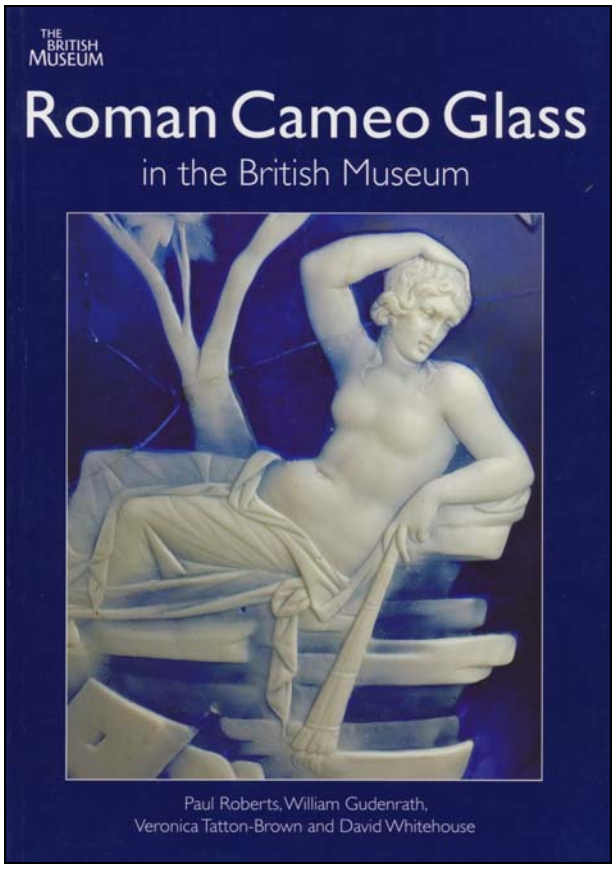
Rosemarie Lierke **Oktober 2011**

Sir Popper and the Portland Vase [1]

SG: Zum Abdruck:
Rosemarie Lierke hat auf der Tagung des **Fachausschusses V der Deutschen Glastechnischen Gesellschaft** (DGG) in Wertheim-Bronnbach **2011** einen Vortrag zum Thema **Cameo** gehalten. Das Original des deutschen Vortrags ist auf der Website der DGG zu finden: **www.hvg-dgg.de/download/gremien/fa-v.html ➔ Fa511b-Lierke.pdf**. Ein besonders ausführlicher deutsch-sprachiger Artikel über die Herstellung der Cameo-Gläser in der neuen **RGZM-Zeitschrift** „**Restaurierung und Archäologie**“ ist **im Druck** Die PK dokumentiert hier eine leicht überarbeitete englische Fassung des Vortrags in Wertheim / Bronnbach 2011.

Abb. 2010-4/344
Roberts, Gudenrath, Tatton-Brown und Whitehouse
Roman Cameo Glass in the British Museum, London 2010
Einband, Figur auf der „Portland Vase“



Rosemarie Lierke

Suche nicht zu verifizieren, sondern zu falsifizieren!
Suche nach Fehlern, nicht nach Bestätigungen.
Karl Popper

At the end of the year 2010 the catalogue of the Roman cameo glass in the British Museum appeared. In this BM-catalogue, it is assumed that the blanks of the cameo glasses were blown, an overlay was created by dipping, and the decoration was cut [2]. A newly-proposed limited dating of the cameo glasses (15 BC - 25 AD) is partly a conclusion based on this presumed manufacturing process [BM catalogue p. 23].

Fifteen years ago, I presented the theory of hot manufacturing of ancient cameo glasses at the meeting of the Fachausschuss V of the Deutsche Glastechnische Gesellschaft [3]. From the beginning, other scholars who investigated the manufacturing details independent of my research shared my view, or supported my results. It therefore may not be a surprise that I do not agree with the theory presented in the new BM-catalogue. However, I would first like to say that I'm very grateful to the scientists of the British Museum for their fairness and friendly help which I have always enjoyed on repeated visits during my research. I hope that my work will contribute to a fair discussion of the controversial issues in the future. A more detailed article about the manufacture of cameo glass will appear in German in the 2011 issue of the journal „Restaurierung und Archäologie,“ published by the RGZM Mainz (quoted: RA 2011).

For my reasoning, I take a little help from the philosopher Karl Popper [4]. According to him, it is dogmatic if ideas are not critically tested, if only confirmation is sought, and contradictions are ignored. Unfortunately and surprisingly, the BM-catalogue seems to fulfil this criterion at least partly. The recent research or critical ideas concerning the assumed manufacture of cameo glass by blowing and cutting are not discussed, or even mentioned [5]

