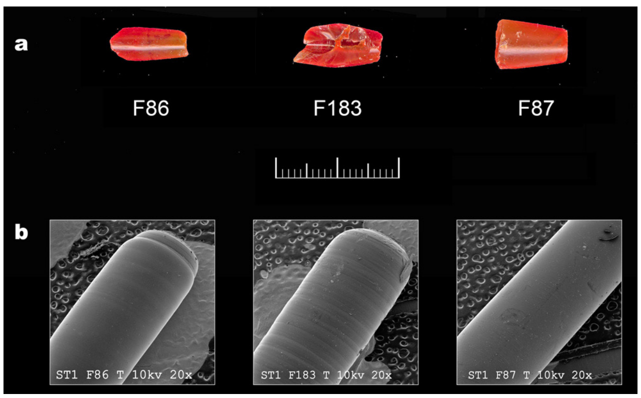

Figure 11. a) Carnelian beads from Salut ST1 and b) SEM images of drill hole impressions.

Bat – Carnelian Beads – German Archaeological Mission

Excavations by the German Archaeological Mission headed by Dr. Conrad Schmidt from the University of Tübingen have discovered one of the largest and most complete examples of a very, very long biconical Indus bead (7.7 cm) in Tomb 155 at Bat (Figure 12, a) (Schmidt and Döpper 2014). Impressions were made of the drill hole and, through SEM analysis, it is possible to confirm that this bead was drilled using Indus-style constricted ernestite drills (Figure 12, b). The production of very, very long biconical or barrel shaped carnelian beads is well documented in the Indus region at the site of Chanhudaro (Mackay 1943), as well as the sites of Mohenjo-daro, Harappa (Kenoyer 2005), and possibly at Dholavira (Prabhakar et al. 2012). In the Indus, these beads were generally worn as part of elaborate beaded belts that would have required around 42 beads to create (Figure 13). The production of these beads required high quality carnelian nodules of suitable length. Based on experimental reconstructions, a full belt of long carnelian beads may have taken more than a year to produce (Kenoyer 1998). The length of the bead and the quality of the carnelian suggest that the bead from Bat was made in the Indus and traded to Oman. The fact that only single beads of this type have been found suggests that they were not part of belts but were probably worn around the neck or as part of a headdress as has been documented from the burials of Ur (Zettler and Horne 1998).

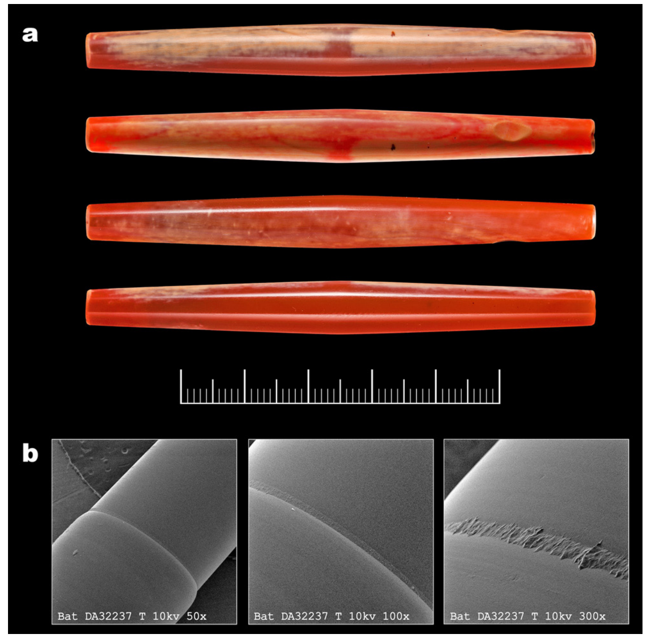

Figure 12. a) Long biconical carnelian bead, four views, Bat (photo: P. Koch, courtesy of Ministry of Heritage and Culture and Conrad Schmidt, German Archaeological Mission); b) SEM images of long biconical bead drilling from Bat.

Bleached Carnelian Beads

Another distinctive bead type produced in the Indus region includes beads that have been decorated artificially with a white design. One of the beads in the Bid Bid collection (668-4) (Figure 14) is decorated with a white design that is referred to as bleaching (Kenoyer 2003), though earlier publications use the term etching (Beck 1933; De Waele and Haerinck 2006; Lessa and Vogt 1972). The bead has a common Indus bleached design of two circles or eyes on each side of the bead similar to that seen on beads from Harappa (Figure 15). The bead shape is a short lenticular ellipse and the drilling is done with an Indus-style drill that leaves a straight cylindrical drill hole with stepped drilling striae and highly polished surfaces (Figure 16).

In contrast to the above bead, two other bleached carnelian beads were drilled using an abrasive and probably a copper/bronze drill (668-3, 5) (Figure 17). The bleaching technology used to decorate the beads is usually associated with the Indus region and Indus technology in general, but

Figure 13. Belt of long biconical carnelian beads, and gold jewelry from Mohenjo-daro, Pakistan (courtesy of the Department of Archaeology and Museums, Government of Pakistan).

the drilling was done using what appears to be an emery abrasive from one end only and the closed end popped out (Figure 18). Abrasive drilling is found at sites in the Indus, but it is done with a softer abrasive such as quartz and is usually done by drilling from both ends. The practice of drilling from one end and popping out the stone at the other was sometimes practiced with stone drills in the Indus and is particularly associated with bleached carnelian beads. These two beads are the first examples of bleached beads that use a combination of Indus decorating and Indus shapes, but possibly using emery abrasive, which is a non-Indus-style drilling. They may have been made in Mesopotamia where other bleached carnelian beads with non-Indus designs have been found (Kenoyer 1997, 1998), or it is possible that they were made in a workshop in the region of Oman or the UAE.

Figure 14. Bleached carnelian bead (front and back), Bid Bid.

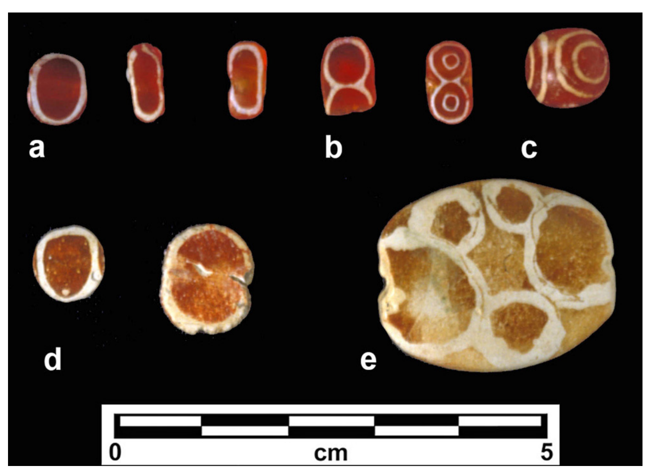

Figure 15. Bleached carnelian beads from Harappa, Pakistan.

