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# BEADS

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**Cover:** *Malay beadwork:* Valance (*lemudi*), Perak, early 20th century (Jabatan Muzium Malaysia).

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KARLIS KARKLINS, editor

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# HISTORICAL DESCRIPTIONS OF MALAY "BEADWORK"

**Hwei-Fen Cheah**

*Little has been published in English about Malay ceremonial textiles. This article relates early-20th-century beaded examples to historical descriptions and court literature to illustrate the link between beaded and bejeweled hangings.*

## INTRODUCTION

At the 1938 British Empire Exhibition in Glasgow, the Malayan Court, at 5,500 square feet, was the "largest of the Colonial displays" (*Straits Times* 1938:14). Assembled by the colonial government to demonstrate both the natural potential and enlightened governance of its colony, the exhibits included traditional Malay craft and native industry. Berlin-trained sculptor Tina Wentscher and her husband, painter Julius Wenstcher, were commissioned to produce a series of realistic, life-size dioramas demonstrating various aspects of Malay industry, including a woman and girl at a traditional handloom (*Singapore Free Press* 1938a:9).[1] To emphasize the international appeal of local handwork, the craft section featured mannequins wearing gowns made by European dressmakers of *songket*, a locally produced gold and silver brocade (*Singapore Free Press* 1938b:7). A *Singapore Free Press* (1938c:9) journalist was scathing about the dearth of native crafts submitted for display, lamenting that local crafts of silverwork, palm-leaf plaiting, and "Malayan bead work" were endangered.

Since the late 19th century, the colonial government of Malaya had made repeated efforts to stem what they considered to be the decline of traditional crafts due to the lack of local demand and competition from cheap mass-produced imports or local Chinese craftsmen.[2] Silversmithing, woodcarving, basketry, and weaving were consistently in the spotlight but beadwork hardly, if ever, rated a mention. What, then, was this local "Malayan bead work" mentioned in the news? Was it the beadwork of the Straits Chinese or indigenous groups in Sarawak, for whom beading formed conspicuous traditions? Or did it refer to lesser-known Malay beadwork?

This brief overview introduces some forms of Malay beadwork and relates them to historical descriptions to provide a context for understanding the craft. Here I concentrate on embroideries from the Malay peninsula that make use of imported glass seed beads. Beadwork from other parts of the Malay world, including the east coast of Sumatra, and textiles that incorporate other types of beads such as silver handkerchief weights known as *buah hara* (e.g., *see* Roth 1993: Figures 131-135), is beyond the scope of this review.

## MALAY BEADWORK

Glass beads were used in some traditional Malay rites. One of the measures to prevent a woman who dies during childbirth from becoming a *langsuir*, a malevolent flying spirit that takes the form of an owl, is to place glass beads in her mouth so that she cannot shriek (Skeat 2005:325). To prevent a stillborn child from morphing into a demonic *pontianak*, the same can be done with beads or "some simple equivalent" (Skeat 2005: 327). Their substitutability suggests that the beads themselves may not have held any particular symbolic meaning.

In a contemporary context, glass beads are embroidered on the *baju kurung*, a thigh length tunic, as a decorative feature. Traditionally, bead embroidery or *sulam manik* was most commonly seen on Malay ceremonial needlework. Several observations indicate that the latter was fairly common in the early 20th century. Colonial officer R.O. Winstedt (1925:73) remarked that mosquito curtain fringes, purses, watch pockets, and slippers were "covered with bead-work." Winstedt (1909:25) also noted that "pedestal trays are decorated on festivals with an embroidered and bead-work fringe, like the fringe on the marriage mosquito net." Referring specifically to craft instruction for Malay girls, Nicola Purdom (1931:177), the Lady Supervisor of Malay Girls' Schools, also observed a "revival of bead craft in Penang and Province Wellesley" in the 1930s. Earlier, schools (such as the Malay girls' school in Bandar established by the Raja Muda of Selangor in the late 19th century) taught beadwork, although it is difficult to determine what exactly this comprised (*Straits Times* 1896:3).[3]

Beading supplemented ornate gold thread couching, particularly *sulam tekat* which produced a raised embroidered surface with a cardboard underlay. Craft historian Siti Zainon Ismail (1994:144) explains that beads and sequins were placed to neaten the edges of couched gold threads and to fill the empty spaces in-between. It was typically found on pillow and mattress decorations, valances, vessel covers, ceremonial handkerchiefs, and shoulder cloths made for weddings and court ceremonial (Figure 1).

Governed by customary rules or *adat*, the use of ceremonial furnishings made a conspicuous visual statement. The couch or *pelamin* was often the centerpiece. Hung with mosquito curtains and valances (*kelambu* or *tirai kelambu*), it was piled high with pillows (*bantal*) of varying shapes and sizes to symbolize mountains (*gunong-gunongan*). The type and number of pillows was rigidly specified and indicated rank (Figure 2) (Skeat 2005:370-371).

We do not yet have enough information to pinpoint the relationship between beading and status although the teaching of beadwork at schools mentioned above suggests that it may have been carried out by women of varied social classes in the early 20th century. In any case, embroideries were certainly produced in royal compounds or by women associated with the courts. In the east-coast state of Kelantan, the family of Nik Rahimah Nik Idris, a septuagenarian embroiderer, was involved in embroidering for the palace; her grandfather, Dato Nik Jaafar, was *Datuk Istiadat* (master of ceremonies) to the Kelantan court in the early 20th century (Nik Rahimah 2007: pers. comm.).

The mother-in-law of embroidery expert Puan Azizah binti Adam used to do the beadwork on Perak gold thread embroideries (*tekat*). A midwife in the Perak palace, she learned the skill from her mother who was a governess in the palace (Puan Azizah 2007: pers. comm.). The wife of the Sultan of Perak was by far the most celebrated aristocratic needleworker. She crafted a set of gold-thread embroidery comprising a long mat, a seven-layer square mat, and two pillows with embroidered ends for the Prince and Princess of Wales when they visited Singapore in 1901 (Figure 3) (Wray 1989:146).

**Figure 1.** A pair of pillow faces (*muka bantal*) and a decorative panel for a long mat (*tikar*), Perak, early 20th century (collection of Enche Nadimah, Chemor, Perak).

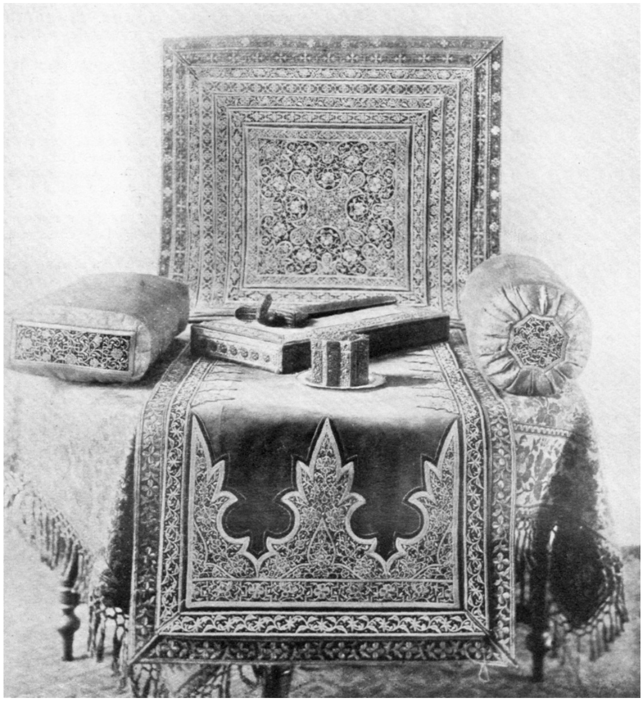

**Figure 2.** The dias for the wedding of Tengku Ngah Aishah Al-Hajjah binti Sultan Zainal Abidin III, Terengganu, early 20th century (courtesy of Tengku Ismail Tengku Su, Terengganu).

Perak state was particularly well known for *tekatan* gold thread embroidery which frequently incorporated glass beads. The ceremonial handkerchief (Plate IA) is typical of early-20th-century Perak embroidery. It is couched with a conventional Malay design: the two triangular forms from which stylized foliage arises allude to the *pucuk rebung* or young bamboo shoot. Color-lined tubular beads are stitched individually or in short rows onto velvet with cotton thread in a repeating diamond shape referred to as *potong wajik* (cut diamond), a pattern common in Malay brocades.[4]

Pillow faces of the type presented by the Sultan of Perak and his wife in 1901 are shown in Plates IB-ID and IIA. Here, tiny blocks of color are beaded in-between raised bands of gold thread. The uncomplicated beadwork sets off the meandering foliate and floral gold thread designs. As in these examples, beadwork was seldom, if ever, an integral part of the embroidered design. The range of colors was limited and the forms simple.

Pillows decorated with glass of various colors ("*bantal saraga iang ber-kacha-kan puspa ragam*" or in standard Malay, *bantal seraga yang berkacakan puspa ragam*) are referred to in Marsden's (1812:246) English-Malay dictionary. On the octagonal pillow face in Plate ID, a sunburst design is composed of appliques of small discs of yellow glass with a pliable metal substrate (possibly tin or a related alloy). Probably referring to such things, Winstedt (1925:72-73) attributes Malay embroidery of beads and "inlet discs of coloured glass" to Chinese influence.[5] The small circular and hexagonal mirrors liberally stitched across the surfaces of Chinese altar cloths and ceremonial banners were imported, sometimes on commission, for the migrant Chinese communities.

The localized Straits Chinese also made intricate embroidered and netted beadwork. A notable difference between Straits Chinese and Malay embroidered beadwork is the lack of shading and color gradation in the latter, the beads being used mainly as color fill rather than to construct the motif. The flat colors on Malay beading bear more visual affinity to ethnic beadwork from Sumatra. Both the Malays and Straits Chinese decorated their wedding bed valances with netted beadwork fringes. The term *bi*, by which the valance is still referred to in Melaka, suggests a Chinese or Straits Chinese association and further comparative research on their techniques could yield valuable insights on the interlinked histories of bead-using cultures in the region.

In Malay court literature, however, the valance was often referred to as *tirai* or *tirai kelambu*, and may indicate a relationship with Indian *toran* hangings (Maxwell 2003:77). In many Malay embroideries from the west coast of the peninsula, the glass applique stitches (Plate IIA) appear to be a variant of buttonhole stitch resembling Indian *shisha* embroidery, although this needs to be verified technically.

Some netted beadwork was produced, mainly for *lemudi* or *ombak ombak* (wave- or scallop-shaped borders), the valances that were hung at the front of a ceremonial dais (*pelamin*) or couch (*petarana*) (Figure 4). Valances from Perak are often constructed of a narrow embroidered strip to which is attached a row of pendant pipal leaf (*daun budi*) forms, sometimes of silver repoussé, the bead netting in-between creating a lace-like effect (*see* cover and Plate IIB). A closely spaced row of beaded tassels, about 10 cm long, usually hangs along the bottom edge (cf. Roth 1993: Figure 2).

Beyond the Indic association, royal chronicles suggest a historical association between beaded and bejeweled hangings. The *Misa Melayu*, a laudatory account of the Perak court written in the 18th century, describes a royal bathing pavilion decorated with "red paint, gilt and silver paper, white and yellow glass; and above, water issued from the mouths of four dragons with gilded scales, red eyes and jeweled crests. An embroidered bead fringe was hung round it all" (Raja Chulan 1919:217). Such descriptions were tropes of Malay court narratives or *hikayat*. Winstedt's translation quoted here aptly conveys the atmosphere intended, but a more precise translation of the relevant section reads: "the

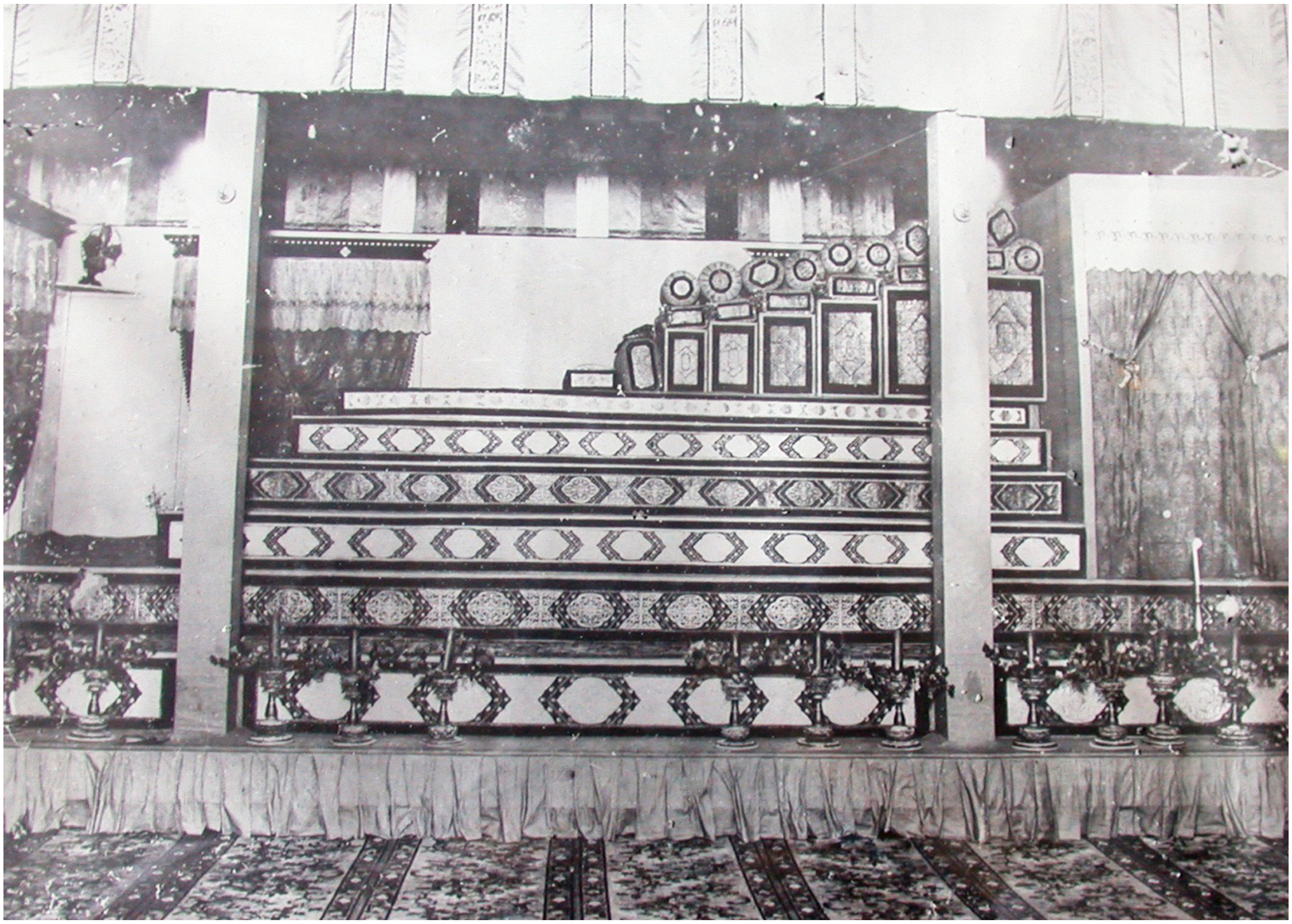

**Figure 3.** Embroideries from Perak presented to the Prince and Princess of Wales in 1901 (Wray 1908: Figure 15).

**Figure 4.** Valance (*lemudi*), Negri Sembilan or Malacca, early 20th century (Jabatan Muzium Malaysia).

bathing place was hung about with [a fringe of] pendants in the shape of pipal leaves with gems, sapphires, alabaster and gemstones of varied colours."[6] The correspondence in the form of the fringe described in the text with actual embroidered valances suggests an affiliation between gems and glass beads.

The image of bejeweled textiles is repeated in Malay texts. A search of the Malay Concordance Project (mcp.anu.edu.au) yields several interesting instances. The *Hikayat Hang Tuah* (9:34, 503:15; *see* Kassim Ahmad 1975), which recounts the exploits of a 15th-century hero of Melaka, describes clothing inlaid with gemstones ("*pakaian kerajaan bertatahkan ratna mutu maknikam* [sic]") and elephants caparisoned with gilded coverings encrusted with jewels ("pakaian gajah itu keemasan bertatahkan ratna mutu maknikam [sic]"). Similarly, the *Sejarah Melayu* (34:2; *see* A. Samad Ahmad 1979), a chronicle of the Melaka sultanate, refers to royal dress gilded and studded with precious stones ("*pakaian raja-raja yang keemasan, bertatahkan ratna mutu manikam*"). While we do not know exactly what these textiles were, we can be fairly certain from vintage embroideries (Plate IIC-IID) that such phrases were more than figures of speech.

Historian Anthony Milner (2008:61, 65) emphasizes the semiotic role of material culture in Malay courts. Descriptions of dress and furnishings in royal chronicles not only reinforced the sense that the "splendor of the royal courts... would have conveyed the capacity of a ruler to extend patronage." Textiles and clothing sustained rank and reputation; departures from the prescribed norms of dress and ceremony were closely observed and commented upon (Milner 2008:60-66). The tropes of jeweled textiles thus reflect a society in which ceremonial paraphernalia served as a nuanced language.

Malay terms reiterate the idea that beads served to imitate gems. *Manik*, the most common of these, is related to *manikam*, a Malay loan-word from Tamil which means gem or a precious stone (Jones 2007:193).[7] John Crawfurd's (1852:57, 96) English-Malay dictionary defines *jajat* as "glass beads" but also "to mimic, to imitate."[8] From afar, the embroidered glass and beads, enclosed by raised gold thread borders, would have resembled gem-studded cloth and inlaid gold repoussé jewellery that the Malay world prized (e.g., *see* Zubaidah 1999:16, 26-27).

If beadwork was secondary embellishment on Malay gold-thread embroideries, it certainly was not perfunctory or mere decoration. Netted or embroidered onto ceremonial decorations, glass beads alluded to the glittering images painted by royal texts, evoking heritage and links to a prestigious Malay history.

## ACKNOWLEDGEMENTS

My thanks to Raimy Ché-Ross in Canberra for helpful pointers and advice on Malay spelling, Enche Nadimah in Chemor, Perak, Tengku Ismail Tengku Su, Terengganu, Jabatan Muzium Malaysia, and Perak State Museum in Taiping for allowing me to examine their Malay embroideries during an Endeavour-Malaysia Research Fellowship funded by the Australian Government in 2006-2007. Thanks also to Valerie Hector for valuable comments.

## ENDNOTES

1. For a brief biography of Tina and Julius Wentscher, *see* Peers (2002).

2. For example, *see* the sections on craft in *Annual Report on Education in the Federated Malay States* (Federated Malay States 1901-1906).

3. Like many girls' schools of this period, it was small, with an enrolment of 36 girls between the ages 7 and 17.

4. A type of sweet, glutinous rice cake goes by the same name. Hence, the pattern is sometimes translated as "rice cake" design.

5. The scope of "Chinese" must be clarified, since the items produced for a Chinese market in Malaya reflected local tastes. On these items, the glass discs were probably attached later, as the stitches are visible on the reverse of the finished product, on the outside of the lining (Jeffrey Eng, Eng Tiang Huat Singapore 2013: pers. comm.).

6. The Malay text reads "*maka pada keliling balai itu digantungnya pula daun budi manikam nilam pualam puspa ragam berbagai-bagai jenis rupanya*" (Raja Chulan 1919: 87). Translation kindly provided by Ian Proudfoot, April 2008.

7. Crawfurd (1852:96) relates *manik* to Sanskrit but *manikam* to Tamil.

8. Unlike *manik*, however, *jajat* does not surface in a search of a selection of historical texts in the Malay Concordance Project (mcp.anu.edu.au) and does not appear to be commonly used. *Mutisalah*, a term used in parts of Indonesia for heirloom beads, is also derived from the compound word that literally means "false pearl" (Francis 2002:251).

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# GLASS BEADS FROM JAR BURIALS OF THE 15TH-17TH CENTURIES IN THE CARDAMOM MOUNTAINS OF CAMBODIA

**Alison Carter and Nancy Beavan**

*A variety of glass beads were encountered in jar burials dating to the 15th-17th centuries found on rock ledges in remote portions of the Cardamom Mountains in southern Cambodia. These burials represent a mortuary ritual in which defleshed bones, often from multiple individuals, were deposited in large ceramic jars predominantly from Thai kilns. Despite the isolated location, the jars and glass beads suggest that the people buried in the jars were active participants in exchange networks. The identification of different compositional types of glass beads can be related to possible trade networks with the lowlands and maritime Southeast Asia. Using ethnographic analogies with other upland communities in Southeast Asia, the authors also propose that the placement of beads in the jar burials may have been an important part of the mortuary ritual of the Cardamom Mountain people.*

## INTRODUCTION

During the 15-17th centuries, a group of people who lived in the upland region of southern Cambodia practiced a burial ritual using ceramic jars and hand-hewn wooden coffins. Eleven of these burial sites, scattered throughout the eastern ranges of the Cardamom Mountains, have been identified as part of the Living in the Shadow of Angkor Project (Beavan et al. 2012a). The mortuary ritual, practiced by an as yet unidentified highland people of the Cardamom Mountains, appears to be distinct from the Hindu-Buddhist cremation practices of the lowland states of the period.[1] In the Cardamom highlander's mortuary practice, the defleshed bones of one or more individuals were placed in 52-cm-high ceramic jars (Figure 1). The jars predominantly originated from Thai kiln sources, specifically the Mae Nam Noi and Singburi kilns along the Chao Phraya river system (Beavan et al. 2012b), which supplied maritime trade cargoes. A second, though less common, type of burial receptacle were hand-hewn wooden coffins made from locally harvested logs (Beavan et al. 2012b). These two types of burial containers were then placed in groups on natural rock ledges (Figure 2; Plate IIIA). Associated mortuary goods were minimal, but many jars contained glass beads, as well as metal rings and earrings, and rarely, metal knives (Figure 3). The consistency in the use of Thai ceramic jars and the types of burial goods found over the 11 known sites suggest that this previously unrecorded burial ritual was a shared cultural practice of at least one of the ethnic minorities which may have inhabited the upland regions of western Cambodia during this period (Martin 1992, 1997). It is not yet possible, however, to connect this burial practice with the extant regional ethnic groups (e.g., Chong, Pear, Samre, or Sao'ch).

**Figure 1.** Burial with defleshed bones from the Phnom Khnang Peung (KPP) site is carefully moved in a basket (all photos by Alison Carter).

This article focuses specifically on the glass beads found at three of the Cardamom Mountain jar burial (CMJB) sites: Phnom Khnang Peung, Okei, and Phnom Pel (Figure 4). To begin, the glass beads are contextualized through a discussion of the upland/lowland exchange systems during the mid-2nd

**Figure 2.** The Phnom Khnang Peung jar burial site.

**Figure 3.** An iron knife (top) and metal rings (bottom) found in jar burials at the Phnom Khnang Peung site.

millennium. A synopsis of chemical analyses of the glass beads is then provided which sheds light on the exchange networks in which the CMJB peoples were participating. The article concludes with a discussion of the use of beads as part of a mortuary ritual, drawing on ethnographic analogies with other upland communities in Southeast Asia. This research expands on a relatively understudied period of bead exchange in Southeast Asia and provides additional information on the trade and consumption of beads by an upland culture in mainland Southeast Asia.

## BEADS AND TRADE IN CAMBODIA DURING THE 15TH-17TH CENTURIES

The absolute dating of the CMJB sites by radiocarbon analyses of human bone and coffin wood has placed the ritual practice from cal 1395 to 1650 (Beavan et al. 2012a). The period in which the CMJB people lived was a time of increasing and intensifying trade in Cambodia. This period was also one of transformation in which the socio-

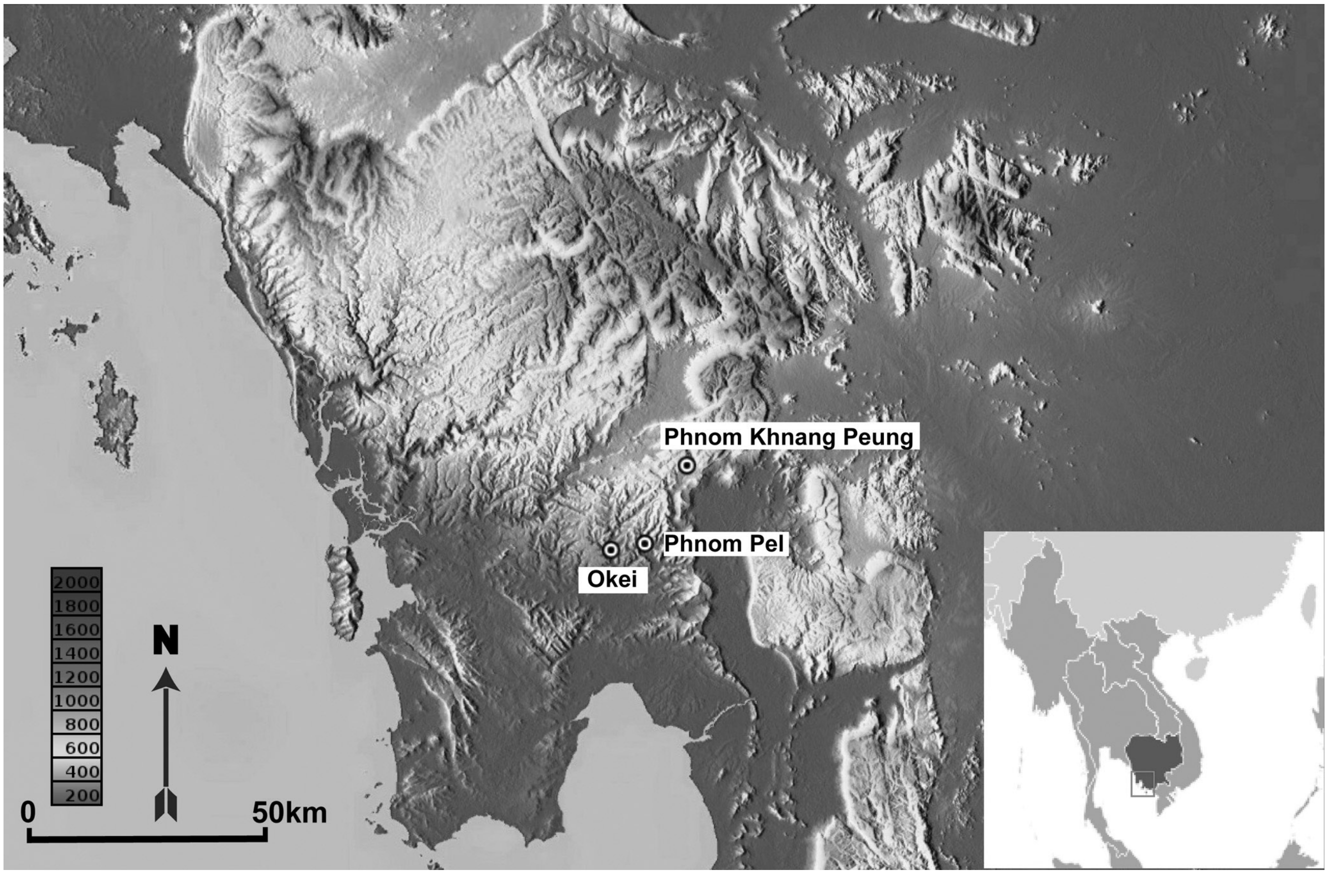


**Figure 4.** The Cardamom Mountain region of southern Cambodia showing the location of the jar burial sites.

political center of the Angkorian Empire, previously based near modern Siem Reap, moved further south to the area near the modern capital of Phnom Penh. Several historians have noted that this move to the Mekong River system was important for taking advantage of increasing maritime trade with China (Chandler 2008; Vickery 1977). Historian David Chandler (2008:94) has noted that Phnom Penh's strategic location at the convergence of the Tonle Sap, Bassac, and Mekong rivers allowed for control of trade from northern regions such as Laos and the Mekong Delta in the south. The presence of Thai-sourced ceramics at upland and lowland sites also suggests that coastal maritime routes along the Gulf of Thailand were becoming increasingly important.

Forest products from the upland regions were one important component of expanding trade. Products sourced from the Cardamom Mountains, including areca leaves, hardwood, and tree resins, were traded with lowland populations (Zucker 2013:24). The 13th-century Chinese emissary to Angkor, Zhou Daguan, describes desirable forest products such as exotic trees, animals, and animal products such as ivory, kingfisher feathers, and rhinoceros horn, as well as cardamom spice and resin (Daguan 2007:69-70). Sixteenth-century Spanish and Portuguese accounts also describe a variety of exotic trees, tree products, and ivory in circulation (Groslier 2006:116-117). The highland people themselves were also perceived as a commodity by lowland communities which sought cheap slave labor. In the 13th century, Zhou Daguan (2007:58-59) describes people from the mountains working as slaves in Angkorian homes.

A small number of historical documents specifically describe the trade of beads into Cambodia. Chinese texts from the mid-14th century describe sending yellow and red beads to Cambodia (Rockhill 1915:107). A later Chinese account of travels to Southeast Asia dated to 1436 also describes trading beads to Cambodia (Rockhill 1915:108). A 17th-century Dutch trader, Van Wuysthof, noted that hill tribe communities would exchange forest products with both the Chinese merchants and the Cambodian court in exchange for various metals, bronze objects such as gongs and drums, Chinese ceramic jars, and glass beads (Richter 2000:116-117). It is likely then that the CMJB culture was involved in the trade of forest products with lowland groups and may have obtained glass beads as part of this economic transaction. Morphological and geochemical analyses of glass beads from the jars offer possible insight on the previously unknown trade relationships these upland peoples had developed.

