



*Roman Brooches in Britain:
A Technological and Typological Study
based on the Richborough Collection*

Justine Bayley and Sarnia Butcher



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ROMAN BROOCHES IN BRITAIN

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A Technological and Typological Study
based on the Richborough Collection

Justine Bayley and Sarnia Butcher

with brooch drawings by Judith Dobie and
other illustrations by John Vallender



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English Heritage. Jenny Hall and Christine Jones of the Museum of London made brooches available for examination and analysis and provided Figures 18 (Plate 8), 29 (Plate 16) and 33 (Plate 20), and Plates 19 and 21, which are Museum of London copyright. Figure 11 (Plate 2) is reproduced courtesy of Bristol City Museum and Art Gallery.

M R Hull's 'Corpus of ancient brooches' was left unpublished when he died in 1976 and we have been very grateful to Dr Grace Simpson for permission to use it. We have also benefited from Paule Spitaels's pioneering work on the chronology of enamelled brooches, sadly unfinished when she died.

The Ancient Monuments Laboratory's study of the Richborough brooches was initiated by John Musty and facilitated by Ian Cross and the conservators working with him. The majority of the conservation work undertaken on the brooches was carried out by Ian Cross and Barry Knight. Throughout the work Leo Biek contributed the occasional insight in his usual unconventional way.

The text was copyedited by Wendy Sherlock and proofread by Rowan Whimster; the index was compiled by Susan Vaughan. Kate Owen dealt with all the demands of publishing this work in her usual calm and professional manner.

JUSTINE BAYLEY AND SARNIA BUTCHER
MARCH 2004

EDITORIAL NOTES

PRESENTATION OF ANALYTICAL RESULTS

The results of the analyses of the Richborough brooches and selected comparanda are presented in Appendix 1, with a copy on the CD to be found in the pocket on the inside back cover of this volume. Each entry in this appendix contains the following information: a four-letter site code (Table 19, Appendix 1 and CD, provides a key), a site number, an Ancient Monuments Laboratory inventory number, a publication reference (where one exists), a Hull type number (Appendix 2 provides a key), codes describing any applied decoration (Table 20, Appendix 1 and CD, provides a key), codes describing enamel colours (Table 21, Appendix 1 and CD, provides a key), the percentages of copper (Cu), zinc (Zn), tin (Sn), lead (Pb) and silver (Ag) present (where quantitative analyses have been carried out), and the alloy name assigned as described in Chapter 2. The entries for the brooches from Richborough form Table 22 in Appendix 1 in this volume (pp 220–9), while Table 23 (only on CD) contains the data for all the analysed brooches.

The CD holds the data in two formats. First is a word-processed document, produced using Microsoft Word (Table 23.doc), that can be printed out to give a fifty-page table. The entries are sorted by Hull type number. The second file (Table 23.csv.txt) is a comma separated variable file, suitable for importing the data into database or spreadsheet programmes. The advantage of using this version of the data is

that it can be sorted on any of the fields, allowing much greater flexibility of use. The file contains 3,426 lines, each of which has thirteen data fields (though some of these are blanks). The data on the CD has also been deposited with the Archaeology Data Service (ADS) and is available on its website: <<http://ads.ahds.ac.uk/catalogue/library/SoA/68fiche/>>.

THE ILLUSTRATIONS

All figures of the brooches found at Richborough (Chapter 4) include a drawn scale and are reproduced at 1:1. The schematic drawings of brooch types in Chapter 5 are reproduced at 2:3.

Most colour plates are also reproduced in black and white as part of the figure sequence in the text.

COUNTY NOTATION

Because of continuing changes in administrative areas and historical county names, the names and boundaries used throughout the volume are those obtaining immediately prior to local government reorganization in 1974.

REFERENCES

Lower case 'p' denotes page number where it might be mistaken for a catalogue or figure number.

SUMMARY

The arrival of the metal objects from the Richborough site museum at the Ancient Monuments Laboratory in the early 1970s was an opportunity to study the brooches as a group, both by the traditional typological method and by scientific methods which had not so far been applied systematically to material of this type. The early work indicated that there were significant correlations between typology, alloy composition and techniques of decoration. The decision was taken to extend the survey to brooches from other sites, with the result that some 3,500 brooches have been analysed and examined. The data on all these brooches is presented, and the overall patterns are summarized and discussed.

Details are given of the methods of brooch construction and the techniques of decoration used. These provide new information on the processes of manufacture and the nature of the metalworking industry in the Roman period. Contrary to the general assumption

current when this study started, that all ancient copper alloy objects were made of bronze, it is shown that a range of alloys was employed and that composition, and hence alloy properties, correlate with brooch type and decoration. The association of certain manufacturing and decorative techniques with certain types of brooch suggests the geographical location of workshops.

The 445 extant brooches from Richborough are catalogued and details are provided of brooches now lost. They are classified by type, using a modification of the system employed by M R Hull. An outline of the main brooch types found in Roman Britain generally, including those not represented at Richborough, is given in order to show how traditional typological methods of study can be related to the technological evidence. Extensive lists of typological parallels for the Richborough brooches are given, and their distribution within Britain is shown in a series of maps.

RÉSUMÉ

L'arrivée du mobilier métallique du musée de Richborough au laboratoire d'Ancient Monuments, au début des années 70, a permis une étude groupée de ces fibules, tant selon la méthode typologique traditionnelle qu'à l'aide des méthodes scientifiques, qui n'avaient pas encore été, à cette époque, appliquées de manière systématique à ce type de matériel. Les premières analyses indiquaient une bonne corrélation entre la typologie, la composition de l'alliage et les techniques décoratives. On prit alors la décision d'étendre l'approche aux fibules d'autres sites: ce sont ainsi 3,500 fibules qui purent finalement être analysées et étudiées. Les données concernant toutes ces fibules sont présentées ici, avec une discussion et un résumé des résultats généraux.

L'ouvrage comprend une étude des méthodes de construction des fibules ainsi que des techniques décoratives. Cette partie inclut des données nouvelles sur les procédés de fabrication ainsi que la nature du travail du métal à l'époque romaine. Contrairement à l'opinion générale qui prévalait au moment où cette étude fut commencée, selon laquelle tous les objets anciens en

alliage de cuivre sont faits en bronze, on montre au contraire qu'une grande variété d'alliages fut employée; leur composition, et donc les propriétés de l'alliage, sont liées au type de fibule ainsi qu'à leur décor. L'association de certaines techniques productives et décoratives avec des types de fibules particuliers suggère la localisation géographique de certains ateliers.

Les 445 fibules conservées de Richborough sont cataloguées, avec les informations disponibles sur les fibules aujourd'hui perdues. La classification typologique suit, avec quelques modifications, le système de M R Hull. Un exposé des principaux types de fibules trouvés en Bretagne romaine, y compris les types non représentés à Richborough, montre jusqu'à quel point les méthodes d'étude typologique traditionnelles peuvent être mises en relation avec les données technologiques. L'ouvrage comporte également des listes de parallèles typologiques, dont la répartition en Bretagne est illustrée par des cartes de répartition.

TRADUCTION: MICHEL FEUGÈRE

ZUSAMMENFASSUNG

Die Ausleihe der Metallobjekte des Richborough Site Museum an das Ancient Monuments Laboratory Anfang der 1970er Jahre bot die Gelegenheit, die Fibeln als zusammenhängende Gruppe zu studieren: sowohl mit traditionellen typologischen Methoden als auch mit naturwissenschaftlichen Methoden, die bis dahin noch nicht systematisch auf Funde dieser Art angewandt worden waren. Die ersten Ergebnisse zeigten signifikante Korrelationen zwischen Typologie, Metallzusammensetzung und Art der Dekoration. Daraufhin wurde die Studie auf Fibeln von anderen Fundorten ausgedehnt, so dass am Ende rund 3500 Fibeln untersucht und analysiert wurden. Der vollständige Datensatz wird hier vorgestellt, und generelle Ergebnisse zusammengefasst und diskutiert.

Die Herstellung der Fibeln und ihre Verzierungstechniken werden im Detail dargestellt; dies führt zu neuen Erkenntnissen bezüglich der Herstellungsprozesse und der römischen Metallindustrie insgesamt. Im Gegensatz zu der damals vorherrschenden Annahme, dass praktisch alle antiken Kupferobjekte aus Bronze

bestehen, konnte gezeigt werden, dass eine Reihe unterschiedlicher Legierungen verwendet wurde, und dass die Zusammensetzung und daher auch die Eigenschaften der Legierungen mit Fibeltypen und Verzierungen korrelieren. Die Kombination bestimmter Herstellungs- und Verzierungstechniken mit definierten Fibeltypen erlaubt eine geographische Zuordnung der jeweiligen Werkstätten.

Die 445 existierenden Fibeln von Richborough sind katalogisiert, zusammen mit allen bekannten Details der zwischenzeitlich verlorenen Funde. Ihre Klassifizierung folgt einem modifizierten System von M R Hull. Eine schematische Darstellung der Romano-Britischen Fibeln einschliesslich der Typen, die nicht in Richborough vertreten sind, zeigt wie klassische typologische Studien mit technologischen Befunden kombiniert werden können. Ausführliche Listen typologischer Parallelen und eine Reihe von Verbreitungskarten der Fibeln in Grossbritannien schliessen den Band ab.

ÜBERSETZUNG: THILO REHREN

CHAPTER 1

INTRODUCTION

The large-scale excavations that took place at Richborough between 1922 and 1938 were published in five volumes of Society of Antiquaries Research Reports: Bushe-Fox 1926, 1928, 1932, 1949, and Cunliffe 1968. About 220 Romano-British brooches were included in these volumes: those considered most important from each successive excavation campaign. When the metal objects in the site museum were brought to the Ancient Monuments Laboratory for conservation in the early 1970s it was discovered that there were over 440 brooches, not counting fragments and loose pins. It was decided to take the opportunity to study these as a group, both by the traditional typological method and by scientific methods, which had not yet been applied systematically to this material.

At the time of excavation the brooches were ‘cleaned’ rather than conserved; the main method used appears to have been stripping in acids to remove corrosion products. Many of these stripped brooches were then ‘restored’ with plastic wood and painted green to give an ‘authentic’ patina. The conservation methods used in the 1970s were also chemical ones, which would not be used today. The green paint was removed using acetone. Most of the brooches were then electrolytically reduced in a dilute alkaline solution, washed, stabilized with benzotriazole, and then lacquered. In some cases this treatment removed deposits produced by the original cleaning, leading to the development of the pock-marked surfaces visible on some of the drawings. In a few cases copper was redeposited on the surface of the brooches from the electrolytic bath. Recent reassessment of the collection showed that the majority of the brooches were stable though a few had signs of active bronze disease and

required further stabilization. Few retain their original patinated surfaces.

The present study of the Richborough brooches has determined their chemical composition. Chapter 2 provides an introduction to copper alloy metallurgy and nomenclature, an outline of the analytical methods used and an explanation of the presentation of the data. Chapter 3 discusses the methods of brooch production and decoration, and the archaeological evidence for these from Britain and the continent. This study illustrates the range of raw materials and manufacturing methods employed by late Iron Age and Roman craftsmen. These techniques were common to many contemporary small copper alloy objects and the principles outlined here can be applied to the study of most metal finds of both Roman and medieval date. Some features are clearly visible but other information can only be obtained by microscopic examination or chemical analysis.

The results have been compared with those of over 3,000 brooches from other sites (data presented in Appendix 1, see CD and editorial note) and used to provide new information on the processes of manufacture and the nature of the metalworking industry in the Roman period. Contrary to the assumption that all ancient copper alloy objects were made of bronze it is shown that a range of alloys was employed and that there is a positive correlation between alloy and type of brooch. Evidently alloys were selected carefully for their known properties, such as the gold-like appearance of brass or the ease of casting of leaded bronze. The association of certain manufacturing and decorative techniques with certain types of brooch can suggest the geographical location of workshops.

The Richborough brooches are catalogued in Chapter 4 where an outline description of each is given, including the alloy identification. All the brooches in the collection are illustrated by new drawings. Inevitably the passage of time since excavation has had some detrimental effects on the collection. A few brooches have disappeared and for these outline information from the excavation reports or original small finds registers has been included in Appendix 4. Brooches that have been published but are now lost are referenced in this volume as 'A00' (see Table 25, Appendix 4, for a complete list). Rather more have deteriorated in storage, and here reference has been made to the earlier more complete drawings and descriptions.

In the catalogue the brooches are classified by type, using a modification of the system employed by M R Hull in his corpus (forthcoming), of which an outline is given in Appendix 2. The typology is summarized below and discussed further in Chapter 5, which also gives an outline of the main types found in Roman Britain generally, including those not represented at Richborough, in order to show how this traditional method of study can be related to the technological evidence. The alloys used to make each brooch type are discussed and illustrated alongside the typological discussion. Appendix 3 supplements this discussion through lists of British and continental parallels for the Richborough brooches, providing a general pattern of distribution and excavation details or publication references for each example; British site information includes four-figure National Grid references.

The nature of the excavations at Richborough – involving the clearance of large areas without detailed recording – does not allow closed site contexts to be ascribed to many of the brooches. Nor are brooches themselves usually susceptible of close dating: they are more durable than pottery and less closely related to historical events than coins, while individual specimens are known to have survived for long periods in use or as 'heirlooms', as can be seen when they are found on sites newly occupied at a much later date than that of their manufacture. But they are common and have distinctive features allowing many of them to be grouped into well-defined types, and these can sometimes be dated fairly closely when they appear frequently in a limited chronological context. This is usually only possible with types in general use, but even those with a more local distribution can sometimes be dated approximately by the adoption of features from the main types.

Since brooches can only be 'dated' in these rather broad terms the chronology of Richborough will not be reconsidered in detail here. The standard account is given

by Cunliffe (1968); subsequent studies have suggested some modification of dates (see for example, Johnson 1970; Johnston 1977; Maxfield 1989) and the review of all the excavated material undertaken by Malcolm Lyne in 1993 will undoubtedly produce further adjustments; his dating for the deposit in which each brooch was found is included in the catalogue entries (Chapter 4). However, the differences suggested so far in dating the main phases are not usually so great as to alter the sort of chronological conclusions which can properly be reached in the study of brooches (Chapter 6).

The interpretation of the nature of the occupation in the main phases does have rather more significance for our material. There can be no doubt that the first substantial occupation was military, when Richborough was a bridgehead for the Roman invasion (see Frere and Fulford 2001 for a discussion of the evidence) and then a supply base for the army as it began the conquest of Britain. Nor is there much doubt of the continuance of a major stores base until the late first century, with all that this implies in trade and other communication between Britain and the continent. The nature of the civilian occupation in the second and early third centuries is rather more doubtful and is discussed further in relation to the brooches found, which indicate continued connections with the continent. By the third century there is renewed military activity and because of the number of brooches which can be paralleled in the German frontier forts they may contribute to discussion of its dating and nature: whether as a base for naval or land units, or whether as an administrative centre for part of the reorganized army in Britain.

By the fourth century Richborough was part of an official system of coastal stations: it is identified in the *Notitia Dignitatum* as a fort under the command of the Count of the Saxon Shore, but although this document probably dates to the early fifth century the surviving stone fort is dated archaeologically to the later third century. In the mid-fourth century there are recorded landings of military expeditions under Lupicinus and Count Theodosius and there are ample archaeological grounds for supposing that Richborough was one of the last bases of Roman power in Britain to be abandoned.

Although the excavations from which the brooches came were in the area showing these military phases, there was important civilian occupation of the wider settlement during the Roman period and this must have contributed to the range of brooches found. Recent geophysical surveys (Martin 2001) have demonstrated the extent of the settlement beyond the area excavated by Bushe-Fox, and a new project is developing which aims to understand

both the nature of this settlement and the ancient topography of the surrounding area (Wilmott 2002). However, it is already clear from the continental and North British brooch types present that, even in the period when there was no military base, there was continued activity through the port and up the major road connections.

The history of Richborough as known from the few ancient references and from excavations to date might result in an over-emphasis on the military use of brooches in the Roman period. Whilst they are known to have been used for fastening the military cloak it is clear (for example, from tomb sculptures and grave-furniture) that they were also generally worn by civilians: both men and women. In Britain brooches were worn by the pre-Roman inhabitants and during the first and second centuries AD they are commonly found on both romanized and native non-military sites. Then fashion

seems to have changed and they are not as abundant on civil sites in the third and fourth centuries; but types known from late Roman military sites are still found in civilian contexts. These topics are further discussed in Chapters 5 and 6, along with the distribution of parallels to the Richborough brooches and the indications they may provide, for each period, of the official, military, or trade connections of the site.

The Richborough collection provides an exceptionally good range of the brooches found in Romano-British contexts but there are of course some types that are not represented. For the discussion of those and of more general considerations the authors have studied the brooches included in Hull's corpus and more recent finds, a total of some 10,000. It is suggested in Chapter 7 that conclusions of interest for the study of Roman technology and of Roman Britain can be drawn from this large body of material.

TYOLOGY

Although the emphasis of the present work is on the technological study of brooches, typology is still a necessary tool for ordering and comparing material. For succinct identification of the brooches analysed the type numbers from Rex Hull's Corpus of Ancient Brooches have been used. Only the first part on pre-Roman bow brooches has been published (Hull and Hawkes 1987), although it has already been used by others, for example, Nina Crummy's catalogue of the brooches from the Colchester excavations of 1971–9 (Crummy 1983) and Richard Hattatt's series of books on ancient brooches (Hattatt 1982, 1985, 1987, 1989). The main part of the corpus dealing with the Romano-British material was in preparation at the time of writing (Hull forthcoming).

A numbered sequence of types is misleading if it is taken to show chronological order. In general Hull put the earliest types first, but often different types are contemporary, while others have a long currency. This is

particularly true of plate brooches, which have a limited range of shapes; later versions can sometimes only be recognized by their decoration. For these reasons it will be found that strict typological order has not been followed either in cataloguing or in discussion.

Hull's typology is given in Appendix 2 and the authors' adaptation is summarized in Tables 1–3 below; this retains most of Hull's numbered types, but some bow brooch types have been grouped differently, while plate and penannular brooches have been newly grouped.

Type numbers are quoted in the form 'T1, T60' etc, penannular brooch types are prefixed 'P'. To identify a type where only the number is given see Appendix 2; Table 4 relates Hull type numbers to typological brooch groups. *Note that where groups are mentioned they are the groups defined in Tables 1–3 and not Hull's groups, which are defined in Appendix 2.*

Table 1 Concordance for typology of bow brooches

The main element of a bow brooch is a strip of metal, of varied shape, with the pin attached to one end (the 'head') either by a spring or a hinge. The point of the pin is held by a catchplate behind the other end (the 'foot'). A question mark denotes uncertainty.

<i>Brooch type</i>	<i>Hull type number</i>	<i>Catalogue number</i>
<i>One-piece sprung brooches</i> (Figures 37–47, 107, 111)		
La Tène I	T1	
Nauheim type	T9	
Simple one-piece or 'Nauheim derivative' brooches	T10, T11, T12	Cat 1–30
Other simple one-piece types	T18–20	
Pseudo-La Tène II	T3C	Cat 32–34
Eye brooch	T40	Cat 35
Knickfibel	T42	Cat 36–38
Kräftig-profilierete type	T84	Cat 39–42
Anchor type	T86	
Flügelfibel	T87	(?) Cat 43
Birdlip type	T88	
Simple Gallic	T89	Cat 44–45
Colchester type	T90–91	Cat 46–67
see also Appendix 2 for	T43–44, T85	
<i>Brooches with spring in cylindrical cover</i> (Figures 49, 113)		
Langton Down type	T21	
Nertomarus	T22A	Cat 72
Rosette or thistle type	T25–27	Cat 73
see also Appendix 2 for	T23–24, T28, T29A	
<i>The Hook Norton and related types</i> (Figure 115)		
Hook Norton or Aesica type	T37	
see also Appendix 2 for	T31, T33–35, T38	
<i>Early hinged brooches</i> (Figures 50–59, 61, 116, 119)		
Aucissa type	T51	Cat 74–92, A1–2
Bagendon type	T52	Cat 93–94
Hod Hill series	T60–79	Cat 95–153, A3
Strip-bow brooches	T13–17, T53–59	Cat 159
see also Appendix 2 for	T30, T45–50, T80–82	
<i>Colchester-derivative brooches</i> (Figures 62–70, 127)		
Two-piece Colchester type	T92–93	Cat 160–201, A6
Dolphin, sprung	T94A	
Dolphin, hinged	T94B	Cat 206–207
Dolphin, deep notches in bow	T94C	
Toothed edge	T144	

<i>Brooch type</i>	<i>Hull type number</i>	<i>Catalogue number</i>
<i>Applied hook brooches</i> (Figure 126)	T112–117	
<i>Polden Hill brooches</i> (Figures 71–72, 128)		
Light T-shaped	T95–98, T102–103	Cat 208–210
Heavier, with short thick crossbar	T99–101	Cat 211–215
<i>Trumpet-headed brooches</i> (Figures 73, 130)		
Trumpet A	T153C, T158A	Cat 216–217
Ai)	T158B	
Aii)	T158C	Cat 218
Trumpet B	T153D, T158D–F	Cat 219
Trumpet C	T154A–B, T155, T159	Cat 220
Trumpet D	T153A–B, T156, T157A–F	Cat 221
see also Appendix 2 for	T169–70	
<i>T-shaped brooches, usually hinged</i> (Figures 74, 127)		
Initial series (south-western)	T104, T118, T121B, T123–125, T130–131, T133–137	
Untypical		Cat 223–224
With moulded waist and fan-tail foot, hinged	T29B	
<i>Headstud brooches</i> (Figures 76–77, 135–136)		
Headstud fore-runners	T143, T145	Cat 225–227
Kinvaston type	T147	
Lamberton Moor type with loose headloop	T148	Cat 228, A8
Lamberton Moor type with fixed headloop	T149	Cat 229–231
<i>Developed T-shaped brooches</i> (Figures 78, 138, 140)		
South-western	T105–111, T119–120, T122, T126–129, T132, T141–142	
Large south-western, with little decoration	T138–140	
Thealby Mine type	T146	Cat 234
<i>Trumpet-headed brooches with expanded decoration on bow</i> (Figures 79, 143)		
Alcester type	T162	Cat 235
Disc on bow, moulded foot	T166	Cat 236–237
Peltate plate on bow	T167	
Winged plate on bow	T168	

<i>Brooch type</i>	<i>Hull type number</i>	<i>Catalogue number</i>
<i>Various brooches related to trumpet-headed and/or headstud series</i> (Figures 79, 142–143)		
'Celtic fan-tailed', with fixed headloop	T36	Cat 238
Neath type	T150	
Wroxeter type	T151	
Prestatyn type	T152	
Large headplate, mouldings on centre bow	T160–161	
Triangular foot and large disc on bow	T163	
Triangular foot and small disc or plate on bow	T164	
see also Appendix 2 for	T169–170	
<i>Enamelled continental brooches with tubular hinge-cover and expanded decoration on bow</i> (Figure 60)		
Hod Hill derivatives	T180	Cat 154–158
Rectangular plate on bow and astragaloid foot	T181	
Geometric plate on bow	T182–183	
<i>Knee brooches</i> (Figures 80, 154)		
Semi-circular headplate, spring between lugs, lengthways catchplate	T171	
Semi-circular headplate, spring on single lug, short catchplate	T172	
Cylindrical head, lengthways catchplate	T173	
Broad bow with S-profile, semi-circular headplate	T174	
Broad bow with S-profile, cylindrical head	T175A	Cat 240
Divided bow with S-profile	T175B	
Bow of rectangular section, cylindrical head	T176	Cat 241–243
Rectangular profile, transverse catchplate	T177	
Divided bow with straight profile	T179	
Pseudo-bow	T178	Cat 245–246
<i>Sheath-footed, P-profiled sprung brooches</i> (Figures 81–83, 157)		
Spring in cylinder		
a) Knobbed plate on upper bow	T185	Cat 247
b) Narrow upper bow	T186	Cat 248–250
c) Divided upper bow	T187	Cat 251–257
Spring on lug, divided upper bow	T189	Cat 258–267
Spring on lug, undivided bow		Cat 268
<i>Sheath-footed, P-profiled hinged brooches: Crossbow series</i> (Figures 84–92, 158)		
Knob on or near head, usually without knobs on ends of crossbar	T191A	Cat 269–278
Small knobs on head and ends of crossbar	T190	Cat 279–287
Knobs on bow and ends of crossbar, bow heavy and moulded	T191B	Cat 288–316, A9
Developed	T192	Cat 317–336, A10
see also Appendix 2 for	T193–195, T197–198	
<i>Armbrustfibeln</i> (Figure 93)		
No crossbar, spring held by a cast loop behind bow	T196	Cat 338

Table 2 Concordance for typology of plate brooches

'Plate' brooches here include disc brooches, and any type where the pin attachment is clearly at the back of and covered by a decorative plate. The use below of an asterisk denotes that the brooch type includes only some of the brooches grouped within that Hull type.

<i>Brooch type</i>	<i>Hull type number</i>	<i>Catalogue number</i>
<i>Early plate brooches</i> (Figures 94–95, 121)		
Central glass setting	T224	Cat 340–341
Flat, cruciform with circular central motif	T225	Cat 342–345
Disc with looped attachments	T242A	Cat 346–347
In form of rosette bow brooch	T238	Cat 348–349
Crescent-shaped	T235	
Various shapes, riveted and engraved decoration	T239	
Wheel-shaped with four 'spokes'	T266B*	
<i>Disc brooches with concentric mouldings</i>	T248*	
<i>S-shaped brooches</i> (Figure 96)		
Dragonesque, enamelled	T200	Cat 350
Plain	T201	
Wire	T202	
<i>Zoomorphic brooches</i> (Figures 96, 150)		
Animal in outline and with some relief, enamel in small cells	T203*, T208*, T211*	Cat 351–353
Flat, enamel in small cells	T222, T223*	
Flat, enamel in large cells, some juxtaposed	T205*, T206–207, T208–209*, T210, T211*, T212, T223*	
Three-dimensional bird brooches with enamel in crescentic cells	T213–214	
Three-dimensional brooches, no enamel		Cat 354–355
Other bird brooches, flat except heads	T217–220	
Horse, flat, enamelled in standard pattern	T205*	
Horse and rider, enamelled	T204	
Fly	T221	
<i>Miscellaneous representational plate brooches</i>		
Fusiform	T273	
Axe- and dagger-shaped	T274	
Shoe-sole-shaped	T275	
Shield-shaped	T277–278	
<i>Enamelled peltate and crescent-shaped brooches</i> see Appendix 2 for	T236–237	

<i>Brooch type</i>	<i>Hull type number</i>	<i>Catalogue number</i>
<i>Openwork brooches</i> (Figure 96)		
Pelta-shaped with attached bar holding transverse catchplate	T241	Cat 356
Quatrefoil	T245	
Lozenge or disc with irregular cutouts	T246	
Irregular curvilinear shapes	T247	
Swastika	T276	
<i>Continental symmetrical plate brooches, usually enamelled, pin usually hinged between two lugs</i> (Figures 97, 152)		
Wide arched plate between two matching terminals	T229	Cat 357
Equal-ended, square, oval or round plate between horizontal bars	T230	Cat 358–359
Equal-ended, rectangular plate with lugs	T231	Cat 360, Cat 367(?)
Equal-ended, narrow rectangular plate at right angle across centre	T232	Cat 361
Equal-ended, rectangular plate	T233	Cat 362
Equal-ended, raised central disc, projections incorporating lunettes	T234	Cat 363
Flat lozenge-shaped, with no lugs	T226	
Lozenge, round, square or rhomboid, with projections at corners	T227	Cat 364
Lozenge, round, square or rhomboid, with zoomorphic lugs	T228	Cat 365–366
With frilled edges	T240	
<i>Continental disc brooches with complex enamel, pin usually hinged between two lugs</i> (Figures 98, 152)		
Concentric rings with millefiori, enamelled central stud, small loop over hinge	T250	Cat 369
Flat disc filled with millefiori enamel	T256	Cat 370–371
Other discs, with or without central stud and/or peripheral lugs; some have wheel-like spokes, raised central disc or open centre	T257B*, T258*, T262–263*, T265, T266*, T279*	
<i>Applied repoussé plate</i> (Figure 98)		
Disc, various designs on applied plate	T249	Cat 373–376
<i>Disc brooches with raised centre and peripheral lugs ('buckler'), hinged</i> (Figure 98)		
	T269	Cat 377
<i>British enamelled umbonate brooches, hinged</i> (Figures 99, 148)		
Outer ring of enamel cells, usually crescentic, central rosette	T268	Cat 379–381
Similar to T268 but with toilet implements	T199	
Concentric rings of small triangular enamel cells	T267	Cat 382–383
<i>British flat disc brooches, enamel in large fields, usually sprung</i> (Figure 100)		
Small, various patterns of decoration	T252–255	Cat 384–385, A11–12
Oval, sometimes with central stone or intaglio, outer band of enamel usually juxtaposed	T260	Cat 386–387
Large discs with concentric enamelled rings the outer band has a ring of reserved metal spots, no lugs on rim	T257A	

<i>Brooch type</i>	<i>Hull type number</i>	<i>Catalogue number</i>
<i>Flat disc brooches, enamelled in large fields, usually sprung</i>		
Six small rings of reserved metal surrounding central ring	T259	
Six semi-circles of reserved metal surrounding central ring	T264	
<i>Gilded disc brooches with central glass setting (Figure 101)</i>		
Circular	T270	Cat 388–390
Oval	T271	

Table 3 Concordance for typology of penannular brooches

The pin is longer than the diameter of the incomplete ring on which it is hinged. The brooch was fastened by drawing the pin (with a fold of fabric) through the gap in the ring. They are classified mainly by the decorative treatment of the terminals of the ring, see Chapter 5. Hull's type numbers are prefixed by 'P'.

<i>Brooch type</i>	<i>Hull type number</i>	<i>Catalogue number</i>
<i>Plain terminals</i>	P1	
<i>Terminals coiled or bent back in same plane as ring, Fowler 1960 type B (Figure 102)</i>		
Omega type	P11	Cat 391
Coiled terminals	P2	Cat 392
<i>Terminals coiled back at right angle to ring, Fowler 1960 type C (Figure 102)</i>		
Ends of ring flattened and coiled back	P3	Cat 393–415, A13–14
Ends of ring drawn out as wire and twisted back	P10	
<i>Terminals turned back over ring and flattened, Fowler 1960 type D (Figure 103)</i>		Cat 416–427
	P4	
Zoomorphic terminals	P5	
<i>Knobbed terminals, Fowler 1960 type A (Figure 104)</i>		
Various patterns	P6, P7, P9	Cat 428–431
<i>Flat discoid terminals</i>	P8	
<i>Terminals rectangular, extended above ring</i>	P12	

Table 4 Hull type numbers cross-referenced to groups in Tables 1–3

BOW BROOCHES

<i>Type number</i>	<i>Typological group</i>	<i>Type number</i>	<i>Typological group</i>
T1	One-piece sprung	T122	Developed T-shaped
T3	One-piece sprung	T123–125	T-shaped
T9–12	One-piece sprung	T126–129	Developed T-shaped
T13–17	Early hinged	T130–131	T-shaped
T18–20	One-piece sprung	T132	Developed T-shaped
T21–22	Spring in cylindrical cover	T133–137	T-shaped
T23–24	Spring in cylindrical cover	T138–140	Developed T-shaped
T25–28	Spring in cylindrical cover	T141–142	Developed T-shaped
T29A	Spring in cylindrical cover	T144	Colchester-derivative
T29B	T-shaped	T143, T145	Headstud fore-runners
T30	Early hinged	T146	Developed T-shaped
T31	Hook Norton and related types	T147–149	Headstud
T33–35	Hook Norton and related types	T150–152	Related to trumpet-headed and/or headstud series
T36	Related to trumpet-headed and headstud series	T153–159	Trumpet-headed
T37–38	Hook Norton and related types	T160–161	Related to trumpet-headed and/or headstud series
T40	One-piece sprung	T162	Trumpet-headed with expanded decoration on bow
T42	One-piece sprung	T163–164	Related to trumpet-headed and/or headstud series
T43–44	One-piece sprung	T166–168	Trumpet-headed with expanded decoration on bow
T45–50	Early hinged	T169–170	Related to trumpet-headed and/or headstud series
T51–52	Early hinged	T171–179	Knee brooches
T53–59	Early hinged	T180–183	Tubular hinge-cover with expanded decoration on bow (continental)
T60–79	Early hinged	T185–189	Sheath-footed, P-profiled, sprung
T80–83	Early hinged	T190–192	Crossbow: sheath-footed, P-profiled, hinged
T84–91	One-piece sprung	T193–195	Sheath-footed
T92–94	Colchester-derivative	T196	Armbrustfibeln
T95–103	Polden Hill	T197–198	Sheath-footed
T104	T-shaped		
T105–111	Developed T-shaped		
T112–117	Applied hook		
T118	T-shaped		
T119–120	Developed T-shaped		
T121	T-shaped		

Table 4 Hull type numbers cross-referenced to groups in Tables 1–3 (continued)

PLATE BROOCHES

<i>Type number</i>	<i>Typological group</i>	<i>Type number</i>	<i>Typological group</i>
T199	Umbonate, enamelled	T256	Disc, hinged
T200–202	S-shaped	T257A	Flat discs, enamelled
T203–223	Zoomorphic	T257B–258	Discs, hinged
T224–225	Early plate	T259	Flat discs, enamelled
T226–234	Symmetrical plate	T260	Flat discs, enamelled
T235	Early plate	T262–263	Discs, hinged
T236–237	Enamelled pelta and crescent shapes	T264	Flat discs, enamelled
T238–239	Early plate	T265–266A	Discs, hinged
T240	Symmetrical plate	T266B	Early plate and discs, hinged
T241	Openwork	T267–268	Umbonate, enamelled
T242	Early plate	T269	Buckler
T245–247	Openwork	T270–271	Gilded discs with central glass setting
T248	Disc with concentric mouldings	T273–275	Miscellaneous representational
T249	Applied repoussé plate	T276	Openwork
T250	Discs, hinged	T277–278	Miscellaneous representational
T252–255	Flat discs, enamelled	T279	Discs, hinged

PENANNULAR BROOCHES

<i>Type number</i>	<i>Typological group</i>	<i>Type number</i>	<i>Typological group</i>
P1	Plain terminals	P8	Flat discoid terminals
P2	Terminals turned back in same plane as ring	P9	Knobbed terminals
P3	Terminals coiled back at right angle to ring	P10	Terminals coiled back at right angle to ring
P4	Terminals turned back over ring	P11	Terminals turned back in same plane as ring
P5	Zoomorphic terminals	P12	Terminals rectangular, extended above ring
P6–7	Knobbed terminals		

CHAPTER 2

METALLURGY AND ANALYTICAL METHODS

Having introduced the typology used in this work, the next essential is to discuss the metals used to make late Iron Age and Roman brooches – effectively a typology of materials.

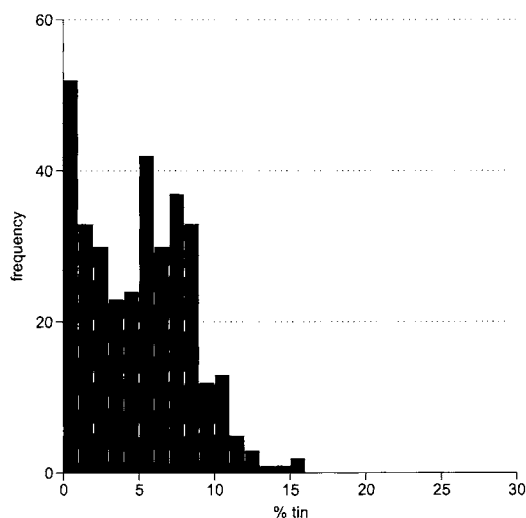
From the Bronze Age onwards copper was seldom used on its own but was deliberately or accidentally mixed with one or more other metals to produce a range of alloys with varied properties. In the past archaeologists have tended to refer to all these copper alloys as ‘bronze’, but with the advent of widespread compositional analysis this has been found to be misleading as only a proportion of copper alloy objects are truly bronze, that is, an alloy of copper and tin.

The composition of a particular object can be precisely defined by quantitative chemical analysis, which identifies the percentage of each element present. An alternative approach is qualitative analysis, which also identifies the elements present, but not the exact amounts. As with any other classification, the data provided by either type of compositional analysis is only a first step and in order that the information may be used it is necessary to develop a terminology which identifies similar compositions and groups them together, with each group given a name that uniquely identifies it. It is with the choice of where to draw the lines between the different groups and the names to call them that the difficulties begin, as at present there is no single accepted terminology for many of the alloys that were used in antiquity.

ALLOY COMPOSITION

In the late Iron Age and Roman period copper alloys contained deliberate additions of one or more of the

elements tin, zinc and lead. Low levels of other elements were also present but they were accidental inclusions that have not been considered in this study. Small amounts of the three alloying elements deriving from mixed metal ores or from recycled scrap metal may also be accidental inclusions. Copper, tin and lead were known to the Romans as metals, so alloys could be made by melting the copper and adding the tin and/or lead (which have much lower melting points) to it in any proportions. Zinc metal can only be produced by distillation and so was not generally known in the West

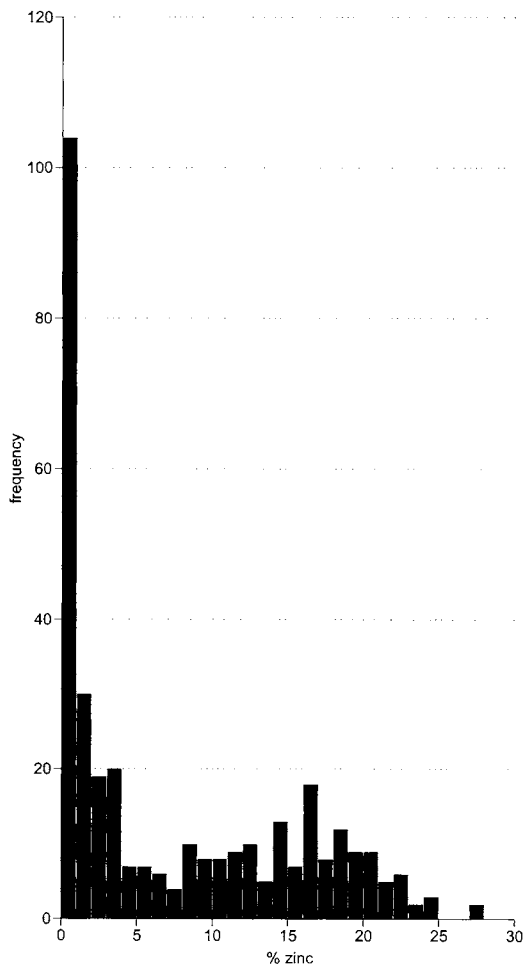


1 *Frequency histogram showing the tin content of the quantitatively analysed brooches from Richborough*

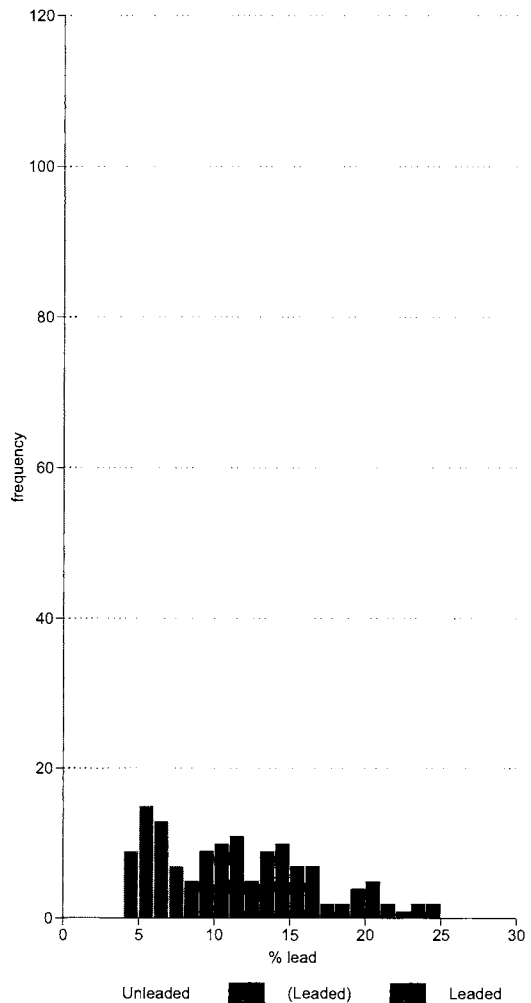
in antiquity; however, its use as an alloying element had been known from the mid-first millennium BC (Bayley 1990). Brass was made by the cementation process: by heating copper metal with zinc ores in sealed crucibles; the maximum zinc content that it is possible to obtain in the resulting alloy is just under 30 per cent (ibid).

In defining a nomenclature it is only the deliberate additions that need be considered, as the craftsman making or using the alloy would have been ignorant of the nature, and probably even presence, of most of the minor and trace elements. These impurities would only have been noticed when they adversely affected the properties of the alloy; their presence was most likely to be recorded as low-quality metal rather than as a different type of alloy. Slight variations in composition are also not important as they would not have been detectable by the craftsman making or working the metal.

The craftsmen of antiquity had no means of performing elemental analyses as we do today but they usually had a good idea of the composition of their raw materials. They would have relied on the properties of the alloys, their colour, hardness, malleability and ductility, all of which would have indicated to a trained eye the nature of the metal. Some alloys such as those with high levels of lead were well suited to casting, while others that were low in lead could also be wrought (hammered to shape). Scrap metal from broken or discarded objects must have been carefully sorted before it was recycled as the analyses of both brooches and other objects (Bayley 1994) show that distinct alloys were maintained, that is, unwanted mixing was



2 *Frequency histogram showing the zinc content of the quantitatively analysed brooches from Richborough*



3 *Frequency histogram showing the lead content of the quantitatively analysed brooches from Richborough*

largely avoided, at least in the first century. There were some changes in the compositions of the alloys used in later centuries.

Roman copper alloys have zinc contents of up to nearly 30 per cent, tin contents mainly under 15 per cent (though some mirrors contain up to 25 per cent tin) and lead levels that go up to around 25 per cent. Occasionally alloys outside this range are found, but not in the form of usable objects (for example, Craddock 1987). Figures 1–3 show the range of tin, zinc and lead contents of the Richborough brooches.

ALLOY NAMES

The above discussion indicates that the names given to copper alloys have to reflect the varying amounts of zinc, tin and lead present in them. The alloy names are not important in themselves but provide a convenient shorthand when discussing metals of different compositions. Qualitative analyses cannot, by definition, provide a specific composition but only an indication of

a more general alloy type so in these cases the use of alloy names is essential, not just a convenience.

The Latin alloy names used in Roman literary sources are not clearly and unambiguously defined, though Craddock (1988) has attempted to unravel Pliny's usage. Rather than use ancient terms where the correlation with composition is not always certain, modern metallurgical terminology has been used here, although there are still problems as not all the alloys of antiquity are in current use and some extrapolations are thus necessary.

Copper-tin alloys are called bronzes and copper-zinc alloys brasses (but note some modern brasses contain far higher zinc levels than any ancient brass). Gunmetal is strictly a bronze with a few per cent of zinc added, but this definition has been stretched to include all mixed alloys with significant amounts of both zinc and tin. Leaded alloys are those that also contain more than a few per cent of lead. In modern practice the very high lead contents found in some antiquities are not normally used. There is no modern equivalent to the copper-lead alloys that are occasionally found, but

Table 5 Compositional boundaries assigned to alloy names

<i>Alloy name</i>	<i>Zinc:tin ratio</i>	<i>Absolute values of alloying elements</i>	
Brass	$Zn > 4Sn$	$Zn \geq 8\%$	Key: Zn = zinc Sn = tin Pb = lead > = greater than ≥ = greater than or equal to < = less than ≤ = less than or equal to
Brass/gunmetal	$2.5Sn < Zn \leq 4Sn$	$Zn \geq 8\%$ or $Sn \geq 3\%$	
Gunmetal	$0.67Sn < Zn \leq 2.5Sn$	$Sn \geq 3\%$	
Bronze/gunmetal	$0.33Sn < Zn \leq 0.67Sn$	$Sn \geq 3\%$	
Bronze	$Sn \geq 3Zn$	$Sn \geq 3\%$	
Copper		$Zn < 3\%$ and $Sn < 3\%$	
Copper/brass		$3\% \leq Zn < 8\%$ and $Sn < 3\%$	
Leaded alloys		$Pb > 8\%$	
(Leaded) alloys		$8\% \geq Pb \geq 4\%$	

Table 6 Alloy frequency for all brooches in Appendix 1

<i>Alloy name</i>	<i>Unleaded</i>	<i>(Leaded)</i>	<i>Leaded</i>	<i>Total</i>	
Brass	1129	19	2	1150	
Brass/gunmetal	110	14	3	127	
Gunmetal	221	45	110	376	
Bronze/gunmetal	104	24	67	195	
Bronze	703	168	636	1507	
Copper*	31	1	1	33	
Copper/brass	11	0	0	11	* 'copper' includes qualitative analyses identified as 'copper/bronze' in Appendix 1
Silver	14	0	0	14	
Other				12	
Total	2335	271	819	3425	

leaded copper is an appropriate and unambiguous term indicating copper with added lead in the same way that leaded bronze indicates bronze containing lead. The range of compositions covered by each alloy name is shown in Table 5. For a discussion of why these boundaries were selected, see the section below on analytical methods.

Not all these alloys were used equally in making Roman brooches. Table 6 shows the number of brooches that have been assigned to each alloy name. The largest single group is the brasses, 32.9 per cent of all analysed brooches, followed by unleaded and leaded bronzes (20.5 per cent and 18.6 per cent respectively). There are far fewer gunmetals (6.4 per cent) and all other alloys are each under 5 per cent of the total. Qualitative analyses have generally not been subdivided so finely as quantitative ones because of the uncertainties associated with the method; in these cases a mixed name denotes uncertainty rather than an intermediate composition (see the section on analytical methods, below, for further details). Note that Tables 7–9, the bar charts in Chapter 5 and Figure 180 divide the alloys into only six groups; brass/gunmetals are combined with brasses and bronze/gunmetals with bronzes, and (leaded) and leaded alloys are combined and called leaded, while the ‘other’ category includes leaded brasses, copper, copper/brass and silver.

ALLOY PROPERTIES

Modern metallurgy describes and explains the properties of metals and alloys in terms of their crystal structures and how these react to applied forces. It provides objective numerical measures of physical properties, which can be used to gauge the suitability of different alloys for particular uses. Rolleson (1973), for instance, discusses this in a simple and accessible way, as does Scott (1991), who mentions only alloys used in antiquity.

Pure copper is not a very suitable metal for most applications as it is soft and has low tensile strength. However, it is malleable, ductile and hardens only slowly as it is worked and hence has a high working capacity and elongation. Trace levels of impurities such as copper oxide, lead or antimony severely affect its working properties.

Alloying other metals with copper greatly improves its mechanical properties, but these depend not only on the chemical composition of the metal but also on its previous treatment. For wrought alloys the degree of working, the temperature at which this was carried out and any subsequent annealing (reheating followed by

slow cooling) are important, while for a cast alloy the temperature at which the metal was poured and the size and type of the mould all affect its properties. Cold working was the sole method of hardening and strengthening copper alloys in antiquity.

All Roman brasses are solid solutions of copper and zinc and therefore have only a single phase present. Their properties thus tend to change only gradually with composition. They can be either wrought or cast with ease. Bronzes, on the other hand, are often multi-phase systems. This means that on a microscopic scale the metal has areas containing variable amounts of tin. This occurs because the wide temperature range over which solidification takes place promotes segregation. The properties of bronzes change more rapidly than those of brasses, but there are no sharp discontinuities. Because the high-tin phases are hard and brittle, bronzes with over 8 per cent tin have to be annealed at about 700°C for long enough to homogenize them before they can be cold worked (Kempster 1975). Many wrought bronze brooches have tin contents well over 8 per cent so this procedure was obviously well known to Iron Age and Roman craftsmen. Gunmetals are mixed alloys and therefore have some of the properties of both brasses and bronzes. If they have more than very low tin contents they will normally have more than one phase present unless they are well annealed. Zinc-rich leaded gunmetals are ‘good casting alloys capable of reproducing fine detail and largely used for ornamental purposes’ (Miller 1941).

Lead is almost completely insoluble in all copper alloys and so is always present as a separate phase, usually in the form of discrete droplets at grain boundaries or as thin inter-granular films. It has relatively little effect on the strength of the metal, but because of its distribution it has a profound effect on its other properties. There seems to be no consensus as to the levels of lead that can be tolerated in alloys that are to be worked. Up to 2 per cent of lead improves the machining qualities of the alloy, making it ‘free cutting’, so engraving removes small chips of metal rather than long turnings. Above this level lead reduces both the strength and ductility of the copper alloy. Parkins (1968) notes that attempts to deform leaded alloys produce inter-granular fracture and Law (1919, 111) agrees, saying that ‘copper or bronze containing ... [lead] cannot be worked to any appreciable extent’. Bailey (1932, 161), however, quotes Gowland as saying that ‘the tenacity of bronze is not seriously diminished by the presence of 5% lead’. More recent experiments by Staniaszek and Northover (1983) have shown that alloys with even higher lead contents than this can be rolled, but

the stresses imposed by forging are rather different so their conclusions should be treated with caution in considering which alloys could satisfactorily be wrought in antiquity. Certainly most wrought Roman brooches contain less than a few per cent of lead.

For some applications mixed alloys are preferable to binary ones. For instance up to 2 per cent of zinc in bronze acts as a deoxidant and makes the molten metal more fluid and so gives castings free from pinholes (which are formed by the release of dissolved gases during solidification); many Roman bronzes have zinc present at these low levels (see Figures 2 and 5). Above 2 per cent zinc, however, the colour of the bronze is altered and the alloy will be harder but weaker (Law 1919). Adding up to 2 per cent of lead to melts reduces viscosity, making it easier to fill a complex mould, but more lead than this just reduces the melting point (Craddock 1988). As lead is subject to gravity segregation the melt must be well stirred to avoid grossly inhomogeneous castings, though this is seldom a problem with small items such as brooches. Figure 3 shows that many Roman copper alloys, even those categorized as unleaded, contain enough lead to affect their working properties.

We can infer from the care with which brooches were decorated with added materials, that colour and colour contrasts were important to those wearing them. Different copper alloys have different colours and the changes in the common alloy used at any period may have had as much to do with fashion as with availability of supplies. Copper has a pinkish appearance, bronze is brown with higher tin contents giving paler colours, while brass is yellow; lead content has little effect on the colour of polished metal, though its presence may alter the colour of patinated surfaces. Silver is a white metal and retains its colour even when alloyed with major amounts of copper as was seen with Cat 337 which is over 60 per cent copper!

We do not know if brooches were polished. However, the very reduced relief and rounding of profiles found on some modern, highly polished objects such as brass name-plates is not normally seen which suggests this was not the way brooches were treated in antiquity. If they were not highly polished, their surfaces may have been allowed to develop a natural patina or could have been deliberately patinated and coloured by treating them with various chemicals, though post-burial corrosion will normally obscure this. Deliberate patination of copper alloys containing a few per cent of gold and/or silver has been noted for Roman objects other than brooches (Craddock 1982;

Craddock and Gumilia-Mair 1995) so the principle of colouring metals was known at this period. Hughes and Rowe (1982) provide examples of the whole range of colouring effects that may be obtained by deliberate patination. While not all the chemicals they employ were available in antiquity, at least some of the effects they illustrate would have been possible.

PATTERNS OF ALLOY USE

Tables 7–9 summarize the analytical data in Appendix 1 by brooch type (defined in Appendix 2), grouped as set out in Chapter 1. The intermediate compositions brass/gunmetal and bronze/gunmetal have been added to the brass and bronze totals respectively and the (leaded) and leaded alloys have been combined. Brooches without definite types and some types with only single analysed examples have been omitted.

Approximately 300 quantitative analyses of late Iron Age and Roman brooches found in Britain have been carried out by others. For some brooch types where the numbers analysed were low, additional published analytical data (Bateson and Hedges 1975; Cowell 1990; Dungworth 1995; Webster with Jones 1995; Northover 2000) was added to that in Appendix 1 when plotting Figures 181–183 and some of the figures in Chapter 5, where there is a detailed discussion of which alloys were used to make which types of brooch.

ANALYTICAL METHODS

Two main techniques were used to obtain the analytical results included in Appendix 1. Atomic absorption spectrophotometry (AAS) gave quantitative results for 1,018 brooches, while the remainder were analysed qualitatively using X-ray fluorescence (XRF). A few of this second group were later sampled and analysed quantitatively by XRF (Dungworth 1995) and these results have been included in Appendix 1.

ATOMIC ABSORPTION SPECTROPHOTOMETRY

The AAS analyses were carried out on a Pye Unicam SP 1900 double beam instrument using methods based on those described by Hughes *et al* (1976); full details are given by Bayley (1992). Samples of 10–20mg of metal were drilled from the back of each brooch, taking care to exclude any of the corroded surface, the metal was weighed, dissolved in aqua regia and the solution analysed.

The random errors in preparing the sample solutions were just over 2 per cent. When the calibration and other machine errors are included the overall precision

Table 7 Summary of analyses of bow brooches in Appendix 1, grouped as in Table 1

<i>Group</i>	<i>Hull Type</i>	<i>Bronze</i>	<i>Leaded bronze</i>	<i>Leaded gunmetal</i>	<i>Gunmetal</i>	<i>Brass</i>	<i>Other</i>	<i>Total</i>
One-piece	1	2	—	—	—	—	—	2
	9	18	—	—	—	1	—	19
	10–12	168	4	2	24	62	3	263
	18–20	10	1	—	—	—	—	11
	3C	4	1	—	—	4	—	9
	40	—	1	—	2	13	—	16
	42	—	—	—	—	6	—	6
	84	1	1	—	—	10	—	12
	87	—	—	—	—	2	—	2
	88	7	1	—	—	—	—	8
	89	—	—	—	—	23	—	23
	90–91	23	—	—	2	217	—	242
	43–44	—	—	—	—	4	—	4
85	—	—	—	1	—	—	1	
Cylindrical spring cover	21	—	—	—	5	62	1	68
	22A	—	—	—	—	5	—	5
	25–27	2	—	1	1	77	—	81
	23–24	—	—	—	—	4	1	5
	28	1	—	—	—	1	—	2
	29A	—	—	—	—	3	—	3
Hook Norton and related types	37	3	6	—	1	1	—	11
	35	1	1	—	—	—	—	2
	34, 38	—	1	—	—	—	—	1
Early hinged	51	—	—	—	5	64	—	69
	52	—	—	—	—	18	—	18
	60–79	30	4	2	26	210	—	272
	13–17	24	—	1	1	3	1	30
	53–59	5	1	—	—	14	—	20
	45–50	—	—	—	—	4	—	4
	80–81	1	—	—	1	2	—	4
Colchester-derivative	92–93	40	179	18	6	2	1	246
	94A	26	10	—	4	3	—	43
	94B	12	10	2	2	1	—	27
	94C	2	2	—	1	—	—	5
	144	—	6	—	—	—	—	6
Applied hook	112–117	—	—	—	1	6	—	7

ROMAN BROOCHES IN BRITAIN

<i>Group</i>	<i>Hull Type</i>	<i>Bronze</i>	<i>Leaded bronze</i>	<i>Leaded gunmetal</i>	<i>Gunmetal</i>	<i>Brass</i>	<i>Other</i>	<i>Total</i>
Polden Hill	95–98, 102–103	16	41	3	2	3	1	66
	99–101	4	27	2	2	3	–	38
Trumpet-headed	153C, 158A	5	1	2	2	18	3	31
	158B	–	1	–	–	–	–	1
	158C	5	–	–	2	7	2	16
	153D, 158D–F	–	15	–	–	–	–	15
	154A–B, 155, 159	1	22	1	–	–	–	24
	153A–B, 156, 157A–F	3	4	–	2	14	–	23
T-shaped	104, 118, 121B, 123– 125, 130–131, 133–137	8	60	4	1	–	–	73
	29B	–	3	1	1	1	–	6
Headstud	143, 145	–	8	–	1	4	2	15
	147	–	–	–	1	1	–	2
	148	4	2	4	6	26	1	43
	149	20	16	3	2	18	2	61
Developed T-shaped	105–111, 119–120, 122, 126–129, 132	6	74	1	–	–	–	81
	138–140	3	17	1	–	–	–	21
	146	2	4	–	2	–	–	8
Trumpet-headed plus	162	1	–	–	1	6	–	8
	166	2	2	1	3	3	3	14
	167	–	–	–	–	6	–	6
	168	–	1	–	1	5	–	7
Related to headstud and/or trumpet-headed	36	10	4	1	2	–	–	17
	151	2	5	–	–	1	1	9
	152	2	2	–	–	2	–	6
	160–161	1	1	–	–	–	–	2
	163	1	–	–	1	9	–	11
	164	1	2	–	2	1	–	6
Continental enamelled	180	–	–	5	–	4	2	11
	181	–	2	–	–	–	–	2
	182–183	–	–	3	1	7	1	12

<i>Group</i>	<i>Hull Type</i>	<i>Bronze</i>	<i>Leaded bronze</i>	<i>Leaded gunmetal</i>	<i>Gunmetal</i>	<i>Brass</i>	<i>Other</i>	<i>Total</i>
Knee	171	4	8	–	2	2	–	16
	172	–	1	–	–	–	–	1
	173A	–	–	–	4	14	–	18
	173B	3	10	1	–	1	–	15
	175A	–	5	–	–	–	–	5
	175B	–	3	–	–	–	–	3
	176	1	12	2	–	–	–	15
	177	–	3	–	–	–	–	3
	179	–	1	–	–	–	–	1
	178	1	4	3	–	–	–	8
Sheath-footed	185	1	1	–	–	1	–	3
	186	6	5	–	1	1	3	16
	187	–	8	3	2	4	2	19
	189	–	15	1	–	–	1	17
	189	–	1	–	–	–	–	1
Crossbow	191A	2	8	–	–	–	–	10
	190	9	10	2	1	–	–	22
	191B	4	21	4	1	3	2	35
	192	2	15	4	–	11	9	41
	193–195	–	–	–	–	–	2	2
Armbrustfibeln	196	–	–	–	–	1	–	1

Table 8 Summary of analyses of plate brooches in Appendix 1, grouped as in Table 2

<i>Group</i>	<i>Hull Type</i>	<i>Bronze</i>	<i>Leaded bronze</i>	<i>Leaded gunmetal</i>	<i>Gunmetal</i>	<i>Brass</i>	<i>Other</i>	<i>Total</i>
Early	224	1	–	1	–	5	2	9
	225	–	–	–	2	9	–	11
	242A	–	–	–	1	2	–	3
	238	1	1	–	–	6	–	8
	235	–	–	–	–	1	–	1
	239	1	–	–	–	–	–	1
	266B*	1	1	1	–	–	–	3
Disc: concentric moulding	248*	–	1	–	–	3	–	4
S-shaped	200	1	1	2	1	3	–	8
	201	–	–	–	1	–	–	1
	202	1	–	–	–	–	–	1

ROMAN BROOCHES IN BRITAIN

<i>Group</i>	<i>Hull Type</i>	<i>Bronze</i>	<i>Leaded bronze</i>	<i>Leaded gunmetal</i>	<i>Gunmetal</i>	<i>Brass</i>	<i>Other</i>	<i>Total</i>
Zoomorphic	203*, 208, 211*	—	—	2	2	1	1	6
	222, 223*	2	—	1	1	1	1	6
	205*, 206–207, 210, 211*, 212	2	3	2	1	1	—	9
	213–214	2	1	—	4	—	—	7
	203*	1	—	1	—	—	—	2
	217–220	—	2	1	1	1	—	5
	205*	2	1	—	—	—	—	3
	204	1	2	3	—	—	—	6
Representational	274	—	—	—	—	1	—	1
	275	1	5	3	—	2	—	11
	277–278	1	—	—	3	1	—	5
Peltate/crescentic	236–237	2	—	—	—	3	—	5
Openwork	241	—	1	—	—	—	—	1
	246	—	—	1	—	1	1	3
	247	1	1	—	—	—	—	2
Symmetrical: continental	229	—	—	—	—	6	1	7
	230	—	3	3	—	2	—	8
	231	—	3	3	2	1	—	9
	232	—	2	1	—	—	—	3
	233	—	—	1	1	—	—	2
	234	—	1	1	—	—	—	2
	226	—	3	—	1	1	2	7
	227	1	6	5	1	5	3	21
	228	—	1	1	—	3	2	7
240	—	—	—	—	1	—	1	
Disc: continental	250	—	—	2	—	1	—	3
	256	—	1	—	—	—	—	1
	257B*	1	4	—	—	—	—	5
	258*	—	—	—	—	1	—	1
	262*	—	—	—	1	3	—	4
	263*	—	2	1	—	3	—	6
	265*	—	—	—	—	1	—	1
	266A	1	2	—	1	2	—	6
279*	—	—	—	2	1	1	4	
Applied repoussé	249	2	12	2	1	2	—	19
Buckler	269	3	4	5	1	1	2	16

<i>Group</i>	<i>Hull Type</i>	<i>Bronze</i>	<i>Leaded bronze</i>	<i>Leaded gunmetal</i>	<i>Gunmetal</i>	<i>Brass</i>	<i>Other</i>	<i>Total</i>
Umbonate	268	1	4	1	2	1	—	9
	199	1	—	—	1	—	—	2
	267	8	4	—	1	3	1	17
Disc: British	252–255	7	14	3	3	7	1	35
	260	—	11	1	1	—	—	13
	257A	1	1	1	3	—	—	6
Disc	259	—	3	—	—	—	—	3
	264	1	—	—	—	—	—	1
Gilded glass setting	270	11	—	—	4	5	—	20
	271	1	—	1	—	8	—	10
Complex symmetrical	280–289	—	—	—	—	2	—	2
Complex asymmetrical	290–303	—	—	—	—	1	—	1

* = only some of the brooches in Hull type

Table 9 Summary of analyses of pennanular brooches in Appendix 1, grouped as in Table 3

<i>Hull Type</i>	<i>Bronze</i>	<i>Leaded bronze</i>	<i>Leaded gunmetal</i>	<i>Gunmetal</i>	<i>Brass</i>	<i>Other</i>	<i>Total</i>
P1	—	1	—	—	—	—	1
P11	—	—	—	—	1	—	1
P2	—	—	—	1	3	1	5
P3	34	3	4	5	20	5	71
P10	1	—	—	—	—	—	1
P4	35	3	2	9	18	6	73
P5	6	2	—	—	—	1	9
P6, P7, P9	31	5	3	9	12	3	63
P12	2	—	—	—	3	1	6

is around 4 per cent; that is, a bronze said to contain 10 per cent tin will contain 10.0 ± 0.4 per cent. The results presented in Appendix 1 are given to one place of decimal but because of the known errors they are not all accurate to this level. Because of the known experimental errors, divisions of the data set based on absolute values have been avoided where possible.

In a few cases the analytical totals were either very high or very low. Unused metal drillings from these brooches were later re-analysed by quantitative XRF,

which showed the errors were mainly in the amounts of copper. This means the alloy names, which were assigned on the basis of the amounts of tin, zinc and lead present, were unaffected by the errors.

X-RAY FLUORESCENCE

XRF analyses were carried out on the conserved but otherwise unprepared surface of the brooches. The XRF spectrometer used for most of the analyses in Appendix 1 was a Link Systems MECA 10–42 energy dispersive

system fitted with a rhodium X-ray tube and a lithium-drifted silicon detector; recent analyses have been made using an Oxford Instruments AN 10000 XRF system. Analytical conditions on both systems were a tube voltage of 35kV and current of 0.03mA, an air path for the X-rays and typically a detector live time of 10 or 20 seconds.

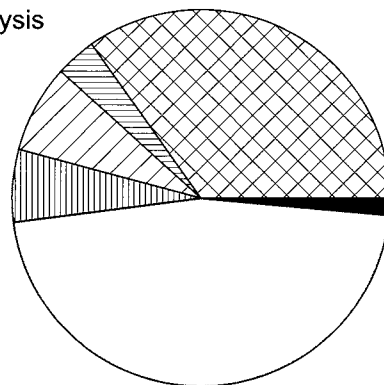
The output from the machine is a spectrum with peaks standing up from the background. The position of the peaks is determined by the elements present, and their height by the amount of each element; however, this latter relationship is not a linear one. Usually individual peak heights were recorded. Analyses of samples of known composition suggest the detection limits under the operating conditions used were under 1 per cent in the bulk metal.

COMPARISON OF AAS AND XRF DATA

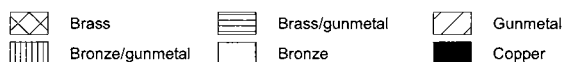
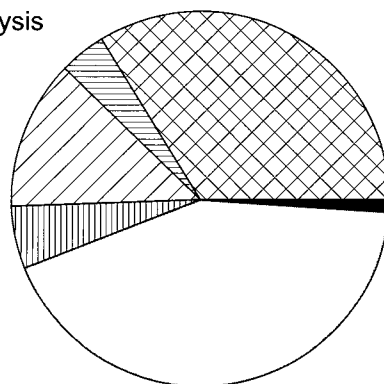
Four groups of brooches from different sites that had been analysed by AAS were re-analysed by XRF in order to estimate the relative peak heights expected for alloys of various compositions. It was found that peak heights could not be correlated with amounts of individual elements present but this is not the disaster it might seem as it is the relative amounts of tin and zinc that define the name given to the alloy. The zinc:tin peak height ratio showed a reasonably good correlation with the zinc:tin percentages ratio, and can usually indicate if tin and/or zinc is present in significant amounts and hence whether an alloy is a bronze, gunmetal or brass.