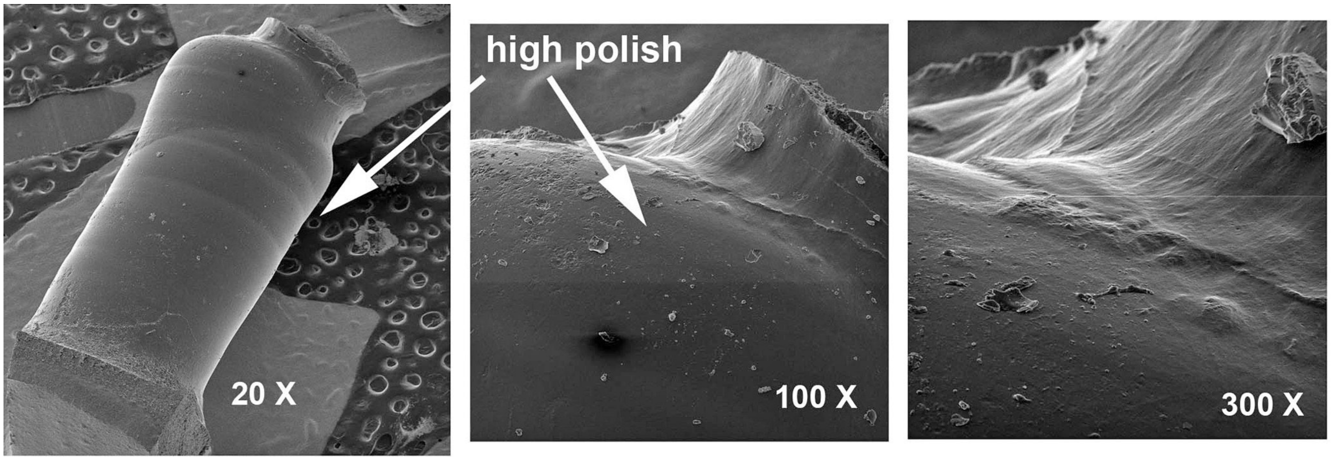

Figure 16. SEM images of Bead 668 4 showing Indus-style stone drilling.

Abrasive Drilling with Metal Drills

All but two of the remaining stone beads in the Bid Bid sample were drilled using an abrasive, possibly emery and a metal drill (Figures 3, 5 and 7; 10, b-c). The type of metal used cannot be determined, but it was probably copper or bronze for beads made during the earlier periods (before 1400 BCE) and iron or steel in later times. Further comparative analysis of the bead shapes and drill holes with samples from well-dated sites will be needed to sort out the periods of these other beads. The beads come in a wide variety of shapes and decorative styles, as well as raw materials. The drilling processes used to perforate the beads are highly varied and include straight cylindrical drill holes, often with flaring collars that would have been made using tubular drills (Figures 3, 7; 10, c). The flaring collars are the result of problems in drilling when the drill tip spreads out from too much pressure. There are also tapered-cylindrical and long or short conical drill holes that were made using solid metal drills. These can also exhibit some collaring if there was too much pressure on the drill, but generally they do not produce as much flaring as tubular drills. Both tubular and solid drills involved drilling from one end and popping the other end out, as well as drilling from both ends. In some cases the drilling from both ends is well aligned, but in other cases they are not centered and barely come together. By looking closely at the raw-material quality, the bead shapes, and the variations in drilling details, it will be possible to identify different workshops and also periods of beadmaking.

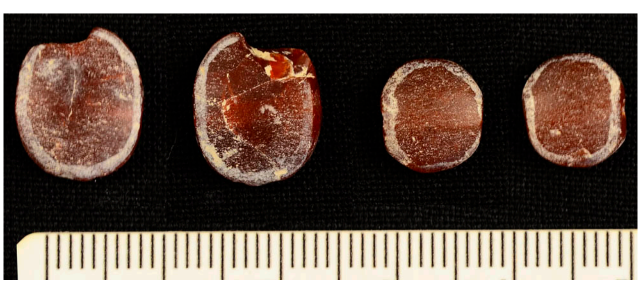

Figure 17. Bleached carnelian beads, Bid Bid collection.

Many of the other beads in this collection are similar to beads found in Mesopotamia, the Indus region, Afghanistan, Baluchistan, Iran, Egypt, and the more distant Mediterranean and Anatolia. Comparative studies of beads from these other regions will help to determine the trade networks that connected the region around Bid Bid and interior Oman to these distant regions.

Banded-Agate Beads, Double-Diamond Drilling

In order to highlight the difference between later historical drilling and the drilling seen in prehistoric beads, an example from a later period showing diamond drilling is presented. Two beads in the sample were made from a distinctive banded agate with the banding oriented perpendicular to the drill holes (Figure 19). Each bead was drilled twice in order to be used as a spacer bead for a necklace or ornament with two strands of beads. The lenticular rectangular form is very thin and has a fine polish; the ends show slight wear. The straight cylindrical drill section with clear drilling striae is diagnostic of diamond drilling using a double-diamond drill (Figures 3, 8; 20). This technique was developed exclusively in South Asia and used in peninsular India beginning as early as 1000-600 BCE. It is still carried out today in the region of Khambhat, Gujarat (Kenoyer, Vidale, and Bhan 1991). The drilling of these beads was done primarily from one end for both drill holes and then well-aligned but shorter drilling from the opposite side. This type of bead is well attested in sites

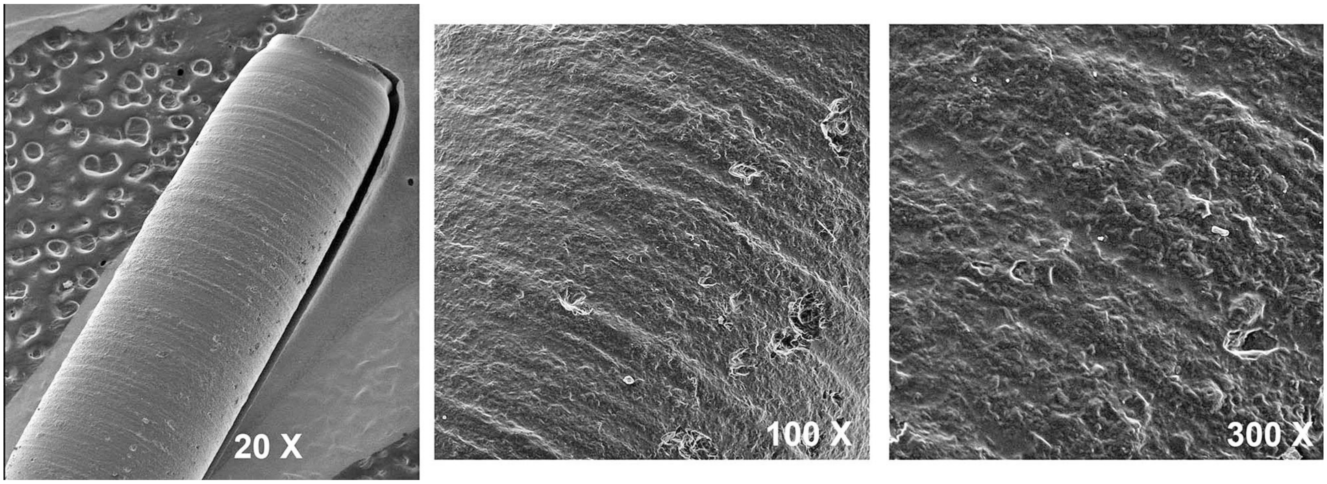

Figure 18. SEM images of Bead 668 3 showing abrasive drilling.

from the 3rd century BCE to 3rd century AD in what is now Pakistan, Afghanistan, and throughout most of the Indian subcontinent. The color of the stone appears to have been created by dying the agate to create the grey, black, and white banding. According to historical accounts, this was done by soaking the agate in a sugar solution and then heating the beads to carbonize or blacken the sugar (Newton 1849; Russell 2008).