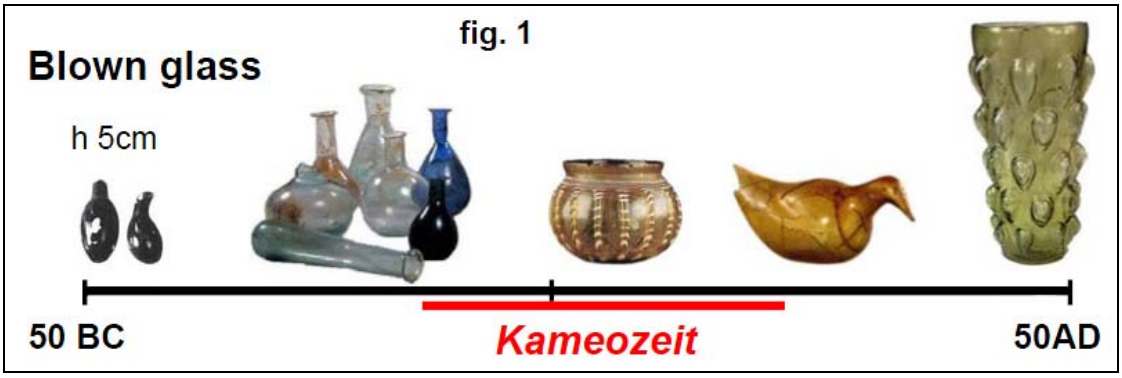
According to Popper, it is not possible to establish the validity of a theory with special observations. This applies, of course, also to any new theory concerning the manufacture of cameo glass. But a wrong theory will not withstand a falsification. I will demonstrate that the cameo blanks were not blown, that there was no dip overlay, and that the cameo decoration was not cut.

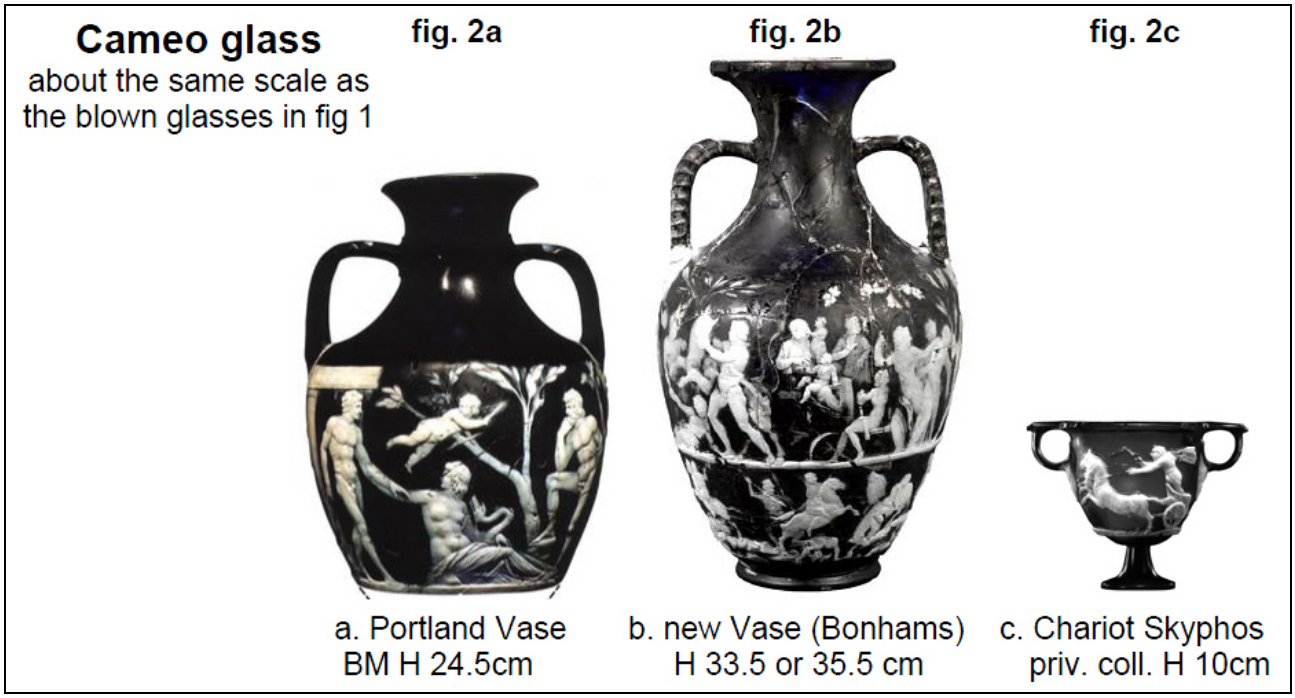
The cameo glass manufacturing theory in the BM catalogue and the archaeological preconditions of its realization

My starting point is W. Gudenrath's chapter, „How Vessel Blanks Were Made“ [BM catalogue p. 25-31]. Here, it is described and illustrated [BM Fig.10-16], how the cutting blanks of the ancient cameo vessels could presumably have been made: an elongated bubble of blue glass is dipped into a crucible with white glass, subsequently it is marvered, blown up, the bottom flattened, a pontil rod applied, and finally, the rim is shaped - thus finishing the blown overlay blank. However, the title of this story needs to be changed. In reality, the demonstration shows only how the cutting blanks of cameo glasses could be made today. The real story of ancient cameo glass manufacturing is obviously not as simple as the demonstration suggests.

A comment on the electrical furnace illustrated is omitted here. Crucibles suited for holding very hot glass for

dipping are known only from the 2nd half of the 1st c AD - after the supposed time of cameo glass [6]. For the dip overlay, two crucibles are needed - one for the dark, and one for the white glass [as also shown by a closer look in BM Fig. 11], more crucibles are needed for multiple overlay glasses [BM fragment No. 10]. But up to late antiquity, the known Roman glass-working furnaces were very small; they contained only one single crucible. For the dipping process, a metal blowpipe is absolutely necessary, but there is no evidence of it before the 2nd half of the 1st c. AD. The use of a pontil rod began in the 3rd quarter of the 1st c. AD, but cameo glasses do not show any evidence of this whatsoever. We could already exclude the dip overlay. The proposed manufacturing process, however, should be scrutinized in three steps: blowing - overlaying - cutting.





