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Cover: *China*: Glazed pottery eye beads, Warring States period (Diameter: 1.2-2.5 cm).
Back cover: *China*: Composite imitation white-jade pendant, Ming dynasty (Length: 37 cm).

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KARLIS KARKLINS, *editor*

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BOOK REVIEWS

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EARLY CHINESE FAIENCE AND GLASS BEADS AND PENDANTS[1]

Simon Kwan
Translated by Jeffrey A. Keller

The earliest Chinese beads and pendants were composed of faience and appeared during the early Western Zhou period, around the 11th Century B.C. True glass began to be made about the time of the Spring and Autumn period (771-467 B.C.). An amazing variety of beautiful "dragonfly-eye beads" appeared in China during the Warring States period (475-221 B.C.), but these were imported and not local products. The complex eye beads were replaced during the Han dynasty (206 B.C.-A.D. 220) by small, plain glass beads generally intended to be strung together. Perforated glass ear spools were also popular during this period and were sometimes adorned with bead strands. Small glass stringing beads as well as other forms continued in use in subsequent dynasties, as did various types of pendants. During the Ming dynasty (1368-1644), glass was used to produce beautiful imitation jade objects including fanciful compound pendants. These were often finely carved and exhibit a high level of craftsmanship.

INTRODUCTION

Glass becomes an inorganic liquid substance after quartz grains are fused at high temperatures. After cooling, it does not acquire a crystalline structure. Glass can be described as still being a type of liquid at room temperature, and some even feel glass is a fourth state that is neither solid, liquid, nor gas. The earliest glass appeared around the 30th century B.C. in the area encompassing Mesopotamia and Syria. This type of primitive glass is called "faience" by modern scholars. True glass appeared around the 15th century B.C. in the same area. Before the appearance of faience, the Badarian culture of pre-dynastic Egypt ca. 3200 B.C. already knew how to use similar faience materials to cover talc beads and fire them to create colored glaze. This faience coating can be said to be the earliest man-made glass substance. Ancient Western legends tell of sailors accidentally producing glass when cooking on a sand beach, but this story does not appear to be historically valid because glass was created after continual improvements in the quality of faience led to a composite man-made material; this process was not accidental.

Early glass is only found in objects such as simple beads and rods. During Egypt's 18th dynasty, Pharaoh Tuthmosis III (1490-1437 B.C.) attacked Syria and his territory then extended to the border of Mesopotamia. This is when more complex shapes and glass containers entered Egypt. The Chinese discovered glass more than a thousand years after the West. The earliest Chinese faience-style glassware appeared in the early Western Zhou period or slightly earlier, around the 11th century B.C., and true glass was not created in China until much later.

Glass is a silicate whose main component is silicon dioxide (quartz). The melting point of quartz is 1,700°C, a temperature which cannot be reached using ancient kiln technology. Consequently, various fusing agents and combinations thereof were used to lower the melting point of the quartz. Ancient Egypt and most of Mesopotamia used pure natural bases such as soda (Na) and lime (Ca) which produced a soda-lime (Na-Ca) glass. Although there are exceptions, this was the main type of glass.

The earliest genuine Chinese glass appeared around the Spring and Autumn period (771-467 B.C.). It was produced from quartz granules mixed with minerals containing lead (Pb) and barium (Ba) which acted as the fusing agents. This glass is called lead-barium or Pb-Ba glass. Chinese glass from the Warring States and Han dynasties is mostly Pb-Ba glass, so its composition is entirely different from that of imported glass.

Ancient Chinese glass has always been seen as coming from outside of China. In the early 20th century, British scholars analyzed the composition of some ancient Chinese glasses and found that the materials used were entirely different from Western glass. This reveals that the Chinese knew how to make glass since ancient times and refutes the theory that Chinese glass was always imported from the West. This changed the history of Chinese glass.

Chinese archaeology has rapidly advanced in recent years and much Chinese glass has been excavated. Much of this has undergone energy dispersive x-ray fluorescence

spectrometry (EDX) which has provided a preliminary outline of the changes in the chemical composition of Chinese glass. Actually, Chinese glass, apart from the widespread use of Pb-Ba glass from the Spring and Autumn period to the Han dynasty, was continually changing. This may be the greatest difference between Chinese and Western glass and is the single most important characteristic of Chinese glass.

The principal use of Chinese glass was as decoration and it was used because of its bright colors and moldability. A large amount of jewelry and other objects were created, and even though these items were not usually highly valued, they have remained an important part of Chinese craftsmanship. Therefore, research into ancient Chinese glass has been related to the important topics of ancient dress, fashion, foreign trade, and cultural exchange.

GLASS AND FAIENCE

In ancient China, glass was called *biliuli* or *liuli* for short. *Liuli* came from a foreign language and its earliest use as a noun in ancient texts must be Heng Kuan's (Western Han dynasty; 206 B.C.-A.D. 25) *Discourses on Salt and Iron*: "Precious hides, colorful banners, and tapestries filled the mansions, and jade, coral, and glass were the state's most treasured objects" (Huan Kwan n.d., 1). The *Book of Han, Western Regions* (vol. 96) states that "glass... comes from... the state of Jibin" (present-day Kashmir). The *Book of Han, Geographical Records* 2 (vol. 28, Xia) reveals, "From the state of Gandulu [near Myanmar] boats travel for around two months, and the state of Huangzhi [in India]... has made offerings since Emperor Wu's time. There were official interpreters who, along with recruits, sent in sea pearls, glass, precious stones, and strange objects." These writings reveal that glass was imported into China. Excavated materials indicate that the earliest Chinese glass appeared during the Western Zhou dynasty (1100-771 B.C.), and genuine, mature glass products began to appear around the transition from the Spring and Autumn period to the Warring States period (ca. 475 B.C.). Why was glass not mentioned in writings before the Western Han dynasty? Some believe that in this passage from the *Book of Shang, Yugong*, "Yongzhou, of Xihe, Heishui... offered *qiulin* and jade-like stones," *qiulin* is glass. The *Erya shidi*, vol. 9 of China's oldest-known encyclopedia, mentions that "*qiulin* and jade-like stones of Kunxu are the beauties of the Northwest." The following volume, *Erya shiqiu*, however, defines *qiulin* as jade, so whether or not *qiulin* meant glass in ancient writings is still a mystery. After this period, the number of alternative words for *liuli*, or glass, multiplied: *biliu*, *luli*, *lulin*, *poli*, *guanziyu*, *guanyu*, *yaoyu*, etc. Many scholars have examined these names in detail so I will not repeat their findings here.[2]

Most modern scholars think *liuli* or *biliuli* comes from the Sanskrit *vaidurya*, but to say that the words *biliuli* and *liuli* came from the pronunciation of *vaidurya* seems a little far-fetched. The 1st-century-B.C. Roman architect Vitruvius Pollio called glass *caeruleum* in his writings (Nicholson 1993:16), and this may be the origin of *biliuli, liuli, lulin*, or *luli*. Many glass objects were imported from Rome during the Han dynasty, and it would have been natural to call it *biliuli* or *liuli* for short in the local dialect. This name for glass seems to not have been used before the Western Han dynasty.[3]

"Faience" originally referred to a type of blue-glazed ceramic that came from Faenza, Italy, in the Middle Ages. Europeans discovered that the color of these ceramics was similar to that of a type of "primitive glass" that the ancient Egyptians made, so they called it faience. After this, faience became the name for the man-made "primitive glass" material found in Mesopotamia (Nicholson 1993:9). Even though the process of making faience is different from that of glass, their components are largely the same. There is only a small difference in the amount of fusing agents used and the temperature at which they are fired. This is why faience is rightly called the predecessor of glass, or "primitive glass."[4]

There is a long history of faience production in Mesopotamia and Egypt, which originated in the pre-dynastic period (5500-3050 B.C.) of ancient Egypt, nearly 2,000 years before the appearance of "primitive glass" in China. The appearance of both types of faience are extremely similar and their relationship is worth investigating.

The process of producing faience in ancient Egypt can be divided into three parts: making the body, applying the glaze, and firing. The core ingredients of faience are soda, lime, and quartz granules; i.e., Na_2CO_3+CaO+SiO_2. According to Pamela Vandiver's research on ancient Egyptian faience, the amount of quartz (SiO_2) can reach 92-99%, CaO 1-5%, and Na_2O 0.5-3%, with trace amounts of other substances (Nicholson 1993:9). After the body is formed, it is dried, reworked, and then glazed. The glaze is also a soda+lime+quartz mixture (i.e., the components of Na-Ca glass), and copper ore is added as a colorant. Its chemical makeup is basically the same as that of the body, but the surface is smoother. After the glazing material is ground to a powder, it can be applied in several ways (Nicholson 1993:11-14) (Figure 1):

1. Efflorescence. The raw materials are mixed with water and after they are formed into the desired object, it is placed in a dark place to air dry. While drying, a part of the "salt" will crystallize on the surface. During firing this will combine with the quartz grains to form a shiny layer.

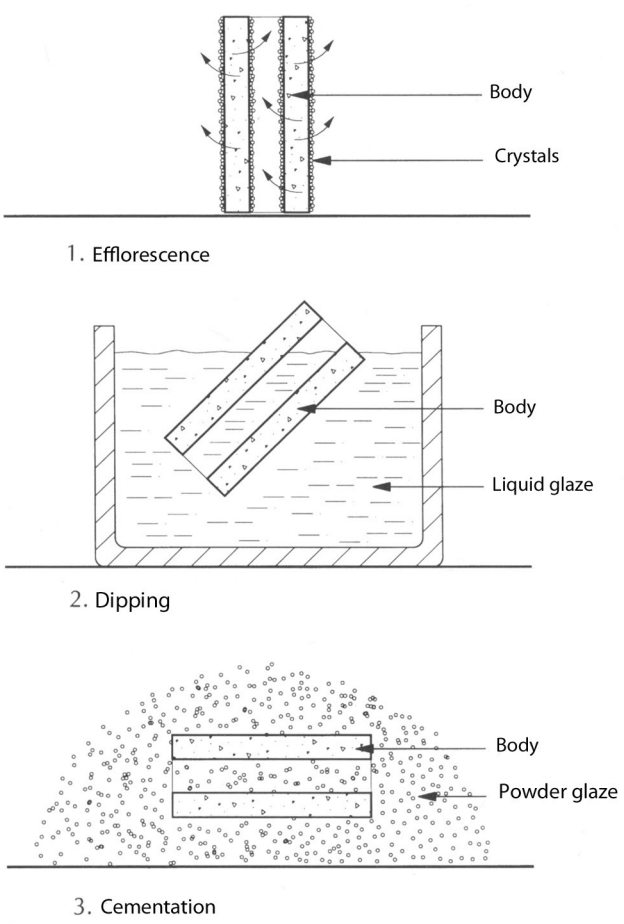

Figure 1. The techniques of applying glaze to faience.

2. Dipping. After the molded faience air dries, it is dipped in a pool of glaze (or it is painted on) in the same way that ceramics are dipped in glaze.

3. Cementation. After the faience air dries, it is embedded in finely ground powdered glaze and the whole thing is fired. The glaze adjacent to the object bonds to it while the rest does not and can be easily cleared away after firing.

These three methods of glazing produce different effects. With efflorescence, the glazed surface is rather thin. In the case of dipping, the glazed surface is thicker and glaze trickles can be seen on the surface. With cementation, the glazed surface is uneven and the areas that were closer to the fire are thicker than those further away. Also, the division between the glaze and the body is apparent and there is no "transition" area. The glaze on Chinese faience is smooth and even, and seems to have been applied by dipping.

Ancient Egyptian faience was fired at 800-1,000°C, the quartz grains exposed to the heat fusing more than those in the core. Usually the glaze on faience is fine grained and, with the addition of coloring agents, has a shiny appearance. The materials in the core are coarser, have a loose structure, and are greyish-white in color. From cross sections it can be seen that there is a clear division between the body and the glaze. In comparison, the cross sections of genuine glass objects are smooth, there is no division between the body and the glaze, and there are no grains.

Quartz melts at around 1,700°C which was unobtainable with ancient technology. With the right fusing agent, this can be lowered to 1,200°C, but the highest firing temperature achievable for ancient faience was 1,000°C, so only a small portion of the quartz granules could fuse to form glass, and most of the granules remained and can be seen with a microscope. Therefore, faience can only be called "primitive glass," "half-glass," or "crystalline quartz that used its glass phase as a bonding agent" (Zhang Fukang et al. 1983:75). Furthermore, the production of faience objects was basically done through firing, similar to ceramics, so it cannot be called "glass."

Ancient Egyptians used faience to create many kinds of objects and used them for 1,500 years. Authentic glass did not appear until the New Kingdom period (1750-1070 B.C.), although the precise date has not yet been determined. Genuine glass uses heated glass materials to form objects so the raw materials must go through an intermediary process of production; in the West this is called "fritting." In this process, the quartz grains and fluxing agent are melted at a temperature of around 700-850°C. The quartz (SiO_2) receives the fusing effect of plant ash (K_2O) or soda (Na_2CO_3) and the lime substances (CaO) in the granules, and begins to soften to form a sodium silicate substance. After cooling, the excess material at the base and the bubbles at the top are removed and the fritting is complete. After the fritted material is purified in an oven, and heated to over 1,000°C, the bubbles in the material disappear, and coloring agents and opacifiers or clarifiers are added to produce genuine glass. When the materials are placed in a mold and cooled, glass ingots, rods, and other shapes can be created, so that glass workshops can form them into objects; during the Qing dynasty these glass pieces were called "materials."[5]

Modern glassmaking uses basically the same principles, but with slightly different fusing and coloring agents, and the firing temperature is higher (around 1,500°C). The major difference between faience and genuine glass is that with genuine glass objects, the glass materials are melted and worked while hot, whereas faience objects are made by shaping materials in a cool state and then firing them.

Primitive Chinese glass from the Western Zhou period was created by fusing quartz granules. This is basically the same technology used to produce faience and the external

appearance is very similar to that of faience beads from Western Asia. The author's collection includes a green-turquoise tube-shaped bead from China whose body and glaze layers have clear divisions. The body is greyish white, the glaze is light green, and it clearly has the characteristics of faience.

A large find of "primitive glass beads" from a Western Zhou Yu tomb was found to be "quartz crystals and glass, with the former in a majority" by the State Construction Commission Academy for Building Materials (Yang Boda 1980:17). The silicate laboratory at the Beijing University of Technology found that "the clay has silicon materials in it... that have been burnt" (Yang Boda 1980:17). These studies show that the early glass beads from the Western Zhou dynasty used faience technology for shaping objects from quartz granules, then firing them. This was not glass produced from bronze metallurgy or ceramic technology that took shape only after heating. Western Zhou faience technology could not have been suddenly discovered locally and must have had ties to Western Asia. The technology required to make faience did not require any special tools and the raw materials needed could be readily found. Based on the level of craftsmanship during the Western Zhou dynasty, there would be no problems posed by oven technology; they would only require someone to come and tell them the secret of how to do it. After simple testing, they could have found a suitable local fusing agent and begun producing large amounts of faience objects. So primitive Western Zhou glass beads derived from local faience that used foreign technology. Because of this, these objects must have held little value, and are found in great numbers in the tombs of ordinary people.

Thousands of faience beads have been excavated in China. The main discoveries include: Zhongzhoulu, Luoyang, Henan, 1954-1955;[6] Shangcunling, Shan County, Henan, 1955-1977;[7] Zhangjiapo, Fengxi, Shaanxi, 1955-1957;[8] Pangjiagou, Luoyang, Henan, 1964;[9] Qiejiazhuang, Baoxi city, Shaanxi, 1975;[10] ancient Lu city Qufu, Shandong, 1978;[11] and Western Zhou or Former Zhou tombs in the Zhou plains area of Shaanxi (Yang Boda 1980:14). These beads are from the Western or Former Zhou period to the late Western Zhou period – a span of around 500 years – and are dispersed throughout the narrow central plains corridor from west to east. The spread from west to east is in accordance with the movement of the Zhou peoples (Yang Boda 1980:14).

According to chemical analyses performed by Zhang Fukang and others from the Shanghai Silicate Research Institute, the Western Zhou glass beads from Luoyang, Henan, "mainly used K_2O as a fusing agent, occasionally contained small amounts of Na_2O, and mostly used CuO for coloring" (Zhang Fukang et al. 1983:71). This composition is different from that of Egyptian faience which mainly used CaO as a fusing agent and did not include K_2O. This shows that primitive Western Zhou glass beads were made from locally produced K_2O (Table 1). They can be seen as faience with Chinese characteristics, or "Na-K faience," to be more precise.

After the Spring and Autumn period, the chemical composition of "faience" tube beads underwent a major change with Na-K fusing agents being replaced by Pb-Ba agents. This change improved the function of the fusing agents and led to improved vitrification of the beads, but the production process remained the same as that for faience and the material may be called "Pb-Ba faience."

Ancient glass beads were made by winding molten glass around a rod and then rolling them on stone or metal surfaces to shape them. In the West these beads are referred to as "wound." Chinese glass beads made by winding were popular during the mid- to late Warring States period. Beads before this time was mostly "faience." Some feel that the use of barium (Ba) in the earliest Chinese Pb-Ba glass was intentional,[12] while others feel it was not, simply being an associate of the ancient Chinese lead ore, galena, that could not be isolated and removed (Li Xiaocen 1996:147). It has yet to be determined which of these viewpoints is correct, but barium is extremely rare in Western Zhou glass, and even though lead is occasionally found in some local products, it is also very rare. Western lead glass was not widely used until the 17th and 18th centuries, so there is no dispute that the Pb-Ba glass objects from China were locally produced.

Table 1. Comparison of Egyptian Faience and Chinese Glass.

	SiO_2	Na_2O	CaO	K_2O
Egyptian faience (Nicholson 1993:9)	92-99%	0.5-3%	1-5%	–
Western Zhou glass beads, Luoyang, Henan	>90%	1-2%	0.4%	3.4%
Western Zhou glass tube beads, Luoyang, Henan	Large amount	0.64%	0.35%	1.3%

CHINESE FAIENCE

Chinese faience beads are characterized by their uniform shape, dull color, and small size. They are predominately turquoise and deep green; other colors are rare.[13] Western Zhou faience bead shapes commonly seen are tubes and round, abacus, and olive-shaped beads; only a small portion of the beads have shapes that are more complex. In terms of quantity, more than 20 faience tubes and beads were unearthed in three early Western Zhou or Former Zhou tombs (tomb numbers unknown) at Beilü village, Shangsongshe, Fufeng County, Shaanxi, and a thousand tubes and beads were unearthed in a Yu tomb from the earlier part of the mid-Western Zhou period. Here the basic tube, round, and abacus shapes are already present, and their craftsmanship is relatively complex. One type of faience bead from the Yu tomb has three to four nodes on it, and one oval bead has as many as 24. Each bead type in Figure 2 (Wang Shixiong 1986a:131-132) lasted until the Spring and Autumn period. Fifty-six faience tubes were unearthed at late Western Zhou tomb no. 5 in Yuntang, Fufeng County, Shaanxi, of which nine were faience tubes decorated with three to four nodes (Yang Boda 1980:21). Similar faience beads were unearthed in several Spring and Autumn tombs at Xiasi, Xichuan, Henan: 16 from tomb M1, 11 from tomb M2, and 5 from tomb M3 (Henan Sheng Wenwu 1991:23, 102, 203, 238).

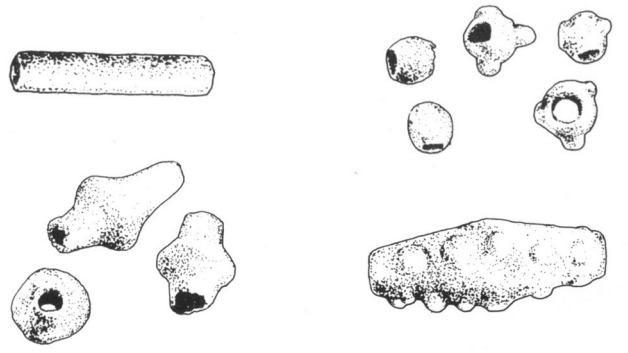

Figure 2. Western Zhou faience tube and beads from a Yu tomb (tube, round, rhomboid, and oval with nodes) (Gan Fuxi 1986).

Apart from tubes and beads, faience inlays were found in the tomb of the Earl of Yu's wife, Jingji, which had "different sizes, lengths, and thicknesses: 0.7-0.95 cm long, 0.17-0.2 cm wide, and 0.05-0.08 cm thick" (Yang Boda 1980:16). Like the faience tubes and beads, the inlay pieces are small in size. The longest faience tubes are only a little over 2.0 cm long, with diameters between 0.2 and 0.5 cm. Olive and abacus beads have diameters mostly between 1.0 and 1.6 cm and lengths of 1-2 cm. The 24-node faience beads from the Yu tomb are 3.0 cm long and 3.5 cm in diameter, and have holes 0.5 cm in diameter with 0.8-cm-thick walls. The tools required to produce these small ornaments were very simple and the end products were very simple as well. Chinese people used faience for approximately 500 years, but it was only popular for about 300 years during the mid-Warring States period on the central plains, before it faded from the scene.

In archaeological contexts, Western Zhou faience beads are generally found with jade and agate tubes and beads associated with human skeletons. Combinations of the beads and tubes were used to form small decorative elements which were duplicated and then connected to form a larger beaded ornament. Many changes in chest and neck ornaments and accessories occurred throughout the Western Zhou period. Many types of materials were used and the beads were relatively large in size. One often-used and colorful combination included red agate tubes and beads along with blue and green Western Zhou faience. This type of combination has been found in an Early Zhou or Former Zhou tomb in Fufeng, Shaanxi, and many groups of similar beaded ornaments were found in the Yu tomb.

Beadwork ornaments at Guo tomb no. 1647 in Shangcunling, Henan, were found around the wrists of a skeleton and included 23 bloodstone tubes, 3 stone tube-shaped beads, 1 jade bead, 9 faience tubes and rhomboid beads, and 1 jade silkworm-shaped decoration. Two ornaments at Guo tomb no. 1714 were found near the skeleton's legs, of which no. 1714:19 was composed of eight rhomboid faience beads and four stone tube-shaped beads. A piece of beadwork composed of three faience abacus beads was found next to each ear of the Guo tomb skeleton. A more complete composition was found in the Marquis of Jin's Tomb, Beizhao village, Quwo County, Shanxi. The upper portion consists of a trapezoidal jade pendant which has six small holes at the top to which six strands of beads are tied. The bottom of the pendant has 10 holes from which hang long beaded strands. The entire piece consists of a jade pendant, 375 agate tube beads, 108 faience tubes, and 16 oblong black amber beads – 500 pieces in total (Zhongguo Wenwu Jinaghua 1997: Figure 31) (Plate IA).

Over 1,000 faience tubes and beads were found in the Earl of Yu's Tomb and the tomb of his wife, Jingji, and that number is clearly linked to their personal status. Nevertheless, during the Western Zhou period, those who possessed faience were not necessarily of high status and faience beads are also frequently found in the tombs of ordinary citizens. In the Zhou tomb at Beilü, Shangsong, Fufeng, Shaanxi, which dates to between the Former Zhou and the mid- to late Western Zhou periods, 400 of 500 graves contained faience beads, including beadwork made from red agate and faience (Wang Shixiong 1986a:131-

137). Furthermore, late Western Zhou tomb no. 5 at Yuntang, Fufeng County, Shaanxi, was also a commoner's tomb and it contained 56 Western Zhou faience beads and tubes, including 9 faience tubes with nodes (Yang Boda 1980:21). There is a good chance that Western Zhou faience was produced in the area around Fufeng County, Shaanxi.

Faience tubes may have been cut from longer ones. Olive and abacus beads were made individually. While olive beads were first found in the Yu tomb, abacus beads were discovered in slightly later contexts; they were found in late Western Zhou or early Spring and Autumn Guo tombs in Shangcunling, Shan County, Henan, and in mid-Spring and Autumn contexts at Xiasi, Xichuan, Henan. Faience beads with nodes were developed based on round beads and olive beads. As the technology was not yet fully developed, the sizes of the tubes and beads are not uniform, their thicknesses are uneven, the diameters of their holes are not uniform and off-center, the holes do not align perfectly, and the angles of their ends are not uniform. These factors reveal that the beads were not made in molds.

Chinese glass is characterized by the use of lead (Pb) and barium (Ba) as fusing agents, and this kind of Pb-Ba glass was not discovered until around the late Spring and Autumn and Warring States periods. Before this, during the Western Zhou period, different faience fusing agents were used. For the primitive-glass beads found at Luoyang, Henan (Western Zhou); Fengxi, Shaanxi (Western Zhou); and the Xiasi, Xichuan, Henan (mid-Spring and Autumn) Chu tomb, their "glass phase compositions belong to K_2O-SiO_2 or K_2O-Na_2O-SiO_2 systems, and are estimated to account for 10-15% of the total" (Zhang Fukang et al. 1983:70; *see also* Wang Shixiong 1986a:131-137). After chemical testing, the Yu tomb glass bead samples were found to contain the elements Si, Al, Fe, Mg, K, Na, Ca, Cu, P, S, Cl, Ge, Sr, and Hg. Only one sample showed small amounts of Ba and no Pb was found. Aluminum oxide and calcium oxide were the main binding components in the Yu glass. These substances originated from local or nearby clay and the Yu glass was made using a small amount of such clay (i.e., raw soil and sediment) mixed with a large amount of pure quartz (Peng Zicheng et al. 1988:647-648). Early Chinese Pb-Ba glass still continued to use the "Pb and Ba faience" (Plate IB) created by faience technology, and it wasn't until the late Spring and Autumn to early Warring States period that real Pb-Ba glass was produced.

The precise date, location, and reasons behind the emergence of Pb-Ba glass still await further research. During the Warring States period, real hot-glass beads (called "dragonfly-eye beads") composed of K-Na-Ca glass were produced in the Hubei region and their chemical composition may be related to Western Zhou faience. China in the early Warring States period could already produce dragonfly-eye beads and other authentic glass products with Chinese characteristics but, unfortunately, without chemical analysis of the recovered objects, it cannot be confirmed that they contain Pb and Ba.[14] Faience beads may have existed at the same time as dragonfly-eye beads, but due to the lack of conclusive evidence, the period when faience beads disappeared cannot be determined. Faience craftsmanship likely died out in the central plains during the 3rd century B.C. (i.e., mid- to late Warring States period) (Zhang Fukang et al. 1983:70). The reason for its disappearance must be related to the discovery of new fusing agents. The introduction of Pb and Ba effectively lowered the firing temperature, and improved the quality of the faience and produced authentic glass.

A storage cellar of the late Spring and Autumn period belonging to the king of Wu was found 20 km west of Suzhou, Jiangsu, at the eastern foot of Yanshan. A large number of jade objects, as well as 48 light-blue faience abacus beads were found inside. Although the original report describes them as "turquoise beads" (Yao Qinde 1996:71), the author's investigations have shown that they are extremely similar to faience abacus beads often found in the late Western Zhou period and should be classified as faience beads, rather than turquoise. Their shape is also very similar to beads found at the Marquis of Jin's tomb in Beizhao, Wo County, Shanxi, and they represent a rather large find of Spring and Autumn faience beads.

Faience craftsmanship is different from bronze smelting and the production of ceramics. Faience objects from the Western Zhou to the Spring and Autumn periods all show a high level of skill and, by the early Western Zhou period, faience making must have developed into an independent craft. It was only the lack of new technology that kept this craft at the same level, and it wasn't until the application of Pb and Ba fusing agents in the mid-Spring and Autumn period and the introduction of dragonfly-eye beads from western Asia that spurred Chinese glass to take the next step in development. After the Spring and Autumn period the use of faience waned and it is rarely found in Warring States tombs. Replacing it were the brightly colored, intricately patterned, glass dragonfly-eye beads.

Faience technology was still used in the central plains region during the early Warring States period and other types of objects besides tube beads were produced. At early Warring States tomb no. 1 in Ye County, Henan, two human-shaped ornaments were found (Fu Juyou 2000:44, Figure 13) (Figure 3), and two Warring States latticed beads were found in Zhengzhou, Henan,[15] and Banpo, Shaanxi[16] – all of which were faience. This reveals that the use of faience was not completely replaced by authentic glass during the early

Figure 3. Faience kneeling figure, early Warring States period (height: 1.4 cm) (author's collection).

Warring States period. There are, however, very few faience tube beads from the mid- to late Warring States period which indicates that by the mid-Warring States period, such beads were no longer popular. Faience tube beads from the late Warring States have been found scattered throughout remote Bashu tombs in Sichuan. Among them, three come from the M2 Ba tomb in Fuling Xiaotianxi, Sichuan;[17] two are from the Sichuan Dongsunba boat-coffins;[18] and three are from the Bashu earth-pit tomb in Qianwei, Sichuan. Of the latter, one still has a pattern of round nodes[19] (Figure 4, right) which has not been found outside of Sichuan.

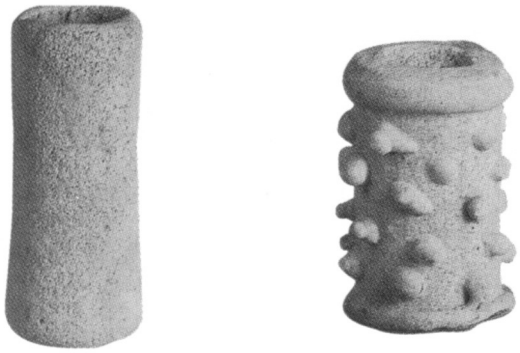

Figure 4. Faience tube beads, late Warring States period (*Zhongguo Meishu Quanji* 1987).

WARRING STATES BEADS (475-221 B.C.)

A new type of glass appeared in China during the late Spring and Autumn period. "Goujian's sword," belonging to the King of Yue, was found in tomb no. 1 at Wangshan, Jiangling, Hubei. Goujian was a ruler of the state of Yue during the late Spring and Autumn period and reigned from 496-464 B.C. The sword was made during this period and on it is engraved "sword used by the King of Yue Jiujian." The sword guard is inlaid with two small, light blue, semi-transparent glass pieces. One is spherical and the other is irregular in shape. Both have diameters of less than 1.0 cm. Also from this period is the King of Wu's "Gouyu Fuchai's sword" which was collected in Hui County, Henan. Fuchai ruled from 495-473 B.C., and this sword guard is inlaid with three relatively transparent glass pieces. The glass inlays on these two swords are completely different from the less-transparent light green faience of the Western Zhou period. Even though the swords are clearly local Chinese objects, this does not mean that their inlays were produced locally. The inlays await harmless x-ray fluorescence spectrometry. While detailed component data have not been obtained, it can be confirmed that they do not contain Pb and Ba, which does not eliminate the possibility that they were imported. The color, purity, and transparency of the glass of the two swords are completely different from that of faience and it can be called authentic glass. Furthermore, many examples of glass products imported from Western Asia have been found at sites of this period, the most important of which are dragonfly-eye beads. This is their name in contemporary Chinese cultural circles; in the West they are simply called "eye beads."

Dragonfly-Eye Beads

The name "dragonfly eye" comes from the patterns found on the beads. They consist of a series of multi-colored rings, some of which protrude from the surface and look just like dragonfly eyes. This is only a general description and in actuality there are many types of dragonfly-eye beads (Figure 5; Plate IC, ID top). Apart from those that protrude from the bead surface, some eyes are flush with the surface, while some are in the form of pyramids. The eye decorations may be in concentric or non-concentric circles. Early eye beads from the late Spring and Autumn period found in Hougudui, Gushi County, Henan (Figure 5, no. 5), "use blue and white glass along with the green glass of the bead body to make a 'nipple-nail' pattern, and if the pattern were to be laid flat, it would not make a complete circle" (Zhang Fukang et al. 1983:69). The tomb occupant was the younger sister of Duke Jing of Song (516-451 B.C.) and the wife of King Fuchai of Wu. She was about 30 years old. Analysis has shown the components of the eye beads to include Fe_2O_3 (0.65%), CaO (9.42%), MgO (0.39%), K_2O (0.52%), and Na_2O (10.94%), which is a composition typical of Western Na-Ca glass (Zhang Fukang et al. 1983:71). The similarity of the composition of these early eye beads to Western ones, coupled with the fact that the so-called dragonfly-eye pattern is not intrinsic to China and is not seen on other Chinese objects, suggests that they may be imports.

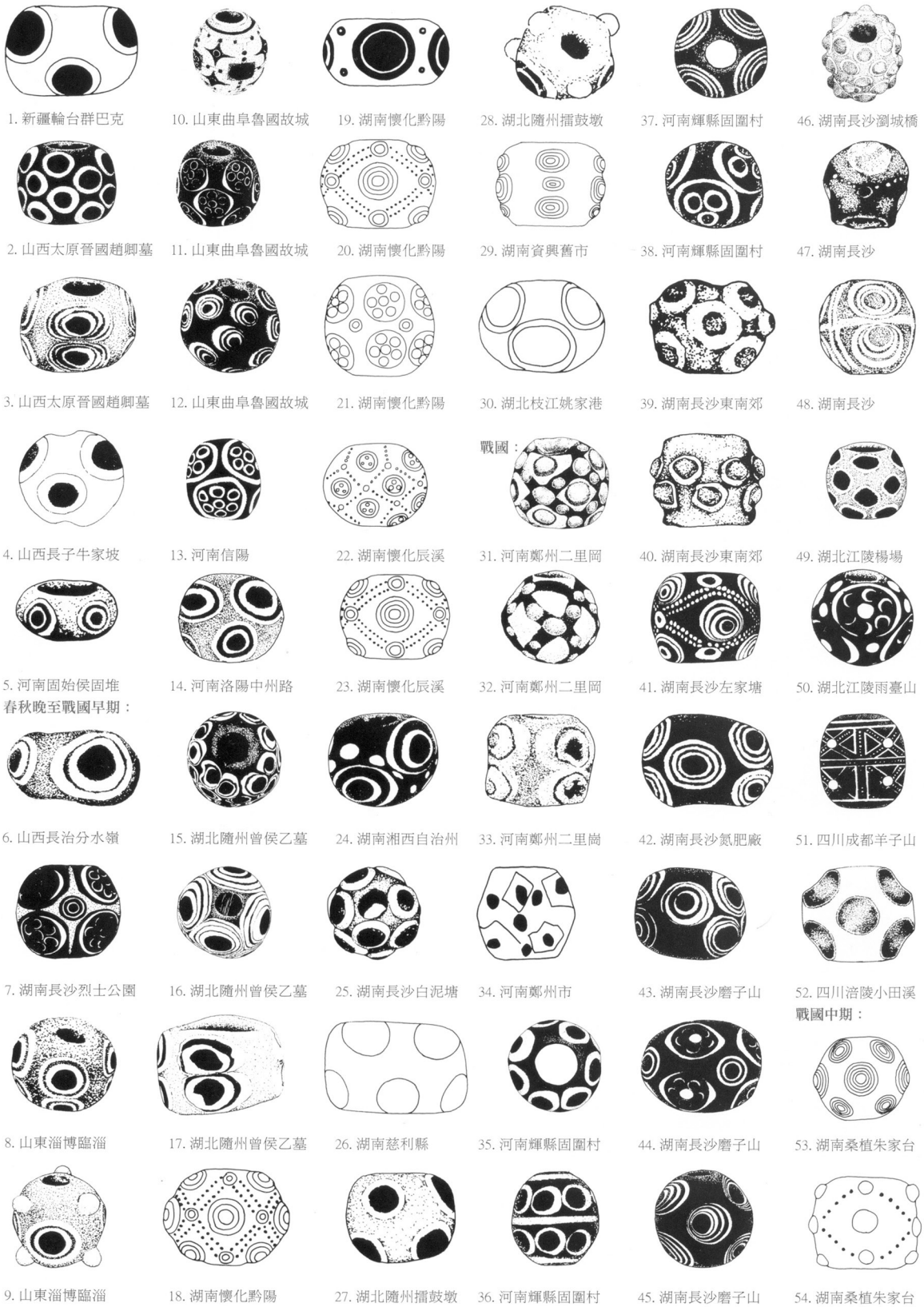

Figure 5. Variations of Chinese eye beads.

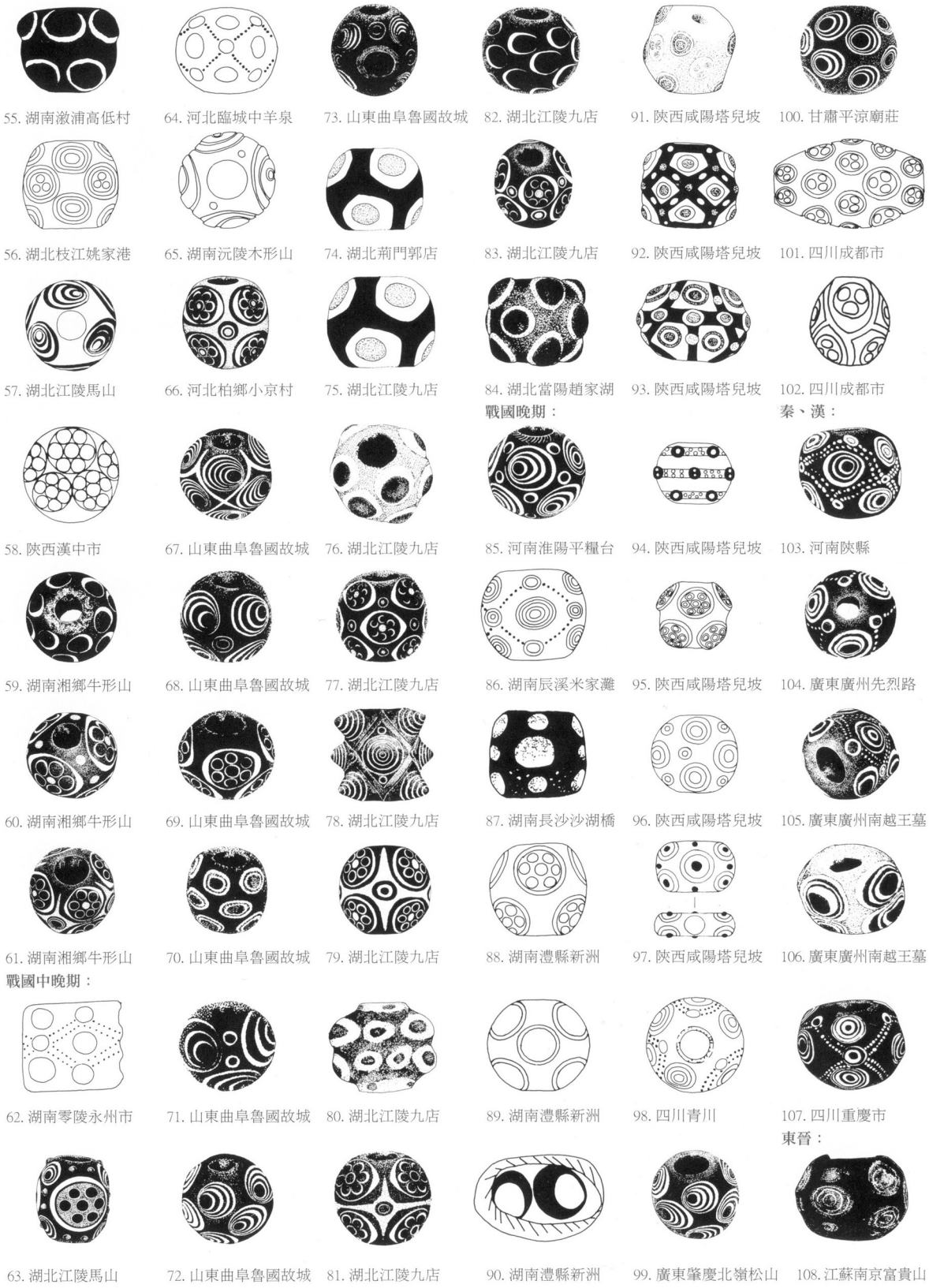

Figure 5. Variations of Chinese eye beads, continued.

Many of these types of eye beads have been found in the Mediterranean region and Western Asia, and there are many variations. As well as the eye beads found in Hougudui, Gushi County, the type of eye beads found in the late Spring and Autumn period Zhao official tomb in Taiyuan, Shanxi (Figure 5, nos. 2-3); tomb M7 at Niujiapo, Changzi County, Shanxi (Figure 5, no. 4); and tomb M270 at Fenshuiling, Changzhi, Shanxi (Figure 5, no. 6), have also been found at Gilan, Iran (Shinji Fukai 1977: Figures 40, 45). It is not difficult to see the close relationship between late Spring and Autumn eye beads and those from Western Asia, and there is a high probability that they were imported from other countries.

Eye beads originated in Egypt during the 14th century B.C., and the eye decorations on these beads are portrayed extremely clearly. There is a sharp contrast between black and white, and they only have two to three layers, with the innermost layer being black – a precise depiction of the pupil and the white of the eye, and a symbol of the eyes of the gods. The beads are not spherical, and many are in the shape of barrels or ovals. The eyes are nearly as large as the beads themselves. At the time, Egyptian images of gods all used glass and precious stone inlays for their eyes and eye beads originated from these ancient Egyptian eyes of the gods. Eventually, the custom of wearing eye beads was transmitted to Western Asia and Europe. The inhabitants of Western Asia saw these eyes as having unmatched power, able to repel evil spirits and bring peace.

An eye bead from the 8th century B.C. found in Greece represents a break from the early period model of a pair of gods' eyes, and simplifies it into an eye bead model that has a longitudinal hole and one eye with several layers (Fitzwilliam Museum 1978: Figure 39). The British Museum in London holds a small eye bead found in Eastbourne, England, that dates to 605-600 B.C. It is oblong and has four eyes that are evenly placed around the bead. The eyes are composed of two layers of deep blue and white glass, and are clearly in the shape of gods' eyes (Dubin 1987: Figure 55).

Eye beads gradually became more popular in Western Asia and the types became more diversified. Their significance as the eyes of gods also weakened significantly. Taking those from Gilan, Iran, as an example, the bodies of the beads are white, yellow, blue, green, and reddish-brown. There are many types of eye decoration and some of the eyes protrude from the surface. Most of the eyes still consist of layered rings of white and a darker color, but the eyes are no longer regular, lack clarity, and are not properly aligned.

Apart from the common eye beads, the Phoenicians developed a type of bead in the form of human or animal heads. The eyes are either human or animal and bring the deified eyes down to the level of everyday life. Along with the development of western Asian government and the movement of nomadic peoples, eye beads and the technology used to make them continually spread outward. The great Assyrian empire was founded in the mid-8th century B.C. in central Asia. Babylon flourished in the late 7th century B.C. and the Persian Empire ruled during the 6th century B.C. Throughout these centuries, the territories of the central Asian empires continually expanded and even reached India in the East. As travelling merchants and craftsmen moved to India and even more remote areas to settle and engage in trade, they brought with them eye beads and the technology used to make them.

The earliest appearance of eye beads in China is in the 5th century B.C. or the late Spring and Autumn period, which is several centuries later than their appearance in Egypt and Central Asia. Few eye beads have been found in contexts preceding the Warring States period and it was not until this period that they became popular. Based on archaeological evidence, the earliest eye beads found in China may be those found in Qunbake tomb IM27 in Luntai County, Xinjiang (Figure 5, no. 1). The entire group of tombs is dated to 955-585 B.C., which equates to the Western Zhou period. The other items found in tomb IM27 are in the style of the Spring and Autumn and Warring States periods. Comparing the IM27 specimens with eye beads found in other parts of China, they may be post-Western Zhou and probably date from the late Spring and Autumn to early Warring States periods (*Kaogu* 1992, 8:692).

In the central plains, the earliest eye beads are from Shandong, Shanxi, Henan, and Hunan, and date to the late Spring and Autumn to early Warring States periods. Concentrated in Shanxi, they were found in three locations, including the late Spring and Autumn Jin Zhao official tomb in Taiyuan, the late Spring and Autumn Niujiapo M7 tomb in Changzi County, and the late Spring and Autumn or early Warring States Fenshuiling M270 tomb in Changzhi.

The original report dates tomb M270 to the late Spring and Autumn or early Warring States period (*Kaogu Xuebao* 1974, 2:81), but Tao Zhenggang (1996), when discussing the date of the Zhao official tomb, states that it is attributable to the mid-Spring and Autumn period. No matter which date is correct, the earliest eye bead from the central plains is still from the Fenshuiling M270 tomb. The tomb with the most eye beads (13 specimens) is the Taiyuan Jin Zhao official tomb. The latest period from which eye beads have been found appears to be the Southern Dynasties (A.D. 420-589) and is represented by beads from the De'an tomb, Jiangxi. The site report does not include illustrations, but mentions "corroded enamel beads" decorated with "blue and white circle [i.e., eye] patterns."[20] An earlier find is from

the early Eastern Jin dynasty (A.D. 317-420), at Fuguishan, Nanjing, Jiangsu. The archaeological report mentions "dragonfly-eye glass rings," and glass eye beads can clearly be identified from the images, despite evidence of rather severe weathering (*Kaogu* 1998, 8:43) (Figure 5, no. 108). Most eye beads come from Warring States tombs. Only a few scattered eye beads have been found from the Han to the Eastern and Western Jin dynasties and these must be relics from earlier periods. Eye beads were popular for only about 300 years and died out after the Eastern Jin dynasty.

Eye beads are not evenly distributed. In terms of their age, they are mainly concentrated in the Warring States period. In terms of their distribution, from the Spring and Autumn to the early Warring States periods, they have only been found in Shanxi, Henan, Hunan, and Shandong, and the concentration is in Shanxi. The eye beads from this period are rather small and mostly green or light green. By the mid-Warring States period, they had spread to areas including Hubei, Hunan, Shandong, Shanxi, Henan, and Shaanxi. That is to say, eye beads spread to the southwest, and were concentrated and found in greater numbers in Hunan and Hubei tombs. During this period, eye beads not only increased in number but in size as well. The site where the most eye beads have been found is the early Warring States Marquis Yi of Zeng tomb in Leigudun, Suizhou, Hubei, which yielded 173 specimens (Hubei Sheng Bowuguan 1989:9) (Figure 5, nos. 15-17). The next largest find is the early mid-Warring States no. 2 tomb in Leigudun, whose occupant has been determined to be the Marquis Yi of Zeng's (Sui) wife. Even though this tomb had been robbed, 24 dragonfly-eye beads were still present (*Wenwu* 1985, 1:27) (Figure 5, nos. 27-28). After this is the late early-Warring States Zhaojiahu JM37 tomb in Dangyang, Hubei, where 15 eye beads were found (Hubei Sheng Yichang 1992:155) (Figure 5, no. 84). Even though many eye beads have been found in Hunan, which neighbors Hubei, no tombs have yet been found there that contain as many eye beads. Few tombs with eye beads have been found in Shandong. One of them is the early Warring States ancient Lu city M52 tomb in Qufu which contained 13 glass eye beads (Figure 5, nos. 10-12).

Eye beads of the mid- to late Warring States period have been found mostly in Hunan and Hubei. While these beads have been found in other areas, there is a clear move towards the west during this period, including Pingliang, Gansu[21] (Figure 5, no. 100); Xianyang, Shaanxi (including beads found in the Ta'erpo tomb)[22] (Figure 5, nos. 91-97); Qingchuan, Sichuan[23] (Figure 5, no. 98); and Qianwei.[24] This is an area encompassing the Qin state of the Warring States period. Expansion to the south only included Zhaoqing, Guangdong[25] (Figure 5, no. 99). After the Warring States period, from the Qin to the Han dynasties, the number of eye beads dropped dramatically, and eye beads were no longer found where they previously had been in late Spring and Autumn Shandong and Shanxi and mid- to late Warring States Hebei. From Western Han Henan, only five eye beads came from Shan County tombs M2001 and M2019[26] (Figure 5, no. 103). Eye beads have been found in greater numbers in the west, including Qin'an, Gansu;[27] Mianyang, Sichuan;[28] and Chongqing[29] (Figure 5, no. 107). In the southwest they extended to Jinning, Yunnan,[30] and Guangzhou, Guangdong[31] (Figure 5, nos. 104-106). Hunan and Hubei, which saw high concentrations of eye beads during the Warring States period, no longer held such a position in the Han dynasty. The only eye bead to come from an Eastern Han tomb is a "color glazed pottery bead" from the late Eastern Han tomb M3 in Zhuanwachang, Yun County, Hubei.[32] There is no evidence to show that this bead is from that era and it can only be interpreted as an ancient relic.

Evidence reveals that even though eye beads were introduced from Western Asia, their movement within China did not go from west to east. During the Western Zhou and Spring and Autumn periods, China's transportation was already quite developed, and when merchants and glass craftsmen brought their goods and technology to China from Western Asia, they had already directly entered the economic and cultural hub of that time; i.e., Shanxi, Shandong, and Henan on the lower reaches of the Yellow River. Eye beads were initially concentrated in the north and south at Changsha, Hunan, before they spread south and west. Their transmission was definitely closely linked with economic and cultural developments. Hunan and Hubei were at the heart of the Warring States state of Chu. During the Western Zhou period, Chu was a small state that was very remote and difficult to access, but throughout the Spring and Autumn period it made use of its rich natural resources to become an economic powerhouse. The state of Qin expanded its territory westward in the mid-Warring States period. Eye beads that come from present-day Gansu, Sichuan, and Shaanxi all came from Qin. No eye beads have been found in the eastern provinces of Anhui, Jiangxi, Jiangsu, Zhejiang, and Fujian, nor have they been found in Guangxi or Guangzhou. It is worth noting that eye beads flourished during the Warring States period, and before and afterwards are only found sparsely scattered about. The rise and fall of the popularity of eye beads was relatively sudden.

Early Chinese eye beads are extremely simple, all have single dots for eyes, and they are very similar to those from Western Asia. The Gushi County, Henan, glass bead composition analysis report shows the presence of Na_2O (10.94%) and CaO (9.42%). The glass does not contain Pb or Ba, but belongs to the Na-Ca glass series. Ca and Na

are characteristics of West Asian glass which shows that these earliest Chinese eye beads, or the materials they were made from, came from Western Asia. China only started making eye beads with Chinese characteristics around the late Spring and Autumn or early Warring States period. In terms of chemical composition and style, Chinese eye beads may be divided into four categories: composite-eye beads, latticed eye beads, square eye beads, and glazed pottery eye beads.

Composite-Eye Beads

Eye beads became more complex beginning with those found in the late Spring and Autumn to early Warring States no. 3 wooden-outer-coffin tomb at Martyr's Park, Changsha, Hunan (Figure 5, no. 7), and the early Warring States ancient Lu city tomb M52 in Qufu, Shandong (Figure 5, no. 11). Similar eye beads have not been found in Western Asia. The beads from these two tombs are composite in style: the Hunan beads have seven eyes (six eyes surrounding one) and the Shandong ones have six (five eyes surrounding one). Composite-eye beads have also been found in Western Asia, but they have simpler patterns and mostly exhibit single eyes. In China, when composite-eye beads are found, they are found in great numbers. Furthermore, one from tomb M52 in Qufu, Shandong, has extremely complex decoration. This bead does not simply have eye decoration, but uses different colored glass to create geometric patterns (Figure 5, no. 10). Similar beads are not seen in Western Asia, suggesting that this eye bead may very well have been made in China. That is to say, not only did one type of eye bead enter China in the late Spring and Autumn and early Warring States periods, but the methods and technology used in its creation may have arrived at the same time. After a brief learning period, the production of eye beads became localized.

One characteristic of Chinese eye beads is a fine, well-proportioned design. The decoration is rich and full and, even though the meaning of "gods' eyes" had diminished, the eyes on the beads are carefully positioned (Plate ID bottom). The composite-eye decoration found in the Warring States Yutaishan tomb group in Jiangling, Hubei (Hubei Sheng Jingzhou 1984:115, Figure 93:5, Plate 76:1) (Figure 5, no. 50) and the later period tombs in the Jiangling Jiudian tomb group (Hubei Sheng Wenwu 1995:332) (Figure 5, no. 83) is the same type as that found in the mid-Warring States Niuxingshan tomb M1 in Xiangxiang, Hunan (*Wenwu Ziliao Congkan* 3:105, Figure 41; *Zhongguo Wenwu Shijie* 1995, 10:55, Figure 5) (Figure 5, no. 60) and the mid-Warring States period or later ancient Lu city tomb M58 in Qufu, Shandong (Shandong 1982:178, Figure 112:1) (Figure 5, no. 69). These beads have composite eyes composed of one eye surrounded by six eyes with round dots or eyes in the spaces between the composite eyes (Plate IIA).

Latticed Eye Beads

Another kind of eye bead found only in China has the eyes arranged in a checkered pattern with small white dots arranged in lines forming a lattice pattern between them (Plate IIB). Some of them have eyes where the lines of dots intersect. The empty spaces in the lattice are filled with larger eyes, making the entire pattern more balanced. The earliest latticed eye bead was found in the early Warring States Qian city M14 tomb in Qianyang County, Huaihua, Hunan (*Hunan Kaogu Jikan* 1989:71) (Figure 5, no. 18). The latest such beads are from the Western Han dynasty and were found in the Xianlie Road Huanghuagang M1048 tomb in Guangzhou, Guangdong (Guangzhou 1981:165) (Figure 5, no. 104); the Guangzhou Southern Yue King tomb (Guangzhou 1991:133-134) (Figure 5, no. 105); and the Nan'an District, Chongqing, Sichuan (*Wenwu* 1982, 7:29) (Figure 5, no. 107). Eye beads have been found in the Chinese provinces of Hunan, Hubei, Henan, Hebie, Shanxi, Shandong, Shaanxi, Sichuan, Guangdong, Yunnan, Gansu, Xinjiang, Jiangsu, and Jiangxi. The provinces in which the most tombs containing eye beads have been found include Hunan, Hubei, and Henan, all of which were situated within the ancient state of Chu. Spotted eye beads and composite-eye beads have been found in these areas that are not seen in Western Asia.

Another type similar to latticed eye beads has only been found in Shandong, Henan, and Xianyang, Shaanxi. Only three tombs with eye beads have been found in Shandong and two of them are in the ancient Lu city of Qufu. Of these, the mid-Warring States or later tomb M58 has a type of eye bead with several off-center layers in each eye. The eyes comprise three intersecting rows and are separated by solid white lines. The eyes maintain the contrast between deep blue and white (Figure 5, no. 67). Compared to latticed beads from Hunan and other areas, the M58 eyes are fuller and arranged closer together. Unfortunately, similar latticed beads have not been found elsewhere so this cannot be confirmed to be a characteristic of Shandong eye beads.

Square Eye Beads

Square eye beads, a form not found in the West, were uncovered at Erligang, Zhengzhou, Henan. Tombs no. 11 and no. 420 each contained one bead which was "somewhat cube-shaped with rounded corners. Each of the eight corners is painted a drab green, with brown circles. Between the

circles are little brown spots. Between the circles and spots white coloring is added" (Henan Sheng Wenhua 1959:78). Two square beads were found in a late Warring States Qin tomb in Ta'erpo, Xianyang, Shaanxi. The report indicates that the background color is purple and the sides are 1.4-1.5 cm wide (Xianyang 1998:178, Figure 135, 3, Plate 60, 2) (Figure 5, no. 91).

Many square eye beads have been preserved and they are mainly made of white glass inlaid with drab green eyes (Plate IIC). These types of square beads were utilized briefly in Henan and Shaanxi. As mentioned above, Ta'erpo is an area of Qin where outsiders came to live, so the square beads may have been created elsewhere. We cannot eliminate the possibility that they are a specialty of Henan, but this must await further archaeological evidence to be confirmed.

Glazed Pottery Eye Beads

A type of glazed pottery bead unearthed in Erligang, Zhengzhou, Henan (Figure 5, nos. 31-32), and Ta'erpo, Xianyang, Shaanxi (Figure 5, nos. 92-93), has solid reddish-brown lattice lines painted on it. Colored dots are present at the intersections of the lattice pattern and the lattice lines and the eyes consist of applied brown, yellow, and sky-blue glass coatings. White is used for the background but not the eyes so the overall effect is that of bright colors. The eyes protrude slightly from the surface and are located within the lattice pattern lines (Plate IID upper left). No eyes are located within the lattice pattern. This type of glazed pottery eye bead has only been reported in Erligang, Henan, and the Ta'erpo District of Xianyang, Shaanxi. It is relatively easy to produce and its price may have been low. Many of them may be found in the same tomb: eight in Erligang tomb M48 and seven in the M272 tomb (Henan Sheng Wenhua 1959:78). According to the archaeological report, the Ta'erpo tomb is that of a commoner, and the time period of the tomb group is very short: from around the late Warring States period to the Qin unification. Even though glass beads and other glass objects have been found in great numbers here, there is still no evidence for a glass workshop in the area. According to the report, Ta'erpo is an area which was settled by outsiders, or non-Qin peoples, so the possibility that the beads were brought in from other states cannot be eliminated. Similar glazed pottery beads have only been found in Erligang, Henan, so it is possible that they were brought from Henan to Ta'erpo.

