

A Precolumbian Presence of Venetian Glass Trade Beads in Arctic Alaska

Michael L. Kunz  and Robin O. Mills

Excavation at three Late Prehistoric Eskimo sites in arctic Alaska has revealed the presence of Venetian glass trade beads in radiocarbon-dated contexts that predate Columbus's discovery of the Western Hemisphere. The bead variety, commonly known as "Early Blue" and "Ichtucknee Plain," has been confirmed by expert examination and comparative Instrumental Neutron Activation Analysis (INAA). The beads are present in sites throughout the Caribbean, the eastern coast of Central and North America, and the eastern Great Lakes region, where they are commonly found in sites dating between approximately AD 1550 and 1750, although a diminishing presence continues into the early 1800s. Beads of this variety have not previously been reported from Alaska. Ascribed to Venetian production by their precolumbian age, the beads challenge the currently accepted chronology for the development of their production methodology, availability, and presence in the Americas. In the absence of trans-Atlantic communication, the most likely route these beads traveled from Europe to northwestern Alaska is across Eurasia and over the Bering Strait. This is the first documented instance of the presence of indubitable European materials in prehistoric sites in the Western Hemisphere as the result of overland transport across the Eurasian continent.

Keywords: Late Prehistoric Eskimo, Venetian glass trade beads, precolumbian occurrence, Eurasia/North American Native contact

Excavación en tres sitios prehistóricos esquimales situados en el ártico de Alaska ha demostrado la presencia de cuentas venecianas de vidrio fechadas a la época precolombina por datación mediante carbono 14. La identificación positiva de estas cuentas de Tipo Ila40 también conocidas como Early Blue y Ichtucknee Plain se ha confirmado por análisis experto y análisis instrumental comparativo de activación neutrón. Esta clase de cuenta está presente en sitios a través del Caribe, la costa oriental de Norteamérica y América Central y la región oriental de los Grandes Lagos donde se las encuentra comúnmente en sitios fechados entre 1550 y 1750, aunque su cantidad disminuye continuamente hasta los 1800s. Esta clase de cuentas no se ha documentado en Alaska anteriormente. Atribuidas a la producción veneciana por su edad precolombina, las cuentas contradicen la cronología aceptada actualmente del desarrollo de su método de producción, disponibilidad y presencia en las Américas. En la ausencia de comunicación transatlántica, la única ruta que las cuentas podrían haber viajado de Europa al noroeste de Alaska era por Eurasia y el estrecho de Bering. Este es el primer caso de la presencia indudable de materiales europeos en sitios prehistóricos en el hemisferio oeste llevados por el transporte terrestre a través del continente Euroasiático.

Palabras clave: esquimal prehistórico reciente, cuentas comerciales de vidrio veneciano, presencia precolombina, contacto entre Eurasia/Nativo de América del Norte

By most accounts, the introduction of glass trade beads in Alaska began in AD 1741 when Vitus Bering made initial contact with Native peoples in southern Alaska (Bundy et al. 2003; Francis 1994; Grover 2016; unless otherwise noted, all dates in this report are AD). Technically, that event ended Alaska's prehistoric period, and although Russian traders

Michael L. Kunz (mike.kunz42@gmail.com, corresponding author) ■ University of Alaska Museum of the North, 1962 Yukon Drive, Fairbanks, AK 99775, USA

Robin O. Mills ■ Bureau of Land Management, Fairbanks District Office, 222 University Avenue, Fairbanks, AK 99709, USA (rmills@blm.gov)

American Antiquity 86(2), 2021, pp. 395–412

Copyright © The Author(s), 2021. Published by Cambridge University Press on behalf of the Society for American Archaeology
doi:10.1017/aaq.2020.100

were active in southern Alaska for the next 125 years, their direct influence in the Arctic (i.e., north of the Arctic Circle) was slight (Ray 1975:129). In essence, arctic Alaska remained prehistoric for another century. Certain Russian trade materials—including tobacco, metal, and beads—did trickle north into arctic Alaska during the last half of the eighteenth century, although it is likely that some exotic goods may have come directly from Siberia via Bering Strait–native trade rather than the Russians (Grover 2016; Spencer 1959:378). Although the majority of the beads traded in Alaska by the Russians were drawn beads manufactured in Europe or Russia, some beads produced in China known loosely today as “Padre” (Blair et al. 2009:82) or “Cook” beads (Bundy et al. 2003; Crowell 1997; Grover 2016) were also traded (Crowell et al. 2008; Dumond and VanStone 1995). The Chinese beads were manufactured by a procedure called “winding” (Francis 1986:36), a distinctly different manufacturing technique than that used to make the drawn beads discussed in this report (see Bead section). Although some examples of the Chinese beads can be somewhat similar in color and size to the beads discussed here, they are easily distinguishable from them because of their manufacturing hallmarks.

Most of the non-native trade materials found in arctic Alaskan Native sites are connected with the commercial whaling era, which began about 1850 and ushered in a period when Natives of arctic Alaska were exposed to sustained Euro-American presence, trade goods, and culture (Bockstoce 1986:180–204; Ray 1975:124; Spencer 1959:378). As a result, most Native sites in arctic Alaska that contain non-native materials date to the later commercial whaling period rather than the earlier Russian activity (Bockstoce 1986:180–204; Burch 2005:235). Whaling-era sites are hallmarked by items such as musket balls; bullet molds; cartridge cases; pieces of bone, ivory, and antler that have been cut by a metal saw; native-style tools made from salvaged (smelted) metal rather than traditional materials (stone, bone, antler, ivory); and glass beads of the period (Bockstoce 1986:180–204, 2009:331–332). The glass beads discussed here (Figure 1) are of a variety previously unreported in Alaska. Furthermore,

radiocarbon dates associated with these beads show that their presence predates Russian activity by multiple centuries, and Columbus’s “discovery” of the New World by decades.

The Beads

The undecorated glass beads recovered from the three arctic Alaskan sites discussed in this report have the following attributes: monochrome turquoise blue (7.5B5/6 Munsell), slightly translucent, short to long, and asymmetrically oblate spheroidal and oblate ovoidal in shape (Figure 1; Ross 2005). The beads range in size from 5.0 to 7.5 × 4.0 to 7.4 mm (greatest diameter × length), with cylindrical perforations ranging from 1.4 to 1.8 mm in diameter, and they weigh 0.3–0.5 g each. The glass contains miniscule bubbles that occur in longitudinal lines paralleling the perforation, indicating that the bead is a drawn rather than a wound type (Francis 1988; Karklins 2012). The slight S-curve exhibited by some bubble lines is characteristic of beads finished by the *a speo* process (Ross 2005), as is their somewhat irregular shape (Francis 1998a; Karklins 1993).

Archaeologists and bead researchers generally regard the bead classification system developed by Kenneth and Martha Kidd (1970) as the standard for historic trade bead identification (Karklins 2016). The arctic beads fall within the parameters of their Ila40 variety, and they have been ascertained as such by archaeologists experienced with their identification (Ross 2005). Ila40 beads are most commonly found in New World contexts dating from approximately 1550 to 1750 and occasionally extending into the nineteenth century at sites in the Caribbean, Central America, and along the eastern seaboard of North America and the eastern Great Lakes (Bennett 1983; Bradley 1983; Deagan 1987:156–183; Kenyon and Kenyon 1983; Miller et al. 1983; Smith 1983). Common regional names for the bead include “Early Blue” and “Ichtucknee Plain,” among others.

The Sites

Ila40 glass beads were first discovered in arctic Alaska at the Punyik Point site (49-XHP-00308)

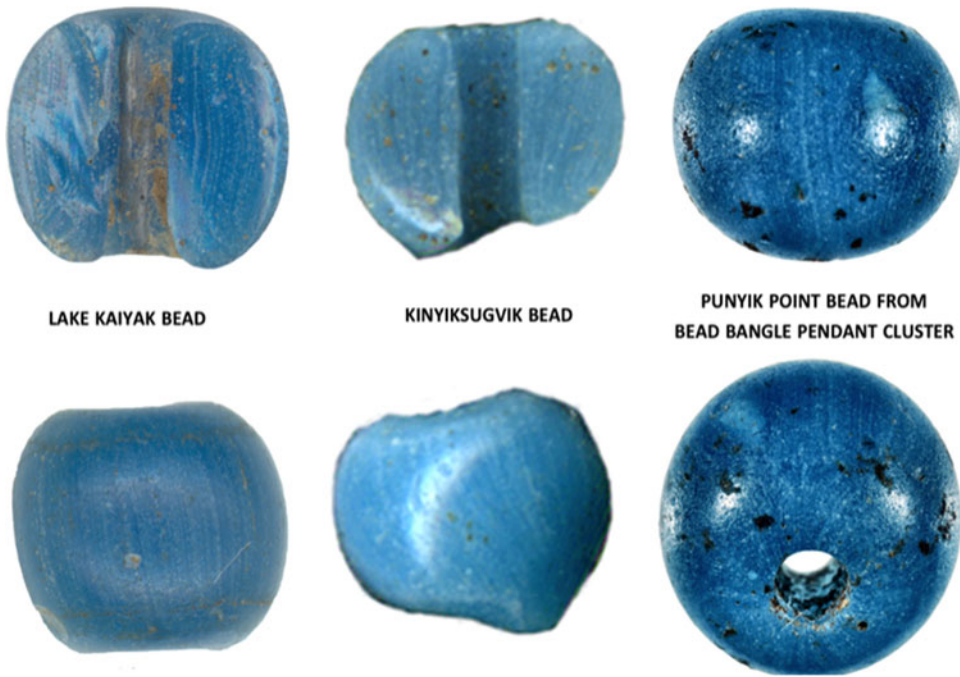


Figure 1. High-resolution images of glass beads from the three sites discussed herein. The images display the diagnostic physical characteristics of the Ila40 glass beads. Two views are shown of each bead. One bead is shown from each site. Images not to scale. Photographs by Lester Ross.

by William Irving more than 60 years ago, although he did not identify them as such (Irving 1964). The site is located along the north shore of Etivlik Lake at the northern margin of the western Brooks Range (Figure 2). Straddling the Continental Divide, the site lies in tundra 175 km above the Arctic Circle. The most conspicuous aspect of this multicomponent site is the remains of about 45 semi-subterranean houses and cache pits largely attributable to a Late Prehistoric Eskimo occupation (Irving 1964).