While the alloy name assigned on the basis of XRF analysis is likely to be representative of the composition of the majority of the objects, there were outliers in the AAS versus XRF ‘calibrations’, so the composition implied by the assigned alloy name cannot be guaranteed to be correct. While this does matter when describing individual objects, it is of little importance in considering overall trends in alloy use, as is done here. The comparability of the AAS and XRF datasets can be demonstrated by dividing the data in Appendix 1 into the two groups and plotting the results side by side (Figure 4). There are slight differences, which may well reflect the different balance of brooch types in the two groups; for instance the AAS group includes 139 brooches from Nornour which are mainly leaded bronzes. The XRF analyses identified a higher proportion of gunmetals and hence a higher overall proportion of mixed alloys (22.1 per cent compared with 17.3 per cent), some of which are probably either impure brasses or bronzes. As gunmetals are not one of the major alloy groups this difference does not materially affect the interpretations offered. In general it appears that the ways of assigning alloy names to

AAS analysis



XRF analysis



4 Pie charts comparing the alloy compositions determined by XRF and AAS analyses (data from Appendix 1)

qualitative and quantitative analyses produce comparable datasets so the two can be combined. Note that alloy names such as ‘bronze/gunmetal’ which are used to describe quantitatively analysed alloys of intermediate composition, are used to indicate uncertainty when applied to qualitative analyses.

In estimating the amount of lead in an alloy the lead:copper peak height ratio was used. Comparing XRF and AAS results showed that low values of the ratio generally correlated well with unleaded alloys and high values with leaded alloys. Values of the ratio between these boundaries can correspond to almost any lead content though it is usually above a few per cent. Most objects with ratios in the intermediate range are described as ‘(leaded)’ though their lead contents do not necessarily fall within the range defined in Table 5 for quantitative analyses. These differences between the AAS and XRF analyses are highlighted by the overall

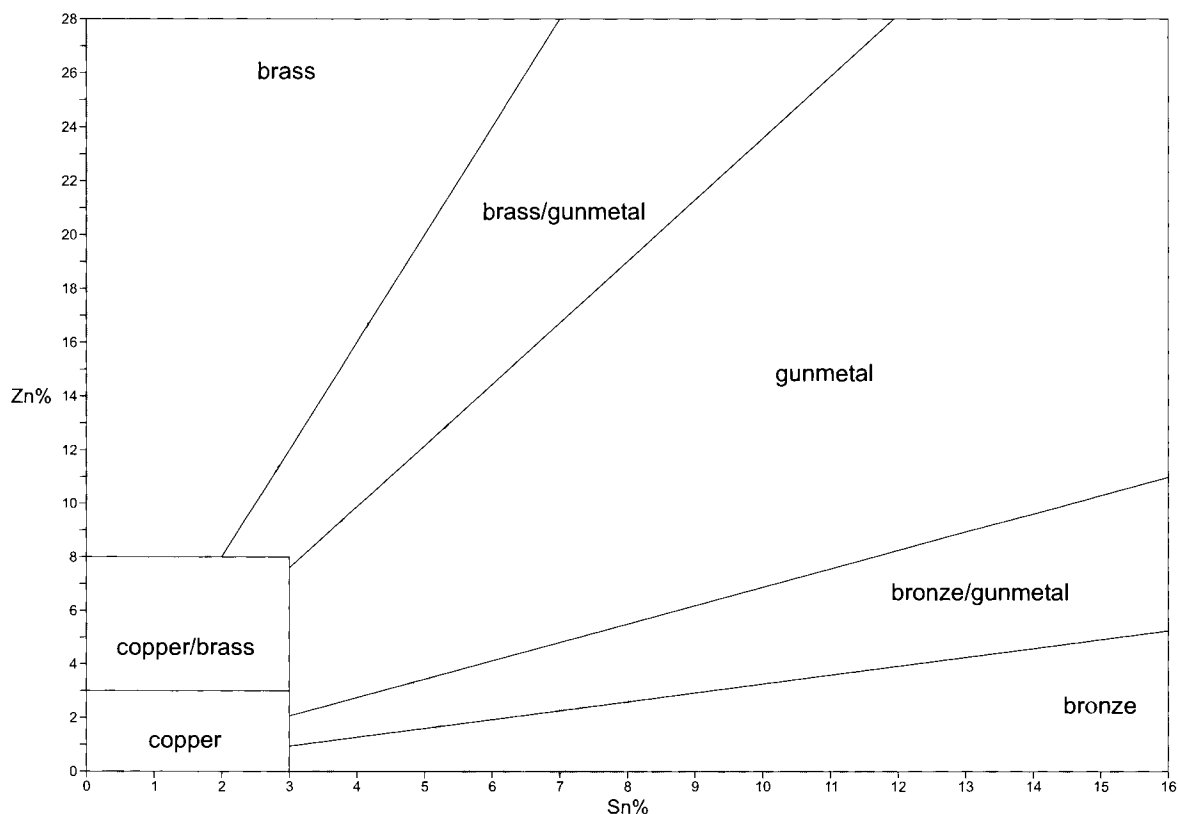
Table 10 Percentage of leaded alloys identified by AAS and XRF analysis

Analytical method	Unleaded	(Leaded)	Leaded
AAS	56	12	32
XRF	74	6	20

proportion of brooches described as leaded which is significantly higher for AAS analyses (see Table 10). While some of this variation may be due to the types of brooches analysed by the two methods, it is likely that some lead contents have been underestimated by XRF. Because of the poor correlation of XRF and AAS data for lead it is not possible to decide which particular analyses are affected, only that around 10 per cent of unleaded alloys identified by XRF are likely to contain significant amounts of lead.

DATA PRESENTATION

The only way to make large numbers of analyses intelligible is to present them graphically. The quantitative analyses for the Richborough brooches were used to define the boundaries to the alloy names presented in Table 5. Figure 5 shows zinc content plotted against tin with dividing lines superimposed. The lines were drawn through the origin in empirically selected positions which did not divide any major clusters of points. The benefit of this method is that moving the lines slightly reclassifies very few objects so the overall proportions of different alloys is almost independent of the specific boundaries selected. The histogram of lead contents (Figure 3) is interpreted as three superimposed distributions. The first group (with lead under 4 per cent) corresponds to 'unleaded' alloys where the lead present is an accidental contaminant rather than a deliberate addition. At the high lead end the 'leaded' alloys are those with large, and presumably

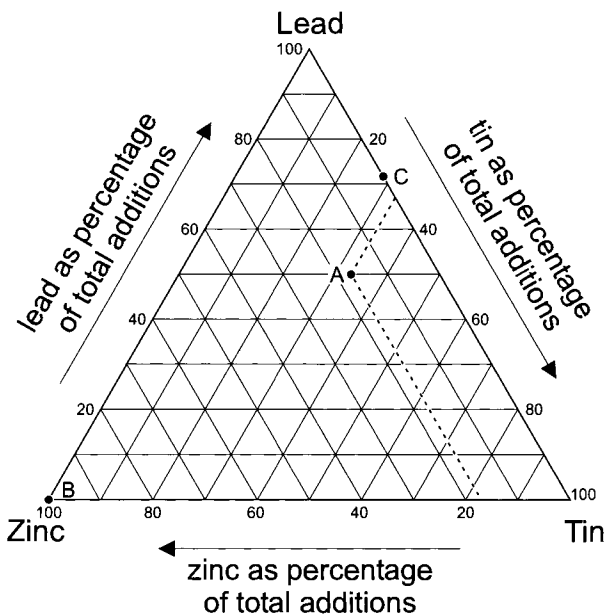


5 *Tin versus zinc contents for the quantitatively analysed Richborough brooches with alloy name boundaries as defined in Table 5 superimposed*

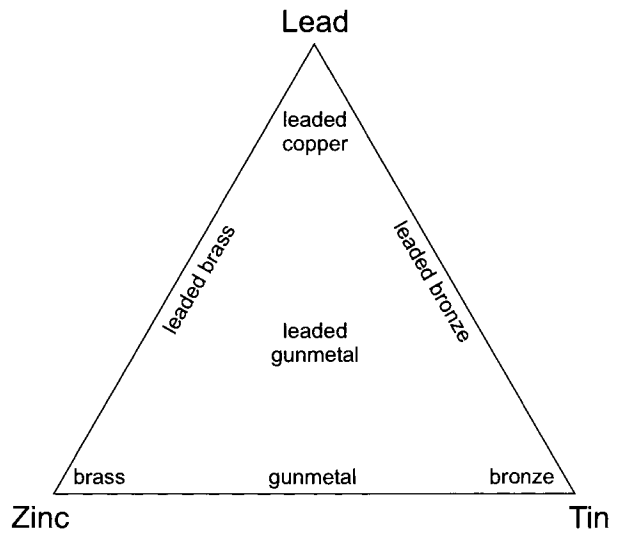
deliberate, additions of lead (over 8 per cent). Between are the ‘(leaded)’ alloys which contain enough lead to affect their properties to some extent.

TERNARY DIAGRAMS

The major alloying elements are tin, zinc and lead and these are found in almost all proportions. Copper alloy composition is thus a three-dimensional continuum, which can be shown graphically on a ternary diagram where the three corners represent the three alloying elements. The variables are the amounts of zinc, tin and lead expressed as a proportion of the total additions in the copper (that is, zinc+tin+lead), therefore, the nearer a point in the diagram is to a corner, the higher the relative amount of that element in the alloy. Figure 6 shows how points are plotted; the grid of lines is a three-dimensional version of ordinary graph paper. An alloy of 70 per cent copper with 5 per cent zinc, 10 per cent tin and 15 per cent lead has a total of 30 per cent additions. The relative proportion of zinc is thus $5/30 = 16.7$ per cent, while tin is $10/30 = 33.3$ per cent and lead $15/30 = 50$ per cent; this composition plots at point A on Figure 6. A pure copper-zinc brass plots at point B, whether it is 85 per cent copper+15 per cent zinc or 75 per cent copper+25 per cent zinc. In a similar way point C represents a leaded bronze with 8 per cent tin and 20 per cent lead. Results plotting together on the diagram indicate similar compositions for the objects analysed,



6 Ternary diagram showing the positions of three points (A, B and C) corresponding to different alloy compositions



7 Ternary diagram with alloy names superimposed

provided their copper content is roughly the same. Bayley and Butcher (1981) pioneered the use of diagrams of this type in discussing the alloy composition of Roman brooches and they are used extensively in Chapter 5.

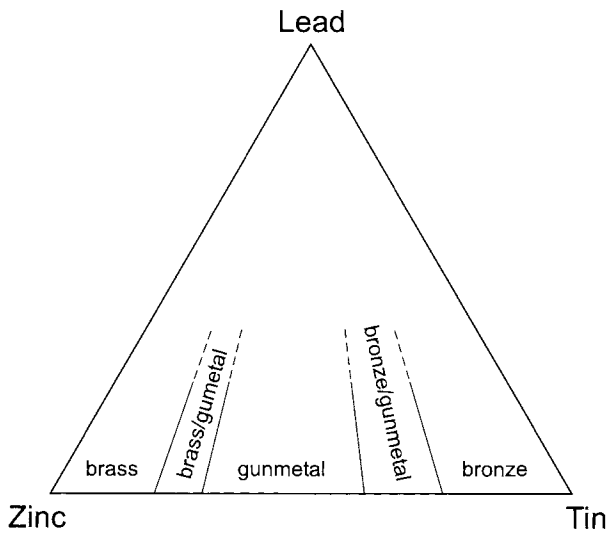
Figure 7 shows the relative positions of the different alloys on the ternary diagram but also the lack of any dividing lines between them. An added advantage of using zinc:tin ratios rather than absolute values as delimiters to the alloy names (see Table 5) is that objects plotting together on the ternary diagram will have the same alloy name, as both procedures cluster objects with the same relative rather than absolute composition. Figure 8 shows a ternary diagram with boundaries defined in Table 5 superimposed.

BAR CHARTS

Ternary diagrams can only plot quantitative analyses so an alternative presentation is needed that can include the qualitative results that make up two-thirds of the data in Appendix 1. The chosen method is normalized bar charts (for example, Figure 24) where the proportions of different alloys used to make brooches with particular types of decoration can be seen.

STATISTICS

For any brooch type or group of types, the quantitative analyses can be used to give an average composition. The mean and standard deviation are commonly used measures but they assume a normal (Gaussian)



8 Ternary diagram with alloy name boundaries as defined in Table 5 superimposed

distribution of the data which is unlikely with small numbers of samples, even assuming a normal distribution of the population from which they come. Inspection of graphical representations (for example,

Figures 1–3) suggests the data is not normally distributed even where samples are relatively large.

Alternative measures of average value and spread are the median and inter quartile range (IQR) which make no assumptions about the shape of the distribution from which the data is taken and so are more appropriate in this case.¹ The median is a robust measure of average value as it is little affected by outliers. The IQR ignores extreme values and at the same time indicates the tightness of the cluster. It also shows the skewness of the distribution as the upper and lower quartiles need not be equidistant from the median. Not all outliers are sufficiently obvious for them to be removed from data sets prior to calculating average values. Sometimes it is not clear which points should be considered as part of a loosely clustered group and which as outliers to it; either way, they will have little effect on the calculated median value.

NOTE

- 1 When a group of measurements is arranged in order, the median is the value of the central measurement. The upper and lower quartiles are the central values of the two halves on either side of the median; the difference between the upper and lower quartiles is known as the inter quartile range.

CHAPTER 3

THE MANUFACTURE AND DECORATION OF ROMAN BROOCHES

INTRODUCTION

Past technologies can be reconstructed with the help of modern technology. In many cases the latter can quantify and make explicit differences of which ancient craftsmen were only empirically aware. It is likely that they made better use of some senses than we do; they would note the 'feel' of a metal being worked or its colour or taste. Our knowledge of the properties of materials allows us to know why processes worked or failed, and to experiment and ask the 'What if ...?' questions. In the past, however, once a method that worked had been devised it tended to be used repeatedly as success could be guaranteed; this explains much of the technical conservatism that is evident in the study of the material culture of the past and makes some of the innovations that did develop all the more remarkable.

As the information reported here all derives from archaeological finds, it has been influenced by the inevitable processes of damage and corrosion that affect all buried artefacts. This sometimes changes the degree of detail that can be seen, it may alter the frequencies with which certain types of metal or decoration on brooches are recorded, and can also produce potentially misleading appearances, for example, when the colour of enamels is altered by decay. Where a brooch is made of more than one type of metal, the more reactive one will preferentially decay and may in some cases even disappear completely. Examples are the lead-tin solder attaching repoussé-decorated foils and the iron inlay found on a few brooches. In these cases it is important to differentiate between what is seen and the interpretation placed on that image, as the image

should be universal but the interpretation may depend on the observer's experience.

In many cases the composition of the metal used to make a brooch constrained the choices of the craftsman – the way the brooch could be shaped and the sort of decoration that could be employed. The design of brooches, which is reflected in their typological classification, is thus a function of the materials and manufacturing methods used.

BROOCH MANUFACTURING PROCESSES

Brooches were mainly made of copper alloys although some early types were also made of iron; silver and, more rarely, gold were also used. Only eight of the 445 surviving brooches from Richborough, Kent, are silver and no gold brooches were found there. The site finds registers record three iron brooches, though one (Cat 25) is bronze, and one iron buckle that is actually a penannular brooch (Cat 407). It is possible there were originally more iron brooches than were recognized during excavation as iron does not survive well on the site and finds were not routinely X-radiographed in the 1920s and 1930s.

Brooches can be seen as typical of the small copper alloy objects made by late Iron Age and Roman craftsmen. They were fashioned in a variety of ways so their study illustrates the range of metalworking techniques used at those times. Some brooches were wrought, some cast, and some show evidence of both types of working; most also carry some form of decoration.

Although brooches are relatively common finds on archaeological sites, there is little evidence to show how

and where they were made; the available information is gathered together below. The relative lack of workshop debris means that much of what is known comes from studies of the brooches themselves.

The first step in making any copper alloy (or silver) object was to obtain enough metal of the right composition. This probably involved a number of craftsmen and merchants, as metal ores would have been mined and smelted, the resulting metal purified and/or alloyed and then transported and sold to the metalworker. There are changes in the composition of alloys used for brooches that suggest that recycled scrap became a more important metal source later in the Roman period.

CASTING AND MOULDS

Cast brooches were made by melting metal in a crucible and pouring it into a mould, where it solidified. Moulds were usually made of fired clay and both investment and piece moulds were known in the Roman period, but from the evidence we currently have the latter were normally used for making small objects including brooches.

The main reason for using piece moulds was undoubtedly because they were labour saving and permitted a far greater degree of mass-production. This was not because the moulds themselves could be re-used but because one original pattern (see below) could be used to make many moulds, each of which was probably used only once. The main evidence against multiple use is that, on all the moulds examined, the clay luting the valves together appears to have been applied at one time, whereas if the mould had been taken apart and re-used, traces of multiple applications would be expected. The only reason for having a mould that could be taken apart was so that the pattern could be removed and used again to make another mould.

A piece mould was made by taking a suitably sized and shaped lump of clay, putting it on a flat surface and pressing the pattern into its slightly convex upper surface. Stab marks or cuts were made in the clay round the pattern to produce locating lugs in the second piece of clay that was pressed over the top, presumably after some sort of parting agent, such as powdered charcoal, had been dusted on. This method of manufacture produces top and bottom valves that can be differentiated easily, even in a fragmentary state, as the upper part is concavo-convex while the lower part is normally plano-convex and usually carries a deeper impression (Figure 9, Plate 1). Once the clay had dried sufficiently the mould was taken apart, the pattern removed and the mould re-assembled. The valves were

sometimes tied together, and the joins were luted (sealed) with more clay. In some cases the sprue cup was integral with the mould valves but sometimes it was added after they had been luted together. The mould was then baked and while still hot the molten metal was poured in. None of these piece moulds had air vents, perhaps because the joint between the valves was not airtight even when luted, or perhaps because the clay fabric itself was sufficiently permeable to make them unnecessary. The molten metal ran into the joint between the valves and solidified, forming a casting flash. Traces of these can often be seen on castings (for example, Figure 10 and Cat 219), proving the use of piece moulds even when no moulds survive. Where the casting has blowholes (for example, Cat 317 and Cat 325) trapped gases or moisture in the mould would usually have been the cause.



9 Two-piece clay piece mould for a trumpet brooch from Prestatyn. Length 60mm (see also Plate 1)

The few clay brooch moulds we have from Britain provide no evidence that more than one was cast at a time. However, continental finds both of unfinished brooches and of moulds suggest that casting two or more brooches at once was not unusual (see Table 12, below). In these cases individual clay (piece or investment) moulds were assembled into multiples before casting (Beck *et al* 1982/3). Multiple moulds for other types of object are known from Britain (for example, Bayley and Budd 1998).



10 *Traces of a casting flash on the back of a Colchester-derivative brooch from Lullingstone. Length 28mm*

If the clay used for the mould was fine enough very detailed ornamentation could be reproduced. Because the mould fabric was not strong the fine detail was usually damaged in removing the casting, one reason the mould was not normally re-used. Sometimes rather coarser details such as fields to receive champlevé enamel were cast in. The examples from Compton Dando, Somerset (Bayley 1985), show that both small triangular and lozenge-shaped fields were cast into the metal (Figure 11, Plate 2) rather than being cut from it when solid, although examination of enamelled brooches suggests that the fields were often cleaned out or their bases roughened after casting to assist adhesion of the enamel (Figure 12, Plate 3).

Although moulds are most commonly made of clay, two-piece bronze moulds for a Colchester-derivative brooch have been found at Old Buckenham in Norfolk (Bayley *et al* 2001; Figure 13, Plate 4) and a further leaded bronze mould valve for a similar brooch has recently been found at Felmingham, Norfolk (Bayley *et al* 2003). Guillaumet (1984) has suggested that metal



11 *Fragment of a clay piece mould for a T-shaped brooch from Compton Dando, showing fields for enamel were formed in the casting. Length c 35mm (see also Plate 2)*



12 *Umbonate disc brooch (Cat 382), showing tool marks produced by a graver in the base of the triangular fields that have lost their enamel. Length 33mm (see also Plate 3)*

and stone moulds were used to cast wax patterns which would then be cleaned up and used to make investment moulds, but in the case of the metal mould from Old Buckenham it definitely has been used to cast metal

brooches as in it is the final casting that was made. Bronze moulds of similar composition to that of the metal that was to be cast in them are common finds in Bronze Age Britain (Tylecote 1986, 91) and replicas have satisfactorily been cast in them (Voce 1951). The casting does not stick to the metal mould as the latter has a sufficiently high thermal capacity for the molten metal in contact with it to freeze almost instantly, contracting and separating from the mould as it does so. The Old Buckenham mould was quite massive, relative to the brooches cast in it, and so was well suited to cast bronze brooches.



13 Two-piece metal mould for a Colchester-derivative brooch from Old Buckenham. Length 70mm (see also Plate 4)

PATTERNS FOR MOULDS

Both investment and piece moulds were made round a pattern or model. This was made of wax or some other easily melted material for investment casting, but was normally of a more durable material that could be re-used many times when a piece mould was made. Clay

moulds could faithfully reproduce fine detail so, to save work later on, the pattern would carry most of the decoration and have the surface finish desired in the metal casting. In some cases suitably prepared castings could have been used as patterns but the majority of finds recorded as patterns have been in softer materials such as lead or bone. Fine-grained wood also could have been used but no wooden patterns have been recognized yet.

One problem with using existing objects as patterns for mould making was that vital, functional parts such as runners and sprues are missing. This difficulty could be overcome by adding temporary extensions of clay or wax to the object or by carving the necessary shapes out of the green-hard mould before it was fired. Another problem was that castings were often subsequently worked so an existing object would not have exactly the same shape as the casting from which it was made. For example, on a brooch the edge of the catchplate was turned over to give a secure location for the pin. A further difficulty with using castings as patterns is that metal contracts as it solidifies so each casting will be slightly smaller than the one used as a pattern.

Patterns have not always been recognized for what they are. Examples are the three lead patterns for brooches from Poole's Cavern, Derbyshire, which Mackreth (1983) suggested had been worn, though careful examination of the admittedly deeply corroded objects suggested they could not in fact have been so used (Bayley and Branigan 1989). The perforations behind the head to take the axis bar for the spring were too small to be functional and the edge of the catchplate was not turned over but instead was thickened, to provide enough extra metal in the copper alloy casting that it could be hammered out and turned over (Figure 14, Plate 5). Lead patterns are recorded from other Roman sites too; interestingly almost all are for brooches. Drescher (1973) illustrates several models of lead and 'bronze' for a variety of Roman objects, though the latter may just be partly cleaned-up castings – they could, however, have been used as patterns.

WORKING SOLID METAL

Many brooches were not cast but were made from one or more pieces of metal that had been hammered and cut to the desired shape; they are described as wrought or smithed. Other brooches had wrought metal, for example the pin, added to a casting.

Smithing was basically a two step process; cast metal ingots were first fabricated into sheet, rod, bar or wire and then this metal stock was made into objects and



14 *Lead pattern for a brooch from Poole's Cavern. Note the incomplete perforation to take the axis bar for the pin and the rib down the edge of the catchplate, which would have been hammered out and turned over in the copper alloy casting. Length 56mm (see also Plate 5)*

decorated. Wire was produced by strip twisting, strip drawing and hammering rods, though there is no evidence for drawing down copper alloy rods in the Roman period (Whitfield 1989). When rods were smithed to elongate them and reduce their cross-section, longitudinal creases could result, and these can sometimes be seen on finished objects (for example, Cat 24). Shaping processes can be divided into two groups; those where the metal was deformed by hammering and bending, and those where it was cut to size and machined, that is, metal was removed using tools. This term, anachronistic perhaps before mechanization, covers sawing, turning, boring, drilling, reaming, grinding, filing and scraping.

Lead in copper alloys is beneficial when machining operations are performed as the metal comes away in small chips rather than long springy turnings. However, lead also confers less welcome properties (see Chapter 2). Therefore, the amounts present in wrought alloys were usually restricted to a maximum of a few per cent.

Techniques that create relief decoration can be subdivided in a similar way. Engraving removes metal, typically leaving a V-shaped groove in the brooch (Figures 15 and 89, Cat 313); the tool used is called a graver or scorper. Chasing, like engraving, leaves a line on the brooch but its profile is usually more rounded (Figure 16, Plate 6) as the metal has been pushed aside rather than removed by the tool, which is a tracer. Punches also deform rather than remove metal. They can be used to produce repeat patterns (Figures 17 and 101, Cat 388–390, Plate 7) and are hammered into the surface of the object. Some 'ring and dot' decoration

may be punched, but some appears to be drilled (for example, Figures 94, Cat 342–345 and 96, Cat 351).



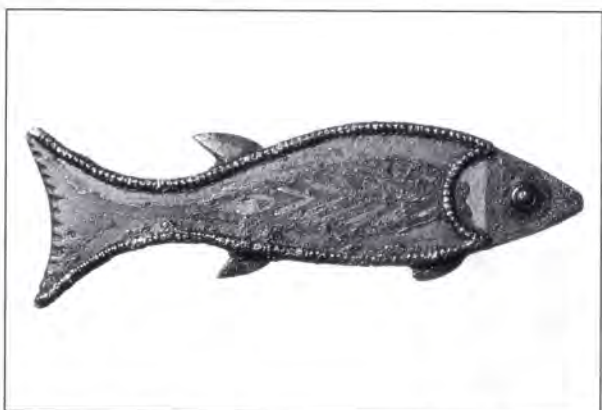
15 *Strip-bow brooch with engraved lines running down the bow (Cat 159). Length 47mm*



16 *Chased decoration on the catchplate of a one-piece Colchester brooch (Cat 59). Length of catchplate 15mm (see also Plate 6)*



17 Gilded disc brooch with repeat punched decoration and a conical central glass 'stone' (Cat 388). Diameter 38mm (see also Plate 7)



18 Beaded silver wire edging a zoomorphic brooch from London; the centre of the eye is also applied silver. The orange enamel now mostly looks green. Length 41mm (see also Plate 8)

Sheet metal overlays of brass and silver were also decorated (Cat 373, Figure 98 and Plate 23). Repoussé designs were produced by using punches on the back of the metal, while a large punch, known as a die, acting on the front of the sheet produced embossing. Where areas are large the sheet metal is often burnished or hammered into the die using a lead backing sheet rather than the die being hit on to the metal with a hammer. Overlays soldered onto brooches are traditionally described as repoussé-decorated sheets or foils but preservation is usually not good enough to be sure

whether the designs are repoussé or embossed. The beaded silver wire used to decorate brooches (Figure 18, Plate 8) was probably shaped using swages, a pair of dies which were placed round plain wire and hammered (Whitfield 1998, fig 18).

All mechanical working processes deform the metal plastically, permanently changing its external shape, and at the same time set up internal stresses which alter its crystal structure. This work-hardening reduces the malleability of the metal, making it harder and stronger. This can be a beneficial change, for example, in the spring of a one-piece brooch, but if the metal is to be worked beyond a certain point the internal stresses have to be relieved by annealing, that is, heating to above the metal's recrystallization temperature (about 400°C for brass and bronze and 200°C for copper and silver). The working-annealing cycle can be repeated any number of times. Surface dirt and oxide scale can be removed by quenching the metal (putting it into cold water while still hot). However, Drescher (1955) says that after it has been annealed brass should not be quenched.

ASSEMBLY AND FINISHING

Once a brooch had been formed, whether cast or wrought, it was filed and scraped, ground and polished to give an acceptable surface finish though sometimes file marks survive (for example, Cat 294). An alternative method of finishing an object was to burnish the surface with a hard tool such as steel or agate (Theophilus documents this in the medieval period (Hawthorne and Smith 1979)). This was particularly necessary when a surface coating of another metal such as gilding had been applied and needed consolidation.

If the brooch was made of more than one piece of metal, the parts had to be assembled and fixed together. Methods of joining that can be identified on brooches include rivets and solder. Rivets were just pieces of wire or rod that fitted through a series of holes and then had their ends burred over to stop them coming out again. Rivets were used to fix the knobbed casting of T185 to the bow of the brooch (for example, Cat 247, Figure 81) and they were also used to attach decoration. Short rivets (now missing) would have attached applied decoration, possibly of bone, to the centre of T225 plate brooches (for example, Cat 342, Figure 94) and a rivet with a decorative washer on the front held a perforated piece of glass into the cupped setting of T148C brooches (for example, Cat 228, Figure 76). Sometimes a lug on one part fitted into a hole on another and was used like a rivet to hold the parts together, as with the openwork plate on the front of rosette brooches (T27, Figure 113).

Lead-tin alloys with low melting points were used as solders to attach decorated metal foils to brooches, for example, T249 (Cat 373, Figure 98 and Plate 23). During burial the solder corrodes (and expands) more rapidly than the surrounding metals so the components may become pushed apart or even separated; the original effect would have been a close fit. Where the applied foils and solder have been lost, their original positions can sometimes still be seen, as for a time they protected the copper alloy substrate from corrosion, for example, Cat 236 (Figure 19, Plate 9).



19 *Trumpet-headed brooch that has lost its applied decoration, though the original positions of the silver spots and strips can still be made out and traces of silver are detectable analytically (Cat 236). Length 72mm (see also Plate 9)*

In other cases the metal of one piece of the brooch was bent round another piece in such a way that it could not come apart. An example is the head of Cat 72 where flaps of metal were bent round the spring to form a cylindrical head to the brooch (Figure 49).

PIN ATTACHMENT

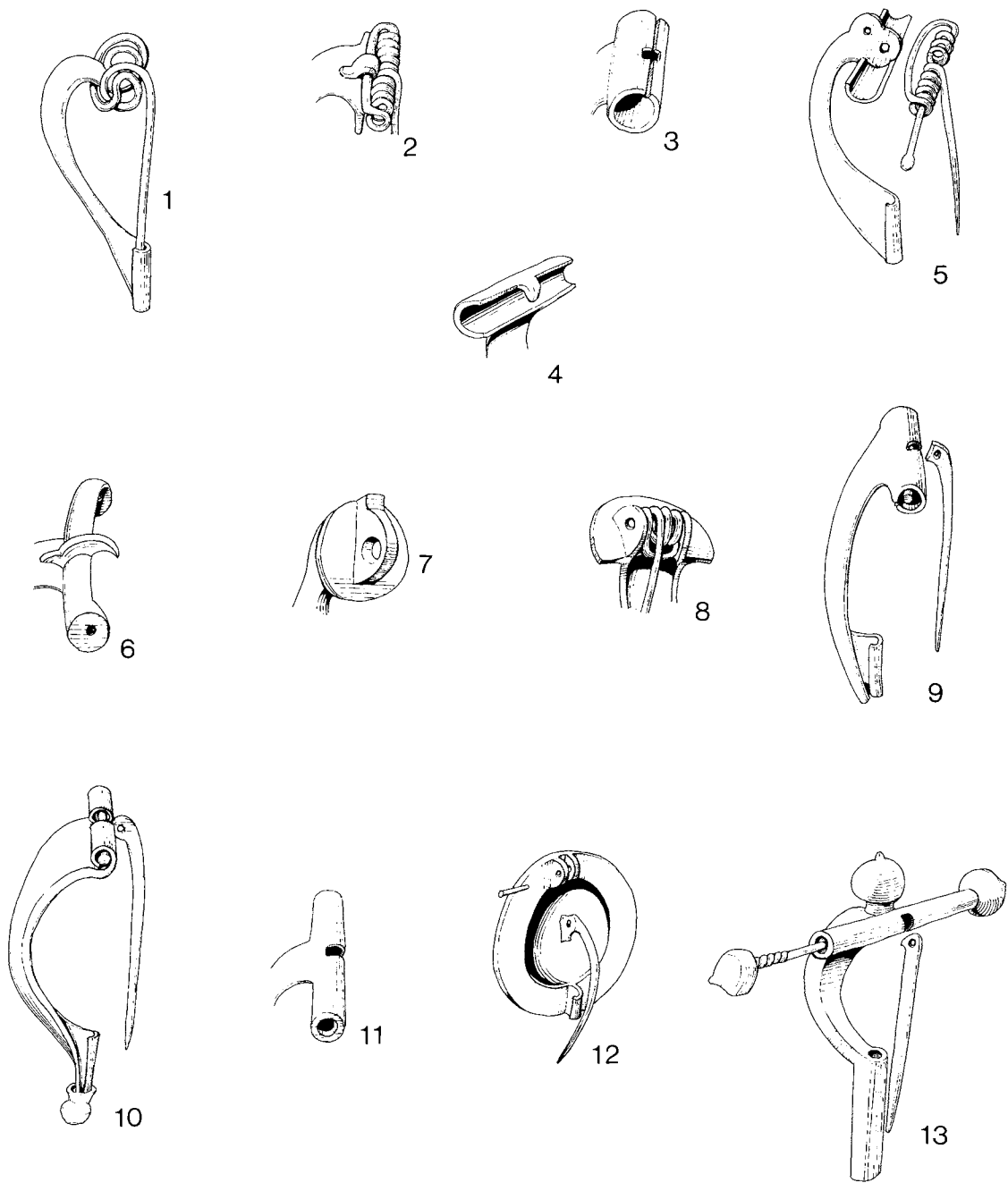
Liversage (1980, 62–3) describes a variety of methods used to attach pins to brooches. Although most of his brooches are types not often found in Britain, some of the mechanisms he describes are known in British late

Iron Age and Roman brooches. These, and others, can be grouped into six main types.

The first are one-piece brooches, usually with a four-turn spring and an internal chord such as T10/11 (Figure 20, 1). The second are one-piece brooches with a crossbar protecting a longer bilateral spring (typically of 6–10 turns) with coils of a smaller diameter but longer external chord which is held by a hook at the top of the bow (for example, T90). Both the hook and spring/pin are parts of the same piece of metal as the brooch bow. The spring arises from the back of the brooch head, its wire spirals outwards to the left side (viewed from the front of the brooch as normally drawn), returns to the far right, making the chord, and then spirals inwards to the centre of the head, in the opposite sense to the first half, with the free end becoming the pin (Figure 20, 2). In both these types the effectiveness of the spring depends on the elasticity of the metal so only unleaded alloys could be used to make brooches with these spring mechanisms; they were used in the earlier first century.

In the third type the pin extends into a bilateral spring, sometimes of only a few turns, which was made separately from the body of the brooch and attached to it, usually by an axial bar. Any alloy could be used to make the body of the brooch but the spring/pin still had to be an unleaded alloy. This type of pin attachment appeared in the first century and continued in use until the third century. The forms of brooch head that permitted this attachment are very varied and some types had only a limited lifespan. The direction the spring is wound is the same as for the previously described types. Brooches with a cylindrical spring cover (for example, Cat 72 and Figure 113) are the earliest types with a separate sprung pin but are atypical as the head of the brooch is wrapped tightly round the spring and there is no axial bar (Figure 20, 3). Type 94A also has no axial bar, the chord being held in place by a small rearward-facing hook on the back of the head (Figure 20, 4). This attachment was rather tenuous and in many cases the spring fell off. In those where it does survive, there are often traces of solder on the back of the head where the spring started, but whether this is an original feature or an alteration to make it more serviceable cannot be said as lack of surviving solder cannot be interpreted as showing there never was any. Most applied hook brooches are a variant of this type, the hook being a separate piece of metal riveted on to the bow.

The classic separate sprung pin is found on T92–93 where the chord is threaded through one hole in a lug behind the brooch head and an axial bar through the coils of the spring passes through the second hole



20 Outline drawings showing different methods of attaching the brooch pin

(Figure 20, 5). A further development is the 'Polden Hill' fixture where the ends of the head turn back and have holes to hold the ends of the axial bar; the chord is held by either a hook or a perforated lug (Figure 20, 6). This is used for all Polden Hill brooches (T95–101, T103) as well as some T-shaped and knee brooches.

The fourth type also has a separate, sprung pin. It differs from the previous type in having only a few turns to the spring. The chord is usually internal, that is, it lies against the back of the brooch, between it and the pin, rather than being visible from the front of the brooch. These sprung pins were fixed by an axial bar to a single lug (Figure 20, 7) or between a pair of lugs (Figure 20, 8) located behind the head on many trumpet-headed and knee brooches.

The fifth type of pin attachment is usually described as hinged, the pin swinging freely on a fixed axial bar. The pin is normally asymmetric at the perforated end so that a corner or lug on the pin presses against the body of the brooch, allowing the elasticity of the pin to provide the pressure necessary to keep the brooch fastened. This type is again independent of the alloy used for the body of the brooch and was used for many bow and plate brooches from the mid-first century onwards. Early examples have the head of the brooch either rolled under, round the axial bar (for example, T19, Figure 20, 9) or rolled forward over the bar (for example, T51, Figure 20, 10). Later, more massive brooches have a hole through all or most of the head into which the axial bar fits; the perforated end of the pin fits into a slot in the head through which the axial bar passes (Figure 20, 11). Many axial bars are made of iron while others are made from a C-sectioned strip of sheet metal that was curled tightly to fit easily into the hole and then expanded, wedging itself firmly in place. Most plate brooches have hinged pins, fixed between two lugs on the back of the brooch (Figure 20, 12) though some, mainly British-made types have pins sprung on a single lug (cf Figure 20, 7). A few late T192 brooches lack a conventional catchplate but have a hole running down behind the foot which holds the pointed end of the pin. The perforated end was held in a slot in the centre of the crossbar by a screwed pin (for example, Cat 327).

The final group are penannular brooches where the pin is captive but swings freely on the hoop. The pin is stuck through the cloth of a garment and the hoop then rotated to lock it over the end of the pin. Dragon-esque brooches (T200) fasten in a similar way.

REPAIRS

The pin/spring assembly is the most vulnerable part of most brooches and repairs are sometimes noted. A one-

piece Colchester brooch (Cat 63) has the end of the spring inserted into a hole behind the head rather than both being part of the same piece of metal. Both parts are brass so this repair may have been made because the spring broke off the brooch during manufacture, though it could have failed later in its life. It is likely that many hinged pins broke but it is not normally possible to identify replacements as the original axial bar would have been removed and then re-inserted through a new pin. Sometimes the repair could not be carried out this neatly and is visible; possible examples are Cat 294 and Cat 296. A plate brooch (T275) from West Stow, Suffolk, has an unusual repair to the pin; the original broken one was not removed but an extension soldered on to make it useable again (Figure 21, Plate 10). Some penannulars have pins made from different alloys to that of the hoop of the brooch; these may be original features or may indicate replacements. A bronze dolphin brooch (T94A) from London has a brass catchplate fixed into a slot cut in the back of the bow; presumably a repair rather than an original feature (Figure 22, Plate 11).



21 Plate brooch from West Stow showing how a new pin was soldered onto the stub of the original one. Length 42mm (see also Plate 10)



22 Colchester-derivative brooch from No. 1 Poultry, London, showing a replacement catchplate of brass fixed into a slot cut in the back of the foot of the bronze brooch. Length 55mm (see also Plate 11)

ARCHAEOLOGICAL EVIDENCE
FOR BROOCH MANUFACTURE

Crucibles and much of the other archaeological evidence for metalworking give no specific indication of the type of objects being made. The only positively identifiable evidence for brooch manufacture is models of brooches, moulds, castings that have not been cleaned up or that failed, and part-made wrought brooches. If tools such as punches survived sufficiently well for their design to be visible, they might be matched with punch marks on finished brooches and so be identified as brooch-making tools. So far evidence of this sort is unknown and other tools such as hammers and files cannot be specifically tied

to brooch making.

Despite the limited range of finds which can provide evidence for brooch manufacture, there is a surprisingly large number of sites where these finds are recorded – far more than for any other class of Roman metalwork. Table 11 details the occurrence of different types of diagnostic finds in Britain while Table 12 lists some comparable material from the continent where many of the Roman brooches found in Britain were made. Much of the continental material has been reviewed by Behrens (1954), Drescher (1973) and Guillaumet (1984) who give (sometimes contradictory) details of the findspot, present location or original publication of the finds, some of which have no detailed provenances or are now lost.

Table 11 British evidence for brooch manufacture

<i>Site</i>	<i>Description</i>	<i>Reference</i>
CLAY MOULDS		
Bletsoe, Bedfordshire	Fragment may be from foot area of brooch mould	–
Caistor St Edmund, Norfolk	Mackreth suggests some of these mould fragments may be from investment moulds for simple Colchester-derivative brooches	Tylecote 1969; Mackreth 1983, 57
Chediston, Suffolk	Fragments, possibly of investment moulds, for Colchester-derivative brooches were made of a coarse sandy clay	–
Compton Dando, Somerset	Hundreds of fragments of two-piece (front/back) moulds for a range of T-shaped brooches were found in a gas pipeline trench (Figure 11, Plate 2)	Bayley 1985
Dymock, Gloucestershire	A fragment from a clay two-piece (left/right) mould for a trumpet brooch and two fragments possibly from piece moulds (front/back) for Colchester-derivative brooches	Dungworth 2000
Prestatyn, Flint	Complete unused two-piece (left/right) mould with integral sprue cup for a trumpet brooch (Figure 9, Plate 1)	Blockley 1989, 184ff
Rudston, Yorkshire	Fragment found	Ramm 1978, 121
STONE MOULD		
Castle Gotha, Cornwall	For large penannular brooch or small bracelet	Saunders and Harris 1982, Fig 10.8
METAL MOULDS		
Felmingham, Norfolk	Back valve of a two-piece leaded bronze mould for a Colchester-derivative brooch	Bayley <i>et al</i> 2003

<i>Site</i>	<i>Description</i>	<i>Reference</i>
Old Buckenham, Norfolk	Bronze two-piece (front/back) mould for a Colchester-derivative brooch, with a failed casting <i>in situ</i> , was found with an identical gunmetal back valve (and several more failed castings and sprues) (Figure 13, Plate 4)	Bayley <i>et al</i> 2001, figs 3–6
<hr/>		
LEAD PATTERNS (MODELS)		
Brough under Stainmore, Westmorland	Pattern for trumpet brooch found in the bed of the river, probably in 1876	Boon and Savory 1975, 43; Snape 1993, pl I
Lydney, Gloucestershire	‘Part of a leaden die’, the lower bow, foot and catchplate of a brooch	Wheeler and Wheeler 1932, 15 and pl VIA, 1
Poole’s Cavern, Derbyshire	Three patterns for T151 brooches (Figure 14, Plate 5)	Mackreth 1983, 56 and fig 3.5; Bayley and Branigan 1989, 42, nos 126–8
Wilderspool, Cheshire	Pattern of a trumpet brooch	May 1904, 75
<hr/>		
FAILED CASTINGS		
Brough under Stainmore, Westmorland	Failed casting of a trumpet-headed brooch	Collingwood 1930b, 52 and fig 10
Old Buckenham, Norfolk	At least six failed castings of Colchester-derivative brooches found with metal moulds in which they were cast	Bayley <i>et al</i> 2001, fig 8
<hr/>		
UNFINISHED BROOCHES		
Salterford, Lincolnshire	Fieldwalking found an incompletely finished brooch	Frere 1983, 301
WROUGHT:		
Baldock, Hertfordshire	Three one-piece Colchester (T90) brass brooches	Stead and Rigby 1986, 122
Catsgore, Somerset	‘The catchplate looks unfinished ...’ on a T113 brooch	Leech 1982, 109, fig 78.24
Owmy, Lincolnshire	Brooch ‘... for which a catchplate has been fashioned from the bronze wire to which it is attached’	Whitwell 1982, 133
Richborough, Kent	Incompletely made sprung pin: three coils attached to a thin bar of variable cross-section	AML No. 7351872
Wanborough, Wiltshire	‘... perhaps this is an unfinished brooch intended to have the usual one-piece spring.’ (T10/11)	Butcher 2001, 44, fig 18.35

<i>Site</i>	<i>Description</i>	<i>Reference</i>
CAST:		
Castleford, Yorkshire	An Alcester type (T162) has the remains of the runner protruding from its foot, the lug for the pin is not perforated and the catchplate is not hammered to shape	Cool 1998, 49
Compton Dando, Somerset	T-shaped brooch with flash	Bayley 1985
Corbridge, Northumberland	T151 brooch appears incomplete, with unfinished catchplate	Snape 1993, 35, fig 5, 10.3
Lullingstone, Kent	Finished fan-tail brooch with visible flash line on back (see Figure 10)	Meates 1987, 63, fig 24, 56
Old Buckenham, Norfolk	Colchester-derivative brooch with attached sprue found <i>in situ</i> in metal mould, together with other identical as-cast brooches	Bayley <i>et al</i> 2001, figs 4 and 7
Poole's Cavern, Derbyshire	'The brooch [T151] still has the flash marking the joints in the mould in which it was cast and a ridge on the catchplate instead of a full return for the pin.' The mould had three parts: left, right and an extra piece for the pin attachment between two lugs behind the head	Mackreth 1983, 56, and fig 3.6
South Shields, Durham	Trumpet brooch of Collingwood type Rii (no. 1925.35), 'appears to be an unfinished casting'	Bateson 1981, 105
Springhead, Kent	A Colchester-derivative brooch '... is an unfinished casting and ... brooches were made on the site'	Penn 1957, 70

Table 12 Some continental evidence for brooch manufacture

<i>Site</i>	<i>Description</i>	<i>Reference</i>
CLAY MOULDS		
Autun, Burgundy, France	280kg of mould fragments include hundreds of investment moulds for Langton Down (T21) and Rosette (T26) brooches which had been assembled into conical multiple moulds for casting	Chardron-Picault and Pernot 1999, 159ff
Magdalensberg, Austria	Fragments of piece moulds for one-piece brooches (T84? and T85)	Drescher 1973, Abb 1.2–1.3
Mont Beuvray (Bibracte), Burgundy, France	Conical investment mould for twelve Langton Down (T21) brooches. It was abandoned unused when the sprue cup broke	Guillaumet 1984, 12; Beck <i>et al</i> 1982/3

<i>Site</i>	<i>Description</i>	<i>Reference</i>
Nandin, Château-Porcien, Ardennes, France	Mould (said to be for casting brooches) is a fragment of sprue cup and runners for casting six objects simultaneously; second century	Maquart 1935
Wels, Austria	Fragment of one valve of a piece mould for a bow brooch	Drescher 1973, Abb 2.2

METAL MOULDS		
Szalacska, Hungary	One valve of a copper alloy piece mould; now lost. Guillaumet suggests it was used to cast wax patterns for making investment moulds	Dechelette 1914, fig 714; Guillaumet 1984, 11
unknown provenance (in Naturhistorisches Museum, Vienna, Austria)	One valve of a copper alloy piece mould for two brooches of a second- to third-century type (Inv. No. 18318)	Drescher 1973, Abb 2.7; Behrens 1954, 235

PATTERNS (MODELS)		
Aquileia, Italy	Pattern for a pair of brooches	Drescher 1973
Magdalensberg, Austria	Copper alloy pattern for a pair of brooches (T85) joined by runners, and pattern (or cleaned-up casting) for a brooch (T84) with runner. All runners attached to head of brooch	Drescher 1973, Abb 1.4 and 1.1
Sisak (Siscia), Croatia	Copper alloy pattern for a pair of brooches (T84) complete with runners, and lead pattern for a knee brooch (T172?)	Drescher 1973, Abb 1.7 and 2.4
Wels, Austria	Copper alloy pattern for a knee brooch (T173B?) with runner attached to foot	Drescher 1973, Abb 2.3
unknown provenance (in Naturhistorisches Museum, Vienna, Austria)	Copper alloy pattern for a pair of knee brooches (T172?), joined at the head (Inv. No. 18230)	Drescher 1973, Abb 2.5 Behrens 1954, 234

FAILED CASTINGS		
Alesia, France	'fibule du type à plaquettes'	Rabeisen and Menu 1985, no. 47
Augst/Kaiseraugst, Switzerland	Failed casting dates to second half of first century AD. A few other castings may be failed castings or unfinished bow brooches	Riha 1994, 16 and Abb 49.3019
Autun, Burgundy, France	Failed castings of eleven Rosette (T26) and Langton Down (T21) brooches with adhering traces of clay mould	Chardron-Picault and Pernot 1999, 178ff

<i>Site</i>	<i>Description</i>	<i>Reference</i>
Mont Beuvray (Bibracte), Burgundy, France	Both one-piece brooches, of which there are four examples (T10D? and T89?), and a variety of brooches with a cylindrical spring cover (T21–27), of which there are about twenty, were cast. The finds include a failed casting of five brooches, still joined at the foot	Guillaumet 1978 and 1984
UNFINISHED BROOCHES		
WROUGHT:		
Augst/Kaiseraugst, Switzerland	Up to eight fragments from part-made bow brooches date to the second half of the first century AD	Riha 1994, 16 and Abb 49
Basle-Munsterhügel, Switzerland	Strip of wrought metal attached to part-formed one-piece brooch (T10?)	Furger-Gunti 1977
Berne-Engelhalbinsel, Switzerland	Unfinished one-piece brooch (T10D?)	Furger-Gunti 1977
Mailhac, Aude, France	Unfinished one-piece brooch (T9?)	Guillaumet 1984, Pl 53.3
Saint-Marcel (Argentomagus), Indre, France	Unfinished or broken pseudo-La Tène II (T3C) brass brooch	Guerra <i>et al</i> 1990, 102, No. 2
CAST:		
Helenenberg, Austria	Unfinished brooch (T84) with runner attached to head, and a pair of brooches (T85) joined by runners attached to their heads (Klagenfurt Museum Inv. No. 4713). These may be the objects described by Drescher as patterns from Magdalensberg	Behrens 1954, Abb 10, 4 and 10, 5
Hungary (in RGZM Mainz)	Unfinished brooch (Inv. No. O.21579), and unfettled casting for two similar brooches, joined at the head (Inv. No. O.3244)	Behrens 1954, Abb 10, 2 and 10, 3
Kempton, Germany	Unfinished plate brooch	Schleiermacher 1993, 37 and Tafel 21, 265
Nepelier, Ardennes, France	Unfinished zoomorphic brooch (T211)	Feugère 1985, 408
Sisak (Siscia), Croatia	Two brooches (T84), one as cast and one with runner partly drawn down to make sprung pin	Behrens 1954, 235; Drescher 1973, Abb 1.5–1.6
Unknown provenance (in RGZM Mainz)	Unfinished brooch with runner attached to head (T84)	Almgren 1897; Behrens 1954, Abb 10,1

Some sites which early publications cited as places where brooches were made have, on re-examination, failed to provide any definite evidence for this. Among British examples are Kirkby Thore, Westmorland, where it is unlikely that trumpet brooches were made (Boon and Savory 1975), South Shields, Durham, where Bidwell (1985) says there is no evidence that crossbow brooches were made locally, and Nornour, Isles of Scilly, where the large number of brooches are now thought to be votive offerings rather than local products (Butcher 1977). One of the Richborough brooches (Cat 233) was originally published as 'straight from the mould and unfinished' (Bushe-Fox 1926, 43), but recent conservation showed it to be enamelled and fully finished. In Belgium the Villa d'Anthée is not now thought to be the origin of many of the continental enamelled second-century brooches (Spitaels 1970).

The most frequently reported evidence for manufacture is unfinished brooches. Some of these are definitely not useable as they lack functional parts; for example, a brooch from Castleford, Yorkshire (Cool 1998, 49), has a catchplate that has not been hammered to shape and the lug behind the head has not been perforated to take the pin. Other brooches are not as fully finished as many similar examples (for example, they have a flash line visible) but they often have surviving pins and so appear to have been used. Where a publication does not provide sufficient details, as is the case for many of the examples in Table 11, it is not possible to say whether the brooch in question was functionally unfinished, and thus an indicator of local manufacture, or whether it was a poor quality product that had been used despite its lack of finish.

Indisputable evidence of manufacture is provided by lead models of brooches since they are only likely to be found where they or clay moulds were being made. Drescher (1973) has also identified copper alloy models, which he differentiates from unfinished castings by the quality of their surface finish; there are no such finds from Britain. Most if not all of the sites where models have been found have also produced other evidence of non-ferrous metalworking. Failed castings, where the metal has not completely filled the mould, complete castings that have not been fettled (excess metal such as sprues, runners and flashing survives), and incompletely made wrought brooches are other good evidence of manufacture; they are unlikely to be transported far from where they were made.

Clay piece moulds tend to survive better than investment moulds as they did not have to be broken as much to remove the casting. However, complete or nearly

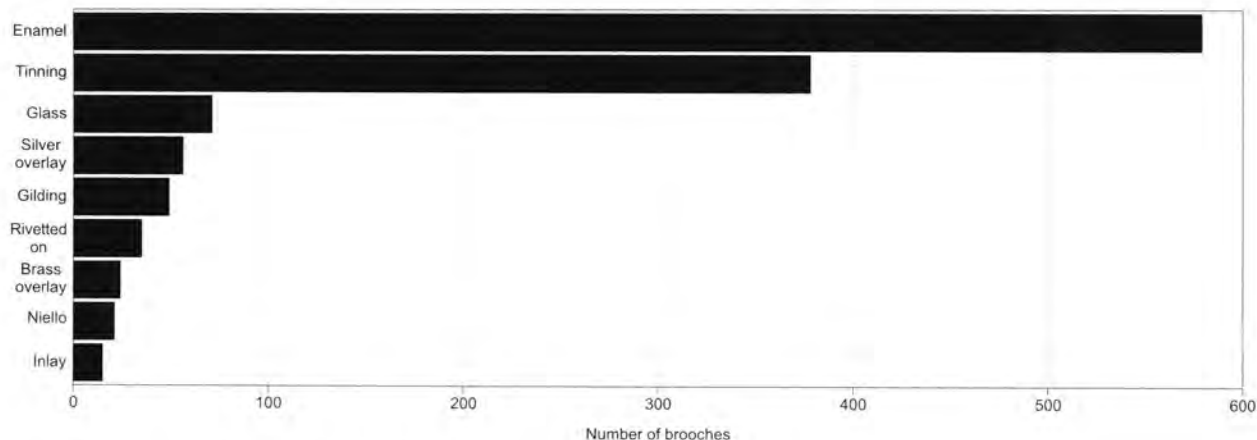
complete moulds often show no sign of having been used, which probably explains their exceptional preservation. They were taken apart, the pattern removed, they were re-assembled, but then lost or discarded before they could be used, as happened to the Roman trumpet brooch mould from Prestatyn, Flint (Blockley 1989, fig 94; Figure 9, Plate 1). This mould had left and right (rather than front and back) valves; incompletely removed casting flashes (for example, Figure 10; Mackreth 1983, fig 3.6) show this arrangement was used where the shape of the brooch made it convenient. Moulds for Roman brooches from continental Europe also show this arrangement (Drescher 1973). In contrast, the brooch moulds from Compton Dando (Bayley 1985) had front and back valves, the fronts bearing the design of the enamel fields as mentioned above (Figure 11, Plate 2). It is the form of these T-shaped brooches and their decoration that make mould valves arranged in this way the obvious choice. The Old Buckingham metal mould (Bayley *et al* 2001) also has a front and a back half that are cleverly designed to fit together and produce a three-dimensional Colchester-derivative brooch (Figure 13, Plate 4). The mould has perforations so the valves can be fixed together, and protruding lugs so it will stand securely, foot-up, for casting. Whether the moulds were made in front/back or left/right halves, the metal usually entered the mould at the foot of the brooch unless it was a one-piece brooch where the runner, which was attached to the head of the brooch, was hammered out to form the spring and pin (for example, Drescher 1973, fig 1.6).

Some unfinished brooches and failed castings are of two (or more) objects, still joined, showing the brooches were cast more than one at a time. In other cases individual moulds were assembled into multiples for casting. An example is the unused multiple mould for Langton Down (T21) brooches from Mont Beuvray (Bibracte), Burgundy, France (Beck *et al* 1982/3). Here the individual brooch moulds are described as investment rather than piece moulds, though failed castings with distinct casting flashes from Autun (Augustodunum), Burgundy (Chardron-Picault and Pernot 1999), suggest piece moulds may also have been used for making brooches of this type.

Not surprisingly, all the lead models and moulds found in Britain are of brooch types thought to be of British manufacture.

DECORATIVE TECHNIQUES

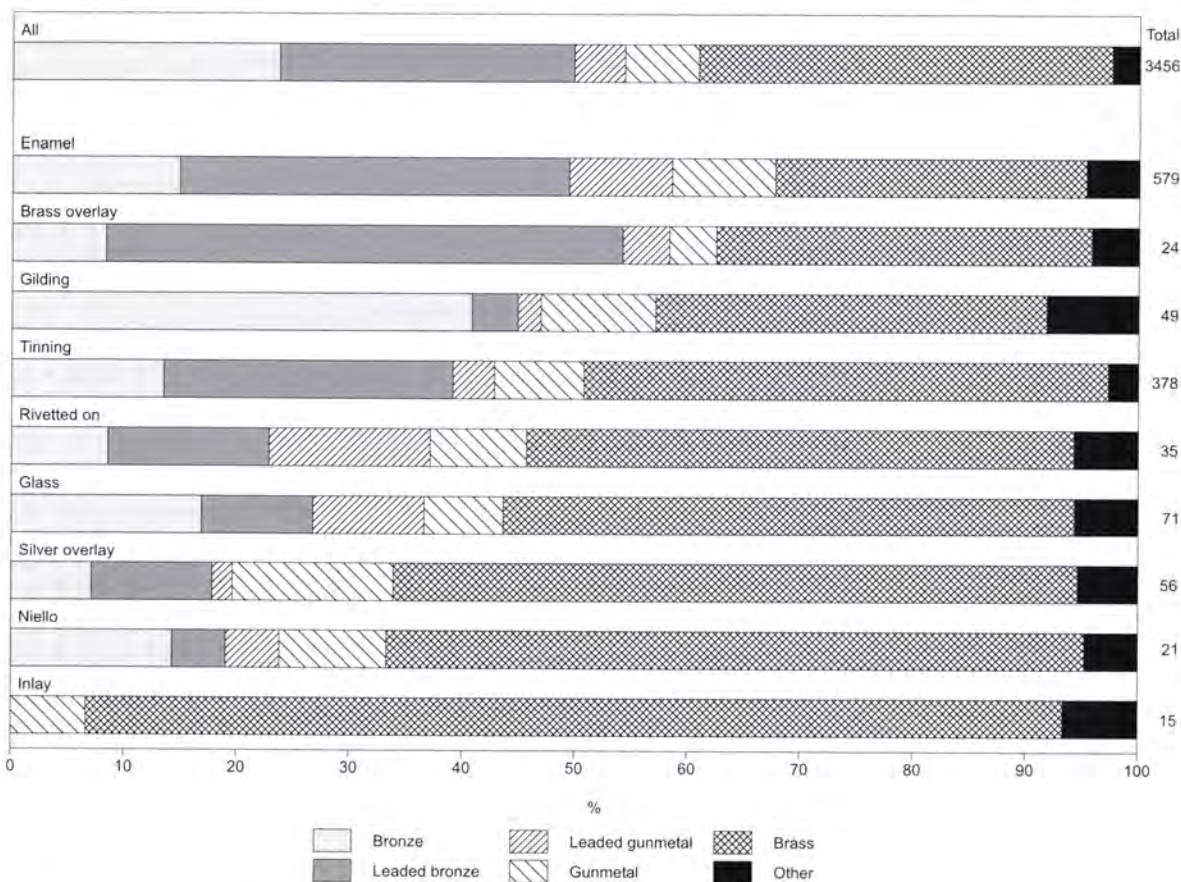
Most brooches carry relief decoration, either cast in or added afterwards, though this varies considerably in its



23 Frequency of different types of applied decoration

extent and complexity. In addition many have some applied decoration which can be divided into two main groups. First are applied metals in the form of platings, inlays or overlays. Usually the applied metal differs in

composition and hence colour from that of the bulk metal of the object; sometimes it provides an overall cover but in other cases just parts are covered, giving a bichrome or polychrome effect. Added non-metallic



24 Proportions of decorated brooches made of different alloys

materials include niello, enamel, glass 'gems' and bone. Figure 23 shows the proportions of brooches where applied decoration of various types survives and Figure 24 shows the correlation of type of decoration with alloy; note the higher than average occurrence of brass, except for enamelled brooches. Often a single object has more than one type of decoration as can be seen from Appendix 1 where the presence of applied metals and non-metallic materials is noted in the column headed 'Decor'; a full key to the codes used there is provided in Table 20.

Applied decoration is often only a thin surface layer and as such it is very susceptible to both abrasion in use and the effects of corrosion after burial. Often it is not possible to determine the full extent of platings, for example, and the original presence of overlays can sometimes only be inferred from patterns of corrosion as none of the metal itself survives. The natural hazards which all brooches have to face have been compounded for the Richborough finds by the treatment they were subjected to after their excavation. Many more-recently excavated brooches have more applied decoration surviving, mainly because of improvements in conservation treatments since the 1920s and 1930s.

GILDING

Gilding has been known since the middle of the third millennium BC. The earliest examples are leaf gilded but by the Roman period an alternative technique known as mercury gilding or fire gilding was also in use.

In leaf gilding the gold was hammered out very thinly, making gold leaf which was then burnished onto a clean metal surface. The thinness of the leaf can be appreciated from Pliny's description (Bailey 1929, 91: Bk 33, para 61) which says that an ounce of gold would produce at least 750 gold leaves measuring four fingers each way, which Bailey calculates as an average thickness of 0.34 microns.

Mercury gilding was known from the middle of the first millennium BC but its use does not become widespread until the third century AD (Oddy 1980). It must, however, have been an accepted if uncommon technology in the mid-first century AD as Pliny notes that it was legal to gild copper using mercury (Bailey 1929, 93: Bk 33, para 64) and goes on to describe the preparation of the surface of the base metal and the application of the mercury and gold leaf (Bailey 1929, 113: Bk 33, para 100). There is a second variant of the technique where a gold-mercury amalgam is made and then applied. In both cases the object is then heated at about 350°C to drive off the mercury, hence the name fire gilding. Oddy (1980) claims that the technique described by Pliny was more difficult, so it may be that mercury gilding did not become common until the use of a gold-mercury amalgam was adopted. It should be noted, however, that Pliny describes the dissolution of gold in mercury in the context of separating gold from other materials (Bailey 1929, 113: Bk 33, para 99), therefore, the existence of gold-mercury amalgams was known in the first century even if their application in gilding was not.

Gilded brooches were analysed qualitatively by X-ray fluorescence analysis (XRF) and if mercury was detected the gilding is described as mercury gilding. Lins and Oddy (1975) comment that mercury can occasionally be detected in gilding that was not applied using it. If XRF gave a strong signal for gold but no detectable mercury the gilding was described as leaf gilding. In some cases only slight traces of gilding survive and here no discrimination could be made.

The majority of the brooches where the type of gilding could be identified are mercury gilded, though the proportion is not as large as might be expected (see Table 13). Most of the gilded brooches are either bronze or brass with no correlation between alloy and type of gilding. It was known in antiquity that mercury gilding could not be used on leaded alloys (Hawthorne and

Table 13 Gilded Roman brooches: type of gilding versus alloy composition

	<i>Mercury gilded</i>	<i>Leaf gilded</i>	<i>Method unknown</i>	<i>Total</i>
Bronze	9	7	4	20
Leaded bronze	–	1	1	2
Leaded gunmetal	–	1	–	1
Gunmetal	2	1	2	5
Brass	10	5	2	17
Other	3	–	1	4
Total	24	15	10	49

Table 14 Gilded Roman brooches: type of gilding versus brooch type

<i>Brooch types</i>	<i>Mercury gilded</i>	<i>Leaf gilded</i>	<i>Method unknown</i>	<i>Mercury/Leaf</i>
Sheath-footed (T186–189)	4	2	2	2.00
Crossbow (T190–192)	5	3	2	1.67
Round plate (T270)	10	5	4	2.00
Oval plate (T271)	3	4	2	0.75

Smith 1979, 145) and the results here show that leaf gilding was used on the few gilded leaded alloys.

None of the gilded brooches in Appendix 1 are early types. With two possible exceptions (a trumpet-headed and a knee brooch) all are third century or later in date. Gilded types are crossbow and other sheath-footed brooches and plate brooches, almost all of which originally had a conical glass setting (for example, Cat 388) or an intaglio (for example, Cat 389). Both types of gilding are used on all gilded brooch types though the sample size is not large enough for the varying proportions shown in Table 14 to be significant.

Gilding is relatively common in the Richborough collection as it has so many later brooches, particularly crossbow types.

TINNING

Tinning is used as a term to describe a very thin surface coating of tin or a tin-rich alloy which appears white or grey in colour. Normally tinning was applied either by fluxing and dipping the object in a pot of molten tin or by rubbing the hot object with a rod of tin or tin-lead alloy (Tylecote 1986; Oddy 1980). Thouvenin (1970) has suggested that electrochemical deposition of tin would also have been possible. Oddy (1980) considers the use of this technique unlikely as none of the early manuscripts mention it though the necessary materials were well known. Some brooches are 'parcel tinned', that is, the tinning was only applied to part of the surface, and this would be easier to execute using a resist (such as wax) and electrochemical plating than with hot metal, though there is no proof that the method was used. Parcel tinned brooches could not have been dipped.

The composition of layers of tinning is variable; both tin and tin-lead alloys were used and the product is sometimes a tin-copper alloy with a far higher melting point than the 232°C of pure tin. Oddy (1980) has argued that these copper-tin layers formed *in situ* by the interdiffusion of the two metals during prolonged heating in a reducing atmosphere below the melting point of tin. Tinning of this type is essential when

mercury gilding is to be applied to the same object (Oddy 1980), as is found in at least thirteen of the brooches examined.

After enamelling, tinning is the commonest type of applied decoration found on Roman brooches; over 10 per cent of those listed in Appendix 1 had traces of tinning on them and many others which had lost their original surfaces were of types that are commonly tinned so the overall figure must originally have been considerably greater. Pliny (Bailey 1932, 67: Bk 34, para 160f) states that a number of different alloys of varying value, mainly tin-lead alloys, were used for tinning. He goes on to comment that 'a method has been devised in Gaul for plating copper articles with pale lead [that is, tin] so skilfully that they can scarcely be distinguished from silver' (*ibid.*).

Tin-lead alloys were not always applied to brooches just to provide a decorative effect. The same alloys were also used as solders to attach sheet metal and beaded wire to brooches (see below). In this case the relevant area of the brooch would have been tinned, the metal overlay would have been tinned on its back, and the join then made by running further molten solder between the two pieces. There is thus a problem in correctly identifying the role of a tin-rich metal coating, particularly when only traces survive. Attempts have been made to address this problem in Appendix 1 where the code 'T' is used for a tin-rich metal coating that was intended to be visible while 'Ts' is used where some or all of the tinning probably originally carried solder. Where more than a thin surface coating survives, it is obvious that it acted as solder and the code 'S' is used and the original presence of a metal overlay is indicated, even where no trace of it survives.

Some types of brooch such as the Hod Hill series (T60–79) were commonly tinned, and a bichrome effect was often obtained by parcel tinning the brass that was the normal bulk metal (see Cat 115, Figure 25, Plate 12). This contrasting yellow and white appearance can be compared with the brass military fittings decorated with silver foil that were also used in the mid-first century (for example, Niblett 1985, fig 61, 8).



