THE LARGE GLASS BEADS OF LEECH FIBULAE FROM IRON AGE NECROPOLI IN NORTHERN ITALY

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During the Iron Age, around 700 BC, artisans in northern Italy produced bronze bow fibulae decorated with large, elongated, leech-shaped glass beads. These extraordinary brooches, known only from women's tombs, required special technical knowledge and skill to create. This article provides an overview of these adornments as well as insights into their production technology, chemical composition, and origin. The wide variety of these objects suggests the existence of several local glass workshops.

HISTORICAL BACKGROUND

Different kinds of fibulae, or brooches, for decorating and fastening clothes were popular in the northern part of the Italian peninsula during the late 8th to 7th centuries BC. Most of the fibulae are of bronze and often characteristic of ancient regional cultures. In Etruscan places like Tarquinia or in the Emilia-Romagna (the Etruscan zone in the region of Bologna, north of its core area in Tuscany), simple bow-shaped fibulae made of a bronze wire with small glass or fine bone beads on the bow were already in use in the 9th century BC. A bronze type with a broad bow resembling the form of a leech became common in the 8th century.[1] Some of these have a large leech-shaped glass bead on the bow (called *Glasbügelfibeln* in German). They occur in various Etruscan and neighboring necropoli utilized from the last third of the 8th century onwards, the beginning of the so-called Orientalizing period.[2] Often elements of bone and amber complete the leech shape at either end.

The glassy leech fibulae are mainly concentrated in cremation necropoli between Bologna and Verucchio (Emilia-Romagna) (Figure 1). They are occasionally found in Tuscan tombs such as at Chiusi, Marsiliana, and Vetulonia, and elsewhere, e.g., Falerii (the ancient Faliskan area), Belmonte (Picenum, present-day Marche), and Este in Veneto. Isolated finds are known from Magdalenska gora (Slovenia), Frög (Austria), and Gorszewice (Poland), all probable imports from northern Italy. Some museum collections hold specimens of these glass-bow fibulae, usually without any provenience information, so this jewelry item has not lost its attraction even in modern times.

MANUFACTURING TECHNIQUES

The glassy fibula beads in leech form ("sliders") are relatively large and can be over 8 cm long. They have a longitudinal perforation and thus "slide" onto the brooch's bow-shaped bronze wire. The generally dark body is decorated with a zigzag pattern of applied yellow and/or white glass threads (Figures 2-3). Other decorative patterns include wavy lines, dots, and circles. A rare type with "horns" (Figure 4) is found mainly in Emilia-Romagna (von Eles 2015: type 84, Plate 195; Koch 2010:66, 70-73, Figures 16, 87, 90). This distinctive form, with its spiral and wavy decoration, has parallels in certain triangular beads from the Balkan area, especially Croatia and Slovenia (Bakarić, Križ, and Šoufek 2006:64, 165 f., nos. 151-152, 155-156). These and other large spherical "Kompolje beads" (so called after the place of discovery in Croatia) have a partially vitrified sandy quartz core coated with dark glass onto which the decoration is applied.[3] The same technique is evident in the large fibula bow beads, in both the horned and the leech forms, and it also appears in glassy spindle whorls from Emilia-Romagna. It seems that an exchange of glass-working techniques took place around the Upper Adriatic in the late 8th and 7th centuries BC.

Eroded and broken leech beads clearly show that the core consists of a bright yellow mass, mostly with a rough crystalline texture (Figure 5) (Koch 2010:52-55; Purowski, Syta, and Wagner 2016; Towle and Henderson 2007:58, Figure 6). This sandy mass has been sintered (partially fused or vitrified), as revealed by internal gas bubbles that also indicate the addition of a flux during production. The individual steps of preparing the core are unknown, e.g., was it sintered before or during the application of the glass surface? In order to obtain the massive leech form, the artisans probably used some kind of two-part mold.

