A GLASS BEAD SEQUENCE FOR SOUTH AMERICA BASED ON COLLECTIONS FROM BRAZIL AND GUYANA

William T. Billeck and Meredith P. Luze

Glass trade bead assemblages recovered during archaeological investigations at nine sites by Smithsonian archaeologists Betty Meggers and Clifford Evans in Brazil in 1948 and 1949 and Guyana in 1952 and 1953 date to multiple time periods, including the early 17th, mid-18th, mid-19th, and mid-20th centuries. The assemblages are used to show that the glass bead chronologies developed in North America are directly applicable to South America and that there is a global glass bead sequence related to European colonialism. White drawn glass beads were independently dated by comparison with known composition changes through time in how the glass was made opaque. Compositions were determined using pXRF.

INTRODUCTION

In the 1940s, Betty Meggers and Clifford Evans began an ambitious, decades-long program to document and establish regional archaeological sequences in South America. Meggers continued the research after Evans' death in 1981 until her own death in 2012, after spending more than 70 years at the Smithsonian. This paper will reexamine one aspect of the material culture they recovered: glass trade beads from European contact-period sites. Of the hundreds of archaeological sites they investigated, they obtained glass beads from just ten and, of those, nine sites are considered here. The tenth site, in Ecuador, is presently under study and dates to the mid-16th century. The beads from the nine archaeological sites are in the collections of the National Museum of Natural History (NMNH), Smithsonian Institution.

In 1948 and 1949, Meggers and Evans recovered glass beads from four sites in Brazil near the mouth of the Amazon (Meggers and Evans 1957). Their excavations in 1952 and 1953 at five sites in Guyana, then known as British Guiana, yielded additional glass beads (Evans and Meggers 1960). They consulted with archaeological bead experts on the chronological placement of the beads from Brazil, including Arthur Woodward, Glenn Black, and Kenneth Kidd. They did not, however, solicit similar opinions for the beads from Guyana.

There are several reasons to reanalyze these glass bead assemblages. First, in their publications, Meggers and Evans rejected the assessments provided by the bead experts and instead suggested that the assemblages could not be dated by comparison to North American chronologies. Second, since glass bead studies have progressed substantially since these assemblages were first described, much more can be said about the bead sources, and glass bead chronologies have been greatly refined. A third reason for a reanalysis is to provide information on glass beads from South America since not many descriptions of glass bead assemblages from that region are available, particularly for assemblages that post-date the 16th century. Another goal of this study is to show that the chronological sequences for glass beads in North America can be directly applied to South American assemblages, demonstrating that the presence of European glass beads provides some of the earliest evidence for colonialism and serve as markers for globalization.

BEAD CLASSIFICATION

The glass beads are described following the classification system developed by Kidd and Kidd (1983) with revisions by Karklins (2012) based on the method of manufacture, color, diaphaneity, and shape. For beads dating to the 18th century and earlier, when these attributes can be matched to a specific bead variety in the classification system, it is recorded as that variety (e.g., IIa56). Beads that do not exactly match a specific variety are noted with an asterisk (*). For 19th-century and later sites, only the type codes are provided (e.g., IIa, IVa, WIb) since the senior author views the classification system for color as best applied to earlier assemblages.

White drawn beads that are described as circular in the Kidd and Kidd system are here referred to as short barrels. In

addition, small heat-rounded white drawn beads sometimes appear to have two or more layers of opaque white glass, often with a degraded thin outer layer of colorless glass which is difficult to discern. This layer is not considered when determining whether a bead is of simple (IIa) or compound (IVa) construction (Karlis Karklins 2019: pers. comm.).

XRF ANALYSIS OF THE WHITE GLASS BEADS

The x-ray fluorescence (XRF) spectrometry analysis of the beads obtained by Meggers and Evans is an offshoot of an ongoing study of North American bead assemblages (Billeck and McCabe 2018) that builds on earlier studies of temporal changes in the composition of opaque white drawn beads (Blair 2017; Hancock 2013; Hancock et al. 1997; Moreau et al. 2002, 2006; Sempowski et al. 2000). Most of the earlier studies have focused on determining the opacifiers used in the 17th century to assist in the dating of sites of this time period. The type of opacifier used changes through time, however, resulting in distinctive chemical compositions and these compositions can be readily detected with XRF.

The compositions were determined using a Bruker Tracer 5i with 3 mm collimator for an assay time of 30 seconds with the settings kV=50, μA=35, and a Cu 200μm, Ti 25μm, Al 300μm filter. The Bruker Tracer 5i is a portable instrument that can be handheld and described as pXRF. The instrument emits an x-ray at a target and the x-ray disrupts the atoms or elements in the object. The energy pattern created by the disrupted elements is mapped as a spectrum that can be examined to identify the glass composition. The opacifiers used to make white beads opaque are typically one or more of the following elements: lead, antimony, and arsenic. All of these can be easily identified in glass beads by using XRF. An advantage of XRF is that it is nondestructive and a large number of glass beads can be quickly analyzed.

Previous studies (Blair 2017; Dussubieux and Karklins 2016; Hancock 2013; Hancock et al. 1997; Moreau et al. 2002, 2006; Sempowski et al. 2000) have documented the temporal changes in white glass bead opacifiers. Blair (2017: Table 1) used XRF to help understand the internal chronology of the Mission Santa Catalina de Guale beads, and summarized all previous studies of the opacifiers used in drawn white glass beads. The studies show that before 1625, white drawn beads were opacified with a tin-lead calx that results in beads that have high levels of tin and lead (hereafter SnPb). Between 1625 and 1675, there is a change in opacifiers from SnPb to a calcium antimonate, resulting in beads that are high in antimony (hereafter Sb). Beginning in the early 1800s, lead arsenate becomes increasingly common, yielding glass that is high in arsenic and lead (hereafter AsPb). White drawn beads are sometimes opacified with lead antimonate, producing beads that are high in antimony and lead (SbPb). Such beads have been rarely identified in 18th-century assemblages, but can be common in those of the 19th century (Billeck and McCabe 2018).

XRF analysis was applied to drawn white beads in the assemblages from Brazil and Guyana to assist in dating them. A total of 161 beads from the nine archaeological sites were sampled (Table 1). White beads from both Brazil and Guyana contained SnPb, Sb, and AsPb. One bead contained Sb and low Pb. A bead recorded with an element relating to the opacifier must have a spectrum peak at least ten times the height of the rhodium backscatter. When an element is recorded as low, it is at least five times and less than ten times the height of the rhodium backscatter. The bead varieties from four sites (E-2, E-28, R-34, and A-3) were sampled with a minimum of 10 beads per variety from each site. All the white beads at five sites were analyzed.

COLONIAL HISTORY

Guyana

The first Europeans to establish a settlement in what became Guyana were the Dutch who began their settlement and trading operation in 1616 with the aim of trading with indigenous communities (MacDonald 1992:3, 6). Prior to the establishment of settlements, various European nations had succeeded in trading along the coast beginning in the 1500s (Smith 1962:13). The Spanish had originally claimed the land of the Guyanese colonies but did not establish settlements and officially recognized Dutch sovereignty in 1648 (MacDonald 1992:6). Soon after Dutch settlement, the French and British also began settling and laying claim to lands between the Orinoco and Amazon rivers, although no single colonizing nation could hold more than small areas (Smith 1962:14). The Dutch quickly abandoned attempts to enslave the indigenous peoples, instead choosing to trade Dutch goods for local cotton, dyes, and wood, while importing enslaved Africans to work on plantations (Smith 1962:14-15). The Dutch settled three separate colonies in Guyana over the course of the 17th and 18th centuries, all governed under the umbrella of the Dutch West India Company (MacDonald 1992:6).

Table 1. Opacifiers Present in Drawn White Glass Beads.