## BEADS FROM THE JAR BURIALS

As noted above, this study focuses on the beads recovered from three CMJB sites (Figure 4). Phnom Khnang Peung (KPP) is the largest of the jar burial sites thus far discovered, consisting of a single rock ledge over 3 m in length, with 40 intact jar burials. Most of the burials were placed in Mae Nam Noi/Singburi maritime-trade ceramic jars (Figure 5; Plate IIIB), with the exception of two burials that used large jars typical of production in Angkorian kilns. These large Angkorian jars may have been produced at the Buriram kilns, situated in what is now northeastern Thailand at the Cambodian border, and associated with ceramic production within the Angkor kingdom during the 11th-13th centuries (Groslier 1981). It is, however, also possible that the jars were manufactured at the recently discovered Torp Chey kiln site located near an ancient highway east of Angkor, which may have been producing ceramics from the 12th to early 15th centuries (Ea 2013) and supplying jars to the central highlands of eastern Cambodia and central Vietnam (Cort and Lefferts 2013; Hendrickson 2008). One Angkorian ceramic jar appears in every one of the 11 known Cardamom jar burial sites, an oddity among the massed Mae Nam Noi/Singburi wares. Prior to work at the KPP site, no human remains had ever been discovered in these types of vessels; at KPP three Angkorian jars were found, two of which contained human remains and grave goods, including glass beads.

A total of 1,332 glass beads were found in 25 of the 40 jar burials at KPP (Figure 6), and 82 glass beads were found in the sediment around the jars. The beads came in a variety of colors, with black, yellow, and blue drawn beads and coiled opaque blue beads predominating (Table 1). The remaining beads considered in this study are from the Okei and Phnom Pel sites. The Okei site consisted of two small ledges, approximately 30 m apart, holding several Mae Nam Noi jars and a single Angkorian jar (Beavan et al. 2012a). Although no human bone was found at this site, 298 glass

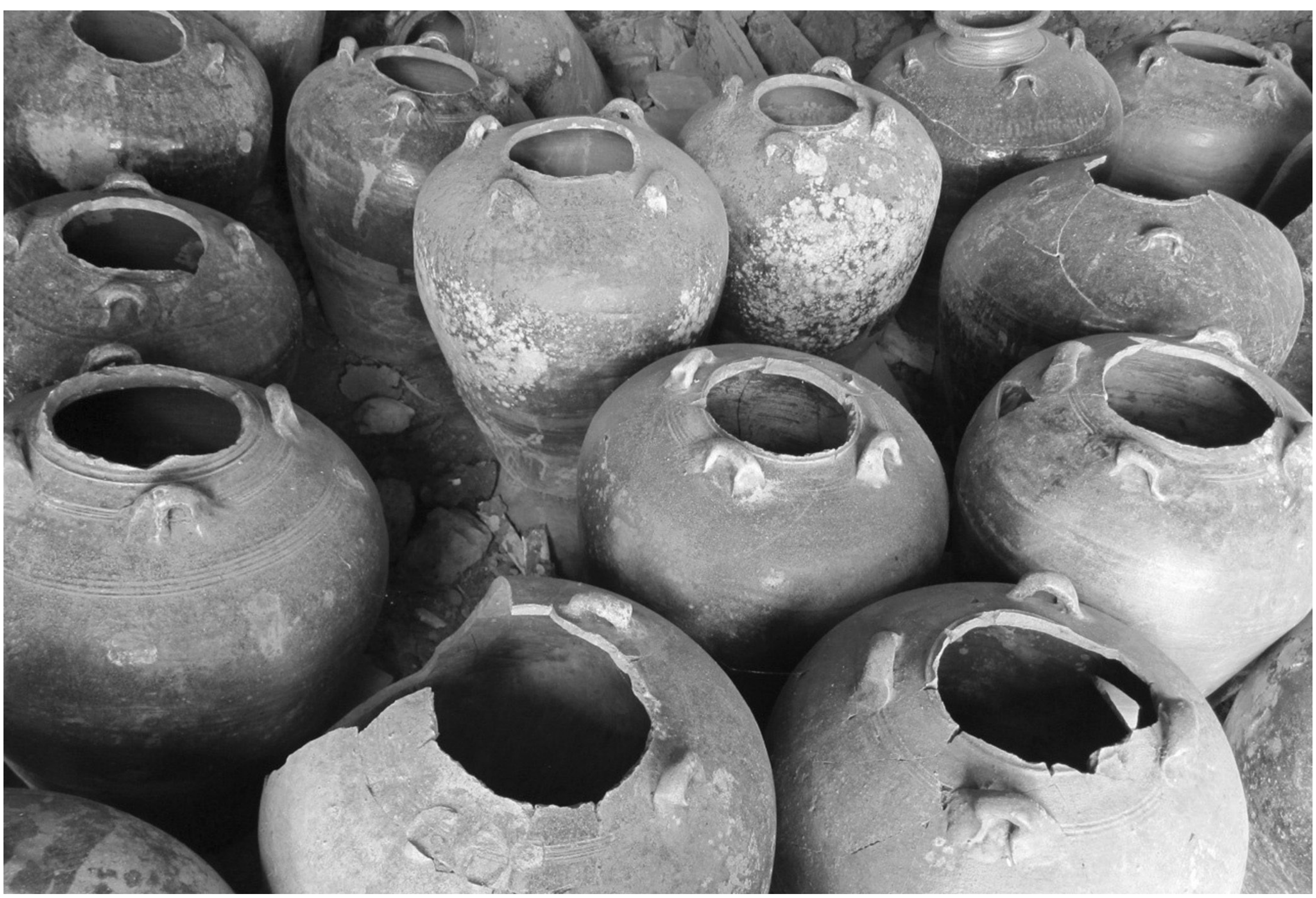

**Figure 5.** Burial jars at the Phnom Khnang Peung site.

**Figure 6.** Glass beads in the burial jars were often intermixed with the bones and the detritus that had accumulated over hundreds of years.

beads were collected in the sediments near the Angkorian jar and are believed to be grave goods. The Phnom Pel site contained seven jar burials on two adjoining ledges and a third ledge that contained 12 wooden coffins. Seven glass beads from one of these coffins were examined.

The glass beads from the CMJB sites can be divided into two groups based on the method of manufacture. The first group is comprised of monochrome coiled glass beads where glass was wound around a wire or rod (*see* Plate IVA, b). This bead type is strongly associated with a Chinese manufacturing tradition (Francis 2002). The majority of the coiled beads are opaque light blue or opaque white, with a smaller number in a translucent dark purple (Plate IIIC, a-b). A single coiled reddish-orange bead was identified at Phnom Pel (Plate IIIC, d). In Indonesia and other parts of island Southeast Asia this particular type of reddish-orange bead is known as *mutiraja* and is considered a valuable heirloom by the local population (Francis 2002:186-187). A polychrome bead found at the KPP site has a wavy red design applied to a blue glass base (Plate IIIC, c). This bead is also associated with Chinese glass bead production, most likely for export (Francis 2002:78-80). A single coiled blue bead was found at Phnom Pel; the Okei site contained no coiled beads.

A second group consists of small, oblate, monochromatic beads made from drawn glass tubing which can be clearly identified by the linear striations that parallel the perforation (*see* Plate IVA, a). These beads are typically referred to as Indo-Pacific beads and were widely traded across the ancient world during the 1st and 2nd millennium (Francis 1990, 2002). The drawn beads at KPP come in a variety of colors, including black, yellow, green, dark purple, and blue (Plates IIID and IVB). Yellow and black drawn beads are the most common type found at Okei.

## COMPOSITIONAL ANALYSIS

A selection of 74 beads from the three sites mentioned above were analyzed using laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS) in order to determine the compositions and glass recipes used to produce the beads. This analysis identified four compositional groups that appear to be related to different production centers and likely different exchange networks (a detailed discussion of the compositions is discussed in Carter et al. 2015).

Table 2 presents estimates of the total number of beads in each compositional group based on visual similarities between analyzed and unanalyzed beads within the same context. This was difficult in certain situations as black, yellow, and green drawn beads could look similar to one another but have been made using different glass recipes. As it was not possible to analyze all of the beads found with the burials, an assumption was made that if a bead or beads from a group of similar or identical looking beads within a specific context were identified as belonging to a particular glass compositional type, then the other beads in that group likely belonged to the same compositional type.

The largest quantity of beads found at the KPP site belong to the high-alumina mineral soda (m-Na-Al) glass category and specifically the m-Na-Al 2 sub-type which contains high uranium concentrations, and lower levels of barium, zirconium, and strontium (Dussubieux et al. 2010). These beads consist of small, drawn, monochromatic oblates that come in light and dark blues, opaque black, opaque yellow, opaque red, and green (Plate IIID). These beads are similar in composition to m-Na-Al Type 2 beads from the trading port of Chaul, located about 50 km south of Mumbai on the west coast of India, in contexts dating to the 9th-19th centuries (Dussubieux et al. 2010). Similar beads have also been found on the east coast of Africa (Dussubieux et al. 2008). Dussubieux et al. (2010) have suggested these beads may have been manufactured at a site near Chaul, for use in the Indian Ocean exchange with Africa.

Seven yellow glass beads, found at both the KPP and Okei sites, belong to a different high-alumina mineral

**Table 1. The Distribution of Drawn and Coiled Beads by Color Within the KPP Jars and Okei and Phnom Pel Sites.**

| Context | Drawn Black | Drawn Yellow | Drawn Red | Drawn Green | Drawn Blue | Drawn Dark Blue | Drawn Brown-purple | Drawn Amber |
|---|---|---|---|---|---|---|---|---|
| KPP Section B1 | 12 | 5 | 2 | | 19 | | | |
| Jar 2 | | | | | 8 | | | |
| Between Jar 5 and Jar 6 | | | | | | | | |
| Jar 7 | 2 | 16 | | | 17 | | | |
| Near Jar 8 | | 1 | | | | | | |
| Jar 9 | | | | | | | | |
| Jar 10 | | | | | 1 | | | |
| Jar 11 | 34 | | | | | | | |
| Jar 12 | | | | | | | | |
| Jar 14 | 1 | 1 | | | 3 | | | |
| Jar 17 | 15 | 105 | | 18 | 3 | 193 | | |
| Jar 19 | | | | | 1 | | | |
| Jar 21 | 20 | | | 1 | | | | |
| Jar 22 | | | | 1 | 1 | | | |
| Jar 25 | 150 | 1 | | | | 8 | | |
| Jar 26 | 3 | | | | | 1 | | |
| Jar 27 | 1 | | | | | | | |
| Jar 28 | 2 | | | | 1 | | | |
| Jar 29 | | | | | 1 | | | |
| Jar 30 | 2 | 6 | | | | | 6 | |
| Jar 31 | 1 | | | 4 | | | | |
| Jar 32 | | 74 | | | | 1 | | |
| Jar 33 | | 1 | | | | | | |
| Jar 34 | 28 | 2 | | 23 | | 1 | | 1 |
| Jar 35 | 1 | 11 | | 3 | 1 | 2 | | |
| Jar 36 | 10 | 3 | | 2 | 16 | 1 | | |
| Soil around Jar 36 | 10 | 1 | 1 | 3 | 3 | 2 | | |
| Jar 37 | 25 | 1 | | | 15 | | | |
| Jar 38 | | 5 | 3 | | | | | |
| Phnom Pel | 2 | | | 2 | | | | |
| Okei | 144 | 152 | | 1 | | | | |
| **Totals** | **463** | **385** | **6** | **58** | **90** | **209** | **6** | **1** |

**Table 1. Continued**

| Context | Coiled Blue | Coiled White | Coiled Purple-black | Coiled Reddish-orange | Coiled Unknown | Poly-Chrome | Yellow Unknown | Total Drawn/ Coiled |
|---|---|---|---|---|---|---|---|---|
| KPP Section B1 | 9 | 1 | | | | | | **48** |
| Jar 2 | 17 | | | | | 1 | | **26** |
| Between Jar 5 and Jar 6 | 5 | | | | | | | **5** |
| Jar 7 | | | | | | | | **35** |
| Near Jar 8 | 7 | | 1 | | | | | **9** |
| Jar 9 | 1 | | | | | | | **1** |
| Jar 10 | | | | | | | | **1** |
| Jar 11 | | | | | | | | **34** |
| Jar 12 | 139 | | 51 | | 13 | | | **203** |
| Jar 14 | | | | | | | | **5** |
| Jar 17 | 4 | | | | | | | **338** |
| Jar 19 | 1 | | | | | | | **2** |
| Jar 21 | 122 | | | | | | | **143** |
| Jar 22 | | 3 | | | | | | **5** |
| Jar 25 | 3 | | | | | | | **162** |
| Jar 26 | | 11 | | | | | | **15** |
| Jar 27 | | | | | | | | **1** |
| Jar 28 | 4 | 1 | | | | | | **8** |
| Jar 29 | 58 | | | | | | | **59** |
| Jar 30 | | | | | | | | **14** |
| Jar 31 | 8 | 1 | | | | | | **14** |
| Jar 32 | | | | | | | | **75** |
| Jar 33 | | | | | | | | **1** |
| Jar 34 | 9 | 1 | | | | | | **65** |
| Jar 35 | | | | | | | | **18** |
| Jar 36 | 19 | | | | 1 | | 6 | **58** |
| Soil around Jar 36 | | | | | | | | **20** |
| Jar 37 | | | | | | | | **41** |
| Jar 38 | | | | | | | | **8** |
| Phnom Pel | 1 | | | 1 | 1 | | | **7** |
| Okei | | | | | | | 1 | **298** |
| **Totals** | **407** | **18** | **52** | **1** | **15** | **1** | **7** | **1,719** |

**Table 2. Estimated Quantities of Each Glass Compositional Type at the Three CMJB Sites.**

| Context | Coiled lead-potash glass | Newly found high-alumina glass | m-Na-Al Type 2 | m-Na-Al Type 4 | Unknown | Total |
|---|---|---|---|---|---|---|
| Jar 2 | 18 | | 8 | | | **26** |
| Jar 7 | | 16 | 17 | | 2 | **35** |
| Jar 9 | 1 | | | | | **1** |
| Jar 10 | | | 1 | | | **1** |
| Jar 11 | | 34 | | | | **34** |
| Jar 12 | 190 | | | | 13 | **203** |
| Jar 14 | | 1 | 3 | | 1 | **5** |
| Jar 17 | 4 | 138 | 196 | | | **338** |
| Jar 19 | 1 | | 1 | | | **2** |
| Jar 21 | 122 | | 21 | | | **143** |
| Jar 22 | 3 | | 2 | | | **5** |
| Jar 25 | 3 | | 158 | | 1 | **162** |
| Jar 26 | 11 | | 4 | | | **15** |
| Jar 27 | | | | | 1 | **1** |
| Jar 28 | 5 | | 1 | | 2 | **8** |
| Jar 29 | 58 | | 1 | | | **59** |
| Jar 30 | | 8 | | | 6 | **14** |
| Jar 31 | 9 | | 4 | | 1 | **14** |
| Jar 32 | | 74 | 1 | | | **75** |
| Jar 33 | | 1 | | | | **1** |
| Jar 34 | 10 | | 55 | | | **65** |
| Jar 35 | | 8 | 9 | | 1 | **18** |
| Jar 36 | 19 | | 32 | 6 | 1 | **58** |
| Jar 37 | | | 40 | | 1 | **41** |
| Jar 38 | | | 8 | | | **8** |
| KPP beads around the jars | 23 | | 27 | | 32 | **82** |
| Okei | 1 | 296 | | 1 | | **298** |
| Phnom Pel | 2 | | | 5 | | **7** |
| **Totals** | **480** | **576** | **589** | **12** | **62** | **1,719** |

soda glass sub-type: m-Na-Al Type 4. This glass has been identified at sites in Sumatra (12th-16th centuries) (Dussubieux 2009), on the Wrecked Junk of Brunei (15th-16th centuries) (Gratuze 2001), and the site of Muasya, Kenya (17th-19th centuries) (Dussubieux et al. 2008, 2010). The beads are drawn, but differ in appearance from the other high-alumina drawn beads found at the CMJB sites. They are irregularly shaped oblates ca. 3-5.5 mm in size, with large uneven holes (Plate IVB, c). The skewed striations in the glass (Plate IVB, b) appear to be related to the twisting or sagging of the glass during the manufacturing process (K. Karklins 2014: pers. comm.).

The second most common bead type found at the CMJB sites is of lead-potash-silicate glass. The lead-potash compositional group includes all the coiled glass beads, as well as the polychrome bead found at KPP. The lead-potash glass recipe was used in China beginning in the 6th century through the Ming Dynasty (Brill et al. 1991; Fuxi 2009:28; Gratuze 2001:10). These beads appear to have been produced for export to Southeast Asia (Francis 2002:76-78) and similar glass beads and artifacts have been found on the Wrecked Junk of Brunei (Gratuze 2001), the site of Ban Non Wat in Northeast Thailand (Carter and Lankton 2012), and at the post-Angkorian site of Krang Kor, near Longvek in central Cambodia (Tamura 2013).

Francis (2002:76-78) describes two stages of Chinese coiled beads that were widely traded to Southeast Asia. During the 12th century, small (3 mm or less in diameter) coiled beads predominated, but appear to have been replaced around the 16th century by a different and larger type of coiled bead, often with multiple coils (Francis 2002:82). It is these later "multiple wound monochrome beads," as described by Francis (2002:82), which were found in the Cardamom Mountains and elsewhere and determined to be made of lead-potash glass. The presence of this bead type at jar burial sites in the Cardamom Mountains, as well as at lowland and shipwreck sites, testifies to their widespread trade across Southeast Asia during the mid-2nd millennium.

An earlier study of coiled beads in Southeast Asia found that a single color of coiled beads often dominated a site, which was perhaps related to manufacturing centers producing a single color of bead for a certain period of time or local demand for a specific color (Francis 2002:77-78). Opaque light blue coiled beads were the most common at KPP (n=406), with smaller numbers of opaque white (n=18) and dark purple/black (n=53) beads. In this sense, KPP shares a similarity with sites in Brunei that were also dominated by coiled blue beads (Francis 2002:77-78).

The final bead type found at the CMJB sites is composed of a previously unidentified high-alumina glass, with higher concentrations of magnesia. These beads are also monochrome oblates similar in appearance to the m-Na-Al Type 2 beads (Plate IVC). This compositional type is represented primarily by opaque black beads, translucent yellow beads with a somewhat greasy appearance, and smaller quantities of green and translucent purple beads. As beads made from this glass type have not yet been identified elsewhere, it is hypothesized that they may have been manufactured locally in Southeast Asia. Yet, an examination of glass artifacts from contemporary sites is needed to determine how widely traded these beads were, and if their manufacturing location can be identified (for more discussion on this glass type *see* Carter et al. 2015).

The four different glass types identified through compositional analysis are not evenly distributed between sites and within the jars at KPP (Table 2). Additionally, there do not appear to be strong patterns in the distribution of different colors of beads within the KPP jars. Because the jars with beads contain the unarticulated bones of multiple individuals, it is difficult to determine if specific beads were associated with a single individual or had any meaning related to status or identity. One notable observation is the dichotomy of jars at KPP with coiled lead-potash glass beads and those with the newly identified high-alumina glass. With the exception of Jar 17, no jars contain both the high-alumina glass and the Chinese coiled lead-potash beads. This pattern is repeated at Okei which yielded no coiled lead-potash beads.

Absolute dating of skeletal material in the jars has produced a corpus of radiocarbon dates that relate mainly to the 15th century. A Baysian statistical treatment of the radiocarbon results currently suggests that the majority of the burials were deposited within a 15-45 year time span (Beavan et al. 2015). Due to this short but intensive period of site use, it is not clear if the differences between these two bead types and their distribution in the KPP jars and at Okei are temporal or cultural. For the time being, this difference is unexplained; it is hoped that future isotopic or bioarchaeological data may help address this problem.

## BEADS AND MORTUARY RITUAL

The meaning the recovered beads held for the CMJB peoples remains unknown, but analogies with other Southeast Asian upland communities provide a starting point for considering this question. Ethnographic and ethnohistoric accounts of upland communities in mainland and island Southeast Asia have detailed the importance of beads as heirlooms (e.g., Adhyatman and Arifin 1993; Francis 1989, 1992; Munan 2005). In these communities, beads serve as markers of status and identity, hold important ritual or magical power, and are important wealth objects (Francis 1989, 1992; Munan 2005). As Francis (1992:13) notes, beads and other objects become heirlooms "according to spoken or unspoken rules in each society which has them." The process for passing down beads from generation to generation also varies greatly between different communities (Francis 1989, 1992). Some heirloom beads seen in Southeast Asian communities today, or in the recent past, date back several hundred to a thousand years (Francis 1992). Chinese coil beads are especially popular among several upland communities including the Akha of Thailand, the Paiwan of Taiwan, and the peoples of the lesser Sundas, as well as Indonesia (including the Toraja of

Sulawesi) and Borneo in general (Adhyatman and Arifin 1993; Francis 1989, 1992; Munan 2005). It is possible that beads found in some of these communities today could have been traded through the same networks as the beads found at the KPP site.

By definition, heirloom beads are not removed from circulation and deposited in burials, but are instead passed on to other family members, though beads often play important roles in mortuary ritual. Among the Kalinga of the Philippines, beads are usually placed on the corpse, but are then removed before burial. A few beads may, however, be placed with the body in the grave (Francis 1992:6). A similar practice is carried out among the Kelabit of Borneo, where a few beads may be buried with corpses, with the rest becoming heirlooms (Francis 1992:9; Munan 2001:30). Munan (2005:6) relates that among the Kayan, beads are used by the dead in the afterlife and that "a person buried without beads would be blind, lame, and deaf in the underworld." The Melanau people also place beads with a corpse, wrapping them around the jaw to keep the mouth in position. During burial, the beads may be placed in the coffin to be used in the afterlife, placed in the coffin temporarily and then later removed, or left on top of the coffin. This latter practice "refers to the time when the Melanau deposited their dead above ground, on wooden scaffolding or in tall carved pillars depending on the deceased's social status" (Munan 2005:63). The Toraja of Sulawesi traditionally buried their dead in caves and cliffs, "sometimes with full-sized dressed effigies in front to guard the valuables buried with the deceased" (Francis 1992:11). It is not clear if beads were included as grave goods, though Francis (1992:11) notes that glass beads, including Chinese coil beads, are among those kept in heirloom bead collections today. On the coast of Borneo, the mortuary ritual appears to have changed over time. Beads were initially buried with their owners until the 10th century when they were removed from graves and kept in circulation as heirlooms (Francis 1989:30, 1992:10).

Few glass beads have been found at lowland sites contemporary with KPP. One important exception is the site of Krang Kor located near the post-Angkorian capital of Longvek, Cambodia. Blue and yellow coiled lead-potash-glass beads similar to those at KPP were found in a burial at the site (Tamura 2013). Beads of other glass types, like those identified at KPP, were not found. It is possible that glass beads were widely circulated within lowland communities as seen in upland groups, though a lack of archaeological research on sites dating to the 15th-17th centuries makes this assessment difficult.

The origins of the CMJB mortuary ritual are obscure. Burials in jars, usually underground, were common during the prehistoric and early historic periods of mainland Southeast Asia, (e.g., Halcrow et al. 2008; Higham 2014:116, 211-212; Indrawooth 1997; Reinecke 2009) over a thousand years earlier than the appearance of jar burials in the Cardamom Mountains. There is no record of exposed jar burials as practiced in the Cardamom highlands during the historic periods in Cambodia, but a number of cultures in island and mainland Southeast Asia have practiced comparable mortuary rituals, exposed jar burials in particular (Beavan et al. 2012a:3). For example, several ethnic groups in Borneo practice elaborate mortuary rituals involving a two-step process in which defleshed or cremated skeletal remains are placed in an above-ground or raised mortuary structure inside a coffin or jar (Winzeler 2004:40-41). The exposed stoneware jar burials in Borneo's Kelabit highlands and in Berawan may date to about the 14th-16th centuries (Harrisson 1962, 1974; Metcalf and Huntington 1991:74-83). The Lawa hill people of Tak Province between Thailand and Burma also practiced exposed jar burials between the 14th and 16th centuries, as inferred from associated Chinese blue-and-white ware and Burmese and Sawankaloke ware (Pitiphat 1992:11-15; Shaw 1985:93-102, 1986:10-13), but the human remains in these vessels were cremated. While the Lawa example provides a regional and chronological possibility for cultural transmission of the Cardamom exposed jar burial practice and use of assorted exotic ceramics, the majority of other jar burial practices have significant geographical separation from the Cardamom highlands (e.g., those of island Southeast Asia).

Perhaps the most tantalizing connection of the jar burials to a living population is a mortuary ritual involving the construction of funerary towers (*phnom yong khmaoch*) as practiced by certain communities in the Cardamom Mountains today and in the recent past. Zucker (2013:89-90) describes two types of funerary towers. The first and more common type is a tall, temporary, wooden structure under which a body is cremated. These small towers are houses for the spirit of the deceased, which eventually decay and collapse over time. The second type is a more permanent tower in which the cremated remains are placed. This practice of elevating the remains, physically and/or spiritually, may be related somewhat to the practice of the CMJB people of placing jars on mountain rock ledges. Villagers in one area also described to Zucker (2014: pers. comm.) how their ancestors would place the ashes of their relatives in bowls or ceramic jars and place them under a boulder located near their old village off an oxcart trail. Although the relationship between the more recent *phnom yong khmaoch* mortuary practices and the jar burials of the 15th-17th centuries is not clear, they are notable for being distinct from the traditional Buddhist funerary practices of lowland Cambodia.

The cultural symbolism of the glass beads and their role in mortuary ritual in the Cardamom Mountains is still under debate. Although it is currently impossible to draw specific conclusions regarding the use and deposition of beads among the people who practiced the Cardamom jar burial ritual, similarities with other upland communities in Southeast Asia can provide hypotheses to be tested against additional data to be collected from ongoing work in the Living in the Shadow of Angkor Project.

## CONCLUSION

Despite the isolated mountain locus of the Cardamom Mountain sites and a likely cultural separation from the Angkorian polity (Beavan et al. 2012a), the evidence from the glass beads suggests that the people buried in the jars were integrated into wide-reaching bead exchange networks that spanned lower mainland and island Southeast Asia, perhaps extending across the Indian Ocean. Ethnographic research suggests that upland communities in this area have long had a westward orientation towards the sea, along routes traveled by elephant and oxcart (Zucker 2013:24-26), while historic documents note connections to the lowlands to the east. The observations drawn from the large dataset at Phnom Khnang Peung, including the diversity in bead types and especially the presence of certain bead types in specific burial jars, suggest the CMJB people were likely participating in multiple trade networks.

The antiquity of certain types of heirloom beads present in Southeast Asia today suggests that during the mid-2nd millennium, beads were desirable and valued by upland communities across Southeast Asia (Francis 1992:14). The use of beads in the CMJB culture sites may represent a similar valuing of beads as seen in other upland communities in mainland and island Southeast Asia. While these similarities may hint at the possibility that regional cultural practices influenced the CMJB peoples, extreme caution must be taken with this observation due to unreasonable geographic distance or chronology. Nevertheless, the Cardamom highlanders do appear to have had more cultural similarities with upland mortuary practices than with their lowland neighbors in Cambodia.

Ethnic minorities in Southeast Asia have been largely overlooked in both the historical and archaeological sources. Yet, the importance of forest products during the mid-2nd millennium likely means they were key participants in the increasingly globalized exchange networks of this period. Beads from the CMJB sites are material indicators of the exchange networks in which these upland people were likely playing important roles. Although the exact nature of exchange is still unclear, the different glass beads found at CMJB sites link these upland communities with lowland communities and broader Chinese trade networks (coiled lead-potash glass beads), possible Indian Ocean exchange networks (m-Na-Al Type 2 beads), island and maritime Southeast Asia (coiled lead-potash beads and m-Na-Al Type 4 beads), and perhaps more localized Southeast Asian exchange (the newly identified high-alumina glass). While there are still many remaining questions regarding the CMJB peoples and other upland and lowland communities, as well as their ancestors and descendants, the findings reported here provide an important first step in situating these upland communities in the regional exchange networks of this seminal period of mainland Southeast Asian history.

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## ENDNOTE

1. It should be noted that Angkorian and post-Angkorian mortuary ritual is still poorly understood and was perhaps quite variable. The late 13th-century Chinese ambassador to Angkor, Zhou Daguan (2007:66-67), mentions several different burial rites practiced by the Angkorian Khmers. Recently, a post-Angkorian coffin burial was excavated at the site of Krang Kor, but no skeletal material was preserved (NARA 2013).

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# SHELL AND GLASS BEADS FROM THE TOMBS OF KINDOKI, MBANZA NSUNDI, LOWER CONGO

**Charlotte Verhaeghe, Bernard-Olivier Clist, Chantal Fontaine, Karlis Karklins, Koen Bostoen, and Wim De Clercq**

*The ancient Kingdom of Kongo originated in Central Africa in the 14th century. In the 15th century, the Portuguese organized tight contacts with the Bakongo. From then on European goods gained new significance in the local culture and even found their way into funerary rites. Among the most important grave goods in the Kingdom of Kongo were shell and glass beads. They occur in many tombs and symbolize wealth, status, or femininity. At the burial site of Kindoki, linked with the former capital of Kongo's Nsundi province, a great number of shell and glass beads were found together with symbols of power in tombs attributed primarily to the first half of the 19th century. Determining the origin of these beads and their use in the Kongo Kingdom leads to interesting insights into the social and economic organization of the old Bakongo society, their beliefs, and the symbolic meaning of the beads.*

## HISTORICAL BACKGROUND

The Kingdom of Kongo occupied the region that is now Angola and the Democratic Republic of Congo in Central Africa (Figure 1). On the basis of oral tradition from the 16th century, Thornton (2001) states it was established by at least the 14th century. Determining the exact date, however, is difficult, given the lack of written sources dating to before first contact with Europeans. From 1483 onwards, the kingdom was in contact with the Portuguese, eventually leading to strong ties with Portugal. Principal activities involved trade, including slave traffic. Furthermore, the Bakongo gradually Christianized. Contact between the Bakongo and Europeans was characterized by an extensive exchange of goods and cultural ideas (Bontinck et al. 1972:66-67; Hilton 1985:55; Thornton 2013:55).

Testimonies of missionaries from the 16th and 17th centuries reveal that the ancient Kingdom of Kongo was bounded on the north by the Loango Kingdom and Stanley Pool, near present-day Kinshasa. This northern limit ran through the Kwilu-Niari Valley. To the east, the Kwango River functioned as a natural boundary while to the south, the Kwanza River marked the southernmost extent. The Atlantic Ocean formed the western border (Cuvelier 1946:339-341; Hilton 1985:1).