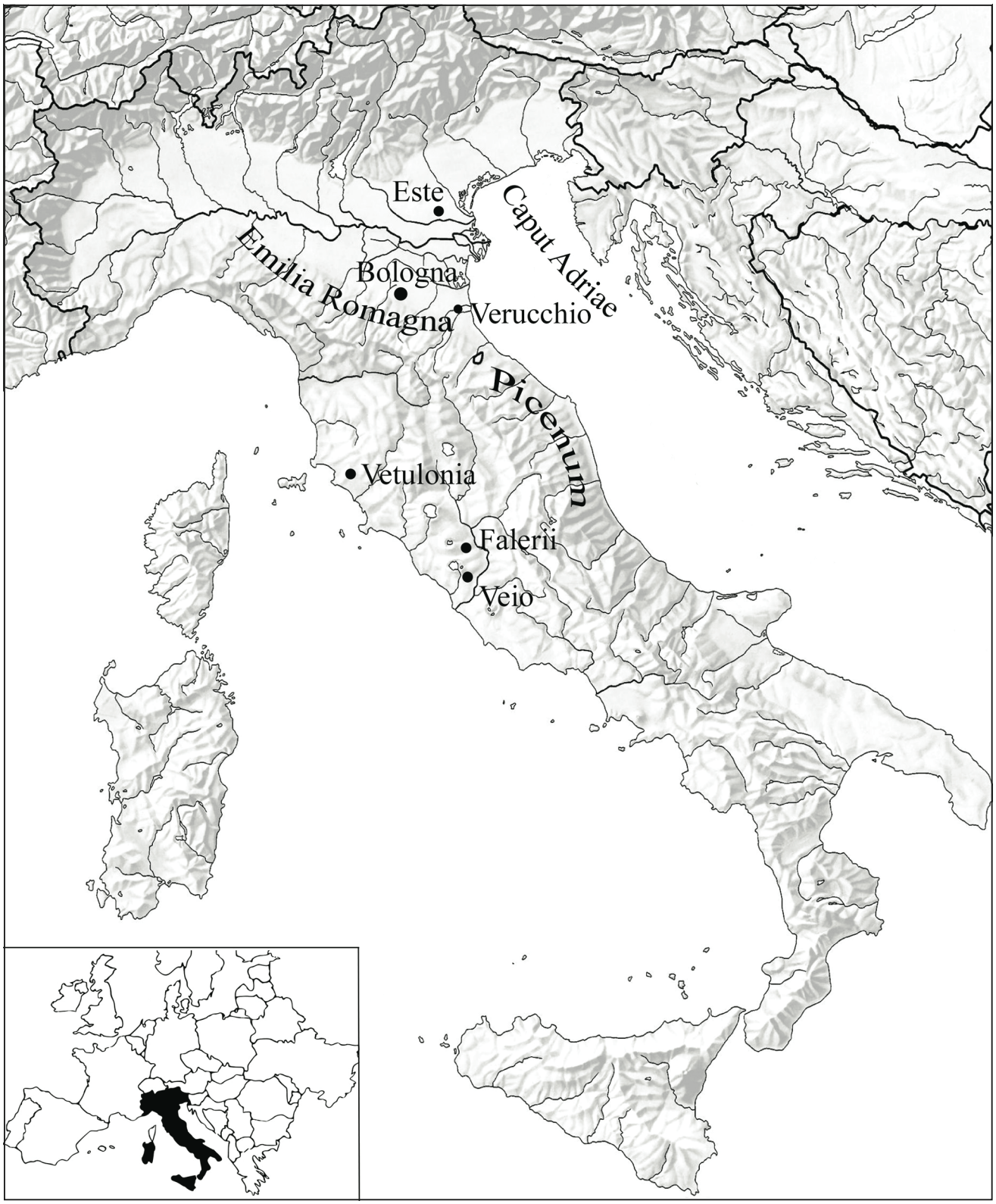

Figure 1. Map of Italy showing the most important find sites and regions mentioned in text (no further reproduction without renewed permission of the proper regional authorities is allowed) (all images by the author).

Figure 2. A pair of fibula bow beads from Verucchio (Lippi tomb 13/1972). The typical herringbone pattern consists of alternating white and yellow lines though the latter have mostly disintegrated (courtesy of the Ministero per i Beni e le Attività Culturali e per il Turismo, Soprintendenza Archeologia, Belle Arti e Paesaggio per le province di Ravenna, Forlì-Cesena e Rimini. Museo Civico Archeologico Verucchio).

This is obvious considering the very similar shape and dimensions of the beads where pairs of fibulae have been discovered (Figures 2 and 11). It is highly unlikely that the cores were produced by coiling molten glass on a mandrel as proposed by T. Purowski (2012:103, Figure 30). It is,

Figure 3. Large fibula bow bead from Bologna (Benacci, without tomb context). The decoration consists of groups of yellow and white lines (courtesy of Museo Civico Archeologico Bologna).