Irving identified five distinct periods of occupation at the site based on artifact typology: the Denbigh Flint Complex; the Norton, Ipiutak, and Late Prehistoric Eskimo cultures; and a historic period occupation postdating 1741. Irving believed the site had been occupied during the historic period because he unearthed four turquoise-blue glass beads (two complete and two halves), a circular copper bangle, and a copper bracelet, all of which he mistakenly assumed were of Euro-American origin (Irving 1964; Figure 3).

The next reported occurrence of Ila40 beads in the region was at another Late Prehistoric Eskimo site at Lake Kaiyak (49-MIS-00032) by Gilbert-Young (2004), located 176 km above the Arctic Circle and 222 km west of Punyik Point (Figure 2). The site consists of eight semi-subterranean house pits and four cache pits. Houses 1 and 2 had been vandalized around 1995, and during the 1996 salvage excavations of the undisturbed portions of the houses, two halves of a single Ila40 bead (one half from each house) were recovered (Gilbert-Young 2004). Neither house was radiocarbon dated at the time of excavation, but both were thought to date to 1578–1760 based on artifact typology. The half beads were originally misidentified as halves of a wound Chinese bead, but they were later correctly identified as the Ila40 variety by Ross (2005). The bead halves, which refit into one bead, were the only artifacts made by non-Natives that were recovered from the houses. They were interpreted as demonstrating the contemporaneity of the two houses and dated them to the historic period (Gilbert-Young 2004).

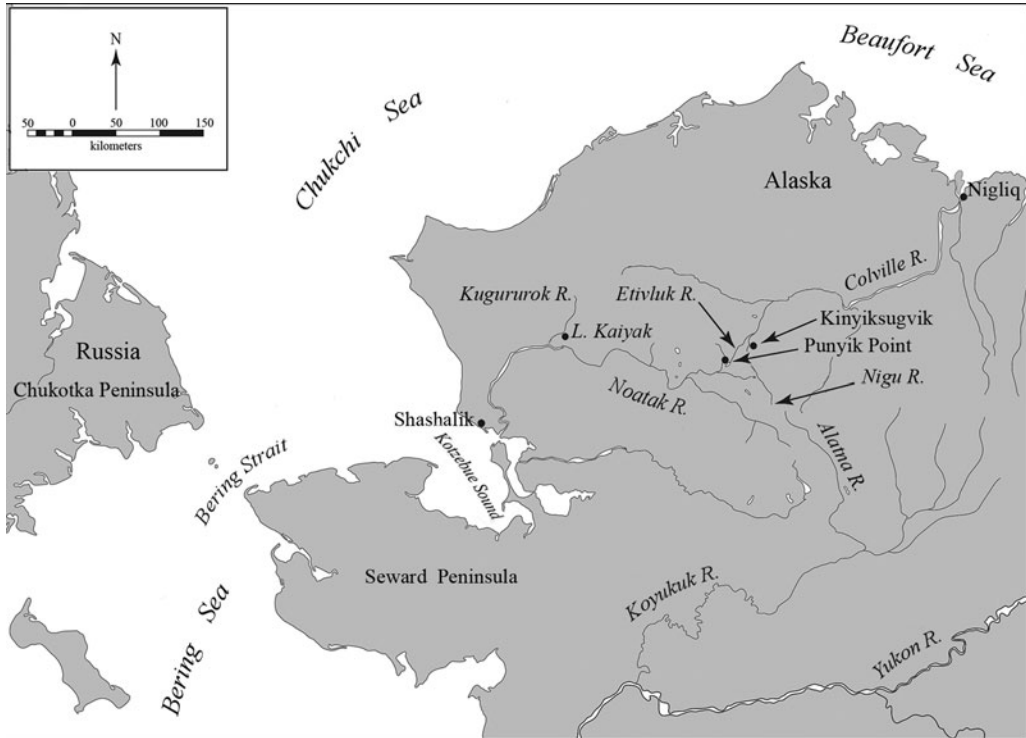


Figure 2. This map shows the proximity of Alaska to Russia across the 85 km wide Bering Strait, the locations of the three Late Prehistoric Eskimo sites discussed in this report, the trading locales of Sheshalik and Nigliq, and the important river drainages of the region. Sheshalik was a primary trading locale of the people of northwest Alaska and occasionally people to the west across the Bering Strait. The Noatak River drainage was a primary travel route that linked the Kotzebue Sound region to the arctic interior via the Aniuk River and Flora Creek. At Punyik Point this route connected interior Alaska with the arctic coast.

In 2004 and 2005, the authors conducted an assessment of the Punyik Point site to determine if it had been degraded during the decades following Irving's work and to collect additional archaeological data. Using accelerator mass spectrometry (AMS) radiocarbon dating, we corroborated Irving's four periods of prehistoric occupation, but we found no Native occupation dating to the historic period (Kunz 2005).

Because of the known presence of metal objects at the site, we conducted a metal-detector survey during our reinvestigation. The survey revealed the presence of 86 metallic objects at scattered locations across the site, 79 of which were quite modern items incorporated in the surface vegetation mat (e.g., tin cans, silverware, spikes, and cartridge cases). These latter items can be attributed to Irving's excavation crews and/or modern-era hunters. Beneath the 8 cm

thick surface vegetation mat, at a depth of 2–4 cm below the surface of the soil profile, four other metal occurrences were recorded: (1) a copper bracelet, (2) a copper bangle fragment, (3) a piece of scrap copper, and (4) a discrete 5 cm diameter cluster of eight artifacts (Figure 3). This cluster contained two circular copper bangles; the twine wrapped around one of the copper bangles; two thin, flat, teardrop-shaped pendants of iron; and three Ila40 beads (Figure 3i–o). The proximity of these eight objects to one another—all of them small, perforated objects that can be strung together—suggests that they were components of a single article of personal adornment, probably a necklace or bracelet. The lone bangle fragment was associated with semi-subterranean House 11, whereas the other items, including the cluster of eight artifacts, were found in open areas of the site between cultural features (Figure 4).

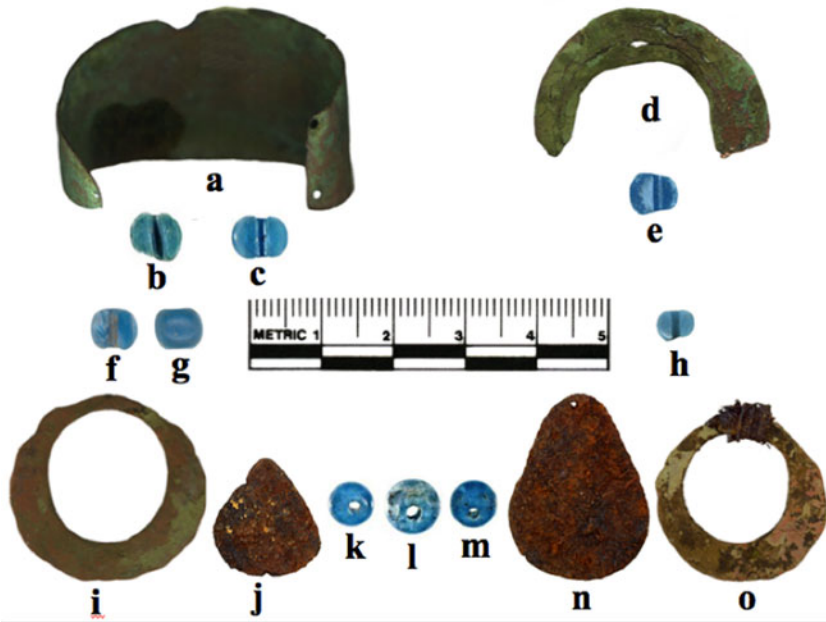


Figure 3. Ila40 glass beads and associated objects recovered from Late Prehistoric Eskimo sites in arctic Alaska: (a) copper bracelet and (b–c) split glass beads recovered from the interior of two semi-subterranean houses excavated by William Irving at Punyik Point in 1961; (d) bangle fragment and (e) split glass bead recovered from the interior of semi-subterranean house H11 excavated by the authors at Punyik Point in 2005; (f–g) the matching halves of a single glass bead, each half recovered from semi-subterranean Houses 1 and 2 at Lake Kaiyak by Gilbert-Young in 1996; (h) half glass bead excavated by the authors at Kinyiksugvik in 2007; (i, o) copper bangles, (j, n) iron pendants, and (k–m) glass beads excavated by the authors at Punyik Point in 2004. Objects (i–o) are the components of an item of personal adornment (necklace or bracelet) recovered together in a 5 cm cluster in an open area of the site and not associated with any cultural feature. Not pictured are two complete glass beads excavated by Irving in 1954 and 1961 from mixed deposits in two semi-subterranean houses. The present location of those beads is unknown. Beads (b), (c), and (e) from Punyik Point; (f) and (g) from Lake Kaiyak; and (h) from Kinyiksugvik may have been split so that they could be mounted in a lip ornament known as a “labret.” All beads are Kidd and Kidd’s (1970) Ila40 variety. Photographs by Lester Ross, Charles Adkins.

