

## Blue/green glass bottles from Roman Britain





ARCHAEOPRESS ROMAN ARCHAEOLOGY 113

BLUE/GREEN GLASS  
BOTTLES FROM ROMAN  
BRITAIN  
SQUARE AND OTHER PRISMATIC  
FORMS

H.E.M. Cool

ARCHAEOPRESS ARCHAEOLOGY



ARCHAEOPRESS PUBLISHING LTD

Summertown Pavilion

18-24 Middle Way

Summertown

Oxford OX2 7LG

[www.archaeopress.com](http://www.archaeopress.com)

ISBN 978-1-80327-743-1

ISBN 978-1-80327-744-8 (e-Pdf)

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Front cover: S52 /S123 from Castleford and Exeter and 150 from Silchester.

Back cover: 276 from Ware.

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*This book is dedicated to the memory of*

Mike Baxter

1950-2018

*dearest companion for so many years*



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## Acknowledgements

This book is the outcome of 40 years' of writing glass reports, and over those years it has been aided by many people including the units who have sent me their glass and the staff at museums who gave me access to their stores. Amongst the latter institutions there were many visits to the Colchester and Essex Museum in the late 1980s and the Yorkshire Museum in the early 1990s. I am aware that researchers such as I add substantially to the workload of museum curators, and I am always most grateful to them for their generous help.

The project has benefitted enormously from the work of my fellow specialists in the world of Roman glass. A glance at the bibliography will show how much. In Britain we all build on the foundations laid by Donald Harden and Dorothy Charlesworth. I started my career in the area working with the late Jenny Price in the 1980s and since then she, Denise Allen and John Shepherd have always been most generous in sharing information. I would also like to acknowledge the help of Elizabeth Foulds who is currently working with the unpublished Corbridge glass, and who has kindly allowed me to mention here various important pieces in advance of her own publication. Then there are the specialists in other countries. Here it is appropriate to thank Danièle Foy, Marie-Do Nenna and all their colleagues who worked so diligently to publish the *Corpus des Signatures et Marques sur Verre Antiques* which has been a vital source for this work. To all my sincere thanks, and I hope you will find this corpus useful.

Background research has been conducted in the Joint Library of the Hellenic and Roman Societies in London and the library of the British School at Rome. As ever these institutions have been a delight to work in, and my thanks to all the staff. The work in the latter was conducted during a stay in the institution during September 2022, and I would like to thank the accommodation manager Christine Martin and her colleagues for making my stay so comfortable.

The analyses for this book have been conducted in the open source statistical package R. Like everyone who uses it, I owe a debt of gratitude to the R community who maintain and develop the packages. Here it is appropriate to mention specifically Hadley Wickham author of ggplot2 and Martijn Tennekes the author of tmap. Illustrations using both packages feature in several places in this book.

I would like to thank Archaeopress for publishing the book and the Archaeological Data Service for hosting the digital part. My thanks to David Davison, Mike Schurer, Robin Orlić of Archaeopress and Valeria Carrillo Garza of the ADS for all their work.

Mike Baxter has not been here during the work on this project, but he left me a legacy of R routines and the knowledge of how to apply and adapt them. They have been extremely useful. Over our many years together, working with him profoundly influenced my research practice. So, in remembrance of all of those discussions where we explored approaches to work in our local pub, I raise a glass to his memory and offer his shade this book.



## Preface

The principle reasons for writing this book are outlined at the start of Chapter 1. Underlying those, however, is a concern I have long had over how the next generation of Roman glass specialists are going to learn their trade. I did not set out to be a glass specialist. The foundation of my skills lie within small finds and pottery. I learnt about glass through being appointed to a post that the predecessor of Historic England established at the University of Leeds in the 1980s to work with the late Jenny Price. The aim of that was to augment the pool of glass specialists in Britain. This had always been small and had been sadly diminished by the death of Dorothy Charlesworth in 1981. The idea was to train another whilst diminishing the very large backlog of Roman glass in need of reports. From my experience of building up expertise in various areas, I know that developing a specialism in Roman vessel glass unaided would be more difficult than in many other areas I know about. Working regularly alongside an established glass specialist, who can provide answers to questions of identity that puzzle you, is the best way to build up knowledge. Such opportunities no longer seem to exist.

Over the years I have run glass handling sessions for small groups and provided more intense one-to-one instruction for individuals. There is a limit, however, to the amount of information that can be imparted or absorbed during the course of a single morning or day. In this book one of my aims has been to provide information in a step-by-step way that I hope will make it accessible to people who are not yet specialists, but who might want to be one. This is especially the case in Chapters 1 and 2 where I outline how to study the material, and what software might be helpful. I am aware that the latter will become outdated and superseded, but the basic principles will remain the same.

I hope my fellow specialists find the contents of the book useful and interesting but, more than that, I hope that younger people who might aspire to develop expertise, will find it helpful and encouraging.

Sorrento  
September 2023



# Chapter 1

## Introduction

*The study of the square bottle is discouraging because so much material yields such small results.*

Charlesworth 1966

When glass square bottles started to be made in quantity in the late AD 60s, people across the Roman Empire rapidly decided that they were a remarkably good thing and started to use them in large numbers. They continued to be of this opinion for two hundred years or so. The result is that it is rare to encounter Roman sites whose vessel glass assemblages lack square bottle fragments. They were used across all society. The military were particularly heavy users, but they are present on urban and rural sites as well. They were also used by people who lived beyond the boundaries of the Empire. Numerous broken pieces are found while complete ones were placed in graves, and sometimes also formed part of deliberate deposits that had religious motives. There is a very large body of data to explore. Yet I have frequently been of a similar opinion to Dorothy Charlesworth at the conclusion of her seminal paper as quoted above. This book is an attempt to make the data from Roman Britain yield better results.

Its genesis has been twofold. In the winter of 2019 I was working on the glass from the excavations in advance of the widening of the A1 road where it ran through the Roman town at Catterick (North Yorkshire).<sup>1</sup> These had produced one of the largest assemblages I had worked with for many years and bottle fragments were particularly well represented. One can always ask more of a large body of data than a small one, and the Catterick material raised various interesting questions. Some I could explore within the confines of the report; others clearly required more extensive research than was possible there.

Whilst working on the Catterick glass, I had frequent recourse to my archive of data on bottles which has accumulated during my working life as a specialist. I have been writing reports on Roman glass for 40 years, and on other categories of finds for longer. As my career has always lain within the specialist field, providing information about material found in excavations, this has resulted in a very large number of reports. Many are published: many are not. Two years prior to the work on the Catterick glass, I had started organising my unpublished material into a form that could be made publicly available. The Catterick work made me realise how useful my collection of bottle base rubbings would be to other specialists, and that it might be useful to focus on the bottles as the first part of this project. This would also allow me to put together a corpus of data which would allow the unexplored questions raised by the Catterick bottles to be addressed.

This book and its online counterpart are the results. My aim has been to provide a corpus which will help fellow specialists, and to use it to explore why bottles were so popular and what light this casts on Roman society. The latter part, I hope, will be of interest to the more general reader. It does not contain all the bottles from Roman Britain but it is sufficiently large to place their study on a sound footing.

This chapter will outline some basic information to put the study of the bottles found in Roman Britain in context. It will start with the range of bottles that can be expected, their broad dating and how their study has developed. It then goes on to discuss how they were made and how this process enables the study of quite small base fragments. This section provides some technical detail and advice on how best

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<sup>1</sup> Cool 2021.

to approach their study. Finally it will consider two other forms whose fragments could be wrongly identified as bottles.

The second chapter reviews the data from Britain discussed in this book. It considers how the corpus has been amassed, and what its strengths and weaknesses are. It also includes a discussion of how the data has been organised into six families, and what information is available in the digital section which is lodged with the Archaeological Data Service.<sup>2</sup>

The core of the book in Section 2 is a detailed typology of the base patterns. The discussion of each type will include information about the size of the bottle, its manufacture and contextual dates.

Finally Section 3 uses the information that can be derived from Section 2 to explore the chronological development, how these bottles were being used, and why they were so popular.

### **Blue/green bottles: a brief introduction**

The type of vessel referred to as a bottle in the Romano-British glass literature has a large body; a folded rim that has often been flattened; a short neck; and an angular handle attached to the shoulder and to the neck/rim junction. The cross-section of the body can be cylindrical or prismatic and it is the latter category that is the subject of this book.

