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Charles Antoine Coypel (French, 1694–1752). *François de Jullienne and His Wife*, 1743. Pastel, 39⅜ x 31½ in. (100 x 80 cm). The Metropolitan Museum of Art, Purchase, Mrs. Charles Wrightsman Gift, in honor of Annette de la Renta, 2011 (2011.84)

for Katharine Baetjer

WHO DEVOTED HERSELF TO THIS PUBLICATION

AND MADE COUNTLESS CONTRIBUTIONS

TO ITS SUCCESS

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Back cover illustration: Detail of El Greco, *A View of Toledo*, ca. 1599–1600. See fig. 1, p. 12.

Illustration on p. 2: Detail of *Mercury Changes Aglauros to Stone* from the *Story of Mercury and Herse*. Design, Italian, ca. 1540. Tapestry, Netherlandish, ca. 1570. See fig. 1, p. 148.

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MANUSCRIPT GUIDELINES FOR THE METROPOLITAN MUSEUM **JOURNAL**

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ABBREVIATIONS

MMA The Metropolitan Museum of Art
MMAB *The Metropolitan Museum of Art Bulletin*
MMJ *Metropolitan Museum Journal*

Height precedes width and then depth in dimensions cited.

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CHRISTOPHER S. LIGHTFOOT

Ennion, Master of Roman Glass: Further Thoughts

During The Metropolitan Museum of Art's recent exhibition "Ennion: Master of Roman Glass" (2014–15), I had the opportunity to study at close quarters the twenty-two intact or nearly complete vessels from Ennion's workshop that formed the core of the show.[1] Indeed, only four other vessels by Ennion have survived in such a complete condition. They were not in the exhibition but are featured or mentioned in the catalogue (cats. 3, 25 and figs. 5, 6 in that volume). This short article serves as an addendum, providing some corrections and adding further thoughts that were prompted by visitors' questions. In the following discussion, catalogue numbers refer to the numbers assigned to vessels in the exhibition and its publication.[2]

THE INVENTION OF GLASSBLOWING

The glassblowing technique was introduced at some point in the first century B.C., probably in the Near East.

fig. 1 One-handled cup signed by Ennion. Translucent pale green with handle in same color, H. 3¾ in. (9.5 cm), Diam. 5⅜ in. (13.5 cm). British Museum, London (GR 1876.11–14.4). Cat. 11. All catalogue numbers refer to Lightfoot 2014.

fig. 2 One-handled jug (amphora) signed by Ennion. Translucent deep amber brown with handle in opaque white, H. 7¼ in. (18.4 cm), Diam. (rim) 2¾ in. (7 cm), Diam. (max.) 4⅛ in. (10.6 cm). The Metropolitan Museum of Art, Gift of J. Pierpont Morgan, 1917 (17.194.226). Cat. 1

The first archaeological evidence for attempts at using a short ceramic blowpipe to inflate small bubbles of glass comes from Jerusalem and dates to about 50 B.C. However, no true blown glass can be dated any earlier than the last decades of the first century B.C., putting the actual invention in the time of the first emperor Augustus (r. 27 B.C.–A.D. 14).[3] Blown glass only starts to appear in any quantity at archaeological sites dating to the early years of the first century A.D.[4]

The question of how glassblowing came to be invented can probably never be answered, but it is worthwhile considering why it did. In the Classical (ca. 480–323 B.C.) and Hellenistic (ca. 323–31 B.C.) periods, glassworkers made glass vessels that were either luxury cast tableware, often quite large and elaborately decorated, or core-formed containers that were also attractive but time-consuming to make. Today we might think that glassworkers who first experimented with the blowpipe did so in order to make their work easier and their products thus less expensive, but these are unlikely to be the reasons for the invention. A more compelling argument is that they needed a quicker method of making glass in sufficient quantities to compete with pottery as tableware and containers. The first century B.C. witnessed a great increase in pottery production, which exploited the expansion of markets and international trade by Roman merchants. Glassworkers wanted to be part of this boom, but with the existing technologies of core forming and casting, their output was limited. Their solution was to develop a new production method.

Once the blowing technique had been perfected, the glass industry experienced an unprecedented expansion, not just in the size of its output but also in the variety of shapes, sizes, and types of vessels and objects (including window glass) that was produced. At first, it seems, Roman glassworkers continued to make luxury glass, such as cameo glass, which remained costly and time-consuming to produce, but they also created very plain and functional free-blown perfume bottles, perhaps made expressly for funereal purposes.[5] Between these two extremes came mold-blown glass, which served to furnish the market with good-quality tableware that could be mass-produced. The idea of using molds was probably taken from the Roman pottery industry, where this technique allowed potters to make large quantities of decorated tablewares, as well as terracotta oil lamps, of a consistent size and quality, enabling them to flood the market quickly with their goods.