Site	Bead Variety	Opacifier					Total
		AsPb	Sb	Sb Low Pb	SnPb	Sn low Pb	
E-2	IIa	10	0	0	0	0	10
E-28	IIa	10	0	0	0	0	10
R-1	IIa12*	0	4	0	0	0	4
	IIa14	10	0	0	0	0	10
R-20	IIa12*	0	1	0	0	0	1
	Ia4*	0	7	0	0	0	7
R-34	IIa12*	0	25	0	0	0	25
A-10	IIa12*	0	12	0	0	0	12
A-15	IIb18	0	3	0	0	0	3
A-3	IIa12*	0	30	0	0	0	30
	IIa13	0	0	1	7	0	8
	IIb18	0	0	0	0	3	3
	IVa11	0	0	0	1	0	1
A-4	Ib11	0	0	0	2	0	2
	IIa13	0	0	0	5	0	5
	IIb20	0	0	0	1	0	1
	IIg3	0	0	0	2	0	2
	IVa11	0	0	0	27	0	27
Total		**30**	**82**	**1**	**45**	**3**	**161**

British colonists began immigrating to the Guyanese colonies in large numbers in the mid-1700s, constituting a majority of the colony of Demerara by 1760 (MacDonald 1992:7; Smith 1962:16). The flow of British colonists continued throughout the 18th century and by 1786, the British effectively controlled the still legally Dutch colony (MacDonald 1992:7). Between 1781 and 1814, the colonies were captured and recaptured by the British, French, and Dutch a total of seven times, until the Netherlands formally ceded the colonies to Britain in 1814 (MacDonald 1992:8-9; Smith 1962:24-25). Britain created the colony of British Guiana in 1831 when it combined the three colonies of Berbice, Demerara, and Essequibo into one, with the capital in Georgetown (MacDonald 1992:3; Smith 1962:26). The slave trade was abolished in 1807 and slavery was finally abolished in 1838, but the colonists still needed vast quantities of labor to work the plantations, leading planters to lure Portuguese, Chinese, German, British, and Indian immigrants to the colony on indenture contracts (Khemraj 2015:161-168; MacDonald 1992; Smith 1962). Surviving indigenous peoples largely retreated beyond the boundaries of colonial settlement, and many descendants of enslaved Africans began to regard themselves as the "natives" of Guyana by the late 19th century (Khemraj 2015:177; MacDonald 1992:6).

Brazil

The first Europeans to view Brazil were Portuguese explorers en route to India in 1500. The Portuguese claimed the land but did not begin to establish settlements until 1530, when they began to feel threatened by French traders who had landed in Brazil in 1504 and established trade relations with the indigenous peoples (Metcalf 1992:27-29; Smith and Vinhosa 2002:1-5).

The indigenous peoples with whom the Portuguese made first contact were the coastal Tupi speakers. As the Portuguese continued their explorations, they encountered other Tupi speakers along the Amazon basin, along with Carib and Arawak speakers, and the Gê of the central plateau (Levine 1999:31; Smith and Vinhosa 2002:31). The Tupi generally described the inland Gê-, Carib-, and Arawak-speaking groups pejoratively as the Tapuia, a name later adopted by the colonists to vilify the groups that resisted colonization (Langfur 2014:16). The Tupi were semi-sedentary, organized primarily into kin- and clan-based villages rather than towns, and largely without a unified political organization (Langfur 2014:7-9).

Although Brazil was a Portuguese colonial territory, other European nations had an interest in the area. The Dutch were present along the coast north of the mouth of the Amazon from about 1600 to 1630 (Meggers and Evans 1957:556-566). The English, French, and Irish also traded along the Amazon River until the 1630s, with the Dutch concentrating on the Amazon valley and the English and Irish focusing on the north bank and mouth of the Amazon (Whitehead 2014:87-89). The Dutch established a colony in Pernambuco south of the Amazon in 1630 and expanded through time to the mouth of the Amazon until their expulsion in 1654 by the Portuguese (Levine 1999:43-44; Smith and Vinhosa 2002:9-10). The Dutch allowed English, French Protestant, German, Polish, Danish, Swedish, and Dutch Jewish colonists to settle in their Pernambuco colony, although the Jews were expelled once the Portuguese regained control of the colony (Levine 1999:43-44). While the indigenous peoples traded with the Portuguese and other Europeans, they did not develop a dependency on European trade goods, although they did integrate these goods into their traditional ornamentation, often adapting them to suit their needs (Bieber 2014:182-183). European goods may also have conveyed a certain prestige to their owners (Bieber 2014:183).

The early colonists favored a paternalistic approach to the indigenous peoples, initially seeking to civilize and Christianize rather than enslave (Langfur 2014:23; Metcalf 2014:37). Missionaries arrived in Brazil in the mid-1500s, and Jesuits established the first *aldeia* (mission village) in 1558 (Metcalf 2014:47). These *aldeias* frequently combined many indigenous villages into one, some combining as many as 15 distinct villages (Metcalf 2014:47). Due to the mixing of numerous distinct ethnic groups within each *aldeia*, the indigenous peoples began to lose their specific tribal identities, instead becoming the Indians of a specific *aldeia* (Almeida 2014:79-80). Within the aldeias, the Native peoples generally continued to live in their traditional multifamily longhouses, called *ocas*, although in some of the oldest *aldeias* the inhabitants changed to small houses (Metcalf 2014:47-49).

Jesuits were not the only missionaries proselytizing to the indigenous peoples of Brazil; the Franciscans, Capuchins, the Fathers of Piedade and Conceição, the Carmelites, and the Jesuits divided the Amazon basin into areas of distinct missionary control (Levine 1999:36). Settlers and planters disliked the missionaries' monopoly over the indigenous population, desiring to control and exploit their labor, and succeeded in expelling the Jesuits in 1759 (Levine 1999:36; Metcalf 2014:52; Smith and Vinhosa 2002:15).

During the second half of the 18th century, indigenous peoples were increasingly enslaved as slaving expeditions into the interior increased. Those who were captured became *administrados* ("administered Indians") who could be held under the *administração* system and forced to labor for their captors, this even passing to their descendants (Langfur and Resende 2014:150; Metcalf 1992:75-76). In order to evade laws prohibiting indigenous slavery, administrators would often refer to their *administrados* by names corresponding to mixed-race categories, as mixed-race individuals born to enslaved mothers of African descent could be legally enslaved (Langfur and Resende 2014:154). Colonists could also enslave indigenous people through what were called "Just Wars," or if the people practiced cannibalism (Metcalf 1992:33). Portuguese planters generally preferred the labor of enslaved Africans to that of the indigenous peoples and, when possible, sought to utilize primarily enslaved African labor (Smith and Vinhosa 2002:23). As indigenous populations shrank, the African population grew as planters expanded African slavery until the abolishment of slavery in 1888 (Metcalf 1992:75, 204; Smith and Vinhosa 2002:33, 75).

Indigenous peoples generally became assimilated into Brazilian society through either voluntary or forced removal to *aldeias*, or they elected to relocate to the remote Amazonian jungle to preserve their lifeways (Smith and Vinhosa 2002:125). Indigenous peoples were largely ignored throughout Brazil's transition to an independent empire in 1821 and a republic in 1889, although several movements in the late 1800s and early 1900s advocated for the integration of indigenous peoples into Brazilian society (Smith and Vinhosa 2002:125). Brazil's tumultuous political climate continued through the 20th century, as military coups continued to unseat presidents until civilian government was restored in 1985.

BEADS FROM EXCAVATIONS IN GUYANA

Clifford Evans and Betty Meggers conducted archaeological investigations in 1952 and 1953 for the

Smithsonian Institution in Guyana, then British Guyana, visiting a number of archaeological sites in the rain forests and the nearby savanna. Glass beads were recovered from one WaiWai phase site and one Taruma phase site along the Essequibo River and from three sites assigned to the Rupununi phase in the Rupununi Savanna (Figure 1).

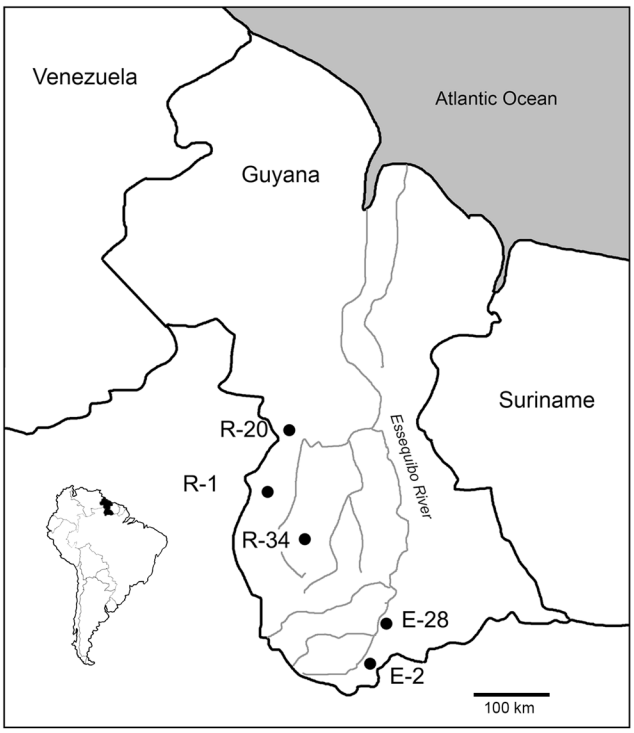

Figure 1. Archaeological site locations in Guyana (all images by William Billeck).