The bottles were produced by either free-blowing or blowing into a multi-piece mould. Cylindrical bottles were free-blown and some prismatic ones also were. In the latter case a square cross-section was produced by flattening the sides resulting in gently rounded angles. These were produced at the beginning of the bottle production and are most frequently found in Italy and areas bordering the Mediterranean. Discoveries of them in Britain are extremely rare.<sup>3</sup>

Most prismatic bottles were made by blowing the body and base into the mould and then finishing the shoulder, neck and rim by manipulation before attaching the handle. The mould blowing results in sharp angles between the sides and base making it easy to distinguish between the two manufacturing methods. Mould-blowing enabled a variety of shapes to be produced and the main forms are shown in Figure 1.1. Most prismatic bottles had bodies with square cross-sections (square bottles). Ones with hexagonal cross-sections were also made but in much smaller numbers. Rectangular cross-sections also occur and these bottles are even rarer. Bottles with other cross-sections are known but are very, very rare. They include ones with long octagonal sections which, like the rectangular ones, have two handles. Even rarer, and often known only from single examples, are bottles such as a triangular one from Pompeii,<sup>4</sup> the five-sided one from Almese (Italy),<sup>5</sup> and one from Kálós (Hungary) with a broadly D-shaped cross section where the curved element consists of eight panels.<sup>6</sup>

The majority have very distinctive short handles which in the English literature are generally referred to as reeded handles. The outer face of the lower part consists of multiple narrow ribs terminating in sharp points on the shoulder/side junction. Sometimes the ribs fade away as they reach the angle, sometimes they remain distinct and can be traced on the upper part. Other handle forms are known, both simple ribbons and ones with two or three wider, rounded ribs. In all cases the handles are angular;

<sup>2</sup> <https://doi.org/10.5284/1117194>, and see Appendix 4.

<sup>3</sup> Cool 2024, 250, 267 no. 152.

<sup>4</sup> Ward-Perkins and Claridge 1976, 44 no. 243.

<sup>5</sup> Gabucci 1996, 85 no. 6, Tav. XXIX.

<sup>6</sup> Barkóczi 1988, 181 no. 438, Taf. XLI; Lazar 2006, 265 no. H27, pl. 4.

INTRODUCTION

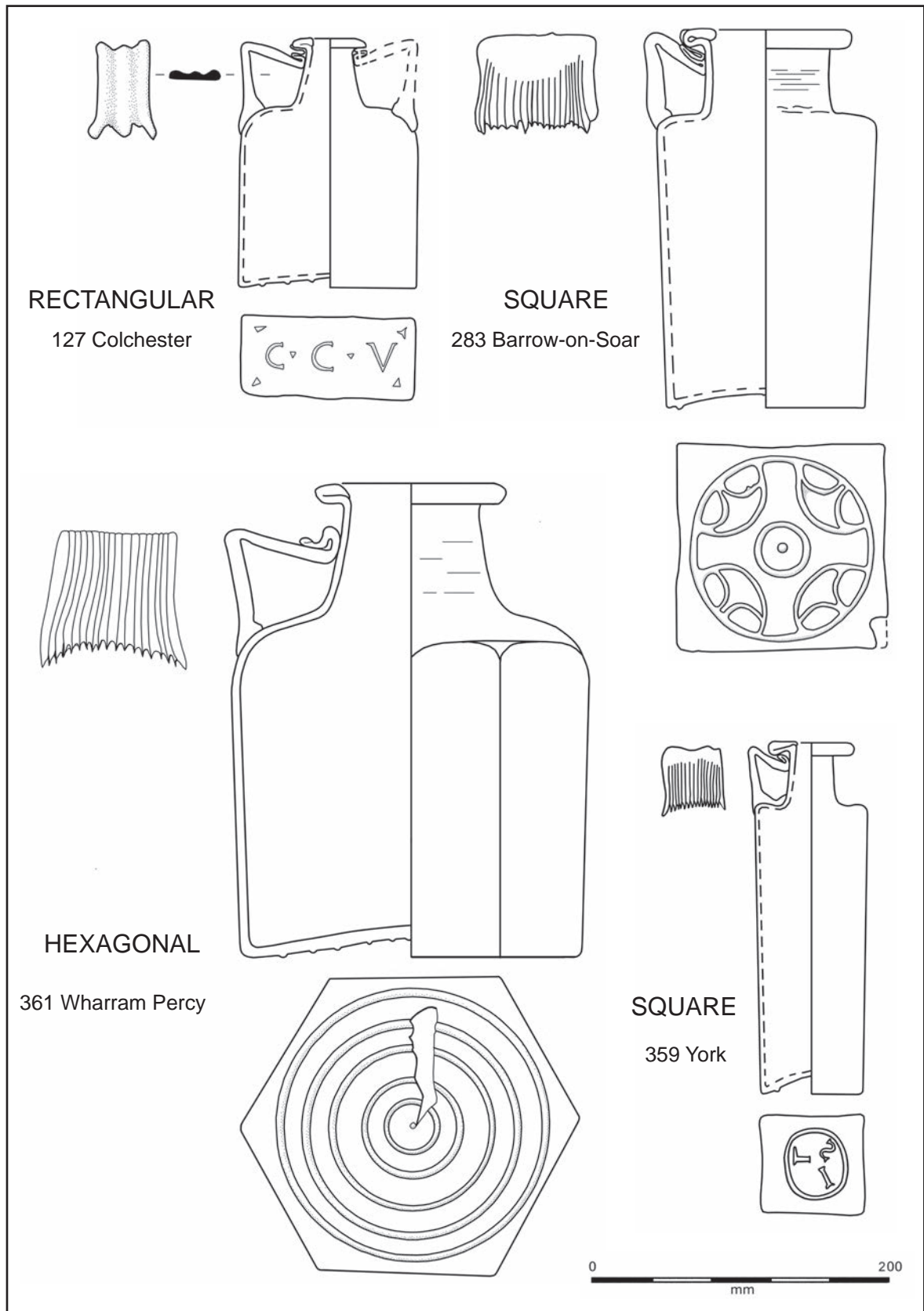


Figure 1.1. The main forms of blue/green glass prismatic bottles. (Scale 1:4).

being dropped onto the shoulder, pulled up, bent in and slightly down, and then joined to the neck with a folded attachment and return trail.

Normally the mould-blown bottles are made of good quality blue/green glass with few bubbles. This is the common glass for the utilitarian forms of the first to third centuries. Square and hexagonal bottles are known in colourless glass but are very rare.<sup>7</sup> I know of only a handful of possible fragments from Roman Britain.<sup>8</sup>

Over the years prismatic bottles have naturally featured amongst the main scholarly discussions of Roman glass. Sometimes attempts have been made to sub-divide them and various dates have been suggested for their introduction. The following is a rapid summary of the suggestions in the more influential publications.

Clasina Isings' *Roman Glass from Dated Finds* (1957) was a landmark publication in glass studies and remains a valuable guide. The typology continues to be an organising principle in many reports. She discussed the square bottles as her Form 50 including free- and mould-blown forms together.<sup>9</sup> She divided them into small (Form 50a) and large (Form 50b) categories and considered the date range to be from the Claudio-Neronian period onwards into the third century. Hexagonal bottles were not distinguished as a separate form but were mentioned within the discussion of Form 50. Rectangular bottles were assigned to Form 90. Dating was scarce for the rectangular bottles but suggested use in the second and third centuries.

A little later Ludwig Berger published the important first century assemblage from Vindonissa. In this he noted that, though bottle fragments were present in contexts belonging to the period AD 43-65 from the Sheepen site at Colchester,<sup>10</sup> they were absent in pre-Flavian contexts at Vindonissa. From this, and the number of dated parallels elsewhere, he considered they were predominantly of Flavian and post-Flavian date.<sup>11</sup>

Charlesworth in her 1966 paper concentrated on the square bottles. She separated out a category of tall, thin bottles as Type B whilst leaving all the others in Type A, noting that further work might show how the latter should be further subdivided.<sup>12</sup> She noted the absence of examples pre-dating the Claudian period and the large numbers present in mid- and late first century contexts. She was of the opinion that most belonged to the period AD 70 to 120/30. Though she thought they may have gone out of production in the western Empire by the end of Hadrian's reign, she provided a number of instances where they were clearly still in use in the late second century.

The catalogue of the large collection of Roman glass from the Rheinischen Landesmuseums Trier published in 1977 may be noted as the Trier typology is often cited, especially in the Continental literature.<sup>13</sup> Trier Form 114 equates to the small square bottles of Isings Form 50b. Trier Form 119 is equivalent to the large square examples of Isings Form 50b with the complete example illustrated being an example of Charlesworth's tall narrow Type B. Trier Form 115 consists of hexagonal bottles.

<sup>7</sup> Foy *et al.* 2018, 226-7, IN 227-8.

<sup>8</sup> Cramond – Price 2003, 93 no. 12; Binchester – Price and Worrell 2010, 284, 320 no. 323; Catterick – Cool 2021a, 271, 273 no. 932; South Shields (unpublished).