The style of the composite-eye decorations from Erligang, Henan; Ta'erpo, Xianyang, Shaanxi; and Shandong are not identical to those from Hunan and Hubei, indicating that the production and spread of Warring States eye beads had a certain amount of commonality and locality. Local transportation was quite developed and it was not uncommon for glass beads imported from Western Asia to be found in all the provinces. Nevertheless, some particular styles only appear in certain areas. These beads were likely produced in smaller workshops with a small market turnover. Their technology was not easily passed along, leading to the phenomenon of eye bead forms particular to certain areas.

Henan seems to have produced many glazed pottery beads and unique forms. Apart from the above-mentioned latticed beads, one bead from tomb no. 48 in Erligang, Zhengzhou, Henan, is "tied onto a white object, uses sky-blue coloring applied to form crossed, slanting S shapes. Brown spots of different sizes are added in the spaces. Little yellow spots are applied on top of the brown spots...." This type of S-patterned pottery bead is seldom seen in other areas (Henan Sheng Wenhua 1959:78) (Plate IIID bottom). Various other forms of glazed pottery beads are shown in Plates IID and IIIA-D.

The Uses of Eye Beads

Late Spring and Autumn eye beads were imported from Western Asia. As the road was long and the precious objects hard to obtain, their price was very high. For this reason, only people of the rank of *shi* (the lowest noble rank in the pre-Qin period) and above could possess them. Thirteen eye beads were found in the Jin Zhao official tomb in Taiyuan, Shanxi, which contained the remains of a first-rank *qing* official. The Hougudui tomb in Gushi County, Henan, belonged to the wife of King Fuchai of Wu; i.e., the younger sister of Duke Jing of Song. The excavation report does not mention the number of eye beads and only states that "upon opening the inner coffin we found beads scattered around the entire corpse. It was evident that they were tied all around the body at the time of burial. The thread decayed, so they scattered all around. The small ones have diameters of only 0.2 cm, and the grinding was done very neatly" (*Wenwu* 1981, 1:7; *see also* Zhao Qingyun 1996:482). Similarly, the seven late Spring and Autumn to early Warring States beads and adornments found in the Langjiazhuang M1 tomb in Linzi, Zibo, Shandong, belonged to a first-rank *qing* nobleman. The report on the late Spring and Autumn or early Warring States Fenshuiling M270 tomb in Changzhi, Shanxi, does not identity the occupant, but notes that the burial artifacts were arranged in the same way as in tomb M269, with an inner and an outer coffin, indicating that the occupant was a *shi*. In the earliest Hunan wooden-outer-coffin tomb at Martyr's Park in Changsha, the occupant was a first-rank *shi* accompanied by a single eye bead.

Even though Chinese-made eye beads occur from the Warring States period onward, due to the limitations

of early technology and low production amounts, along with governance by the feudal lords, eye beads retained their status as objects of the highest levels of society. The inner and outer coffins of early Warring States ancient Lu city tomb M52 in Qufu, Shandong, had decayed, but the remnants revealed that there had been one inner and two outer coffins; 13 eye beads were found in this tomb. The feudal lord Marquis Yi of Zeng's (Sui) tomb contained 173 eye beads. His wife's tomb (no. 2) at Leigudun had been robbed, but 24 eye beads remained. The number of beads in these two tombs far surpasses the number of those found elsewhere. Probably around the mid-Warring States period, the quantity of locally produced eye beads increased and their value noticeably decreased. Many were found in Hunan and Hubei tombs, some of which belonged to lower ranking *shi* and commoners. Of the 38 eye beads unearthed in the Jiudian area of Jiangling, Hubei, some belonged to the late Warring States lower-rank *shi* tombs M703, M1274, and M51, and commoner's tomb M421.

The use of eye beads in the Spring and Autumn and Warring States periods seems to be unrelated to gender and, from the above list, it can be seen that tombs of both men and women contained them and this did not change throughout the period. Fenshuiling tombs M271 and M269 in Changzhi, Shanxi, must have been for husband and wife, but tomb M269 did not contain any eye beads. The tombs of this couple had the characteristic that the wife's tomb contained much clothing and no weapons, while the husband's tomb contained some weapons but less clothing. This means that the eye beads were attached to the woman's clothing.

Western Asian eye beads represented gods' eyes and the gods had the power to repel evil spirits. In the early periods only one may have been worn at a time. Egyptian eye beads of the 14th century B.C. had holes at their tops which was not conducive to stringing many together. Later, beads changed to having holes through the body so they could be strung in a row. The most common method may have been tying strung eye beads around one's neck. Many of the eye beads created by Phoenicians in the 8th century B.C. were used in necklaces and in the center of the necklaces were glass head-shaped beads particular to the Phoenicians, while the other beads were ordinary eye beads.

Chinese eye beads have all been found in tombs and to understand their uses one must first look at their position within the tombs. The earliest Chinese eye beads are from the late Spring and Autumn to early Warring States periods, and the eye beads in the Martyr's Park no. 3 outer-coffin tomb in Changsha, Hunan, were "located in the space between the... inner and outer coffins" (*Wenwu* 1959, 10:70). Twelve eye beads were uncovered in the Eastern Zhou Jiudian M410 tomb in Jiangling, Hubei, one of which "was found with a silk ribbon through it located at the center of the southern dividing wall of the outer coffin" (Hubei Sheng Wenwu 1995:332). The reports lack details and only the one on Mashan tomb no. 1 in Jiangling, Hubei, provides clearer information. Two glass eye beads were encountered in this tomb, that of a woman between 40 and 50 years of age with a rank of a high *shi*. One eye bead was found by the woman's waist. The other was between the outer and inner coffins. The coffin chamber was divided into a head chamber, side chamber, and coffin chamber by the headboard, dividing beams, and dividing boards. The burial objects were mostly placed in the head and side chambers. The coffin chamber utilized a coffin cover (*huangwei*) on top of which was a silk painting, a bamboo stalk, and a coffin ornament. The coffin ornament "is vertically placed against the coffin cover beneath the *huangwei* and is made of a strip of gauze threaded through a glass tube and a glass bead" (Hubei Sheng Jingzhou 1985:17) (Figure 6). Even though the tomb is from the mid- to late Warring States period, the glass bead and tube were clearly seen as having mystical powers that could protect the deceased. This concept must have originated from the Western belief in the power of "gods' eyes" to repel evil spirits.

This tomb is rather unique in that the corpse was wrapped in 13 layers of clothing and blankets. After unwrapping these

Figure 6. The coffin ornament (right) and its location within Warring States Mashan tomb no. 1 (left), Jiangling, Hubei (Hubei Sheng Jingzhou 1985).

layers, the deceased was found to be wearing a cotton dress. Her eyes were closed, and a silk ribbon bound her hands and feet. Both hands were in a silk "handshake." Because of this, the eye bead next to the waist may have been a burial object intended to repel evil spirits. There is another possibility, however, considering the placement of the eye bead. A yellow silk ribbon encircled the corpse's waist and was tied in a slipknot in front with a silk ribbon hanging down on the left side tied to a jade tube. "When looking at the entire article, the jade tube is placed above the glass bead and both are in the center of the silk ribbon. Because each is threaded onto two sections of ribbon, they can move freely" (Hubei Sheng Jingzhou 1985:17). The jade tube and glass eye bead would only have been able to move freely when the wearer was walking, and this decoration must have been used in this way by the deceased during her life. This style of decoration reflects to a large degree the way in which eye beads were worn at the time (Figure 7).

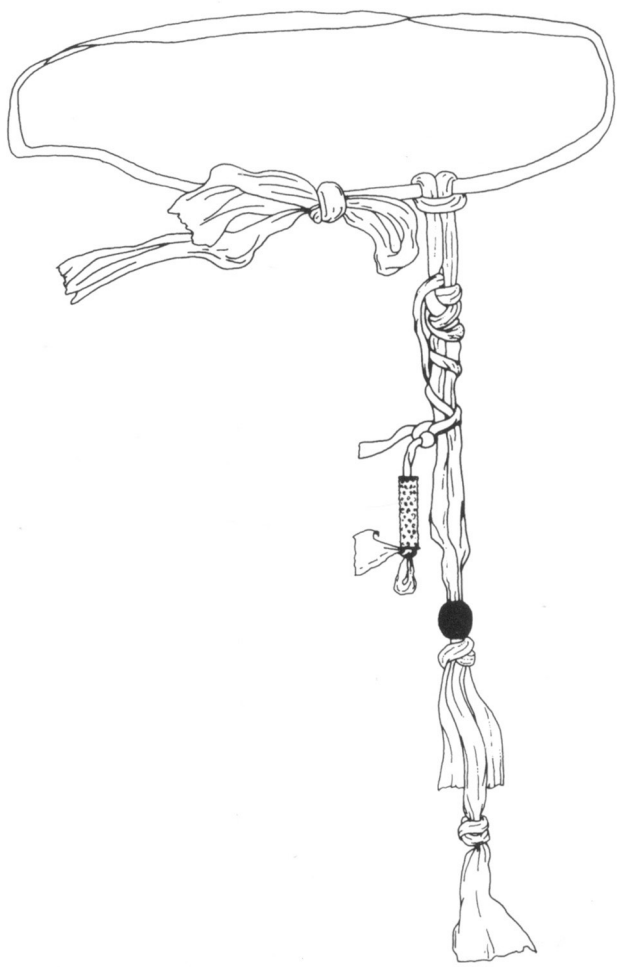

Figure 7. Ornament from Warring States Mashan no. 1 tomb, Jiangling, Hubei (Hubei Sheng Jingzhou 1985).

An eye bead found at Yangchang, Jiangling, Hubei, "forms a decoration along with a bone archer's ring and the silk ribbon it is tied with is in excellent condition" (Peng Hao 1996:198). Even though this is in the same Jiangling area, the way in which it is tied is different from Mashan tomb no. 1, indicating that there were many ways of using strung eye beads. Eye beads have also been found in the area of the head. Those from late Warring States Huangjiagou in Xianyang city, Shaanxi, were found by the "skeleton's head and chest" (*Kaogu yu Wenwu* 1982, 6:12), while in boat-coffin tomb M49 in Dongsunba, Sichuan, "one [was] by the head and one by the stomach" (*Kaogu Xuebao* 1958, 2:93). Furthermore, "many have been found in Warring States tombs in Changsha, all of which were located near the head" (*Kaogu Xuebao* 1957, 4:47).

The eye beads found in Mashan tomb no. 1 and at Yangchang are both single-bead decorations. A more composite beaded decoration was found in Erligang, Zhengzhou, Henan, in which the "beads excavated were mostly found together with copper pendants, agate rings, bone tubes, copper rings, pearls, and crystal beads." Especially in Erligang tomb M272, seven alternating beads and bone tubes were found with their holes facing one another indicating that they had all been strung together (Henan Sheng Wenhua 1959:78).

The archaeological evidence reveals that Warring States glass beads were used as personal adornment in two principal ways. The first was as components of larger hanging ornaments. From the Western Zhou to the Warring States periods, hanging jade ornaments (*yuzupei*) were very popular. Written during the Han dynasty, the *Zhouli* (an ancient ritual text) states, "without good reason, jade should not leave the side of a gentleman." This was the main function of the glass beads found in the late Western Zhou period Marquis of Jin's tomb, Tianmaqu village, Northern Zhao, and the eye beads from the tomb of the Marquis Yi of Zeng. The glass eye beads found in the tomb of the Western Han King of Southern Yue, Guangzhou, were also part of a hanging ornament.

The other personal use of eye beads was as belt decoration. The beads from Chu tomb no. 1 in Mashan, Jiangling, Hubei, and the Jiangling Yangchang Chu tomb were used singly and threaded on silk ribbons that served as belts. A similar ribbon was found in tomb no. 1 in Mashan, Jiangling, on which was threaded an eye bead as a coffin ornament. The above three tombs are all in the ancient state of Chu and this type of decoration may have been a style exclusive to the Chu people.

Eye beads and eyed glass inlays were also set into objects. Five eye beads found in Qin to early Han tombs

M2001 and M2019 in Shan County, Henan, "came from lacquer makeup boxes" (Zhongguo Shehui 1994:153). Two eye beads in the late Warring States Pingliangtai M16 tomb in Huaiyang, Henan, "were found by copper mirrors" (*Wenwu* 1984, 10:27). Another copper mirror excavated at Warring States tomb CIM3923 in the Xigong District, Luoyang, Henan, is inlaid with 18 six-eyed (one eye surrounded by five), bubble-shaped glass beads. This tomb belonged to a late Warring States noblewoman,[33] revealing that inlaid eye beads were still highly valued during this period. Clearly, there were many uses for eye beads and they were used in great numbers during the Warring States period.

The Composition of Eye Beads

The fusing agents and colorants used in the production of glass determine its chemical composition. Of the late Spring and Autumn glass that has undergone compositional analysis, that from Hougudui, Gushi County, Henan, includes 10.94% Na, 9.42% Ca, and trace amounts of K, but no Pb or Ba. Its elements belong to those used in the composition of Western Na-Ca glass. Eye beads from Hougudui with this composition show that the earliest Chinese eye beads may have been imported from the West. The impurities in different raw materials will often be different. Even though Pb-Ba glass was already present by the late Spring and Autumn and early Warring States periods, all batches were not the same. Analysis of some of the 173 eye beads found in the early Warring States Marquis Yi of Zeng tomb in Hubei revealed that they contained "56.1% SiO_2, 4.07% CaO, 6.99% Na_2O, and negligible amounts of Ba and Pb.... It can be concluded that they are products from Arabia" (Hubei Sheng Bowuguan 1980:658). Hou Dejun (1986:60, 62), however, cites similar data but also presents the results of x-ray fluorescence spectrometry testing of objects from the same tomb. He found that CaO and K_2O were rather high, PbO and BaO were either very low or absent, and Na_2O could not be detected at all. Based on this data, he concluded that the glass belonged to the K-Ca system, and that "among ancient Western glass from the same period, it is very rare to find glass with high amounts of potassium oxide, and over 100 pieces of this type of glass were found in the Marquis Yi of Zeng's tomb, which means that they must have been independently made within China." Hou Dejun believes that the differences in the two data sets may have been caused by differences in the samples. More conclusive results await further analysis.[34]

There are also historical references that provide support for local beadmaking. Wang Chong of the Eastern Han dynasty writes in his *Lunheng* (vol. 2, "*Shuaixingpian*") of a "Marquis of Sui (Zeng) making beads from medicine."[35] This Marquis of Sui is the Marquis Yi of Zeng and the "medicine" referred to must have been used to make the kind of high K and Ca glass mentioned above. The Marquis of Sui's beads can be used as a reference, and scholars often cite this record as showing that China produced glass in the early Warring States period. If the beads uncovered in the tomb of the Marquis Yi of Zeng's wife (Leigudun tomb no. 2) are combined with those from the tomb of the marquis, altogether some 200 eye beads were recovered, a number which cannot be matched by any other Spring and Autumn or Warring States tomb. Imported eye beads are extremely valuable treasures and to collect such a large number would have required a considerable expenditure of time and money, so it is more likely that they were made locally. Nevertheless, the eye beads from the Marquis Yi of Zeng tomb are completely in a Western Asian style and identical eye beads were found in Gilan, Iran, in 1964. The body of these beads is blue, inlaid with blue and white eyes (Shinji Fukai 1977: Figure 45). Furthermore, one of the eye beads from Leigudun tomb no. 2 is also in a style exclusive to Western Asia. We can take this to mean that Marquis Yi of Zeng did not only obtain glass beads from Western Asia, but also procured Western Asian glassmakers and even refined materials.

The Marquis' eye beads introduced Western Asian technology to Chinese glass. We know that the first glass of the Western Zhou period did not achieve true vitrification throughout the many centuries from the early Former Zhou to the Spring and Autumn periods. Imported Western Asian glass started to appear in the mid-Spring and Autumn period and by the late Spring and Autumn period, Chinese glassmaking included the K-Ca glass ornamentation on the swords of King Fuchai of Wu and King Goujian of Yue. Even though the sword inlays are of Chinese manufacture, they reveal that by the end of the Spring and Autumn period, local glass production could only make pieces the size of beans. Yet, by the early Warring States period, larger glass beads were already becoming common and their craftsmanship was exquisite. They were more beautiful than those from the Western Zhou period. The advance of glassmaking technology relied upon foreign techniques and the eye beads from the tomb of Marquis Yi of Zeng are examples of this. Taking another look at the chemical composition of these, CaO and Na_2O only comprise 4-7% which is far lower than in Western Asian glass, and trace amounts of Pb (2.80%) and Ba (0.05%) were detected, which are substances rarely found in Western glass. Thus, it can also be said that the Marquis of Sui's composition had already started to use Pb and Ba as fusing agents.

The state of Zeng (also called Sui) was small during the Warring States period and located within present-day Hubei

province. Many eye beads were found in the mid- to late Warring States Jiudian, Jiangling, tombs which are also in Hubei, and they are of the same composition as those that belonged to Marquis Yi of Zeng. Of the three samples of eye beads from Jiudian M286 tomb that were analyzed, two did not contain Pb, contained only trace amounts of Ba, and had 4-5% Na_2O and CaO. The remaining eye bead contained 13.4% Na_2O and 0.11% PbO (Hubei Sheng Wenwu 1995:533). M286 is a lower-*shi* tomb so the occupant was of a low status and it would have been difficult for him to obtain high-priced Western Asian items. This suggests that the beads accompanying the Marquis of Sui were produced locally in Hubei and that their composition remained about the same until the mid- to late Warring States period.

Further south, many eye beads have been recovered from tombs in Hunan. Among these, the composition of the glass beads found in Changsha was 43.69% SiO_2, 25.68% PbO, and 5.92% BaO, according to a report by Gao Zhixi (1995:54-63) of the Hunan Provincial Museum. This is typical of Chinese Pb-Ba glass. Eye beads unearthed in Erligang, Zhengzhou, Henan, and Guwei village M1, Hui County, were also tested. Those from Erligang were all glazed pottery. One of these had brownish-black glass on its surface. It did not contain Pb or Ba, and the amounts of Na_2O and CaO were lower than those of the beads found in the Marquis Yi of Zeng and the Jiangling Jiudian tombs.[36] The "inlaid glass bead" from the M1 tomb in Guwei village, Hui County, underwent x-ray fluorescence spectrometry and was found to contain larger amounts of Pb and Ba.[37] Erligang, Zhenghou, and Hui County both lie within Henan, but the compositions of the samples from these two places differ greatly. This reflects the diversity of glassmaking materials at the time.

Although no remains of glass workshops from the Warring States period have been discovered as yet, we know from the differences in the composition of the eye beads discussed above that there was much variation in eye beads during that period. The compositions of glass from Henan and Hunan also differ. As glass containing Ba is not found in the West, Pb-Ba glass has attracted scholars such as Zhao Kuanghua who has the following view on the source of Pb-Ba glass. He feels that the Ba in Pb-Ba glass from the Warring States period comes from the barite found in lead ore. Barite ($BaSO_4$) is the only mineral that contains Ba and "galena, especially that found in igneous mineral deposits, is often found together with barite or, to put it another way, barite is often produced together with galena in warm liquid mineral lodes. If these two types of minerals were oxidized and calcined, then the calx PbO produced would naturally contain BaO" (Zhao Kuanghua 1991:147). The area around Changsha has barite minerals that are associated with galena and the lead ore from Changsha and Xinhua also has barite components, so the Hunan Pb-Ba glass should be local. Yet, Dr. Robert H. Brill's analysis of a large amount of ancient Pb-Ba glass has shown that the proportion of Pb to Ba in such glass is not consistent. Actually, the percentage of Ba is relatively stable, while the percentage of Pb varies greatly. This suggests that the Ba in ancient Chinese glass did not necessarily come from lead ore.

Tubular Glass Eye Beads

Warring States glass eye beads include those that are tube shaped. Most are around 5 cm long and 0.8 cm in diameter. The body color is mostly dark blue or dark brown and they are decorated with eyes (Plates IVA-D) and lattice patterns. These types of tubes are not found in other countries and are genuine Chinese products. They were used in the same way as the popular jade tubes of the period. Two were found in tomb no. 1 in Mashan, Jiangling County, Hubei (Figure 8 top),[38] one was found at tomb M12 in Mashan (Figure 8 center),[39] and one was found at tomb no. 1 at Niuxingshan, Xiangxiang County, Hunan (Figure 8 bottom).[40] This form of tube-shaped eye bead seems to have been a popular ornament in the state of Chu. They were not popular for long and not many of them have been found. They are only found in extremely small numbers after the Warring States period.

The method of producing tubular glass eye beads is mostly the same as for other eye beads, and they are mostly decorated with a combination of crescent and "persimmon

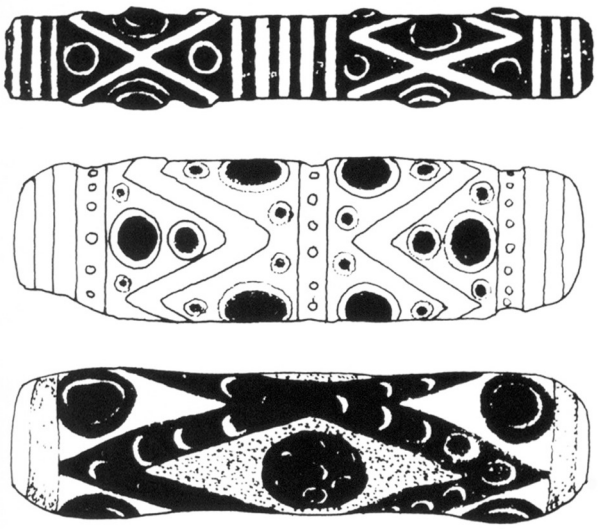

Figure 8. Tubular glass eye beads, Warring States period. **Top:** Mashan tomb no. 1, Jiangling County, Hubei. **Center:** Mashan tomb M12, Jiangling County, Hubei. **Bottom:** Niuxingshan tomb no. 1, Xiangxiang County, Hunan.

calyx" patterns (Plates IVB-C). This type of pattern is not seen on round eye beads. The spotted lattice patterns found on round eye beads are also present on many of the tube beads as well (Plate IVD). The tubular eye beads can be divided into two groups – long and short – with the long ones measuring around 4 cm and the short ones around 2 cm.

HAN DYNASTY ADORNMENTS (206 B.C.-A.D. 220)

After the Qin unified China, cultural interaction and trade developed throughout the land and the local characteristics of Han glass gradually disappeared. Han glassware mostly comprises ornaments and funerary objects, and their composition is mostly Pb-Ba glass which developed from Warring States molding technology. Common glass objects from the Han dynasty include beads (Plates VA-VB) and pendants (Figure 9), as well as ear spools, garment components, plugs, belt hooks, bi-discs, and little animals.

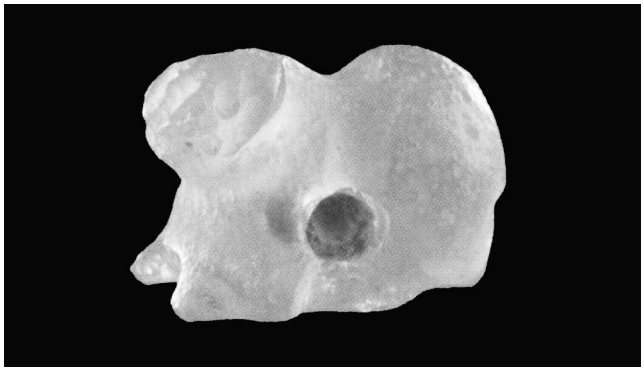

Figure 9. Animal pendant of yellow glass, mid-Western Han to Eastern Han dynasties (Length: 1.8 cm) (author's collection).

Bead Adornment

Glass eye beads had already disappeared by the Han dynasty and another form of small glass bead became common in Han tombs (Figure 10). These are green, blue, yellow, and white, and a large number of them have been found in Guangxi, Guangdong, and Hunan. A scattering has been found in tombs in other areas. Tombs in which large numbers of Han glass bead ornaments have been found in recent years include:

1. Early Western Han dynasty, Dengfeng Road, Guangzhou, Guangdong; 111 glass stringing beads.[41]

2. Early to mid-Western Han dynasty, King of Southern Yue tomb, Guangzhou, Guangdong; 2,110 glass stringing beads.[42]

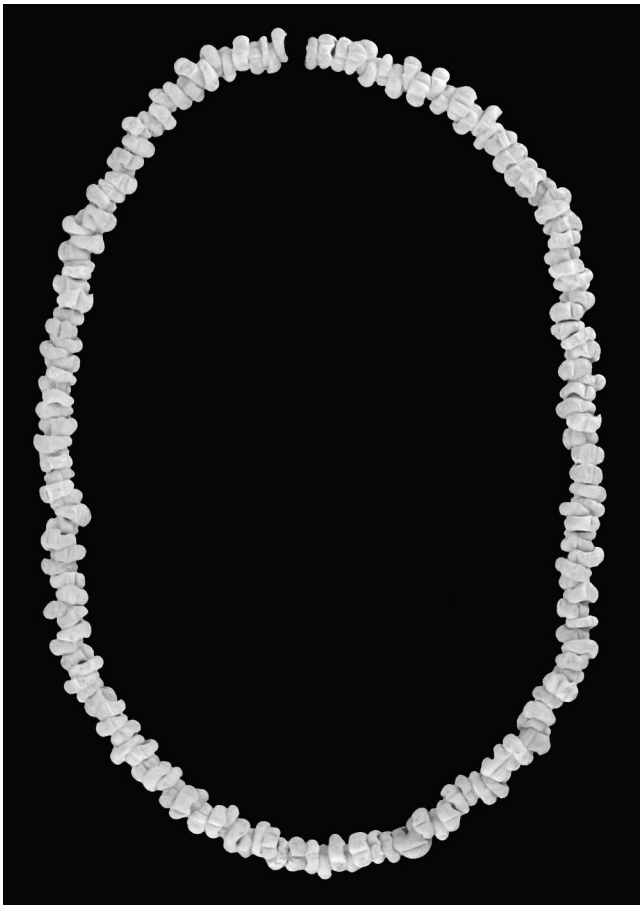

Figure 10. Strand of lobed beads, yellow glass, Eastern Han dynasty (Diameter: 0.6-0.7 cm) (author's collection).

3. Late Western Han dynasty, Dayong city area, Xiangxi, Hunan; 1,183 glass stringing beads.[43]

4. Late Western Han dynasty, Youyugang, Dengfeng Road, Guangzhou, Guangdong; 2,629 glass stringing beads.[44]

5. Late Western Han dynasty, Hepu, Guangxi; three strings of blue glass beads, ca. 5-6 mm in diameter (*Kaogu* 1972, 5:29).

6. Eastern Han dynasty, tomb group in Jianxi District, Luoyang, Henan; 142 glass beads.[45]

7. Eastern Han, Gui County, Guangxi; 1,504 glass beads.[46]

8. Eastern Han, Zixing, Hunan; 125 glass beads.[47]

9. Eastern Han, Mount He Temple, Yiyang, Hunan; 169 glass beads (*Kaogu Xuebao* 1981, 4:547).

10. Eastern Han, Longshenggang, Xianlie Road, Guangzhou, Guangdong; 1,965 glass stringing beads.[48]

11. Eastern Han, Fengmenling, Hepu, Guangxi; 149 glass beads.[49]

12. Eastern Han, Huizhou cemetery, Xianlie Road, Guangzhou, Guangdong; 101 glass beads.[50]

Nearly one thousand glass beads were recovered from the main inner coffin chamber in the Western Han King of Southern Yue tomb in Guangzhou. These beads served as accessories to jade garments along with gold, copper, and silver ornaments:

> The glass beads were on the breast of the jade garment and had scattered. A small number of them are strung on a string. There is serious decay and they break immediately upon touch. A thousand have been collected as samples. Most are yellow/white or greyish yellow, and a few are green. After washing, they become light blue. They are in the shape of flat rings and were formed by winding glass filaments in a circle at high temperatures. They are all roughly the same size, with body diameters of 0.3-0.4 cm and hole diameters of 0.2 cm.[51]

A total of 1,500 glass beads were also excavated at other tombs in Guangzhou. Guangdong, Guangxi, and Hunan were very likely the production centers for Han glass beads (Figure 11). The Han glass excavated in Guangdong and Guangxi belongs to the K-Si series which is different from the Pb-Ba composition popular in the central plains area. Wang Junxin and others have studied the Pb isotopes of Western Han K glass tubes, beads, and fragments excavated in Hepu, Guangxi. The samples were light blue and blue with a composition of SiO_2 75.8-79%, K_2O 10.4-14.5%, CaO 1.3-2.1%, Al_2O_3 1.9-2.7%, MgO and Na_2O less than 1%, and trace amounts of PbO and BaO. Copper was the coloring agent and no cobalt was detected. The high ratio characteristics of Chinese lead isotopes found in the small amounts of lead that were tested confirmed that the beads "were made from local Chinese minerals" (Wang Junxin et al. 1994:499-501). This study seems to have solved the problem of the origin of Guangdong and Guangxi glass, but taking into account that this area was an important commercial area during the Han dynasty, we cannot eliminate the possibility that this large quantity of small glass beads was imported from Southeast Asia.

During the Han dynasty, glass beads were called *suizhu* ("following beads" [likely beads intended to be strung]). The *Book of Han, Traditions of the Western Regions* (vol. 96) mentions beads:

> Ode: During the Xiaowu reign [156-87 B.C.], the emperor planned on conquering the barbarians as he was afraid they would follow the Western states and unite the southern Qiang. He cordoned off the western Yellow River, set up the four counties, opened the Jade Gate, and cleared the western regions... he built a palace with a thousand gates and ten thousand doors, built a heavenly terrace, and created ordered tents that were wrapped in Sui pearls and He jade...."

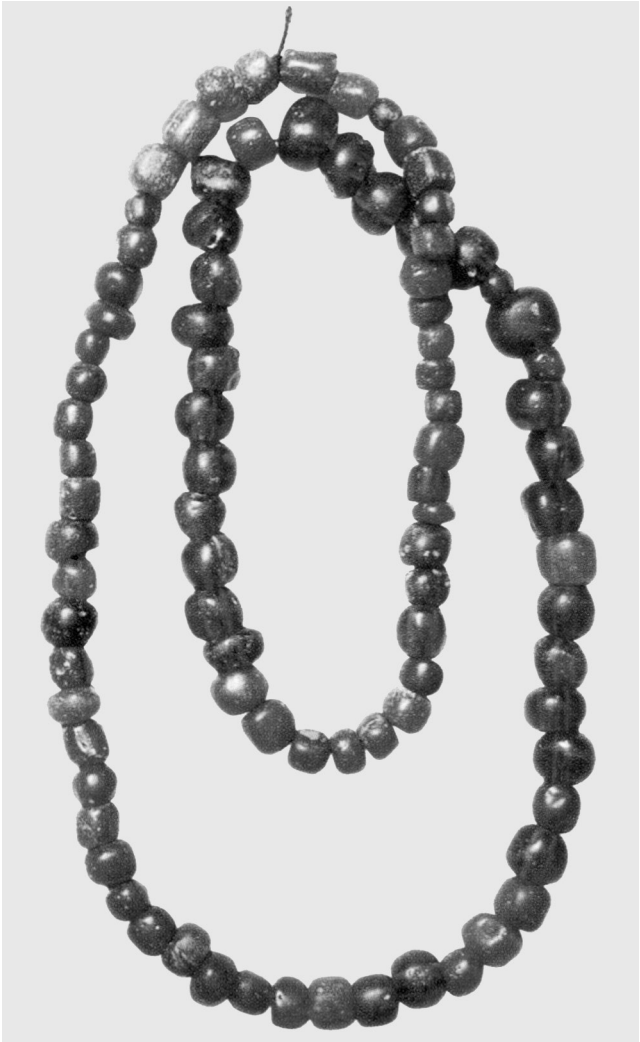

Figure 11. Han dynasty, K-Si series, blue-glass bead strand (author's collection).

Further mention is made in the *Ode to the Western Capital*: "sewed with brocade, wrapped in silk with the Marquis of Sui's legendary pearls scattered throughout." The "pearls" made from "medicine" by the Marquis of Sui refer to glass beads. The *suizhu* of the Han dynasty must have been beads that were strung together to form ornaments. The large number of small glass beads from Guangdong and Guangxi very likely are the Han *suizhu*.

Beads were also used to adorn splendid swords. In his *Miscellaneous Records of the Western Capital*, Han historian Liu Xin wrote:

> Han Emperor Wu received the white jade seal offered by Qin King Ziying and Liu Bang's sword, the White Serpent Slayer. The sword was decorated with beads of seven colors and exquisite jade, and its sword case was decorated with five-colored glass. Inside the light from the sword could light up a room as if it were outdoors... (Jin Gehong 1985).

Glass Ear Spools

Glass earrings were very popular during the Warring States period, but are seldom seen during the early Western Han dynasty. They were replaced by smaller glass ornaments called spools[52] (Figure 12). While the Han dictionary *Shuowen Jiezi* by Xu Shen does not include the word "spools" and the word does not appear until the Song dynasty in Xu Xuan's *Notes on the Shuowen Jiezi*, the Han work *Explaining Names – Explaining Jewelry* by Liu Xi states very clearly that "spools are beads passed through the ear." Sometimes beaded decorations hung from the holes in them. Their origin can be traced back to the Warring States period and early ear spools (Plate VC top) are similar to the Warring States tube beads with eye-pattern inlays.

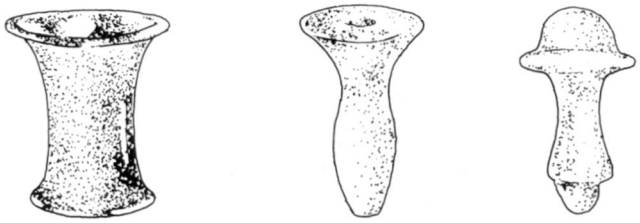

Figure 12. Types of glass ear spools, Han dynasty. Left to right: concave drum, horn shaped, and unperforated.

Han ear spools are mostly dark blue or light blue. Western Han tombs in which such spools have been found include those in Sandaohao, Liaoyang, Liaoning (*Kaogu Xuebao* 1957, 1:123); Shaogou, Luoyang, Henan (19 specimens) (Zhongguo Shehui 1959:210); and Zhibuchang, Xianyang, Shaanxi (*Kaogu yu Wenwu* 1995, 4:27). Eastern Han tombs producing such spools include those in Pingba, Qingzhen, Guizhou (*Kaogu Xuebao* 1959, 1:101); Guanmahu, Wuzhong, Ningxia (*Kaogu yu Wenwu* 1984, 3:34); Qianping, Yichang, Hubei (*Kaogu Xuebao* 1976, 2:143); Zixing, Hunan (*Kaogu Xuebao* 1984, 1:108); Zhaoping, Guangxi (*Kaogu Xuebao* 1989, 2:226); Liujiaqu, Shanxian, Henan (*Kaogu Xuebao* 1965, 1:152); Xicun, Guangzhou, Guangdong (Guangzhou 1981:352); Guixian, Guangxi (*Kaogu* 1985, 3:211); Zhaowan, Baotou, Inner Mongolia (Jinji Sun 1997, 9:230); Tomb M689, Luoyang, Henan (*Kaogu* 1992, 8:718); Mozuizi, Wuwei, Gansu (*Kaogu* 1960, 9:25); Baojintou, Qianping, Yichang, Hubei (*Kaogu* 1990, 9:827); Changsha, Hunan (Fu Juyou 2000:47); Mount Tianhui, Chengdu, Sichuan (*Kaogu Xuebao* 1958, 1:102); Linxian District, Xiqian, Guichou (*Wenwu* 1972, 11:44); Longgang Temple, Nanzheng, Shaanxi (*Kaogu yu Wenwu* 1987, 6:32); and Songzui, Fangxian, Hubei (*Kaogu Xuebao* 1992, 2:253). Clearly glass ear spools were very popular ear decorations in all places during the Eastern Han dynasty. A total of 35 glass ear spools from the late Eastern Han dynasty were found in 22 tombs at the Han Jin group tomb in Shangsunjia Zhai, Houzi He Xiang, Xining city, Datong County, Qinghai (Qinghai 1993:164-166). Ear spools disappeared following the Northern and Southern dynasties.

The most common ear spools are shaped like concave drums with broad ends and a constricted middle, with a hole down the center (Plate VC bottom). They comprise over 90% of all ear spools. The broad ends required a large ear hole. An improved version appeared later which had one flared end while the other was tapered. A hole passed down the center. These were easier and much more comfortable to wear than the drum-shaped ones. There was also another type of improved and simplified ear spool that was popular during the late Western Han dynasty which had no hole.

Different types of ear spools have been found together in some tombs, revealing that various types were in use at the same time (Zhongguo Shehui 1959a:210). By the Tang dynasty (618-907) there were no holed ear spools and the prevalent custom was to wear earrings. Looking at the excavated material, drum-shaped ear spools of blue glass were the most popular ear ornaments during the Han dynasty and the other two types of ear spools came later and only held a secondary position.

Most excavated light-blue glass ear spools are intact with some showing slight weathering. Most exhibit grinding marks and have smooth surfaces. It is noted in the Luoyang Shaogou Han Tomb report that "all those [spools] that are light blue still shone brilliantly as if they were new, despite their being buried in the ground for two thousand years" (Zhongguo Shehui 1959a:210). Chemical analysis has shown that none of the light-blue drum-shaped ear spools are of the Pb-Ba glass series and none of the 17 that were analyzed had Pb or Ba in them. Shi Meiguang has also analyzed similar light-blue ear spools excavated in Gansu and Guangxi and the results show no Pb or Ba (Shi Meiguang et al. 1986:307-313). Nevertheless, this form of glass ear spool is a typical type of Chinese jewelry and was produced in China.

Dr. Robert H. Brill has done a detailed analysis of two similar light-blue ear spools from the author's collection:

> This Han glass is a type of extremely interesting K_2O:SiO_2 (K-Si) series glass. This is a series that has recently been discovered and, as yet, has only been found in East Asia, Southeast Asia, and India. The samples we know of are from the 4th century B.C.E. to pre-4th century(?) C.E. Evidence has shown that India is one country that produced it, and we are still not sure if it was produced in other areas of Asia. Samples have been found in China, Japan, Thailand, Vietnam, and other Southeast Asian areas, and these may have been traded from India or other locations.

The problems surrounding this type of light-blue ear spool are quite complicated and more research must be conducted to determine whether they were imported from India or produced in China.

Ear spools of other colors are mostly standard Han Pb-Ba glass and exhibit weathering. Very few of the excavated spools came with beaded adornments and such adornments must have hung from silk threads, most of which have decayed. Only a small number of those that hung from metal threads have been excavated from tombs.

Han Glass Beadmaking

Han glass beadmaking utilized three primary methods: molding, winding, and drawing. The first process involved the use of two-piece clay molds (Figure 13). A small mass of molten glass was taken from the furnace and wrapped around an iron rod coated with clay and formed into a rough bead. The rod and glass were then placed in the mold and the two halves pressed together to impart the desired shape. After cooling, the iron rod and bead were placed in water until the clay on the rod softened, allowing the bead to be removed. This is probably the way that the bodies of eye beads were formed, which would explain why many eye beads produced in China are extremely round and even.

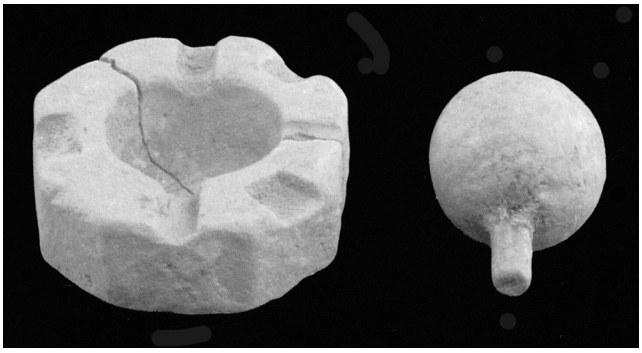

Figure 13. Clay mold for making glass beads (Width: 3.8 cm) (author's collection).

The drawing method was frequently used to make small beads. Common in the West, it was less used in China. A narrow tube was drawn from a hollow gather of molten glass. Once cool, it was cut into short sections that become beads. Drawn beads have parallel-sided holes and longitudinal decoration.

Winding is the method used early on in China to produce glass beads. It involved winding a strand of molten glass around a tapered iron rod. Before the glass hardened, it was rolled on an iron plate or in a grooved mold until it achieved the desired form. Wound beads have tapered holes and their decorations are generally oriented around the bead. Most Han glass beads were formed by winding.

BEADS OF THE WEI, JIN, AND SOUTHERN AND NORTHERN DYNASTIES (220-589)

Chinese glassmaking entered a new era during the Wei, Jin, and Southern and Northern dynasties. During this period, a large amount of Western glass was imported into China and glassblowing technology was introduced. Looking at recently excavated glass objects from this time, most Six Dynasties glass consists of imported vessels such as bowls and vases. Locally produced beads and small thin-bodied vases may have been created due to the introduction of West Asian glassmaking technology.

An interesting find is a gilt-glass bead excavated from the M385 Southern dynasty tomb in Zixing, Hunan. According to the archaeological report it was "transparent... had a pure gold face, was broken, and had a diameter of 0.8 cm" (*Kaogu Xuebao* 1984, 3:347). Glass does not suit the description of "pure gold" so this bead must have had gold leaf applied to it. This type of decoration was popular during the Jin dynasty (Plate VD top). It is unknown if this item was made in China or is an import.

The *Book of Wei* mentions glass three times: in "Persia" it is called *poli* and *liuli*; in the "State of Dayue" it is called *liuli*; but in the "Great State of Qin" it is called *qiulin*. From this we can infer that glass imported during the Jin dynasty may have come from any of these three areas, but it would be a stretch to say that they were called by their Indian name.[53] Glass may have been first introduced from India or may be related to the *moni* produced in southern India. The *Book of Wei*, "Southern India," states: "Fuchou city lies in southern India, 31,500 *li* from here. The city is 10 *li* in

circumference, and produces moni beads and coral. 300 *li* east of the city lies Balai city, which produces gold..." (Wei Shou n.d.). "*Moni* beads" may be "glass beads." Therefore, Indian glass beads may have come to China during the Six Dynasties period.

In 1994, around 150,000 small glass beads were excavated from the West Gate ruins at the Northern Wei Yongning Temple in Luoyang. These were of many colors, including red, blue, yellow, green, and black. They were about 0.35 cm in diameter and "formed by cutting them from thin tubes" (Cheng Zhuhai 1981:101). These were composed of Na-Ca glass and were identified by Peter Francis, Jr., as Indo-Pacific trade beads; "we can only vaguely say that they are Indian glass beads" (An Jiayao 2000, 1:92). These beads may be the "*moni* beads" mentioned in the *Book of Wei*. Others think *moni* beads are a kind of hanging decoration. The word *moni* originates in Sanskrit and is a general term for precious pearls. The *Nirvana Sutra* says "if you throw *moni* beads into dirty water, the water will become clear." *Moni* beads are used in Buddhism and it is very likely they were introduced to China along with Buddhism during the Wei, Jin, and Southern and Northern dynasties.

GLASS BEADS OF THE SUI DYNASTY (589-618)

In 589, Sui Emperor Di defeated the Chen and unified China, ending its division under the Wei, Jin, and Southern and Northern dynasties, furthering the technology and culture of China's ethnic groups. Sui Emperor Yang built the Grand Canal, linking the North and South, and China's economy developed rapidly. Unfortunately, Emperor Yang was overly extravagant and resentment built up among the people; he died after only 37 years. The amount of glassware used during the Sui dynasty clearly increased and recent excavations of Sui tombs have discovered many examples. Most of these tombs were of the nobility, and the excavated glassware for the most part was not the traditional Pb-Ba glass. The more important objects include:

1. Kaihuang 9th year (589), Qingchan Temple, Xi'an, Shaanxi; one thin-necked glass vase (Sassanian Persia style), 10 colored beads, 13 green gaming pieces, and 4 dark blue ornaments (*Kaogu yu Wenwu* 1988, 1:62).

2. Renshou 4th year (604), Hali column base, Hui County, Shaanxi; 1 glass covered vase, 1 brick of materials, and 2 glass beads (*Kaogu* 1974, 2:126).

3. Daye 4th year (608), Li Jingxun tomb, Xi'an, Shaanxi; 1 small-mouthed glass vase, 2 egg-shaped glass objects, 1 small oval glass vase, 2 glass pestles, 1 glass covered can, 1 glass (brush) tube, 15 glass beads, and 1 remnant of a glass tube (Zhongguo Shehui 1980:22-23; *Kaogu* 1959, 9:471).

Excavated Sui glass vessels were mostly imported ones. The largest number of locally produced glass vessels was excavated from the Sui Li Jingxun tomb. Analysis of the glass covered can (box), egg-shaped object, and the tube-shaped object revealed that all had a high Pb content, were transparent green, and had shiny inner and outer walls. The two small glass cups (blue and green), neckless vase, and green oblong vase were Na-Ca glass.[54] Through an analysis of the object forms, An Jiayao (1984:424-425) believes that the Na-Ca glass excavated from the Li Jingxun tomb was produced in China. This reveals that the Pb-Ba glass composition used from the Warring States period to the Han dynasty was no longer in use by the Sui dynasty. During this time the glass made in China used a high-Pb system, as well as an Na-Ca system. According to the *Book of Wei*, the Na-Ca glass composition was introduced by the Darouzhi people, but others believe it was created by He Chou of the Sui.

GLASS BEADS AND PENDANTS OF THE TANG DYNASTY (618-907)

Sui Emperor Yang loved grandeur, neglected his army, worked his people hard, and squandered money. By the end of the Sui dynasty, armies had rebelled in all quarters and, in 618, the imperial guard commander Yu Wenhua initiated a mutiny. Emperor Yang was killed, bringing an end to the Sui dynasty. The Sui official Li Yuan grasped this opportunity to raise an army in Taiyuan and gathered men from all over China to establish a regime. He united China in 618 and founded the Tang dynasty, calling himself Emperor Gaozu. Later, in the hundred-year period from Tang Taizong, Li Shimin (Zhenguan, 627-649) to Tang Xuanzong, Li Longji (Kaiyuan, 713-741), China was at peace and the country's politics, economy, culture, and foreign relations reached a level of prosperity never seen before. The Tang had close relations with the western regions and the states in the southeast, and people and merchants from all over came to the capital, Chang'an, by the hundreds of thousands. The An Shi Rebellion broke out in 755, causing the central government to lose its prestige. The government became corrupt and levied harsh taxes on the people so that there was no way for them to make a living. The Huang Chao rebellion began in 874, to which the whole country responded. Even though the rebellion failed, the Tang court could no longer be saved. In 907, the military leader Zhu Wen usurped the Tang throne and established himself as the Liang emperor, thereby ending 289 years of Tang rule. Early Tang

government and politics were well developed, and attracted many foreign cultures. During this time arts and handicrafts developed very quickly, and trade and communication with the outside world was widespread. Much West Asian glass was imported by land, sea, and the Silk Road.

Glass beads and pendants produced in China during the Tang dynasty have been recovered from the following archaeological sites:

1. 888, Jingling, Qian County, Shaanxi; glass pendant (Wu Zhenfeng and Han Zhao 1998: Figures 111-112).

2. Hongzunyu Square tombs, Ning'an County, Heilongjiang; 31 glass beads and one tube.[55]

3. Gao Shuying tomb, Xida Yingzi village, Chaoyang, Liaoning; 1 glass bead (Zhongguo Shehui 1984, 4:451).

4. Ximing Temple ruins, Xi'an, Shaanxi; light-blue fish pendant (Archaeological Institute of Kashihara 1995: Figure 79).

5. Jia village, Shangji County, Henan; a glass pendant with three holes and 111 glass beads (*Wenwu* 1964, 2:64).

Very few descriptions of glass ornaments excavated from Tang sites have been published, but Japan's Shosoin treasure house holds a good number of them, including necklaces and stringing beads (Shimonaka 1989: Figure 18). All have been preserved intact as if new and provide important information about Tang glass ornaments. A deep-blue glass fish pendant 4.9 cm in length and 0.15 cm in thickness excavated from the Tang Ximing Temple ruins, Xi'an, Shaanxi (Archaeological Institute of Kashihara 1995: Figure 79), is an example of typical Tang glass pendants (Figure 14). The fish pendant originated from "fish tallies" – upon entering and exiting the Tang palace gates, people had to present their fish tallies. The *New Book of Tang, Record of Carts and Clothing* relates: "Those of the fifth rank and above carried silver fish bags with them to prevent against receiving false orders... in the second year of Tianshou (Wu Zetian, 691) these were changed to fish pendants... this is the origin of the official fish pendants." Later the pendants became available to ordinary people. There is a collection of Tang glass fish pendants in Japan's Shosoin.[56]

Even though Tang dress codes did not require the use of glass pendants, these must have been popular at the time. Over 100 High Tang glass pendants and paste beads were excavated at Jia village, Shangcai County, Henan, in 1962. The report calls the pendants "crescent moon decorations." A hole has been drilled through at the upper edge and they have soft white bodies which are 5.9 cm wide. The report does not mention their disposition on excavation, but they may have been used in combination with the paste beads to form pendant adornments (*Wenwu* 1964, 2:64). In 1995, a couple of flat glass pendants (Figure 15) were excavated at Xizong Jingling, Qian County, Shaanxi, that were formed in a mold. One is somewhat pentagonal in outline while the other one consists of a perforated disc. Both appear grey from heavy weathering. Such pendants appear the same as

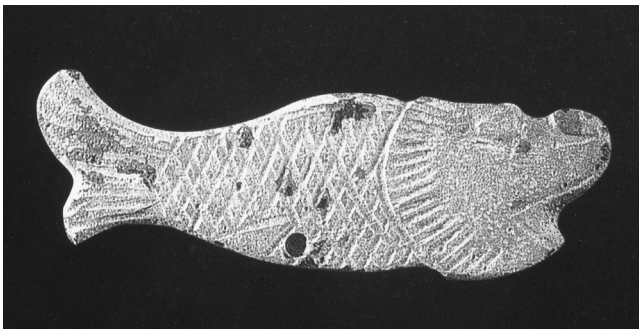

Figure 14. Fish pendant of deep-blue glass, Tang dynasty (Archaeological Institute of Kashihara 1995).

Figure 15. Glass pendants with dragon phoenix design, late Tang dynasty (Wu Zhenfeng and Han Zhao 1998).

Tang jade carvings, so they must have been carved in the same way. The pendants are from the late Tang reign of Tang Xizong (873-888) and reflect the status of the glass pendants used by late Tang nobility. The author's collection also includes a set of Tang belt buckles of light yellow glass that were carved in an animal design using a jade-carving chisel. These are in the same style as Tang jade buckles, indicating that there was a close relationship between Tang glass and jade pendants.

GLASS BEADS AND PENDANTS OF THE FIVE DYNASTIES AND SONG DYNASTY (907-1279)

A group of glass-bead adornments was recovered from a Five Dynasties Chu tomb on the outskirts of Changsha, Hunan. It consisted of 25 objects, most of which were individually used beads and not beads intended for stringing. They were of many colors, including sauce red, colorless transparent, blue, ginger yellow, peacock blue, purple blue, and black and white. There were many forms including pea-, gourd-, and girdle-shaped.[57] These beads were more varied and more colorful than those of the Tang dynasty.

A few beads have been recorded from Northern Song archaeological contexts:

1. Jiayou period 3rd year (1058), Sharira Tower Earth Palace, Dasheng, Nanfeng County, Jiangxi; 9 glass beads.[58]

2. Yuanfeng period 1st year (1078), Ganlu Temple, Zhenjiang, Jiangsu; colorless, transparent, glass stringing beads.[59]

Excavated decorative objects from the Southern Song period are very few in number and include hairpins, earrings, double-diamond-shaped decorations, and seed-shaped adornments. Beads and pendants have been recovered from the following two published sites:

1. Third Tower, Chongsheng Temple, Dali, Yunnan; several glass stringing beads, 0.2 cm in diameter.[60]

2. Huangsheng tomb, Fuzhou, Fujian; fragmentary pendant of semi-transparent brown glass (Fujian 1982:81).

It is worth noting that the fragments of the glass pendant found by the chest of the burial in the Fuzhou Huangsheng tomb "were brown and semi-transparent." According to the report, its chemical composition was "mostly Pb, Si, and As, with small amounts of Fe, Mg, Mn, Bi, Sn, Ag, Cu, Ca, and Na" (Fujian 1982:81). The composition of the pendant is clearly different from the traditional high-lead composition of the Song dynasty. The Huangsheng tomb dates to the late Song Chunyou period 3rd year (1243), revealing that the composition of late Song glass had begun to diversify and was not limited to just high-lead compositions.

During the Southern Song dynasty, the northern regions mostly fell into the hands of the Liao and Jin, and most of the objects found there were decorative glass beads. The lands of the Southern Song, which lay in the south, mostly produced small decorative glass objects such as glass earrings, bead adornments, hairpins, and pendant adornments. For these, sky blue and white were the most popular colors. Marbled glass beads (Plate VD bottom) appeared during the Song dynasty and continued into the Yuan dynasty.

The *Southern Song: Record of Clothing and Dress* states: "Now the caps of all the servants have imitation jade and green beads on them and velvet threads of five colors, unlike the two and three colors of jade traditionally worn on caps..." (*Songshi* n.d., vol. 152). It also mentions "belts, shirts, jade-like pendants, threaded imitation beads, red brocade ribbons, silver hoops..." (*Songshi* n.d., vol. 152). Apparently court dress of the Song dynasty used glass beads as decoration. Song dynasty pendant ornaments also included glass. The *Songshi: Record of Clothing and Dress* relates that "pendants incorporated false beads, and *heng* and *huang* jade pieces." These three items were components of ancient composite pendants, revealing that such were used during the Song dynasty, but unfortunately none have been excavated as yet.

GLASS BEADS AND PENDANTS OF THE LIAO AND JIN DYNASTIES (916-1234)

There is very little information about the glass beads and pendants of the Liao and Jin dynasties. Very few ornaments were used by ordinary people during the Liao dynasty, but globular pendant beads of transparent off-white and cream-yellow glass (Figure 16) were a popular form during the Liao and Yuan dynasties. After the body of the bead had been formed and the glass was still viscid, a tab of glass was pulled from it and perforated to create the suspension element. About 1.3 cm in diameter and 1.6 cm in height, these beads were found to contain a large amount of K_2O and 2.25% CaO. They were tied to cloth bags and clothing.

Glass beads and pendants were also scarce during the Jin dynasty. The pendants include several mold-pressed forms (Plate VIA) which also continued to be used during the Yuan dynasty. Archaeological reports have only mentioned the following items:

1. Aolimi ancient city, Suobin County, Heilongjiang; glass stringing beads, 1 animal-head pendant, 1 black glass oval pendant with blue painting, and 3 white glass gourd-shaped pendants (the upper end has a small iron ring attached) (*Beifang Wenwu* 1995, 2:123; *Wenwu* 1977, 4:56).

Figure 16. Transparent glass pendants, Liao dynasty (Diameter: 1.3 cm) (author's collection).

2. Yan Deyuan tomb, Datong, Shanxi; 1 small glass ring 1.9 cm in diameter and 2 strings of blue glass beads (*Wenwu* 1978, 4:1).