Figure 4. Rare horned fibula bow beads with spiral decoration on the horns; some of the yellow glass is missing (Verucchio, Lippi tomb 13/1972) (courtesy of Ministero per i Beni e le Attività Culturali e per il Turismo, Soprintendenza Archeologia, Belle Arti e Paesaggio per le province di Ravenna, Forlì-Cesena e Rimini. Museo Civico Archeologico Verucchio).

Figure 5. An eroded bow bead showing the light-colored sandy quartz core beneath the dark glass layer; the decoration is gone (tomb Strada Provinciale 1970, Verucchio) (courtesy of Ministero per i Beni e le Attività Culturali e per il Turismo, Soprintendenza Archeologia, Belle Arti e Paesaggio per le province di Ravenna, Forlì-Cesena e Rimini. Museo Civico Archeologico Verucchio).

however, plausible that the exterior glass coat was applied in this way.

Most fibula sliders have a blackish glass coating, though there are rare hints of a yellow one (Koch 2010:79). After the coating was applied and smoothed by heating, the decorative threads were wound around the body – a difficult moment in the manufacturing process that required the artisan to understand the properties and workability of the glass that they used. Their expertise is manifest, since only in rare cases do we see faults in the application of the decorative threads which consist of monochrome yellow or white glass, or bichrome using both colors. In the case of bichrome decoration, the change from one color to the other generally occurs on the lower side and is not visible when the brooch is in use (Figure 3). Yellow and white lines may alternate (Figure 2) or constitute alternating groups of several threads of each color. This "group decoration" is found on relatively large bow beads from Bologna (Figure 3), and the example from Gorszewice in Poland also seems to be of this kind.[4]

The final production step was to comb the white and yellow lines into a zigzag or herringbone pattern with a pointed tool. This step produced deep longitudinal grooves in the glass coating which we can also see as a decorative element. The surfaces of cores that have lost their glass coating exhibit traces of these grooves (Koch 2010: Plate 2, no. 1), revealing that the core was hot and soft at this stage.

Some bow beads from the Bologna region were made using a different technique. Here, the whole body is colored but it contains a large portion of unfused quartz or sand granules that are visible to the naked eye (Figure 6). It may be that a pre-produced colored glass was ground to a powder and mixed with common sand or crushed quartz. There is no

Figure 6. A broken bow bead from Bologna (Malvasia Tortorelli, formerly tomb 2). The entire body consists of a colored glassy mass (courtesy of Museo Civico Archeologico Bologna).

evidence of an extra layer of glass on the surface so it seems that enough glass (powder?) was soft during the sintering and/or decoration process to allow the applied white or yellow glass threads to sink into the surface. Possibly, the artisans added a liquid to the glass powder and sand/quartz mix to obtain a workable mass that could be pressed into a mold, as for the cores described above. This is reminiscent of the process used to make faience beads. In both cases it was necessary to form the bead around a rod for further working and decorating – and to leave an opening for the fibula bow. Usually, the hole is much larger than actually needed, and sometimes small pieces of wood were slipped into the hole to fix the bead on the thin bronze wire of the fibula (e.g., Koch 2010: nos. 122 and 123).

There is also a third production technique. In a few cases, smaller leech-shaped beads, 4-5 cm long and made of pure translucent blue or dark brown glass (Koch 2010:

nos. 164 and 165), seem to have been formed on a bronze wire that was then shaped into a fibula. Other beads have a large round hole and were worked like a common bow bead on a rod that was coated with a parting agent (Figure 7). To achieve the bowed leech form, these beads, while in a hot and workable state, were bent over a narrow curved form or some tool. This procedure is rather tricky and the glass must have the right temperature. In the case of beads produced on a fine fibula wire, there would have been no problem in removing the working rod. For the other examples, we may hypothesize a slightly curved rod. The smooth bottom side that is formed like a segment of a circle provides unambiguous evidence that the beads were shaped in a hot state (Figure 7). On the blue examples, wrinkles are present on the underside where the glass was pushed together and cooled on the surface of the form. These wrinkles indicate that the beads were shaped after they had been decorated. Thus these objects, in all their variants, reveal the high technical ability of their makers over 2500 years ago.