25 *Hod Hill brooch showing parcel tinning on the foot and sides of the bow, and a strip of inlaid copper down its centre (Cat 115). Length 56mm (see also Plate 12)*

SILVERING

Silvering, meaning a thin surface coating similar in appearance to tinning, appears to be unknown in the Roman period except on coins which are sometimes described as ‘silver washed’. However, thin sheets and beaded wires of silver which were soldered on (see below) were used to decorate some brooches.

METAL OVERLAYS

Overlay is used here as a term to describe the thin metal sheets and wires which were attached to the surface of brooches with lead-tin solder. The disadvantage to archaeologists of this method is that, on burial, the juxtaposition of different metals provides an electrochemical environment where the solder corrodes preferentially, often leading to the separation of the overlay from the object. With repoussé-decorated sheet metal overlays the solder had the added advantage of filling the back of the design, thereby preventing it from being dented during use.

Most commonly, the applied metal is silver in the form of beaded wire or thin metal foils stamped with a relief design. This is found occasionally on trumpet brooches and regularly on trumpet-headed types

(T162, T166–168) and small knee brooches (T173A). Brasses, some containing enough tin to be reclassified as gunmetals, are the normal alloys used for making these brooches (see Figure 24). Many more trumpet-headed brooches are also brasses and, though no silver survives, traces of partial tinning or marks from differential corrosion where the metal was protected by the applied metal can often still be seen (for example, Cat 236, Figure 19, Plate 9). Some of the wide range of flat enamelled disc and zoomorphic brooches also have traces of silver on the tinned reserved metal between the enamel fields. With zoomorphic brooches in particular it is clear that the tinning was often not an overall cover but forms an even band between and around the enamel fields (Figure 26, Plate 13). The proportion where silver is detectable is small but it is likely that it was originally far more widespread, though when new the visual effect of tinning would have been similar to silver.



26 *Zoomorphic brooch from Chichester with an even band of tinning between and around the enamel fields. This may originally have had attached beaded silver wire (as on Figure 18). Note that the fish's head and fins are not tinned. Length 40mm (see also Plate 13)*

Thin copper alloy sheets with repoussé decoration were also applied to brooches; where this metal is sufficiently preserved to be analysed, it has been shown to be brass. Brooches with this sort of overlay are mainly first-century types. They include rosette or thistle brooches both with cylindrical heads (T26; for example, Cat 73) and with hinged pins (T238; for example, Cat 349), as well as contemporary plate brooches where the applied metal is usually tinned (T224; for example, Cat 340). The bulk metal of all these types is normally brass. For later disc brooches with elaborate designs in the sheet metal (T249; for example, Cat 373, Plate 23) the main part of the brooch is usually leaded bronze. Both brass and leaded bronze

are well represented in Figure 24, as there are almost equal numbers of the earlier and later brooches.

INLAYS

Inlays are wires or twisted, multi-strand wire ropes, soldered or hammered into place in a groove in the surface of a brooch. They appear to lie flush with the surface, unlike the overlays, but were a different colour from the bulk metal so this contrast provides the decorative effect. Inlays are rare in Roman brooches, with a total of fifteen definite or possible examples recorded in Appendix 1. As Table 15 shows, this type of decoration is found mainly on a limited range of brooch types that were current in the early to mid-first century where the bulk metal is brass.

Four Langton Down (T21) brooches have a tin inlay and a further nine have traces of tinning in some of the grooves running down the reeded bow so these brooches probably once also had tin-rich inlays. In three of the four Hod Hill brooches the inlay is a copper-iron cable, which would probably have looked dark grey and pinkish against the yellow of the brass; Richborough has produced two examples (Cat 95 and Cat 114, Figure 27, Plate 14) and a further one with a copper inlay (Cat 115).



27 *Traces of a twisted two-strand copper/iron wire remain inlaid in the central grooves on this incomplete Hod Hill brooch (Cat 114). Length 27mm (see also Plate 14)*

Table 15 Brooches with metal inlays

<i>Site</i>	<i>Type</i>	<i>Inlay</i>	<i>Bulk metal of brooch</i>
Baldock, Hertfordshire	21	Tin	Brass
Redcliff, Yorkshire	21	Tin	Brass
Sandy, Bedfordshire	21	Tin	Brass
Sandy, Bedfordshire	21	Tin?	Brass
St Albans, Hertfordshire	22	Copper	Brass
Dragonby, Lincolnshire	26A	Tin	Brass
Dragonby, Lincolnshire	53A	Tin	Brass
Wanborough, Wiltshire	58	Tin	Brass
Hayling Island, Hampshire	60	Copper and iron	Brass
Richborough, Kent	60	Copper	Brass
Richborough, Kent	61	Copper and iron	Brass
Richborough, Kent	65	Copper and iron	Brass
Sandy, Bedfordshire	162A	Silver	Gunmetal
London*	164+	Tin	Brass
London*	192	Lead?	(Leaded) brass

* London brooches from the old London Museum/Guildhall Museum collections, specific sites not known

NIELLO

Niello has a black, slightly lustrous appearance and, in the Roman period, consists mainly of copper or silver sulphides; most copper alloy objects have copper sulphide niello, though there are exceptions. La Niece (1983) has published the results of a wide-ranging study of its composition and use and these comments draw freely on her paper.

The earliest, positively identified niello is found on first-century AD objects when the Romans used it to decorate tableware, jewellery (including brooches) and military fittings. La Niece found that brass is the copper alloy that most frequently carries niello decoration and this is borne out for the brooches analysed here (see Figure 24). On nine of these brooches tinning also survives so perhaps the tinned copper alloy should be seen as mock silver as silver is certainly the metal that is most often decorated with niello.

The single-sulphide niellos used in the Roman period decompose at temperatures below their melting points, 861°C for Ag₂S and 1121°C for Cu₂S. They thus had to be softened and burnished into place at about 600°C rather than being melted with a flux. Tinning requires lower temperatures than this and so could be applied afterwards but where enamel was also present it would have to be applied first.

Most niello is found on Hod Hill brooches, Hod Hill derivatives (T180–183) and the initial group of symmetrical (equal-ended) plate brooches. It is also found on trumpet-headed brooches and a miscellany of other bow and plate brooches. The fields containing niello are usually narrower than those intended to hold enamel so that even where nothing survives it is usually possible to identify correctly the original filling (for example, Cat 357, Figure 28, Plate 15).



28 Niello in small fields either side of the central enamel fields on an equal-ended plate brooch (Cat 357). Length 31mm (see also Plate 15)

ENAMEL

Champlevé enamel was widely used, with sunken fields to hold it cut or cast into the brooch to be decorated. It is the commonest type of applied decoration recorded in Appendix 1; 17 per cent of the brooches are enamelled. The reserved metal between the fields was an integral part of the design and was sometimes decorated with tinning or applied silver (see above).

Enamel itself is a glass, often opaque but sometimes translucent, which was fused *in situ* thereby adhering to the underlying metal. It would normally have been applied as a moistened powder mixed with an organic binder but sometimes a slab of glass appears to have been cut roughly to shape, softened and pressed into place. Once fused, the enamel may have been left with its 'fire-polished' surface, but the very flat surfaces of well-preserved enamels suggests that more often the surface was ground and polished smooth.

Bateson and Hedges (1975) suggest that lead, which is found almost universally in ancient enamels, was added to help 'wet' the metal more effectively, forming a better bond. Table 16 summarizes the alloy data for all the enamelled brooches in Appendix 1 and shows that every alloy was sometimes enamelled, though leaded bronzes made up just over a third, and brasses just over a quarter of the total. Table 16 also shows the proportion of brooches of each alloy type that are enamelled; the figures vary from 11 to 36 per cent, with leaded gunmetals and gunmetals most often being enamelled while enamelled bronzes and brasses were relatively uncommon. This variation probably owes more to the types of brooches that were enamelled than to the ease with which enamel could be applied to different alloys; for instance Vargin (1967) states that brasses with over 10–13 per cent zinc are hard to enamel. Despite this, high zinc brasses were enamelled; of 53 enamelled brasses where the metal was analysed quantitatively, 28 (53 per cent) have zinc contents over 13 per cent and a further 16 (30 per cent) contain 10–13 per cent zinc.

Several types of champlevé enamel can be distinguished. In simple enamelling each field was filled with a single colour or occasionally with two colours (Figure 26 and Plates 13 and 24). Complex enamelling covers a variety of techniques that are found less frequently (see Table 17). Juxtaposed blocks of enamel (often of two alternating colours) could be used to fill a field (Figure 29, Plate 16), blocks of millefiori could be used on their own (Figures 31 and 98, Plate 17), alternating with plain colours (Figure 32, Plate 18), or set randomly into a field of a single colour of enamel. Some

Table 16 Enamelled Roman brooches

<i>Alloy</i>	<i>Number of enamelled brooches</i>	<i>Percentage of all enamelled brooches</i>	<i>Enamelled as a percentage of this alloy</i>
Bronze	85	14	11
Leaded bronze	205	34	23
Leaded gunmetal	56	9	36
Gunmetal	50	8	23
Brass	157	26	13
Other	42	7	39
Total	595		

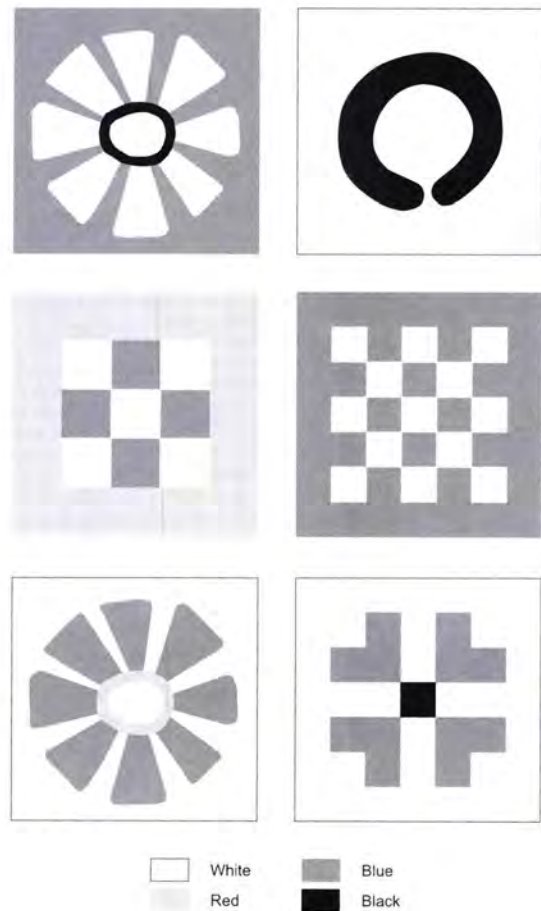
enamel fields had spheres or cylinders of glass set into them to give the effect of spots (Figure 33, Plates 20 and 21), sometimes of one colour surrounded by a second (Figure 34, Plate 22), a pattern described as ‘eyes’ on glass beads (Guido 1978).

Millefiori is the name now used to describe small polychrome patterns in glass. These are made by arranging glass rods of various colours side by side, heating them just enough to fuse them and stretching the bundle of rods into a long thin cane. When cold,

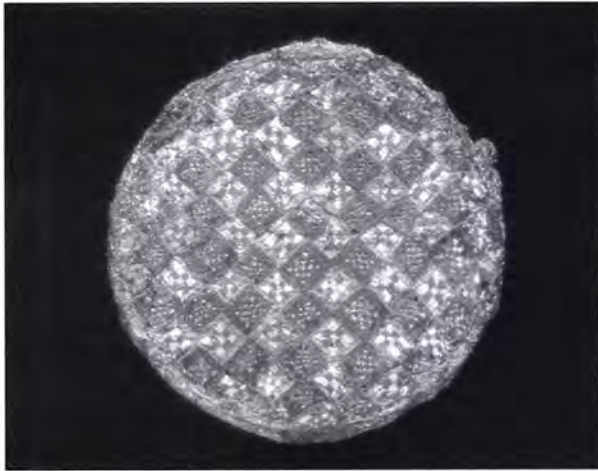
slices can be cut from the cane and used as part of enamelled designs as described above. A few commonly occurring patterns are illustrated in Figure 30.



29 Zoomorphic brooch from London with juxtaposed blocks of enamel on the animal's belly. Length 40mm (see also Plate 16)



30 Millefiori patterns typical of those found on brooches



31 Disc brooch with millefiori enamel from Alcester (cf Cat 370). Diameter 32mm (see also Plate 17)



33 Shoe-sole-shaped plate brooch with inset spots in enamelled field, from London. Length 43mm (see also Plate 20)



32 Detail of enamelled disc from Nornour showing an outer band of turquoise enamel with inset 3 x 3 black and white millefiori blocks, and an inner band (centre) of millefiori blocks with a floret on a white background (cf Figure 30, bottom left) alternating with blocks of plain red enamel, and a central field of inhomogeneous red enamel (below). Image is 15mm across (see also Plate 18)



34 Detail of disc brooch from Nornour with hemispherical spots of white cased in red set in a blue field of enamel). Image is 15mm across (see also Plate 22)

The range of opaque (o) and translucent (t) enamel colours recorded on the brooches in Appendix 1 are red (o), orange (o), yellow (o), golden brown (t), green (ot), turquoise (ot), blue (ot), purple (t), 'black' (t) and white (o), though the frequencies with which each colour was used are very varied (see Table 17). Some enamels weather so badly that the apparent colour can be misleading (Bayley 1987). Changes in the visible colour are caused both by decay of the enamel itself and by staining or impregnation of the enamel by copper corrosion products from the underlying metal which can

be various shades of red, blue, turquoise and green. The corrosion products probably cause, and certainly fill, cracks in the enamel. When translucent enamels decay they tend to appear paler in colour as one can only see a reduced distance into the glass so the original effect of a thick coloured layer is lost. With opaque colours, particles contained in the glass give it its colour. The decay of the glass exposes these particles and some of them then corrode. This happens most frequently with red and orange enamels where the colour is due to the presence of finely divided copper or cuprous oxide (Hughes 1972). These colourants corrode in the same way as the bulk metal of the brooch and the end result is usually a dull greenish hue, varying from pale 'dried-pea soup' to quite dark; sometimes the original surface of these enamels develops an almost black crust.



1 Two-piece clay piece mould for a trumpet brooch from Prestatyn. Length 60mm



2 Fragment of a clay piece mould for a T-shaped brooch from Compton Dando, showing that fields for enamel were formed in the casting. Length c 35mm



3 Umbrate disc brooch (Cat 382), showing tool marks produced by a graver in the base of the triangular fields that have lost their enamel. Length 33mm



4 Two-piece metal mould for a Colchester-derivative brooch from Old Buckenham. Length 70mm



5 Lead pattern for a brooch from Poole's Cavern. Note the incomplete perforation to take the axis bar for the pin and the rib down the edge of the catchplate, which would have been hammered out and turned over in the copper alloy casting. Length 56mm



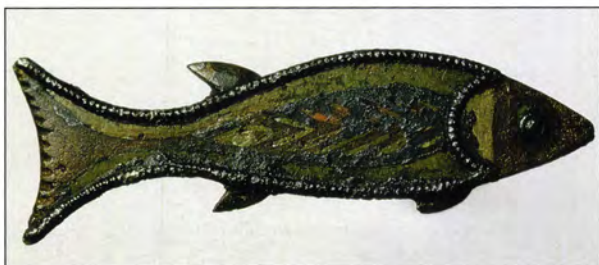
6 Chased decoration on the catchplate of a one-piece Colchester brooch (Cat 59). Length of catchplate 15mm



7 Gilded disc brooch with repeat punched decoration and a conical central glass 'stone' (Cat 388). Diameter 38mm



10 Plate brooch from West Stow, showing how a new pin was soldered onto the stub of the original one. Length 42mm



8 Beaded silver wire edging a zoomorphic brooch from London; the centre of the eye is also applied silver. The orange enamel now mostly looks green. Length 41mm



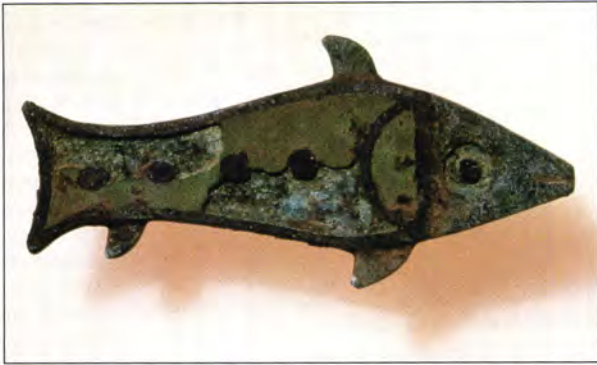
11 Colchester-derivative brooch from No. 1 Poultry, London, showing a replacement catchplate of brass fixed into a slot cut in the back of the foot of the bronze brooch. Length 55mm



9 Trumpet-headed brooch that has lost its applied decoration, though the original positions of the silver spots and strips can still be made out and traces of silver are detectable analytically (Cat 236). Length 72mm



12 Hod Hill brooch showing parcel tinning on the foot and sides of the bow, and a strip of inlaid copper down its centre (Cat 115). Length 56mm



13 Zoomorphic brooch from Chichester with an even band of tinning between and around the enamel fields. This may originally have had attached beaded silver wire (as on Plate 8). Note that the fish's head is not tinned. Length 40mm



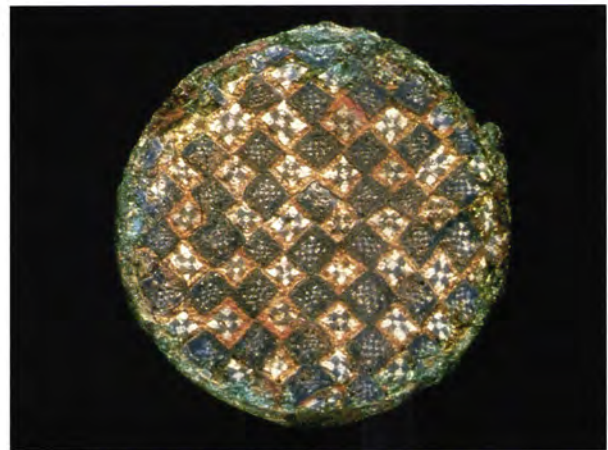
16 Zoomorphic brooch from London with juxtaposed blocks of enamel on the animal's belly. Length 40mm



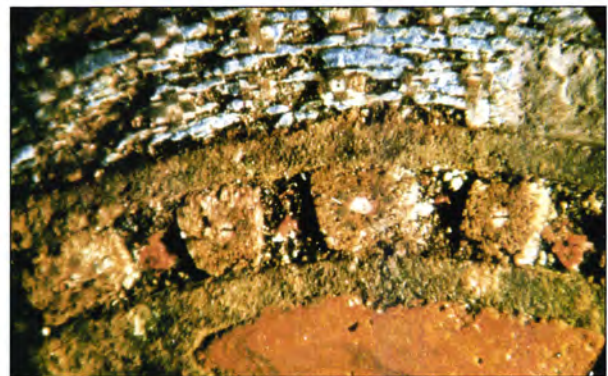
14 Traces of a twisted two-strand copper/iron wire remain inlaid in the central grooves on this incomplete Hod Hill brooch (Cat 114). Length 27mm



15 Niello in small fields either side of the central enamel fields on an equal-ended plate brooch (Cat 357). Length 31mm



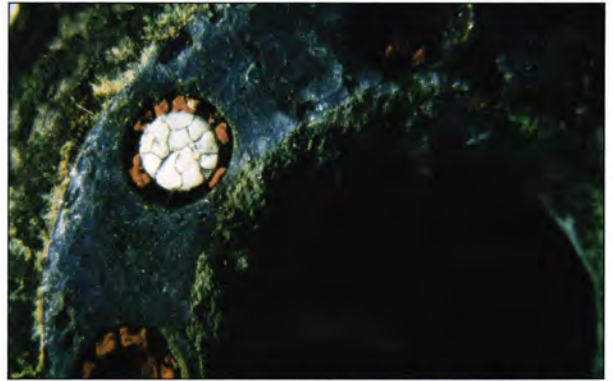
17 Disc brooch with millefiori enamel from Alcester (cf Cat 370). Diameter 32mm



18 Detail of enamelled disc from Nornour showing an outer band of turquoise enamel with inset 3 x 3 black and white millefiori blocks, and an inner band (centre) of millefiori blocks with a floret on a white background (cf Figure 34, bottom right) alternating with blocks of plain red enamel, and a central field of inhomogeneous red enamel (below). Image is 15mm across



19 Enamelled disc brooch from London (left), showing simple enamel, juxtaposed blocks of enamel and millefiori, and inset spots in the enamel on the central stud. Diameter 45mm. To the right is a modern brooch, the design and enamel colours based on the original but not faithfully copying it. The bright colours give a good idea of the original appearance of Roman enamels.



22 Detail of disc brooch from Nornour with hemispherical spots of white cased in red set in a field of blue enamel. Image is 15mm across



20 Shoe-sole-shaped plate brooch from London with inset cylindrical spots of yellow and turquoise in a field of green enamel. Length 43mm



23 Plate brooch with applied repoussé-decorated brass sheet (Cat 373). Diameter 24mm



21 Bow brooch from London with zoomorphic foot and inset turquoise spots in a field of red enamel. Length 37mm



24 Enamelled disc brooch (Cat 380). The opaque turquoise and yellow colours have survived well but much of the red enamel now has a weathered green surface. Length 46mm

In about 80 per cent of the enamelled brooches sufficient survives for one or more colours to be identified, though these do not necessarily represent all the colours that were originally present. The colour identifications were made visually, using a low magnification (x10–x30) microscope, looking particularly at any newly damaged areas where less decayed enamel could be seen and a better estimate made of its original colour. Although copper corrosion products have the same colours as some enamel, their structure and surface texture usually differ, as does the hue. With experience, confusion can be minimized.

Because so many decay processes can give rise to a greenish colour it is difficult to be sure that an enamel was originally green, so this colour is almost certainly under-represented in Table 17. Whites can be stained green, but decayed pale translucent colours can appear white so the effect of decay on the identification of white enamels is probably neutral. Blues and to a lesser extent turquoise appear to be relatively resistant to decay so they tend to be over-represented. Translucent turquoise was also used as an ‘undercoat’, to partly fill large fields before

a final coloured layer of glass was added. This was clearly seen on a plate brooch from Chichester, Sussex (Figure 26; Mackreth 1989, fig 26.2, 86), and suggests that where traces of translucent turquoise enamel survive at the base of a field it may not always have been the intended final colour. Traces of reds and oranges can often be seen peeping out from masses of decayed greens of various hues and it is likely that many of the other totally greenish remains were once also red or orange, though a few were probably always green. Reds and oranges appear to decay equally, and since red enamel is recognized far more often than orange it is likely that many of the decayed greenish enamels were once red.

A different palette of colours was used for each type of enamelling (see Table 17 and Figure 35). In compiling this data, all the enamel colours on a brooch that had any enamel fields containing millefiori were counted under the millefiori heading as those were the colours that were used by craftsmen who worked with millefiori; the range of colours found in the millefiori itself was nearly as broad with only orange not used. The same comments apply to other complex enamels.

Table 17 Occurrence of enamel colours

	<i>Simple</i>	<i>Two</i>	<i>Spots</i>	<i>Juxtaposed</i>	<i>Millefiori</i>	<i>Total</i>	<i>%</i>
Red	127	3	12	21	16	179	21.1
Orange	15	–	5	10	3	33	3.9
Yellow	14	–	6	3	6	29	3.4
Golden brown	4	–	–	–	–	4	0.5
Green	20	2	6	2	–	30	3.5
Turquoise	93	1	15	11	8	128	15.1
Blue	114	5	17	15	15	166	19.5
Purple	–	–	–	1	1	2	0.2
Black	13	–	13	6	7	39	4.6
White	18	3	21	7	16	65	7.6
Decayed greenish	148	–	7	15	5	175	20.6
Total	566	14	102	91	77	850	
No. of brooches	362	6	42	37	22		

NOTES:

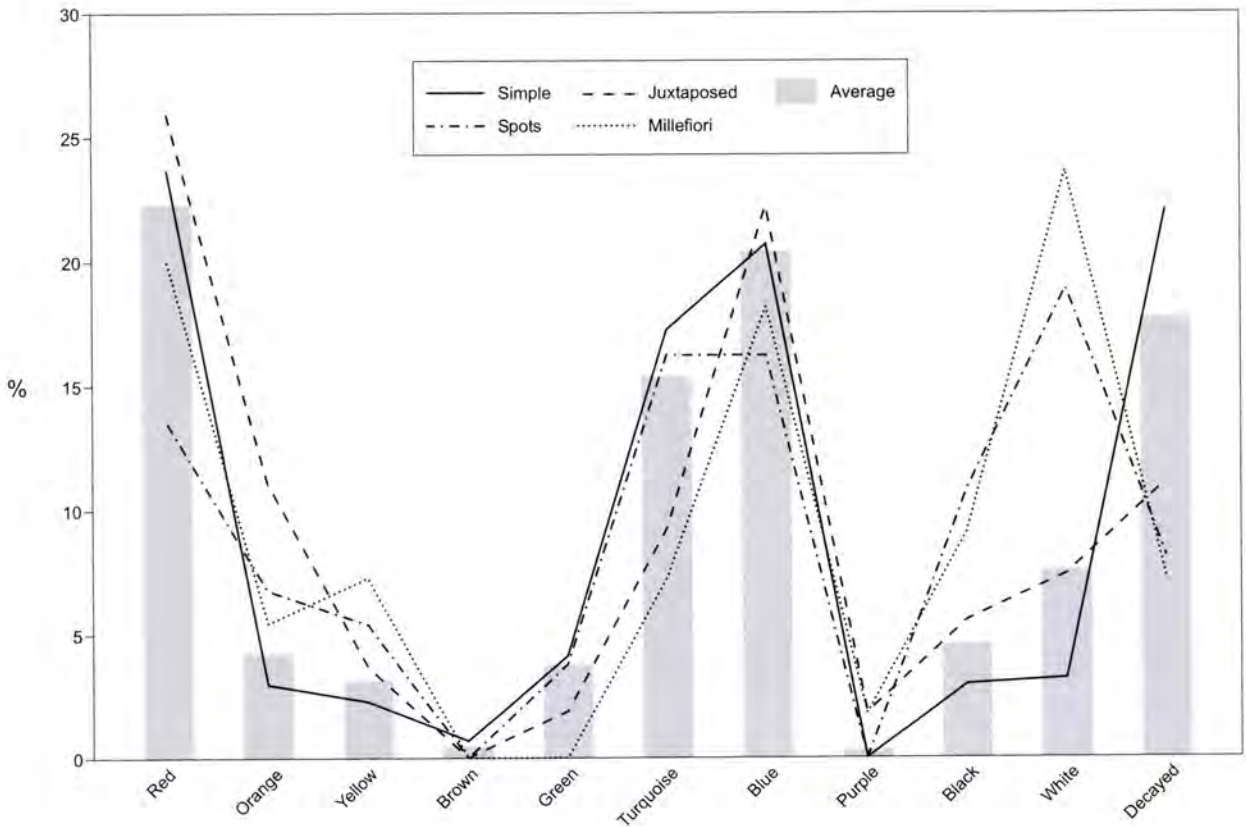
The figures in the main block of the table are the numbers of brooches with each colour surviving.

For example, 15 of the 37 brooches with juxtaposed enamelling have blue enamel present.

The total column shows how many of the brooches in Appendix 1 had each colour of enamel surviving.

The % column shows the relative frequency of each colour.

The bottom row shows how many brooches were decorated with each type of enamel.



35 Graph showing the relative frequency of different colours in different types of enamelling

In simple enamelling the dominant surviving colours are red followed by blue and turquoise, with everything else present at under 5 per cent and purple absent. This is the only type of enamelling where a translucent golden brown has been recognized and it may be a product of decay processes rather than the original intention of the craftsman. Where cylindrical or hemispherical spots are present, the main colours are blue and white, with red, turquoise and black also present at over 10 per cent and more orange and yellow than for simple enamel; there is no purple or brown. When juxtaposed blocks of enamel are present red and blue are dominant with turquoise and orange the only other colours present in over 10 per cent of cases. In millefiori enamel white, red and blue are dominant; there is no green or brown. White appears in most millefiori designs which explains its frequency in this group. Although there are some differences, the simple, juxtaposed and millefiori colour frequencies are similar, but on brooches decorated with enamel spots the major colours are very different though the range is the same.

A general discussion of correlations between brooch type and type of enamelling is included in Chapter 7.

ATTACHED DECORATION

Most attached decoration is made of glass. This takes various forms, depending on the type of brooch to which it is applied. Rosette/thistle brooches can have a small glass sphere in the centre of the panel on the bow, presumably held in place by an adhesive, while some variants of headstud brooches have an annular glass bead held in place by a decorative rivet at the top of the bow and at the foot (for example, Cat 228, Figure 76); in both of these cases the glass was normally opaque red though like red enamels it is often discoloured.

Some plate brooches have plano-convex glass 'gems' held in place by sheet metal soldered to a backing plate (for example, Cat 341, Figure 94); these are translucent glass, usually blue or golden brown (amber). Cone-shaped glass 'gems' (for example, Cat 388, Figure 101) or cast glass intaglios (for example, Cat 389, Figure 101) are attached to gilded plate brooches sometimes with

some sort of packing material underneath (for example, Cat 390). The conical 'gems' most commonly look black but the glass is normally a deep olive green, sometimes overlying a colourless or multi-coloured core. Other colours are known but are rare.

In a few cases metal parts, rather than just decoration are soldered on. As with the metal overlays described above, this type of attachment rarely survives *in situ* though in some cases the unfinished appearance of the centre of a plate brooch (for example, T257) suggests that it must once have been there.

Several types of plate brooch can be seen to have lost riveted decoration of some description. The rivet was often iron, which corrodes preferentially when in contact with copper alloys, destroying the join. Brooch types with this sort of decoration include T225, T238 and T242. It is not known for certain what the attached material was; bone or shell are possibilities. Bone is known to have been used by brooch makers, it survives occasionally when the rivets are made of copper alloy (for example, Niblett 1985, fig 76, 43).

CHAPTER 4

CATALOGUE OF BROOCHES FOUND AT RICHBOROUGH

NOTES AND CONVENTIONS

Form of catalogue entries

Running catalogue no.; original Richborough publication reference, if any; L = length; W = width; D = diameter; * = incomplete or distorted; alloy; any added material identified; question mark denotes uncertainty.

Reference to original publication

If the brooch was published in the Richborough excavation reports a reference is given in the first line of the catalogue entry, in the form: RI (Bushe-Fox 1926); RII (Bushe-Fox 1928); RIII (Bushe-Fox 1932); RIV (Bushe-Fox 1949); RV (Cunliffe 1968); followed by a number, which is that of the brooch in the catalogue in that report.

Alloy identification: data from Appendix 1

Site provenance

SF: Number in small find registers surviving from Bushe-Fox excavation records. The site context is quoted from these registers where available; abbreviations as given there except that ' is given as ft (feet) and " as ins (inches). See also Appendix 4.

Context date

ML: Malcolm Lyne's dating for the deposit in which the brooch was found, following his re-examination of the pottery and other evidence in 1993. The context dating in the excavation reports sometimes differs from this, presumably where residual material had not been recognized.

Typology

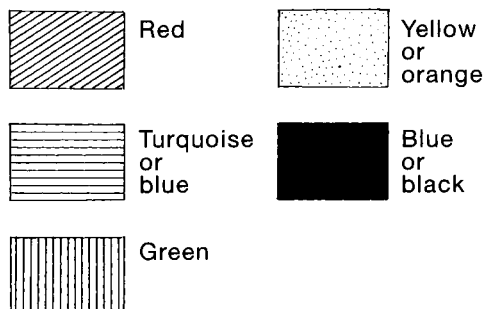
Where possible the definition of each type contains a type number in the form T00 (see Chapter 1 and Tables 1-3). These are an adaptation of M R Hull's typology, set out in Appendix 2.

Decoration

No decoration mentioned means that none is visible. Where only traces of enamel survive the illustrations show its extent. Where most of the enamel in a field is present, its colour is indicated by shadings as in Figure 36. The original surface does not survive on many of the Richborough brooches.

Parallels

Parallels are given in the catalogue only where individual brooches are not discussed elsewhere. Appendix 3 lists those discussed in Chapter 6 as



36 Key to enamel colours

evidence of the history or the administrative and economic connections of the site at Richborough. Where Richborough brooches are discussed as part of the history of Roman brooches in Britain in Chapter 5 their parallels are cited there.

Missing brooches

Those brooches now missing which are identifiable in the earlier publications are listed in Table 25 (Appendix 4) with the prefix A and the published drawings are reproduced in Figure 184 (Appendix 4); a cross reference is given in the catalogue. Information about further brooches that were mentioned but not illustrated in the earlier publications is given in Table 26 (Appendix 4). A further group of brooches could not be associated with any of the extant brooches and the information from the small find registers is given in Table 27 (Appendix 4). Some of these were sketched in the registers and these illustrations are reproduced in Figure 185 (Appendix 4).

BOW BROOCHES

ONE-PIECE SPRUNG BROOCHES

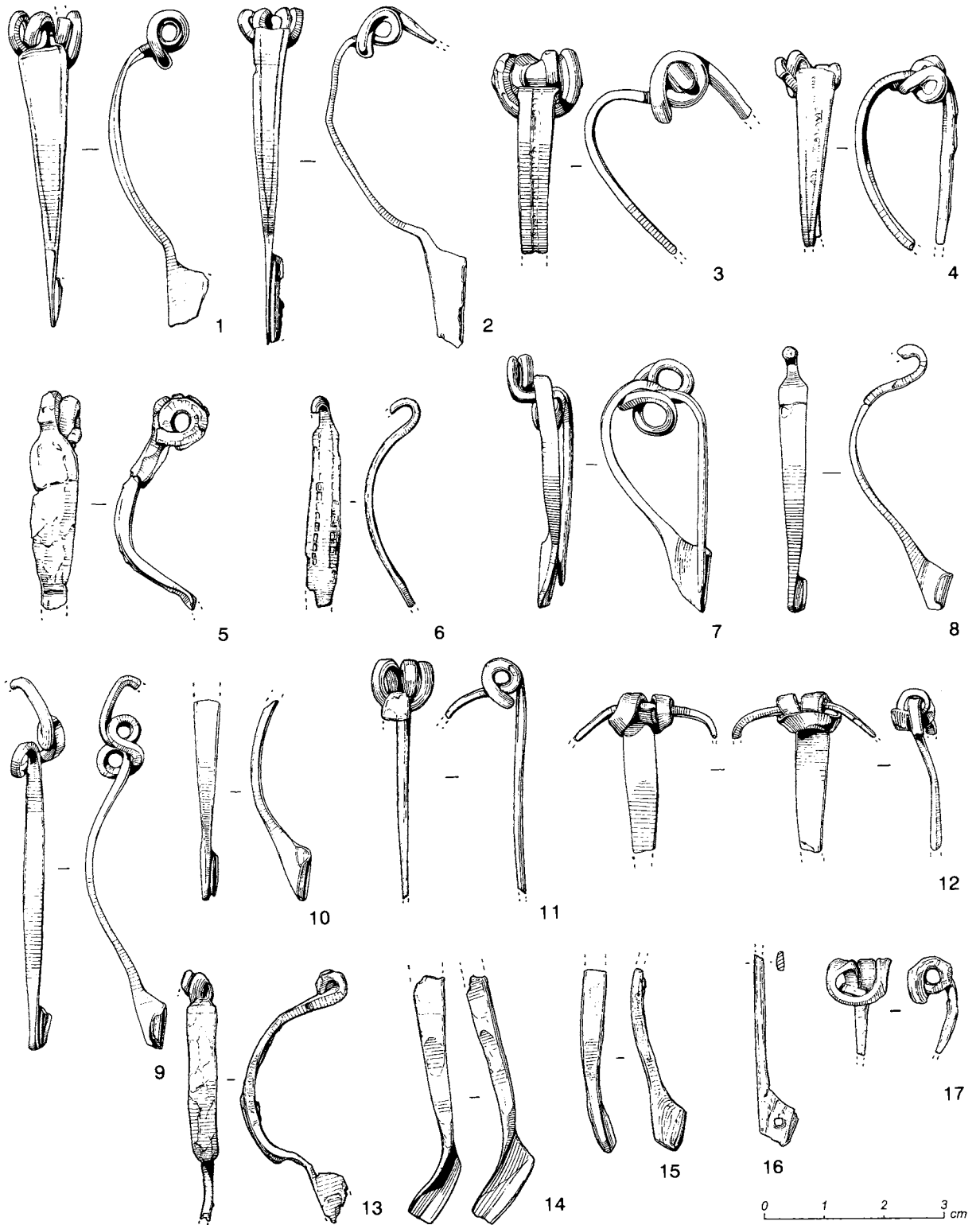
The 'simple one-piece' or 'Nauheim derivative' brooch: no crossbar, bilateral four-coil spring, inferior chord, solid catchplate. T10–11

In the catalogue the main distinction has been drawn between those with a flat-sectioned bow and those which seem to be made from a simple piece of wire, the 'rod bow', sometimes called the 'poor man's brooch'. Hull distinguished those with a 'reversed curve' in profile (T10) from those with a simple curve (T11), and subdivided these types by the shape and decoration of the bow. He admitted that the division by profile was merely a classificatory device which did not seem to have much significance, and it has been dropped here as a number of incomplete specimens cannot be defined in this way. Further, the alloy analyses do not distinguish these sub-types. See Chapter 5 (pp 147–8) for discussion, and Appendix 3 (pp 241–3) for parallels.

a) *With bow of flat cross-section, sometimes decorated*

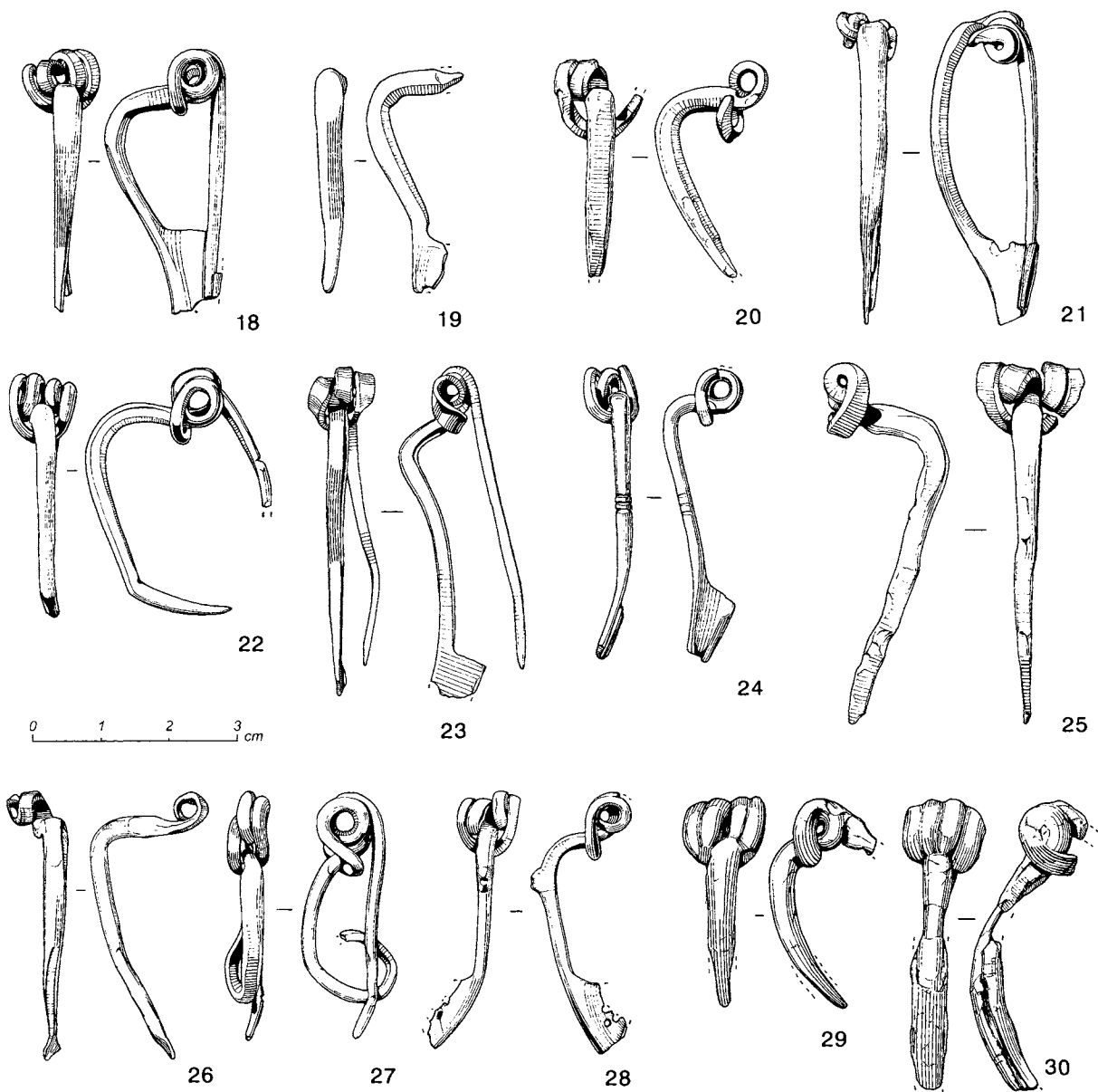
1. L 53mm Bronze
The bow tapers to the foot and has fine marginal grooves; in profile it shows a curved upper bow, with an angle where it meets the straight foot. (Hull's T10, with 'reversed curve').
SF 3469 Inner ditch N side filling. ML AD 280–400+.

2. RIV, No. 3 L 57mm* Brass
Similar to Cat 1 above though longer.
SF 1649 Pit 125, Area VI. ML AD 75–90.
3. RV, No. 9 L 35mm* Bronze
The upper part only; the bow has a central longitudinal groove with beaded decoration (effected by shallow punching). There is a bar formed from rolled up sheet metal through the spring.
SF 4978 In black patch on berm of Claudian ditch. ML Claudian.
4. L 32mm* Bronze
From the curve of the upper bow this probably had an angle at the foot. The bow tapers towards the foot and is decorated with a fine zigzag line between marginal grooves.
SF 2556 Area XVI below burnt layer S of cellar. ML about AD 75–90.
5. L 36mm* Bronze
The upper part only: a leaf-shaped upper bow. Profile possibly recurved.
SF 845 Trench NE end 7ft [2.1m] down. ML second century.
6. RV, No. 4 L 36mm* Bronze
The upper part only, with one coil of the spring and bow of flat profile with two bands of relief decoration.
SF 4201 Area XIX Lower occupation layer. ML about AD 65–80.
7. L c 40mm* Bronze
Narrow flat-sectioned bow with angle at foot. For parallels see Appendix 3.
SF 2367 Fort ditches outside W gate. ML about AD 400+.
8. RV, No. 5 L 45mm Bronze
Narrow flat-sectioned bow with angle at foot; first coil only of spring survives. Now broken across bow.
SF 4076 Surface of SW area inside stone fort. ML AD 280–400+.
9. RII, No. 1 L c 52mm* Gunmetal
Narrow flat-sectioned bow with angle at foot.
'Topsoil' (RII, p 40).



37 Simple one-piece brooches or 'Nauheim derivative'; group a) with flat bows. Cat 1-17

10. L 33mm* Bronze/gunmetal
The lower part of a brooch with narrow flat-sectioned bow tapering to foot; slight angle at foot. SF 862 Pit 502 Solley's field. ML about AD 150–200.
11. L 40mm* Gunmetal
The spring (three coils), pin and upper part of a flat-sectioned bow. SF 1272 Tip outside N wall.
12. L 25mm* Bronze
The upper part of a brooch with flat-sectioned bow. A separate strip of metal is threaded through the spring of only three flat coils. SF 667 Surface near Trench A.
13. RV, No. 3 L 41mm* Bronze
Highly arched bow of flat section, narrowing abruptly at both head and foot, angled above foot. Two coils of spring remain. SF 4326 Surface of SW area inside stone fort. ML AD 280–400+.
14. L 42mm* Bronze
The head is missing; the flat bow, twisted but apparently with reverse curve, is decorated with fine engraved lines; rectangular catchplate. No site provenance.
15. L 31mm* Bronze
The lower part only of a plain flat bow with small catchplate. No site provenance.
16. L 30mm* Bronze
Lower bow only: straight with flat section. The small catchplate has one round perforation. SF 2573 Area XVII surface. ML AD 200–400+.
17. L 16mm* Bronze
The three-coil spring and part of pin of a one-piece brooch with top of flat-sectioned bow. SF 835 Trench N N extension 5ft [1.5m] in black pocket.
- b) *Rod or wire bows*
18. RIV, No. 4 L 39mm* Brass
Plain rod bow tapering to foot. Arched profile with slight angle at foot. SF 1049 Area X S end 6ins [152mm].
19. L 33mm* Bronze
Rod bow with similar profile to Cat 18 above; spring missing and foot incomplete. SF 4957 W of sect. 39 above posthole W of gully 17.
20. L 32mm* Bronze
Rod bow with similar profile to Cat 18 above; lower part and half of spring missing. SF 1846 Outside W gate. Surface of inner ditch. ML about AD 400+.
21. L 45mm?* Brass
Flatter profile than Cat 18 above and rod bow of trapezoidal cross-section. SF 2747 Area V. Filling over middle ditch. ML about AD 250–80
22. RV, No. 7 L c 40mm* Brass
Rod bow with arched profile; the lower part bent and broken. SF 4996 Area XVII/32 U/S.
23. L 48mm Brass
Angled rod bow with spring of three coils. SF 1860 S of entrance. Inner ditch middle layer. ML AD 400+.
24. RV, No. 6 L 44mm Brass
Rod bow with three grooves across centre (not shown on pl xxvi, RV); it also has longitudinal striations which are not decoration but result from the formation of the rod. Three coils of broken spring remain. Now bent but the profile was flattish, with slight angle at foot. SF 4806 'Area XVII. W extension, W of outer Claudian ditch. Top layer' (RV, p 78).
25. RV, No. 2 L 53mm* Bronze
Rod bow, arched profile near head but straightens towards foot. In RV the brooch, obviously the same, shown on pl xxvi and bearing the same excavation number (4167) is described as iron. SF 4167 Surface of SW area inside stone fort. ML about AD 280–400+.
26. L 40mm* Brass
Rod bow with sharp angle in upper profile. Foot and half of spring missing. SF 2260 Tip 2 outside N wall.



38 Simple one-piece brooches or 'Nauheim derivative'; group b) with rod bows. Cat 18-30

27. L c 35mm* Bronze/gunmetal
Rod bow and spring of three coils; foot missing.
SF 1979 Inner ditch middle layer. ML about
AD 400+.

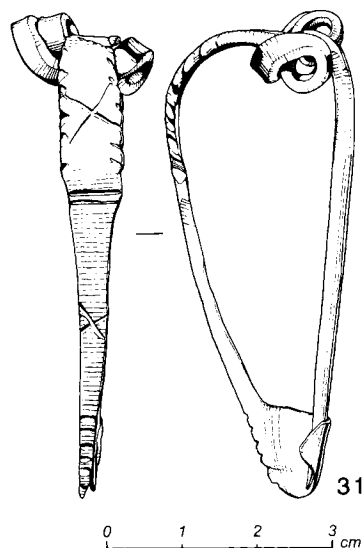
29. L 27mm* Copper/bronze
The upper part only of a rod bow with one-piece
spring of four coils.
No site provenance.

28. L 39mm* Brass
Rod bow of flattish profile with boss on upper
bow; foot broken, three round holes in catchplate.
SF 917 Claudian ditch, 6ins [152mm] of fallen
soil. ML Claudian.

30. L 35mm* Bronze
Upper part of a badly corroded bow and spring of
four coils.
No site provenance.

'Giubiasco' brooch

31. RV, No. 8 L 60mm Brass
 Stout flat-sectioned bow decorated with two engraved Xs; cross-grooves and notched sides to the upper bow. The four coils of the spring are of flat section. The highly arched profile runs in a single line to the foot.
 SF 4400 Surface of SW area inside stone fort. ML about AD 280-400+
 Hull identified this as a brooch of Giubiasco type (1968a, 78; Werner 1955, 181, Abb 2, 3). The type comes from northern Italy, where it is usually datable to the first century BC, and is clearly out of context here.



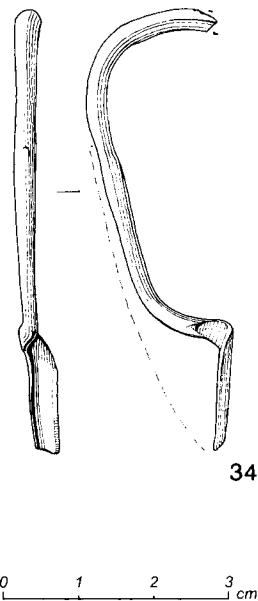
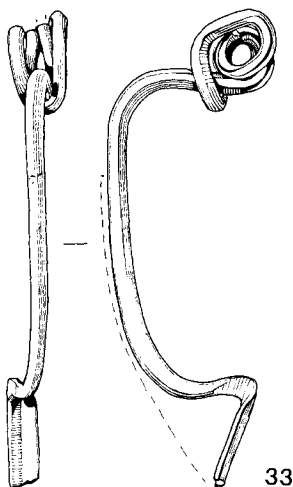
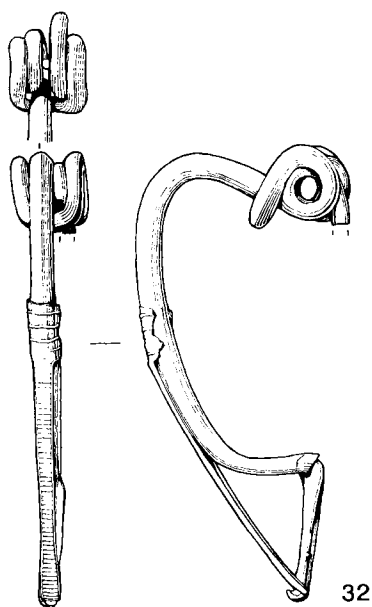
39 Giubiasco brooch. Cat 31

Pseudo-La Tène II: one-piece brooches with returned foot. T3C

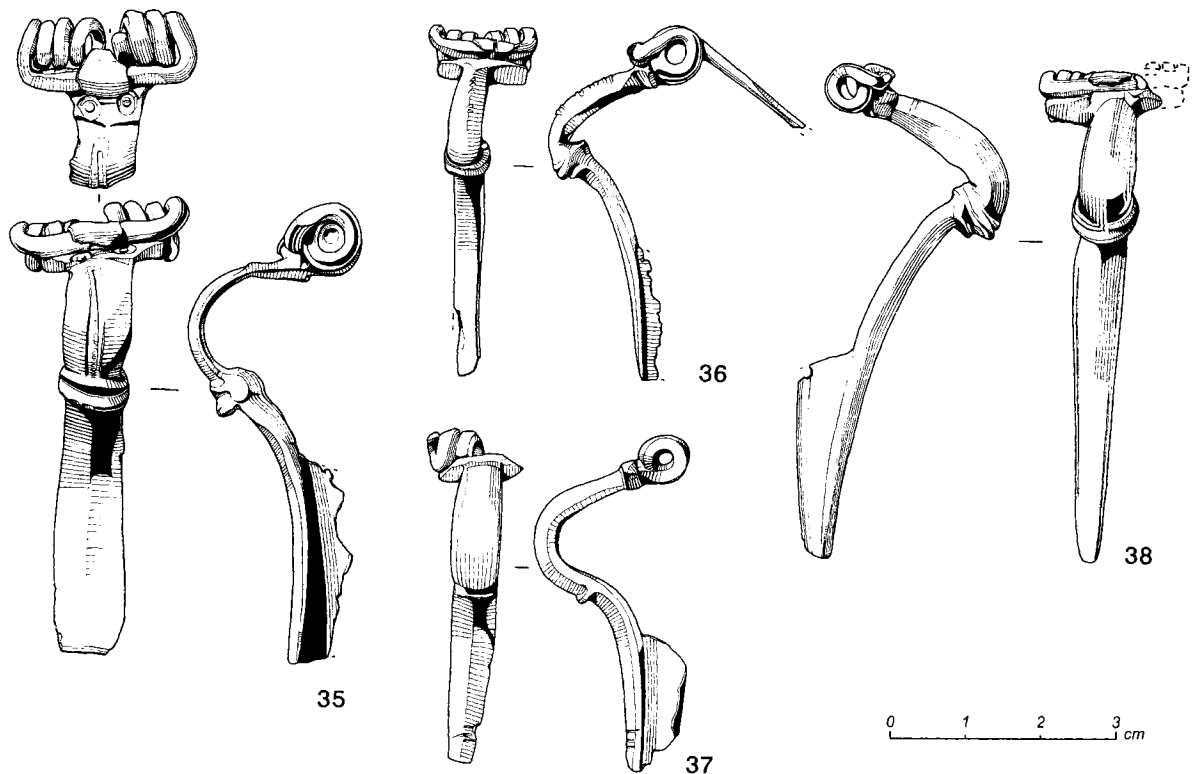
Although the returned foot is the main feature of La Tène II brooches, the Richborough examples can be distinguished by details of construction: the short spring with inferior chord and arched upper bow. See Chapter 5 (pp 145-6).

32. RIV, No. 2 L 60mm Brass
 Bilateral spring of four turns with inferior chord; highly arched upper bow, the lower part straight and channelled to form a catch for the pin. The

flattened rod is bent sharply back from the foot to meet the arch of the upper bow, where it forms a cross-ribbed clip. Pin missing.
 SF 1265A Tomb S Trench 4ft [1.2m] down. ML up to AD 200.



40 *Pseudo-La Tène II brooches. Cat 32-34*



41 Eye brooch. Cat 35. Knickfibeln. Cat 36–38

33. RIV, No. 1 L 58mm* Brass
 This was more complete when drawn for RIV (pl xxv) where it is shown as very similar to Cat 32 above, but larger: 70mm overall. Now the returned foot is missing.
 SF 999 Area VII Room C. ML second-third century.

34. RV, No. 1 L 58mm* Brass
 When drawn for RV (pl xxvi) this had half of its bilateral spring. Now only the arched upper bow and channelled foot remain, but it was clearly similar to the two preceding brooches.
 SF 5006. 'No provenance' (RV, p 77).

Continental one-piece brooches: the upper bow sharply raised in profile, spring of several turns with superior chord, hook for chord, short crossbar, moulding in centre of bow.

Eye brooch. T40

With broad bow and 'eye' decoration on the head.
 Discussed in Chapter 5 (p 148); parallels listed in Appendix 3 (p 243).

35. RIV, No. 8 L 60mm Brass
 The spring of eight turns has a superior chord, held by a broad central hook turned back over the head. Two 'eye' motifs are punched on top of the expanded head. The arched upper bow has a central rib, faintly beaded, ending at a double cross-moulding. The flatter lower bow is broad and plain except for a transverse groove at the foot. The long catchplate is broken.
 The 'eyes' were not seen when this brooch was first published (Bushe-Fox 1949, no. 8, p 109).
 SF 1496 Outside W gate (stone fort). Surface.

The 'Knickfibel'. T42

With more angular profile and narrower foot than T40 above. The type is discussed in Chapter 5 (p 148); parallels are given in Appendix 3 (p 243).

36. RIII, No. 7 L 46mm Brass
Spring of six turns, sharply angled bow, the upper part triangular in section, with traces of beading on the arris. Below the cross-moulding the bow is plain; the catchplate is broken.
SF 611 Trench B top pit 29. ML AD 50–120.

37. L 42mm Brass
Similar to Cat 36 but the upper bow more arched, wider, and in section rounded on top; the lower bow has a triangular section. Only three turns of the spring survive.
SF 2648 Area XVIII on floor 16. ML Flavian.

38. L 65mm Brass
Large brooch with stout bow sharply angled above the cross-moulding and long plain foot.
Only one side of the bilateral spring remains; this has four turns.
SF 1260 Section 47 bottom of Claudian ditch under 1st road. ML about AD 43.

The 'Kräftig-profilierete' type. T84

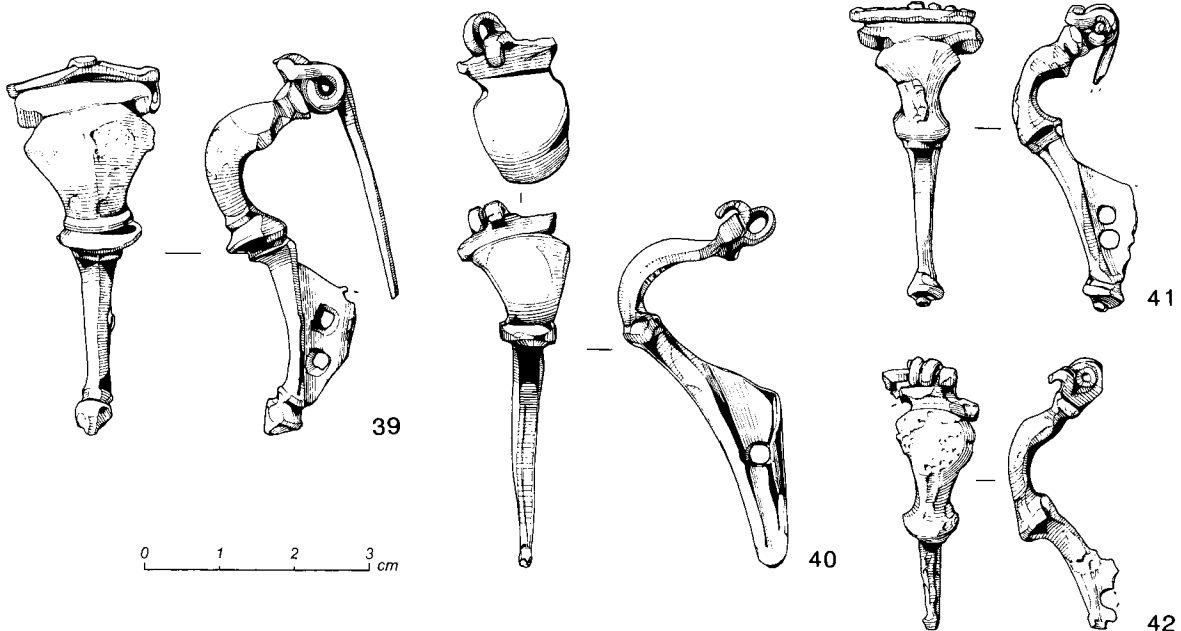
One-piece brooches with spring of about eight turns and superior chord held by a rearward-facing hook above a wide crossbar; the upper bow expands towards a narrower neck at the head; upper bow profile highly

arched and angular above a central encircling moulding, the foot narrower and curved upward to a terminal knob. The Richborough examples belong to Hull's subdivision B, with triangular catchplate, which has one to three round perforations, or none. The type is discussed in Chapter 5 (p 148) and parallels are listed in Appendix 3 (p 243).

39. RV, No. 38 L 50mm Brass
As type description above; the catchplate long and triangular, pierced by two holes.
SF 4563 Area XVIII posthole house in E–W gully ... below mixing. ML pre-AD 85.

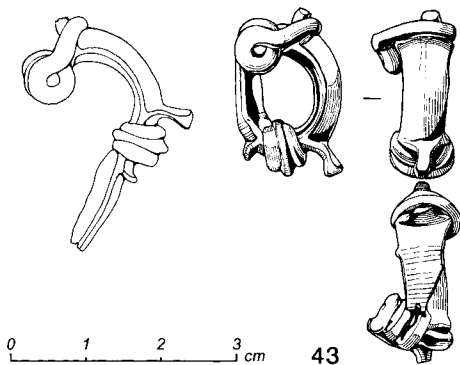
40. RV, No. 39 L 50mm Brass
Similar to Cat 39 above but only one turn of spring survives; there is only one hole through the catchplate and the brooch appears more crudely made.
SF 5056 No site provenance (RV, p 83).

41. RV, No. 37 L 40mm Brass
As Cat 39 above but smaller. A rod is threaded through the coils of the spring.
SF 4977 Pit 279 3ft [0.9m] down. ML AD 75–100.



42 *Kräftig-profilierete brooches. Cat 39–42*

42. RIV, No. 9 L 36mm* Brass
 As Cat 39 but smaller and the lower bow and part of catchplate now missing; it has a rod threaded through the coils of the spring. The drawing in RIV shows a footknob similar to the others and two holes in the catchplate.
 SF 2590 Area XVI 1ft 8ins [0.5m] below level of burnt layer E of road. ML AD 50–80.



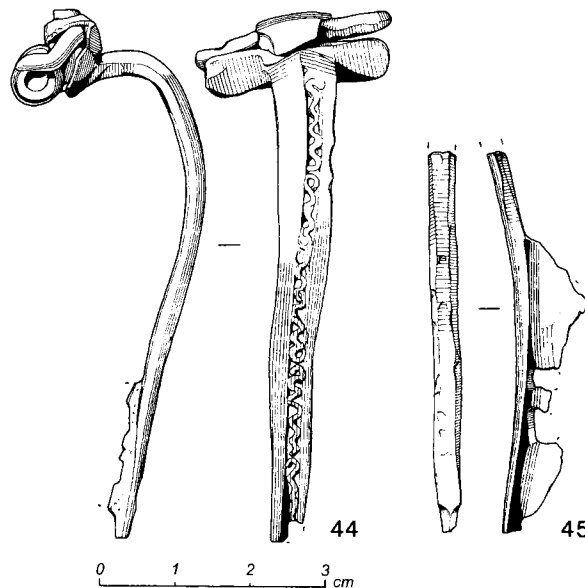
43 One-piece brooch fragment. Cat 43

One-piece brooch: fragment perhaps related to the Flügelfibel. T87

43. L 37mm* Brass
 The upper part only, badly bent; broken head showing part of a bilateral spring of six to eight turns with external chord held by rearward-facing hook. No crossbar, the upper bow fairly broad but parallel-sided and with triangular section. The bow is arched above a triple moulding formed of a central flange with two wire loops (also of brass) circling the bow; this is flanked by horn-like projections above and below. The lower bow is broken but appears to be plain and tapering slightly towards the foot. Textile was noted in conservation. No site provenance.

No parallel can be cited for this fragment but it may derive its 'horns' from the Pannonian Flügelfibel, a very ornate brooch found in the Danube region (Kovrig 1937, 108–12). Feugère illustrates two plainer brooches from Vieille-Toulouse, France, which may be related; from context-dated examples of his type he concludes that it is Augustan (Feugère 1985, nos 1181–2, type 13c, pp 258–9).

The 'Simple Gallic' and 'Colchester' types: one-piece brooches with short plain crossbar and spring with external chord held by rearward hook. T89–91
 These types are discussed in Chapter 5 (pp 148–50); parallels are listed in Appendix 3 (pp 244–5).