The Kingdom of Kongo consisted of six provinces: Mpemba, Soyo, Mbamba, Nsundi, Mpangu, and Mbata (Thornton 2001:102), which were independent chiefdoms before European contact (Randles 1968:19). The kingdom was ruled by a king or *ntinu*, its capital was Mbanza Kongo, and its inhabitants were the Bakong, speaking Kikongo (Heywood 2002:41-55).

## SHELL AND GLASS BEADS IN THE KINGDOM OF KONGO

In many places, shells were often used to adorn necklaces or clothing. Moreover, they symbolized femininity and fertility. Cowries (*kaori*), especially, were used as such in the Kingdom of Kongo (Dartevelle 1953:50-55). Shell necklaces have been used in rituals by various cultures over time to this very day (Dartevelle 1953:35). Another common use of shells was that of currency. In the Kingdom of Kongo, both the *kaori* shells (*Cypraea moneta*), originally from the Far East, and the *nzimbu* shells (*Olivancillaria nana*), collected in the Luanda region to the southwest of the Kongo Kingdom, were used as a means of payment (Mahieu 1924:47).

Glass beads were used not only for adornment but also for magical purposes; e.g., as a talisman to protect a person from evil spirits. Social status was often displayed by the beads a person wore. Thus, a person could distinguish himself/herself within a group by his/her beads (Figure 2). In some African societies, girls wore beads for protection during their menstrual period (Fourneau 1955:15). Moreover, femininity was expressed by beads as well (Figure 3) (Nyambura 2012:4, 43). As Europeans gradually


**Figure 1.** The Kongo Kingdom and its provinces, 16-17th centuries (Randles 1968:22).

**Figure 2.** The governor of Mbanza Soyo wearing beads, 17th century (Randles 1968:29).

introduced glass trade beads into West Africa, the Kingdom of Kongo adopted glass beads as its currency. Beads were used as a main form of currency from 1858 onwards (Farcy 1987:553, 557-558).

In general, the types of glass beads used in the Kingdom of Kongo are of European manufacture and similar to those found throughout West and Central Africa. In addition, a vast range of European beads was put into circulation until the early 20th century. These beads originated from various European production centers including Venice, Amsterdam, Bohemia, France, and Bavaria (Karklins 2012:81-83; Vierke 2004; Wood 2000:90). These beads purchased valuable products such as gold, copper, ivory, palm wine, and slaves (Farcy 1987:555). The European beads that circulated in West Africa and the Kingdom of Kongo varied greatly. The more unusual a bead was, the more valuable it was to the African people; thus, more valuable African products were only obtainable by means of more unusual beads (Jurriaans-Helle 1994).

## THE KINDOKI SITE AND ITS BEADS

The KongoKing project, which is a collaboration of Ghent University, the Université Libre de Bruxelle, and the Royal Museum for Central Africa in Tervuren, Belgium, was responsible for the 2012-2013 excavations of the Kindoki tombs (Clist et al. 2013a:22-24; Clist et al. 2013b:63-66). This is an interdisciplinary project that addresses both historical linguistics and archaeology to reconstruct the history of the Kingdom of Kongo (for more information *see* www.kongoking.org).

The Kindoki burial site lies close to the top of Kindoki Hill near the village of Mbanza Nsundi in the Lower Congo (05°04’069 S, 15°01’403 E). Eleven tombs, some with very rich grave goods, were found there (Plate V). All the tombs were covered with a layer of stone. Tomb 9 differed from the basic plan by having two additional layers of stone between the burial and the upper stone layer.

**Figure 3.** A princess of Malembe with beads, late 18th century (Grandpré 1801:74).

The burials were all orientated southwest-northeast with the head to the southwest. The tombs were constructed close to each other, but did not overlap. This suggests that the cemetery was created in a relatively short time and with people who were related either socially or through kinship. The cemetery is believed to have been used during the 18th and 19th centuries. The skeletal remains were analyzed by Caroline Polet, physical anthropologist at the Royal Belgian Institute of Natural Sciences. The distinction of the age and sex of those interred in the Kindoki tombs and specific female pathologies are the subject of a paper by Clist et al. (2015).

Only tombs 8, 9, 11, and 12 contained beads (Figure 4). Furthermore, the number of beads found per tomb differed: female tombs 8 and 11 contained numerous beads (1,853 and 540, respectively), while male tombs 9 and 12 merely contained only 16 and 18 beads, respectively.

The beads will be discussed by tomb. The glass beads were initially assigned arbitrary type numbers (e.g., type 1) which have been supplemented by the appropriate type codes in the bead taxonomic system developed by Kenneth and Martha Kidd (2012) and expanded by Karklins (2012). Colors are designated using the Munsell Color (2012) system.

### *Tomb 8*

Tomb 8, probably constructed between 1825 and 1845, contained the burial of a woman 40-60 years old (Plate VIA) which was in association with the remains of a person 20-40 years old (Clist et al. 2015). The woman was wrapped in textiles and wore a metal anklet on the right leg. Other grave goods included a copper chain, a gold chain, an iron necklace, 32 copper hawk bells, two types of marine-shell beads, a copper bead, and necklaces of glass beads. The latter were of five types.

#### *Tympanotonus fuscatus* Shell Bead

A single *Tympanotonus fuscatus* shell bead was found in tomb 8 (Plate VIB, top). It was 34 mm long and 17 mm wide. These shells were used in rituals related to *Bakhimba*, a local religion that venerated *Mbumba*, its creator deity. This type of shell served the faithful. The shells were buried in a cruciform trench in front of *Mbumba*'s altar, and were often called *zinga*, which symbolized eternal life (Dartevelle 1953:23-24). Those who had lived a proper life enjoyed the privilege of living twice. According to the Bakongo, they reincarnated as a similar shell (Thompson and Cornet 1981:37).

There has been no previous mention of *Tympanotonus fuscatus* shells as grave goods. The shell in tomb 8 may have been placed there because the deceased believed that it embodied eternal life after death in the ancestral village. Another line of reasoning suggests the deceased had a spiritual function in society (Thompson et al. 1981:37), and that the deceased was believed to return as a shell. It is also possible that the shell functioned as a protective talisman for the deceased's journey into the afterlife.

#### *Pusula depauperata* Shell Beads

Tomb 8 contained 660 *Pusula depauperata* shells (false cowries) of different sizes. Based on several specimens, the

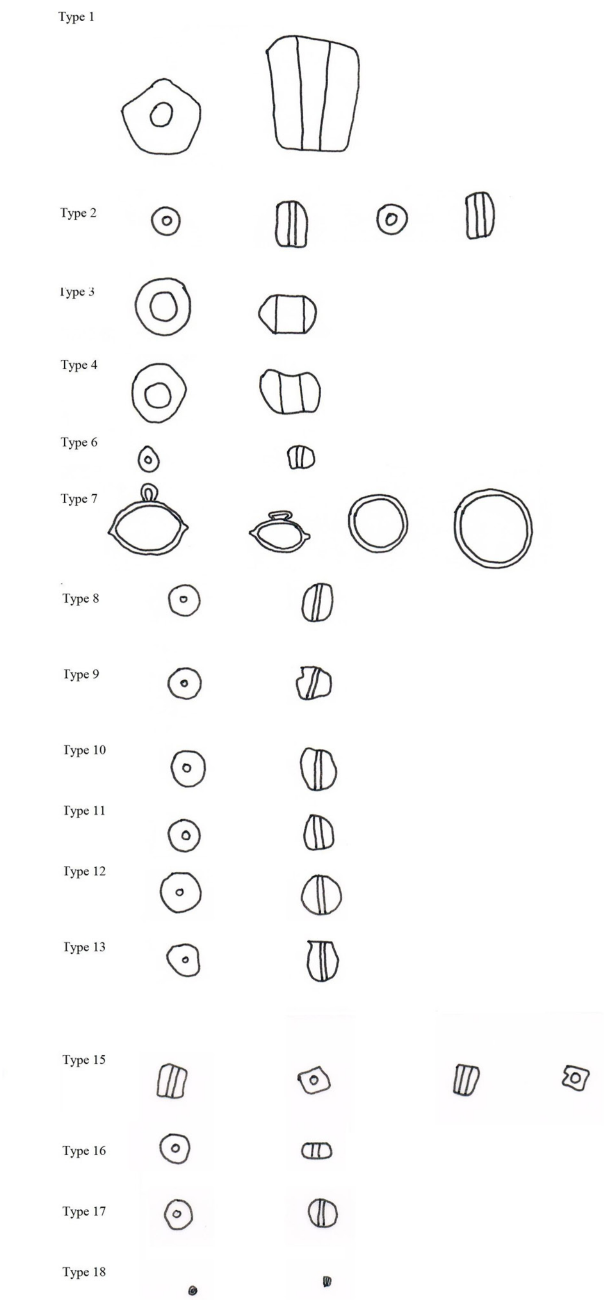


**Figure 4.** Forms of the beads and bells from the Kindoki tombs (Verhaeghe 2014).

shells are ca. 13 mm long and 7.8-11 mm wide. Each shell exhibits two holes that have been ground into it to permit their being threaded or sewn onto clothing (Plate VIB). The shells lay under the deceased's chin, indicating that they had formed part of one or more necklaces.

These shells are occasionally found near the Congo River estuary. Dirk Fehse, a German mollusc expert, states that this species occurs along the sea coast from Angola to Cameroon (D. Fehse 2014: pers. comm.). Jan Haspeslagh, librarian of the Flanders Marine Institute, confirms this species is commonly found on the coasts of Congo (C. Verhaeghe 2014: pers. comm.). Finding and collecting these shells must therefore have been fairly easy. Consequently, the shells found in the Kindoki tombs probably had a decorative or symbolic function rather than financial value. By the time the tombs were constructed, *kaori* shells had lost their value almost completely in the Kingdom of Kongo and were only used for ornamental purposes (Nwani 1975:189). The fact that an inhabitant of Landana, in the province of Cabinda, Angola, was seen wearing a *Pusula depauperata* shell as a talisman (Schilder 1955:71-72), and that this type of shell can be found in high numbers in funerary deposits, suggests it had replaced the almost valueless *kaori*.

## Wound, Ridged Tube, Dark Blue Beads

Fourteen ridged-tube beads (Kindoki type 1; Kidd type WIIf) of translucent dark blue (Munsell 7.5PB 2/5) glass were found in tomb 8. These consist of a cylindrical bead likely of furnace-wound construction that was pressed while the glass was still viscid to impart five longitudinal facets (Plate VIC). The beads are 22-29 mm long and 17-18 mm in diameter. The surfaces exhibit various patterns of white corrosion products. The glass colorant is cobalt (Coccato and Rousaki 2014).

These distinctively shaped beads have a wide temporal and geographical distribution, having been found on various archaeological sites in Africa, North America, and the Caribbean, as well as in Holland (e.g., Karklins and Barka 1989:71-73; Opper and Opper 1989) where they were believed to have been produced (Jurriaans-Helle 1994:25). There is, however, no evidence for the production of wound beads in Holland. In fact, recent research suggests that they may actually have been produced in the Fichtelgebirge region of Bavaria in southeastern Germany, and that they were simply exported through Amsterdam and other Dutch ports (Jargstorf and Zeh 2003). These beads appear on sites dating to the period 1700-1845 with the optimal period of utilization being 1715-1830 (Karklins and Barka 1989:74).

## Wound, Cylindrical, Red-on-White Beads

Wound cylindrical beads with a transparent ruby (Munsell 2.5R 3/10) outer layer and an opaque white (Munsell N 9) core were numerous, 1,140 specimens being recovered (Kindoki type 2; Kidd/Karklins type WIIIa). They are 7.5-11.0 mm long and 6.0-7.7 mm in diameter. Some specimens are fused end to end (Plate VID), apparently due to carelessness during production. Others have broken ends indicating instances where the joined beads broke or were snapped apart. The degree of corrosion varies.

Commonly called Cornaline d'Aleppos, the beads are composed of mixed-alkali glass. Arsenic, lead, and calcium are present and likely served as opacifiers or pigments in the form of lead arsenic. Arsenic has been used as an opacifier since the 18th century (Tournié 2010:42).

Wound, cylindrical, red-on-white beads appear on several Venetian sample cards (Davis 1972:219-220) and sample books (Karklins 1985:31, 2002:31), and were likely produced in Venice. Generally, in North American archaeological contexts, these beads do not appear before about 1830 but extend into the 20th century (Karklins 2014).

### Wound, Oblate, Yellowish White Bead

A wound oblate bead of translucent pale yellowish white (Munsell N 9) glass is 7.2 mm long and 12.0 mm in diameter (Plate VIB) (Kindoki type 3; Kidd type WIb). It is composed of potash-lime glass. Arsenic is also present and probably served as an opacifier or pigment (Coccato and Rousaki 2014).

The van der Sleen bead collection at the Allard Pierson Museum in Amsterdam contains similar beads collected at Matadi, the major coastal town of the Democratic Republic of the Congo, which have long been believed to be the products of Amsterdam. This, however, is unlikely. The bead has the characteristics of a furnace-wound bead produced in the Fichtelgebirge region of Bavaria.

### Wound, Oblate, Dark Blue Bead

Another wound oblate bead is composed of a translucent dark blue (Munsell 7.5PB 2/5) glass (Plate VIB) (Kindoki type 4; Kidd type WIb). It is 8.2 mm long and 11.0 mm in diameter. Composed of potash-lime glass with the presence of lead, it is colored with cobalt (Coccato and Rousaki 2014).

A similar bead is in the Allard Pierson Museum and has also long been considered a Dutch product. Again, this is unlikely and it is postulated that the bead originated in the Fichtelgebirge.

### Blown, Round, Silvered Beads

At least three round blown beads were found in tomb 8 (Kindoki type 5; Karklins BIa). All were fragmentary but one could be reconstructed (Plate VIIA). It is 13 mm long and 11 mm in diameter. Likely blown in a mold, the beads are composed of clear glass coated on the interior with a silver-colored layer of bismuth and lead (Fontaine 2014).

Blown beads have been produced in a number of centers over the centuries including Venice, France, Bohemia, and Germany. Unfortunately, round blown beads have been made for a long time and continue to be made. Consequently, it is difficult to assign a tight date to these specimens.

### Copper Bead

The single copper bead (Kindoki type 6) is heavily corroded so it is not possible to determine if the form is tubular or slightly rounded (Plate VIB). It is 4.9 mm long and 4.5 mm in diameter. The corrosion also makes it impossible to determine the method of manufacture.

The bead may have been made locally. The Nsundi province of the Kongo Kingdom had access to the copper from the Mindouli mines in the north of the kingdom, in current Congo-Brazzaville, since the early 16th century (Hilton 1985:32-33, 40; Nikis et al. 2013).

### Copper-Alloy Hawk Bells

Thirty-two copper-alloy hawk bells (Kindoki type 7) are included here as they likely served as pendants. The form found at Kindoki is called "flushloop" in North American archaeological contexts, and consist of two hemispheres formed from sheet metal generally soldered together (Plate VIIA). The joint is clearly visible. A narrow suspension loop of brass protrudes from the upper half. The Kindoki specimens are of two sizes: 16.7 mm in diameter and 9.9 mm in height, and 12.5 mm in diameter and 7.8 mm in height. Their weight varies between 1.22 g and 1.70 g. One of the bells contains a lump of oxidized iron. It is believed that flushloop bells were made in France or England. They first appear in the 17th century but are most common during the 18th and 19th centuries (Brown 1979:201). Metal bells were also manufactured in Africa, but these were generally larger and heavier (Balandier 1965:104).

Africans frequently used bells of various forms. Similar items were made of natural materials, such as nuts, which were often used as rattles, and sometimes hung in the hair, or around the waist, wrists, or ankles to produce rhythmic sounds during ritual dances. During mass or funerals, bells were also used to arouse a supernatural atmosphere. In all probability, the bells from tomb 8 had a supernatural significance, given that such items were often associated with ancestors. They may also be indicative of the importance of the deceased. Yet another possibility is that the bells were used during the funeral ceremony and were then put in the tomb.

***Tomb 11***

Tomb 11, the burial of a woman 40-60 years of age (Clist et al. 2015), contained 268 red-on-white glass beads (Kindoki type 2; Kidd/Karklins type WIIIa) on and around the neck (Plate VIIB, bottom). As in tomb 8, many of the beads were joined end to end, suggesting that such manufacturing errors were neither rejected by the traders nor the inhabitants of Kindoki. There were also 272 *Pusula depauperata* shell beads. The glass beads suggest that tomb 11 is similar in date to tomb 8.

The head of the deceased was adorned with a thick layer of brown textile with copper-alloy buttons attached and presumably functioned as a headdress (Plate VIIB, top). She also had three heavy iron anklets, each weighing about 500 g, on each leg.

***Tomb 9***

Tomb 9 contained the burial of a man between the ages of 40 and 60, with evidence of another person 20-40 years of age in association (Clist et al. 2015). The man wore a necklace composed of 17 glass beads, mostly white and blue with a floral wreath around the middle. He also had two iron bracelets on the right arm and a musket by his left side.

The tomb was covered with three layers of stone which probably explains the skeleton's better preservation. As this is the only tomb in the cemetery to have such a feature, the interred individual may have had high social status in Kongo society.

Wound, Round, White with Blue Floral Inlay

Five wound round beads of opaque white (Munsell N 9.5 and 5.0Y 9/2) glass are decorated with an inlaid stylized wreath of blue glass around the middle (Plate VIIC) (Kindoki types 8-9; Kidd/Karklins type WIIIb). Only remnants of the inlay are present in two of the specimens. The beads are 6.1-7.2 mm long and 5.7-7.1 mm in diameter. They are likely of Venetian origin.

The raw materials of the glass were difficult to determine with Raman spectroscopy due to high photoluminescence. In several of the beads the concentration of arsenic and lead was very high, but the calcium content was low. The former likely served as opacifiers. The blue glass was colored with cobalt (Coccato and Rousaki 2014).

Wound, Round, Blue with White Floral Inlay

Two wound round beads of translucent moonstone blue (Munsell 5.0 PB 3/4) glass are decorated with a floral wreath of what appears to have been opaque white glass around the middle (Plate VIIC, bottom) (Kindoki type 10; Kidd/Karklins type WIIIb). The specimens are 6.4-6.8 mm long and 6.8-7.4 mm in diameter. Their chemical composition is very similar to that of the previous type.

Wound, Round, Dark Blue with Floral Inlay

This is a wound round bead of translucent dark shadow blue (Munsell 7.5B 3/3) glass (Plate VIIC, row 2, right). It is 8.0 mm long and 7.7 mm in diameter. Although the floral spray around the equator is missing, the indentation in which it lay remains (Kindoki type 11; Kidd/Karklins type WIIIb). Based on other blue beads with such decoration, the likelihood is that the inlay was opaque white. The bead is composed of mixed-alkali silicate glass.

Wound, Round, Dark Blue Beads

Two wound round beads are coated with a thick white patina (Plate VIIC, upper right) (Kindoki type 12; possibly Kidd/Karklins type WIIIb). When moistened, however, it is clear that the original color was dark blue. Although no decoration is visible, it is possible that these beads were also decorated with white floral sprays around the middle originally but which are now obscured by the patina. The beads are 7.8-8.1 mm long and 8.3-9.6 mm in diameter. They are composed of soda-lime glass, and contain lead. Cobalt, iron, and manganese are also present with the former being the likely colorant (Coccato and Rousaki 2014).

Wound, Drop-Shaped, White with Floral Inlay

Tomb 9 contained five drop-shaped wound beads of opaque white (Munsell N 9.5) glass (Plate VIIC, left) (Kindoki type 13; Kidd/Karklins type WIIIb). While none of the inlay remains, the indentations of a floral wreath are present in the surface. Based on the other white beads with intact inlays, it is likely that the wreaths were blue. The beads are 6.3-6.8 mm long and 6.3-7.0 mm in diameter. They are composed of mixed-alkali glass with lead (Coccato and Rousaki 2014).

Rose-on-Gray Beads

Two severely degraded beads have a rose-colored exterior and a gray core (Kindoki type 14). While the shape was not discernable, it is likely that these two specimens belong to the cylindrical red-on-white (Kindoki type 2; Kidd/Karklins type WIIIa) group.

***Tomb 12***

Tomb 12 contained the burial of a 6-year-old boy (Clist et al. 2015). Burial goods included 16 glass beads of three types, two minute beads made of shell or coral, a copper crucifix, a copper cross, a religious medallion, a copper chain 52 cm in length, a sword, and two iron fragments.

Wound, Pentagonal-Faceted, Black Beads

Fourteen pentagonal-faceted beads of black (Munsell N 1) glass (Plate VIID) (Kindoki type 15; Kidd variety WIIc1) were found in tomb 12. While the glass appears black, when held up to a strong light it is actually a deep burgundy color. Of wound construction, the beads exhibit eight pentagonal facets applied with a paddle while the glass was viscid. The beads are 5.9-6.1 mm long and 4.9-5.1 mm in diameter. Chemical analysis revealed that the glass contained manganese and iron which likely served as colorants.

The faceted black beads were associated with a copper cross, apparently at the deceased's right wrist. As there are not enough beads for a chaplet, it is possible that the cross and beads formed a Christian bracelet. It is, however, also possible that the objects may have been used as *nkisi* (fetish), with the cross decorated with beads. As such, the Christian element has an indigenous significance.

Wound, Oblate, Black Bead

Tomb 12 contained a single, wound, oblate, black (Munsell N 1) glass bead (Kindoki type 16; Kidd type WIb) with flattened ends (Plate VIID, upper center). As with the previous type, the glass is actually a deep burgundy color when held up to the light. The bead is 3.5 mm long and 5.9 mm in diameter. It is composed of a calcium-rich glass with manganese and iron (Coccato and Rousaki 2014).

Drawn, Round, Navy Blue, White Stripes

This round bead of translucent navy blue (Munsell 10B 2/4) glass with three, broad, opaque white (N 9) stripes (Plate VIID, upper right) (Kindoki type 17; Kidd type IIb) is the only one of drawn manufacture in the Kindoki collection. It is 5.1 mm long and 5.9 mm in diameter. The glass consists of calcium silicate with cobalt as the colorant (Coccato and Rousaki 2014).

Beads of Shell or Coral

Two minute tubular beads (Kindoki type 18) appear to be made of shell or coral (Plate VIID) based on the presence of calcite and aragonite (Coccato and Rousaki 2014). They are 2.2 mm long and 1.7 mm in diameter. It is possible that the beads were manufactured locally.

## DATING AND SOURCING THE KINDOKI BEADS

Tomb 8 is easy to date due to the presence of the cylindrical red-on-white beads and the pentagonal ridged-tube beads. Based on their temporal ranges, it is likely the tomb was created during the 1825-1845 period. The beads found in the tomb originated from a number of sources.

The red-on-white specimens were likely made in Venice, while the ridged tubes and at least some of the monochrome wound beads exhibit characteristics of the furnace-wound beads created in the Fichtelgebirge region of Bavaria. The blown beads could have been produced in several European centers. The copper-alloy hawk bells likely originated in France or England, while the copper bead may be of local origin. The shell beads are also natural resources of the kingdom and only indicate trade relationships between Mbanza Nsundi and the Atlantic coast during the late 18th-early 19th centuries.

Tomb 11, dominated by the cylindrical red-on-white beads, likely dates to about the same time period as tomb 8.

The diagnostic varieties in Tomb 9 are the wound beads decorated with an applied wreath about the middle (white with a blue wreath, blue with a possible white wreath, and white drop-shaped with a wreath inlay). Two exact matches for the white bead with a blue wreath are from contexts dating 1830-1870. Based on Brain (1979:113), the maximum date range for this general style is 1725-1850. In the case of Tomb 9, the likelihood is that its probable temporal position is between 1800 and 1835. It is likely that all the beads are of Venetian origin.

Tomb 12 contains the earliest of the four burials. Based on a survey of over 10 sites in eastern North America, Brain (1979:110) finds the maximum temporal range for the pentagonal-faceted beads is ca. 1650-1833. The blue bead with three broad white stripes is distinctive and while no direct correlative could be found for it, a visually identical bead with the addition of two internal layers (Kidd variety IVb30) is present on Mohawk sites in New York state that are attributed to the 1615-1630 period (Rumrill 1991:13-14). That the tomb also contained a religious medal and crucifix attributed to the 17th and 17th-18th centuries, respectively (Clist et al. 2015), suggests that tomb 12 likely dates to the 1650-1750 period.

The pentagonal-faceted beads that predominate in tomb 12 were probably produced in the Fichtelgebirge region of Bavaria. There, large numbers of beads were manufactured for chaplets, and the shape of the beads is typical of Fichtelgebirge production (Dillon 1907:278). The single drawn bead may have been manufactured in Venice or Holland, while the shell or coral beads may be local products.

## CONCLUSION

The Bakongo displayed their social status, affluence, descent, and social position by means of the various types and quantities of the shell, metal, and glass beads they wore. Thus, the beads expressed one's identity. For example, large quantities of glass and shell beads were a mark of femininity. On the other hand, the power and importance of men were demonstrated by specific and apparently more valuable beads associated with known male status symbols such as swords, muskets, and chief bracelets. Some shell and glass beads had symbolical value and were used as protective amulets. The Bakongo buried their dead with their most important personal belongings. Thus, shell and glass beads, which displayed the deceased's identity and social status, were included.

Anthropological analysis of the bones found in tomb 8 revealed that the principal burial was that of a mature woman. This identification is supported by the large number of glass and shell beads found in association; large quantities of glass beads have a female connotation in Bakongo culture. *Kaori* shells also symbolize femininity and fertility. That the *Pusula depauperata* beads found in the tomb are similar in appearance to *kaori* shells suggests that the beads had a similar meaning. The hawk bells may also be a female trait, given that they often expressed femininity and intimacy. The presence of the *Tympanotonus fuscatus* bead suggests the woman was spiritually important.

The woman was wrapped in a large quantity of textiles, clearly indicating her social importance. Examination of the skeletal material revealed evidence of diffuse idiopathic skeletal hyperostosis, indicating that the deceased was obese and diabetic (Clist et al. 2015). This suggests the woman lived in affluence. Moreover, the tomb also contained the remains of another person, possibly a slave. Burying slaves with their owners was a Kongo custom until the start of the 20th century. It is, however, possible that the remains are those of an older burial. The second individual was not as well preserved as the woman.

Tomb 11 also contained a mature woman and the finds are very similar to those of tomb 8. Both the Venetian red-on-white beads and the perforated *Pusula depauperata* shells were also found in this tomb. This leads to the question: why do tombs 8 and 11 contain *Pusula depauperata* shells instead of *kaori* or *nzimbu*? One line of reasoning suggests that the Kingdom of Kongo was in decay at the time the tombs were constructed. Having been attacked by the Portuguese, the kingdom was tremendously weakened and the king lost power (Hilton 1985:164-165; Thornton 1992:59). So perhaps the Bakongo elite were not as rich as before and displayed their power by means of personal belongings rather than by *kaori* or *nzimbu*. It is also known that *kaori* had lost their value by the 19th century (Nwani 1975:189). Consequently, the *Pusula depauperata* were of equal value as the *kaori* of older days at the time the tombs were constructed. The shell beads found in tombs 8 and 11 were used as ornaments, particularly in necklaces. Thus, at the time, it was probably unimportant which shells were used. The headwear and abundance of shell and glass beads suggest the woman buried in tomb 11 held a high position in society. An affluent lifestyle is also suggested by the fact that, like the woman in tomb 8, the deceased was obese and/or diabetic (Clist et al. 2015).

The man buried in tomb 9 was accompanied by far fewer beads than the two previous burials, with no shell beads at all. The deceased wore iron bracelets on his right arm and a musket lay at his side. His tomb was strikingly more refined, being covered with three layers of stones rather than just one. Consequently, the skeleton was very well preserved. The remains of a second person, possibly a slave, were found in association. These were less well preserved and may represent an earlier burial.

A six-year-old boy was interred in tomb 12. Relatively few beads were found in association and most of these were found with a metal cross, possibly forming a bracelet. This and the presence of yet another cross and a religious medallion strongly suggest that the child had a relationship with Christianity, though it is possible that the Bakongo put the religious objects in the tomb as *nkisi*. A sword was also present and is a symbol of masculine power (Sengelov 2014). Possibly, the child underwent an initiation rite, after which he was considered an adult. It may also be that he inherited his status from his mother, after which he did not need to prove himself before being considered an adult. Initially, social status was inherited from the mother's side in Bakongo culture (Balandier 1965:30, 181). After the arrival of Europeans and Christianity, however, this tradition gradually shifted to a patrilineal heritage system (Hilton 1983:189).

Shell and glass beads have long been undervalued as sources of information in the examination of various cultures. Nonetheless, they do provide much information about societies, given their symbolical and religious function. Beads also often have a very personal significance. Furthermore, large quantities of shell and glass beads have been used in trade. In each place, the beads gained a new meaning in the local environment. Thus, beads also offer information about trading networks and how the value and meaning of objects shift. Though small, beads are of great value to archaeologists, especially if found in carefully excavated archaeological contexts, as at Kindoki.

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# ARCHAEOMETRICAL ANALYSIS OF GLASS BEADS: POTENTIAL, LIMITATIONS, AND RESULTS

**Adelphine Bonneau, Jean-François Moreau, Ron G.V. Hancock, and Karlis Karklins**

*Over the past few decades, several new analytical techniques have been used to determine the composition and the likely production centers of glass beads found at archaeological sites around the world. Made since antiquity, glass beads are important artifacts which can provide much more information than their small size suggests. This article reviews the most common analytical techniques used to study glass beads – optical microscopy, scanning electron microscopy (SEM), x-ray fluorescence (XRF), instrumental neutron activation analysis (INAA), laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS), and Raman spectroscopy – and discusses their potential, limitations, and what results may be expected.*

## INTRODUCTION

Glass beads are found around the world in many different cultures and societies from antiquity to the present day. Their study is very important and can provide technical and cultural information regarding their manufacturers and users. Most of the analytical techniques utilized are the same as those applied to glass in general. Recently, Janssens (2013) compiled a review of a large range of techniques for analyzing glass. Previous studies include Pollard and Heron (1996:149-193) and Bertolotti et al. (2013). It is, however, sometimes difficult to apply the same techniques to glass beads because of their size and the limited possibilities of sampling. Based on a workshop conducted by the authors in January 2014 at the annual meeting of the Society for Historical Archaeology, this article summarizes the various analytical techniques, indicating what is involved and what the results might reveal. Technical details have been kept to a minimum so the descriptions will be understandable by everyone. For more detailed information on each process, see Janssens (2013).