RESULTS OF CHEMICAL STUDIES

The Early Iron Age glasses in Italy differ from those of the Late Bronze Age mainly in the use of different flux materials. The glass of the Final Bronze Age (12th-10th centuries BC) that was worked and maybe also produced in well-known Frattesina and other nearby workshops (e.g., Bellintani 2014) is a mixed-alkali glass containing both soda and potash. In contrast, Iron Age glasses have a different and more variable chemical composition. Due to their soda content of ca. 14-20% NaO, they are considered to be natron glasses with soda as the only flux (Angelini, Gratuze, and Artioli 2019). When this soda content is combined with very low amounts of magnesia (MgO) and potash (K_2O), it seems feasible to argue that a mineral soda source, namely natron, was used (Purowski, Syta, and Wagner 2020; *see also* Koch n.d.). This is not the place to discuss European Early Iron Age glass chemistry in greater detail, so we will highlight only some interesting results regarding the leech-shaped beads.

Recently, T. Purowski (2012) and co-workers (Purowski, Syta, and Wagner 2016) carried out new chemical analyses on a fibula bow bead found in Poland. They analyzed the oxides of the basic glass ingredients as well as trace elements in the vitrified portion of the quartz core and in the superficial dark glass coat. Purowski, Syta, and Wagner (2016:113) suggest that a plant-ash flux was used because of the relatively high levels of MgO and K_2O in both the glasses. Due to the proportion of zirconium and strontium, the authors believe that the sand came from an inland source and not from the seacoast (Purowski, Syta, and Wagner 2016:113). They emphasize that the glasses

Figure 7. A pair of fibula bow beads made of translucent glass from Veio (Vaccareccia tomb 24). Note the smooth underside that was probably formed while the glass was viscid; the ends are ground flat (courtesy of Museo delle Civiltà – Museo Preistorico Etnografico "Luigi Pigorini" and the Ministero per i Beni e le Attività Culturali).

of the core and the colored layer are of the same type and similar in composition, differing only in the amounts of trace metal oxides thought to stem from the coloring agents used (Purowski, Syta, and Wagner 2016:113, Table 2, 116, Figure 7). This important finding implies that the quartz-rich mass of the leech bead's core was mixed in the same workshop and using the same basic materials as the colored glass. As previously mentioned, we know the core technique was only used in a few geographical areas and only to produce certain glass artifacts. If further research can confirm this finding for other fibula beads, it would be good evidence to argue that local workshops produced their own glass in Italy around 700 BC.

The researchers also detected a rather high concentration of cobalt oxide (0.88%). This is in line with the dark glasses of other fibula sliders, although it is among the highest cobalt content noted to date. Other results currently available for CoO are in the range of 0.16-0.93%, namely 0.16% for a leech bead without context (Braun 1983: Table 21), 0.23% for a sample from Este discussed below (Casa di Ricovero 235; Towle 2002:315, Table 5.43), 0.25% for another bead without context (Bomford collection, Bristol; Towle 2002:315, Table 5.43; Towle and Henderson 2007: Table 5), 0.31% (Este, Rebato 100; Towle 2002:279, Table 5.24), and up to 0.93% on an example said to come from Slovenia.[5] These levels are remarkably high considering that cobalt is a strong coloring agent that can impart a dark blue color at a concentration of only 0.02% (*see* e.g., Henderson 1985:278-281, 1988:438). For this reason, Purowski, Syta, and Wagner (2016:116) suggest that "the coloring process was apparently out of control of the artisans." This does not take into account, however, that the artisans may have deliberately added a high concentration of cobalt in order to create a blackish color. Most fibula bow beads with a preserved surface are of a very dark color, occasionally altered (by the funeral pyre?) to reddish brown, but sometimes clearly identifiable as dark blue when held up to a strong light (e.g., Figures 2 and 5). Black glasses are among the very first glasses in the Early Iron Age, from the 10th-9th centuries BC onwards, and were colored by adding different elements, primarily iron, in various amounts.[6] With the availability of cobalt toward the end of the Early Iron Age, this efficient colorant seems to have been preferred.

The dark glass of the Gorszewice bead also contains higher amounts of nickel, copper, lead, and iron oxides (2.77% FeO) that may in part have been introduced to the glass batch with the cobalt mineral. This finding correlates with the analysis of other sliders that have iron oxides in concentrations from 1.03% Fe_2O_3 to 5.55% FeO. This is much less than in the earliest Iron Age black beads, but high enough to have an effect on the glass batch. So I think that a black glass matrix was desired – and successfully obtained by all available means.