Figure 19. Lenticular rectangular and barrel beads of banded agate, Bid Bid collection.

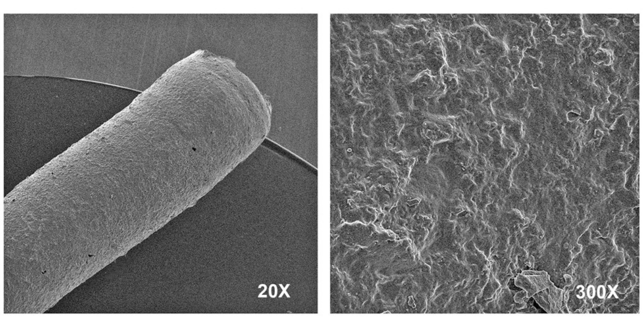

Figure 20. SEM images of diamond drilling, spherical carnelian bead, Samad (DA26612.3).

CONCLUSION

The samples of beads studied from Bid Bid, Bat, Salut, and other sites that are currently under analysis provide a wide range of stone-bead types and manufacturing techniques. These variations reflect the overall changes in bead-production styles and technologies over time and in different geographical regions of Arabia, North Africa, West Asia, and South Asia. The production of soft-stone beads and beads from shell is well attested in Oman from the 4th millennium BCE at sites such as Ras al-Hamra (Azzara and Cattani 2018) and Ras al-Hadd (HD-6) (Azzara and Cattani 2018; Panei, Rinaldi, and Tosi 2005), but there is very little evidence for the production of hard-stone beads such as carnelian from any sites in Oman. Except for the two carved steatite beads, all of the beads in the collections studied to date are made from hard stones that may have been manufactured in some distant region and brought to Oman through various trade networks. The beads from the Bid Bid collection appear to have been accumulated from many different archaeological contexts and may have come from disturbed tombs or settlement sites or from hoards of ornaments buried by ancient communities. They clearly demonstrate the long use life of beads since some of the beads may belong to the earliest Neolithic period (4000 BCE or earlier), while others date to the Bronze Age (3000-1900 BCE), the Iron Age (circa 1500 BCE), and later historical periods. The beads from Bat all come from tombs that can be assigned to specific periods. The long carnelian biconical bead can clearly be dated and linked to the Indus civilization and the beads from the RTF Site 1 excavations appear to be from the early Iron Age. These later beads also appear to include some curated beads that come from earlier times and SEM analysis of the drill holes will help to sort them out.

This overview of the bead analysis represents the first stage of a long-term study of all Indus-related crafts represented in Oman. The initial results from this study demonstrate it is possible to determine the distribution and local use patterns of Indus objects. It is also clear that many carnelian beads found in Oman come from other sources and that it is important to broaden our study of ancient trade networks to include areas such as Afghanistan, Iran, Yemen, Egypt, and Anatolia. When combined with the data being studied for pottery and copper, it will be possible to develop a new interpretive model for explaining the interactions between Oman and its neighbors in the prehistoric and early historic periods.

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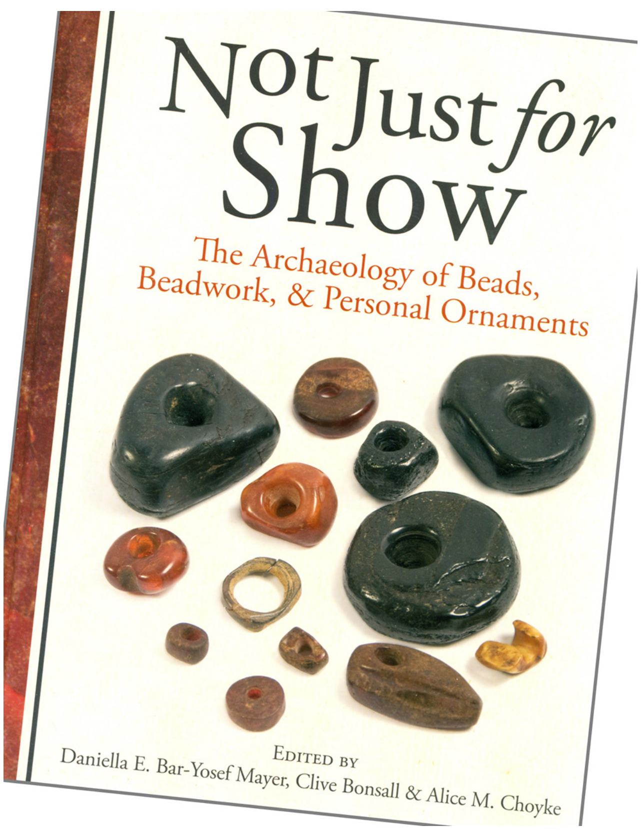
BOOK REVIEWS

Not Just for Show: The Archaeology of Beads, Beadwork and Personal Ornaments.

Daniella E. Bar-Yosef Mayer, Clive Bonsall, and Alice M. Choyke (eds.). Oxbow Books, Oxford and Philadelphia. 2017. 224 pp., 97 figs. ISBN-13: 978-1785706929; ISBN-10: 1785706926. £48 (hard cover).

This excellent volume is an outgrowth of a session with the same name at the 78th Annual Meeting of the Society for American Archaeology held in Honolulu in 2013. It includes five of the papers presented supplemented by another six, plus an introduction to the volume by Alice M. Choyke and Daniella E. Bar-Yosef Mayer. The 11 articles are grouped into four sections: Socio-Cultural Reflections, Audio and Visual Social Cues, Methodological Approaches, and Experimentation and Technology.



Five papers comprise the **Socio-Cultural Reflections** section. "Traditions and Change in Scaphopod Shell Beads in Northern Australia from the Pleistocene to the Recent Past," by Jane Balme and Sue O'Connor, reveals that beads composed of *Conus* and scaphopod (tusk) shells have been found in the oldest archaeological contexts in northern Australia, some dating back to at least 35,000 cal BP. This article discusses the archaeological contexts and chronology of these beads, with emphasis on the scaphopod specimens, as well as their uses in antiquity and in relatively recent times. Attention is also paid to how the use and value of the beads changed not only through time but also as the beads moved inland from the coast.