What kind of non-blown, cut, or blown glasses existed at and around the assumed time of cameo glass?

A survey of the non-blown glasses in this period shows their great variety and their partly enormous size: we know gold glasses and wound reticella glasses, an early cameo lagynos (jug) with inserted bottom [7], large footed bowls and the huge Berlin Amphora [8], mastoi (conical drinking vessels) and bowls with cut grooves, agate and goldband glasses, skyphoi (compare fig. 2c), very large [9] and rather small boxes, mosaic bowls, glasses resembling ceramics, pressed beakers with relief decoration, ribbed bowls, and more. Most of these vessel-types were made during more than a century.

Intaglio cut (engraved) facet beakers are known from the 2nd half of the first century AD on. Remarkably, it is not before the end of the 1st-, beginning of the 2nd c. AD that the first simple wheel engraved figural decoration appeared. That is about 100 years after the cameo period. The decoration of cameo glass - if it really would have been cut - would be „Hochschnitt" which became known only after the introduction of powerful cutting equipment in the 16th or 17th century. There is substantial doubt that the early relief glasses from about the 2nd half of the 1st c. AD are correctly interpreted to be „Hochschnitt". Their strikingly-simple protrusions seem to have been made with applied elements, or to have been pressed in lost plaster moulds [10]. Especially suspicious are missing working traces (grinding marks) on the fond of a relief, or handles applied on the presumably-abraded surface. This applies also to cameo glasses.

The first blown vessels appearing in the middle of the 1st c. BC were tiny. They were blown from small drawn tubes [11]. Sylvia Fünfschilling searched for my topic

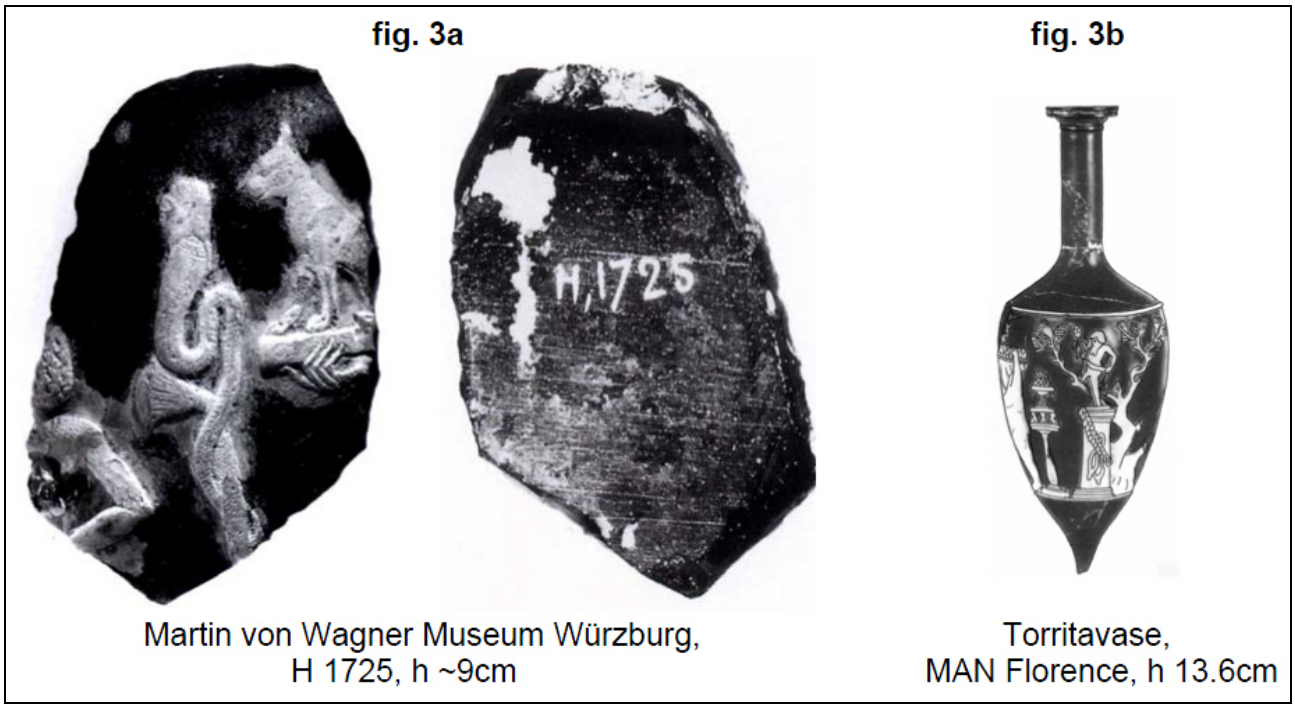
through 20 excavation reports which included early blown glass [12]. Her result: blown glasses are, into the first half of the 1st c. AD, small, lightweight, and thin-walled (fig. 1). Overwhelmingly, they were small unguentaria. The real success story of blown glass commenced in the 2nd half of the 1st c. AD - after the time of cameo glass.

The necessary conclusions concerning blown or non-blown cameo glass blanks and a discussion of the internal scratches

Cameo glasses obviously belong to the non-blown vessel types (fig. 2) [13]. This conclusion is supported by their size, and by the existence of related non-blown vessel types, as there are the cameo lagynos, the same types of skyphoi with or without the cameo decoration, a cameo box comparable to small non-blown boxes [BM catalogue No. 29], and the somewhat later monochrome vessels with relief. There is, however, also an unequivocal distinctive mark. Most of the non-blown vessel-types and the cameo glasses feature typical rotary scratches. These scratches are visible on the in- and/or outside of non-blown ancient vessel types. They are an important manufacturing mark, so far often mistaken for grinding [14].