GLASS ADORNMENTS OF THE YUAN DYNASTY (1271-1368)

Yuan dynasty glass was used in more ways than glass from the Song or Liao and Jin dynasties. Small decorative glass objects excavated at Yuan sites include the following:

1. Wuxu Xidianzi, Donggangzi village, Hunchun, Jilin; 15 glass beads and spiral ornaments.[61]

2. Welcome Brickyard, Shiqiao, Fuyu County, Jilin; 8 flower ornaments (4 each of blue and white), 1 blue glass ingot-shaped ornament, 8 ear spools, 3 spiral ornaments, 1 dove-shaped ornament, 3 hoop ornaments, 3 melon-shaped ornaments, and 17 bead ornaments.[62]

3. Sunjiashan, Yiliang County, Yunnan, late Yuan to early Ming tomb; 22 flower-petal-shaped glass bead adornments, 2 glass tubes, and 1 glass piece.[63]

4. Daijitun M4, M7, and M9 tombs, Fuyu County, Jilin; glass flower hair adornment, 26 tube-shaped glass bead ornaments with spiral patterns, 3 semicircular glass ear spools (1 by each ear in the M7 tomb and by the right ear in the M9 tomb), 1 glass square pillar-shaped ear decoration, 3 semicircular glass beads, and 1 olive-shaped glass bead.[64]

Most of the glass ornaments excavated from Yuan tombs come from the north and none have been found south of the Yangzi River. The most popular Yuan glass ornaments were flower petals (Plate VIB top), beads, ear ornaments (Plate VIB bottom), and hairpins. Beads were mostly used individually, the most prominent of which is a spiral shaped one. Many melon-shaped glass beads have also been found from the later period (Plate VIC). Yuan glass ornaments are mostly white and light blue; other colors are fairly rare.

In 1982, the remains of a late Yuan to early Ming glassmaking workshop were discovered in Zibo city, Shandong. The archaeological report relates:

> Traces of glass furnaces were congregated close together and arranged in a fairly neat manner. There was a large furnace located at the south end of the workshop. There were 21 smaller furnaces arranged largely south to north in a line. The furnaces were anywhere from 10.8 meters apart to 1 meter apart. The shallowest furnace was 1 meter, and the deepest was 1.65 meters. The large furnace had a square base, and the small furnaces had been completely cleaned. The furnace bases were flat and either double gourd-shaped or shaped like an inverse "T." Most of the other small furnaces were buried under the walls of troughs in the ground.... By analyzing the remains of the objects left in the smaller furnaces, we know that each of the smaller furnaces mostly produced one type of product. For example, a larger number of green glass beads were excavated from L1 and more milky-white hollow glass hairpins were found at L2... (Zibo 1985, 6:531).

The large furnace served to melt the raw materials used to make glass and the smaller ones were used to produce each type of object. Based on the research of Yu Jiafang, the glassmaking process used in Yuan dynasty Zibo has passed down to modern times. An old Zibo glassworker explained:

> First saltpeter cans filled with ore were placed in these old hand-operated furnaces which were then sealed tightly. At high temperatures the ore in the cans would melt and become liquid glass. Once a certain temperature was reached, the glassworker would open one side of the furnace and use a long hook to open the lids of the cans and get rid of the material floating on the liquid glass. A metal bar (also called "material head" or "material scoop," which is a type of long-handled fire-resistant tool made of iron with a ball on the end) is dipped into the liquid glass in the cans and quickly pulled out to let the liquid glass flow onto a long metal slab lying on the ground. The glass then quickly forms a strip. While it is still soft, a glassworker stretches it to around one meter in length with iron pliers for use in the smaller furnaces (Zibo 1985, 6:531).

Based on the shape of the small traditional glass furnaces in modern Zibo as well as the remains of the glass workshop, the small Yuan glassmaking furnaces were gourd-shaped, with two larger ends and a smaller section in the middle forming a gourd shape on top. The area around the fire was closed off and the face of the furnace was flat with a hole in the middle for access to the fire. The worker would hold an iron rod with one hand and a glass strip in the other. Using the flames that came out of the hole in the furnace, the glass was softened and wrapped around the iron rod to be worked into spiral beads and stringing beads, as well as hairpins and small rings. Almost all Yuan glassware was made using this type of small furnace.

A type of melon and spiral bead was popular during the Yuan dynasty and most of these beads were used individually as ornaments and not strung together. Of many colors, they are commonly seen scattered in Yuan tombs. The Yuan Yunnan Yiliang Sunjiashan fire burial tomb group consists of a total of 91 tombs, 20 of which contained a single glass bead and two contained two glass beads.

Glass objects recently excavated from Yuan tombs have mostly been from the late Yuan dynasty. Apparently the use of glass ornaments only started to become popular during the late Yuan dynasty and developed even more during the Ming and Qing dynasties.

The chemical composition of Yuan glass clearly differs from that of the Song dynasty. Analysis of glass pieces excavated from the Yuan glassmaking workshop in Zibo revealed them to be

> different from the Chinese glass of the pre-Qin and Western Han dynasties. The clearest difference is that there is a high amount of silicon dioxide and it does not contain barium oxide. They may include lead oxide, or include it in very small amounts. Another clear characteristic is the large amount of potassium oxide. The amount of sodium oxide is close to the amount of these two and these amounts are far less than the large amount of sodium oxide found in glass from the ancient Mediterranean (*Kaogu* 1985, 3:538).

There is also a rather large amount of Al_2O_3. According to the findings of the Glass and Enamel Research Institute, Ministry of Light Industry, Shanghai, the glass that came from the workshop "had a high amount of K_2O because of the large amount of saltpeter used. The Al_2O_3 in the glass comes from the use of feldspar minerals and F comes from fluorite" (Yi Jialiang and Tu Shujin 1984:408). According to the early Qing work, *Random Notes from Mount Yan: Glass* by Sun Yanquan, "glass is made from stone mixed with niter and refined with sea stones and transformed with copper, iron, and red lead...." Niter has long been used as a raw material for making glass and the evidence from the Yuan glass workshop confirms that, as early as the Song dynasty or even earlier, the "lead, niter, and gypsum" composition mentioned by Zhao Rushi in the Song-era *History of the Various Foreign Countries* is correct and was continually used until the Yuan dynasty.

GLASS BEADS AND PENDANTS OF THE MING DYNASTY (1368-1644)

Glass was used much more widely in the Ming dynasty than in the Yuan and its main use was to produce imitation jade. This was used to create numerous items including composite imitation white-jade pendants. There were clear rules for the use of pendants and jade belts by officials during the Ming dynasty. The *Mingshi* (History of the Ming) states:

> First rank: caps have seven bridges and do not use cicada ties. Leather belts and pendants should be jade. There are two tassels and hoops. Second rank: six bridges, leather belts, tassels and hoops, ivory, and the rest are like the first rank. Third rank: five bridges; leather belts with gold; jade pendants; tassels made of green, red, and purple; crane and flower brocade; a knot below in a green silk net; two golden tassels and hoops. Fourth rank: four bridges, leather belts with gold, "imitation jade" pendants, the rest like the third rank. Fifth rank: three bridges; leather with silver inlaid flowers; "imitation jade" pendants; tassels made of yellow, green, red, and purple; circling flower brocade; a knot below in a green silk net; two silver and gold tassels and hoops (Zhang Tingyu 1739a).

Ming dynasty dress codes apparently forbade the use of jade belts and pendants for those of second rank and below. Those of fourth rank and below could only use gold buckles and imitation jade pendants. The "imitation jade" refers to glass. A complete Ming composite jade pendant can be seen in the Wanli Emperor's mausoleum and is composed of 236 jade pieces of different sizes. A large Ming imitation jade composite pendant is composed of a total of over 100 glass components (Plate VID) and may be of the type mentioned in the *Mingshi* as being worn by those of the fourth, fifth, and sixth ranks.

The reason Ming dynasty imitation jade objects were popular was probably because of the rather strict enforcement of the dress code. According to the *Mingshi*:

> The dress of ordinary people,... jewelry, hairpins, and bracelets, may not use gold, jade, pearls, or *feicui* jade, and silver is no longer used. In the [Hongwu

> period] 6th year the scarf hoops of ordinary people could not use gold, jade, agate, coral, or amber. Those who did not have a rank were treated the same as ordinary folk..." (Zhang Tingyu 1739b).

Many Ming imitation jade pendants have been passed down and this is also related to the dress code. During the Ming dynasty, jade was seen to be the most valuable material and those who were not officials or nobility could not use it. Even the first-place and successful examination candidates could not use jade with their court dress. Based on the Ming code, "the first place examination candidate has two bridges, red gauze, round collar, single scarf with brocade tassels, knee covers, gauze cap, pagoda-tree wood tablet, bright silver belt, 'imitation jade' pendant, court slippers, and wool socks – all as proclaimed by the emperor..." (Zhang Tingyu 1739c). We know that the emperor ordered that the first place candidate's pendant ornaments be made of imitation jade, consequently the quality of the material was quite high. Not only were the transparency, luster, and quality just like that of jade, especially that of jade pendants, but jade craftsmen used jade-carving tools to create the patterns. They worked the glass when it was hard into exquisite things of beauty. Ming imitation jade pendants exhibit the same designs as their genuine jade contemporaries. These include flowers and birds, cranes and deer, and people, or some other auspicious markings, with clear, crisp lines that give them the strong style associated with the Ming dynasty.

Not many Ming tombs have been excavated recently and there are even fewer glass objects found in them. Those mentioned in archaeological reports include:

1. Huishun City Hall, Changchun, Jilin; 2 glass beads and 2 glass buttons (Jinji Sun 1997, 20:707).

2. Fuyu County, Jilin; 127 glass stringing beads, 6 glass flowers, 3 glass flower rings, 5 glass buttons, and 1 glass ladder-shaped flower decoration (Jinji Sun 1997, 20:735).

3. Fangjia Street, Xiaoyang, Hailong County, Jilin; 1 batch of glass stringing beads (Jinji Sun 1997, 20:777).

4. Xizhuangzi, Tieling city, Yinzhou District, Liaoning; 142 glass pinched beads (Jinji Sun 1997, 19:388).

Other smaller Ming tombs may have contained scattered glass beads and other objects, but these are not given much notice so there are no detailed archaeological reports on them. Based on the above list, all the sites where glass beads have been found are in the Northeast, concentrated in Jilin and Liaoning provinces. This suggests that the use of bead ornaments during the Ming dynasty was in the Northeast and this may have been a custom of the Manchus. The inhabitants of the central plains and southern areas don't seem to have used bead ornaments or included them with burials. The stringing beads that came from the Northeast were mostly simple round beads of many colors and in conformity with the customs of Manchu dress. They may have been locally produced.

Zibo, Shandong, was a main production site for glass from the Yuan dynasty all the way through the Qing, but unfortunately tombs from Shandong province rarely contain glass objects. Not many Ming glass objects have been passed down to the present day, and more material needs to be excavated and chemical analyses performed before research can progress.

Sun Tingquan (1613-1674) of the late Ming/early Qing dynasties wrote in his *Random Jottings from Mount Yan: Glass*:

> The most valued of glass objects is the blue-green curtain. This is made from crystal with Mohammedan blue added and made into a strip like a chopstick. Like water flowing off ice it is wrapped like a thin curtain and transferred to redwood. Auspicious smoke slowly rises and at daybreak the shadows flee over the ground and its light resembles an imperial screen; our spirits are focused as one and combine with the darkness. They are used in altars and imperial temples and entrusted to Prison Wardens, called "state works" (*Wenwu* 1972, 10:20).

The most famous glass object of the Ming dynasty was called the "blue-green curtain" and, from Sun Tingquan's description, it was made from highly transparent crystal glass with Mohammedan blue (cobalt oxide) as a coloring agent. The glass was drawn into a long chopstick-like tube that was then cut into tubular beads.[65] Unfortunately, no Ming "blue-green curtains" have survived nor have remnants so far been found in the remains of "altars and imperial temples."

Random Jottings from Mount Yan: Glass also lists the basic techniques of glass beadmaking: "Long beads are made by coiling [winding], thin beads are poured [molded], large beads are made by coiling and breaking [likely pinching]." It also provides a quite comprehensive description of the glassmaking materials used in late Ming Yanshen town (present day Mount Bo): the raw materials of glass are stone, saltpeter, silver-rich ore, and copper, iron, and red lead. Later different amounts of "horse-tooth stone" (called "white"), "ice stones" (called "ice"), and "purple stones" (called "purple") are added to achieve different colors. Sun Tingquan states that horse-tooth stone was snowy white like frost and when cut it formed a four-sided crystallized ore (possibly feldspar). Purple stone was a shiny purple ore resembling purple quartz. Ice stone was a transparent ore with many corners. There still is no consensus as to what these stones really were.

CONCLUSION

Glassmaking began in the Tigris-Euphrates region some 2,000 years before it came to China. Western glass may have been transmitted to China as early as the early Western Zhou or late Shang dynasty. Even though Chinese people knew how to make glass throughout the Western Zhou, Han, and Tang dynasties, glass continued to be imported from the West during this period. The exact route of this "glass road" is still not clear today, but it certainly predated the Silk Road by close to a millennium. Presently the earliest glass object found within China appears to be the "white bead with hole" excavated in 1972 from the early Western Zhou tomb in Luoyang Zhuangchungou, Henan (*Wenwu* 1972, 10:20). A larger group of similar glass stringing beads was excavated from the early to mid-Western Zhou Earl of Yu tomb. These so-called glass beads were in actuality a kind of "faience." Chinese faience was mostly used to produce tube beads. This may be related to the limitations of the technology which was much inferior to that of the ancient Egyptians. China's faience production techniques in the Western Zhou period must have copied those of the Mediterranean, and also independently created a Chinese faience utilizing a fusing agent different from that used in the West. The technique used to make faience tube beads lasted for about seven centuries until the late Western Han dynasty, a time when the Sichuan and Yunnan areas still used a similar, primitive, light-green faience tube bead (*Kaogu* 1983, 9:783).

Around the late Spring and Autumn and early Warring States periods (ca. 5th century B.C.), China successfully began making genuine glass objects and produced highly transparent glass as well as very fine eye beads. Early glass eye beads were valued objects imported from Western Asia. The eye beads excavated from the late Spring and Autumn Henan Gushihou Gudui and Shanxi Taiyuan Jin state Zhao official tombs were all made of typical Na-Ca glass imported from Western Asia. Not long after this, domestic eye beads with strong Chinese characteristics appeared. The composite-eye bead designs found on beads excavated from the early Warring States Shandong Qufu Lu ancient city M52 tomb and the late Spring and Autumn to early Warring States Hunan Changsha Martyr's Park no. 3 wooden-outer-coffin tomb is different from those on eye beads from Western Asia. It appears that during the late Spring and Autumn period, the Chinese learned how to form genuine glass and copied Western Asian eye-bead concepts and production techniques to create genuine Chinese glass beads.

From the Western Zhou to Eastern Han dynasties, the main fusing agent in Chinese glass was a combination of Pb and Ba, which does not seems to have derived from the Na-Ca glass of Western Asia. The composition of faience of the Western Zhou period changed many times and was not at all uniform. Faience tube beads from the Warring States period basically used the Pb-Ba composition exclusively. Glass objects from the Warring States period were mostly eye beads, inlays, tube ornaments, ear ornaments, sword orna-ments, and funerary objects. Production techniques included pressing, molding, and drawing, and glass vessels had not yet been produced. Glass production of this period had, in principle, developed into an independent craft form. Glass was used to create new decorative items that were completely different from the style of contemporary gold, silver, jade, stone, horn, and lacquer objects.

Han glass design and production techniques saw great advances and the transparency of the glass was greater than that of previous eras. Glass products from this period were mostly ear spools, cicada mouthpieces, small ornaments, stoppers, bi-discs, and rings. Glass produced during the Eastern Han period belonged to the K-Ca glass system. This type of glass was also once found in India and Southeast Asia and its chemical composition is extremely similar to one type of dark-blue glass ear spool that was popular during the Han dynasty. The Pb-Ba system of glass was no longer produced by the late Eastern Han dynasty.

According to the *Wei shu*, during the Northern Wei period, the Darouzhi people cast glass in the capital. They not only introduced Western glass compositions, but may have introduced glassblowing techniques as well. During the Western Zhou to Eastern Han dynasties, Chinese glass had continually used a Pb-Ba composition, but by the Southern and Northern Dynasties it had, for the most part, been completely replaced by the Western Na-Ca glass composition. The pressed molding and casting methods popular during the Han dynasty gradually died out after the Eastern Han period.

The Sui dynasty continued the use of Na-Ca glass that was seen in the Wei and Jin periods. Even though the Sui dynasty only lasted 37 years, glass craftsmanship appears to have undergone extraordinary development during this period. Molds were seldom used during the Sui dynasty and casting had already died out completely by that time. The glass is mostly green with a high level of transparency. The items produced, such as egg-shaped objects, brush holders, and jars with lids, were all of a clearly Chinese style, which established the characteristics of Chinese-made glass vessels.

During the Tang dynasty, trade with other countries developed along the Silk Road which brought in much Western glass. Tang glass was mostly Na-Ca series and

highly transparent. Glass vessels were mostly colorless and transparent and other decorative objects and inlays were bright green, red, and yellow, and very finely made. This was one of the peaks in the development of Chinese glassmaking.

The glass of the Song dynasty employed highly purified red lead as a fusing agent and did not contain Ba, so it was consequently a high-lead composition. Northern Song glassmaking techniques continued the developments of the Tang dynasty and primarily produced small bottles though small bead ornaments were produced as well. After the Northern Song period, glass was used even more infrequently. Blown glass dishes were no longer made and fewer glass bead ornaments were seen. From the Northern Song period up to the present day, no Chinese-made glass vessels have been found, revealing that Song glassmaking went into decline after the Song court moved south.

A large number of imported glass objects were excavated from Liao dynasty tombs of nobles, but domestically made glass was extremely rare. By the Jin dynasty both imported and Chinese-made glass was extremely rare. According to the *Jin shi*, while ordinary people were clearly ordered to observe the rule that "dishes and eating utensil containers may not be made of... glass," Jin glass bead ornaments were commonly used by ordinary folk.

Yuan glass was also mainly used for decoration and vessels were rare. The composition of glass was not uniform, which may be related to differences in local workshops. By the end of the Yuan dynasty, glassmaking had made a comeback, as can be seen by the example of the late Yuan glassmaking workshop excavated in Zibo, Shandong. Imitation jade made of glass was popular during the Ming dynasty and used as a replacement for white-jade pendants.

Ming glass objects mostly consisted of common everyday objects like "blue-green curtains," hairpins, chess pieces, ink stones, wind chimes, handled cups, and belt buckles. A high level of craftsmanship went into the imitation jade pieces which could easily be mistaken for genuine jade, and "imitation jade" pendants were made using jade-carving tools, resulting in exquisite pieces.

Through missionaries, Qing dynasty (1644-1911) emperors imported European glassmaking techniques from the West and made glass in the imperial palace. Chinese glassmaking drew a new breath of life. Qing glass was appreciated and praised by the emperors and saw much development, becoming a new art. Produced in the heart of Beijing, it was called "Jing material." Glass was produced in other areas such as Boshan, Shandong; Guangzhou, Guangdong; and Suzhou, Jiangsu. After the Qing dynasty, Chinese glassmaking craftsmanship quickly waned and mostly focused on snuff bottles and small decorative objects.

Since 1949, over 500 tombs mentioned in publications have produced ancient glass objects and their number is limited. Based on a rough estimate, apart from eye beads, fewer than 200 types of glass objects have been excavated in China. Bead ornaments are the most numerous, followed by imitation jade pendants and funerary objects. Chinese glass was mainly used for decorative objects and Chinese people used its special characteristics of bright colors and plasticity to create many ornaments with unique styles. This is an achievement of Chinese material culture that is worthy of study and appreciation. Modern Western glassmaking has already become a form of "pure art." In comparison, China's glassmaking craftsmanship has clearly lagged behind, which we must take note of and work on developing.

ENDNOTES

1. Editor's note: In 2001, Simon Kwan published his exemplary work on *Early Chinese Glass* which presents a thorough examination of Chinese glassware from the Western Zhou (1100-771 B.C.) to Qing (A.D. 1644-1911) dynasties. As the text is in Chinese and relatively little is known about Chinese glass, this article presents a translation of the sections relevant to beads and pendants. Consequently, information about glass vessels and non-perforated ornaments is generally not included. Although it was not possible to include the massive catalog that comprises the bulk of the book, a representative sample of the beads and pendants depicted therein have been included in the article. To view all 231 entries, each of which has a brief English heading, the reader is encouraged to consult the book. It also contains two English-language articles on the chemical composition of early Chinese glasses that may be of interest to some readers.

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2. For related articles see Zhang Weiyong (1986, 2:64-69, 96), Li Suzhen and Tian Yucheng (1986, 2:70-73), and Shen Fuwei (1981, 4:275-286; 1982, 2:352-364).

3. As stated previously, glass (*boli*) appeared in China as early as the Spring and Autumn period, but the word

liuli did not appear until the Western Han dynasty. There was no uniform, definite word for "glass" before the Western Han dynasty.

4. The phrase "primitive glass" was used as early as the 1980s, as in Wang Shixiong (1986:26-30), and accepted into use (*see* Qi Dongfang 1999:23-29). Regarding the problem of the origins of Chinese glassmaking techniques, Yang Boda believes that Western Zhou faience was already glass and that the techniques could have been used as early as the Shang dynasty, but Zhang Fukang believes that Western Zhou faience cannot be called glass. "Primitive glass" is situated between the two. Even though it cannot be called glass in the modern scientific sense, it is still a stage in the development of glassmaking techniques, just like the period of developing ceramics, which is called "primitive ceramics."

5. Beijing was the site of glass production during the Qing dynasty and merchants of the time called glass made in Beijing *Jingliao* (Beijing glass). The character *liao* originated from the industrial language of the glass artisans of Boshan, Shandong. During the Qing dynasty, local and nearby minerals were used to produce glass pieces and rods in Boshan and these were semi-finished products. Glass artisans in Beijing imported these semi-finished glass pieces and rods to form glass items of all styles. Strictly speaking, the Beijing glass industry was just a processing industry.

6. The beads "were all unearthed near the head, there were many of them... light green and spherical, 0.5 cm in diameter and a hole diameter of 0.3 cm" (Zhongguo Shehui 1959b:59).

7. The faience tubes had a quality, luster, and corrosion identical to those from the tomb of Duke Yu (Yang Boda 1980:22; Zhongguo Shehui 1959c:24).

8. The report states that "*liao*" beads and glass beads were unearthed; the "*liao*" beads were light green and irregularly shaped; the glass beads were pinkish-purple and very thin (Zhongguo Shehui 1963:62).

9. White "*liao*" beads were unearthed (*Wenwu* 1972, 10:26).

10. The faience beads included rhomboid tubes and spherical beads and oval beads with spotted decoration, grayish-green; originally strung together with agate, stone, and pearl tube beads, over 1,300 pieces (*Wenwu* 1976, 4:43).

11. The three light-blue beads "had irregular shapes and holes, the wall thickness of the beads varied, they were corroded and had spots that looked like sugar, and they had extremely small grooves and air holes" (Yang Boda 1980:21).

12. Barium may have been introduced as a component of additional materials because it can have a flux effect like a base or a stabilizing effect on calcium. On the other hand, it could have been associated with ingredients containing lead. Barium can produce a certain muddiness in glass, therefore barium may have been introduced by Chinese glassmakers to create a jade-like effect (Bubeier et al. 1986:27).

13. A white glass bead was found on the disturbed soil layer of the early Western Zhou Luoyang Panjiagou M54 site and pinkish-purple glass beads were unearthed from the Western Zhou Zhangjiapo H423 site.

14. The eye beads from Spring and Autumn to early Warring States Martyr's Park tomb no. 3 in Changsha, Hunan (*Wenwu* 1959, 10:70) and the State of Lu ancient city Tomb M52 (early Warring States) in Qufu, Shandong (Shandong Sheng Wenwu 1982:178) all have Chinese characteristics but lack chemical analysis.

15. The drawing in the report is not clear and the report says, "unearthed from 3 tombs... inner body is white, exterior painted with colored material, some engraved with floral patterns and have soft textures." Based on the decoration shown in the report and the description, these must be faience beads with lattice patterns (*Zhongyuan Wenwu* 1997, 3:21).

16. "The body is pillar-shaped... green glaze applied to the exterior, pierced with a small hole. Located by the skeleton's neck at the time of excavation, it was a hanging decoration used at the time" (*Kaogu Xuebao* 1957, 3:86, Fig. 14:10-11).

17. "Bluish-green, not transparent... 2.2 cm long, 0.2 cm hole diameter." From their luster and size, we know that faience tubes and beads were still used in the Sichuan region (*Wenwu* 1974, 5:66).

18. Five tubes and beads were unearthed from Dongsunba boat-casket tombs M5, M10, M49, and M50, of which "two were bluish-green... had holes that were large at one end and small on the other, 2.4 cm and 1.6 cm long respectively, with roughly 0.6 cm diameters" (*Kaogu Xuebao* 1958, 2:93).

19. "Pinkish-green, one of the tubes had protruding rings on each end and its center was covered in a protruding dot pattern" (*Kaogu* 1983, 9:783).

20. The blue and white circular patterns should be the dragonfly-eye decorations often seen during the Warring States period, but the report also says: "the etched-pattern *liuli* beads developed from etched stone beads; the eye patterns from the etched stone beads were used on the etched *liuli* beads and brought from India and Pakistan. Extremely few etched stone beads and etched *liuli* beads have been unearthed in China; most of them have come from the Southwest and Xinjiang, and they are even less common within Jiangxi." The dragonfly-eye beads we know of now are not concentrated in the Southwest and Xinjiang, so it cannot be determined whether this report refers to dragonfly-eye beads or etched beads (*Nanfang Wenwu* 1993, 4:16).

21. Sixteen eye beads were unearthed from sites M1, M6, and M7 (late Warring States period) in Pingliang, Gansu. The beads were already fragmented and 2.2 cm in diameter and 0.5-0.7 cm thick (*Kaogu yu Wenwu* 1982, 5:2).

22. Locations where eye beads of the late Warring States period have been unearthed in Xianyang, Shaanxi, include the Xianyang petroleum plant (*Kaogu yu Wenwu* 1996, 5:4), Huangjiagou (*Kaogu yu Wenwu* 1982, 6:12), and Taerpo (Xianyang 1998:176).

23. An eye bead was recovered from the M13 tomb (late Warring States period) in Qingchuan, Sichuan (*Wenwu* 1982, 1:12).

24. An eye bead was recovered from the late Warring States tomb at Jinjing, Wulian, Qianwei County, Sichuan (*Kaogu* 1983, 9:783).

25. An eye bead was recovered from Tomb M1 (late Warring States period) at Beilingsongshan, Zhaoqing city, Guangdong (*Wenwu* 1974, 11:76).

26. Nine eye beads from the Qin to early Han dynasties were unearthed in Shan County, Henan (Zhongguo Shehui 1994:153).

27. A total of 16 eye beads were unearthed from the Yuan family M6 Qin tomb at Qin'an, Gansu (*Kaogu Xuebao* 1997, 1:68).

28. One eye bead was unearthed at Mianyang, Sichuan (*Kaogu yu Wenwu* 1986, 2:20).

29. Two western Han "etched beads" (dragonfly-eye beads) were excavated in Chongqing, Nan'an District, Sichuan (*Wenwu* 1982, 7:29).

30. The oblong glass beads recovered from the early and middle Western Han tombs at Shizhaishan, Jinning County, Yunnan, "were dark blue and had six light blue spots inlaid in their surfaces" (Yunnan 1959:126). These must be eye beads.

31. A single eye bead came from Tomb M1048 (early Western Han dynasty) at Huanghuagang, Xianlie Road, Guangzhou (Guangzhou 1981:165). Others were recovered from the King of Southern Yue tomb of the early and middle Western Han dynasty (Guangzhou 1991:133-134).

32. According to the report, this "glazed pottery bead" was "grayish-white, spherical, and had a small hole running through it. It had a sunken rolling-cloud pattern in its surface. Remnants of a low-temperature sky-blue and light-green glaze can be seen in some of the patterns (like the shallow sunken grooves). It was 1.2 cm in diameter with a hole 0.2 cm in diameter" (*Jianghan Kaogu* 1986, 2:48). This must be an eye bead with a pottery body.

33. Both mirrors are fragmentary, "they have basically the same form, size, and decoration... decorated with 18 inlaid glass beads... diameter 14.5 cm, thickness 0.6 cm" (*Wenwu* 1999, 8:9, 32:5, Figure 1:1-2)

34. According to An Jiayao (2000:21), in the latest analysis of the three other eye beads from the tomb of Marquis Yi of Zeng, "the results still have not been officially published, but the analyst, Senior Engineer Shi Meiguang, told me that these three samples are all ordinary sodium-calcium glass and contain no lead or barium. He suspects the 2.8% lead oxide contained in the first sample may have come from contamination of the glass surface."

35. In ancient times the word for medicine referred to various chemicals as well.

36. The pottery-bodied eye beads from Erligang, Zhengzhou, underwent three tests; their "surfaces were brown-black glass" and they contained 2.70% Na_2O and 3.33% CaO (Zhang Fukang et al. 1986:71).

37. Fan Shimin and Zhou Baozhong (1983:104) report that x-ray fluorescence analysis of the "inlaid color glass beads" revealed Si++, K++, Ca++, Pb+++, Ba+++, Fe+, Cu+; other components include Sr+, Gd+, Ga+.

38. The tubes are 7.2 cm long, 0.8 cm in diameter, and have a hole 0.5 cm in diameter (Hubei Sheng Jingzhou 1985:92).

39. The tube is 2 cm in diameter with a hole 0.65 cm in diameter (*Jianghan Kaogu* 1988, 3:32).

40. The tube is 3.0 cm long and 1.1 cm in diameter with a hole 0.5 cm in diameter (Gao Zhixi 1995:55).

41. The stringing beads included 77 that were "round or oblong in shape, dark green, vertical holes, diameter of 0.4 cm, found on a copper mirror," 17 that were "oblong, opaque black, vertical holes, diameter of 0.2 cm, located in the center of the coffin," and 17 that were "oblong, white or blue, vertical holes, diameter of 0.2 cm, located at the center of the coffin" (Guangzhou 1981:165).

42. The beads appear to have been attached to a garment: "the glass beads on the breast of the jade coat were already scattered and a small number could be seen to be arranged as if strung.... some of the aforementioned beaded garment decorations had traces of silk at their bottoms and they were originally sewn onto the fabric" (Guangzhou 1991:133-134).

43. "Shaped like abacus beads, different sizes, the large ones had diameters of 4 mm and thicknesses of 3 mm; the small ones had diameters of 3 mm and thicknesses of 2 mm; opaque dark blue" (*Hunan Kaogu Jikan* 1989, 5:118).

44. The beads are of "two types: 1) transparent, dark blue, light blue, light green, moon white, dark green, light green, lake green, white, and a few light yellow ones. Round, oblong, oval, tube-shaped, long hexagonal, long square, and flat jug shaped. Included is one white melon-shaped bead with six lobes and a gilt surface. 2) opaque, mostly brick red, yellow, green, and some black. Apart from some rhomboid specimens, the rest are all round or oblong" (Guangzhou 1991:292).

45. The beads are "bead or ring shaped, holes in the center, more or less the same size. The large ones are bead shaped with floral patterns on their sides; the small ones are flat ring shapes. All are white" (*Kaogu Xuebao* 1959, 2:84-85).

46. Bead cores "are light green, exteriors are dark green, both sides are slightly flat, and there are small round holes in their centers" (*Kaogu Xuebao* 1957, 1:161).

47. Of the beads, "3 are light green, transparent, large in the middle, small at the ends, with twelve or eight sides, 0.8-1.0 cm diameter.... 122 are bead shaped, oblong, cylindrical, or flat jug shaped... brightly colored dark blue and light blue. Most are transparent, some are semi-transparent. Diameter: 0.4-1.5 cm" (*Kaogu Xuebao* 1984, 1:108).

48. "Found within the right (female) coffin... one oblong black glass bead, three light black-green, two round... also, many scattered glass beads in front of two (male and female) coffins, totaling 1,965 beads, dark blue, light blue, and green" (Guangzhou 1981:352; *Kaogu Xuebao* 1957, 1:152).

49. "Some green and coffee colored, only one pink one, four are carved into fish, flower-basket, and melon shapes" (*Kaogu* 1995, 3:283).

50. "54 purple oblong, 27 yellow-white oblong, 20 olive-shaped that are light yellow with white stripes, length 1.1 cm, diameter 0.7 cm; 13 agate beads with dark brown stripes, holes drilled in both ends but do not connect; 2 white heart-shaped jade beads. Scattered at time of excavation" (Guangzhou 1981:454).

51. These are components of a beaded coat. The report says "some of the aforementioned beaded coat decorations [glass beads, glass shells, and gold, copper, and silver bulbs] have traces of silk at their bottoms and were originally sewn onto the fabric" (Guangzhou 1991:213).

52. [Editor's note] While technically not beads, because many ear spools were perforated and some were actually adorned with beads, they are included here.

53. *Poli* in literary Sanskrit is *pozhijia* or *popozhijia*. The 7th-century *Yiqie jing yinyi* (Phonetic and Semantic Dictionary for all Sutras) (Hui Lin n.d., vol. 24) explanation of *Apidamo jushe lun* (Abhidharma Storehouse Treatise), vol. 11, has *pozhijia*, "also called *popozhijia* (*spatika*), the name of a treasure in Western countries. In the past what was called *poli* was an error and omission in the transliteration." The common pronunciation of *poli* or *popozhijia* was *phaliha*.

54. X-ray fluorescence analysis revealed that lead was a major element in the glass jar (box) while the little cup and vase did not contain lead. The jar, vase, and little cup all contained potassium and calcium. Even though analysis did not reveal their sodium content, we can be sure that the vase and little cup were not high-lead glass made in China and must be from a Na-Ca system (An Jiayao 1984:424-425, 456; Qi Dongfang 1998:126, 127).

55. The glass beads include 1 gear-shaped green bead, 2 white connecting beads, 5 yellow beads, 2 black beads, 2 blue beads, 15 dark blue beads, and 1 yellow tube (*Kaogu* 1997, 2:15).

56. There are yellow, green, blue, and colorless transparent fish pendants; the yellow and green ones are made of lead glass and the blue ones are Na-Ca glass (Shimonaka 1989: Figure 59).

57. A total of 27 beads were uncovered at tomb no. 125 outside Changsha City, Hunan. "Apart from orange-red shuttle-shaped agate beads and brownish-red amber beads, the rest were all *liuli* beads that were pea-shaped stringing beads and single beads. The single beads included two brownish-red, six colorless transparent, and one ordinary blue. The stringing beads included nine colorless transparent, one ginger yellow, two peacock blue, one alternating black and white in a watermelon pattern, one dark blue, and one long ordinary blue with a tapered midsection" (*Kaogu* 1966, 3:164).

58. Of the beads, "seven were green and round but not very regular... the largest was 2 cm in diameter and the smallest was 1.4 cm in diameter; one was iron-gray and shaped like a screw; one was white and had powder stuck to its surface, round, 3 cm in diameter" (*Jiangxi Wenwu* 1989, 2:31).

59. The stringing beads "were colorless and transparent, had diameters ranging from 1.2-1.5 cm, had holes through them, and were prayer beads" (*Kaogu* 1961, 6:312).

60. The glass beads "were mostly round and oblong, there were also some oval, ring, square, and flower shapes. They were black, dark blue, light blue, green, brown, tea colored, emerald green, light yellow, and white. One of the square-shaped beads was multi-colored" (*Kaogu Xuebao* 1981, 2:259).

61. "Most of type I were round and had a small hole through their center. They were black, white, or blue and transparent or opaque. Type II were spiral-shaped, had holes through their centers, were blue or white, and were all transparent. Type III were white, opaque, irregular-shaped, and had holes through their centers" (Jinji Sun et al. 1997, 20:838).

62. The floral decorations "were flat and oval-shaped, there were four of each of blue and white, four were petal-shaped with two needle holes in their center; 2.7 cm long, 2.3 cm wide." The one ingot-shaped decoration "was flat, had a tapered waist, and was blue and transparent. A floral pattern was carved in relief on one side, the other side was flat. Both ends had needle holes. 3.7 cm long, waist 1.5 cm wide." There were two types of ear spools. The three screw-shaped decorations "had round pillar bodies, were carved with screw patterns, and there was one each of blue, green, and brown; 0.5-0.9 cm long." The one dove-shaped decoration "was flat, white and semi-transparent, had a hole through the top and bottom, rhomboid patterns carved in both wings; 2.5 cm long." The bead decorations "were semi-circular or olive-shaped, some were transparent, there were also some that were white, brown, and sky blue... 0.7-1.4 cm long, 1.0-1.6 cm in diameter" (*Wenwu* 1995, 4:42).

63. The beads "were mostly petal-shaped. M33: 1, white... 1.6 cm long, 2.3 cm in diameter." The tubes "had a hole through the middle. M80: 1, blue, 2.1 cm long, 1 cm in diameter" (*Kaogu* 1993, 11:1018).

64. The floral decoration from M4 was found "by the head. Flat oval-shaped, blue, four-petal shapes, two needle holes in the middle; 2.7 cm long, 2.3 cm wide." The bead decorations from M4 "were scattered around the neck. Round pillar bodies, carved with screw patterns, light blue... 0.6 cm long." The ear spools unearthed from M7 "were found one by each ear. Semi-circular, black, one large and one small, all connected to small rings. 1.3-1.6 cm long." The ear decoration from M9 "was located by the right ear. Colorless, semi-transparent, nearly square pillar shaped, narrow at the top and wide at the bottom, hole through the top. 1.8 cm long." The beads from M9 "were located under the neck. One was olive-shaped, colorless and semi-transparent, hole through the middle, 1.7 cm long; three were semi-circular, one white and two green, all with holes through the middle, 0.4-0.6 cm long" (*Wenwu* 1996, 11:69-75).

65. [Editor's note] This is not the only interpretation. Valerie Hector (2013: pers. comm.) has carefully reviewed the Chinese text and concludes that the curtain was, in fact, composed of glass strips or rods that were connected by twining.

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CHINESE BEAD CURTAINS, PAST AND PRESENT

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Relatively little is known about how beads were combined to form larger structures in China. To address this situation, this paper focuses on Chinese bead curtains. Adopting an approach that is broad rather than deep and empirical rather than theoretical, it collates evidence from the textual, material, oral, and pictorial records to consider bead curtains from various perspectives. To begin, this study defines bead curtains as textiles, door and window ornaments, screens, and types of beadwork. It then discusses bead curtains of the imperial era (221 B.C.-A.D. 1911) as they are referenced in the Chinese textual record from the 4th century on. A discussion of bead curtains of the post-imperial era (1912-present) follows, offering a small database of 20th- and 21st-centuries examples composed of organic and inorganic bead materials. While contemporary, commercially-produced Chinese bead curtains are mentioned in passing, they are not the focus of this article. Nor are bead-embellished valances addressed. As further research is undertaken, it should be possible to refine or revise the information offered here.

INTRODUCTION

Bead curtains have been made in many cultures. Structurally they tend to be similar, typically consisting of two elements: a horizontal board, bar, or rope at the top which supports a panel of beads below. In rare cases, the beaded panel consists in part or whole of netted, twined, woven, or knotted beads. Such a panel may be thought of as a textile, properly speaking. More commonly, especially in China, the beaded panel consists of parallel vertical strands of beads strung on long threads secured at the top but not at the bottom. Such multi-strand bead curtains are challenging to classify. Not textiles *per se*, they are textile-like, first, because the beads are usually strung on string, rope, or monofilament line and, second, because the strands can be likened to tassels or fringes,[1] well-known textile structures. Multi-strand bead curtains also resemble textiles in their ambiguous spatiality, appearing in a flat or 2-dimensional format one day (Figure 1) and in a curving 3-dimensional format the next (Figure 2). Finally, like most textiles, bead curtains are not self-supporting. They are generally affixed to architectural structures, often to the frames of doors or windows, where they serve several purposes simultaneously. They embellish openings in the facade of a building, especially doorways and, to a lesser extent, windows. Usually, the bead curtain spans the height of the opening or most of it. Bead curtains also accentuate boundaries, distinguishing public and private realms or defining interior spaces.

In China, the bead curtains that hang in doorways belong to a broader category of door- and window-frame ornaments. While some of these are talismanic, part of a cultural system of attracting positive and repelling negative influences, it is not clear that bead curtains can be called talismanic. There is no question, however, that in China as elsewhere bead curtains serve other purposes, such as deflecting flying insects and promoting ventilation, especially in the warmer months. In North China, residential door and window bead curtains tend to be displayed seasonally, generally from April to October. In the winter they are usually taken down and stored. There are some exceptions; shops and restaurants sometimes keep them up all year. The bead curtains that hang in interior spaces may also be kept up year round.

Bead curtains also belong to the category of the "screen," an ancient type of object in China which can be thought of as "a framework whose basic function is to distinguish space" (Wu 1996:10). Like many screens of wood, stone, or cloth, bead curtains generally function as portable space dividers capable of bearing images, geometric designs, or calligraphic inscriptions. But bead curtains are particular kinds of screens. Unlike the canonical screens of Chinese art history, which often hide from sight that which lies beyond them, bead curtains, being diaphanous in nature, simultaneously inhibit and permit sight, depending on how the beads are united and from what vantage point they are viewed. Multi-strand bead curtains are unique in other ways – they are permeable, permitting a body to pass through them. They are also kinetic, moving with the slightest breeze or the passage of a body, like lightweight cloth screen panels move. Yet, from the perspective of the human body, walking through a screen made of cloth panels is qualitatively

Figure 1. Plastic bead curtain in the courtyard of the 18 Tea Garden restaurant, Beijing, 2011 (photo: Valerie Hector).

Figure 2. Green plastic bead curtain tied in the center in the doorway of a tea shop in Qufu, Shandong province, 2012 (photo: Valerie Hector).

different from walking through a screen made of multiple strands of beads. The difference manifests itself not only at the tactile but the aural, visual, and temporal levels as well; it is a singular and profoundly sensuous experience, imparted by the fluidity of the moving strands.

While painted wooden screens surface in the Chinese archaeological record by the 2nd century B.C. (Wu 1996: Figure 5), we have no material evidence of bead curtains before the 20th century, though the beaded strands attached to the crowns worn for centuries by members of the Chinese imperial family and high ranking civil officials may be thought of as small beaded screens. These "crowns with suspended tassels" (*mian guan chui liu*) were worn on ceremonial occasions to screen illustrious faces from direct frontal view, shielding the wearers' eyes and facial expressions. While they provided wearers a separate semi-private space, the tassels also served as mnemonic devices, reminding wearers to focus their eyes forward in a dignified manner (Gao 2001:196).

Instructions for making *mian guan chui liu* appear in the *Rites of Zhou* (*Zhou Li*), a text that may date to the 3rd century B.C. (Gao 2001:196). Tassel quantity and length combined with bead material and color to symbolize social rank. Regulations changed over time. Emperors of the Han dynasty (206 B.C.-A.D. 220) were allotted 12 tassels made of white jade beads at the front and back, while members of the royal family, high officers, low officers, and scholars wore 9, 7, 5, and 3 tassels, respectively. In China, jade and other hard, precious materials were thought to confer longevity upon the body during life and to protect or otherwise benefit the body after death. In the Tang dynasty, *mian guan chui liu* featured beads made of jade, emerald, coral, agate, and purple quartz (Gao 2001:196).

The earliest depiction of a *mian guan chui liu*, a drawing from a tomb in Shandong province dating to the Eastern Han dynasty (25-220), shows a scholar wearing one with three tassels (Gao 2001:197). More *mian guan chui liu* are visible in the *Thirteen Emperors Scroll* attributed to Tang dynasty (618-907) painter Yan Liben (601-673) (Gao 2001:197). An actual example with nine tassels suspended from a framework of lacquered cane survives from the early Ming dynasty (1368-1644) tomb of Prince Zhu Tan, King Huang of Lu (died 1389) in Shandong province (Yang 2006:40, Figure 1; Gao 2001: Figure 427). *Mian guan chui liu* fell out of use at the end of the Ming dynasty, terminating a 1,500-year custom of systematically using beaded tassels as wearable screening devices encoding status and rank.

Bead curtains may also be seen as examples of Chinese beadwork, loosely defined as objects for use or wear, embellished with or composed of beads. Much has been written about the ancient history of beads in China (An 2006; Dubin 2009; Francis 1986, 1990, 2002; Han Han 1998; Hong-En Jiang et. al. 2008; Hui Li 2008; Kwan 2001; Liu 1975a-b, 1995; Rawson 2008; Zhang 2008; Zhu 2010) which goes back to at least 16,000 B.C. (Dubin 2009:58), but the subject is far from exhausted. As noted above, little is known about how the Chinese combined beads to create larger structures. Suffice it to say that the list is extensive, the objects diverse. Only a few will be mentioned here, focusing first on multi-strand structures and then on structures featuring other techniques.

Centuries before bead-tasseled crowns entered the written record, male and female nobles of the Western Zhou era (ca. 1046-771 B.C.) were buried with pectorals, and wrist and waist ornaments made of linked and/or tasseled beads and pendants of jade, agate, shell, serpentine, faience, and glass (Gao 2001:707-717; Gu 2007:146-147; Kwan 2001:32). One of the earliest such ornaments, found in tomb 6214 at the Tianma-Qucun site in present-day Shanxi province has 10 strands made of carnelian and shell beads suspended from a jade plaque. It dates to the 10th century B.C. (Rawson 2008: Figure 2).

The ornaments also took the form of knotted bead nets (Zhang Runping 2007: Figure 91). Like the crowns just discussed, these objects "were partners in a complex ritual display of rank and wealth" (Rawson 2008:3), emblematic of trading networks connecting Han Chinese peoples to the larger world (Rawson 2008:9ff.). Evidence of another type of multi-strand structure, called a "jade bead mattress, comforter, or quilt" (*yuzhuru*), was found in a Western Han (206 B.C.-A.D. 24) tomb in Yunnan province, long the home of minority or non-Han peoples. The object reportedly served, by itself or in combination with other materials, as a "corpse curtain" (*shiti de shilian*) (Gu 2007: 270).[2] Measuring 150 cm x 80 cm, roughly the size of a small human body, the object, as reconstructed, is composed of several dozen vertical strands of tiny jade cylinder beads united at regular intervals by thin horizontal strips of longer jade cylinder beads united in a ladder stitch. In short, it seems to be the case that Chinese peoples of Han and minority heritage have been making multi-strand bead ornaments for at least 2,000 years.

Evidence of bead embroidery and knotted bead netting also appear by the Western Zhou dynasty if not earlier. Funerary face covers of the era were made of jade and hard-stone plaques apparently stitched to cloth panels so as to depict the features of a face (Wang Tao and Liu Yu 1997). Garments were also embellished with beads or bead-like elements. In 1977, the remains of a "glass garment" were recovered from a Western Han tomb in Yangzhou, Jiangsu province (Cheng and Zhou 1991). How the 600

small, perforated glass plaques were united to form the garment is not known; they too could have been stitched to a fabric ground. Samples of complex bead netting in China apparently do not appear intact until the late Southern Song dynasty (1127-1279), when a woman was buried in Jiangxi province with a tiny scent bag-cum-hair ornament made of seed pearls united in octagon stitch (pers. obs.; cf. Zhou et al. 1992: Figure 3). Right angle stitch seems to have developed by the Ming dynasty (1368-1644) as an inscribed panel thought to have been made in China demonstrates (cf. Blair 1973: Figure 131). Hexagon stitch was also apparently known in China by this time, judging by an enormous lantern composed of 1.5 million glass beads. Housed at the Nanzenji Temple in Kyoto, the lantern is thought to have originated in China. Beadwork continued to develop during the Qing dynasty. To cite one example of many, Emperor Qianlong possessed a suit of armor made of 600,000 tiny steel platelets united to form a dense beaded ground depicting dragon and cloud motifs (Gong Yan 1985; Hector 2005:22).

The foregoing are but a few highlights of Chinese beadwork history. A complete study would fill several volumes.

BEAD CURTAINS OF THE IMPERIAL ERA (221 B.C.-A.D. 1911)

Textual References

In China, research often begins with the textual record, especially with respect to objects such as bead curtains. While examples from past centuries may not survive, references to them do. The first to study the topic in depth was Meng Hui who published three articles which cite references to bead curtains in approximately 40 poems, histories, and essays dating from the Eastern Jin (317-420) to the Qing (1644-1911) dynasties (Meng 2003, 2004, 2009). Bead historian Zhu Xiaoli (2010:233) follows suit, citing 10 additional references to bead curtains in texts of the Song dynasty (960-1279) alone. References to bead curtains may also be found in Chinese literary encyclopedias which define words by citing examples of usage in poems, histories, essays, and other texts. For instance, the *Great Chinese Word Dictionary* (*Hanyu dacidian*) contains approximately 17 references to bead and crystal curtains spanning a time frame similar to Meng's (Luo 2001:549-554). The *Encyclopedic Dictionary of the Chinese Language* (*Zhongwen dacidian*) provides 19 references (Zhang Qiyun et al. 1985:444-450).[3] Together, these six secondary sources comprise approximately 86 references. After eliminating duplicates, we come up with approximately 76 references. What percentage of the total number of references to bead curtains in Chinese texts from the 4th to 20th centuries these 76 represent is difficult to estimate without further research.

Twenty of the references are cited in the following paragraphs. Setting aside literary genres, poems, histories, and essays are given equal consideration, the better to focus on the early associations of bead curtains, as well as their venues of display, their material, visual, kinetic, and aural qualities, and, finally, their mnemonic potential. Time frames are disregarded for the most part and all references are treated without regard to when they were written. A more detailed study might show that the references increase in some centuries, or follow distinct trends in others. The relationship of these references to actual bead curtains is unknown. That figurative language is often involved, and descriptions of bead curtains tend to be imagined or remembered rather than factual, makes reconstruction difficult. Nevertheless, the references portray attitudes, beliefs, and customs. Admittedly the portrayals are biased; they give us bead curtains as perceived by members of the educated literate elite, since members of the lower social orders were generally illiterate.

Before proceeding, a few words about the Chinese term for "bead." *Zhu* is ambiguous; it means both "bead" and "pearl." Only when *zhen* ("real," "true") precedes *zhu* can we be reasonably sure that "pearl" is meant. *Zhu* also functions as an adjective meaning "beaded" or "pearl-embellished" on the one hand, or "exceptionally fine" on the other. Thus, a "pearl" or "bead" curtain might refer to an actual pearl or bead curtain, or to an exceptionally beautiful curtain that is not necessarily beaded. For purposes of disambiguation, in the excerpts below, *zhu* is translated as "bead," and *zhen zhu* as "pearl." Terms in braces have been checked against the primary texts, and where the primary and secondary texts differ, the primary text is followed. Information in brackets, apart from titles of books or poems, was supplied largely by Jeff Keller and Chyi Chung.

Early Associations

One of the earliest firmly dated accounts of a bead curtain was written by Wang Jia (d. 390) of the Jin dynasty (265-420). A writer of "stories of strange events" (*zhiguai*), some of which are vaguely historical in nature (Theobald 2010), Wang associates bead curtains with ancient emperors, opulent interiors, and beautiful, secluded women. In this account, two imperial concubines are secluded behind a bead curtain:

> Yue had two beauties, one who was named Yiguang, and another Xiuming, and they were presented

> to [Emperor] Wu. Wu placed them in the royal concubines' residence, and strung up a curtain {*lian huang*} of fine beads behind which they hid during the day and admired the moon at night. The two would come inside and sat down, making themselves up in front of a mirror behind the bead curtain. All who caught a glance of them were affected, and all called them goddesses (Zhang Qiyun et al. 1985:448 [under *zhu bo*], citing *Record of Omissions: King Ling of Zhou* [*Shiyiji: Zhoulingwang*] by Wang Jia; cf. Meng 2004:107).

Bead curtains often screen women who, in keeping with traditional Confucian values, are appropriately ensconced in the inner quarters of a home (Ebrey 1993:23ff.), but nevertheless look wistfully outward while awaiting the return of husbands or lovers. In this poem, a woman momentarily toys with the boundaries of propriety: "The imperial bodyguard armed with a halberd protected the hall, the multitudes admired the heavenly music. A beauty in the tower leaned and watched, passing her exquisiteness through the crystal curtain {*shui jing lian*}" (Meng 2003:101, citing "Palace Poetry" [*Gongci*] by Ma Feng [flourished ca. 804] of the Tang dynasty).

On occasion, solitude leads to resentment: "The beauty rolled down the bead curtain {*zhu lian*} and sat, furrowing her brows" (Zhang Qiyun et al. 1985:449 [under *zhu lian*], citing "Resentful Feelings" [*Yuanqing*] by Li Bai [701-762] of the Tang dynasty).

Some writers, like this 5th-6th-centuries poet, underscored the fact that wealthy wives had little to do: "The eldest wife dusted her jade box, the middle wife tied up the bead curtain {*zhu wei*}, and the youngest wife, with nothing to do, tidied her eyebrows in the mirror" (Luo Zhufeng 2001:549 [under *zhu wei*], citing "Poem on Three Wives' Beauty" [*Sanfuyanshi*] by Shen Yue [441-513] of the Southern and Northern Dynasties [420-589]).

Venues

Other writers did not mention beautiful women. Instead, they emphasized the luxuriousness of the settings in which bead curtains were hung. In this 7th-century history, bead curtains appear in palaces: "Shi Hu [295-349] built the Taiwu Palace in Xiang and the East and West Palaces in Ye... both had lacquered tiles, gold dishes, silver rafters, gold pillars, bead curtains {*zhu lian*}, and jade discs, all made with the finest craftsmanship" (Meng 2004:108, citing *Book of Jin: Unofficial History of Shi Jilong* [*Jinshu: Shi Jilong Zaiji*], edited by Fang Xuanling [579-648] et al. of the Tang dynasty [618-906]).

Venues considered appropriate for bead curtains included imperial temples: "The emperor built a spirit hall... with a curtain {*bo*} made of white beads hung from a tortoise-shell support" (Meng 2004:107, citing *Stories of Han Emperor Wu* [*Han Wu gushi*], traditionally attributed to Ban Gu [32-92] but may have been compiled during the Eastern Jin [317-420] or Southern and Northern dynasties [420-589]).

Bead curtains were also displayed in temple gate towers, according to this Song dynasty (960-1279) text:

> Shisun lies outside the west gate of the Yamen where two tree stumps remain, and it is called the Pearl Tower Base. Barbarians had erected the Daqin Temple here, which had ten gate towers that each had its own curtain {*lian*} made of pearls {*zhen zhu*} and green jade {*cui bi*}. The temple was destroyed and now every time it rains at its base rare objects like pearls, precious blue stones, and gold and jade can be found (Meng 2004:111, citing *Stories of the Shu Capital* [*Shudu gushi*] by Zhao Qingxian of the Song dynasty [960-1279]).

In such passages, exactly where bead curtains were hung – whether in doors, windows, or interior areas – is often left to the reader's imagination; it is the evocative presence of bead curtains rather than their precise location that seems to matter. In one 12th-century text, however, a precise location is specified: "I looked up and saw green buildings and magnificent towers, and doorways decorated with bead curtains {*zhu lian*}" (Zhu 2010:233, citing *Record of Dreams of Former Glory in the Eastern Capital* [*Dongjing Menghua Lu*] by Meng Yue [b. 1103] of the Song dynasty [960-1279]).

Bead Materials

Bead materials are not always specified in textual references to bead and crystal curtains. Pearls, jade, and white beads have already been mentioned in the texts excerpted above. Multiple curtains made of real pearls are reported in a 9th-century text: "Ever since Princess Tongchang came down her residence was in Guanghua, and in its halls were placed pearl curtains {*zhu zhang*} made from real strings of pearls" (Zhang Qiyun et al. 1985:446 [under *zhu zhang*], citing *Duyangzabian* [*Random Writings from Duyang*] by Su E [flourished ca. 890] of the Tang dynasty [618-906]).

Glass is sometimes named. The word *liuli* seems to appear more frequently than its counterpart, *boli*. Both mean "glass."[4] The transparency and reflectivity of glass are frequent themes: "[The people of] Wu skillfully made

tinkling-jade... weaving a sea of silver with ten thousand strands" (Meng 2003:99, citing "Ode to a Liuli Curtain" [*Yong liuli lian*] by Ma Zuchang [1279-1338] of the Yuan dynasty [1271-1368]).

Occasionally, colors are noted: "A tortoise-shell tower was built on the city gate that was decorated solely with gold and silver, a 5-colored bead curtain {*wu se zhu lian*}, and white jade hooks..." (Meng 2004:110, citing *Spring and Autumn Annals of the Sixteen Kingdoms: Later Zhao: Shi Hu* [*Shiliuguo Chunqiu: Hou Zhao lu, Shihu*] compiled 501-522 by Cui Hong of the Southern and Northern dynasties [420-589]).