"Magdalenian 'Beadwork Time' in the Paris Basin (France): Correlation between Personal Ornaments and the Function of Archaeological Sites," by Caroline Peschaux, Grégory Debout, Olivier Bignon-Lau, and Pierre Bodu, reveals that the production of beads among hunter-gatherer peoples at the end of the Paleolithic period in the region of what is now Paris was a seasonal activity. Data derived from 16 occupations dating from the Upper Magdalenian suggest that "Beadwork Time" principally took place between the winter and spring, with autumn being an especially poor time.

"Personal Adornment and Personhood among the Last Mesolithic Foragers of the Danube Gorges in the Central Balkans and Beyond," by Emanuela Cristiani and Dušan Borić, examines how the inhabitants of the Late Mesolithic site of Vlasac in Serbia produced and utilized perforated gastropods and carp pharyngeal teeth as ornaments. This study has provided insight into how the social identities and personhood of these people were constructed.

In "Ornamental Shell Beads as Markers of Exchange in the Pre-Pottery Neolithic B of the Southern Levant," Ashton Spatz postulates that beads from the Red and Mediterranean seas arrived in the Southern Levant by down-the-line exchange. While the Red Sea provided both beads and shell for their manufacture, the Mediterranean region primarily furnished completed objects.

"Games, Exchange, and Stone: Hunter-Gatherer Beads at Home," by Emily Mueller Epstein, employs the life-history or *chaîne opératoire* approach to the interpretation of a group of marine-shell, bone, and stone beads recovered from a Late Archaic site in southeastern Oregon which is within the Great Basin region. Coupling the archaeological data with ethnographic data collected during the first half of the 20th century has revealed that the beads could have been employed in several socio-cultural contexts and not just as ornaments.

The **Audio and Visual Social Cues** section is comprised of three articles. "The Natufian Audio-Visual Bone Pendants from Hayonim Cave," by Dana Shaham and Anna Belfer-Cohen, proposes that a group of 52 pendants found in pairs about the pelvis of a young female burial in northern Israel were affixed to a belt or other object to provide a rhythmic sound while dancing. The feasibility of this interpretation is examined using a musicological perspective.

"Bead Biographies from Neolithic Burial Contexts: Contributions from the Microscope," by Annelou van Gijn, investigates the changes that took place in funerary rites during the Dutch Middle and Late Neolithic (between 3750 and 2000 cal BC), including how amber, jet, and bone beads were perceived and used. Microscopic examination of the beads revealed evidence of repairs, how they were worn, and the degree of wear. Coupled with their archaeological context and associated grave goods, this permitted the formulation of "bead biographies" that reveal a bead's life history.

In "The Tutankhamun Beadwork, an Introduction to Archaeological Beadwork Analysis," Jolanda E.M.F. Bos presents a three-tier system for recording Ancient Egyptian beadwork based on the finds in the tomb of Tutankhamun who reigned during the 18th dynasty. It involves providing an overall description of the object, and then determining the techniques and patterns used in its construction. A beaded tunic from the tomb is used as a case study. While this system was developed to record Egyptian beadwork, it may be used to describe and interpret archaeological beadwork from any part of the world.

The first of two articles in the **Methodological Approaches** section is "A Mother-of-Pearl Shell Pendant from Nexpa, Morelos," by Adrián Velázquez-Castro, Patricia Ochoa-Castillo, Norma Valentín-Maldonado, and Belem Zúñiga-Arellano. The authors reveal that a thorough analysis of a shell pectoral from an Early Formative period site in southern Mexico that depicts two lizards carved in relief has allowed the species of both the shell and the lizards to be determined, as well as the techniques used to produce the object. Its cultural affiliation is also discussed, as are the exchange networks that distributed such prestige goods.

In the second paper, "Detailing the Bead Maker: Reflectance Transformation Imaging (RTI) of Steatite Disk Beads from Prehistoric Napa Valley, California," Tsim D. Schneider and Lori D. Hager employ recently developed RTI technology to produce three-dimensional images of a group of 29 steatite beads which clearly reveal traces of the manufacturing process. These traces were quite varied considering the relatively small sample size, suggesting that the beads were made by craft specialists and non-specialists alike.

The **Experimentation and Technology** section contains two papers. "Experimental Replication of Stone, Bone and Shell Beads from Early Neolithic Sites in Southeast Europe," by Maria Gurova and Clive Bonsall, comes to the rather obvious conclusion that disc beads made of materials with a hardness less than 5 on the Mohs scale (e.g., bone, shell, limestone) are easier to drill than those with a hardness of 5.5 and above (e.g., amazonite and nephrite). The fact that those involved in the project had little or no experience in beadmaking but were able to produce decent replicas of Neolithic disc beads suggests that while beads of the harder materials were likely the domain of specialists, fashioning beads from softer materials could have been a common household activity.

"The Reproduction of Small Prehistoric Tusk Shell Beads," by Greg Campbell, uses replication experimentation to demonstrate how very short (1-3 mm) tusk-shell (dentalium) beads were made during the Epipaleolithic of the Levant.

Covering a wide range of topics, *Not Just for Show* will be a valuable addition to the research library of anyone interested in beads and beadwork. Available in hard cover as well as an ebook, it is highly recommended.

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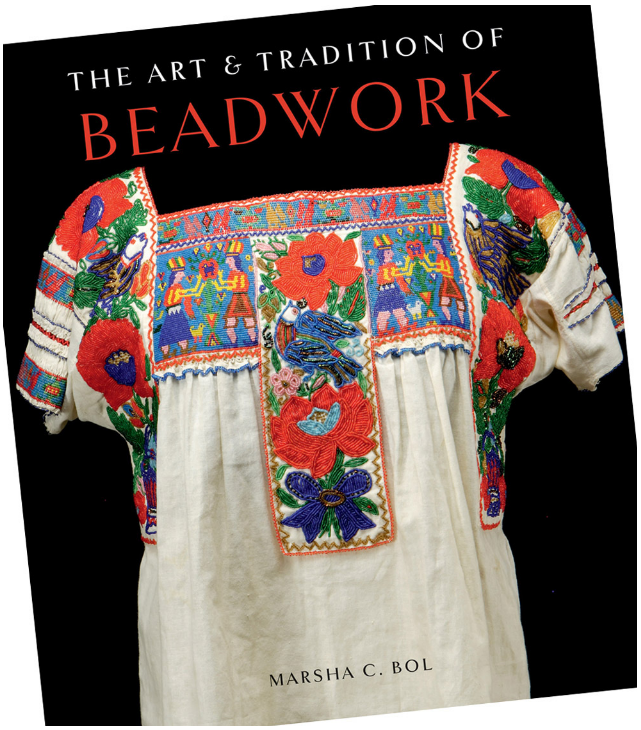
The Art & Tradition of Beadwork.

Marsha C. Bol. Gibbs Smith, P.O. Box 667, Layton, UT 84041. 2018. 256 pp., 560 color and B&W figs., index. ISBN-13: 978-1-4236-3179-8. $75.00 (hardcover).