Twentieth-Century Beads from the WaiWai and Taruma Phases, Upper Essequibo Rain Forest

Site E-2, the Erefoimo site, is a WaiWai phase habitation on the right bank of the Essequibo River. The phase represents a 20th-century intrusion into the area by the Carib-speaking Waiwai (Evans and Meggers 1960:247, Figure 126). E-2 had standing structures when visited by Evans and Meggers and they reported that the site had been occupied from about 1944 to 1950. Among the items collected at the site are "glass 'seed' beads, some still strung on twisted cotton thread" (Evans and Meggers 1960:247-249, 256-257). The collection consists of very small and small, heat-rounded drawn beads in white, pink, blue, and red (Table 2; Figure 2). A sample of ten white beads was analyzed using XRF and all were high in AsPb (Table 1) and, based on the opacifier chronology, date to the second half of the 19th century or later.

Site E-28, Yukumnalulum, is a habitation site on the right bank of the Esseqibo River, and was assigned to the Taruma phase by Evans and Meggers. European-derived diseases decimated the Taruma Indians in the early 20th century and the Taruma phase is dated from ca. 1700 to ca. 1925, ending when the few surviving Taruma Indians went to live with other tribes (Evans and Meggers 1960:246, 339, Figure 126). The site was a surface scatter of objects 9 m in diameter consisting of sherds, 141 glass beads, two pieces of glass, one olive-green glass bottle fragment, and manioc grater chips (Evans and Meggers 1960:206, Table H). Some beads still had fragments of cotton thread from their original stringing and Evans and Meggers (1960:245, Table H) suggested the beads probably derived from a woman's beaded apron. The preservation of cotton thread is an indication that the site was occupied in the early 20th century. The beads are all small, heat-rounded drawn beads in white, black, colorless, orange, teal, blue, pink, and red (Table 2, Figure 2). A sample of ten white beads was analyzed with XRF and all were found to be high in AsPb (Table 1) and, based on the opacifier chronology, date to the second half of the 19th century or later.

Site E-2 is known to have been occupied between 1944 and 1950 by the Waiwai tribe, about two years before the beads were collected, with some of the beads still strung on cotton thread. Since cotton thread was also found with the beads from Site E-28, they are also likely to have been left only a few years before they were collected in 1952 or 1953. The bead varieties represented and the opacifiers used in the production of the white drawn beads are consistent with a 20th-century date for both sites.

Nineteenth-Century Beads from the Rupununi Phase, Rupununi Savanna

Site R-1, the Moco Moco Rock Shelter, is a Rupununi phase cemetery site on the side of the Kanuku Mountains near the Moco Moco River. Several funerary jars were present including a Kanuka Plain vessel that was associated with 14 very small white glass beads (Figure 2) (Evans and Meggers 1960:285, Table L, Plate 64c) that have an average diameter of 1.7 mm and average length of 1.0 mm. There are four IIa12* beads that have a thin colorless layer on opaque white (Munsell N 8.5/). These are listed here as IIa12* because IIa12 beads in the Kidd classification are translucent, and the R-1 beads are identified as opaque. Ten IIa14 beads are opaque white (Munsell N 9.0/) and have an average diameter of 1.8 mm and average length of 1.0 mm. The objects from R-1 were too few and undiagnostic, preventing Evans and Meggers from dating the site, but other

Table 2. Twentieth-Century Glass Beads from Sites E-2 and E-28, Guyana.

Site	Kidd Code	Color and Shape	Average Diameter mm	Average Length mm	Count
Site E-28, Yukumnalulum, Taruma Phase	IIa	Opaque white, N 9.25/, short barrel	2.3	1.1	92
	IIa	Opaque pink, 2.5RP 6/6, short barrel	2.5	1.6	14
	IIa	Opaque light blue, 7.5B 5/4, short barrel	2.1	1.1	9
	IIa	Opaque blue, 7.5PB 3/12, short barrel	2.0	0.9	24
	IIa	Translucent blue, 7.5PB 3/12, short barrel	3.0	1.7	1
	IVa	Translucent red, 10R 3/10, opaque white core, short barrel	3.0	2.5	1
	Ic	Opaque black, N 1/, hexagonal	1.9	1.4	40
	Ic	Translucent teal, 5BG 5/8, hexagonal	1.8	1.4	1
Site E-2, Erefoimo, WaiWai Phase	IIa	Colorless, short barrel	2.3	1.5	139
	IIa	Opaque white, N 9/, short barrel	2.3	1.2	9
	IIa	Opaque orange, 3.75YR 6/14, short barrel	2.4	1.2	1
	IIa	Translucent light purple-blue, 5PB 5/8, short barrel	2.8	1.5	22
	IIa	Translucent to opaque blue, 7.5PB 2/8, short barrel	2.2	1.1	724
	IIa	Opaque reddish-pink, 2.5R 4/4, short barrel	2.2	1.4	78
	IIa	Transparent red, 5R 3/8, short barrel	2.1	1.0	168
	IVa	Translucent red, 2.5R 5/10, white core, short barrel	2.1	1.2	1
Total					**1324**

Rupununi phase sites they excavated that had European trade objects were dated by them to the 19th and early 20th centuries (Evans and Meggers 1960:323, Tables M and N). XRF testing of the white beads revealed that the ten IIa14 beads are high in AsPb and the four IIa12* beads are high in Sb (Table 1). The very small size of the beads and their chemistry is typical of the first half of the 19th century when beads opacified with Sb or AsPb occur (Billeck and McCabe 2018). It is likely that the use of R-1 and the glass beads found there date to the 19th century.

Site R-20, the Uteteta Rock Shelter on Kawari-eng Mountain, was a habitation site with ceramics dating to the Rupununi phase. The shelter consists of several overhangs, each referred to as a cave, and glass beads were only found in Cave 2, along with sherds and deer bone (Evans and Meggers 1960:276-277, Table L). Ceramic seriation places Cave 2 within the later part of the Rupununi phase and Evans and Meggers (1960:Table N, Figure 125) suggest that occupation of the site occurred after 1900. One bead from Cave 2 is IIa12* that measures 2.9 mm in diameter and 2.2 mm in length. There are also seven opaque oyster white specimens with a thin colorless outer layer (Figure 2). Six are medium-sized beads that average 5.2 mm in diameter and 3.5 mm in length. One is small and measures 2.7 mm in diameter and 1.9 mm in length. XRF testing of all eight beads found they were all high in Sb (Table 1). The opacifier chronology would place the site in the first half of the 19th century or earlier. This disagrees with Evans and Meggers suggested date of after 1900.

Site R-34, Bei-Tau Rock Shelter No. 1, is a Rupununi phase site that had stone slabs covering funerary urns. While no human remains were preserved, funerary objects associated with a Kanuka Plain jar consisted of a perforated coin with an 1809 date, glass mirror fragments, a scraping tool chipped from a pale green glass bottle, part of an iron knife, and glass beads. Another Kanuku Plain jar contained approximately 3000 small white glass beads.

Figure 2. Glass bead varieties from sites in Guyana. Row 1) site E-28; Row 2) site E-2; Row 3, left) site R-20; Row 3, right) site R-1 (NMNH cat. nos. A419345, A419449, A419547, and A419595).

The beads were described and illustrated in drawings (Evans and Meggers 1960: Figure 124, Table L) and are redescribed here (Table 3; Figure 3). There are four dark blue and two black long faceted drawn beads and three red faceted spherical beads that are mold-pressed. These types are typical of those made in Bohemia and they appear in archaeological assemblages in the early- to mid-19th century in the United States (Billeck 2010, 2018a-c; Ross 1990, 2000). Small heat-rounded drawn beads occur in several colors including gray, light turquoise, light bluish-grey, dark reddish-grey, teal, white, and black. The beads have diameters that are generally about 3.5 mm and have lengths of about 2.5 mm; they are much larger than the average small heat-rounded drawn beads of the late-19th and 20th centuries. There are also several small, dark reddish-purple drawn beads that have been heat-rounded and then faceted with several random cuts. These beads are also common in the early- to mid-19th century (Billeck 2010, 2018a-c; Ross 1990, 2000). The 1809 coin, combined with comparisons to archaeological bead assemblages from the United States, dates the R-34 bead assemblage to after 1809, likely to the first half of the 19th century, a finding supported by the chemical composition of the beads. XRF testing of a sample of 25 white drawn beads found they were all high in Sb (Table 1). The transition from Sb to AsPb occurs in the first half of the 19th century (Billeck and McCabe 2018; Hancock et al. 1997) which, along with the bead styles, dates R-34 to the first half of the 19th century.