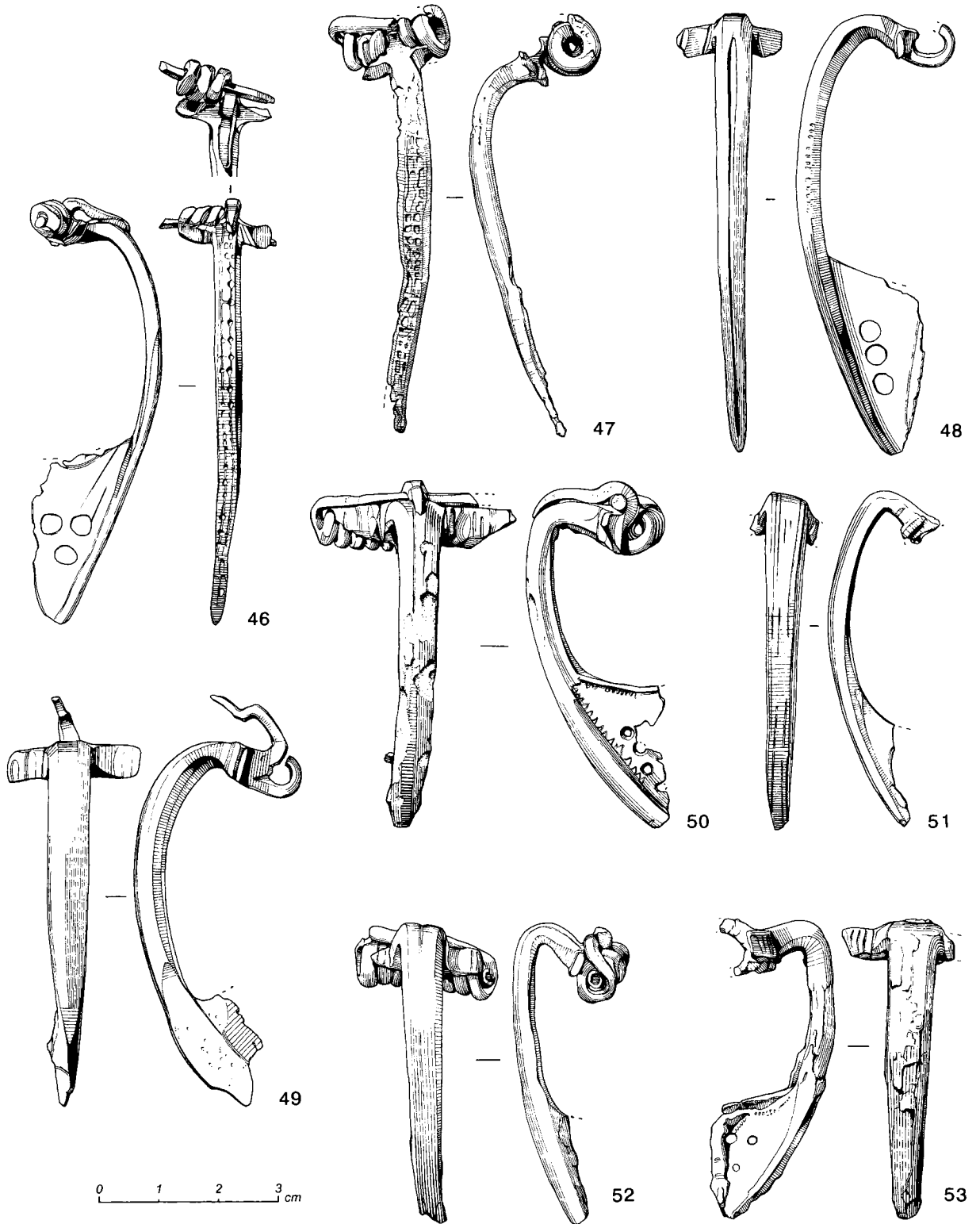


44 Simple Gallic brooches (T89). Cat 44–45

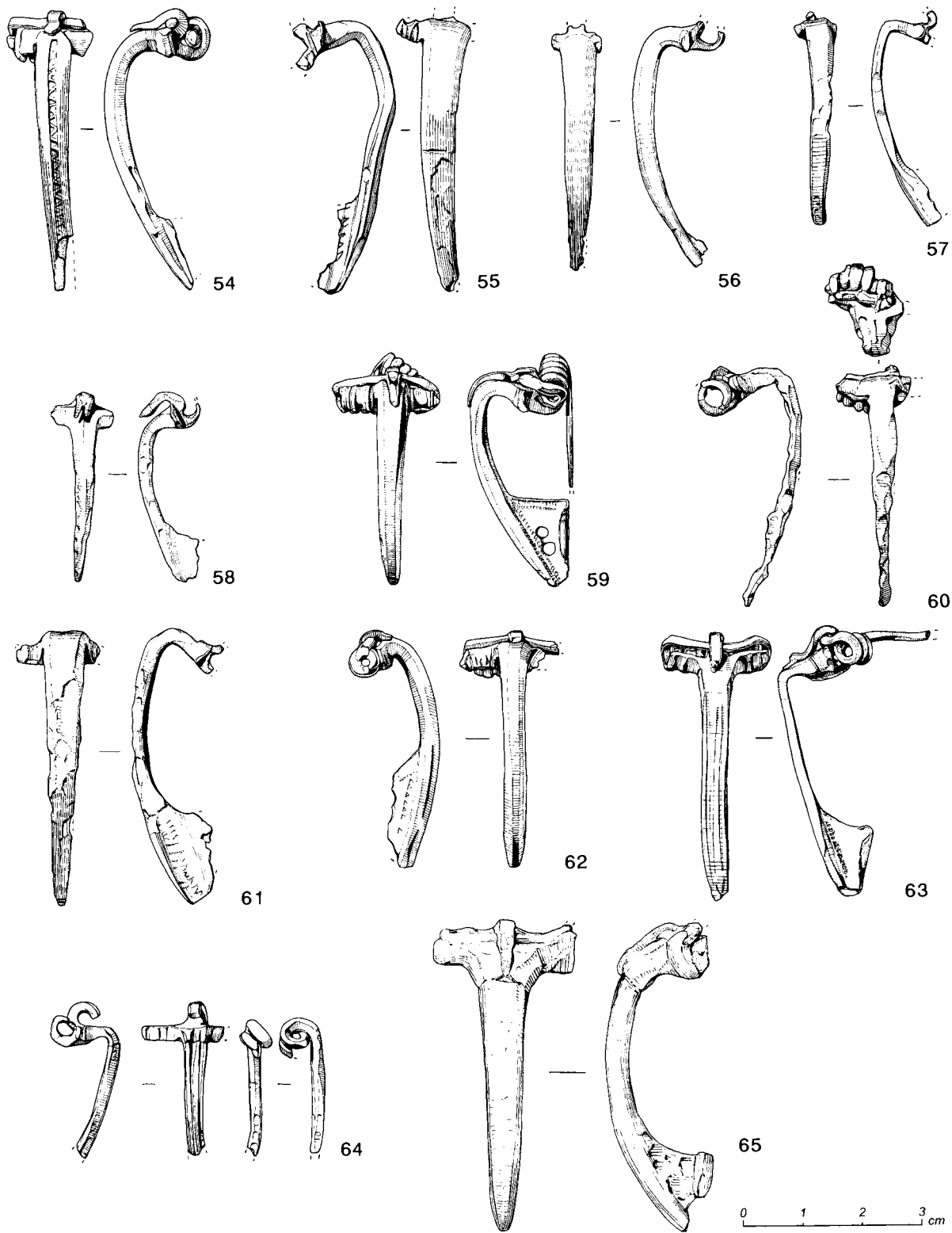
a) *Bow straight or with reversed curve; usually with fretted catchplate. T89*

44. RIV, No. 30 L 70mm* Brass
 The spring was of eight turns (RIV), though now broken, and the chord is held by a rather wide hook. The long tapering bow has decoration down the centre not shown in RIV: two grooves, the ridge between punched alternately to left and right to produce a wavy line. The catchplate is broken but looks as if it had rectangular openings.
 SF 1574 Area XV below stone fort road. ML about AD 90–280.

45. RV, No. 10 L 50mm* Brass
Only the lower half remains but the drawing in RV (pl xxvii) shows the brooch almost complete, measuring about 85mm. It had a plain tapering bow, nearly flat (ribbon-like) in section, with a marked reversed curve. The spring was too corroded for details to show and there was a narrow crossbar. The remains of the catchplate show that it had rectangular openings.
SF 4242 Bottom of outer Claudian ditch. ML about AD 43.
- b) *Large brooches (over 50mm); bow with simple curve, sometimes with a line of decoration down the centre. T90*
46. RI, No. 1 L 72mm Brass
Half of the spring remains, originally it had eight turns. It is threaded by a metal rod which may be a repair as the spring appears to have been deliberately cut, not broken. Down the centre of the bow there are two engraved lines with irregularly spaced punch marks in them, giving a crude beaded effect; in section the bow is rounded on top, flat below. The triangular catchplate is pierced by three round holes.
SF 62 Site 1 Room 8 3ft [0.9m] down.
47. RV, No. 11 L 70mm* Brass
Spring of six turns. Decoration similar to 46 above. The catchplate missing.
SF 3626 South motor road surface.
48. L 75mm Brass
Only the stump of the spring remains; there is a short crossbar with two diagonal grooves (probably chased) on one side of the head, and only one on the other side, which is broken. The bow is of rounded section and has a central groove. The triangular catchplate is pierced by three round holes.
SF 3028 Inner ditch 4–8ft [1.2–2.4m] down. ML about AD 400+.
49. L c 62mm Brass
The spring is broken, the crossbar lightly grooved; the bow plain and rounded in section. The catchplate is broken or unfinished, possibly with some secondary reworking; it shows no sign of having been perforated.
SF 854 Site V low level N of foundation. ML first century.
50. L 60mm* Brass/gunmetal
Half of the spring remains, originally of twelve turns; a wide ribbed crossbar covers it. The bow is sharply angled and the chord hook is long enough to wrap over the angle; there is a single groove down the centre. The triangular catchplate is broken but had several small round holes, and there are bands of rocker decoration on both sides.
SF 2589 Area XVI in occupation soil below sand and burnt layer S of Cellar. ML AD 60–90.
51. L 58mm* Bronze
The head is broken and no details survive; the bow has a sharp angle at the head and two faint lengthwise grooves. The catchplate is broken.
SF 725 Above Pit 35 4ft [1.2m] down. ML AD 80–120.
52. L 50mm* Bronze
The spring is of eight turns and is threaded by a cylinder formed from rolled up sheet metal. The crossbar is plain; the bow, with sharp angle at the head, is damaged but apparently undecorated and broken, lacking the catchplate.
SF 2473 Area XVI in E drain? of road over Claudian ditches.
53. L 52mm Bronze
The spring is missing, the crossbar ribbed. The bow is of thick section, rounded on top, with sharp angle at the head; the triangular catchplate has three small holes.
SF 720 Red layer site. Low level. ML pre-Flavian.
- c) *Small brooches (30–50mm length). Various profiles*
54. RV, No. 12 L 45mm* Brass
Three turns of the spring remain; a rod of rolled up sheet metal is threaded through it. The bow is of rounded section and has a sunken central band of punched opposed triangles, the upstanding metal between giving a zigzag effect. In profile it shows a simple curve.
SF 4729 Area XVII/32 W extension S of Chalk House. Surface.

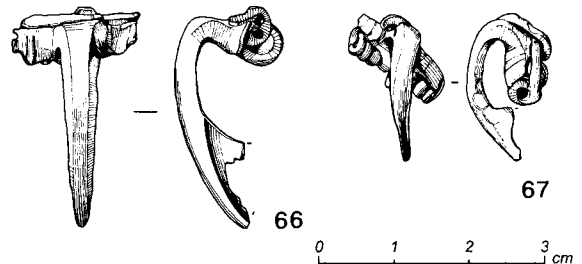


45 Colchester brooches, group (b). Cat 46-53



46 Colchester brooches, group (c). Cat 54-65

55. L 45mm* Bronze/gunmetal
Only the stump of the spring and part of the ribbed crossbar remain. The bow is broad, plain and tapering, with fairly sharp angle near the head. The catchplate is broken but shows faint rocker decoration.
No site provenance.
56. Perhaps RV, No. 13 L 40mm* Brass/gunmetal
The spring is broken off; there is a very short crossbar. The bow is too corroded for any decoration to show; it tapers towards the broken foot, where only a fragment of catchplate remains. The profile shows a fairly sharp angle near the head.
No site provenance.
57. L 36mm* Bronze
Spring broken, crossbar very short. The bow is too corroded for any decoration to show; it is tapering, and has a sharply angled profile. Catchplate broken.
SF 2542 Trench VIII W end on skeleton.
58. RV, No. 15 L 31mm Bronze
This almost qualifies as a miniature brooch – see those under d) below. Only the stump of spring and chord remain; the crossbar is short and plain. The tapering bow has traces of a single groove; flattish profile. Unperforated catchplate.
SF 5310 Middle triple ditch 0–2ft [0.0–0.6m] down. ML about AD 280.
59. RIV, No. 26 L 39mm Brass
Spring of ten turns covered by a ribbed crossbar; long rearward hook reaching beyond the bow angle. The bow is faceted and tapering. The catchplate has two round holes and punched decoration imitating rocker patterns on both sides (Figure 16 and Plate 6).
SF 990 Area VII 1–12ins [25–305mm] below upper concrete floor. ML AD 70–85.
60. L 40mm* Brass
Four turns of the spring remain on one side of the head, with the corresponding length of crossbar. The bow is tapering, with fairly sharp angle; it is too corroded for any decoration to survive. Foot and catchplate missing.
SF 2789 Pit 195. ML pre-Flavian.
61. L 45mm* Bronze
The spring and hook are missing; short plain crossbar. The bow is sharply angled; it is undecorated. The catchplate is damaged but has no perforations; there is a band of punched decoration on both sides.
No site provenance.
62. L 39mm Brass
Half the spring remains (four turns); the crossbar is roughly ribbed. The bow is slightly faceted and the broken catchplate has faint punched decoration.
SF 2391 Trench 5 S motor road.
63. L 45mm Brass
The spring of six turns is covered by a wide ribbed crossbar and has a prominent hook holding the external chord. The spring is a separate piece of metal, its end inserted into a hole behind the head of the brooch, and may represent a repair or a variant on the normal design; both parts are brass. The ribbon bow forms a right angle at the head and has faint relief decoration. The catchplate is unpierced and had punched decoration.
SF 2372 2nd trench for Claudian ditch outside S wall.
64. RV, No. 14 L 35mm when complete Gunmetal
The spring is broken; the bow has only a slight curve, two longitudinal ribs give it a fluted appearance; it is now broken above the catchplate; RV, pl xxvii, shows this as triangular and unpierced.
SF 4923 Area XVII/32. South of Chalk House, 2ft [0.6m] above gully level. ML late first century.
65. L c 45mm Brass
Broken and obscured by corrosion; there is a rearward hook holding the chord of the spring.
SF 5189 No site provenance.



47 Colchester brooches, group (d). Cat 66–67

d) *Miniature brooches (under 30mm length)*

66. L 28mm Brass
Half of the spring remains, with four turns. The crossbar is ribbed. The bow of D-section is faceted and tapers to the foot; it has a fairly sharp angle at the head. The catchplate is broken but had at least one circular perforation.
No site provenance.

67. RV, No. 16 L c 19mm Brass
Very small brooch, bent but complete apart from catchplate. The spring has eight turns and is covered by a ribbed crossbar. The bow is of D-section, plain and tapering.
SF 4366 Area XXI In pebbles of road, west side. ML AD 70–85.

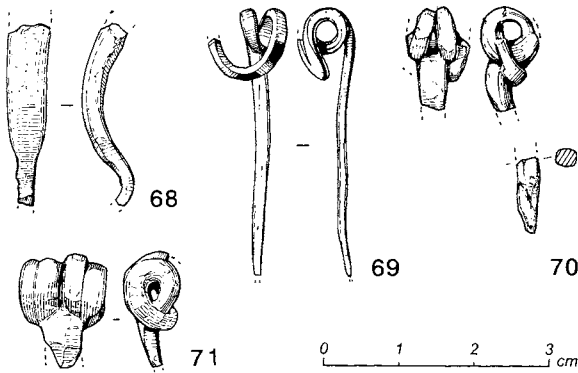
Fragments: one-piece brooches

68. L 25mm* Bronze/gunmetal
The upper part of a thick flat-sectioned bow and the beginning of the spring only.
SF 1575 pit 111. ML third–fourth century.

69. L 35mm* Brass/gunmetal
Half of spring and pin of one-piece brooch.
SF 2029 Inner ditch N of Watling St middle layer. ML about AD 400+.

70. L 14mm* Bronze
The spring only of a one-piece brooch; three coils.
No site provenance.

71. L 16mm* Bronze
The spring only of a one-piece brooch; four coils.
No site provenance.

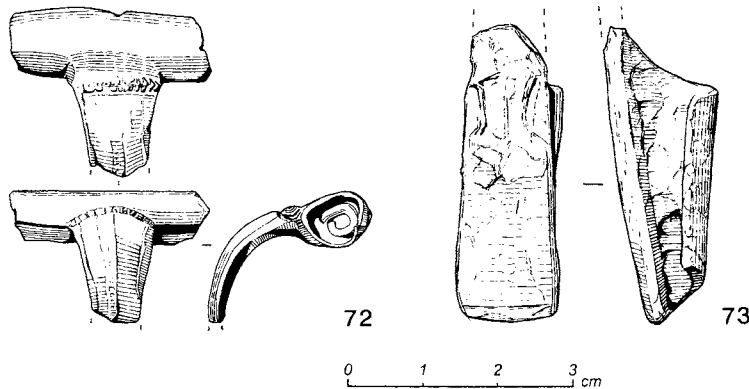


48 *Fragments of one-piece brooches. Cat 68–71*

BROOCHES WITH SPRING IN CYLINDRICAL COVER

The 'Nertomarus' type. T22A

72. RV, No. 40 L 26mm* Brass/gunmetal
The head only: a cylinder which contains some coils of a spring, and the upper part of a slightly arched bow with central aris and a beaded cross-rib where it joins the head. The drawing in RV shows the remains of what is described as raised decoration on the cylinder (Cunliffe 1968, 84).
SF 4502 Area XVIII. Trial trench east of triple ditch, in filling.



49 *Cat 72: head of brooch with spring in cylindrical cover; Cat 73: fragment*

Fragment, probably a rosette brooch. T26A

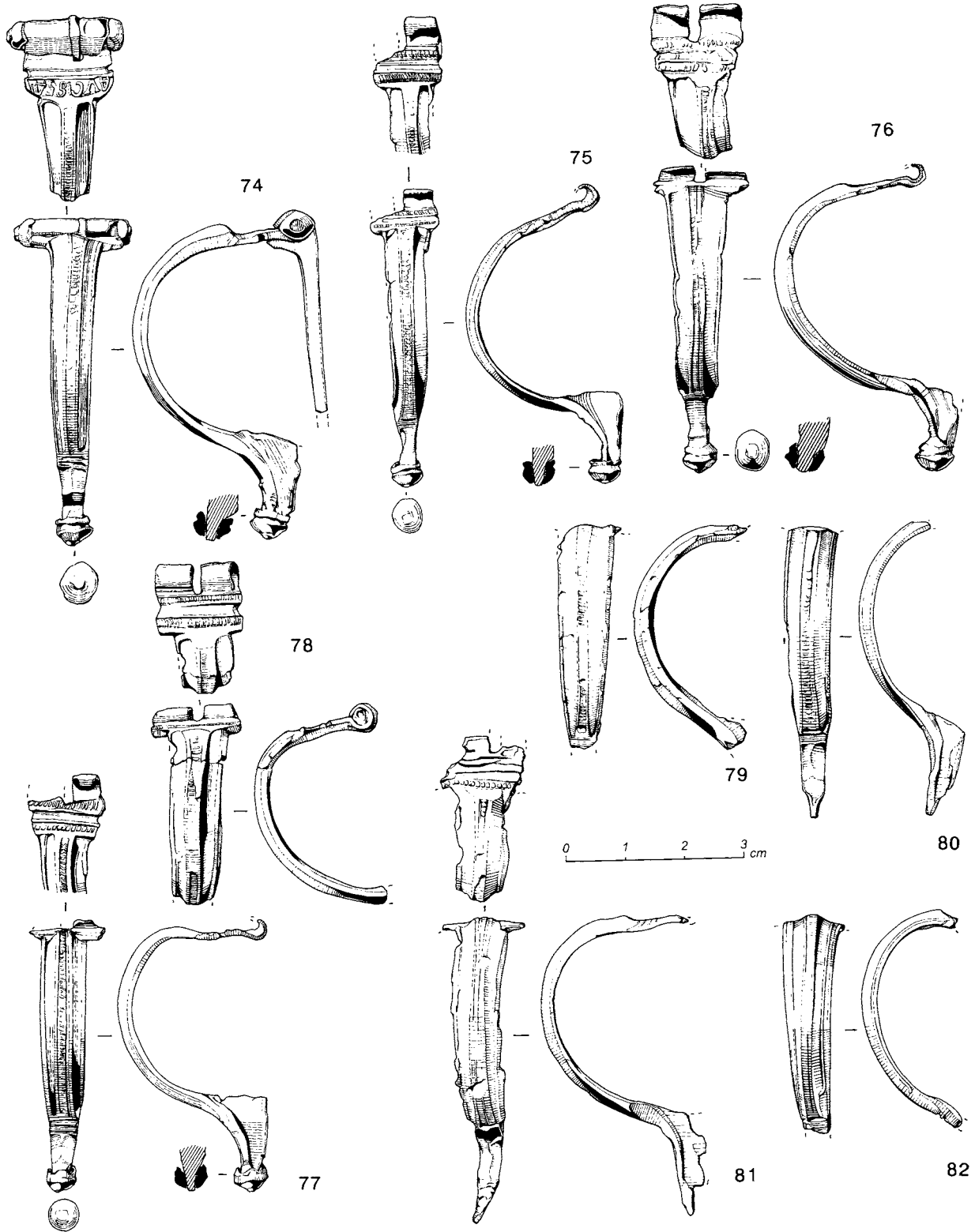
73. L 40mm* Brass
 The foot only of a large brooch. It is flat and flares slightly towards a straight end. It is badly corroded but appears to have an applied plate covering the whole area; this may have had repoussé decoration. There is a large unperforated catchplate down the centre of the back. This may be part of a rosette brooch; these often have applied repoussé plates, though not usually on the foot.
 No site provenance.

EARLY HINGED BROOCHES; THE PIN HINGED IN A NARROW TUBE FORMED FROM THE TOP OF THE BOW ROLLED BACK, ABOVE THE HEADPLATE

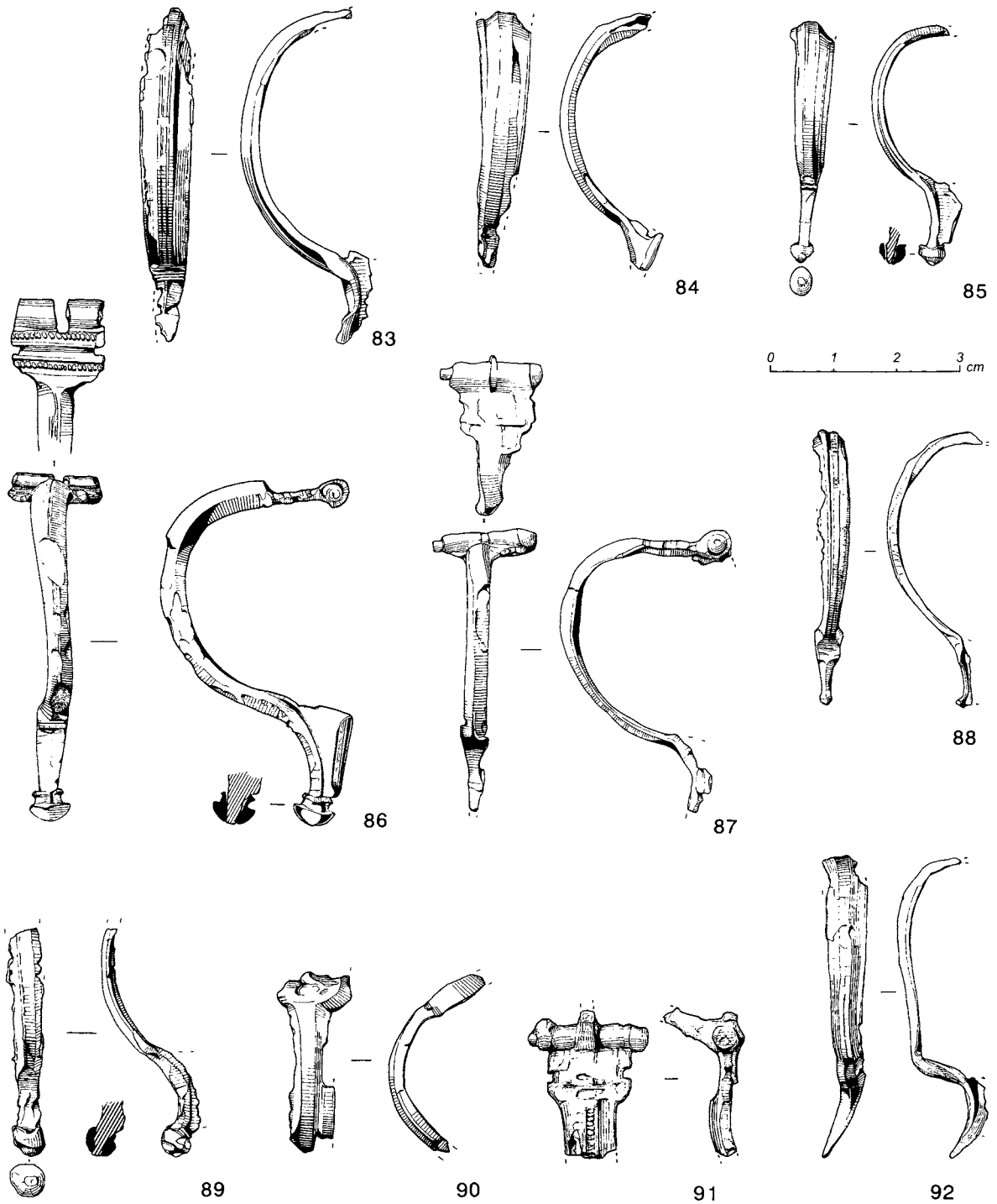
The Aucissa type: the pin is hinged in a narrow tube formed as above; the upper bow is highly arched; small plain lower bow; the foot a separate knob. T51

The type is discussed in Chapter 5 (p 151); parallels are listed in Appendix 3 (pp 245–6).

74. RV, No. 42 L 55mm Brass
 Complete except for the tip of the pin and the turn of the catchplate. The iron axial rod on which the pin was hinged has separate end knobs to hold it within the headtube. The flat plate immediately below this bears the name AUCISSA in relief lettering. The arched bow has a central rib with faint beading, terminated by cross-mouldings. The foot ends in a narrow rod on which a separate collared knob is fitted. See also *RIB* n.3, 2421.21.
 SF 4337 Area XIX lower occupation level. ML about AD 65–80.
75. RV, No. 47 L 51mm Brass
 Similar to Cat 74 above except that it is smaller and lacks the Aucissa stamp: instead it has two rows of fine beading. Part of the head is missing.
 SF 4860 Area XXII, surface. ML fourth century.
76. L 52mm Brass
 Similar to Cat 75; the pin and hinge are missing.
 SF 2354 Tip.
77. L 46mm Brass
 Similar to Cat 75 above; only part of the head remains but the rest is complete. Probably RIV (p 122, additional brooches).
 SF 1023 Pit 86 22–28ft [6.7–8.5m]. ML about AD 90.
78. RV, No. 48 L 35mm* Brass
 The upper part only of a brooch similar to Cat 75 but stouter.
 SF 4869 Area XVII/32. Top of pebbles. ML about AD 80–100.
79. L 39mm* Brass
 The arched upper bow only, showing a central beaded rib as on the preceding examples.
 No site provenance.
80. Perhaps RV, No. 44 L 50mm* Brass
 The bow only of a similar brooch to Cat 75, lacking the head and separate footknob, although the peg for it survives. RV no. 44 was wrongly identified as SF 6987 (the highest SF no. was 5677).
 SF 5462 Inner earth fort ditch filling. 0–2ft [0.0–0.6m] down.
81. L 52mm Brass
 Similar to Cat 75. Part of the head and footknob are missing; the peg for the latter can be seen.
 SF 1548 Area X extension. Surface.
82. L 37mm* Brass
 The upper bow only; the central rib shows faint traces of beading.
 No site provenance.
83. L 53mm* Brass
 The bow only; it has a central rib terminated by cross-mouldings as on all the preceding examples.
 SF 2486 Area XVI in rubbish deposit. W of road over Claudian ditches.
84. L 42mm* Gunmetal
 The bow arch only; it has the usual central rib but any decoration is now lost. Probably RIV (p 122, additional brooches).
 SF 1851 Pit 140. ML pre-Flavian.
85. RV, No. 45 L 38mm* Gunmetal
 A smaller brooch; the head is missing but there is an upper bow less highly arched than all the preceding, with a median rib terminated by cross-mouldings. The narrow foot ends in a separate knob.
 SF 4717 South of Section 19, on gully level bottom layer. ML about AD 60–80.



50 Aucissa brooches. Cat 74-82



86. RV, No. 43 L 55mm Brass
Complete except for the pin. The plate adjoining the head bears two rows of beading with a groove between. The arched upper bow has a slighter central rib than most of the preceding examples, with traces of decoration; there is a cross-moulding between bow and foot. The plain foot ends in a separate knob. SF 4917 Area XVII/32. 22–25ins [559–635mm] below datum. ML pre-Flavian to early second century.

87. L 45mm* Brass
In poor condition; narrow bow with faint traces of a decorated rib; the foot and catchplate broken. SF 4778 Area XVII/32. Metalling of N–S road. ML Flavian.

88. L 43mm* Brass
The bow and foot of a narrow specimen, with beading on upper bow. The foot seems to have a small knob rather than a separate attachment. SF 1251 Section 47 67–70ft [20.4–21.3m] 3ft [0.9m] below top filling W ditch. ML Claudian.

89. L 35mm* Brass
The head and upper part of the bow are missing; traces of beading on the central rib. There is a separate knob on the damaged foot. No site provenance.

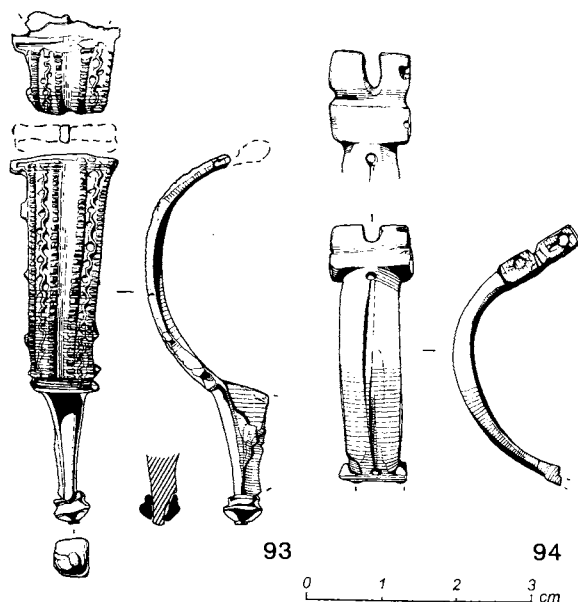
90. L 30mm* Brass
Badly damaged fragment: part of the upper bow with central rib. SF 1648 W of Section 47 below Claudian road. ML about AD 43.

91. RV, No. 49 L 15mm* Brass
The head only of an Aucissa brooch; it has the pin hinged on an iron axial bar with two end stops, a plain plate and the beginning of a centrally ribbed and beaded bow. SF 4701 Area XVII/32 ... W of outer Claudian ditch, first layer. ML late first–second century.

92. L c 48mm* Brass
Twisted upper bow and part of the foot only. SF 1123 Area X from gully level. ML first century.

A1 (R111, No. 1). See also Appendix 4, Table 25.

A2 (RV, No. 46). See also Appendix 4, Table 25.



52 Bagendon brooch and variant. Cat 93–94

The Bagendon type. T52

The pin hinged in a narrow tube formed from the top of the bow rolled upward; upper bow divided or ribbed and threaded by transverse iron rods, or lugged in imitation; lower bow narrower and plain; usually a separate footknob.

93. RIV, No. 11 L 46mm* Brass
The head is now missing but the drawing in RIV, pl xxvi, shows the standard narrow tube with central gap for the pin. The upper bow is broad and gently arched; it bears two bands of decoration: a zigzag line showing punch marks, between two rows of beading. The edges have four small projections between projecting cross-mouldings at the top and bottom of the decorated panel. The foot tapers to a peg holding a separate knob.

SF 2528 Area XVI below pebble path S of cellar. ML mostly pre-Flavian.

See Chapter 3 for discussion of this brooch and the type in general.

Variant of Bagendon type?

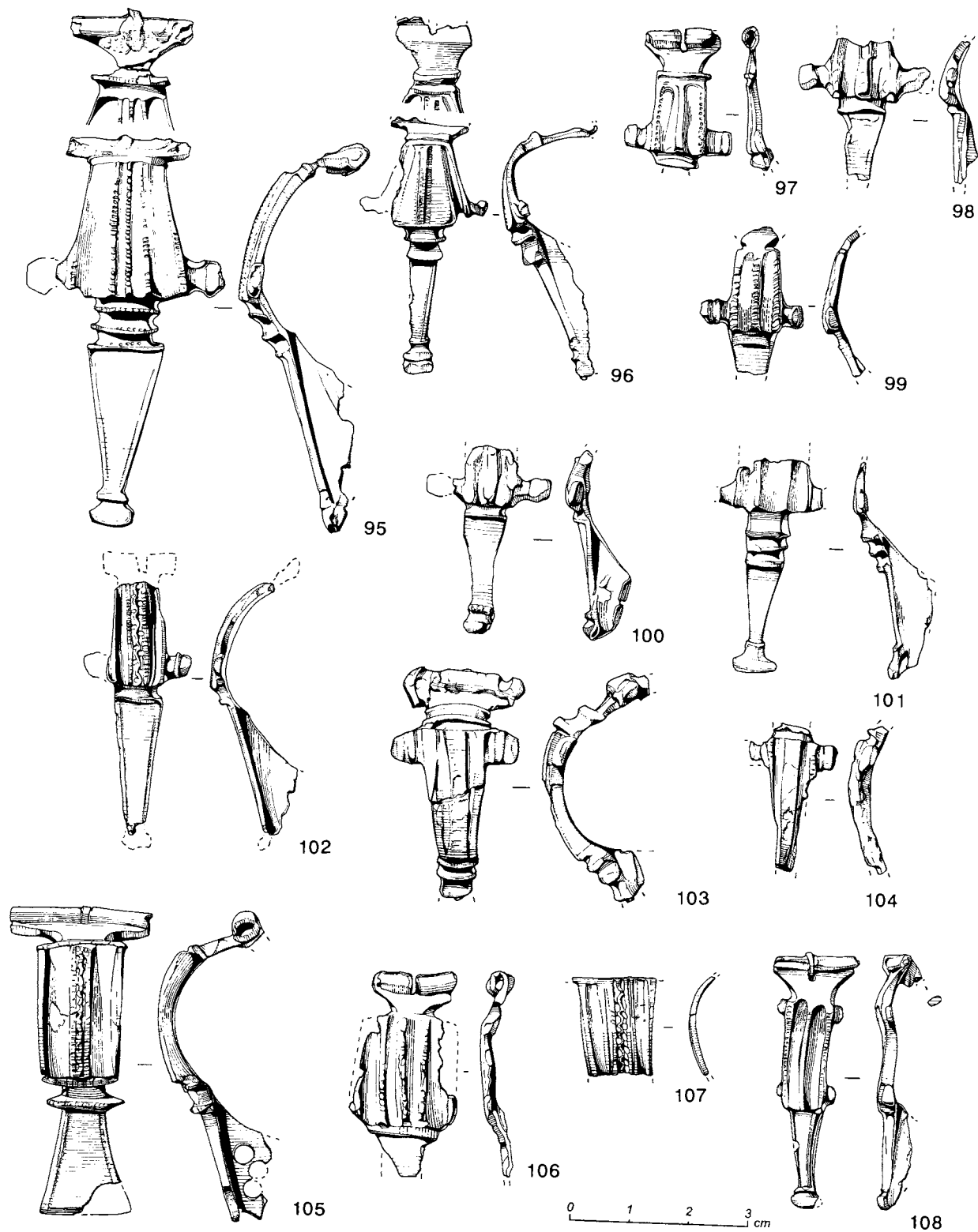
94. L 33mm* Bronze
The arched upper part only; head with narrow tube cast and drilled rather than folded over, slot for hinged pin, below this a rectangular plate threaded by an iron rod; the upper bow is straight-sided and has a central groove with small round holes, possibly for the attachment of a decorative plate, at top and bottom; below this the beginning of a cross-moulding which may also have had a threaded rod: part of a slot survives at the break; the lower part missing.
SF ?2232 Tip 2 outside N wall

This seems likely to be based on the Bagendon type; it is not unlike the brooches with two broad ribs threaded by iron rods such as those from Maiden Castle, Dorset (Wheeler 1943, no. 30, p 262, from a deposit dated AD 25–70); Colchester, Essex (Niblett 1985, no. 27, p 116, from a Neronian deposit), and Mandeuire, France (Lerat 1957, pl iv, no. 66). It may well have been like a brooch from St Bertrand-de-Comminges, France, published by Feugère (1985, pl 137, no. 1712): this has rods through the headplate and midbow and has a rib down the centre terminated by studs top and bottom. Feugère treats this as a variant of the Aucissa type (1985, 316).

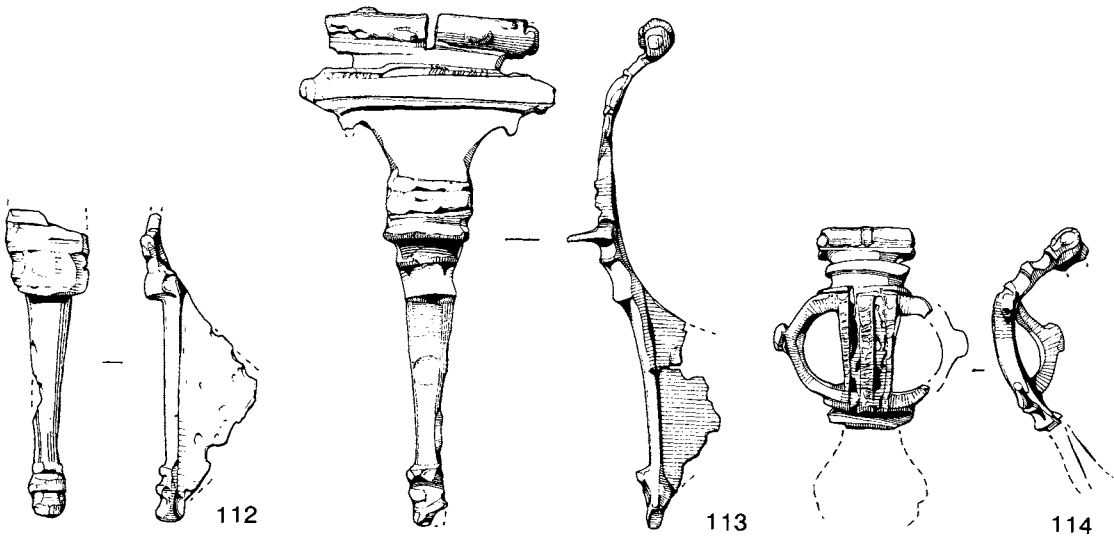
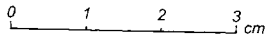
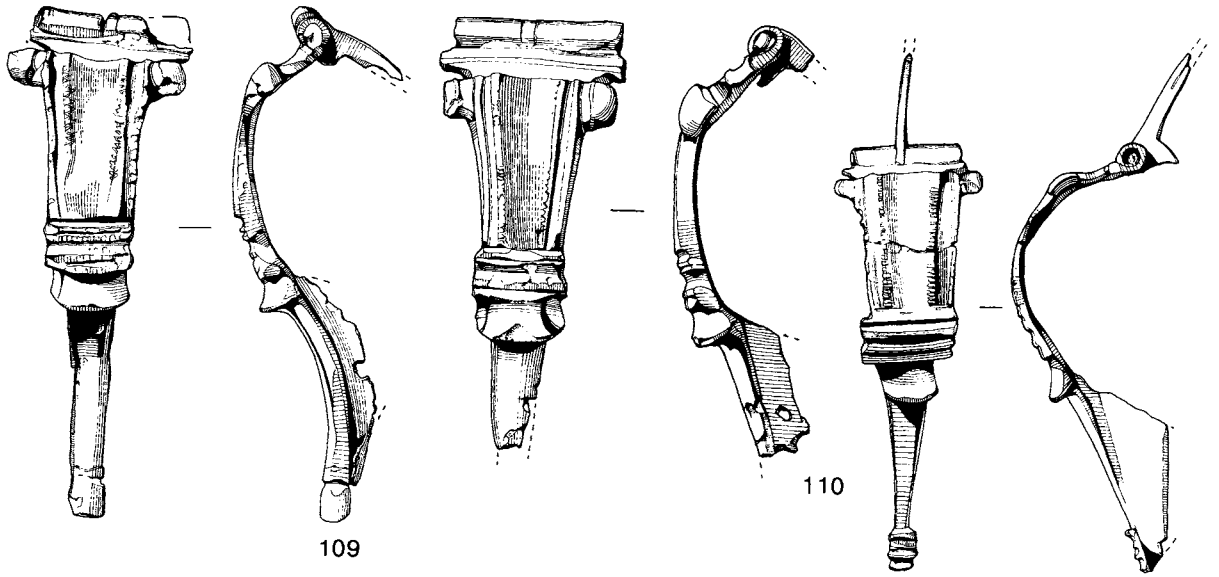
The Hod Hill series

The pin hinged, usually on an iron axis bar, in a narrow tube formed from the top of the bow rolled back; the bow profile either gently arched near the head or straight, with a right angle at the head; the decoration of the bow usually changes in the middle, where distinguished the lower bow is usually flat and of various outline shapes, or cross-ribbed; the catchplate triangular, occasionally perforated. There is nearly always a footknob though sometimes it is small. Most (probably all) specimens are tinned or partly tinned. There is a very wide variety of decoration and it is unusual to find two identical brooches. M R Hull classified British Hod Hill brooches into numerous types, his nos 60–79. Here they are grouped into larger and more generalized sub-types: a)–e), which are discussed in Chapter 5 (pp 152–4), but Appendix 3 (pp 246–9) lists parallels to the Richborough brooches under Hull type numbers for more detailed comparison.

- a) *The upper bow a distinct panel with side wings, often with lugs. T61–63, T65–69; Ettliger 1973, type 34, 101; Riha 1979, type 5.7, 126–32*
95. RIV, No. 17 L 66mm Brass, inlay
Large panel on upper bow, with a moulded lug on the two lower corners. The drawing in RIV, pl XXVI, fails to show the beaded decoration on all the mouldings of the bow and the marginal groove on the lower bow, but it does show a round hole in the catchplate, now broken. The two central grooves on the upper bow held a bi-metallic inlay: twisted wires of iron and copper.
SF 1594 Area X W extension. Surface.
96. RIV, No. 18 L 44mm Brass
The drawing in RIV, pl XXVI, shows the hinge of the pin complete. There is fine beading in the grooves on the upper bow panel; plain marginal grooves on the lower bow.
SF 2530 Area XVI 1ft 4ins [406mm] below level of burnt layer E of road under ditches. 'Area XVI. AD 50–80' (RIV, p 111).
97. RV, No. 58 [not illust] L 24mm* Brass
The upper part only, showing a rectangular panel with three longitudinal ribs, the outer ones beaded, and a lug at each lower corner.
SF 3422 Outer ditch, bottom layer. ML about AD 280+ probably 400+.
98. L 24mm* Bronze
Fragment; the upper panel similar to Cat 97.
No site provenance.
99. L 25mm* Brass/gunmetal
Fragment, part of upper panel with three beaded ribs.
SF 2043 Outside W gate, inner ditch S of Watling St upper layer. ML about AD 400+.
100. L 31mm* Bronze?, tinned
Fragment; the lugged upper panel similar to the last three; this one has a complete foot, corroded but showing part of a row of small dots; it ends with two cross-mouldings.
SF 3016 Surface.



53 Hod Hill brooches, group (a). Cat 95-108

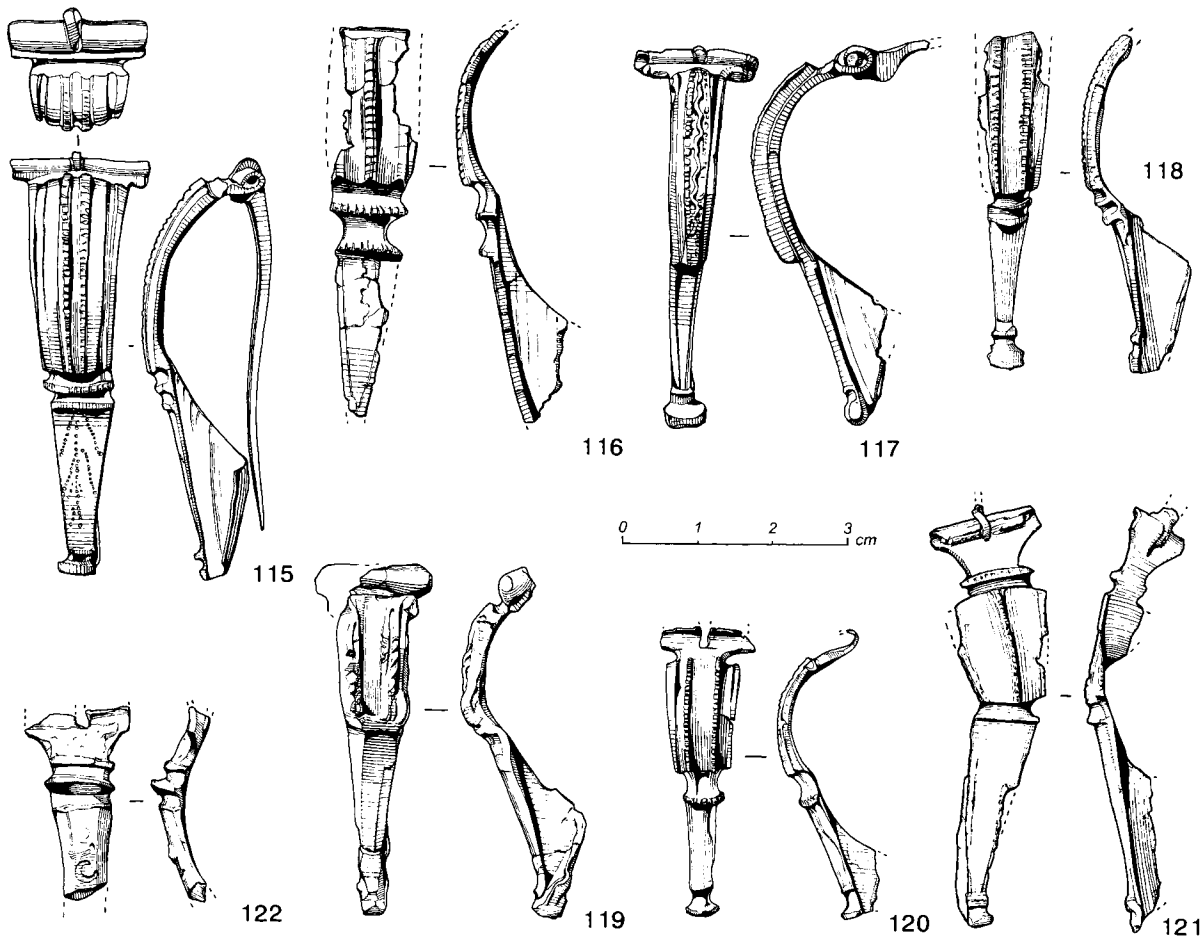


101. L 35mm* Bronze, tinned
Fragment: part of another ribbed and lugged upper panel; below, three cross-mouldings and then a plain foot with wide terminal moulding. SF 1974 Inner ditch middle layer. ML about AD 400+.
102. RV, No. 53 L 45mm* Brass
The head now missing, but part shown in RV, pl xxx. Upper bow panel ribbed; the outer ones slightly beaded, central rib a zigzag with punch marks alternately to left and right. The flat tapering lower bow has marginal grooves; the foot, shown in RV, is missing. SF 4536 SW area. Cobble layer, surface clearing.
103. Probably RIII, No. 5 L 39mm* Gunmetal?
The crossbar is masked by corrosion but clearly has end knobs on the axial rod for the missing hinged pin. The panel on the upper bow has longitudinal ribs and two lateral lugs at the top. Below this there are several cross-mouldings before the break; the drawing in RIII, pl VIII, shows these continuing to the foot. No SF record. 'In a deposit dating up to third century' (RIII, no. 5, p 76).
104. L 25mm* Brass
Fragment: the upper bow of a brooch similar to Cat 103 but smaller. SF 5627 Site IV 1937. Just above oolite. ML about AD 90.
105. RIV, No. 15 L 53mm Brass
Fine brooch with wide rectangular panel on the upper bow and flared foot. The side flanges and central ribs of the panel are very much raised; the latter are beaded and there is a wavy line down the centre of the panel. The catchplate has three round perforations. No SF record. 'Filling of earth fort ditches' (RIV, p 111).
106. L 35mm* Bronze
Fragment: head and broken wide rectangular panel, ribbed. SF 2654 Area XVIII on floor 14. ML Flavian.
107. L 17mm* Brass
Fragment: part of a rectangular panel which may come from a brooch similar to Cat 105 above, although it is thinner and the ribs are much less pronounced. SF 5663 Unstratified in burnt area.
108. L 43mm Brass, tinned
Small brooch, complete except for the pin; the axis rod is of copper alloy. There is a narrow panel on the upper bow with beaded ribs and four small lugs at the ends, a tapered lower bow and a footknob. No site provenance.
109. RIV, No. 16 L 67mm Brass
Large brooch with broad panel on upper bow which has ribs with rocker or punched decoration down each side and two lateral lugs at the top. Below it there are several beaded cross-mouldings, a broad flange, and a plain narrow lower bow with slight footknob. The catchplate has a round perforation, not shown in RIV, pl xxvi. See Cat 111 below. SF 1556 Between sections 53 and 47 in Claudian road metal. ML about AD 44.
110. L 56mm* Brass
Very similar to Cat 109 above except that the foot is missing. No site provenance.
111. RV, No. 54 L 56mm Brass
Very similar to Cat 109 except that it is smaller and the catchplate is unperforated. In RV Hull remarked that (Cat 109 above) appeared to be a clumsy copy of this; it may be that he was misled by the drawing of the larger brooch in its uncleaned state which was published in RIV. SF 4879 Pit 245 N, 2ft 6in [0.8m] below gully level. ML about AD 200.
112. RV, No. 57 [not illust] L 41mm* Brass
The lower part only; apparently similar to Cat 109. SF 4779 Area XVII/32. Metal of N-S road. ML Flavian.
113. RIII, No. 2 L 68mm Brass
Large brooch with wide transverse moulding at top of bow, below this a plain panel tapers to cross-mouldings at the waist; plain foot. SF 711 Pit 35. 20ft 6in [6.2m]. ML Claudian.

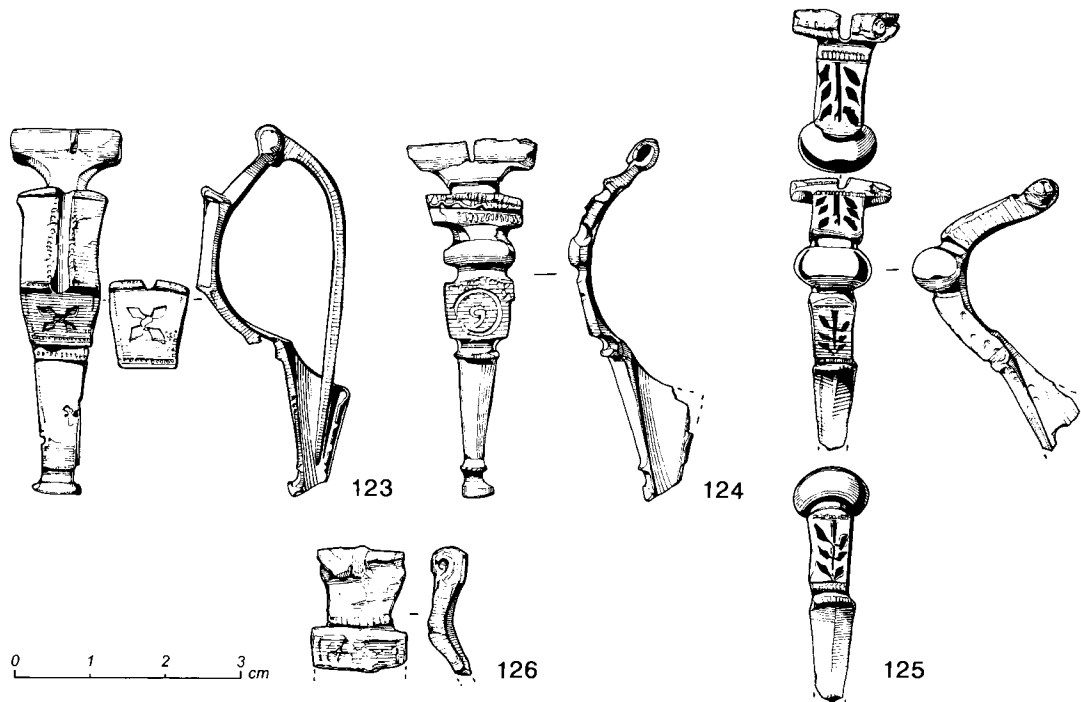
114. RIII, No. 3 L 27mm* Brass, tinned, inlay
 The head and upper part of the bow only, with semicircular openwork wings on each side. Unusually, the axial bar is is of copper alloy. The brooch was complete when drawn for RIII (pl VIII, 3) although that drawing omits the two strips of two-ply inlay, of copper and iron, between the upper bow's central ribs (Figure 27 and Plate 14); it shows a plain flat lower bow with undifferentiated footknob: the outline is shown on our Figure 54. It seems possible that there was in fact some engraved or punched decoration.
 SF 739 Outside W wall Trench 1 Pit 38 (undug).
 'With a stamp of Licinus' (RIII, p 76).

b) *Narrow panel on upper bow, without side wings. Hull T60; Ettlinger 1973, type 31, 97-8; Riha 1979, type 5.12, 137-43*

115. RIV, No. 12 L 56mm Brass, tinned, inlay
 Ribbed panel on upper bow and tapering lower bow with lines of punched dots in firtree motif. The central ribs and mouldings are beaded. Different colours of metal show: white (tinning) on the head, part of the upper and all the lower bow, yellow (brass) on the upper bow, with a central pink strip (copper inlay) (Figure 25 and Plate 12).
 'Area south of the fort, in association with first-century pottery' (RIV, p 110).



116. L 50mm* Brass/gunmetal
The head and footknob are missing. Ribbed panel on upper bow and central cross-mouldings beaded; tapering lower bow with marginal groove. No site provenance.
117. RII, No. 2 L 50mm Bronze
Narrow panel on upper bow with central wavy line formed by two offset lines of punch marks; lower bow narrow, tapering, with marginal grooves. Decoration not shown in RII, pl XVI. SF 184 Top 3ft [0.9m], NE corner. ML about AD 280–400+.
118. RIII, No. 6 L 46mm* Bronze
The head is missing; there are two beaded ribs on the upper bow. Two cross-mouldings mark off the narrow lower bow. SF 701 'Pit 33, 21ft 6in [6.5m]' (RIII, p 76). ML AD 50–75.
119. L 46mm Brass
Half the head missing; two ribs on upper bow. The details are obscured by corrosion. SF 5580 Area VI 1936 U/S.
120. RIV, un-numbered, L 38mm Brass
p 122
Similar in design to the last three but smaller. SF 1599 W of Section 47 below burnt layer. ML pre-Flavian.
121. RIV, un-numbered, L 54mm Brass/
p 122 gunmetal, tinned
Twisted but complete except for the broken edges of the small rectangular panel on upper bow; this has a beaded central rib. The lower bow is plain and tapered. SF 2529 Area XVI below pebble path S of cellar. ML about AD 50–80.
122. RIII, No. 4 L 25mm* Gunmetal,
tinned, niello
Fragment: head and upper bow only; a curved cell on the bow holds traces of niello. The brooch was complete when drawn for RIII, pl VIII; no decoration was shown but the catchplate had one round hole. SF 672 S of site II, bottom of E Claudian ditch.
- A3 (RV, No. 52). See also Appendix 4, Table 25.
- c) *With one or more small panels, often square, bearing either recessed circles or niello decoration. Hull T71, T73, T75–76*
123. RIV, No. 14 L 48mm Brass, tinned
Sharply angled at the waist, where there is a square panel bearing a recessed quatrefoil, of a type often filled with niello. This and the groove down the centre of the upper panel are outlined by faint relief decoration. SF 905 Area VI unstratified. Line of section 45 in fallen sides.
124. RV, No. 59 L 48mm Brass/
gunmetal, tinned
Bold cross-mouldings at head, the widest having a crudely executed raised wavy line between two beaded ribs; at the waist a rectangular panel bearing an incised circle and scroll (not shown in RV, pl xxx). There is no sign of niello in this. SF 5058 Stray.
125. RIV, No. 24 L 36mm* Brass, niello
Boss in centre of highly arched upper bow; above and below this are panels of niello decoration – three 'leaves' on either side of a central stem. The lower bow plain, the foot missing; half of a round hole remains in the break of the catchplate. The drawing in RIV, pl xxvii, shows no decoration. SF 3068 Inner [stone fort] ditch, 4–6ft [1.2–1.8m]. ML about AD 400+.
- Fragment*
126. L 15mm* Brass
The head shows the typical narrow tube with axis for hinged pin; below this there are cross-mouldings and part of a rectangular panel with faint marginal decoration. No SF number. No site provenance.



56 Hod Hill brooches, group (c). Cat 123–126

d) Upper and lower bow not distinguished: a strip-bow brooch but with the head, foot and profile of the Hod Hill series; it usually has cross-mouldings at the head, often with a sharp angle. Hull T64, T70, T77–79

127. RV, No. 60 L 35mm Brass
Typical of the d) series; first published in RV where the drawing on pl xxx does not show the beading on the cross-moulding at the head. The catchplate is perforated.

SF 5134 Middle triple [earth fort] ditch, 1ft 2ins–3ft 6ins [0.4–1.1m] between Sections 19 and 20. ML about AD 280.

128. RIII, No. 11 L 34mm (Leaded) gunmetal
Quite similar to Cat 127 above, except that it lacks the marked flange on the head and instead has a beaded rib with bordering grooves down the centre of the bow; there is no hole in the catchplate.
SF 710 Pit 33 tip.

129. RV, No. 51 L 52mm Brass
Arched bow of D-section; beaded rib with bordering grooves down the centre. The footknob is a separate piece fitted on the peg-like foot.
SF 5016 Tip 'from Area XVII' (RV, p 85).

130. RIV, No. 32 L 30mm*; originally c 70mm? Brass
Only the upper part survives but the complete brooch was drawn for RIV, pl xxviii, although in a blurred state due to corrosion. It still shows the central rib on the upper bow. The earlier drawing shows a sheathed foot, which is unlikely with the type of head-construction still visible.

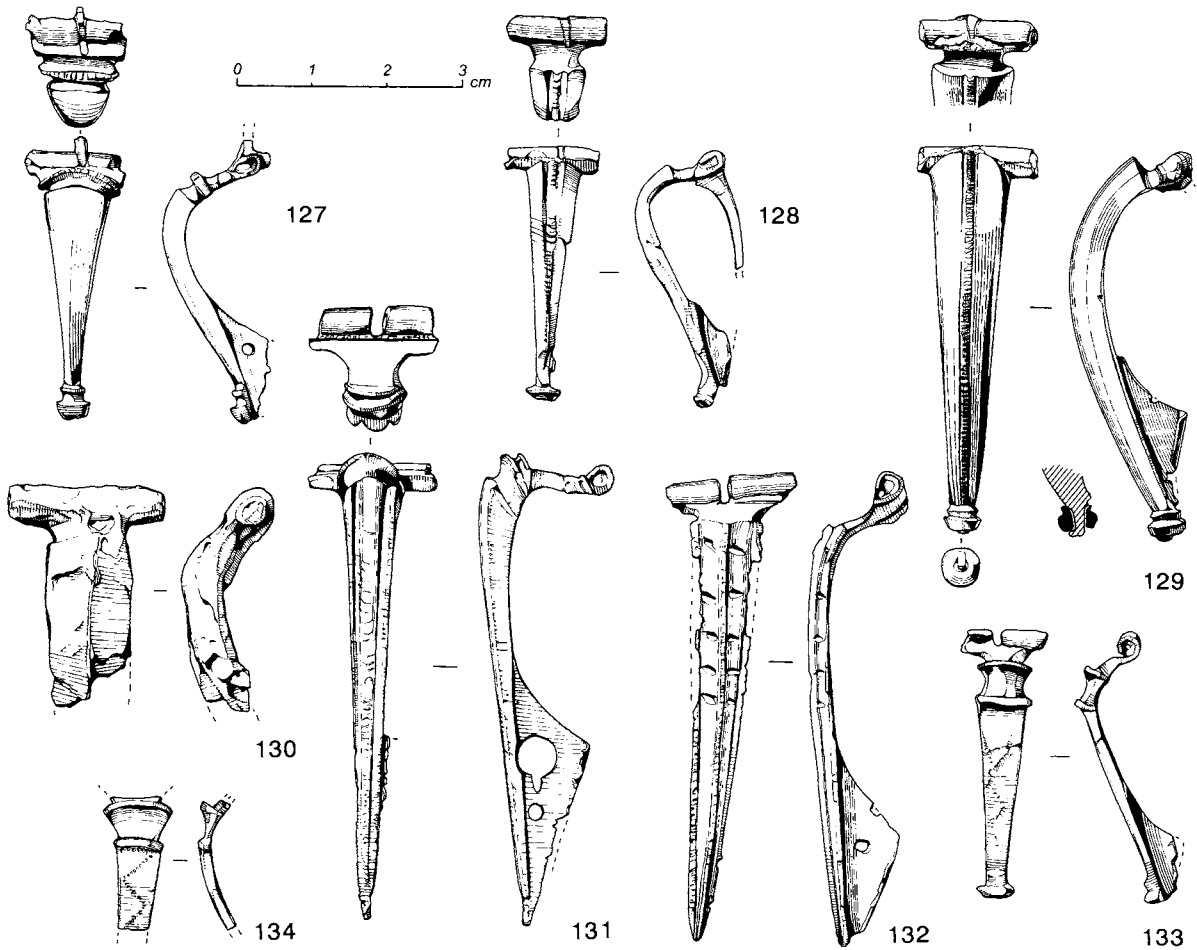
SF 1080 Near entrance to earth fort, 6 ins [152mm]. 'Inner stone fort ditch' (RIV, p 113).

131. RV, No. 50 L 61mm Brass
Long straight tapering bow with three ribs; cross-mouldings above the right-angled turn at the head. Two perforations in catchplate. In RV, Hull cited Camulodunum no. 54 as a close parallel (Hawkes and Hull 1947, 312).

SF 4854 West of section 19 between mound between inner and middle ditch. Bottom.

132. L 62mm Gunmetal
The axis rod of the hinge is iron; the pin is missing. Long straight tapering bow with beaded central rib and flanged edges. Five deep diagonal punch marks may once have held niello (cf Rieckhoff 1975, no. 94, Tafel 6). One round hole in catchplate.

SF 1975 Inner ditch middle layer. ML AD 400+.



57 Hod Hill brooches, group (d). Cat 127-134

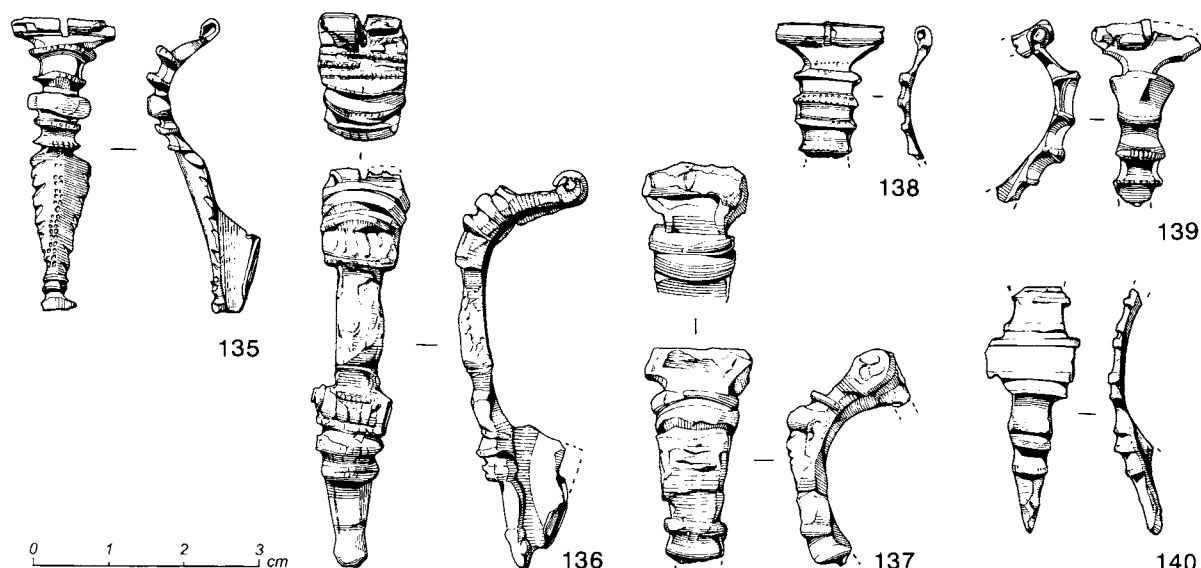
133. L 35mm Brass/gunmetal
Two flanges at the top of the bow; below these it is flat and slightly tapering to a moulded footknob. Decorated with faint zigzag line of punched dots.
SF 3705 Tip 1.

134. L 18mm* Bronze
Fragment: upper bow only, apparently similar to Cat 133.
No site provenance.

e) Several cross-ribs on the upper bow and sometimes also on the lower bow. Hull T74; Ettlenger 1973, type 32, 99; Riha 1979, type 5.6, 123-5

135. RIV, No. 13 L 38mm Bronze
The upper bow bears a series of cross-ribs; the lower bow is flat with triangular outline, notched edges and a central double row of punched dots; small moulded footknob.
SF 1549 Between sections 53 and 47. Surface.

136. RV, No. 56 [not illust] L 53mm Brass
Badly corroded: details obscure. The sharp angle at the head of the bow is marked by three cross-mouldings below which there is a narrow straight element and a further group of cross-mouldings near the foot, which appears to be plain.
SF 4666 Area XVII/32 S of Chalk House, bottom layer. ML AD 43-90.



58 Hod Hill brooches, group (e). Cat 135–140

137. L 28mm* Brass
 Fragment: head and upper bow only of a badly corroded brooch with several cross-ribs below the head.
 SF 1357 Tip.

138. L 18mm* Bronze
 Fragment: the head and upper bow only. Four narrow cross-ribs on thin flat bow.
 SF 1602 W of Section 47 below burnt layer at Claudian level. ML Claudian.

139. RIII, No. 8 L 24mm* Brass/
 gunmetal, tinned
 Fragment: head and four flanged cross-mouldings; profile more curved than the last. This is shown too large in RIII, pl ix.
 SF 785 Surface find.