<sup>9</sup> Isings 1957, 63-7.

<sup>10</sup> Harden 1947, 306 no. 98.

<sup>11</sup> Berger 1960, 78.

<sup>12</sup> Charlesworth 1966, 28.

<sup>13</sup> Goethert-Polaschek 1977.

## INTRODUCTION

Into the general consensus that the start of the production of prismatic bottles should be looked for during the mid-first century AD, the publication of the glass from the Austrian site at Magdalensberg in 1979 provided a surprise. Magdalensberg is an important site because it was using Roman material culture from the late first century BC to the mid AD 40s when it was abandoned. It thus provides a very useful overview of Augusto-Tiberian vessels forms. In the report it was noted that fragments found in a cellar indicated that square bottles were already in use in the Augustan period, and so the date of the introduction was earlier than had been previously thought.<sup>14</sup> Doubts about this have often been expressed.<sup>15</sup> As this date is still quoted in the literature from time to time, it will be useful to look at the evidence in a little more detail.

The cellar in question was built in the Augustan or immediately post-Augustan period with the highest layers having finds of this period. Claudian layers were also observed and there was clearly a burning episode dated to the post-Augustan and pre-Claudian period. In the Claudian period the area was used as a rubbish dump. The possibility that the fragments could have been associated with the later activity was rejected. The grounds for this are a little obscure but were due to a belief that the fragments would not have been distributed in the rubbish in the way they were. It may be noted that the fragments in question consist of two rim and neck fragments, one of which retained a handle. There were also 62 fragments of melted body fragments from cylindrical and square bottles. The state of the body fragments might suggest they were associated with the burning episode. The evidence for an Augustan date is thus not convincing.

What is certain is that secure evidence of mould-blown prismatic bottles at Magdalensberg as a whole is very scarce. This can be compared to the large numbers of vessels on the site which are typical of Augusto-Tiberian glass assemblages elsewhere. In the 1979 publication Czurda-Ruth notes a small fragment with a curved moulding but it was so small that it could not be assigned to the bottle category with any certainty. She also notes that evidence for reeded handles is entirely absent.<sup>16</sup> In the subsequent publications of glass from Magdalensberg, evidence for prismatic bottles continues to be very scarce.<sup>17</sup> It is not always clear whether free- or mould-blown bottles are being described, some of the identifications are tentative and others unconvincing because of the colour.

The publication of the very large assemblage from the excavations at Augst (Switzerland) in 1991 allowed Beat Rütli to develop a typology which has been much used since. In this square bottles are form AR156, rectangular bottles are AR157 and hexagonal bottles are AR158. Augusta Raurica was the site of a thriving *colonia* and the excavations have produced useful evidence about vessel glass usage from the Augustan period onwards. A start date in the Augustan / early Tiberian period was proposed for the square bottles with use extending into the third century. A possible start date in the first century for the rectangular bottles was noted, with use from the mid-second to early third century certain. The suggested dates for the hexagonal bottles were from the Neronian/Flavian period to the third century.<sup>18</sup>

In 2015 Sylvia Funfschilling published a second report on the glass from Augst. This dealt with all the excavated material that had been found since Rütli had worked on his assemblage. It expanded the typology with new forms and set all the Augst material within the wider landscape of the knowledge that had accumulated in the quarter century since the first volume. In this she more cautiously proposed a start date for square bottles within the Claudian period (AD 40/50) noting that the earliest stratified

<sup>14</sup> Czurda-Ruth 1979, 135 nos. 1020-22, Taf. 7.

<sup>15</sup> Cool and Price 1995, 184; Funfschilling 2015, 427; Grose 2017, 190 (a posthumous publication originally completed in the mid-1980s).

<sup>16</sup> Czurda-Ruth 1979, 132 no. 1124, 136.

<sup>17</sup> Czurda-Ruth 1998, 481 nos. 767-71; 2004, 283 nos. 299-302.

<sup>18</sup> Rütli 1991 volume 2, 131 (square bottles), 148 (rectangular and hexagonal bottles).

examples from the Augst excavations came from contexts that post-dated AD 30. Rectangular bottles were more firmly dated to the mid-second to mid-third century and hexagonal bottles were dated from the Claudian period to the early third century.<sup>19</sup>

In 1995 the publication of the vessel glass from the city centre sites at Colchester provided more useful data about the introduction date of prismatic mould-blown bottles.<sup>20</sup> The excavations had dealt with the sites of the legionary fortress founded in AD 43 and the *colonia* that replaced it in c. AD 49. The *colonia* had been burnt to the ground in AD 60/1 in the Boudiccan rising, and the sites provide very close dating within the AD 43 to 61 period. The evidence suggests that prismatic bottles were very rare in Claudian contexts but starting to appear in slightly greater numbers by the early Neronian period. The discussion of the bottles in the Colchester report remains the main extended discussion of the type for the material from Roman Britain. In it, we were able to point to evidence that prismatic bottles were still in active use in the late third century.

Finally it is useful to note the evidence from Pompeii. The numbers of both free-blown and mould-blown square bottles in the eruption level deposits of AD 79 have frequently been cited as evidence that they were in common use at that time. The large glass assemblage from the excavations in Insula VI.1 provides an insight into vessel use before the eruption, stretching from the late second century BC onwards. The eruption levels in the insula had been stripped during the 18th century and so it lacks in-situ material of AD 79. The sequence does, however, include deposits that post date the earthquake(s) of c. AD 62-4. In total only five fragments of prismatic bottles could be identified, three of which came from phased contexts that post-dated the earthquake with the others either unphased or from modern contexts whose contents frequently contain eruption period material. By weight they accounted for only 1.7% of all the free- and mould-blown fragments that could be assigned to a form.<sup>21</sup> Had these bottles been at all common at Pompeii during the Claudian or beginning of the Neronian period, it would have been expected that fragments would have been incorporated into the levelling and make-up deposits that were associated with the re-building necessitated by the earthquake(s), but they were not. Other material including vessel glass was, but bottle fragments were absent. This evidence suggests that at Pompeii bottles only became a common part of material culture in the final 15 years of the city's life.

From the forgoing, it becomes clear that prismatic bottles started to be used in the c. AD 40-50 period but it probably took a decade or two before they developed into the popular form that was to dominate glass assemblages across the empire for more than two centuries. Within that time there were to be changes and these will be explored in detail in Chapter 10.

Before leaving this survey of the principle literature, a work that will be referred to many times in the rest of the book must be introduced. This is the *Corpus des signatures et marques sur verre antiques* published by the Association Française pour l'Archéologie du Verre in three volumes (henceforth CSMVA).<sup>22</sup> The Association marshalled glass scholars across the empire to gather together the mould patterns found on different types of glass vessels, including prismatic bottles, from across the empire. It provides a very robust corpus of data to set the Romano-British material within.

<sup>19</sup> Funfschilling 2015 volume 1, 427 (square bottles), 429 (rectangular and hexagonal bottles).

<sup>20</sup> Cool and Price 1995, 179-99 see also Table 1.4.

<sup>21</sup> Cool 2016, 152-3, Table 5.11.

<sup>22</sup> Foy and Nenna. 2006a; 2006b; 2011.



## How the bottles were made

The bodies and bases of prismatic bottles were shaped by blowing a gather of glass into an open mould. Given that hundreds of thousands of bottles were probably made, the number of moulds that have been recovered and published is miniscule. Appendix 1 provides details of the ones I know of. This list owes much to the hard work of all the contributors to the CSMVA. Although the number of mould pieces is small, they are sufficient to show how a square bottle mould was constructed.

Most of the examples are made of stone with marble being especially favoured, but examples in fired clay are also known at Aoste (France), Apulum (Romania) and from an unknown provenance now in Mainz.<sup>23</sup> A mould fragment in fired clay for a rectangular bottle has been found at Cáceres (Spain).<sup>24</sup> As will be discussed below, there are reasons for thinking fired clay moulds were commonly used despite few having been found. It is also tempting to wonder whether wood might have been used as well as that might explain why so few moulds are known. An early report of what had been found at Saintes, mentioned that some of the side panels were made of wild cherry wood.<sup>25</sup> The CSMVA publication of the moulds from there, however, makes no mention of this.

To make a square bottle five mould pieces were required. The moulds consisted of a piece for the base, and four panels to form the sides. The base mould consisted of a square block with the central part raised a few millimetres. This part is referred to here as the die, and was cut with the desired base pattern in intaglio. After blowing, the design appears as raised ridges on the base. The surrounding part of the base mould acted as flange on which the side panels were placed. There were two types of rectangular side panels. One had either straight or slightly bevelled edges. The other had a lower flange on both long sides. The forms are shown in Figure 1.2 together with a reconstruction of how they probably fitted together with flanged and straight-edged panels paired opposite each other (Figure 1.2 nos. 1a-c).