The Rupununi phase is estimated to date from approximately 1700 to 1900 (Evans and Meggers 1960: Figure 126) and the ceramics from the sites are Kuanuka Plain and Rupununi Plain vessel types, with the former being more common earlier in the phase. The glass bead assemblages from sites R-1, R-20, and R-34 can be dated by the bead varieties present, the opacifiers used in the manufacture of the white drawn beads, and by the presence of other artifacts. European trade goods appear in the Rupununi phase in the early to mid-19th century and persist into the early 20th century according to Evans and Meggers (1960:323, Tables M, N). The bead assemblages are consistent with this temporal range. The presence of the coin at R-34 establishes a firm post-1809 date (Evans and Meggers 1960:290) and the style of the beads indicates it is one of the earliest sites in the Rupununi phase to yield European trade goods, dating to the first half of the 19th century. Evans and Meggers (1960: Table N) estimate that R-20 dates to after 1900, but the opacifier used in the white beads is consistent with the first half of the 19th century or earlier. R-1 has very small heat-rounded drawn beads and their bead chemistry is consistent with that found in the first half of the 19th century or earlier.

BEADS FROM EXCAVATIONS IN BRAZIL

Meggers and Evans (1957) conducted archaeological investigations near the mouth of the Amazon River and

Table 3. Nineteenth-Century Glass Beads from Site R-34, Bei-Tau Rock Shelter No. 1, Rupununi Phase, Guyana.

Kidd Code	Color and Shape	Average Diameter mm	Average Length mm	Count
If	Opaque black, N 1/, long, 7-sided, 5 rows of facets	6.9	18.9	2
If	Translucent dark blue, 5PB 2/8, long, 7 sided, 5 rows of facets	6.8	18.9	4
IIa12*	Opaque white, 2.5Y 8.5/4; with a thin colorless outer layer, short barrel; these differ from IIa12 in that they are opaque rather than translucent	3.5	2.9	3162
IIa	Opaque blue-grey, 7.5B 8/2, short barrel	2.6	1.7	1
IIa	Translucent blue-green, 5BG 4/4, short barrel	3.3	3.2	1
IIa	Translucent teal, 7.5BG 5/6, short barrel	3.2	2.6	1
IIa	Transparent blue-purple, 2.5PB 4/6, short barrel	3.6	3.8	1
IIa	Translucent dark reddish-purple, 5RP 3/6, short barrel	3.4	2.5	26
IIa	Opaque black, N 1/, short barrel	3.5	1.9	2
IIf	Translucent dark reddish-purple, 5RP 3/6, short barrel, randomly cut facets	4.6	2.8	11
MPII	Transparent purple, 7.5P 4/8, spherical with a rounded equatorial ridge	9.4	5.3	1
MPIIa	Translucent red, 5R 3/8, spherical faceted, 3 rows of 6 cut facets, biconical perforation	7.4	4.7	7
Total				**3219**

also at a site several kilometers to the north of the river in 1948 and 1949. They recovered glass beads at two sites and also obtained beads from other investigators who excavated two additional sites. They identified Aristé phase sites predominantly in the region north of the Rio Araguarí-Amaparí which enters the Atlantic Ocean about 20 km north of the mouth of the Amazon (Figure 4). The Aristé phase did not have a specific date range proposed by Meggers and Evans (1957:587), but they believed it could extend into the 18th century. Meggers and Evans investigated 15 Aristé phase sites, but glass beads were present at only sites A-10 and A-15. The Mazagão phase was identified north of the Amazon River and south of the Rio Araguarí-Amaparí. Six Mazagão phase sites were investigated, two of which (A-3 and A-4), contained European contact material in the form of glass beads. Meggers and Evans (1957:587) believed that the contact-period Mazagão phase could be as early as 1500 but, based on warfare and colonialism in the area from 1600 to 1630, were unlikely to post-date 1630. They did not provide date estimates for any of the specific sites they investigated.

Aristé Phase Sites North of the Rio Araguarí-Amaparí

Site A-15, Vila Velha, is an urn cemetery excavated by Eurico Fernandes before it was destroyed by village expansion. One urn contained 373 glass beads, a fused mass of glass beads, a stone axe, and seven stone pendants. While most of the beads are now in the collections of the Comissão Brasileira Demarcadora de Limites in Belém, a sample of 13 beads of six varieties were given to Meggers and Evans. During their research, Meggers and Evans (1957: Table C) had access to the entire bead collection and described the 373 beads in their report, separating them into at least 11 varieties (Table 4). In addition, a photograph of most of the 373 beads (Meggers and Evans 1957: Plate 25a) includes three melon beads, raising the number of varieties represented to 12. Two of the 11 varieties identified by Megger and Evans are not described in sufficient detail for all of them to be identified precisely today, however. Drawn bead varieties present in the Smithsonian collections (Figure 5) are oval, translucent blue beads (IIa54) and colorless "gooseberry" beads with white stripes (IIb18). Furnace-wound beads are represented by spherical beads

Figure 3. Glass bead varieties from site R-34, Guyana. Top rows and lower left, from left: If* (n=2), IIa* (n=7), and IIf* (n=1); Bottom center, from left: MPIIa* and MPII* (NMNH cat. nos. A419595 and A419600-419604).

of translucent alabaster glass (WIb5); pentagonal-faceted beads that are colorless (WIIc2), blue (WIIc11), or green (WIIc7?); colorless, blue, and amber "raspberry" beads (WIId); and melon beads (WIIe). Unfortunately, the exact colors and counts by color for some of the beads described by Meggers and Evans cannot be determined. The presence of the gooseberry and furnace-wound beads dates this assemblage to approximately the first half of the 18th century, with comparable beads from well-dated contexts at the Guebert site in Illinois (Good 1972) and the Tradeau site in Louisiana (Brain 1979). There were no white drawn beads at A-15, but low amounts of Sb were detected with XRF in the three gooseberry beads (Table 1), probably in the white stripes.

Site A-10, Montanha da Pluma, is a cave containing burial urns that dates to the Aristé phase (Meggers and Evans 1957:107-108). Sherds from broken urns near the mouth of the cave were intermixed with 12 small IIa12* beads of opaque white glass that average 3.5 mm in diameter and 2.2 mm in length. While small white beads were traded for many years making them difficult to place in time based on their physical appearance, examination of the opacifiers provides some estimate of the age of the beads. XRF analysis of 12 of the white beads found that all were high in Sb (Table 1). White beads high in antimony are common from the late 17th to early 19th centuries (Billeck and McCabe 2018; Hancock et al. 1997; Sempowski et al. 2000).

The Aristé phase extends into the contact period based on the presence of European trade items at some sites. A seriation of burial urn styles places A-10 earlier in time than A-15 (Meggers and Evans 1957: Figure 46). This may not be the case, however, due to the disparate number of vessels at

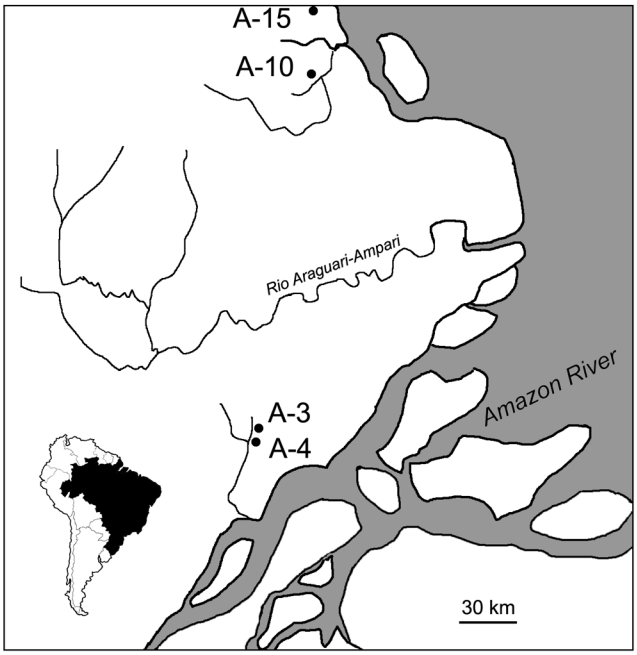

Figure 4. Archaeological site locations in Brazil.