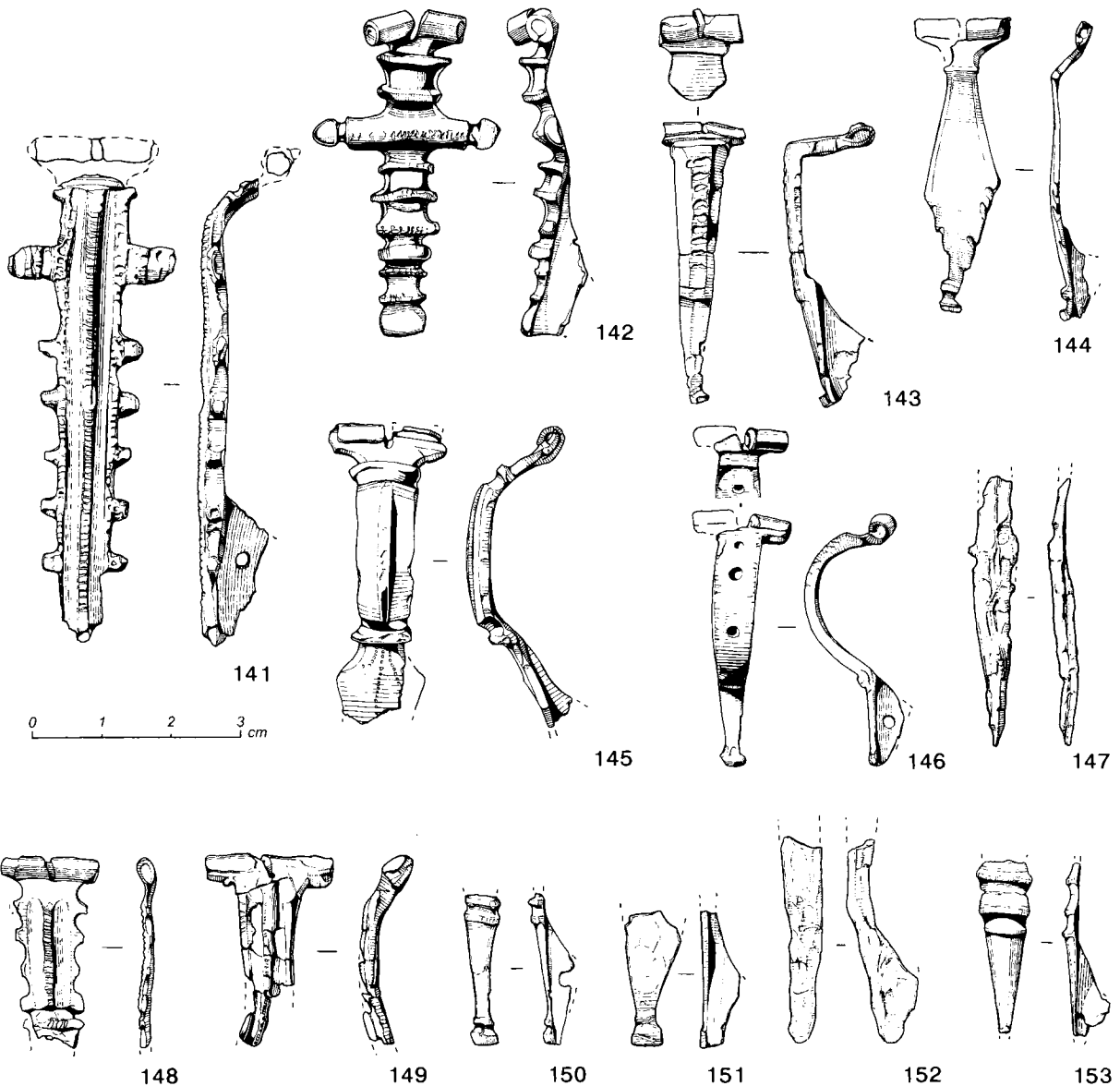
140. L 32mm* Brass/
 gunmetal, tinned
 Fragment: centre of bow with wide cross-moulding and cross-ribs above and below.
 SF 2554 Area XVI below pebbles S of cellar. ML AD 50–80.

f) *Unclassified: single brooches which fall outside the above groups, also fragments*

141. RIV, No. 20 L 66mm* Brass
 The drawing in RIV, pl xxvii, shows this complete with typical headtube for the hinged pin. The surviving long broad strip bow has three beaded ribs and a series of lugs down the sides, the upper pair being larger and cross-moulded. The bow appears to end in the sort of peg to which a separate footknob might have been attached. There is one round hole in the catchplate.
 SF 1375 Pit 101 14ft [4.3m]. ML AD 80–110.

142. RIV, No. 19 L 47mm Brass
 This has no distinct upper panel, being cross-ribbed down the whole length of the bow. There is one wider transverse moulding with knobbed ends partway down. Most of the ribs are beaded or knurled.
 'East of site 1. Top soil' (RIV, p 111).

143. RIV, No. 22 L 40mm Gunmetal
 The upper bow has a raised central rib with a row of crescent-shaped cells, unlikely to have contained niello. The profile is almost straight, below a sharp angle at the head.
 SF 904 [Area VI, RIV, p 112] line of Section 45 in fallen sides.

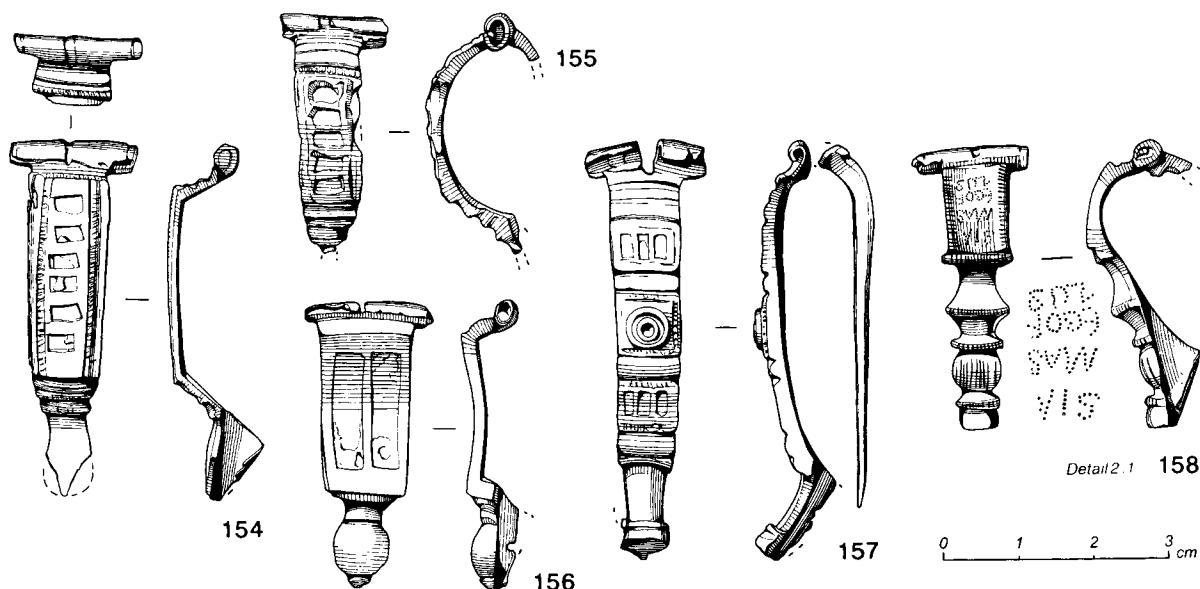


59 Hod Hill brooches, group (f). Cat 141-153

144. RIV, No. 23 L 42mm Brass
 Flat lozenge-shaped bow with marginal groove, the lower edges notched; sharp angle at head; small moulded footknob.
 SF 1805 outside W gate. Inner [stone fort] ditch filling. ML about AD 400+.

145. L 43mm* Brass
 Lower part of foot missing. The upper bow is straight-sided with raised central rib; below a cross-moulding the flat lower bow is expanding towards the break: it has three radiating lines of punched dots.
 SF 3402 Inner ditch on N side opposite postern. Filling. ML late fourth century.

146. L 36mm (Leaded) gunmetal, tinned
 This has a more arched profile than most Hod Hill brooches and perhaps is closer to the Aucissa type. The head is rolled upwards to form a tube for the hinge; the arched upper bow is nearly straight-sided and has three deep conical holes; inlay is suggested for the small holes in three rather similar brooches from Augst, Switzerland (Riha 1979, nos 1348–50, p 154). The lower bow is plain, ending in a small moulded knob; triangular catchplate with one round hole.
 SF 3742 Tip 1.
147. L 38mm* Brass/gunmetal
 Fragment: part of a bow of straight profile with cross-mouldings near head and a central rib.
 No site provenance.
148. RV No. 55 L 27mm* (Leaded) bronze/gunmetal
 Fragment: head and fluted panel with serrated edges and beaded central rib; cross-moulding below.
 SF 4557 Area XIX on surface of upper road. ML about AD 90–100.
149. L 27mm* Brass
 Fragment: head and part of a narrow fluted panel.
 SF 2108 Outside W gate inner ditch S of Watling St middle layer. ML about AD 400+.
150. L 22mm* Gunmetal
 Fragment: plain tapering lower bow with footknob, two cross-mouldings at waist. Round hole in catchplate.
 SF 299 No site provenance.
151. L 20mm* Brass, tinned
 Fragment: flat lower bow narrowing towards a very shallow moulding at the foot.
 No site provenance.
152. L 30mm* Brass
 The head is missing. A narrow rectangular panel on the upper bow has two longitudinal ribs; the lower bow is cross-ribbed.
 No site provenance.
153. L 25mm* Brass
 Fragment: middle part of bow with three cross-ribs, possibly beaded; plain tapering foot, the end missing. Triangular unperforated catchplate.
 No site provenance.



*Hod Hill derivatives**Enamelled Hod Hill derivatives*

Bow brooches with pin hinged in a narrow tube formed from the top of the bow rolled back; a panel of enamel decoration on the straight-sided upper bow; a distinct foot. T180.

154. RIII, No. 16 L 47mm (Leaded) gunmetal, enamel
The long rectangular panel contains six small rectangular cells for enamel; traces of red survive in alternate fields. It is flanked by raised knurled bands. The foot is broken but shows traces of a 'snakeshead' moulding.
SF 875 'Group south of site V. c 200' (RIII, p 79).

155. RV, No. 69 L 32mm* Brass, enamel
A similar brooch but more arched, and with only five cells: traces of red enamel survive in two of them. The foot is now missing but RV, pl xxxi, shows it complete, with plain cross-mouldings.
SF 5077 Mixed soil above inter ditch mound between ditch sections 20 and 46.

156. L 39mm (Leaded) gunmetal, enamel
Generally similar to the last two but shorter and with broader panel on which there are two much larger rectangular fields for enamel, mostly missing but traces now appearing green in both; there are faint indications that there may have been juxtaposed colours originally. The foot is a bold domed moulding.
SF 5603 Section 53 50ft [15.3m] 4ft [1.2m] deep. On surface of N-S road west of Great Foundation.

157. RV, No. 68 L 55mm* Brass, enamel
This probably had a more arched upper bow than now appears; it has a series of cross-mouldings, with a raised annular cell surrounding a circular cell in the centre, and two groups of three small rectangular cells above and below. Enamel (red) only survives in the annular cell. The narrower foot ends in a small knob.
SF 4137 Surface of SW area inside stone fort. ML about AD 280-400+.

There are few parallels for these brooches from Britain but they are common on the continent; in the typological summary (Table 1, Chapter 1), they have been included within the group called 'Brooches with

tubular hinge-cover and expanded decoration on bow'; none of the other types occurs at Richborough. The first two seem to be the standard type; they are found with either flat or arched decorated panel and with various mouldings on the foot. The small rectangular enamel cells are typical. The earliest dated context is late first century and they are found over a wide area, including France, the German frontier, Belgium and Pannonia (Riha 1979, sub-type F5.17.3, 157).

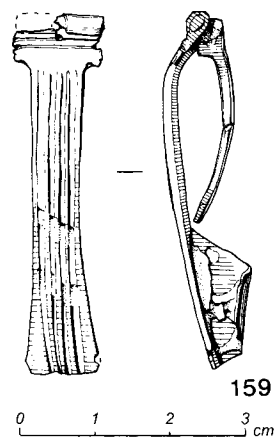
Inscribed brooch of Hod Hill derivative form

158. RV, No. 61 L 37mm Leaded bronze/gunmetal, tinned
The (broken) pin was hinged in a narrow tube formed from the top of the bow rolled upwards; a broad rectangular panel on the upper bow has knurled borders and bears an inscription in punched dots: SIA/MAS/EGOP/LUS. Below this there is a series of bold mouldings, all knurled; the decoration is a mixture of engraved and punched. See also *RIB* II.3, 2421.50.
SF 4240 Diagonal Trench 1 in drain to early road. ML up to about AD 180.

A few other brooches of this form are known; most are enamelled but there is another inscribed one from Geneva, Switzerland (Böhme 1972, 16, notes 71 and 72). None are from dated contexts; typologically they are likely to date from the later first century.

Strip-bow brooches

The pin hinged in a narrow tube formed from the top of the bow rolled back; the bow a broad reeded strip, flared slightly towards the foot; nearly flat profile below angle near the head; the catchplate triangular. T58.



61 *Strip-bow brooch. Cat 159*

159. RIV, No. 21 L 47mm Brass
 Half of the tube for the iron axial rod remains; at the top of the bow is a grooved plate, projecting at the sides (Figure 15).
 SF 3266 Inner ditch on S side, 6–9ft [1.8–2.7m] down. ML AD 280+, probably 400+.

The type defined above has several varieties: some examples have a footknob and the catchplate is sometimes pierced; even including these there are not many. Brooches quite similar to the Richborough one have been found at St Albans, Hertfordshire (Waugh and Goodburn 1972, no. 20, p 116, in context AD 105–30), Wanborough, Wiltshire (Butcher 2001, fig 19, no. 50), Sea Mills, Bristol (Ellis 1987, no. 3, fig 18), London, London Wall (Wheeler 1946, no. 4, p 89), and Wroxeter, Shropshire (Bushe-Fox 1916, no. 2, p 22). We know of no continental parallels.

Strip bows in general are discussed in Chapter 5 (p 154).

COLCHESTER-DERIVATIVE BROOCHES

Two-piece Colchester brooches. T92–93

A lug behind the head is pierced to take an axial bar threaded through the spring itself and its chord is held in an upper hole in the lug, which continues as a crest resembling the rearward hook of one-piece Colchester brooches. The crossbar is longer than those, to cover the longer spring, and can be plain or ribbed; it is nearly always open-ended. The bow is usually plain and tapering; only a few have footknobs. Decoration is confined to the central rib or groove on the bow and to the catchplate, which may be pierced (Hawkes and Hull 1947, type IV, 310–11).

The type and its subdivisions are discussed in Chapter 5 (pp 155–7); parallels for the Richborough brooches are listed in Appendix 3 (pp 249–51).

a) *Central rib down whole length of bow*

ai) Large (over 45mm length); usually with pierced catchplate.

160. RIII, No. 10 L 68mm Leaded bronze/gunmetal
 The spring is missing but the typical lug with its two holes remains. The beaded crest continues as a rib right down the bow. The triangular catchplate, now broken, had a central round opening flanked by two triangular ones.
 SF 740 Pit 35 above 7 1/2ft [2.3m]. ML AD 80–110.

161. L 53mm Gunmetal
 Part of the iron spring remains behind the ribbed crossbar. The brooch is a heavy casting with a thick catchplate pierced by two triangular openings.
 SF 927 Area X Angle 4.

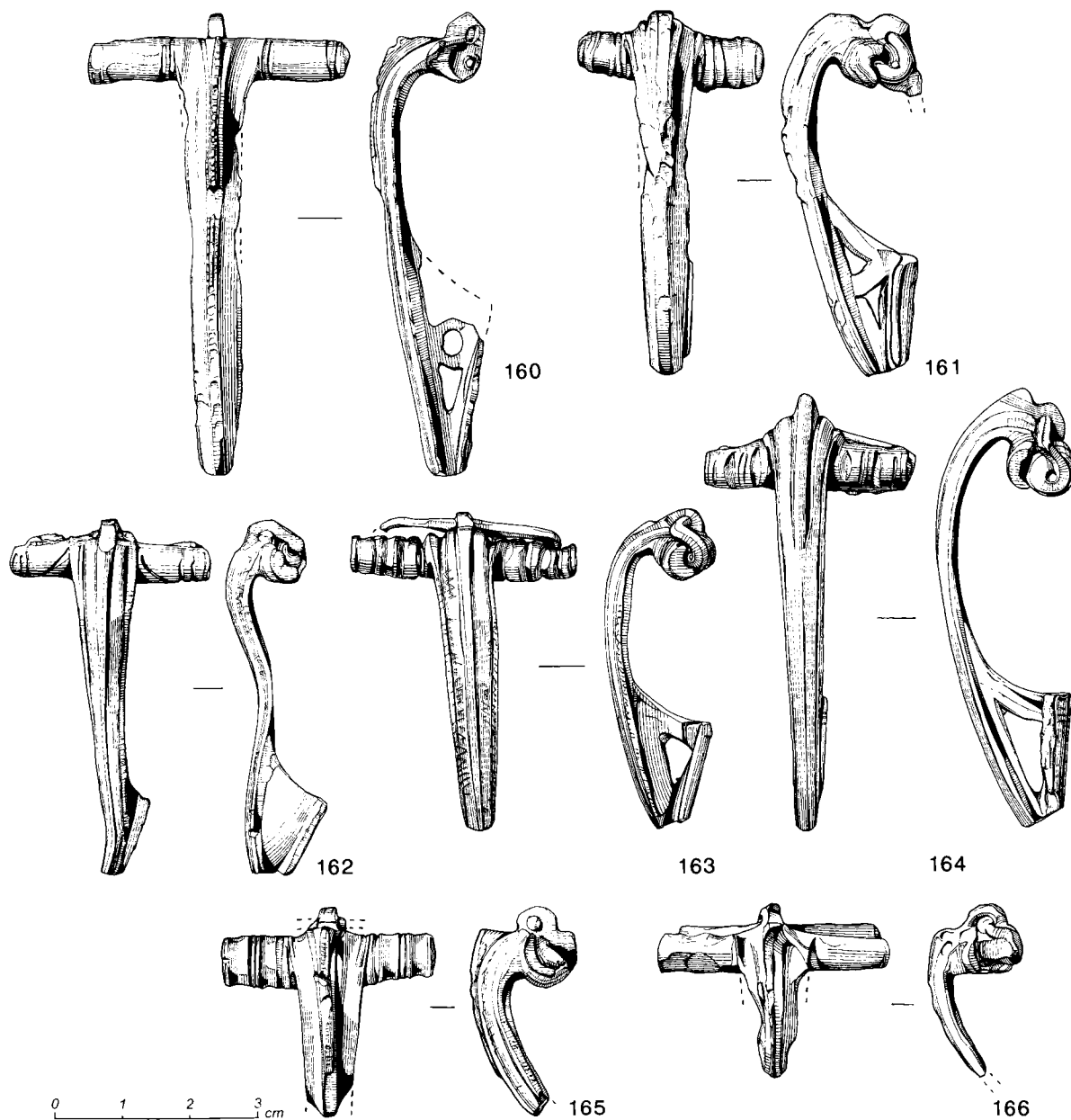
162. RII, No. 4 L 53mm Leaded bronze
 Part of the spring remains behind the long crossbar which has diagonal and end grooves. The central rib and the catchplate appear to be undecorated. According to RII (p 41) the spring had twelve coils.
 SF 234 III 5. ML first century.

163. RV, No. 25 L 47mm Leaded bronze
 The spring is of at least ten coils and is covered by a ribbed crossbar. The ends of the crossbar are partly covered. Hull (RV, p 80) says that this approaches the Polden Hill construction; however, the spring and chord are still held in two holes in the lug behind the head. There is faint beading on the flanges of the bow, not shown in RV. The catchplate has one triangular opening.
 SF 4823 Area XVII/30 Surface.

164. RIV, un-numbered, p 122 L 60mm Leaded bronze
 Spring of ten coils behind a ribbed crossbar. There is a crest on the upper part of the bow; otherwise it is plain except for marginal grooves. The thick catchplate has a large triangular cutout and a slot for the pin.
 SF 2513 S motor road Trench IV Pit 179 14–25ft [4.3–7.6m]. ML Claudian.

165. L 30mm* Leaded bronze
 Although only the upper part remains, the proportions appear to put this into the ‘large’ group; it also has the central rib with ‘cavetto’ side mouldings which usually run the whole length of the bow. The spring is of twelve coils and the crossbar is ribbed.
 SF 2632 Outer ditch in clay Area XI. ML about AD 280.

166. L 26mm* Leaded bronze
 From the size of the crossbar this is probably to be placed in the large category and the upper bow has a central rib and cross-section which seem to belong to the a) group. A corroded spring of about ten coils remains.
 SF 1079 End of mound of refuse near entrance to earth fort 6ins [152mm] down.

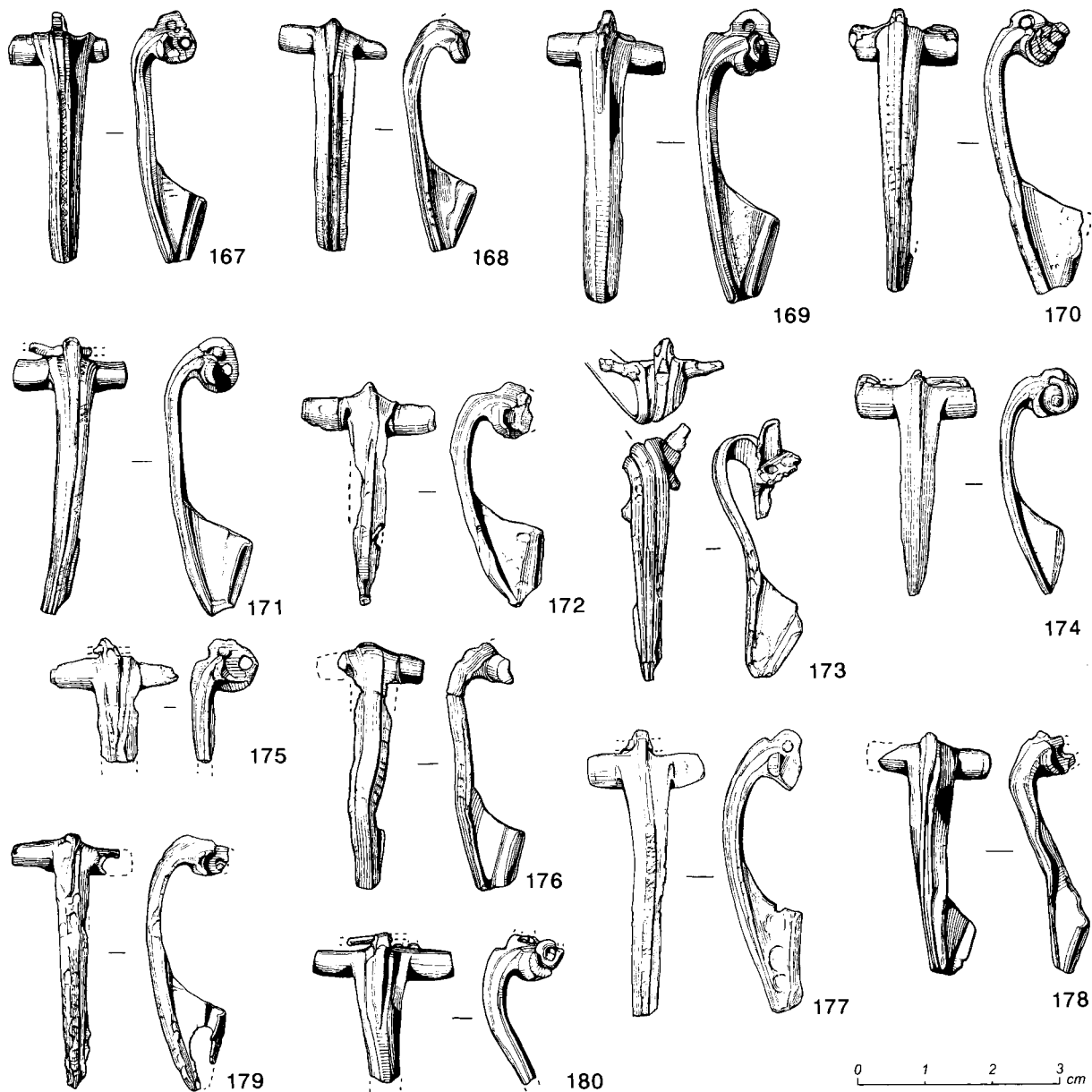


62 Two-piece Colchester brooches, group (ai). Cat 160–166

aii) small (under 46mm length); usually with solid catchplate.

167. L 37mm (Leaded) bronze
The spring is missing but the two holes in the lug behind the head are clearly seen. Fine zigzag decoration is recessed in the central rib.
SF 5561 Top of inner bank of Claudian ditch. Area VI 1936. ML Claudian.

168. RV, No. 18 L 34mm (Leaded) gunmetal
The lug behind the head is broken and the spring is missing. A groove runs down the central rib, which may have been decorated.
SF 5057 Stray.



63 Two-piece Colchester brooches, group (aⁱⁱ). Cat 167-180

169. RI, No. 2 L 43mm (Leaded) bronze
The spring is missing and the central rib appears to be plain; otherwise it has all the standard characteristics.
SF 31 Site 1, room 3, layer 2. ML AD 80-100.

170. RV, No. 24a L 42mm Leaded bronze
The spring was probably of eight coils (four remain on one side); the crossbar short and plain. In section the bow is D-shaped, lacking the 'cavetto mouldings' of the main type.
SF 5061 Stray.

171. L 42mm Leaded gunmetal
The spring is lacking. Traces of a casting flash run down the underside of the bow.
SF 1277 Area X SE corner of platform 9ins [229mm] down. ML late Flavian.

172. RV, No. 19 L 33mm (Leaded) bronze
According to RV (p 79), this brooch had a spring of at least eight turns, but this is now missing. The central rib appears to be plain but is very corroded.
SF 4889 Area XVII/32. Top of Gully 13. ML Neronian.

173. L 42mm Leaded bronze
The spring is missing and the head twisted. Bow with central rib. Distorted.
SF 2064 Big tip outside N wall.

174. L 35mm Leaded bronze
Spring of about ten coils; central rib faintly decorated.
SF 1832 Outside W gate, inner ditch near bottom. ML about AD 280–400.

175. L 19mm* Leaded bronze
The head and upper bow only.
SF 2034 Inner ditch N of Watling St middle layer. ML about AD 400+.

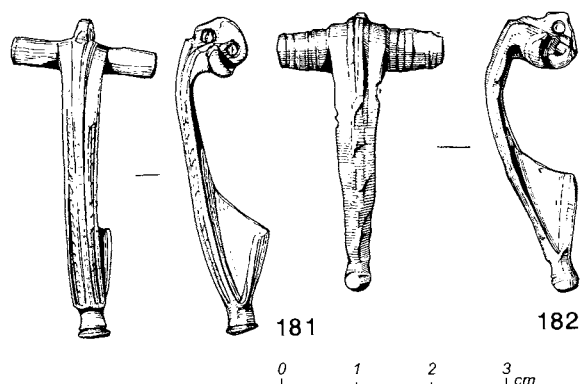
176. RV, No. 20 L 40mm* Leaded bronze
The spring is missing and the head broken, but shows the typical lug and short crossbar; rib down centre of bow.
SF 4497 Surface SW area inside stone fort. ML about AD 280–400+.

177. L 40mm Leaded bronze
Spring missing, part of chord remains. Fine zigzag decoration on central rib. Surface mostly obscured by corrosion. Possible perforations in catchplate.
SF 5170 S of Section 45 in yellow soil. ML about AD 280–300.

178. RV, No. 17 L 35mm* Leaded bronze/
gunmetal
The brooch is twisted and damaged but shows a grooved central rib and plain catchplate.
SF 4664 Stray.

179. L 38mm* (Leaded) bronze
Spring missing and the lug damaged but shows part of the upper as well as the lower hole. There is a central rib down the bow, also damaged.
SF 1047 Area X SW 9–12ins [229–305mm]. ML up to about AD 150.

180. L 22mm* Leaded bronze
Part of the spring remains, made of rolled up sheet metal; also part of the upper bow with central rib.
SF 5529 U/S Area VI.

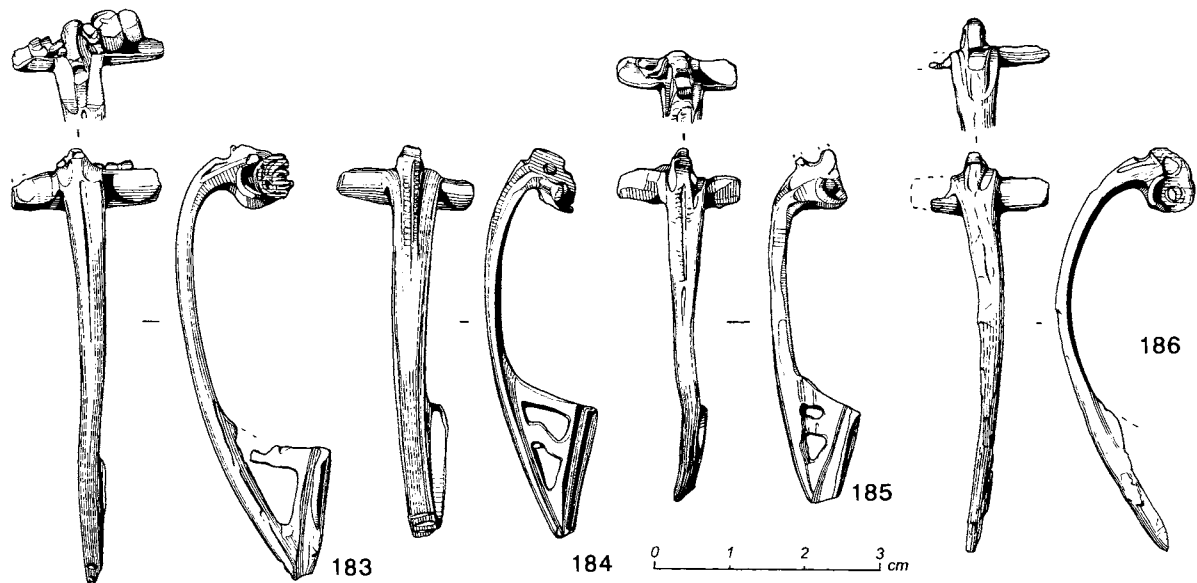


64 Two-piece Colchester brooches, group (aⁱⁱⁱ). Cat 181–182

aⁱⁱⁱ) with footknob

181. RIV, No. 27 L 43mm Leaded bronze
The head construction, and the bow with central rib and faint relief decoration on either side, are usual for the type, but it is distinguished by having a moulded footknob.
SF 1037 Pit 87 recovered from tip. ML about AD 90.

182. L 37mm Leaded gunmetal
This also has a moulded footknob, though slighter than the preceding. The crossbar is ribbed, open-ended, and covers a lug with two holes for the spring and chord. The bow is damaged: the double central rib only survives at the top. The catchplate is solid.
SF 2482 Area XVI mixed soil to W of road over Claudian ditches below level of burnt layer. ML about AD 70–85.



65 Two-piece Colchester brooches, group (bi). Cat 183–186

b) Crest or groove on the upper bow only

bi) large (over 45mm length).

183. L 58mm Leaded bronze/
gunmetal
Spring of about six coils behind short plain crossbar; a narrow plain bow of D-section with only a small central groove on the upper part and two short cross-grooves indicating the foot. The catchplate has a large triangular opening.
No site provenance.

184. RII, No. 3 L 53mm Leaded bronze
The spring is missing but the typical two-holed lug remains, also the short plain crossbar. There is a crest on the upper bow, with faint relief decoration and a central groove; three short cross-grooves indicate the foot. Two curvilinear openings in the catchplate.
SF 297 Top soil (RII).

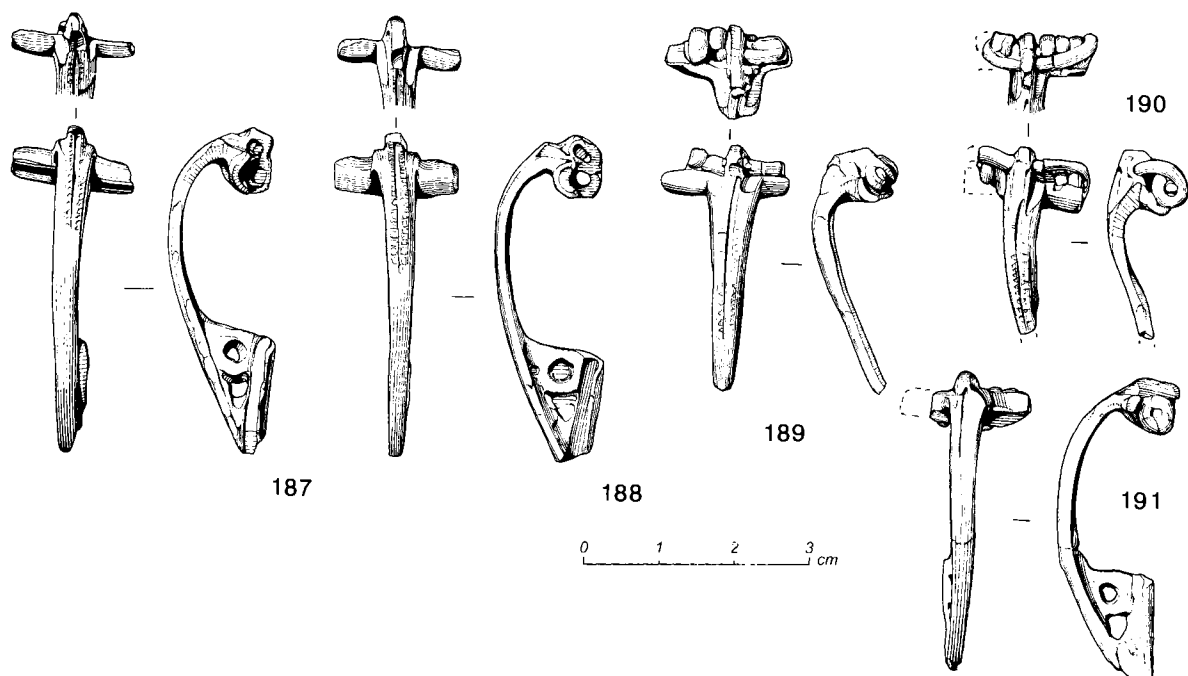
185. L 48mm* (Leaded) bronze
Only a fragment of the spring's axial bar remains in the lower hole of the lug. There is a crosshatched groove down the upper part of the narrow bow; two irregular cutouts in the catchplate.
SF 2395 Trench VI S motor road. ML about AD 50–90.

186. L 54mm* (Leaded) bronze
The spring and catchplate are missing and the foot seems to be broken. There is the usual lug with two holes and the crossbar is short and plain.
SF 5472 Area XXIV U/S.

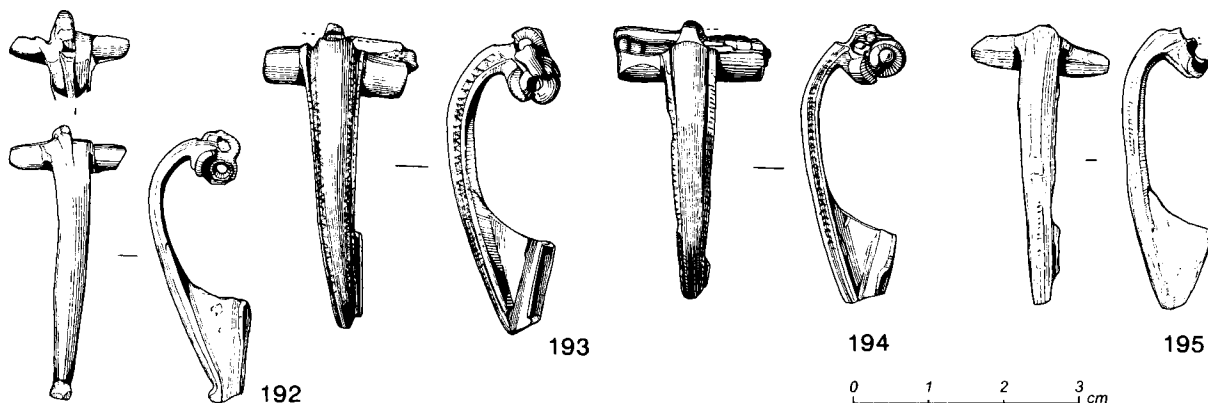
bii) small (up to 45mm length). T93A

187. L 43mm Leaded bronze
The spring is missing but the brooch is otherwise complete and typical; it has a plain crossbar covering a lug with two holes for the spring and chord. The bow is plain except for a crosshatched groove on the upper part. The catchplate has two crudely cut holes, one in a triangular sinking.
Casting flash on the back of the bow.
SF 1914 Outside ditch top layer.

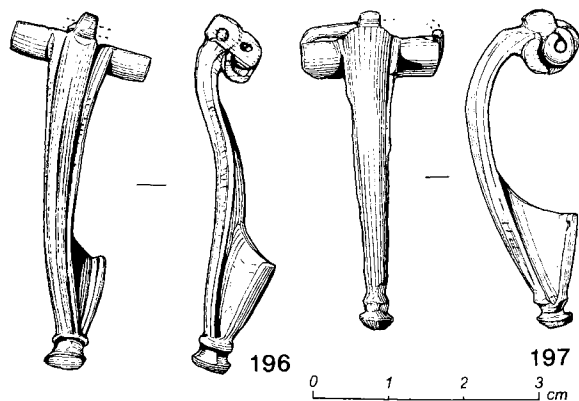
188. L 43mm Leaded bronze
Very similar to Cat 187 above except that here the holes in the catchplate are indicated but apparently not cut through.
No site provenance.

66 *Two-piece Colchester brooches, group (bii). Cat 187–191*

189. L 33mm* Leaded bronze
Although the foot is missing it is clear that this is a brooch with narrow plain bow and with a crosshatched groove on the upper part only. Part of the spring remains, showing at least four coils. No site provenance.
190. L 25mm* Leaded bronze
The upper part of the bow only, showing a crosshatched groove. The head is broken but four coils of the spring survive on one side, suggesting eight in all.
SF 1581 W of Sect 47 above burnt layer. ML AD 80–110.
191. RI, No. 3 L 40mm Leaded bronze
The drawing in RI, pl XII, shows a much thicker brooch with solid catchplate, but according to the find number and to the overall length this is the same brooch, presumably transformed by the removal of corrosion products. It has a slight groove on the upper bow. There are two irregular cutouts in the catchplate.
SF 59 Room 4, layer 2. ML AD 80–100.
- c) *Bow plain. T93B*
192. L 36mm Leaded bronze
The spring missing; there is a short plain crossbar covering a lug with two holes for spring and chord. The rounded bow is plain except for a very small footknob; the catchplate is solid.
SF 700 Pit 33 18ft [5.5m]. ML AD 50–75.
- d) *Rounded bow, plain except for side flanges the whole length.*
- di) without footknob
193. L 41mm Leaded bronze
Half of the spring (four coils) remains; it was held in two holes in the rearward lug, as in the main type. The crest is not continued down the bow, which is rounded and plain except for rocker engraving on the side flanges. The catchplate is solid, with a slot for the pin.
SF 3240 Inner ditch. SW corner 4–8ft [1.2–2.4m] down. ML AD 400+.



67 Two-piece Colchester brooches, group (c). Cat 192. Group (di). Cat 193–195



68 Two-piece Colchester brooches, group (dii). Cat 196–197

194. L 38mm Leaded bronze
The spring of eight coils survives, fixed through the holes in the rearward lug. The bow and catchplate are similar to Cat 193.
SF 1369 Section 53 50ft [15.3m] 4ft [1.2m] deep.
ML AD 75–100.

195. RV, No. 24 L 39mm Leaded bronze
The spring is missing and the lug broken but has traces of the two holes. The rounded bow has beaded flanges down each side; the catchplate is plain.
SF 4820 Stray.

dii) with footknob

196. L c 50mm (Leaded) bronze
The brooch is distorted and lacks a spring. It is similar to Cat 193 and Cat 194 except that it has a footknob.
SF 3009 Surface.

197. L 42mm Leaded bronze
As Cat 196 but smaller; spring of eight coils.
No site provenance.

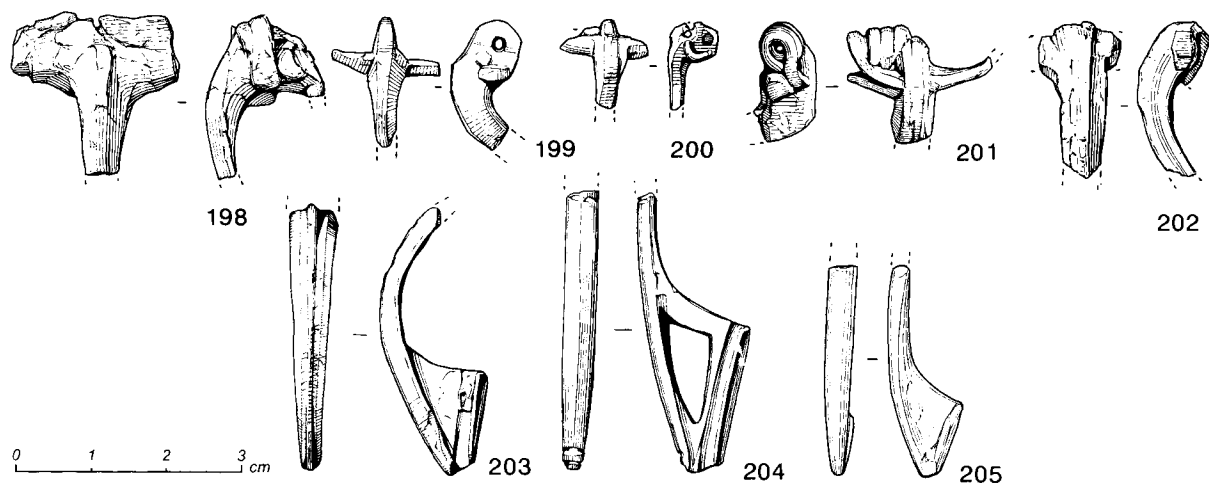
Fragments

198. RV, No. 22 L 23mm* Leaded bronze/gunmetal
The head only, badly corroded. Part of the spring and chord remain.
SF 4318 Surface of SW area inside fort.

199. L 17mm* Bronze
The head only: narrow bow, small plain crossbar, lug with two holes for spring and chord.
No site provenance.

200. L 12mm* Leaded bronze/gunmetal
Similar to Cat 199, but even smaller.
No site provenance.

201. L 16mm* Bronze
Head only: crest holding chord, part of small plain crossbar, four coils forming one half of the spring, its axial bar held in lug behind head.
SF 5347 Inner triple ditch, between Sections 44 and 46A 0–3ft [0.0–0.9m].



69 Two-piece Colchester brooch fragments. Cat 198–205

Fragments and unusual forms probably belonging to this group

202. L 18mm* Brass
The head only, badly corroded and damaged. Apparently a crest continuing as a rib down the centre of the bow; broken crossbar; broken lug for missing ?spring.
No site provenance.
203. L 36mm* Leaded bronze
Head missing; the bow arched, with faintly beaded central rib; solid catchplate.
SF 1131 Section 35, W extension 20ft [6.1m], wall 9–13ins [229–330mm].
204. L 37mm* Leaded bronze/
gunmetal
The lower half only but probably a Colchester-derivative: arched bow, plain except for grooves across foot; open catchplate.
No site provenance.
205. L 26mm* (Leaded) bronze
Lower half only; plain tapering bow, solid catchplate.
No site provenance.

See also brooches now missing (Appendix 4, Table 25):

- A4 (RIII, No. 9).
A5 (RIV, No. 39).
A6 (RV, No. 23).
A7 (RV, No. 21).

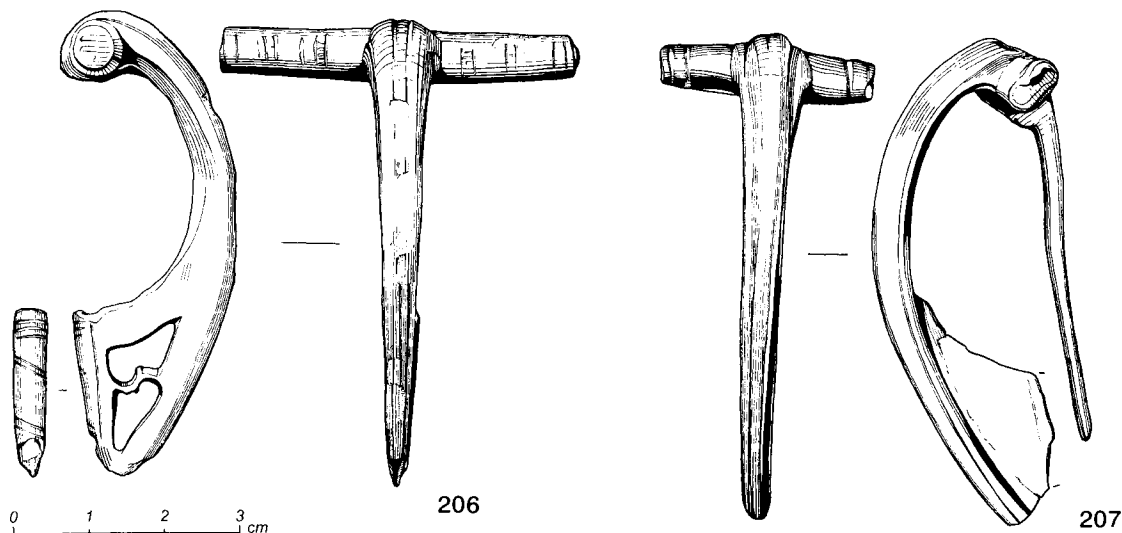
The hinged version of the 'Dolphin' brooch; the pin is hinged in a long crossbar, the bow arched in a single curve. T94B
See Chapter 5, p 157, and Appendix 3, pp 251–2.

206. RIV, No. 28 L 61mm Leaded bronze
The wide cylindrical crossbar has bands of beaded decoration; a faint beaded groove runs down the centre of the bow. In profile the large catchplate forms part of the main curve; it has two curvilinear cutouts and grooved decoration on the turn.
SF 2754 Area XVI below burnt layer. ML about AD 70–85.
207. RIV, No. 31 L 64mm (Leaded) bronze
Much shorter crossbar than Cat 206 and lacks the beaded decoration; the catchplate is solid.
SF 928 Area X unstratified 1ft 6ins [457mm] down. ML up to AD 200.

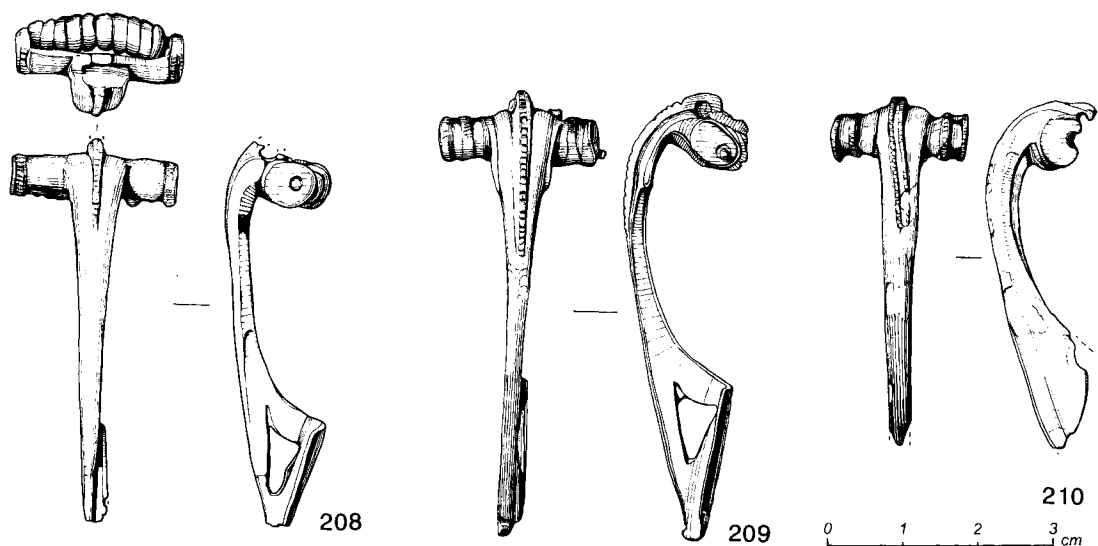
POLDEN HILL BROOCHES. T95–103

The spring is carried in a semi-cylindrical crossbar, which has closed ends to hold the axial rod; the chord is held by a hook or threaded through a crest on the head. Polden Hill brooches are discussed in Chapter 5 (pp 159–60), and parallels for the Richborough brooches are given in Appendix 3, pp 252–3.

- a) *With long tapering bow, decoration usually confined to a crest and flanges on the upper part; the crossbar often ribbed and beaded; sometimes a triangular opening in the catchplate; occasionally a footknob. T95–97, T103*



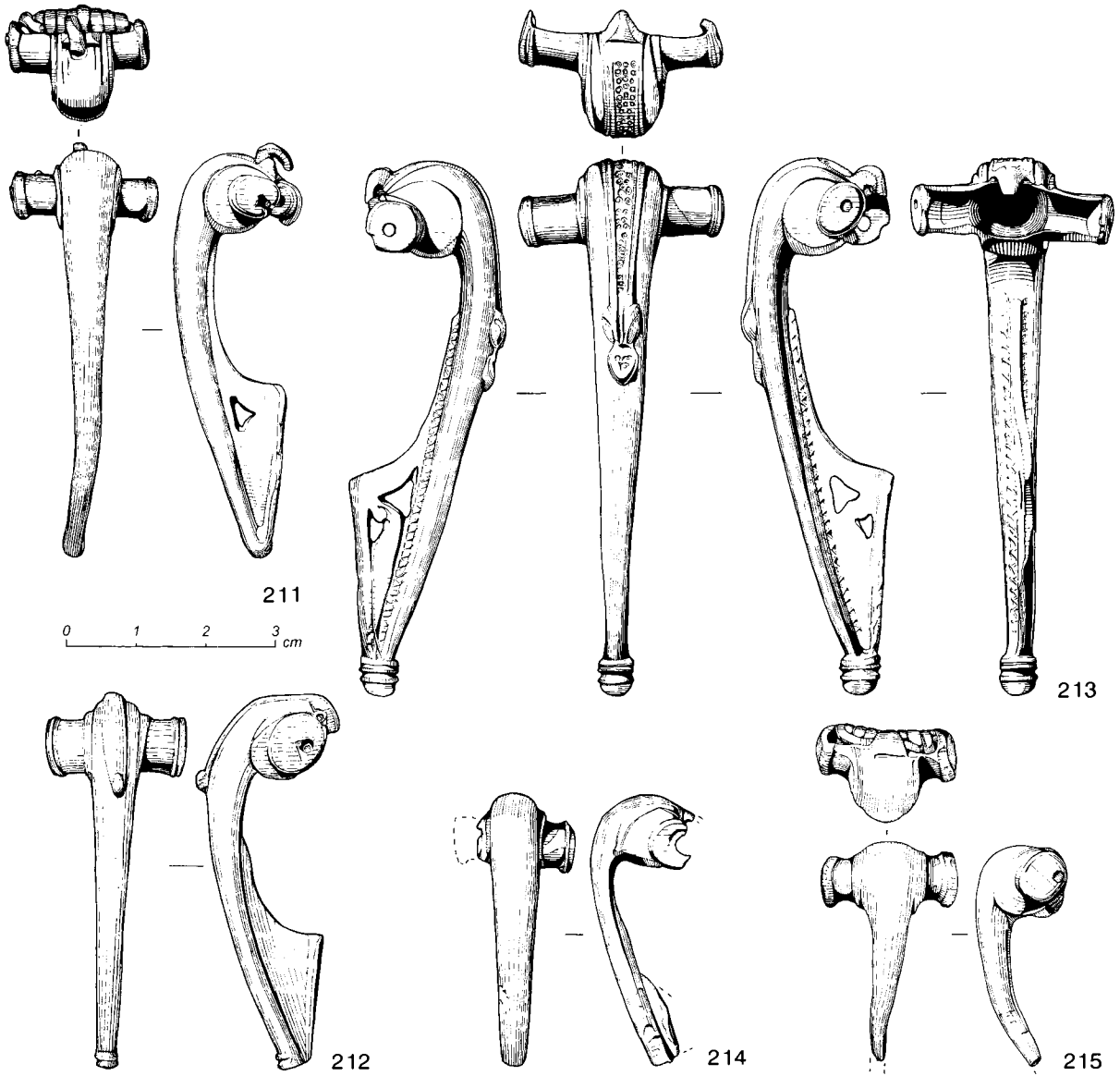
70 Hinged dolphin brooches. Cat 206–207



71 Polden Hill brooches, group (a). Cat 208–210

208. L 52mm Leaded bronze
Spring of nine coils; chord and part of perforated crest missing; plain except for short crest on head and beaded ribs at each end of crossbar.
No site provenance.

209. RV, No. 28 L 60mm Leaded bronze
Spring of eight coils, chord through hole in crest. Plain flanges either side of head; the crest is beaded. Very small footknob.
SF 4010 Surface of SW area. ML about AD 280–400+.



72 Polden Hill brooches, group (b). Cat 211–215

210. L 48mm* Gunmetal
 Bow plain except for crest on head, of two beaded ribs; this extends back over head to form a hook to hold the chord of the (missing) spring. The head rather humped, but not hollow as in the b) group below. The crossbar has two beaded ribs on each side. Foot and catchplate broken.
 SF 530 No site provenance.

b) Heavier brooches, usually large; the upper bow humped forward over the crossbar; the effect often increased by a slight lateral extension showing as disc-shaped flanges beside it. The tapering lower bow is usually plain but the upper half can have a range of cut or moulded decoration, sometimes enamelled. A few have footknobs, some have cutouts in the catchplate. T100C

211. RV, No. 27 L 58mm Leaded bronze
 The spring of eight coils is enclosed in a cylindrical crossbar, open at the back; the missing chord was held by a rearward-facing hook on the head, which is plain and markedly domed; it has disc-like flanges on either side. The crossbar is plain except for enlarged discs at each end. There is a small triangular opening in the large catchplate, whose web extends the whole length of the bow to meet the head.
 SF 3946 Surface SW area. ML about AD 280–400+.

212. L 54mm Leaded bronze/
 gunmetal
 Smaller brooch but generally similar to Cat 211 except that the crest extends down the upper bow, ending with a knob, the catchplate is solid and its web does not extend up the bow, and there is a small footknob.
 No site provenance.

213. RIV, No. 25 L 75mm Leaded bronze
 Fine large brooch, the spring (missing) held in half-cylindrical crossbar, the chord in a rearward-facing hook. The upper bow has a band of punched circles or rings between two ribs, terminating in a raised moulded pellet, possibly zoomorphic. The back of the head is hollow, presumably to save weight. There is a collared footknob. The catchplate has two triangular openings and a long web; it has fine zigzag ornament on both sides. Parallels for the decoration of this brooch include Croft Ambrey, Herefordshire (Stanford 1974, no. 2, p 144), Wroxeter, Shropshire (Bushe-Fox 1916, no. 5, p 23), and Woodcock Hall, Norfolk (Brown 1986, no. 128, p 27).
 SF 2866 'Filling of outer earth fort ditch' (RIV, p 112).

214. L 39mm* Leaded bronze
 Spring and lower bow missing, the head similar to Cat 211 above, the back of it hollow. The rearward hook for the chord is broken.
 SF 2385 Tip.

215. L 32mm* Brass
 Only the upper part survives, but it retains its spring of nine coils, with rearward hook for the chord, and the top of the web from the catchplate joining the head.
 SF 2038 Outside W gate inner ditch S of Watling St upper layer. ML about AD 400+.

TRUMPET-HEADED BROOCHES. T153–159

Instead of a crossbar these have an expanded head, likened to the bell of a trumpet; this covers either a short spring or a hinge for the pin attachment. Nearly all have a moulding at the waist. The main types are considered further in Chapter 5 (pp 160–4); parallels for the Richborough examples are listed in Appendix 3 (pp 253–5).

A: *Plain; the spring held on a single lug; the lobed waist-moulding continues at the back. T153C and T158A*

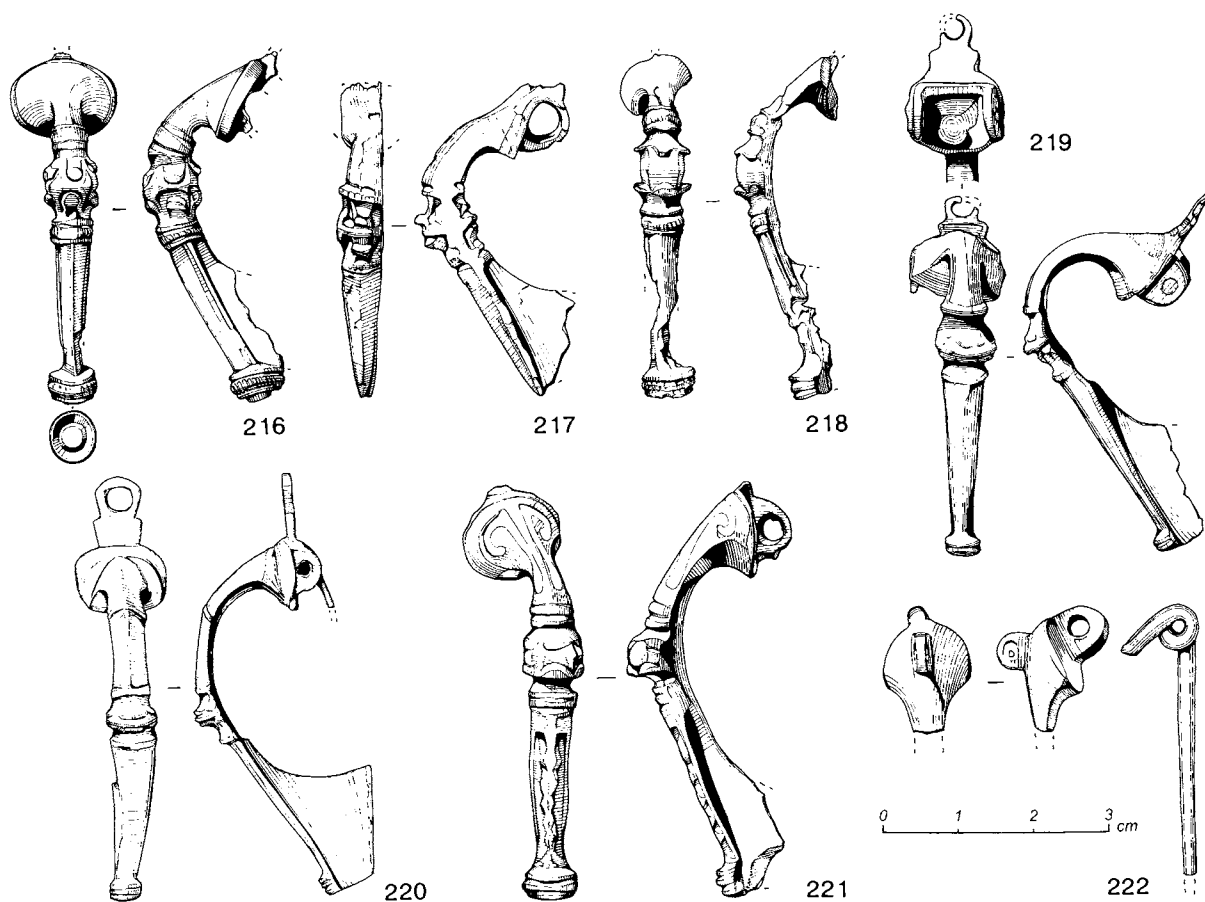
216. L 49mm Brass/gunmetal
 The spring is missing but was held on a lug behind the plain trumpet head; at the top there is a broken tab which probably supported a loose wire headloop. There is a full-round moulding flanked by lobes at the centre of the bow; the plain lower bow tapers towards a drum-shaped footknob which is cast in one with the bow.
 SF 3900 S motor road.

217. RV, No. 30 L 44mm* Bronze/gunmetal
 The brooch is in very poor condition and has been ground flat on one side; the foot is missing. What remains appears to be similar to Cat 216. This may be RV no. 30, but the find number given there (5016) does not agree with that now attached.
 SF 175 Top 3ft [0.9m], NE corner. ML third or fourth century.

Aii) *As above but the waist-moulding flat at back. T158C*

218. RV, No. 32 L 47mm* Brass
 Badly damaged by corrosion but seems to have been a poorly made version of the last two, the only major difference being the flat back. The drawing in RV, pl xxviii, shows the ends of the usual lug behind the head to hold a spring, and a small tab on the head of the sort intended to support a loose wire loop. The moulding in the centre of the bow is flanked by lobes and knurled ribs, and the drum-shaped footknob has a triple moulding, the central rib knurled.
 SF 4202 Area XIX, surface. ML about AD 100–400.

A brooch from an Antonine pit at Camelon, Stirlingshire, seems to have exactly the same features, detailed in the same way (Maxfield forthcoming, no 76–84). Other brooches, similar, but not in every detail – for example, knurling missing – come from Winterton, Lincolnshire,



73 *Trumpet-headed brooches, groups (A) Cat 216–17; (Aii) Cat 218; (B) Cat 219; (C) Cat 220; (D) Cat 221; fragment Cat 222*

from an Antonine context; Watercrock, Westmorland, and St Albans, Hertfordshire, from deposit of AD 145–50. References for these and other parallels are given in Appendix 3 (p 254).

B: Waist-moulding flat at back, fixed headloop, and spring held on a bar between two lugs. T153D, T158D–F

219. RIV, No. 41 L 50mm Bronze including headloop

The missing spring was held (on an iron axis bar) in a recess between two lugs behind the large trumpet head. A small headloop was cast in one with the head. The bow is plain and tapering except for a triple moulding at the waist: this is flat at the back, except for two cross-grooves. The small footknob is drum-shaped with faint cross-grooves. A casting flash is visible on the back of the bow.

‘Filling of earth fort ditch’ (RIV, p 115).

C: As B above but more elongated and the head a flat plate. T154A–B, T155, T159

220. RV, No. 33 L 56mm Leaded bronze including headloop

Spring of three coils in recess between two lugs behind head; iron axis bar. The small trumpet-shaped expansion of the upper bow becomes part of a large rounded headplate ending in a stepped loop. The bow is long and narrow, undecorated except for two cross-ribs on the upper part and a multiple cross-moulding – almost an acanthus – in the centre. The foot is expanded and has three cross-mouldings.

SF 5430 Surface east of hearth just over ditch filling. [Earth fort ditches (RV, p 82).] ML about AD 280–300.

As with Cat 219 above the parallels for this brooch are mainly in the South and West, including Lydney, Gloucestershire (Wheeler and Wheeler 1932, no. 18, p 77), and Caerleon, Monmouthshire (Wheeler 1928, no. 16, p 164). The latter was with pottery of AD 130–60.

D: Decorated

Enamelled. T157

221. RV, No. 31 L 55mm* Brass, enamel
A perforated lug behind the head held the missing spring, and a broken tab on top of the head indicates that there would have been a loose wire loop. In the middle of the bow there is a moulding flanked by lobes, almost flat at the back; the narrow lower bow ends in a triple-ribbed footknob. There are traces of red enamel in curvilinear fields on either side of the head, and in some of the row of small triangular cells on both sides of the lower bow.
SF 4847 Area XVII/32, surface. ML up to AD 200.

Although this is a rather weakly shaped and finished specimen it must be related to a group of enamelled trumpet brooches with similar decoration listed in Appendix 3 (pp 254–5). The Richborough brooch is probably to be regarded as a less well-made near-contemporary of the main type rather than as a much later ‘devolved’ specimen.

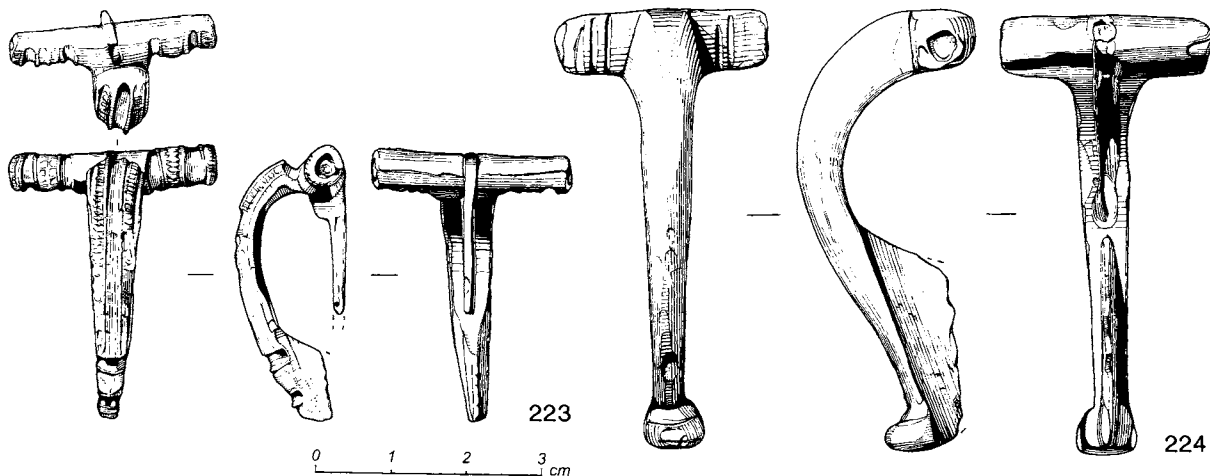
Trumpet-headed fragment

222. L 18mm* Leaded bronze
The spring was held on a single lug behind the head. There is an unusual loop set longitudinally on the head.
SF 2466 Area XVI 6ins–1ft [152–305mm]. ML AD 75–90.

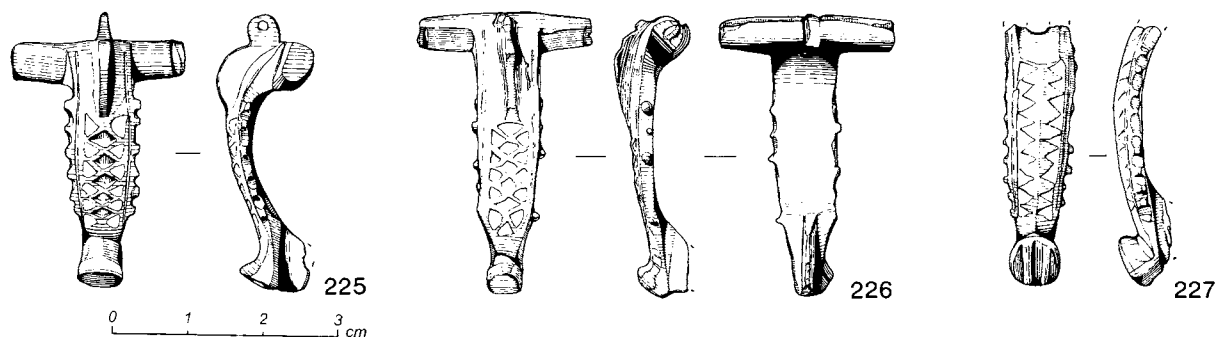
HINGED T-SHAPED BROOCHES

223. RV, No. 26 L 36mm (Leaded) bronze, tinned
T-shaped brooch with long ribbed and knurled cylindrical crossbar; a seam at the back shows how it was formed. It contains the iron axis bar for the hinged pin. The upper two-thirds of the arched bow is also ribbed and knurled; the lower part has cross-ribs, shown as knurled in RV, pl XXVIII, although this decoration is no longer visible. Small triangular catchplate, unpierced.
SF 4239 Found while grass cutting. ‘... possibly from dumped layers in Area xvi’ (RV, p 80).

This brooch follows the hinged Colchester-derivatives of T94, Cat 206–207 above, in its general construction, although details differ; a brooch from Hod Hill, Dorset (Brailsford 1962, fig 10, C95) is quite similar; this one is unlikely to be much later, and therefore probably dates from the mid-first century AD or slightly later.