The pieces would have had to be held in place by an assistant, or physically clamped together, to keep them fitting closely during the blowing process. The glass had to be inflated so that it filled the mould and formed the well-defined angles between the sides. The problems of inadequately clamped multi-piece moulds which did not allow the desired shape to be achieved have been described by Wright in her account of experimental work to reproduce mythological beakers.<sup>26</sup>

Some of the moulds found in a late first century context within the legionary fortress at Bonn ingeniously used a form of scaffolding to keep the pieces in position (Figure 1.2 nos. 2a-c).<sup>27</sup> Two of the long panels with straight edges had two circular bores drilled through the thickness of the whole width of the short axis. The other three straight-edged panels had pairs of perforations on the long edges. On all five, one short edge had a circular bore drilled vertically for a short distance centrally. Two of the base moulds also had perforations placed centrally on the flanges. With these pieces a plausible solution is that the pieces were fastened together with pegs placed in the perforations on the base flanges which then fitted into the vertical bores on the side panels. The sides could be clamped together by battens threaded through the bored channels and perforations and then tightened. Clearly the workshop must have used two different methods of holding the mould pieces together as the complete base die and the complete flanged side panels found there have no perforations.

<sup>23</sup> Appendix 1 nos. 4, 12 and 3.

<sup>24</sup> Appendix 1 no. 20.

<sup>25</sup> Appendix 1 no. 11; Hochuli-Gysel in Foy 1991, 58.

<sup>26</sup> Wright 2000, 77.

<sup>27</sup> Appendix 1 no. 2.

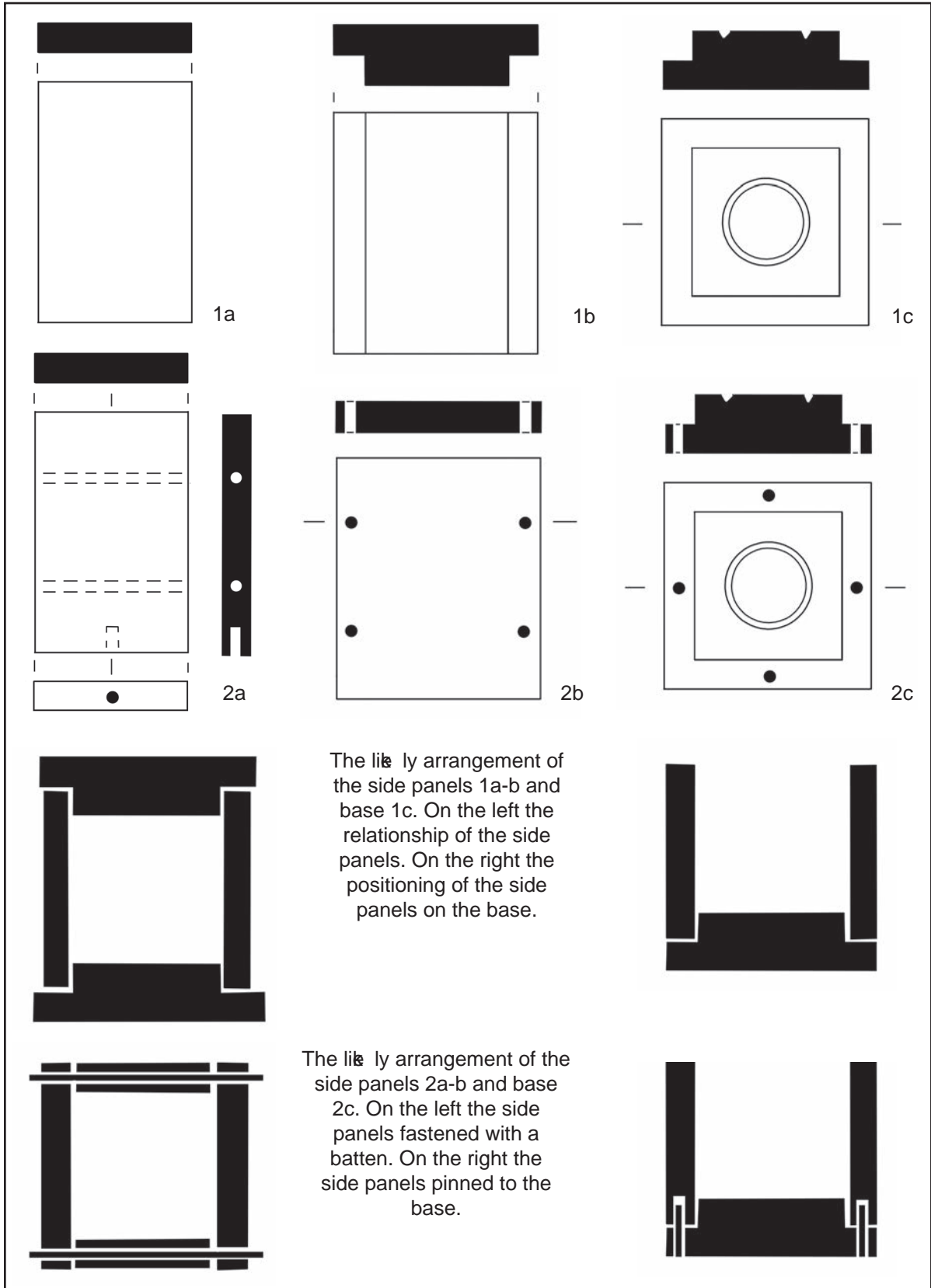


Figure 1.2. Square bottle mould types and their relationships.

## INTRODUCTION

The perforations and the circular bores are not present on any of the mould pieces found elsewhere. This is probably not surprising. They would have been more difficult to produce, requiring skilled stone masons. A glass blower working within the confines of a Roman legion, with access to its resources and the pool of skilled craftsmen, could have requested moulds made in this way. Their cost for a civilian enterprise may well have been prohibitive.

There may also have been advantages in not having the moulds permanently clamped. Stern notes that for closed moulds it is important to remove the vessel rapidly from the mould after inflation.<sup>28</sup> Mark Taylor, in his very useful article sharing his experience of reproducing Roman square bottles, notes the top of the side panel must be very slightly wider than the base to enable removal.<sup>29</sup> In the better recorded side panels which have been drawn carefully, this can be seen. An assistant or assistants holding the pieces together would also have enabled the mould to be rapidly dismantled to enable the quick removal of the vessel as can be seen in Figure 1.3.

The two rectangular base moulds, from Cáceres (Spain) and Salona (Croatia),<sup>30</sup> both have traces of side flanges and so similar arrangements of base and side panels seems likely. The only evidence for the manufacture of hexagonal bottles is a fragmentary base mould from Avenches (Switzerland).<sup>31</sup> This is unusual in that it appears just to consist of the die and there are no traces of a surrounding flange. How the mould would have functioned and how many parts it would have consisted of is unknown.

After the vessel had been removed from the mould it needed to be detached from the blowing iron so the rim and neck could be formed and the handle attached. How they were held during this process is something of a puzzle. At this point in the process, Mark Taylor attaches a pontil iron to the bases of his reproductions so that the body and base are now held on that. In the first and earlier second centuries this would not have been likely. The evidence for use of the pontil iron is, effectively, absent from Roman glass vessels of that date. It is only from the later second century that they regularly start to show the scars caused by detaching the pontil (pontil scars) on their bases. Square bottles are no exception to this. Pontil scars do occur, but only on ones that that can be shown to be late in the sequence. Sometimes it is possible to see that a side has been pushed in, out of the true vertical. This might reflect the use of tool such as tongs or pincers. Normally, however, the vessels retain no signs of how they were held during the final stage of manufacture.

Where the moulds pieces listed in Appendix 1 have been found in well stratified contexts, they generally date to the first or very early second centuries. This is certainly the case for four sites where they have been found as part of the equipment of a glass vessel workshop.<sup>32</sup> The installation at the Monté de la Butte at Lyon was active during the AD 40-70 period and thus belongs to the first phase of square bottle production. Glass vessel production at Bonn, Saintes and the rue Saint-Didier site in Lyon was taking place within the last quarter of the first century and, in the case of the last two sites, into the beginning of the second. By that period the use of square bottles was well established.

The lack of well-dated moulds at workshops of the later second century could open the question of whether the same mould technology continued to be used. The recovery of a base mould from the Theatre site at Augst in a context belonging to the first half of the third century suggests it was.<sup>33</sup> It was found on a site with occupation material that did not include any other evidence for glass vessel

<sup>28</sup> Stern 1995, 47.