## ANALYTICAL TECHNIQUES

There are two extreme positions in archaeometry regarding analytical techniques: the intensive use of them without a real archaeological question behind the analysis and, the opposite, the rejection of their use. Luckily, more and more studies adopt a middle ground.

Years ago, archaeometry was seen as a very peculiar science, the preserve of physicists and chemists who carried out analyses that could only be understood by them and who did not necessarily understand the problems and needs of archaeologists. This attitude has changed significantly in the last decades thanks to large-scale diffusion of information and the training of scientists in archaeological sciences. Still, relatively few studies are being conducted with good collaboration between scientists and archaeologists. It is extremely important to know when and where to consult an archaeological scientist (Pollard and Bray 2007).

Where does one find an archaeological scientist? Well-known museums such as the British Museum, the Louvre, and the Smithsonian have their own laboratories with such scientists but they generally only work on their museum's collections or on collections from other collaborative museums. Other archaeological scientists are situated in dedicated laboratories such as the Research Laboratory for Archaeology and the History of Art at the University of Oxford and the Canadian Conservation Institute in Ottawa, Ontario. Most archaeological scientists, however, are situated in non-archaeometrical/archaeological laboratories (mainly in universities), in departments such as geology, chemistry, physics, or material sciences, and thus are not too easy to find by someone who is not in the field of archaeometry. A good way to find one is to consult recent publications where their details are provided; *see* the Archaeometric Analysis section of the Researching the World's Beads Bibliography (http://www.beadresearch.org/Pages/Archaeometric%20Analysis.pdf) or Janssens (2013).

Most of the time, archaeologists and other researchers come to archaeological scientists when they have heard of a new technique that they want to apply to their artifacts, or when they have many artifacts and do not know what to do with them. In such cases, analysis tends to give unusable results and wastes time and money. Before analysis is undertaken, the archaeologist must pose specific questions to the archaeological scientist that need to be addressed in the analysis and will determine the appropriate technology that is required. Generally, questions about specimen sampling, time, and costs will be the center of initial discussions. A research plan can then be created, keeping in mind that analytical techniques should always be used coupled with typology and other historical and archaeological methods. Before any kind of analysis, beads should be well cleaned (ultrasonification may be needed) to avoid contaminating the results.

The most common techniques used to analyze glass beads are optical microscopy, scanning electron microscopy (SEM), x-ray fluorescence (XRF), instrumental neutron activation analysis (INAA), laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS), and Raman spectroscopy. These instruments are not specifically dedicated to the analysis of glass and glass beads, and unless they are in a specific laboratory dedicated to archaeometrical studies, they are rarely used for this purpose. They were initially developed for the fields of chemistry, biology, materials sciences, and geology. Interdisciplinary studies subsequently brought scientists and archaeologists together and new protocols and sometimes new components were created to allow the various techniques to be applied to archaeological materials. It is thus extremely important to have a technician who can correctly prepare samples and apply the correct protocol to get good results.

## Optical Microscopy

Macro- and microscopic observation of beads is often ignored as a first step in bead analysis but is a very important step of any study. Indeed many questions regarding manufacturing techniques and use of the artifacts can be answered by visual examination.

For instance, bubbles in drawn glass beads and striae on the surface are elongated while those in wound beads tend to be round (Figure 1). Wound beads also exhibit wind marks that encircle the diameter. In the case of blown beads, the presence of elongated bubbles reveals that they were blown in heated drawn tubes rather than free blown.

Drawn beads were sometimes flashed in clear glass to prevent discoloration and make them shinier. This thin layer may sometimes only be visible under magnification (Figure 2). Some specimens exhibit crackled surfaces (Figure 3), probably the result of thermal shock due to improper annealing.

Information regarding bead use may also be observed using the microscope. An examination of the ends of a bead may reveal battering suggesting their use in necklaces or bracelets. There may also be thread wear on the edges of the perforation.

Finally, microscopic observation reveals the state of degradation of the glass. Most of the analytical techniques detailed below perform surface analysis, so they give results from the first micrometers of the glass. If the glass is altered, the results will not reveal the true composition of the glass. Degraded glass results from the chemical reaction between it and the molecules present in its environment, whether archaeological or ethnological. This results in changes to the glass structure and the chemical composition.

Chemically altered glass has a very particular texture which can be easily identified under the microscope: one can see holes with a texture like honeycombs and sometimes iridescence is present as well (Figure 4A). On the other hand, mechanically altered glass is characterized by elongated holes on the surface (Figure 4B). These are caused by usage and/or soil conditions.

These features have little influence on the results but these areas should be avoided for better results as small secondarily deposited crystals may be in the holes and affect the results.

## Scanning Electron Microscopy Coupled with X-ray Energy Dispersive Spectrometer

After microscopic observations, elemental analysis is often required to identify the type of glass and the colorants used and then to identify sub-groups based on the composition of the glasses. One of the methods used to obtain this information is scanning electron microscopy coupled with an x-ray energy dispersive spectrometer (SEM-EDS, sometimes designated SEM-EDRX or SEM-EDX). This technique uses an electron beam, generated by a (usually) tungsten filament, that is focused on the sample (Figure 5). The electrons interact with the sample and generate three principal rays:

1) Secondary electrons which provide a topographic image of the surface.

2) Backscattered electrons which give a chemical contrast image; i.e., parts of a sample with heavy elements will be brighter than parts with lighter elements. Newer machines, using two or more backscattered electron detectors, can product an image with topographic details as well.

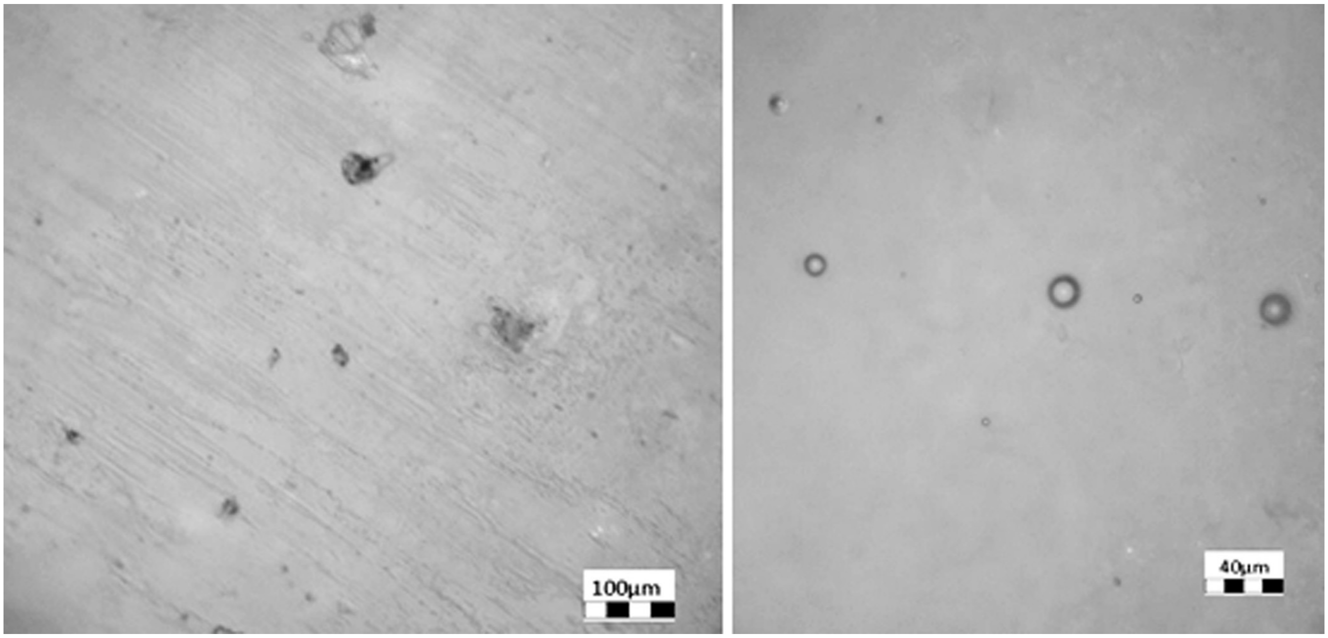


**Figure 1.** Microscopic view of elongated (left) and round (right) bubbles in the matrix of glass beads (all images by A. Bonneau unless otherwise specified).

3) X-rays which are characteristic of chemical elements present in the sample.

SEM-EDS thus permits both surface observation and elemental analyses. The observation function allows one to determine the nature of any alteration (Figure 6), natural or mechanical. When beads are sectioned and polished, the interaction between the layers can be investigated. Indeed, this is the area where preferential crystallization may take place and thus reveal the type of colorant/opacifier used (for an example with calcium antimony, *see* Lahlil et al. 2010).

Two kinds of systems are widely used: environmental/variable vacuum SEM and high vacuum SEM. In the first instance, no sample preparation is required. The specimen can be put directly in the chamber, but secondary electron images cannot be obtained because the secondary electrons interact with the air in the chamber before reaching the detector. In the second instance, as the chamber and sample are in a high vacuum atmosphere, electrons diffuse everywhere and create interference, called charges. To avoid this, a thin layer of carbon, gold, or another metal (called "coating") can be applied to the sample. While a carbon

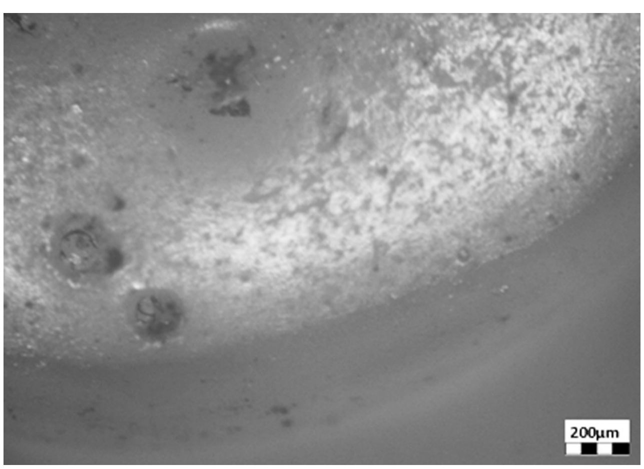


**Figure 2.** Bead with two layers; the core is white glass while the outer layer is transparent glass.

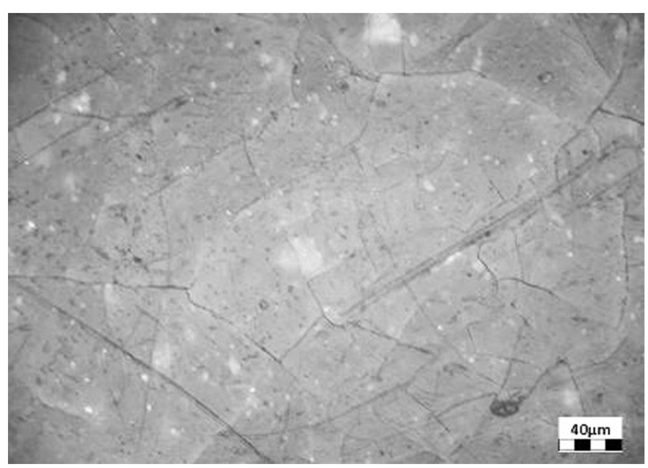


**Figure 3.** The crackled surface of a glass bead viewed under the microscope.

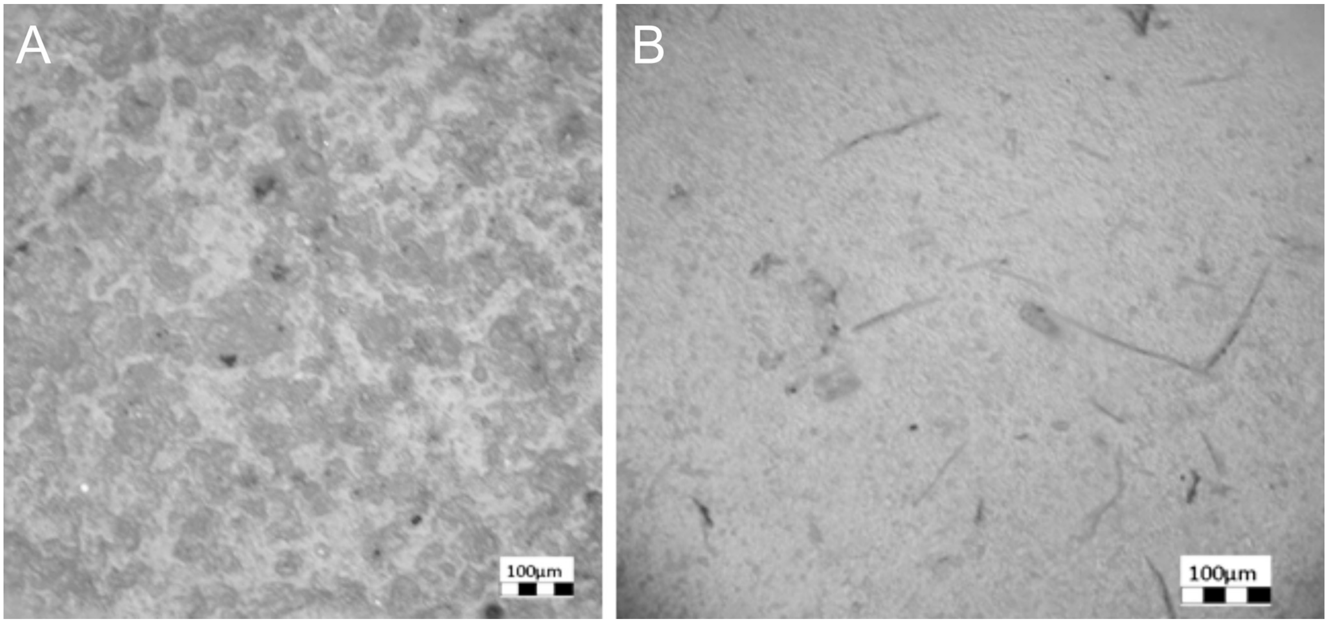


**Figure 4.** Chemically altered glass (A) and mechanically degraded glass (B).

layer can be removed after analysis if the bead has a smooth surface, gold and other metal layers cannot.

Elemental analysis is also possible with SEM-EDS. Using the energy of the x-rays emitted by the sample, it is possible to determine which chemical elements are present. Unfortunately, as the electron beam has limited power, it is not possible to detect all the chemical elements in the periodic table and their detection depends on the amount in the sample. Chemical elements can be detected from boron to lead, with differences depending on the instrument used. Moreover, they need to be present in amounts greater than 1-2% oxide weight to be detected.

Using these qualitative elemental results, it is possible to identify the type of glass (alkali, lead, etc.) and the colorants and opacifiers used (Figure 7). Semi-quantitative analysis, which allows the identification of glass sub-groups, is also possible but the samples need to have flat, polished faces. This requires that the beads be embedded in epoxy resin, sectioned, and polished (Figure 8). In this case, it is not possible to recover the bead after analysis. Moreover, as

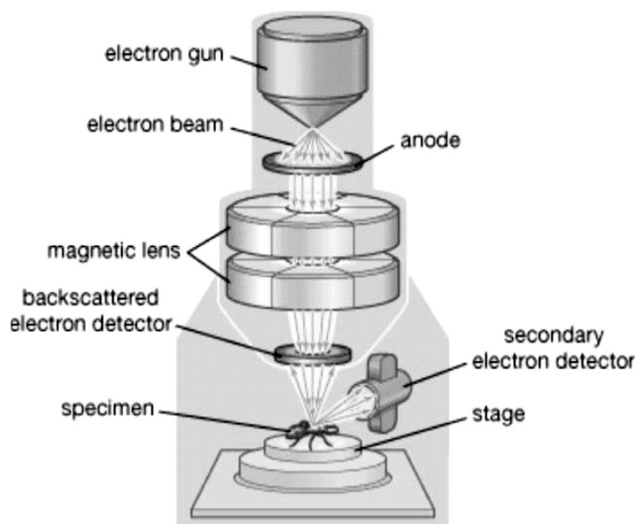


**Figure 5.** Schema of the SEM-EDS apparatus (*Encyclopedia Britannica*).

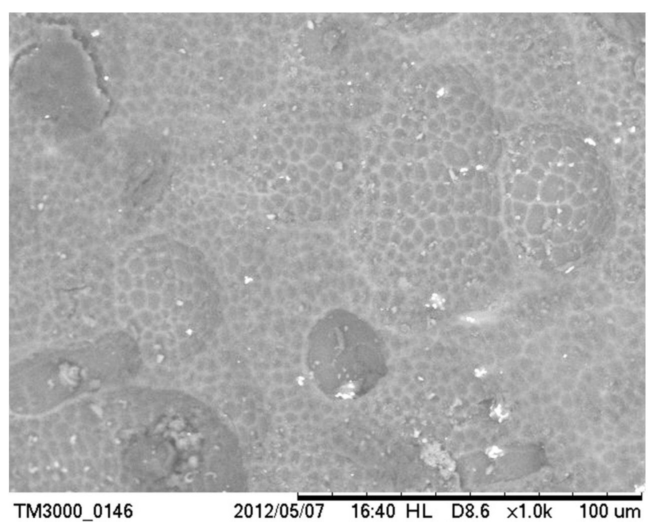


**Figure 6.** Backscattered electron image of a chemically altered glass.

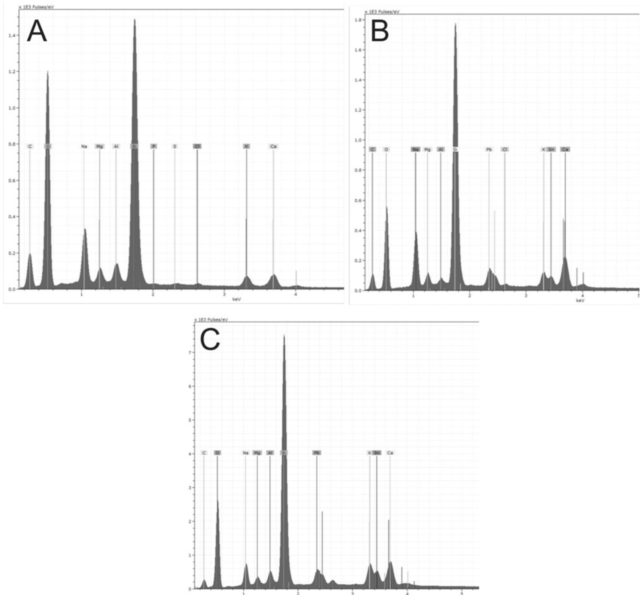


**Figure 7.** Examples of EDS spectra (x: x-ray energy in keV; y: counts). A, alkaline glass; B, lead-glass; C, glass opacified with tin.

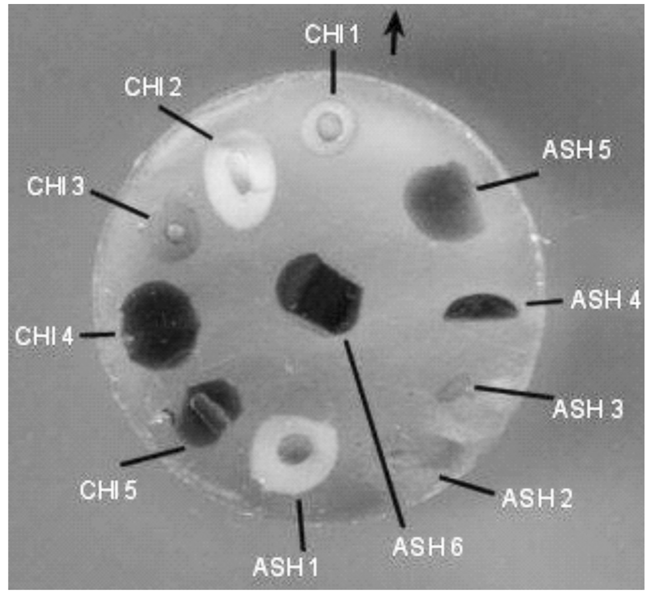


**Figure 8.** Glass beads prepared for semi-quantitative analysis with SEM-EDS.

detailed earlier, a layer of carbon or metal may be applied to it. The kind of coating used needs to be carefully chosen to avoid skewing the results. These are expressed in oxide weight or elemental weight with a relative error of 2-10%. Researchers need to remember that each percentage comes with an error, not always provided by the machine. To reduce the error, use glass standards and take readings at different points on the specimen to assess the homogeneity of the glass.

A useful technique for both observation and elemental analysis, SEM-EDS has been widely used to study glass beads; e.g., Garcia-Heras et al. (2005), Heck and Hoffmann (2002), and Shugar and O'Connor (2008). It is easy to find a lab and the cost is relatively low. If more detailed results are desired (e.g., trace elements, heavy elements, or more precise quantification), x-ray fluorescence (XRF) should be considered. SEM-EDS and XRF are often used together (the three cited articles are good examples).

## X-ray Fluorescence

X-ray fluorescence (XRF) is very similar to SEM-EDS but observation is not possible. In this process, x-rays are focused on the sample which is excited and generates new x-rays which characterize the chemical elements. The results are expressed as spectra, as for the SEM-EDS.

As x-rays are more powerful than electrons, XRF can detect chemical elements from sodium to, theoretically, the end of the periodic table, and the rays go deeper into the sample (ca. 1µm for SEM-EDS; ca. 10-100 µm for XRF). As for SEM-EDS, the limits of detection (LOD) depend on the chemical elements. To simplify, the LOD is about 0.2-1% oxide weight for light elements and about 3 ppm to 20 ppm oxide weight for the heavy elements. These limits are provided as indications only and differ from one machine to another.

As in the case of SEM-EDS, XRF analysis cannot be quantitative without a prepared plane surface. Depending on the machine used, samples need to be in a powder form or polished in an epoxy resin (micro-XRF). Moreover, this technique requires the use of standards that have the same texture and density as the samples. Glass standards, such as NIST 610 or NIST 612, are well known but need to be in the same form as the samples; i.e, as a powder if the sample is in that form or polished if the sample was prepared that way. Furthermore, quantitative analysis for elements lighter than aluminum and silicon are not recommended even with prepared samples and using standards. This is a limitation for glass analysis in general.

In the case of portable XRF, only qualitative analysis should be performed. This instrument is a great tool for pre-selecting beads to be analyzed using laboratory techniques. Keep in mind, however, that x-rays can have very similar readings for different chemical elements; lead and antimony are great examples. This requires a good understanding of the machine and the ability to interpret automatic identifications made either by laboratory or portable instruments. This applies to both SEM-EDS and XRF analysis.

As for SEM-EDS, many researchers have used XRF to analyze glass beads. The articles cited in the SEM-EDS section are good examples and show the differences and similarities of the two techniques. Researchers should bear in mind that portable XRF should be used only for qualitative analysis and not for quantitative analysis.

XRF analysis is relatively inexpensive and very useful in quantifying chemical elements in glass, even in small proportions, and to define glass sub-groups which may be linked to production sites. For provenance studies, however, XRF is sometimes not precise enough and instrumental neutron activation analysis (INAA) or laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) may be better suited for this purpose.

## Instrumental Neutron Activation Analysis

INAA is based on the irradiation of a sample by neutrons in a nuclear reactor. A minute portion of the sample is turned into radioactive isotopes representing the chemical elements present in it. When they return to their stable state, they release gamma-rays which, recorded by a gamma spectrometer, can be related to an atom. As for SEM-EDS and XRF, each level of gamma-ray energy is linked to a specific element in the periodic table. This technique identifies the elements present in the sample and their quantity. As for XRF, it requires standards for quantification. One of the great advantages of INAA is that no sampling is generally required for beads. Beads of a mass of 5-10 mg are placed in plastic tubes that go directly into the irradiation site of the nuclear reactor. On the other hand, if a bead is composed of more than one layer of glass, the results will reflect the composition of the entire bead with no distinction between the layers. If the two glasses are very different in composition, the results will not reveal this.

Intensive chemical analysis of glass trade beads excavated in North America has been performed since the 1990s using INAA (e.g., Hancock et al. 1996, 1997; Moreau et al. 2002, 2006; Moreau and Hancock 2010). More than 30,000 beads have been analyzed, resulting in a very important database maintained by R.G.V. Hancock of McMaster University, Toronto, Ontario. Unfortunately, to be able to return beads to their owners, only short-life elements have been studied: aluminum, calcium, chloride, magnesium, potassium, sodium, tin, antimony, cobalt, copper, manganese, vanadium, arsenic, and gold. INAA is able to quantify almost all the elements in the periodic table but then samples need to be irradiated for a long time and thus they stay radioactive for decades, precluding their return.

Using the INAA database, attempts have been made to date beads using elemental composition comparison and a pattern of the use of opacifiers in white beads from the 17th century onward has been established (Figure 9) (Moreau et al. 2006; Moreau and Hancock 2010; Sempowski et al. 2000). The database is so significant that it was used in studies of trade glass beads found in Europe (Karklins et al. 2002) and in South Africa (Prinsloo and Colomban 2008).

A recent pilot study conducted by Bonneau et al. (2014) investigated the influence of INAA on the matrix of glass beads. Ten beads were analyzed and no important changes were recorded. Nevertheless, if Raman analysis is planned, it is recommended that it be carried out before INAA analysis. To be able to quantify other elements for provenance studies, for example, LA-ICP-MS is one of the possibilities.

The main limitation of INAA is that it turns a minute part of the sample into radioactive isotopes, thus limiting analysis to elements with short half lives unless one is willing to sacrifice the samples. Another limitation is that INAA is more expensive than the previous techniques.

## Laser Ablation Inductively Coupled Plasma Mass Spectrometry

LA-ICP-MS is a combination of three apparatus: a laser which ablates (pulverizes) a minute part of the sample, a plasma source which ionizes the ablated material, and a mass spectrometer which sorts the elements depending on their mass and charge (Figure 10). The sample is placed inside a vacuum chamber and a laser is focused on the point to be sampled. This point, depending on the laser and the machine, is about 100 µm which cannot be seen with the naked eye. The ablated material is then transported to the plasma source in a gas where it is ionized; i.e., each atom is separated and positive or negative charges are attached to it. The mass spectrometer then separates and quantifies the ions. The results are presented in the form of a chromatogram (Figure 11). There are two methods to undertake the initial ablation: spot or line. Using the spot method, the laser goes deeper and deeper into the bead. This is useful when the bead is composed of several layers as the constituents of each layer can be determined. In line analysis, the laser moves across the surface.

The LA-ICP-MS technique requires knowing the amount of one of the chemical elements in the sample (an "internal standard") before it is analyzed. For beads, silicon is often the chosen element. Another way to obtain quantification has been developed by Gratuze (*see* Janssen 2013:201-234) which does not require quantifying an element before analysis. Almost all of the elements in the periodic table can be recorded, but interference may occur

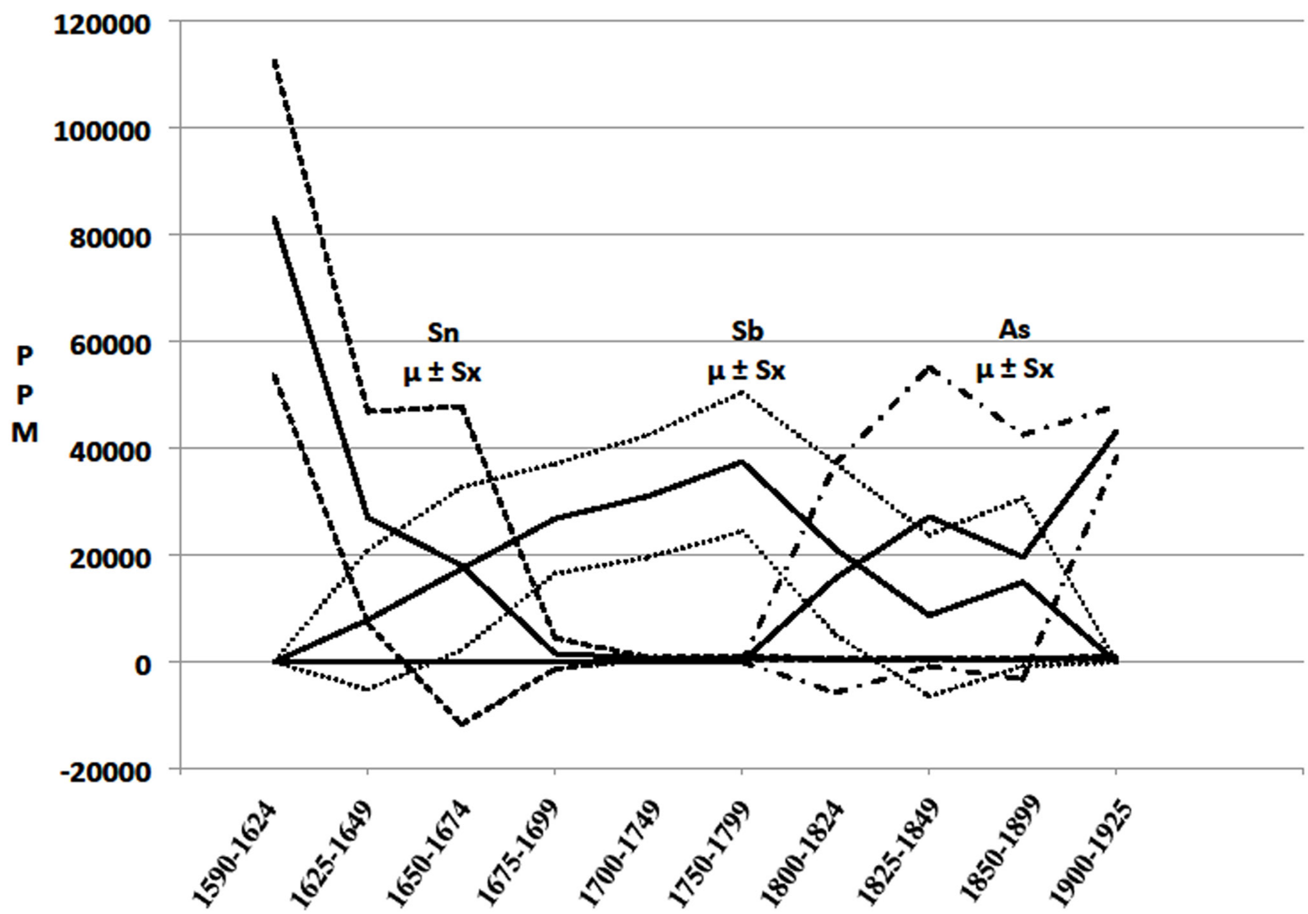


**Figure 9.** Pattern of the use of opacifiers in white beads over time (courtesy: J-F. Moreau).

where some ions interfere with the detection of others. To avoid any misunderstanding of the results, a careful discussion is recommended with a technician who has a thorough knowledge of the apparatus.