74 Hinged T-shaped brooches. Cat 223–224

75 *Hinged T-shaped brooches with toothed edge. Cat 225–227*

224. RII, No. 5 L 58mm Bronze
Heavy cast T-shaped brooch; the bow is plain but has a substantial footknob; the crossbar is grooved. SF 146 Top 3ft [0.9m], NE corner. ML about AD 280–400+.

These two (Cat 223–224) fit the general title ‘T-shaped brooches’ better than most but belong to no defined type (for the group as a whole see Chapter 5). While Cat 223 is clearly related to the Colchester-derivatives and must be of fairly early date, the second, Cat 224, has few distinctive features. Both the general shape of its bow and the footknob resemble the headstud brooches catalogued below.

Enamelled hinged T-shaped brooches with toothed edge. T145A

All have a panel of triangle-and-lozenge enamel decoration on the bow. Hull’s ‘Sawfish brooches’. See discussion in Chapter 5 (p 165), and list of parallels for the Richborough brooches in Appendix 3 (p 255).

225. RIV, No. 38 L 37mm Brass/
gunmetal, enamel

The missing pin was hinged in the plain crossbar, which was rolled round the axis bar with a seam at the back. A large crest on the upper bow has a hole in its upper lobe: this may be intended for a chain but it also echoes the chord-holder of sprung brooches of two-piece Colchester type. There are traces of enamel, now green, in the triangular cells and of red in one lozenge. The footknob is plain and slightly upturned.

SF 3426 Inner [stone fort (RIV)] ditch, N side, filling. ML about AD 400+.

226. RV, No. 36 L 37mm Brass, enamel
Similar to Cat 225 above although of different proportions and the crest much slighter and unpierced. The crossbar was rolled round the copper alloy axis bar: seam visible at back. The enamel looks green but was originally red, at least in the triangular fields.

SF 5095 NW of pit 288 between ditch Sections 20 and 46. ML fourth century.

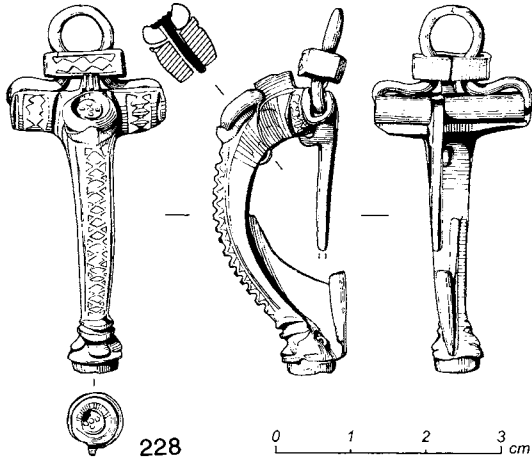
227. L 34mm* (Leaded)
bronze, enamel

The lower part of a brooch generally similar to the two above: it has the toothed edges and the forward-facing footknob. It also has a panel of enamel decoration in a similar position, but here the lozenges are reserved metal and only the triangular cells were enamelled (red). The head is missing but at the break there is a rounded opening where a separate crest was riveted on. Similar brooches from Priddy (Bristol Museum), and Dragonby, Lincolnshire (Olivier 1996, fig 11.9, no. 102), have a crest in the shape of a dog attached in this way.

SF 377 No site provenance.

HEADSTUD BROOCHES. T148–149

The ‘Lamberton Moor’ series: with decorative stud near the head of the arched bow, short decorated crossbar, headloop, and substantial foot, either moulded or bearing another stud. Individual types are distinguished by cast or loose headloops and by the type of decoration; some can be either hinged or sprung. See Chapter 5 (pp 164–7) for description and discussion of the group as a whole, and Appendix 2 (Group 7) for Hull’s definition of the types.



228. RIV, No. 34 L 38mm plus headloop Brass, enamel

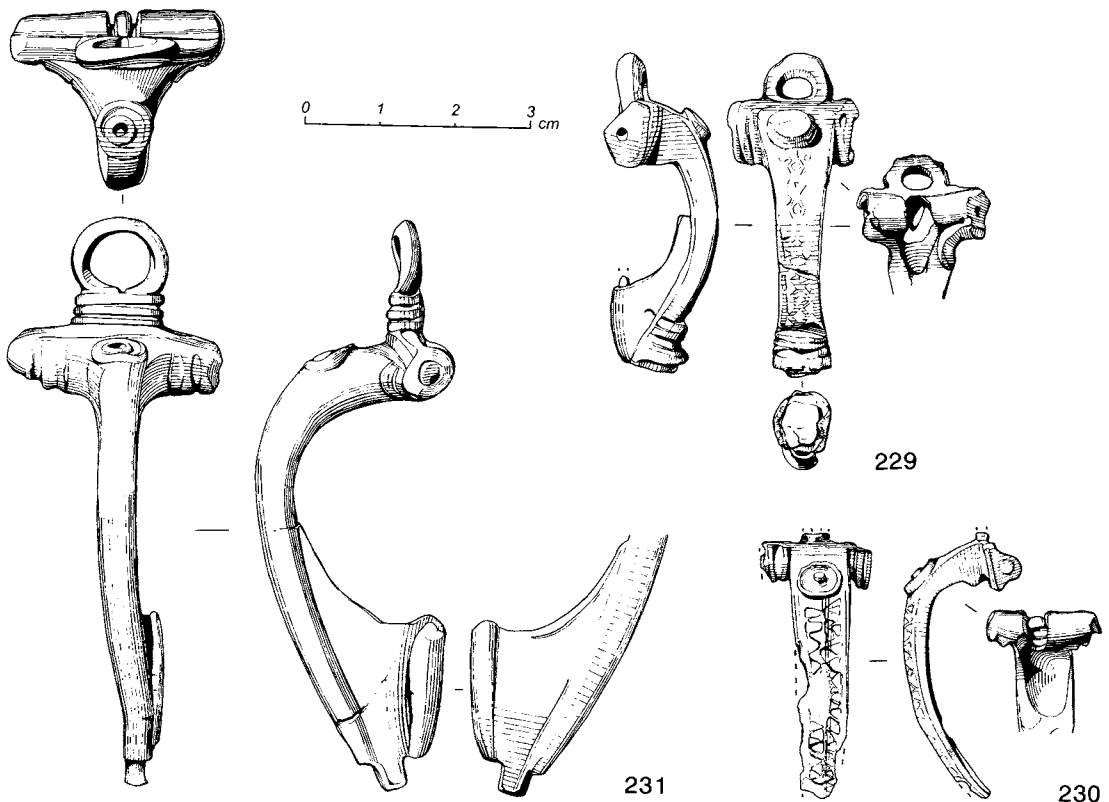
The pin is hinged in a narrow tube behind the head, yet the brooch has a loose wire loop which protrudes from the ends of the crossbar (apparently part of the axis on which the pin is hinged inside the tube). This is clipped above the head by an enamelled collar. At the top of the bow there is a crest and immediately below it the headstud, which is an annular bead riveted in a cone-shaped hollow in the bow. Another bead is riveted into the bottom of the moulded footknob. Both are now green but were probably made of opaque red glass; the head of each rivet is decorated with a quincunx of small spots.

A panel of enamel in small lozenge-and-triangle cells runs down the length of the bow below the headstud; traces of blue in the lozenges, red in the triangles. On the wings the lozenges are in reserved metal, outlined by red enamelled triangles; the same scheme is used on the clip of the headloop.

SF 1048 Area X 6ins [152mm] down S corner.

76 Headstud brooch (a). Cat 228

a) With loose wire headloop although the pin is hinged; cupped headstud; the bow and crossbar enamelled. T148C (parallels listed Appendix 3, p 255)



77 Headstud brooches (b). Cat 229-231

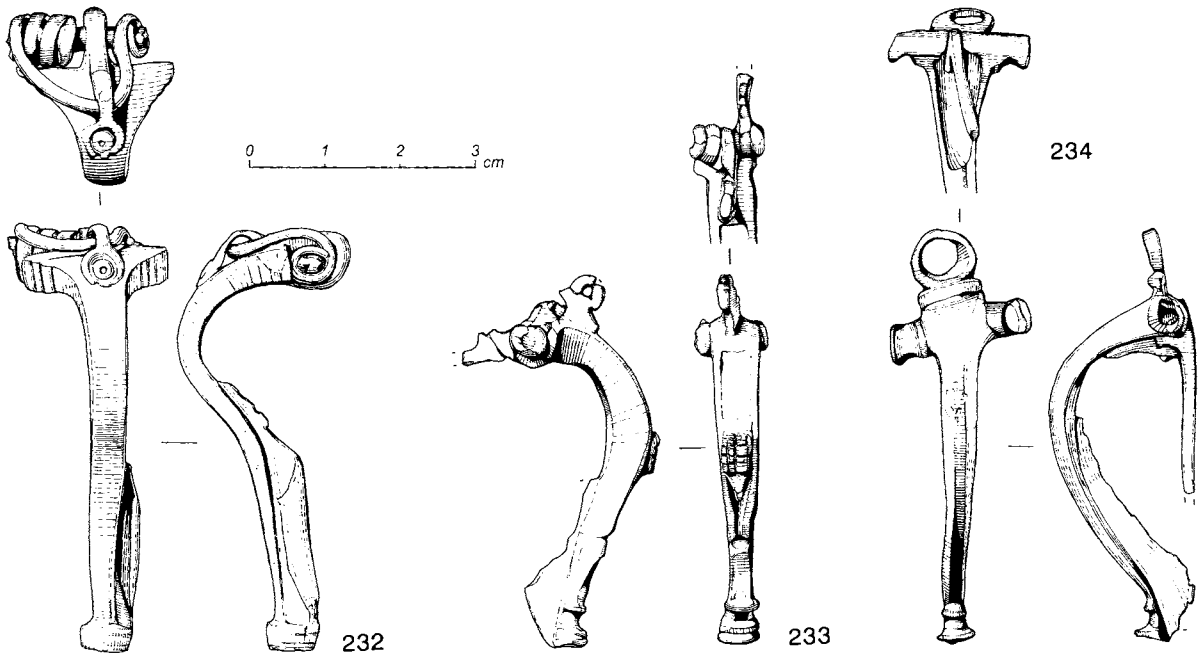
A8 (RIV, No. 35). See also Appendix 4, Table 25. Now missing from the collection. Of very similar construction to Cat 228 but with different decoration.

b) *Hinged and with fixed headloop. T149*

229. RIV, No. 36 L 43mm Copper, including headloop enamel
 A hinged brooch with plain fixed headloop and short crossbar; the pin and axial bar missing. Corrosion damage obscures details of the decoration but there was a headstud and a line of lozenge-shaped cells down the bow, with traces of blue enamel bordered by triangular cells with red enamel. The drawing in RIV, pl XXVIII, shows the bow as plain. The footknob was moulded. An 'identical' brooch was found with this one according to RIV (p 114): possibly Cat 230 below as the findspot is the same.
 SF 1813 Pit 127 16ft [4.9m]. ML about AD 70–120.

230. L 35mm* (Leaded) bronze/gunmetal, enamel
 A fragmentary brooch with tube containing a copper alloy axial bar for a pin hinged behind the crossbar, and with the broken ends of a fixed headloop. The headstud has reserved metal in the centre; it was probably not enamelled. A row of small triangular cells down each side of the bow shows traces of red enamel.
 SF 1812 Pit 127 16ft [4.9m]. ML about AD 80–90.

231. RV, No. 35 L 75mm Bronze/gunmetal including headloop
 The pin was hinged on an axis bar of rolled up copper alloy sheet and there is a large fixed headloop with triple cross-mouldings. The short crossbar is stepped. The bow seems to be plain except for the headstud, which has reserved metal rings round a central spot, not enamelled. The drawing in RV, pl XXIX, shows a rounded footknob but this is now missing and only a peg remains.
 SF 4545 Trench outside S wall, SE corner.



78 *Headstud-related brooches. Cat 232–234*

Related to the headstud type

232. RIV, No. 33 L 52mm Gunmetal
Spring, broken but probably of eight coils, on lug behind the head, the chord held by a hook, the end of which is punched in imitation of a rivet, although there is no actual attachment to the bow. There is no trace of a wire headloop although it probably had one, housed in the sheet metal roll that is threaded through the spring. The bow is plain and tapers to a large knob, which is hollowed on the underside, with a reserved metal spot in the centre, which possibly imitates the peg of a separate footknob (cf Cat 231, above). SF 2773 'Unstratified' (RIV, p 114).

233. RI, No. 5 L c 50mm Leaded bronze, enamel
A spring of four coils is attached to a lug projecting from the back of the head, which continues as a high crest on top of the bow; the crossbar is very short. The pin may be a repair, as it seems to be separate from the spring. There is a hole through the top of the crest; this seems rather high to be a chord-holder and it may have held a chain, as did some headloops. A possible second hole to hold the chord is obscured by corrosion. The bow is of square section; below the crest there is a rectangular field of turquoise enamel, then a raised crosscut square, then a V-shaped cell, now empty but possibly for enamel. The footknob is moulded.
In RI (p 43), the brooch is described as 'straight from the mould and unfinished'. However, it is unlikely that an unfinished brooch would have been enamelled and the illustration on pl XII shows none of the decoration and the brooch very thick; presumably it was covered with corrosion products.
SF 101 Pit 2, 12ft [3.6m] down. ML second century.

No parallels have been found for this strange object, but the bow shape and foot are similar to the headstud type, while the crest and the decorative elements appear on various other, chiefly south-western, types. These analogies suggest a date somewhere in the late first or early second century.

The Thealby Mine type. T146

234. RIV, No. 37 L 54mm (Leaded) bronze
 including headloop
The pin is hinged in a short stepped crossbar; a large loop is cast in one with the head. The bow is arched, slightly faceted, and tapers to a moulded footknob. The catchplate has an exceptionally long web.
SF 1050 Area X Angle of SW corner 2ft [0.6m]. ML up to AD 250.

The profile and general shape are very like the headstud brooches. There are several quite closely resembling this one and they are virtually all from northern sites: see list in Appendix 3 (pp 255–6). One from Camelon, Stirlingshire, was in an Antonine ditch fill.

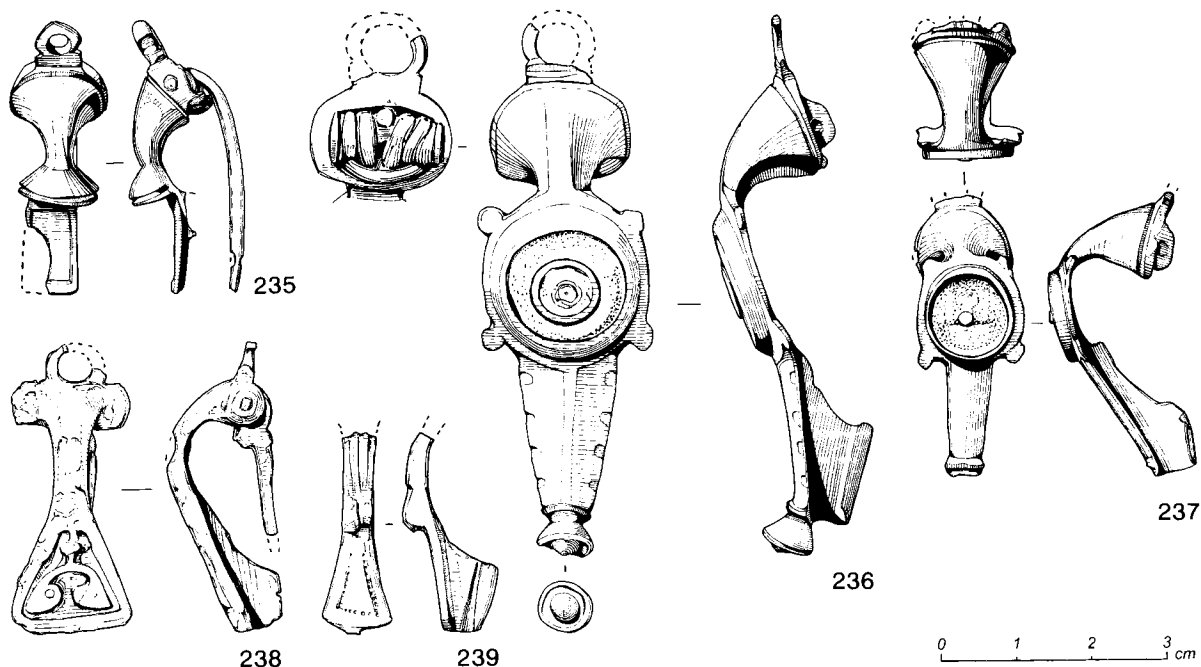
VARIOUS BROOCHES RELATED TO THE TRUMPET-HEADED AND/OR HEADSTUD SERIES

Trumpet-headed brooches with expanded decoration on bow. T162–168

The types are discussed in Chapter 5 (pp 168–70).

Trumpet-headed brooches with cone-shaped or lunate moulding at midbow, and broad flat foot. T162

235. RV, No. 29 L 36mm Brass, tinned
 including headloop
The spring of five coils is held on an iron axis bar between two lugs in a recess behind the trumpet-shaped head. There is a small angular loop cast in one with the head. A domed moulding projects from the middle of the bow, and below this the foot is flat, broad, and expands slightly; it contains a large field possibly for enamel, now empty. The catchplate is broken. There are traces of tinning (solder) down the centre of the trumpet head, a spot to each side, across the base of the loop, in the groove around the domed moulding, and on the foot; silver wire would originally have been attached by this solder.
SF 4800 Area XVII/32 S of Chalk House. ML early second century.



79 Brooches related to the trumpet-headed and headstud types. Cat 235–239

Trumpet-headed brooches with disc on bow. T166

236. RIV, No. 40 L c 72mm (Leaded) brass/gunmetal, enamel
The spring of five turns is held in a recess, on an iron bar between two lugs behind the head; there is a broken headloop, cast in one with the head, with two cross-mouldings at its base. On the trumpet-shaped head there are discoloured marks produced by differential corrosion of areas once covered with soldered-on silver foils (Figure 19 and Plate 9). A large disc on the bow has four metal lugs on its circumference and contains enamel in separate fields: an inner disc of red surrounded by turquoise (only fragments remain). The broad lower bow has notched edges and the mark of a median strip of applied foil; the footknob is conical, with a central metal knob, perhaps imitating the rivet which sometimes fixes a separate setting; there is no sign of enamel (See Plate 9).

SF 903 Railway tip.

Richardson 1960, no. 33, p 212.

237. RV, No. 34 L 36mm* Copper/brass, enamel

A smaller and simpler version of Cat 236. The main difference is at the foot, which is broken; only a cross-rib remains, but it may have had an open ring. The decoration shows no sign of applied metal foils but there are casting flaws on the trumpet head, which may have been hidden by foils now lost. There are fragments of blue enamel in the large field of the disc, and a reserved central metal spot.

SF 4727 Area XVII/32 W extension S of Chalk House. Surface. ML late first–second century.

Richardson 1960, no. 34, p 212.

'Celtic fan-tailed': brooches with fixed headloop and flared enamelled foot. T36

238. RI, No. 4 L 39mm Bronze, enamel
The brooch is much slimmer than the drawing in RI, pl XII, suggests: it was presumably then encrusted with corrosion products. The head consists of a short tubular crossbar in which the pin is hinged (on a copper alloy axis) surmounted by a (broken) loop, which is part of the main casting. The middle bow is narrow, with cross-grooves as the only decoration; below this the brooch flares to a flat triangular foot. This bears a reserved metal motif of double trumpet or bud shape outlined by an enamelled field: traces of red enamel remain. There is a suggestion of a lozenge-shaped cell above the main motif. The catchplate lies behind the centre of the flared foot and its web extends to the narrow midbow. This is the standard type of the later first century: see Chapter 5 (pp 168–9) and Appendix 3 (p 255) for parallels. SF 63 Pit 12, 8ft [2.4m] down. ML about AD 70–120.

Fragment

239. L 26mm* Gunmetal
The lower part only of a brooch with flat triangular foot and arched midbow bearing longitudinal ribs; faint traces of punched decoration outline the foot. A sub-rectangular catchplate is placed centrally behind the foot; its line is continued by a casting flash. No site provenance.

This is not the standard 'Celtic fan-tailed' type but there are two apparently similar brooches, from Lullingstone, Kent (Meates 1987a, no. 65, p 63), and Gorhambury, Hertfordshire (Butcher 1990a, no. 16, p 117). These had sprung pins held on a lug behind the head as in two-piece Colchester brooches (T92–93). However, some other brooches of similar shape are hinged: for example, Old Winteringham, Lincolnshire (Stead 1976a, no. 10, p 198). This was from a third-century context and the Gorhambury brooch was in a second-century level, but the method of decoration suggests a first-century date.

KNEE BROOCHES T171–179

The types are discussed in Chapter 5 (pp 179–81) and parallels for the Richborough brooches listed in Appendix 3 (p 256).

Bow wide and flat in section but with S-shaped profile; the crossbar a cylinder open at the back. The catchplate is transverse (that is, at right angles to the bow). T175A

240. L 30mm Leaded bronze, tinned all over
The spring is held on an iron axis bar within a cylinder open at the back. The broad bow has an S-shaped profile; it is plain except for cross-mouldings near the centre. The catchplate projects as a flat plate from the bottom of the bow. Labelled 'Old Museum'. No site provenance.

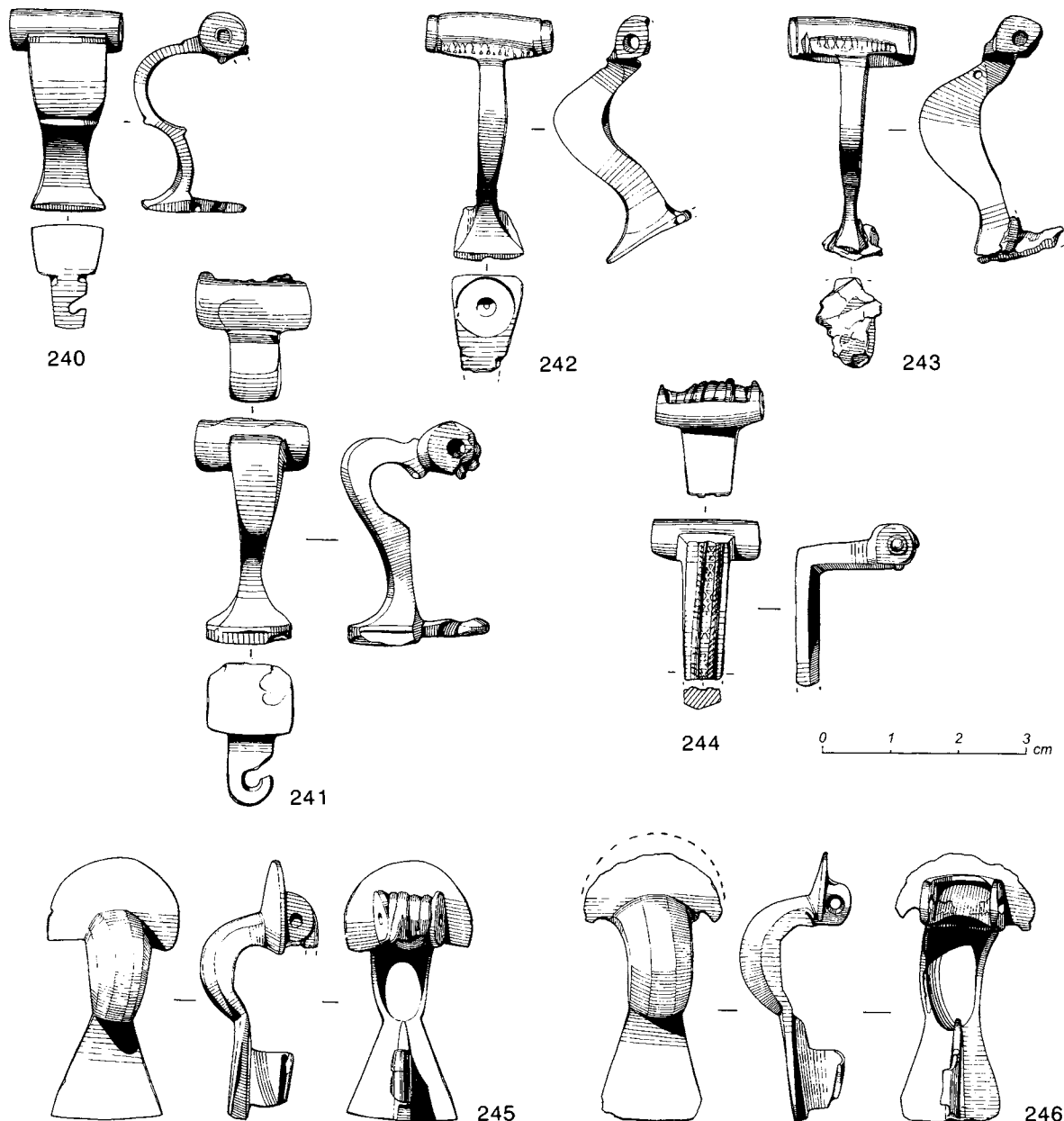
Bow of rectangular section, expanding towards foot; the crossbar a cylinder open at the back. The catchplate is transverse. T176

241. RIV, No. 52 L 33mm Leaded bronze/gunmetal
The bow is of rectangular section, strongly arched near the head, narrow at the waist, and flaring at the foot, which bears a transverse catchplate as on Cat 240. Little of the spring remains; it was held on an iron bar within the head cylinder. SF 3522 Inner triple ditch clay. 'Filling of earth fort ditches' (RIV, p 118). ML AD 250–80.

242. L 33mm Leaded bronze, tinned
Similar to Cat 241 except that the bow is narrower, the head thinner, there is a panel with faint punched decoration between the head and the bow, and concentric decoration on the underside of the catchplate. Labelled 'Old Museum'. No site provenance.

A brooch from Corbridge, Northumberland, has similar decoration on the foot (Snape 1993, fig 8, no. 44, p 44), where it is suggested that this may be a continental feature.

243. L 32mm (Leaded) bronze
Another similar to Cat 241, again with a narrower bow and decorated panel behind the head. The spring is missing but had an iron axis bar. The foot is damaged and the catchplate missing. No site provenance.



80 Knee brooches and pseudo-bow brooches. Cat 240–246

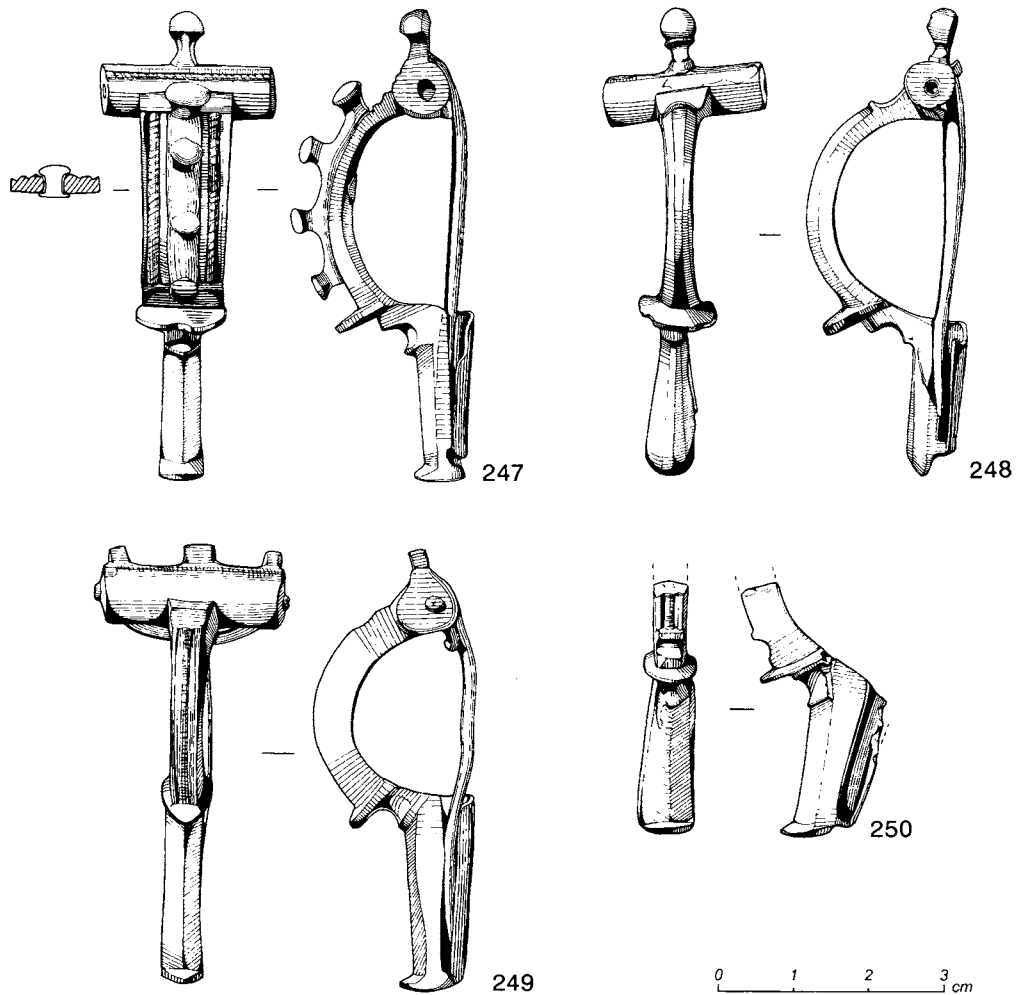
Fragment: angular profile; spring in half-cylinder

244. L 25mm* Copper/brass, mercury gilding

Upper half only; spring of six turns on rod in short rounded crossbar open at the back. The straight-sided upper bow forms a rectangle to meet the crossbar; it is rectangular in section and has a

central line of fine xxx decoration (upstanding saltires produced by a punch with four triangles) between two cabled ribs. No site provenance.

Probably to be related to the knee brooches or those of another group (T186) with similar bows, though these have P-profile.



81 Sheath-footed sprung brooches, group (a) Cat 247; and group (b) Cat 248–250

Pseudo-bow brooches. Large flat semicircular headplate; the short spring held on a rod between two lugs behind this. The bow is P-shaped in profile: the highly arched upper bow joins a flat expanding footplate. T178A

These brooches are discussed in Chapter 5 (p 181) and parallels listed in Appendix 3 (p 256).

245. RIV, No. 51 L 38mm (Leaded) bronze
The spring is of four turns and is held between two lugs behind the headplate. There is a hollow behind the faceted upper bow. The catchplate is central and parallel behind the triangular foot.
SF 2677 Area XVII in pebbles of road S of Chalk House. ML late third–fourth century.

246. RV, No. 84 L 39mm (Leaded) gunmetal
Very similar to Cat 245.
SF 5346 Inner triple ditch sections 44–46a 3ft [0.9m] down. ML fourth century.

SHEATH-FOOTED, P-PROFILED SPRUNG BROOCHES
These form part of Hull's Group 11 and are discussed in Chapter 5 (pp 181–3). Parallels for the Richborough brooches are listed in Appendix 3 (pp 256–8).

Sheath-footed, P-profiled brooches with spring on iron axis rod in a cylindrical head. T185–187

a) *With knobbed plate on upper bow. T185*

247. RIII, No. 13 L 63mm Leaded bronze, tinned
The spring of fourteen coils of thin wire is held on a rod in the cylindrical head, which is open at the back; there is a small knob projecting from the head, which also has a knurled cross-moulding. Two further knurled mouldings run down the arched upper bow, flanking a plate bearing four knobs which is attached by a single rivet. A transverse flange projects just above the angle with the lower bow, which is plain apart from faceting and a small cross-moulding at the foot.
SF 717 Outside N wall Trench II 2ft [0.6m] down. 'Topsoil, outside north wall' (RIII, p 78).

A very similar brooch was found at Brougham, Westmorland; however, it was made of bronze. Others came from the amphitheatre at Caerleon, Monmouthshire (described as plated with gold on the upper part and silvered on the foot and undersurface), in a deposit dated about AD 220, and from Corbridge, Northumberland (one has four knobs on the plate, the other three); they seem to be rare on the continent: one from Zugmantel, Germany, was regarded as a British import (Böhme 1972, no. 611, p 24). See references and other examples in Appendix 3 (p 257).

b) *With narrow upper bow, flanged near waist. T186*

248. RIV, No. 54 L 61mm Bronze/gunmetal
Part of the spring remains in the cylindrical head, which is open at the back; a small knob projects from the head. The arched upper bow is slightly faceted but otherwise apparently plain, except for a large flange just above the angle with the lower bow, which is plain, keeled, and has a rounded end. The sheath catchplate stops short of the end of the brooch.
SF 1078 Area XI, layer 1. ML about AD 280–400+.
249. RIV, No. 58 L 59mm Brass, mercury gilded, tinned
The spring of ten coils is in a cylinder open at the back; there is a three-knobbed crest on top of the cylinder. The arched upper bow of rectangular section has three slight ribs, the central one knurled. There is a flange just above the angle with the lower bow, which is also faceted, with a cross-moulding at the foot. Tinning survives on the head, foot, sides and back of the bow, with gilding on the front.
'Inner stone fort ditch, upper layer' (RIV, p 120).

We do not know of a parallel for the crest, but otherwise similar brooches come from several civil and military sites: see Appendix 3 (p 257).

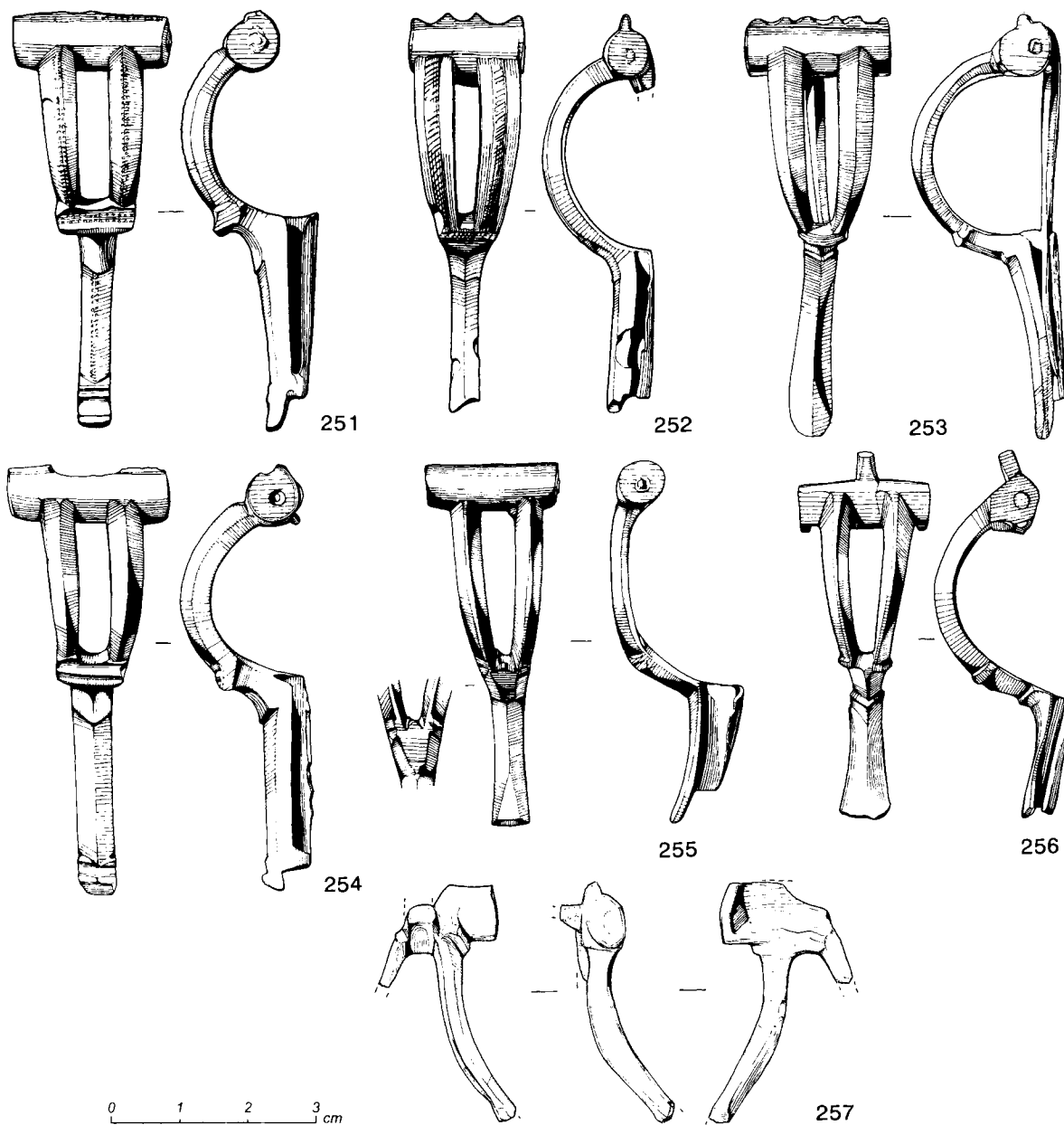
250. L 34mm* Copper/brass, mercury gilded, tinned
Lower half only, with sheath foot; the mouldings quite like those of Cat 249 and Cat 247. The upper bow was of rectangular section, gilded, and has three longitudinal ribs, the central one knurled, as Cat 249. The foot is shorter and thicker and is also knurled; it has traces of tinning.
SF 2112 Outside W gate, inner ditch S of Watling St middle layer. ML about 400+.

c) *With divided bow. T187*

251. RV, No. 75 L 58mm Copper/brass, tinned all over
SF 4237 SW interior of fort. Diagonal trench I. 158ft [48.2m] from SW angle.
252. RII, No. 11 L 60mm* Leaded bronze, tinned
'Topsoil' (RII, p 43).

These two are generally similar in design although Cat 251 is bulkier and the metal is different: they both have a spring in the half-open cylinder; Cat 252 has had a hinge inserted and has a wavy-edged crest on the head and bands of knurled decoration on the ribs of the upper bow and the cross-moulding at its junction with the lower bow. Cat 251 is shown with a wavy crest in RV but it never had one; presumably a corrosion crust led to this misinterpretation. The ribs of Cat 252 are rectangular in section, those of Cat 251 are sub-triangular. Cat 251 has two rows of punched dots on the head, ribs, lower bow and cross-ridges at the foot; Cat 252 seems to be plain and the end is broken.

253. RII, No. 12 L 62mm Leaded bronze, tinned
SF 293 'Topsoil' (RII, p 43).
254. L c 60mm (bent) Gunmetal
SF 703 Trench I S of Watling St 130–135ft [39.6–41.1m] on datum line.
255. RV, No. 74 L 52mm Leaded bronze
The catchplate is open rather than sheathed.
SF 4022 SW area inside stone fort. Surface. ML about AD 280–400+.



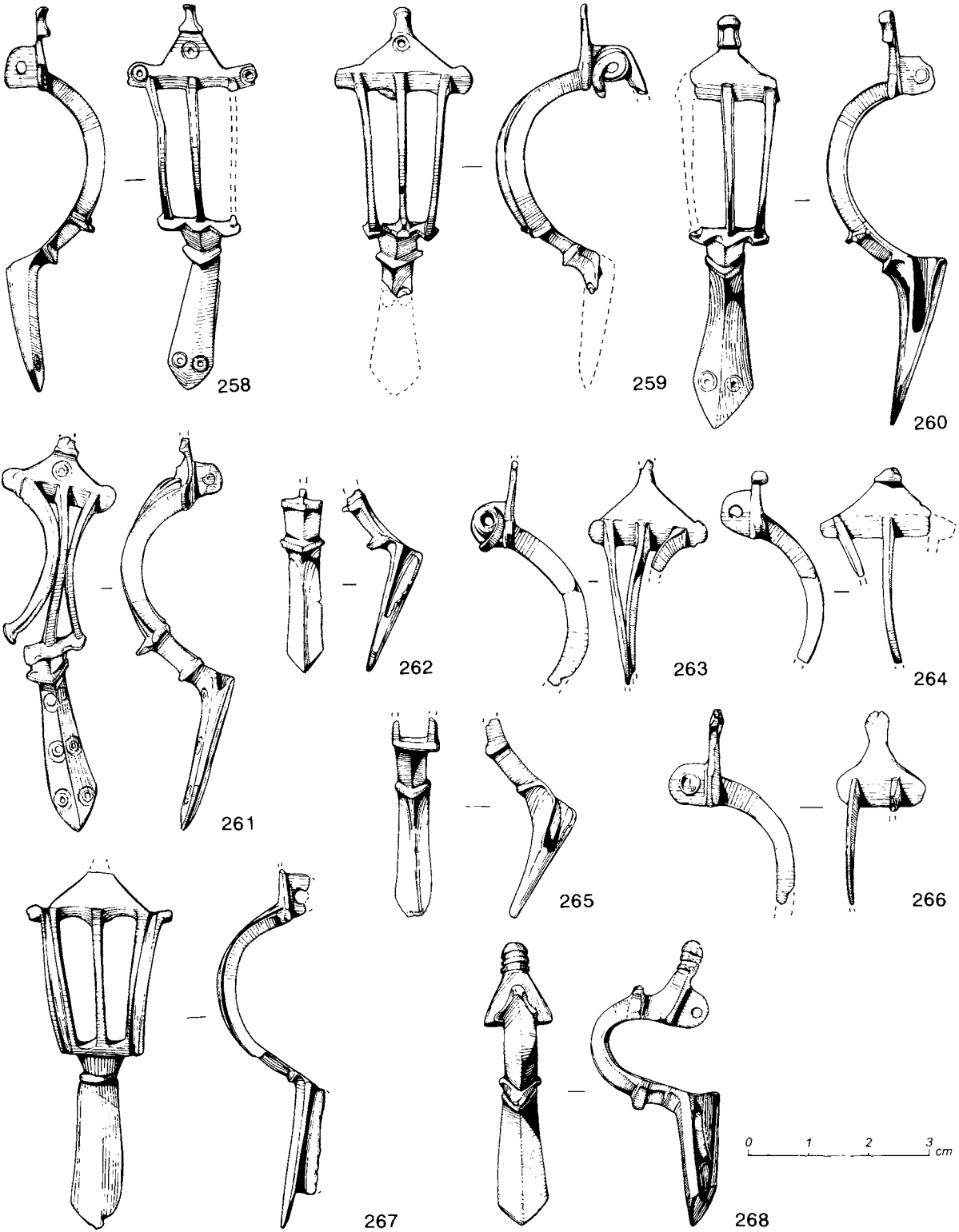
82 Sheath-footed sprung brooches, group (c). Cat 251–257

256. L 55mm* Leaded gunmetal
SF 949 Area X 6–12ins [152–305mm]. ML up to
AD 200.

257. L 35mm* Brass
SF 1104 S road Section 4a 0–1ft 5ins [0.0–432mm].

These five brooches (Cat 253–257) resemble the

previous two (Cat 251–252) and are alike in their main features: spring enclosed in cylinder open at the back, upper bow consisting of two ribs, converging at a small flange above the angle with the lower bow, and some form of sheath foot. They differ in minor details as shown, and particularly in that the first two have a crest on the head, and the last two have a small plain headknob.



83 Sheath-footed brooches with spring on lug. Cat 258–268

With spring on lug behind headplate; the upper bow consisting of three or two separate ribs. T189

258. RII, No. 13 L 65mm Leaded bronze, tinned
SF 531 'Topsoil' (RII, p 43).
259. RV, No. 72 L 48mm* Leaded bronze, tinned
SF 4921 Diagonal trench IV, near W wall.
260. L 70mm Leaded bronze, tinned
SF 1164 Tip Area X.
261. L 66mm Leaded bronze, tinned
SF 5105 In red burnt clay in black topsoil between ditch sections 19 and 20. ML about AD 280–300.
262. L 32mm* Leaded bronze
SF 3531 Inner ditch N side. ML AD 400+.
263. L 36mm* Leaded bronze
SF 298 S of platform.
264. RV, No. 73 L 34mm* Leaded bronze, tinned all over
SF 4696 Area XVII/32 W extension. W of outer Claudian ditch. Surface. ML mixed first–second century.
265. L 34mm* Leaded bronze
SF 257 Pit 15. ML about AD 150–250.
266. L 30mm* Leaded bronze, tinned
Possibly part of same brooch as Cat 265.
267. L 62mm* Leaded gunmetal
SF 301 'Topsoil' (RII, p 43).

Although some of the above brooches are fragments they all clearly belong to this type, varying only in minor details: three ribs or two, presence or absence of ring and dot decoration. Cat 267 is the only one of different alloy, and its ribs and catchplate differ from the others.

Sheath-footed, P-profiled brooch with spring on lug behind head; upper bow undivided

268. RIV, No. 53 L 47mm Leaded bronze, tinned all over
The head is a triangular plate with cross-ribbed knob finial; it covers a small lug with a hole in which the missing spring was held. The upper bow is of triangular section with mouldings top and bottom, it looks somewhat distorted; the lower bow plain, slightly keeled, flaring to a triangular end. It covers a stout sheath catchplate. SF 1880 Outside W wall N of entrance. Inner [stone fort] ditch, middle layer. ML AD 400+.

Similar to T189 above in all characteristics except the undivided bow; like those it presumably dates to the late second or early third century.

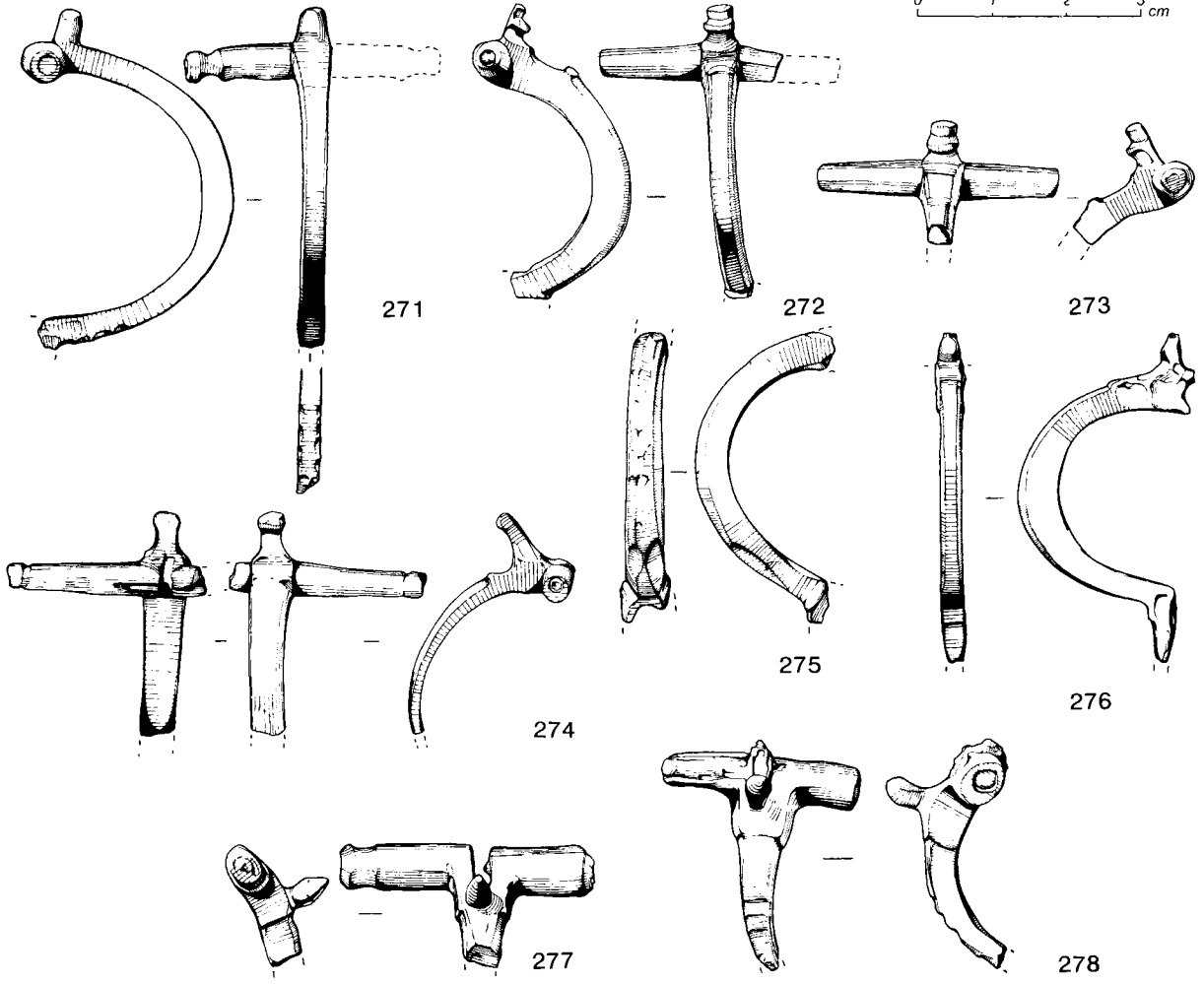
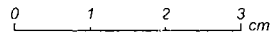
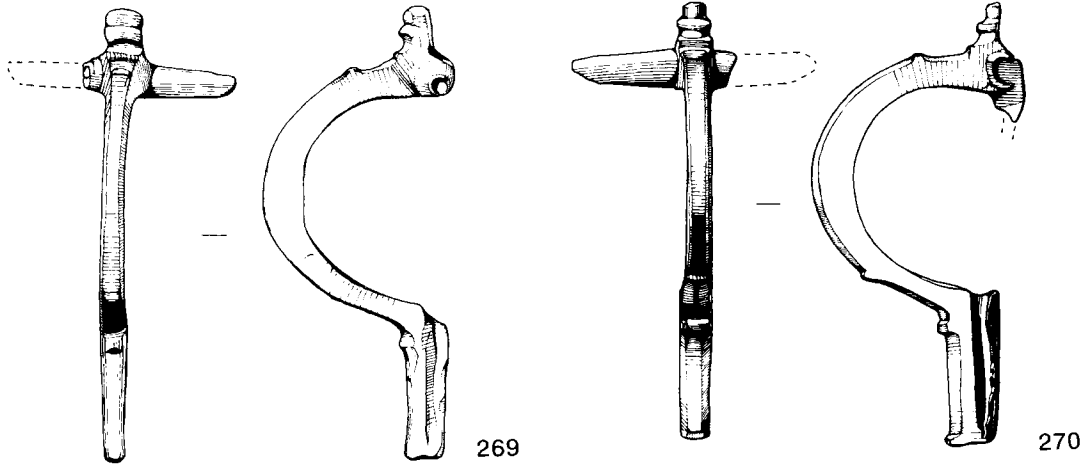
SHEATH-FOOTED P-PROFILED HINGED BROOCHES:
THE CROSSBOW SERIES. T190–192

Discussed in Chapters 5 (pp 183–5) and 6 (p 199 and p 204); parallels are listed in Appendix 3 (pp 258–9).

Light crossbow brooches

a) *with highly arched upper bow, very narrow, of rectangular section; usually lacks knobs on the ends of the narrow rounded crossbar; the central knob set slightly back from the crossbar, but still flat at the back or completely rectangular; very slight mouldings at the top and bottom of the upper bow; the sheath foot narrow and plain, or slightly faceted. The axis rod of the hinge is usually of iron. T191A*

269. L 60mm Leaded bronze
No end knob on surviving half of crossbar. Bow of chamfered rectangular section.
SF 915 Site I fallen earth near drain.
270. L 60mm Leaded bronze
The crossbar is broken; bow of chamfered rectangular section.
SF 2243 Tip 2 outside N wall.
271. L 46mm* Leaded bronze
The upper bow and half of crossbar only. Bow of sharp rectangular section. The axis bar is of rolled copper alloy sheet.
SF 828 Area V over cobbled area S of hearth. ML fourth century.



84 Light crossbow brooches, group (a). Cat 269–278

272. L 43mm* Leaded bronze
The upper bow and half of crossbar only. Bow of chamfered rectangular section.
SF 682 Above Pit 33. ML post-second century.
273. Perhaps RV, No. 79 L c 17mm* Leaded bronze
The head only: plain rounded crossbar, rolled round the axis bar and showing seam at back. The upper bow of chamfered rectangular section and with moulding typical of this group.
SF 4441 Surface of SW area inside fort. ML about AD 280–400+.
274. L c 30mm* Leaded bronze
Upper bow with part of flat-backed knob and half of long round crossbar with groove forming a rudimentary end knob. The bow is broader and flatter than preceding brooches.
SF 3477 Inner ditch opposite postern on ledge. ML late fourth century.
275. L 40mm* Bronze
Part of arched upper bow only, plain and of chamfered rectangular section. Beginning of sheath foot visible.
SF 1442 Area XI/7 surface road. ML about AD 280–300.
276. L 44mm* Leaded bronze
Part of bow only; narrow arched upper bow with small flat-backed knob on head. Bow of chamfered rectangular section.
SF 546 No site provenance.
277. L 17mm* (Leaded) bronze/gunmetal
Head only: flattened rounded crossbar with rudimentary end knob; rolled copper alloy axis bar. Very small pointed knob at top of bow, which is of chamfered rectangular section.
SF 4077 Surface of SW area inside stone fort. ML about AD 280–400.
278. L 31mm* Bronze
Upper part only: rounded crossbar without end knobs; solid copper alloy axis bar. Small pointed knob on enlarged platform at top of bow, which is probably of square section.
SF 1162 Area XI layer 1. ML about AD 280–400.
- b) *With small collared knobs on each end of a narrow rounded crossbar; an iron axis rod goes right through this. A central knob, flat at the back, stands on a square moulding on the crossbar itself; the arched upper bow is of D-section, with large flange and small volute moulding where it joins the lower bow. Usually undecorated but tinned or gilded. T190*
279. L 57mm Leaded bronze, tinned
Standard type, complete.
SF 1392 N guard chamber, surface. ML about AD 280+.
280. L 64mm Bronze/gunmetal, mercury gilded, tinned
One arm of crossbar missing; band of punched circles down centre of upper bow, which is gilded; the head and the bow below the flange are tinned.
SF 3231 Inner ditch N side, filling. ML about AD 400+.
281. RI, No. 9 L 55mm Bronze, leaf gilded
Band of small punched circles down the centre of upper and lower bow; knurled collars on all three knobs. Upper bow and central knob gilded.
SF 124 'Found near the north wall of the fort in the topsoil' (RI, p 44).
282. RIV, No. 55 L 57mm (Leaded) bronze/gunmetal, tinned
Standard type, complete except for pin. Tinning on crossbar.
SF 3000 'Filling of middle earth fort ditch, before about AD 275–300' (RIV, p 119).
283. L 55mm Bronze/gunmetal, gilded, tinned
Complete; very narrow bow; foot more rounded than usual. Traces of gilding survive on the upper bow, tinning on the head and flange.
SF 3887 E of Site 1, surface.
284. L 26mm* Leaded bronze
Part of arched upper bow only, with D-section and flange typical of present group.
No site provenance.
285. L 16mm* Leaded bronze
One arm of rounded crossbar with small end knob; a small pointed knob at centre.
No site provenance.

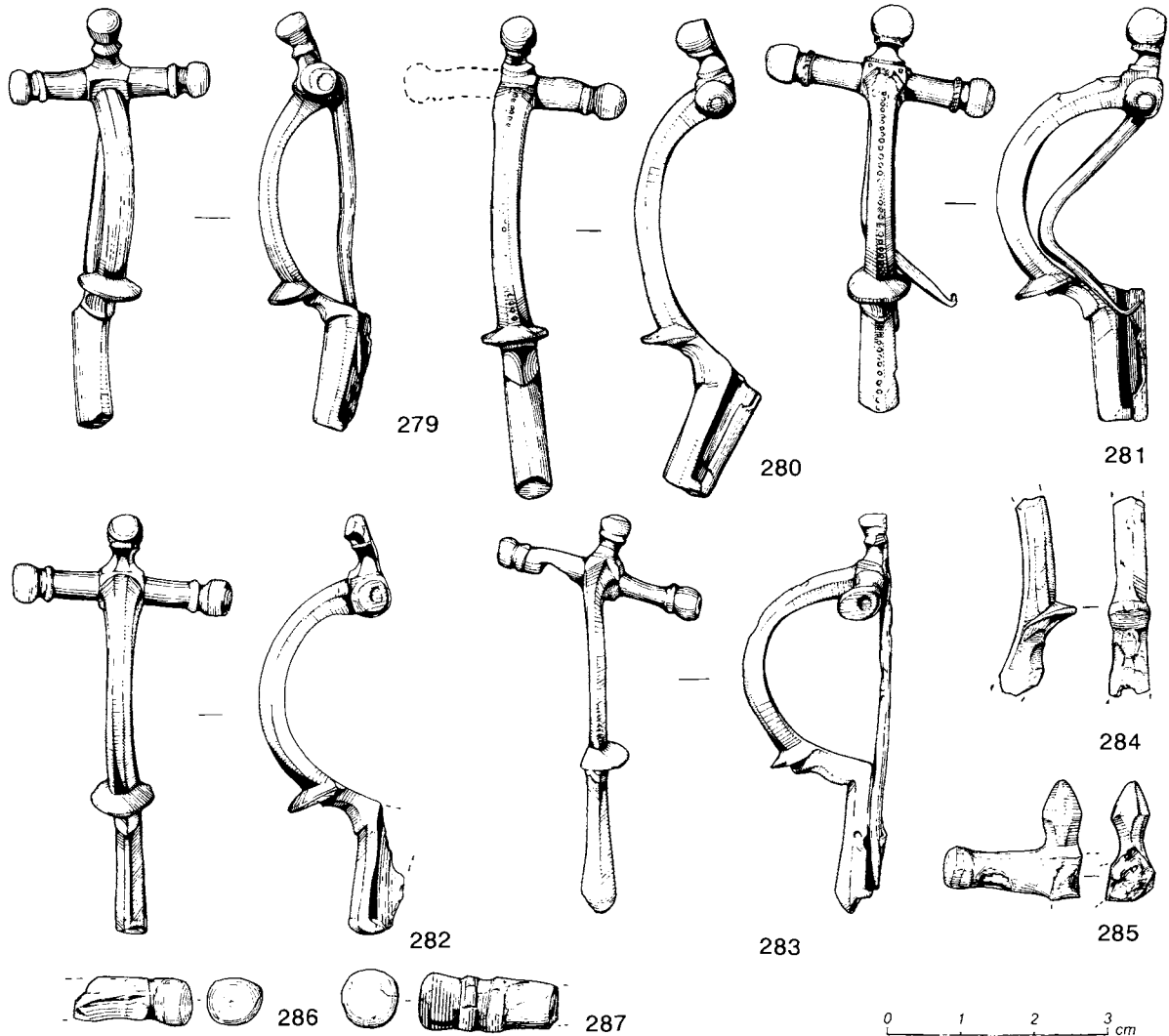
286. L 16mm* Bronze
 Fragment of rounded crossbar with faceted small end knob.
 No site provenance.

287. L 19mm* (Leaded) bronze, tinned
 Fragment of rounded crossbar with small end knob, iron axis rod; two collars.
 No site provenance.

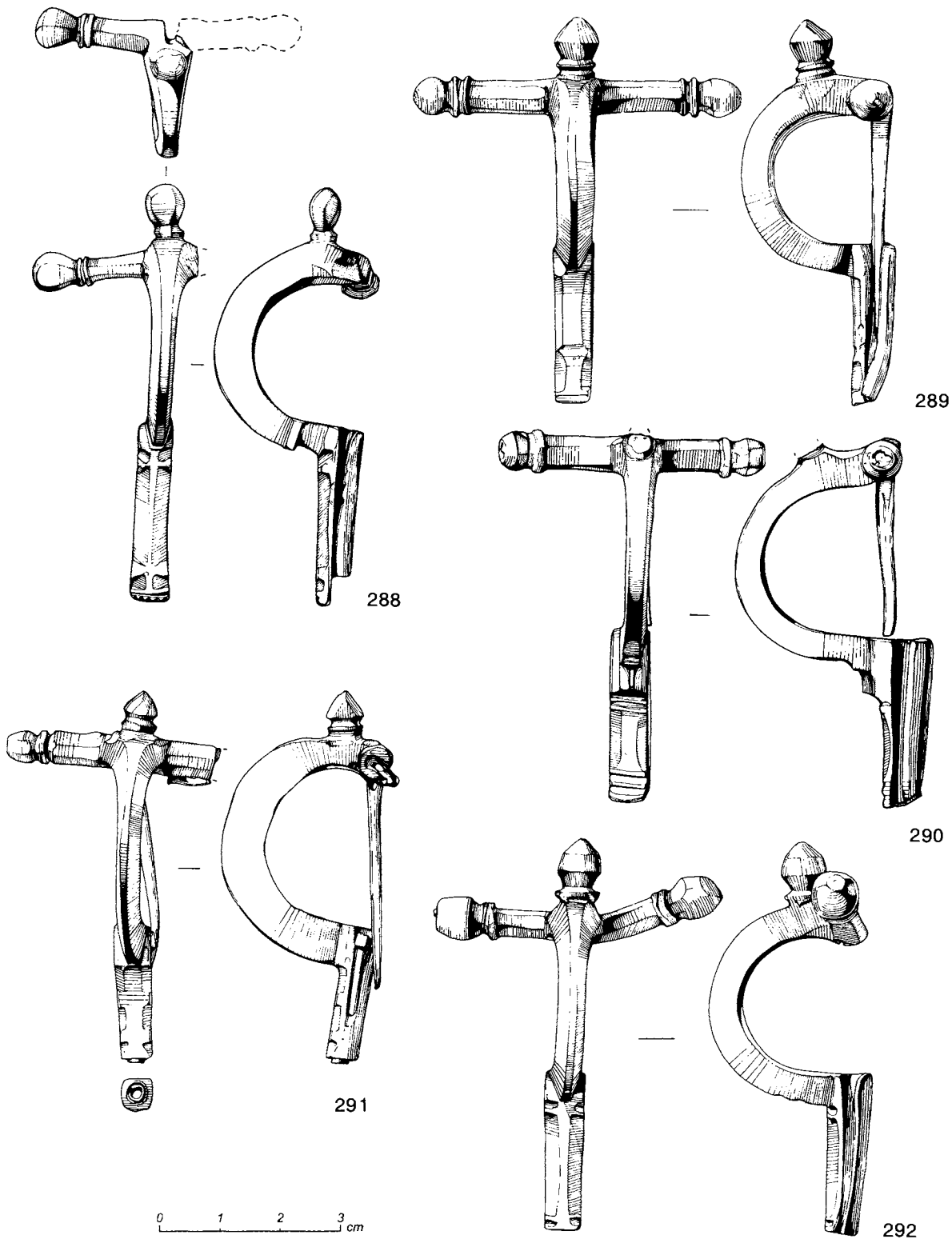
Crossbow brooches with three fairly small knobs and little decoration. T191B
 The pin is hinged on an iron axis rod which may not go right through the crossbar, which is of square or

hexagonal section. The central knob is on the upper part of the bow itself rather than on the head as in group b) of the 'light' type above; the knobs are fully round, sometimes collared and/or faceted. The upper and lower bows are usually of about equal length, or the upper longer; this is highly arched and has a sub-triangular cross-section, the front edge very narrow. The lower bow often has alternately chamfered and reserved zones; some have chip-carved decoration. Keller 1971 type 1.

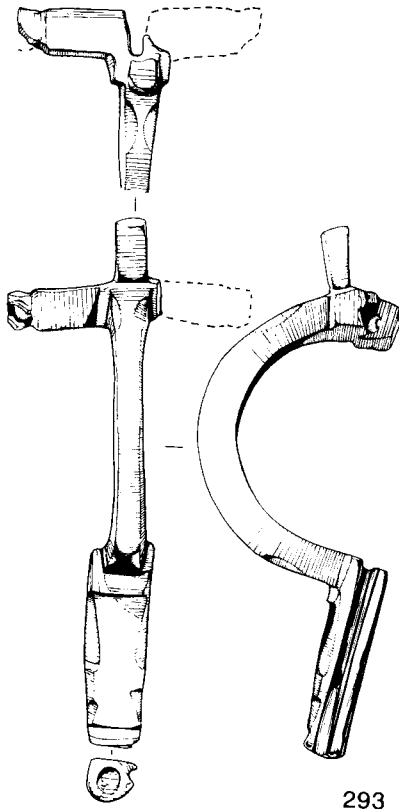
288. RIV, No. 59 L 70mm Leaded bronze
 One side of the crossbar is missing but otherwise this is a good example of the type.
 SF 2334 Pit 148 Top in trench near SW bastion.
 ML about AD 350.