<sup>29</sup> Taylor 1998.

<sup>30</sup> Appendix 1 nos. 20 and 21.

<sup>31</sup> Appendix 1 no. 18.

<sup>32</sup> Appendix 1, nos. 2, 5, 6, 11.

<sup>33</sup> Appendix 1 no. 17.



Figure 1.3. Bill Gudenrath demonstrating how to blow a square bottle in a five-piece mould at the Glass Techniques through 5000 Years conference held at the Edinburgh College of Art, 24-27 September 1992. On the left the bottle being inflated in the mould. On the right Ray Flavel, acting as the assistant, is rapidly dismantling the pieces at the end of the process.

production, and so it could be argued that this was an old, residual, re-deposited piece. Its size argues against this being the case. Though similar in every respect to the other base moulds, it would only have produced a bottle with a base width of 21mm. It is far smaller than any known square bottle but would be the right size for a Mercury flask (Isings Form 84). These were normally made in colourless glass and had narrow, square-sectioned bodies expanding out slightly and long necks. They were in use from the later second century and into the third century. It seems likely, given its size and date, that this mould was probably used in the manufacture of Mercury flasks. It provides some evidence that the same mould technology continued to be used through the second century and possibly later.

### The study of base patterns

The patterns cut into the dies and then reproduced as ridges on the bases of the bottles can be divided into three broad categories. By far the commonest one consists of one or more concentric circular mouldings with or without a central pellet and /or corner mouldings. The second category can be described as geometric. Often these have patterns such as a central cross or rosettes made with arcs within a circular frame, but more complex patterns are also known. Finally, and very occasionally, there are bases which depict figured patterns of vegetation such as wreaths, animals such as the horse from Catterick (7) or human beings like the gladiator from Caersws (385).<sup>34</sup>

<sup>34</sup> Numbers in **bold** throughout the text are the reference numbers of individual bottles fully documented in the database.

The base patterns are a large and somewhat daunting body of data, but one with much potential. First though, they have to be accurately recorded. I have found that the best way to do this is to take rubbings. As rubbings are such an important source of information in this book, it will be useful at this point to describe the best way to make them.

My initial experiments were in 1984 when I was working on the glass from Piercebridge. I first tried using a pencil and a piece of thin paper but that was not very successful as can be seen in the rubbing for bottle 371 in the digital section. At the time I was working at the University of Leeds with Jenny Price in a project established by English Heritage (now Historic England). The aim of this was to address the backlog of glass reports from excavations they had funded. On the other side of the campus, and in a different department, Brian Hartley and Brenda Dickinson were engaged with a similar project to deal with the backlog of samian pottery. I knew that they used rubbings extensively to record stamps and they very kindly introduced me to their method using cigarette papers and flake graphite.<sup>35</sup>

The method had to be adapted to glass as obviously cigarette papers are normally not large enough to accommodate bottle base fragments. I have found that tissue paper provides a good medium. A piece of this can be placed over the moulded face and fastened securely with masking tape or the like. Flake graphite can easily be produced by sharpening a 'lead' pencil with a blade. The resulting powder can then be rubbed carefully over the moulded surface with a forefinger and will result in an image of the piece. The paper can be unfastened, carefully (!), and the surplus edges trimmed. I normally then stick them to a backing sheet.

It is a slightly messy business. Brian, Brenda and the other specialists who spent a lot of time recording samian from La Graufesenque used to refer to themselves as the Black Hand Gang for obvious reasons. Getting a little messy though is a price well worth paying as the rubbings are an invaluable record. They can be used as the foundation for drawings, they aid reconstruction of the size of the bottles, they are vital if mould parallels are to be identified and they also provide important insights into how the patterns were created.

On the bases, in addition to the mouldings deliberately cut into the dies, faint additional markings can sometimes be seen. These were clearly the laying out marks that helped the mould maker cut the patterns. Sometimes they can be seen by visual inspection of the piece. Often though, they can be difficult to detect as they are very slight. This is where rubbings are so useful as a carefully made rubbing will show even slight markings. Figure 1.4 shows two examples. On the base from Carlisle (no. 1) the crossed lines locating the centre are clear. On the one from Silchester (no. 2) they are less distinct but can be seen. 'X' in red has been placed at the end of each to help the reader. On the piece itself (no. 3) they are easy to miss. I may mention that this photograph was one of many I took of the piece with the intention of trying to obtain one that showed the markings. When you know what to look for they can just about be detected. Many of the other photographs taken at different angles and in different lighting conditions did not show them at all.

From the laying out lines that can be seen on these two vessels and various others in the corpus,<sup>36</sup> it seems that one of the first things the mould maker did, once the edges of the die had been defined, was to draw diagonal lines from corner to corner to accurately position the centre. The fact that these

<sup>35</sup> Hartley and Dickinson 2008, 1.

<sup>36</sup> See, for example, 163, 268, 295, 342, 483.

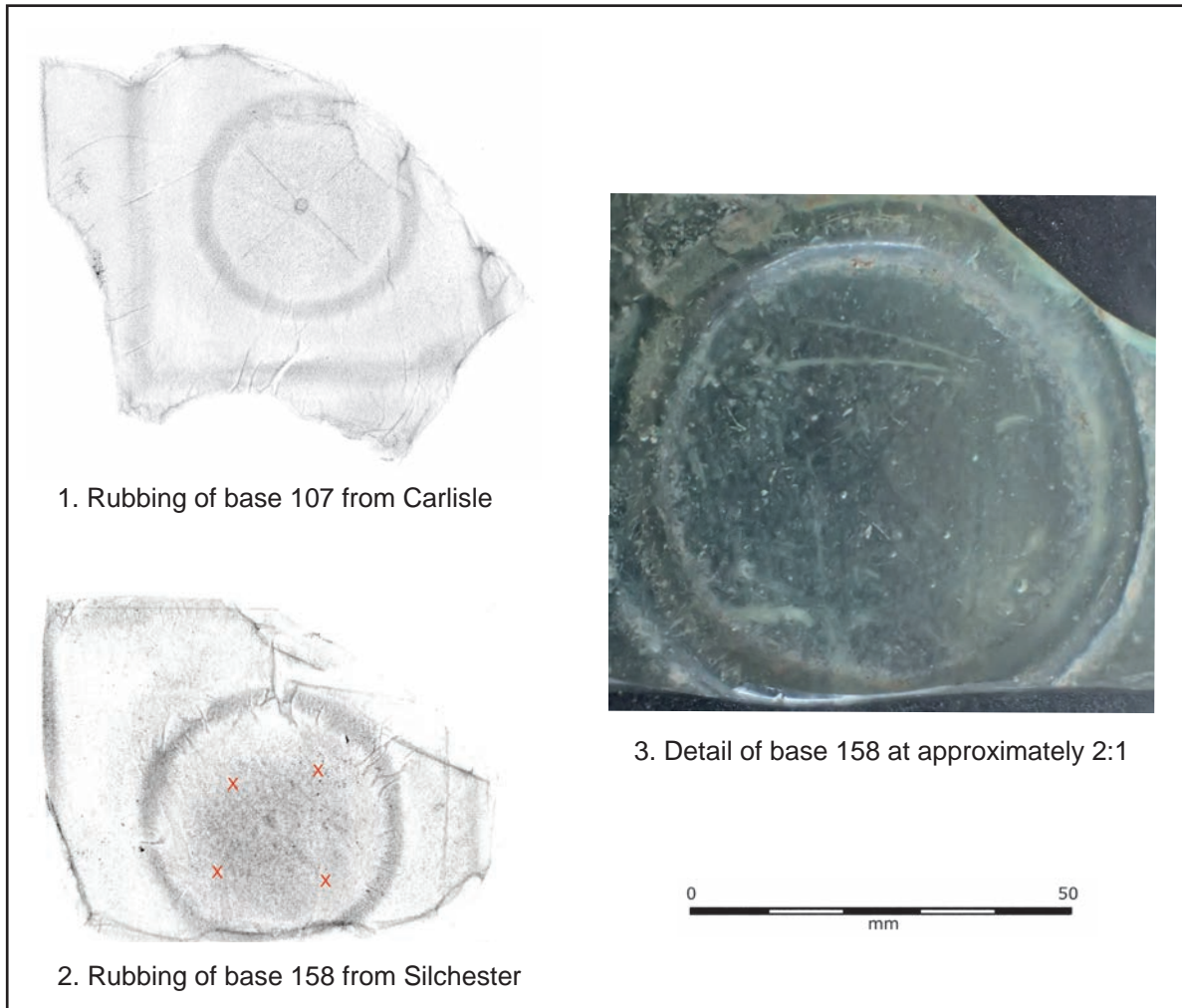


Figure 1.4. Rubbings showing guidelines marked on the moulds.

lines are reproduced on some moulds indicates that in some cases these lines were lightly scored. This possibly suggests that the mould where the lines were scored were made in clay. Scoring lines into marble and other stone seems much less likely. It would have been more effort when they could as easily have been marked in ink.