Additionally, the excavation of House 11 produced half of a Ila40 bead (Figure 3e). A total of eight beads have been recovered from the site, four by Irving (two complete and two halves) and four by the authors (three complete and one half).

In 2007, the authors conducted archaeological excavations at a site at the southwestern end of Kinyiksugvik Lake in the Nigu River valley, 20 km north of Punyik Point. The Kinyiksugvik site (49-XHP-00115) lies on a hillside above the lake, and it contains 28 semi-subterranean houses and 41 cache pits (Davis et al. 1981:375–395). Our excavations revealed both prehistoric and contact period occupations that were originally differentiated by artifacts and later corroborated by AMS radiocarbon assays.

One half of a Ila40 bead was recovered during excavation (Figure 3h).

All three of these sites have archaeological components related to Late Prehistoric Eskimo, and they occur along a generalized travel route crossing arctic Alaska (Burch 1975, 1976, 2005:116; Figure 2). The route follows the drainages of the Noatak, Nigu, Etivluk, and Colville Rivers, along which the sites discussed are found. This route connects the trading center of Sheshalik near the mouth of the Noatak River and Bering Strait with the trading center of Nigliq, at the mouth of the Colville on the Beaufort Sea coast, which is 1,287 km overland to the northeast (Burch 1975, 1976, 2005:180–195; Grover 2016; Figure 2). Sheshalik was the scene of an important trade fair, and it drew

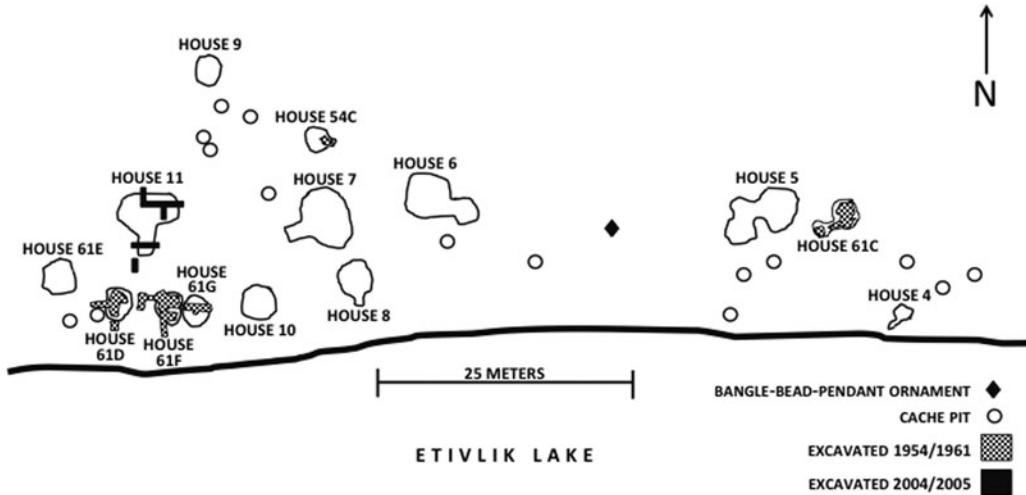


Figure 4. Map of the central portion of the Punyik Point site showing both the open area where the bangle/bead/pendant artifact was recovered by metal detector survey and the location of House 11 where a bangle fragment and a bead were recovered through excavation.

Native groups from both sides of the 85 km wide Bering Strait (Burch 2005:180–195; Giddings and Anderson 1986:35–37; Grover 2016). Consequently, it was a port of entry for goods from northeast Asia (Bockstoece 2009; Cooper et al. 2016; McCartney 1988). Although a few non-Native items have been recovered from prehistoric sites in the region, they are—almost without exception—metal, and their presence is singular and scattered (Cooper et al. 2016; Mason 1998), a situation dissimilar to that of the Ila40 beads discussed here. Given these circumstances and the uniqueness of the beads (i.e., no other occurrence of Ila40 beads within thousands of kilometers), we think it more than likely, if not probable, that the 10 beads recovered from the three sites arrived at Sheshalik as part of a group and then dispersed from there. Besides being on the Sheshalik-Nigliq route, Punyik Point and Kinyiksugvik also lie on the Nigu, Alatna, Koyukuk, and Yukon Rivers route that connects the study area with interior Alaska (Burch 1975, 1976).

A Brief History of Italian Bead Manufacture

European glassmaking originated in Venice around 700 (Francis 1998a). By at least the early eleventh century, Venetian glassmakers

were organized into a guild (Francis 1998a, 2008). At the same time, Venetian trade was expanding, and by the thirteenth century, it was trading deeply into the Asian continent (Bergreen 2007:27). By the last decades of the fourteenth century, Venice had dominated regional glass manufacturing (Blair et al. 2009:56; Francis 1998a) and established solid trading relationships throughout Asia (Bergreen 2007:27). In 1291, all glass production was moved from central Venice to the island of Murano as a fire safety precaution but also to allow tighter governmental control over an increasingly profitable industry (Blair et al. 2009:56; Francis 1998a).

The first record of Venetian glass beads occurs in 1268 (Gasporetto 1958:182), and a reference to the use of Venetian glass beads in embroidery follows in 1296 (Francis 1998a). This may suggest that the manufacture of embroidery beads (i.e., typically beads less than ca. 4 mm in diameter) may have been occurring by that time, although beads larger than 4 mm are also used for that purpose (Francis 1988; Karklins 2012). Twelve years later, in 1308, the Margariteri bead-makers guild was established (Blair et al. 2009:56; Francis 1998a), indicating that beadmaking had become important enough to warrant regulation.

Margariteri guild beads were made initially by the furnace-winding method (Francis 1988, 2008). Furnace-wound beads were made by dipping an iron rod (mandrel) into molten glass in a furnace and twisting it until a bead was built up (Blair et al. 2009:56–57; Francis 1988). The rod creates the bead's perforation, and coating applied to the rod's surface, like kaolin, allows the bead to be easily struck off (Francis 1988). Beads of this type tend to be large and imperfect with large perforation diameters (Francis 1988). Winding causes any inclusions in the glass—such as striations, swirls or bubbles—to align at 90° to the perforation, which is an identifying hallmark of this bead type (Francis 1988; Karklins 2012). By the last third of the fifteenth century, the Margariteri stopped making furnace-wound beads and adopted or developed the tube-drawing method of bead manufacture (Blair et al. 2009:56–57; Francis 1988). In 1486, a second glass bead-making guild, the Paternostri, was established (Blair et al. 2009:56; Francis 1998a).

Drawn beads are made from a glass tube sometimes referred to as a “cane” (we will use the term “tube” exclusively because “cane” can also refer to the drawn, solid-glass rods used in bead decoration and the production of lamp-wound beads [Francis 1988]). Initially, researchers thought that drawing a tube was started by blowing a bubble in a glass gather (Kidd and Kidd 1970). Subsequent study, however, has shown that this is likely not the case (Blair et al. 2009:55). To make the tube, a gather of molten glass was shaped into a stubby, thick-walled cylinder on the end of an iron called a “pontil.” A smaller gather of cooler glass on a flat-ended post was melded with the cylinder. Two people—one holding the iron, the other holding the post—walked rapidly away from each other, drawing the glass out to form a tube of the desired diameter (hence the term “drawn bead”). Simultaneously, other workers fanned the tube until it was cool enough to be laid across a wooden support framework. The tube was then cut into sized segments that would become beads (Blair et al. 2009:55; Francis 1998a; Karklins 1993; Kidd and Kidd 1970). It is not known which guild invented tube drawing (Blair et al. 2009:55; Francis 2008), but history and circumstances strongly suggest that it was the

Margariteri because they had been making glass beads for more than 150 years before the formation of the Paternostri guild in 1486.

The final drawn-bead production step is a reheating process that smooths the uneven ends of the tube segments. There are two procedures for doing this, and which procedure is used depends on the size of the bead being finished. Beads smaller than approximately 4 mm in diameter (seed beads) were placed in a heated iron pan and stirred to smooth the rough edges. This process was termed *a ferrazza* (“on the pan”; Blair et al. 2009:65; Francis 1998a). Beads larger than roughly 4 mm in diameter could be finished by either painstakingly grinding the ends of each tube segment or placing multiple segments on the tines of a circular tool that was inserted into a furnace and rotated, thereby heating and smoothing out the rough ends and making the segment more spherical. This process was termed *a speo* (“on the spit”; Blair et al. 2009:53; Francis 1988; Karklins 1993).