Somewhat problematic is a bead from Este (Towle 2002:315, Table 5.43, sample 370) which has the "usual" high amounts of cobalt (0.23%) and iron oxide (1.83%), but also a significant content of lead (8.33% PbO) and antimony (1.21% Sb_2O_5). Towle (2002:270), who analyzed a large sample of artifacts from the Italian Iron Age, describes the glass material as "green and opaque," as one would also expect from the detected coloring agents such as cobalt and lead antimonate yellow. To my knowledge there is no green opaque glass during this period, and the bead appears to be covered with a dark layer of unknown material that could give the impression of being green. From Tomb Ricovero 235 (Koch 2010: no. 132), this bead is broken, weathered, and probably also suffered from the heat of a funeral pyre. From the broken section, it is clear that the quartz core is not covered by a dark glass layer but by a yellow one, and the yellow glass is confirmed by chemical analysis. Only in a few other cases from Este and Bologna are there indications of a yellow coating, though it may not be as durable as the dark glass. The yellow glass matrix has been noted in combination with a white decoration, thereby creating very bright trinkets (Koch 2010:79). Based on the chemical analysis, it may be that a dark cobalt-colored glass thread was wrapped around the yellow body to create the herringbone decoration. The instrument readings may have been taken at a spot where traces of the blue/black glass remained or cobalt molecules had diffused into the yellow matrix.

LOCAL WORKSHOPS?

Glass workshops are difficult to identify archaeologically because the tools used are not very specific (like tongs or tweezers) and a small oven or even a small forced fire would be sufficient to obtain the temperatures required to work the glass (Koch 2011:28-31 with literature). The only positive evidence of glass workshops in European prehistory so far available comes from the region of Frattesina di Fratta Polesine (Rovigo) in the Italian Veneto. It dates to the local Final Bronze Age (12th-10th centuries BC) and includes technical ceramics like crucibles and earthen working platforms together with glass waste and dark colored cullet (Angelini 2019; Bellintani and Stefan 2009; Towle et al. 2001). It is not known, however, if the raw glass was produced here or if there were other glass workshops in existence during this period, though both seem likely. Without any archaeological information regarding glass workshops in the Italian Iron Age, one has to look for evidence elsewhere.

The shape of the leech fibulae is very specific to Italy in the advanced Early Iron Age, so the occurrence of a

glass variant is the best evidence for the existence of local glass workshops. Chemical investigations may offer new arguments for local manufacture and raw glass production as discussed above. The artifacts themselves – their style and occurrence – also undergird some arguments. For example, sliders of "true" translucent glass (Figure 7) have been found in Veio and the adjacent area of the Faliscan territory (Koch 2010: nos. 154-161). A few other variations are known, e.g., from Chiusi or the Picenian territory. Excavations in the latter region have produced a bead fragment made of a translucent bottle-green glass (probably colored by iron oxides) and decorated extraordinarily with opaque red glass (Figure 8). There may even be two examples of this type.[7]

Figure 8. A fragment of a glassy slider made of green and red glass from the Picenean area (courtesy of the Museo Archeologico Nazionale delle Marche Ancona and the Ministero per i Beni e le Attività Culturali e per il Turismo – Direzione Regionale Musei Marche; no further reproduction without renewed permission is allowed).

The beads with colored bodies (Figure 6) have different textures and colors ranging from blue to dark reddish brown or nearly black. A pair from Bologna has hammered spiral bronze wires inside the glass mass, probably for technical reasons (Koch 2010: nos. 10-11, Plate 2, no. 4). So it is obvious that the same technology was used in different workshops over time and some examples exhibit characteristics that may indicate local experimentation and development of glass working technology.

A comparison of a fibula bow bead from Verucchio (Lippi, grave 38/2006) and a pair from Veji (Quattro Fontanili, grave EE 7-8B) reveals that these beads – with dots and circular decoration at the middle and alternating straight and wavy lines instead of a herringbone pattern at the ends – are of the same ornamental tradition (Figures 9-10). They are, however, obviously made of different kinds of glass materials, and were found at sites about 350 km apart, separated by the Apennine Mountains: one near the Adriatic coast, the other close to Rome.