With the centre securely located, the pattern could be laid out. If it contained circular elements, and most bottles do, these were undoubtedly normally drawn with a compass. The patterns are generally far too regular to have been drawn freehand. Some bottles have very small central circular mouldings. Whilst larger circular pellets were sometimes included as part of the deliberate moulded pattern, these very tiny central moulding may well have been the by-product of the positioning of the compass point. As can be seen in the case of the base from Silchester in Figure 1.4, though a small central moulding is indicated in the rubbing, it can scarcely be detected in the photograph whereas the circular moulding is in high relief.

Again the possibility arises that the moulds where the tiny central dot can be detected were made of clay. An unprovenanced marble die from Lyon has a tiny central dot which might suggest that compasses

would make marks on a marble mould.<sup>37</sup> Unfortunately it cannot be used as confirmation of this. The markings on the entire die are very shallow and it has been suggested that either it was a mould in the process of being made, or one that had been worn down through long use.

The third clue that many moulds were made of clay can be observed in some of the bottles which include lettering as part of their design. Normally the letters are well made with sharp outlines including serified terminals. Sometimes it is possible to see that one of the letters appears to be doubled with a faint ghost image of it to one side. Examples include square bottles from Corbridge (**659**) and Carlisle (**404**) (Figures 4.3, 4.5) and a rectangular bottle also from Corbridge (**701**) (Figure 9.2). It is sometimes suggested that this is the result of movement whilst blowing the bottle. That, however, would have affected the whole design if true, and it does not. The other letters and mouldings on the bottles do not have this ghost effect. In publishing the rectangular bottle from Corbridge, the authors of RIB II.2 made the interesting suggestion that the double impression showed 'the use of a single-letter punch either directly or to make the mould'.<sup>38</sup> Clearly it would have had to be the mould that was impressed and again this implies the mould maker was working with a soft medium that could be impressed like clay.

The tool kit for a mould maker clearly included a carpenters' square to ensure the die was regular, a ruler to mark out spacing and a set of compasses. These are the sort of tools that were widely used by Roman craftsmen. In Italy compasses, associated with either rulers or carpenters' squares and sometimes with both, have been observed on a variety of altars and gravestones where they can be associated with wheelwrights, shipbuilders, carpenters and stone masons.<sup>39</sup> A square and a set of compasses also occur on the unprovenanced tombstone of Breitenos Hermes in the Louvre. He specialised in making couches.<sup>40</sup> Some Roman compasses were fitted with locking mechanism to keep the circumference of the circle fixed,<sup>41</sup> and it was probably this variety which were used to mark out the circles on a die.

With the role of compasses established it becomes easy to estimate the full size of a bottle base even if only a small part survives, providing that part retains evidence of the edge and part of a circular moulding. I used to measure the diameter of fragmentary circles using a set of graduated templates which I would align with the moulding on the piece or the rubbing. This is a satisfactory method, but these days I find it much quicker to reconstruct the design within Adobe's Photoshop program. Figure 1.5 shows the steps that have been used for the drawings in this book.

In theory bottles made using the same base die should be identical. In practice this depends on the skill of the glass blower. Taylor notes that, for a successful result, stone and fired clay moulds must be kept slightly damp. A mould that is too dry can result in small pieces of the mould sticking to the glass. A mould that is too damp may result water pooling in the design on the base resulting in steam that prevents the mouldings being accurately defined. The base of the paraison is the hottest part of it precisely to ensure good definition in the mouldings so steam is a natural result. The heat of the base of the paraison can clearly be seen in the right-hand view on Figure 1.3 where it is still glowing orange as the bottle is removed from mould.

The result of steam within the mould is that the edges of the mouldings lack sharpness and often appear as if they have 'spilled' beyond their bounds. Figure 1.6 shows an example of this. If the photograph and rubbing are compared to those in Figures 1.4-5 the effect is obvious. Although there are other examples of this in the corpus presented here, on the whole most bottles have well-defined mouldings and the

<sup>37</sup> Appendix 1 no 7.

<sup>38</sup> RIB II.2, 119 no. 2419.140.

<sup>39</sup> Zimmer 1982, nos. 61, 65, 70, 87, 92-6, 98-9, 103-106a, 111.

<sup>40</sup> Richter 1966, 127, fig. 612.

<sup>41</sup> Funfschilling 2012, 196-7, 228 nos. 282-5, Taf. 10.

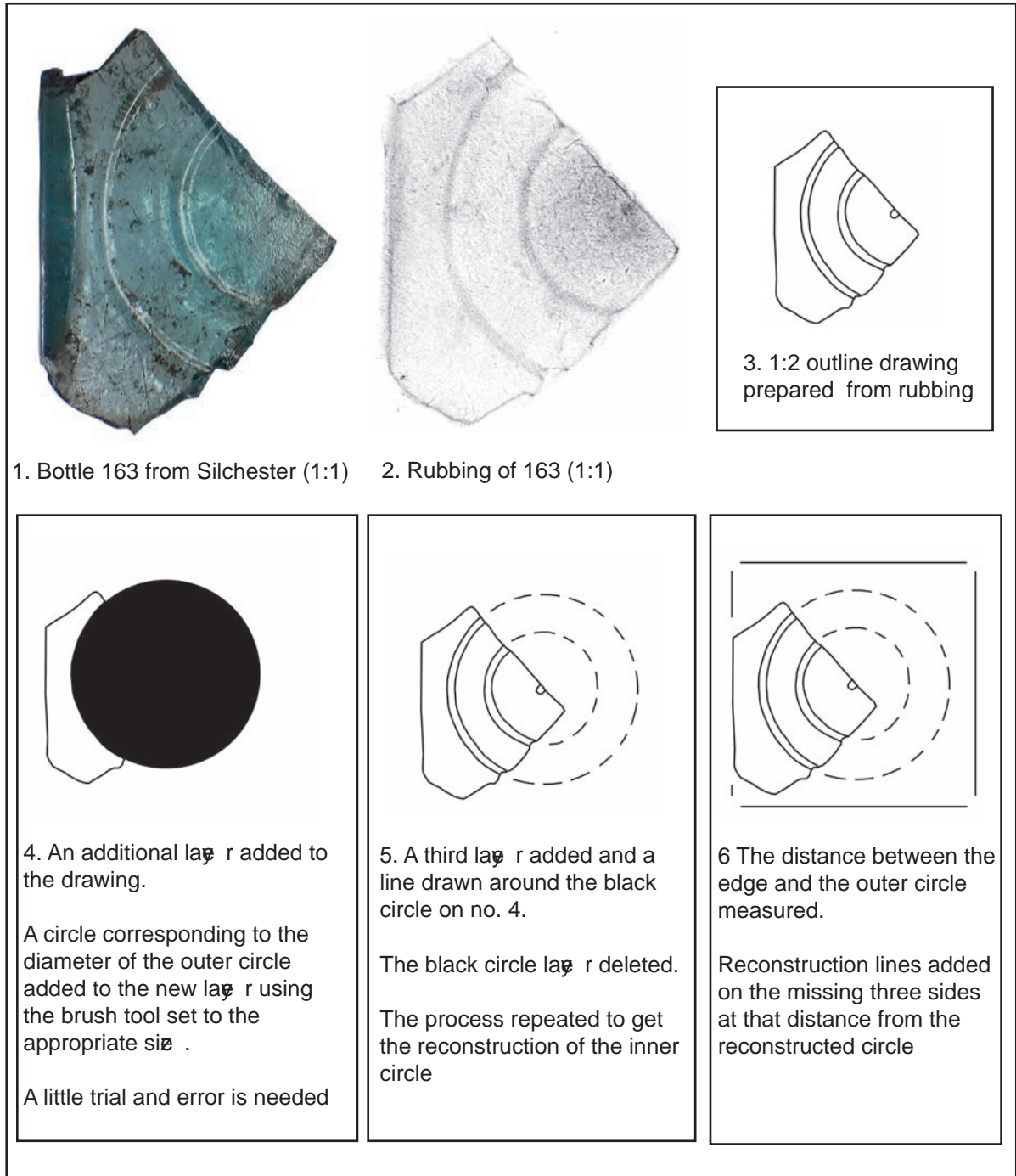


Figure 1.5. The stages in reconstructing a base fragment.

glass blowers must have been skilful and prepared their moulds well. This holds out the hope that it is possible to identify mould parallels and, indeed, it is the case that it can be. Two of the more pleasing cases are set out below with details of how it was achieved.