The scratches on the Portland Vase can be seen through the now-open bottom on the inside of its shoulder, unfortunately only faintly visible on BM Fig 20: they are separate sharp scratches in a shiny (!) surface, not continuously circulating, and not strictly parallel - just like the scratches of the Great Amphora in Berlin (note 8). On this large vessel, rotary scratches are covered somewhat obliquely by a fused-on neck cuff. Without any doubt, here, as in other types of glass vessels, the scratches are not grinding marks. One more example will be shown after the next paragraph for further confirmation.

In the BM catalogue, however, the Portland Vase was presumably ground out inside to a depth of 1-2mm [BM catalogue p. 28/29], in order to test for stress, or, according to the latest explanation, to discover bubbles which could interfere with cutting the decoration on the outside [BM catalogue p. 29]. None of these explanations is convincing, especially since there is no overlay on the shoulder of the vessel where the scratches appear on the inside. In addition: stress that would preclude an abrasive treatment of the outer surface can not be discovered by internal grinding (see RA 2011); and this grinding would in any case have created a rough and very porous surface - not a shiny one with scratches. The sharply-edged scratches show that the existing, rather smooth surface was not polished. In fact, no cameo-glass vessel was ground inside, as is also shown by the following example.



Carina Weiss recognized that a fragment in Würzburg is part of a narrow-necked vessel which resembled the small Torrita Vase (fig. 3 a, b) [15]. The bulbous body of this vase could not have been ground internally through the narrow neck. This means that the internal traces of the fragment can not be grinding marks either; they must be traces of the hot glass manufacture. A production by blowing leaves no scratches inside. One can therefore rule out the blowing process for the manufacture of the cameo-glass blanks - but this does not come as a surprise after what has already been said. A realistic method of manufacture which may produce the scratches will be presented later.

The vessel fragment No. 7 in the BM catalogue is also compared to the Torrita Vase. Nevertheless, its internal scratches are assumed to be grinding marks. An internal dent is called a „cross-sectioned bubble with carefully-smoothed edges". Just how was this achieved? By a micro-invasive cutting and polishing procedure through

the long neck under the control of an antique oil-lamp endoscope? The internal dent corresponds to an outside bump, which, even according to the catalogue description, was not finished by cutting or grinding. I maintain that neither the inside of the vessel nor the cameo decoration was cut or ground at all, and that the bump is evidence for this statement. But a few more words on the overlay before we turn to the cutting of the decoration:

fig. 4a

Significant irregularities of the boundary between the glass layers of cameo glass

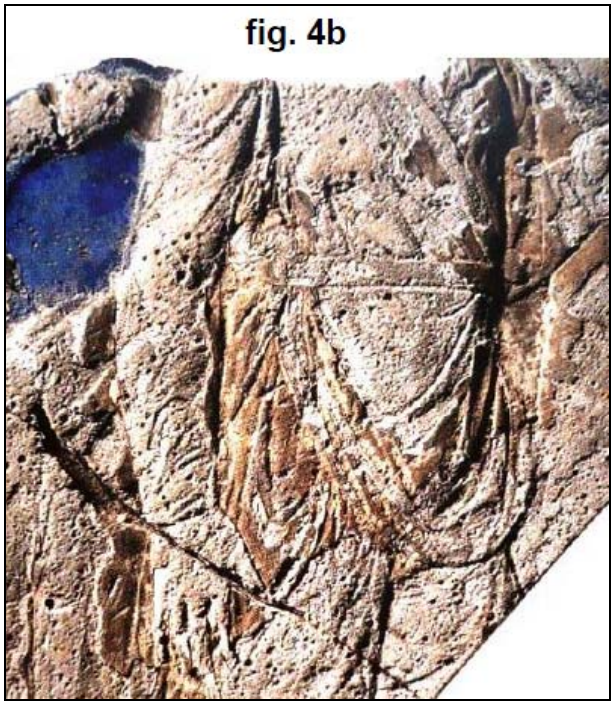
In an overlay glass, there is always a smooth boundary between the differently-coloured glass layers. This insight is shared in the catalogue [BM catalogue p. 31]. But in a detail picture of the second cameo vessel of the British Museum, the Auldjo Jug (see fig. 11a), the basic blue glass penetrates into the glass of the white decoration beside an insertion (fig. 4a). BM-fragment No. 25 shows a well-rounded relief in stepped levels where the white glass is abraded. Not to be overlooked are the common faults at protruding rings where a blue ring appears under the abraded white, such as in BM-fragment No.12 or 14. Here, it is simply said: „At this point the blue glass has an uneven surface". I note: there is no continuous, smooth boundary between the layers of cameo glass, and that means that there is no continuous smooth overlay - as it was previously taken for granted.

Doubts concerning the assumed cutting of the cameo decoration

Another quotation [BM catalogue p. 29]: "Both the blue and opaque white glass from which the Portland Vase and the Auldjo Jug are made contain myriad bubbles." The same is true for all cameo glasses. In particular, the white glass is always full of small bubbles. Imagine a relief cut into a bubble-rich glass. Would you expect that it looks like the smooth, superficially almost bubble-free figures of the Portland Vase as shown for instance on the title of the BM catalogue? If a bubble-rich glass would be cut or ground - today, of course, nobody would do any such thing - it would look like worm-eaten wood. Such a sight is provided by a cameo-glass fragment in the Louvre [16; fig. 4b]. The almost bubble-free brownish surface of this fragment was largely removed by weathering, and the bubble-rich glass became visible. In this and other examples, the almost bubble-free top layer - as far as preserved - is proof that the relief was not made by cutting or grinding. The top layer must have been sealed by the heat, and the decoration was made hot, together with the vessel.