If the Margariteri developed tube drawing and the *a ferrazza* and *a speo* finishing procedures, as seems likely, then they were the makers of all sizes of drawn beads prior to approximately 1486. This suggests that the Paternostri emerged as an offshoot of the Margariteri, with the primary distinction between the two bead-making guilds being the size of the beads they produced: the Margariteri making beads generally smaller than 4 mm in diameter and finishing them by *a ferrazza*, and the Paternostri making beads larger than 4 mm in diameter and finishing them by *a speo* (Blair et al. 2009:56–57; Francis 1988, 2008).

The development of tube drawing, as well as *a ferrazza* and *a speo* finishing procedures, allowed for the profitable mass production of beads. Despite Venetian attempts to maintain its monopoly, bead manufacturing had spread to other European cities by at least the last decade of the sixteenth century (Blair et al. 2009:56; Francis 1998a). As guild trade secrets were ferociously guarded, the history and development of these methods is currently unclear. The only hard facts we have are the years when the Margariteri (1308) and Paternostri (1486) guilds were established, but how long tube drawing existed and how long *a ferrazza* and *a speo*

finished drawn beads were made prior to approximately 1486 is unknown.

It is expected that some time lag would occur between bead development, successful production, and subsequent guild establishment. But how long? Francis (1998b, 2008) offers a clue, pointing out that the man most likely responsible for the development of tube drawing died in 1460, implying a development period for that technique of at least 25 years. The lag time for the formation of a guild to engage in and govern that production is demonstrated by the time lapse of as much as 40 years between the initial observation/production of glass beads in Venice in 1268 (Gasparetto 1958:182) and the formation of the Margariteri glass bead-makers' guild in 1308 (Blair et al. 2009:56; Francis 1998a). Finally, if the Margariteri were the inventors of the drawn-bead manufacturing procedures, which seems likely, then it is quite possible that IIA40 beads, which Francis (1988, 2008) states is one of the earliest drawn-bead varieties, could have been manufactured and dispersed decades prior to 1486.

Artifact Analysis

Instrumental neutron activation analysis (INAA) is used to quantify the relative amounts of chemical elements in a material (Eby 2017). This is accomplished by bombarding the sample with neutrons, causing each elemental component to become a radioactive nuclide. As the radioactivity of the nuclides decay, they emit gamma rays whose energies are unique to each element present. The energy emitted by the decay process is proportional to the element's atomic number, thereby allowing elemental identification. Samples of glass from the same manufacturing source made at the same time will display the same general "elemental fingerprint." Variations beyond a minor degree would indicate different geographical and/or temporal origins.

In the early 1990s, INAA was used to analyze IIA40 beads from sites in the eastern Great Lakes region (Hancock et al. 1994). The beads were determined to be from three time periods based on associated artifacts: Period I (1580–1600), Period II (1600–1620), and Period III (1620–1650). A subsequent study of beads from the

same region extended the temporal range of the IIA40 beads (Kenyon et al. 1995). The beads from both studies were analyzed for the presence of 11 elements. Bead element profiles from sites of the same approximate age were compared to see if there was continuity among the element profiles. Although there was appreciable overlap in many of the elements, it was statistically determined that there was enough differentiation in certain key elements (e.g., Ca, Na, Cl, Cu) through time to establish chronological groupings (Hancock et al. 1994: Tables 2 and 4; Kenyon et al. 1995: Tables 1 and 2). To be clear, these studies used INAA to determine chronological groupings, but unfortunately not geographical origins.

In 2005, Ron Hancock conducted INAA on five of the Punyik Point beads, including all three from the pendant/bangle/bead cluster, and two beads from William Irving's earlier excavations (Table 1; Hancock 2005). When compared to the earlier INAA studies' elemental profiles, in particular to their key elements' ratios (Hancock et al. 1994: Figures 2–4; Kenyon et al. 1995: Figures 2–4), the data show that the Alaskan beads are made of soda glass, typical of fifteenth-century Venetian and later European manufacture (Blair et al. 2009: 71, 76–77; Francis 1988), and they are unequivocally of the IIA40 variety. Their elemental profiles, however, overlap broadly with all of Hancock and colleagues' (1994) time periods, not aligning specifically with any of the chronological groupings. In effect, the Alaskan INAA data are not currently useful in assessing the beads for chronological purposes.

The copper bangles and iron pendants associated with the Punyik Point beads (Figure 3) were analyzed at the University of Alberta Department of Chemical and Materials Engineering (Wayman and Cooper 2005). Analysis of the iron pendants showed they are made from smelted iron. Smelted metal attributed to northeast Asia has been recovered in arctic Alaska sites dating as early as the first millennium AD and is the probable source for the pendants (Cooper et al. 2016; McCartney 1988). The circular bangles are made from natural/native copper, cold-hammered into shape, and they are certainly of native manufacture (Wayman

Table 1a. Punyik Point Ila40 Glass Bead Samples Analyzed by Instrumental Neutron Activation Analysis (INAA) at the McMaster Nuclear Reactor in Hamilton, Ontario, Canada.

Bead ID No.	Al%	Ca%	Cl%	Co ppm	Cu%	Mn ppm	K%	Na%	Sn ppm	As ppm	Sb ppm
MD 48-1	0.52	4.2	1.67	37	0.76	149	1.5	12.6	<850	<100	<150
MD-48-2	0.45	2.5	1.88	<31	0.86	3,100	1.8	13.2	<1,500	<130	<180
MD 48-3	0.44	3.2	1.79	65	1.04	414	2.6	11.0	<930	<88	<110
NOAT 14310	0.41	3.5	1.97	48	0.91	868	<0.5	13.1	<1,000	<100	<140
NOAT 14311	0.41	3.9	1.58	77	0.62	236	<0.5	12.1	<1,200	240	<140

Table 1b. Calibration check samples.

	Al%	Ca%	Cl%	Co ppm	Cu%	Mn ppm	K%	Na%	Sn ppm	As ppm	Sb ppm
co	1.90	5.9	<0.04	410	<0.04	83	<0.4	9.9	<730	420	<82
Co	1.88	6.2	<0.05	420	<0.05	66	1.4	10.2	<910	430	<100
db2	0.82	6.8	<0.05	<14	<0.03	103	<0.4	10.3	<920	<79	<100
db5	1.02	6.3	<0.05	<16	<0.04	<46	<0.4	9.7	<1,100	<92	<120

and Cooper 2005). The bangles are fashioned so that the ends overlap to form a complete circle. A length of plant fiber (twine) was wrapped around the overlapping ends of the bangles to draw them tight so that the bangle could be securely strung (Figure 3o). Although Cooper's (2012:Figure 3) map shows four copper sources within several hundred kilometers of Punyik Point, those sources contain little or no free copper. Significant sources of naturally occurring copper are the Copper River drainage of south-central Alaska, approximately 800 km to the south—the presumed source for most copper in Alaskan Native sites (Cooper 2012)—and the Coppermine River drainage of the Central Canadian Arctic, approximately 1,600 km to the east. Unfortunately, none of these metallic items possesses culturally diagnostic traits, and none can be used to date the associated beads.

Radiocarbon Assays

As outlined in previous sections, other potential sources of data (historical documents, INAA, and associated metal artifacts) are unclear or mute relative to helping us date the arrival of the Ila40 beads in arctic Alaska. Consequently, we rely on AMS radiocarbon dating of organic material associated with the beads to date them by proxy, with the exception of the bangle/bead/pendant artifact, which is dated by the vegetal twine that is part of the artifact. Unless otherwise noted, all radiocarbon dates shown

here are calibrated utilizing Calib7.1/Intcal13 (Reimer et al. 2013; Stuiver et al. 2020) and presented at the 2σ (95.4%) level of confidence (Table 2, Figure 5). All of the organic material assayed was associated with one or more Ila40 beads, and calibration created several temporal segments for each assay, except for Kinyiksugvik, which had a single temporal segment. That said, the alignment of the fifteenth-century temporal segments as plotted in Figure 5, overlapping between 1443 and 1488, exhibits the greatest probability for representing the time period during which the beads arrived at the sites.

Of all the dates run, the radiocarbon assay with the opportunity for best accuracy (i.e., degree of correctness for an age, based on certainty of association between the dated material and the behavior or event that the archaeologist is seeking to date in the past) and the best precision (i.e., "the time interval within which a ^{14}C -inferred age expression lies" [Taylor and Bar-Yosef 2016:130]) for dating the earliest-known presence of Ila40 beads in arctic Alaska is Beta-201353 (Table 2, Figure 5). This assay was run on thin vegetal twine that had been carefully wrapped around the overlapping ends of a copper bangle (Figure 3o) from the eight-component bead/bangle/pendant cluster at Punyik Point (Figure 4). The wrapping of the twine prevented the bangle from slipping off of the cord of the necklace/bracelet of which it was a part. The twine is a component of the

Table 2. Sample Data and Results from AMS Radiocarbon Assays of Material Associated with Ila40 Glass Beads Recovered from Three Late Prehistoric Eskimo Sites in Arctic Alaska.