Like *Beadwork: A World Guide* by Caroline Crabtree and Pamela Stallebrass (2002), *The Art & Tradition of*

Beadwork presents beadwork in cross-cultural perspective, offering hundreds of splendid illustrations. Yet, while the text of the former tends to be airy and abbreviated, the text of the latter promises to be more substantive insofar as the author is a scholar.



Whereas *Beadwork: A World Guide* is organized geographically, the present volume is organized thematically, addressing issues and events common to humans the world over as they move from one stage of life to the next, adapting to changing roles, identities, aspirations, and abilities. Ten chapters follow Bol's "Introduction" and "Acknowledgments:" Life Begins; Becoming an Adult; Fostering Life's Continuity; In Memoriam; Gender in Beadwork; Emblems of Social Status, Prestige and Wealth; Symbols of Leadership; Conversing with the Spirits; Dressing for Festive Occasions; and Beyond the Village.

From 2009 to 2015, Bol served as director of the Museum of International Folk Art in Santa Fe (MoIFA) which houses an extensive collection of beadwork from around the world. *The Art & Tradition of Beadwork* showcases the MoIFA collection in dozens of glorious color images, many produced specially for the book. Pieces made by poorly documented beadworking groups such as the Bani Malik of Saudi Arabia (Figures 1.19A-B, 1.20A-B); the Mbukushu of the Okavango Delta, Botswana (Figures 2.1-2.12); the Bedouin of historic Palestine (Figures 3.30, 3.31-33, 8.15, 8.17, 8.21B); the Montagnards of highland Vietnam (Figure 9.51); or the residents of São Luís, capital of Maranhão state, Brazil (Figure 9.55), gratify readers unaccustomed to such rarities. Bol further enriches the book's global coverage by drawing upon the holdings of other museums and private collectors. Living beadworkers fare especially well; Bol wisely allows them to explain in their own words how current personal or societal events affect their work.

Despite its many admirable qualities, *The Art & Tradition of Beadwork* suffers from serious flaws. The first stems from the absence of definitions. Even books written for general audiences, as this one seems to be, benefit from the conceptual clarity that definitions provide. Bol does not define what qualifies as "beadwork," beyond the tautologous "*working beads* resulting in *beadwork*" (author's italics) or the ambiguous "a collective of beads" (p. 8). Nor does she define what constitutes a "bead;" for bead researchers, a "bead" has a centrally located hole. Bol features a dozen or so photos of metal jewelry entirely devoid of beads (e.g., Figures 3.37, 8.42-3) although some of the pieces bear metal pendants whose metal bails (suspension loops), render them bead-like (Figures 2.56, 3.34, 3.38-41, 8.28, 8.40, 8.47-8). Also lacking is a definition of "tradition," notwithstanding the presence of the word in the title of the book, leaving readers to wonder how beadworking traditions form; how long traditions usually last; and whether all pieces in the book are equally "traditional?" Bol should have anticipated these basic questions.

A second flaw concerns scholarly bias. Six of the book's ten chapters open with discussions of North American Indian beadwork, primarily the beadwork of the Lakota, one of the three Sioux groups inhabiting the Plains. According to the book's dust jacket, Bol's "academic specialty is Plains Indian, especially Lakota, women's arts of beadwork and quillwork." The remaining four chapters open with discussions of African beadwork. There is nothing inherently wrong with favoring certain cultures over others, but Bol should have articulated her rationale. Once the pieces opening each chapter are out of the way, Bol often groups the remaining pieces under a heading that concludes with "Elsewhere" – a heterogeneous, catch-all category (pp. 27, 55, 64, 89, 132, 156, 177, 191, 245). By the end of the book, one gets the impression that North American Indian and African beadwork are somehow more significant than beadwork relegated to "Elsewhere."

That Bol situates pieces of beadwork in rigid, reductive thematic categories results in a third flaw. Two examples will suffice. Bol correctly describes the umbrella-like beaded *kanduare* made by the Sa'dan Toraja peoples of Indonesia's Sulawesi (Figure 4.7) as a funerary item displayed or worn by men during mortuary rituals (p. 111). Accordingly, she situates the *kandaure* in Chapter 4, entitled "In Memoriam," ignoring the fact that *kanduare* are also worn by Toraja women during weddings or other rituals invoking the very opposite of death and decay (Hector 2005:46; Nooy-Palm 1979:255). To take a second example, Chinese bamboo-bead undergarments of the sort shown in Figure 7.35 were worn not just by "male members of the Chinese royal court" (p. 161) but by bridal couples on their wedding day (Garrett 1994:79-80) and by low-status farmers and actors (Hector 1995:22-23). Like *kandaure* and other objects in Bol's book, bamboo-bead garments resist simplistic categorization, crossing boundaries of gender, status, or ritual function. The phenomenon should have been acknowledged in a paragraph, if not a whole chapter.

Fourth, Bol should have reflected upon the critical role of the museum as a storehouse of objects and an arbiter of what is deemed worth preserving. This is odd , since so many of the pieces shown in the book currently belong to museums such as the MoIFA. Plenty of recent studies interrogate the assumptions and procedures by which museums, especially ethnographic museums, select, present, and describe the objects they possess – and the layers of meanings that objects gain or lose when removed from their original contexts and subjected to curatorial analysis or the museum-goer's gaze.

Finally, the Bibliography privileges African and Native North American sources over their Asian and European counterparts. Many major publications on beads and beadwork are missing while comparatively minor anthropological works abound. Interestingly, text from unnamed sources occasionally makes its presence felt. For example, as a source for her discussion of Kathi beadwork of Gujarat State, India (pp. 79, 208-209), Bol cites only her private 2016 communications with Cristin McKnight Sethi. Yet portions of Bol's commentary on Kathi beadwork uncannily parallel words, phrases, or sentences that appeared long ago in Nanavati et al. (1966), the only extended study yet published on the topic, or in my own brief writings on Kathi beadwork which reference the latter (Hector 1995:18-19, 2005:40-41).

A poorly conceived Index ends the book. Was this prepared by the author or the editorial staff? One searches in vain for basic terms such as "Borneo" or "*kandaure*" that turn up repeatedly in the text but not the Index. Readers must resort to paging through the volume hoping to find what they saw earlier, as I myself did while preparing this review. This frustrates readers and reduces the book's utility.

I will allow other reviewers to identify further shortcomings of *The Art & Tradition of Beadwork*. Although the book is marred by deficits that general readers may not notice, bead and beadwork scholars should regard it with caution. Readers of all backgrounds will appreciate this ambitious, if imperfect, book for the breadth and enduring beauty of its images.