Table 4. Glass Bead from Site A-15, Vila Velha, Aristé phase, Brazil.

Kidd Code	Color and Shape	Average Diameter mm	Average Length mm	Present Count	Count by Meggers and Evans (1957: Table C)
IIa54	Translucent blue, 5PB 2/6, oval	6.8	16.0	1 large	8
IIb18	Colorless with 14 or 17 opaque white stripes, N 8.5/, spherical, "gooseberry"	6.9	8.3	3 large	274
WIb5	Translucent alabaster, N 8.5/, spherical	11.8	9.8	2 very large	5
WIIc2	Colorless, pentagonal faceted	9.9 16.1	8.7 13.4	1 large 3 very large	45 colorless or dark blue
WIIc11	Translucent blue, 5PB 2/6, pentagonal faceted	14.0	11.3	1 very large	
WIIc7?	Green, pentagonal faceted, 8-11 mm in diameter and length			0	8
WIId1	Colorless, transparent, "raspberry"	10.0	8.4	2 very large	26
WIId	Dark blue or amber, "raspberry"			0	
?	Dark blue, small, spherical, 5 mm diameter			0	2
?	Colorless, spherical to oval, 3-4 mm diameter			0	5
WIIe	"Melon" beads; although not described, Meggers and Evans (1957: Plate 25a) illustrate at least three; color cannot be determined from the B&W image			0	0
Total				**13**	**373**

the two sites: only two vessels from A-15 but 24 from A-10 (Meggers and Evans 1957: Table 11). The bead assemblage at A-15 can be dated to the first half of the 18th century. Site A-10 can only be dated to somewhere between the late 17th and the early 19th century, based on the opacifier.

Mazagão Phase Sites Near the Amazon River

Site A-3, the Piçacá cemetery, is a Mazagão phase urn burial site where glass beads were obtained from a single urn by Fritz Ackermann. Meggers and Evans obtained a sample of 109 glass beads apparently from Ackermann, but were unable to record the total number obtained from the urn. The rest of the collection is at a museum in Macapa (Meggers and Evans 1957:51). The glass beads (Table 5; Figure 6) are all of drawn manufacture and consist of 66 opaque white short-barrel beads (IIa12*); eight opaque white spherical beads (IIa13); three transparent turquoise short-barrel beads (IIa32); 13 robin's egg blue barrel-shaped to spherical beads (IIa40); seven robin's egg blue short-barrel beads (IIa41); one opaque shadow blue short-barrel bead (IIa47); two bright navy short-barrel beads (IIa56); three barrel-shaped to spherical gooseberry beads (IIb18); two robin's egg blue beads with three opaque white stripes (IIb56); one robin's egg blue spherical bead with six redwood-on-white stripes (similar to IIbb'2 which has a lemon yellow rather than a white stripe); one short-barrel with a colorless exterior, an opaque white middle layer, and a colorless core (IVa11); one blue, white, red, white, and blue chevron with ground facets (IIIk3); and one colorless, green, red, and white star bead (IVk5). About half of the small white beads (IIa12*), several of the small blue beads (IIa41), one shadow blue bead (IIa47), one large white bead (IIa13), and one gooseberry bead (IIb18) were once glued to an unidentified surface that is still present on one end of the beads. It is not known why this residue is present only on some of the glass beads.

A-3 can be dated by a bead sequence proposed by Marvin T. Smith (1983, 1987:31-33) for Spanish contact

Figure 5. Glass bead varieties from site A-15, Brazil. From left: IIa54, IIb18, WIb5, WIIc2, WIIc11, and WIId1 (NMNH cat. no. A431302).

sites in the southeastern United States. Smith proposed four periods, of which only the third period is relevant here. At site A-3, beads that are diagnostic of Smith's 1600-1630 period are the star beads (IVk5) and the turquoise beads with white stripes (IIb56). Other bead varieties from A-3 that are present in the 1600-1630 framework and other periods are the gooseberry beads (IIb18) and turquoise beads (IIa40). The faceted chevron (IIIk3) is generally uncommon by 1600, but is known to occur in low numbers after that date (Loewen 2016; Smith 1987:33), especially in trade contexts that are not Spanish (Little 2010:224). Smith (1983: Table 1) dates compound seed beads from the southern United States to the 16th and 17th centuries, which likely includes IVa11 from A-3.

Marcoux (2012) has produced a bead chronology for English colonial sites in the southeastern United States identifying the most typical bead varieties assigned to four time periods between 1607 and 1783. A-3 varieties IIa12*, IIa32, IIa41, IIa47, IIbb'2, IIIk3, and IVk5 do not fall into any cluster. Beads attributed to Cluster 1 date to the first half of the 17th century and this typically includes variety IVa11 and occasionally IIa13, IIa40, and IIb56, varieties that all occur at A-3.

XRF analysis identified the opacifiers used in the manufacture of eight IIa13, one IVa11, thirty IIa12*, and three IIb18 beads from A-3 (Table 1). Seven of the medium to large IIa13 beads and one small IVa11 bead were found to be high in SnPb. Sn and low Pb could also be detected in the white stripes of the three IIb18 gooseberry beads. One large IIa13 bead which is a brighter white than the other IIa13s contains Sb and low Pb. All 30 of the IIa12* beads are high in Sb. Overall the smaller beads have Sb as an opacifier whereas the larger beads most often contain SnPb.

By about 1675, white beads of all sizes found at Seneca archaeological sites in northeastern North America are opacified with Sb (Sempowski et al. 2000). Overall, the presence of beads high in SnPb and beads high in Sb suggests the bead assemblage postdates 1625 based on comparative opacifier studies in northeastern North America (Sempowski et al. 2000).

Site A-4, the Valentim cemetery of the Mazagão phase, produced 42 glass beads from a concentration of several fragmentary vessels (Meggers and Evans 1957: Figure 11 and Table B). The collection now contains 38 beads (Table 6; Figure 7). One small bead is missing, along with the fragments of three beads that were described by Meggers and Evans (1957: Table B) as spherical opaque blue beads 5 mm in diameter. The missing blue beads are likely robin's egg blue (IIa40), and the missing small white beads are likely IVa11 since these are the only small white beads represented in the assemblage. Present in the Smithsonian collections are two tubular white beads with red stripes (Ib11), five large spherical white beads (IIa13), one spherical white bead with red stripes (IIb20), two spherical white "flush-eye" beads (IIg3), one long tubular Nueva Cadiz bead (IIIc1), and 27 colorless/opaque white/colorless compound short barrel beads (IVa11).

The IVa11 beads could be easily misclassified as IVa13 (opaque white on colorless glass) since the outer layer on many of the IVa11 beads is thin and these beads are best identified under magnification. Sempowski and Saunders (2001) combined IVa11/12/13 in their descriptions perhaps because of the difficulty in separating these varieties. The compound white and colorless, small to medium, short barrel beads in the IVa11/12/13 group have been reported at sites in

Table 5. Glass Beads from Site A-3, Piçacá, Mazagão phase, Brazil.

Kidd Code	Color and Shape	Average Diameter mm	Average Length mm	Present Count
IIa12*	Opaque white, N 8.5/, with thin colorless outer layer, short barrel	3.3 4.3	2.0 ------	64 small 2 medium
IIa13	Opaque white, N 8.5/-N 8.75/, spherical	4.9 6.3	5.3 6.7	1 medium 7 large
IIa*	Transparent green, 7.5GY 3/6, short barrel	2.9	1.9	1 small
IIa40	Opaque to slightly translucent robin's egg blue, 5B 3/6, 4/4, and 4/6, barrel to spherical	5.2 7.3	4.1 5.7	1 medium 12 large
IIa41	Opaque to slightly translucent robin's egg blue, 5B 4/4-4/6, short barrel	3.3	2.4	8 small
IIa45	Transparent bright copan blue, 2.5PB 6/10, short barrel	2.9	1.5	1 small
IIa47	Opaque shadow blue, 5PB 4/6, short barrel	6.05	3.35	1 large
IIa56	Transparent to translucent bright navy, 5PB 3/8, short barrel	3.0	1.5	2 small
IIb18	Colorless with 11 or 12 opaque white, N 8.5/, stripes, barrel to spherical, "gooseberry"	7.3	6.9	3 large
IIb56	Opaque robin's egg blue, 5B 4/6, with 3 opaque white, N 8.5/, stripes, spherical	8.0	7.7	2 large
IIbb'2*	Opaque robin's egg blue, 7.5B 4/6, with 6 slightly twisted stripes of opaque redwood, 7.5R 3/6, on opaque white, N 8.5/, spherical	8.5	7.1	1 large
IIIk3	Transparent bright navy, 2.5PB 2/8, opaque white, N 8.5/, opaque redwood, 7.5R 3/6, opaque white, N 8.5/, and transparent bright navy, 2.5PB 2/8, faceted barrel, "chevron"	6.8	7.9	1 large
IVa11	Colorless on opaque white, N 8.5/, on colorless, short barrel	3.4	2.4	1 small
IVk6	Colorless, opaque dark palm green, 10GY 4/4, opaque white, N 8.5/, opaque redwood, 7.5R 3/8, opaque white, N 8.5/, and colorless, spherical, "star"	9.0	7.3	1 large
Total				**109**