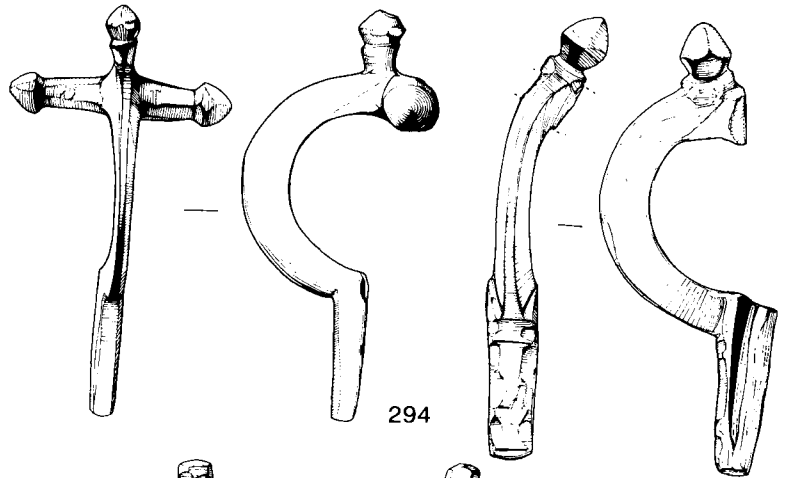
85 *Light crossbow brooches, group (b). Cat 279-287*



86 Crossbow brooches. Cat 288–292

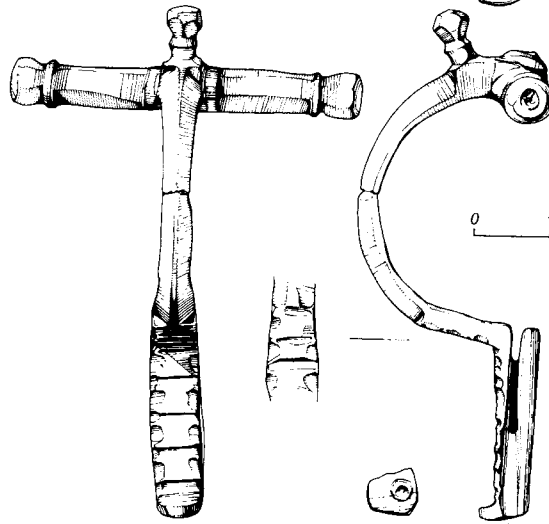


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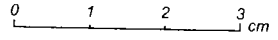


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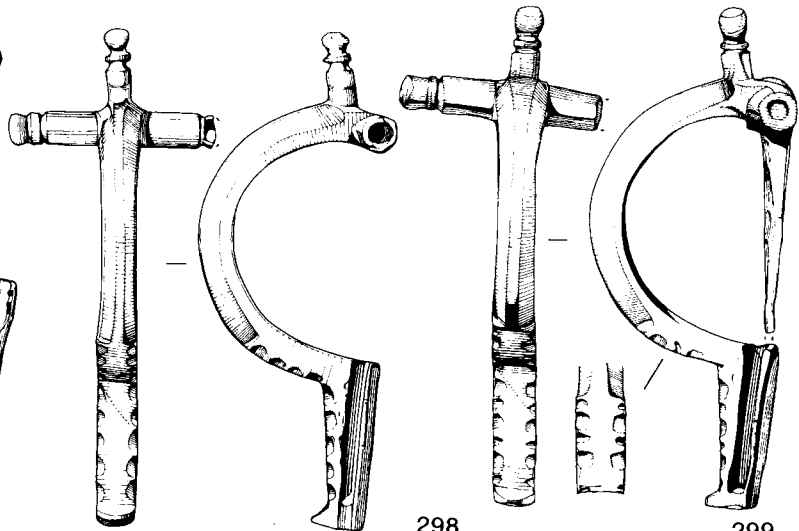
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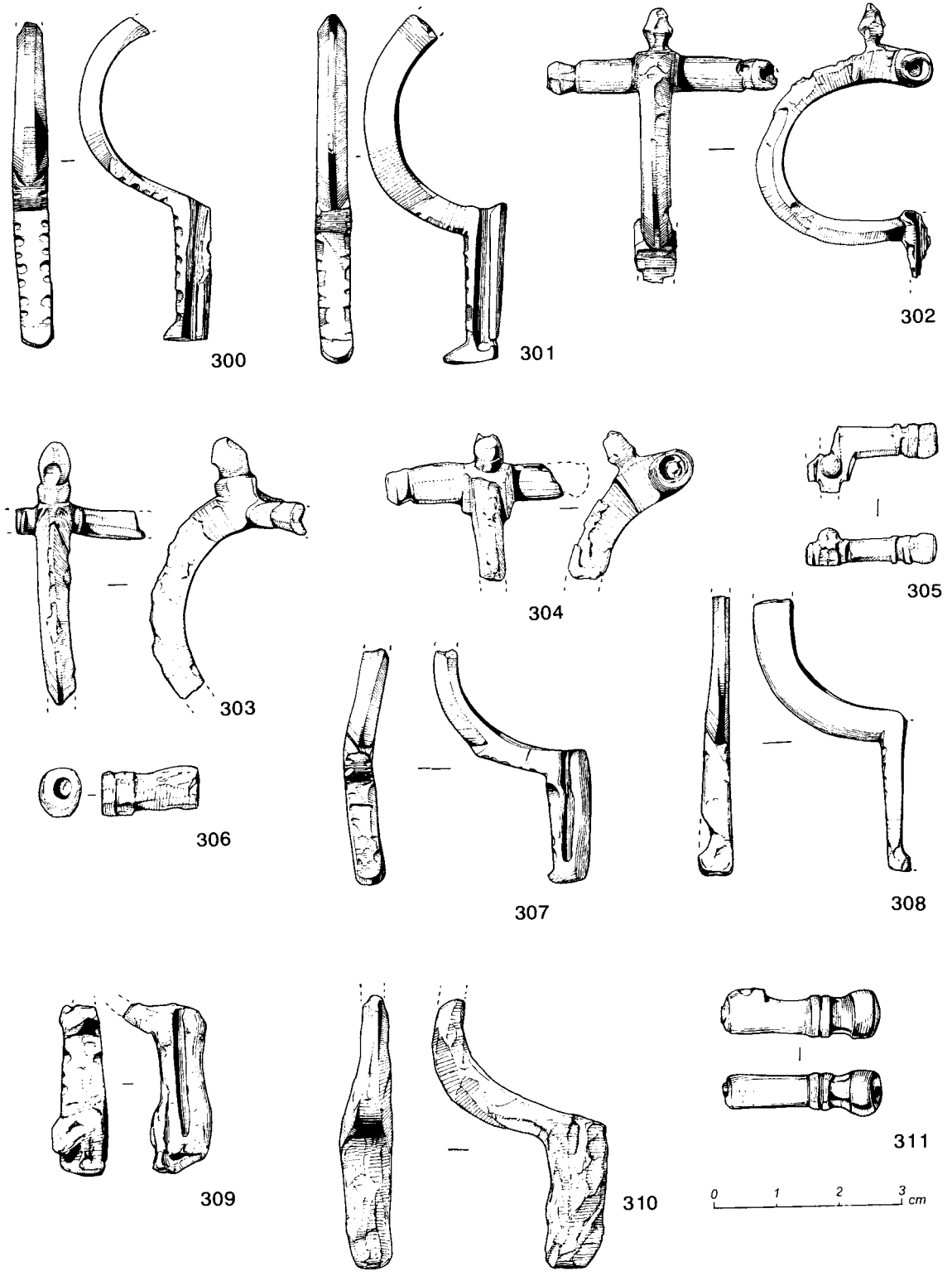


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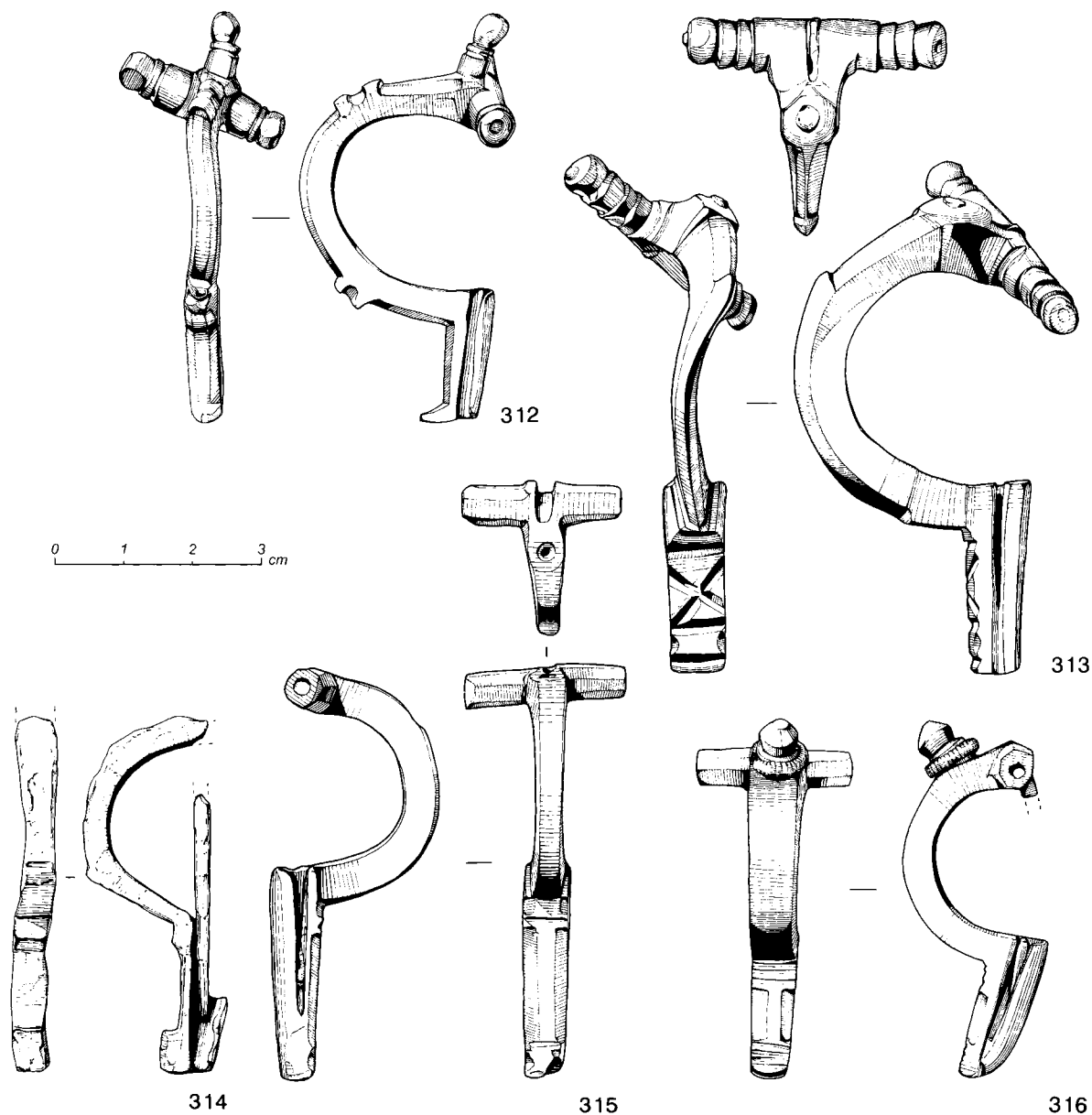
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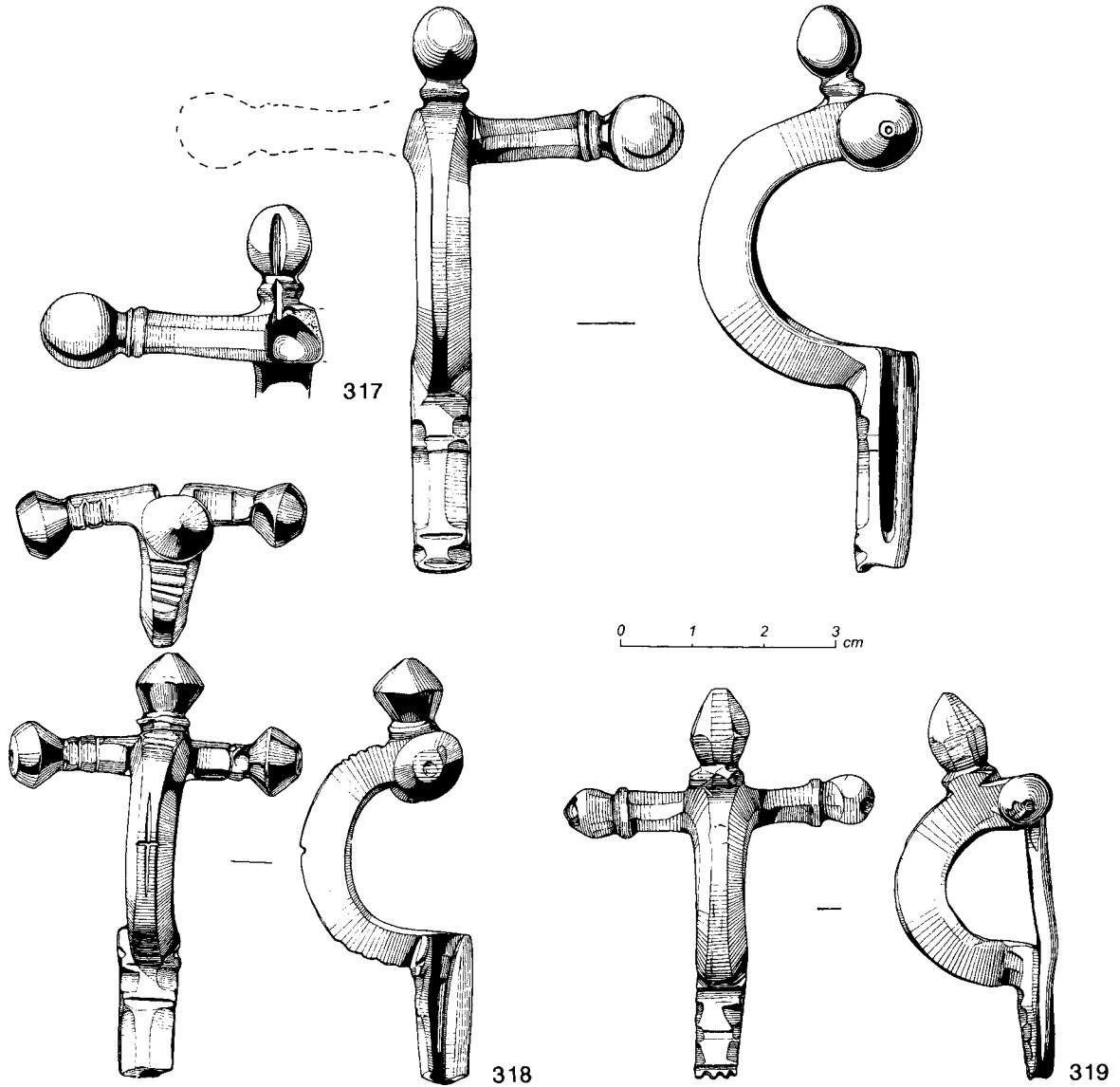
88 Crossbow brooch fragments. Cat 300-311

300. L 52mm* Leaded bronze
SF 1624 Outside W gate between N turret and NW bastion.
301. L 54mm* Leaded bronze
SF 145 Top 3ft [0.9m] NE corner. ML about AD 280–400+.
- Both lack the head and crossbar but the remaining upper and lower bows are very similar to Cat 298 and Cat 299 above.
302. ?RII, No.15 L 44mm* (Leaded)bronze/
gunmetal
Damaged and the foot missing. This may be the brooch shown complete in RII, pl xvii, no. 15 (from topsoil, p 43). Central knob small and pointed, the terminals of the crossbar also small and faceted.
?No site provenance.
- Fragments probably of this type:*
303. L 42mm* Leaded bronze
Part of the upper bow with collared knob near head; part of crossbar.
No site provenance.
304. Bronze, tinned
Small knob on surviving crossbar arm; small faceted knob on upper bow.
SF 2101 Outside W gate, inner ditch S of Watling St middle layer. ML about AD 400+.
305. Leaded bronze
One arm of faceted crossbar with small collared end knob; top of bow only, with shank of knob.
No site provenance.
306. Leaded bronze
One arm of thick ?rounded (corroded) crossbar with two end mouldings of equal size.
No site provenance.
307. (Leaded) bronze
Lower part only; chip-carving on foot; upper bow of triangular section. Possibly another brooch similar to Cat 298 and Cat 299 above.
SF 673 No site provenance.
308. Leaded bronze
Lower part only; part of foot missing but trace of sheath visible.
No site provenance.
309. Gunmetal
Lower bow only: chip-carved.
No site provenance.
310. Brass
The lower part of the bow only; badly corroded. No details visible except opening in sheath foot.
No site provenance.
311. (Leaded) gunmetal
One arm of faceted crossbar, with integral knob and two collars.
SF 4546 Trench outside S wall.
- A9 (RV, No. 78). See Appendix 4, Table 25.
- Unusual brooches apparently related to crossbow brooches with three fairly small knobs and little decoration. T191B*
312. L 58mm Leaded gunmetal
Short rounded crossbar with small knobs; the central knob though small stands on a high shank; the upper bow very narrow, of rectangular section and with two pairs of raised cross-ribs; projecting terminal to foot.
SF 1267 Found in cleaning ditch section 33.
313. RIV, No. 62 L c 73mm (Leaded)bronze
The central knob is broken off; the crossbar is ribbed and has small end knobs; upper bow very narrow but deep in profile. There is a deeply cut diagonal cross on the lower bow, and a slot for some form of safety device across the top of the sheathed catch. The pin is missing and the upper bow is twisted.
SF 2913 Inner [stone fort] ditch 4–8ft [1.2–2.4m] down. ML about AD 400+.
314. RIV, No. 61 L 50mm Leaded bronze/
gunmetal
The upper part is now missing; the description in RIV (p 121), and drawing (pl xxxi) shows that it had a rounded crossbar with small flattened knobs at the ends, also a plain rod in the centre described as an incomplete headknob. There is a rectangular recess on the upper bow and a raised moulding on the foot.
SF 1015 Pit 83. ML AD 300–50.



89 Crossbow brooches, unusual forms. Cat 312–316

315. L 59mm* (Leaded) bronze/gunmetal, tinned
The iron shank of a separate knob remains in a socket on the upper bow; the crossbar is faceted and may have had end knobs; it shows the groove for a hinged pin. Upper bow of rectangular section, lower bow chip-carved; sheath foot with hole through end. SF 1675 Outside W gate, outer ditch 1ft [0.3m] from bottom. ML AD 280+, probably *c* 400+.
316. RIV, No. 60 L 48mm Silver
Hexagonal crossbar; the central knob is placed on the bow well below the head; it has a knurled collar (a separate piece of beaded wire) seated in a groove. The lower bow is faceted and cross-ribbed; sheath foot. SF 1328 Area XIII Pit 107 20ft [6.1m] down. ML about AD 250–300.



90 *Developed crossbow brooches. Cat 317–319*

The developed crossbow brooch. T192

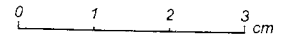
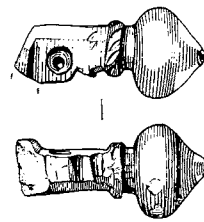
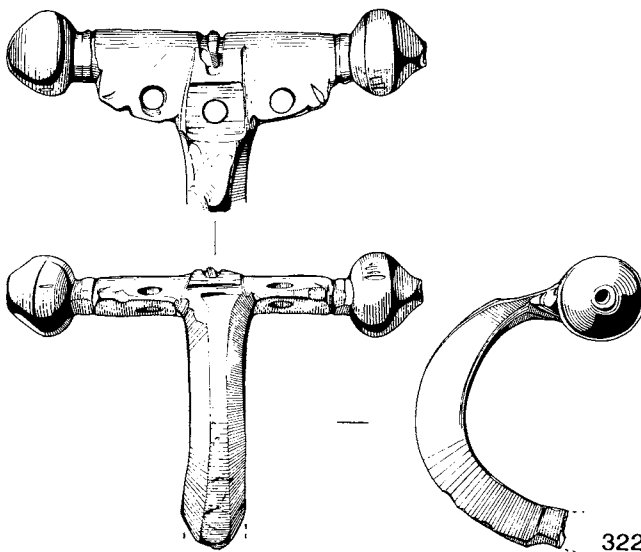
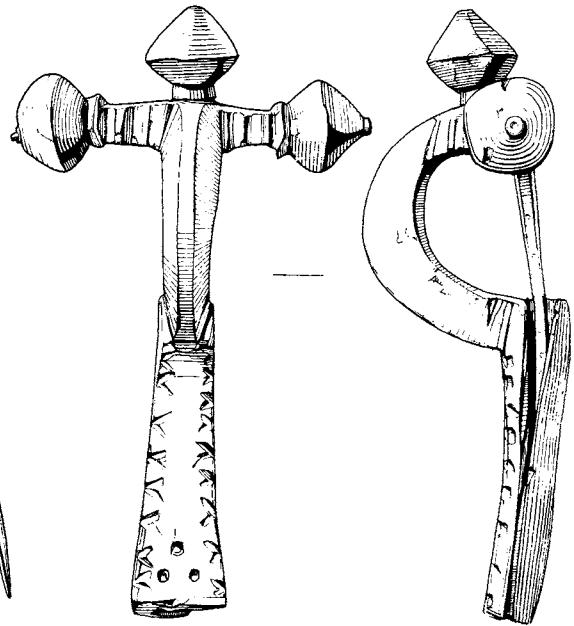
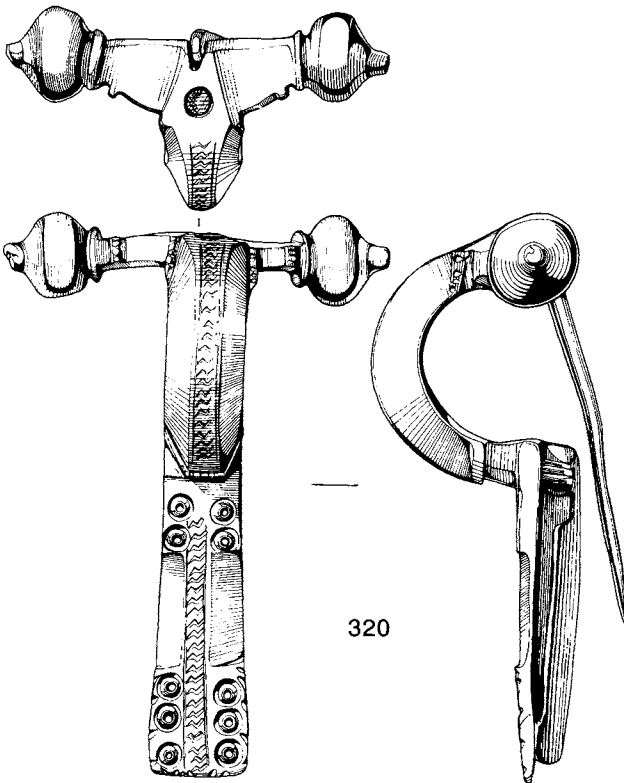
The highly arched upper bow is usually shorter than the lower and in section much deeper than wide. The long lower bow splays towards the foot and is sometimes elaborately decorated. There are always knobs on the ends of the crossbar and another on the upper bow; these are all large, often 'onion-shaped'. Sometimes the knobs are separate pieces and the most elaborate brooches are made up from a number of pieces.

Intermediate with the last group

317. RII, No. 16 L 79mm Leaded bronze
 One arm of crossbar missing, a large blowhole (casting flaw) is visible at the break. The knobs are cast in one with brooch; the back of the central knob is deeply gashed. A hole through the foot may be for a safety catch.
 SF 143 Top 3ft [0.9m] NE corner. ML third–fourth century.

318. L c 60mm* Leaded bronze
The foot broken off; knobs cast in one with brooch. A long gash with short crossing groove in centre is cut on the leading edge of the upper bow.

The pin is missing. The iron axis rod goes right through the crossbar.
SF 2670 Area XVII SW of chalk house. Surface find above larger cement floor. ML fourth century.



319. L c 56mm* Brass/gunmetal
The knobs cast in one with brooch. A separate sheath foot may have been soldered on; now lost. SF 1874 Outside N wall. Small tip.

Cat 317–319 are nearer to the last type, with similar features, including the chamfered decoration on the foot, but they are heavier and show the enlarged knobs of the developed type. Lankhills no. 532 (Clarke 1979, 260) is quite similar; it was in a grave dated AD 350–90. Like it the Richborough brooches show features of Keller's types 1–3, the latter being dated AD 340–60.

- A10 (RV, No. 80) See Appendix 4, Table 25.
This brooch was published by Hull (1968a), but is no longer in the collection. It is generally similar to the last three.

Main group of developed crossbow brooches

320. RIV, No. 65 L 72mm* Brass
The large terminal knobs are cast in one with the crossbar, which holds a rolled copper alloy sheet axis rod. There is a hole for a separate knob on the upper bow. At the top of the sheath there is an iron peg which fits into a hole in the bow, possibly forming a safety catch for the pin. A band of punched zigzag decoration runs down the front of the brooch and there are two groups of punched ring and dot decoration on the long splayed foot. SF 3375 Inner stone fort ditch filling on N side. ML about AD 400+.
321. RIV, No. 64 L 80mm Leaded bronze
The crossbar is stepped; the central knob is a separate casting riveted on, but those on the crossbar are integral; chevron chip-carving down sides of lower bow; a triangle of three holes at foot. SF 2840 Inner stone fort ditch along S wall above bottom. 'Found with a hoard of bracelets' (no. 177, p 142) (RIV, p 121). ML about AD 400+.

Cat 320–321 may be regarded as the standard developed crossbow type as described above. There are several parallels for Cat 320, including its decoration, for example, Lankhills, Hampshire, no. 74 (Clarke 1979, 260, from a grave of AD 350–70); Uley, Gloucestershire (Butcher 1993b, fig 125, no. 1, p 155); Lydney, Gloucestershire (Wheeler and Wheeler 1932, no. 26, p 78); Oudenburg, Belgium (Mertens and van Impe 1971, several, including grave 72, no. 2); Lauriacum, Austria (Jobst 1975, nos

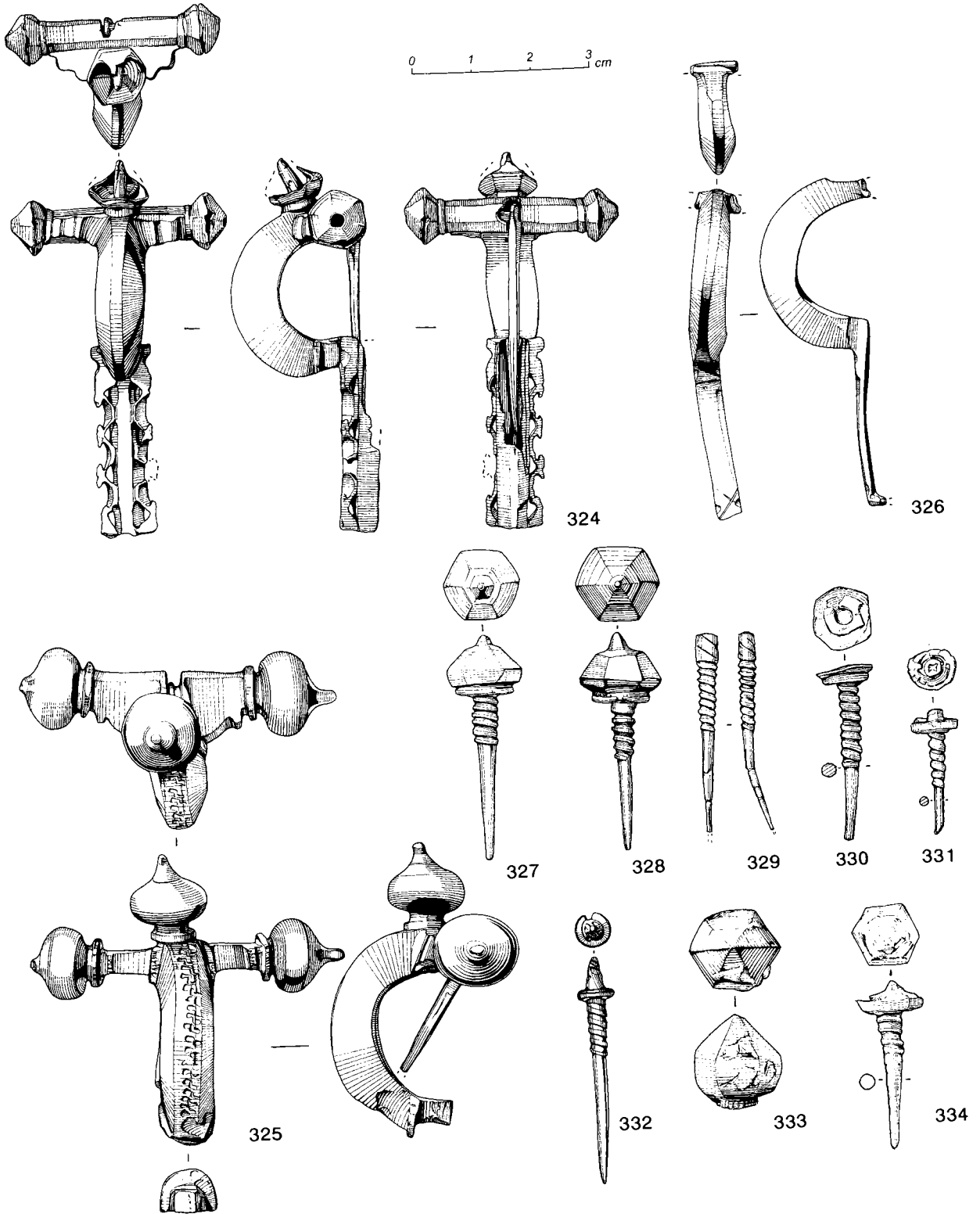
248–50, pp 187–8); Augst, Switzerland, several (Riha 1979, nos 1467, 1470–2 and 1479, p 174). A brooch from Ickham, Kent, not far from Richborough, differs only slightly from Cat 320 (Young 1981, no. 1, p 37).

322. RII, No. 18 L 55mm* Leaded gunmetal, tinned
Although only the upper part survives this demonstrates the elaboration of the crossbar: this is stepped and has holes probably originally carrying a separate decorative casting. The terminal knobs are cast in one with the crossbar but where the central knob should be there is a hole with traces of tinning, perhaps solder, round it. The end of the arched upper bow is a peg with a central hole, which would have slotted into the lower bow. SF 296 'Topsoil' (RII, p 44).

323. L 25mm* (Leaded) gunmetal
One arm of crossbar only, stepped and with knurled collar to the large integral knob. There is a deep round hole on the arm. SF 3186 Pit 204. ML about AD 350.

324. RII, No. 19 L 64mm Copper/brass
This brooch is constructed from several pieces of sheet metal brazed together: the back of the bow is a plate covering a hollow casting, the openwork decoration on the foot is attached to a plain tube and the knobs are hollow, made in two pieces and riveted into place. The crossbar is stepped; the upper bow short, plain and of deep triangular section. Both axis rod and pin are made from rolled copper alloy sheet. SF 274 Outside NW corner of Site 1 about 3ft [0.9m] [down].

Although less elaborately decorated Cat 324 may be compared with nos 447 and 587 from Lankhills, Hampshire (Clarke 1979, 261–2), which came from late fourth-century graves. Generally similar brooches also come from Lydney, Gloucestershire (Wheeler and Wheeler 1932, no. 27, p 78), Oudenburg, Belgium (Mertens and van Impe 1971, grave 124, no. 7), and Augst, Switzerland (Riha 1979, Tafel 56, no. 1497, p 177, gilded, with niello decoration, from a rich burial of about AD 400).



92 *Developed crossbow brooches. Cat 324–334*

325. RII, No. 17 L 50mm* (Leaded) brass
The upper part only of a brooch with large collared knobs, the central one a separate casting riveted on; stepped crossbar; band of zigzag punch marks down the front of the bow, and a peg to attach it to the now missing lower bow. Three blowholes are visible, one on the right side of the lower bow (see Figure 92), one on the back of the bow, and one by the collar on the left knob. SF 295 'Topsoil' (RII, p 44).

326. L 57mm* Leaded bronze, solder
Fragment; the lower bow incomplete, the upper bow showing the profile of this type. Traces of tinning on the sides and under the lower bow and at the head. Parts that are missing may have been soldered on. SF 5502 Unstratified.

Separate knobs and pins from developed crossbow brooches

NB in all cases the screw thread is a left-hand one; that is, the reverse of that used on most modern screws and bolts.

327. RII, No. 20 L 39mm Brass, leaf gilded
Hexagonal hollow knob on the end of a pin, which has a screw thread only on the upper part. SF 286 'Topsoil' (RII, p 44).

328. RV, No. 82 L 37mm Brass, leaf gilded
Very similar to the last. SF 5244 Upper black layer between triple ditch [earth fort] sections 46 and 44. ML about AD 400+.

329. RIV, No. 66 L 34mm Brass
Pin only; the point plain and the upper part with screw thread as in the last two; here the upper end is rectangular and diagonally grooved; it probably once carried a hollow knob. SF 2342 Stray.

330. L 29mm Brass/gunmetal
Pin with screw thread on the upper part, with a fragment of metal presumably the base of a hollow knob as Cat 327. The top of the pin has a flange turned over to hold it in place. No site provenance.

331. L 21mm Copper, gilded
Pin with screw thread on the upper part, the top apparently broken, with a fragment of sheet metal probably the base of a knob. No site provenance.

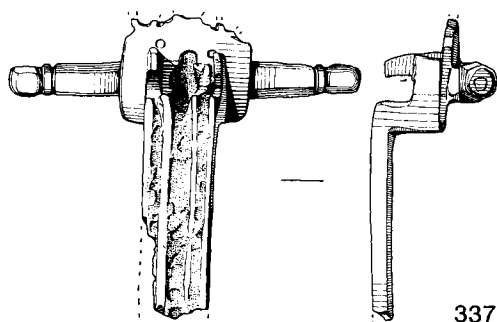
332. L 40mm (Leaded) gunmetal
Pin with screw thread on upper part, the top pointed. It carries a collar, possibly remaining from a knob such as Cat 327. No site provenance.

333. L 16mm* Brass, mercury gilded
Hexagonal knob, very like that of Cat 328 above. No site provenance.

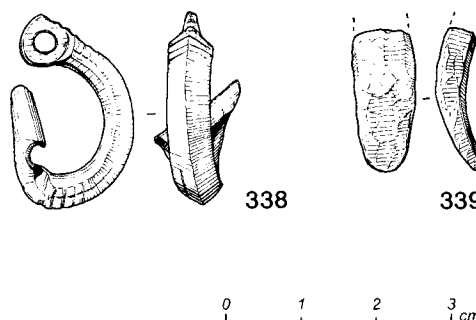
334. RV, No. 83 L 28mm Brass, gilded
Flat hexagonal knob; pin with screw thread on upper part. SF 4156 Surface of SW area inside stone fort.

335. Missing; not illustrated
Globular-headed screw.

336. Missing; not illustrated
Pin with screw. No site provenance.



337



93 Bow brooch fragments. Cat 337-339

Related to crossbow brooches

337. RIV, No. 57 L 40mm* Base silver
 The upper half only of a very unusual brooch. Long hexagonal crossbar with small faceted end knobs behind a flat headplate; this has three small holes and the broken upper edge shows signs of cutout decoration. The surviving part of the bow is straight-sided and is divided into deep channels lengthways by four ribs (the channels are now filled with some organic material). The bow meets the headplate at a right angle, and the two outer ribs end in hooks.
- SF 2689 S motor road Trench VIII.

Some brooches from the Saalburg, Germany, have a similar profile and crossbar (Böhme 1972, Tafel 21, nos 824–7, pp 28–9); these lack the headplate and channels but Böhme (1972, Abb 1, nos 5–7, p 28) also illustrates brooches from the Danube (gilded), Mainz (silver) and Osztropataka which have the headplate; the last is an elaborate gold filigree-decorated brooch. Böhme considered the main type to date to the first half of the third century.

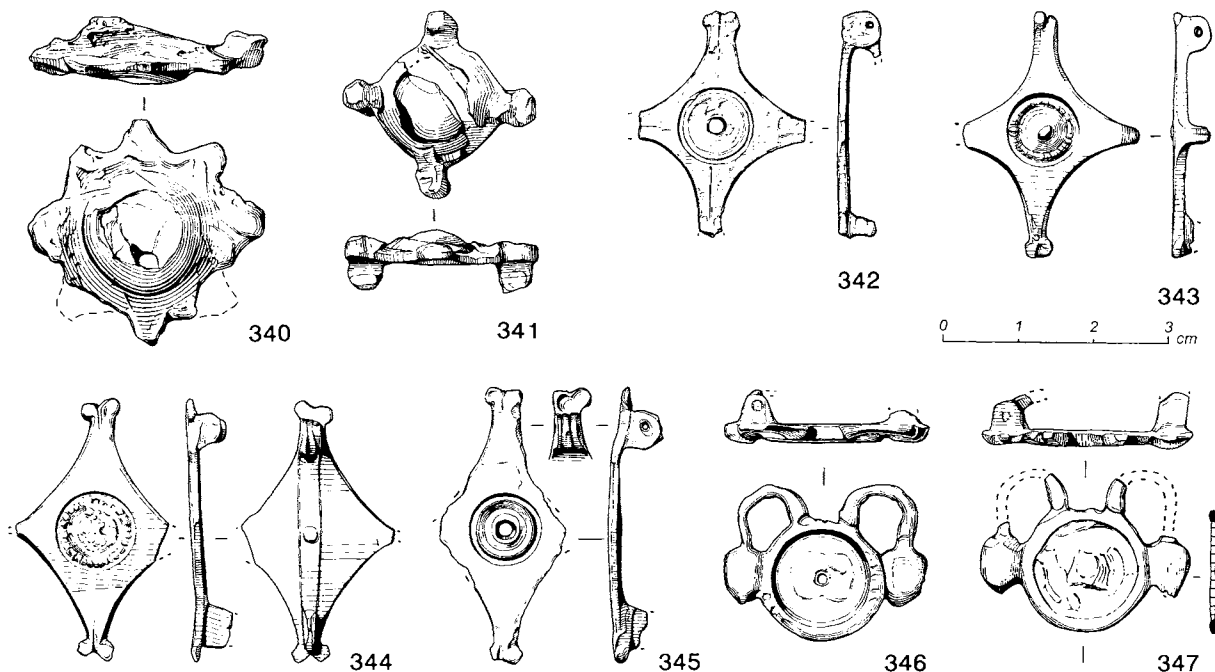
ARMBRUSTFIBELN: BROOCHES WITH NO CROSSBAR,
 THE SPRING HELD ONLY BY A CAST LOOP
 BEHIND THE TOP OF THE BOW. T196

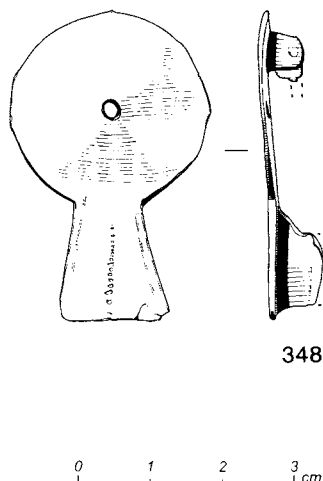
338. L (straightened) c 40mm Brass
 The spring is missing and the thin lower bow has been bent. The upper bow is of stout triangular section, with triple chevrons formed by grooves at its top and bottom. The catchplate is merely the edge of the triangular foot turned upwards.
- SF 5306 Middle triple ditch filling. ML about AD 250–80.

Similar brooches have been found on the German *limes* in late second- and third-century contexts (for example, brooches from the Saalburg and Zugmantel, Germany, Böhme 1972, nos 900–14, pp 33–5). The type's distribution is mainly in North (Free) Germany and southern Scandinavia.

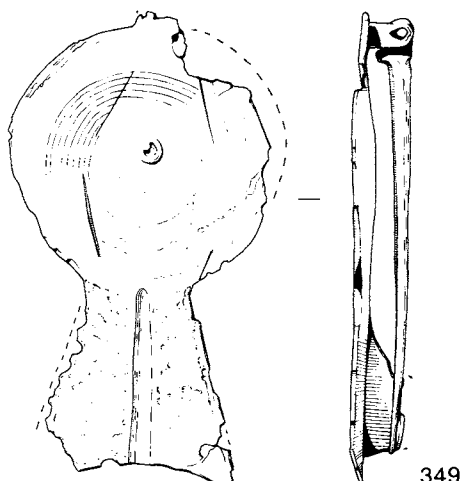
Fragment of bow brooch

339. L 18mm* Brass
 Part of plain tapering bow.
 No site provenance.





348



349

95 Early plate brooches. Cat 348–349

349. RIV, No. 5 L 64mm Brass
 Very similar to Cat 348 above, except that it is larger, there is a central groove on the foot, and a trace of some projection at the top of the disc. Some iron remains in the central hole: according to RIV (p 108) there was then the 'remains of a thin iron plate and rivet in the centre of the bow' – possibly a brass plate stained by corrosion products from the iron rivet.
 SF 1011 Area V tip.

DRAGONESQUE BROOCHES. T200

An S-shaped plate; each terminal takes the form of a head with curved snout and large ears, and has a circular sinking representing an eye. The centre of the plate bears conventional decoration, usually enamelled; the pin is looped round one of the necks and is secured by that at the opposite end.

350. RIII, No. 12 L 52mm* Brass, enamel
 Only one terminal survives: a head with curling snout and large upright ears. The centre of the plate is broad and is crossed by a panel of four orange enamelled lozenges; on either side there is curvilinear decoration outlined by reserved metal ridges within which a trace of white enamel survives. The circular sinking indicating the creature's eye is deep, but no enamel remains. The back of the 'body' is slightly dished, with a small knob in the centre; this occurs on some other examples: possibly it tensioned the pin.
 SF 641 'West of site I. Unstratified' (RIII, p 78).
 See Chapter 5 (pp 171–2) and list of parallels Appendix 3 (pp 259–60).

ZOOMORPHIC PLATE BROOCHES

The animal shown in outline and partly in relief, enamelled in small cells

351. RIV, No. 229 L 30mm* (Leaded) brass, enamel
 Small brooch in the form of a horse moving to the right. There is low relief on one side indicating the head, neck and rump while the other is flat except for the head, which is three-dimensional; this side also carries the stump of a catchplate behind the forelegs, and of the two lugs for the hinge to carry the pin behind the rump. The legs and tail are all broken off. There are four round cells for enamel along the length of the body: turquoise nearest the head, then (now) green, empty, and (now) green respectively; on the neck a row of three ring-and-dot motifs in very shallow relief, and another three on a collar across the base of the neck.
 SF 1130 S road Section III 9ins [229mm]. ML fourth century.
 Hull T203. See Chapter 5 (p 174).

352. RIV, No. 50 L 44mm* Leaded gunmetal, enamel

In the same style as Cat 351 above: a lion shown in outline, moving to the right, with its head in relief, turned outwards. The flat back of the plate carried the pin and catchplate; the pin is missing, but was hinged between two lugs behind the rump. There is a conical hollow behind the animal's head, which is very crudely represented: two raised circles hatched to represent hair surround it; round sockets for eyes ('green glass' in one, according to RIV, p 118), with two small raised triangles above for ears. Hatching down the neck represents the mane; the tail and legs are broken off. Five of the round spots contain red enamel and there are traces of turquoise in two.

SF 3012 Surface.

Hull T203. See Chapter 5 (p 174).

353. RIV, No. 44 L 23mm Gunmetal, tinned, enamel

Flat plate in the shape of a hare, containing enamel cells with the outline of two small hares. The pin is hinged between two lugs behind the rump and a very small catchplate is behind the front legs. The head is undamaged so that it seems to be intentionally very small in proportion, almost completely taken up by the stamped eye and the oddly open mouth (unless this results from a damaged mould?); there are traces of tinning on the neck and ears. The legs may be broken, if not they are also rudimentary. The enamel now appears green.

SF 2844 'Inner stone fort ditch, near bottom' (RIV, p 116).

Included by Hull in T211 but differs from main type. A few very similar brooches are known: see Appendix 3 (p 260). Feugère quotes an unfinished one from Nepelier in the Ardennes, France (1985, 408). An example from Winchester, Hampshire, was in a deposit of about AD 60.

Three-dimensional zoomorphic brooch

354. RV, No. 62 L 44mm Leaded gunmetal

Unlike the preceding brooches, in which the creatures are shown in outline, this figure of a hippocamp is shown fully in the round. An otherwise naturalistic horse's head has two

globular attachments where the mane should be; the tail is arched and of triangular section, ending in a flat plate with indented edges, the end possibly broken. Two broken-off legs project from the chest. The pin is hinged between two lugs under this and the broken catchplate was beneath the rump.

SF 3945 Surface of SW area.

This is included by Hull in T203 but quite different from the others. It is remarkable in being so completely plastic in design; there is no surface decoration. Brooches in which the bulk is so high above the pin are very unusual: presumably it would be ill balanced in use, falling to one side. The nearest parallel found is one in the form of a dolphin from Straubing, Germany (Walke 1965, Tafel 94, 19) but this does not seem to be so top-heavy. Otherwise brooches with the creature in the round seem to be confined to doves, ducks and hens (see Chapter 5, pp 174–5), where the base is naturally larger and the body is usually made hollow. Hippocamps occur in outline on a well-known type of enamelled brooch, and in Roman art generally, often associated with Bacchus or Neptune. This is such an individual piece that no date or origin can be suggested.

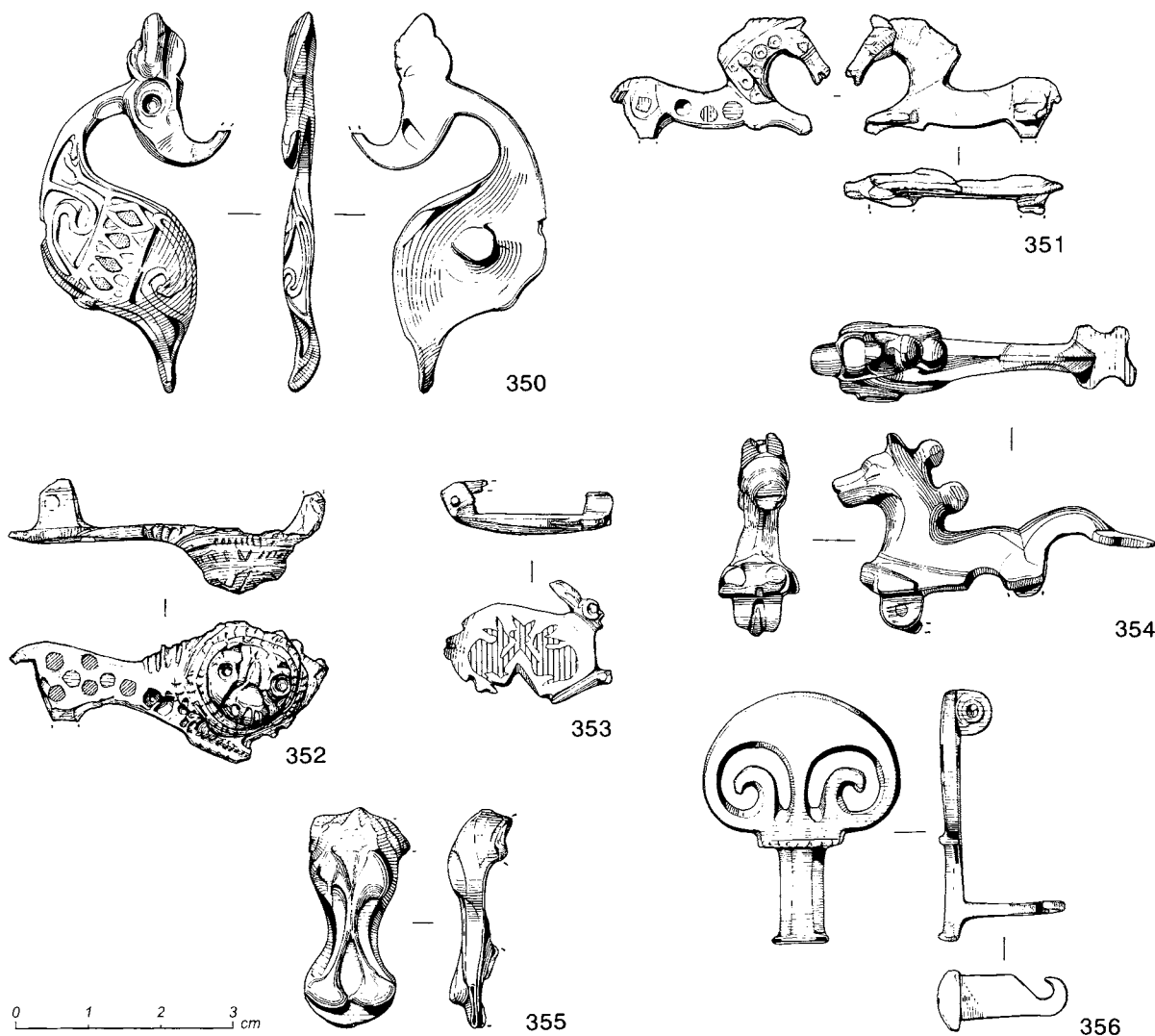
Pseudo-bow brooch with cast zoomorphic decoration

355. RIV, No. 29 L 29mm Bronze

A figure-of-eight-shaped plate, almost flat at the back, with remains of a crossbar at one end and of a central catchplate at the other. Cast relief decoration on the upper surface gives the impression of a stylized bull or horse head.

SF 3872 Area W of St Augustine's chapel. 'Top soil' (RIV, p 113).

Included by Hull in T203 but no brooch of similar design has been noted. The motif is clearly Celtic, cf the mask on the Standlake, Oxfordshire, mount and the slightly less abstract horse's head on a fitting from the Stanwick hoard, Northamptonshire (Fox 1958, pl 22A and 52B respectively; also MacGregor 1962, no. 102, pp 26–7). Somewhat similar abstract masks appear on several trumpet brooches, both in relief and in enamel. Not enough of the crossbar remains to define the type of construction to which it belongs; it can only be suggested that the brooch probably dates to the mid-first century AD on the basis of the decoration.



96 *Dragonesque brooch. Cat 350; Zoomorphic brooches. Cat 351–355; Openwork brooch. Cat 356*

OPENWORK BROOCH

356. RII, No. 10 L 34mm Leaded bronze, tinned
- Flat plate with openwork cutouts giving it the shape of a pelta; a 'leg' extending from the lower edge is faceted and is terminated by a straight moulding. A single lug for the attachment of a missing spring ('fragments of a bilateral spring' (RII); traces of an iron axis rod survive) is behind the top of the plate, and there is a long transverse catchplate behind the leg.
- SF 304 'Top soil' (RII, p 42).

T241. As pointed out in RII the elongated catchplate seems to belong to the late second/early third century (cf various knee brooches), and most examples of the present type have been found in German forts occupied at that period. Six are known from the Saalburg and Zugmantel (Böhme 1972, nos 1154–64, p 44, other examples are listed on p 69). They are rare in Britain but two come from South Shields, Durham (Allason-Jones and Miket 1984, nos 154–5, p 120).

SYMMETRICAL PLATE BROOCHES
OF CONTINENTAL ORIGIN

Hull's types refer solely to the shape of the brooch; here they are arranged in suggested chronological order. The group is discussed in Chapter 5 (p 171).

Wide arched plate between two matching terminals. T229

357. L 31mm Brass, enamel, niello
Arched rectangular central plate set between two moulded projections, which cover the pin attachment: two lugs for (missing) hinged pin at one end, small catchplate at the other. On the plate a slightly raised central rectangle has three small double-axe-shaped cells containing decayed greenish enamel; on either side there is a row (six one side, five the other) of narrow bar-shaped cells containing niello (Figure 28 and Plate 15). The edges of the plate are flanged and beaded.
SF 2183 Outside W gate, inner ditch S of Watling St bottom layer. ML about AD 280+, probably 400+.

Equal-ended, square, oval or round plate between horizontal bars. T230

358. L 31mm* Brass?
Raised central square plate with wider bar each end; beyond one of these there is a projection with snakeshead motif; the other end is broken off. The double lug to carry a hinged pin is behind the neck of the 'snake'. The plate is badly corroded but shows traces of small toothed cells for enamel or niello, though none survives; it is surrounded by beaded stepped mouldings. The snake has two sockets for eyes; probably originally with glass settings as in a similar brooch from Augst, Switzerland (Riha 1979, no. 1654, p 193).
SF 992 Pit 63 12–15ft [3.6–4.8m]. ML about AD 400+.
359. RIV, No. 43 L 27mm* Brass
Raised oval plate between two decorated projections: the complete one has wavy line cross-mouldings and carries a double lug for a hinged pin on the back. The whole plate is recessed for enamel but none survives.
SF 2068 Big tip outside N wall.

Equal-ended, rectangular plate with lugs. T231

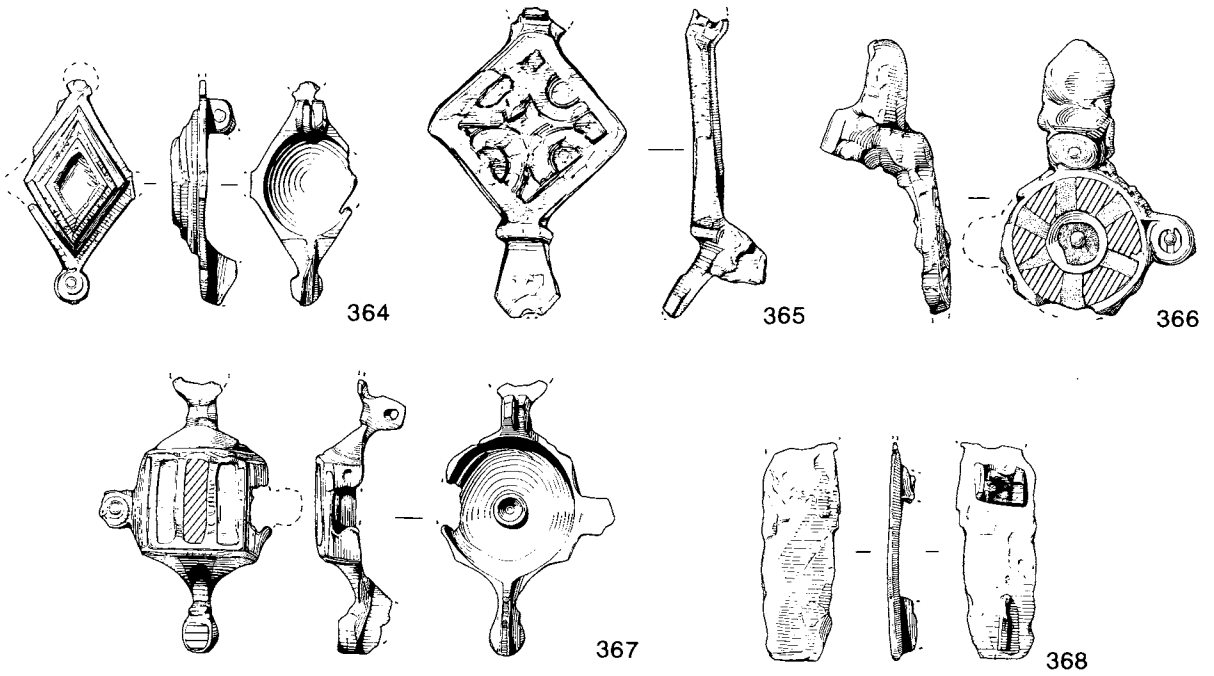
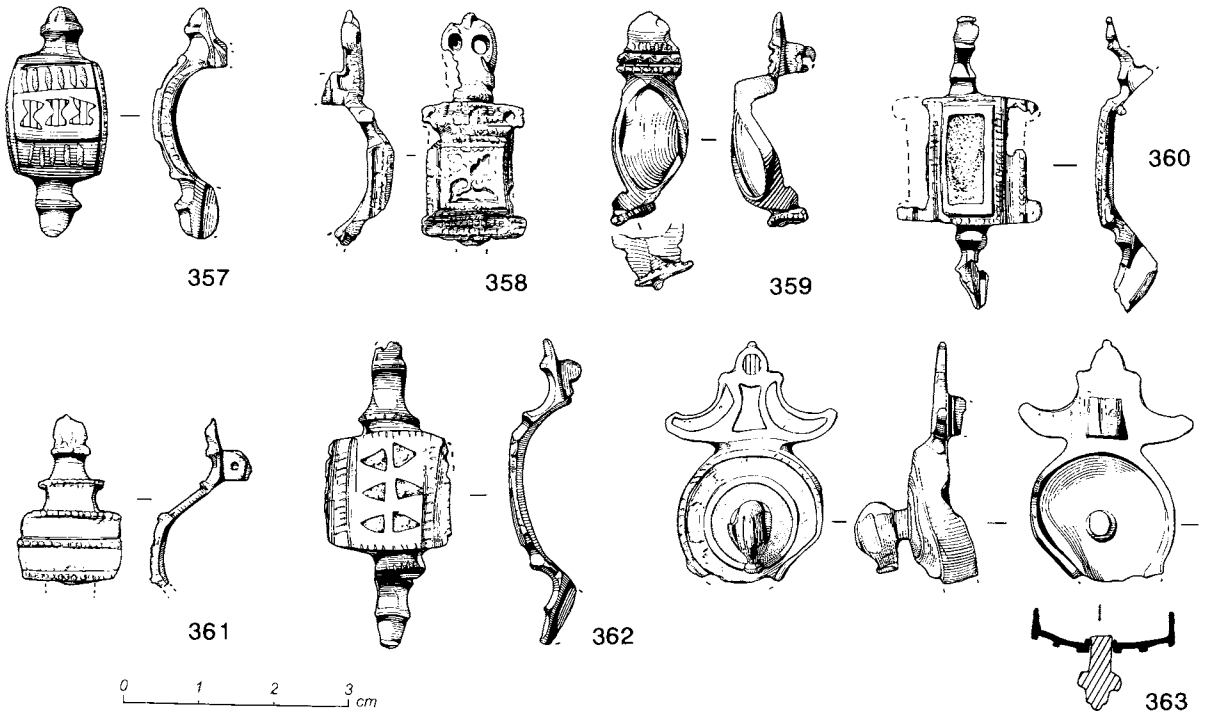
360. RIII, No. 15 L 40mm Brass/gunmetal, enamel
Raised central rectangular plate between two moulded projections, which cover the double lug for the hinged pin, and the catchplate. The centre of the plate is a further raised rectangle, containing a large enamelled field; only traces of translucent turquoise enamel remain. It is flanked by side panels with beaded ribs and traces of small lugs at the outer corners.
SF 874 'Group south of site V, c 200' (RIII, p 78).
Hull T231A.

Equal-ended, narrow rectangular plate at right angle across centre. T232

361. RV, No. 71 L 27mm* (Leaded) bronze
(c 40mm if symmetrical)
Raised rectangular plate with one moulded projection carrying the double lug for a hinged pin. The matching projection on the other side carrying the catchplate is now lost. The plate is cross-ribbed, with no sign of the enamel decoration that is usual on T232.
SF 4472 Surface of SW area inside stone fort. ML about AD 280–400+.

Equal-ended, rectangular plate. T233

362. RV, No. 70 L 40mm Gunmetal, enamel
Raised central square plate between two moulded projections; the double lug for the hinged pin and a small catchplate are behind these. Two rows of three small triangular enamelled cells occupy the centre of the plate, which is flanked by knurled flanges. The enamel in the central cells is probably turquoise; one end is probably red and the others are lost.
SF 4152 Surface of SW area inside stone fort. ML about AD 280–400+.
- Similar brooches but with different patterns of cells occur at Besançon, France (Lerat 1956, pl xv, no. 278), and Augst, Switzerland (Riha 1979, nos 1638–9, p 193). One with the same cell-pattern but with terminals of different shape 'found in East Anglia' is published (Hattatt 1985, no. 555, p 153). One of the Augst brooches was with pottery of the second half of the first century.



97 Symmetrical plate brooches. Cat 357-368

Equal-ended, raised central disc, projections incorporating lunettes. T234

363. RI, No. 8 L 32mm* Leaded gunmetal, enamel
 Circular plate, hollow beneath; at one side a flat plate with crescent-shaped sides and small terminal disc; there would have been a matching plate at the other side. A large stud (perhaps representing a bird's head – or a fish?) is riveted through the centre of the main disc, which has two concentric rings outlined by reserved metal: both contain enamel, the outer one apparently in juxtaposed blocks of different colours including white, the inner one all orange. On the attached plate there were two crescentic fields containing enamel that was originally red flanking a central cell with ?white enamel, and a circular cell with enamel that is now green; also the remains of a double lug for a hinged pin on its underside. SF 7 'Site 1' (RI, p 44). See Chapter 5 (p 176).

Lozenge, square or rhomboidal, with projections at corners. T227 and T228

364. RIV, No. 49 L 29mm* Leaded bronze
 Lozenge-shaped brooch with three stepped stages, the central one containing a lozenge-shaped field for enamel, now empty. One lug remains at the end over the catchplate; this has a punched double ring. The incomplete lug at the opposite end covers the double lug for a hinged pin: it seems to have similar decoration. There were probably similar lugs at the remaining two corners. The edge of the second stage is faintly knurled. The back of the plate is a circular hollow. SF 2338 Big tip outside N wall.

Stepped lozenge-shaped plates occur with a number of different decorative attachments or with none, but nearly all have a central field of enamel containing inset glass spots of a different colour and can probably be regarded as a single type. Unfortunately the Richborough brooch has lost most of its enamel so that the citation of parallels is limited to those which seem to have a similar outline. These include Nornour, Isles of Scilly (Hull 1968b, no. 149, p 48), Mandeure, France (Lerat 1957, pl vi, no. 139) and Zugmantel, Germany (Exner 1939, Tafel 12, no. 13, p 100). None is well dated on site, but the main production of enamelled plate brooches with inset spots dates to the middle or later second century (Spitaels 1969, 127–8).

365. RV, No. 67 L 42mm* Copper
 Badly corroded. A large rhomboidal plate survives, with one projection in the shape of a snakeshead. Below there was a double lug for a hinged pin. The projection on the opposite end is broken off short. The drawing in RV, pl xxxi, shows a small disc on one of the intermediate angles of the plate. The plate itself seems to have had a cruciform arrangement of cells for enamel, but they are now very much obscured and no enamel survives. SF 4873 Area xvii/32 W of N–S road. ML about AD 70–180.

A number of generally similar brooches are known, from most Roman provinces. Some have moulded projections rather than snakesheads; one of these from Sibret, Belgian Luxembourg, came from a Hadrianic grave (Spitaels 1969, cat no. 299).

366. RI, No. 6 L 36mm* Leaded gunmetal, enamel
 Circular plate with small side discs (probably originally four) raised above end projections, of which only one survives. This is badly obscured by corrosion but seems to have been a snakeshead, with the attachment for a pin below it. The whole of the main disc is enamelled: the inner ring appears green but was orange originally, the outer ring has six blocks of opaque yellow marbled with translucent purple, separated by red enamel but without metal divisions. There is also orange enamel in the two surviving side discs, which, like the central field, have a reserved metal spot. SF 85 Site 1.

This is a variable type: sometimes with more side lugs, sometimes with moulded projections. A close parallel was found at the Saalburg, Germany (Böhme 1972, Tafel 24, no. 950, p 37); others generally similar come from Nornour, Isles of Scilly (Hull 1968b, no. 180, p 51), and Vienne, France (Feugère 1985, nos 1889 and 1890, pl 151, pp 357 and 360–2). Probably second century.

Other symmetrical plate brooches

367. RII, No. 82 L 46mm* (Leaded) gunmetal,
enamel

Although this is superficially of the same design as the last five brooches – a square plate with projections – it is actually a hollow circular moulding with the top squared. Nor is it strictly equal-ended since one surviving projection carries a small round cell with turquoise enamel while the opposite end seems to have had an open loop. There is also a side lug with punched concentric ring decoration. The double lug for a hinged pin is under the shank of the loop, and the catchplate under the enamelled projection. On the flat top of the main plate there are three equal-sized rectangular cells for enamel: red in the central one, the others empty.

SF 589 'Pit 26' (RII, p 51). ML early fourth century.

Near Hull T231B. No close parallel has been noted (without a rear view it is impossible to see whether some fairly similar published brooches were made in the same way), but the circular hollow plate sometimes appears as the basis for lozenge- and other-shaped brooches: cf Carvossa, Cornwall (Carlyon 1987, no. 23, p 126), and Wanborough, Wiltshire (Butcher 2001, no. 129, p 62). Some of these have millefiori decoration and thus should date not earlier than the second half of the second century.

368. L 28mm* Gunmetal?

Fragment of a very thin plate brooch. It is now rectangular in shape but only one edge is original; this seems to be straight but is not enough to determine the original shape of the brooch. At the back are the remains of the catchplate and a short spring between two lugs.

SF 2629 Site III outer ditch section in silt at bottom. ML about AD 250–80.

CONTINENTAL DISC BROOCHES WITH COMPLEX ENAMEL
See discussion Chapter 5 (pp 177–8).

369. RIV, No. 46 D 20mm Leaded gunmetal,
without loop enamel

Small disc brooch, flat except for central stud, and with broken remains of a loop projecting from the plate; this is over the two lugs between which the pin was hinged. The annular field of the main plate is enamelled in eight segments without metal divisions: alternately plain (now green) and millefiori, the latter of minute black, white and red chequers with a turquoise border.

SF 2997 Outer stone fort ditch, 0–4ft [0.0–1.2m].
ML about AD 400+.

T250. A very similar brooch from Colchester, Essex, had millefiori in all the segments, though still in alternating patterns (Crummy 1983, no. 81, p 17). Although it is difficult to find other close parallels for the detailed design of this brooch it should be related to the series of disc brooches in which two or more rings of alternating blocks of enamel or millefiori surround a central stud: for example, Exner 1939, group III, type 26, pp 103–5, with numerous examples from the Rhineland. Datable examples are from the middle or later years of the second century.

370. RIV, No. 47 D 26mm Leaded bronze/
gunmetal, enamel

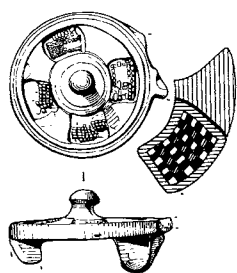
T256. Flat disc brooch with no projections from the edge. The missing pin was hinged in a split lug. Within a narrow rim the whole field of the disc is set with millefiori decoration: alternating chequers, either of 3 x 3 alternately white and blue rods within a red border, or of 5 x 5 rods, also white and blue, within a blue border. Remarkably, these are all intact (See Plate 17).

SF 2978 Tip.

371. D 20mm Brass, enamel

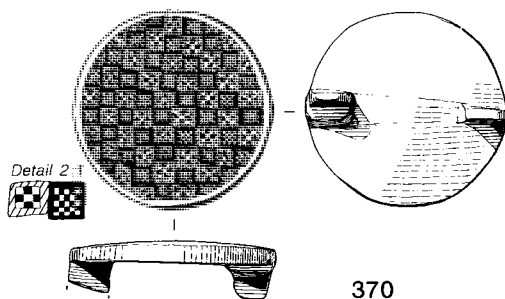
Small flat disc brooch with no projections. The missing pin was hinged in a split lug. There is a narrow rim round the disc and a hollow in its centre; traces of millefiori chequers in red, blue and white with a turquoise border can be seen in the base of the central hollow.

SF 2393 Trench V S motor road. ML mainly third–fourth century.