A putto on the Neapolitan amphora has a large, vertically-elongated bubble in its hair. The bulbous edge of the bubble shows that it was not cut open, but has rather burst open while the glass was hot. In addition, this putto and the others around it seem to be vertically elongated [17]. The stretching suggests a partial deformation of the vessel while it was still hot, with its decoration already in place.

fig. 4b



More indications of the ancient manufacturing process

A hot production of the cameo decoration is confirmed by the Auldjo Jug. No glass-cutter or engraver would cut such a warped and wavy shoulder-ring from an overlay as shown by this jug (fig. 11a) [even more distinct: BM catalogue p. 45]. The Auldjo Jug also provides a clue to its manufacture. The wrinkles on the inside of the neck [18] are explained by Bill Gudenrath by the narrowing of the neck. I fully agree with him in this case. However, the necessity to narrow the neck confirms what we already know: the Auldjo Jug as a cameo vessel was not blown. On a blown glass, the blow pipe leaves a very small opening for the neck. This has to be widened, not constricted - and the widening does not produce any wrinkles. The neck of the non-blown sagged hollow vessels, such as the gold band- and the agate-glass bottles, is inevitably narrowed (fig. 5, 6). Here, wrinkles actually occur on the inside of the neck if the glass has become too cool and stiff by contact with the mould, and could therefore not contract itself smoothly [19]. The Auldjo Jug is obviously a sagged vessel (see fig. 11a, b).

The Auldjo Jug shows still another remarkable detail: its handle is seamlessly connected to the rim of the vessel (fig. 7a). In the British Museum in 1983, investigations under a microscope by Mavis Bimson revealed that

there is really no sign of an application of the handle. The handle seems to be an extension of the neck [20]. Surprisingly, with no regard to the published BM-investigations, the handle is described in the BM catalogue as being applied to the rim. The place of its application had theoretically been heated just once together with the whole vessel and presumably became seamless this way [BM catalogue p. 30]. As it seems, such a daring story must be told because, according to the BM catalogue, all cameo blanks were blown. A blown blank with handle extension would have had to measure more than 50 cm in height - and this may have been considered to be too large.

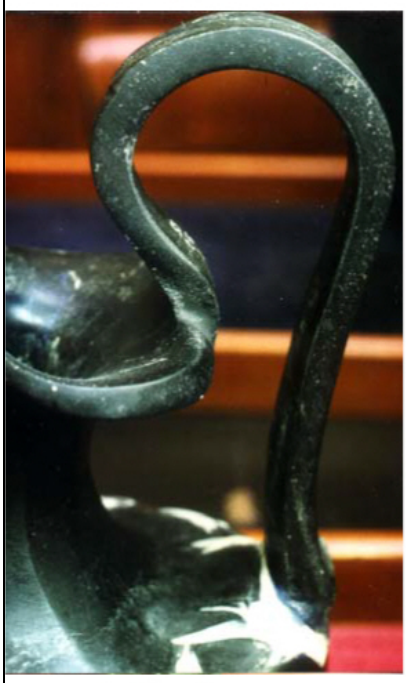
fig. 5

Manufacturing of an agate glass bottle by sagging

fig. 6

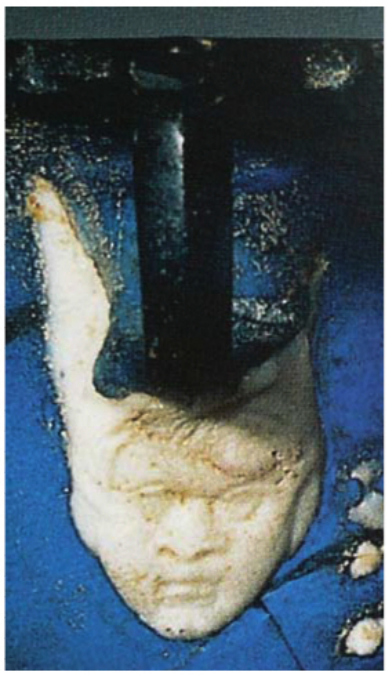
Fragment of an agate glass bottle with internal wrinkles, Museo Sacro Rome

fig. 7 a



Auldjo Jug

fig. 7 b



Chariot Skyphos

fig. 7 c

Portland Vase

The picture shows, in addition, something generally ignored: the handle is fused at its lower end onto the finished decoration, which here happens to be a bird or an insect. The same applies to all cameo glasses with handles, such as the Getty Cup and the Neapolitan Amphora [21], or the Chariot skyphos (fig. 7b). On the latter, one is supposed to have removed some of the blue glass on the right side by grinding, and to have cut off a little bit of the long horn on the left side. But none of the cameo glasses has been touched by a cutting tool, and this also applies to the Portland Vase (fig. 7c). Already in 1957, Erika Simon noted in her habilitation thesis, „Die Portlandvase“, that the white glass, which was used to fuse the handles to the body of the Vase, had not been touched by cutting or grinding [22]. This was later confirmed by the director of the British Museum, B. Ashmole. If a glass technologist would have thought just once about the consequences of this finding, we would certainly have been spared the current controversy. Because of the stress problems, hot glass can not be fused to a cut decoration. These problems would have been even worse in antiquity, and they are still worsened by the fact that the white glass in most cameo glasses contained additional lead, which reduced its melting temperature, the decoration would melt before the handle is fused on [23]. The conclusion is that the decoration must have been manufactured hot. The whole cameo vessel was finished in one hot manufactur-

ing procedure, including the cameo decoration and the application of the handles.