Makers of glassware were so successful at applying and developing the blowing technique that, during the course of the first century A.D., their products not only competed with similar wares in pottery but also, in some cases, supplanted them.[6] In addition, the invention of glassblowing brought some beneficial and, perhaps, unexpected consequences. As glass grew more readily available, it also became fashionable and popular; its qualities and advantages were more widely appreciated, and finally, as demand for glassware rose, so the production of raw glass increased. This led to the fall in price of the raw material, which in turn was passed on to the consumer, making glass more affordable for a larger percentage of the population. As early as the first decades of the first century A.D., Strabo was able to claim that in Rome it was possible to purchase a glass bowl or small drinking cup for the price of a bronze coin.[7] By the second half of the first century A.D., the poet Martial referred to peddlers in Rome who

collected up broken glass in exchange for dry tinder soaked in sulfur.[8]

Ennion, however, did not want to flood the market with cheap glass containers. Rather, he set up his workshop, probably in Sidon, Lebanon, in the first decades of the first century A.D., in order to compete with the local glass industry that was already producing cast tablewares.[9] His surviving signed vessels show that he strove to produce quality blown glass that was attractive yet affordable. He put his name on the molds, clearly wanting customers to recognize them as his. He was, so far as is known, the first maker of glassware to do so.

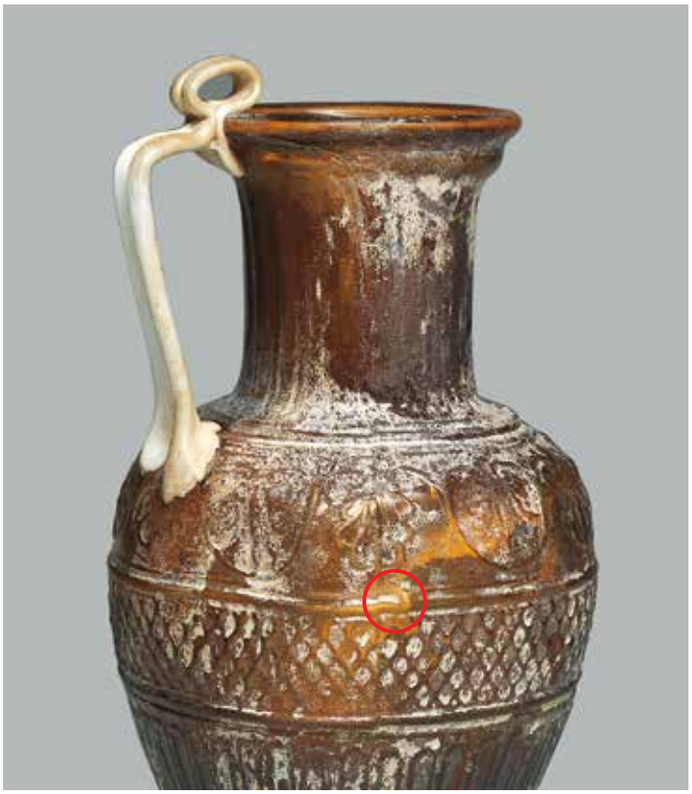
fig. 3 Cup signed by Aristeas. Translucent light green, H. 2⅜ in. (6 cm), Diam. 3½ in. (9 cm). Strada Collection, Scaldasole, Pavia (68). Cat. 27

SEQUENCING ENNION'S GLASSWARE

The sequence in which Ennion made his glassware has long been debated. For example, it has been argued that he first made the jugs and then turned to making the cups. Nevertheless, this view, derived from the theory that he transferred his workshop from the East to the West, cannot be taken as a valid basis for understanding how his repertoire developed. Instead, it might be argued that as his skill and experience at making and using multipart molds increased, the forms of, and decoration on, his wares became more sophisticated. Thus, it could be reasoned that Ennion's earliest products were the two-handled cups of the so-called Geometric style (cats. 21, 22, one of which was found in a tomb at Caresana, near Vercelli, Italy) or the globular bowls (cats. 23, 24, both of which are said to come from Sidon), since they have simpler and more regular forms of decoration. There is, however, no evidence to prove this was actually the case.