In some cases, *liuli* curtains, apparently made of glass strips instead of glass beads, are monochrome and blue (or blue-green) in color, or so we are told in *Random Jottings of Mt. Yan*, a memoir written in 1665 by Sun Tingquan (1613-1674) of the late Ming to early Qing dynasties:

> A blue curtain {*qing lian*} was probably the most expensive and noble kind of glass {*liuli*} product. Blend a certain amount of crystal with Mohammedan blue [cobalt]. Make the mixture into strips shaped like chopsticks {*ru zhu si tiao*}, as sparkling as ice. Weave into curtains {*wei wei huang bo*} and apply them to the vermilion window lattice {*fu yu zhu ling*} (Sun [1665]; cf. Meng 2003:104 and Zhang Weiyong 2008:279).

Visual Qualities

Other visual characteristics were also described. An unspecified light source may create reflections within or around beads. Or a particular light source may play across the surface of a curtain, producing other visual effects: "The candle flame dances in the bead curtain {*zhu lian*}, moonlight floats on the bright columns" (Meng 2003:101, citing "Four Poems on a Winter's Night" [*Dongxiao gewei siyun*] by Li Shimin [599-649], personal name of Emperor Taizong of the Tang dynasty [618-907]).

Shadows also attract attention: "The cold moon fills the quiet inner rooms, the shadow of a parasol tree falls on a pearl curtain {*zhu lian*}. Hands first feel the arrival of autumn frost, the tailor's scissors are cold in the lamplight" (Meng 2003:103, citing "Lament on Empty Inner Chambers" [*Kongguiyuan*] by Bai Juyi [772-846] of the Tang dynasty).

Wafting incense smoke creates other effects, activating the senses of sight and smell: "Repeatedly adding incense to the jade burner, light smoky lines float across the floor. Thick smoke passes through the hanging bead curtain {*zhu lian*}, a painted swing waits leisurely outside, under the brilliant sky" (Meng 2003:103, citing "Beauty from Yu" [*Yu meiren*] by Mao Wenxi [fl. ca. 913]).

Kinetic Qualities

Kinetic qualities sometimes enhance visual qualities while betraying structural particularities. The movements of long vertical strands seem to be described in this 6th-century reference to what might be a multi-strand bead curtain: "enchantingly fluctuating – now clustered, now spread apart, secretly reflecting the person in the window" (Meng 2003:101, citing "Ode to Bead Curtains" [*Yongzhulian*] by Lu Sidao [531-582] of the Sui dynasty [581-618]).

An object with a different kinetic range seems to be implicated in this 8th-century reference: "The western palace was quiet at night among a hundred flowers' fragrance, I wanted to roll up the bead curtain {*zhu lian*} as I felt spring sorrow" (Zhang Qiyun et al. 1985:449 [under *zhu lian*], citing "Lamenting Spring in the Western Palace" [*Xigongchunyuan*] by Wang Changling [698-756] of the Tang dynasty).

In these and other references, verbs in their various forms betray different types of movements. It seems doubtful that multi-strand bead curtains could be rolled up or down while hanging; their very structure prohibits such treatment. Instead, the strands were probably tied to one side or gathered in the middle (Figure 2). How then to account for the many texts that speak of handling a bead or crystal curtain in such a way, rolling it up or down according to a mood or time of day? Another structure must have been involved (Meng 2003:101; Meng 2009). We will return to this issue later when we discuss crystal curtains.

Aural Qualities

Pleasant aural effects are typically attributed to bead curtains. A woven curtain tinkles in the wind in this early reference: "Pearls were woven {*zhi zhu*} to make a curtain {*lian*} at the Zhaoyang Hall; when the wind blew it would make sounds like the tinkling of jade" (Luo Zhufeng 2001:558 [under *zhu lian*], citing *Miscellaneous Records of the Western Capital* [*Xijingzaji: Qinling fenglian*], traditionally attributed to Ge Hong [284-364] of the Jin dynasty [263-420] but may be later; cf. Meng 2004:107).

In one 9th-century text, the strands carry on a sort of metaphorical dialogue: "A cold bead curtain {*zhu lian*} of dew on red strings, the long fine threads talk as they hang" (Meng 2003:98, citing "Tune for Spring Sorrows" [*Chunchouqu*] by Wen Tingyun [812-870] of the Tang dynasty).

Mnemonic Potential

At least one writer of the imperial era commented on the mnemonic potential of bead curtains. Meng (2003, 2004) refers obliquely to this writer by subtitling her articles *jishi zhu*, which may be translated as "remembering beads," "memory beads," or "beads for remembering things." Meng was probably thinking of Feng Zhi (flourished ca. 907), a late Tang dynasty writer who composed a series of anecdotes under the title *Jishi zhu* in which he recalls counting "the beads on a bead curtain in his house to keep track of what he learned" while he was a student (Kieschnick 2003:132). The association of beads and memory may not be surprising, given the ancient use in China and elsewhere of rosaries for telling prayers and abacuses for performing calculations. At some point, certainly by the Tang dynasty, the association seems to have crystallized in the term *jishi zhu*.[5]

A Scathing Critique

The early associations of bead curtains with beautiful, secluded, and pampered women endured, eventually becoming tropes or conventional metaphors which were still in use at the end of the imperial era. Some found the tropes oppressive. Moving beyond our six secondary sources, we discover that early Chinese feminist Jin Tianhe (1874-1947) launched a scathing critique in his 1903 essay "A Woman's Bell" (*Nüjie zhong*). Jin urged women to liberate themselves from the confines of the inner chambers, the proper place of women in traditional Confucian thought: "Pearl-stringed curtains {*zhu lian*} and embroidered chambers may look like palaces in the heavens, but in fact they are worse than prisons" (Jin Tianhe 2013 [1903]:255). While Jin's critique did not end the production and use of bead curtains in post-imperial China, it may have contributed to shifts in perception and function. In other words, by the end of the Qing dynasty, bead curtains no longer symbolized idealized femininity, or not to the same extent.[6]

Terms for Bead Curtains, Crystal Curtains, and Related Objects

At least 13 terms for bead curtains, crystal curtains, and related objects appear in texts of the imperial era, according to the six secondary sources. Precisely how these terms apportion the semantic universe of bead curtains and related objects has yet to be studied. The diversity of terms does not necessarily correspond to a diversity of objects. Terms such as "wind curtain" (*feng lian*), for example, seem to originate in the figurative use of language. The first seven terms, consisting of "curtain" (*lian*) preceded by a modifier, may be found in Meng (2003, 2004, 2009): *feng lian* (wind curtain), *jing lian* (crystal curtain), *liuli lian* (*liuli* [glass] curtain), *qing lian* (blue or blue-green curtain), *shui jing lian* (crystal curtain), *wu se zhu lian* (5-colored bead curtain), and *zhu lian* (bead curtain). Six additional terms and their definitions are listed in sub-entries under "bead/pearl" (*zhu*) in the *Great Chinese Word Dictionary* (Luo Zhufeng 2001:549-554). In each case, the word "bead" (*zhu*) modifies a different noun referring to a type of curtain-like structure: *zhu bo* (bead curtain), *zhu huang* (bead curtain), *zhu lian* (bead curtain; i.e., "a curtain made of strings of beads"), *zhu long* (bead window; i.e., "a window lattice decorated with beads), *zhu wei* (bead curtain or net), *zhu xuan* (a window decorated with pearls), and *zhu zhang* (bead tent or curtain; i.e., "a net or curtain decorated with beads").

While a few of the terms (*huang, bo, lian*) connote flat or 2-dimensional structures such as curtains or screens, others (*zhang, wei, long*) connote 3-dimensional structures such as tents, canopies, veils, or window frames. Terms could be conjoined for poetic effect, with no change in meaning; *lian huang*, for instance, simply means "curtain." Terms such as *zhu xuan* may be archaic.

Zhu lian seems to have been the most common term over the centuries. Cao Xueqin's *Dream of the Red Chamber* (*Honglou meng* or *Shitouji*), one of the most widely read novels in classical Chinese literature, makes an interesting case in point. First published in 1791, the novel offers unique insight into 18th-century China and the social, intellectual, and material lives of wealthy families with close ties to the Qing imperial court, living in elegant, object-filled interiors. As many as seven references to *zhu lian*, one reference to a *jing lian*, and one reference to a *lian zhu zhang* or canopy-like beaded curtain may be found in the *Renmin wenxue chubanshe* edition of *Dream of the Red Chamber*, that is, if we include a bead curtain discussed in a footnote (Cao 2000).[7] Unfortunately, these objects are not well described. The material from which a bead curtain is made is specified only once, in Chapter 48, where it is said to be "pearls" or *zhen zhu*, or twice if we are inclined to view a "crystal curtain" or *jing lian* as a type of bead curtain. Far more attention is lavished upon other kinds of curtains and blinds; Chapter 17 alone lists some 1,120 curtains and blinds made of silk, satin, felt, and lacquered bamboo, special-ordered for an important event. None of these is described as beaded. Thus, in the richly furnished imaginary world of *Dream of the Red Chamber*, bead curtains are rare – rare enough, perhaps, to seem exotic. Most of them were called *zhu lian*.

Linking the Textual and Material Records

The textual record only goes so far; words alone cannot show us what bead curtains of the imperial era might have looked like. The material record can be considered, but it too reduces us to speculation. Meng Hui (2004:110) is apparently the first to try and link the textual and material records, seeking real-world correlatives for bead and crystal curtains mentioned in texts of the imperial era. As noted above, Meng posits two correlatives that are especially thought-provoking: the first, concerning a hypothetical 6th-century glass bead curtain at the Yongning Temple in Luoyang, and the second, concerning actual "crystal curtains" produced at the Old Summer Palace (Yuanmingyuan) in Beijing during the Qing dynasty. These will be discussed in turn.

A Hypothetical Bead Curtain at the Yongning Temple, ca. A.D. 534

It seems fair to assume that where bead curtains once existed, mass quantities of beads might later turn up. In 1994, 151,000 glass beads (Plate VIIA top) were recovered by archaeologists excavating the former west gate area of Yongning, a Buddhist temple complex built in Luoyang, Henan in the year 516, Northern Wei dynasty (386-534). A lightning strike reduced the complex to ashes in 534, scattering the beads.

Approximately 145,000 of the Yongning Temple beads range from 1.0 to 3.0 mm in diameter, while some 6,100 have diameters of 3.1-4.5 mm. Bead lengths are not provided, but images of them reveal that, on average, they are less than or equal to the bead diameters. Most of the beads are oblate, a small number are cylindrical, but all are monochrome and of drawn manufacture. The perforations are quite small: from 0.5 to 1.0 mm. Bead colors and opacities are as follows: black (31.2%), translucent green (17.9%), opaque yellow (15.8%), opaque brick red (14.3%), colorless (7.2%), transparent dark blue (4.3%), opaque white (3.8%), transparent sky blue (3.5%), and opaque purplish red (1.9%) (An 2000:81). Chemical compositional analysis of seven beads indicates they were "made from soda glasses that were high in alumina and low in lime," a composition consistent with what Francis calls "Indo-Pacific beads" (An 2000:82). According to Robert Brill and others, glass of this composition is known to have been "made in India from perhaps the 2nd c. B.C. to 9th c., but not elsewhere, as far as is known at present" (An 2000:83, citing Brill, Fenn, and Lang 1995:270-279). More recent studies support additional production of Indo-Pacific beads (and very likely the raw glass used to make them) in Sri Lanka and Thailand (James Lankton 2013: pers. comm.). A few beads of rock crystal and agate were also found among the Yongning beads (An 2002:59).

How did such a quantity of foreign glass beads arrive at the Yongning Temple? They might have been "transported there by Indian monks who came to live and work in China;" during the 6th century, as many as 3,000 Buddhist monks "from 100 countries (including India), resided in the Yongningsi Temple" (An 2000:84). Other possible sources include Indian workers employed in the building of the temple, or pilgrims who came to visit it (An 2002:61). A large market flourished in 6th-century Luoyang that was frequented by many traders (Lewis 2009:163), and this too might have been a conduit for bead distribution.

After they arrived in Luoyang, Meng Hui (2004:109-110, 113) posits that the Yongning Temple beads led "illustrious... lives" in a multi-strand bead curtain that hung in or above the temple's west gate. Five texts support this hypothesis, Meng argues. Two of them, the *Stories of Shu Capital* (excerpted above) and *Huayangji*, relate legends of beads found in the ground where temples and towers once stood (Meng 2004:111). The next two texts, the 6th-century *Spring and Autumn Annals of the Sixteen Kingdoms: Later Zhao: Shi Hu* (*Shiliuguo Chunqiu, Hou Zhao lu, Shi Hu*) and the *Jin Remnants* (*Jin Shiyi*) by Xie Chuo, reproduced in *Taiping Yulan*, vol. 700, compiled 977-983, refer to bead curtains made of "5-colored *liuli*," which might describe the colors of the glass beads found at the Yongning Temple (Meng 2004:110).[8] Most convincingly, the fifth text (*Record of Luoyang Buddhist Monasteries*, vol. 2: *Eastern City* [*Luoyang qielangji: chengdong*]), purportedly provides a retrospective eyewitness account written in 547 by Yang Xuanzhi (1984) of bead curtains hanging at Jingning, another Buddhist temple in mid-6th-century Luoyang (Meng 2004:110-111). Yang does not, however, mention bead curtains at the Yongning Temple.

Intriguing though they are, these textual parallels (for the possible presence of beads in the ground where temples and towers once stood; for the possible existence of multi-colored glass-bead curtains; and for the supposed appearance of bead curtains at another Buddhist temple in mid-6th-century Luoyang) amount to circumstantial evidence for the presence of one or more bead curtains at the 6th-century Yongning Temple. Considering such issues may not lead to firm conclusions but it broadens our understanding of the contexts, physical characteristics, and legends associated with bead curtains during the imperial period.

Interestingly, the quantity of glass beads found at the Yongning Temple would have been sufficient to create a multi-strand bead curtain of a size consistent with some 20th-century glass bead curtains. Table 1 provides a range of

Table 1. Width Estimates for the Beaded Area in the Yongning Temple Bead Curtain.

Bead Length (in mm)	Number of Beads (per 183-cm strand)	Total Strands (at 6.3-mm intervals)	Width of Beaded Area (in meters)
2.0	915	165	1.0
2.5	732	206	1.3
3.0	610	247	1.5
3.5	523	288	1.8

estimates for the width of the beaded area, assuming strand lengths of 183 cm, strand intervals of 6.3 mm, and bead lengths of 2.0-3.5 mm. If, for instance, the 151,000 Yongning Temple glass beads averaged 3 mm in length, the strand area would be about 1.5 m in width. These calculations assume that the beads formed a single curtain; it is also possible that they formed more than one curtain. In any case, a question remains: would glass beads of ostensibly high value have been used to form a curtain displayed far from the temple's inner precincts?

Other scholars envision other applications for the beads within the inner precincts. An Jiayao (2000:84) suggests that beads similar to those found at the Yongning Temple served "as necklaces and strings of ornaments on Buddhist images" of the era. This is consistent with a passage in the 6th-century *Record of Luoyang Buddhist Monasteries* that tells of three *xiu zhu xiang*, meaning bead-embroidered, bead-embellished, or bead-studded statues or images that once stood in a Buddha hall near the center of the Yongning Temple grounds. Mark Edward Lewis interprets the passage as follows: "North of the pagoda was a Buddha-hall, modeled on the Supreme Ultimate Hall of the imperial palace. It contained an eighteen-foot-high gold statue, ten man-sized gold statues, three statues studded with pearls {*xiu zhu xiang*}, five statues woven from gold thread, and two jade statues" (Lewis 2009:110).

The *Record* does not say how the beads were combined, but the presence of the word *xiu* is significant. Usually translated "embroidery," it also connotes other types of textile-like structures. Bead historian Zhu Xiaoli (2010:200-201) believes the Yongning Temple beads were linked together to form peyote-stitch-like coverings for the three statues. This seems doubtful, given the disparity in bead sizes and shapes. Textile historian Li Wenying (2013:184) envisions another type of object altogether, interpreting the *xiu zhu xiang* as motifs on a large panel embroidered with pearls and gold. Li does not mention the Yongning Temple's glass beads at all. James Lankton reminds us of another possibility: perhaps the beads were not used, but merely collected as offerings from the Buddhist faithful.

Crystal Curtains at the Yuanmingyuan in Beijing

Other real-world correlatives for the bead curtains and related objects referenced in imperial-era texts may lie in the *shuijing lian* fabricated in imperial workshops at the Old Summer Palace or Yuanmingyuan (Garden of Perfect Brightness) in Beijing during the Qing dynasty. *Shuijing* is an ambiguous term – it refers to both "rock crystal" and "glass," making "crystal" an acceptable English equivalent. *Lian*, as we have seen, means "curtain." Located on the outskirts of Beijing when construction began in 1707 under the Kangxi Emperor (1654-1722), the Yuanmingyuan was an imperial resort full of pagodas, palaces, lakes, ponds, and gardens. Successive emperors continued work on the Yuanmingyuan and the adjacent Changchunyuan (Curtis 2009:44-48). Both compounds were sacked and looted in 1860 by Anglo-French forces engaged in the Second Opium War. Today almost nothing remains of either one. The luxury objects they once contained have been dispersed across the globe. If examples of the *shuijing lian* have survived intact, I am not aware of them.

The best evidence for these imperial crystal curtains is once again textual, and one text is especially productive. Written anonymously as one of many texts detailing "handicraft regulations and precedents" (*jiangzuo zeli*) (Song and Moll-Murata 2002), the resolutely factual "Regulations on Crystal Curtains" (Wang Shixiang et al. 2000:832; Meng 2009) lists the materials, measurements, and numbers of man days required to make crystal curtains (*shuijing lian*). As administrative texts for regulating quality and controlling costs, *jiangzuo zeli* are silent on a number of issues including, in this case, how many crystal curtains were customarily displayed at the Yuanmingyuan and Changchunyuan, when or where they were displayed, what they looked like, and how they were assembled. Archival research may help resolve some of these questions.

The opening lines of the "Regulations" text are most relevant for our purposes. They contain archaic terms, reproduced in italics below, which have fallen out of use, making translation difficult. The lines read:

> In regard to crystal curtains, its height should be in accordance with the *ge chuang xin* [probably the center opening of a wood lattice partition] and five *fen* [ca. 16 mm] should be removed from both its top and bottom for every square *chi* [ca. 1/9 sq. m] in area. In addition to the twenty-one *liang* [imperial treasury {*kuping*} *liang*: 37.37 g] of glass strips used, add three *liang* of strips for every catty [600 g], and use five *qian* [five maces; approx. total 18.79 g] of copper [possibly red brass] thread/wire for every *chi* [1/3 m]. In regard to brass *mietiao* [typically strand-shaped slices of bamboo, rattan, reeds, or sorghum stalks cut for use in weaving, braiding, or plaiting; here possibly, trim strip or molding], its length should be calculated in accordance with the width of the *ge chuang xin*; they have a width of five *fen* and are one *fen* thick; [use] 3.6 *liang* in weight for each *zhang* [3.33 m] in length. The length of brass *yatiao* should be calculated in accordance with the height of the *ge chuang xin*; they have a width of five *fen* and are five *li* thick. For each one *zhang* in length of both *mietiao* and *yatiao*, use twenty-five wrought brass nails, with each nail three candareens [about 1.13 g total] in weight. (Information in brackets supplied by James Stand.)

We may draw several conclusions from these lines. Much care was expended on the production of imperial crystal curtains. That materials, weights, and dimensions were standardized suggests the curtains were produced in some quantity. *Zhu*, the word for bead, is absent from the text. Instead, we have *boli tiao*. *Boli* usually refers to "glass" but it also means "rock crystal" (An 2002:80, n. 22). *Tiao* typically means "strip," "long thin piece," or "rod;" i.e., an object devoid of a hole.[9] It probably makes sense to assume that *boli* in this context refers to "glass," if only because of the difficulty of carving rock crystal into long thin strips. The "Regulations" text does not say how the *boli tiao* were united, but it appears they were somehow framed with copper or red brass strips or moldings and secured with brass nails. The ensemble was situated within a *ge chuang xin*, probably the center opening of a lattice partition (Meng Hui 2009), a kind of free-standing, multi-panel wooden screen used to divide a room or frame a window. Judging by the ostensible weight of strips needed for each crystal curtain (21 x 37.37 g = 0.7847 kg), the center openings of the lattice partitions may have been relatively small. Small panes of glass, possibly made in imperial glass workshops, were also set within lattice partitions and windows at the Yuanmingyuan and Changchunyuan during the 18th century (Curtis 2009:47). Examples of wood-lattice partitions inset with silk gauze, jade, glass, or porcelain survive in the 18th-century Qianlong Garden of the Palace Museum in Beijing (Berliner et al. 2010:218-219, Figures 2-8). *Shuijing lian* are associated with small openings not only in the "Regulations" text but in the 13th-14th-centuries *Ancient Matters from Wulin Garden* (*Wulin Jiushi*) by Zhou Mi (1232-1308). Zhou (1956, 2:368) describes decorations at the imperial court during the Lantern Festival: "A 5-colored *liuli* pavilion was set up in the court.... The small crystal curtains were hung among the miniature windows (*xiao chuang jian chui xiao shui jing lian*). The fringes and precious bands reflected brilliant lights at each other."

In addition to establishing a precedent of several hundred years for the crystal curtains in the "Regulations" text, this account also alludes to the reflection of light, which is part of what would have made glass in any guise – strip, sheet, or piece – a desirable material for this application. The word "strip" (*tiao*) in the "Regulations" text is significant in another way. It allows us, following Meng, to relate the crystal curtains at the Yuanmingyuan to: 1) the *qing lian* (blue or blue-green curtain) described by Sun Tingquan in his 1665 essay *Random Jottings of Mt. Yan: Glass*; 2) a 19th-century reference to a blue glass blind introduced to us by Peter Francis (1986:21); and 3) a possible correlative for a crystal curtain in the material record. It should be noted that Sun refers to *liuli tiao*, possibly meaning translucent or opaque glass strips, instead of the *boli tiao* in the "Regulations" text. Sun gives us a few other details; his *liuli tiao* are blue or blue-green, "woven" into curtains (*wei wei huang bo*) and applied to vermilion window lattices (*zhu ling*), the conceivable structural counterparts of the center openings of lattice partitions (*ge chuang xin*) referenced in the "Regulations" text. What did Sun mean by "woven?" Was it a metaphor for a dense, intricate structure composed in part with thread, or an attempt to describe an actual technique? Clues to a possible technique are provided by a British Protestant missionary who spent 57 years in China, 30 of them in Beijing. In 1869, Joseph Edkins observed blue glass curtains he called "venetians" hanging in the windows of the "structure rising over the north altar" of the Temple of Heaven in Beijing (Francis 1986:21, citing Hommel 1969:305). This is precisely the type of location identified by Sun Tingquan as appropriate for the display of *qing lian* (cf. Meng 2009 and Zhang Weiyong 2008:279). The blue glass rods used in the Temple of Heaven "venetians," Edkins wrote, came from Shandong province. In 1867, another European observer named A. Williamson reported that glass "rods" were being produced at glass workshops in Boshan, Shandong. The rods were "about 30 inches long," tied up in "bundles," and exported "to all parts of the country" (Hommel 1969:305). If by "venetians" Edkins was referring to "Venetian blinds," the glass rods were probably oriented horizontally and connected with sets of vertical threads spaced at regular intervals. If so, it makes sense that Sun

Tingquan and others might have likened the technique to "weaving."

As previously mentioned, a correlative survives in the material record for the Yuanmingyuan crystal curtains and Temple of Heaven glass-rod blinds. Rather, fragments of the correlative survive. Housed at the Kanazawa Bunko Museum in Yokohama, Japan, they consist of more than 800 glass strips in shades of transparent yellow and light green (Miho Museum 2006: cat. 76), plus a portion of the brocade-embellished frame that once surrounded the strips. The object they once formed is known in Japanese as a *tamasudare* (*tama*: "bead," "jewel," or "precious;" *sudare*: "blind," "curtain"). The equivalent term in Chinese would be "jade curtain" (*yu lian*). Although it is believed that the *tamasudare* originated in the late Kamakura period (1185-1334) (Miho Museum 2006: cat. 76), the object does not appear in the written record until the year 1486 of the Muromachi period (1334-1573). By this time it had been donated to the Shomyoji Temple in Yokohama where it may have hung in the pagoda, perhaps in an inner shrine room. Measuring 78.7 cm in height by 90.6 cm in width when unrolled, the *tamasudare* is relatively small. Dimensionally variable, it was stored at the temple in rolled-up form inside a box which is also preserved at the museum (Mukozaka 2012:482).[10]

The *tamasudare's* glass strip fragments measure 0.2-0.4 cm in width and 4.8-30 cm in length (Miho Museum 2006: cat. 76) (Figure 3). They look to be rectangular in profile. The strips' specific gravity of 3.83-4.0 corresponds to a relatively high lead content, potentially qualifying them as "crystal," which was one of the ingredients of the *qing lian* noted by Sun Tingquan. In fact, precisely because of their presumed high lead content, museum officials believe the strips are of Chinese origin. A high lead content, however, is not diagnostic for Chinese glass. Where in China the strips might have been made has not been established; Boshan specialized in leadless glass in the 14th century (Francis 2002:74-75). At any rate, the strips were probably not made in Japan. Glass production there had declined by the Kamakura period (1185-1333) and, with the exception of beads, glass was "chiefly... imported" (Blair 1973:145). Glass beads were made in Japan "from glass rods" by the Edo period (1615-1868), however, and "*sudare*" (door curtains) were sometimes composed of strings of glass beads (Blair 1973:204, 245).

As for the technique used to join the rods in the *tamasudare*, it is believed they were "twined in hexagonal fashion" with threads that disappeared long ago[11] (Mukozaka Takyua 2012: pers. comm.). Fortunately, the Kanazawa Bunko Museum houses more than fragments; it also houses a reproduction of the *tamasudare* (Plate VIIA bottom).

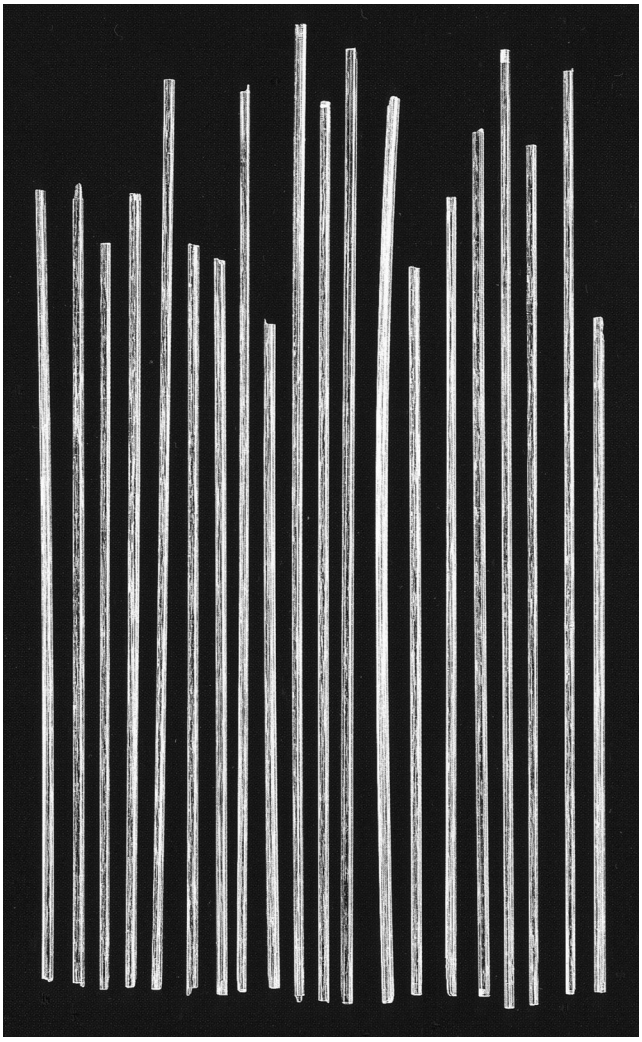

Figure 3. Fragments of glass strips from an original *tamasudare* found at the Shomyoji Temple, Yokohama, Japan (ca. 15th century) (courtesy: Kanazawa Bunko Museum).

Thought to be faithful to the original, the reproduction was made ca. 1970 of acrylic rods twined together with string and encased in a frame partly covered with the same Japanese-style cotton brocade that framed the original. The reproduction resembles a type of blind common in East Asia that is made of twined lengths of split bamboo (Figure 4). Such a blind can be rolled up or down as it hangs, much like a Venetian blind. In fact, it seems plausible that blinds of twined glass strips or rod could have developed by analogy with such bamboo blinds. Going one step further, it is possible that the glass strips used to make the Yuanmingyuan crystal curtains and Sun Tingquan's *qing lian* were also twined. If they were twined, the curtains could be rolled up or down like blinds, and this might explain the many references in imperial-era texts to bead or crystal curtains that could be handled in this way.

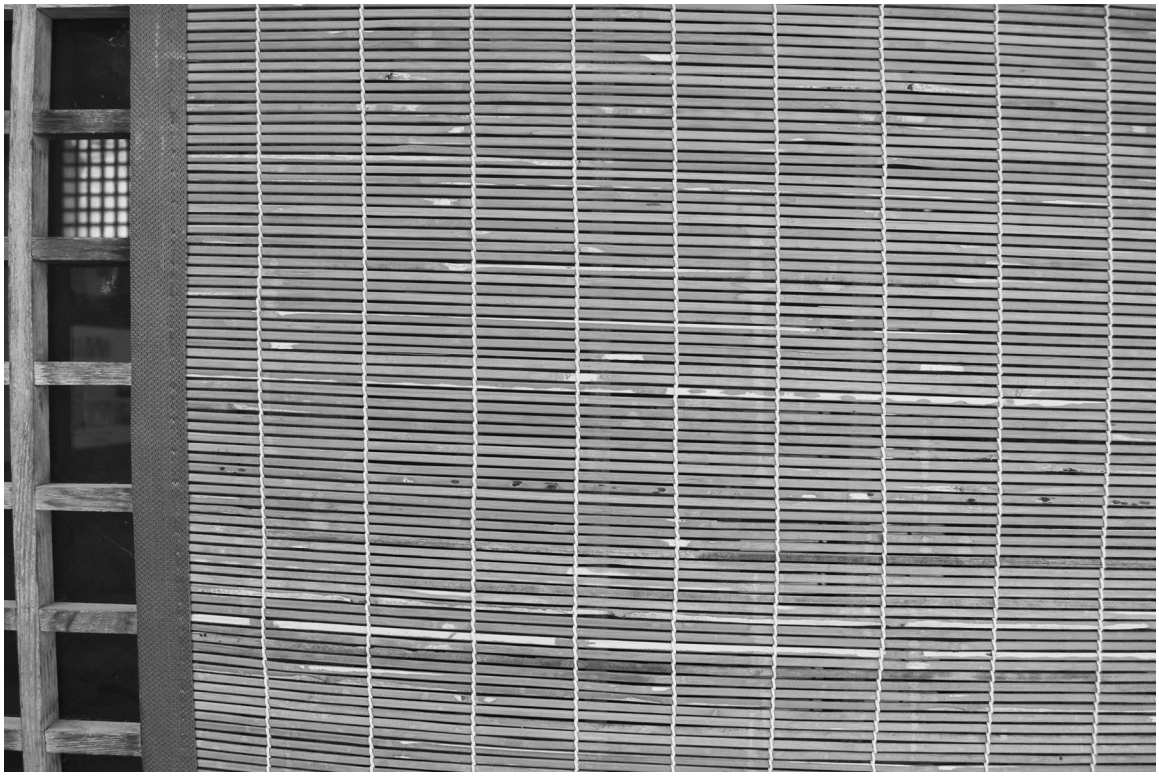

Figure 4. Detail of a twined bamboo-strip door curtain, Cuandixia, 2012 (photo: Valerie Hector).

A few caveats are in order before we depart the topic of "crystal" curtains. First, we cannot be sure that the terms *jing lian* and *shuijing lian* refer in every case to a curtain or blind made of twined glass strips or rods; other structures might have been involved. Further, multi-strand bead curtains might also have been called "crystal curtains" to capture their light-reflecting capacities. Second, crystal curtains or blinds composed of glass strips or rods are not "bead" curtains properly speaking if no beads are involved. Yet, the strips or rods could have been confused for beads. Third, whatever their structure, crystal curtains might have been relatively less common than other types of bead curtains in China over the centuries. We have already encountered a hypothetical 18th-century ratio in *Dream of the Red Chamber* which mentions one *jing lian* or "crystal curtain" as against six *zhu lian* or "bead curtains." Fourth, even when they are structurally distinct, crystal curtains seem to have been thought of as special kinds of bead curtains in imperial China, as Meng (2003, 2009) points out.

BEAD CURTAINS OF THE REPUBLIC OF CHINA (1912-1949) AND PEOPLE'S REPUBLIC OF CHINA (1949-PRESENT)

Here we take up the material record. Instead of trying to imagine what bead curtains of the past may have looked like, we now examine bead curtains made during the last 75-100 years. Much of my research on bead curtains has been limited to the greater Beijing area and to parts of Shandong province, so there is a North China bias to the information that follows, and it cannot be taken as representative of China as a whole. To temper this bias, I adopt a wide perspective, exploring curtains made of various bead materials, displayed in various contexts, and conveying various sensibilities. The material is assigned to two major categories: organic and inorganic.

Curtains Made of Organic Bead Materials

In the previous section, historic texts made reference to bead curtains made of real pearls, but since no examples are known, we cannot be sure they actually existed. The same can be said for curtains made of shells and the parts of various animals. Nevertheless, it seems reasonable to suppose that Chinese bead curtains have long been made of organic materials, especially those derived from plants. This section examines bead curtains made of four such materials: Job's tears, bamboo tubes, various seeds or seedpods, and recycled paper. These are modest substances by today's standards, but Chinese people have long recognized their potential, going to great lengths to collect, modify, and string

them in both commercial and domestic settings. Although bead curtains made of wood beads are also popular in China, they will not be discussed here since the examples available for study are products of the mass market.

Job's Tears and Bamboo Tubes

Job's tears and bamboo stems have long been used as beads in China, perhaps because they are naturally hollow and highly durable. Both plants belong to the grass family known as *Poacae*. Necklaces made of Job's tears (*Coix lacryma-jobi*) have been found at an archaeological site dating to 2000 B.C. in modern-day Xinjiang province (Hong-En Jiang et. al. 2008:1311). It is possible that bamboo tubes, created from the cylindrical inter-nodal sections of a stalk, have been used as beads in China for many centuries as well. We know that they have been used since at least the Qing dynasty to form knotted net garments (Hector 2005:24).

The curtain in Plate VIIB is made of Job's tears and bamboo tube beads. The design is simple. The bamboo tubes create a horizontal zigzag band that runs across the top of the curtain breaking the monotony of the Job's tears below (Plate VIIC top). Bamboo tubes also appear at the bottom of the curtain as a kind of border. While the two bead colors, greyish-white and tan, are soft and neutral, the bead surfaces are opaque and unreflective. If bead curtains made of inexpensive organic materials existed in China's imperial era, this is one example of what they might have looked like.

Lobed Brown Seedpods

Another simple curtain appears in Figure 5. At first glance it looks to be made solely of seedpods that range in color from caramel to dark brown. There are 8,138 of them, and they measure 4.5-6 mm in diameter and 9-13 mm in length. As yet unidentified, the pods are lightweight and the entire curtain, which measures 0.88 m wide by 1.6 m high, weighs only 1.36 kg. Black striations run the length of the pods, imparting texture as they delineate the boundaries between lobes. Although the pods are somewhat glossy, they are totally opaque. This is not a bead curtain that dazzles the eyes with refracted light; its plain brown expanse bespeaks traditional Chinese cultural values such as modesty, sobriety, and frugality. Its origin is unknown.

Closer inspection reveals that brown is not the only color in the curtain. Nearly a third of the surviving bead strands contain beads made from small, irregular lengths of plastic tubing (Plate VIIC bottom). The 978 plastic tubes vary greatly in size, measuring 2.0-3.0 mm in diameter and 0.5-15.0 mm in length. They appear in three colors, all of them somewhat faded: red, yellow, and blue. No discernible rationale governs the size, color, or placement of the plastic

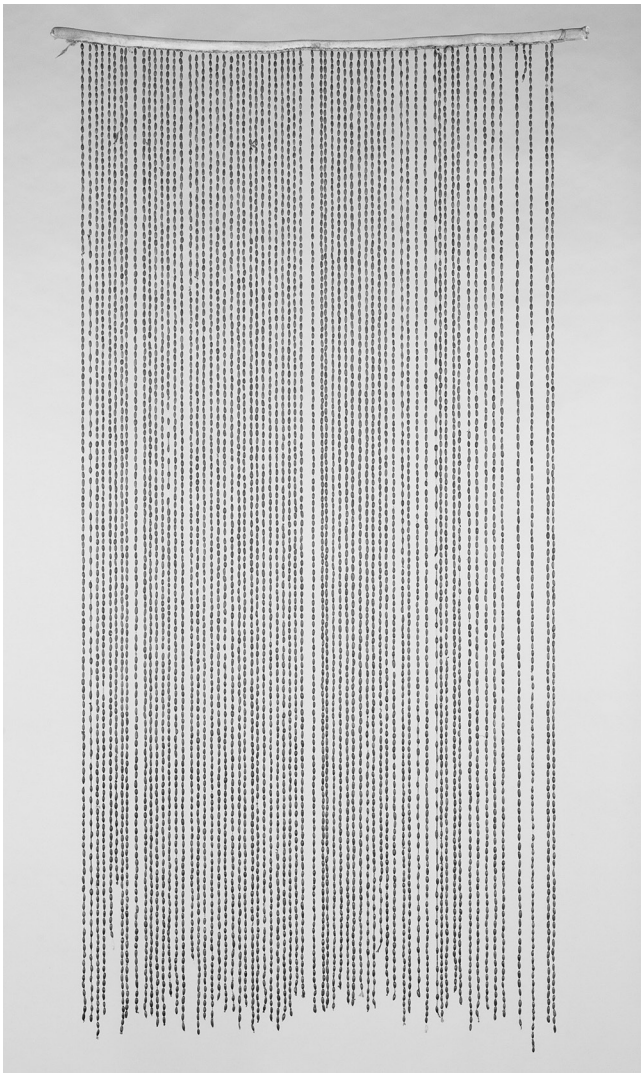

Figure 5. Bead curtain of lobed brown seedpods and plastic tubes, 20th century. Private collection (photo: Sanders Visual Images).

beads. Perhaps they were introduced when the curtain was repaired, in part, with black cotton threads. The black threads are visible in only 8 of the 22 plastic-bead-bearing strands. Most or all of the remaining 59 strands are strung on tan-colored 3-ply synthetic threads. These same threads were used to create the narrow panel of commercially woven fabric that encases the curtain's hanging rod, a bamboo stalk or tree branch. The 67 surviving bead strands are stitched directly into the fabric where the two edges meet to form a tube. Specifics concerning this curtain are presented in Table 2 ("Seedpod").

The same lobed brown seedpods are mixed with beads of plastic and other materials in another curtain found hanging in a residential doorway in the Liulichang area of Beijing's Xuanwu district in 2008 (Plate VIID top).

Table 2. Comparative Data for Seven Select Bead Curtains.

Curtain	Dimen. (in meters)	Weight (in kg)	Bead Shape	Ave. Bead Dimen. in mm (diameter x length)	Bead Symmetry (and possible Chinese name)	Ave. no. Beads per Strand	Total Strands	Intervals Between Strands (in mm)	Est. Total Beads in Curtain
Seedpod (Fig. 7) seed pods, plastic; 20th c.	0.88 x 1.6	1.36	oval (seedpod) tubular (plastic)	4.5-6 x 9-13 2-3 x 0.5-15	regular irregular	136	67	9.5	9,116
Geometric (Pl. VIIID) wound glass; 20th c.	1.27 x 2.12	9.09	oblate to globular	4-6 x 3-8.5	highly irregular ("5-*qian*" beads/ *wu qian zhu*)	345	130	8	44,850 (not incl. netted panel)
Landscape (Pl. IXB) wound glass; 20th c.	0.99 x 1.99	8.64	oblate	4.5 x 3	regular ("curtain" beads/ *lianzi zhu*)	596	137	6-7	81,652
Self-Reliance (Fig. 8) wound glass; 20th c.	1.0 x 2.02	6.82	barrel: white oblate: red oval: amber blue pink	5 x 6 5 x 2-2.5 4.5-5 x 8-10 4.5 x 7-11 4.5 x 7-10	regular ("curtain" beads/ *lianzi zhu*)	357	114	7-8	40,719
Crane/Pine (Pl. IXC) wound glass; 20th c.	0.88 x 1.83	7.27	oblate teardrop (1-hole)	5 x 3-5 5 x 10-11	irregular ("5-*qian*" beads/ *wu qian zhu*) irregular (name?)	480	118	6-8	56,640
Peacock (Pl. XA bottom) drawn and wound glass; 20th c.	0.89 x 1.9	3.64	tubular (drawn) oblate (wound)	3 x 4.5-13 4 x 2.5-4	irregular ("tube" beads/ *guan zhu*) irregular ("5-*qian*" beads/ *wu qian zhu*)	217	108	7-8	23,436
Hutong Pizza (Pl. XD) molded plastic; ca. 2007	1.06 x 1.39	5	ovoid biconical	12 x 13.5 6 x 5	regular regular	156	72	10	11,232

Miscellaneous Seeds or Seedpods

Other seeds or seedpods have been used in Chinese bead curtains as well. The curtain in Plate VIID bottom consists of variegated brown seeds or seed pods mixed with segments of green plastic tubes. Irregular in length, the tubes were probably cut by hand (Plate VIIIA top). Along with the curtains in Figure 5 and Plate VIIB, this curtain appears

to be homemade and fashioned from low-cost materials. It hung in the doorway of a small residence in the Liulichang neighborhood of Beijing's Xuanwu district.

Paper Beads

The Chinese are believed to have invented paper during the later Han dynasty (206 B.C.-A.D. 220). It is conceivable that curtains composed of paper beads were made in China long ago, but surviving evidence dates to the later 20th and early 21st centuries. Two kinds of paper beads have been recorded: rolled and folded. Both are made from recycled paper which reduces cost while assuring a range of colors.

Rolled-Paper Beads

Curtains made of rolled paper beads were fashionable in China in the 1960s-1970s (An 2012: pers. comm.). Bead-curtain makers found outdated calendars especially useful. After cutting the pages into long, tapering triangles they would roll the triangles into elongated bicones. Dimensions varied but the average bead seems to have measured about 8 x 35 mm (pers. obs.). At some point in the process, glue or a fixative was applied to the paper to render the bicones stiff and durable. The bicones were subsequently connected with wire loops to form multi-strand curtains. When the Chinese learned to make beads in this way is not known; this simple technique may be quite old. In any case, it was also circulating in the West in the 20th century (Littlejohns 1930:90-99; Seyd 1973:18-23).

Rolled-paper-bead curtains can still be found in rapidly modernizing Beijing, although curtains made of plastic and wood beads enjoy greater popularity. A different ratio prevails in Cuandixia, a small village some 100 km west of central Beijing. Cuandixia operates as a living tourist site for day-tripping Beijing urbanites and others seeking a sense of old-fashioned village life. At least a dozen paper-bead curtains may be seen during a short walk at Cuandixia, where they typically hang in the doorways of rooms facing courtyards. In some cases, the curtains contain only rolled beads in mixed colors; in others, rolled beads combine with Job's tears to sketch intriguing patterns and color schemes (Plate VIIIA bottom). Once in a while the beads are painted, but not so as to depict pictorial scenes. After being exposed to the elements for a period of time, the rolls begin to unravel, creating the illusion that the beads are significantly longer. It remains to be determined who makes the beads and strings them into curtains. It is likely that they are made in domestic settings for domestic use. That such curtains are difficult to find on the Internet suggests they are not produced in great quantities.

Folded-Paper Beads: Rectangular Shapes

Curtains composed of folded-paper beads are also made for domestic use in China by individuals of modest means, working in homes or small shops. Once again, the raw material consists of recycled paper cut into rectangular strips. Some curtain makers harvest the paper from garbage dumps. Color is a key criterion; several trips may be needed to assemble the desired variety. Ramen noodle containers, frozen food wrappers, and cigarette packs are said to deliver the strongest hues. Uniformity of bead size is a second criterion. Typical dimensions are 10 x 22 mm, a size that corresponds well to the paper clips commonly used to connect these beads, one at a time, to form long curtain strands. It is probably the case that several initial folds are made before the bead is finished as it is folded around the paperclip (Plate VIIIB top). Occasionally, folded-paper beads are strung with Job's tears and plastic beads in the same curtain (Plate VIIIB bottom).

Curtains of both rolled- and folded-paper beads were on display at Cuandixia in September 2012, sometimes hanging on all four sides of a courtyard or in a row of three doorways (Plate VIIIC top). By September 2013, things had changed. Adjacent doorways in at least two courtyards near the entrance of the village featured commercial plastic bead curtains in the same solid color, either pink or blue. These plastic bead curtain groupings had not been on display a year earlier. Whether the beads are old-fashioned or modern, the presence of bead curtain groupings certainly contributes to a sense of visual coherence, one presumably arising from traditional neighborhood life and shared values. In the past, quantities of bead curtains were also hung in small neighborhoods, heralding festive occasions, or so it seems in *Dream of Sorghum* (*Mengliang Lu*), a set of essays written by Wu Zimu (1956) of the Song dynasty (1127-1279). Recounting the Lantern Festival as it was celebrated in Lin'an (modern-day Hangzhou), Wu states: "And even in some obscure neighborhoods and small, unknown alleys, there were embroidered hangings and bead curtains {*zhu lian*}." People wore creatively designed fashionable clothes, flaunting the splendor and luxuriance (Gernet 1962:188; Wu Zimu 1956, 1:141). Further research is required to determine whether the bead curtain groupings at Cuandixia are considered to be festive.

Folded-Paper Beads: Star Shapes

A third type of bead curtain featuring recycled-paper beads folded into five-lobed, star-shaped structures was hanging in the doorway of the *Wei Shan Lake* Specialty Foodstuffs Shop in Qufu, Shandong province, in September

2012. The stars are separated by clear plastic tubes just long enough to allow all sides of the stars to be seen (Plate VIIIC bottom). The juxtaposition of paper and plastic beads generates subtle contrasts: between curvilinear and rectilinear contours; colored and uncolored elements; fragility and durability; and opacity and translucency. The beads are strung on red string which can be seen inside the clear plastic tubes, adding an additional contrast between visible and hidden threads. One wonders whether such a delicate curtain could withstand much use.

Where did the technique for making these five-lobed structures originate, and how did it come to Qufu? One source might be print media. Dozens of small books are now published in China with instructions for many types of handicraft projects, including beadwork. Perhaps one of the books contained instructions for these folded-paper puff beads and/or their rectangular counterparts. Other explanations are also possible; the technique may have been transmitted orally.

Curtains Made of Inorganic Bead Materials

This section deals with curtains made of glass beads which date principally to the 20th century and those made of plastic beads which date to the 20th and 21st centuries. Generally, the production of inorganic beads entails raw materials and technologies more complex than those used to produce organic beads. Nevertheless, many of the same design strategies that inform organic bead curtains also inform inorganic bead curtains. For the most part, stringing techniques are also similar between the two genres. It is possible that curtains were also made of stone beads, but no evidence for such has yet been found.

Wound Glass Beads

Glass beads have been made in quantity in China since the middle of the Warring States period (475-221 B.C.) of the Zhou dynasty (ca. 1046-221 B.C.) (Hui 2008:115). Over the centuries, one of the most common Chinese glass beadmaking techniques was "winding." Beadmakers in many parts of the world have produced wound beads. In the process, a strand of molten glass is twisted or "wound" around an iron mandrel. At least three methods have been distinguished by Peter Francis (2002:11): furnace winding, drip winding, and lamp winding. As it now stands, most, if not all, of the glass beads used to create 20th-century Chinese curtains were furnace wound. The steps involved in heating and manipulating the glass require further research. It is possible that the molten glass was worked in strip form, as Paddy Kan observed in Boshan in 1984 (Kan and Liu 1984) or that the molten glass was worked from a crucible inside a furnace (Francis 2002:11).

Although we know that glass beads and possibly bead curtains were produced in the Chinese cities of Guangzhou, Quanzhou, and Suzhou (Francis 2002:58-59), my research has thus far focused on Boshan which eventually became "the glassmaking center of China" (Francis 2002:59-60). A brief history of the industry in the 20th century is presented in Appendix A.

Wound beads have been used in Chinese beadwork for centuries, in knotted net garments and toggles (Han Han 1998:88, 101), scent bags (Hector 2005:15), hair ornaments, lantern ornaments, table screens, beaded beads, and so on (pers. obs.).

Glass bead curtains may be divided into five major iconographic categories: geometric, pictorial, inscriptive, hybrid, and monochrome. The recovered data suggest that purely geometric, pictorial, inscriptive, and plain bead curtains were relatively uncommon in the 20th century, but the database is relatively small (ca. 50 curtains) and biased towards North China. Hybrid combinations of two or more design categories, uniting geometric, pictorial, and/or inscriptive motifs, seem to have prevailed. If monochrome glass bead curtains existed in the 20th century, no examples have been found to date; the one example seen dates to 2012.

Geometric Glass Bead Curtains

Plate VIIID depicts a simple geometric design consisting of vertical stripes of various widths and colors. Blues and greens predominate. At 1.27 m across, it is unusually wide, indicating that it was made to span the doorway of a large home or other building. Its height of 2.12 m is also unusual. Another clue to the curtain's pedigree lies in the narrow panel that hangs from the wooden support bar. The panel is made of netted beads (Plate IXA) edged with cotton tassels. Netted panels are rare. The panel features diamond shapes, some of which may represent *panchang* or endless knot motifs.

The curtain's larger bottom register comprises 130 strands strung on what looks like heavy cotton string. Under the netted panel the strands are devoid of beads; this may indicate a desire to conserve beads and limit weight. Each strand bears an average of 345 beads which brings the estimated total of beads in the strand area alone to 44,850. Highly irregular, the beads are 4.0-6.0 mm in diameter, 3.0-8.5 mm in length, and range in shape from oblate to barrel-like. Sharp points protrude from edges where the

molten thread was disengaged during the winding process. Occasionally, two beads are fused together. The curtain weighs approximately 9 kg, the heaviest recorded thus far. Further data for this curtain are summarized in Table 2.

Pictorial Glass Bead Curtains

The pictorial category is exemplified by the curtain in Plate IXB which depicts a landscape. The mountains at the upper right and the tree-studded outcropping at the lower left seem to float off the picture plane, echoing the implicit motions of the two boats that drift between them. The three sets of motifs are elegantly united by the clear glass beads of the background, which reads ambiguously as sky or water until interrupted by a dozen or so undulating black lines, probably intended to represent waves or currents. Countless fine Chinese artists have depicted landscapes of this general nature in their paintings. Whether the design of this curtain derives from a particular landscape painting or amounts to an aspirational emulation remains to be determined. In any case, this is not the first time that a landscape has been rendered in Chinese wound glass beads; small beaded screen panels dating to the late 19th or early 20th century also manifest landscapes motifs (pers. obs.).

This landscape curtain is quite large, measuring 0.99 m wide by 1.99 m high. As Table 2 indicates, it weighs 8.61 kg. The 137 strands carry an average of 596 beads for an estimated total of 81,652 beads, an unusually high number. The beads are an average of 4.5 mm in diameter and 3 mm in length. Although the beads are uniform and smooth, various small irregularities and conjoined beads indicate they are of wound manufacture. The strands are neatly attached to holes in a groove on the back of the smoothly-finished curtain board (*lian ban*) (Figure 6). Less effort was expended on the board in Plate VIIID where threads run through holes drilled vertically through the bar, a more common approach.

Either the beads in the landscape curtain were made with more care than the beads in the geometric curtain, or they were graded more carefully. In any event, the beads in the geometric curtain fare poorly when compared to the beads in the landscape bead curtain. These differences pertain to Chinese wound beads generally, not just those used in bead curtains. Bead scholars have long been aware of the existence of two grades of furnace-wound glass beads in China: "those that were ordinary, and those that were well-made" (Jamey Allen 2012: pers. comm.). These disparities may have originated long ago, but they are reflected in glass bead terminology current in 20th-century Boshan where "5-*qian*" beads (*wu qian zhu*)[12] were poorly made and irregular, while "curtain beads" (*lianzi zhu*) were more regular and therefore more costly to produce (Zhang Weiyong 2008:270, 279). Further, curtain beads were reportedly invented by master Boshan glass beadmaker Ren Silong in 1964 (Zhang Weiyong 2008:270). It may be that the geometric curtain is made of 5-*qian* beads and the landscape curtain of *lianzi* beads. If we allow 45 seconds for the production of each bead in the landscape bead curtain, the total would have absorbed about 1,021 hours or about 127 8-hour days. This highly speculative estimate does not include the time spent to prepare other curtain materials, design a layout, or string the beads. Thus, the estimate may fall far short of the actual amount of time expended on this one bead curtain.

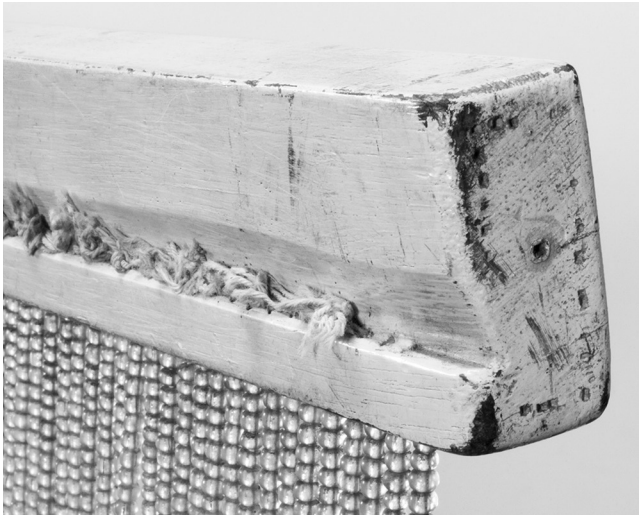

Figure 6. Detail of the suspension board of the landscape curtain showing wound glass beads on cotton threads (photo: Sanders Visual Images).

A much larger curtain with landscape motifs was observed by Robin Atkins during her 1991 visit to the Zibo Color Glass and Art Factory in Boshan (Figure 7). The curtain dwarfs her student interpreter. The landscape motifs are well-placed, seemingly according to a pre-existing design. How many glass beads are involved is unknown; assuming bead lengths of 3-3.5 mm, 320,000 seems a credible guess. Neither is it known if the beads are wound or drawn.

Inscriptive Glass Bead Curtains

A third design category consists solely of inscriptive motifs; i.e., Chinese characters. It is represented by the curtain in Figure 8 which contains four characters framed on at least three sides with bands of red and amber-colored beads, bands that may be interpreted as geometric motifs. Repairs at the bottom of the curtain make it difficult to tell whether bands were once present there. The curtain presently measures 1.0 m wide x 2.02 m high. The four characters

Figure 7. Interpreter Zhang Jinghong by the enormous glass bead curtain at the Zibo Color Glass and Art Factory, Boshan, 1991 (photo: Robin Atkins).