Brian Hartley and Brenda Dickinson set out in the introduction to their monumental index of samian potters' stamps how they established which impressed stamps on the pottery were the result of the same die. They folded each rubbing in half horizontally and placed that over another rubbing to check



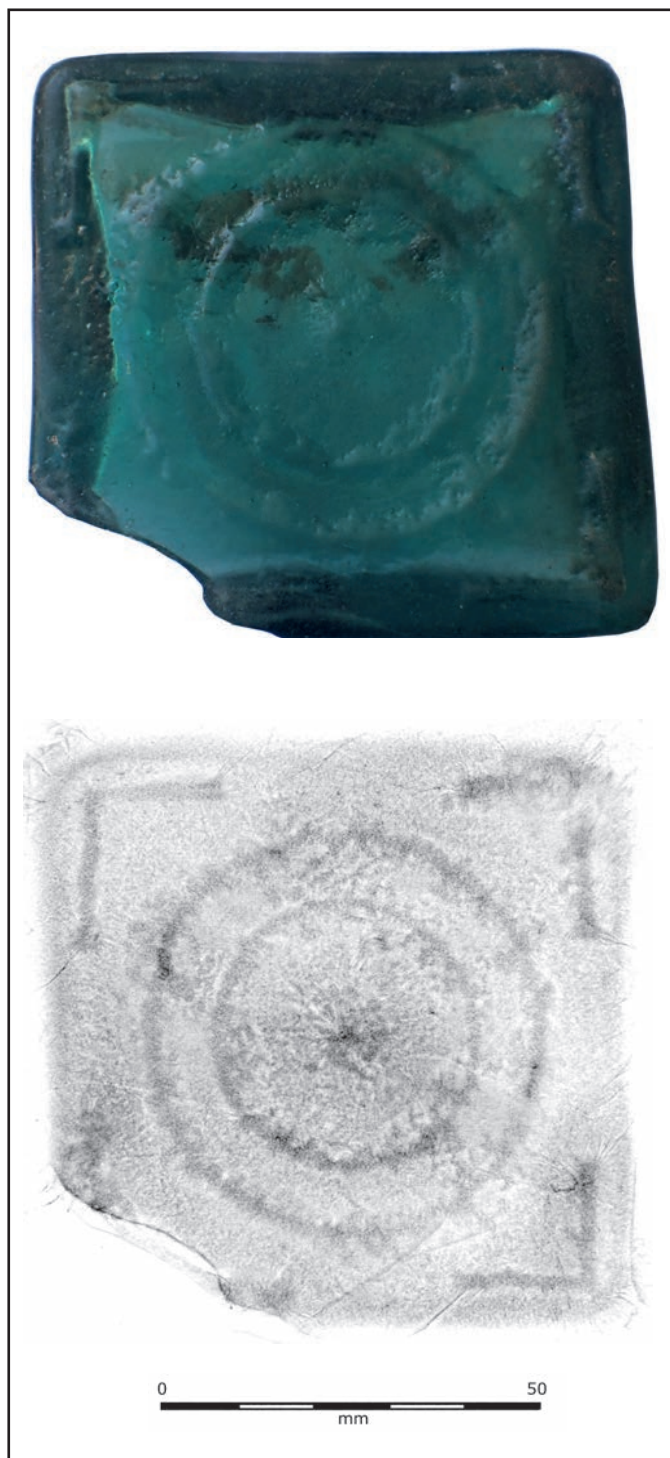


Figure 1.6. The effect of steam in the mould as seen on bottle 276 from Ware. (Scale 1:2).

whether the shapes and spacing of the letters matched.<sup>42</sup> That publication was the result of forty years of data collection from the mid-1960s and the authors did not have the benefit of Photoshop. I, by contrast, have had; and I recommend its use to others who may want to continue this work. For this reason I have set out the stages I go through so people can copy them if they wish.

The first example deals with matching two base fragments to the actual mould they were made from.<sup>43</sup> A remarkable and unexpected experience given how few moulds are known. I had long suspected that a fragment from an excavation at Rocester (Staffordshire) which I had reported on in 2007 (309) had come from the same mould as a fragment from Annetwell St., Carlisle which I had dealt with in 1992 (108). Neither of the sites were ever published and I forgot about them. Years later looking through my archive of rubbings, I was reminded of them and, furthermore, realised it was the same unusual pattern as on one of the dies from Bonn.<sup>44</sup>

To check whether they did all match, I first made a 1:2 drawing of the die from Bonn based on the excellent illustrations Follmann-Schulz had published.<sup>45</sup> The scans of the rubbings of the pieces from Carlisle and Rocester were then reduced to the same scale. Note that it is important to have all the elements that are to be compared at the same resolution as otherwise the scaling will not be true. I normally work at 1200dpi.

The next stage requires that the rubbings have transparent backgrounds. This can be achieved by making a duplicate of the background layer and selecting the Magic

<sup>42</sup> Hartley and Dickinson 2008, 1.

<sup>43</sup> Cool 2022.

<sup>44</sup> Appendix 1 no. 2. Mould D-M4

<sup>45</sup> Follman-Schulz 2011, pl. 4.

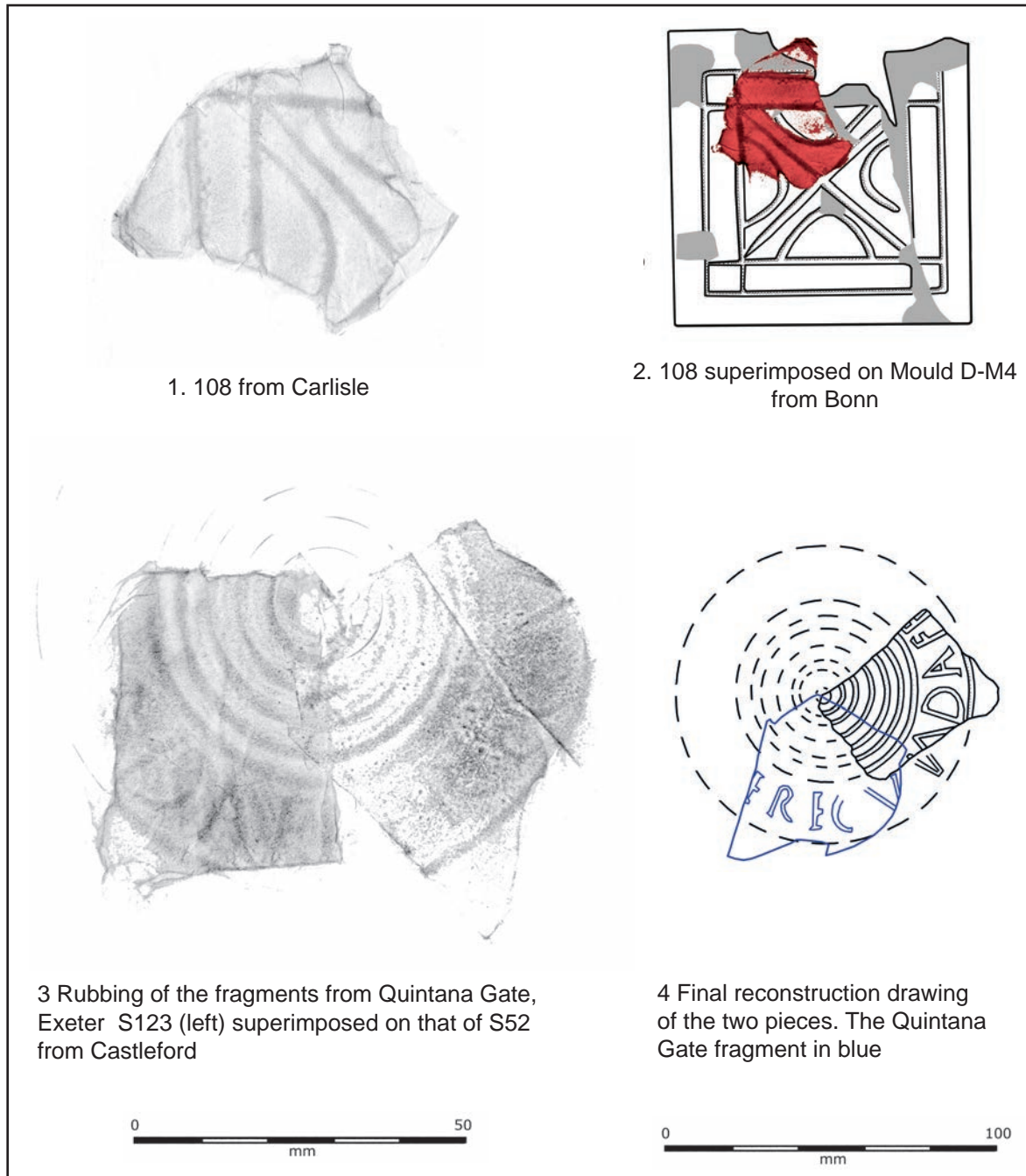


Figure 1.7. Examples of mould parallels (rubblings at 1:1, drawings at 1:2). Mould shown in no. 2 after Follman-Schulz 2011.