A more valid and worthwhile approach may be to examine the inscriptions and to argue that his first attempts at labeling would be those that are poorly formed in terms of either grammar or layout. The largest of his cups, the single-handled examples from Tremithus, Cyprus, and Adria, Italy (cats. 11, 12), bear inscriptions in a plain square panel (fig. 1 [cat. 11]). They run on into four lines and appear to have been poorly planned. His signed inscription, for example, although it consists of only two words, is arranged so that his name is divided between lines 1 and 2, and the verb is spread out across three lines with the final letter appearing on its own in line 4. In other words, as a label it is very badly designed, suggesting that it might be one of Ennion's first attempts at putting his name on his products. Perhaps, too, the plain frame is earlier than the *tabula ansata* (a rectangular frame with projecting handles at the sides) that appears on the majority of the signed vessels from his workshop. Certainly, the latter design is striking, calling attention to the labels and, as has been mentioned before, exploiting a well-known feature of Roman inscriptions.[10] In addition, it may be argued that the molds for these large cylindrical cups were easier to make and, especially, to use than those for the vessels with more elaborate profiles or of smaller size (such as the two-handled cups cats. 15–20).

We may speculate that Ennion first made his large cups (that is, cats. 11–13, which are one-handled, and 14, a two-handled example) and that he followed with his smaller two-handled cups, all of which have inscriptions within the *tabula ansata* frame. Other reasons may also be put forward for this sequence. Perhaps Ennion initially wanted to make large and impressive cups but subsequently found their functionality disappointing: such a vessel, filled with liquid, presumably wine, must have been very difficult to hold and prone to overbalancing. Thereafter, Ennion may have turned to making smaller cups with two handles that were better suited for use. By then, too, his labeling was more refined. He adopted the Roman *tabula ansata* and organized the inscription so that all of his name appeared on the first line (see cats. 1–7, 9, 15–26). The final version of his "brand label" may well be ENNIWN ΕΠΟΙΕΙ in two lines (fig. 2 [cat. 1]). Of the twenty-six surviving vessels mentioned above, nearly half have this form of inscription. It should be noted that all of these examples, which include cups, beakers, bowls, and jugs, have convex or concave curving sides (rather than straight profiles) where the vertical sections of the mold were used. Aristeas, probably following Ennion, used the same label design for his products (fig. 3 [cat. 27]), inserting the word ΚΥΠΡΙΟC as an additional line in the case of his bowl (cat. 28). However, it is notable that fragments of two Aristeas cups found at Narona and Burnum in Croatia bear similar inscriptions, but in those the last letter of Aristeas's name appears on the second line and the last letter of ΚΥΠΡΙΟC spills over



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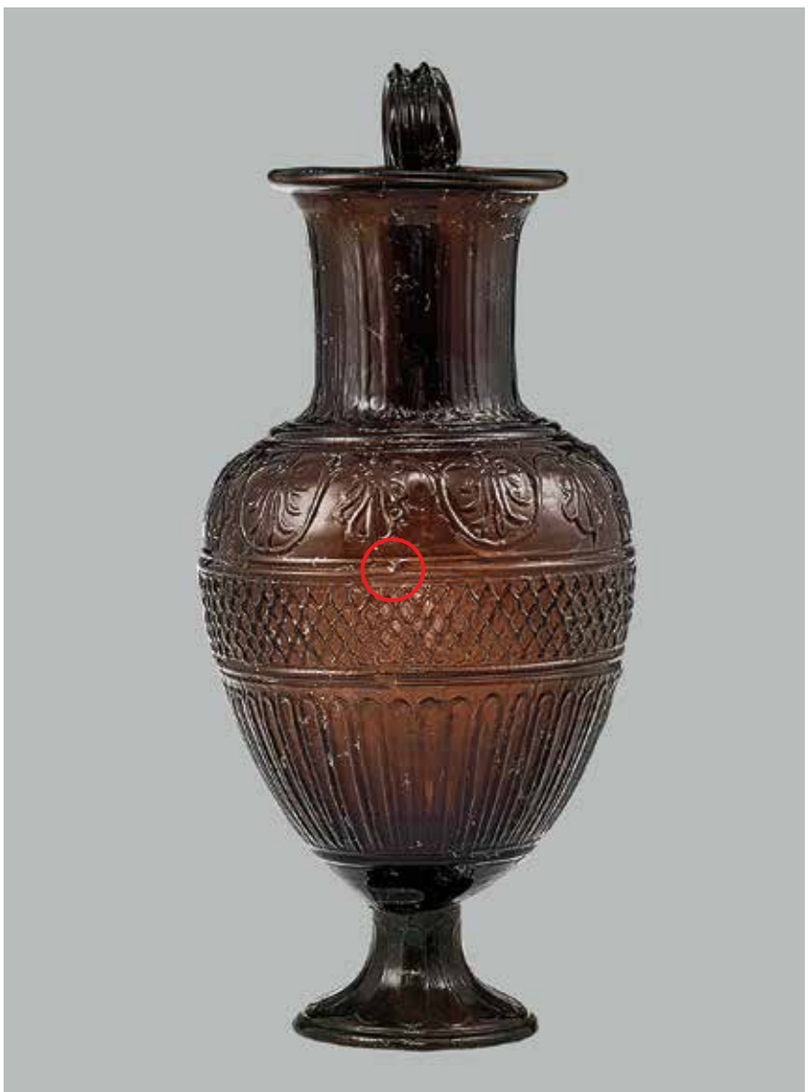