A possible solution in accordance with the manufacturing marks

Here, in brief, is how I would explain the making of the ancient cameo glasses (fig. 8): a wax model is made, a plaster mould is taken from the model, and the cavities of the mould are filled with glass powder - with or without a binder. With a stamp, made of plaster for instance, very hot glass is pressed into the rotating mould. The heat of the very hot glass melts the glass powder in the cavities of the mould. After this step, indicated by the dotted line in the drawing, the finished cameo bowl - shown here floating above - could even become fire-polished if so desired. The final step in any case would be a controlled cooling with or without the mould.

This process is like enameling the other way around: very hot glass is melted onto tightly-packed glass powder, instead of powder fused onto a glass vessel at moderate heat. By rotary pressing, which is necessary to force the hot glass on and into the powder-filled cavities, the inside of the bowl could become scratched by the plaster stamp. The plaster - in another example shown here (fig. 9) - has lost its crystal water through evaporation during the contact with the hot glass, and became brittle. You could squeeze it, break it, or rinse it off with water. The steam created a temporary parting layer between the hot glass and the mould, and, in this manner, provided the glass with a smooth surface. Antique plaster (see the ancient dead-mask with a modern cast, fig. 10a, b) [24] was not as homogeneous and fine-grained as it is today. This may explain the scratches.

For a hollow vessel, the process must have proceeded as shown to the right of the dotted line on fig. 8. A bowl with a very thick rim was pressed, and sagged upside-down while it was still very hot or reheated. The glass flows, pulled by gravity, and is finally shaped by a tool.

Finally, the sagging of the Auldjo Jug is described very briefly (fig. 11a, b): a bowl with an extension for the handle is pressed, the handle drawn out, folded back, and fused with white glass to the body of the jug. The shape of the handle and the deformation of the vessel body at the lower contact point of the handle are caused by the workings of gravity [25.]

fig. 8

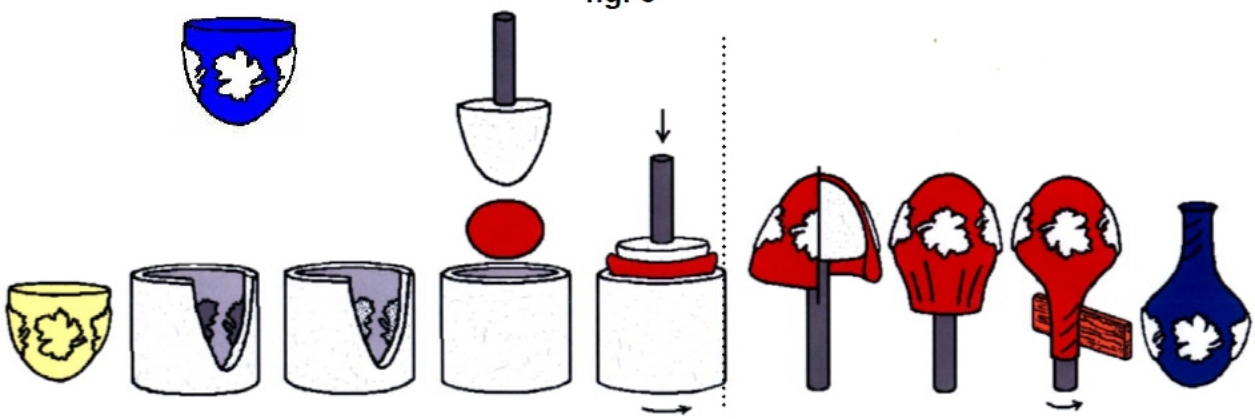


fig. 9

plaster mould after use

fig. 10a

modern cast

fig. 10b

ancient dead-mask made of plaster

→→

Experiments and their limitations

Thanks to the support of the Deutsche Forschungsgemeinschaft, I was able to do some experiments (fig. 12 a, b), but I made no vessel replicas. Neither Gudenrath's experiments, nor the existing famous cut copies of the Portland Vase have clarified the ancient method of manufacture - instead, they spread persistent errors. For a scientifically sound reproduction, knowledge of many aspects, such as the raw glass melted in the ancient fashion, is still lacking today. My experiments have answered specific questions: can I create a cameo decoration with glass powder on the vertical walls of a vessel? Can the relief copy intaglio-carving? What does the glass-powder boundary look like? How much precision is possible? … and so on. An experiment of 1996 (fig. 13 a-d) shows the basic sequence: model - plaster mould - glass powder filled in - and the resulting cameo glass, pressed here with a thick layer of blue glass. The white decoration is positioned on a blue socle. The white peaks - without being planned this way - have slightly pulled back, showing the blue glass underneath. This is just like the case on the numerous originals in the BM-catalogue, for instance fragment No. 8. It seems to me that I'm on the right track.