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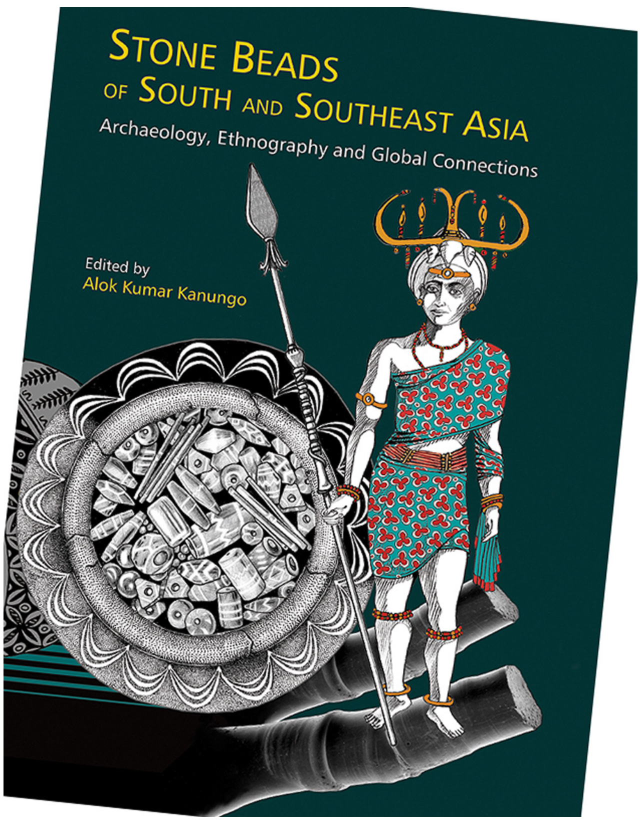
Stone Beads of South and Southeast Asia: Archaeology, Ethnography and Global Connections.

Alok Kumar Kanungo (ed.). Aryan Books International, Pooja Apartments, 4B, Ansari Road, New Delhi-110002; aryanbooks@gmail.com. 2017. xvi + 444 pp., 358 color and B&W figs. ISBN: 978-81-7305-585-0 (hb); 978-81-7305-587-4 (pb). US $124.99 (hard cover).

This large-format volume contains the papers presented during the "Short Term Course cum Workshop on History, Science & Technology of Stone Beads" held at the Archaeological Sciences Centre, Indian Institute of Technology Gandhinagar, Ahmadabad, Gujarat, India, in August of 2015. The aim of the five-day course was to inform the attendees about the history, technology, and products of the South Asian stone bead industry, as well as how to properly record, analyze, and interpret the archaeological material.



The book is divided into four sections. The first of these – **Beads: Importance and Literature** – contains four papers. The first of these, "Small Find, Immense Impact: Importance of Bead Studies" by Kishor K. Basa, discusses the advances made in bead research over the years and stresses its importance in understanding past cultures. In "Jewels and Jewellery in Early Indian Archaeology and Literature," R.S. Bisht relates the history of bead jewelry in India, emphasizing the Harappan Culture, using both literary and archaeological sources. He also discusses the various stones and other materials utilized in bead production.

References to "Beads and Ornaments in Early Tamizh Texts" from southern India are discussed by V. Selvakumar. In "Ratnattin Tiruvābharanangal (Sacred Gemstone Ornaments) in the Inscriptions of Brihatīswarā Temple, Tañcāvūr," he presents a detailed statistical report on the ornaments donated to the various deities as recorded in ancient temple engravings.

Beads: History, Methodology and Ethnoarchaeology is represented by six papers. "Geological Aspects of Raw Materials for Stone Beads," by Ravi Prasad, V.N. Prabhakar, and Vikrant Jain, aims to assess the geological and chemical properties of the various types of stone used to manufacture beads at Dholavira, a Harappan Civilization site in Gujarat state, India, with an eye to determining their origins. It also delves into how the different stones are affected by physical and chemical weathering.

In "History of Stone Beads and Drilling: South Asia," Jonathan Mark Kenoyer provides an excellent overview of stone beadmaking with emphasis on the drilling aspect. In "Stone Beads of the Indus Tradition: New Perspectives on Harappan Bead Typology, Technology and Documentation," he presents a new approach to the identification, documentation, and interpretation of Harappan stone beads, and itemizes what information needs to be documented and how.

"Living Tradition: Stone Bead Production in Khambhat – An Ethnoarchaeological Approach," by Kuldeep K. Bhan, Jonathan Mark Kenoyer, and Massimo Vidale, documents the existing traditional Khambhat stone-bead industry – the largest in the world – which is on the threshold of being transformed by modern technology and socio-economic change. In "Transitions in the Stone Beadmaking at Khambhat: An Ethnohistorical Survey," Alok Kumar Kanungo reports on the changes that have occurred in the Khambat bead industry, with emphasis on the source of the raw material, technology, organization, and commerce.

The final paper in the group is "Stone Bead Users – Symbolic Value and Trade: The Nagas," by Manabu Koiso, Hitoshi Endo, and Ayumu Konasukawa. It provides ethnographic details about the beads and necklaces used by the Nagas of northeastern India.

Eight papers comprise the third group: **Beads: Case Studies from South Asia**. "Early Evidence of Beadmaking at Mehrgarh, Pakistan: A Tribute to the Scientific Curiosity of Catherine and Jean-Francois Jarrige," by Massimo Vidale, Maurizio Mariottini, Giancarlo Sidoti, and Muhammad Zahir, deals with the archaeological material recovered from a Chalcolithic craft center. The emphasis is on lapis lazuli and chert drill heads.

In "Stone Bead Production through the Ages in Gujarat," Kuldeep K. Bhan stresses the Harappan period. More details about the industry are provided in "Early Harappan Bead Production in Gujarat: Technology, Adaptation and Contacts," by P. Ajithprasad and Marco Madella, including information about the sources of the raw material, drilling techniques, and trade.

"Documentation and Analysis of Stone Drills from Dholavira," by V.N. Prabhakar, reports on the microscopic and statistical analysis of the large number of Ernestite drills recovered from the Harappan site of Dholavira in Gujarat, India. This has led to a better understanding of the different drill types and sub-types, and their attributes.

Rabindra Kumar Mohanty's paper on "Antiquity of Semi-precious Stone Beads from Deccan" covers the period from the earliest beadmakers to the Early Historic Period and encompasses most of central and southern India. In "South Indian Stones Beads: Archaeological, Textual and Ethnographic Approach to Traditional Gemstone Industry," K. Rajan uses information gathered from present-day gem cutters in Kangayam, central India, to better understand the technology used to produce beads recovered from excavations at nearby Early-Historic Kodumanal.

"Early Historic Stone Beads from Ahichhatra," by Bhuvan Vikrama, concentrates on the beads recovered from the Painted Grey Ware levels at this site in northern India, while "Ancient Stone Beads of Southeast Asia and Indian Connection," by Bunchar Pongpanich, briefly surveys beads recovered primarily from Thailand and discusses the bead trade with India.

The final section – **Beads: Scientific Studies** – contains three articles. "Scientific Analyses and Stone Beads," by Laure Dussubieux and Mark Golitko, explains the different analytical methods used to determine the chemical composition of stone beads, using lapis lazuli from sites around the world as a case study. In "Non-Destructive Identification and Characterization of Ancient Beads: A Case Study from Harappa," Randall Law reveals how X-ray diffraction (XRD) analysis of a small red bead believed to be glass proved it was actually made from indurated hematitic kaolinite. Finally, "Using SEM to Study Stone Bead Technology," by Jonathan Mark Kenoyer, notes how useful a stereoscopic scanning electron microscope is in properly identifying bead manufacturing techniques, colorants, and raw materials.