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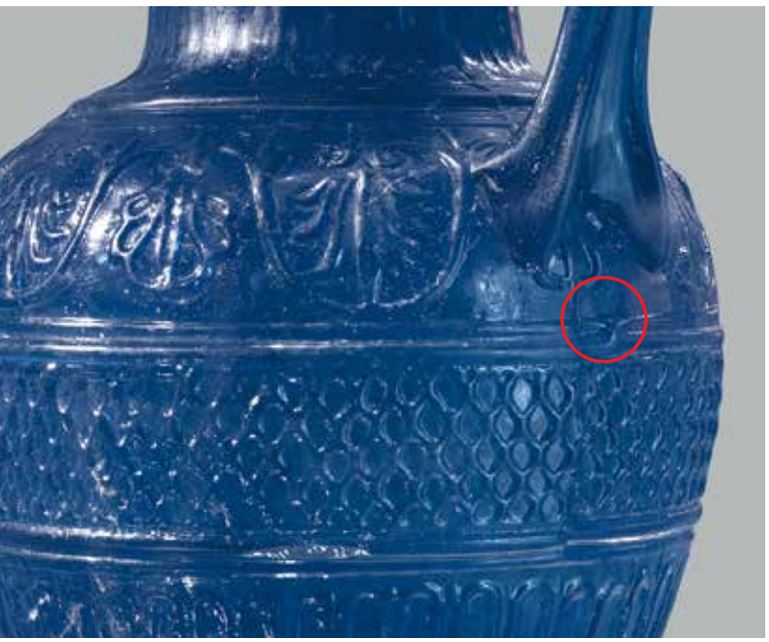
figs. 4–8:
Examples of anomaly (ringed) on the back, opposite the *tabula ansata* and to right of seam 2

fig. 4 Detail of fig. 2 (cat. 1)

fig. 5 Detail of two-handled jug (amphora) signed by Ennion (see also fig. 11). Translucent blue green with handles in same color, H. 6⅞ in. (17.5 cm). Shlomo Moussaieff Collection. Cat. 2

fig. 6 One-handled jug signed by Ennion. Translucent amber brown with handle and pedestal foot in same color, H. (to rim, including restored foot) 8¼ in. (21.1 cm), H. (to handle) 9⅜ in. (23.8 cm), diam. (rim) 2⅞ in. (7.2 cm). diam. (max.) 4¼ in. (10.8 cm). The Corning Museum of Glass, Corning, New York (59.1.76). Cat. 4



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from the second onto the last line. The fragments belong to vessels of two different shapes and designs, one with cylindrical sides and the other with a convex profile.[11] So it would appear that Aristeas, too, experimented with the arrangement of his labels.

ENNION'S MOLDS

Previous detailed studies of the glass vessels signed by Ennion have allowed scholars to identify several as coming from the same molds. Thus, for example, the two globular bowls (cats. 23, 24) come from the same set of molds, and several of the different types of cups were also made in the same molds (cats. 16, 22). Although Donald Harden stated in 1935 that figures 2 and 6 (cats. 1, 4) were blown in the same mold, detailed comparison of all the jugs with the same decoration has not been attempted.[12]

Having all of the known surviving examples on display together at The Metropolitan Museum of Art, however, provided the opportunity for close inspection and comparison. Particular attention was paid to the mold seams on the upper part of the body since they provide fixed points of reference. On all of the examples, they occur in the same places. Seam 1 runs through the downturned palmette with inward-facing leaves to the left of the *tabula ansata*; seam 2 is located at the rear, diametrically opposite the *tabula*, again splitting a downturned palmette with inward-facing leaves; and seam 3 is to the right of the *tabula*, running through another downturned palmette with inward-facing leaves.[13] Just to the right of seam 2 at the rear on the horizontal ridge above the net pattern, there occurs an anomaly in the form of a slightly raised bump that extends upward. It is visible in five vessels (figs. 4–8 [cats. 1, 2, 4–6]), and it may be taken as a good indication that all of these jugs were blown in the same vertical mold sections. Sadly, the jug from Jerusalem (fig. 9 [cat. 7]) lacks this part of the body, but other details appear to confirm that this jug, too, was made in the same set of molds around the upper body. For example, the inscription and the network pattern, especially its arrangement to either side of the *tabula ansata*, match very closely on all of the jugs, although these details appear to be much crisper and better