Site	Lab No.	Material	¹³ C/ ¹² C Ratio	Conventional C ¹⁴ Age BP	Calendar Years AD 2σ Calibration CALIB Ver. 7.1	Comment
Punyik Point	Beta 201353	Plant fiber (twine)	-22.0	470 ± 40	AD 1332–1337 (0.6%) AD 1397–1488 (98.9%) AD 1604–1608 (0.4%)	Twine wrapped around overlapping ends of a copper bangle that was recovered with glass beads and iron pendants.
Punyik Point House 11	Beta 193802	Charcoal	-25.1	540 ± 40	AD 1308–1362 (38.7%) AD 1386–1441 (61.3%)	Charcoal recovered from hearth of semi-subterranean House 11, one season occupational event, ½ glass bead recovered from house bench.
Lake Kaiyak House 1	CAMS 141635	Caribou bone	-19.1	385 ± 30	AD 1443–1524 (68.7%) AD 1559–1564 (1.3%) AD 1569–1631 (30.1%)	Caribou bone recovered from floor of semi-subterranean House 1; ½ glass bead associated with bones recovered from house.
Lake Kaiyak House 1	CAMS 141638	Caribou bone	-19.0	400 ± 30	AD 1437–1521 (80.3%) AD 1575–1624 (19.7%)	Caribou bone recovered from floor of semi-subterranean House 1; ½ glass bead associated with bones recovered from house.
Lake Kaiyak House 2	CAMS 141637	Caribou bone	-20.0	405 ± 30	AD 1434–1521 (84.2%) AD 1576–1584 (1.0%) AD 1590–1622 (14.8%)	Caribou bone recovered from floor of semi-subterranean House 2; ½ glass bead associated with bones recovered from house.
Lake Kaiyak House 2	CAMS 141636	Caribou bone	-19.2	245 ± 30	AD 1523–1559 (9.4%) AD 1630–1681 (58.4%) AD 1739–1743 (0.4%) AD 1763–1802 (26.7%) AD 1938–1950 (4.5%)	Caribou bone recovered from floor of semi-subterranean House 2; ½ glass bead associated with bones recovered from house. This assay is anomalous when compared with other bead-associated assays in general and the other Lake Kaiyak bead assays in particular.
Kinyiksugvik	Beta 233006	Charcoal		320 ± 40	AD 1470–1648 (100%)	Charcoal recovered from a dump adjacent a domestic structure. Charcoal and bead from same dump layer and same 50 × 50 cm unit.

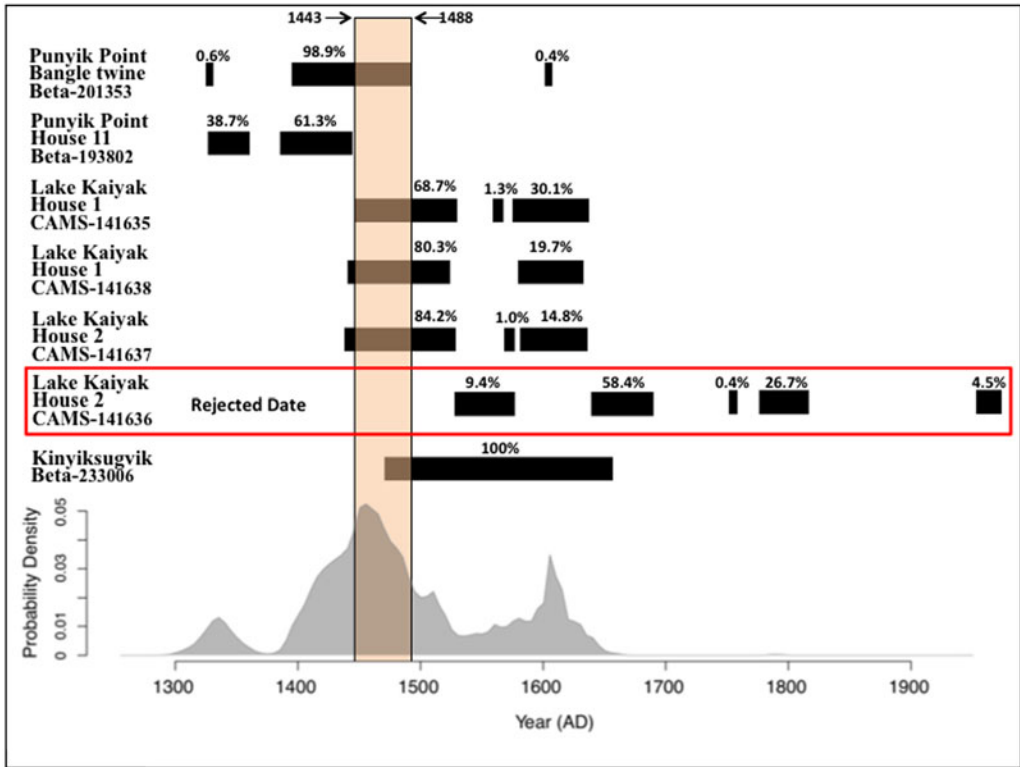


Figure 5. The horizontal black bars plot the distribution of the temporal range (calendar years AD) of each radiocarbon assay associated with the Ila40 beads from the three sites. The tan column highlights the time period where the bangle twine, which is considered to have an indubitable association with the bangle/bead/pendant artifact, and three other assays overlap. It also emphasizes the probability density of the alignment of those dates. Because of the presence of a glass bead in House 11, the authors feel that assay (Beta-193802) may have been made on charcoal from wood a few decades old when it was burned, which is why the date falls slightly outside the overlap period (see text for discussion). The Lake Kaiyak House 2 CAMS-141636 assay is anomalous when compared with the other Lake Kaiyak assays and is dismissed from consideration (see text for discussion).

artifact, and its association with the beads is unquestionable. Furthermore, the twine was a short-lived material—possibly one made from the inner bark of a shrub willow (Burch 2005:187)—that was likely replaced regularly, so there would be no significant time lag between when the twine plant was photosynthesizing and when it was used to hold the ornament together. More than 98% of this date’s 2σ probability falls in the temporal segment spanning cal AD 1397–1488. There is only a 1% probability that the date falls outside of that temporal segment (Table 2, Figure 5).

We believe the next most accurate date is from a piece of hearth charcoal from House 11 at Punyik Point (Beta 193802). Unlike many semi-subterranean houses in arctic

Alaska—including several at Punyik Point, which have multiple overlapping floor layers and hearth layers indicating several periods of occupation—House 11 has only a single 2–3 cm thick floor/bench layer (in which the Ila40 bead was found) and a single layer of charcoal in the central hearth. This indicates a single period of occupancy—in this case, one winter season (Figure 6a and 6b). There is no stratigraphic evidence or other indication that any bioturbation has occurred within House 11 or that there was any type of subsequent use after the dwelling’s abandonment.

The charcoal was not identified to species, but it likely came from surrounding stands of shrub willow (*Salix* spp.), which is the only locally occurring woody plant that is plentiful enough

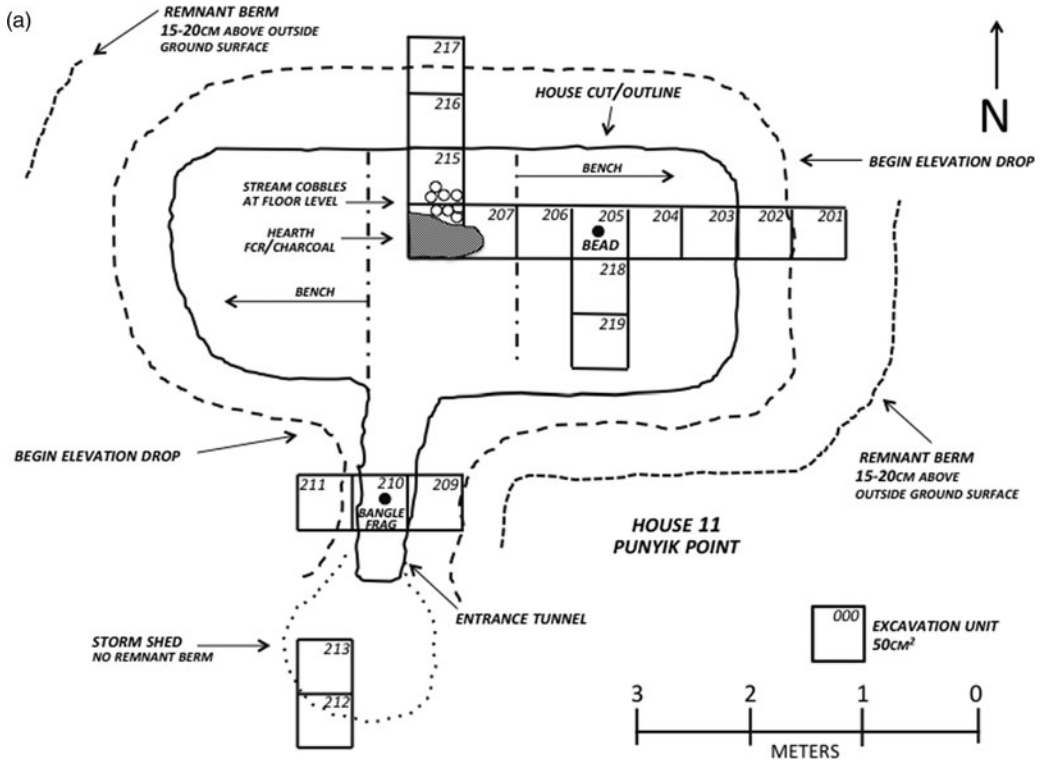


Figure 6a. Plan view of House 11 at Punyik Point showing the relationship of the bangle fragment and bead to each other, the house features, and the excavation units.