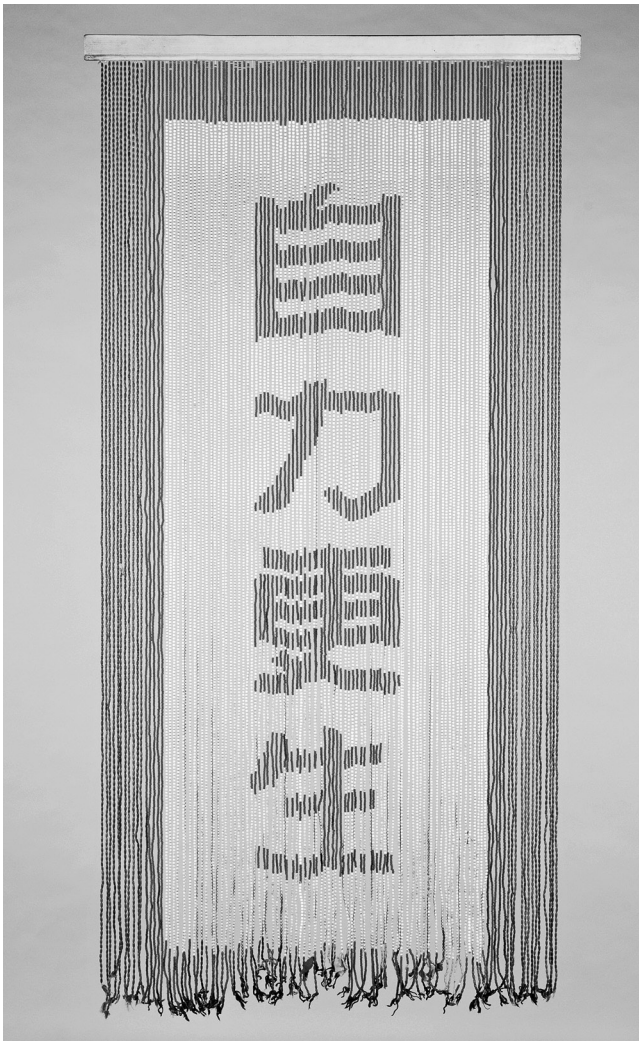

Figure 8. "Self-reliance" curtain of white, red, and amber-colored wound beads, 20th century. Private collection (photo: Sanders Visual Images).

create a phrase that became a political slogan. Written in bold red standard script on a plain white ground, they read *zili gengsheng* which may be translated as "self-reliance." Self-reliance, a virtue extolled in China for many centuries, assumed added significance in the 1950s to 1970s when, struggling to modernize with minimal resources and little foreign aid, Chairman Mao urged the Chinese people to rely upon their own initiative to further the country's social, economic, and political progress. Although it is not possible to accurately date this curtain, it probably does not predate the 1960s or 1970s, when the same slogan, often worked in red, asserted itself on other items of Chinese visual and material culture, among them political banners and wall posters (Landsberger and van der Heijden 2009:183).

The "self-reliance" curtain is unusual in that it is composed of three different shapes of beads, all of them smooth and made with care, not unlike the beads encountered by Sprague in China in 1986 (Sprague and An 1990: Plates VIC, VIG-H), but more regular. Yet small inconsistencies remain, suggesting that all of the beads in the curtain are wound, possibly according to curtain bead (*lianzi zhu*) standards (Figure 9). Exactly 40,719 beads comprise the curtain: 18,490 opaque red, 17,282 opaque white, 4,842 translucent amber, 102 opaque blue, and 3 opaque pink. The two latter colors were probably introduced when repairs were made. Perhaps some 1-2% more beads have fallen away over time.

Laser Ablation Inductively Coupled Plasma Mass Spectrometry (LA-ICP-MS) analysis of one red and one white bead conducted by Laure Dussubieux of The Field Museum in Chicago reveals the beads are made of a silica glass containing significant quantities of soda, alumina, and lime. The red bead is unusually high in boron; the white bead contains far less. The red bead also contains significant

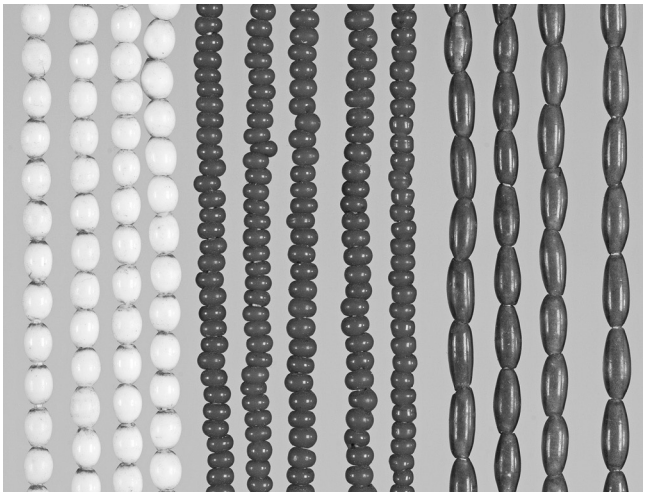

Figure 9. The white, red, and amber-colored wound beads of the "self-reliance" curtain, possibly known as *lianzi zhu* or "curtain beads" (photo: Sanders Visual Images).

quantities of the coloring agent cadmium, with no excess of the expected companion element zinc. The white bead contains low concentrations of iron and high quantities of arsenic. Further details are provided in Table 3.

Hybrid Glass Bead Curtains

A fourth style of glass bead curtain may be thought of as "hybrid" in that it merges geometric, pictorial, and/or inscriptive motifs. An example appears in Plate IXC. It measures 0.88 m wide by 1.83 m high. Because the cotton (?) threads have stretched over time, the motif outlines are blurred. The majority of the beads are irregular oblates, probably 5-*qian* beads. The depictive space is divided into two registers: a small, horizontal register at the top with three red *shou* or longevity motifs on a black ground, and a larger, vertical register at the bottom featuring an asymmetrical vignette of a crane looking skywards, standing before a pine tree against a clear ground. Individually and collectively, the crane and the pine tree are symbols of longevity. Together, they may be read as a rebus, a pictorial pun that calls to mind a saying, in this case, a typical birthday wish: "May you, like the crane and pine, enjoy similar longevity" (Bartholomew 2006:7.13.5). The crane is also a symbol of high civil rank, a rare and treasured achievement. The motifs are framed on all four sides by blue meander motifs on a white ground. A common decorative device since the Yuan dynasty, meander (*huiwen*) motifs have appeared on Chinese textiles, porcelain, wood, bronze, and stone. Because they create a visual effect

Table 3. LA-ICP-MS Analysis of Beads from the Self-Reliance and Crane/Pine Curtains.

Elemental Oxide	Self-Reliance Curtain, Red Bead	Self-Reliance Curtain, White Bead	Crane/Pine Curtain, Black Bead	Crane/Pine Curtain, Green Teardrop
SiO_2 (Silicon dioxide)	71.77%	68.31%	61.40%	66.46%
Na_2O (Sodium oxide)	19.06%	21.87%	17.47%	16.13%
MgO (Magnesium oxide)	0.51%	0.03%	0.37%	0.17%
Al_2O_3 (Aluminum oxide)	1.57%	6.60%	8.12%	6.39%
P_2O_3 (Phosphorus triox.)	0.04%	0.01%	0.08%	0.01%
Cl (Chlorine)	0.03%	0.02%	0.79%	0.10%
K_2O (Potassium oxide)	0.31%	0.17%	2.13%	0.95%
CaO (Calcium oxide)	6.19%	2.88%	9.10%	9.26%
Fe_2O_3 (Iron oxide)	0.18%	0.09%	0.44%	0.29%

of being unending, meanders are associated with longevity, eternity (Bartholomew 2006:7.39), or never-ending luck or fame. One wonders whether the strands of a bead curtain, themselves quite long, might also have connoted longevity. As components of 20th-century glass bead curtain design, meander motifs energize a curtain's edges and balance its other design elements, transforming a composition into a stable, well-structured, symmetrical whole.

The same design modules – registers, pictorial center panels, and meander borders – recur on many 20th-century glass bead curtains. In fact, they appear to be interchangeable and drawn from a stock set of motifs combined so as to produce variations on a theme, thereby likely satisfying all tastes (Hector 2013). Lothar Ledderose (2000:1-7) has studied the principle of modularity in China, tracing evidence from ca. 1200 B.C. on to demonstrate that modular patterns and production procedures were applied in many media, including bronze, pottery, lacquer, and wood, not to mention in the Chinese writing system itself.

The crane/pine curtain affords rare glimpses into the manufacture of 20th-century glass bead curtains. At least one family of curtain makers was active in Boshan, Shandong province, during the Republic of China period (1912-1949) (Zhang Weiyong 2008:279-280). The family, headed by Liu Zaihai, a master glass beadmaker with many master apprentices, owned several bead furnaces. In fact Liu Zaihai is reportedly responsible for initiating glass bead curtain production in Boshan. Liu reportedly developed specific bead curtain designs, among them "phoenix piercing (or amongst) peony" (*feng chuan mudan*), possibly a marital bliss motif, "phoenix flying towards the sun" (*danfeng chao yang*), and "mountain solitude" (*gaogang du li*). Many of the patterns featured inscriptions and meanders. The Liu family used two-part bamboo boards to support their curtains. One of the boards was small and hinged in the middle. The bead strands were connected to this board which was later folded for ease of packaging and transport. When the folded board reached its destination it was unfolded and embedded in the back of a second, larger board, making the small board invisible from the front. The curtain board in Figure 10 is constructed in precisely this way, likely shaped by hand. Thus, it might have been made by the Liu family between 1912 and 1949. A curtain with such a folded board could be strung by two people in the course of a long working day. Liu family bead curtains were reportedly sold mainly in Sichuan province and, later, in Yantai, Shandong province. The curtains were also sold in Boshan, where they hung in the doorways of barber shops and restaurants.

Liu Zaihai is said to have used 5-*qian* beads in his curtains (Zhang Weiyong 2008:279). He may also have used one-holed glass teardrops such as those wired to the bottoms

Figure 10. The small hinged bar set in the larger wood curtain bar of the crane/pine curtain (photo: Sanders Visual Images).

of many strands in the crane/pine curtain (Plate IXD top). This is the only one of about 50 curtains that features such pendants. Possibly called "flower petal" (*huaban*) or "water droplet" (*di shui*) beads (Zhang Weiyong 2008:272), they average 5 mm in diameter by 10-11 mm in length.

LA-ICP-MS analysis of one green teardrop and one black bead indicates that they too are made of silica glass containing significant quantities of soda, alumina, and lime. The teardrop beads are colored using chromium (1075 ppm), an ingredient found in 19th-century green-glass beads from the Sullivans Island site, Washington state (Burgess and Dussubieux 2007:69). The teardrop also contains selenium (155 ppm), an ingredient "used to color glass no earlier than the end of the 19th century, and more likely around 1910" (Dussubieux 2013: pers. comm.). Thus, the teardrop pendant establishes a *terminus ante quem* for the production of the crane/pine curtain: it cannot predate the late 19th century and may not predate 1910. The black bead exhibits "no excess of any coloring agent such as cobalt or manganese, although iron is present in slightly high concentrations (0.44%)." Table 3 provides further chemical data.

The crane/pine curtain also affords some insights from former owners of glass bead curtains. Glass scholar An Jiayao (2012: pers. comm.) remembers that her mother had a similar crane curtain, although "the patterns were more complex and prettier." A native of Shandong, An grew up in the port city of Yantai in a home whose furnishings included two glass bead curtains. According to An,

> glass bead curtains were the best. They were very decorative and felt good when hung. The sound they made when passing through them was pleasing to the ear, and they effectively prevented mosquitoes and flies from entering the room.... They were

> mainly used when it was hot, the door to the house would be open, and the curtains would let in air while preventing flies from entering. They also could prevent people in the yard from seeing what the people inside were doing.

An's mother received the curtains as part of her dowry in the 1940s. The curtains were displayed seasonally in the front door of the house from May until October. Glass bead curtains, An notes, were luxury items owned only by "wealthier families in Shandong." She believes that only 10% of all Chinese bead curtains at the time were made of glass beads; others were made of "grass seeds" or rolled-paper beads (An 2012: pers. comm.). It is unclear what "grass seeds" refers to but could be Job's tears or some other seeds or seedpods.

Drawn Glass Beads

The glass beads comprising the next two curtains were probably made using a drawing method that came into use in the mid-1980s. Drawn beads known as "tube beads" (*guan zhu*) were produced in Boshan at that time (Zhang Weiyong 2008:280). Whether the technology was indigenous or imported has not been established. Tube-bead curtains (*guan zhulian*) soon followed. While curtains composed of tubular beads may have seemed modern in the 1980s, there were probably earlier versions. Bead scholars believe that drawn tubular beads may have been made in Boshan during the 1937-1945 Japanese occupation of northeast China. Evidence is provided by small cardboard boxes containing tubular glass beads of uncertain date and irregular dimensions; the boxes were labeled "Made in Japan" and distributed by the Japanese (Plate IXD bottom). Bead scholars believe these beads may have been made in Chinese factories (Francis 1990:126; Liu 2013; cf. Fenstermaker and Williams 1979: Figure 1). It is difficult to imagine what such tube beads were used for, if not bead curtains (Robert K. Liu 2013: pers. comm.). On some curtains, knots might have been made between beads to prevent edges from chipping (Plate XA top).

Intact examples of 1980s tube-bead curtains are hard to find. One was, however, hanging in the doorway of the Jiuheng Car Service station (*Jiuheng Qiche Fuwu*) in Boshan in September 2012 (Plate XA bottom). Owned by the Li family, it has been in their possession for decades. Measuring 0.89 m in width and 1.9 m in height, the curtain features a single pictorial motif of a colorful peacock displaying its feathers against a clear background. Most of the beads are tubular, and probably would have been called *guan zhu* (Plate XB top), though wound beads of the 5-*qian* variety are also present. As Table 2 shows, there are approximately 23,436 beads in the curtain which, at 3.6 kg, weighs significantly less than the wound glass bead curtains discussed above.

The Li family owns three other tube-bead curtains, two of them still rolled up inside worn cardboard boxes stamped with characters that read "Spark Brand *liuli* bead curtain, Zibo, Boshan Fine Arts Glass Factory." Two of the curtains feature leafy bamboo trees; the other, another peacock, albeit in different colors (pers. obs.). All of the tube beads resemble those found by Sprague in Chengde in 1984 (Sprague and An 1990: Plate VIH).

Monochrome Glass Bead Curtains

Another bead curtain was hanging in a different Boshan doorway belonging to the Desheng Glass (*Desheng Liuli*) artistic glassware shop. Devoid of motifs, this curtain consisted entirely of bright yellow glass beads, reportedly made recently in Boshan (Plate XB bottom). It is the only example of a motif-less, monochrome glass bead curtain. A number of other shops in Boshan displayed identical yellow curtains, indicating that as of 2012, they were being made or distributed locally, probably in a commercial fashion. Such yellow curtains have not yet been observed elsewhere in Shandong or in the Beijing region, but a similar one hangs in the canopy bed frame of a young girl at the Kang Family Manor in Henan province, which was restored in the 1990s (Knapp 2005:153). Whether the curtain was introduced before, during, or after the restoration process is not known.

Plastic Beads

When people think of plastic bead curtains, they generally think of mass-produced beads made in two halves, permanently bonded around curtain threads. The beads may not move, but the strands do, producing a gentle clicking sound. Plastic bead curtains are common in China today; their attraction is understandable. A recent search of alibaba.com using the term "plastic bead curtains" brought up listings for 3,147 products offered by wholesale suppliers in Zhejiang, Fujian, Guangdong, and other provinces. The documentary film *Mardi Gras: Made in China* (Redmon 2005) provides a general sense of the kind of factory in which plastic beads and curtains might be made. Judging by the wide variety of available designs, bead factory personnel are ingenious, devising bead colors ranging from intense sky blues to soft pale yellows, shapes ranging from round and oval to gourd shaped (Figure 11), and surfaces either plain or faceted to reflect light. Plastic bead curtains owe their

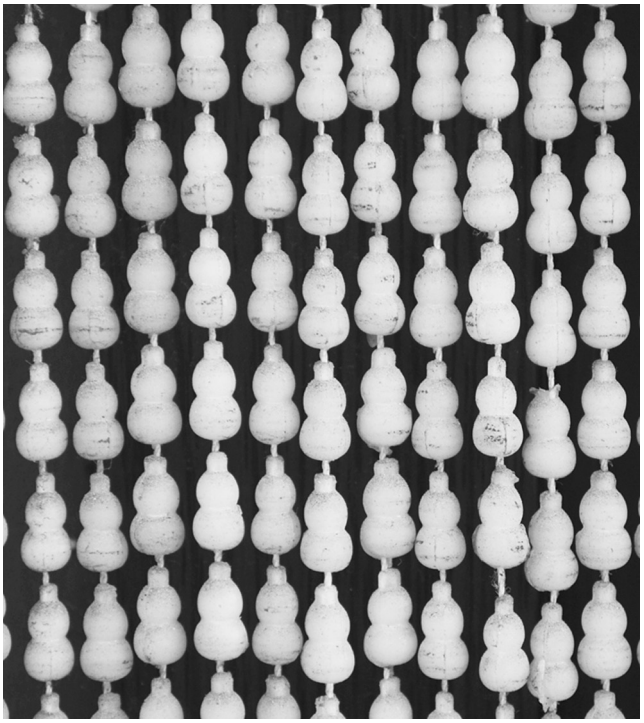

Figure 11. Plastic gourd-shaped beads in a curtain of a shop at Mt. Tai in Shandong province, 2012. Gourds are auspicious symbols in China (photo: Valerie Hector).

origins to China's petrochemical industry which launched in the 1950s with equipment bought from the Soviet Union (Li and Todeva 2000:3). Today it is one of the world's largest industries. In the last decade, numerous small retail shops selling plastic beads individually and in bulk have opened in home-product malls in Beijing and other cities. The shops are generally filled with buyers wanting to make their own beaded figures, purses, curtains, and so on.

Plastic Tube-Bead Curtains

Presented here are interviews with several Chinese individuals who either made or commissioned plastic bead curtains for their homes or shops between 1984-2009, thereby personalizing an impersonal petrochemical industry, adapting global products for local needs.

It is not know exactly when plastic bead curtains first appeared in China, but Peter Haslund, Professor of Political Science at Santa Barbara City College, photographed one in Shijiazhuang village, Anqiu county, Shandong province, in 1984 (Plate XC). The photo was reproduced later that year in an English-language magazine published in China. Mentioning the curtain, the article's author erroneously wrote that it was made of "dried Chinese sorghum stems threaded together on long strings" (Wang Zheng 1984:26). When interviewed in January 2013, the owner, Liu Fengwei, said the curtain was made of plastic tube beads about 4-5 cm long that she cut with the help of her husband from longer lengths of plastic tubing obtained from a local store. No sorghum stems were used. At Liu's request, a local carpenter carved the wood hanging board from the branch of a parasol tree (*wutong*; *Firmiana simplex*). Liu's husband helped her string the plastic tubes using heavy nylon monofilament. Liu had never seen a glass bead curtain, nor were any bead curtains displayed in Liu's mother's home. Liu learned to make bead curtains by observing other local women making them. The Chinese government had built new homes in Shijiazhuang village in the early 1980s, some of them two stories tall. Women wanted to hang bead curtains in the doorways to deflect flying insects and allow ventilation, as well as to beautify their new homes. Sometimes a plastic bead curtain was displayed on one floor and a paper bead curtain on another. Liu had strung other bead curtains over the years, including five or six made of rolled calendar-paper beads. Her husband helped her make and string those beads, too. Bead curtains generally lasted three or four years, she recalled, before they had to be replaced.

Nowadays, Liu Fengwei observes, it is almost impossible to find old plastic tube-bead curtains where plastic tubes are mixed with Job's tears to create a zigzag pattern. Photos taken in the 1980s help date this type of curtain. Two bead curtains with zigzag motifs not unlike the ones favored by Liu Fengwei in 1984 are shown hanging in two doorways of the Zhang Yanfu family home in Gaomaowan village near Yan'an, Shaanxi, ca. 1985-1990 (Golany 1992: Figure 4.33). Another photo of unknown date shows a similar curtain hanging in a traditional cave home in Yan'an, Shaanxi province (Chen et al. 2008:301), which served as headquarters for Mao Zedong and the Chinese Communist Party from 1936-1948. Photo captions in Golany and Chen do not say whether the curtains are made of plastic, painted bamboo, or glass. In fact, the captions do not mention the bead curtains at all.

Plastic Faceted-Bead Curtains

A curtain of faceted plastic beads was created in 2007 for the Hutong Pizza restaurant in Beijing. The business opened in a historic building at no. 9 Yindingqiao Hutong in Beijing's Xicheng district in 2003. Located in Shichahai, a heavily touristed scenic neighborhood, the restaurant needed to keep its front door open without letting flies enter or *qi* (understood as positive energy) escape. Privacy was also a concern. In 2007, the staff decided to make their own bead curtain. The boss determined that the curtain should

portray the shop's logo, the same one printed on its menus and business cards (Plate XD). The logo playfully spells out the word *hutong* in classical Chinese, a reference to the China of centuries past. Plastic beads in corresponding colors were obtained from a small Beijing home-goods mall, as was an aluminum curtain rod. The pastry chef, a man in his 20s, came up with the idea of using beads of different sizes. It took a long time to string the curtain; everyone helped. It measured 1.06 m wide x 1.39 m high. Suspended in the restaurant's doorway, the curtain did not last long, even though it was only displayed during the warm weather months, from April until the end of November. The sun bleached the bead colors and children tore at the strands. After only a few years, the staff made an identical curtain to replace the first, but the same things happened. In the spring of 2012, the second bead curtain was put away for good. A cloth curtain now screens the front door, its blandness a lackluster substitute for an engaging predecessor.

Plastic Unfaceted-Bead Curtains

In 2009, the 18 Tea Garden (*Shiba Chayuan*) restaurant and tea house opened at no. 8 Banchang Hutong in Beijing's Dongcheng district. A number of window, door, and wall curtains were commissioned from a Beijing curtain company as part of the interior decoration. The curtains' designs were planned by Huang Rui, one of China's most famous contemporary artists and the brother of Huang Ling, the restaurant's manager. He chose to use non-reflective plastic beads in restful shades of pale blue, black, and clear. The beads all measure about 12 mm in diameter, rather large for a bead curtain. Chinese characters are the only motifs. Eight small bead curtains hang in the windows facing the street (Figure 12). The curtain at the left spells out "18 Tea Garden." The others begin to spell out a couplet from a poem by Song-dynasty poet Su Dongpo (1037-1101) entitled "Tasting Huoyuan New Baked Tea Given by Caofu." The couplet likens tea to a beautiful young lady: "good tea is like a pretty young lady/heavy makeup, light makeup, she will always be pretty" (*cong lai jia ming si jia ren/nong zhuang dan mo zong xiang yi*). The curtains reportedly contain a total of 180,000 beads. The work took place in a curtain workshop over a two-month period and cost 20,000 *renmimbi*, about US $30,000 in 2013. The beads are strung on heavy nylon monofilament making the curtains resistant to weather and wear.

The large curtain that hangs in the shop's doorway is often tied to one side or gathered in the middle, reducing the risk of wear while easing access. It bears a single character from the poem mentioned above. As one enters the shop, another curtain hangs in the vestibule. Others gradually become visible in the adjacent courtyard, bearing further characters (Figure 13). This bead curtain grouping, a layered construct, can be interpreted as a kind of living logo. Part business branding strategy, part aesthetic device, the grouping evokes the ambience of a traditional Chinese tea house as it is understood in early-21st-century Beijing. Cognizance of Chinese literary culture and, by implication, Chinese history is part of that ambience, as is a certain minimalist, modern sensibility. Whether traditional Chinese tea houses actually displayed bead curtains in like manner is almost beside the point. It is a near certainty, however, that older pieces of Chinese beadwork were inscribed with lines from poems. A small panel thought to date to the Ming dynasty survives in the Tokyo National Museum in Japan (Blair 1973: Figure 131). As mentioned previously, the panel appears to be composed of right angle stitch. The glass beads measure a scant 2 mm in diameter (Blair 1973:398). Seven characters in highly expressive running script flow down its length, forming a sentiment that may be transliterated as *kan qu dan qing chang bing bing*. It does not quote any published poem. Several translations are possible, among them, "to look upon a work of art brings endless longing" (Kenneth J. DeWoskin 2000: pers. comm.). In sum, the bead curtains at 18 Tea Garden participate in China's history of rendering poetic language in beads. Quite possibly, Chinese bead curtains of past eras did so too.

CONCLUSION

Information about early Chinese bead curtains is almost entirely to be found in texts of the imperial era which often associate the curtains with beautiful, secluded women, properly situated indoors and surrounded by attractive furnishings. These perceptions seem to have shifted towards the end of the imperial era as bead curtains accrued new layers of meaning. Twentieth-century glass bead curtains often bore motifs and inscriptions that conveyed auspicious wishes or, in some cases, political slogans. It is possible that another shift has been underway in the early 21st century. In curtain maker Liu Fengwei's experience, bead curtains are appropriate for low-rise buildings of the sort that used to fill China's traditional residential neighborhoods. Nowadays, across China, many of those neighborhoods are being torn down to make way for high-rise apartment blocks and commercial buildings (Johnson 2013). Yet, demand for bead curtains, especially plastic bead curtains, continues as Chinese people slowly relocate to multi-story buildings. Experts in *feng shui* or Chinese geomancy advocate the use of plastic bead curtains to redirect the *qi* or energy of a residence or business, believing that plastic bead curtains, carefully selected for length and color and hung in exactly

Figure 12. The 18 Tea Garden restaurant in Beijing's Dongcheng district, 2011, with plastic bead curtains in its windows. The curtain at the far left spells out the restaurant's name (photo: Valerie Hector).

Figure 13. Plastic bead curtains in the courtyard of the 18 Tea Garden restaurant, Beijing, 2011 (photo: Valerie Hector).

the right spot, can act like "liquid correction fluid" (*xiu gai yi*), attracting positive while deflecting negative influences (Buddha Tower Team 2013). Although it is possible that *feng shui* theory influenced bead curtain use in centuries past, it does not appear to be mentioned in the groups of textual references that were explored for this article.

Thus, it seems that bead curtains are being displayed in new venues, even as they acquire new layers of meanings. For now, it appears that the bead curtain genre will endure, in part by adapting to the needs of the times. As of 2013, bead curtains continue to enjoy an enduring place in Chinese visual and material culture. Their longstanding place in the Chinese imaginary also seems assured; contemporary novelists such as Wang Anyi (1995:145) continue to reference bead curtains in their texts. In the future, perhaps Chinese museums will consider bead curtains worth preserving and documenting. Although bead curtains tend to be vernacular, everyday objects, sometimes equated with "kitsch," they are also beautiful, expressive, and thought-provoking. Their history follows no simple linear trajectory. Influences stem from the past as well as the present, as ideas with deep roots in Chinese culture are rendered in new materials and modalities. This capacity for self-renewal contributes to the incredible tenacity of a genre that spans a minimum of 1,500 years.

Much still needs to be learned about Chinese bead curtains. The archival records of factories that produced beads and bead curtains may contain valuable information. Ideally, we could learn more about Liu Zaihai, Ren Silong, their families, rice-bead furnaces, and curtain-making operations. For a start, we might ask to what extent tasks were apportioned by gender, who determined designs, whether templates were used, and how social and political upheavals affected bead curtain production. Chinese municipal, county, and other archives might also be worth consulting for information on the production of other kinds of bead curtains.

Photographic archives also need to be investigated. Photos taken in the 19th and 20th centuries may show bead curtains in production or on display. Chinese, Japanese, and Western photographers have all left extensive photographic records. Chinese paintings and prints could also be reviewed for depictions of bead curtains, although such depictions seem to be rare.

Insights into bead curtain production, display, and lore may also be culled from interviews with bead curtain owners, makers, and sellers. This generally requires fieldwork in China, which may reveal experiences, perspectives, and tensions not reflected in the existing bead curtain literature. Interviews with An Jiayao, Liu Fengwei, the staff of the Hutong Pizza shop, and Huang Ling, manager of 18 Tea Garden, have already told us something about lived experiences of bead curtains in China in the 20th and 21st centuries. Future interviews will no doubt reveal more. For, as Peter Francis often reminded us, "It's not about the beads. It's about the people."

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APPENDIX A: 20TH-CENTURY GLASS FURNACES IN BOSHAN

Ten types of glassmaking furnaces were in use in Boshan during various parts of the 20th century (Zhang Weiyong 2008:256-265). Four are relevant to this study. "Big" furnaces (*da lu* [*da*: "big," *lu*: "furnace"]) were generally housed in large workshops or factories (*zuofang*) that produced glass from raw materials as well as finished glass products. "Glass strip" or "strip" furnaces (*liaotiao lu,*

tiao lu) produced strips or rods, in part to supply "round" furnaces (*yuan lu*), which produced large beads (*gan zhu*), accessories, furnishings, artistic objects, bracelets, snuff bottles, buttons, gaming pieces, etc. Beads for curtains were produced using rice-bead furnaces (*mizhu lu*) which were owned by individual families and located in homes.[13] While the largest rice-bead operations had two or three furnaces run by four to six people, the smallest had one furnace run by a husband/wife or older brother/younger brother team who sold their products in a small store attached to the home, called a "husband-and-wife store" (*fuqi laopo dian*) (Zhang Weiyong 2008:265). Thus, both genders appear to have been involved in rice-bead production in Republican (1912-1949) Boshan. In some cases, unmarried girls made rice beads, but they were not taught all of the procedures for fear they would eventually transfer their natal family's proprietary knowledge to their marital families. The technique of preparing iron mandrels (*gan zhangzi*) was one such proprietary technique (Zhang Weiyong 2008:269). In addition to family members, furnace owners also engaged apprentices who had to work a year or more before they were entrusted with proprietary techniques.

Like artisans in general, rice-bead workers were poor. They ranked low on the social ladder partly because they worked in cramped, smoky spaces that darkened their skin and dirtied their clothes, conditions not easily remedied at the time since bathing facilities were rudimentary or not easily accessed. Production halted when supplies of the raw materials needed to produce rice beads ran short. When small rice-bead-furnace workers did not have enough work, they would serve as temporary workers for larger rice-bead furnaces (Zhang Weiyong 2008:269). Small or large, all rice-bead furnaces operated only part of the year, from December to May or thereabouts, months that encompassed the lucrative New Year period and also avoided the summer heat. More research is required to determine what the rice-bead and other furnaces looked like and whether they used glass strips as a primary raw material.

The vicissitudes of war and political change adversely affected Boshan's glass industry. From 1911 to the 1980s, the overall trend for glass bead production was one of decline, characterized by periodic upticks as furnaces reopened after closing. The first major closure was at the outbreak of World War I. Then again in 1937, when the Japanese invaded North China, and once more in 1949, when the Communists came to power (Zhang Weiyong 2008:260-261). Zhang (2008:258, 273) estimates that around 1911 there were some 300 beadmakers in Boshan with perhaps 50 furnaces making beads and 30 more factories with 40 furnaces making strip (*liaotiao*). By 1936, there were only 80-90 beadmakers using about 14 furnaces. In the 1950s there were 12 furnaces, all run by the government, and by the 1980s, most or all of the furnaces had disappeared (Zhang Weiyong 2008:273; cf. Shandong 2013). Only very small factories still made beads. Furnace-wound glass beads continued to be made until at least 1984, when Paddy Kan witnessed three glass beadmakers at work around a coal-fired furnace with six openings at the Boshan Glass Factory in Shandong province (Kan and Liu 1984: Figures 1-15). Of the 4,000 workers employed at the factory, only five still made beads.

ENDNOTES

1. The distinctions between "strand," "tassel," and "fringe" are difficult to articulate, making the use of one term over another an arbitrary decision. In this article "tassel" is used to denote a relatively short string of beads or group of threads and "strand" to denote a long string of beads.

2. The term "corpse curtain" may be a modern derivation. In ancient texts the more common term is "beaded shroud jade cover" (*zhuru yuxia*) (Alice Yao 2013: pers. comm.).

3. The references in these two dictionaries appear in the sub-entries *zhu zhang, zhu wei, zhu huang, zhu bo, zhu lian* and *zhu long* under *zhu*, bead/pearl.

4. It is generally accepted that the term *liuli* was in use in China by the 2nd century B.C. during the Han dynasty (206 B.C.-A.D. 220), and that it might derive from the Sanskrit *vaidurya* (Francis 1986:5) or Pali *vainurya*, both meaning "blue stone or lapis lazuli" (Dien 2007:287). The term *boli* came into use later (Francis 1986:5); its derivation is more obscure. By the 6th century, *boli* and *liuli* were recognized as distinct substances (Dien 2007:287). The distinction, then as now, seems to turn on relative degrees of opacity. Albert Dien clarifies current usage as follows: "Today the terms are used with a certain degree of imprecision to distinguish the degree of opacity; that is, *liuli* applies to opaque or semitranslucent glass used for jewelry, beads, and other such objects while *boli* refers to transparent glass. The term *liaoqi* seems to have referred generally to glassy substances" (Dien 2007:287). Dien regrets the terminological inconsistencies that vex archaeological reports on Chinese glass beads, in which "*liao, liuli,* and *boli*" are sometimes used interchangeably (Dien 2007:287). Another point worth underscoring is that in addition

to meaning "glass," *liuli* has also meant "radiance," and been used as "a metaphor for dispersion"(Kim 2012:11, citing Needham 1962:104). Thus, there is an outside chance that a *liuli* curtain might not always refer to a "glass" bead curtain *per se*.

5. It is possible that the curtain in question was made not of beads but of cloth, and Feng may have been counting the beads affixed to the lower edges, ostensibly to weigh the cloth down. If this is correct, the object in question was more like a bead-edged curtain than a multi-strand bead curtain. The association of beads and memory also drives the use in China of "mutual-longing beads" (*xiangsi dou*), which are strung on thread and worn as bracelets. The beads are seeds of the *Adenanthera pavonina* tree.

6. Dorothy Ko (1994:12) argues that even before the advent of the 20th century, "the image of the cloistered woman, crippled by bound feet and imprisoned in her inner chambers" was to some extent a misconception. In fact, boundaries between the domestic and public spheres were often negotiable.

7. The references in the *Renmin Chubanshe* edition are as follows (Han Zhang 2012: pers. comm.; Jeff Keller 2012: pers. comm.): Chapter 5 (1 ref., p. 71, *lian zhu zhang* [bead curtain or canopy]; 1 ref., p. 79, *zhu lian* [bead curtain]); Chapter 18 (1 ref., p. 237, *zhu lian* [bead curtain]); Chapter 37 (1 ref., p. 500, *jing lian* [crystal curtain]); Chapter 48 (1 ref., p. 649, *zhen zhu lian* [pearl curtain]); Chapter 116 (3 refs., pp. 1546-1547, *zhu lian* [bead curtain]); and a footnote (1 ref., p. 250, no. 1, *zhu lian* [bead curtain]).

8. The term "5-colored" apparently originated centuries earlier in a text from the 4th century B.C. which relates how the goddess Nuwa smelted "stones of all five colors to patch up the flaws" in one of the pillars that supports Heaven (Kim 2012:5). In some cases it may function as a figure of speech. Its association with glass is longstanding. According to An Jiayao (2002:46), Daoist philosopher Ge Hong of the Western Jin period (265-316) refers to "bowls that look like rock crystal" being made in foreign countries "by melting a mixture of five different types of sands."

9. "Cane," a term favored by glass scholars, might be an acceptable English translation of *tiao*. For the purpose of consistency, however, "strip" will continue to be used in this article unless sources dictate otherwise. "Strip" is an established term in the English-language literature on 20th-century Chinese glass beadmaking; it appears several times in Kan and Liu 1984. Francis seems to prefer "cane" (Francis 2002:60).

10. Another object (a 12th-century sutra wrapper) apparently made of twined (?) glass strips and resembling the reproduction *tamasudare* is shown on the Miho Museum website: http://www.miho.or.jp/english/collect/archives/tp060821ne.htm, "World of Beads 2" link, accessed August 30, 2012).

11. According to Irene Emery (1966:196), twining involves two distinct sets of thread elements, in which one set typically consists of two threads that pass "alternately over and under successive elements of the opposite set." In the *tamasudare*, the horizontal glass rods function as one set of thread elements.

12. Prior to 1911, the term *qian* referred to a unit of money, but now, when referring to beads, it appears to denote a unit of weight, with one *qian* weighing 3.78 g and five *qian* weighing 18.9 g. It seems to be the case that some beads were organized in strings of 100, so that 100 "5-*qian*" beads weighed 18.9 grams, or five *qian*. Exceptionally skilled glass beadmakers could make beads so small that 100 of them weighed only two instead of five *qian* (Zhang Weiyong 2008:271).

13. Glass bead nomenclature was diverse in early-20th-century Boshan. The *ganzhu* or large bead category produced in round furnaces (*yuan lu*) included "round" (*yuan zhu*), "abacus" (*shuanshi zhu*),"lotus-seed" (*lianzi zhu*), "flat lotus seed" (*bian lianz zhu*), "pomegranate-shape" (*shiliuzi zhu*), and "gourd-shaped" (*gualengxing zhu*) beads. The smaller *mizhu* category included "round" (*yuan zhu*) and "lotus-seed" beads, plus "necklace" (*xianglian zhu*) and "Yao" beads (*Yao* [a minority group] *zhu*). The "round" bead (*yuan zhu*) category of *mizhu* beads was further divided into "small rice" (*xiao mizhu*), "two-six" (*erliu zhu*, which ran 260 beads to the string, with each string weighing one *liang*), "5-*qian*" (*wu qian zhu*), "bean-shaped" (*douxing zhu*), and "curtain" (*lianzi zhu*) beads. The "necklace" category of *mizhu* beads included "pagoda-shaped" (*baota zhu*), "egg-round" (*danyuan zhu*), "lotus root" (*ouxing zhu*), "pomegranate" (*shiliuzi zhu*), "porcelain bottle" (*ciping zhu*), "lion's-head-shaped" (*shizitou zhu*), "pagoda-egg-shaped" (*danyuan baota zhu*), "Yao", etc. Old-fashioned glass beads included "buddha" (*fo zhu*), "burning hot" (*tang zhu*), and "flower-petal-shaped" (*huaban zhu*), which were apparently also known as "water droplet" beads (*di shui zhu*) (Zhang Weiyong 2008:269ff.).

GLOSSARY

Note: Terms in italics are Chinese unless otherwise noted. When multiple English translations are possible, only the ones most relevant to this study are listed.

bo (curtain, screen) 箔

boli (glass) 玻璃

boli lu (glass furnace)玻璃炉

boli tiao (glass strip, rod, or possibly "cane") 玻璃條

chui liu (suspended tassels) 垂旒

cong lai jia ming si jia ren/nong zhuang dan mo zong xiang yi (good tea is like a pretty young lady/heavy makeup, light makeup, she will always be pretty) 从来佳茗似佳人/浓妆淡抹总相宜

cui bi (green jade) 翠碧

da lu (large furnace)大炉

danfeng chao yang (phoenix flying towards the sun) 丹凤朝阳

di shui (water droplet) 滴水

feng chuan mudan (phoenix piercing peony) 凤串牡丹

feng lian (wind curtain) 风帘

fu yu zhu ling (vermilion window lattice) 傅于朱棂

fuqi laopo dian (husband-and-wife store) 夫妻老婆店

gan zhangzi (lit.: to roll, polish, or otherwise prepare strips or rods, in this case, possibly iron mandrels) 擀杖子

gaogang duli (mountain solitude) 高岗独立

ge chuang xin (center opening of wooden lattice screen) 槅窗心

guan zhu (tube bead) 管珠

guan zhu lian (tube bead curtain) 管珠帘

gui (woman's apartment) 闺

huaban (flower petal) 花瓣

huiwen (meander) 回纹

jiangzuo zeli (handicraft regulations and precedents) 匠作則例

jing lian (crystal curtain) 晶帘

jishi zhu (memory beads) 记事珠

kan qu dan qing chang bing bing (possibly, to see a thing of beauty brings endless longing) 看取丹青長怲怲

li (Chinese mile; equal to 0.3106856 English mile) 里

lian (curtain) 帘

lian ban (curtain bar or board) 帘板

lian hua (lotus) 莲花

lian huang (curtain) 帘幌

lian zhu zhang (canopy-like bead curtain) 联珠帐

liang (unit of measure; an imperial liang was equal to 37.37 grams) 量

lianzi zhu (curtain bead) 帘子珠

liaotiao lu (glass strip or rod furnace) 料条炉

liuli (glass) 琉璃

liuli lian (glass curtain) 琉璃帘

liuli tiao (glass strips or rods) 琉璃条

mian guan chui liu (hats or crowns with suspended tassels) 冕冠垂旒

mietiao (long thin strips) 篾條

mizhu (rice bead) 米珠

mizhu lu (rice-bead furnace) 米珠炉

panchang (endless knot) 盤長

qian (a unit of weight equal to 3.78 grams) 錢

qing lian (blue or blue-green curtain) 青帘

qing lou (blue or blue-green buildings) 青楼

ru zhu si tiao (strips shaped like chopsticks) 如箸斯条

shiti de shi lian (corpse curtain) 尸体的尸帘

shui jing lian (crystal curtain) 水晶帘

Shuijing lian zeli (Regulations for Crystal Curtains) 水晶簾則例

tamasudare (Japanese: bead, jewel, or precious blind or curtain) 玉帘

tiao (measure word for long thing objects; strip or rod) 条

tiao lu (furnace for making strips or rods) 条炉

wei wei huang bo (woven into curtains) 纬为幌薄

wu qian zhu (5-*qian* bead) 五錢珠

wu se zhu lian (5-colored bead curtain) 五色珠帘

xiao chuang jian chui xiao shui jing lian (the small crystal curtains were hung among the miniature windows) 小窗間垂小水晶簾(小窗间垂小水晶帘)

xiao shui jing lian (small crystal curtain) 小水晶帘

yatiao (trim strip or molding) 押條 or 壓條

yu lian (jade curtain) 玉帘

yuan lu (round furnace) 圆炉

yuzhuru (jade bead mattress, comforter, or quilt) 玉竹褥

zhang (distance equal to 10 feet) 丈

zhen zhu (precious bead or pearl) 珍珠

zhen zhu ("real" bead, i.e. "pearl") 真珠

zhen zhu lian (precious bead or pearl curtain) 珍珠帘

zhi zhu (beads were woven) 织珠

zhu (bead, pearl) 珠

zhu bo (bead or pearl curtain) 珠箔

zhu huang (bead or pearl curtain) 珠幌

zhu lian (bead or pearl curtain) 珠帘

zhu ling (bead or pearl lattice) 朱棂

zhu long (bead or pearl window) 珠栊

zhu wei (bead or pearl curtain or net) 珠唯

zhu xuan (a window decorated with beads or pearls) 珠轩

zhu zhang (a bead or pearl tent or curtain) 珠张

zuofang (workshop or factory) 作坊

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BEADS FROM THE HUDSON'S BAY COMPANY'S PRINCIPAL DEPOT, YORK FACTORY, MANITOBA, CANADA

Karlis Karklins and Gary F. Adams

There is no other North American fur trade establishment whose longevity and historical significance can rival that of York Factory. Located in northern Manitoba, Canada, at the base of Hudson Bay, it was the Hudson's Bay Company's principal Bay-side trading post and depot for over 250 years. The existing site of York Factory is the last of a series of three posts, the first of which was erected in 1684. Completed in 1792, York Factory III functioned as the principal depot and administrative center for the great Northern Department until the 1860s when its importance began to wane. It then entered a long period of decline which ended in 1957, when the post was finally closed. Subsequent archaeological work at the site has revealed many structural features and associated artifacts including a large and varied assemblage of beads, mostly glass, which are the subject of this report.

HISTORICAL BACKGROUND

Perched on the west bank of the Hayes River in northern Manitoba just a few kilometers from Hudson Bay (Figure 1), York Factory's position was to gather furs and manage one of the largest tracts of land ever controlled by a single, private company. For nearly 300 years, York Factory – named for James, the Duke of York, second governor of the Hudson's Bay Company – was the Hudson's Bay Company's trading post, entrepôt, port of entry, management headquarters, shipyard, distribution center, and home for up to 120 employees. In peak summer months, its population could exceed a thousand people including Homeguard Indians, tripmen, sailors, and trappers. Though the first expedition of the *Nonsuch* in 1668 was destined to taste the Nelson River, it was not until 1682 that the first post was established. In that year, French interests under Pierre Radisson, Company interests under Zachariah Gillam and John Bridger, and a private New England group under Benjamin Gillam arrived at the mouths of the Hayes and Nelson Rivers. It was the start of 275 years of continuous fur-trade occupation at this location.

Intrigue, warfare, and circumstance caused York Factory and its short-lived competitor posts to change hands half a dozen times in two separate international conflicts. It witnessed a naval engagement and suffered three direct attacks. The factory was rebuilt seven times and was the base of operations for such fur trade personalities as Pierre Radisson, James Knight, Henry Kelsey, Samuel Hearne, Andrew Graham, James Isham, Joseph Colin, George Simpson, James Hargrave, and Joseph Fortesque. It figured in many issues of importance in the development of the Hudson's Bay Company and the evolution of Canada including control of Hudson Bay, the French and Indian wars, Arctic and western exploration, the Dobbs Affair, the 1810 HBC reorganization, westward expansion, the settling of Red River, the 1821 amalgamation with the North West Company, and the search for the Franklin expeditions.

The story of the York Factory beads is intimately linked to the story of York Factory III. The history of this occupation actually began on 24 August 1782. Four days earlier Jean-François de Galoup, Compte de Lapérouse, fresh from the sacking of the Prince of Wales Fort, arrived at the Hayes River. Sighting the *King George*, a 26-gun HBC ship at Five Fathom Hole, he decided to attack York by foot. He landed cannons, mortars, and 250 men opposite the site on the Nelson River and marched them overland. Chief Factor Humphrey Marten capitulated immediately, having already managed to get most of the furs out of the fort. York was occupied by the French and then razed on 1 September.

One significant result of this act was that it forced a much-needed physical reconstruction of York Factory so that it could meet the economic changes already in progress. York was no longer a trading post and had not been for some time. The many forts of the 17th and 18th centuries had been designed to service Indians traveling from the interior to trade, but since 1774, York had been a regional center for an ever-expanding hinterland that began with the construction of Cumberland House. York Factory's role was changing with meteoric rapidity. In 1782, there was already a second inland post, Hudson House, and numerous trading parties spread throughout the hinterland. The first big change came

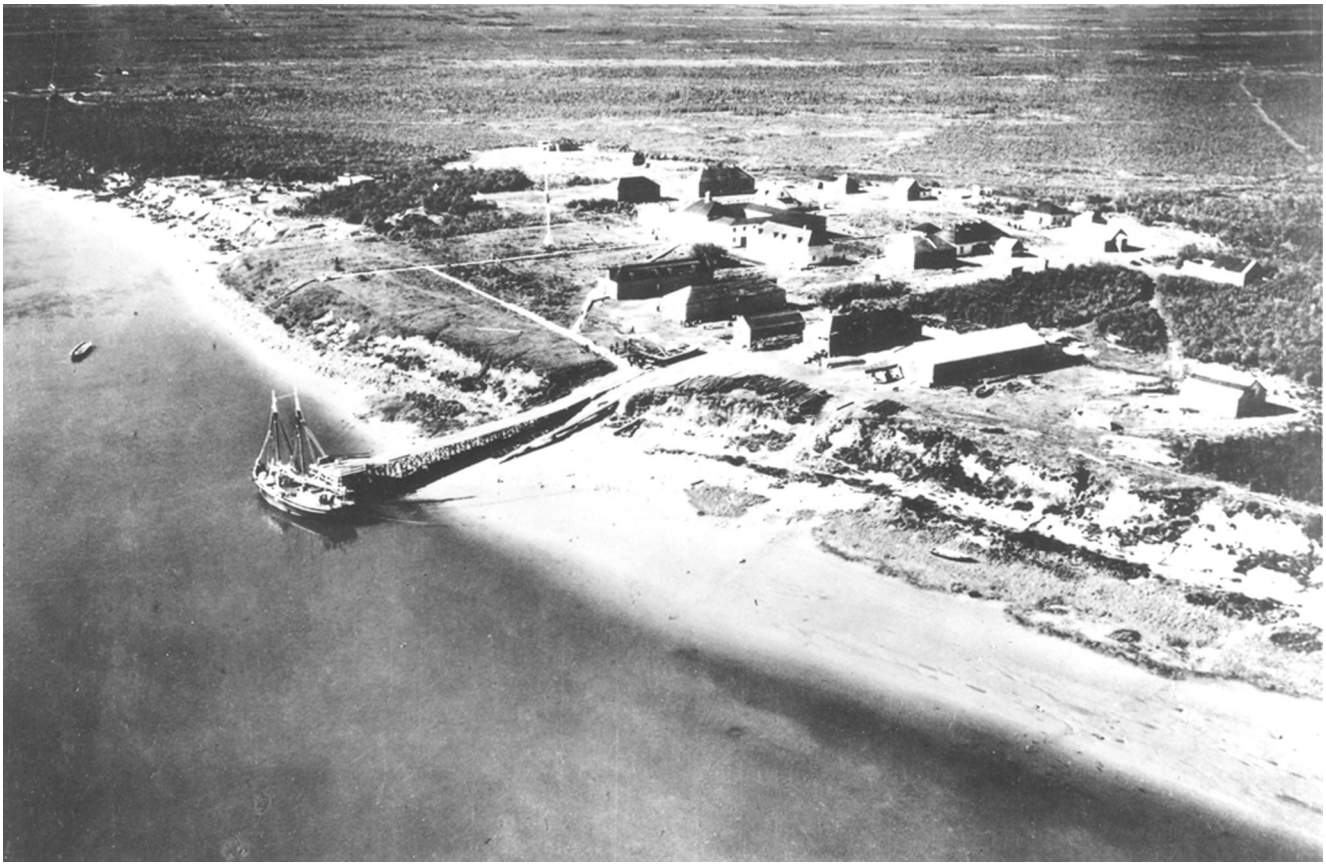

Figure 1. Aerial view of York Factory around 1925. Only the centrally located depot and a small building to its rear remain today (Public Archives Canada/Neg. no. PA-41571).

in 1786 when it was dictated that all effort be put into inland trade. Of the 112 men assigned to York, approximately three-quarters would be sent inland, including the chief factor, William Tomison. The "resident" or second in command left in charge of the "factory" was Joseph Colen.

Consequently, to keep operations at York going and to prevent even further trade losses in the aftermath of the French attack, an immediate replacement was necessary. Two prefabricated buildings were assembled in 1783 and 1785 as interim structures. In 1786, Colen began the construction of a large flanker-style fort as was traditional along the bay. Work progressed until May 1788, when a spring flood devastated the site.

The day after the flood waters peaked, the intrepid Colen manned a canoe with two other men and paddled up one of the footpaths until they reached dry ground. Their landing point was where York Factory III now stands. The partially assembled buildings at the flood-prone site were dismantled and moved to the new location. The operations were formally relocated in 1791. The new fort, called the Old Octagon in later years, was the base of operations until the 1820s when a rebuilding period would see the factory's character change again.

The increasing number of posts in the interior strained the administrative system to the point that in 1810, York, Churchill, and the Saskatchewan and Winnipeg rivers posts were formed into the Northern Department, managed from York. The following year was to see the arrival of the first Selkirk settlers who wintered at York and used it as a port of entry and supply. The amalgamation of the Hudson's Bay Company with the North West Company in 1821 further enhanced the role of York Factory. Throughout the 1830s and 1840s it controlled the accounting, distribution, and transportation of virtually every commodity between Fort William in what is now western Ontario and the Rocky Mountains and from the American frontier to the Arctic Ocean.

It was during this period that the Old Octagon was razed and the "Great House" – the three-storey depot that still dominates the site today – was constructed. This held a quantity of goods and provisions sufficient to meet the demands of the northern trade for a period of two years. It

was also a manufacturing center for sundry trade goods. By the 1860s, however, it had became more practical to bring goods into Rupert's Land by way of St. Paul, Minnesota, and Red River. As a result, York entered a long period of decline that ended in 1957 when the post was officially closed. The Hudson's Bay Company transferred ownership of the site to the Government of Canada in 1968. It was subsequently declared a National Historic Site under the jurisdiction of Parks Canada.

In its heyday, York Factory III consisted of more than 50 buildings with the massive depot at its center (Figure 2). Unfortunately, human depredation and shore erosion have caused the disappearance of almost all of the structures. Only the depot, the adjacent one-room library, and the stone walls of a nearby magazine have survived to the present day.

THE ARCHAEOLOGY

The archaeological investigation of York Factory began in 1970, when James V. Chism and Karlis Karklins performed a preliminary assessment of the site and its archaeological and architectural components (Chism and Karklins 1970). A thorough survey followed in 1978, when Gary Adams led a team of three archaeologists to examine and identify the historical resources of the site and any problems associated with them. Their report demonstrated how much York Factory had suffered for its role. Of the first five building phases – over 120 years of history – not a trace remained. The two York Factory III phases (1788-1920s and 1920s-1957) were represented by one magnificent standing structure, the Depot Warehouse, and a graveyard. The majority of the site was defined entirely by its archaeological resources and the Hayes River was actively eroding the bank, sending structures and artifacts tumbling into the river.

Parks Canada formally launched a four-year archaeological program to rescue some of the most endangered resources by excavating and recording individual features and collecting associated artifacts. A series of surveys, testing programs, and structural excavations yielded a mass of information. The work concentrated on the riverbank resources, an area about 70 meters wide and over one kilometer long. One of the first conclusions was that York Factory was exceptional. First of all, a 190-year occupation in a single swampy location had created a major stratigraphic sequence. The area along the riverbank typically contained at least four stratigraphic zones with numerous other layers and events. Further inland this would increase to over a meter of archaeological deposits. The Subarctic environment created excellent conditions for preservation. The ground is saturated with water and seldom exceeds 5°C in temperature. While this condition is hard on

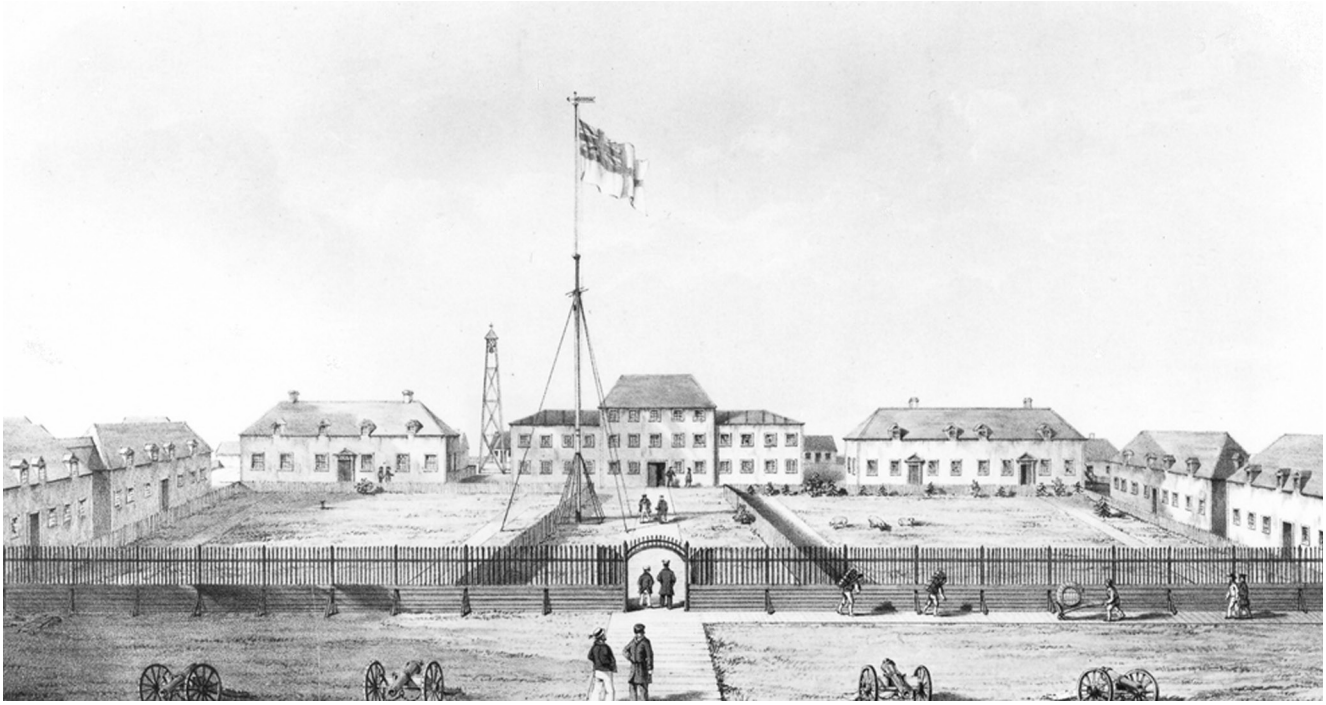

Figure 2. York Factory in 1853; the Depot is situated in the center. The illustration is purportedly based on a sketch by Chief Trader Alexander H. Murray (Public Archives Canada/Neg. no. C-16826).

some iron artifacts and tends to cause spalling of ceramics, it is a wonderful preservative for cloth, wood, paper, and leather.