fig. 7 Detail of one-handled jug signed by Ennion (see also fig. 13). Translucent cobalt blue with handle and pedestal foot in same color, H. 8⅝ in. (22 cm). Glass pavilion collection, Eretz Israel Museum, Tel Aviv (MHG1200.58). Cat. 5

fig. 8 Detail of one-handled jug signed by Ennion (see also fig. 14). Translucent pale blue green with handle and pedestal foot in same color, H. (including restored foot) 9½ in. (24 cm). Shlomo Moussaieff Collection. Cat. 6

fig. 9 Jug signed by Ennion. Translucent pale green with pedestal foot in same color, H. (including restored foot) 5¾ in. (14.6 cm). Israel Antiquities Authority, on permanent exhibition at The Israel Museum, Jerusalem (1982-1105). Cat. 7

fig. 10 Detail of fig. 13, showing left side of the *tabula ansata*. Cat. 5

defined on the fragmentary Jerusalem example (see also figs. 2, 10 [cats. 1, 5]).[14]

If it is accepted that the same three vertical mold sections were used for all the jugs, the question then has to be asked whether the same bowl-shaped mold in which the lower body was formed was employed for all of them as well. Donald Harden, in stating that the Metropolitan Museum's flat-bottomed jug (fig. 2 [cat. 1]) and the pedestal-footed example now in the Corning Museum of Glass (fig. 6 [cat. 4]) were "blown in the same mould," clearly believed that such was the case.[15] In order to explain the different ways in which the base was finished, he argued that the bowl-shaped mold "must have been open at the base." This seems unlikely, and a more convincing explanation is needed that still allows for the use of the same mold. Harden also later stated, followed by Yael Israeli, that the jug now in the Eretz Israel Museum (fig. 13 [cat. 5]) came "from the same mold" as the jugs in figures 2 and 6 (cats. 1, 4),

but he added that they were "finished off differently at the base," since the plain, curving bulb below the bottom register of decoration on the footed jugs is pushed in on the Metropolitan Museum's flat-bottomed jug.[16] It is also worth noting that, whereas the handles on the jugs in figures 2 and 11 (cats. 1, 2) are applied in different ways, those on figures 6, 13, and 14 (cats. 4–6) are remarkably similar—so much so that they were probably formed by the same hand.

It is difficult to identify telltale marks on all the jugs that prove they were all blown in the same set of molds. Nevertheless, it does seem possible to identify one common anomaly: a small projecting bump, which is visible just above one of the vertical flutes formed in the bowl-shaped mold. Remarkably, this feature is more easily seen with the naked eye than captured in a photograph, but it does exist. Furthermore, the anomaly is found in exactly the same position on all the jugs—that is, it is to the left of seam 1 vertically below the right side of the next downturned palmette with outward-facing leaves (figs. 11–14 [cats. 2, 4–6]; see also fig. 2 [cat. 1]). The fact that the anomaly is located in the same position on all of the jugs strongly suggests that the mold sections were locked together in a set order. Although the bump is hard to detect on the fragmentary jug from Jerusalem (see fig. 9 [cat. 7]), other details (as noted above) indicate that this vessel may also have been blown in the same molds.

Little has been said in previous publications about the splayed foot, and one good reason for this reticence is that it has survived on only two of the jugs (figs. 9, 13 [cats. 5, 7]), together with the fragmentary foot of another jug (cat. 8). No mold seams can be detected on these examples, implying that they were made in a mold that had three parts—one for the foot itself and two detachable side elements for the moil (the excess glass between the blowpipe and the foot).[17] The molds used for figures 9 and 13 (cats. 7, 5) appear very similar, but there is one clear difference on the finished jugs, for on the fragmentary jug from the Old City in Jerusalem (fig. 9), there is a solid horizontal ring around the top of the foot where it joins the base of the body. It may be, therefore, that different molds were employed to make the feet, just as different molds were used for the bottom section of some cups (see cat. 15). As pointed out by David Hill, the foot moil played an important role during the making of the jugs, especially during the adding of the handle and the shaping of the rim.[18] The foot in effect served as the punty during the finishing of the vessel; it is not necessary to envisage the use of "some sort of clamp-like tool."[19] However, this does not resolve the question of how the vessels with flat bases (figs. 2, 11 [cats. 1, 2] and cat. 3) were held during the finishing process.