the 16th (Rumrill 1991: Table 3) and 17th centuries (Bennett 1983:52-53; Blair 2017; Kent 1983: Table 2; Rumrill 1991; Sempowski and Saunders 2001; Wray 1983:42-43). Wray reports compound beads identified as IVa13 as occurring before 1635. Rumrill (1991: Tables 3-5) dates them to his earliest period (1600-1615). Kent (1983: Table 2) dates IVa11 as occurring before 1630, but has them appearing again during 1676-1680. These beads are also present at Fort Orange, 1642-1647 (Huey 1983: Table 3). The flush-eye beads (IIg3) occur from 1575 to the 1630s (Smith 1983:33).

Nueva Cadiz beads typically dominate assemblages from areas of known Spanish contact during the early 16th century, but these beads are also known to occur occasionally in 17th-century contexts in northeastern North America within the colonial spheres of the French, Dutch, and English (Kenyon and Kenyon 1983; Lapham 2001; Little 2010; Loewen 2016; Smith and Good 1982). The Nueva Cadiz bead at A-4 shows little wear or deterioration of the glass suggesting it is not an heirloom and it seems most likely that the presence of this bead is the result of trade during the 17th century.

XRF analysis of 27 IVa11, five IIa13, two IIg3, two Ib11, and one IIb20 bead revealed that all had a high SnPb content (Table 1). The presence of only SnPb-opacified beads indicates a pre-1625 date for the assemblage (Sempowski et al. 2000).

Figure 6. Glass bead varieties from site A-3, Brazil. Top rows, from left: IIa/IVa, IIa13, IIa*, IIa40, IIa41, IIa45, IIa47, and IIa56. Bottom rows, from left: IIb18, IIb56, IIbb'2*, IIIk3, IVa11, and IVk6 (NMNH cat. nos. A431220-431221).

The glass beads from sites A-3 and A-4 have strong similarities to an assemblage of 20,402 glass beads from Dutch Hollow, a Seneca site in New York that dates to ca. 1605-1625 (Sempowski and Saunders 2001, 1:10, Table 3-86). Six of the seven bead varieties at A-4 are also present at Dutch Hollow, only variety Ib11 is absent. There are 13 bead varieties at A-3, 11 of which are present at Dutch Hollow. Varieties IIa32 and IIbb'2* at A-3 are not present in the Dutch Hollow assemblage, but very similar varieties (IIa31 and IIbb25) do occur there. The similarity of the A-3 bead collection to the 1605-1625 Dutch Hollow beads suggests that sites A-3 and A-4 are likely contemporary. The Dutch Hollow beads are thought to be the result of Dutch trade (Sempowski and Saunders 2001, 3:689), and these same beads at A-3 and A-4 are likely to also be the result of Dutch trade. The location of sites A-3 and A-4 in the early 17th century would primarily have been near Dutch settlements (Meggers and Evans 1957:556-562). These had been established north of the Amazon River by about 1600, but most had moved further north by 1630 to what is now French Guiana or further south along the Brazilian coast centered near Recife (Meggers and Evans 1957:562).

Overall the beads from A-3 and A-4 are likely the result of Dutch trade with indigenous communities. The presence of flush-eye beads (1575-1630), a Nueva Cadiz bead (present in low numbers after 1575 and into the 1600s in non-Spanish areas), and opacifiers that predate 1625 indicate that A-4 dates to between 1575 and 1625. The similarity with the Seneca assemblage at Dutch Hollow (1605-1625) and the presence of Dutch settlements in the area north of the Amazon after 1600 indicates that the assemblage can be more tightly dated to between approximately 1600 and 1625. Nueva Cadiz beads and faceted chevrons were present in glasswork waste deposits dating to the 1590s in Amsterdam soon after Venetian glassworkers arrived in the Netherlands (Baart 1988; Karklins 1974:75; Little 2010:226). If the Nueva Cadiz bead at A-4 was made in Amsterdam, it must date to the end of the 16th century or later based on the arrival of Venetian glassworkers. The association of a Nueva Cadiz bead with the beads at A-4 that are likely the result of Dutch trade adds to the growing body of evidence that Nueva Cadiz beads are associated with Dutch trade and Dutch manufacture in the early 17th century. Nueva Cadiz and chevron beads have also been found in early 17th-century

Table 6. Glass Beads from Site A-4, Valentim, Mazagão phase, Brazil.

Kidd Code	Color and Shape	Average Diameter mm	Average Length mm	Present Count
Ib11	Opaque white, N 8.5/, with 6 redwood stripes, tubular Opaque white, N 8.5/, with 8 redwood stripes tubular	2.6 3.0	7.5 6.8	2 small 5 large
IIa13	Opaque white, N 8.5/-N 8.75/, spherical	6.8	6.9	0
IIa40?	Opaque blue, round, 5 mm in diameter; not present in the collection but three fragments are described by Meggers and Evans (1957: Table B)			1 large
IIb20	Opaque white, 5GY 7/1, with 3 redwood stripes, spherical	7.1	6.5	2 large
IIg3	Opaque white, 5GY 7/1, with 3 eyes containing a redwood, 5R 4/6, star on opaque white on opaque blue, 10B 3/4, spherical, "flush-eye"	8.0	6.7	1 large
IIIc1	Transparent blue, 2.5B 3/6, on opaque white, N 8.5/, on transparent blue, 2.5B 3/6; square cross-section, long tube, Nueva Cadiz similar to type 52 in Smith and Good (1982)	6.2	73.9	22 small
IVa11	Colorless on opaque white, N 8.5/, on colorless, short barrel; a few beads have lengths that are almost equal to the diameter.	3.5 4.4	2.3 2.8	5 medium
Total				**38**

glassmaking contexts in France and there are likely to have been several sources for these beads in northeastern North America (Karklins 2019). How long Nueva Cadiz beads continued to be made is debatable, but they have been found in 17th-century contexts in northeastern North America and there is evidence that they may have been made possibly as late as 1710 (Karklins and Oost 1992:27). Earlier, in the 16th century, Nueva Cadiz beads were most likely only made in Venice. A-3 is more recent than A-4 based on the presence of beads opacified with Sb as well as SnPb, placing the site after 1625. Since the Dutch left the general area of the site in 1630, A-3 likely dates no more than a few years after 1630, and likely within the time frame of 1625 to 1650.

MEGGERS AND EVANS' INTERACTIONS WITH BEAD EXPERTS

In their report on the Amazon investigations, Meggers and Evans note that they sent the beads from A-3, A-4, and A-15 to bead experts for date estimates. They were disappointed in the results and stated that "in spite of the

Figure 7. Glass bead varieties from site A-4, Brazil. Top rows, from left: Ib11 (6 stripes), Ib11* (8 stripes), IIa13, IIg3, IIb20, and IVa11. Bottom row: IIIc1 (NMNH cat. nos. A431223-431224).

fact that the beads include distinctive types, no more precise date can be attributed to them... [and did not produce] evidence to indicate what types of beads were traded first and by which Europeans in South America" (Meggers and Evans 1957:97). They thought the dates assigned to specific bead types by the North American bead researchers were too recent for the sites in the Amazon: "Europeans were trading in the area from A.D. 1500 onward, almost 150 to 200 years earlier than the dates assigned to the same types of trade beads in the North American area" (Meggers and Evans 1957:97). Based solely on a review of historical records, Meggers and Evans (1957:587) believed that sites of the Aristé phase could date from 1500 to the 18th century and sites of the Mazagão phase could date from 1500 to ca. 1630.