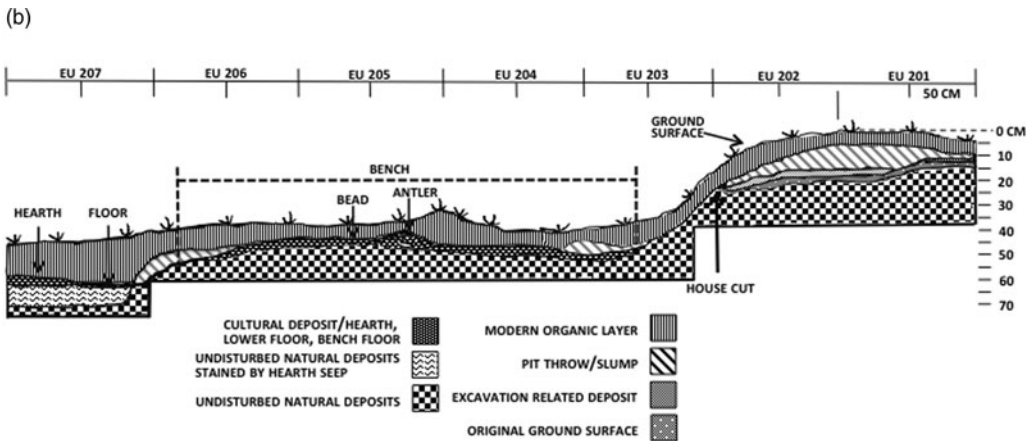


Figure 6b. Profile of the north wall of excavation units 201–207 of House 11 at Punyik Point showing the relationship of the bead and the hearth.

to have enduring firewood value (Gubser 1965:240). The unlikely alternative is spruce (*Picea* spp.), the nearest examples of which are approximately 20 km to the south, or alder

(*Alnus* spp.), which occurs sporadically in this region. In addition, we believe the charcoal is willow because the placement of the site at this locality is undoubtedly due to the extensive

willow stands that grow there (Binford 1980:212–213; Gubser 1965:73, 111–112, 240; Ingstad 1954:126). We are not aware of any published or unpublished reports of any inland, late-prehistoric winter-habitation locale above latitudinal treeline (68° N) that is not situated in or adjacent to a sizeable stand of shrub willow. Gubser (1965:240) notes that in some cases, a large early to mid-twentieth-century Nunamiut family, probably equal in size to two late-prehistoric families (Burch 2006:89), would burn as much as 50 lb (22.7 kg) of willow in a 24-hour period.

Most of the House 11 assay's probability falls in the cal AD 1386–1441 span, which is several decades earlier than the mean of the overlap of the other bead-related dates (Table 2, Figure 5). As with any wood, shrub willow consists of the carbon that was fixed from the atmosphere during the summer that a particular growth ring was established. Consequently, a radiocarbon age of the wood charcoal may predate the year that it was burned if the assay sample came from wood deep within the shrub's stem, or if the wood was from a shrub that stopped growing some length of time before it was burned. This situation (i.e., "old wood effect") can overestimate the ages of cultural material associated with charcoal radiocarbon ages. In the case of the House 11 date, research suggests any potential old wood effect would likely be only a few years to decades.

Support for this comes from the dendrochronology of shrub willow sampled from various locations on the North Slope of Alaska that indicates they are rarely more than 60 years old, and often only around 30 years old (Ackerman et al. 2017, 2018; Andreu-Hayle et al. 2020; Tape et al. 2012). Given this, a shrub willow whose age was approximately 60 years in 1488 initiated stem growth around 1428, and a willow whose age was 60 years in 1443 initiated stem growth around 1383. It is also worth noting that the innermost (oldest) growth rings of arctic shrub willows comprise a very small portion (volume) of the stem. As such, charcoal from early-growth wood is much less likely to be encountered and/or selected for assay than charcoal from recent-growth stem wood, which is of greater circumference and comprises a much greater volume of the stem. The House 11 date is only a few decades

out of alignment with the adornment object bangle twine date and the house dates from Lake Kaiyak (see below). The difference between the oldest calibrated age of the bangle artifact and the oldest calibrated age of the House 11 assay is 47 years, an offset easily attributable to wood several decades dead when burned. Consequently, we believe it very likely that House 11's assayed charcoal came from a stem that had been dead for several decades when it was burned rather than from early-growth stem wood. Regardless, we view the House 11 date as consistent with the other bead-associated dates in Figure 5.

We believe the next most *accurate* dates are those deriving from Lake Kaiyak. Subsequent to the 1996 excavations at the site (Gilbert-Young 2004), Houses 1 and 2 were radiocarbon dated as part of another project, with two assays from each house (Shirar 2011). The radiocarbon dates from House 1 (Cams-141635, Cams-141638) and House 2 (Cams-141636, Cams-141637) derive from unmodified caribou bones from the floors of each house (Shirar 2011). Although both beads and faunal remains derived from the same houses, and no evidence of bioturbation was reported by Gilbert-Young (2004), the direct association between deposition of the beads and the deposition of the faunal remains is less secure than the hearth charcoal and twine dates from Punyik Point. Stratigraphic evidence (Gilbert-Young 2004:25) and the fact that the bead halves found in each house refit to form a single bead clearly demonstrate that the two houses were occupied at the same time. Both dates from Lake Kaiyak House 1 are essentially the same, ranging from cal AD 1437 to 1631, with the greatest probability falling between cal AD 1437 and 1524 (Table 2, Figure 5). Although one of the House 2 assays (Cams-141637) produced a nearly identical date to those from House 1, the other House 2 date (Cams-141636) intercepts the calibration curve at five places between the early sixteenth and mid-twentieth centuries, and it is clearly suspect. Although the faunal remains from the site indicate a single fall-winter occupation, which is reinforced by the artifact assemblage (Gilbert-Young 2004), it is not impossible that the aberrant date is (1) the result of later temporary reuse of this house, (2) a

subsequent dumping episode, (3) is simply anomalous, or (4) was somehow contaminated in the 13–14 years of museum storage between excavation and radiocarbon assay.

The last date to consider comes from Kinyiksugvik (Beta-233006), and we feel it is the least secure for accurately dating the presence of the IIA40 bead at the site. The half bead from this site was not found in situ. Instead, it was found during water-screening of troweled soil from what is interpreted as a midden or dump area adjacent to a dwelling. An assay on willow charcoal from the excavation unit and level from which the bead was recovered returned a single date range of cal AD 1470–1648. The stratigraphy in this area was shallow and complex, likely illustrating multiple dumping episodes over an unknown length of time. The fact that the bead was recovered from a dump likely explains the temporal offset between this date and the other dates discussed above (Table 2, Figure 5), given that such deposits are often subject to animal bioturbation. Similarly, the object might have been curated longer and lost at a later time period than the beads at the other sites—a scenario known as the “heirloom effect” (Adams 2003:49). In short, although the dated piece of charcoal and the bead were both found in close proximity (i.e., from the same excavated layer within a 50 cm² excavation unit), the security of association between the two is considered “low” (Taylor and Bar-Yosef 2016:130), and the likelihood of the dated material to correctly represent the timing of any one dumping episode (i.e., accuracy) should be viewed accordingly.

Conclusion

The AMS radiocarbon assays with the highest accuracy, as far as can be ascertained based on security of association, and precision for dating the earliest-known presence of IIA40 beads in arctic Alaska are (1) the one associated with the bead/bangle/pendant cluster at Punyik Point (Beta 201353) and (2) the one associated with House 11 (Beta 193802) at Punyik Point (Table 2, Figure 5). Taking into account the approximately 60-year limit on willow ages and/or possible “old wood effect” with the House 11 date, we conservatively date the

beads at Punyik Point to the age range provided by the twine date from the bead cluster: 1397–1488. Discounting the aberrant date from Lake Kaiyak House 2 (Cams-141636), as well as the low accuracy of the Kinyiksugvik date, the remaining bead-associated AMS dates overlap comfortably in the 1443–1488 timeframe (Table 2, Figure 5). Although it is possible for the actual date of any ¹⁴C assay to fall anywhere within the temporal segments generated by its calibration, the highest probability is accorded to the largest temporal span. Taken together, the probability density of the assays indicates the arrival of the beads in Alaska between approximately 1443 and 1488 (see bottom of Figure 5).

Although the manufacturing history of IIA40 glass beads is somewhat obscure, the chronology developed from the radiocarbon assays from the three arctic sites supports an arrival of the beads in the decades prior to the formation of the Paternostri guild in 1486. Francis (1988) states that drawn seed beads were being made at least by 1490 and probably earlier by the Margariteri. By general consensus, most bead researchers agree that any drawn bead produced in fifteenth-century Europe was made in Venice (Blair et al. 2009:71, 76–77). Although Francis (1988) states that IIA40 beads made by the Paternostri were among the earliest of the larger drawn beads to be produced, a conundrum arises in the fact that the first physical evidence of their production in Europe is around 1590 in the Netherlands, over 100 years after the founding of the Paternostri guild (Francis 1988). The fact that IIA40 trade beads are present in some Central and North American sites by at least 1550, and probably earlier, refutes the European evidence, which probably reflects a lack of current historical research rather than a terminus a quo for the bead variety. Given these circumstances—the time lag between bead development and production, and the radiocarbon dates of the arctic Alaska beads—there should be little doubt that some manner of production of IIA40 beads was occurring in Venice prior to the founding of the Paternostri guild. As such, this not only indicates an earlier production of drawn-glass beads finished by the *a speo* process than is currently accepted, but it also establishes their availability and distribution well before 1486.