fig. 11 a The Auldjo Jug, h 22,8cm (with handle)

fig. 11 b

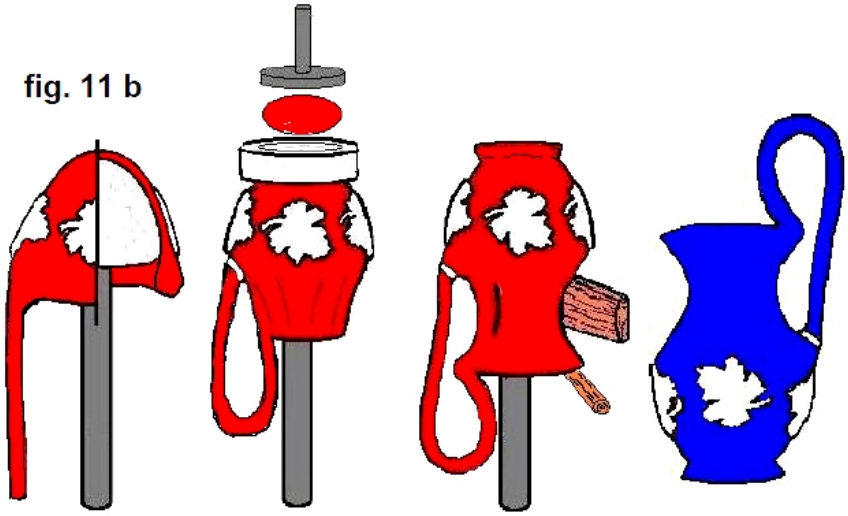


fig. 12a

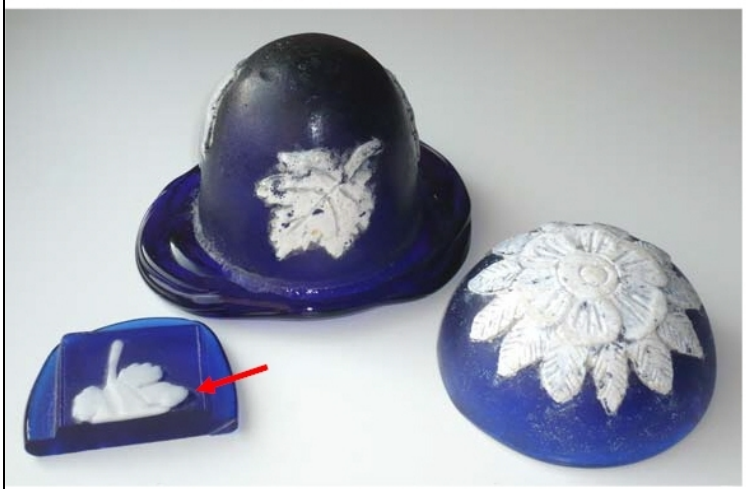


fig. 12b

9mm

Left agate fragment in the Glasmuseum Wertheim, right glass reproduction

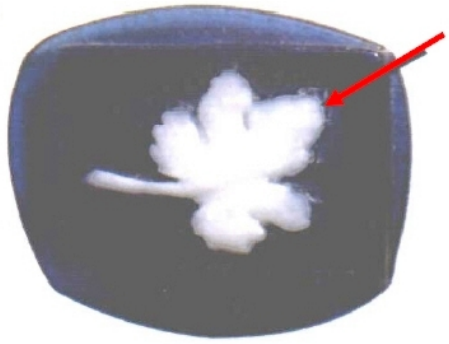


fig. 13

Conclusion

The BM-catalogue does not invite a discussion, but I hope it initiates one. The facts are not changed one way or the other if a debate is prevented, as I have observed it for 15 years. Our young people need a sound foundation for their own research - and this does not apply only to cameo glass. Maybe you can help them.

Karl Popper has shown how to determine by falsification that the cameo glasses were not blown, not dip-overlayed, and not cut. On this basis, further investigations can proceed. It would be desirable that, in doing so, Popper's sage advice also be followed:

Ich mag unrecht haben und Du magst recht haben;
und wenn wir uns bemühen, dann können wir zusammen vielleicht der Wahrheit etwas näher kommen.
Karl Popper

Annotations

[1] I'm grateful to Dr. R. Avila for reading the English draft of this paper. I'm responsible for any possible language incorrectness in the final version.

[2] P. Roberts, W. Gudenrath, V. Tatton-Brown. D. Whitehouse, Roman Cameo Glass in the British Museum, London, The British Museum Press 2010. The first publication of the debated manufacturing theory appeared in the special cameo glass issue of the J. Glass Studies 32, 1990.

[3] Published: R. Lierke, Die Portlandvase - ein Produkt der Töpferscheibe, Antike Welt 27/3, 1996, 191-207; R. Lierke, Glass vessels made on a turning wheel: cameo glass, Annals 13th congr. AIHV Pay Bas 1995 [1997], 63-76; R. Lierke, M. R. Lindig, Recent investigations of early Roman cameo glass 1, Glastechn. Ber. 70/6, 1997, 189-197; R. Lierke ed. with M.R. Lindig, A. Locher, H. Mommsen, B. Schlick-Nolte, E. Simon, B. Rütti, C. Steckner, E.M. Stern, C. Weiss, Antike Glastöpferei, Mainz 1999; R. Lierke, Die nicht-geblasenen antiken Glasgefäße / The non-blown ancient glass vessels, Deutsche Glastechnische Gesellschaft Offenbach, 2009.

[4] The quotations and interpretations of Popper's thoughts are based on H.J. Niemann, Karl Raimund Popper (1902-1994) - eine kleine Biographie und Bibliographie, 1996 and K. Popper, Die Logik der Forschung, 1934.