Meggers and Evans report does not provide the dates proposed by the experts who are identified as Arthur Woodward, Glenn A. Black, and Kenneth Kidd (Meggers and Evans 1957:xxviii, 588), but the context suggests that the bead assemblages were dated 150 to 200 years after 1500, in the range of 1650-1700. It appears that Meggers and Evans assumed that the glass beads were from archaeological sites that date to soon after initial contact with Europeans in 1500. Based on this assumption, they concluded that the same bead varieties could be traded more than a century later in North America than in South America, and additional studies were needed to establish a glass bead chronology. It is possible to reconstruct the ways in which Meggers and Evans came to the erroneous conclusion that the North America chronology could not be applied in South America by examining their archived correspondence and notes related to their interactions with the bead experts. The correspondence shows a detailed assessment of the age of a specific bead only once and most of the letters tend to provide only general assessments of the age of the assemblages.

Evans sent a sample of beads from A-3, A-4, and A-15 to Arthur Woodward on 21 February 1951. Woodward replied on 27 February that he would date the beads to the late 17th to early 18th centuries, and that he would tentatively date most of the bead types to after 1650 (National Anthropological Archives [NAA], Meggers and Evans Papers, Series 3, Box 44). Evans then sent the bead samples from A-3, A-4, and A-15 to Glenn Black on 23 March 1951, and Black replied on 28 March that the beads most likely date to shortly after 1650 (NAA, Series 3, Box 44). Black wrote again on 11 April that he did not believe the beads could be linked to specific colonial presences of the Spanish, Portuguese, Dutch, French, and English near the mouth of the Amazon because most beads were derived from the same source in what is today Italy. Black was skeptical about the ability to use glass beads to date bead assemblages, which likely was a contributing factor in Meggers and Evans' conclusion that the North American bead chronology was of little value in dating South American archaeological sites. Black's opinion that beads could not be successfully used to date archaeological sites is surprising given how beads have become one of the most reliable dating tools used today.

Evans also showed the beads to Kenneth and Martha Kidd on 20 March 1952 and notes that they attributed A-3 and A-4 to the period prior to 1650-1675, and said that the beads from A-15 dated to a later time period. Evans's notes do not provide further details regarding the suggested time range for A-15. Some of the correspondence with John Witthoft, a bead expert who worked on Pawnee glass bead assemblages from Nebraska, is also in Evans's records (NAA, Meggers and Evans, Box 24). Witthoft replied to Evans in a letter dated 29 January 1952 that the wound faceted beads depicted in a figure from an Aristé phase site sent to him by Evans are almost an "index fossil of the 1720-1750 period in North America." While the correspondence does not identify the site, Witthoft can only be referring to the beads from site A-15, which is the only site that has this bead type. Evans replied on 3 February 1952 that this date was not possible because several European nations established colonies near the mouth of the Amazon in the 1500s and that by the late 1600s archival records indicated that the Indians in the area were being actively removed. Evans' expectations that indigenous communities were not present in the area, based on his knowledge of historical records, further led him to reject the applicability of using the North American bead chronology to date sites in South America.

The present analysis dates the beads from A-3 to ca. 1625-1650, A-4 to ca. 1600-1625, and A-15 to ca. 1700-1750. One problem with the age estimates from Woodward and Black is that they did not break down their dates by specific sites. Instead, Woodward described the aggregate date range for all three sites as being from the late 17th to the early 18th centuries, or after 1650. The findings of this study have yielded earlier dates for A-3 and A-4 than Woodward's assessment which placed all of the beads in a post-1650 context, but his early 18th-century estimate does match this study's date estimate for A-15. Black believed that all three assemblages jointly postdated 1650 but was pessimistic about the reliability of bead assemblage to establish a time frame for archaeological sites. Black was, however, correct in his post-1650 date for A-15, but the current study dates sites A-3 and A-4 to a pre-1650 time period. Kenneth and Martha Kidd dated the three assemblages individually, and their dates are the closest to those provided by the present study. They placed A-3 and A-4 in a time frame prior to 1650-1675, and described A-15 as being "late." Witthoft

dated A-15 to 1720-1750, and his findings are in agreement with this study. In hindsight, the age estimates for the bead assemblages from 1950s bead experts have been modified by a few decades by the present study of bead varieties and XRF, which has clearly benefitted from the past 60-plus years of advances in glass bead research.

CONCLUSION

The glass bead chronologies developed in North America and elsewhere for beads made in Europe can be effectively applied to archaeological sites in South America and other areas of the world that were subjected to European colonial expansion and trade. In effect, the North American bead chronologies provide a global chronology for glass beads derived from Europe, with some degree of regional adjustment. Meggers and Evans' investigations in Guyana and Brazil obtained bead assemblages from nine sites that date from the early 17th century to the mid-20th century. In the present study, the bead assemblages from South America were dated based on changes in bead stylistic attributes and manufacture methods, including changes in the opacifiers used in making white drawn beads.

REFERENCE CITED

Almeida, Maria Regina Celestino de

2014 Land and Economic Resources of Indigenous Aldeias in Rio de Janeiro: Conflicts and Negotiations, Seventeenth to Nineteenth Centuries. In *Native Brazil: Beyond the Convert and the Cannibal, 1500-1900*, edited by Hal Langfur, pp. 62-85. University of New Mexico Press, Albuquerque.

Baart, Jan

1988 Glass Bead Sites in Amsterdam. *Historical Archaeology* 22:67-75.

Bennett, Monte

1983 Glass Trade Beads from Central New York. In *Proceedings of the 1982 Glass Trade Bead Conference*, edited by Charles F. Hayes III, pp. 51-58. Rochester Museum and Science Center, Research Records 16.

Bieber, Judy

2014 Catechism and Capitalism: Imperial Indigenous Policy on a Brazilian Frontier, 1808-1845. In *Native Brazil: Beyond the Convert and the Cannibal, 1500-1900*, edited by Hal Langfur, pp. 166-197. University of New Mexico Press, Albuquerque.

Billeck, William T.

2010 Glass, Shell and Metal Beads at Fort Pierre Chouteau. In *The 1997-2001 Excavations at Fort Pierre Chouteau, Volume 2: Material Culture*, edited by Michael Fosha and James K. Haug, pp. 1-100. South Dakota State Historical Society, Archaeological Research Center, Research Report 3.

2018a Bead Analysis. In *Excavations at Fool Chief's Village (14SH405)*, by Tricia J. Waggoner, pp. 135-150. Contract Archeology Program, Cultural Resources Division, Kansas Historical Society, Report Submitted to the Kansas Department of Transportation and the Kansas State Historic Preservation Office.

2018b Fort Atkinson Beads. In *Archeological Investigations at Engineer Cantonment: Winter Quarters of the 1819-1820 Long Expedition, Washington County, Nebraska*, edited by John R. Bozell, Gayle F. Carlson, and Robert E. Pepperl, Appendix D, pp. 339-350. Nebraska State Historical Society, Publications in Anthropology 12.

2018c Glass and Shell Beads. In *Archeological Investigations at Engineer Cantonment: Winter Quarters of the 1819-1820 Long Expedition, Washington County, Nebraska*, edited by John R. Bozell, Gayle F. Carlson, and Robert E. Pepperl, pp. 172-181. Nebraska State Historical Society, Publications in Anthropology 12.

Billeck, William T. and Kendra McCabe

2018 pXRF Analysis of Opacifiers Used in White Drawn Glass Beads in the 17th to 19th Century in the Plains and Midwest. Paper presented at the 76th Plains Anthropological Conference, San Antonio, TX.

Blair, Elliot H.

2017 An XRF Compositional Analysis of Opaque White Glass Beads from 17th-Century Mission Santa Catalina de Guale, Georgia. *Beads: Journal of the Society of Bead Researchers* 29:31-48.

Brain, Jeffery P.

1979 *Tunica Treasure*. Papers of the Peabody Museum of Archaeology and Ethnology, Volume 71.

Dussubieux, Laure and Karlis Karklins

2016 Glass Bead Production in Europe During the 17th Century: Elemental Analysis of Glass Material Found in London and Amsterdam. *Journal of Archaeological Science: Reports* 5:574-589.

Evans, Clifford and Betty J. Meggers

1960 *Archeological Investigations in British Guiana*. Smithsonian Institution, Bureau of American Ethnology, Bulletin 177.

Good, Mary Elizabeth
1972 *Guebert Site: An 18th Century Historic Kaskaskia Indian Village in Randolph County, Illinois*. Central States Archaeological Societies, Memoir 2.

Hancock, R.G.V.
2013 European Glass Trade Beads in Northeastern North America. In *Modern Methods for Analyzing Archaeological and Historical Glass, Vol. 1*, edited by Koen Janssens, pp. 459-471. John Wiley & Sons, Chichester, UK.