In sum, *Stone Beads of South and Southeast Asia* contains a wealth of information on the South Asian stone-bead industry, from the earliest times to the present day. The last three papers discuss technology that has greatly helped researchers to identify and source bead raw materials, as well as uncover details concerning beadmaking tools and techniques. The book is a welcome addition to the literature.

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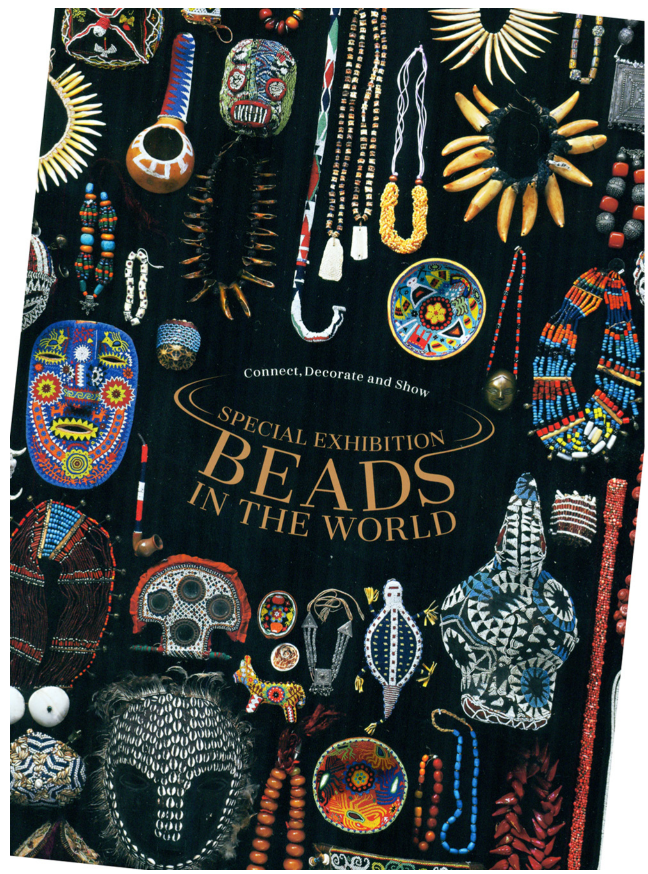
Beads in the World.

Kazunobu Ikeya (ed.). National Museum of Ethnology, Osaka, Japan. 2018. 136 pp., numerous color images. ISBN: 978-4-906962-67-9. 2,400 yen (paper).

Beads in the World is the catalog for an exhibition held in 2017 at the National Museum of Ethnology in Osaka, Japan, at the time of the museum's 40th anniversary. The book and exhibition aim to demonstrate the remarkable role beads have played in connecting the world throughout history. This colorful, richly illustrated book shows a wonderfully wide assortment of ethnographic artifacts and beads.



The volume is organized into five sections, each comprised of a series of one- to two-page sub-sections. Twenty-nine Japanese authors, ranging from academics to bead artists, have written text providing a basic overview of each topic. Accompanying images show representative samples of culture-specific adornment, clothing, bead craft, and/or beads, some with explanatory maps and historical or contemporary photos showing cultural items in use. Each

BEADS: Journal of the Society of Bead Researchers 30:82-83 (2018)

image is meticulously credited, generally including country and region, ethnic group, description, and source. A majority of the items featured appear to be from the collection of the National Museum of Ethnology, with the rest credited to private collections and other Japanese institutions.

The cover and initial pages of the book feature attractive full-page images of beaded artifacts, costumes, and beads from a broad range of cultures. A whimsical introduction encourages the reader to marvel that humans have cherished and used beads as adornment for more than 100,000 years and posits that *Beads in the World* will reveal bead crafts to be among the best masterpieces of material culture. A two-page world map identifies the location of the 84 ethnic groups featured in the volume with country or region cross-referenced by page number and coded by bead material. Color-coded arrows mark the traditional trade routes for glass and amber beads that have connected bead production and sourcing sites to cultures on all continents.

The first section, **What are Beads?**, explores the age-old quandary of how to define a bead and presents examples of the wide array of materials that have been used as beads over time with pages devoted to, among others, black coral, iron, faience, human teeth, and hornets! The second section, **Human History and Beads**, presents a mix of historical periods, civilizations, and bead types. Beginning with the world's oldest beads (perforated shells from archaeological sites in Africa and West Asia), it then presents topics spanning bead use by ancient civilizations in Asia and Africa, historical trade routes for shell, stone, pearl, amber, and glass beads, and beads in modern fashion. The third section, **Why do People Wear Beads?**, showcases an eclectic range of ways beads have been used in material culture with examples including adornments denoting rights of passage (Zulu beaded marriage cape), wealth (Dinka beaded corset), protective powers (dZi-bead amulet), and religious devotion (prayer beads). The fourth section, **A Tour for Beads of the World**, features examples of beads, traditional beadwork, and costumes by region or country in every part of the globe. The shorter fifth and final section, **Pursuing Beauty of a Global Age**, offers examples of contemporary beadmaking, bead craft, and art. An **Afterword** asks the reader to consider the enduring allure of beads and ponders how their use and distribution routes will continue to evolve in the future. A bibliography lists reference books by Japanese authors and 18 Japanese museums and galleries.

The text of *Beads in the World* tends to be elementary, quirky, and inconsistent given the imperfect translation, multiple authors, and stated intention to serve as an introduction to world bead culture. Scholars and experienced collectors of beads and ethnographic artifacts may quibble with definitions and facts and will not likely find new information. For the layperson interested in world bead traditions, the book covers similar territory to other introductory books on bead history such as *Beadwork: A World Guide* by Caroline Crabtree and Pam Stallebrass (2002), *Ethnic Jewelry from Africa, Europe and Asia* by Sibylle Jargstorf (2000), *Beads: An Exploration of Bead Traditions Around the World* by Janet Coles and Robert Budwig (1997), and *Beads of the World* by Peter Francis, Jr. (1994). Although not adding new content to the canon, for those with a love of the humble bead and an appreciation of human ingenuity, and artistic and cultural expression, this book is a delightful mash-up and visual feast showing a cornucopia of beads and bead traditions stretching across cultures, continents, and time.