If I am right in claiming that all of the jugs in the exhibition, regardless of whether they had a flat bottom or a pedestal base, were blown in the same molds, then there is good reason for believing that Ennion used only one set for jugs such as those in figures 2, 6, 9, 11, 13 and 14 (cats. 1, 2, 4–7). If he had made several versions of these molds, the chances are remote, at best, that none of the jugs blown in the other molds would have survived. Obviously, he did make another set of four molds, as the two-handled jug from Panticapaeum, in the Crimea (cat. 3), demonstrates, but the design there is more elaborate and the vertical sections of the mold extend from the neck to the base. Only the *tabula ansata* and its inscription remain the same. I would place this type of jug later than the others in his sequence of production.

FURTHER OBSERVATIONS

Finally, some addenda and corrigenda to the exhibition catalogue can now be offered. For the one-handled jug in the Metropolitan's collection, an indent was noted on the upper side of the body (see fig. 4 [cat. 1]), although no attempt was made to explain this feature.[20] In fact, the flattened area was probably caused when the jug was laid on its side in the annealing oven, the floor of which was too hot, making the glass become slightly soft.[21] This explanation, however, raises the question of why it was necessary or desirable to lay the vessel on its side when it presumably already had a finished flat bottom.

In the catalogue it was stated that the two-handled cup from the Shlomo Moussaieff Collection (cat. 14) was blown in a three-part mold.[22] Close inspection of the piece during installation revealed three vertical mold seams, indicating that it was, in fact, blown in a four-part mold. The mold seams run across the rosette near the handle to the right of the Ennion inscription, to the left of the palmette to the left of the Ennion inscription, and along the right edge of the other inscribed panel on the back. Likewise, with regard to the cup found at Vercelli in 1981 (cat. 20), I was unwisely critical of the description provided in its first publication, where it was argued that one of the handles had been malformed or damaged during production.[23] My firsthand observation of the cup showed that there are two raised areas on the side of the vessel where the handle should be. These were not left jagged or smoothed over by grinding, as would be expected if the handle had broken off during use; rather, they appear to be fire-worked, a treatment that can only have been done in the workshop.

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figs. 11–14: Examples of anomaly (ringed) to the left of seam 1

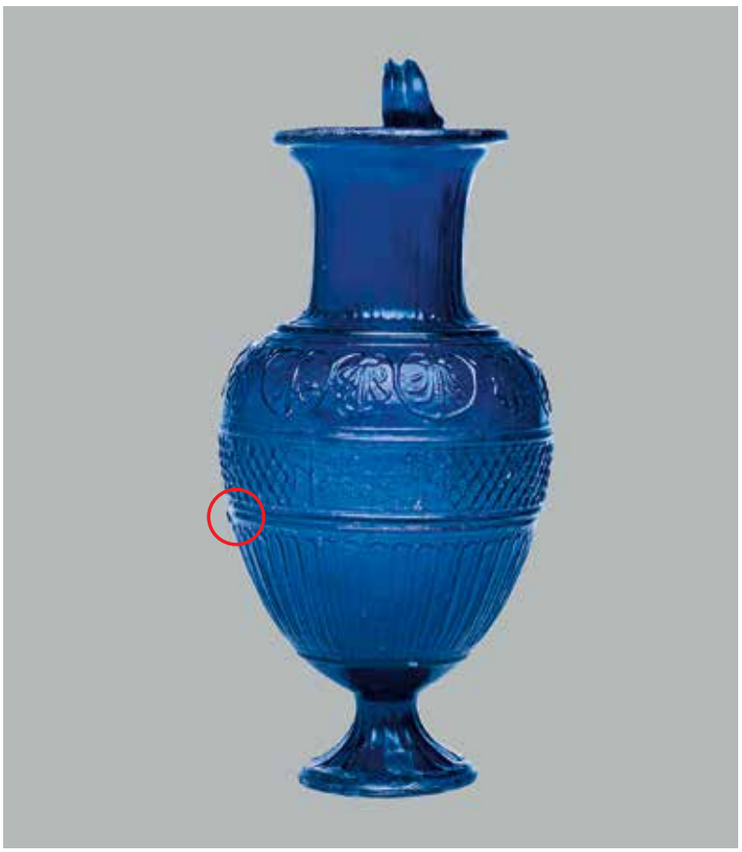
fig. 11 Cat. 2 (see fig. 5)
fig. 12 Cat. 4 (see fig. 6)
fig. 13 Cat. 5 (see fig. 7)
fig. 14 Cat. 6 (see fig. 8)