Large bow beads with bicolor decoration that may have originated in the same workshops are known from Bologna as well as Verucchio (Koch 2010:79-81) (Figure 3). To my knowledge, however, sliders with only yellow herringbone

Figure 9. A bow bead with circular and wavy lines (Veji, Quattro Fontanili tomb EE 7-8B) (courtesy of Direzione Regionale Musei Lazio – Civita Castellana [VT], Museo Archeologico dell'Agro Falisco Forte Sangallo).

decoration come solely from Bologna and environs (the pair from Vetulonia [Figure 11] is of another type), while examples with only white decoration come from Verucchio. The white trailed decoration on a dark matrix is common on distinctive beads and pendants from Verucchio and seems to have been a local specialty (Koch 2015: type 12 or 15). It could, therefore, be concluded that in Verucchio, in the Rimini hinterland on the Adriatic coast, glass workshops produced their own trinkets based on local demand and tastes, supplemented by imports from Bologna.

Some distinctive beads from Este in the Veneto deserve mention as well. Three of the rare fibula bow beads with a yellow coating come from Este (Koch 2010: nos. 132, 133, 136), as does a huge, somewhat distorted bow bead with a unique decoration of yellow and white threads from an unknown context (Koch 2010: no. 135). In the decades that followed, the glass workers of Este produced objects based on local glass making traditions. They exhibit an opaque, porous glass often formed into objects with spikes or knobs, including spindle whorls and even fibula sliders (Koch 2010: nos. 137-139). Local diversity in style and glass type is obvious here.

"Unusual" types of glassy bow beads are also known from the main Etruscan area, such as the brownish and

Figure 10. A small slider decorated with circular and wavy lines (Verucchio, Lippi tomb 38/2006) (courtesy of Ministero per i Beni e le Attività Culturali e per il Turismo, Soprintendenza Archeologia, Belle Arti e Paesaggio per le province di Ravenna, Forlì-Cesena e Rimini. Museo Civico Archeologico Verucchio).

Figure 11. A pair of leech-shaped fibulae with glassy bow beads from Vetulonia (Secondo Circolo delle Pellicce). The decoration of the upper bead is missing and may have been of a different glassy material (white glass?) than the lower bead (courtesy of Museo Archeologico e d'Arte della Maremma Grosseto).

hot-formed example from Cetona (the only one from the Chiusi area) and the unique example with two lateral lobes and a yellow zigzag pattern (Figure 12) from Vetulonia (Koch 2010: nos. 153, 147). Other regionally specific glass objects like "simple" beads also raise the possibility of local glass workshops. Research on Early Iron Age glass, be it archaeometric or archaeological, is still in its infancy (Koch 2011, 2015, n.d.). One must reckon concurrently with imports of raw glass and beads from other workshops, on a regional and inter-regional scale, from the Aegean or the Balkans.

Figure 12. A uniquely shaped glass bow bead from Vetulonia (Primo Circolo delle Pellicce, pit 4) (courtesy of Museo Archeologico e d'Arte della Maremma Grosseto).

These special ornaments expressed a particular esthetic and, as part of costume, they formed an element of women's identity. Furthermore, they were used in certain local funerary rituals and excluded from others. A good example is the glassy fibula pair from the tomb of a ca. four-year-old girl in the Veji necropolis which is the only example among several hundred tombs in the necropolis of Quattro Fontanili (Figure 9). In the cremation burials of the Emilia-Romagna they adorned dead women and were incinerated with them (Figure 13). Their role in decorating funerary urns, probably during a process of anthropomorphizing the vessel, is also well known from the necropoli of Verucchio.

Figure 13. A pair of glassy fibula sliders from Verucchio (Lippi tomb 31/1972). They are partly deformed from the heat of the funeral pyre and covered with melted bronze from other costume elements (courtesy of the Ministero per i Beni e le Attività Culturali e per il Turismo, Soprintendenza Archeologia, Belle Arti e Paesaggio per le province di Ravenna, Forlì-Cesena e Rimini. Museo Civico Archeologico Verucchio).

The items draped around the vessels were mainly pairs of various bronze fibulae, some decorated with a glass slider or amber, together with clothes or scarves, necklaces of glass and amber beads, girdles, pendants, and ear-rings (Bentini et al. 2015; Koch 2008). Over three to four generations, extravagance increased and by the middle of the 7th century, very large and elaborate bronze-and-amber brooches, in part with figural decorations, were produced (von Eles 2013; von Eles and Trocchi 2015; Scarnecchi, Siboni, and Zanardi 2015). Among the 48 fibulae around the urn in Lippi tomb 40bis/2006 at Verucchio – which is among the richest and the latest (phase V) tombs in the Lippi necropolis – was a pair with glassy bows that had been reduced to quartz sand (von Eles 2015: Plate 197, nos. 1788 and 1789). Similarly, only fragments of the core remained of a massive pair measuring ca. 17 cm in length (Figure 14) (Manzoli and Poli 2015). Apparently the intention to make the largest glass bow fibulae resulted in products that were huge, and maybe splendid at the moment of burial, but not durable. Considering their high weight, it is possible that they were produced only for the funeral and not for use during life. Thus knowledge of this extraordinary glassy jewelry, as well as the less-impressive smaller beads, allows us to understand much more about it than just production techniques and distribution.