[5] For instance: E. Dodero, Il vetrocammeo nella prima età imperiale: una sintesis; Facta, A Journal of Roman Material Culture Studies, Pisa 2 (2008) [2009] 39-60 (after her doctoral thesis of 2002: „Il vetrocammeo nella prima etá imperiale: un nuovo catalogo") with an investigation of the BM cameo fragments (with different conclusions compared to the BM-catalogue).

[6] For the preconditions and procedures of early glass working see especially: E.M. Stern, Roman Glassblowing in a Cultural Context, American J. of Archaeology 103, 1999, 441- 484. More references in RA 2011.

[7] Cameo lagynos, Corning Museum of Glass 68.1.1, h 27,5cm. S.M. Goldstein, Pre-Roman and Early Roman Glass in the Corning Museum of Glass 1979, 137. Lierke 1999. fig. 150. Ceramic parallels ~ 2nd/1st century BC.

[8] Great Amphora, Antikensammlung Berlin 30219.254, h.59.6cm. 1st c. BC. R. Lierke, Auf den Spuren der Amphora, Restaurierung und Archäologie 2, 2009, 67-80 with earlier literature. See also Pressglas-Korrespondenz 2010-1, 214-223.

[9] Large box, BM London GR 1873.8-20.127, h.18cm, d.40cm. H. Tait, ed., 5000 years of Glass, 1991, 59. Here are also illustrations to be found of most other vessel types mentioned.

[10] Lierke 2009 (note 3) 77, 117.

[11] Y. Israeli, The Invention of Blowing. In: M. Newby, K. Painter eds., Roman Glass - two Centuries of Art and Invention. Soc. Ant. London Occ. Papers 13. London 1991, 46-55.

[12] S. Fünfschilling, unpublished manuscript „Zur Frage der augusteischen geblasenen Gläser" in preparation of a publication of the glasses from Augst ~ 2013. For more references see RA 2011.

[13] Portlandvase [BM-Catalogue p. 38]; New Cameo Vase (Bonhams): after H.C. v. Mosch, „Outdoorsex" unter dem Pfirsichbaum? Die Portlandvase im Lichte einer sensationellen Neuentdeckung. Quaderni Ticinesi di numismatica e antichità classiche 39, 2010, 195-223. T. II (concerning its size see RA 2011); Chariot skyphos: Christie's Catalogue Fine Antiquities, London 25 Nov. 1997, No. 226.

[14] R. Lierke The 'Grinding Marks of ancient glass - a critical assessment. Glass Sci. Technol. 75/4, 2002, 202-208; Lierke 2009 (note 3), 30/31 (101/102), 56/57.(110/111).

[15] C. Weiß, U. Schüssler, Kameoglasfragmente im Martin von Wagner Museum der Universität Würzburg und im Allard Pierson Museum Amsterdam, Jb. DAI 115 (2000), Berlin 2001, 199-251 (220) Abb. 6-8. Illustration Torrita Vase: R. Lierke The 'Grinding Marks of ancient glass - a critical assessment. Glass Sci. Technol. 75/4, 2002, fig. 4.

[16] V. Arveiller-Dulong, M.-D. Nenna, Les Verres Antiques du Musée du Louvre III, Paris 2011, 405, Fragment of a cameo plaque No. 678 (detail). For another example of a porous withered cameo decoration see RA 2011.

[17] Illustration: see Harden et al., Glass of the Cesars, Milano 1987, 71 (or Glas der Caesaren 1988, 71). The stretching illustrated in RA 2010, in Lierke et al. 1999, 74/75 and 2009, 66 (both see note 3).

[18] Illustrated: D. B. Harden, New Light on the History and Technique of the Portland and Auldjo Cameo Vessels, J. Glass Studies 25, 1983, 45-53, fig. 7. Lierke et al. 1999 (note 3) 71; Lierke 2009 (note 3) 67, and RA 2011.

[19] Fig. 6 aus Fremersdorf 1975: F. Fremersdorf, Antikes, Islamisches und Mittelalterliches Glas, sowie kleinere Arbeiten aus Stein, Gagat und verwandten Stoffen in den vatikanischen Sammlungen Roms. Catalogo del Museo Sacro 5, Rom 1975, No. 139.

[20] See Harden (note 18).

[21] Lower handle attachments of both vessels illustrated in Lierke et al. 1999 (note 3), 72.

[22] E. Simon, Die Portlandvase, Mainz 1957

[23] M. Bimson, I.C. Freestone, An Analytical Study of the Relationship between the Portlandvase and other Roman Cameo Glasses. J. Glass Studies 25, 1983, 55-64. H. Mommsen., Röntgenfluoreszenzanalyse früher römischer Kameogläser, in Lierke et al. 1999 (note 3) 85-87 (extract of H. Mommsen et al., Recent Investigations of Early Roman Cameo Glass 2. X-ray Fluorescence Analyses Induced by Synchroton Radiation. Glastechn. Ber. 70/7, 1997, 211-219).

[24] Maria Tsimbidou-Avloniti. „Hominis autem gypso e facie ipsa...“. Two peculiar funerary finds from Roman Thessaloniki. Memory of Manolos Androkos, Thessaloniki 1997, 385-398 (in Greek).
See also Pressglas-Korrespondenz 2010-1, 419
[25] For more details Lierke 2009 (note 3), 72; Pressglas-Korrespondenz 2010-4, 381/82 or RA 2011.

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