Wand tool. Touch the white area of the surround with the Magic Wand tool. This selects all the white area. Press delete and the white area is removed on that layer. Delete the original background layer, which still has a white background, and you are left with a single layer with a transparent background. Save this as the rubbing file you will work with. From this point the rubbing can be positioned over any other rubbing or drawing to check for matches. The commands are 'Select all' >'Copy'>'Paste'. The Free Transform command in the Edit menu will allow you to move one image over the other provided they are on different layers.

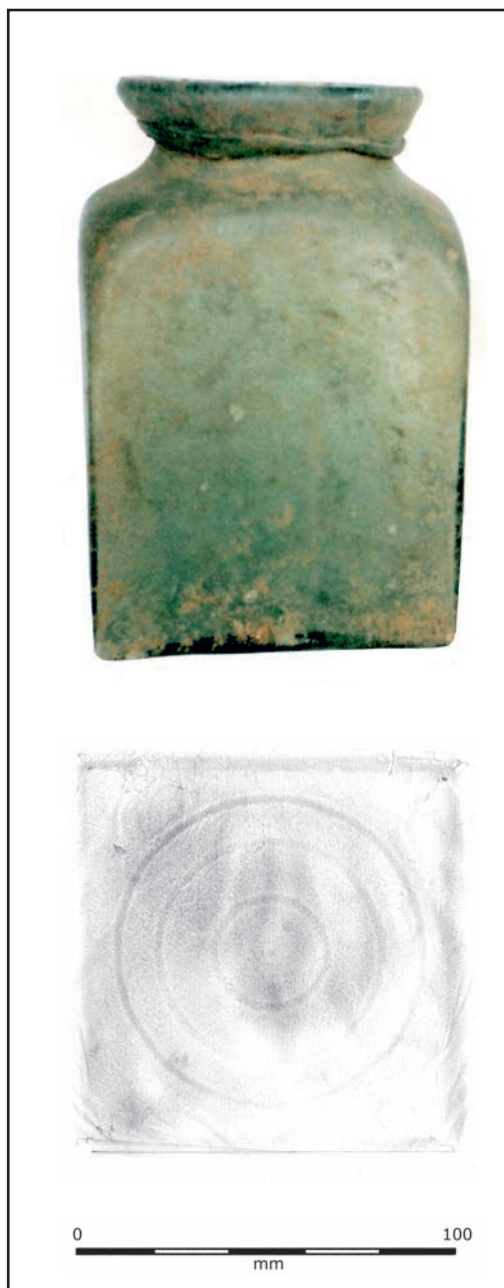


Figure 1.8. Collared square jar from Handford House, Colchester. (Scale 1:2).

In the case of the Carlisle and Rochester fragments matching was straightforward. Figure 1.7 no. 2 shows one of the rubbings dropped onto the Bonn mould so the match can be seen. The next case is one that is more normally encountered where one is looking for matches between two fragments.

The fragments in question come from Quintana Gate, Exeter and Castleford. Denise Allen was working on the assemblage from the former which had been excavated in 2017 (S123) and had noticed similarities with the Castleford fragment (S58). Comparing rubbings of the two it became clear they were from the same mould. Figure 1.7 no. 3 was the first overlay I produced with the aim of seeing if the multiple circular mouldings matched. They did exactly confirming it was a mould parallel. There was no overlay of any of the letters so the position of the fragments was unclear. When this was shown to Roger Tomlin he realised that if the Exeter fragment was placed to the right of the Castleford one, there was an inscription that read [..]ERECVINDAFE[..]. Given the space this would leave, it seemed plausible that the full inscription running around the base would have been *Iulia Verecunda fecit*.<sup>46</sup> Figure 1.7 no. 4 shows the final positioning.

These two instances of identifying mould parallels raise all sorts of interesting questions that will be explored later in the book. In the first instance there are insights into military provisioning. In the second only the fourth female glass worker, or owner of the installation, in the Roman world has been identified, as plausibly *Iulia Verecunda* can now join *Sentia Secunda*, *Ennia Fortuna* and *Iulia Soteridis* also known from moulded bases.<sup>47</sup> Not all mould matches deliver such surprising results, but all can help us explore Roman society more.

### Other prismatic blue/green vessels

Before concluding this introduction it is appropriate to note that bottles were not the only prismatic form in the second half of the first century and into the second to be made of blue/green glass and blown into multi-piece moulds. This raises the question of whether broken body and base fragments normally identified as coming from bottles were originally parts of other vessel types.

<sup>46</sup> Tomlin 2021, 467 no. 4 and 481 no. 30.

<sup>47</sup> Tomlin 2021, 467 footnote 9; Foy 2006, 85.

There are two types, both belonging to jar categories. One is the square jar with a collared rim (Isings Form 62).<sup>48</sup> These have moulded bases showing patterns of concentric rings. From Figure 1.8 it will be appreciated that the lower part of a vessel like this would be hard to distinguish from a square bottle.<sup>49</sup> It has a distinctive collared rim which is first bent in and then out and down producing the lower ridged effect seen on the Handford House example in the figure. This type of rim is also found on another type of jar which has a ribbed globular body and a cut-out base ring (Isings Form 67c). These are made in blue/green glass and also in the range of colours typical of the second half of the first century (deep blue, yellow brown, yellow/green etc. Some are thin-walled, others have thicker walls.

Collared rim fragments are a regular feature of first to second century Romano-British assemblages. By far the majority are broken close to the rim, generally as the body curves out. There is, therefore, the possibility that some of these come from square jars. The possibility of confusing fragments from square jars with bottles and globular collared jars would lead us to underestimate how frequent they were.

I increasingly think the square jars were rare in Roman Britain. One reason is that where most collared jars are broken would be an obvious point of weakness in a globular jar where there is a more abrupt curve out to the body. As can be seen from the jar in Figure 1.8, the shoulder on the square jar slopes out more gently to the shoulder. If square jars were relatively common, I would expect to encounter more rim fragments retaining parts of bodies sloping out like that and, on the whole, I don't. It is sometimes suggested that thick-walled collared rim fragments may have come from square jars.<sup>50</sup> If that was the case, again it could be expected more of the shoulder would be preserved. Fragments from the upper bodies of prismatic bottles, for example, frequently retain parts the neck, the relatively abrupt angle to the shoulder and the shoulder itself. In the examples cited however, the rim fragment is broken in exactly the same place as on all of the other fragments.

The scarcity of securely identified square jars with collared rims in Roman Britain, compared with the large numbers of square bottles securely identified, is a pattern also seen in France. There only a very small number of square jars are known with the bulk having been recovered in central France.<sup>51</sup>

The other form with a prismatic body is a small jar normally referred to as an inkwell because of the very distinctive, inturned rim formation that leaves only a small aperture (Isings Form 77).<sup>52</sup> Normally they have free-blown cylindrical bodies but a small number have hexagonal-sectioned ones clearly blown into a mould. These have concentric circular mouldings on their bases. Glass inkwells of any type are rare. A diligent search by Klein across the north-western provinces only produced a total of 81.<sup>53</sup> The shape of most was unknown as they had been identified from the rims; but where body shape could be identified, cylindrical examples outnumbered the hexagonal ones by a factor of two to one. I used to think that having identified the characteristic rim form, in future more inkwells would be identified from fragments.<sup>54</sup> Since my work on glass assemblages in the 1980s which lead me to this view, I have only encountered two other examples in the assemblages I have worked with subsequently. It seems therefore I was mistaken, and the form was indeed very rare in any shape.

From the foregoing, it will be obvious that though some fragments identified as bottles *could* be from other vessel types, the probability is that few are. The forms in question were rarely used in Roman Britain and their contribution to the very large number of broken fragments was probably very small.

<sup>48</sup> Price and Cottam 1998, 135-6.

<sup>49</sup> Illustrated vessel unpublished.

<sup>50</sup> Price and Cottam 1998, 135.

<sup>51</sup> Cabart *et al.* 2006, compare Figs. 1 and 2.

<sup>52</sup> See also Cool and Price 1995, 116-7.

<sup>53</sup> Klein 2017.

<sup>54</sup> Cool and Price 1995, 116.