Figure 14. Leech-shaped fibula with two amber elements and remnants of the core of a huge glass bow bead that adorned an urn in Lippi tomb 40bis/2006, Verucchio (courtesy of the Ministero per i Beni e le Attività Culturali e per il Turismo, Soprintendenza Archeologia, Belle Arti e Paesaggio per le province di Ravenna, Forlì-Cesena e Rimini. Museo Civico Archeologico Verucchio).

CONCLUSION

Regarding archaeological glass objects and the glass itself, one of the most important questions is whether the beads or pendants were made locally or imported. Glass workshops can rarely be identified and studied archaeologically. A lucky exception and rare prehistoric example is Late Bronze Age Frattessina in Veneto. Glass beads are also known in Italy from the Earliest Iron Age, but only in the subsequent Orientalizing period are local workshops suggested in the excavated finds. A few glass items in specific shapes are the first hints of local workshops. One of these items is the leech-shaped fibula with a glassy slider bead. Examination of nearly 200 of these beads reveals regional differences in manufacturing technique, shape, ornamentation, and the kinds of glass used (Koch 2010). While many are single finds, regional characteristics nevertheless become apparent and may indicate local workshops. Some technically unique cases can be interpreted as evidence for a much larger production of glassy bow beads from northern Latium to the Veneto than is apparent at first sight. Consequently, it can be supposed that in the decades around 700 BC, several glass artisans or workshops found specific solutions for the production of these glassy leech-shaped beads which are difficult to form, and produced various types under locally specific conditions and possibilities – and for different tastes and demand. Chemical analyses, only rarely performed until recently, can provide further clues regarding the existence of local workshops or even the local production of raw glass.

The use of these beads and fibulae in local burial rites differs. While the glass-bow fibulae often occur in

rich female tombs until the middle of the 7th century BC in Emilia-Romagna, in Etruria and other regions, these ornaments were only exceptionally worn by deceased females or placed in their graves.

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ENDNOTES

1. For details and distribution, *see* Koch (2010) (in German with an Italian summary).

2. First mentioned in the literature by Dehn (1951) and Haevernick (1959). New finds not dealt with in Koch (2010) are from Bologna, Via Belle Arti (von Eles 2019) and Imola, Ponte Santo, tomb 7, with maybe six pairs (Esposito 2019:23, types C 16, and C 22, 104, Plates 62-63; 65-66).

3. In general, the structure of the fibula sliders looks like that of frit-core beads of the 16th-17th centuries (Karklins 2019: Figure 1).

4. In new photos published by T. Purowski (2016: Figure 1), it can be seen that the grooves that once held the decoration are of different sizes. On other examples of this type it was observed that the different glass colors leave different traces in the matrix glass. In dimensions it conforms with other large examples (*see* Koch 2010:79-81, Figure 25, Plate 1, no. 2). It is therefore very likely that the imported glassy leech-fibula bead from Gorszewice is of the massive type with group decoration (nine groups of two to six lines) that finds direct parallels in Bologna (Figure 3).

5. The bead with three "horns" is held by the Römisch-Germanisches Zentralmuseum, Mainz, Germany (Koch 2010:196, Figure 87, no. 180). Six measurements at different points were taken by S. Greiff, member of the museum staff; the results are unpublished. Together with high levels of FeO, PbO, CuO, MnO, and NiO, the glass contained between 0.40-0.93% CoO.

6. FeO was found in very high concentrations (up to 20%), e.g., Conte et al. (2018); summary in Koch (n.d.).

7. Beinhauer (1985:801, Plate 187, no. 2182) records fragments of a fibula bow slider made of "green glass" from the Novilara necropolis, Fondo ex-Servici, grave II. We have not been able to verify the object, but another fragment with inv. no. 18726b lacking context information (but surely not the same as the one from Novilara) is held by the National Museum at Ancona (Figure 8).

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