Another source of amazement was the sheer size and scale of the site and the natural factors affecting it. Approximately 30 primary company structures were typically 10 m by 15-30 m in size and were supplemented by over twice as many other buildings. The site is over a kilometer long and its entire length is being eroded at a rate of about a half meter each year. Initial evaluation in 1983 identified 33 structures in immediate danger (Adams 1983).

Finally, the archaeologists discovered that the detailed state of the historical documentation for York Factory could provide an unequaled opportunity for research of all kinds. A proper archival study can augment virtually any analysis with detailed information seldom seen for archaeological sites.

The archaeological project provided a comprehensive study of the resources along the riverbank. Only one possible building from the early period was encountered, the 1799 Launch House, but eight structures from the second phase were partially salvaged. The Dog Meat House, Oil Cloth Factory, Ice House, East Fur Store, Inland Cargo House, Canoe Shed, 1840 Boat House, and 1916 Boat House all received from 2% to 38% excavation while all the extant remains of the Sawpit were salvaged. In addition, excavation exposed portions of the front palisades, boardwalks, drainage systems, and some specific features such as a dock ramp, timber storage facilities, a firepit, a warping box, and some unidentified features. Of particular note are the Native encampments. Historically, all traders were obliged to set up camp outside the palisades so the remains of these camps are all situated in the area between the front palisade and the river. Basic descriptions for each operation related to this work have already been published in a series of internal manuscripts (Adams 1982b, 1983, 1985; Adams and Burnip 1981).

Subsequently, a major internal report was completed to summarize the recovered artifacts (Lunn 1985). The salvage project also spurred several artifact-specific studies including ceramics (Hamilton 1982), Carron stoves (Moat 1979), arts and crafts (Adams 1982a), and personal artifacts of the early 19th century (Adams and Lunn 1985). The present bead study was also initiated as part of this project.

In August of 1989, Gary Adams led a team to mitigate resources in response to an environmental impact assessment for the development of a site staffing facility. The location of the staffing facility was to be in the area to the back and upstream from the main post. This was in the vicinity of the 1930s schoolhouse that burned down and close to several barns which were built in the previous century (Donaldson 1981). The impacted area did not directly encompass any major structure but it did manage to provide interesting archaeological contexts and artifacts. Once the areas where the staffing facility footings would go had been investigated, the crew spent two days examining the eroding remains of a limekiln located along the riverbank just south of the dry-dock area.

In the early 1990s, a new challenge faced the archaeologists at York Factory. The most visible and spectacular feature of the site is the Hudson's Bay Company warehouse and packing room, called the Depot. This building, over 150 years old and imposing in its scale even when constructed, became the central focus of the entrepôt's activities over time, consolidating almost all of them under one roof. The Depot is massive, measuring about 30 m square, with an internal courtyard measuring 11 by 16 m. This wood-frame building was constructed in sections over a seven-year period beginning in 1831.

By 1990, the ground floor had severely deteriorated and sunk into the saturated soil. As a result of the vertical displacement, the substructure composed of heavy squared-timber floor joists, sleepers, and mud sills no longer provided necessary structural support. It was decided that a long-term Depot conservation and management strategy needed to include the structural stabilization and repair of the building which would begin in 1992. The planning process recognized that there would be the remains of an earlier occupation under the Depot. Therefore, a team of archaeologists led by Peter Priess arrived in 1991 to remove fill and excavate subsurface remains between the floor joists (Figure 3). What they found were the well-preserved remains of the "Old Octagon" (Ebell and Priess 1993). In the following two years, additional remains were found when the floor was completely removed and insulation and drainage trenches were excavated outside the Depot walls and in the courtyard. In a three-year period of conflicting objectives, mediation, compromise, and frustration, building engineers, restoration crews, and archaeologists worked to restore the Depot while protecting and salvaging as much of the Old Octagon as possible. In addition to cellars, foundations, and fireplaces from the earlier occupation, the crew discovered many subsurface attributes from the Depot. Working through very difficult conditions, they also recovered three pieces of intact beadwork, as well as a bear-claw necklace, clothing remnants, a felt hat, three human molars (containing large caries), and other fragile artifacts too numerous to mention.

In the late 1990s, efforts at York Factory concentrated on resource monitoring. Every year since 1996, a team has gone onto the site to monitor the archaeological resources most threatened by riverbank erosion and other destructive

Figure 3. Excavations being conducted inside the Depot at York Factory (Parks Canada/9K-1591T).

agents. Most of this work has entailed little excavation. In 2000, however, a loading platform was salvaged near the Lower Pier and part of the pier itself was examined in 2002. The two field seasons also involved the partial recovery of the 1857 Church of St. John.

THE BEAD INVENTORY

The various York Factory excavations produced a total of 28,598 beads. All but eight of these are made of glass and represent all four major manufacturing categories: drawn, wound, mold pressed, and blown. Three ceramic (Prosser-molded) beads are also represented, as are specimens of metal (2), plastic (2), and bone (1). In all, 277 varieties are represented.

The glass beads are classified using the taxonomic system developed by Kenneth E. Kidd and Martha A. Kidd (1970) as expanded by Karklins (2012). Varieties that do not appear in the Kidds' lists are marked by an asterisk (*) followed by a sequential letter for ease of reference. The York Factory laboratory number (YF #) is also included so that future researchers may easily find specific varieties when examining the collection. Complex bead shapes are identified using Beck (1928).

The color names and codes used are those provided in the *Munsell Bead Color Book* (Munsell Color 2012) and the names generally correspond to those used by the Kidds. Diaphaneity is described using the terms opaque (op.), translucent (tsl.), and transparent (tsp.). Opaque beads are impenetrable to light except on the thinnest edges. Specimens that are translucent transmit light but diffuse it so that an object (such as a pin in the perforation) viewed through them is indistinct. A pin in the perforation of a transparent bead is clearly visible.

All measurements are in millimeters. A plus sign (+) after a measurement indicates that it is of an incomplete specimen.

The beads have generally been assigned to two principal occupation periods: 1) the late 18th and 19th centuries, and 2) the 20th century. The former period encompasses the

1788-1831 occupation of the original fort (the Octagon) situated beneath the extant Depot which was constructed between 1831 and 1837. It also includes the subsequent occupation of the Depot until about 1870, by which time the majority of the earlier bead varieties were no longer current. The beads attributed to the 20th century doubtless also include some used in the late 19th century but were primarily used during the first half of the 20th century. In those cases where it was possible to narrow these temporal ranges, more-specific dates are provided.

Where possible, the dates provided for the different varieties are based on their archaeological contexts. In poorly dated contexts, they are based on comparable material from firmly dated loci at the site or from other contemporary sites and, in some cases, on specific physical attributes and the type of manufacture of the beads.

Drawn Glass Beads

The 28,194 beads in the drawn bead category comprise 98.6% of the York Factory bead assemblage. They were produced from segments of glass tubing drawn out from a gather of molten glass. Prior to the 20th century, the drawing was done manually (hand drawn). A mechanical means (inclined downdrawing) to accomplish this was perfected and patented in 1917 by Edward Danner of the Libby Glass Company, Toledo, Ohio (Ross 2005:43). In this process, a constant stream of molten glass flowed over a rotating, hollow blowpipe which introduced air into the gather to form the hole (Francis 1996:5). Depending on the cross-section of the pipe, the resultant beads could have perforations that were triangular, square, or some other shape (Francis 1996:5). The Danner and subsequent processes, however, could only produce monochrome beads. Tubes for striped and multi-layered beads continued to be drawn by hand and still are. Beads representative of both techniques are present in the York Factory collections but there is no way to segregate them visually, except for those with shaped perforations (these are marked SP in the inventory that follows).

When the tube had cooled, it was broken into bead lengths. These could be used as is or their rough ends were rounded by subsequent heating and agitation. Initially this was done by hand. Smaller beads were heated in a pan mixed with sand and wood ash. The mixture was stirred and the bead segments gradually became viscid and their angular edges were rounded. Larger beads were placed on a spit (*a speo*) which was rotated in a furnace until the desired roundness had been achieved. Because of the way they were produced, *a speo* beads often exhibit certain characteristics that help to identify this method (Karklins 1993). A mechanical means (heat tumbling) to round beads was devised in 1817 and greatly helped to speed the process (Karklins and Adams 1990). There is no way to distinguish pan-rounded from heat-tumbled beads.

The drawn-bead assemblage is quite varied with 18 Kidd/Karklins types being represented by 188 varieties (Plates XI-XVII). Small seed beads (type IIa) predominate.

Ia – Tubular, Monochrome, Undecorated

Ia2 (YF-v). Tubular; op. black (N 1/0); glass appears tsl. rose wine (10RP 4/6) on thin edges when held up to a strong light; ends range from unaltered breaks to well rounded; some specimens fall into the category of imitation wampum; late 18th/19th centuries; no. = 6.

Diameter: 3.0-4.6 Length: 6.2-21.5

Ia3 (YF-jj). Tubular; tsp. light gray (N 7/0); iridescent patina; very fragmentary specimen; late 18th/19th centuries; no. = 1.

Diameter: 4.7 Length: 4.0+

Ia4 (YF-1). Tubular; tsl. oyster white (N 8/0) flashed in clear glass; ends range from unaltered breaks to rounded; some specimens fall into the category of imitation wampum; late 18th/19th centuries; no. = 184.

Diameter: 1.6-6.1 Length: 0.7-32.0

Ia5 (YF-y). Tubular; op. white (N 9/0) flashed in clear glass; the white glass has a granular, porcelain-like appearance; broken ends; fragmentary specimen; late 18th/19th centuries; no. = 1.

Diameter: 3.5 Length: 6.8+

Ia*(a) (YF-s). Tubular; tsl. white (N 9/0) satin sheen; ends consist of unaltered breaks; 19th century; no. = 4.

Diameter: 2.0-2.7 Length: 2.1-3.2

Ia*(b) (YF-49c). Tubular; tsp. ruby (2.5R 3/10); pinkish-white patina; the glass tends to be cracked and crumbly; late 18th/19th centuries; no. = 10.

Diameter: 2.8-3.3 Length: 3.0-5.1

Ia*(c) (YF-3). Tubular; op. amber (10YR 7/8); earthy patina; ends range from unaltered breaks to slightly rounded; late 18th/19th centuries; no. = 10.

Diameter: 2.6-3.3 Length: 3.4-5.4

Ia*(d) (YF-2). Tubular; tsl./op. sunlight yellow (5Y 8/8); thick earthy patina; ends consist of unaltered breaks; late 18th/19th centuries; no. = 4.

Diameter: 5.0-6.3 Length: 12.0-23.8

Ia*(e) (YF-4). Tubular; tsl./op. dark palm green (10GY 4/4-6); thick earthy patina; ends range from unaltered breaks to rounded; late 18th/19th centuries; no. = 11.

Diameter: 2.3-3.8 Length: 2.2-6.0

Ia15 (YF-56a). Tubular; tsp./tsl. bright blue (5B 5/7); numerous linear bubbles in glass; ends consist of unaltered breaks; late 18th/19th centuries; no. = 2.

Diameter: 3.3 Length: 3.7-3.9

Ia*(f) (YF-o). Tubular; op. dusty blue (2.5PB 5/2); ends range from unaltered breaks to slightly rounded; late 18th/19th centuries; no. = 345.

Diameter: 3.0-4.6 Length: 2.3-6.2

Ia*(g) (YF-6). Tubular; op. medium blue (5PB 3/6); ends range from practically unaltered breaks to slightly rounded; late 18th/19th centuries; no. = 55.

Diameter: 3.2-5.7 Length: 3.3-7.7

Ia*(h) (YF-cc). Tubular; op. powder blue (5PB 6/3); ends range from unaltered breaks to rounded; late 18th/19th centuries; no. = 8.

Diameter: 2.6-2.8 Length: 2.2-4.4

Ia19 (YF-5). Tubular; tsp. bright navy (7.5PB 2/7); ends range from unaltered breaks to well rounded; late 18th/19th centuries; no. = 147.

Diameter: 1.4-5.1 Length: 2.0-16.2

Ib – Tubular, Monochrome Body, Decorated with Straight Simple Stripes

Ib*(a) (YF-7). Tubular; tsp./tsl. bright navy (7.5PB 2/7) with 12 thin op. white (N 9/0) stripes; ends consist of unaltered breaks; late 18th/19th centuries; no. = 2.

Diameter: 4.3-4.5 Length: 12.8-15.5

Ibb' – Tubular, Monochrome Body, Decorated with Spiral Compound Stripes

Ibb'*(a) (YF-yy). Tubular; tsp./tsl. deep brown (10YR 3/4) body exhibiting 2 sets of closely spaced simple and compound spiral stripes, one on either side of the bead: 1) op. aqua blue (2.5B 6/4), 2) op. white (N 9/0)/op. brick red (7.5R 3/8)/op. white/op. brick red, 3) op. light gold (2.5Y 7/8), 4) op. white , 5) 3 very narrow tsp. aqua green (7.5BG 6/6), and 6) op. white; relatively flat but diagonal ends; late 18th/19th centuries; no. = 1.

Diameter: 6.1 Length: 16.6

Ic – Tubular, Straight, Monochrome, Polyhedral Body

Ic*(a) (YF-9). Tubular, hexagonal; iridescent op. black (N 1/0); ends consist of unaltered breaks; late 19th/early 20th century; no. = 2.

Diameter: 1.6 Length: 6.5

Ic*(b) (YF-8). Tubular, hexagonal; tsp. light gray (N 7/0) (colorless); uneven, slightly rounded ends; 20th century; no. = 16.

Diameter: 1.8-1.9 Length: 1.4-1.8

Ic*(c) (YF-15a). Tubular, hexagonal; tsp. ruby (2.5R 3/10); slightly rounded ends; 20th century; no. = 1.

Diameter: 2.0 Length: 1.5

Ic*(d) (YF-15). Tubular, hexagonal; op. ruby (2.5R 3/10); slightly rounded ends; 20th century; no. = 9.

Diameter: 1.9-2.0 Length: 1.5-2.2

Ic*(e) (YF-14). Tubular, hexagonal; op. scarlet (8.75R 4/14); slightly rounded ends; 20th century; no. = 64.

Diameter: 1.7-2.2 Length: 1.4-2.1

Ic*(f) (YF-13). Tubular, hexagonal; op. poppy red (8.75R 4/14); slightly rounded ends; 20th century; no. = 24.

Diameter: 1.8-2.3 Length: 1.5-2.2

Ic*(g) (YF-12). Tubular, hexagonal; tsp. bright coral red (10R 5/14); slightly rounded ends; 20th century; no. = 1.

Diameter: 1.7 Length: 1.8

Ic*(h) (YF-11). Tubular, hexagonal; op. bright orange (1.25YR 5/12); slightly rounded ends; 20th century; no. = 7.

Diameter: 1.7-2.1 Length: 1.5-1.8

Ic*(i) (YF-10). Tubular, hexagonal; tsp. orange (2.5YR 6/14); slightly rounded ends; 20th century; no. = 2.

Diameter: 1.5-2.0 Length: 1.5

Ic*(j) (YF-17). Tubular, hexagonal; tsp. grass green (10GY 5/10); slightly rounded ends; 20th century; no. = 2.

Diameter: 1.8 Length: 1.6-2.0

Ic*(k) (YF-16). Tubular, hexagonal; tsp. bright green (2.5G 5/10); slightly rounded ends; 20th century; no. = 1.

Diameter: 1.9 Length: 1.9

Ic*(l) (YF-18). Tubular, hexagonal; tsp. bright blue (5B 5/7); slightly rounded ends; 20th century; no. = 2.

Diameter: 1.8 Length: 1.7

Ic*(m) (YF-19). Tubular, hexagonal; tsp. cerulean blue (7.5B 4/8); slightly rounded ends; 20th century; no. = 1.

Diameter: 2.0 Length: 1.5

Ic13 (YF-20). Tubular, hexagonal; tsp. bright navy (7.5PB 2/7); rounded ends; 20th century; no. = 3.

Diameter: 2.1 Length: 1.8

Ic (lined) – Tubular, Monochrome Polyhedral Body Having Silvering or Colored Enamel on the Perforation Surface

Ic (lined)*(a) (YF-21a). Tubular, hexagonal; tsp. light gray (N 7/0) with a silvered layer on the surface of the perforation; slightly rounded ends; 20th century; no. = 3.

Diameter: 1.9-2.1 Length: 1.2-1.5

Ic (lined)*(b) (YF-21). Tubular, hexagonal; tsp. light gray (N 7/0) with op. pink (ca. 5RP 6/8) enamel on the perforation surface; slightly rounded ends; 20th century; no. = 16.

Diameter: 1.7-2.3 Length: 1.3-1.9

Ic (lined)*(c) (YF-22). Tubular, hexagonal; tsp. light gray (N 7/0) with op. purplish enamel (ca. 5P 5/4) on the perforation surface; slightly rounded ends; 20th century; no. = 4.

Diameter: 1.7-1.9 Length: 1.6-1.8

If – Tubular, Monochrome Beads with Surfaces Modified by Grinding

If*(a) (YF-MPu). Tubular, multifaceted; op. black (N 1/0); 20 irregular cut facets ranging from triangular to hexagonal cover the surface; relatively flat ends; very narrow cylindrical perforation; late 18th/19th centuries; no. = 1.

Diameter: 4.9 Length: 3.9

If*(b) (YF-z). Tubular, multifaceted; tsp. light gray (N 7/0); 24 irregular cut facets cover the surface; uneven ends; probably 19th century; no. = 2.

Diameter: 6.2 Length: 4.5-4.8

If*(c) (YF-vv). Tubular, multifaceted; tsp. light gray (N 7/0); 24 irregular diamond-shaped cut facets about the middle, and 8 triangular to pentagonal cut facets around either end; surface is extensively faceted but tiny sections of the original tube surface are visible; slightly rounded ends; probably 19th century; no. = 1.

Diameter: 7.2 Length: 9.0

If*(d) (YF-ww). Tubular, multifaceted; tsl. ruby (2.5R 3/10); 24 irregular diamond-shaped cut facets about the middle, and 8 triangular to pentagonal cut facets around either end; battered ends; late 18th/19th centuries; no. = 1.

Diameter: 8.0 Length: 12.2

If*(e) (YF-aa). Tubular, multifaceted; tsp. turquoise green (5BG 4/8); 18 diamond-shaped cut facets about the middle, and 6 pentagonal cut facets around either end; flat ends; late 18th/19th centuries; no. = 2.

Diameter: 6.2-7.7 Length: 9.1-11.6

If*(f) (YF-ee). Tubular, multifaceted; tsp. turquoise (10BG 4/8); 18 diamond-shaped cut facets about the middle, and 6 triangular to pentagonal cut facets around either end; ground flat ends; late 18th/19th centuries; no. = 1.

Diameter: 7.0 Length: 12.0

If*(g) (YF-27). Tubular, cornerless hexagonal; op. iridescent black (N 1/0); slightly rounded ends; 20th century; no. = 8.

Diameter: 2.0-2.1 Length: 1.6-2.2

If2 (YF-23). Tubular, cornerless hexagonal; tsp. light gray (N 7/0); ends consist of unaltered breaks; 19th century; no. = 10.

Diameter: 7.3 Length: 6.7

If2 var. (YF-26). Tubular, cornerless hexagonal; tsp. light gray (N 7/0); slightly rounded ends; 20th century; no. = 22.

Diameter: 1.9-2.0 Length: 1.2-1.9

If*(h) (YF-24). Tubular, cornerless hexagonal; tsp. light gold (2.5Y 7/8); slightly fire-polished ends; 19th century; no. = 1.

Diameter: 8.5 Length: 8.0

If*(i) (YF-25). Tubular, cornerless hexagonal; tsp. russet orange (5YR 6/12); the surface has been extensively faceted and no original body facets remain; ends consist of unaltered breaks; 19th century; no. = 2.

Diameter: 3.7-8.3 Length: 7.4-7.6

If*(j) (YF-30). Tubular, cornerless hexagonal; op. ruby (2.5R 3/10); slightly rounded ends; 20th century; no. = 27.

Diameter: 1.9-2.2 Length: 1.3-2.8

If*(k) (YF-31). Tubular, cornerless hexagonal; tsp. deep red (7.5R 3/10); slightly rounded ends; 20th century; no. = 147.

Diameter: 1.8-3.4 Length: 1.5-3.4

If*(l) (YF-29). Tubular, cornerless hexagonal; op. scarlet (8.75R 4/14); slightly rounded ends; 20th century; no. = 27.

Diameter: 1.8-2.1 Length: 1.3-1.8

If*(m) (YF-28). Tubular, cornerless hexagonal; tsp. burnt orange (10R 5/10); very slightly rounded ends; 20th century; no. = 3.

Diameter: 1.8 Length: 2.2

If*(n) (YF-a). Tubular, cornerless hexagonal; op. bright coral red (10R 5/14); slightly rounded ends; 20th century; no. = 11.

Diameter: 1.7-2.1 Length: 1.2-2.3

If*(o) (YF-33). Tubular, cornerless hexagonal; tsp. grass green (10GY 5/10); very slightly rounded ends; 20th century; no. = 1.

Diameter: 1.8 Length: 1.9

If*(p) (YF-32). Tubular, cornerless hexagonal; tsp. bright green (2.5G 5/10); slightly rounded ends; 20th century; no. = 2.

Diameter: 2.0 Length: 1.4

If*(q) (YF-34). Tubular, cornerless hexagonal; tsp. bright blue (5B 5/7); some specimens exhibit intentionally iridized surfaces; very slightly rounded ends; 20th century; no. = 8.

Diameter: 2.0-2.4 Length: 1.3-2.0

If*(r) (YF-35). Tubular, cornerless hexagonal; tsp. cerulean blue (5B 5/7); slightly rounded ends; 20th century; no. = 1.

Diameter: 1.9 Length: 1.6

If*(s) (YF-36). Tubular, cornerless hexagonal; tsp. ultramarine (6.25PB 3/12); slightly rounded ends; 20th century; no. = 2.

Diameter: 1.7 Length: 2.6

If*(t) (YF-37). Tubular, cornerless hexagonal; tsp. bright navy (7.5PB 2/7); slightly rounded ends; 20th century; no. = 44.

Diameter: 2.0-2.1 Length: 1.4-2.0

If (lined) – Tubular, Monochrome Polyhedral Beads with Surfaces Modified by Grinding and Silvering or Colored Enamel on the Perforation Surface

If (lined)*(a) (YF-38). Tubular, cornerless hexagonal; tsp. light gray (N 7/0) with a silvered layer on the surface of the perforation; some specimens exhibit intentionally iridized surfaces; slightly rounded ends; 20th century; no. = 23.

Diameter: 1.8-2.2 Length: 1.0-2.2

If (lined)*(b) (YF-39). Tubular, cornerless hexagonal; tsp. light gray (N 7/0) with light red (ca. 5R 5/12) enamel on the perforation surface; slightly rounded ends; 20th century; no. = 12.

Diameter: 1.8-2.1 Length: 1.3-2.0

If (lined)*(c) (YF-40). Tubular, cornerless hexagonal; tsp. light gray (N 7/0) with op. purplish (ca. 5P 5/4) enamel on the perforation surface; slightly rounded ends; 20th century; no. = 6.

Diameter: 1.8-2.0 Length: 1.6-1.9

IIa – Non-tubular, Monochrome Body, Undecorated

IIa2 (YF-w). Circular; op. brick red (7.5R 3/8); late 18th/19th centuries; no. = 30.

Diameter: 1.4-3.7 Length: 1.2-2.6

IIa2 var. (YF-62). Circular; op. brick red (7.5R 3/8); 20th century; no. = 67.

Diameter: 1.4-2.0 Length: 0.9-1.7

IIa7 (YF-41). Circular; op. black (N 1/0); glass appears tsl. rose wine (10RP 4/6) on thin edges when held up to a strong light; late 18th/19th centuries; no. = 331.

Diameter: 1.4-4.8 Length: 0.9-3.4

IIa*(a) (YF-42). Circular; tsp. light gray (N 7/0); late 18th/19th centuries; no. = 96.

Diameter: 1.5-5.6 Length: 1.4-4.1

IIa*(a) var. (YF-63). Circular; tsp. light gray (N 7/0); 20th century; no. = 251.

Diameter: 2.1-2.3 Length: 1.4-2.0

IIa*(b) (YF-64). Circular; tsl. light gray (N 7/0); 20th century; no. = 31.

Diameter: 2.1-5.6 Length: 1.3-3.9

IIa11/IIa12 (YF-43/44). Circular/round; tsl. oyster white (N 8/0); most specimens are flashed in clear glass; shape ranges from distinctly barrel shaped to short tube sections with rounded ends; late 18th/19th centuries; no. = 5,323.

Diameter: 1.3-5.5 Length: 0.7-5.4

IIa14 (YF-46). Circular; op. white (N 9/0); shape ranges from distinctly barrel shaped to short tube sections with rounded ends; late 18th/19th centuries; no. = 5,703.

Diameter: 1.4-5.7 Length: 1.0-4.3

IIa14 var. a (YF-66). Circular; op. white (N 9/0); 20th century; no. = 402.

Diameter: 1.4-2.5 Length: 0.9-2.1

IIa14 var. b (SP) (YF-119). Circular; op. white (N 9/0); square perforation; 20th century; no. = 26.

Diameter: 1.5-2.0 Length: 1.0-1.9

IIa*(c) (YF-45). Circular; tsp. pale blue (7.5B 8/2) (milk white); glass has a golden cast; late 18th/19th centuries; no. = 27.

Diameter: 2.0-3.2 Length: 1.2-2.4

IIa*(c) var. (YF-67b). Circular; tsp. pale blue (7.5B 8/2) (milk white); glass has a distinct golden cast; 20th century; no. = 47.

Diameter: 2.0-3.4 Length: 1.3-3.0

IIa*(d) (YF-67a). Circular; tsl. pale blue (7.5B 8/2) (milk white); glass has a deep golden cast; 20th century; no. = 100.

Diameter: 1.8-2.2 Length: 1.0-1.6

IIa*(e) (YF-49a-b/83). Circular; tsp. ruby (2.5R 3/10); shape ranges from distinctly barrel shaped to short tube sections with rounded ends; some specimens exhibit a pinkish-white patina and the glass tends to be cracked and crumbly; late 18th/19th centuries; no. = 615.

Diameter: 1.7-3.9 Length: 1.3-4.9

IIa*(e) var. (YF-84). Circular; tsp. ruby (2.5R 3/10); 20th century; no. = 29.

Diameter: 1.5-2.3 Length: 0.9-1.6

IIa*(f) (YF-82). Circular; op. ruby (2.5R 3/10); 20th century; no. = 121.

Diameter: 1.6-2.4 Length: 1.2-1.7

IIa*(g) (YF-116). Circular; tsp. pink (2.5R 7/6) with golden cast; 20th century; no. = 18.

Diameter: 1.7-2.0 Length: 1.0-1.7

IIa*(h) (SP) (YF-116a). Circular; tsp. pink (2.5R 7/6); square perforation; 20th century; no. = 1.

Diameter: 1.8 Length: 1.6

IIa*(i) (YF-115). Circular; op. wine (7.5R 2/6); 20th century; no. = 2.

Diameter: 2.3-2.5 Length: 1.3

IIa*(j) (YF-81). Circular; op. scarlet (8.75R 4/14); 20th century; no. = 209.

Diameter: 1.9-2.4 Length: 1.1-1.8

IIa*(k) (YF-nn). Circular; tsl. light tomato red (7.5R 5/13); 20th century; no. = 3.

Diameter: 1.7 Length: 0.9

IIa*(l) (YF-n). Circular; op. light tomato red (7.5R 5/13); 20th century; no. = 48.

Diameter: 2.0-2.2 Length: 1.0-1.8

IIa*(m) (YF-79). Circular; tsp. bright coral red (10R 5/14); 20th century; no. = 8.

Diameter: 1.6-2.2 Length: 1.1-2.2

IIa*(n) (YF-80). Circular; tsp. bright coral red (10R 5/14); 20th century; no. = 5.

Diameter: 1.6-3.8 Length: 0.9-2.3

IIa*(o) (YF-78). Circular; op. bright coral red (10R 5/14); 20th century; no. = 89.

Diameter: 1.7-2.4 Length: 0.9-2.0

IIa*(p) (YF-77). Circular; op. bright orange (1.25YR 5/12); 20th century; no. = 25.

Diameter: 1.9-2.3 Length: 1.2-2.0

IIa*(q) (YF-76). Circular; op. orange (2.5YR 6/14); 20th century; no. = 21.

Diameter: 2.0-2.6 Length: 1.5-1.8

IIa*(r) (YF-75). Circular; op. russet orange (5YR 6/12); 20th century; no. = 4.

Diameter: 1.4-2.3 Length: 1.1-1.5

IIa*(s) (YF-74). Circular; tsp. cinnamon (10YR 5/6); 20th century; no. = 1.

Diameter: 1.5 Length: 1.0

IIa19 (YF-47). Circular; op. amber (10YR 7/8); earthy patina; the glass is often decomposed; late 18th/19th centuries; no. = 282.

Diameter: 1.2-4.0 Length: 0.9-2.7

IIa19 var. (YF-73). Circular; op. amber (10YR 7/8); 20th century; no. = 20.

Diameter: 2.2 Length: 1.3

IIa*(t) (YF-72). Circular; op. bright yellow (10YR 7/14); 20th century; no. = 48.

Diameter: 1.8-2.6 Length: 0.9-2.3

IIa*(u) (YF-48). Circular; tsp. light gold (2.5Y 7/8); the beads often consist of short tube sections with rounded ends; earthy patina; late 18th/19th centuries; no. = 133.

Diameter: 1.2-3.6 Length: 0.7-4.0

IIa*(v) (YF-71). Circular; tsp. sunlight yellow (5Y 8/8); 20th century; no. = 6.

Diameter: 1.5-2.3 Length: 1.0-1.7

IIa*(w) (YF-70). Circular; tsl./op. sunlight yellow (5Y 8/8); 20th century; no. = 97.

Diameter: 1.8-2.2 Length: 0.9-1.4

IIa*(x) (YF-69). Circular; op. buttercup (5Y 8/12); 20th century; no. = 97.

Diameter: 1.7-2.7 Length: 1.1-1.8

IIa*(y) (YF-68). Circular; tsl. lemon yellow (10Y 8/10); 20th century; no. = 10.

Diameter: 2.0-2.1 Length: 1.2-1.5

IIa*(z) (YF-98). Circular; op. bright chartreuse (2.5GY 7/10); 20th century; no. = 19.

Diameter: 1.5-2.6 Length: 1.0-1.6

IIa*(aa) (YF-97). Circular; tsp. leaf green (7.5GY 6/6); 20th century; no. = 21.

Diameter: 1.8 Length: 1.6

IIa*(bb) (YF-ll). Circular; op. leaf green (7.5GY 6/6); 20th century; no. = 35.

Diameter: 1.7-2.4 Length: 1.2-1.6

IIa*(cc) (YF-52). Circular; tsl./op. dark palm green (10GY 4/4-6); the color varies; thick earthy patina; late 18th/19th centuries; no. = 258.

Diameter: 1.3-3.7 Length: 1.3-4.6

IIa*(dd) (YF-ii). Circular; op. deep grass green (10GY 4/8); 20th century; no. = 47.

Diameter: 1.8-2.0 Length: 1.1-1.3

IIa*(ee) (YF-96). Circular; tsp. grass green (10GY 5/10); 20th century; no. = 10.

Diameter: 2.1-2.3 Length: 1.1-1.8

IIa*(ff) (YF-95). Circular; tsl. apple green (10GY 6/6); 20th century; no. = 35.

Diameter: 2.0 Length: 1.2

IIa*(gg) (YF-94). Circular; op. apple green (10GY 6/6); 20th century; no. = 134.

Diameter: 1.8-2.5 Length: 1.1-2.0

IIa*(hh) (YF-92). Circular; op. dark green (2.5G 3/6); 20th century; no. = 7.

Diameter: 2.1 Length: 1.3

IIa*(ii) (YF-51). Circular; tsl. bright green (2.5G 5/10); shape ranges from distinctly barrel shaped to short tube sections with rounded ends; earthy patina; late 18th/19th centuries; no. = 146.

Diameter: 1.3-3.9 Length: 1.1-4.0

IIa*(jj) (YF-qq). Circular; tsp./tsl. bright green (2.5G 5/10); 20th century; no. = 94.

Diameter: 2.2-2.6 Length: 1.2-2.2

IIa*(kk) (YF-91). Circular; op. bright green (2.5G 5/10); 20th century; no. = 40.

Diameter: 1.7-2.5 Length: 1.0-1.7

IIa*(ll) (YF-93). Circular; tsl. light almond green (2.5G 6/4); 20th century; no. = 4.

Diameter: 1.8-2.2 Length: 1.0-1.5

IIa*(mm) (YF-c). Circular; tsl. bright mint green (2.5G 7/8); 20th century; no. = 20.

Diameter: 1.7-1.8 Length: 1.2-1.4

IIa*(nn) (YF-90). Circular; tsp. mint green (5G 6/6); 20th century; no. = 5.

Diameter: 1.9 Length: 1.1

IIa*(oo) (YF-87). Circular; tsl. dark jade green (10G 4/5); 20th century; no. = 57.

Diameter: 1.8-1.9 Length: 1.1-1.2

IIa*(pp) (YF-88). Circular; tsp. emerald green (10G 5/10); 20th century; no. = 15.

Diameter: 1.5-2.7 Length: 0.9-2.5

IIa*(qq) (YF-89). Circular; op. light jade green (10G 6/6); 20th century; no. = 7.

Diameter: 2.0 Length: 1.0

IIa*(rr) (YF-86). Circular; tsp. turquoise green (5BG 4/8); 20th century; no. = 15.

Diameter: 2.0-2.3 Length: 1.2-1.9

IIa*(ss) (YF-85). Circular; op. aqua green (7.5BG 6/6); 20th century; no. = 10.

Diameter: 2.0-2.2 Length: 1.4-1.9

IIa*(tt) (YF-113). Circular; tsl. robin's egg blue (5B 6/6); 20th century; no. = 48.

Diameter: 1.9-2.1 Length: 1.0-1.4

IIa*(uu) (YF-112). Circular; tsl. robin's egg blue (5B 6/6)

with golden cast; color varies; 20th century; no. = 308.

Diameter: 1.7-2.7 Length: 0.9-1.7

IIa41 (YF-111). Circular; op. robin's egg blue (5B 6/6); 20th century; no. = 353.

Diameter: 1.4-2.8 Length: 0.8-1.6

IIa43/IIa*(vv) (YF-55/56). Circular/round; tsp./tsl. bright blue (5B 5/7); color varies considerably; numerous linear bubbles in glass; late 18th/19th centuries; no. = 3,892.

Diameter: 1.3-7.1 Length: 1.1-6.0

IIa*(vv) var. (YF-114a). Circular; tsp./tsl. bright blue (5B 5/7); 20th century; no. = 2.

Diameter: 2.0 Length: 1.2

IIa*(ww) (YF-eeee). Circular; tsl. light aqua blue (5B 8/4); 20th century; no. = 17.

Diameter: 1.9 Length: 1.3

IIa*(xx) (YF-eee). Circular; op. light aqua blue (5B 8/4); 20th century; no. = 28.

Diameter: 1.7-2.7 Length: 1.0-1.7

IIa*(yy) (YF-109). Circular; tsp. cerulean blue (7.5B 4/8); 20th century; no. = 95.

Diameter: 1.5-2.2 Length: 0.9-1.9

IIa*(zz) (YF-57). Circular; tsl./op. cerulean blue (7.5B 4/8); late 18th/19th centuries; no. = 83.

Diameter: 1.5-4.3 Length: 1.0-3.1

IIa*(aaa) var. (YF-110). Circular; tsl. cerulean blue (7.5B 4/8); 20th century; no. = 125.

Diameter: 1.8-2.4 Length: 1.0-1.8

IIa*(bbb) (YF-108). Circular; op. cerulean blue (7.5B 4/8); 20th century; no. = 42.

Diameter: 1.8-2.4 Length: 1.2-1.6

IIa*(ccc) (YF-m). Circular; tsl. sky blue (7.5B 6/6); 20th century; no. = 30.

Diameter: 1.9-2.2 Length: 1.2-1.6

IIa*(ddd) (YF-107). Circular; tsl. sky blue (7.5B 6/6) with golden cast; 20th century; no. = 86.

Diameter: 1.8-2.6 Length: 0.9-1.6

IIa*(eee) (YF-114). Circular; op. sky blue (7.5B 6/6); 20th century; no. = 10.

Diameter: 1.8-2.4 Length: 1.0-1.6

IIa*(fff) (YF-107a). Circular; tsl. mist blue (10B 6/3); probably 20th century; no. = 2.

Diameter: 1.7 Length: 1.1

IIa*(ggg) (YF-107aa). Circular; op. mist blue (10B 6/3); probably 20th century; no. = 1.

Diameter: 2.1 Length: 1.3

IIa*(hhh) (YF-54). Circular; op. dusty blue (2.5PB 5/2); shape ranges from distictly barrel shaped to short tube sections with rounded ends; late 18th/19th centuries; no. = 487.

Diameter: 1.3-4.4 Length: 0.9-5.2

IIa*(iii) (YF-106). Circular; tsp. bright copen blue (2.5PB 6/9) with golden cast; 20th century; no. = 8.

Diameter: 1.5-1.7 Length: 0.9-1.2

IIa*(jjj) (YF-105). Circular; op. bright copen blue (2.5PB 6/9); 20th century; no. = 25.

Diameter: 1.5-2.8 Length: 1.2-1.6

IIa*(kkk) (YF-58). Circular; op. medium blue (5PB 3/6); shape ranges from distictly barrel shaped to short tube sections with rounded ends; late 18th/19th centuries; no. = 404.

Diameter: 2.0-5.3 Length: 1.4-6.0

IIa*(lll) (YF-104). Circular; tsl./op. dark blue (5PB 4/10); 20th century; no. = 219.

Diameter: 1.8-2.3 Length: 0.9-1.7

IIa*(mmm) (YF-103). Circular; op. copen blue (5PB 5/7); 20th century; no. = 104.

Diameter: 1.9-2.7 Length: 1.2-1.7

IIa*(nnn) (YF-53). Circular; op. powder blue (5PB 6/3); shape ranges from distictly barrel shaped to short tube sections with rounded ends; late 18th/19th centuries; no. = 456.

Diameter: 1.5-4.0 Length: 1.1-4.3

IIa53 (YF-102). Circular; tsp. ultramarine (6.25PB 3/12); 20th century; no. = 37.

Diameter: 1.8-3.1 Length: 1.1-2.0

IIa*(ooo) (YF-101). Circular; tsl./op. ultramarine (6.25PB 3/12); 20th century; no. = 160.

Diameter: 1.7-2.2 Length: 0.9-1.6

IIa56 (YF-59). Circular; tsp. bright navy (7.5PB 2/7);

the intensity of the color varies greatly as some specimens are quite pale; shape ranges from distinctly barrel shaped to short tube sections with rounded ends; late 18th/19th centuries; no. = 219.

Diameter: 1.2-4.1 Length: 1.0-4.4

IIa57 (YF-60). Oval; tsp./tsl. bright navy (7.5PB 2/7); distinct broken projection at one end indicating it was rounded using the *a speo* technique (Karklins 1993); late 18th/early 19th centuries; no. = 1.

Diameter: 10.0 Length: 15.4

IIa*(ppp) (YF-100). Circular; tsl./op. bright navy (7.5PB 2/7); 20th century; no. = 111.

Diameter: 1.8-2.5 Length: 1.0-1.8

IIa*(qqq) (YF-99). Circular; op. bright Dutch blue (7.5PB 4/11); 20th century; no. = 215.

Diameter: 1.8-2.3 Length: 0.8-1.5

IIa59 (YF-50). Circular; tsp. rose wine (10RP 4/6); late 18th/19th centuries; no. = 46.

Diameter: 1.4-4.1 Length: 1.4-3.8

IIa59 var. (YF-118). Circular; tsp. rose wine (10RP 4/6); 20th century; no. = 5.

Diameter: 1.9-2.3 Length: 1.2-1.4

IIa*(rrr) (YF-117). Circular; op. rose pink (10RP 7/6); color ranges to baby pink (5R 8/4); 20th century; no. = 395.

Diameter: 1.4-2.3 Length: 0.8-1.5

IIa (lined) – Non-Tubular, Undecorated Monochrome Body with Silvering or Colored Enamel on the Perforation Surface

IIa (lined)*(a) (YF-122a). Circular; tsp. light gray (N 7/0) with silvering on the surface of the perforation; 20th century; no. = 4.

Diameter: 2.0 Length: 1.9

IIa (lined)*(b) (YF-122). Circular; tsp. light gray (N 7/0) with light red (ca. 5R 5/12) enamel on the surface of the perforation; 20th century; no. = 6.

Diameter: 1.8-2.5 Length: 1.3-2.0

IIa (lined)*(c) (SP) (YF-120). Circular; tsp. light gray (N 7/0) with ca. light red (ca. 5R 5/12) enamel on the surface of the square perforation; 20th century; no. = 5.

Diameter: 1.8-2.0 Length: 1.1-1.4

IIa (lined)*(d) (SP) (YF-121). Circular; tsp. bright chartreuse (2.5GY 7/10) with silvering on the surface of the square perforation; 20th century; no. = 1.

Diameter: 2.4 Length: 1.3

IIb – Non-Tubular, Monochrome Body Decorated with Straight Simple Stripes

IIb12 (YF-123). Circular/round; op. black (N 1/0) with 4 op. white (N 9/0) stripes; glass appears tsl. rose wine (10RP 4/6) when held up to a strong light; one specimen consists of two beads fused together end to end, possibly indicative of *a speo* manufacture (Karklins 1993); late 18th/19th centuries; no. = 19.

Diameter: 2.5-4.0 Length: 2.2-3.6

IIb*(a) (YF-124). Circular; op. black (N 1/0) with 6 op. white (N 9/0) stripes; late 18th/19th centuries; no. = 1.

Diameter: 4.1 Length: 2.7

IIb*(b) (YF-125). Circular; op. black (N 1/0) with 2 op. brick red (7.5R 3/8) and 2 op. white (N 9/0) stripes; late 18th/19th centuries; no. = 1.

Diameter: 3.7 Length: 2.2

IIb31 (YF-130). Circular/round; op. white (N 9/0) (bluish tint) with 2 op. brick red (7.5R 3/8) and 2 tsp. bright navy (7.5PB 2/7) stripes; flashed in clear glass; late 18th/19th centuries; no. = 1.

Diameter: 4.3 Length: 4.2

IIb31 var. (YF-130a). Circular; op. white (N 9/0) with 2 op. brick red (7.5R 3/8) and 2 tsp. bright navy (7.5PB 2/7) stripes; 20th century; no. = 2.

Diameter: 2.0 Length: 1.3

IIb*(c) (YF-128). Circular; op. white (N 9/0) with 4 tsp. bright turquoise (7.5BG 6/8) stripes; 20th century; no. = 7.

Diameter: 2.2-2.6 Length: 1.1-1.4

IIb*(d) (YF-128a). Circular; op. white (N 9/0) (bluish tint) with 6 tsp. bright turquoise (7.5BG 6/8) stripes; 20th century; no. = 2.

Diameter: 2.0 Length: 1.3

IIb*(e) (YF-ss). Circular; op. white (N 9/0) with 4 tsp. bright navy (7.5PB 2/7) stripes; 20th century; no. = 5.

Diameter: 1.6 Length: 0.8

IIf – Non-Tubular, Monochrome with Surfaces Modified by Grinding

IIf*(a) (YF-135). Faceted circular; tsp. rose wine (10RP 4/6); surface exhibits random cut facets; late 18th/19th centuries; no. = 5.

Diameter: 1.3-4.0 Length: 1.9-3.1

IIIa – Tubular, Multi-Layered, Undecorated

IIIa3 (YF-136). Tubular; op. brick red (7.5R 3/8) exterior; tsp. apple green (10GY 6/6) core; ends range from unaltered breaks to well rounded; late 18th/19th centuries; no. = 25.

Diameter: 1.7-4.3 Length: 2.1-17.0

IIIf – Tubular, Multi-Layered, Polyhedral Beads with Surfaces Modified by Grinding

IIIf1 (YF-137). Tubular, cornerless hexagonal; tsp. light gray (N 7/0) exterior; tsl. pale blue (7.5B 8/2) core with slight golden cast; the bead consists of a six-sided tube segment with a pentagonal facet ground on each corner; broken but relatively flat ends; 19th century; no. = 2.

Diameter: 5.0-8.1 Length: 4.5-7.6

IIIf*(a) (YF-140). Tubular, cornerless hexagonal; tsp. bright orange (1.25YR 5/12) exterior; tsp. light gray (N 7/0) core; slightly rounded ends; the bead consists of a six-sided tube segment with an irregular facet ground on each corner; 20th century; no. = 54.

Diameter: 1.8-1.9 Length: 1.5

IIIf*(b) (YF-138). Tubular, cornerless heptagonal; tsp. bright navy (7.5PB 2/7) exterior; op. aqua blue (2.5B 6/4) core; the bead consists of a seven-sided tube segment with a pentagonal facet ground on each corner; broken but relatively flat ends; 19th century; no. = 1.

Diameter: 9.0 Length: 8.0

IIIf*(c) (YF-139). Tubular, cornerless hexagonal; tsp. bright navy (7.5PB 2/7) exterior; op. aqua blue (2.5B 6/4) middle layer; tsp. bright navy core; the bead consists of a six-sided tube segment with a triangular facet ground on each corner; slightly rounded ends; 19th century; no. = 1.

Diameter: 7.0 Length: 6.4

IIIk – Tubular, Undecorated, Multi-Layered Chevron Beads

IIIk*(a) (YF-141). Tubular chevron bead with faceted ends; 4 starry layers (the rays are slightly bent): 1) op. brick red (7.5R 3/8) exterior; 2) op. white (N 9/0) ; 3) op. brick red; 4) op. white core; uneven ends; late 18th/19th centuries; no. = 3.

Diameter: 10.3-11.3 Length: 19.0-20.0

IIIk*(b) (YF-142). Tubular chevron bead with faceted ends; 4 starry layers (all the rays are bent): 1) op. black (N 1/0) exterior; 2) op. white (N 9/0); 3) op. redwood (10R 4/8); 4) op. white core; uneven ends; late 18th/19th centuries; incomplete; no. = 3.

Diameter: 9.3-10.5 Length: 20.9-24.1

IIIk*(c) (YF-143). Tubular chevron bead with faceted ends; 4 starry layers (the rays are bent): 1) tsp. dark green (2.5G 3/6) exterior (rays of second layer show through as whitish stripes); 2) op. white (N 9/0); 3) op. redwood (6 ne); 4) op. white core (bent or spiral rays); uneven ends; eroded surface; late 18th/19th centuries; incomplete; no. = 2.

Diameter: 8.3-12.0 Length: 15.3+-22.1

IIIk*(d) (YF-144). Tubular chevron bead with faceted ends; 4 starry layers: 1) tsp. bright navy (7.5PB 2/7) exterior; 2) op. white (N 9/0); 3) op. redwood (10R 4/8); 4) op. white core; uneven ends; light patina; late 18th/19th centuries; incomplete specimens; no. = 4.

Diameter: 9.0-9.5+ Length: 19.8+-31.6+

IIIl' – Tubular, Multi-Layered Chevron Beads with Undecorated, Twisted, Polyhedral Bodies

IIIl'*(a) (YF-gg). Tubular, twisted hexagonal chevron with faceted ends; 3 starry layers: 1) op. black (N 1/0) exterior; 2) op. brick red (7.5R 3/8) ; 3) op. white (N 9/0) core; the 12 rays are diagonal, especially in layer #4; uneven ends; shiny iridescent patina; late 18th/19th centuries; no. = 1.

Diameter: 7.2 Length: 22.1

IIInn-a – Tubular, Multi-Layered Chevron Beads Decorated with Compound Stripes

IIInn-a*(a) (YF-kk). Tubular chevron with faceted ends; 4 starry layers: 1) tsl./op. bright navy (7.5PB 2/7) exterior with 6(?) op. brick red (7.5R 3/8) on op. light gold (2.5Y 7/8) stripes; 2) op. white (N 9/0) ; 3) op. brick red; 4) op. white core; uneven ends; light earthy patina; fragmentary specimens; late 18th/19th centuries; no. = 2.

Diameter: 9.0 Length: 12.2+

IVa – Non-Tubular, Multi-Layered, Undecorated

IVa3 (YF-145). Circular; op. brick red (7.5R 3/8) exterior; tsp. light gray (N 7/0) core; late 18th/19th centuries; no. = 945.

Diameter: 1.5-4.2 Length: 1.0-4.3

IVa6 (YF-146). Circular; op. brick red (7.5R 3/8) exterior; tsp. apple green (10GY 6/6) core; late 18th/19th centuries; no. = 2,108.

Diameter: 1.4-5.0 Length: 1.1-4.7

IVa*(a) (YF-r). Circular; op. brick red (7.5R 3/8) exterior; tsp. ruby (2.5R 3/10) core (consists of filaments of red glass in light gray or pale apple green glass which give it a pale to deep ruby color); late 18th/19th centuries; no. = 19.

Diameter: 2.4-4.0 Length: 1.9-3.4

IVa*(b) (YF-150). Circular; tsp. ruby (2.5R 3/10) exterior; op. white (N 9/0) core; 20th century; no. = 59.

Diameter: 1.8-3.1 Length: 1.0-2.0

IVa*(c) (YF-149). Circular; tsp. scarlet (8.75R 4/14) exterior; op. white (N 9/0) core; 20th century; no. = 120.

Diameter: 1.9-3.1 Length: 0.8-2.1

IVa*(d) (YF-149a). Circular; tsp. scarlet (8.75R 4/14) exterior; op. light gold (2.5Y 7/8) core; 20th century; no. = 4.

Diameter: 2.5 Length: 1.6

IVa*(e) (YF-148). Circular; tsp./tsl. bright coral red (10R 5/14) exterior; op. white (N 9/0) core; 20th century; no. = 84.

Diameter: 1.7-3.2 Length: 0.9-2.5

IVa*(f) (YF-147). Circular; tsp. bright orange (1.25YR 5/12) exterior; op. white (N 9/0) core; 20th century; no. = 2.

Diameter: 2.3-2.4 Length: 1.3-2.0

IVb – Non-Tubular, Multi-Layered, Decorated with Straight Simple Stripes

IVb*(a) (YF-fff). Circular; op. brick red (7.5R 3/8) exterior with 4 op. white (N 9/0) stripes; tsp. apple green (10GY 6/6) core; late 18th/19th centuries; no. = 1.

Diameter: 3.1 Length: 3.3

IVb*(b) (YF-126). Circular; op. white (N 9/0) exterior with 4 tsp. scarlet (8.75R 4/14) stripes; tsl. pale blue (7.5B 8/2) core with a slight golden cast; late 18th/19th centuries; no. = 15.

Diameter: 2.4-3.9 Length: 1.8-3.2

IVb*(c) (YF-127). Circular; op. white (N 9/0) exterior with 4 tsp. emerald green (10G 5/10) stripes; tsl. pale blue (7.5B 8/2) core with a slight golden cast; late 18th/19th centuries; no. = 17.

Diameter: 2.1-2.9 Length: 1.7-2.5

IVb*(d) (YF-129). Circular; op. white (N 9/0) with 4 tsl. bright navy (7.5PB 2/7) stripes; tsl. pale blue (7.5B 8/2) core with a slight golden cast; late 18th/19th centuries; no. = 6.

Diameter: 2.5-3.1 Length: 2.4-3.0

IVb*(e) (YF-151). Circular; op. white (N 9/0) exterior with 4 tsp. bright navy (7.5PB 2/7) stripes; tsl. dark blue (5PB 4/10) core; 20th century; no. = 1.

Diameter: 1.8 Length: 0.9

IVb*(f) (YF-131). Circular; op. white (N 9/0) with 2 tsp. scarlet (8.75R 4/14) and 2 op. light gold (2.5Y 7/8) stripes; tsl. pale blue (7.5B 8/2) core with a slight golden cast; late 18th/19th centuries; no. = 1.

Diameter: 2.7 Length: 4.0

IVb*(g) (YF-132). Circular; op. white (N 9/0) exterior with 2 tsp. scarlet (8.75R 4/14) and 2 tsp. emerald green (10G 5/10) stripes; tsl. pale blue (7.5B 8/2) core with a slight golden cast; late 18th/19th centuries; no. = 23.

Diameter: 2.3-3.0 Length: 1.6-2.8

IVb*(h) (YF-133). Circular; op. white (N 9/0) exterior with 2 tsp. scarlet (8.75R 4/14) and 2 tsp. bright navy (7.5PB 2/7) stripes; tsl. pale blue (7.5B 8/2) core with a slight golden cast; late 18th/19th centuries; no. = 79.

Diameter: 1.9-3.2 Length: 1.5-3.0

IVb*(i) (YF-134). Circular; op. white (N 9/0) exterior with 2 tsp. emerald green (10G 5/10) and 2 op. light gold (2.5Y 7/8) stripes; tsl. pale blue (7.5B 8/2) core with a slight golden cast; late 18th/19th centuries; no. = 58.

Diameter: 2.1-3.4 Length: 1.9-3.7

Wound Glass Beads

Beads of wound manufacture were formed by winding a gather of molten glass around a metal mandrel until the desired size and shape were achieved. Decoration could be applied to the surface or marvered into it while the glass was still viscid. There are 12 Kidd/Karklins types represented by 71 varieties (Plates XVII-XXA).

WIb – Monochrome Round Beads

WIb*(a) (YF-p). Round (irregular); op. black (N 1/0); glass appears tsp. dark green (2.5G 3/6) on thin edges when held up to a strong light; thick brown patina; late 18th/19th centuries; no. = 1.

Diameter: 4.0 Length: 3.5

WIb*(b) (YF-W5). Round (shape ranges from near globular to slightly ovoid); op. black (N 1/0); glass appears tsp. rose wine (10RP 4/6) on thin edges when held up to a strong light; late 18th/19th centuries; no. = 5.

Diameter: 4.3-5.5 Length: 4.3-5.8

WIb1 (YF-W1). Round; tsp. light gray (N 7/0); numerous tiny bubbles in glass; wind marks evident; light patina; probably late 18th/19th centuries; no. = 1.

Diameter: 10.5 Length: 9.5

WIb*(c) (YF-W2). Round; tsl. light gray (N 7/0); late 18th/19th centuries; no. = 27.

Diameter: 4.5-6.0 Length: 4.2-5.3

WIb*(c) var. (YF-W2a). Round; tsl. light gray (N 7/0); shiny surface; 19th (?) century; no. = 1.

Diameter: 6.3 Length: 5.5

WIb2 (YF-W3). Round to slightly ovoid; op. white (N 9/0); porcelain-like appearance; semi-glossy surface; wind marks evident; light brownish patina; late 18th/19th centuries; no. = 38.

Diameter: 3.4-6.0 Length: 3.5-9.3

WIb2 var. (YF-W4). Round; op. white (N 9/0); small perforation; matte surface; 19th (?) century no. = 4.

Diameter: 4.3 - 5.8 Length: 4.2 - 5.4

WIb5 (YF-W7). Round; tsl. pale blue (7.5B 8/2); milk white with slight alabaster cast; 19th (?) century; no. = 2.

Diameter: 6.3 Length: 5.6-5.7

WIb*(d) (YF-W8). Round; tsl. bright yellow (2.5Y 8/12); slightly patinated; 19th or 20th century; no. = 1.

Diameter: 5.8 Length: 4.8

WIb*(e) (YF-W6). Round; tsp. ruby (2.5R 3/10); brown earthy patina; late 18th/19th centuries; no. = 9.

Diameter: 3.4-6.9 Length: 3.3-7.2

WIb*(f) (YF-W10). Round (slightly ovoid); op. leaf green (7.5GY 6/6); wind marks evident; late 18th/19th centuries; no = 1.