FUTURE RESEARCH

Many questions about Ennion and his glassware remain unanswered and await further study and future archaeological discoveries. Nevertheless, the exhibition "Ennion: Master of Roman Glass," in bringing together so many examples of his work, undoubtedly has provided a welcome and unparalleled opportunity to study this enigmatic craftsman and to acknowledge his major contribution to the Roman glass industry. Indeed, this new study of Ennion's workshop has wider implications for our understanding of Roman trade, commerce, and industry.[24] Glass clearly played a role in long-distance trade, and Ennion was at the forefront in creating a market for it by using his name as a label and so developing a recognizable brand. As a result, it may be argued that he was more famous in his own day than he is now.

Did he also play a leading role in the invention of glassblowing? Many years ago Harden espoused the view that mold blowing was the first stage of blowing glass.[25] In 1971 the discovery in Jerusalem of material providing evidence of glassblowing activity as early as the mid-first century B.C. swept away Harden's contention, and it is now generally accepted that free blowing preceded mold blowing.[26] Some reservations have been voiced, notably by David Grose, who saw the introduction of the metal blowpipe as the key element in the creation of a blown-glass industry.[27] Ennion must have used the metal blowpipe, but can it be proved that he did so in imitation of glassworkers making small, free-blown glass bottles?[28] Or was he, perhaps, instrumental in its invention, as well as in the revolutionary use of molds in which to blow glass?

Finally, since Ennion used molds to create multiple examples of the same object, can his surviving works be regarded as art? Does the fact that we have five or, possibly, six jugs all blown in the same set of molds



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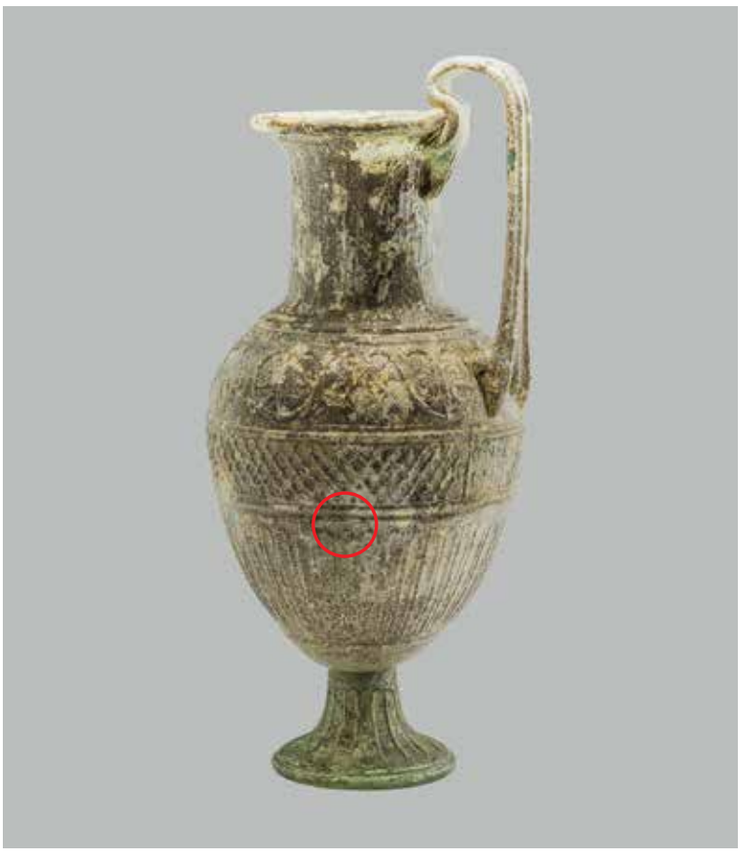

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detract from their artistic merit? They cannot be regarded as exact replicas of a single prototype but are mass-produced copies, all of equal merit.

The vessels' mass production is not the only reason why Ennion (and much of Roman glassware in general) is not discussed in most books on Roman art. Rather, I would contend that his work is often overlooked because there is no iconography to study; his products are devoid of human, allegorical, or mythological figures. Was it beyond his skill to carve them on his molds? It certainly was not impossible to do, as is shown by the fragment of a cast or mold-pressed bowl in the exhibition (cat. 42). Or was his choice dictated by other factors? Again, contemporary makers of cameo glass showed no such inhibitions, but in fact very little glassware before Ennion's time was decorated with figural scenes. Roman cameo glass led the way in this respect, and it was inspired not by earlier types of glass but by hardstone carving, which its makers attempted to imitate.[29] Perhaps, then, we should not expect Ennion to have thought of everything, despite his genius, his technical skill, and his entrepreneurship.