LA-ICP-MS and other mass-spectroscopy techniques have been used in many different studies around the world (e.g., Dussubieux 2001; Dussubieux and Gratuze 2003; Dussubieux et al. 2008, 2009; Walder 2014). This process has the great advantage that only a tiny portion of a sample is required for analysis, but the sample needs to be homogenous. Thus, replicate analysis needs to be performed at different points to avoid interference with highly crystallized spots, for example. Moreover, it is a surface technique so testing points need to be free of degradation. A quick, initial laser ablation of the spot or the line to be tested is often carried out to remove the first micrometers of glass which may be altered. For most of the other mass-spectroscopy techniques, which are not discussed here, samples have to be prepared; i.e., dissolved in acid or other chemicals before being introduce into the machine. It is, nevertheless, a requirement for isotopic analysis (*see* Janssen 2013:235-245, for more details).

LA-ICP-MS and INAA are both expensive techniques but are of great help for determining glass composition which often allows the determination of its place of manufacture.

### Raman Spectroscopy

Raman spectroscopy is another analytical technique which has been developed during the last decade. This technique is still poorly known in glass studies but is cheap and can reveal a lot about glass composition. Unlike the other techniques detailed above, Raman spectroscopy analyzes molecular bonds and, thus, the matrix of the bead. It allows the determination of the "shape" of the opacifiers and colorants, and the type of glass.

In the process, a laser is focused on the sample (Figure 12). It excites molecular bonds in the sample which react

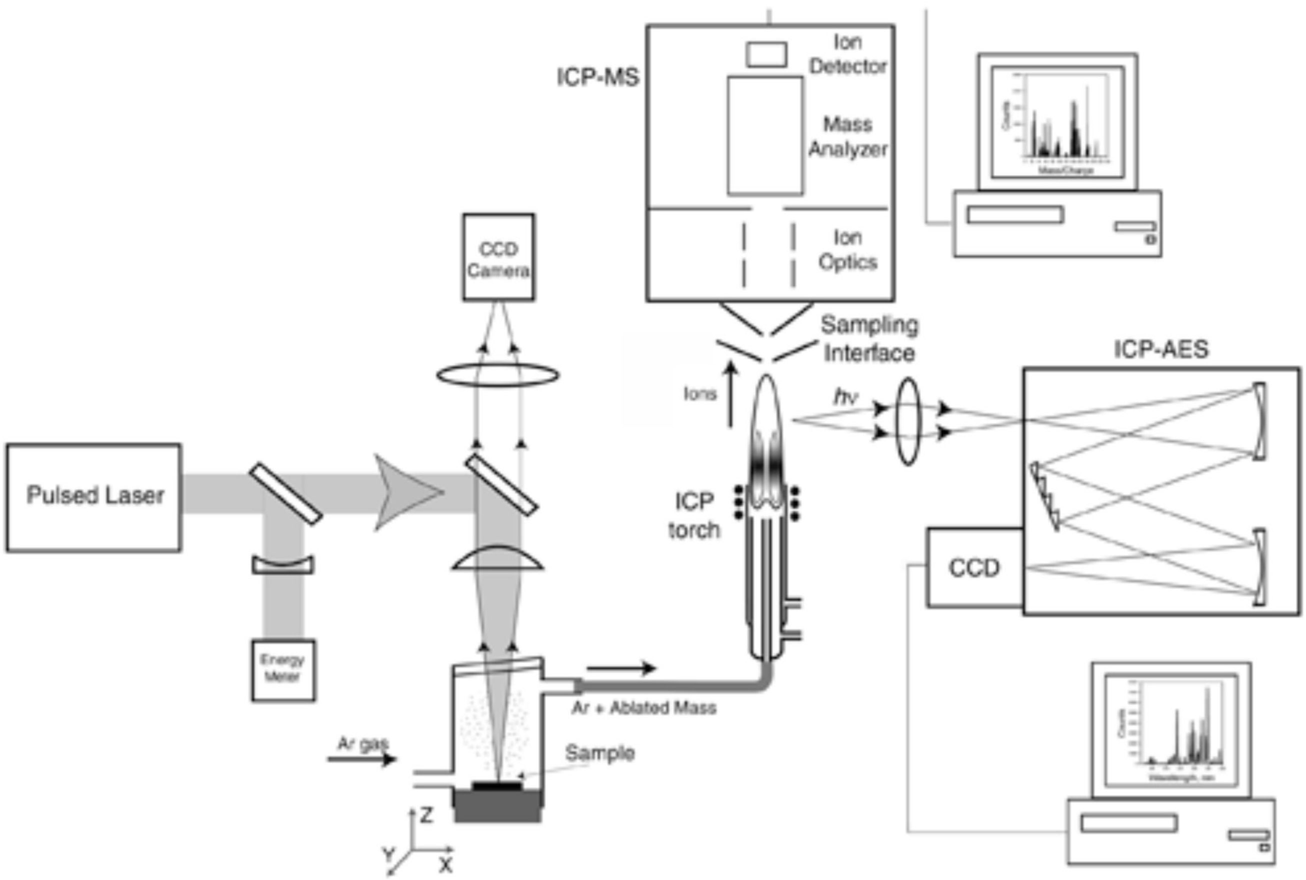


**Figure 10.** Schema of the LA-ICP-MS instrumentation (Energy Storage and Distributed Resources Department 2014).

by emitting three kinds of rays: Rayleigh rays which have the same wavelength as the laser, and Stokes rays and anti-Stokes rays which are characteristic of the molecule bonds that have been excited. Only the Stokes rays, which are the most intense, are recorded and the results are show as a spectrum (Figure 13). Different types of lasers are available for Raman analysis (488 nm, 514 nm, 532 nm, 633 nm, 785 nm, and 1064 nm). For glass analysis, green and red lasers (514 nm, 532 nm, and 633 nm) are the most used because they are more suitable for exciting molecular bonds in glass.

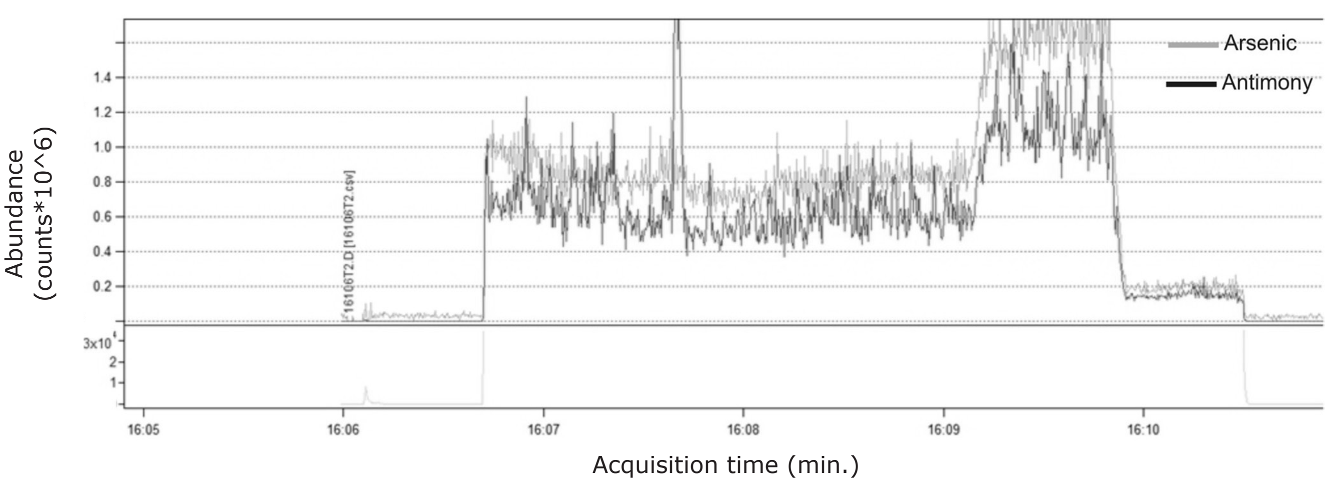


**Figure 11.** Example of a chromatogram from line analysis.

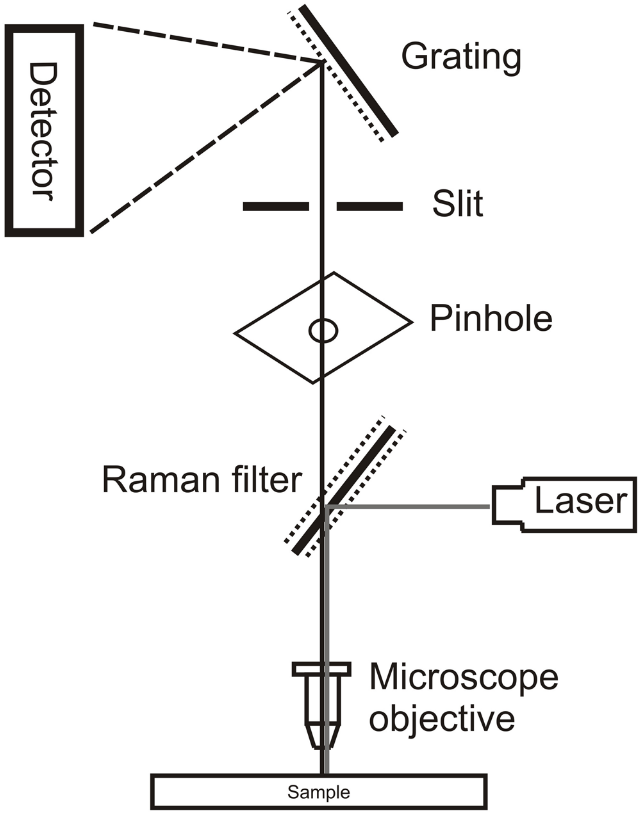


**Figure 12.** Schema of a Raman spectrometer.

Coupled to a microscope, the instrument is called a micro-Raman spectrometer. It is then possible to focus the laser on a very small part of the bead (ca. 5 µm², depending on the microscope objective used) which permits the analysis of different layers of glass or specific inclusions. Raman spectroscopy can identify the type of glass, the kind of opacifiers and colorants used, and using spectra treatments, determine glass sub-groups. This last step requires the use of specific software such as Grams, Origin Lab, or Matlab.

The Raman spectrum of a glass is composed of two massifs (broad peaks): one centered at ca. 500 $cm^{-1}$ (bending massif) and another at ca. 1000 $cm^{-1}$ (stretching massif). Calculating the area under each massif and dividing them reveals the polymerization index (Ip = A500/A1000) which is related to the amount of silicon in the glass and thus following Colomban (2003, 2004), to the processing temperature of the glass. The stretching massif can be investigated using the "Qn model" which requires the identification of the different peaks composing the massif. These peaks are linked to the molecular bonds in the glass matrix and thus can reveal differences in the same glass type, due to the manufacturing processes. Combining the "Qn model" and the Ip, it may be possible to identify sub-groups of glass types (for more details, *see* Janssens 2013:275-300).

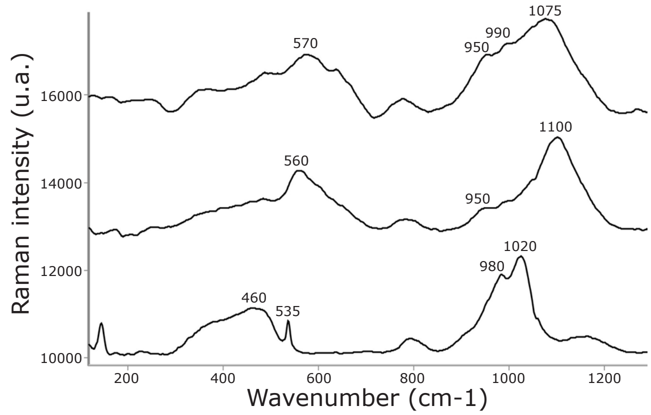


**Figure 13.** Example of Raman spectra of glass.

These kinds of spectra treatments require a good knowledge of the software and the mathematical processes behind the treatment.

So far, only a few studies have used Raman spectroscopy on glass beads (Bonneau et al. 2013; Prinsloo and Colomban 2008; Prinsloo et al. 2011). This technique has, however, proven its suitability and significance in other glass studies (e.g., Colomban et al. 2004, 2006; Colomban and Tournié 2007).

Raman spectroscopy is an inexpensive and quick technique to obtain information from glass beads. Its great advantage is that no preparation or sampling is required. Lasers can be powerful, however, and may burn samples if not used correctly. Raman spectroscopy suffers from fluorescence interference which is linked to sample composition and it is sometimes impossible to obtain any result. Once again, a well-trained technician is required.

## CONCLUSION

This article describes six of the most commonly used and potentially useful methods to analyze glass beads. These are summarized in Table 1. Apart from INAA which examines the entire bead and portable XRF where spot analysis is ca. 1mm², all of them test a very small part of the sample (ca. 1 µµm to 100 µm). It is, therefore, necessary to test different parts (at least five) of each specimen to assess the homogeneity and reproducibility of the results. Thus, a number of results will be obtained for each object. Depending on the question asked by the researcher, one to several dozen beads will need to be analyzed.

As shown in Table 1, the cost of performing the various analytical techniques varies. SEM-EDS, XRF, and Raman analyses are generally less than $50 per hour with the help of

**Table 1. Summary of Archaeometric Techniques Used to Analyze Glass Beads.**

| Technique | Research Potential | Sample Preparation | Relative Cost | Technician/ Training |
|---|---|---|---|---|
| Microscope | Observation | None or as needed | Generally none | Not required |
| SEM-EDS | Observation; elemental analyses (qualitative and semi-quantitative) | Coating; sections with polished surface for semi-quantitative analyses | Inexpensive | Required |
| XRF | Elemental analyses (qualitative and semi-quantitative) | Sections with polished surface for semi-quantitative analyses; standards required | Inexpensive | Required |
| INAA | Elemental analyses (qualitative and quantitative) | None | Expensive | Required |
| LA-ICP-MS | Elemental analyses (qualitative and quantitative); spatial repartition of chemical elements | None | Expensive | Required |
| Raman Spectroscopy | Observation if coupled to a microscope; molecular analysis | None | Inexpensive | Required |

a technician (3-5 beads can be analyzed per hour). For INAA and LA-ICP-MS, the cost is about $70-$100 per bead. The fees charged depend on whether the researcher is a student or associated with a commercial firm, if the assistance of a technician is required, or if an agreement may be made with an institution to use their equipment.

Each technique has its merits and drawbacks, and the researcher wishing to use one or more of them should consult with an archaeological technician to determine which is the best for what information is desired. For example, it is impossible to say that SEM-EDS is better than XRF for elemental analysis as it depends on the questions asked and on the samples available to answer them. Other techniques are also available (such as x-ray diffraction or ion-beam analysis) and new ones will doubtless be developed as new requirements arise.

As most of the techniques described herein are of a complicated nature, only a brief summary of the technological aspects has been provided. The researcher should bear in mind that a well-trained person is needed to carry out the analyses detailed herein. It requires long training and a sound knowledge of each technique to be able to provide accurate results and to interpret them correctly. Moreover, more than one method is sometimes needed to answer all the questions. Thus, more than one trained person may be required to carry out the analyses.

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# GLASS BEADS FROM CHAMPLAIN'S *HABITATION* ON SAINT CROIX ISLAND, MAINE, 1604-1613

James W. Bradley

*One of the earliest French attempts at settlement in northeastern North America occurred on a small island in the St. Croix River along the Maine/New Brunswick border. Built under the auspices of Pierre Dugua, Sieur de Mons, and his young lieutenant, Samuel de Champlain, this settlement barely survived the winter of 1604-1605 and was abandoned the following summer. Given its clear historical association and brief occupation, the glass beads from St. Croix Island are an important archaeological marker for reconstructing French influence during the first decades of the 17th century. Knowing who used these beads in trade, however, does not indicate where they were made. Current evidence suggests that many, and perhaps most, of these beads were produced at the Carel-Soop glasshouse in Amsterdam (1601-1624) and are a material expression of the culturally diverse partnerships that sponsored many of the early-17th-century voyages to Terra Nova.*

## INTRODUCTION

The *habitation* on St. Croix Island was established during the summer of 1604 by Pierre Dugua, Sieur de Mons. A Protestant from Saintonge, he had been to Terra Nova before, as a participant in Pierre Chauvin's abortive attempt to establish a settlement at Tadoussac in 1600. In 1603, Henry IV appointed him Sieur de Mons and made him lieutenant general for all of Acadia, a vast section of the Atlantic coast between 46° and 40° north latitude, or from Cape Breton to the northern edge of what the English claimed as Virginia. After failing to find a suitable location for a permanent settlement along the eastern shore of the Bay of Fundy, de Mons explored the western shore, reaching the mouth of a wide and deep river in late June. Joined by two tributaries just upstream, this river was named the St. Croix by de Mons. The actual settlement was built on a small island near the mouth of the river (Figure 1; Plate WIIIA). Initially, the island seemed a good choice. It was easy to defend and had ready access to fish, game, and other resources. St. Croix was a good choice for economic reasons as well. It could serve as a base for finding the region's reputed copper and silver mines, as well as an excellent location to trade for furs, an increasingly lucrative business, with the local Etchemin (Passamaquoddy) people.

With construction begun during the summer, the island seemed a safe place to winter. The reality proved to be quite different. With no fresh water source on the island and the river frequently choked with ice, firewood and food were soon in short supply. By March 1605, nearly half of the 79 men in the garrison had died, many of scurvy. Although provisions and new recruits arrived that spring, a decision was made to find a more suitable location for settlement and by August the buildings had been dismantled and shipped across the Bay to a new site named Port-Royal at the mouth of the Equille River.

Although the French never resettled on St. Croix, the site remained a place of pilgrimage for the French over the next

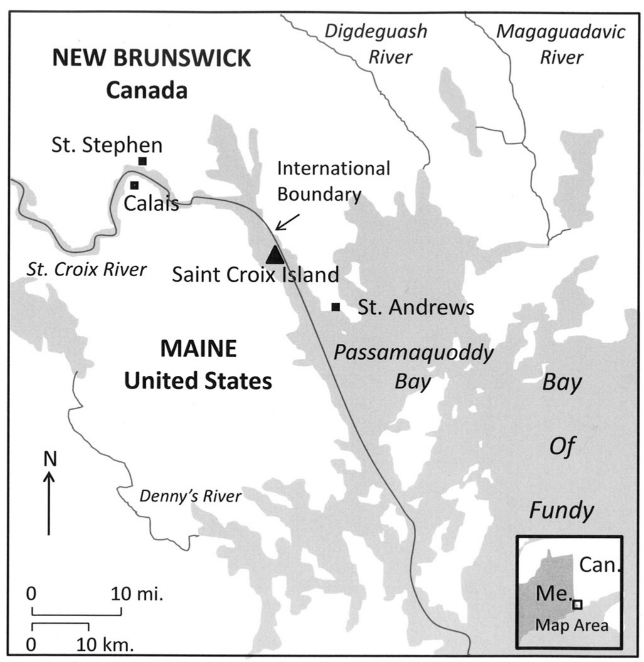


**Figure 1.** Saint Croix Island and Passamaquoddy Bay (reproduced with permission, Maine Historic Preservation Commission).

decade. Marc Lescarbot visited it in 1607, and in 1610, Jean de Poutrincourt noted that the local Native population had left everything untouched. The English were also frequent visitors, primarily to fish but also to defend their own claims, even though George Popham's 1607-1608 colony at the mouth of the Kennebec River had fared no better than St. Croix. In 1613, the French received a more forceful remainder of English ambitions in the region when Samuel Argall, on behalf of the Virginia Company of London, was ordered to destroy all French settlements and fortifications as far north as Cape Breton. This he did, burning what was left of St. Croix in October and Port-Royal in November (summarized from Thierry 2012).

On the archaeological side, St. Croix also has a complex history. In 1797, excavations were made in order to help determine the location of the United States/Canada border. Nearly 150 years later, Congress authorized that St. Croix Island be declared a National Monument and National Park Service archaeologist J.C. Harrington devised a research plan for the site. A series of excavations took place during the 1950s and 1960s uncovering several foundation walls and the colony's cemetery, but little of this information was publically available until a recent report (Pendery 2012). This article is a modified version of Chapter 10 in that report (Bradley 2012). In terms of the site itself, a memorandum of understanding was signed in 1982 by the United States and Canada agreeing to share information and coordinate preservation efforts. In 1984, the island was designated an International Historic Site, the only one in the National Park system.

## THE SAINT CROIX BEADS

Glass beads, whether intended as gifts or as trade merchandise for the local Native people, are an important component of the Saint Croix site assemblage. Although the number and variety of beads has not changed significantly from previous reports, the broader context for interpreting them has. The glass bead assemblage from Saint Croix Island is significant for four reasons. First, it is the artifact group with the widest distribution across northeastern North America. Given the site's brief occupation (1604-1613) and specific cultural associations, the glass beads from the island have served as a benchmark (Glass Bead Period 2) in defining regional site sequences from the Canadian Maritimes to the western Great Lakes. Second, by comparing the Saint Croix Island beads with those from production sites in Europe, it is possible to begin documenting the multi-cultural, if not international, nature of Western European trade consortiums at the turn of the 17th century. Third, as a class of material selected specifically for trade rather than to support settlement, glass beads provide an important measure as to what Native people wanted as consumers, especially in terms of color. Finally, because of the early and precise dates of the Saint Croix occupation, it is possible to demonstrate that its glass bead assemblage predates the development of wampum. In other words, wampum appears to have been developed in response to these beads and did not serve as a model for them (Bradley 2011).

Although glass beads were recovered during the various archaeological excavations on Saint Croix Island, the actual number remains unclear. The current National Park Service (NPS) artifact database for Saint Croix Island lists 47 beads (Table 1). Hadlock's fieldwork in 1950 produced at least "one oval blue bead" (Johnson 1996:36-37) while Gruber reported that 51 beads were found during his excavations in 1970. When I examined the glass beads from Saint Croix stored at the NPS Charlestown Navy Yard curatorial facility in 1983, 51 of the 56 reported beads were present (Plate VIIIB). My amended list of these beads using the taxonomic system developed by Kenneth and Martha Kidd (1970) is presented in Table 2 (in the tables, an asterisk [*] denotes varieties not recorded by the Kidds).

If the actual number of beads is unknown, so is the exact context in which many of them were found. Forty-four of the 47 beads in the NPS database can be identified by archaeological context (Plate IXA). The remaining three beads are unprovenienced.

**Feature 1.** This roughly oval trash deposit contained mammal bone, shell, and charcoal as well as "plentiful" artifacts including "a number of small glass beads" (Cheek 1969:62). Ten beads are recorded from this feature: Ia5 (2), IIIb* (1), and IIa40 (7).

**Feature 2.** This shallow deposit of dark brown, possibly burned, soil contained charcoal, glass and ceramic fragments, nails, and one bead (Ia5) (Cheek 1969:61). At least ten other glass beads were found, including Ia5 (4), IIa40 (4), and those described as "green oval beads" (IIa15?) (2). Another cluster of six beads (all Ia5) was found east of those listed above.

**"Cobble floor" and "Wall B."** These building features are often identified as remnants of the "storehouse." Eight beads appear to be related to this structure. One (Ia5) was recovered from the cobble floor while three others (Ia5 [1], IIa40 [1], and IIa15 [1]) were found in the subsoil. In an adjacent excavation unit, three beads (IIa40 [2] and Ia5 [1]) were found in association with Hadlock's "Wall B" while one Ia5 bead was recovered from the subsoil. The remaining

**Table 1. Current National Park Service Inventory of Glass Beads from Saint Croix Island (Distribution by Excavation Unit and Catalog Number).**

| Kidd Code | IIa40 | Ia5 | IIa15 | IIa57 | IIIb* | IVa16? |
|---|---|---|---|---|---|---|
| | 162 | 165, 180 | 191 | | | |
| | | 188 | | | | |
| | 164, 176 | 163, 175 | | | | |
| | 155, 156, 157, 158, 159, 160, 161, 168, 170, 172, 174 | 153, 154, 167, 171, 177, 994 | 169, 173 | | 152 | |
| | | 182, 183, 184, 185, 186, 1021 | | | | |
| | 179, 189, 190 | | 693 | | | 692 |
| | 166 | | | | | |
| | 181 | | | | | |
| | 187 | | | | | |
| | 178 | | | | | |
| | | 2328, 2329, 2330 | | | | |
| **Totals** | **21** | **20** | **4** | **0** | **1** | **1** |

**Table 2. Total Reported Glass Beads from Saint Croix Island.**

| Rank | Kidd Code | Shape | Size | Description | Qty. | Comments |
|---|---|---|---|---|---|---|
| 1 | IIa40 | round | S | op. robin's egg blue | 1 | |
| | IIa40 | round | M | op. robin's egg blue | 24 | |
| 2 | Ia5 | tubular | S-M | op. white | 24 | 4 mm ave. diameter; 12-16 mm length; quite regular & even in glass quality; ends are slightly finished |
| 3 | IIa15 | oval | M | op. white | 5 | 5 mm diameter; reported as "greenish;" not seen (cat. # 169, 173, 191, 693) |
| | IIa57 | oval | M (?) | tsp. (?) bright navy | 1 | reported, not seen |
| | IIIb* | tubular | M | tsl. robin's egg blue w/ 3 red stripes; white core | 1 | ends are unfinished (# 152) |
| | IVa16? | round | M (?) | op. "blue w/ 2 white stripes" | 1 | reported, not seen (# 692) |
| **Total** | | | | | **57** | |

13 beads were found in other test or excavation units across the site.

These beads appear to have been associated with the Sieur de Mons occupation of 1604-1605. Given the ongoing French interest in this site until 1613, however, when Captain Samuel Argall destroyed all remaining structures, it seems prudent to date this assemblage to the period 1604-1613.

## COMPARABLE FRENCH ASSEMBLAGES

Are the beads from Saint Croix Island consistent with those from other early-17th-century assemblages in northeastern North America? Two sites in Quebec City, Champlain's *habitation* (151QU and CeEt-9)[1] and Fort St. Louis,[2] have produced comparable glass bead assemblages dating from the first decades of the 17th century. Excavations at Champlain's *habitation* produced a particularly important assemblage: at least 135 glass beads from three well-defined contexts dating between ca. 1600 and 1629.[3]

**Champlain's *habitation*, Phase 1: Contact period (1600, 1608-1624).** Nadia Charest reports 89 beads from three Phase 1 contexts: 11A26, 14A26, and 16A11 (Bradley 2012:286, Table A6.1). It was not possible to examine the Phase 1 beads, but by reorganizing Charest's counts, they could be placed into rank order (Table 3).

**Champlain's *habitation*, Phase 2: Champlain's first occupation (1608-1624).** Charest reports 38 beads from five Phase 2 contexts: 11A25, 14A24, 14A25, 15A9, and 16A10 (Bradley 2012:286, Table A6.1). It was possible to examine three samples of beads (n=5) identified as coming from Phase 2 (Table 4). Based on this examination and reorganizing Charest's counts, the beads could be put into rank order (Table 5).

**Table 3. Glass Beads from Champlain's *Habitation*, Quebec (Phase 1, 1600-1624).**

| Rank | Kidd Code | Shape | Size | Description | Qty. |
|---|---|---|---|---|---|
| 1 | Ia5 | tubular | S-M | op. white; some have slightly finished ends | 33 |
| 2 | Ia19 | tubular | S-M | tsp. bright navy | 22 |
| 3 | IIa15 | oval | S-M | op. white | 10 |
| 4 | Ia6 | tubular | S | op. light ivory | 3 |
| 5 | Ia8 | tubular | S | tsl. citron | 3 |
| 6 | IIa19 | circular | S | op. amber | 2 |
| | IIa48 | round | S | op. dark shadow blue | 2 |
| | IIIa1 | tubular | M | op. red; black core | 2 |
| | IVk3 | ? | M (?) | op. blue "star" bead; probably IIIk3 | 2 |
| 7 | Ic6 | tubular | VS-S | tsp. oyster white; 5 sides | 1 |
| | IIa1 | round | VS-L | op. red; black core | 1 |
| | IIa13 | round | VS-L | op. white | 1 |
| | IIa14 | circular | S | op. white | 1 |
| | IIa57 | oval | S | tsp. bright navy | 1 |
| | IIIb9 | tubular | L | tsp. bright navy w/ 15 white stripes; white core | 1 |
| | IVk4 | round | L | op. blue "star" bead | 1 |
| **Total** | | | | | **86** |

**Table 4. Sample of Glass Beads Identified from Champlain's *Habitation*, Quebec (Phase 2, 1608-1624).**

| Context | Kidd Code | Size | Shape | Description | Qty. | Comments |
|---|---|---|---|---|---|---|
| CeET 9 13A25 | 1a5 | VS | tubular | op. white | 1 | 5 mm long, 5 mm diameter; very thin |
| | IIa32 | S | oval | tsp. turquoise | 1 | 8 mm long, 2 mm diameter |
| CeEt 9 16A10 | IIIk3 | S | tubular | op. blue "star" bead | 1 | faceted ends |
| | Ia5 | S | tubular | op. white | 1 | 5 mm long, 5 mm diameter |
| CeEt 9 15A9 | Ibb* | M | tubular | op. apple green w/ 3 red-on-white stripes | 1 | 12 mm long, 6 mm diameter |
| **Total** | | | | | **5** | |

**Table 5. Glass Beads from Champlain's *Habitation*, Quebec (Phase 2, 1608-1624).**

| Rank | Kidd Code | Shape | Size | Description | Qty. |
|---|---|---|---|---|---|
| 1 | Ia5 | tubular | S-M | op. white; some have slightly finished ends | 15 |
| 2 | Ia19 | tubular | S-M | tsp. bright navy | 4 |
| 3 | IIa39/40 | round | S | tsl. aqua blue (NC – IIa39; JB – IIa40) | 3 |
| 4 | IIa15 | oval | S-M | op. white | 2 |
| 5 | Ia15 | tubular | L | tsl. bright blue | 1 |
| | Ibb* | tubular | L | op. bright mint green w/ 3 white-on-red stripes | 1 |
| | IIa11 | round | VS | tsl. oyster white | 1 |
| | IIa32 | oval | S | tsp. turquoise | 1 |
| | IIa35 | round | M | op. light aqua blue | 1 |
| | IIa57 | oval | S | tsp. bright navy | 1 |
| | IIIbb7 | tubular | L | tsp. bright navy w/ 3 red-on-white stripes | 1 |
| | IIIk3 | tubular | S | op. blue "star" production tube with ground, faceted ends (NC reports this as IVk3) | 1 |
| | IVa1 | round | M | op. red; black core | 1 |
| **Total** | | | | | **33** |

**Champlain's *habitation*, Phase 3: Champlain's second occupation (1624-1629).** Nineteen Phase 3 beads came from three Phase 3 contexts: 11B8, 12A41, and 12A50 (Bradley 2012:286, Table A6.1). Two samples of beads (n=4) identified as coming from Phase 3 were studied (Table 6). Based on this examination and a reorganization of Charest's counts, it was possible to order the beads as shown in Table 7.