Diameter: 6.5 Length: 7.9

WIb*(g) (YF-Wx). Round (irregular); op. dark palm green (10GY 4/4); shiny surface; late18th/19th centuries; no. = 8.

Diameter: 3.6-4.6 Length: 3.4-4.1

WIb*(h) (YF-W9). Round (slightly barrel shaped); op. aqua green (7.5BG 6/6); wind marks evident; lightly pitted surface; late 18th/19th centuries; no. = 1.

Diameter: 4.7 Length: 5.5

WIb*(i) (YF-W14). Round; op. medium turquoise blue (2.5B 5/5); late 18th/19th centuries; no. = 26.

Diameter: 3.5-5.8 Length: 3.9-5.4

WIb11 (YF-Waaa). Round; op. robin's egg blue (5B 6/6); late 18th/19th centuries; fragmentary specimen; no. = 1.

Diameter: 6.0+ Length: 6.0+

WIb16 (YF-W15). Round; tsl./op. bright navy (7.5PB 2/7); wind marks evident; whitish patina; late 18th/19th centuries; no. = 2.

Diameter: 4.5-9.3+ Length: 3.4-7.5+

WIb*(j) (YF-Wtt). Round (?); op. bright navy (7.5PB 2/7); small perforation; shiny surface; 20th century; fragmentary; no. = 1.

Diameter: 5.0+ Length: ?

WIb*(k) (YF-W13). Round; op. cerulean blue (7.5B 4/8); wind marks evident; broken elongated bubbles at the matte surface; late 18th/19th centuries; no. = 1.

Diameter: 6.8 Length: 7.2

WIb*(l) (YF-W11). Round; tsp. light gray blue (7.5B 6/2); numerous tiny bubbles in glass; small perforation; crizzled surface; small areas of brown patina; late 19th or early 20th century; no. = 1.

Diameter: 6.4 Length: 5.9

WIb*(m) (YF-W12). Round; tsl. copen blue (5PB 5/7); numerous bubbles in glass; shiny surface; 19th (?) century; no. = 1.

Diameter: 5.1 Length: 4.3

WIc – Monochrome Oval Beads

WIc*(a) (YF-W26). Oval; op. black (N 1/0); glass appears tsp. dark green (2.5G 3/6) on thin edges when held up to a strong light; earthy to iridescent patina; late 18th/19th centuries; no. = 10.

Diameter: 2.9-5.0 Length: 5.3-10.2

WIc*(b) (YF-W16). Oval; tsl. light gray (N 7/0); late 18th/19th centuries; no. = 1.

Diameter: 5.8 Length: 9.2

WIc1 (YF-W17). Oval; op. white (N 9/0); irregular surface, smooth to lightly pitted; wind marks evident; late 18th/19th centuries; no. = 2.

Diameter: 6.5-6.6 Length: 10.5-11.1

WIc1 var. (YF-W18). Oval; op. white (N 9/0); smaller version of WIc1; wind marks evident; late 18th/19th centuries; no. = 22.

Diameter: 2.9-4.1 Length: 4.7-7.4

WIc*(c) (YF-Wmm). Oval; tsp. ruby (2.5R 3/10); earthy to iridescent patina; late 18th/19th centuries; no. = 1.

Diameter: 5.2 Length: 8.5

WIc*(d) (YF-W20). Oval; tsp. light red (5R 5/12); thin ends; silvery patina; late 18th/19th centuries; no. = 8.

Diameter: 2.5-3.4 Length: 3.7-5.4

WIc*(e) (YF-W19). Oval (slightly teardrop shaped); op. amber (10YR 7/8); eroded surface; earthy patina; late 18th/19th centuries; no. = 6.

Diameter: 3.1-3.4 Length: 2.7-7.8

WIc*(f) (YF-Wq). Oval; op. dark palm green (10GY 4/4); brown patina; late 18th/19th centuries; no. = 8.

Diameter: 3.1-3.6 Length: 5.3-7.5

WIc*(g) (YF-W22). Oval; tsp. teal green (5BG 3/6); shiny surface; late 18th/19th centuries; no. = 2.

Diameter: 5.4-6.4 Length: 8.9-9.1

WIc*(h) (YF-W21). Oval; op. aqua green (7.5BG 6/6); late 18th/19th centuries; no. = 2.

Diameter: 3.7-3.9 Length: 6.5-7.3

WIc*(i) (YF-Wrr). Oval (irregular); op. medium turquoise blue (2.5B 5/5); light earthy patina; late 18th/19th centuries; fragmentary specimen; no. = 1.

Diameter: 5.6 Length: 6.0+

WIc*(j) (YF-W24). Oval; op. copen blue (5PB 5/7); late 18th/19th centuries; no. = 7.

Diameter: 2.6-2.9 Length: 3.7-5.3

WIc*(k) (YF-W23). Oval; tsp. bright navy (7.5PB 2/7); thin whitish to iridescent patina; late 18th/19th centuries; no. = 20.

Diameter: 3.4-4.2 Length: 6.2-10.4

WIc*(l) (YF-Wb). Oval "pigeon egg" bead; tsl. bright navy (7.5PB 2/7); burned and heat distorted; late 18th/19th centuries; no. = 1.

Diameter: 20.4 Length: 27.4

WIi – Monochrome Truncated Teardrop Beads

WIi*(a) (YF-W25). Truncated teardrop; tsl. light gray (N 7/0); dull surface; late 18th/19th centuries; no. = 1.

Diameter: 5.9 Length: 7.8

WIi*(b) (YF-W25a). Truncated teardrop; op. white (N 9/0); late 18th/19th centuries; no. = 1.

Diameter: 3.7 Length: 6.0

WIi*(c) (YF-Whh). Truncated teardrop; op. medium turquoise blue (2.5B 5/5); late 18th/19th centuries; no. = 1.

Diameter: 5.7 Length: 6.6

WIIo – Monochrome Square Barrel Beads

WIIo*(a) (YF-W30). Long square barrel (Beck IX.D.1.b.); op. medium turquoise blue (2.5B 5/5); slight earthy patina; late 18th/19th centuries; no. = 3.

Diameter: 2.9-3.9 Length: 4.2-4.9

WIIr – Monochrome, Truncated Square Convex Bicone Beads (these exhibit pressed facets that taper slightly towards either end from a medial ridge)

WIIr*(a) (YF-W29). Standard truncated square convex bicone (Beck IX.C.1.f.); tsp. light gray (N 7/0); light whitish patina; late 18th/19th centuries; no. = 1.

Diameter: 4.2 Length: 5.3

WIIr*(b) (YF-W31). Short truncated square convex bicone; tsp. ruby (2.5R 3/10); one longitudinal pair of facets is sometimes poorly formed so the bead appears to have a triangular cross section; slight patina; late 18th/19th centuries; no. = 19.

Diameter: 3.1-3.8 Length: 2.6-3.8

WIIr*(c) (YF-W27). Short truncated square convex bicone; op. aqua green (7.5BG 6/6); light brownish patina; late 18th/19th centuries; no. = 2.

Diameter: 3.6 Length: 3.0

WIIr*(d) (YF-W28). Long truncated square convex bicone; op. mist blue (10B 6/3); the sides of the bead are

convex longitudinally; light brownish patina; late 18th/19th centuries; no. = 15.

Diameter: 3.4-4.7 Length: 4.5-5.4

WIIs – Monochrome, Truncated Pentagonal Convex Bicone Beads

WIIs*(a) (YF-W33). Standard truncated pentagonal convex bicone (Beck XII.C.1.f.); op. mist blue (10B 6/3); the sides of the bead are convex longitudinally; light whitish patina; late 18th/19th centuries; no. = 4.

Diameter: 4.5 Length: 4.5

WIIt – Monochrome, Truncated Hexagonal Convex Bicone Beads

WIIt*(a) (YF-W33a). Standard truncated hexagonal convex bicone (Beck XIII.C.1.f.); op. mist blue (10B 6/3); the sides of the bead are convex longitudinally; light whitish patina; late 18th/19th centuries; no. = 1.

Diameter: 4.5 Length: 4.2

WIIu – Monochrome, Truncated Hexagonal Bicone Beads

WIIu*(a) (YF-W32). Long hexagonal truncated bicone (Beck XIII.D.2.f.); tsp. ruby (2.5R 3/10); thick earthy patina; late 18th/19th centuries; fragmentary specimens; no. = 2.

Diameter: 7.0+-8.1+ Length: 11.0+-14.0+

WIIdd – Monochrome, Flattened Oblate Beads

WIIdd*(a) (YF-W30a). Flattened oblate (bead has been pressed flat parallel to the perforation); tsl./op. robin's egg blue (5B 6/6); crackled surface; late 18th/19th centuries; no. = 1.

Width: 6.9 Length: 4.5 Thickness: 4.1

WIIIa – Multi-Layered Beads with Simple Shapes; Undecorated

WIIIa*(a) (YF-W34). Round; tsp. ruby (2.5R 3/10) exterior; op. white (N 9/0) core; fine iridescent patina; 19th century; no. = 1.

Diameter: 9.5 Length: 8.8

WIIIb – Monochrome Beads with Simple Shapes; Inlaid Decoration (flush with surface)

WIIIb*(a) (YF-W36). Round eye bead; op. black (N 1/0) with 5 op. aqua green (7.5BG 6/6) on op. white (N 9/0) eyes around either end and 5 tsp. ruby (2.5R 3/10) on op. white eyes around the middle; patinated; late 18th/19th centuries; no. = 2.

Diameter: 7.8-10.0 Length: 6.8-8.2

WIIIb*(b) (YF-W37). Round eye bead; op. black (N 1/0) body divided into 8 squares by an op. light gold (2.5Y 7/8) grid; each square contains a tsp. ruby (2.5R 3/10) on op. white (N 9/0) eye; shiny surface; late 18th/19th centuries; no. = 2.

Diameter: 8.8-9.4 Length: 9.3-10.2

WIIIb*(c) (YF-Wccc). Round (?); op. black (N 1/0) body decorated with flowers having op. white (N 9/0) and tsp. scarlet (8.75R 4/14) blossoms, and op. robin's egg blue (5B 6/6) leaves; the flowers appear to have been separated from each other by longitudinal aventurine bands; eroded surface; late 18th/19th centuries; very fragmentary specimen; no. = 1.

Diameter: ? Length: 13.3+

WIIIb*(d) (YF-Wff). Round eye bead; tsl. light gray (N 7/0) with 5 tsl. bright navy (7.5PB 2/7) on op. white (N 9/0) eyes around either end and 5 tsp. scarlet (8.75R 4/14) on op. white eyes around the middle; dull to shiny brown patina; late 18th/19th centuries; no. = 3.

Diameter: 8.2-9.2 Length: 7.6-9.2

WIIIb*(e) (YF-W42). Oval; op. white (N 9/0) with 4 tsp. bright navy (7.5PB 2/7) wreaths set parallel to the perforation; semi-glossy surface; late 18th/19th centuries; no. = 7.

Diameter: 7.0-8.9 Length: 11.3-15.5

WIIIb*(f) (YF-W35). Round; op. white (N 9/0) with 2 tsp. ruby (2.5R 3/10) and 2 op. dark palm green (10GY 4/4) wreaths set parallel to the perforation; late 18th/19th centuries; no. = 11.

Diameter: 8.9-10.1 Length: 9.4-10.6

WIIIb*(g) (YF-Wuu). Round; op. white (N 9/0) with 2 tsp. ruby (2.5R 3/10) and 2 op. teal green (5BG 3/6) wreaths set parallel to the perforation; the ruby glass has deteriorated; late 18th/19th centuries; no. = 3.

Diameter: 9.1-10.0 Length: 9.8-9.9

WIIIb*(h) (YF-43). Oval; op. white (N 9/0) with a tsp. ruby

(2.5R 3/10) wavy line around the middle; shiny surface; late 18th/19th centuries; no. = 1.

Diameter: 5.2 Length: 9.6

WIIIb*(i) (YF-W45). Oval; op. white (N 9/0) with a tsp. ruby (2.5R 3/10) wavy line around either end and an op. dark palm green (10GY 4/4) wavy line around the middle; late 18th/19th centuries; no. = 14.

Diameter: 7.2-8.4 Length: 11.9-14.6

WIIIb*(j) (YF-W46). Oval; op. white (N 9/0) with an op. dark palm green (10GY 4/4) wavy line around either end and a tsp. ruby (2.5R 3/10) wavy line around the middle; the ruby glass has deteriorated; late 18th/19th centuries; no. = 4.

Diameter: 6.9-7.8 Length: 12.1-13.0

WIIIb*(k) (YF-Wt). Oval; op. white (N 9/0) with an op. dark palm green (10GY 4/4) wavy line around either end and a tsp. ruby (2.5R 3/10) wreath around the middle; light patina; late 18th/19th centuries; no. = 13.

Diameter: 7.5-8.3 Length: 13.4-15.2

WIIIb*(l) (YF-W44). Oval; op. white (N 9/0) with a tsp. ruby (2.5R 3/10) wreath around the middle; shiny surface; late 18th/19th centuries; no. = 1.

Diameter: 6.1 Length: 10.5

WIIIb*(m) (YF-Wddd). Oval; op. white (N 9/0) with swirls of op. light gold (2.5Y 7/8), tsp. scarlet (8.75R 4/14), op. aqua green (7.5BG 6/6), and aventurine; the red and green glass is much eroded; late 18th/19th centuries; no. = 1.

Diameter: 8.6 Length: 15.7

WIIIb*(n) (YF-Wdd). Round; tsp. ruby (2.5R 3/10) with an op. white (N 9/0) wreath around the middle; iridescent patina; late 18th/19th centuries; no. = 7.

Diameter: 7.5-9.0 Length: 7.6-9.1

WIIIb*(o) (YF-W39). Round; tsp. ruby (2.5R 3/10) with an op. light gold (2.5Y 7/8) wreath around the middle; light iridescent patina; late 18th/19th centuries; no. = 1.

Diameter: 8.9 Length: 8.3

WIIIb*(p) (YF-W38). Round; op. sunlight yellow (5Y 8/8) with a tsp. ruby (2.5R 3/10) wreath-like applique around the middle; shiny surface; late 18th/19th centuries; no. = 1.

Diameter: 9.0 Length: 7.8

WIIIb*(q) (YF-W41). Round to oblate eye bead; op. aqua green (7.5BG 6/6) with 5 tsp. bright navy (7.5PB 2/7) on op. white (N 9/0) eyes around either end and 5 tsp. ruby (2.5R 3/10) on op. white eyes around the middle; late 18th/19th centuries; fragmentary; no. = 3.

Diameter: 8.2-10.1 Length: 7.2-9.5

WIIIb*(r) (YF-W47). Oval; op. aqua green (7.5BG 6/6) with a spiral band of tsp. scarlet (8.75R 4/14) and op. white (N 9/0) diagonals, and a spiral band of aventurine; late 18th/19th centuries; no. = 11.

Diameter: 7.3-8.6 Length: 12.7-14.4

WIIIb*(s) (YF-W48). Round; tsp. turquoise (10BG 4/8) with ca. 6 ovate blossom-like inlays of tsp. ruby (2.5R 3/10) on op. white (N 9/0) and what appear to be op. light gold (2.5Y 7/8) leaf-like swirls at either end of these; eroded and patinated surface; late 18th/19th centuries; fragmentary specimen; no. = 1.

Diameter: 16.9+ Length: 16.1

WIIIb*(t) (YF-Woo). Round; tsp. cerulean blue (7.5B 4/8) with an op. white (N 9/0) wreath around the middle; brown patina; late 18th/19th centuries; incomplete specimen; no. = 1.

Diameter: 12.5 Length: 11.1

WIIIb*(u) (YF-W40). Round eye bead; op. copen blue (5PB 5/7) with 5 tsp. bright navy (7.5PB 2/7) on op. white (N 9/0) eyes around either end and 5 tsp. ruby (2.5R 3/10) on op. white (N 9/0) eyes around the middle; brownish patina; late 18th/19th centuries; no. = 5.

Diameter: 9.5-9.8 Length: 9.0-9.5

WIIIb*(v) (YF-Wbbb). Round; tsl. bright navy (7.5PB 2/7) with an op. white (N 9/0) wreath around the middle; light earthy patina; late 18th/19th centuries; no. = 1.

Diameter: 9.9 Length: 8.2

WIIId – Monochrome Beads with Simple Shapes; Overlaid Decoration (rests on or protrudes from the surface)

WIIId*(a) (YF-W50). Cylindrical; op. black (N 1/0) with a wavy op. light gold (2.5Y 7/8) thread around either end; the decoration rests on the glass and is not pressed into it; late 18th/19th centuries; no. = 2.

Diameter: 6.0 Length: 11.1

WIIId*(b) (YF-W49). Ovoid (ellipsoid); swirled op. bright Dutch blue (7.5PB 4/11) and op. bright navy (7.5PB 2/7) with raised diagonal squiggles of aventurine; late 18th/19th centuries; mostly fragmentary specimens; no. = 10.

Diameter: 11.5-14.5 Length: 14.8-19.4

Mold-Pressed Glass Beads

Eleven mold-pressed beads representing 10 varieties (Plate XXA) were recovered. These were generally produced by placing a molten glob of glass in a two-piece mold and letting it harden. A wire pushed through the glass while it was still soft imparted the perforation. In a variation of this, two viscid pieces of glass were pressed together in a mold to fuse them. This was frequently done where the glass contained a pattern that would have been distorted if the former method were used. In the case of "mandrel-pressed" beads, a tapered pin attached to one half of the mold formed the perforation. As the pin did not reach all the way to the other side of the mold when it was closed, the narrow end of the perforation was sealed and had to be broken through or ground down once the glass had hardened.

MPIa – Plain Monochrome Round Beads

MPIa*(a) (YF-MPzz). Round; tsl. amber (10YR 7/8); relatively small, parallel-sided perforation; shiny surface; 19th (?) century; no. = 1.

Diameter: 9.2 Length: 8.9

MPIa*(b) (YF-MP1). Round; op. scarlet (8.75R 4/14) with a slightly raised mold mark around the middle; small parallel-sided perforation; probably early 20th century; no. = 2.

Diameter: 5.0-5.1 Length: 4.7

MPIb – Plain Polychrome Oval Beads

MPIb*(a) (YF-MP9). Oval; tsl. amethyst (7.5P 4/8) containing numerous op. white streaks; composed of two longitudinal halves fused together; a slightly raised mold mark encircles the bead parallel to the cylindrical perforation; lightly abraded surface; 20th century; no. = 1.

Diameter: 8.0 Length: 14.0

MPIIa – Monochrome Round Beads with Faceting

MPIIa*(a) (YF-MP2). Multifaceted; "mandrel-pressed" type; tsp. ruby (2.5R 3/10) body covered with irregular cut facets; the perforation tapers noticeably; the end of the bead containing the narrow part of the perforation has been punched through and ground flat; 19th century; no. = 1.

Diameter: 9.6 Length: 9.2

MPIIa*(b) (YF-MP3). Multifaceted; "mandrel-pressed" type; tsp. bright rose (10RP 5/10) body covered with irregular cut facets; the perforation tapers noticeably and the narrow end has been punched through; 19th century; no. = 1.

Diameter: 5.3 Length: 5.5

MPIIa*(c) (YF-MP4). Multifaceted; "mandrel-pressed" type; tsp. bright mint green (2.5G 7/8) body covered with irregular cut facets; sections of the original molded surface are visible; remnants of a mold mark encircles the middle; the perforation tapers noticeably and the narrow end has been punched through and is concave; 19th century; no. = 1.

Diameter: 8.2 Length: 6.5

MPIIa*(d) (YF-MP5). Multifaceted, pentagonal cross section; tsp. dark blue (5PB 4/10) body covered with irregular cut facets: 5 pentagonal facets around either end and 10 paired broad pentagonal facets around the middle; small cylindrical perforation; shiny surface; probably 20th century; no. = 1.

Diameter: 6.3 Length: 5.6

MPIIg – Monochrome Round Beads with Molded Designs

MPIIg*(a) (YF-MP6). Ribbed round (7 contiguous ribs encircle the bead perpendicular to the cylindrical perforation); op. medium turquoise blue (2.5B 5/5); dull surface; late 18th/19th centuries; fragmentary specimen; no. = 1.

Diameter: 6.0 Length: 5.8

MPIIg*(b) (YF-MP7). Ribbed round (9 contiguous ribs encircle the bead perpendicular to the cylindrical perforation); tsl. bright navy (7.5PB 2/7); late 18th/19th centuries; no. = 1.

Diameter: 7.6 Length: 8.1

MPIIh – Monochrome Oval Beads with Molded Designs

MPIIh*(a) (YF-MP8). Ribbed oval (7 contiguous ribs encircle the bead perpendicular to the perforation); op. scarlet (8.75R 4/14); a distinct raised mold mark encircles the bead parallel to the cylindrical perforation; small perforation; probably 20th century; no. = 1.

Diameter: 8.0 Length: 10.9

Blown Glass Beads

Represented by three specimens of a single variety (Plate XXA), blown beads were produced by blowing a bubble in a heated glass tube or a small gather of molten glass. As a result, they are all hollow. The bubbles could

be free-blown or blown in small molds. The interiors were frequently silvered or covered with colored enamel.

BIIc – Monochrome, Faceted Round Beads

BIIc*(a) (YF-B1). Round faceted (probably mold blown); tsp. light gray (N 7/0) with remnants of op. red enamel (ca. 10R 5/8) on the interior surface; 24 irregular cut facets encircle the middle; the area around either hole protrudes outward slightly and has been fire polished; late 18th/19th centuries; no. = 3.

Diameter: 8.2-10.0 Length: 8.5-9.5

Unidentifiable Glass Beads

Nine specimens were either too fragmentary or burned to be properly classified.

Prosser-Molded Beads

In the manufacture of Prosser-molded beads, three of which were encountered (Plate XXA), a powdered mixture of sand, feldspar, and calcium fluoride made plastic with milk was pressed into shape in gang molds. The beads were then deposited on a metal sheet and fired in an oven. Depending on the relative frequency of the constituents, the beads may range from translucent and glass-like to opaque and having the appearance of porcelain. First applied to the manufacture of buttons, the process was patented by Richard Prosser in 1840.

PMIa – Monochrome Round Beads, Undecorated

PMIa*(a) (YF-PM3). Round; op. ultramarine (6.25PB 3/12); distinct equatorial belt (mold seam); granular texture; the perforation tapers slightly; both ends are rough; shiny surface; 20th century; no. = 1.

Diameter: 5.9 Length: 5.4

PMIa*(b) (YF-PM2). Round; op. coral (10R 5/8); distinct equatorial belt (mold seam); one end is smooth, the other is pebbled; one end of the parallel-sided perforation was obstructed during manufacture (unusable); shiny surface; 20th century; no. = 1.

Diameter: 4.1 Length: 3.8

PMIa*(c) (YF-PM1). Round; tsl. orchid mist (2.5RP 7/4); one end is smooth, the other is pebbled; one end of the parallel-sided perforation was partially obstructed during manufacture; shiny surface; 20th century; no. = 1.

Diameter: 4.8 Length: 4.5

Metal Beads

Two faceted brass beads consist of short sections of hexagonal tubing with a facet stamped on each corner.

Metal 1. Faceted, cornerless hexagonal; 20th century; no. = 2.

Diameter: 1.6 Length: 1.2

Bone Beads

A single bird-bone bead of probable Native manufacture is in the collection (Plate XXA).

Bone 1. Tubular, slightly curved; soil-stained dark brown; probably late 18th/19th centuries; no. = 1.

Diameter: 10.1 Length: 30.5

Plastic Beads

The two plastic beads were not examined directly. The descriptions are based on photographs and measurements provided by Parks staff (Plate XXA).

Plastic 1. Circular; op. light red (5R 5/12); 20th century; no. = 1.

Diameter: 2.2 Length: 1.8

Plastic 2. Round; op. bright coral red (10R 5/14); 20th century; no. = 1.

Diameter: 5.0 Length: 4.0

DISCUSSION

As would be expected of a major fur trade depot, beads were found over much of the site. There were several concentrations, however, and these provide much useful chronological information.

Over 8,500 glass beads were found during the extensive excavations conducted under and around the Depot which centered on the remains of the Old Octagon. A major concentration of approximately 5,000 glass beads encountered in a refuse deposit located outside the southwest curtain shed of the Octagon is especially significant as it can

be attributed to a very short period in the fort's early history. As an 1815 plan of the fort shows this area to be occupied by a cook room, the deposit has to date between 1795, the year the Octagon was completed, and some time before the plan was drawn. This gives us insight into what the fort's bead inventory consisted of at this time. Fifty-eight more or less distinct varieties are represented (Table 1) with white (IIa11/IIa12 and IIa14), bright blue (IIa43/IIa*[vv]), and red (IVa6) specimens predominating. Another refuse deposit adjacent to the southeast corner of the Octagon produced about 1,500 glass beads that generally replicate those from the sealed deposit. They are doubtless associated with the Octagon occupation.

Another major source of beads was the site of the Inland Cargo House situated to the north of the Depot. Attributed to the period from 1824 to 1939, this feature produced 7,869 beads. An examination of them reveals that many duplicate those from the sealed Octagon deposit. In fact, the four most common varieties – comprising 80% of the Cargo House total – are identical to those from the Octagon deposit. This suggests that most of the beads from the Cargo House excavations are coeval with the later occupation of the Octagon and the early occupation of the Depot.

A smaller concentration of beads (3,389 specimens) of like age were recovered from the North Garden and Drainage Ditch to the east of the depot. The finds are generally attributed to the period from 1831 to 1930. Once again the three most common varieties (IIa14, IIa11/IIa12, and IIa43/IIa*[vv]) replicate those from the sealed Octagon refuse deposit and the bulk of the remaining varieties have counterparts in that deposit as well. Clearly the beads from this area and the Inland Cargo House are of the same approximate date.

A final concentration of 1,783 beads was recovered from Cabin 2 in the North Village which extended along the river bank to the north of Dry Dock Creek. These dwellings were occupied by temporary employees, mostly Cree Indians and Métis. Consequently, the recovered beads represent material utilized locally by the occupants. The cabin may have been inhabited as early as the late 19th century but the recovered varieties indicate an occupation sometime during the first half of the 20th century. The beads were recovered from one of the bedrooms, suggesting that this was a principal beading and sewing area. It is, however, possible that the beads represent a discarded beaded garment that has since disintegrated.

The beads characteristic of the early occupation of York Factory III (1795-1815) as revealed by the specimens found in sealed deposits beneath and adjacent to the Depot (Table 1) may be summarized as follows. Undecorated seed beads clearly prevail with just six varieties – dominated by tsl. oyster white (IIa11/IIa12), tsp./tsl. bright blue (IIa43/IIa*[vv]), and op. redwood on tsp. gray or green (IVa3/IVa6) beads – making up 79% of the collection. Unfortunately, there are no tightly dated contexts that can definitely be attributed to the second half of the 19th century.

The 20th century is represented primarily by monochrome seed beads, comprising 85% of the 20th-century bead assemblage. The five most common varieties are, in sequence: op. white (IIa14), op. pink (IIa*[rrr]), op. robin's egg blue (IIa41), tsl. robin's egg blue (IIa*[uu]), and tsp. light gray (IIa*[a] var.). They make up 30% of the seed beads. Tubular hexagonal beads were a distant second in popularity (10%). As for color frequency, blue beads predominate (40%), followed by red (22%), green (10%), white (8%), purple (8%), colorless (6%), yellow (5%), and black (1%).

The beads shipped to York Factory and other HBC trading establishments during the 19th century were supplied by a number of British merchants, ten of whom have been identified (Table 2). The majority were located in London. The exception is J.P. Sturgis and Co., fur merchant for the HBC in Canton, China. He is known to have supplied small blue glass beads in 1827-1828 (Laflèche 1979:58; Ross 1979:172). Whether these were actually produced in China or were just being exported from there is uncertain. Unfortunately, it is not known where most of the others obtained their beads but some clues are provided by information gleaned from various London business directories concerning the business owned by Moses Lewin Levin. Already an importer of beads in 1830, Levin built up his business over the years to such an extent that "between sixty and seventy tons of beads" were destroyed by fire on his premises around 1895 (Hartshorne 1897:106 n.). About this same time he is listed as importing "coral, amber, and glass beads" from Venice, Bohemia, and Germany (Karklins 2004:40). It is probable that the other suppliers were obtaining their beads from the same countries.

Some idea of the quantity of beads that was sent to York Factory III in its early days is provided by several invoices. In 1802, the post received 350 lbs. of "common beads" and 13 "bead necklaces." The following year the shipment included 145 yards of "common beads." In 1805 and 1806, the incoming trade goods included 50 lbs. and 221 lbs. of "common beads," respectively (HBC Archives 1802-1806). While some of these beads were kept for local trade, the majority were shipped to inland posts in much smaller quantities. For instance, in 1803, at Nottingham House at the east end of Lake Athabasca, the inventory of trade goods included 4-3/4 lbs. of "blue common" beads and 3 lbs. of "fine white" beads (Karklins 1983:329).

Table 1. Early Octagon Bead Varieties, 1795-1815 (by Manufacturing Technique and Frequency) (no. = 4,440).

Kidd Variety	YF No.	Description	Quantity	%
Drawn Beads				
IIa11/IIa12	YF-43/44	Circular/round; tsl. oyster white	1,069	24.1
IIa43/IIa*(vv)	YF-55/56	Circular/round; tsp./tsl. bright blue	1,049	23.6
IIa14	YF-46	Circular; op. white	732	16.5
IVa6	YF-146	Circular; op. brick red exterior; tsp. apple green core	663	14.9
IIa7	YF-41	Circular; op. black	212	4.8
IIa*(e)	YF-49a-b/83	Circular; tsp. ruby	175	3.9
Ia19	YF-5	Tubular; tsp. bright navy	88	2.0
IIa*(kkk)	YF-58	Circular; op. medium blue	87	2.0
IIa19	YF-47	Circular; op. amber	66	1.5
IIa56	YF-59	Circular; tsp. bright navy	24	0.5
IIa*(ii)	YF-51	Circular; tsl. bright green	20	0.5
Ia4	YF-1	Tubular; tsl. oyster white flashed in clear glass	19	0.5
IIa*(cc)	YF-52	Circular; tsl./op. dark palm green	19	0.5
IIa2	YF-w	Circular; op. brick red	18	0.4
IVa*(a)	YF-r	Circular; op. brick red exterior; tsp. ruby core	16	0.4
IIa*(nnn)	YF-53	Circular; op. powder blue	15	0.3
IIa*(hhh)	YF-54	Circular; op. dusty blue	15	0.3
Ia*(g)	YF-6	Tubular; op. medium blue	10	0.2
IIIa3	YF-136	Tubular; op. brick red exterior; tsp. apple green core	10	0.2
IIa59	YF-50	Circular; tsp. rose wine	9	0.2
IIa*(a)	YF-42	Circular; tsp. light gray	8	0.2
Ia2	YF-v	Tubular; op. black	5	0.1
IIa*(u)	YF-48	Circular; tsp. light gold	4	>0.1
IIb12	YF-123	Circular/Round; op. black with 4 op. white stripes	4	>0.1
IIf*(a)	YF-135	Faceted circular; tsp. rose wine	3	>0.1
Ia*(c)	YF-3	Tubular; op. amber	2	>0.1
Ia*(h)	YF-cc	Tubular; op. powder blue	2	>0.1
If*(b)	YF-z	Tubular, multifaceted; tsp. light gray	2	>0.1
Ia5	YF-y	Tubular; op. white flashed in clear glass	1	>0.1
Ia*(a)	YF-s	Tubular; tsl. white satin sheen	1	>0.1
If*(a)	YF-MPu	Tubular, multifaceted; op. black; 20 irregular cut facets	1	>0.1
If*(e)	YF-aa	Tubular, multifaceted; tsp. turquoise green; 24 cut facets	1	>0.1

Table 1. Continued

Kidd Variety	YF No.	Description	Quantity	%
If*(f)	YF-ee	Tubular, multifaceted; tsp. turquoise	1	>0.1
IIIk*(b)	YF-142	Tubular chevron with faceted ends; 4 starry layers: 1) op. black exterior; 2) op. white; 3) op. redwood; 4) op. white core	1	>0.1
IIIl'*(a)	YF-gg	Tubular, twisted hexagonal chevron with faceted ends; 3 starry layers: 1) op. black exterior; 2) op. brick red; 3) op. white core	1	>0.1
Wound Beads				
WIb*(i)	YF-W14	Round; op. medium turquoise blue	17	0.4
WIc*(k)	YF-W23	Oval; tsp. bright navy	11	0.2
WIb2	YF-W3	Round to slightly ovoid; op. white	7	0.2
WIc*(f)	YF-Wq	Oval; op. dark palm green	7	0.2
WIIIb*(k)	YF-Wt	Oval; op. white with an op. dark palm green wavy line around either end and a tsp. ruby wreath around the middle	7	0.2
WIIIb*(i)	YF-W45	Oval; op. white with a tsp. ruby wavy line around either end and an op. dark palm green wavy line around the middle	5	0.1
WIc1 var.	YF-W18	Oval; op. white	4	>0.1
WIb*(g)	YF-Wx	Round (irregular); op. dark palm green	4	>0.1
WIb*(c)	YF-W2	Round; tsl. light gray	3	>0.1
WIb*(e)	YF-W6	Round; tsp. ruby	3	>0.1
WIc*(e)	YF-W19	Oval (slightly teardrop shaped); op. amber	3	>0.1
WIIIb*(n)	YF-Wdd	Round; tsp. ruby with an op. white wreath around the middle	3	>0.1
WIc*(j)	YF-W24	Oval; op. copen blue	2	>0.1
WIIIb*(g)	YF-Wuu	Round; op. white with 2 tsp. ruby and 2 op. teal green wreaths set parallel to the perforation	2	>0.1
WIIIb*(r)	YF-W47	Oval; op. aqua green with a spiral band of tsp. scarlet and op. white diagonals, and a spiral band of aventurine	2	>0.1
WIb*(a)	YF-p	Round (irregular); op. black	1	>0.1
WIc*(a)	YF-W26	Oval; op. black	1	>0.1
WIi*(c)	YF-Whh	Truncated teardrop; op. medium turquoise blue	1	>0.1
WIIIb*(d)	YF-Wff	Round; tsl. light gray with 5 tsl. bright navy on op. white eyes around either end and 5 tsp. scarlet on op. white eyes around the middle	1	>0.1
WIIIb*(f)	YF-W35	Round; op. white with 2 tsp. ruby and 2 op. dark palm green wreaths set parallel to the perforation	1	>0.1
WIIId*(b)	YF-W49	Ovoid (ellipsoid); swirled op. bright Dutch blue and op. bright navy with raised diagonal squiggles of aventurine	1	>0.1
Blown Beads				
BIIc*(a)	YF-B1	Round faceted; tsp. light gray with remnants of op. red enamel	1	>0.1

Table 2. British Suppliers of Beads to the Hudson's Bay Company, 1820-1875.

Name	Description	Dates	Location	Goods	References
John T. Burgon and Son	Hardwareman and flint dealer	1820-1842	London	Beads, gun flints, finger rings, tobacco, and snuff boxes, etc.	Laflèche 1979:16; Ross 1979:48-49
Heinzmann and Rochusson		1862-1864	London?	Beads and Northwest guns	Laflèche 1979:34
Ephraim Levin		1862-1864	London	Beads and meerschaum pipes	Laflèche 1979:39
Moses Lewin Levin	Manufacturer and importer	1864-1875	London	Beads, coral, cutlery, etc., for the African, American, and Indian markets	Karklins 2004:39; Laflèche 1979:39
Albert Pelly and Co.	Merchant	1846-1854	London	Beads, oatmeal, and flour	Ross 1979:146; Sussman 1979:124-125
Jonas Phillips and Sons	Bead merchants	1820 to 1850	London	Beads	Laflèche 1979:48; Ross 1979:149; Sussman 1979:127
Lawrence Phillips and Sons	Merchants and importers of beads and East India agents	1839-1850	London	Beads	Ross 1979:150; Sussman 1979:127
Octavius Phillips and Co.		1843-1850	London	Beads	Ross 1979:150; Sussman 1979:128
J.P. Sturgis and Co.	Fur merchant for the HBC	1827-1828	Canton, China	Small blue glass beads	Laflèche 1979:58; Ross 1979:172
G. Trinsby and Co.		1873	London?	Beads, etc.	Laflèche 1979:60

The relative value of glass beads shortly before York Factory moved to its present location is provided in the Standard of Trade at York Factory in 1776 which lists the number of prime beaver pelts required to purchase specific quantities of trade goods (Rich 1951:358-359). Information specific to beads is presented in Table 3. A sampling of other goods is also listed for comparative purposes. The list reveals that a pound of fancy "flowered" beads was almost equivalent to the value of a pistol or a blanket, and that a pound of small long white or red beads was equivalent to a trunk, a laced hat, or a gallon of English brandy. Even the large, middling, and small round white and blue beads at two pelts per pound had the same value as a shirt or a pair of shoes, eight jackknives, or eight dozen coat buttons. In other words, beads were not an inexpensive commodity.

While it is not known exactly which bead varieties were produced in which country, it is possible to suggest likely origins for many of them. The glass beads recovered from the early deposits almost certainly came from Venice/ Murano, the principal supplier at the time. Those from later contexts could either be of Venetian or Bohemian origin. The cornerless hexagonal beads (If and IIIf) are generally regarded as being Bohemian, as are the mold-pressed and blown specimens. The Prosser beads likely came from France though Bohemia is also a possible source. What Germany may have contributed is unknown but its products included wound, blown, and molded beads.

Although the bulk of the beads from the Octagon represent material destined for inland trading posts, some

Table 3. York Factory Standard of Trade, 1776.

Beads	**Beaver Pelts/Pound**
Large long white	5
Small do.	4
Large, middling & small rod. [round] white	2
Large, middling & small rod. blue	2
Small long red	4
Large round red	2
Small rod. red, yellow, green & dove colour'd	2
Large & middling rod. black & white	6
Round white flowd. [flowered] red & green	6
Barley-corn white flowd. red & green	6
Barley-corn white, black, red, green & yellow	6
Other Goods	**Beaver Pelts**
Pistol	7
Blanket	7
Trunk	4
Laced hat	4
English brandy, gallon	4
Shirt or Shoes	2
Coat buttons, 4 doz.	1
Jackknives (4)	1

of them were definitely also utilized by the inhabitants as revealed by the presence of several beadwork remnants, probably Cree, including a moccasin vamp (Plate XXB), in the Octagon deposit. The Cree were the home guard Indians at York Factory and it is likely that the beadwork was produced by them. Similarly, it is likely that the single bone bead is also of local manufacture.

Some insight into how the local Cree utilized beads to adorn themselves and their garments is provided by Robert M. Ballantyne (1848) who visited York Factory in 1841-1842:

> The summer dress of the [male] Indian is almost entirely provided for him by the Hudson's Bay Company; it consists chiefly of a blue or gray cloth, or else a blanket capote reaching below the knee, made much too loose for the figure, and strapped round the waist with a scarlet or crimson worsted belt. A very coarse blue striped cotton shirt is all the underclothing they wear, holding trousers to be quite superfluous; in lieu of which they make leggins of various kinds of cloth, which reach from a few inches above the knee down to the ankle. These leggins are sometimes very tastefully decorated with bead-work, particularly those of the women, and are provided with flaps or wings on either side [Figure 4], which have a pretty and novel appearance (Ballantyne 1848:43-44).
>
> Their jet black hair generally hangs in straight matted locks over their shoulders, sometimes ornamented with beads and pieces of metal, and occasionally with a few partridge feathers (Ballantyne 1848:42).

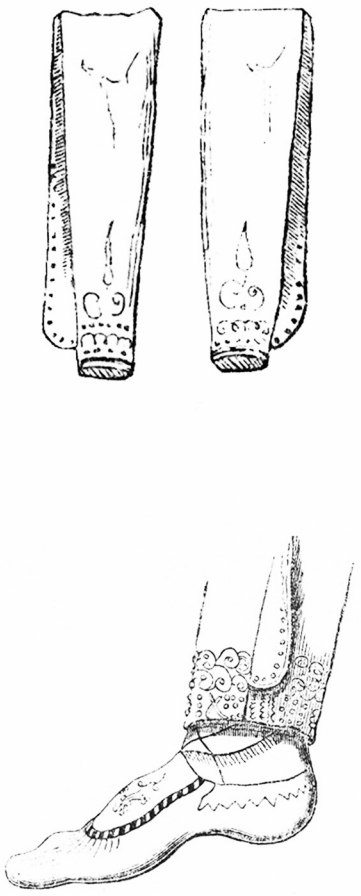

Figure 4. Leggings and moccasins worn by the Swampy Cree around York Factory in the 1840s (after Ballantyne 1848:43-44).

As for the Cree women:

> Their dress is a gown, made without sleeves, and very scanty in the skirt of coarse blue or green cloth; it reaches down to a little under the knee, below which their limbs are cased in leggins beautifully ornamented. Their whole costume, however, like that of the men, is almost always hid from sight by a thick blanket without which the Indian seldom ventures abroad. The women usually make the top of the blanket answer the purpose of a head-dress; but when they wish to appear very much to advantage, they put on the cap represented in the illustration [Figure 5]. It is a square piece of blue cloth, profusely decorated with different coloured beads, and merely sewed up at the top (Ballantyne 1848:45).

Figure 5. Swampy Cree woman's beaded cap (after Ballantyne 1848:46).

Visiting York in 1840, Letitia Hargrave adds a bit more information: "One woman had large gold earrings wch were put half way up her ears & stuck out a good deal, & a beautiful turquoise ring. She wore a green tartan gown mocassins & blanket. The other women had all 3 or 4 large glass bead necklaces – different colours" (MacLeod 1947:76).

Beads were put to many other uses by the Cree and their neighbors (Karklins 1992). In the hands of company traders and Indian middle men, they were distributed far beyond the borders of the Hudson's Bay Company's territory and applied to sundry articles "in a very tasty and beautiful manner" (M'Keevor 1819:56).

CONCLUSION

While it is probable that not every bead variety that made its way to York Factory is represented in the archaeological collection, the recovered specimens do provide excellent insight into what the Hudson's Bay Company was importing into Rupert's Land from the late 18th to the early 20th century. While trade beads may not have been as sought after as guns, gun powder, knives, kettles, and cloth, their presence at most contemporary archaeological sites in the region and on many ethnographic objects made by the indigenous population reveals that they were nonetheless in great demand. It is hoped that this report will help fur trade researchers as well as others to better classify, date, and interpret their trade beads.

ACKNOWLEDGEMENTS

The authors would like to thank all those who worked on cataloging the York Factory bead collection, especially Elizabeth Jorgensen, Shelley Lugg, and Catherine Quinlan, all former employees of the Archaeological Research Section of Parks Canada, Ottawa, and Cesare D'Annibale of the Ontario Service Centre, Parks Canada, Cornwall, Ontario. The late Betty Burrows, a dedicated volunteer from Ottawa, was also very helpful in this respect. Thanks are also extended to Jennifer Hamilton, former Collections Archaeologist, Western and Northern Service Centre, Parks Canada, Winnipeg, Manitoba, for providing provenience data and other material, and to Louis Laflèche, Ontario Service Centre, Parks Canada, Ottawa, for producing the wonderful images of the York Factory beads.

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BOOK REVIEWS

Zhongguo gudai zhuzi (Chinese Ancient Beads).

Zhu Xiaoli. Guangxi Fine Arts Publishing House, 9 Wangyuan Road, Nanning, Guangxi 530022, China. 2010. 330 pp., 300+ color and B&W figs., fold-out bead timeline. ISBN: 978-7-80746-964-3. 150 Chinese yuan (available for $50.00 including shipping within the continental U.S. from Leekan Designs: paddy@leekan.com) (paper cover).

In Chinese, with an English table of contents (pp. 325-329), *Chinese Ancient Beads* has received rave reviews in China where it is apparently heralded as the Chinese counterpart to Lois Dubin's *The History of Beads from 30,000 B.C. to the Present* (Harry N. Abrams, Inc., New York, 1987). Zhu reportedly spent nearly a decade researching her book, earning a Ph.D. in the process. True to its ostensible prototype, *Chinese Ancient Beads* ends with a fold-out color timeline extending to 8 pages that presents dozens of Chinese beads, necklaces, earrings, and other ornaments dating from 16,000 B.C. to A.D. 1911. As many know, Dubin originated the bead timeline concept.

The links to Dubin 1987 do not end there. Regrettably, they underscore global differences in scholarly practices and publishing standards. At least four images originally commissioned by Dubin for use in her book appear in *Chinese Ancient Beads*: Figure 172 (cf. Dubin Figures 10-11, a beaded cloak in the collection of the University Museum, Philadelphia, PA); Figure 173 (cf. Dubin Figure 29 of double-spiral beads in the collection of Henry Anavian); Figure 254 (cf. Dubin Figure 214, a Tibetan prayer box and shoulder ornament in the collection of Ivory Freidus); and Figure 271 (cf. Dubin Figure 69, a Viking-period necklace in the collection of the Trondheim Royal Norwegian Scientific Society Museum). Dubin's 1987 book appears to be credited only once, in the caption for Zhu's Figure 254.

According to Dubin, in at least one (Figure 173) and possibly all four cases, reproduction rights were not obtained from the owners of the objects or the photographer, which is to say, according to international copyright regulations established by the Berne Convention, the rights were violated. Dubin finds the probable unauthorized use of the images from the museums and the definitely unauthorized use of the Anavian collection image disturbing (Dubin 2013: pers. comm.). There are several other images in *Chinese Ancient Beads* that, one suspects, may also derive from English-language publications.

It should be noted that since China is not a signatory to the Berne Convention, from the Chinese perspective, Zhu Xiaoli has done no wrong. Nor is she alone. China's apparent lack of concern for what much of the rest of the world identifies as intellectual property has sparked a debate that will likely continue for some time. In fact, as Nancy Berliner recently observed, "more and more scholars are noticing that their research, originally published in English, has been appearing in Chinese without attribution or credit" ("Lin, Mo, Fang," *Orientations 43* [Nov. /Dec. 2012]: 126).

There are dozens of images in *Chinese Ancient Beads* which apparently originate in China. The image quality is uneven – some images look like scans – but the images are memorable for the broad assortment of ancient beads and beaded body ornaments they display. Readers may be unfamiliar with many of them as they were unearthed from archaeological contexts and typically first published in Chinese excavation reports and other sources. Beads from other countries are also occasionally depicted.

There are 15 chapters in *Chinese Ancient Beads*:

Chapter 1: About Beads

Chapter 2: (5000-3500 B.C.) – Beads in Prehistoric Village Culture

Chapter 3: (3500-1500 B.C.) – Beads in Prehistoric Rural Settlement Culture

Chapter 4: (1800-1000 B.C.) – Beads of the Xia and Shang Dynasties

Chapter 5: (1000-700 B.C.) – Aristocratic Adornment of the Western Zhou Dynasty

Chapter 6: (700-200 B.C.) – Beads of the Spring and Autumn and Warring States Periods

Chapter 7: (260 B.C. - A.D. 220) – Beads of the Han Dynasty

Chapter 8: (A.D. 220-589) – Beads of the Wei and Jin and Southern and Northern Dynasties

Chapter 9: (A.D. 581-907) – Beads of the Sui and Tang Dynasties

Chapter 10: (A.D. 960-1234) – Beads of the Song and Liao Dynasties

Chapter 11: (A.D. 1206-1244) – Beads of the Yuan and Ming Dynasties

Chapter 12: (A.D. 1616-1911) – Beads of the Qing Dynasty

Chapter 13: Additional Discussion of Questions Relating to Beads

Chapter 14: Tibetan Beads

Chapter 15: Well-Known Ancient Beads of Other Civilizations

Bead scholars who do not read Mandarin will be able to evaluate the accuracy of the information provided in these chapters only after they have been translated into English or other languages and checked against Chinese and other bead scholarship. For the moment, on the basis of unpublished English translations of two sub-chapters, we may conclude that there is much of value in Zhu's text, though it falls short of perfection.

The sub-chapter "Glass Beads of Yongning Temple in Luoyang" (pp. 200-202, Chapter 8) concerns the approximately 150,000 drawn glass beads dating to A.D. 534 unearthed at the Yongning Temple in Luoyang, Henan. The information provided is accurate until Zhu ventures the problematic assertion that the beads were netted together in a technique akin to that used by the ancient Egyptians to unite faience beads into mummy ornaments. There is no evidence for such a claim. What 6th-century Chinese netted beadwork might have looked like, let alone that it proceeded two beads at a time in a technique known as peyote stitch to many English-speaking beadworkers, has not been established, as far as I know. Early Chinese beadnetting techniques may well follow a different logic. Color images of the Yongning Temple bead finds (Figure 182) and of an ancient Egyptian mummy bead ornament (Figure 183) add much to the presentation.

The sub-chapter "Bead Curtains and *Liuli* Techniques of the Song" (pp. 233-234, Chapter 10) discusses Song dynasty (960-1279) glass bead curtains as they are referenced largely in Song Dynasty poems. Such a literary perspective is helpful as far as it goes, but much is missing. Bead curtains existed in Chinese textual and material culture long before and after the Song dynasty, a fact Zhu does not mention. Further, they were made of other materials besides glass and used in a wide variety of contexts. No images of bead curtains accompany the text – another disappointing omission. Zhu says little in this sub-chapter about *liuli* production techniques (*liuli* is a common Chinese term for glass).

Chinese Ancient Beads concludes with six appendices: 1) Distribution and Chronicle of Beads of the Prehistoric Period, 2) Chinese Dynasty Chronicle and Beads Variety, 3) Chinese Ancient Literature Related to Beads and Personal Adornment, 4) Bibliography (which includes approximately 55 Chinese publications as well as several English-language ones), 5) Illustration of Chinese Ancient Beads (the timeline), and 6) English Table of Contents.

Appendix 5 presents Zhu's timeline of Chinese beads, which runs from 16,000 B.C. to A.D. 1911. The timeline is structured by the dates of Chinese dynasties, whose lengths vary considerably. While Chinese readers may take such a periodicity for granted, Western readers may find it confusing. In Zhu's timeline it is difficult to draw a line up from a bead to find the exact date of its origin. Moreover, Zhu sometimes grants the beads of one dynasty a disproportionate amount of space, even as beads of other dynasties receive comparatively less (Robert K. Liu 2013: pers. comm.). The disparity is particularly noticeable with respect to beads of the Zhou (ca. 1046-221 B.C.) and Qing (1644-1911) dynasties. Thus, while beads dating to the 825 years of the Zhou dynasty occupy a generous 56 cm on the timeline, beads from the 267 years of the Qing receive a scant 6 cm. In sum, although the timeline is visually compelling and especially strong on ancient Chinese beads, it should not be regarded as definitive for all dynasties.

Note: Robert K. Liu (2013: pers. comm.) reports that a second, revised edition of *Chinese Ancient Beads* has been published. To what extent it differs from the first edition remains to be seen.

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Journal: Borneo International Beads Conference 2013.

Heidi Munan and Kay Margaret Lyons (eds.). Crafthub, No. 96 Main Bazaar, First Floor, 93000 Kuching, Sarawak, Malaysia. 2013. i-vi + 206 pp., 59 color figs., 9 B&W figs. $50.00 postpaid (paper cover). To order, contact crafthub@gmail.com.

This volume contains the ten papers presented at the third Borneo International Beads Conference which was held in Kuching, Sarawak, Malaysia, in October of 2013. While the bulk of the articles deal with Asian beads and beadwork, there are also two that deal with African material and another that surveys the various organic materials that have been used to produce beads in various parts of the world.

"Conserving Ancient Beads Within Shifting Contexts: A Case Study among the Kelabit of Sarawak," by Poline Bala, examines why ancient beads play important roles in the social life of the Kelabit of the highlands of Borneo and discusses efforts to preserve the value of such beads in contemporary Kelabit society.

"Exploring the Cultural Meanings Conveyed by the Paiwanese Beads," by Kathy Chen Huei Yun, explores the way in which the visual patterns on the glass beads utilized by the indigenous Paiwanese peoples of Taiwan encode meanings.

"Jewellery in Action – Examples from East Africa," by Martina Dempf, discusses the use of beads as adornment in East Africa with specific examples from the Toposa of the Southern Sudan, the Turkana of Kenya, and the Rashaida of Eritrea.

"The Story of Beads: Ghana/Africa," by Akwele Suma Glory, presents a brief survey of a very complex subject, glass beads and beadmaking in Ghana, West Africa.

"20th-Century Chinese Glass Bead Curtains," by Valerie Hector, begins with a look at the historical evidence for bead curtains in Imperial China followed by a discussion of 20th-century curtain iconography and the beads that comprise the curtains.

"Ancient and Modern Beads of Korea," by Elaine Kim, introduces the reader to the World Jewellery Museum established in Seoul in 2004 by Lee Kang-won, followed by a lengthy discussion of the ancient and modern bead culture of Korea, as well as beads made by contemporary Korean artists and jewellery designers.

"An Overview of Beads in the Sabah Museum," by Joanna Datuk Kitingan and Su Chin Sidih, consists only of an abstract and some images of Tengara and Rungus individuals wearing beads.

"Borneo Beads in Literature," by Heidi Munan, discusses publications that deal with the beads of Borneo and includes a bibliography of such publications as well as a list of Internet sources.

"Opulence in Organic Bead Jewellery," by Stefany Tomalin, presents an overview of the various organic materials that have been used to produce beads around the world.

"Discovery and Research of Various Types of Beads in Bujang Valley, Kedah," by Zuliskandar Ramli, discusses the glass beads of the early centuries A.D. excavated from sites in the Bujang Valley of Peninsular Malaysia. Most of these appear to be Indo-Pacific beads of local manufacture but there are also polychrome beads which appear to be imports.

As in the past, this volume was printed in time to be distributed at the conference, a commendable practice. Unfortunately, to meet the deadline, editing suffered. For example, in Plate XIV, which depicts a woman with a beaded headpiece, the caption incompletely reads, "Plate XIV: Girl with bead." In the case of Valerie Hector's article, no attempt was made to change her figure references in text to the appropriate plate number. Instead, the captions read, for example, "Plate XXII: Fig. 1 striped curtain."

In Stefany Tomalin's article, there are problems with some of the headings. For example, the heading "Fossils as Beads" (p. 159) looks to be a main section heading but should be the same as the other headings on the page. Further along, the sub-section "Operculum" (p. 161) also incorporates sea urchins, stone beads, and shell slices! In a number of instances, what appear to be the speaker's personal notes have been included (e.g., pp. 164, 165, 175).

Despite these minor shortcomings, bead researchers and collectors will find this volume a good source for information on the beads and beadwork of various Asian and African cultures, past and present.

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Glass Beads: Selections from The Corning Museum of Glass.

Adrienne V. Gennett. The Corning Museum of Glass, One Museum Way, Corning, NY, 14830-2253. 2013. 88 pp., 55 color figs. ISBN-13: 978-0-87290-192-6. $19.99 (paper).

This beautifully produced book is a companion to the exhibition "Life on a String: 35 Centuries of the Glass Bead" (May 18, 2013 to January 5, 2014) at The Corning Museum of Glass, Corning, NY. The volume presents full-color photographs of 50 of the finest items from the exhibit along with information regarding their manufacture, history, and cultural context. The images can also be found on the museum's website (www.cmog.org), sometimes with a bit more descriptive material, but are larger in the print version and for this reason alone, the book is worthwhile. A visitor to the exhibition mentioned the difficulty of seeing the items in the dim light needed to conserve the integrity of the items. In the book they are large, well lit, and clear.

A question I had from the beginning was "who was this written for?" Karol B. Wight, Executive Director of the museum, provides the answer in her Forward: "These entries... may inspire the reader to seek more information in the specialistic literature on beads." The book, then, is for a glass lover or a potential glass-bead lover, not a bead scholar.

The format for the book has a heading for each item which provides information on provenance, time period, mode of manufacture, color, and dimensions, as well as the accession number. This is followed by a description of the item itself.

I have a quibble about the headings of some of the pages: "107 Beads," "147 Beads," "String of Beads," and "Bead." These contrast with the more informative headings such as "*Magatama* Amulet," "Chevron Bead," "Beaded Fringe Sample Cards," etc. It would have been more instructive to write, for example, "Southern Indian Indo-Pacific Bead Strand," "Malaysian Indo-Pacific Bead Strand," and "Islamic-Period Trailed-Bead Strand" to give some distinction among the presently anonymous beads.