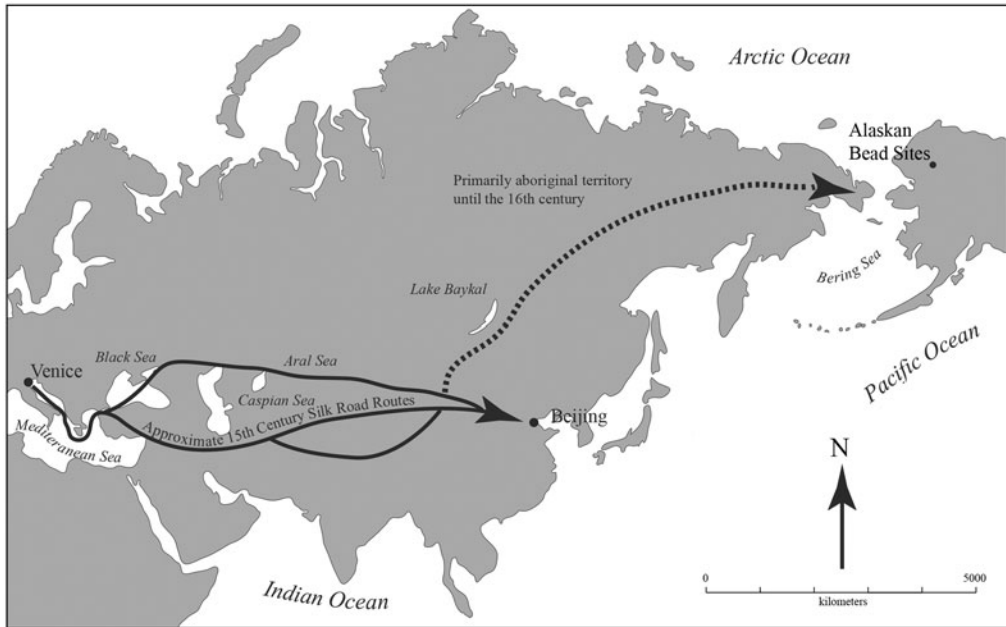


Figure 7. The location of the three Late Prehistoric Eskimo sites in arctic Alaska that contain Ila40 Venetian glass trade beads is shown in relation to Venice, selected generalized fifteenth-century European overland trade routes, and the generalized trans-Eurasian aboriginal network that the beads likely followed eastward for 17,000 km from Europe across Siberia and the Bering Strait to Alaska.

So, how did the Ila40 beads travel from Venice to arctic Alaska? With the exception of arctic Alaska, there is no evidence that beads of this variety occur anywhere in the Western Hemisphere prior to 1492, and the most parsimonious explanation is that they traveled eastward from Venice across Eurasia along routes that are currently unknown. We suggest the following scenario: prior to and during much of the Renaissance period, Venice was a major force in trade with Asia (Bergreen 2007:13–25). Venetian goods moved along various maritime and overland trade routes, including the so-called Silk Road, which connected Europe and the Middle East with India and China via Central Asia. (Bergreen 2007:27–28; Figure 7). Along such eastbound routes, these early Venetian beads found their way into the aboriginal hinterlands, with some moving to the Russian Far East and, ultimately, to the Bering Strait region and into Alaska (Figure 7). A growing body of evidence from the Bering Strait region indicates that the movement of non-native materials from northeast Asia to northwest Alaska has been occurring

via undefined routes since the first millennium AD, if not longer (Burch 2005:231; Cooper et al. 2016; Grover 2016; McCartney 1988; Mason 1998). The paucity and limited variety of non-native objects recovered from prehistoric sites in the region, however, suggests that such occurrences were uncommon and that they do not demonstrate a consistent trade in such goods.

The arctic Alaska Ila40 beads represent the first evidence of an overland connection between Europe and northeast Asia/Alaska prior to the sixteenth century. That the Ila40 beads reported here traveled eastward roughly 17,000 km from Venice to arctic Alaska before 1492, facilitated by Early Renaissance and aboriginal trade routes, is the most parsimonious explanation of the present data. Prior to the discovery of the “New World” across the Atlantic, no other practical possibility existed. This finding is reinforced by a complete absence of Ila40 beads of any age elsewhere in Alaska, anywhere in North America west of the Great Plains, or anywhere across the Canadian arctic (Ross 2005).

Acknowledgments. The authors' work at Punyik Point and Kinyiksugvik was aided by the volunteer efforts of Sarah Meitl, Dale Slaughter, Susan Will, Stacie McIntosh, Jean Schaeffer, Richard Reanier, Natasha Slobodina, and Daniel Odess. We thank Sarah Jansen for translating the abstract into Spanish. We also thank Benjamin Gaglioti and Daniel Mann for reviews of earlier versions of the manuscript, as well as Jeffrey Mitchem and six anonymous reviewers (especially reviewer #5) for insightful comments that improved the quality of this report. The excavations mentioned in the text were performed by federal agency personnel working on federal lands. No permits were issued. All radiocarbon assays from Punyik Point and Kinyiksugvik mentioned here were paid for by the Bureau of Land Management, US-DOI.

Data Availability Statement. Artifacts from Punyik Point and Kinyiksugvik are accessioned and curated at the University of Alaska Museum of the North in Fairbanks, Alaska, and by National Park Service curatorial facilities in Anchorage, Alaska.

References Cited

- Ackerman, Daniel, Daniel Griffin, Sarah E. Hobbie, and Jacques C. Finlay
2017 Arctic Shrub Growth Trajectories Differ across Soil Moisture Levels. *Global Change Biology* 23:4294–4302.
- Ackerman, Daniel E., Daniel Griffin, Sarah E. Hobbie, Kelly Popham, Erin Jones, and Jacques C. Finlay
2018 Uniform Shrub Growth Response to June Temperature across the North Slope of Alaska. *Environmental Research Letters* 13(4). DOI:10.1088/1748-9326/aab326.
- Adams, William H.
2003 Dating Historical Sites: The Importance of Understanding Time Lag in the Acquisition, Curation, Use, and Disposal of Artifacts. *Historical Archaeology* 37(2):38–64.
- Andreu-Hayle, Laia, Benjamin V. Gaglioti, Logan T. Berner, Mathieu Levesque, Kevin J. Anchukaitis, Scott J. Goetz, and Rosanne D'Arrigo
2020 A Narrow Window of Summer Temperatures Associated with Shrub Growth in Arctic Alaska. *Environmental Research Letters* 15(10):105012. DOI:10.1088/1748-9326/ab897f.
- 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. Research Records 16. Rochester Museum and Science Center, Rochester, New York.
- Bergreen, Laurence
2007 *Marco Polo from Venice to Xanadu*. Vintage Books, New York.
- Binford, Lewis R.
1980 Willow Smoke and Dogs' Tails: Hunter-Gatherer Settlement Systems and Archaeological Site Formation. *American Antiquity* 45:4–20.
- Blair, Elliot H., Lorann S. A. Pendleton, and Peter J. Francis Jr.
2009 *The Beads of St. Catherine's Island*. Anthropological Papers 89. American Museum of Natural History, New York.
- Bockstoce, John R.
1986 *Whales, Ice, and Men: The History of Whaling in the Western Arctic*. University of Washington Press, Seattle.
- 2009 *Furs and Frontiers in the Far North: The Contest among Native and Foreign Nations for the Bering Strait Fur Trade*. Yale University Press, New Haven, Connecticut.
- Bradley, James W.
1983 Blue Crystals and Other Trinkets: Glass Beads from 16th and Early 17th Century New England. In *Proceedings of the 1982 Glass Trade Bead Conference*, edited by Charles F. Hayes III, pp. 111–126. Research Records 16. Rochester Museum and Science Center, Rochester, New York.
- Bundy, Barbra E., Allen P. McCartney, and Douglas W. Veltre
2003 Glass Trade Beads from Reese Bay, Unalaska Island: Spatial and Temporal Patterns. *Arctic Anthropology* 40(1):29–47.
- Burch, Ernest S., Jr.
1975 Inter-Regional Transportation in Traditional Northwest Alaska. *Anthropological Papers of the University of Alaska* 17(2):1–11.
- 1976 Overland Travel Routes in Northwest Alaska. *Anthropological Papers of the University of Alaska* 18(1):1–10.
- 2005 *Alliance and Conflict: The World System of the Inupiaq Eskimos*. University of Nebraska Press, Lincoln.
- 2006 *Social Life in Northwest Alaska: The Structure of Inupiaq Eskimo Nations*. University of Alaska Press, Fairbanks.
- Cooper, Harold K.
2012 Innovation and Prestige among Northern Hunter-Gatherers: Late Prehistoric Copper Use in Alaska and Yukon. *American Antiquity* 77:565–590.
- Cooper, Harold K., Owen K. Mason, Victor Mair, John F. Hoffecker, and Jeffery R. Speakman
2016 Evidence of Eurasian Metal Alloys on the Alaskan Coast in Prehistory. *Journal of Archaeological Science* 74:176–183.
- Crowell, Aron L.
1997 *Archaeology and the Capitalist World System: A Study from Russian America*. Plenum Press, New York.
- Crowell, Aron L., David R. Yesner, Rita Eagle, and Diane K. Hanson
2008 A Historic Alutiq Village on the Outer Kenai Coast: Subsistence and Trade in the Early Russian Contact Period. *Alaska Journal of Anthropology* 6(1–2):225–251.
- Davis, Craig W., Dana C. Linck, Kenneth M. Schoenberg, and Harvey M. Shields
1981 *Slogging, Humping, and Mucking through the NPR-A*, Vol. 2. Occasional Paper 25. Anthropology and Historic Preservation, Cooperative Park Studies Unit, University of Alaska, Fairbanks.
- Deagan, Kathleen
1987 *Artifacts of the Spanish Colonies of Florida and the Caribbean, 1500–1800*, Vol. 1. Smithsonian Institution, Washington, DC.
- Dumond, Don E., and James W. VanStone
1995 *Paugvik: A Nineteenth-Century Native Village on Bristol Bay, Alaska*. Fieldiana Anthropology 24. Field Museum of Natural History, Chicago, Illinois.
- Eby, Nelson
2017 Instrumental Neutron Activation Analysis (INAA). Electronic document, https://serc.carleton.edu/research_