**Fort St. Louis, pre-1629 context.** It was possible to examine 23 glass and 18 discoidal shell beads[4] from this context (Table 8).

It is always tricky to compare artifact distributions across a series of sites, especially when different sampling and excavation strategies have been used. Nonetheless, in comparing the occurrence of bead varieties from Saint Croix with those from Champlain-related sites in Quebec, the similarities are notable (Table 9). Although there is variability, all four of the assemblages from Quebec have more than a 50% overlap with the beads from Saint Croix Island.[5] More specifically, two varieties (Ia5 and IIa57) are present in all five samples while two more (IIa15 and IIa40) occur in four of the five. The similarity of these assemblages may reflect Native preferences, or the possibility that many of these beads were acquired from the same production source.

## COMPARABLE ENGLISH-RELATED SITE ASSEMBLAGES

The glass bead assemblages from two English-related settlements of the early 17th century – one on the Gulf of Maine coast, the other in Virginia – provide a useful comparison with the French-related glass beads.

**Table 6. Sample of Glass Beads Identified from Champlain's *Habitation*, Quebec (Phase 3, 1624-1629).**

| Context | Kidd Code | Size | Shape | Description | Qty. |
|---|---|---|---|---|---|
| CeET 9 12A41 | 1a5 | S | tubular | op. white | 2 |
| | IIa57 | M | oval | tsp. bright navy | 1 |
| CeEt 9 12A50 | IIa40 | M | round | op. robin's egg blue | 1 |
| **Total** | | | | | **4** |

**Table 7. Glass Beads Identified from Champlain's *Habitation*, Quebec (Phase 3, 1624-1629).**

| Rank | Kidd Code | Shape | Size | Description | Qty. |
|---|---|---|---|---|---|
| 1 | Ia5 | tubular | S | op. white | 12 |
| 2 | Ia11 | tubular | M (?) | tsl. teal green | 1 |
| | Ia18 | tubular | S | tsp. ultramarine | 1 |
| | IIa11 | round | S | tsl. white | 1 |
| | IIa37 | circular | S | op. aqua blue | 1 |
| | IIa39/40 | round | M (?) | op. robin's egg blue (NC – IIa39; JB – IIa40) | 1 |
| | IIa57 | oval | S | op. bright navy | 1 |
| | IVa1 | round | M (?) | op. red; black core | 1 |
| **Total** | | | | | **19** |

**Table 8. Glass Beads from Fort St. Louis, Quebec (pre-1629).**

| Rank | Kidd Code | Shape | Size | Description | Qty. |
|---|---|---|---|---|---|
| 1 | IIa40 | round | M | op. robin's egg blue | min. 9 |
| 2 | IVa2 | round | M | op. red with clear core | 5 |
| 3 | IIa55 | round | S | tsp. bright navy | 1 |
| | IIa55 | round | L | tsp. bright navy | 2 |
| 4 | IIa15 | oval | S | op. white | min. 1 |
| 5 | Ia5 | tubular | S | op. white; slightly finished ends | 1 |
| | Iab* | tubular | M | op. white w/ 6 red & 6 gold stripes | 1 |
| | IIa34 | circular | VS | op. light aqua blue | 1 |
| | IIa57 | oval | S | tsp. bright navy | 1 |
| | IIIbb2 | tubular | M | op. red w/ 3 blue-on-white stripes; black core | 1 |
| **Total** | | | | | **23** |

**Table 9. Comparison of Glass Beads from Champlain-Related Sites.**

| Kidd Code | Saint Croix (n=57) | Champlain's *habitation*, Phase 1 (n=86) | Champlain's *habitation*, Phase 2 (n=33) | Champlain's *habitation*, Phase 3 (n=19) | Fort St. Louis (n=23) |
|---|---|---|---|---|---|
| IIa40 | 25 (44%) | 0 | 3 (9%) | 1 (5%) | 9 (39%) |
| Ia5 | 24 (42%) | 33 (38%) | 15 (45%) | 12 (63%) | 1 (4%) |
| IIa15 | 5 (9%) | 10 (12%) | 2 (6%) | 0 | 1 (4%) |
| IIa57 | 1 (1.5%) | 1 (1%) | 1 (3%) | 1 (5%) | 1 (4%) |
| IIIb* | 1 (1.5%) | 0 | 0 | 0 | 0 |
| IVa16? | 1 (1.5%) | 0 | 0 | 0 | 0 |
| **Totals** | **57 (100%)** | **44 (51%)** | **21 (63%)** | **14 (73%)** | **12 (51%)** |

**Fort St. George, Maine (1607-1608).** Excavated under the direction of Dr. Jeffery Brain (2007), this important, if little-known site produced a well-dated sample of glass beads.[6] Of the 162 monochrome specimens recovered, 154 are described as opaque white and oval in shape (IIa15), seven are opaque blue and round (IIa40 or IIa46), and one is too deteriorated to classify. In addition, two small multi-layered beads are present; both have an opaque red exterior and a translucent green core. One is oval (IVa7) and the other round (IVa5). Finally, a single striped bead was recovered: translucent dark blue with six (?) white stripes (similar to IIb68).

Although this English attempt at settlement differed from Champlain's in many ways, the glass bead assemblages are remarkably similar, certainly more than might be expected. Well over 95% of the beads from Fort St. George (IIa15 [93%] and IIa40/46 [4%]) appear to overlap with those from Saint Croix Island. Whatever the reason, this lack of distinction between "French" beads and "English" ones is striking and instructive. It certainly suggests that such "national" designations are not useful or accurate and should be avoided in describing these objects.

**Jamestown, Virginia (1607-1623).** In contrast to Fort St. George, this well-known site, the location of the first successful English settlement in North America, has received considerable archaeological attention. Most recently, the Jamestown Rediscovery project identified and excavated a substantial portion of the original (1607-1623) fort, supplying a more detailed and controlled view of this early settlement. Not surprisingly, glass beads were an important part of the artifact assemblage. These have been well described (Lapham 2001). Of the 188 beads reported from the Early Fort Period, the ten most frequently occurring are listed in Table 10.

Although the Jamestown beads do have some distinct differences, especially in the presence of Nueva-Cadiz-like and wound cone-shaped beads, the overall assemblage does not differ substantially from those of the Maine coast or Quebec. White and blue beads predominate while other colors and striped specimens are far less common.

## COMPARABLE NATIVE SITE ASSEMBLAGES

So far, the bead assemblages discussed have been from French or English sites and represent the European side of the exchange/trade equation. What kinds of glass beads have been recovered from Native sites of the same time period?

Considerable research has been done on the occurrence of glass beads on Native sites in both Canada and the United States. Initial work by Kenyon and Kenyon (1983) and subsequently refined by Fitzgerald et al. (1995) defined a series of Glass Bead Periods for which specific beads styles and assemblages were present. A comparable set of Glass Bead Horizons has been defined for Five Nations Iroquois sites in the United States (Bradley 2007:42-3, 184). Although these two approaches have their differences, both agree that

**Table 10. Glass Beads from Jamestown, Virginia (Early Fort, 1608-1623).**

| Rank | Kidd Code | Shape | Size | Description | Qty. |
|---|---|---|---|---|---|
| 1 | IIa56 | circular | VS-S | op. shadow blue (appears to be IIa47, not IIa56 ) | 49 |
| 2 | IIa40 | round | M | op. robin's egg blue | 28 |
| 3 | IIIc1 | tubular | M | op. bright blue exterior & core; white middle layer; ground ground ends | 21 |
| 4 | IIa13 | round | M | op. white | 16 |
| 5 | WI* | | | "cone-shaped yellow beads" | 15 |
| 6 | IIIc3 | tubular | M | op. bright navy exterior; gray core; ground ends | 14 |
| 7 | IIb18 | round | L | tsp. light gray w/ 8-12 white stripes | 12 |
| 8 | IIa15 | oval | S | op. white | 7 |
| 9 | IIa55 | round | M (?) | tsp. bright navy | 5 |
| 10 | IIIm1 | tubular | M (?) | op. blue "star" beads with ground, faceted ends | 4 |
| | IVa19 | circular | S | op. bright navy | 4 |
| **Total** | | | | | **175** |

from 1600 to 1614, four bead varieties – simple tubular beads in white (Ia5) and dark blue (Ia19) as well as small oval beads in the same colors (IIa15, IIa57) – constitute a significant proportion of any bead assemblage (Figure 2). The other bead varieties likely to occur in assemblages from the first quarter of the 17th century include the ubiquitous round robin's egg blue (IIa40) bead as well as varying percentages of multi-layered and often decorated beads such as IIbb2, IIbb7, IIIb9, IIIbb1, IIIk3, IVa1/2, IVa19, and IVk4. These can occur as tubes with unfinished ends, finished beads, and occasionally, as wasters.

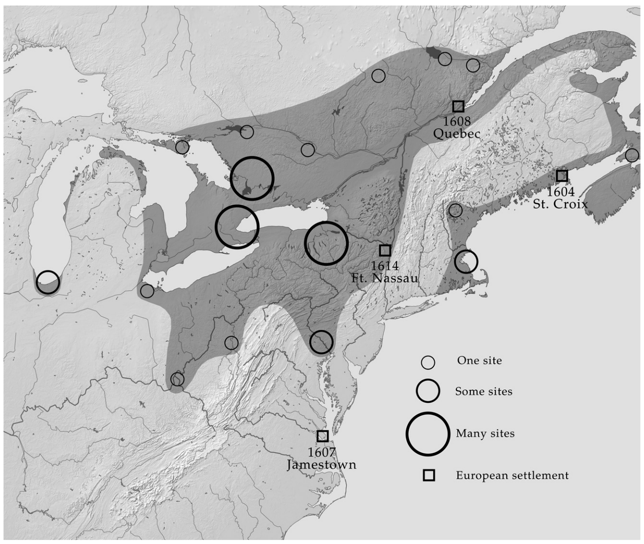


**Figure 2.** An estimate of French trade networks ca. 1600-1630 as defined by the occurrence of Glass Bead Period 2 beads (after Bradley 2011:33).

Three early-17th-century burial sites, one in the Canadian Maritimes and two on the shore of Massachusetts Bay, illustrate an Algonquian pattern of bead preference. The Avonport site, Nova Scotia, produced more than 1,000 glass beads, all either tubular white (1a4/5) or dark blue (Ia19) (Whitehead 1993:77). The glass beads reported by Willoughby (1924) from Winthrop, Massachusetts, are also exclusively small white (Ia5) and dark blue (Ia19) tubes. Along with these are white tubular shell beads of similar dimensions made from *Busycon* columella and a few small purple discoidal beads made from mussel shell (*Mytilus edulis*). No wampum beads are present. The glass beads from the nearby burials on Chelsea Beach, Revere, reported by Hadlock (1949:68-69), are very similar except that these are small white (IIa15) and dark blue (IIa57) ovals instead of tubes. Here too, "long strings of both the long tubular and discoidal forms of [white] shell beads" are found although the former are "rather coarse in comparison to the later historic wampum." Once again, a few thin discoidal beads made from locally available mussel shell are reported (Hadlock 1949:68-69).

Two contemporary Iroquoian sites, one Huron and the other Seneca, provide comparative examples from further inland. The Huron Warminster site, the likely location of Cahiagué visited by Champlain in August 1615, has yielded a substantial sample of glass beads. From a total of 426 beads, the most frequently occurring varieties are: 1) Ia5, op. white tubes (n=177 [42%]); 2) IIa15, op. white ovals (n=119 [28%]); 3) IIa57, tsp. dark blue ovals (n=44 [10%]); and 4) Ia19, tsp. dark blue tubes (n=23 [5%]). Small percentages of other beads, including striped and multi-layered specimens, are present as well (Fitzgerald et al. 1995:128, Table 2).

To the south, the Seneca Cameron site, located in the Genesee River drainage of western New York, was likely occupied between 1595 to 1610 (Wray et al. 1991:411).[7] Of the site's total of 522 glass beads, the most frequently occurring varieties are: 1) Ia4/5, op. white tubes (n=200 [38%]); 2) IIa15, op. white ovals (n=114 [22%]); 3) IIa40, op. robin's egg blue round (n=81+ [16%]); 4) IIa46/47, op. shadow blue round (n=37 [7%]); and 5) IIa13/14, op. white round (n=28 [5 %]). Other varieties present include: IIa43 (n=19 [4%]), IIa57 (n=12 [2%]), Ia19 (n=9 [2%]), IIa8 (n=6 [1%]) as well as small numbers of striped and multi-layered beads (Wray et al. 1991:317-321, Table 7-67). Discoidal marine-shell beads are also a significant component of the Cameron site assemblage.[8]

As Bill Fitzgerald (1990:167, Figure 12) has argued, the distribution of these tubular white and dark blue beads essentially marks the extent of French influence during the early decades of the 17th century. Sites with a significant number of these beads occur as far south as the Susquehannock Schultz site in Pennsylvania (Kent 1984:218-22; Smith and Graybill 1977:54, 57) and as far west as the Oneota New Lenox site at the foot of Lake Michigan (Billeck 2010). Wherever they were made and however they reached Native people across the Northeast, this group of glass beads forms a remarkably consistent horizon marker on both European and Native sites.

## THE QUESTION OF PRODUCTION: GLASS BEADMAKING IN WESTERN EUROPE

With growing affluence as well as the centralization of political authority, the finely made decorative arts of Italy increasingly served as markers of status and wealth during the 16th century. Glassware, especially made in the Venetian style, was one of the most visible of these indicators of taste and style (Page 2004). During the late 16th and early 17th centuries, glassmaking in western Europe occurred at two fundamentally different levels. One was the traditional production of glass for bottles, flasks, windows, and other utilitarian uses, which may have included simple beads. The second focused on replicating the elaborate tableware and drinking glasses of Italy that otherwise had to be imported. This level of glassmaking was an industrial, not cottage, undertaking, requiring highly skilled artisans, technically demanding facilities, and substantial financing (whether entrepreneurial or municipal) to produce not just the highly desired *cristallo* glass but also the multi-colored, multi-layered glass accompanying it.

### The Dutch Republic

While glassmaking, like many of the other fine arts, was initially centered in Antwerp in the southern portion of the Spanish Netherlands, with the Dutch Revolt in 1568 and the subsequent capture of Antwerp by the Spanish 17 years later, Amsterdam quickly emerged as the new center for glassmaking (Liefkes 2004:227-235). The history of these glasshouses, especially those specializing in *façon de Venise* glass, is well documented and indicates continued production of glass beads as well as tablewares and other items from 1601 into the 1670s (Baart 1988; de Roever 1991:156-173, 193; Hudig 1923; Karklins 1974).

The documentary record of beadmaking in Amsterdam has been complemented by a considerable amount of archaeological evidence. As early as 1960, van der Sleen observed that not only beads but production waste could be found in several locations in and around the city (Karklins 1974; van der Sleen 1963, 1967). Supplemented by Karklins' (1985) ongoing studies, Jan Baart (1988) provided the first systematic review of both documentary and archaeological evidence for beadmaking in Amsterdam. Most important have been recent excavations at two glasshouses by the Archaeological Department of the Bureau of Monuments and Archaeology, under the direction of Jerzy Gawronski. These include the Carel-Soop glasshouse (KLO10) that operated between 1601 and 1624 (Hulst 2013:28-29) and the second Two Roses glasshouse (RO21), located on the Rosengracht, in use between 1657 and 1676 (Gawronski et al. 2010).

It is the Carel-Soop glasshouse that is of particular interest here. Although several deposits of waste glass, including beads, had been found on the Kloveniersburgwal in central Amsterdam (KLO3 and KLO8), as well as on the Keizersgracht (KG10),[9] the actual production facility remained unknown until the Archaeology Department salvaged a portion of the site (KLO10) in April 2001. Among their finds were the base of a large, circular glass oven, a smaller rectangular annealing oven, and material apparently from the production floor. In terms of construction, the excavated oven is very similar to that illustrated by Antonio Neri in 1669 (Liefkes 2004:242, Figure 12). The Carel-Soop glasshouse was a large facility occupying three house lots (excavations occurred in the backyard of one lot). Michel Hulst, a glass researcher with the Archaeology Department, estimates that as many as 80 people had been employed there, with six glassblowers working at each of the three ovens.

In addition to the structural evidence, a large quantity of waste glass and other material was recovered, including large crucible fragments up to 60 cm in diameter, chunks of waste glass in many colors, a great number of production tube fragments (several showing the marks from pontil attachment), and examples of drinking glass and bead wasters. The Carel-Soop assemblage is dominated by production waste and contains relatively few finished beads (Plate IXB). Hulst believes this material was simply left behind when the glasshouse closed.

Through the courtesy of Jerzy Gawronski, I was able to make an initial inventory of the bead-related glass from this site in November 2005. With his permission, that inventory is reproduced in Table 11. As can readily be seen, nearly every style of glass bead found, not just at Saint Croix Island but on Native sites across the Northeast, is represented in the Carel-Soop assemblage.

### France

There is no doubt that French traders used simple glass beads during the first decade of the 17th century. Lescarbot (1911, II:322) describes "necklaces and armlets or chaplets of tubes of white and blue glass" among the presents that M. de Poutrincourt presented to Native Americans at a place in Maine called Marchin Bay in 1604. The question of where these beads were manufactured is, however, quite a different matter.

France's fascination with Venetian glass profoundly affected its glassmaking. Unlike the Dutch Republic, glassmaking in France benefitted traditionally from royal support; Henry IV in particular encouraged the establishment of new glasshouses. In 1598, he granted a factory in Rouen the exclusive right to manufacture Venetian-style glass. The main French center for the production of glass *à la façon de Venise* during the late 16th and most of the 17th centuries was, however, the city of Nevers, located on the upper Loire River (de Rochebrune 2004:148).

Although some scholars have suggested that French producers, especially in Rouen and Paris, were important

**Table 11. Glass Beads and Associated Wasters from the Carel-Soop Glasshouse (KLO9), Amsterdam (1601-1624).**

| Group | Kidd Code | Size | Shape | Description | Qty. |
|---|---|---|---|---|---|
| I. Plain production tubes | Ia1, IIIa1 | | tubular | each ~50%, red tubes are the most common | |
| | Ia5, IIIa8 | | tubular | white tubes present but not common | |
| | Ia16 | | tubular | shadow blue tubes were less common | |
| | Ia20, IIIa12 | | tubular | each ~50%, dark navy tubes common | |
| | | | | | |
| II. Striped production tubes | Ib* | | tubular | op. red w/ 3 white stripes | |
| | Ib* | | tubular | op. red w/ 8 white stripes | |
| | Ib3 | | tubular | op. black w/ 3 red stripes | |
| | Ib* | | tubular | op. black w/ 5 white stripes | |
| | Ib* | | tubular | op. black w/ 3 red & 3 white stripes | |
| | Ib* | | tubular | op. robin's egg blue w/ 3 white stripes | |
| | Ib* | | tubular | op. light aqua blue w/ 8 red stripes | |
| | Ibb1 | | tubular | op. red w/ 3 blue-on-white stripes | |
| | Ib'2 | | tubular | op. white w/ 3 sets of spiral blue stripes | few |
| | Ib'* | | tubular | op. white w/ 8 spiral blue stripes | few |
| | IIIb1 | | tubular | op. red w/ 6 white stripes; black core | |
| | IIIb* | | tubular | op. red w/ 10 white stripes; black core | |
| | IIIb7 | | tubular | op. shadow blue w/ 8 white stripes; white core | many |
| | IIIb9 | | tubular | tsp. bright navy blue w/ 15 white stripes; white core | many |
| | IIIbb1 | | tubular | op. red w/ 3 blue-on-white stripes; black core | many |
| | IIIbb6 | | tubular | op. black w/ 3 white-on-red stripes; black core | |
| | | | | | |
| III. Chevron production tubes | IIIk* | | tubular | op. honey gold w/ white & red layers | several |
| | IIIk3 | | tubular | op. bright navy blue w/ white & red layers | some |
| | IIIn* | | tubular | op. white w/ red & green layers | |
| | | | | | |
| IV. Plain beads | IIa6 | M-L | round | op. black | 4 |
| | IIa13 | M | fat oval | op. white | 3 |
| | IIa20 | M-L | round | op. cinnamon | 2 |
| | IIa40 | M-VL | round | op. robin's egg blue | 7 |
| | IIa44 | M | circular | tsp. cerulean blue | 1 |
| | IIa46 | M-L | round | op. shadow blue | 4 |
| | IIa48 | M-L | round | op. dark shadow blue | 4 |
| | IIe*? | L | round | tsp. bright navy w/ 8 spiral ridges | 1 |
| | IVa1 | S-M | circular | op. red; black core; flattened ends | 2 |
| | IVa* | M/L | circular | tsp. bright navy; white core | 9 |
| | **Total** | | | | **37** |

**Table 11. Continued**

| Group | Kidd Code | Size | Shape | Description | Qty. |
|---|---|---|---|---|---|
| V. Beads with stripes | IIb6 | VL | round | op. red w/ 6 white stripes | 1 |
| | IIb8 | L | round | op. red w/ 6 mustard stripes | 1 |
| | IIb18 | M-L | round | tsp. "gooseberry" w/ 12 white stripes | 10 |
| | IIb48 | M-L | round | op. mustard w/ 8 red stripes | 8 |
| | IIb* | VL | flat | op. mustard w/ 8 red stripes | 2 |
| | IIb50 | VL | flat | op. mustard w/ 8 white stripes | 2 |
| | IIb54 | M-L | round | op. light aqua w/ 8 red stripes | 2 |
| | IIb55 | M-L | flat | op. light aqua w/ 6 red stripes | 5 |
| | IIb* | VL | round | op. light aqua w/ 8 red & 8 blue stripes | 1 |
| | IIb57 | L-VL | round | op. robin's egg blue w/ 4 white stripes | 3 |
| | IIb61 | M-L | round | op. shadow blue w/ 6 red stripes | 7 |
| | IIbb2 | M-VL | flat | op. red w/ 3 blue-on-white stripes | 3 |
| | IIbb* | M | round | tsp. mustard w/ 3 red-on-white stripes | 17 |
| | IIb'* | L | round | tsl. cerulean blue w/ 3 white spiral stripes | 1 |
| | IIb'* | VL | round | op. black w/ 3 white spiral stripes | 1 |
| | IVb5 | M | round | op. red w/ 6 white stripes; black core | 1 |
| | IVnn* | L | round | op. white w/ 8 red & 8 blue stripes over a ridged red core | 5 |
| | **Total** | | | | **70** |
| | | | | | |
| VI. Eye beads | IIg4 | M-L | round | op. white w/ blue eyes | 2 |
| | IIg* | M | round | op. red w/ white eyes | 1 |
| | **Total** | | | | **3** |
| | | | | | |
| VII. Chevron beads | IVk4 | M-VL | round | classic op. blue "star" bead | 2 |
| | IVn* | VL | round | 4 red, 4 blue, & 4 green stripes over a ridged op. red core | 3 |
| | IVn* | VL | round | 6 red & 6 blue stripes over ridged op. red core | 1 |
| | IVn* | VL | round | 4 red, 4 blue, & 4 gold stripes over ridged op. red core | 3 |
| | IVn* | VL | round | 6 red & 6 green stripes over ridged op. red core | 6 |
| | IVn* | VL | flat | 6 red & 6 green stripes over ridged op. red core | 6 |
| | **Total** | | | | **21** |

suppliers of glass beads during the first decade of the 17th century (Fitzgerald et al. 1995:122; Turgeon 2001:64, 70), a careful review of the historical and archaeological literature does not support this interpretation. Most of the Venetian-style glass made in France during the late 16th and early 17th centuries was produced for the court, the church, or other high-end customers. Glass bead production has yet to be documented archaeologically (de Rochebrune 2004:150-163). Turgeon's analysis of inventories and contracts in Paris does indicate that beads were manufactured there, but it is often unclear what kind of beads these were or the use for which they were intended. Indeed, since beadmakers were members of the paternostriers guild (Turgeon 2001:68), it is likely that rosary beads were their primary product. In addition, several of the glass beads illustrated by Turgeon from the Jardins de Carrousel in Paris fit comfortably within known late-16th-century Venetian assemblages.[10] This does not mean that glass beads for trade were not produced in France, rather that the evidence to demonstrate this has yet to be presented.

The one exception might be the round, robin's egg blue beads (IIa40) that are ubiquitous on New World sites of the last half of the 16th century and well into the 17th (*see* Lapham 2001 for a summary). These were often described as "turgyns" (turquoise) in the contemporary notarial records (Turgeon 1998:601-602, 2001:76). Peter Francis has argued that these were manufactured in France (2009:78-79) and, given the extremely broad distribution of these beads, spatially and chronologically, it is likely that they were made in more than one location.

**England**

The demand for Venetian glass also inspired the production of high quality glassware in England during this time. There, as in France, production was initially for the court and upper classes with drinking glasses as the particular focus. To date, no archaeological evidence of glass beadmaking has been reported from any of these glasshouses (Willmott 2004). The exception is the recent discovery of beadmaking at the Hammersmith Embankment in west London. This appears to have been a small-scale operation undertaken by Sir Nicholas Crisp in an attempt to copy Amsterdam bead styles, perhaps for the African slave trade. Although it remains uncertain when production began, probably after 1620, the facility did not function after 1640 (Geoff Egan 2008: pers. comm.). Karlis Karklins (2014: pers. comm.) has examined the recovered beads and recorded 42 varieties. Interestingly, none of these have correlatives in the Saint Croix assemblage.

**DISCUSSION**

The glass beads from Saint Croix Island fit comfortably with other well-documented early-17th-century assemblages from across the Northeast; indeed, they are remarkably similar. The two most common bead varieties at Saint Croix Island – round robin's egg blue (IIa40) and tubular white (Ia5)[11] – also rank either first or second in the assemblages from the other French and English sites discussed. This similarity extends to the overall bead assemblage as well. Whether the sites are European (as distributors) or Native (as consumers), the glass beads appear to be remarkably consistent during the first decade of the 17th century. This assemblage consisted primarily of simple tubular beads in white (Ia5) and dark blue (Ia19) as well as small oval beads in the same colors (IIa15, IIa57), along with the ubiquitous round robin's egg blue beads (IIa40) and a small number of multi-layered, multi-colored beads. After the establishment of the New Netherland Company in 1614, Dutch-related trade used a much higher percentage of multi-layered, multicolored beads; glass bead assemblages among the Five Nations began to differ substantially from those in Quebec and Ontario (Bradley 2007:42-43).

In spite of the similarities, there may have been subtle differences in the glass beads preferred by English and French entrepreneurs. English sites, for example, yield primarily oval or round beads while tubular beads predominate on French sites. However, in either case, color preferences remain the same: white and dark blue.

Given these color preferences as well as the apparent Native demand for small tubular beads, one might speculate about the role glass beads may have played in the development of wampum, the small tubular beads of white and dark purple marine shell that served as "the source and mother of the beaver trade" after 1624.[12] What is important here is that no shell beads were recovered from Saint Croix, and those from the Champlain-related sites in Quebec are discoidal in shape, not tubular.

Although some scholars have suggested that discoidal shell beads were made in France (Turgeon 2001:70-72), it is clear that they were an established form long before European contact. Discoidal marine-shell beads have been documented on Native sites across the Northeast for nearly 3,000 years (Heckenberger et al. 1990:127) and are the most common shell bead form on Iroquoian and Algonquian sites of the late 16th and early 17th centuries (Petersen et al. 2004:17-20; Wray et al. 1991:411). In fact, they may be what Robert Juet saw in September 1609 when he described the many "stropes of Beads" brought aboard *de Halve Maen* by local Mahican people to revive an apparently dead (drunk) head man (Jameson 1909:2223). The archaeological evidence certainly indicates that the most likely form of shell used for ritual purposes at the turn of the 17th century was a string of discoidal beads.

The glass beads from Saint Croix Island and related sites also supply clues to their production and distribution. In terms of production, it is clear that, based on visual evidence, a very strong similarity exists between the beads produced in the Carel-Soop glasshouse and those recovered from both European and Native sites in the Northeast. The next steps would be to make a formal comparison between the beads from Amsterdam and North America, then conduct an appropriate analysis of comparable specimens to determine chemical signatures or other quantitative markers. An example is the work that has been done over the past 20 years on those ubiquitous, round, robin's egg blue beads (IIa40). Neutron activation testing has demonstrated that, although visually similar, some late-16th-century beads have a different chemical composition than some early 17th-century examples (Chafe et al. 1986; Hancock et al. 1994). It remains unclear whether these differences reflect temporal or production differences (Fitzgerald et al. 1995). To date, none of the beads from St. Croix Island have been analyzed. This would be a logical next step and could provide a useful basis for comparison with the ongoing analyses of samples from Amsterdam and other production centers.