Tina Oldknow, Curator of Modern Glass, wrote about the six contemporary pieces in the book. Adrienne Gennett, formerly curatorial assistant at the museum, wrote about all the other items. Her expertise is in 18th-century English silver and 19th-century French furniture.

The selected items are arranged chronologically from a Greek or Cretan necklace with pendants (1400-1250 B.C.) to Kristina Logan's "Constellation Necklace" of 2011. Often the items are or show beads that were common and much loved/valued in their time; too often we are shown great rarities which, while beautiful, do not really assist with understanding the bead trajectory through time. Examples of the well-known in the book are the Indo-Pacific beads, millefiori, the ubiquitous glass seed beads, and Czech molded beads. Of course, the contemporary offerings are unique, but still the products of their time.

The last six items in the book are contemporary works of art featuring glass beads and differ enormously from the others. They refer to historic events (Joyce Scott's beaded memento of the Rodney King beating), are works of contemporary sensibility (David Chatt's "108 Meditations in Saffron"), or are a reworking of ancient and modern (Laura Donefer's "Blue Note Amulet Basket"). The other 44 items are anonymous, part of the stream of bead history.

For someone beginning to study beads, how beads are made becomes of paramount importance and it was the descriptions of fabrication that often confounded me. On page 52, the illustration shows three faceted Czech glass beads made to imitate carnelian. The technique listed at the top of the page states "ground," while the text below describes the invention of the two-part tong mold which was used to initially form these beads; the grinding being used for finishing and removing the mold seams. A more complete technique description would have been "tong-molded, ground." The next page, "Snake Beads," correctly describes them as "molded," but misspells the manufacturer's name, Redlhammer, as Redhammer in the footnotes. Further, the text about the glass carnelians suggests the "beads were made in imitation of garnets or other red stones, such as carnelian." Garnet and carnelian are not at all similar and this is a surprising suggestion. A usage in the text, "semiprecious stones" is outmoded; current usage requires "gemstones" to refer equally to emeralds, agates, and carnelians.

In the case of the glass carnelians, only the second manufacturing phase was mentioned; in other cases only the first is. On page 34, the millefiori bead is described as "wound" with no mention of the additional need of fused canes or marvering, but for the chevron bead on page 30, techniques are correctly listed as "cased, drawn, ground." It is more puzzling when two beads with similar decoration have the technique described differently. On page 22, "String of Beads" (Islamic-period trailed and feathered beads) is noted as being "tooled, decorated" in the heading, and in the text it is described as "trails were inlaid into the glass and then tooled to create patterns in feathered or geometric forms." The term "inlaid" gives the wrong impression. At the same time, "Bead, Fancy Type," a Venetian feather bead (page 33), is correctly described as "combed. Its colored trails were laid around the matrix... and a tool was used to drag the hot trails... creating a feathered pattern." Apparently the similarity between these beads was not noticed. In the case of beaded objects (e.g., "Italian Beaded Fringe Sample Cards," "Ceremonial Court Chain," and "Beadwork Bag"), however, Gennett is much more at home and fills the text page with details concerning the uses, social rank, popularity, and design characteristics of the items as well as historical connections.

The beauty of the book is in the photographs of the beads and beadwork. It's usefulness is in the text and bibliography, and the text leads to curiosity and further investigation.

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Plate IA. *China:* Western Zhou blue-faience and agate bead ornament from the Marquis of Jin's Tomb, Beizhao village, Quwo County, Shanxi (*Zhongguo wenwu jinghua* 1997).

Plate IB. *China:* Pb-Ba faience tubular beads, late Spring and Autumn to early Warring States periods (Diameter: 0.6-0.7 cm) (these and all subsequent beads are from the author's collection).

Plate IC. *China:* Varieties of stratified eye beads, late Spring and Autumn to early Warring States periods (Diameter: 1.3-2.3 cm).

Plate ID. *China:* Warring States period. **Top:** Horned eye beads (D: 3.0-3.7 cm). **Bottom:** Composite-eye beads (D: 2.0-2.5 cm).

Plate IIA. *China:* Varieties of composite-eye beads, Warring States period (Diameter: 1.0-2.4 cm).

Plate IIB. *China:* Latticed eye beads, Warring States period (Diameter: 2.2-2.6 cm).

Plate IIC. *China:* Square glass eye beads, Warring States period (Diameter: 1.2-1.4 cm).

Plate IID. *China:* Glazed pottery eye beads, Warring States period (Diameter: 2.2-3.0 cm [top]; 1.5-1.7 cm [bottom]).

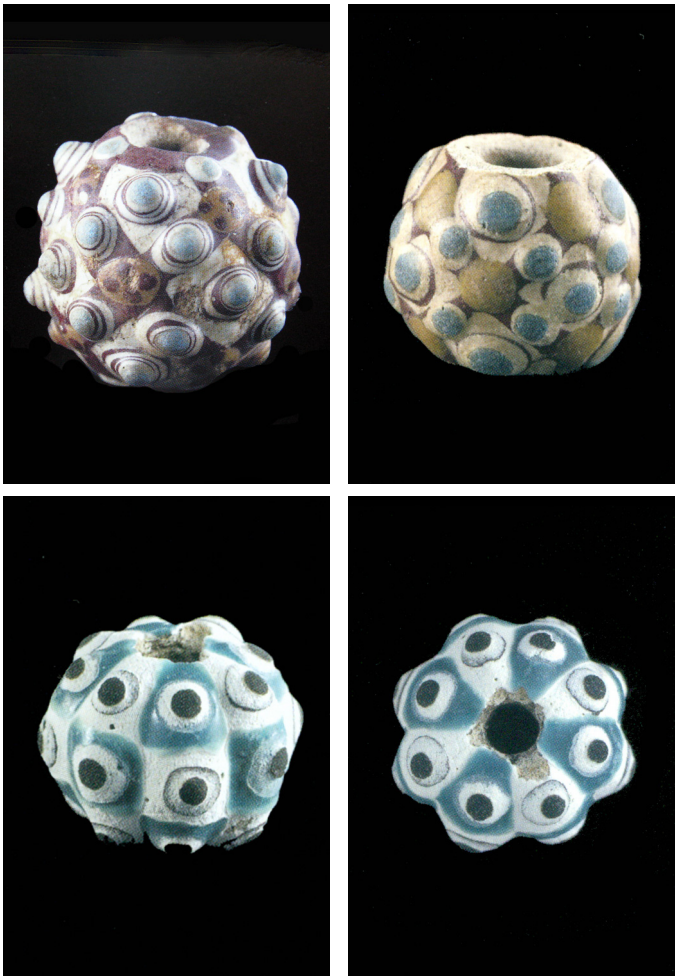


Plate IIIA. *China:* Glazed pottery eye beads, Warring States period (Diameter: 1.1-1.3 cm).

Plate IIIB. *China:* Glazed pottery eye beads, Warring States period (Diameter: 1.2-2.5 cm).

Plate IIIC. *China:* Glazed pottery eye beads, Warring States period (Diameter: 1.6, 2.2 cm [top]; 1.9 cm [bottom]).

Plate IIID. *China:* Glazed pottery eye beads, Warring States period (Diameter: 1.7, 2.0 cm [top]; 1.4-1.9 cm [bottom]).

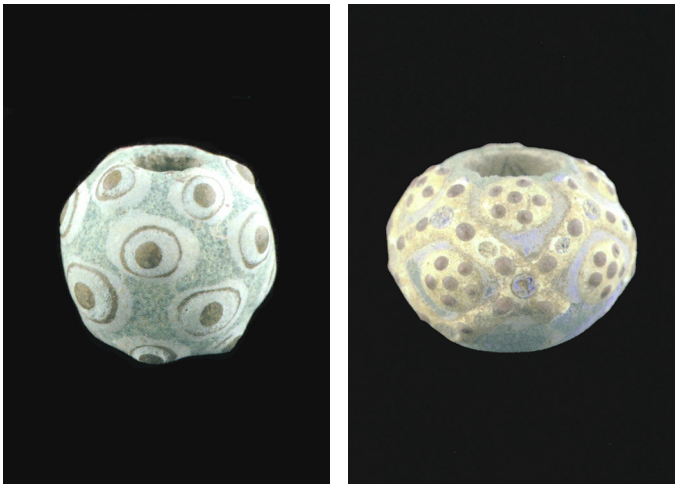


Plate IVA. *China:* Tubular glass eye beads, Warring States period (Length: 2.3-2.5 cm).

Plate IVB. *China:* Tubular glass eye beads with persimmon-calyx designs, Warring States period (Length: 3.8-3.9 cm).

Plate IVC. *China:* Tubular glass eye beads with persimmon-calyx designs, Warring States (Length: 4.1-4.3 cm [top]; 1.8 cm [bottom]).

Plate IVD. *China:* Latticed tubular glass eye beads, Warring States period (Length: 5.3, 1.3 cm [top]; 4.2-4.3 cm [bottom]).

Plate VA. *China:* Baluster-shaped beads of white glass, Eastern Han dynasty (Diameter: 1.6 cm).

Plate VB. *China:* Tabular beads of yellow glass, Eastern Han dynasty (Width: 2.2-2.7 cm).

Plate VC. *China:* Glass ear spools. **Top:** Persimmon-calyx and heart-shaped decoration, late Warring to Western Han dynasties (Length: ca. 2.0 cm). **Bottom:** Han dynasty (Length: 1.9-2.6 cm).

Plate VD. *China:* **Top:** Blue glass bead with twin horses in gold foil, Southern and Northern dynasties (Diameter: 2.3 cm). **Bottom:** Marbled glass beads, Song/Yuan dynasties (Diameter: 1.0 cm).

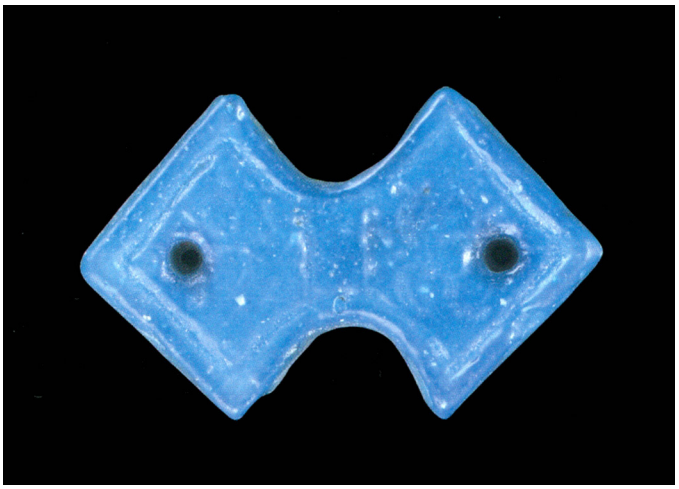


Plate VIA. *China:* Blue glass pendants, Jin to Yuan dynasties (Length: 3.7 cm). **Top:** "Buffalo under the moon" pattern. **Bottom:** Double lozenge (Length: 3.7 cm).

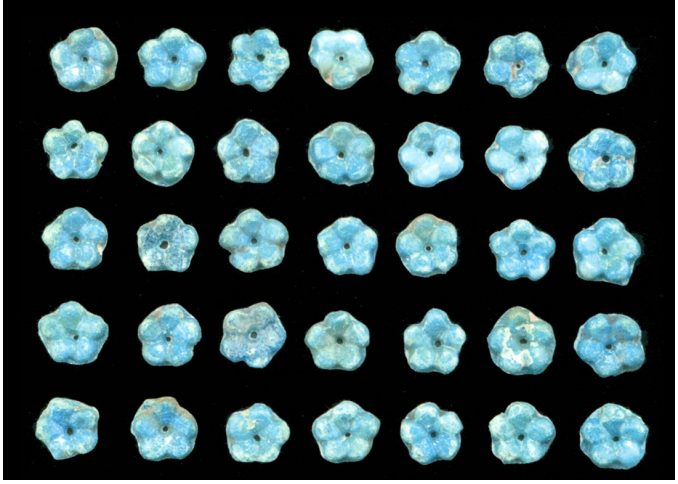


Plate VIB. *China:* Yuan dynasty adornments. **Top:** Perforated flower-shaped ornaments (Diameter: 1.2-1.4 cm). **Bottom:** Gold earrings with glass components (Length: 4.0 cm).

Plate VIC. *China:* Melon-shaped glass beads, Yuan dynasty (Diameter: 1.4-2.7 cm).

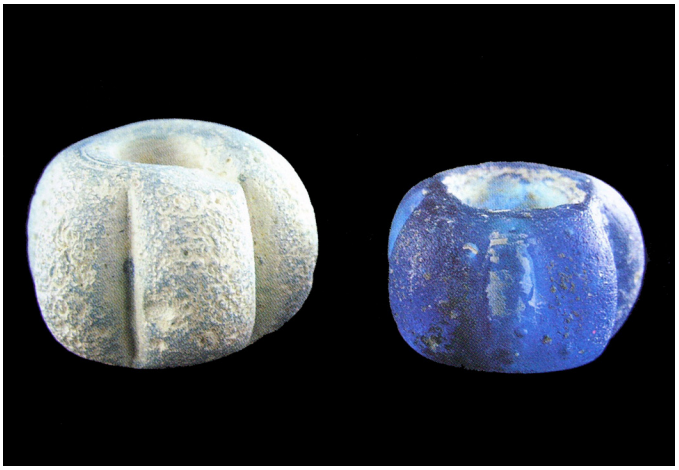


Plate VID. *China:* Composite imitation white-jade pendant, Ming dynasty (Length: 37 cm).

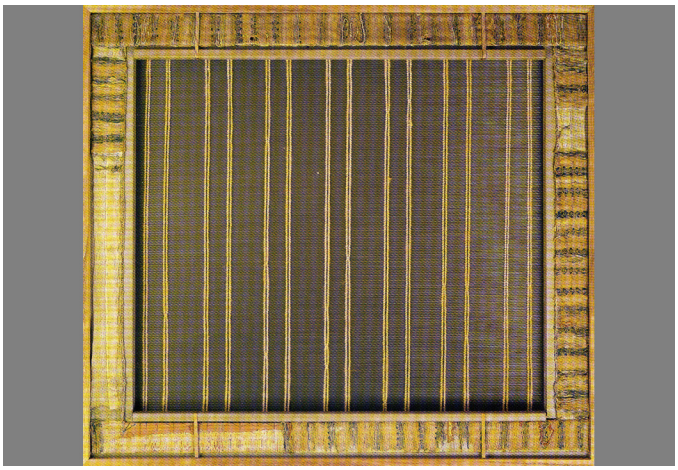


Plate VIIA. *Curtains:* **Top:** Indo-Pacific glass beads from the Yongning Temple (photo: An Jiayao). **Bottom:** *Tamasudare* reproduction (courtesy: Kanazawa Bunko Museum).

Plate VIIB. *Curtains:* Curtain of bamboo tubes and Job's tears, Beijing, 2008 (all photos by Valerie Hector unless otherwise indicated).

Plate VIIC. *Curtains:* **Top:** The Job's tears in Plate VIIB. **Bottom:** Curtain detail showing seedpods, plastic tubes, and suspension bar (photo: Sanders Visual Images).

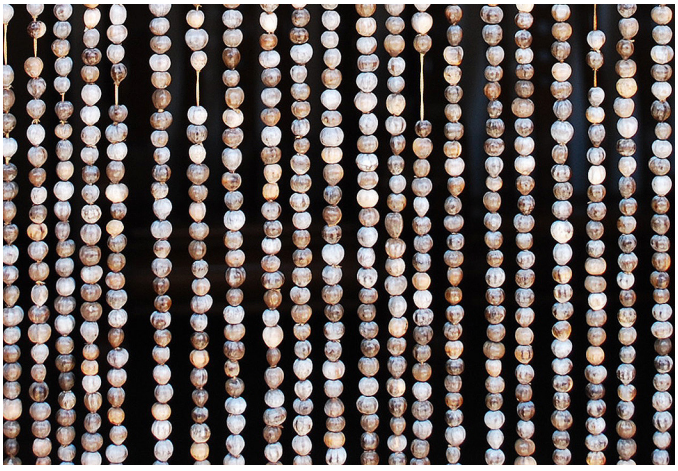
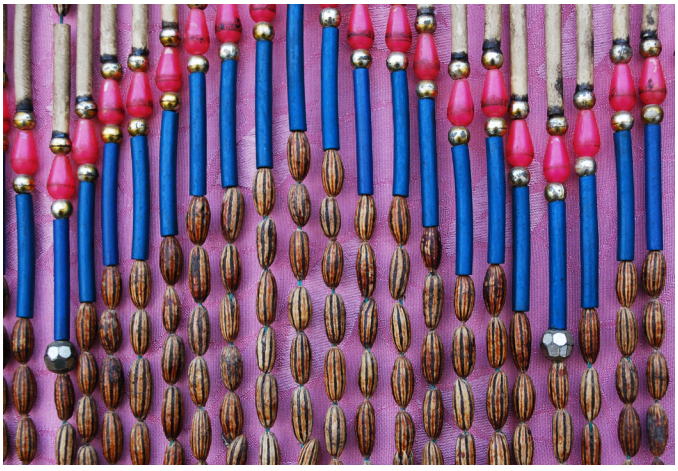


Plate VIID. *Curtains:* **Top:** The lobed seedpods and plastic beads of a Beijing curtain, 2008. **Bottom:** Bead door curtain of seeds and plastic tubes, Beijing, 2013.



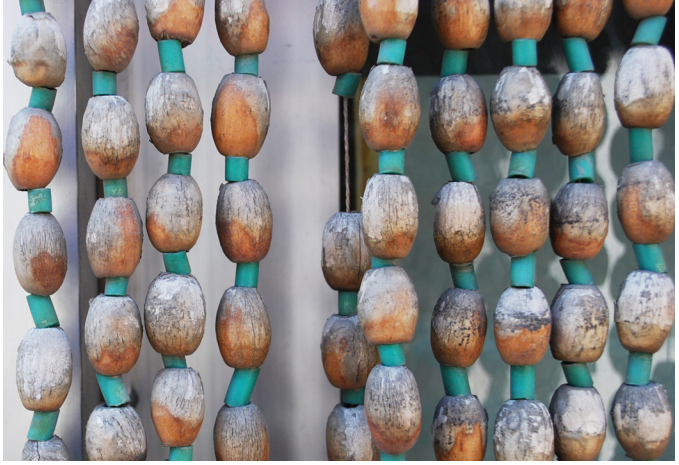


Plate VIIIA. *Curtains:* **Top:** The seeds and green plastic tubes of the curtain in Plate VIID bottom. **Bottom:** Rolled paper beads, Job's tears, and plastic tubes, Cuandixia, 2012.

Plate VIIIB. *Curtains:* **Top:** Folded-paper beads connected with paper clips. **Bottom:** Folded paper and biconical plastic beads, and Job's tears. Both Cuandixia, 2012.

Plate VIIIC. *Curtains:* **Top:** Folded-paper bead curtains hanging in doorways, Cuandixia, 2012. **Bottom:** Star-shaped folded-paper beads and plastic tubes, Qufu, Shandong province, 2012.

Plate VIIID. *Curtains:* Curtain featuring geometric motifs and a rare netted valance, 20th century. Private collection (photo: Sanders Visual Images).

Plate IXA. *Curtains:* Detail of the netted valance of the geometric curtain.

Plate IXB. *Curtains:* Curtain featuring landscape motifs, 20th century. Private collection (photo: Sanders Visual Images).

Plate IXC. *Curtains:* Curtain featuring hybrid motifs, with a crane standing before a pine tree, 20th century (photo: Sanders Visual Images).

Plate IXD. *Curtains:* **Top:** The beads and pendants at the bottom of the crane/pine curtain. **Bottom:** Box of drawn glass tubes (courtesy: Robert K. Liu). (Photos: Sanders Visual Images).

Plate XA. *Curtains:* **Top:** Knotted strands with drawn tubular and wound oblate glass beads, probably Chinese, 20th century (courtesy: Jamey Allen). **Bottom:** Peacock curtain, Boshan, 2012.

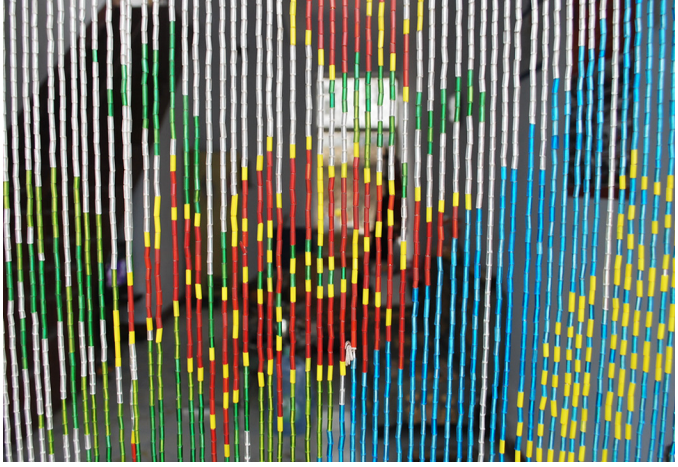


Plate XB. *Curtains:* **Top:** Detail of the peacock curtain. **Bottom:** Large yellow curtain of drawn glass beads, Boshan, 2012.

Plate XC. *Curtains:* Prof. Peter Haslund with Liu Fengwei's mother in front of the Liu home with its colorful plastic curtain, Shijiazhuang, Shandong province, 1984 (courtesy: Peter Haslund).

Plate XD. *Curtains:* Reproduction of the plastic faceted-bead curtain of the Hutong Pizza restaurant, Xicheng district, Beijing, 2012. Private collection (photo: Sanders Visual Images).

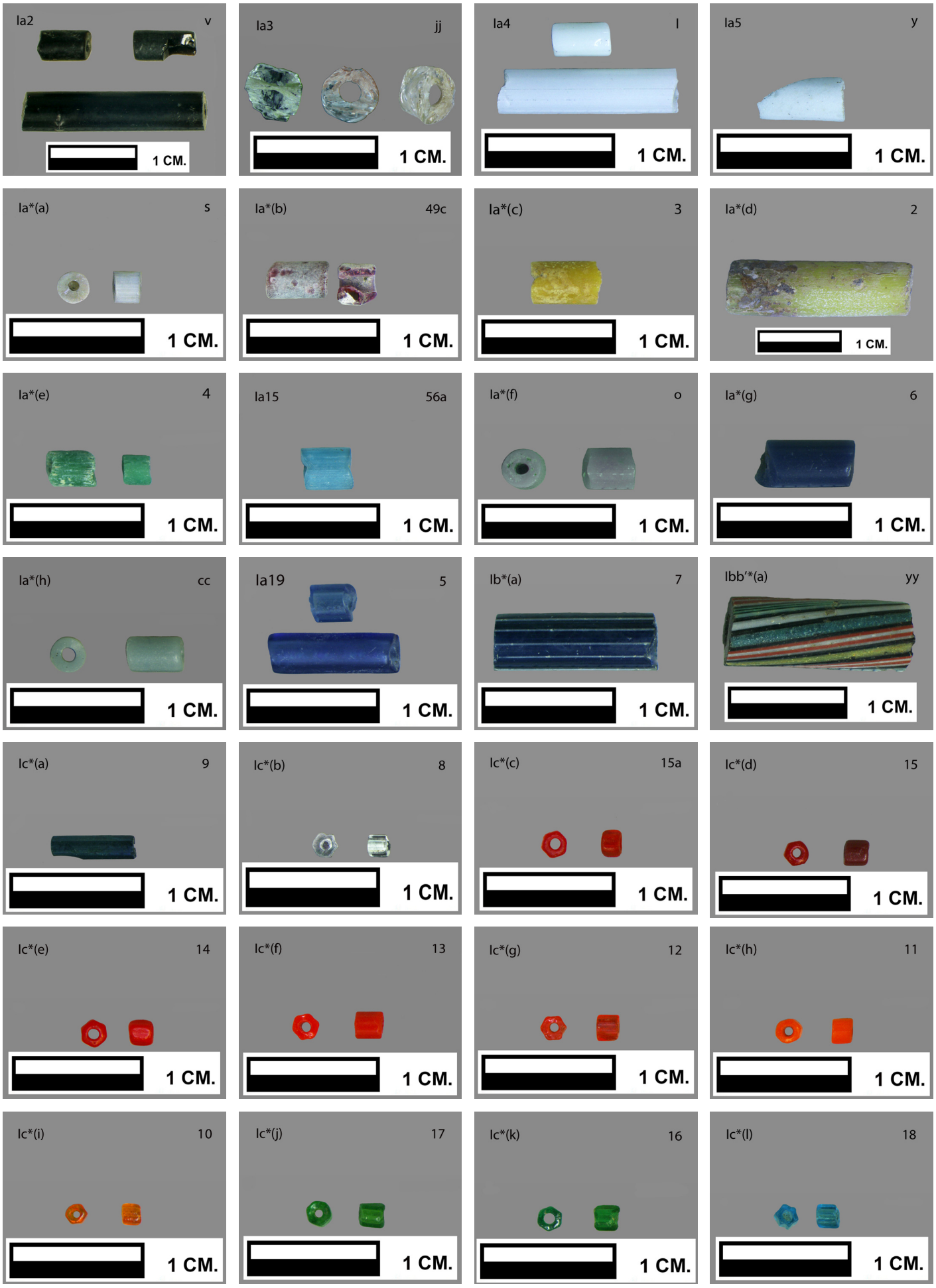


Plate XI. *York Factory:* Glass bead varieties (photos: Louis Laflèche, Parks Canada).

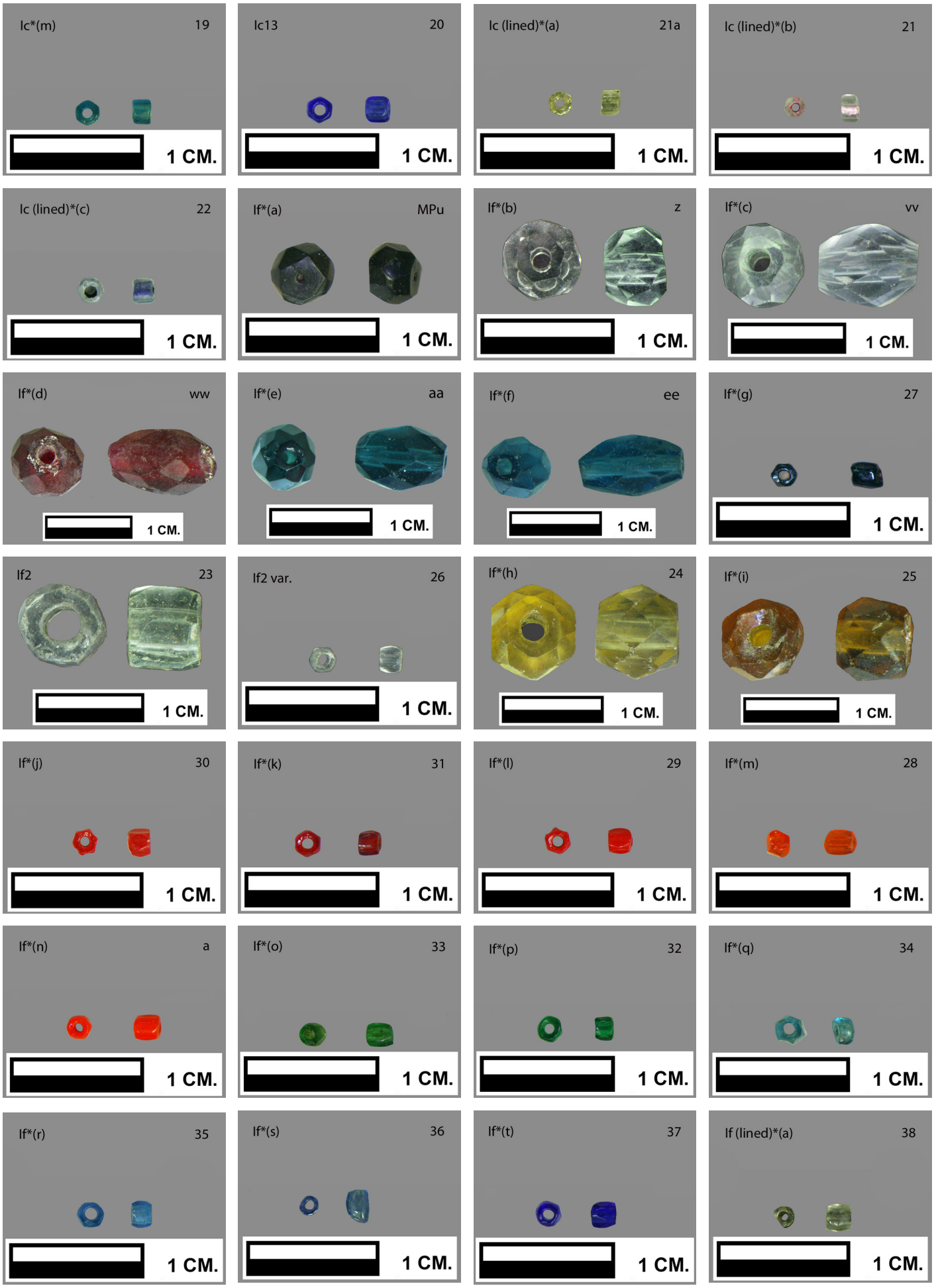


Plate XII. *York Factory:* Glass bead varieties.

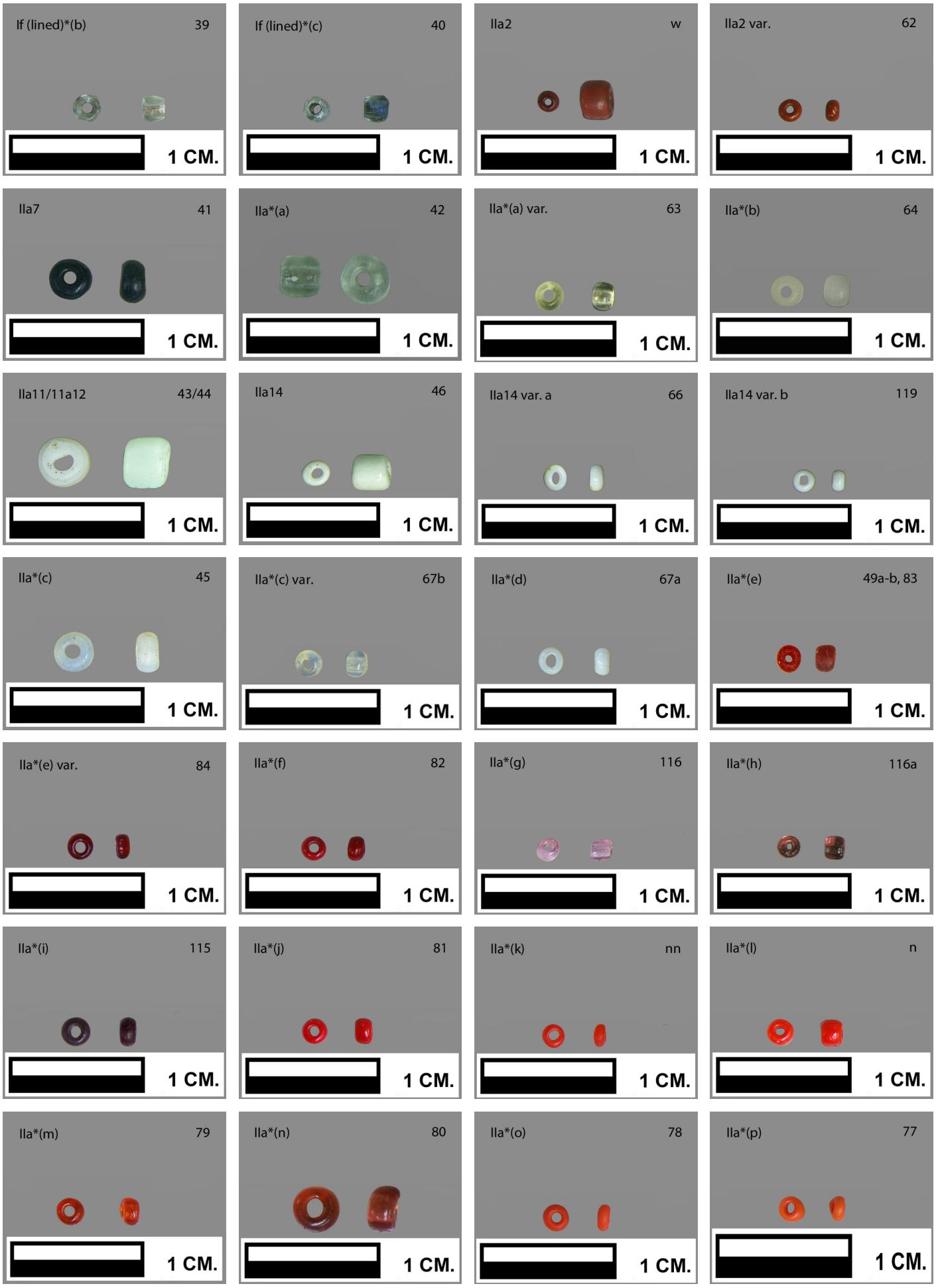


Plate XIII. *York Factory:* Glass bead varieties.

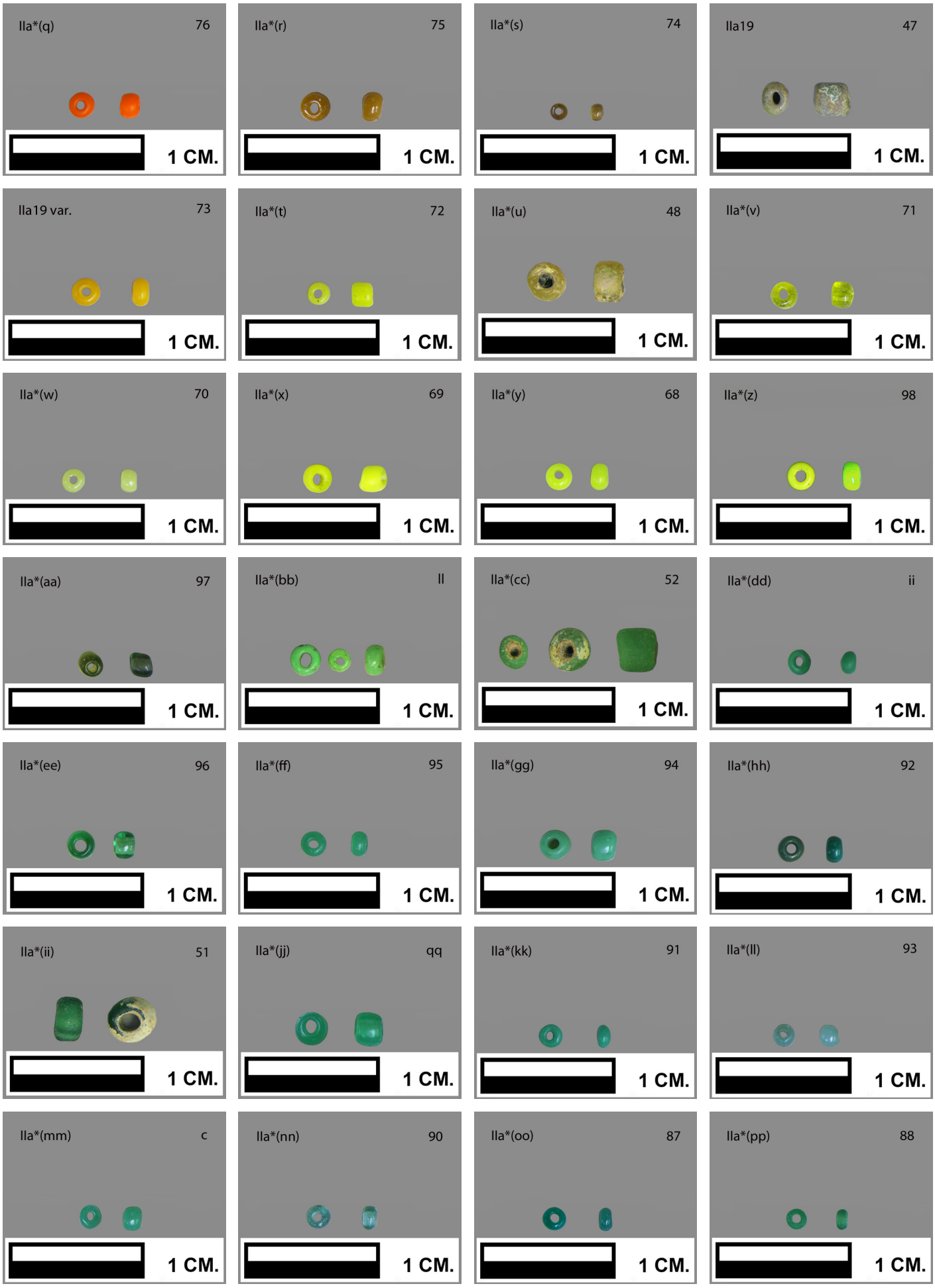


Plate XIV. *York Factory:* Glass bead varieties.

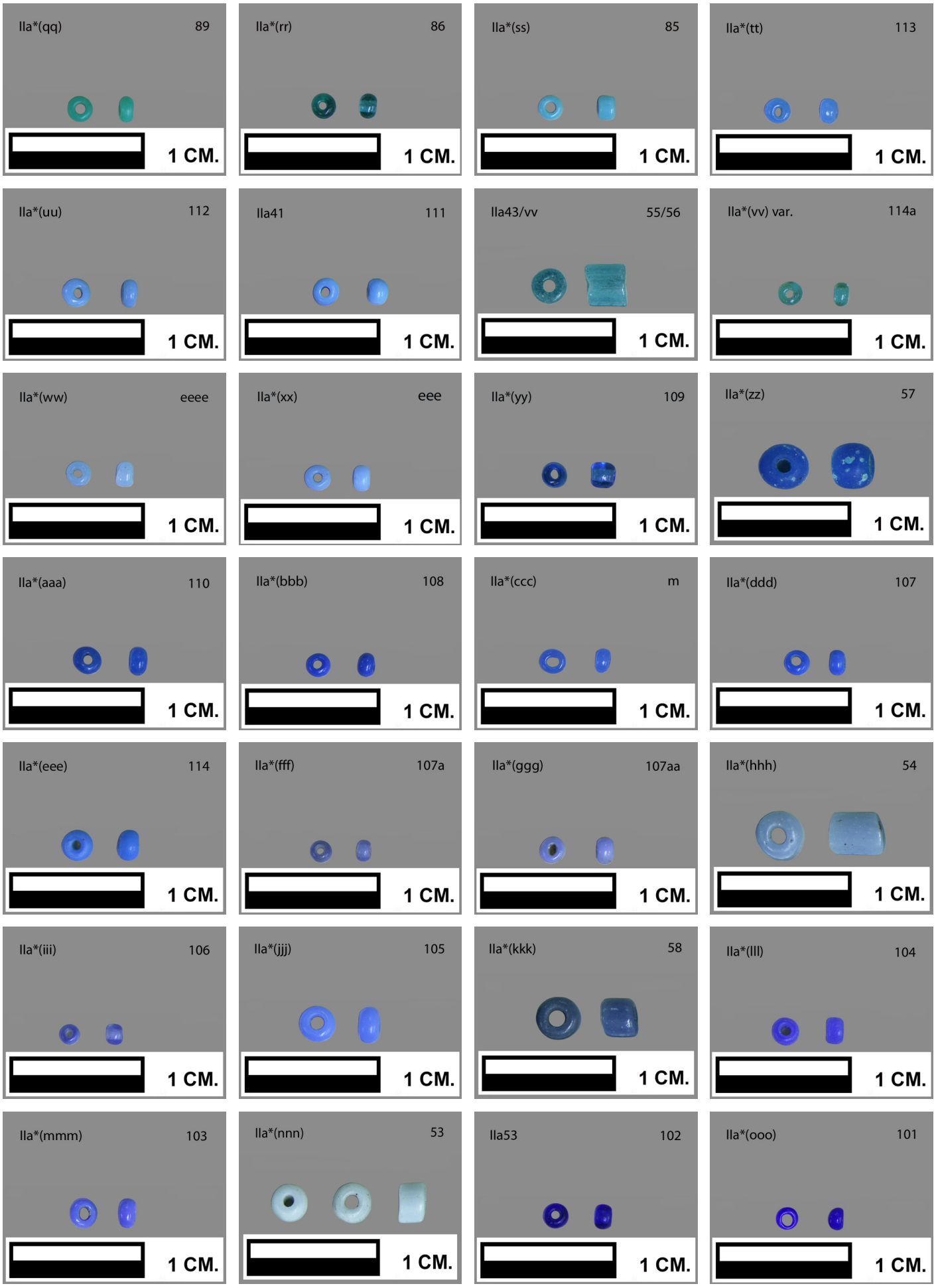


Plate XV. *York Factory:* Glass bead varieties.

Plate XVI. *York Factory:* Glass bead varieties.

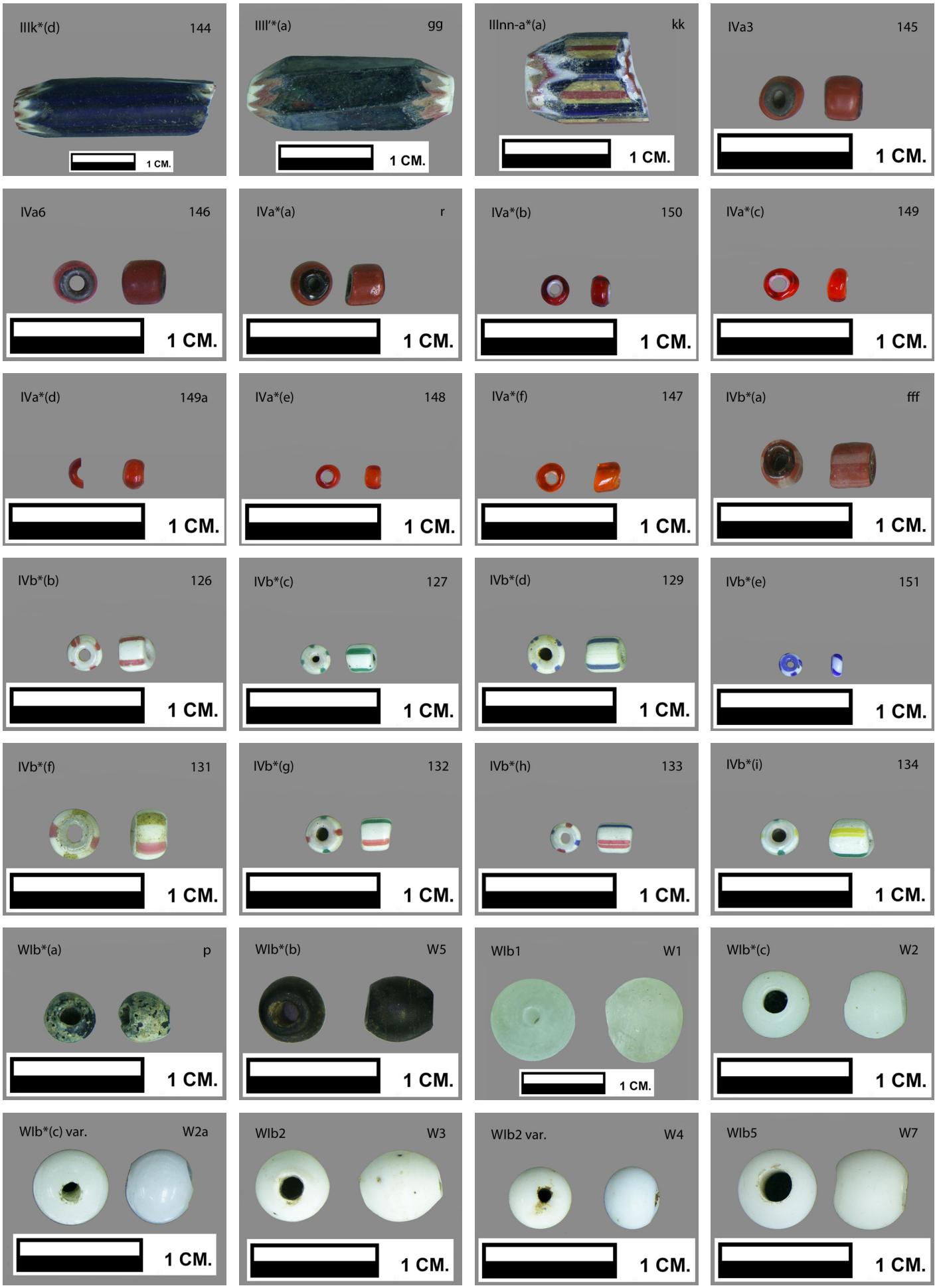


Plate XVII. *York Factory:* Glass bead varieties.

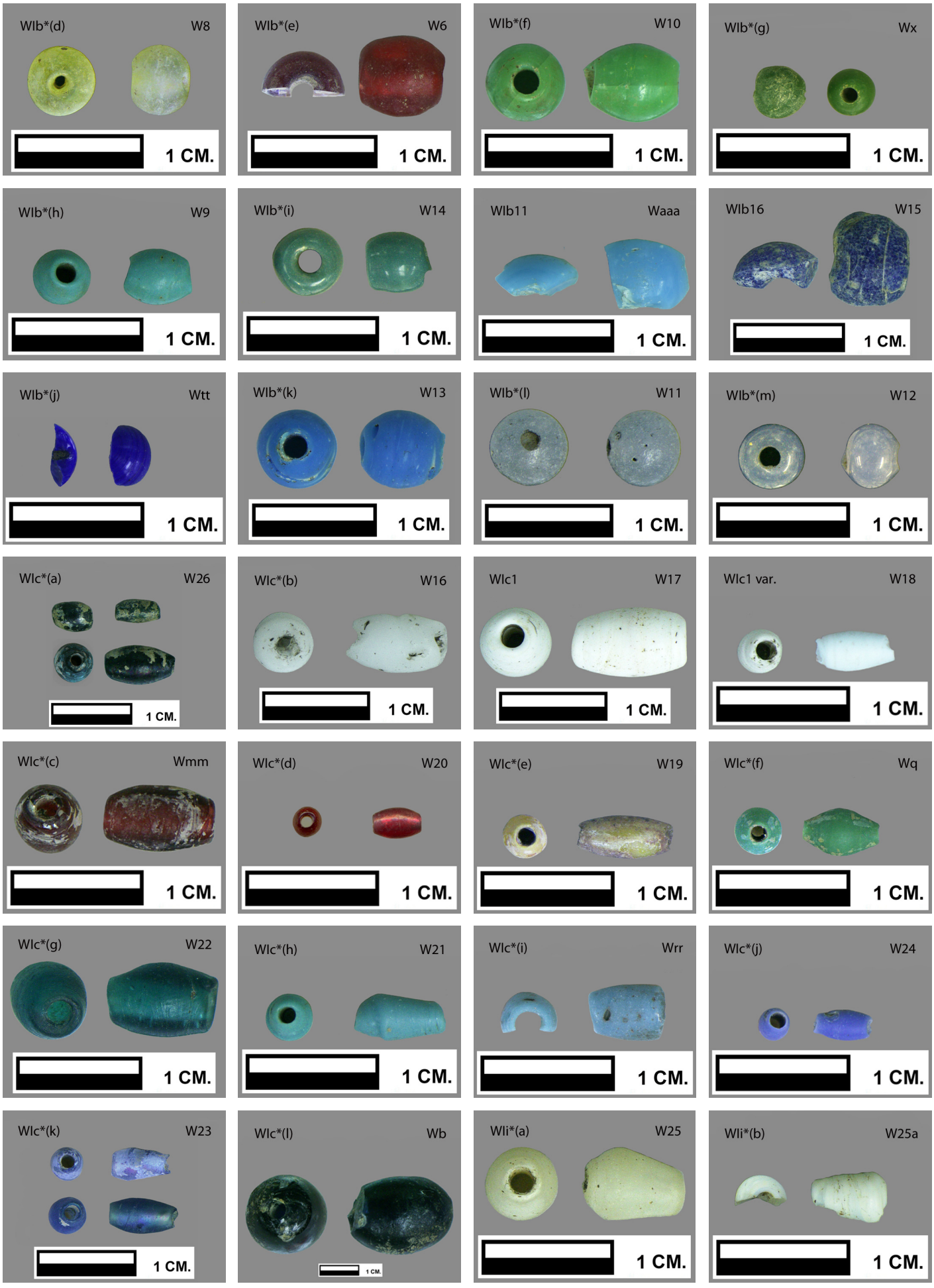


Plate XVIII. *York Factory:* Glass bead varieties.

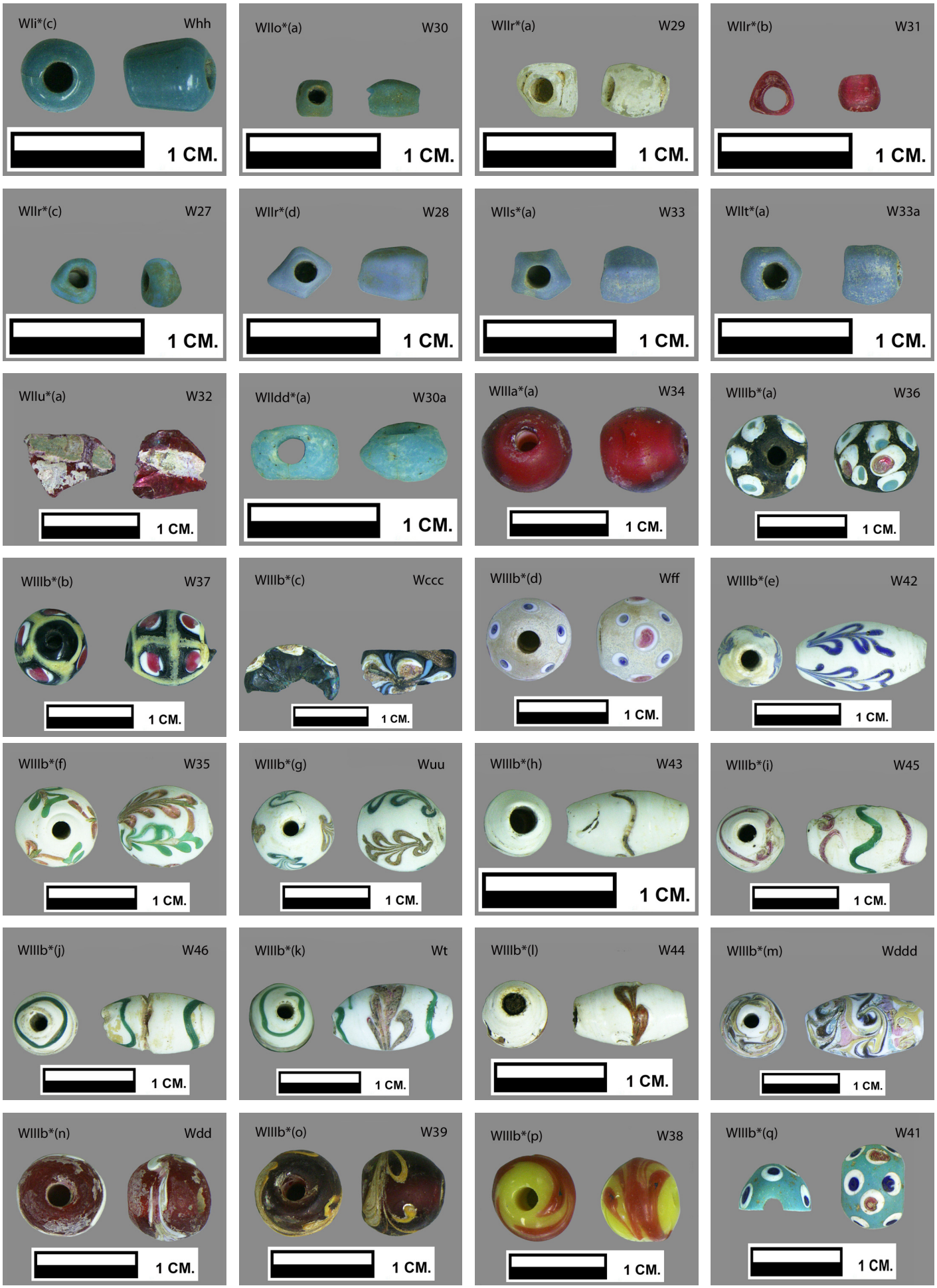


Plate XIX. *York Factory:* Glass bead varieties.

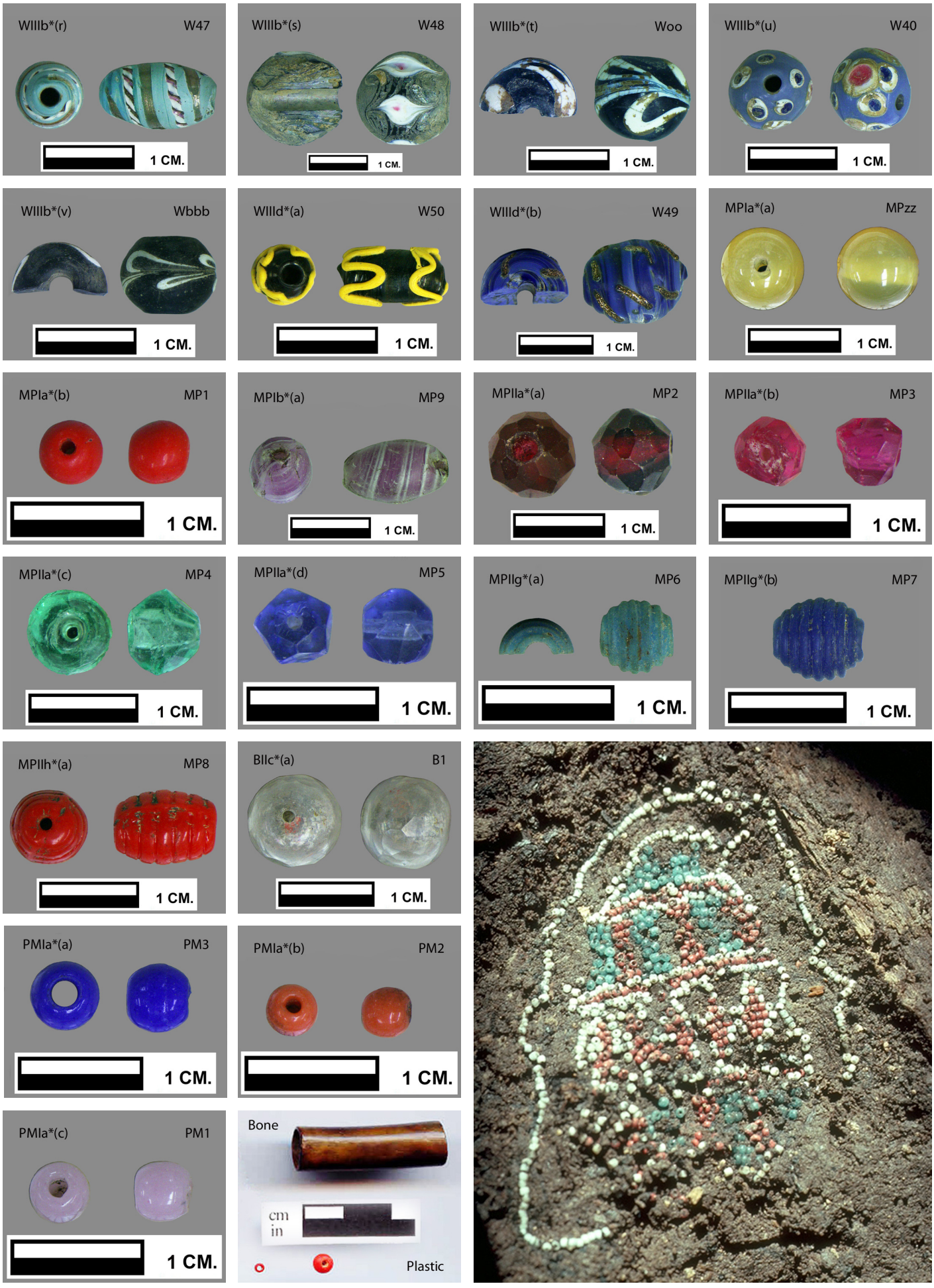


Plate XXA. *York Factory:* Glass, ceramic, plastic, and bone bead varieties.

Plate XXB. *York Factory:* Beaded moccasin vamp remnant from the Octagon deposit (Parks Canada/9K-1936T).