- <https://www.youtube.com/watch?reload=9&v=QRRTUJxiw5w>, accessed May 9, 2019.
- Francis, Peter J., Jr.
1986 *Chinese Glass Beads: A Review of the Evidence*. Occasional Papers No. 2. Center for Bead Research, Lake Placid, New York.
- 1988 *The Glass Trade Beads of Europe: Their Manufacture, Their History, and Their Identification*. World of Beads Monograph Series 8. Lapis Route Books, Lake Placid, New York.
- 1994 Beads at the Crossroads of Continents. In *Anthropology of the North Pacific Rim*, edited by William W. Fitzhugh, and Valerie Chaussonnet, pp.281–305. Smithsonian Institution, Washington, DC.
- 1998a Analysis of Indo-Pacific Beads. *Margaretologist* 11(1):9–14.
- 1998b The Venetian Bead Story 1. *Margaretologist* 11(2):2–11.
- 2008 The Venetian Bead Story. *BEADS: Journal of the Society of Bead Researchers* 20:62–80.
- Gasparetto, Astone
1958 *Il vetro di Murano: Dal origini ad oggi*. Neri Pozza, Venice.
- Giddings, J. Louis, Jr., and Douglas D. Anderson
1986 *Beach Ridge Archeology of Cape Krusenstern: Eskimo and Pre-Eskimo Settlements around Kotzebue Sound, Alaska*. U.S. Department of the Interior, Washington, DC.
- Gilbert-Young, Sabra A.
2004 The Archaeology of a Severely Vandalized Site, 49-MIS-032, at Lake Kaiyak, Noatak National Preserve, Northwest, Alaska. Master's thesis, Anthropology Department, Washington State University, Pullman.
- Grover, Margan Allyn
2016 Late Prehistoric and Protohistoric Glass Beads in Alaska. *Arctic Anthropology* 53(2):69–80.
- Gubser, Nicholas J.
1965 *The Nunamiut Eskimo, Hunters of Caribou*. W. W. Norton, New York.
- Hancock, Ron V. G.
2005 *Instrumental Neutron Activation Analysis (INAA) Results on Select Blue Glass Beads from the Punyik Point Archaeological Site*. Contracted by and on file at the Bureau of Land Management, Fairbanks District Office, Fairbanks, Alaska.
- Hancock, Ron V. G., Anne Chafe, and Ian Kenyon
1994 Neutron Activation Analysis of Sixteenth- and Seventeenth-Century European Blue Glass Trade Beads from the Eastern Great Lakes Area of North America. *Archaeometry* 36:253–266.
- Ingstad, Helge
1954 *Nunamiut: Among Alaska's Inland Eskimos*. Unwin Brothers, London.
- Irving, William N.
1964 Punyik Point and the Arctic Small Tool Tradition. PhD dissertation, Anthropology Department, University of Wisconsin, Madison.
- Karklins, Karlis
1993 The *a speo* Method of Heat Rounding Drawn Glass Beads and Its Archaeological Manifestations. *Beads* 5:27–36.
- 2012 Guide to the Description and Classification of Glass Beads Found in the Americas. *Beads* 24:62–90.
- 2016 How to Describe and Interpret Glass Trade Beads. Laval University Lecture Video. Original lecture April 8, 2016; YouTube video, 37:22, February 2, 2018.
- <https://www.youtube.com/watch?reload=9&v=QRRTUJxiw5w>, accessed October 4, 2018.
- Kenyon, Ian, Ron G. V. Hancock, and Susan Aufreiter
1995 Neutron Activation Analysis of AD 1660–1930 European Copper-Coloured Blue Glass Trade Beads from Ontario, Canada. *Archaeometry* 37:323–337.
- Kenyon, Ian T., and Thomas Kenyon
1983 Comments on 17th Century Glass Trade Beads from Ontario. In *Proceedings of the 1982 Glass Trade Conference*, edited by Charles F. Hayes III, pp. 111–126. Research Records 16. Rochester Museum and Science Center, Rochester, New York.
- Kidd, Kenneth E., and Martha A. Kidd
1970 *A Classification System for Glass Beads for the Use of Field Archaeologists*. Occasional Papers in Archaeology and History No. 1. Department of Indian Affairs and Northern Development, National and Historic Parks Branch, National Historic Sites Service, Ottawa.
- Kunz, Michael
2005 The Denbigh Flint Complex at Punyik Point, Etlivik Lake, Alaska. *Alaska Journal of Anthropology* 3(2):101–115.
- Mason, Owen K.
1998 The Contest between the Ipiutak, Old Bering Sea, and Birmirk Polities and the Origin of Whaling during the First Millennium A.D. along Bering Strait. *Journal of Anthropological Archaeology* 17:240–325.
- McCartney, Allen P.
1988 Late Prehistoric Metal Use in the New World Arctic. In *The Late Prehistoric Development of Alaska's Native People*, edited by Robert D. Shaw, Roger K. Harritt, and Don E. Dumond, pp. 57–79. Aurora Monograph Series Vol. 4. Alaska Anthropological Association, Anchorage, Alaska.
- Miller, Henry M., Dennis J. Pogue, and Michael A. Smolek
1983 Beads from the Seventeenth Century Chesapeake. In *Proceedings of the 1982 Glass Trade Bead Conference*, edited by Charles F. Hayes III, pp. 127–144. Research Records 16. Rochester Museum and Science Center, Rochester, New York.
- Ray, Dorothy J.
1975 *The Eskimos of the Bering Strait, 1650–1898*. University of Washington Press, Seattle.
- Reimer, Paula J., Edouard Bard, Alex Bayliss, J. Warren Beck, Paul G. Blackwell, Christopher Bronk Ramsey, Caitlin E. Buck, Hai Cheng, R. Lawrence Edwards, Michael Friedrich, Pieter M. Grootes, Thomas P. Guilderson, Hafid Hafflidason, Irka Hajdas, Christine Hatté, Timothy J. Heaton, Alan G. Hogg, Konrad A. Hughen, K. Felix Kaiser, Bernd Kromer, Sturt W. Manning, Mu Niu, Ron W. Reimer, David A. Richards, E. Marian Scott, John R. Southon, Richard A. Staff, Christian S. M. Turney, and Johannes van der Plicht
2013 IntCal13 and Marine13 Radiocarbon Age Calibration Curves 0–50,000 Years cal BP. *Radiocarbon* 55:1869–1887.
- Ross, Lester A.
2005 *European Glass Beads from the Punyik Point Site (XHP-308), Etlivik Lake, Alaska, ca. Late 16th to Mid-18th Centuries*. Report contracted by and on file at the Bureau of Land Management, Fairbanks District Office, Fairbanks, Alaska.
- Shirar, Scott
2011 Late Holocene Chronology of the Noatak and Kobuk Rivers. *Alaska Journal of Anthropology* 9(2):1–16.

- 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. Research Records 16. Rochester Museum and Science Center, Rochester, New York.
- Spencer, Robert F.
1959 *The North Alaskan Eskimo: A Study in Ecology and Society*. Bureau of American Ethnology Bulletin 171. Smithsonian Institution, Washington, DC.
- Stuiver, Minze, Paula J. Reimer, and Ron W. Reimer
2020 CALIB 7.1. Electronic document, <http://calib.org>, accessed May 5, 2020.
- Tape, Ken D., Martin Hallinger, Jeffrey M. Welker, and Roger W. Ruess
2012 Landscape Heterogeneity of Shrub Expansion in Arctic Alaska. *Ecosystems* 15:711–724.
- Taylor, Robert E., and Ofer Bar-Yosef
2016 *Radiocarbon Dating: An Archaeological Perspective*. 2nd ed. Routledge, London.
- Wayman, Michael L., and H. Kory Cooper
2005 *Analysis of Copper and Iron Objects from Punyik Point*. Report contracted by and on file at the Bureau of Land Management, Fairbanks District Office, Fairbanks, Alaska.

Submitted March 5, 2019; Revised July 2, 2020; Accepted July 9, 2020