Issues of production can be clarified through well-designed analysis; distribution is likely to remain much murkier. Simple designations such as "English," "Dutch,"or "French" not only mislead, they blur the fundamental reality of early-17th-century commercial activity. At that time, Spain was the primary enemy of the emerging nation-states in western Europe. As small Protestant countries, England and the Dutch Republic were frequently allied against the Spanish. Although Catholic, France likewise saw Spain as a threatening neighbor with territorial ambitions. Obstructing those ambitions was a fundamental part of French policy, regardless of who was king.

Such factors helped create new and diverse economic partnerships. A good example is Lambert van Tweenhuysen who was born in the old Hanseatic town of Zwolle and became one of Amsterdam's most successful merchants with economic ties from Archangel to Istanbul and northwest Africa to northeast North America (Hart 1959:39-44). Among Van Tweenhuysen's close contacts were two La Rochelle merchants, Samuel Georges and Jean Macain, who had strong connections with the emerging fur trade in Terra Nova. In fact, Georges and Macain shared a one-fifth ownership in a new company established in Rouen in 1604 to promote trade and colonization in Canada. The director of the company was Pierre Dugua, Sieur de Mons. Although no documentary trail connects Amsterdam glass beads with the provisioning of the Saint Croix Island expedition, it is not a stretch to suggest that beads from the Carel-Soop glasshouse could easily have been incorporated into a cargo from Rouen. Indeed, van Tweenhuysen continued to play a very strong role in the emerging fur trade: as leader of the first Dutch company to trade in the Hudson Valley, as a director of the New Netherland Company, and, finally, through his own firm. Only after the West India Company received a monopoly on the Hudson River trade did van Tweenhuysen's interests move on (Hart 1959:40). Van Tweenhuysen was not a unique case. Another successful Amsterdam fur trader, Arnout Vogels, also established a partnership with two Rouen merchants in June 1611, specifically to trade in Canada. As with van Tweenhuysen, the fur trade became Vogels' primary interest and within a few years, he too shifted his focus to the Hudson Valley (Hart 1959:15-16, 20-41).

These connections among Dutch, French, and English entrepreneurs during the first decades of the 17th century help to explain the overall similarity in bead assemblages across the Northeast. There were very few sources for high-quality glass beads and it appears that buyers purchased much of their trading stock from the same source. In all likelihood, that source was the Carel-Soop glasshouse.

## CONCLUSION

Traditionally, most researchers have looked to Venice as the likely source for glass trade beads, especially the multi-layered and multi-colored varieties (Francis 2009; Lapham 2001). Yet, based on archaeological evidence and visual comparison, the glass beads from Saint Croix and other Champlain-related sites in Quebec were most likely made in Amsterdam. This seems especially the case with complex and distinctive bead varieties, such as IIbb1 and IIIk3, that are present as production tubes, wasters, and finished beads at the site of the Carel-Soop glasshouse (KL010) in Amsterdam. The presence of production tubes and beads for the more generic styles (IIa40, Ia5, and IIa57) at KLO10 and related waster deposits (KLO3 and KLO8) suggest that at least some of the beads of these styles found at Saint Croix Island and in Quebec were produced in Amsterdam as well. The beads produced at the Carel-Soop glasshouse in Amsterdam are a material expression of the culturally diverse partnerships that sponsored many of the early-17th-century voyages to Terra Nova.

## ACKNOWLEDGMENTS

The generosity of many friends and colleagues made the initial report on these beads possible. In particular, I would like to thank Steve Pendery for the opportunity to participate in the St. Croix volume and Arthur Spiess of the Maine Historical Preservation Commission for permission to reproduce Figures 5.1, 6.1, 10.1, and 10.2 from that work. I also want to thank Jerzy Gawronski and Michel Hulst for access to and information on the materials recovered from the KLO10 site. Finally, my deep thanks go to Karlis Karklins for encouraging me to submit this for publication in *Beads* and letting me express my opinions, even when he did not agree with them.

## ENDNOTES

1. *La habitation de Champlain* is part of the larger Place-Royale archaeological district, the first permanent settlement area in New France. Several excavations have been undertaken in this area. *See* Niellon and Moussette (1985) for an initial report. My thanks to Claudine Giroux of the Ministère de la Culture, des Communications et de la Condition Feminine, Quebec, for her assistance in allowing me to study this assemblage.

2. This series of forts and governors' residences was excavated by Parks Canada in 2005, 2006, and 2007. The Parks Canada site code is 38G and most of the beads I saw were from one lot, 38G29A28. I thank Paul-Gaston l'Anglais for his assistance in allowing me to study these beads.

3. Although I was able to examine several of the beads from Champlain's *habitation*, limits of time and collection availability made it impossible to locate all the specimens that had been recovered. Claudine Giroux therefore informed me that another researcher, Nadia Charest, a graduate student from Sheffield University, had spent a week examining the bead assemblage in 2008. Ms. Giroux permitted me to copy the summary notes that Ms. Charest had made. Although Ms. Charest also used the Kidd system to classify the beads, we each appear to have applied that system in slightly different ways. The descriptions in Tables 3-7 are therefore based on my application of the Kidd system. I am extremely grateful to Ms. Charest for the opportunity to utilize her data. Any errors or omissions are my, not her, responsibility.

4. At Fort St. Louis, 18 (42 %) of the 41 beads recovered from the pre-1629 context were shell. Of these, 16 were white and two were dark gray to black. These beads were generally 6-8 mm in diameter and 2-4 mm in thickness. They appear to have been made from both *Busycon* and *Merceneria* species. Interestingly, no tubular beads were observed. Although I did not have the opportunity to count the shell beads from the three phases at Champlain's *habitation*, my sense is that similar shell beads were also present in a comparable degree.

5. Glass beads, in particular white tubes (Ia5) and ovals (IIa15), were also recovered from the pre-1642 level at Pointe-à-Callière in Montreal. These beads appear to be related to Champlain's brief use of the site during the summer of 1611 (Brad Loewen 2009: pers. comm.).

6. Brain (2007:133-134) reported 166 drawn glass beads (counting 29 half beads as 15 whole beads) and 2 wound beads although there appear to be provenience issues with the latter. In addition, Brain utilized his own classification system for describing these beads and this makes it more difficult to compare them with those from other sites. I have assigned Kidd and Kidd numbers to these beads based on Brain's descriptions and the published photographs, and have not examined the beads myself.

7. It should be noted that the majority of the beads were recovered from mortuary contexts, and that the distribution of bead varieties from mortuary (intentional) and non-mortuary (random) contexts on the same site can be significantly different.

8. A total of 1,353 marine-shell beads were recovered from the Cameron site, primarily from burials. Of these, 1,059 (78%) are discoidal. These occur in three sizes: small (averaging 3.5 mm in diameter), medium (averaging 6.4 mm in diameter), and large (averaging 11.6 mm in diameter). Medium-size beads are the most frequent. The majority of these beads appear to be white, although color is not specified (Wray et al. 1991:342-346).

9. Recent re-assessment of the KG10 assemblage now indicates these beads were probably from the first Two Roses glasshouse (1621-1657) located on the Keisersgracht, and not from the Carel-Soop glasshouse as previously suggested (Baart 1988:70). My thanks to Michel Hulst (2010: pers. comm.; 2013:28-29) for this information.

10. The Gnalic wreck, a Venetian merchant vessel that sank off the Dalmatian coast around 1580 to 1600, has provided a large assemblage of comparable Venetian-made glass beads (Hugh Willmott 2008: pers. comm.).

11. George Hamell has argued that among the Northeast Woodland peoples, "sky-blueness" appears to be interchangeable with "whiteness" in most mythic and ritual contexts (Hamell 1983:6, 1992).

12. Petrus Stuyvesant to the WIC Directors, April 1660 (O'Callaghan and Fernow 1853-1887, 14:470). For a more comprehensive evaluation of the relationship between Glass Bead Period 2 beads and the origins of wampum, *see* Bradley (2011) and Hamell (1996).

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# FROM THE PAST (1854): A CHAPTER ON NECKLACES, OLD AND NEW

**Mrs. White**

*Originally published in* Godey's Magazine and Lady's Book *in 1854 (pp. 213-216), this article presents a brief history of necklaces among the classic Egyptians, Greeks, and Romans, as well as the British, from the perspective of an educated English lady. It is an instructive early study of strung adornments based on antiquarian, historical, and literary sources.*

It is curious to trace the first appearance of necklaces amongst the Egyptians, in the same form as they exist at the present day upon the necks of the Patagonians, and the natives of the islands of the Pacific; for the ancient dwellers by the Nile wore necklaces of the seeds of leguminous plants, berries, and feathers (especially those of the *poule de Numidie*), precisely the same substances which are used in this ornament by the above people, except that the emu supplies the feathers, and that shells are occasionally mingled with the bright-colored berries. But shells were also used in necklaces by the Egyptians, as our readers may perceive in the table-cases of the Egyptian gallery in the British Museum.

Here, we may trace the next appearance of this trinket, when art began to be applied in its composition, and spherical beads of various substances were used; as well as its progression from a simple ornament to its superstitious use as an amulet.

In one of these cases some very interesting specimens of our subject may be seen, tracing, as plainly as more important things might do, the gradual advance of art; there is one of round blue beads capped with silver, another representing deities and symbols, and a third with pendants in the form of the lock of horns, fishes, and cowries, which are well deserving of attention.

The two latter were of course worn as amulets, and, being impressed with sacred images, were supposed to ward off danger and infection, to render the wearer courageous or agreeable, or invest him with the various qualities which their symbolism, or the substances of which they were composed, represented in the mythic language of the East.

Perhaps it might have been with such intentions that we find the necklace so favorite an adornment with the warriors of antiquity. The Medes, Persians, Indians, and Etruscans wore them in the valuable shape of strings of pearls, sometimes enriched with jewels; while the chiefs and great men amongst the northern nations were distinguished by necklaces and collars of gold, culled *torques*, so that, when conquered, the necklaces of both oriental and Celtic nations must have made an important part of the spoils. Hence, probably, the adoption of the *monile* by the Romans as a reward for military valor, and hence also the surname of *Torquatus* Manlius, who was so called from his having torn the golden *torque* from the neck of an enemy on the field of battle.

Necklaces were worn by both Greek and Roman women, but only within doors, and on occasions of domestic festivity, as at weddings and dances; they were especially used as bridal presents, and the learned in mythology will remember that it was upon the occasion of Hermione's marriage that Vulcan, to revenge her mother's infidelity, bestowed upon her the fatal necklace which worked such wondrous evils on her race. Here we perceive that the Eastern superstitions connected with this ornament had accompanied the fashion of wearing it into Greece: the rich and beautiful necklace of Hermione was a talisman – not to counteract evil, but to produce it; so that by-and-by we find this very necklace, which Ovid tells us was of gold, and to the description of which Nomus devotes fifty lines of his Dionysica, bribing Eriphyle, the wife of Amphiaraus, to betray her husband.

At Rome, as with the old Egyptians, the materials of the necklace soon altered from a simple row of berries or small spheres of glass, &c., to pearls and amber, and precious stones; the single chaplet, which primitively encircled the throat, gradually extended to a second, and even a third row: after which we find the original necklace adorned with drops or pendents, which, when worn, fell round the neck like rays from a centre.

For this description of *monile*, emeralds, and other gems of a greenish hue, were greatly prized; and amongst the treasures which time has restored to the museums and cabinets of the curious, from the buried toilets of Pompeii, a golden necklace is enumerated, which was enriched with twelve small emeralds.

Etruscan graves have also yielded up their treasures, and amongst a variety of other matters affording the most interesting illustrations of the domestic economies of the ancient Tuscan people, have preserved for us the fashion of these ornaments. Those purchased from the Prince of Canino, and deposited in the British Museum, are of gold; one represents a wreath of ivy leaves in pairs, the stems of the leaves joining; and the ornaments of the others consist of circles, lozenges, rosettes, hippocampi (sea horses), and a heart depends centrally from one of them.

Necklaces in the shape of serpents were worn by the Greeks and Romans, by whom this emblem was regarded as a charm against witchcraft and the "evil eye;" they were made to coil round the neck of the wearer, and it is remarkable that the necklace so fatal to Hermione and Eriphyle was of this form. Some years back an inscription, found in France, mentioned a *torque* dedicated to Æsculapius, having been made by twisting together two golden snakes, and offerings of trinkets in this shape were often made in honor of him by persons during illness, or their recovery from it.

Besides decorating the necks of brides and conquerors with these ornaments, the Romans carried their admiration of the necklace so far as to adorn the statues of their divinities with them; thus, a statue of Fortune, found at Herculaneum, had the representation of a necklace incrusted with silver, and a figure of Mercury, in the gallery of Greek and Roman antiquities in the museum (thought by some to be the most exquisite bronze in Europe), has a gold torquis round its neck; this honor, however, the deities shared in common with favorite domestic animals; and horses were frequently adorned with them.

So much more remains to be said of the use of them by the ancients, that we leave, reluctantly, these classic reminiscences, to trace the history of the necklace at home, where it appears to have an existence coeval with Stonehenge, and to have preserved its memoirs in the funeral barrows of the Britons and Anglo-Saxons. In these *tumuli*, necklaces of various kinds have been found, and beads of crystal, jet, amber, and colored glass, are quite common in them. In some, necklaces of bone and ivory have been discovered, and the Archaeological Society have engraved one in their Journal, which is formed of beads of bone and canel coal.

In the wills of the Anglo-Saxons, we find the neck-bracelet, as its name implied in their language, frequently mentioned: and amongst other articles of jewellery, we read of golden vermiculated necklaces. Boadicea wore a golden necklace, and subsequently the torquis, or collar of honor, commonly of gold, was made the *insignia* of dukes and earls, both by the Anglo-Saxons and the Normans. The Norman kings wore a collar or necklace of gold, adorned with jewels, and which depended on the breast, like the collar or [sic] knighthood, of which, no doubt, these antique ornaments were the prototypes; while such of our Saxon ancestors as could not procure the precious metals, rather than be without this favorite ornament, wore them of brass, and even iron.

Amber appears, from the very earliest period, a favorite material for the necklaces of women, probably on account of its perfume, which Autodycus, the roguish peddler, in the "Winter's Tale," alludes to in his rhyming list of wares –

"Necklace amber,
Perfume for a lady's chamber."

In Italy, we learn from an ancient chronicler that ladies wore them made of bent gold coins, and that whistles in the shape of a dragon, set with gold and pearls (probably to call servants), sometimes depended from them.

A picture of Joan of Navarre, wife of Henry IV, in whose reign necklaces were much worn by ladies, represents her wearing a collar of Esses.

A necklace on the ancient effigy of Lady Peyton at Isleham Church, Cambridgeshire, is formed of pear-shaped stones or pearls, attached to a string or narrow band of gold, while another, represented in the Harleian MS., looks like a wreath of small stars, and was, in all probability, of the same precious metal.

In the Middle Ages, we read that the necklaces of women were set with jewels and stones; and that some, called *serpents*, from the fashion of them, were also in vogue; and in the fifteenth and sixteenth centuries, the necklaces of English ladies were arranged in the same manner as the rayed ones of the Romans.

Queen Elizabeth is always represented wearing strings of pearls, or jewelled carcanets, and the royal example appears to have been very generally followed by the dames of her realm, whose taste for a profusion of such ornaments has been handed down to us by the dramatists and other writers of the period; though in her reign, as in her father's, sumptuary laws were made to prevent persons below a certain rank from appearing in them.

Barclay, in his "Ship of Fools," printed A.D. 1508, speaks of some who had their necks

"Charged with collars and chains,
In golden withes."

And in a curious work called "The Four Pees," of John Heywood, written 1560, he makes the Peddler vaunt, amongst other vanities of women, "of all manner of beads." The penalty for wearing anything of gold or gilt about the neck, in Henry VIII.'s time, unless the wearer was a gentleman, or could prove that he possessed, over all charges, 200*l*. yearly value, was the forfeiture of the same; a regulation well calculated to maintain the restriction in tact.

All this while certain superstitions existed with regard to the necklaces, as well as to all other trinkets of which gold and precious stones made part, occasioned, probably, by the antique use of gems as amulets, and from the pretended occult powers ascribed to them by the alchemists. Even Elizabeth, with all her keenness and masculine strength of mind, save where vanity and its natural craving, the love of admiration, were concerned, appears to have been just as impressible upon such subjects as a peasant girl; and we find the Lord Chancellor Hatton sending her a ring (in all probability an agate), to be worn on her breast, against infectious air. The physicians of those days did much to sustain the "charm" of our subject. Necklaces made of the root of the male peony were worn for the prevention of the falling sickness, while those made of amber were deemed good against infection; and to the doctrine of signatures, which connected the medical properties of substances with their forms and color, we may safely trace the common practice of ornamenting young children with necklaces of coral, as well as the invention of the silver-belled trifle, so called.

With the same purpose (that of assisting their teething), the anodyne necklace, which is made of beads of the white bryony, is sometimes hung around the necks of infants, sustaining, even in our own times, a lingering faith in the medical virtues of the amulet.

But that our space forbids, the necklace worn by nuns might lead us to a dissertation on the religious uses of this ornament; but we must briefly glance at its secular history in modern times, when its most powerful spells have been those of fashion.

Coming down to the seventeenth century, we find the necklace quite as much in vogue as in the reign of Elizabeth: in Massinger's "City Madam," after her husband's knighthood, we find her brother observing to the lady,

"Your borrowed hair,
Powdered and curled, was by your dresser's art
Formed like a coronet – hang'd with diamonds,
And richest orient pearls – your carkanet,
That did adorn your neck, of equal value;"

so that the love of gems and jewellery was by no means on the decline. In the picture of Charles and his queen, in "Heath's Chronicle," (1662), Catherine of Braganza wears two necklaces, one clasping the throat, and the other, to which a pendent is attached, falling low on the shoulders. Planché tells us that in Mary's reign, jewelled necklaces sparkled on the bosom, a fashion continued in that of her sister Anne of Denmark, who is usually drawn wearing one.

With the accession of George III., the maudlin sentimentality of the belles and macaronies of the period gave the name of *esclavage* to the necklace then in fashion, which consisted of several rows of gold chains, or beads, or jewels, arranged one under the other in successive festoons, so as to cover the entire neck.

This was again replaced by the carcanet, or band of jewels set in gold, and we ourselves remember the *négligé*, with its tasselled ends falling gracefully beneath the throat; since then the necklace has gradually grown into disuse, so that our friend's information, that short golden ones were again in fashion, sounded pleasantly as news of an old acquaintance.

# BOOK REVIEWS

*Floral Journey: Native North American Beadwork.*

**Lois Sherr Dubin.** Autry National Center of the American West, 4700 Western Heritage Way, Los Angeles, CA 90027. 2014. 258 pp., 216 color figs., 15 B&W figs., index. ISBN 978-0-615-88449-3. $65.00 hardcover; $48 paperback.

*Floral Journey: Native North American Beadwork* is the catalog for the exhibition of the same name which runs through 26 April 2015, at the Autry Museum in Los Angeles, CA. It is written by the author of *The History of Beads* and *North American Indian Jewelry and Adornment*, as well as numerous other titles dealing with Native cultural material, both modern and old.

*Floral Journey* is a tour through a style of beadwork practiced by Indians all over the U.S. and Canada, that of working the floral form in beads, generally via embroidery. Dubin includes everything from moccasins to bags, clothing and horse adornment. While much of it was made during the 19th and early 20th centuries, some late 20th century work is used to illustrate particular points, and the finale is a chapter devoted to new pieces. There are a few examples of pre- and early-contact work pictured as precedents for the floral material, including a gorgeous, elaborately-scrolled Naskapi robe collected in Labrador in 1740, worked in quills and paint on caribou skin, and a wampum belt woven in the late 18th century.

Following an "Introduction" in which Dubin lays out the importance of both flowers and beadwork to Native peoples, she begins with "Cosmology: Sacred Foundations, Art, and Floral Imagery." A section called "Adornment: History, Trade, and Transformation" then follows. After these opening chapters giving the backstory, both the sacred and the secular, she divides *Floral Journey* into different sections of the continent: Woodlands (nearly half the continent), Southeast Woodlands, Northeast Woodlands, Great Lakes, Subarctic, Great Plains, Plateau, and Great Basin. Some chapters more tribally related cover material of the Cree, the Métis, and the Northern Athapaskan (Dene).

Dubin supplements the geographical sections with more narrowly focused writing, to wit "The Double Curve Motif and Floral Imagery;" "Floral Art as Commodity;" "Great Lakes Birch Bark, Quillwork, and Flowers;" "The Iroquois and 'The Art of Flowering';" "The Great Lakes Bandolier Bag;" "Moose-Hair Tufting;" "A Thorny Identification: Rosebuds as Symbols of Native Identity;" "The Delaware Pouch;" "The Prairie Style;" "Sioux-Métis Flower Beadwork;" "Contour Floral Beadwork and Numerology;" "The Gould Family: Six Generations of Beadwork Legacy;" "The Octopus Bag;" and "Flowers and Formal Attire: Indians and Cowboys." On a personal level, I found the sections dealing with the Delaware pouch and Prairie Style to be especially fascinating as these are two areas of North American Indian beadwork of which I've been only peripherally aware. It was great to have the chance to dive deeply enough into them to have a good basic sense of their origins/changes over time and their place in the larger picture.

Other voices weigh in at times. The first is that of Ella Barnes Bluestone Ree from Barbara Feezor Buttes' (Mdewakanton), "Beading the Medicine Flowers: Mdewakanton Women and the Art of Survival," on the importance of medicine plants to Native peoples, and the recognition that flowers were often the means of identifying medicine (and food) plants when seeking them. The second important voice is that of Steven L. Grafe, Art Curator at the Maryhill Museum of Art in Goldendale, Washington, who places the use of flower imagery in beadwork in its correct Plateau context, noting that the pleasure in doing beadwork and an appreciation of its ability to make its wearer "beautiful" is how the doing of beadwork on the Plateau is generally approached. Dubin is to be commended for welcoming this voice, contrary to some of her major points, including her emphasis on sacred meanings and numerology in Plateau design.

The final chapter, "Contemporary Expressions: The Cultural Continuum," is devoted to the work of Indian artists now, thus reinforcing the reality that beadwork lives on for Native people, sometimes worked in the old styles, sometimes making witty plays on traditionally familiar techniques used by people who nonetheless live in a very modern world.

One of the great strengths of *Floral Journey* – and indeed, of all her books – is Dubin's firm commitment to an abundance of great pictures of wonderful work, mostly shown in color. Many of the pieces pictured are supplemented with additional detail shots and happily the book's designer eschews an unfortunate contemporary design style of tiny pictures surrounded by lots of white space popular with all too many designers these days. Many of the pictures here fill the page and provide the avid beadwork fan with more than enough detail for hours of pleasurable browsing. Another of Dubin's regular features in her books that has always been appreciated by the reader are her inclusion of good, clear maps. Especially interesting is the one in the section dealing with the Prairie Style of beadwork that illustrates the coming together in Oklahoma environs of various tribal peoples from West Virginia to Wyoming and many points in-between, due to the Indian Removal Act of 1830, and how all those various folks influenced beadwork designs in the coming decades.

Dense, detailed information about each of the tribal groups gives a good sense of how trade and contact influenced each area and over what time period. The writing is enriched by quotes from copious interviews she has done with Native people around the U.S. over the last few decades, relating their thinking about the beadwork done by them or their ancestors.

Reading about the beads which filtered into the Woodlands, one gains the impression on page 40 that Woodlands people may have been the origin for the terms "gooseberry bead" and "seed" bead; nothing could be further from the truth. Peter Francis, Jr., posited that the term "seed bead" likely stemmed from the popular term "seed pearl," which seems as good a theory as any and notes several uses in literature from 1803 and later, along with corresponding terms in French and German. Regarding the coining of the term "gooseberry" beads, Francis notes that "the first known use of the name was in 1704 when John Barbot… engaged in the slave trade in Nigeria" described the beads most in demand as including "beads gooseberry color, large and small."

And while it's popularly assumed, as Dubin notes for Figure 40, that the paper patterns behind the beading in Iroquois beadwork served as templates for the beading, likely of equal importance, if not the main reason, is the fact that whatever is used to back the beads serves to reflect light back through the largely transparent beads, rather than allowing the light to die on the usual dark blue or black velvet ground. The templates also raise the beads above the velvet pile, preventing them from sinking in.

The caption for a photo in Figure 167 showing Warm Springs women holding large flat bags, some beaded and some cornhusk, records that "after Euro-American contact, Plateau women turned their large woven root-storage bags into smaller versions called 'twined flat bags'…." Actually, the larger root-storage bags were also "twined flat bags;" the term is not a description for a new, smaller style. She also notes in the same caption that "most Plateau beadwork designs were pictorial, of which floral motifs comprised a percentage." In general, many Plateau flat bags, whether beaded or especially those that are twined, show pictorial images on one side, including many with flower motifs, and geometric images on the reverse. In my experience, it is the rare twined bag that doesn't follow this two-sided format and this has been true as well with many of the bead*woven* Plateau pieces I've had the opportunity to study over the last seven years. She also says that "many women therefore applied their weaving skills to making smaller personal items such as woven handbags (now called 'cornhusk bags')." To be more precise, strips of corn husks were used in lieu of the earlier beargrass to ornament twined bags during the making of them. The term "cornhusk bag" doesn't refer to a size, as there are both small and large cornhusk bags. It refers to a material that has in many cases been dyed and is visible in the pattern, the use of which marks a change from the usual use of one material to the later use of a different material.

Regarding dating the arrival of seed beads on the Plateau, Dubin notes "beginning in the mid-1860s, as small glass seed beads in a variety of colors arrived in the Plateau…." Yet, a beaded firebag picked up along the Columbia River between December 1849 and June 1850 clearly shows that glass seed beads as small as size 14 were available on the Columbia River during that time, though admittedly in a relatively limited color palette. Given the sophistication of the work collected, it's not unreasonable to assume that such beads had likely been available in the area for several years, possibly back to the mid-1840s.

Much is made in *Floral Journey* of the notion of cultural resistance and an emphasis on secret language. While I think that much that is in modern Indian design most definitely speaks to a sense of Indian identity and yes, cultural resistance, I think in earlier times, if Native people used designs and cultural references from their heritage, whether in lieu of Euro-American designs or coupled with them, it was as often as not because it was simply what was familiar and available to them and what they considered beautiful. Undoubtedly there may have been a few examples in which someone incorporated an important element "under the noses of the oppressors;" however, there appears to be a trend of which this book is part, to give voice to the notion that cultural resistance was a much bigger part of the act of creating objects 100-150 years ago than I believe it likely was. I think it's impossible to know what any one person from long ago thought about their work. So many Indian cultures were in a state of disarray, due to catastrophic losses of community – both geographic and human – and the need to quickly adapt to a dominant culture which controlled their access to resources. Given the immense amount of energy and desire needed simply to survive, I'm not convinced what the point would have been to stitch resistance into their beadwork, nor can I imagine an organized sense among many people to do so, let alone across a continent among peoples with little to no contact with each other.

Regarding numerology on the Plateau, while individual numbers may possibly have had meaning for an individual beadworker (and we can't know, since we can't speak with them), in general, the sense of there being a consistent, region-wide, readily understood meaning to specific numbers as used in the counts of beadwork motifs is unlikely.

In general, I am uncomfortable with the impression that most Native beadwork of the 19th and early 20th centuries was suffused with *secret* meaning. Through time immemorial, women have beaded largely because they love the medium – its beauty, tactility, color, and sparkle – and the sense of accomplishment and pride in seeing it worn by those they love, as well as to provide sustenance for their families by making beadwork for barter. White people studying native cultures have a tendency to want to see more deep and significant meaning to things than is often there. White people like to name things, to pin them down, and in a sense, through knowing, to own them. Sometimes heightened meaning is there and sometimes it's not. And sometimes Native people don't want to share what is truly theirs with outsiders. That should be their prerogative and respected. We've certainly taken enough from them.

One final wistful note: I would love to have seen one of those specialized side chapters devoted to the Grey Nuns and their impact on the beadwork of hundreds, if not thousands, of Native women in the northern latitudes, rather than having tantalizing bits of information about them sprinkled across several chapters, along with similar repetitive references to the fur trade, both of which understandably were done by the author and her publishers to allow each chapter to stand on its own. I've always been curious about them and wanted to know more about what they taught and, more importantly, how they taught it. I found fascinating how Dubin related stories of how the moosehair embroidery was swapped back and forth between the nuns and the Native girls, as to who was teaching who and at what point in time. Some day, someone is going to *have* to write the definitive paper on those women and their beadwork/needlework teaching practices.

In *Floral Journey*, Dubin has skillfully stitched together the thoughts of many important voices in the field, including David W. Penney, Ruth Phillips, Ted Brasser, Barbara Hail, Benson Lanford, Dennis Lessard, Martha Berry, Barbara Loeb, Steven L. Grafe, James Teit, Frank Speck, Kate Duncan, and Cath Oberholtzer, among others. Dubin has curated and written yet another desirable book for several audiences: beadworkers, of course, as well as material culture lovers, those who are interested in the cosmology of Native peoples, history buffs, and most definitely, Native people themselves. *Floral Journey* is dense with useful, intriguing information and the author's deep respect for the creators of the work covered shines forth from every page. Native peoples could scarcely ask for someone who cared more about them and their work.

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## *World on a String: A Companion for Bead Lovers.*

**Diana Friedberg.** Self published, Los Angeles, CA. 2014. 440 pp., numerous color figs. ISBN-13: 978-1-62620-778-3. $45.00 (soft cover) in the U.S.; $77.50 and $87.50 postpaid to Canada and international destinations, respectively. Available from Amazon.com or www.worldonastringproject.com.

In a blazingly beautiful book documentarian Diana Friedberg has recorded her 10-year journey producing the DVD series, *World on a String*. Highlighted are still images of the beadmakers, wearers, and users who were seen in action in the DVDs. Thus *A Companion for Bead Lovers* allows the reader to return again and again to contemplate and savor the dramatic diversity of the many places where beads come alive. Because the text is concise, informative, and unique in its on-site insights, readers learn as well as enjoy the book.

As she traveled, photographed, and interviewed for the series, Diana also collected many of the beads and beaded articles that she saw – and she saw a lot! The visual journey continues as strands and individual beads, having been strung, are shown as interpreted by various leading bead artists. Also featured are double-page spreads of finished bead art not seen in the DVD series.