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NOTES

1 The exhibition, held at The Metropolitan Museum of Art between December 9, 2014, and April 13, 2015, was made possible by Diane Carol Brandt, The Vlachos Family Fund, and The David Berg Foundation. I am grateful to the glassmaker David Hill (www.romanglassmakers.co.uk) for many fruitful and instructive discussions via email on the subject of Roman mold blowing.

2 For the vessels signed by Ennion and Aristeas, see Lightfoot 2014, pp. 70–115, nos. 1–28.

3 For discussion of the enigmatic find of a blown perfume bottle at En-Gedi in the Judaean Desert, thought to date before about 40 B.C., see Grose 1977, p. 11, and Stern 1977, p. 31.

4 Israeli 1991, especially pp. 47, 53; Stern 1999, pp. 446–47; Di Pasquale 2004, p. 34; Stern 2004, pp. 82–89; Israeli 2005, pp. 55–56; Antonaras 2012, pp. 22–24; see also the caveat in Price 2012, p. 256.

5 It is far from proven that the Portland Vase and other examples of early Roman cameo glass were blown; *pace* Lightfoot 2014, p. 34, with n. 115 (and references).

6 Grose 1977, p. 9.

7 *Geography* 16.2.25: "ὅπου γε καὶ τρυβλίον χαλκοῦ πρίασθαι καὶ ἐκπωμάτιον ἔστιν." For this and other Roman sources, see Di Pasquale 2004, pp. 34–35.

8 *Epigrams* 1.41.3–4: "Transtiberinus ambulator, qui pallentia sulphurata fractis permutat vitreis." See also Juvenal, *Satires* 5.46; Whitehouse 1999, p. 78; Lightfoot 2007, pp. 18–19.

9 Zrinka Buljević in Lightfoot 2014, pp. 19, 26.

10 Ibid., p. 27.

11 Lightfoot 2014, pp. 66–67, figs. 58, 51, nos. 13a–c.

12 Harden 1935, p. 168.

13 See Wight 2014, p. 53, figs. 41–43.

14 David Hill has explained in an email that good, sharp impressions from the mold resulted when the glassblower blew with sufficient force. In other cases, where the design is less distinct (as on cats. 18, 19), the glass has not been forced into the details of the mold.

15 He thought then that the jugs were made in a tripartite mold; Harden 1935, p. 168 and n. 12. This error was later corrected; see Harden et al. 1987, p. 166, no. 87.

16 Harden 1944–45, pp. 89–90; Israeli 1964, pp. 34–35. It is interesting to note that this blue jug was sold by Dikran Kelekian in New York directly to Dr. Walter Moses, the founder of the Museum Haaretz (personal communication from Nanette Kelekian); Kelekian died in 1951, Moses in 1955. See www.metmuseum.org/exhibitions/listings/2012/buried-finds/dikran-kelekian, and www.eretzmuseum.org.il/e/113/. It should be noted that Kelekian started his business in Istanbul (Constantinople), where the Metropolitan's jug (fig. 2 [cat. 1]) was acquired in the late nineteenth century.

17 For the complete definition of a moil, see Whitehouse 1993, p. 58, s.v. "Overblow"; Ignatiadou and Antonaras 2008, p. 184, s.v. "Moil/Moile" (with helpful illustration).

18 Email from David Hill, January 18, 2015.

19 *Pace* Wight 2014, p. 54.

20 During the installation of the Ennion exhibition at the Corning Museum of Glass in April 2015, it was noticed that one side of the Moussaieff footed jug (fig. 14 [cat. 6]) is also slightly flattened.

21 I am grateful to William Gudenrath for pointing this out to me.

22 The description follows that in Israeli 2011, p. 32.

23 Gabucci and Spagnolo Garzoli 2013, p. 44.

24 Roman shipwrecks containing raw and/or worked glass provide some insight into the nature and size of the trade; see, most recently, Fontaine and Cibecchini 2014.

25 Harden 1969, pp. 46–47.

26 Israeli 1991.

27 Grose 1984, pp. 32–34.

28 It has been argued, however, that the iron blowpipe replaced clay ones only in about A.D. 70; Stern and Schlick-Nolte 1994, pp. 81–82. This date is too late for Ennion's production; see Lightfoot 2014, p. 26.

29 See Roberts, Whitehouse, and Gudenrath 2010, pp. 18–19.

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