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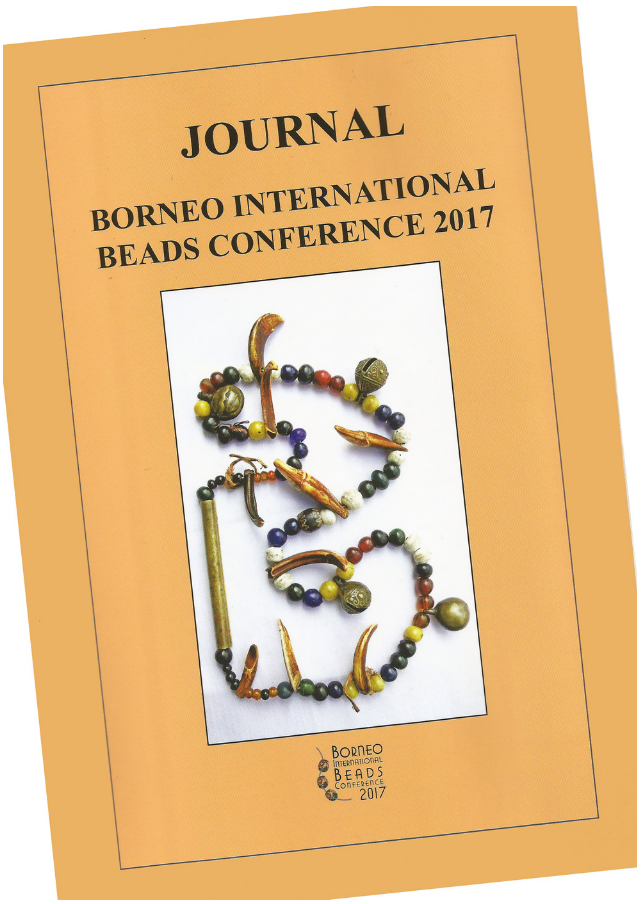
Journal: Borneo International Beads Conference 2017.

Heidi Munan and Anita MacGillivray (eds.). Crafthub, Queen's Tower, Unit C, Ground Floor, Lot 10801, Jalan Wan Alwi, 93350 Kuching, Sarawak, Malaysia. 2017. 232 pp., 116 color figs., 55 B&W figs. $40.00 postpaid (paper). To order, contact crafthub@gmail.com.

The *Journal* of the Borneo International Beads Conference 2017 is a volume of proceedings. It reflects the truly international aspect of the conference as well as the rich diversity in expertise on the subject of beads. Coming from almost the four corners of the world, the contributors include an Australian art teacher and an Australian designer; a Dutch researcher; an American artist and two American archaeologists, one based in Singapore; a Nigerian senior lecturer; a Thai independent scholar; a Chinese historian and archaeologist; and, more locally, a museum ethnology curator from Sarawak. The conference was heavy on contributions from the field of archaeology but also included input from artists and researchers which, strung together, make for interesting reading and a fine reference for further study. There are ten papers in all.

Pamela Annesley shares a meticulous, but comprehensive, description of the production of metal clay. This material originated in Japan in the early 1990s and developed as a precious-metal plasticine for industrial purposes before turning into a moldable artistic application around 1995. A variety of base metals are used (silver, bronze, and gold), and Annesley walks the reader through the process of making metal clay jewelry as well as reconstituting metal clay bits and dust created in the process. Color plates show fine examples of her creations.



Dora Jok of the Sarawak Museum discusses the changes in beaded hats of the many Sarawak indigenous ethnic groups using the museum collection as a reference. She provides a general introduction to how beads were traded into and throughout Borneo, and how they became cultural objects ranging from decoration, currency, and status markers to grave gifts and healing objects. Dating back to 1891, the hat collection is categorized based on style, tthe types of beads used, function, and the significance of designs and motifs. Religious conversions have led to departures from traditional motifs and their meanings although beading remains an integral part of Sarawakan material culture. There are excellent images of beaded headgear although the age of each item is not always indicated.

Floor Kaspers provides details about three historical bead manufacturing centers of Europe: Jablonec (Czech Republic), Lauscha (Germany), and Briare (France). Venice was far from being the only source. Kaspers outlines why these places were centers of production, how beads were manufactured at each, and their significant contributions to beadmaking technology, especially the introduction of tong molding (Jablonec) and the refinement of the Prosser process (Briare).

Eleanor Lux takes the reader to North America and clarifies the authenticity of the term "gourd stitch" used by Native Americans. She shares her artistic journey to this favorite stitch and provides fine examples of her artwork that utilize this stitch.

Margaret Meuller focuses on Ethiopian beads, past and present. She offers a thorough description of historical personal ornamentation within the context of Ethiopian history and the unique use of crosses, anklets, and *telsum* in various metals. The timeline of bead trade is reviewed with reference to archaeological evidence. There is an overview of the current use of beads and NGO projects in which Meuller is engaged. Unfortunately, we are not told where the present-day beads are coming from and if they are a continuation of early trade routes. (Note: Illustration plate numbers referred to in the text do not appear in the published plates.)

Dr. John Miksic gives an excellent archaeological overview of the history of bead trade in Southeast Asia. Interestingly, there were recycling projects in Java where beads from 5th/6th-century Egypt and Persia were formed into *Jatim* beads. Miksic first deals with China and its production and trade of glass beads in general, discussing the techniques and chemistry involved. He then focuses on Singapore as it was a centrally located trading port, mostly referencing sites at Fort Canning that have produced more evidence of trade and local recycling of glass beads.

Emmanuel Osakue writes of the origins of African beads: their function and value in cultural, socio-economic, and religious context. Also discussed is the trade of beads as objects of value by environmental, social, geographical, and governmental influences. He explains the various reasons for bead use in West Africa. Based on a study of the archaeology collection in various museums in Nigeria and Ghana, as well as interviews with bead artists and experts, Osakue suggests a format for bead analysis.

Bunchar PonPanich provides a good and well-illustrated explanation of the Maritime Silk Road from 4,000 years ago to around 1800. He analyzes the beads found at archaeological sites in north, west-central, and peninsular Thailand which provide evidence of maritime trade with India, China, Arabia, Greece, and Rome.

Dr. Marilee Wood looks at the colored glass beads of the 8th-9th centuries unearthed in Zanzibar and traces their origins and distribution throughout Africa, Egypt, Thailand, the Near East, and Scandinavia. Wood sets the stage for trade through the politics of Africa, China, and Scandinavia, and then takes us on a "Who done it?" excursion of who made the beads and who carried them to such faraway lands.

Yao An Jia traces the origin of glassmaking in China where evidence of its manufacture dates as far back as the Spring and Autumn period (770-476 BC). Yao also covers the entrance of imported eye beads in the 8th-5th centuries BC into China, from Central Asia to Xinjiang. This quickly led to imitations being made for the local market. Due to high demand, production increased and so did the development of styles, influenced by the ever-increasing trade occurring on the well-established Silk Road and Maritime Silk Route. This final paper offers a good overview of a variety of beads found in China dating back to 600 BC, their origins, and chemical composition.

On a personal note, these papers have opened my eyes to a global, yet regional, perspective of beads and their historical human-made connection through geography and time.

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INFORMATION FOR AUTHORS

Manuscripts intended for *Beads: Journal of the Society of Bead Researchers* should be sent to Karlis Karklins, SBR Editor, 1596 Devon Street, Ottawa, ON K1G 0S7, Canada, or e-mailed to karlis4444@gmail.com.

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