The illustrated backstory of how the whole *World on a String* project came to be is presented in the preface. There is a very useful map marking the 45 locations documented in the book. The introduction discusses the earliest history of the bead. The section "What is a Bead?" offers physical and philosophical definitions of a bead and its meanings.

"The Legacy of Glass" presents 201 images of sites of glass bead manufacture. Photos on this subject include glass and faience beads from Egypt, Italy, the Czech Republic, Africa, Austria, and the United States, worked by renowned artisans such as Luigi Cattelan, Art Seymour, Gail Be, Valerie Hector, Stuart Abelman, Cedi Djaba, Tim Meikle, and Suzanne Miller.

"The Power of Stones" includes 230 photos of precious stones such as amethyst, carnelian, and jade. Others are shown from myth to mine to method. It is followed by "The Metamorphosis of Metals" which illustrates gold coins and ancient plaques, Royal Ashanti gold jewelry, and the products of metalsmiths from Mali to Mexico, silverwork of Bali, Nepal, India, Thailand, Nagaland, and Egypt, plus examples of brass, copper, and aluminum ornaments made in Africa. "Organic Gems" are represented by such natural materials for beads as shell, coral, pearls, amber, ivory, bone, wood, cork, paper, seeds, and nuts, all shaped and strung into spectacular necklaces.

"The Ubiquitous Seed Bead" has been manufactured for centuries in Asia and Europe. The application of seed beads is a specialty of the Huichol of west-central Mexico who use the beads to create psychedelic images, Zulu and Ndebele artisans in South Africa who message with beads, and designers worldwide who embellish adornment with them.

The section "Body, Soul, and Beads" presents 190 photographs, large and small, that depict protective Anatolian "eye" beads, precious Tibetan Dzi beads, and mystical talismans, amulets, and prayer boxes hung on strands of prayer beads. In "Anything Goes – Fun with Beads" the focus is on modern wearable bead art such as Jamey Allen's original use of polymer clay to make replicas of ancient beads. Finally, "Bead Lovers Around the World" shows bead markets in Ghana and Ecuador, mountain men in Utah, Masai men and women in full beaded regalia in Kenya, bead buyers and sellers in Morocco – in fact, people enjoying beads just about everywhere. This section ends with a useful study aid, a page of organized topics.

The author acknowledges the fine professional colleagues who helped her create *World on a String: A Companion for Bead Lovers*. Special mention is given to Los Angeles photographer Joel Lipton. Diana Friedberg had a precise, worldly vision for her book, including high-fashion models, a contemporary take on tribal make-up and textile styling, state-of-the-art technology, and a presentation that honors each object. By collaborating with Joel Lipton in the studio, Diana's vision has been realized with stunning results.

*World on a String: A Companion for Bead Lovers* is an important addition to bead literature. The book has been well received by the international bead community and is likely to bring new members into the fascinating world of beads.

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**Plate IA.** *Malay beadwork:* Ceremonial handkerchief (*sapu tangan*), Perak, early 20th century (Jabatan Muzium Malaysia).

**Plate IB.** *Malay beadwork:* Pillow face (*muka bantal*), Perak, early 20th century (Jabatan Muzium Malaysia).

**Plate IC.** *Malay beadwork:* Detail of the pillow face in Plate IB.

**Plate ID.** *Malay beadwork:* Pillow face, Perak, early 20th century (Jabatan Muzium Malaysia).

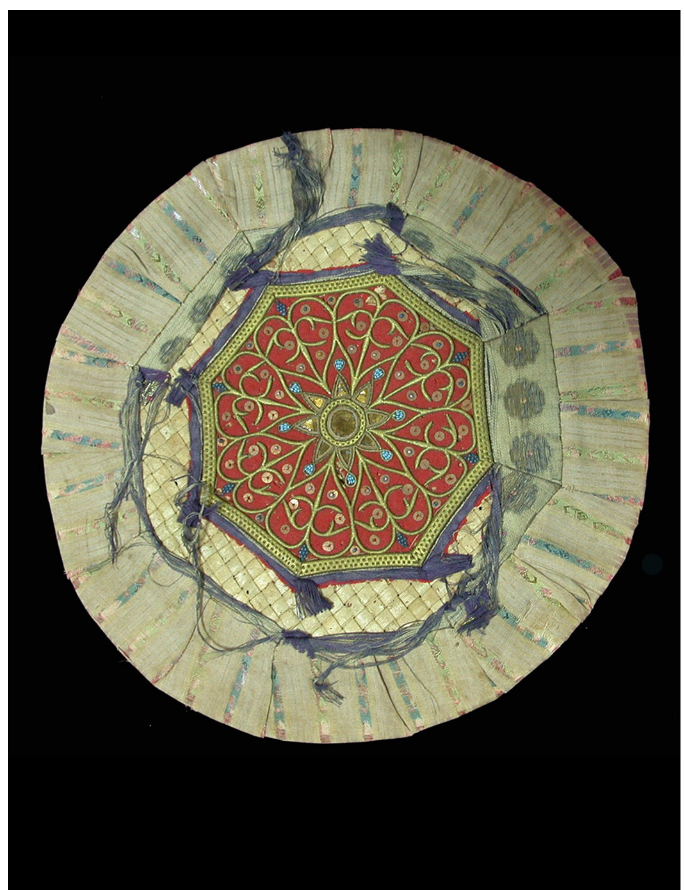


**Plate IIA.** *Malay beadwork:* Detail of the Perak pillow face in Plate ID ; early 20th century (Jabatan Muzium Malaysia).

**Plate IIB.** *Malay beadwork:* Bridal couch, Perak, late 20th century; embroideries, early 20th century (collection of Enche Nadimah, Chemor, Perak).

**Plate IIC.** *Malay beadwork:* Central panel for a ceremonial mat (*tikar*), Perak, late 19th century (courtesy of Perak State Museum).

**Plate IID.** *Malay beadwork:* Detail of the Perak mat panel in Plate IIC (courtesy of Perak State Museum).

**Plate IIIA.** *Cambodia:* Jar burials on a rock ledge at the Phnom Khnang Peung site.

**Plate IIIB.** *Cambodia:* The burial jars at the Phnom Khnang Peung site.

**Plate IIIC.** *Cambodia:* Coiled glass beads: a) op. light blue, purple, and purplish black; b) white; c) polychrome; and d) reddish-orange.

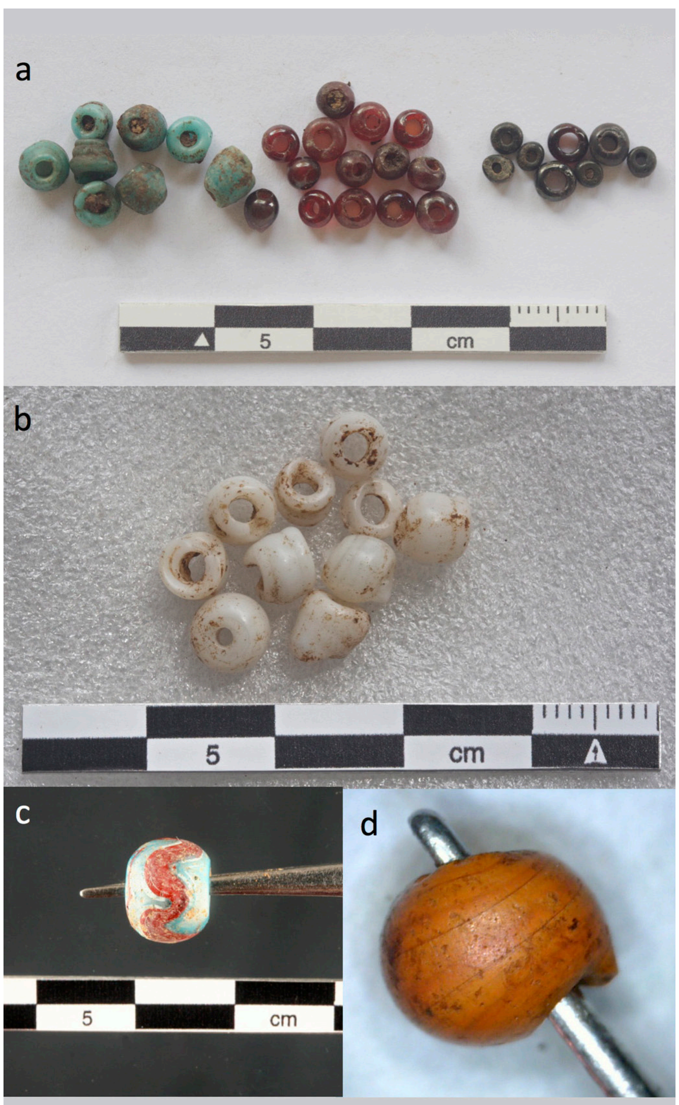



**Plate IIID.** *Cambodia:* Examples of m-Na-Al type 2 drawn glass beads from the Cardamom Mountain jar burial sites.

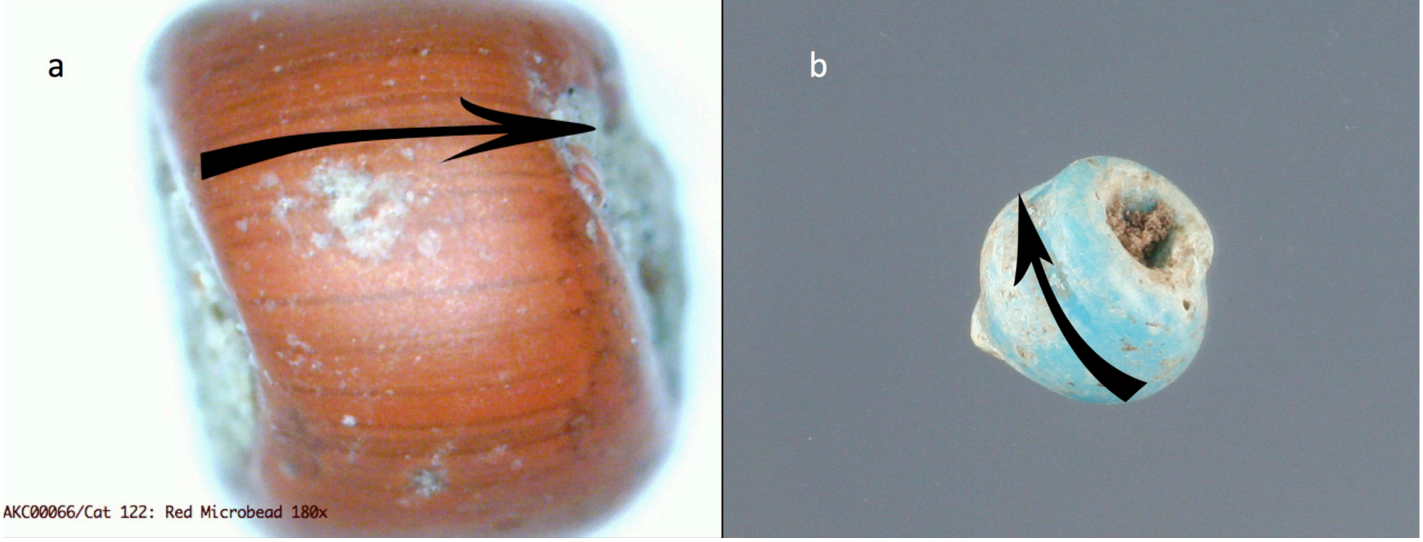



**Plate IVA.** *Cambodia:* Cardamom Mountain jar burial site beads: a) striations on a drawn glass bead and b) striations on a coiled (wound) glass bead.


**Plate IVB.** *Cambodia:* Yellow bead (center) with unusual striations suggesting sagging or twisting during the manufacturing process: a) digital microscope image (50x) of a yellow bead from the Okei site showing parallel striations; b) digital microscope image (60x) of one of the yellow beads from Jar 36 at the KPP site with unusual striations; c) the unusual yellow beads from Jar 36.

**Plate IVC.** *Cambodia:* Examples of the newly identified high-alumina glass type from the Cardamom Mountain jar burial sites.

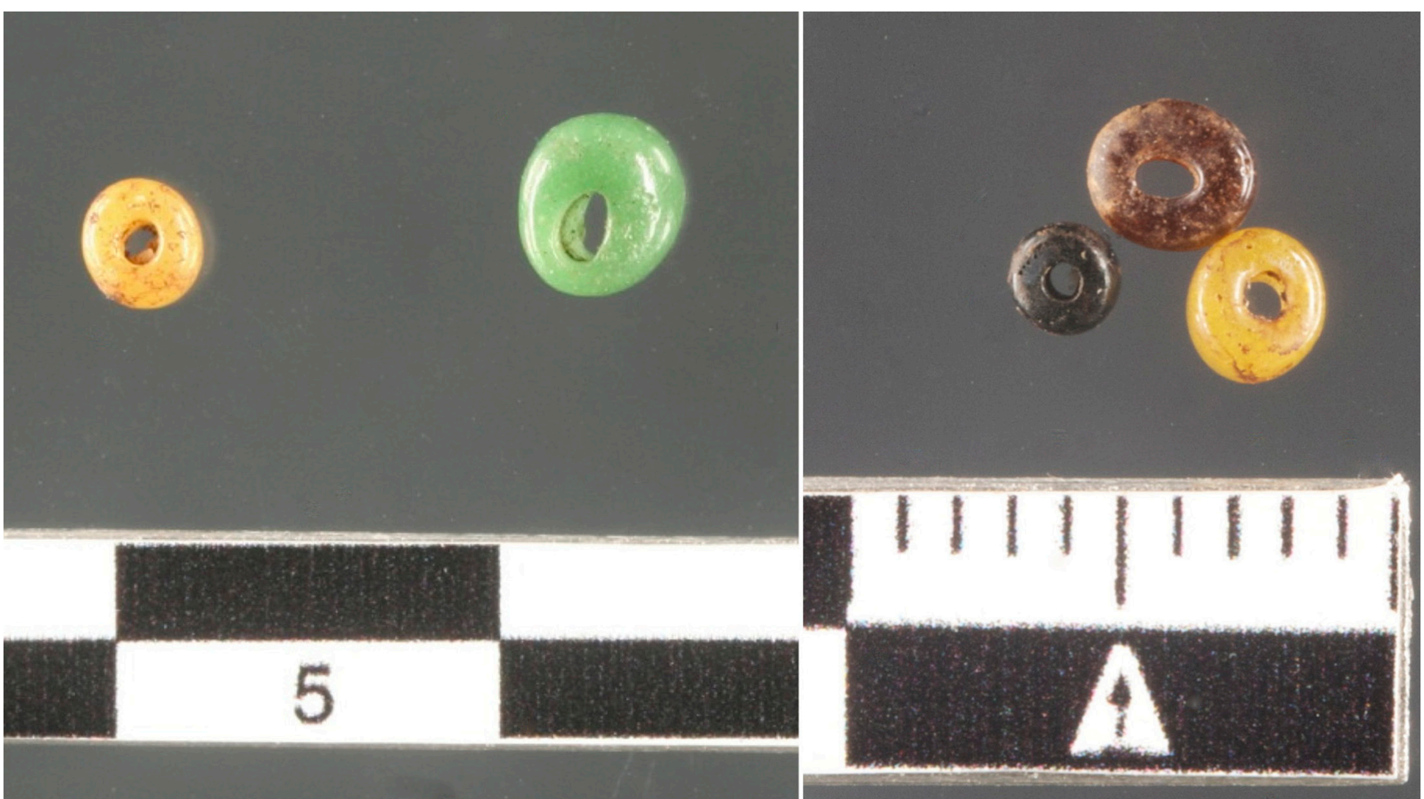
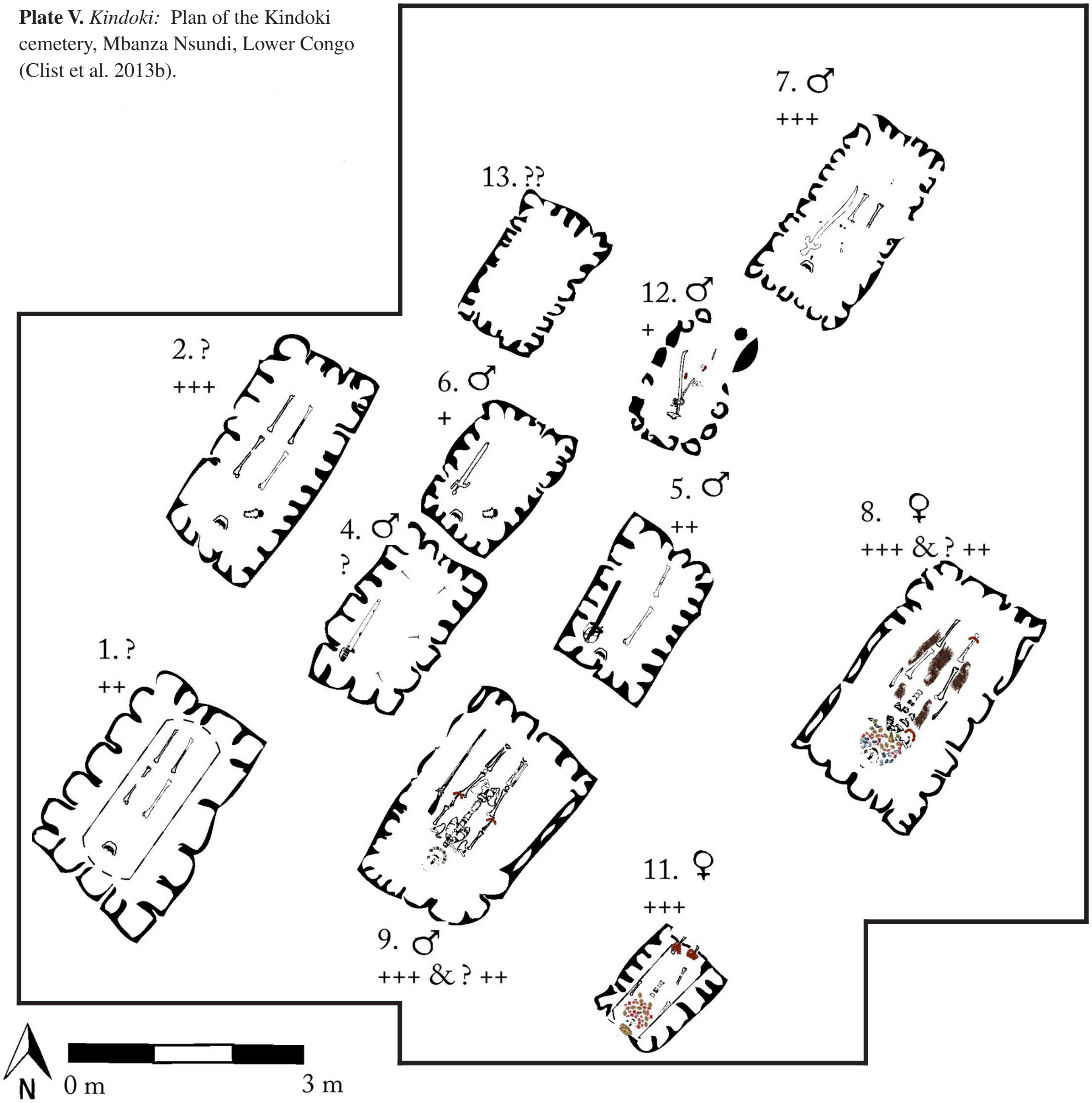


**Plate V.** *Kindoki:* Plan of the Kindoki cemetery, Mbanza Nsundi, Lower Congo (Clist et al. 2013b).



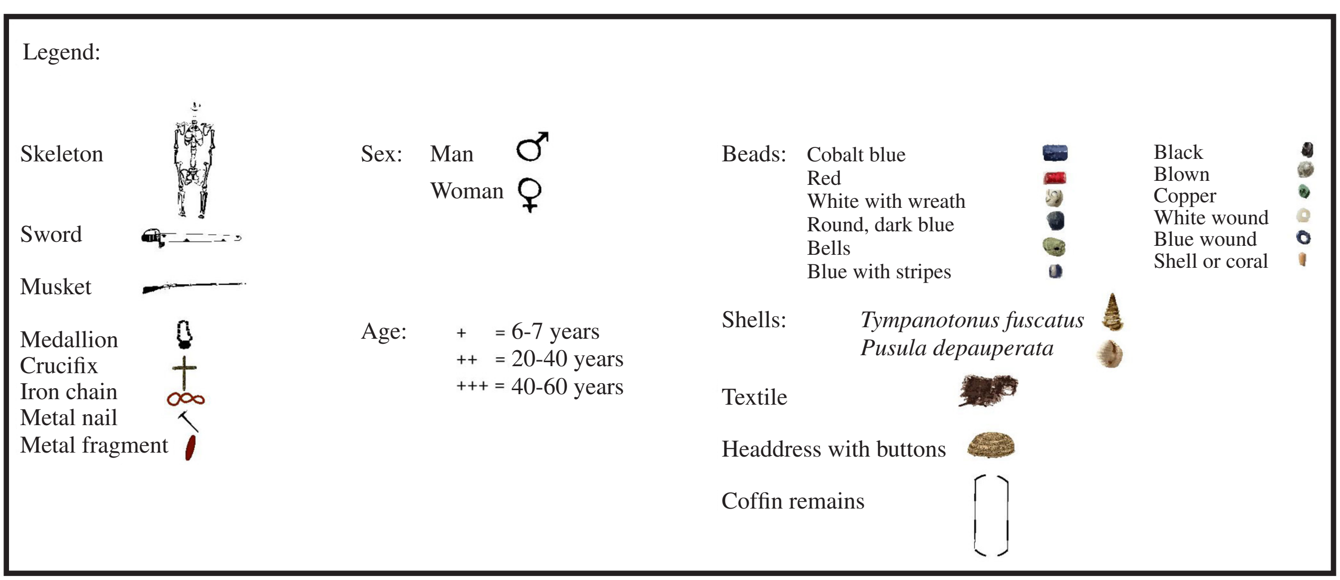



**Plate VIA.** *Kindoki:* The female burial in tomb 8 was wrapped in textiles and accompanied by rich grave goods including shell and glass beads and copper hawk bells (photo: Bernard Clist).

**Plate VIB.** *Kindoki:* The shell, copper, and miscellaneous glass beads of tomb 8 (all bead photos: Jean-Luc Elias, KIK/IRPA).

**Plate VIC.** *Kindoki:* The wound, blue, ridged-tube beads of tomb 8.

**Plate VID.** *Kindoki:* The wound, cylindrical, red-on-white beads of tomb 8. Note the many beads fused end to end during the manufacturing process.

**Plate VIIA.** *Kindoki:* Examples of the silvered blown beads and copper hawk bells found in tomb 8.


**Plate VIIB.** *Kindoki:* The burial in tomb 11 with a view of the skull showing the red-on-white beads at the neck and the buttons on the headdress (photos: Bernard-Olivier Clist and Igor Matonda).

**Plate VIIC.** *Kindoki:* The wound glass beads from tomb 9. Most were decorated with inlaid wreaths.

**Plate VIID.** *Kindoki:* The glass and shell or coral beads of tomb 12.

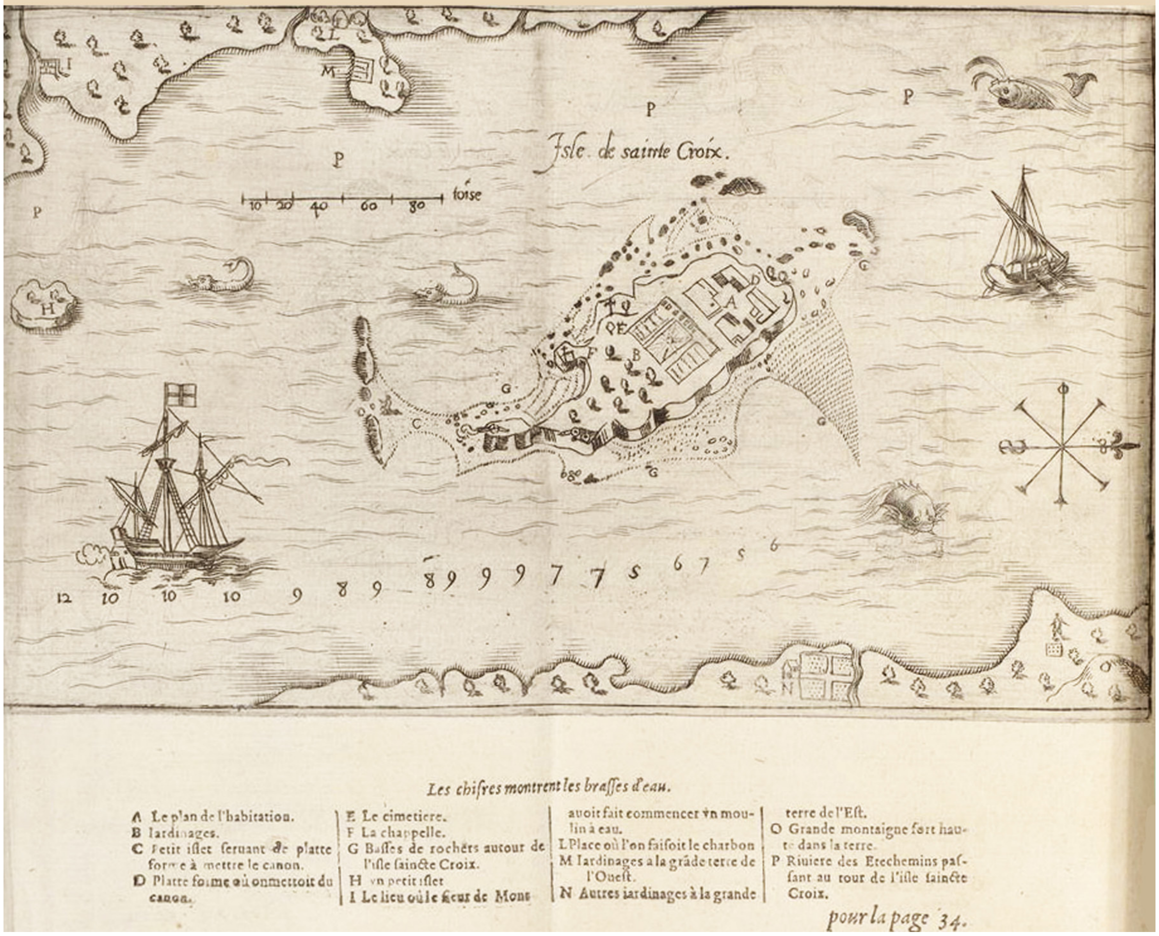



**Plate WIIIA.** *Saint Croix:* Champlain's 1613 plan of the Saint Croix Island *habitation* from *Les Voyages* (reproduced with permission, Maine Historic Preservation Commission).

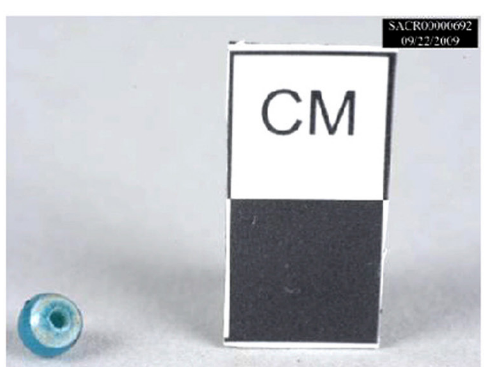
**Plate VIIIB.** *Saint Croix:* Bead varieties from Saint Croix Island: a) IIIb* (#152), b) Ia5 (#153), c) IIa40 (#159), d) IIa15 (#191), e) IVa16 (?) (#692) (reproduced with permission, Maine Historic Preservation Commission).


a


b


c


d




e

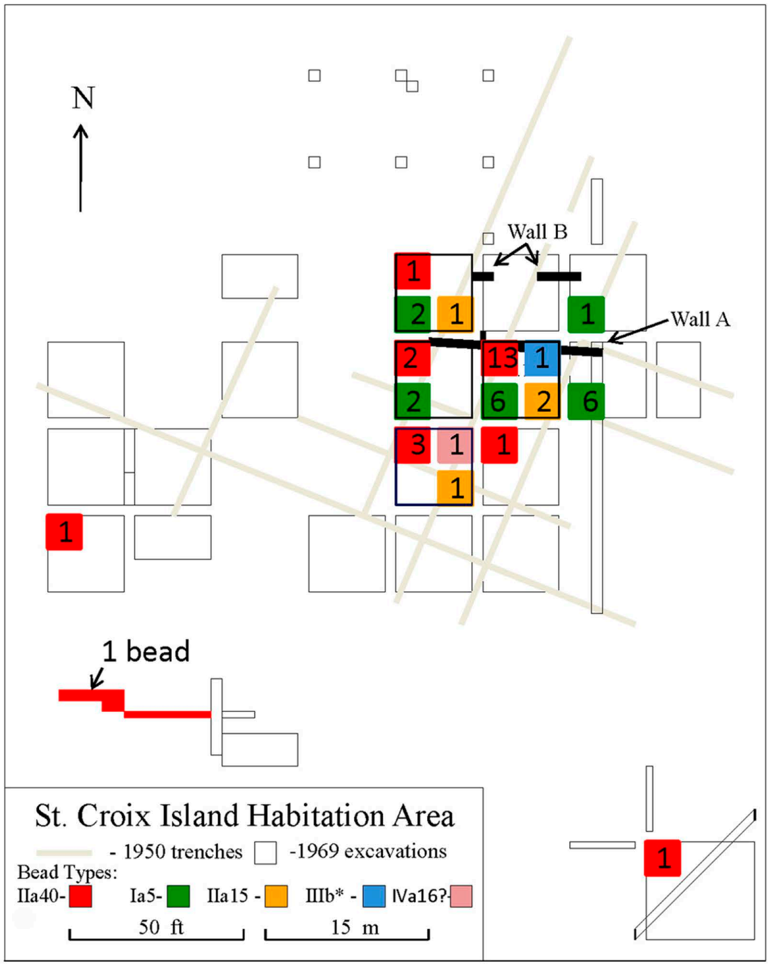



**Plate IXA.** *Saint Croix:* Distribution of beads at the Saint Croix Island *habitation* (reproduced with permission, Maine Historic Preservation Commission).

**Plate IXB.** *Saint Croix:* A sample of the glass wasters from the Carel-Soop glasshouse (1601-1624) in Amsterdam (photo: James W. Bradley).