Hancock, R.G.V., S. Aufreiter, and I. Kenyon
1997 European White Glass Beads as Chronological and Trade Markers. In *Material Issues in Art and Archaeology* 5, edited by Pamela B. Vandiver, James R. Druzik, John F. Merkel, and John Stewart, pp. 181-191. Material Research Society, Symposium Proceedings 462.

Huey, Paul R.
1983 Glass Trade Beads from Fort Orange, Albany, New York c. A.D. 1624-1674. In *Proceedings of the 1982 Glass Trade Bead Conference*, edited by Charles F. Hayes III, pp. 83-110. Rochester Museum and Science Center, Research Records 16.

Karklins, Karlis
1974 Seventeenth Century Dutch Beads. *Historical Archaeology* 8:64-82.
2012 Guide to the Description and Classification of Glass Beads Found in the Americas. *Beads: Journal of the Society of Bead Researchers* 24:62-90.

Karklins, Karlis and Adelphine Bonneau
2019 Evidence of Early 17th-Century Glass Beadmaking in and around Rouen, France. *Beads: Journal of the Society of Bead Researchers* 31:3-8.

Karklins, Karlis and Tony Oost
1992 The Beads of Roman and Post-Medieval Antwerpen, Belgium. *Beads: Journal of the Society of Bead Researchers* 4:21-28.

Kent, Barry C.
1983 The Susquehanna Bead Sequence. In *Proceedings of the 1982 Glass Trade Bead Conference*, edited by Charles F. Hayes III, pp. 75-81. Rochester Museum and Science Center, Research Records 16.

Kenyon, Ian T. and Thomas Kenyon
1983 Comments on 17th Century Glass Trade Beads from Ontario. In *Proceedings of the 1982 Glass Trade Bead Conference*, edited by Charles F. Hayes III, pp. 59-74. Rochester Museum and Science Center, Research Records 16.

Khemraj, Tarron
2015 The Colonial Origins of Guyana's Underdevelopment. *Social and Economic Studies* 64(3-4):151-185.

Kidd, Kenneth E. and Martha Ann Kidd
1983 A Classification System for Glass Beads for the Use of Field Archaeologists. In *Proceedings of the 1982 Glass Trade Bead Conference*, edited by Charles F. Hayes III, pp. 219-257. Rochester Museum and Science Center, Research Records 16.

Langfur, Hal
2014 Introduction: Recovering Brazil's Indigenous Pasts. In *Native Brazil: Beyond the Convert and the Cannibal, 1500-1900*, edited by Hal Langfur, pp. 1-28. University of New Mexico Press, Albuquerque.

Langfur, Hal and Maria Leônia Chaves de Resende
2014 Indian Autonomy and Slavery in the Forests and Towns of Colonial Minas Gerais. In *Native Brazil: Beyond the Convert and the Cannibal, 1500-1900*, edited by Hal Langfur, pp. 132-165. University of New Mexico Press, Albuquerque.

Lapham, Heather A.
2001 More Than "A Few Blew Beads": The Glass and Stone Beads from Jamestown Rediscovery's 1994-1997 Excavations. *The Journal of the Jamestown Rediscovery Center* 1: n.p.

Levine, Robert M.
1999 *The History of Brazil*. Greenwood Press, Westport, CT.

Little, Keith J.
2010 Sixteenth-Century Glass Bead Chronology in Southeastern North America. *Southeastern Archaeology* 29:222-232.

Loewen, Brad
2016 Sixteenth-Century Beads: New Data, New Directions. In *Contact in the 16th Century: Networks among Fishers, Foragers and Farmers*, edited by Brad Loewen and Claude Chapdelaine, pp. 269-286. Canadian Museum of History, Mercury Series, Archaeology Paper 176.

MacDonald, Scott B.
1992 Guyana: Historical Setting. In *Guyana and Belize: Country Studies*, edited by Tim Merrill, pp. 1-28. Government Printing Office, Washington, DC.

Marcoux, Jon Benard
2012 Glass Trade Beads from the English Colonial Period in the Southeast, ca. A.D. 1607-1783. *Southeastern Archaeology* 31:157-184.

Meggers, Betty J. and Clifford Evans
1957 *Archeological Investigations at the Mouth of the Amazon*. Smithsonian Institution, Bureau of American Ethnology, Bulletin 167.

Metcalf, Alida C.
1992 *Family and Frontier in Colonial Brazil: Santana de Parnaíba, 1580-1822*. University of California Press, Berkeley.
2014 The Society of Jesus and the First Aldeias of Brazil. In *Native Brazil: Beyond the Convert and the Cannibal, 1500-1900*, edited by Hal Langfur, pp. 29-61. University of New Mexico Press, Albuquerque.

Moreau, Jean-Francois, R.G.V. Hancock, and Marcel Moussette
2006 Toward A Chrono-Seriation Method Based on European Trade White Beads in Northeastern North America. In *34th International Symposium on Archaeometry, 3-7 May 2004, Zaragoza, Spain*, edited by J. Pérez-Arantegui, pp. 85-90. Institutión Fernando el Católico, Zaragoza.

Moreau, J.-F., R.G.V. Hancock, S. Aufreiter, and I. Kenyon
2002 Late French (1700-1750) to Early English (1750-1800) Regime White Glass Trade Beads from a Presumed Decorated Bag Found at the Ashuapmushuan Site (Eastern Central Québec), Canada. In *Archaeometry 98: Proceedings of the 31st Symposium, Budapest, April 26-May 3, 1998*, edited by E. Jerem and K.T. Biro, pp. 613-619. Bar International Series 104.

Ross, Lester A.
1990 Trade Beads from Hudson's Bay Company Fort Vancouver (1829-1860), Vancouver, Washington. *Beads: Journal of the Society of Bead Researchers* 2:29-67.
2000 *Trade Beads from Archeological Excavations at Fort Union Trading Post National Historic Site*. National Park Service, Midwest Archeological Center, Lincoln, NE, and Fort Union Associations, Williston, ND.

Rumrill, Donald A.
1991 The Mohawk Glass Trade Bead Chronology: ca. 1560-1785. *Beads: Journal of the Society of Bead Researchers* 3:5-45.

Sempowski, Martha L., A.W. Nohe, Jean-Francois Moreau, Ian Kenyon, Karlis Karklins, Susan Aufreiter, and Ronald G.V. Hancock
2000 On the Transition from Tin-Rich to Antimony-Rich European White Soda-Glass Trade Beads for the Senecas of Northeastern North America. *Journal of Radioanalytical and Nuclear Chemistry* 224:559-666.

Sempowski, Martha L. and Lorraine P. Saunders
2001 *Dutch Hollow and Factory Hollow: The Advent of Dutch Trade among the Seneca, Part I*. Charles F. Wray Series in Seneca Archaeology 3. Rochester Museum and Science Center, Research Records 24.

Smith, Joseph with Francisco Vinhosa
2002 *History of Brazil, 1500-2000: Politics, Economy, Society, Diplomacy*. Longman, London.

Smith, Marvin T.
1983 Chronology from Glass Beads: The Spanish Period in the Southeast, 1513-1670. In *Proceedings of the 1982 Glass Trade Bead Conference*, edited by Charles F. Hayes III, pp. 147-158. Rochester Museum and Science Center, Research Records 16.
1987 *Archaeology of Aboriginal Culture Change in the Interior Southeast: Depopulation During the Early Historic Period*. University of Florida Press, Gainesville.

Smith, Marvin T. and Mary Elizabeth Good
1982 *Early Sixteenth Century Glass Beads in the Spanish Colonial Trade*. Cottonlandia Museum Publications, Greenwood, MS.

Smith, Raymond T.
1962 *British Guiana*. Oxford University Press, London, UK.

Whitehead, Neil L.
2014 Colonial Intrusions and the Transformation of Native Society in the Amazon Valley, 1500-1800. In *Native Brazil: Beyond the Convert and the Cannibal, 1500-1900*, edited by Hal Langfur, pp. 86-107. University of New Mexico Press, Albuquerque.

Wray, Charles F.
1983 Seneca Glass Trade Beads, c. A.D. 1550-1820. In *Proceedings of the 1982 Glass Trade Bead Conference*, edited by Charles F. Hayes III, pp. 41-49. Rochester Museum and Science Center, Research Records 16.

William T. Billeck
Department of Anthropology
National Museum of Natural History
Smithsonian Institution
Washington, DC
billeckb@si.edu

Meredith P. Luze
Department of Anthropology
National Museum of Natural History
Smithsonian Institution
Washington, DC