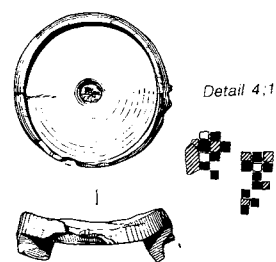
Detail 2:1

369



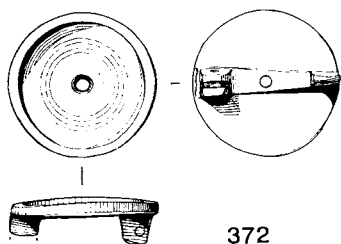
Detail 2:1

370

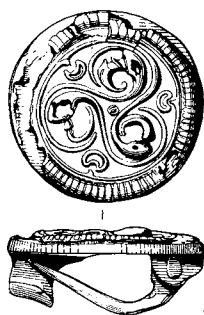


Detail 4:1

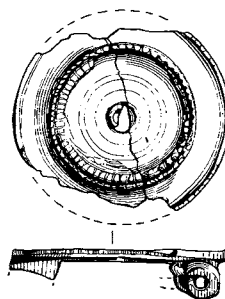
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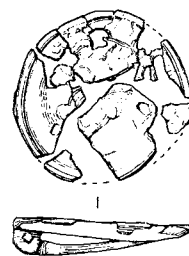
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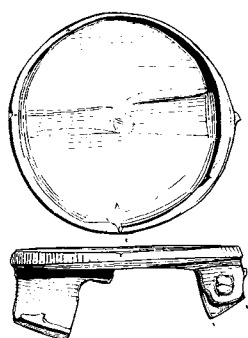
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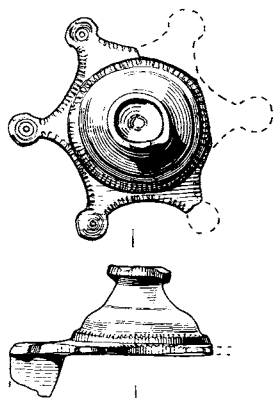
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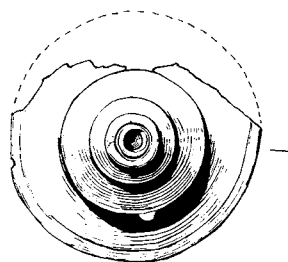
375



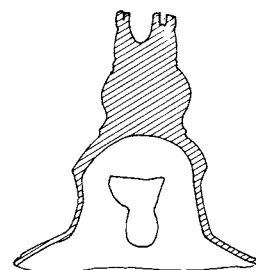
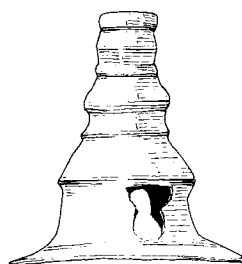
376



377



378



0 1 2 3 cm

This is presumably a smaller version of Cat 370 above, and would have had an all-over filling of millefiori, possibly alternating with plain enamel as with some similarly sized millefiori disc brooches. Examples have been found at Nornour, Isles of Scilly (Hull 1968b, nos 189 and 190, p 52, and fig 20; no. 190 had two patterns of chequers set in red enamel), the Saalburg and Zugmantel, Germany (Böhme 1972, nos 1007 and 1011, p 38), Augst, Switzerland (Riha 1979, nos 1623 and 1624, p 191, with pottery of late second/early third centuries) and Biësme, Belgium (Brulet 1969, fig 21, no. 3, from a burial with Flavian to early third-century pottery).

372. RV, No. 64 D 19mm Leaded bronze
Very like the last, Cat 371, but the disc is completely empty and the central hollow pierced through to the back. Hull (RV, p 88) also supposed that this once held enamel, possibly millefiori. SF 3956 'Earth at south end of Sandwich Bay' (RV, p 88).

DISC BROOCHES WITH APPLIED REPOUSSÉ PLATES. T249

373. RIV, No. 170 D 24mm Gunmetal
A plain disc carrying the pin, hinged between two lugs, and its catchplate; to this a brass disc is attached with solder; it has elaborate repoussé decoration: a triskele within a broad beaded rim (Plate 23). SF 3906. 'Topsoil. Between the outer and middle earth fort ditches' (RIV, pp 139–40). See discussion Chapter 5 (p 173), and Appendix 3 (p 260) for a list of parallels.

374. D 28mm (Leaded) bronze/
gunmetal, tinned
Thin plate with faintly knurled raised rim, small central depression, and intermediate beaded ring. The outer band shows tinning; there are traces of a copper alloy plate with beaded edge soldered within the inner rim. At the back there is a single lug holding a bilateral spring of four turns; a rib links this with the stump of the catchplate. SF 4697 Berm of N wall.

Although this cannot be identified with certainty owing to the lack of the main decoration, some details suggest that it belongs to a type best known in the German provinces: cf Böhme 1972, type 44 a), 41–2, Tafel 28. These have the outer and inner ring, an applied plate within the latter, and a spring on a single lug rather than a hinged pin. They are thought to date to the mid-second century onwards.

Lacking applied plate but probably of preceding type.

375. D c 23mm (Leaded) bronze/
gunmetal, tinned
Fragments of a disc brooch with pin hinged in a split lug. It has a slightly raised outer rim, a band of tinning on the outer part of the disc, and a dished centre. SF 3798 'Outer ditch. N side filling' (on label). ML about AD 400+.
376. D 29mm (Leaded) bronze/
gunmetal, tinned
Flat disc brooch with no projections from the edge. The pin is hinged in a split lug and there is a large catchplate with shaped inner edge. The face is dished within a plain rim; the whole field is now empty but must have held some decoration: all that survives is tinning on the rim and in the field. No site provenance.

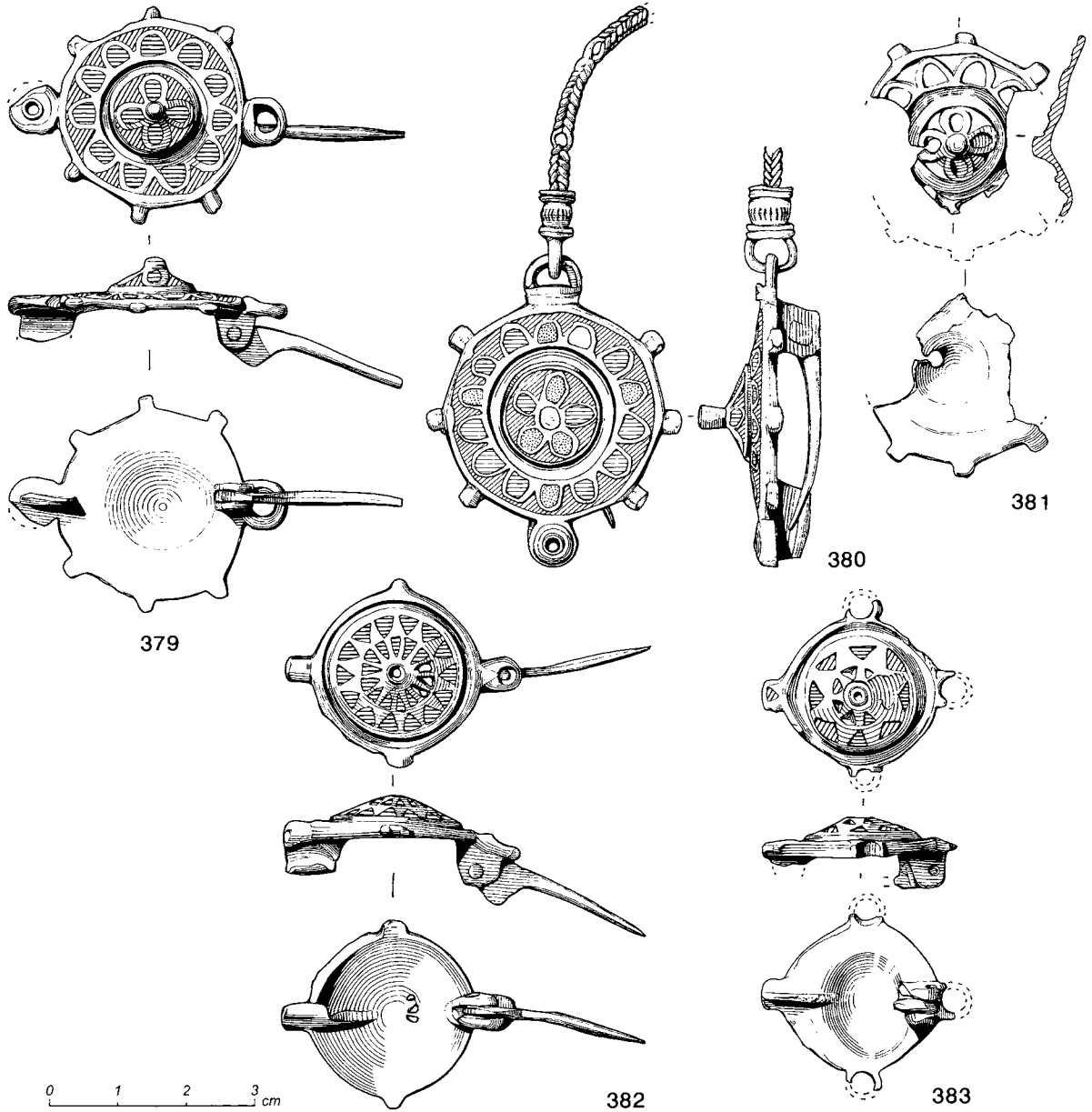
DISC BROOCH WITH CONICAL CENTRE AND LUGS ON RIM

377. RIV, No. 42 D c 35mm (Leaded) brass/
gunmetal, enamel
The main disc is hollow behind and is raised to a central stud which contains traces of turquoise enamel with a central hollow, showing that it originally contained an inset spot of a separate colour. There is an outer flange, of scalloped outline, which originally carried six projecting lugs, of which three remain, with concentric rings in shallow relief. (RIV, pl xxix, shows a fourth, which gives the approximate overall diameter; a hinged pin is also shown, now missing.) Both the central disc and the outer flange have finely knurled edges. SF 3250 Filling of outer [stone fort] ditch on S side. ML about AD 400+.

This is presumably related to the large group of 'bucker' or tutulus brooches, T269; the standard type is continental. See Chapter 5 (p 178).

Fragment

378. L 30mm* (Leaded) gunmetal
Conical casting, hollow in lower part. Perhaps the centre of a tutulus brooch, but much higher than most. SF 2638 Site III. Section inner ditch. Top soil.



99 Disc brooches. Cat 379–383

BRITISH ENAMELLED UMBONATE BROOCHES, HINGED

Outer ring of enamel cells, usually crescentic; central rosette. T268

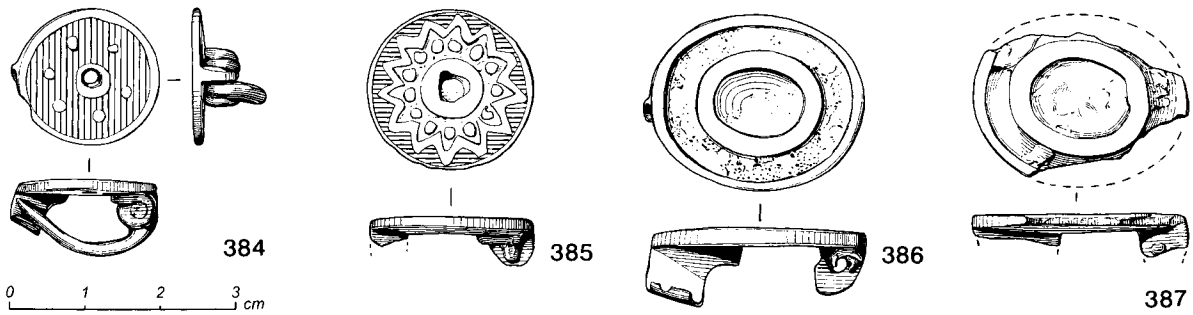
See Chapter 5 (pp 172–3).

379. RIII, No. 14 L (pin axis) Leaded bronze, enamel
40mm
- The centre has a rosette of four cells and rises to a

small knob; the outer ring, separated by a groove, has eleven scale-shaped cells. There are six plain metal lugs on the rim, plus a larger loop over the pin-hinge and a disc with concentric rings, originally enamelled, over the catchplate. The back of the brooch is concave. Enamel survives: the rosette and scales turquoise, the intermediate cells red.

SF 823 Area VIII near Pit 60.

380. RV, No. 66 L (pin axis) (Leaded) brass/
46mm gunmetal, enamel
Very similar in design to Cat 379, but larger and with a rosette of five cells in the centre (Plate 24). A broken chain is attached to the loop over the hinged pin. The outer ring of fourteen scale-shaped cells has yellow enamel in four and turquoise in eight, with red in the intermediate spaces; three of the inner ring of cells are yellow and two turquoise, again with red enamel between them.
SF 4479 Surface near S wall inside stone fort. ML about AD 280–400+.
381. L c 20mm* Leaded bronze?,
enamel
Fragment of a brooch very similar to Cat 379 above, and apparently the same size. The centre with four cells intact, and part of the outer ring, with plain lugs on rim. Traces of red enamel survive between the inner scale-shaped cells.
SF 2414 Area XVII.
- Smaller brooches with concentric rings of small triangular enamel cells. T267B*
See Chapter 5 (p 173).
382. RI, No. 7 L (pin axis) Bronze?,
33mm enamel
Within an outer groove the whole of the disc is domed and is covered with two concentric rings of small triangular enamel cells (Figure 12 and Plate 3); a small conical hollow at the centre shows no trace of enamel. There is a lug over the pin-hinge with a deep central cell, also devoid of enamel, and three plain metal lugs symmetrically spaced round the rim, that over the catchplate being larger. Where a colour can be ascribed to the remaining enamel, in seven (of fourteen) cells in the outer ring and four (of fourteen) in the inner ring, it is translucent turquoise, although it was described as dark blue and yellow in RI. The pin is hinged between two lugs.
SF 26 'Found in tip from site I' (RI, p 43).
383. L 29mm* (Leaded) bronze,
enamel
Very similar to Cat 382 (raised disc same size) except that the outer ring consists of only eight triangular cells, and the three lugs on the edge are all perforated, while that over the catchplate has a red enamel triangle. In the centre of the dome is a relief ring and dot. The enamel in the outer row of triangles is alternately red and blue; blue remains in one cell in the innermost ring.
No site provenance.
- BRITISH FLAT DISC BROOCHES,
ENAMEL IN LARGE FIELDS, SPRUNG
- Small, with various patterns of decoration. T252–255*
See Chapter 5 (p 178).
384. D 18mm (Leaded) bronze,
enamel, tinned
Small flat disc brooch with no projections from the edge. The whole field is enamelled except for six reserved metal spots and a ring round a central hole; the enamel now looks pale green. A spring of four turns is attached to a single lug with an iron axial rod.
No site provenance.
- A11 (RV, No. 63). See Appendix 4, Table 25.
Not found: similar but slightly larger than Cat 384 and with eight metal spots. The central ring is larger and 'probably held a stud'. The enamel was 'white or colourless'.
- Cat 384 and A11 belong to T252B. This type is found in Germany (for example, Böhme 1972, no. 998, p 38, Tafel 26) but is apparently commoner in Britain than in other provinces. Parallels are listed in Appendix 3 (pp 260–1); those from dated contexts are St Albans, Hertfordshire (Kenyon 1935, fig 12, no. 13, p 259), in fourth-century rubbish deposit, and Baines Farm, Catterick, Yorkshire (Butcher 2002, fig 307, no. 13), slightly larger, site context pre-AD 200.
385. RIV, No. 45 D 21mm Bronze, tinned,
enamel
Flat disc brooch with no projections from the edge; spring (incomplete) on a single lug. The enamelled field is divided by a concentric zigzag ring of reserved metal, with metal spots in each space, and the centre has a broad metal ring. There is blue enamel in the outer zone, the others seem to be empty. All the reserved metal is tinned.
SF 2792 Outer stone fort ditch. 0–4ft [0.0–1.2m] down. ML about AD 400+.
- T252C. See list of parallels in Appendix 3 (p 261); these include two from Nornour, Isles of Scilly; others at Newstead, Roxburghshire; Cold Kitchen Hill, Wiltshire, which had 'silver beading' on the star-shaped motif;



100 Disc brooches. Cat 384–387

Chesterholm, Northumberland; Standlake, Oxfordshire; Rapsley, Surrey; and Uley, Gloucestershire. The last was in a fourth- or fifth-century deposit on the temple site, but although most of the others are undated the Newstead example should not be later than about AD 211 and was associated with the Antonine occupation; the Chesterholm brooch was with mid-third-century material.

A12 (RV, No. 65, p 88). See Appendix 4, Table 25.
 Not found: flat 'enamelled disc brooch, the field divided into two bands and a central disc. Enamel in outer band uncertain, in inner band blue; central space vacant ... Pin hinged' (RV).
 SF 4805 'S of W wall in Trench IV, above upper pebble layer'.

OVAL FLAT BROOCHES WITH BROAD OUTER BAND OF ENAMEL T260

See discussion in Chapter 5 (p 178) and list of parallels in Appendix 3 (p 260).

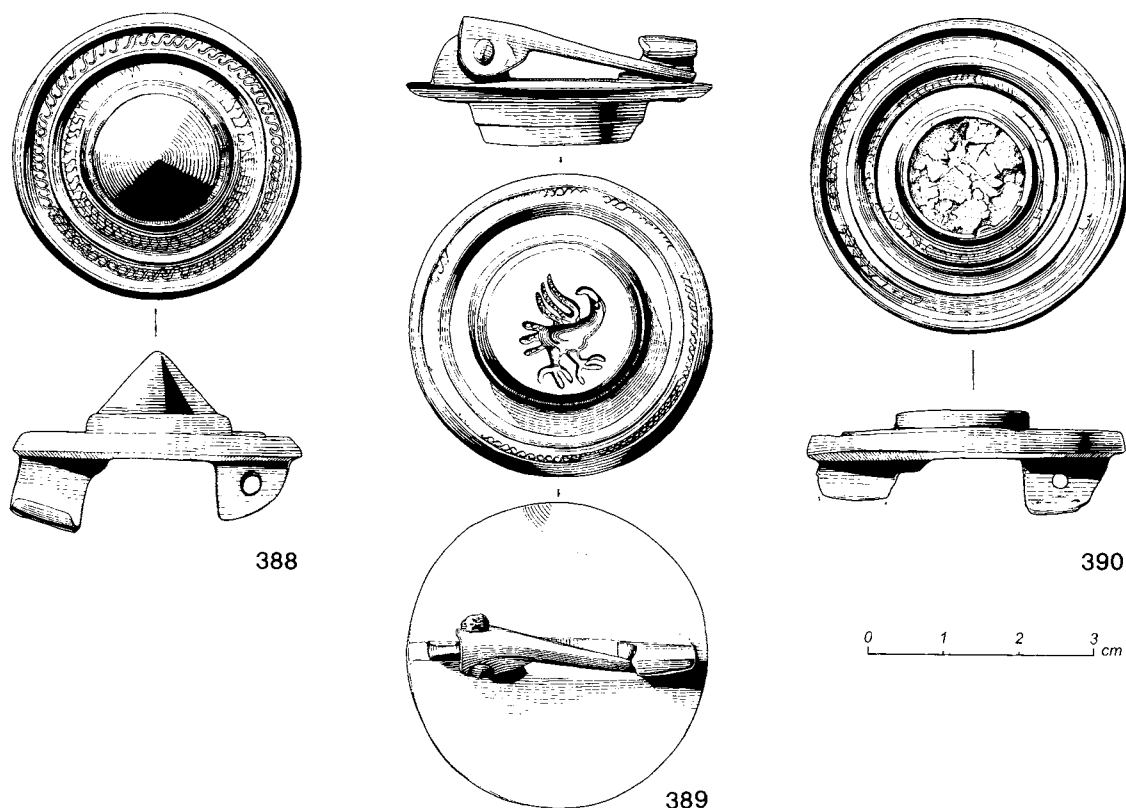
386. RIV, No. 48 L 28mm (Leaded) bronze, enamel, tinned
 The flat plate is divided into two zones by a reserved metal ridge concentric with the oval outer rim; the central oval field is empty but there are traces of turquoise enamel in the outer band. One coil of a spring remains on the single lug at the back, and there is a large catchplate with concave inner edge. Both upstanding metal ridges were tinned.
 SF 1573 Area XV, below stone fort road. ML AD 150–250.

387. L 29mm (Leaded) bronze, enamel, tinned
 Very similar to the last except that the outer oval band contains fragments of turquoise enamel, possibly in blocks showing that two colours were originally juxtaposed. The pin attachment and catchplate are broken.
 SF 1694 Outside W gate, outer ditch near surface. ML about AD 400+.

GILDED DISC BROOCHES WITH A CENTRAL GLASS SETTING

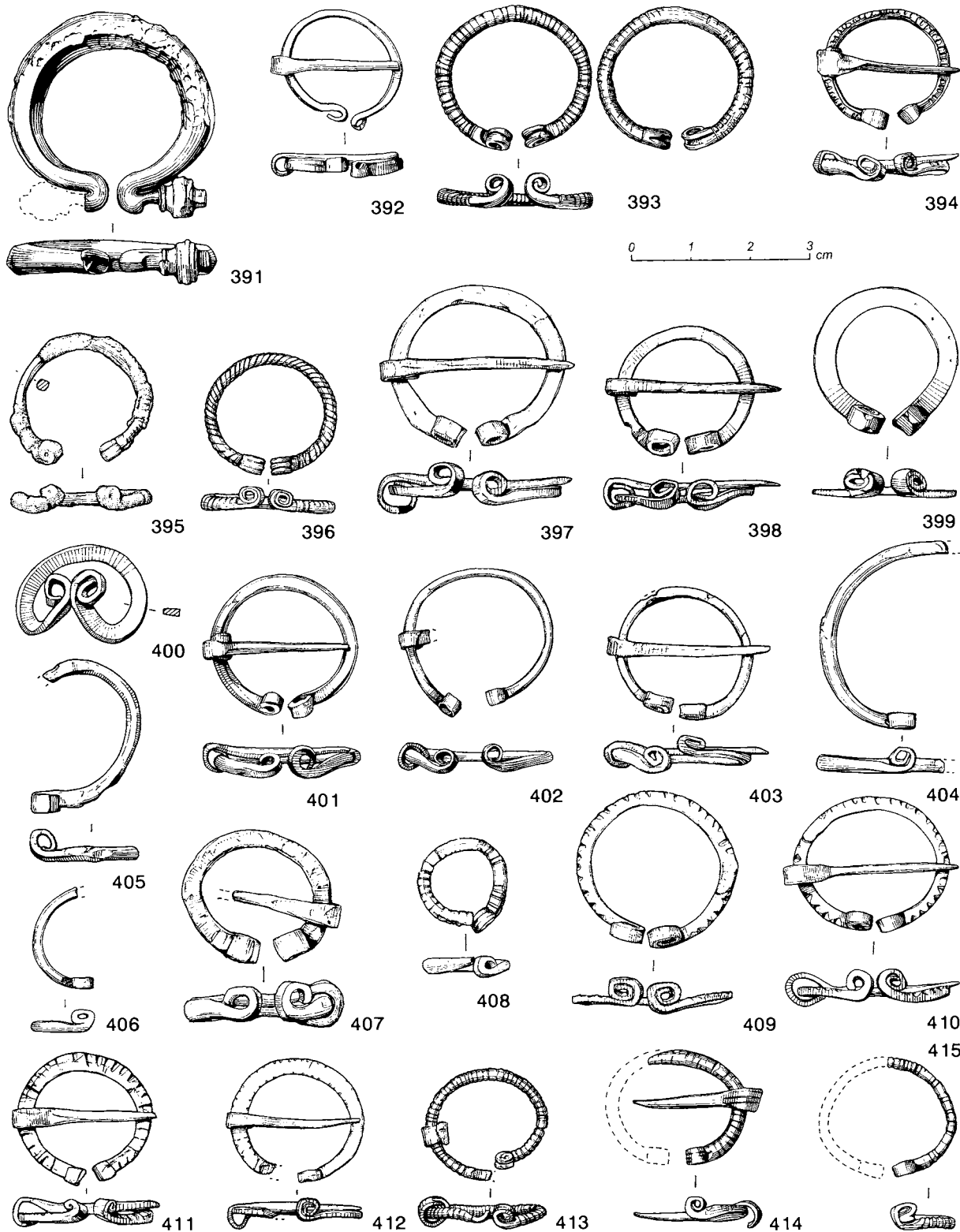
Circular T270
 The type is discussed in Chapter 5 (pp 178–9), and parallels for Cat 388 are listed in Appendix 3 (pp 261–2).

388. RIV, No. 63 D 38mm Brass, mercury gilded, tinned, glass
 Well-preserved brooch; the disc divided into three zones by bold concentric ribs. The inner collar secures a conical setting of 'black' (dark olive) glass; the next ring has relief decoration, the pattern punched but now very worn; the outer ring is decorated with fine punched SSS. The two outer rings are gilt (Figure 17 and Plate 7). There is a single lug on the back, which is tinned; probably for a spring, but compare the hinge arrangement on Cat 389 below; the catchplate is large. Niello is mentioned in the description of this brooch (RIV, p 121), but this may be a misinterpretation of the dark metal showing through the gilding where it is worn away, as niello is unusual after the first century, and none was noted.
 SF 1872 Outside N wall Small tip.

101 *Disc brooches. Cat 388–390*

389. D 40mm Bronze, leaf gilded, tinned, glass
 Very like Cat 388 in design and most features, but the central 'black' (dark olive) glass setting is flat-topped and bears the boldly executed cast impression of a bird with raised wings and hooked beak, probably an eagle. There is very faint decoration of linked SSS in the outer ring, the inner ring appears plain. The pin of rolled sheet metal is folded and hinged over a single lug, a very unusual arrangement and possibly a replacement of a broken spring. The back is tinned and the front gilded.
 No site provenance.
390. RII, No. 9 D 41mm Gunmetal, gilded
 Similar in general design and features to the last two, but here the centre is filled with reddish-coloured substance, possibly fired clay, which has a flat top and no decoration. Perhaps this was substituted for a lost 'stone' or formed the packing behind it? There is very faint decoration, apparently a running lozenge design, in the outer ring. The pin is missing, but there is a single lug with a hole, presumably to hold the spring, but see Cat 389.
 SF 208 'From top of burnt layer iii, 3' 'Topsoil' (RII, p 42).

Hull's corpus lists an almost identical brooch (no. 8040), complete with intaglio of a similar bird, from Barrington, Cambridgeshire. It is presumably to be grouped with the numerous brooches like Cat 388 above, as a British product of the third or fourth century.



102 Penannular brooches. Cat 391-415

PENANNULAR BROOCHES

TERMINALS COILED OR BENT BACK IN SAME PLANE AS
THE RING. FOWLER 1960 TYPE B

The 'omega' brooch. Type P11

See Chapter 5 (p 186).

391. RV, No. 87 W 31mm Brass
The ring is faceted and narrows towards the terminals, which are, bent outwards at a sharp angle. One terminal is missing, the other has a broad ribbed cylinder flanked by narrower mouldings. The pin is missing.
SF 4932 S of Section 19. Pit 271. ML Claudian.

With coiled terminals. Type P2

392. W 21mm Gunmetal
Ring of flat section, undecorated, surface damaged. The terminals are further flattened and rolled back once only. The pin is wrapped round the ring; its tip is missing.
SF 3781 Inner ditch N side filling. ML AD 400+.

This shape falls within Fowler's type B (1960, 157–61), but not the very distinctive form with spiral terminals which is found at Glastonbury, Somerset, and other early sites. Very few brooches similar to the simpler Richborough brooch have been noted.

TERMINALS COILED BACK AT RIGHT ANGLES TO THE
RING. TYPE P3; FOWLER 1960 TYPE C

393. W 25mm Brass/gunmetal
Ring of round section, given a segmented appearance by multiple cross-grooves. The terminals have a deeper central longitudinal groove and are strongly coiled upwards. The pin is missing.
SF 1329 'Area XI – 16. Trial ditch South'.
394. W 22mm Brass
Similar in general appearance to Cat 393 but smaller and thinner and the terminals not grooved. The ring is cross-grooved on the upper surface only and has a seam, which suggests that it is made from a rolled piece of sheet metal. The pin was also made from rolled sheet metal, flat at the hook that attached it to the ring.
SF 302 No site provenance.

395. W c 25mm Silver
A somewhat larger brooch, of silver; the ring is of round section but is only faintly ribbed; the terminal is coiled upwards and grooved as in the other examples.
SF 943 Line of Section 42, surface 10ft 10ins [3.3m].

396. W 23mm Brass
The ring is of rounded section and is diagonally grooved on the upper surface, giving a rope-like effect. The terminals are coiled upwards and longitudinally furrowed. The pin is missing.
No site provenance.

397. W 23mm Bronze
Ring of flat section. The pin has a crease along the upper side, which shows that it was formed from thin sheet metal.
SF 2337 Outside W gate, top layer S. ML AD 400+.

398. W 23mm (Leaded) gunmetal
Ring of flat section. The pin has a slight crease, as Cat 397 above.
SF 153 Top 3ft [0.9m] NE corner. ML about AD 280–400+.

399. W 23mm Bronze
Thin flat ring with damaged surface. Pin missing.
SF 376 No site provenance.

400. W c 22mm Bronze/gunmetal
Distorted ring of flat section. Pin missing.
SF 1468 E of Section fort road metal. ML about AD 280–400.

401. RI, No. 26 W 25mm Bronze/gunmetal
Fairly thick wire ring, slightly flattened. Plain pin showing crease.
SF 79 'Site I, surface' (RI, p 46). ML about AD 400.

402. W c 24mm Brass
Ring of thin wire. Pin broken: only the hook survives.
SF 3808 Inner ditch N side filling. ML about AD 400+.

403. W 22mm Bronze
Ring of thin wire. Pin shows crease.
SF 148 Top 3ft [0.9m] NE corner. ML about AD 280–400+.

404. D c 32mm Bronze
Part only of a rather large brooch, the ring of plain wire. Pin missing.
No site provenance.
405. D c 25mm Bronze
Part only, similar to Cat 404 above but a different brooch.
No site provenance.
406. D c 18mm Leaded gunmetal
Half of a small ring of thin wire with one terminal.
SF 404 No site provenance.
407. W 26mm Iron
Complete but deeply corroded.
SF 3737 No site provenance.
408. D c 14mm Brass
Very small brooch of ribbed wire bent to make ring. Incomplete.
SF 2091 Outside W gate, inner ditch. ML about AD 400+.

A13 (RV, No. 85, p 92). See Appendix 4, Table 25.

A14 (RV, No. 86, p92). See Appendix 4, Table 25.

Brooches with upward-coiled terminals of Fowler 1960 type C are common in East Anglia and southern central Britain, and are regarded as mainly 'Belgic' products of the pre-conquest era and soon after. When Dr Simpson discussed those included in Hull's corpus (Simpson 1979, 329–30) only three were known from Richborough and they were consequently regarded as rare on Roman military sites. The above list gives eighteen specimens, of varied design and metal composition, and further specimens follow, separated because it seems possible that they may be later versions of this rather simple design. Böhme (1972, 46) published two from Zugmantel, Germany, and refers to others from third- and fourth-century contexts in Raetia, Noricum and Pannonia.

409. W 26mm Bronze
Ring of flat section with triangular notches round the outer edge; the terminals coiled back over ring. Pin missing.
SF 3191 Inner ditch. N side 0–2ft [0.0–0.6m] down. ML AD 400+.

410. W 26mm Bronze
Similar to Cat 409 though less well preserved. A crease is visible down the side of the pin.
SF 3194 Inner ditch on N side. ML about AD 400+.

411. W 23mm Brass
Similar to Cat 409 though smaller and the triangular notches more crudely cut. Working creases visible on both sides of the ring. The plain pin is of a different alloy from that of the ring.
SF 3079 Outer ditch bottom. ML about AD 280.

412. W 22mm Brass
Ring of flat section, both edges with small triangular notches; the terminals coiled back over ring; plain pin.
No site provenance.

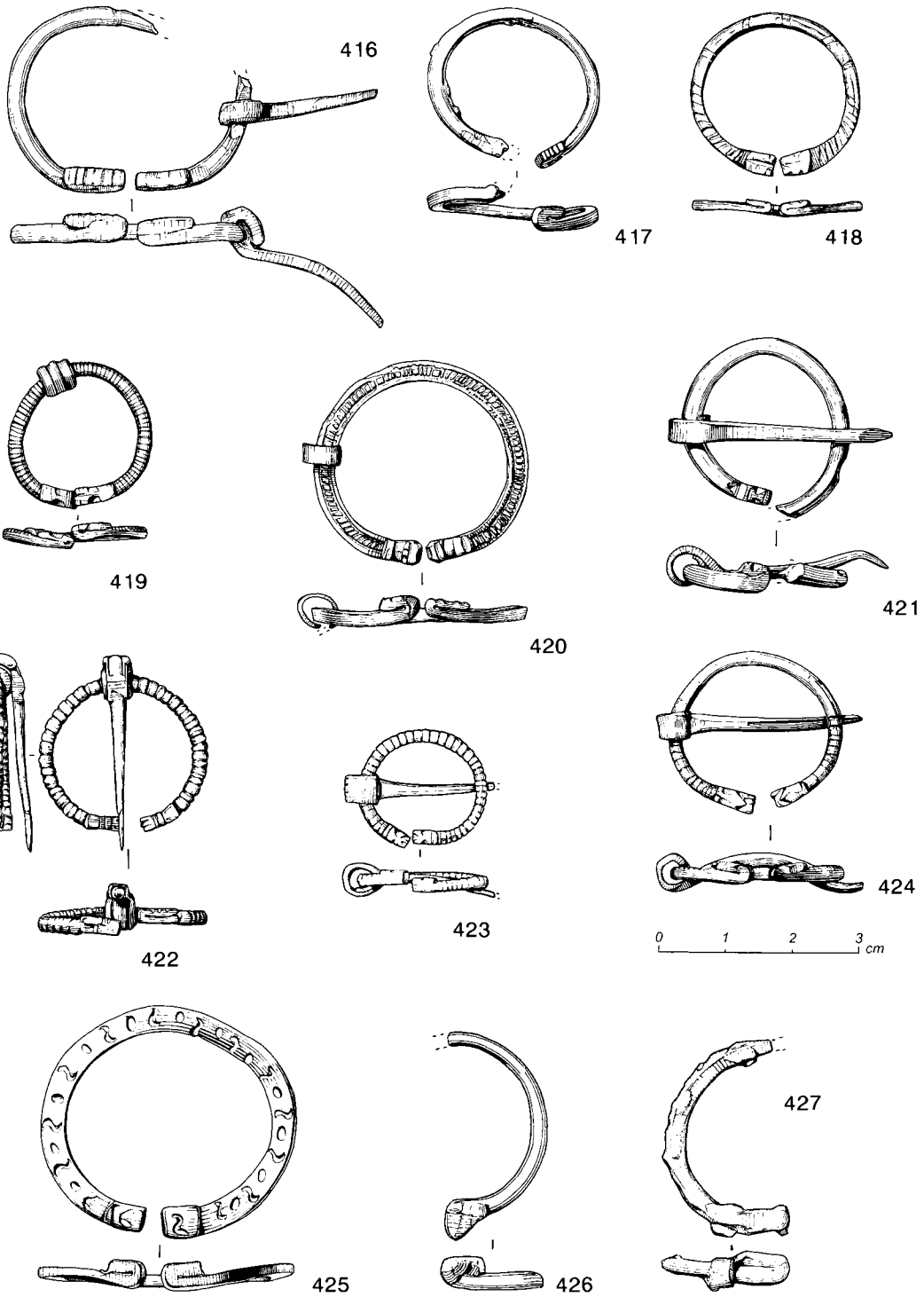
Cat 409–412 may belong to a sub-group distinguished by Mrs Fowler (1983, 165–6): flat decorated rings, sometimes with chip-carving. By analogy with continental finds she considers that these are more likely to date to the fourth century AD.

413. W 19mm Silver
Small silver brooch; the ring is of round section and is ribbed with fine cross-grooves which run all the way round. The terminals are flattened and coiled upwards; one has two longitudinal grooves. The pin is missing.
No site provenance.

414. W c 20mm Silver
Half of another small silver brooch with ring of round section and fine cross-grooves, not continued at the back. The surviving terminal is flattened and coiled upwards, and has three fine longitudinal grooves. The pin has similar grooves on its hook.
SF 2814 Outer ditch 4–8ft [1.2–2.4m] down. ML about AD 400+.

415. W c 20mm Silver
Half of a brooch very similar to Cat 414 above, but it is not the other half: it has the same terminal and the grooves continue at the back. No pin survives.
SF 5171 S of Section 46 in black soil.

An even smaller silver brooch from Colchester, Essex, is similar to the last three (Crummy 1983, no. 103, p 18); it came from a burial dated to AD 367 or later. In the absence of other dating it is uncertain whether these silver brooches belong with the main series of morphologically similar early brooches.



TERMINALS TURNED BACK OVER THE RING AND
FLATTENED. TYPE P4, FOWLER 1960 TYPE D

The terminals are usually decorated, and in some examples they are cast rather than wrought.

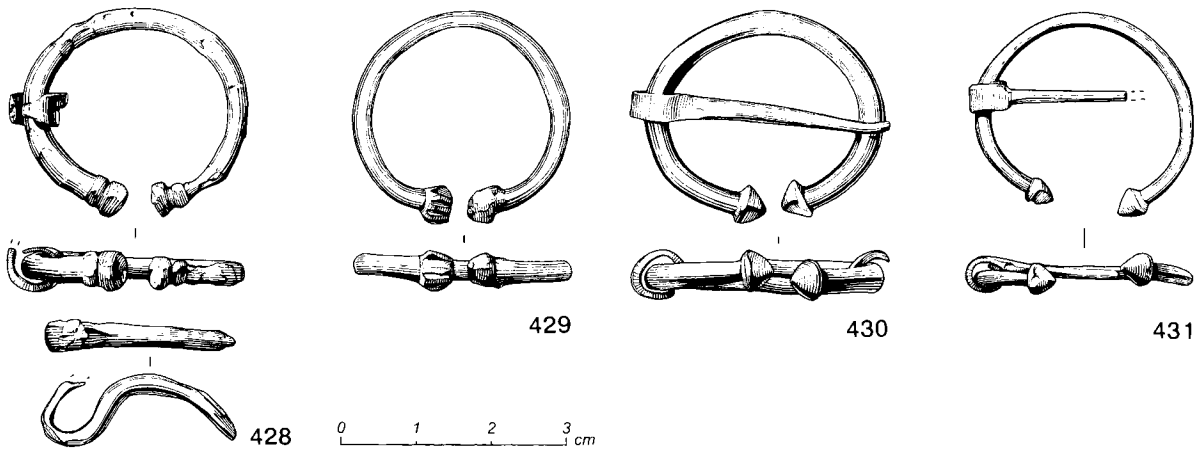
416. W c27mm Brass
The ring is of plain round wire, now broken into two pieces, and the terminals are cross-grooved. The pin is plain and hooked round the ring. No site provenance.
417. W 25mm Bronze
Similar to Cat 416; one terminal and the pin missing. SF 5668 In surface soil south-west area. ML about AD 280–400+.
418. RV, No. 88 W 25mm Bronze/gunmetal
Ring of thin, almost flat section, decorated with groups of diagonal cross-grooves. The terminals have side notches and a central groove. Pin missing. SF 4630 Area XVII, SW corner of Chalk House, above concrete floor. ML fourth century.
419. W 22mm Brass
Small ring of thin, almost flat section, the upper side finely cross-ribbed. The terminals have a central waist and indistinct grooves either side of it. Only the top of the pin remains, hooked over the ring and showing two shallow furrows. SF 4190 Surface of SW area. ML about AD 280–400+.
420. W 32mm (Leaded) bronze
Ring of flat rectangular section, decorated with a continuous band of punched diagonal cross-grooves forming a rope pattern, between two engraved outer grooves. The terminals have a central waist as in Cat 419 but with deeper cross-grooves either side. This forms an astragalus-like motif, which occurs fairly frequently on these brooches. Only the top of the pin remains, hooked over the ring; it is undecorated. SF 15 Site I courtyard 3ft 6ins [1.1m] down. ML fourth century.

This is quite similar to a brooch found in a late fourth-century context at Maiden Castle, Dorset (Wheeler 1943, no. 9, p 264). However, another which appears from the drawing to be very close was found at Hod Hill, Dorset, and is therefore presumably to be dated to

the first half of the first century (Brailsford 1962, E15, p 12). Another, from Poole's Cavern in Derbyshire was of the same alloy (AML, DERSB 5259).

421. W c25mm Bronze/gunmetal
Thick plain ring, slightly flattened. One terminal is missing, the other is waisted and cross-grooved. A thick plain pin is hooked round the ring. SF 3617 Tip 1.
422. RI, No. 25 W 26mm Silver
Boldly ribbed ring; the terminals grooved across the centre, with finer grooves at right angles either side. The pin is wrapped twice round the ring and has faint grooved decoration on its head. 'Found during operations undertaken by the Office of Works' (RI, p 46).
423. W 20mm Silver
Another silver brooch, but smaller than Cat 422 and the ring is only grooved on the upper side. The terminals are waisted as Cat 419 but have trefoil mouldings at the ends; faint longitudinal creasing shows that it was wrought. The pin is furrowed at the head where it is hooked round the ring. SF 1081 Area XI layer 1. ML AD 300+.
424. W 26mm Bronze
Ring of thin round section, flattened at the back and cross-grooved near the ends. The terminals are wrought; they widen slightly towards the ends, which have diagonal facets producing the effect of two ears. SF 3241 Inner ditch SW corner 4–8ft [1.2–2.4m] down. ML about AD 400+.
- This brooch is discussed in Chapter 5 (p 186), and parallels are listed in Appendix 3 (p 262).
425. RII, No. 7 W 38mm Brass
Broad flat ring with punched decoration: SSS alternating with oval pits. The terminals each have an S, facing the same way as those on the ring, which suggests that the decoration was punched after the brooch was formed. No pin survives. SF 178 Top 3ft [0.9m] NE corner. ML about AD 280–400+.

No close parallel has been found but some of the brooches from Lydney, Gloucestershire, are of similar size, with punched decoration (Wheeler and Wheeler 1932, fig 14, pp 78–9).



104 Penannular brooches. Cat 428–431

426. W c 28mm Gunmetal
Half only; plain ring, the terminal apparently plain.
No site provenance.

427. W c 28mm Bronze/gunmetal
Half only, plain ring; the terminal badly corroded.
Hook of pin remains.
No site provenance.

KNOBBED TERMINALS. TYPES P6 AND P7;
FOWLER 1960 TYPE A

428. W 29mm Bronze
Plain ring of round section. One terminal damaged, the other has a mushroom-shaped knob and a narrower collar. The pin is wrapped twice round the ring; its pointed end is broken. There is another complete pin in the box: this is highly arched and is just too short to engage the opposite side of the ring if it is hooked over, so presumably does not belong to this brooch.
SF 25 Site I courtyard tip. ML late fourth century.

Fowler 1960 type A3. In addition to the examples quoted there, some more recent finds are listed in Appendix 3 (p 262).

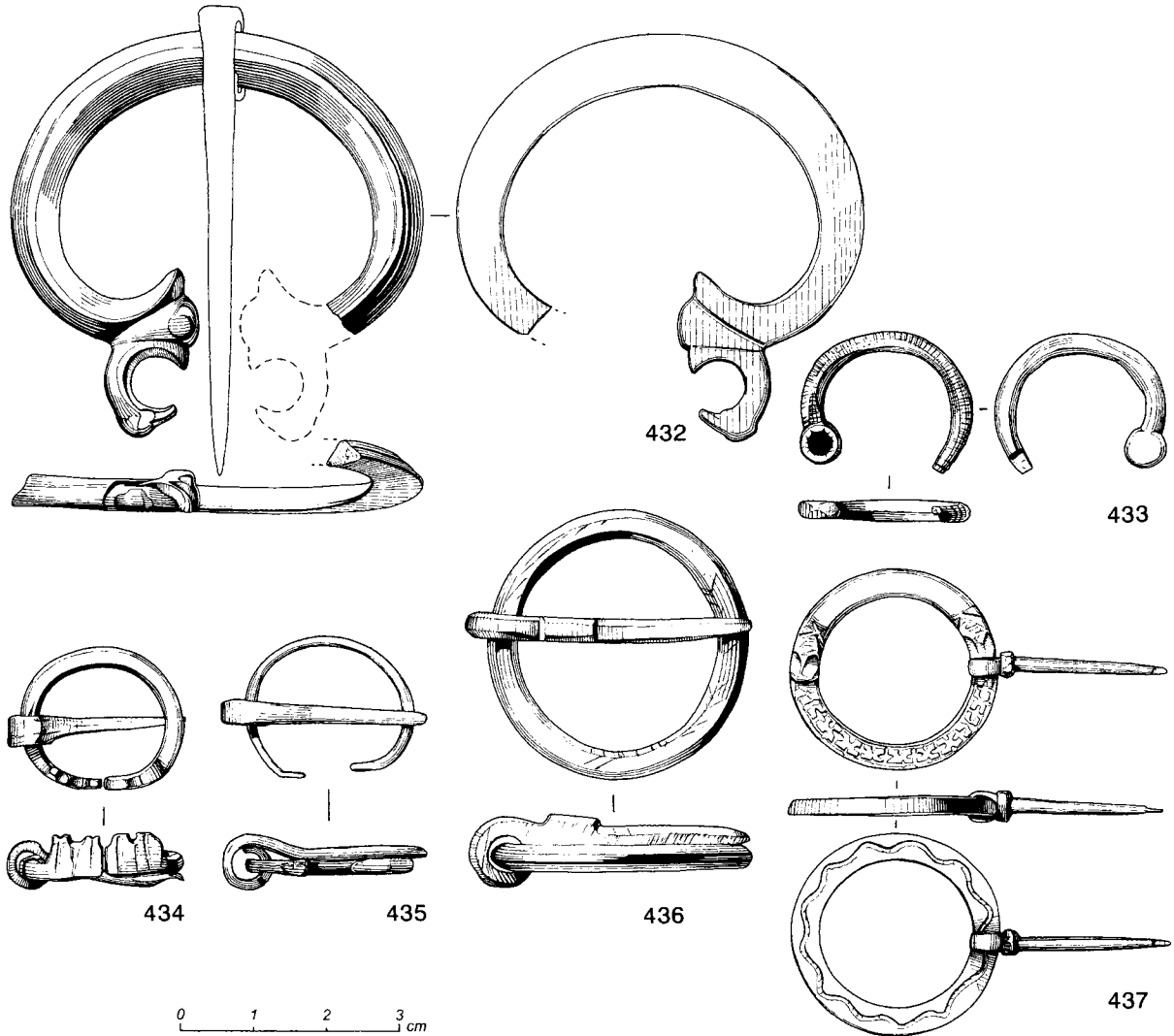
429. RV, No. 89 W 28mm Bronze
Plain ring of round section. One of the terminal knobs is damaged, the other is 'written': it has slightly diagonal grooves. The pin is missing.
SF 4875 W of Section 19, in mound between inner and middle ditches; bottom layer. ML about AD 250–80.

Fowler 1960 type A2, dated there to the first to fourth centuries AD (1960, 174). Numerous examples are given (Fowler 1960, 174) most of them from sites in the northern half of Britain, though with exceptions including London, Woodeaton, Oxfordshire, and Stockton, Wiltshire. More recent finds continue this pattern: see Appendix 3 (p 262).

430. W 32mm Leaded gunmetal
Thick plain ring of round section; the terminal knobs conical. Pin hooked round ring.
SF 1850 Stray.

431. W 29mm Bronze
Thin plain ring of round section; the terminal knobs conical as 430, though smaller. The pin is shouldered where it is flattened to hook round the ring.
SF 151 Top 3ft [0.9m] NE corner. ML about AD 280–400+.

The conical knobs of Cat 430 and Cat 431 are much rarer than the other terminals in this section. The only parallels found are brooches from Shapwick, Somerset, and 'South Wiltshire' in the British Museum and one from Duston in Northampton Museum, listed in Hull (forthcoming).



105 Penannular brooches. Cat 432–435. Annular brooches. Cat 436–437

UNUSUAL FORMS

432. RII, No. 6 W 56mm Leaded gunmetal
 The heavy moulded ring is of triangular section, with a slight ridge on top and flat reverse. The surviving terminal has the end of the ring curved inwards and pointed; attached to this is another crescent, with a rounded pellet between the two. No pin survives but one was shown in RII, pl XVI; however, it is suggested there that 'the coarse bronze pin, of poor workmanship, is probably not original' (RII, p 41).

SF 147 Top 3ft [0.9m], NE corner. ML about AD 280–400+.

This is sufficiently unlike most penannular brooches to raise the possibility that it was adapted to this use by the addition of the pin. However, some brooches found at Augst, Switzerland, have similar heavy rings with flat backs (for example, Riha 1979, no. 1826, pp 208–9) and Wheeler compared a Lydney brooch to the Richborough example (Wheeler and Wheeler 1932, no. 40, p 79).

433. W 26mm Bronze, enamel
 Ring of round section, fine cross-grooving on top. The surviving terminal is round and flat and has black enamel in a toothed cell.
 SF 360 No site provenance.

434. RII, No. 8 W 22mm Copper
 Ring of round section, slightly flattened in places. The terminals are flattened and extended upwards, with a toothed upper edge. The pin is plain; it is shouldered below where it is hooked round the ring.
 SF 303 'Topsoil' (RII, p 42).

This belongs to type P12, defined by Hull as 'The ends developed upwards and variously shaped', but none of the few examples in his corpus show any close resemblance. M E Snape (1992) has suggested that some of these belong to a sub-Roman type.

435. W 22mm Brass
 Very thin ring of flattish section, slightly expanded upwards at the terminals, which are flattened and at an angle to the ring. A much thicker brass pin was found with it: probably a replacement.
 SF 3325 Inner ditch south side. 0-3ft [0.0-0.9m] down. ML about AD 400+.

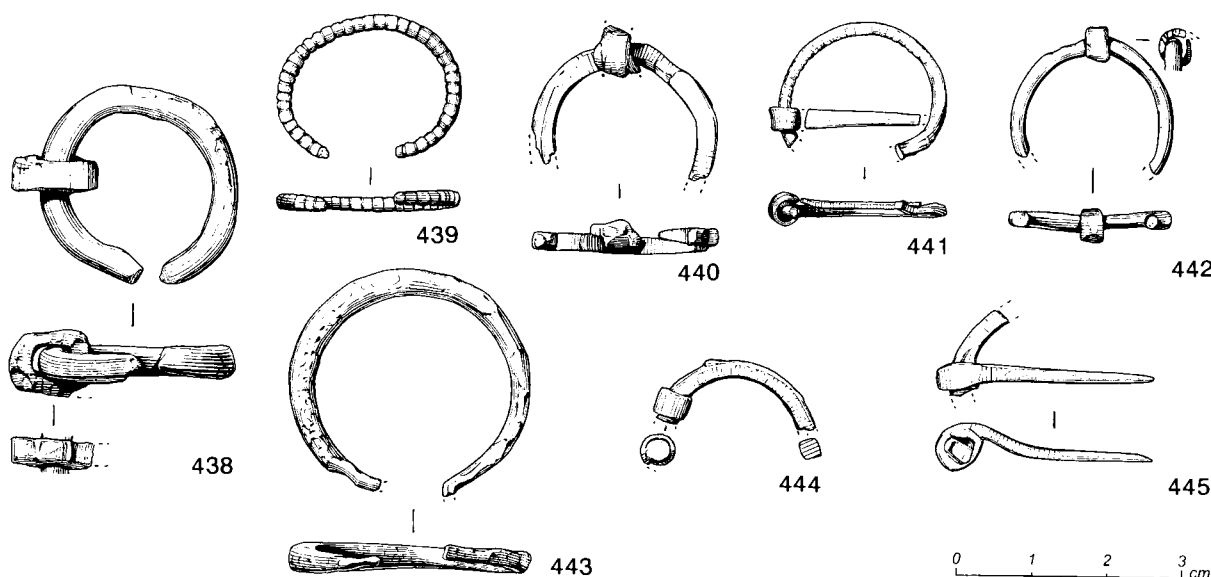
ANNULAR BROOCHES

436. D 37mm Gunmetal
 Thick faceted ring, complete, thick faceted pin hooked round it.
 No site provenance. Probably medieval.

437. D 28mm Gunmetal, mercury gilded
 Flat ring with relief decoration of quatrefoils, on reverse a running wave. The pin is held in a groove. The decoration makes this brooch unlikely to be Roman.
 SF 152 Top 3ft [0.9m] NE corner. ML about AD 280-400+.

Fragments, type uncertain

438. W 25mm Copper
 Plain thick ring of round section; broken, but the gap is hardly sufficient for terminals - perhaps this was originally annular. Part of the pin survives; this forms a complete ring, unlike the usual hooked arrangement.
 SF 1628 Outside W gate, inner ditch. ML about AD 400+.



106 Penannular brooch fragments. Cat 438-445

439. W 24mm Copper
Thin ring of round section, cross-grooved to give the effect of ribbing, all round. Terminals and pin missing.
SF 3985 In surface soil SW area. ML about AD 280–400+.
440. W 25mm Bronze
Part only of ring of flat section, showing two tapering ends overlapped and ?soldered together. A fragment of the pin survives where it is hooked over the ring.
SF 5295 Inner triple ditch. Section across N–S road 4ft 6ins [1.4m] down.
441. W 22mm Brass
Part of very thin ring of round section, faintly grooved. Terminals missing, the hook of the pin survives.
SF 944 Line of Section 42, surface 10ft 10ins [3.3m]. ML about AD 280+.
442. W 22mm Bronze/gunmetal
Part of plain thin ring of round section. The terminals are missing, the hook of the pin survives.
SF 154 Top 3ft [0.9m] NE corner. ML about AD 280–400+.
443. W 32mm Gunmetal
Ring of thick rounded section, tapering towards the missing terminals, which appear to be turning outwards as in type P2. Alternatively this might be an earring.
SF 1499 E of Section 53, rubbish under yellow road. ML about AD 85.
444. W c 22–25mm Bronze/gunmetal
Plain ring; the hook of the pin survives.
No site provenance.
445. L (pin) 27mm Brass
Fragment of plain flat ring with attached pin.
No site provenance.

CHAPTER 5

BROOCHES FROM ROMAN BRITAIN: CHRONOLOGY, TYPOLOGY AND METALLURGY

INTRODUCTION

This survey of brooches from Roman Britain sets the Richborough collection into the context of similar material found elsewhere: showing to what extent it is typical and indicating its value for the study of brooches generally. Types not present at Richborough are included to indicate the main trends throughout the period. (The chronology of the Richborough brooches is related to the history of the site itself in Chapter 6.)

A note on the typology used here appears in Chapter 1. Descriptions of types which are represented at Richborough appear in the catalogue (Chapter 4); rather than repeat these in detail a cross-reference is given here, but the other main types are described, and most are illustrated since the diagnostic features are not always clear, even on types which are represented by drawings in the catalogue.

Chapter 2 has shown that most examples of each type of brooch were usually made of a specific alloy. Here the results of the analyses of nearly 3,500 brooches are used in the discussion of the principal types of Roman-period brooches found in Britain, with particular reference to those from Richborough. The complete list of brooches analysed appears in Appendix 1; in the present chapter statements that 'most of' a particular type are of a certain alloy should be understood to mean 'most of those analysed'.

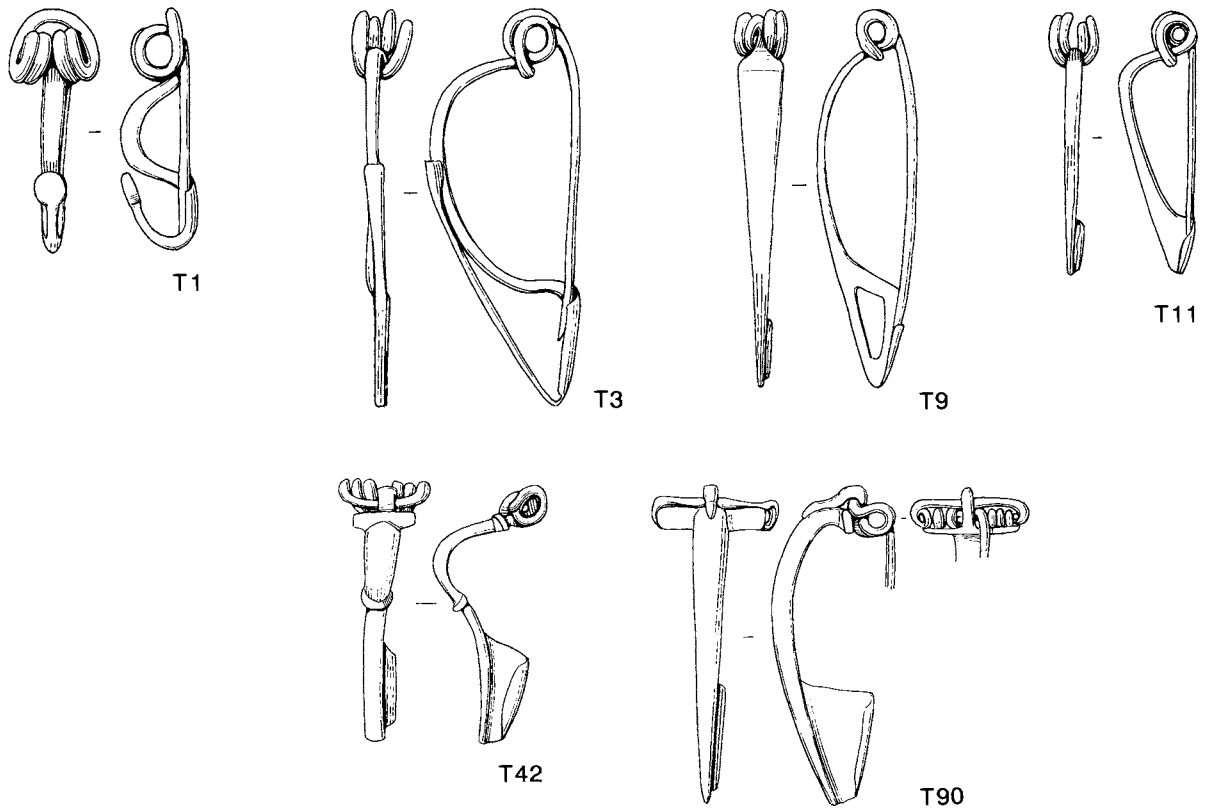
EARLY TO MID-FIRST-CENTURY BROOCHES

ONE-PIECE BROOCHES

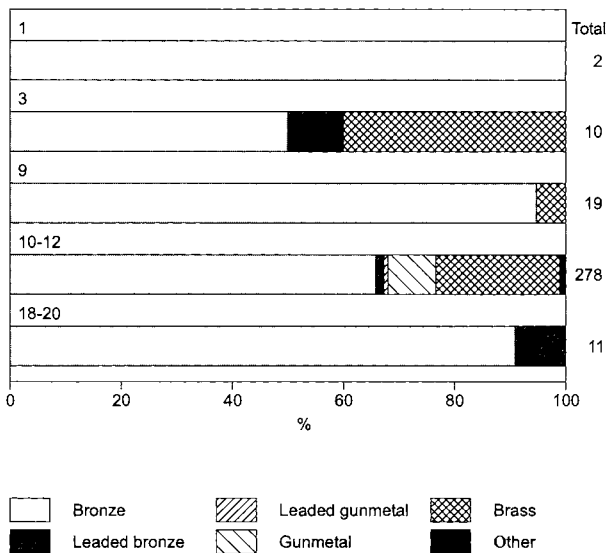
The development of brooches through the first

millennium BC culminated in the form known as the La Tène brooch, which in numerous variants was widespread throughout much of Europe in the second half of the millennium. Essentially it was a single piece of wire twisted in the centre to form a spring; the end of one half was pointed to pierce the garment, the other half was hooped to hold some of the material and its end (the 'foot') shaped to secure the point of the pin; the bow or hoop was often widened and decorated. The conventional outline of its development is: (Figure 107) La Tène I (T1), where the foot is bent upwards, nearly meeting the hooped bow; La Tène II (T3), where the foot is joined to the bow, and La Tène III, where this construction is transformed into a triangular catchplate (for example, T9). Modifications were made at each stage of the design, producing many different types; the La Tène III brooch was the forerunner of numerous brooch types of the first century AD and later, but the main development had taken place before the Roman conquest of Britain.

Analyses of La Tène I (T1) and some La Tène II (T3) brooches show that they are bronzes. So too are most of the Nauheim brooches (T9), a common form of La Tène III on the continent (Figure 108). These all belong to the pre-Roman tradition of metalworking, in which bronze was the normal alloy in use, but there are also T3 brooches (for example, Richborough Cat 32–34) which were made of brass: these are 'pseudo La Tène' types made in the first century AD, after brass came into general use. Although they have the returned foot which is the main feature of La Tène II brooches, these later versions are distinguished by other details of construction: the short spring with inferior chord and



107 One-piece brooches: La Tène I = T1; Pseudo-La Tène II = T3; La Tène III = T9; T11, T42, T90. Scale 2:3



108 Alloys used for some one-piece brooches (T1, T3, T9, T10-12, T18-20)

the arched upper bow, as in the T3 example on Figure 107. These features are shared by continental examples from Roman sites of the first century AD, for example, Vindonissa, Switzerland (Ettlinger 1973, type 3, 39-40), Tiberian-Claudian; at Kempten, Germany, one is from a Tiberian context (Krämer 1957, Tafel 13, 1).

The evidence for later examples from the German forts is outlined by Rieckhoff (1975, 49). At Bolards, France (Fauduet et Pommeret 1985, 67), there are several examples from Neronian deposits. It also occurs in later first-century contexts (cf Riha 1979, 56-7, Augst type 1.4). Feugère illustrates several pages of examples from southern France which serve to show the uniformity of the type (1985, pls 8-17). It is not common in Britain but there are fairly close parallels to the Richborough examples from Colchester, Essex (Hawkes and Hull 1947, no. 2, p 308), and London, Walbrook (Hull forthcoming, no. 2938) with no context dating, and from the Neronian fort at Dodderhill, Worcestershire (Hurst forthcoming).

The term 'one-piece brooches' has been adopted to

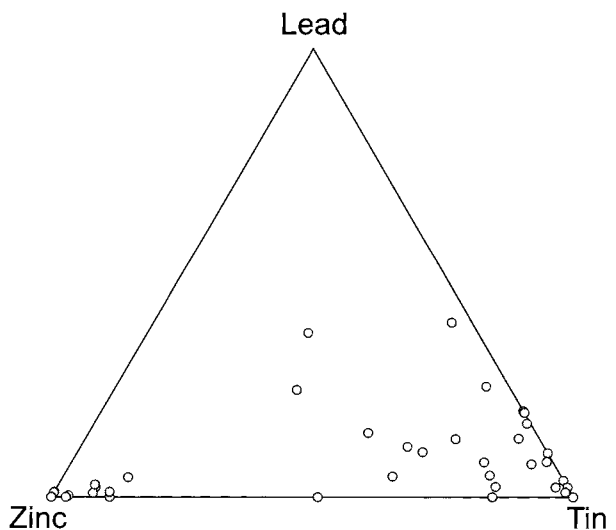
cover a large group of early to mid-first-century variants of the La Tène III form. It refers to the method of forming both pin and bow out of one piece of metal, as described above for La Tène brooches generally. Richborough, a base for the invading Roman army in AD 43, has many of these brooches. By this date the catchplate is usually a plain piece of metal formed out of the main rod, though sometimes perforated. The type known as the 'Nauheim derivative' or 'simple one-piece' (T10 and T11, Figure 107; Cat 1–30) shows the design at its most basic, while the Colchester brooches (T90–91, Figure 107; Cat 46–67) have a short plain crossbar protecting the spring, which can thus be made longer.

Simple one-piece or 'Nauheim derivative' brooches. T10/11 'Nauheim derivatives' are found on the continent but were presumably also made in Britain, where they are abundant. The name has often been thought unsatisfactory for this type of brooch, especially since it seems to belong to a markedly later period than the true Nauheim brooch: the first century AD rather than the first century BC. The term 'simple one-piece British brooches' has been proposed for the whole group but 'Nauheim derivative' has become so widely used that it is retained here. These brooches are very simple (for example, T11, Figure 107), but they can be divided into several groups, some with a restricted distribution and some widespread (Olivier 1988, 36–8).

Finds from Britain show that the general type was in use before the Roman conquest although not so common as it became later. There are two from pre-conquest burials in a cemetery at St Albans, Hertfordshire (Stead and Rigby 1989, 100); at Skeleton Green, in the same county, Group I dating about AD 10–40 contained five 'Nauheim derivatives', two of them iron and some with rod bows (Mackreth 1981, 131). For the period up to and including the conquest, Hod Hill, Dorset, has several: Brailsford 1962, fig 7, C16–21, rod bows with single curve, and C20, C23–6, flat bows with reverse curve; at Colchester the specimens with a dated context belong to the period AD 43–65 and have flat bows (Hawkes and Hull 1947, 312, type VII); at Baldock, Hertfordshire, a distinction between flat (decorated) and rod bows was made, the former suggested to be pre-Flavian and the latter continuing to the end of the first century (Stead and Rigby 1986, 123). At Fishbourne, West Sussex, this is borne out amongst the 'Nauheim derivatives' published by Hull (1971, 100): most of the flat decorated bows come from pre-Palace (but post-AD 43) levels, and most of the rod bows from construction levels of the Flavian palace (about AD

75). The distribution lists for parallels to the Richborough brooches show that sub-type (a), the flat bows, are all from the southern counties while there are several rod bows (b) from the North Midlands and a few further North, for example, Corbridge, Northumberland, and Newstead, Roxburghshire, Scotland (see Appendix 3, pp 241–3, and Figure 168).

The analyses of 'Nauheim derivative' or simple one-piece brooches of T10–11 show that there are two distinct compositional groups, brasses and 'bronzes'. The former is a relatively tight group, most also with a small tin content (Figure 109). The 'bronze' cluster is far less well defined, with higher average lead levels than the brasses. The gunmetals and leaded alloys are outliers to the bronze cluster, being part of the same continuum. The few leaded alloys are all lightly leaded, which is to be expected as these brooches were obviously hammered and bent to shape; the spring depended on the elasticity of the metal for its effectiveness. The brass brooches are a quarter of the total, but attempts to find a correlation with any typological trait have failed though, on some but not all sites where there are relatively large numbers of T10–11 brooches, more of those with rod bows are brass and those with flat bows bronze. This may be related to the origin of these particular brooches since in Germany many rod bows are found and are thought to be



109 Ternary diagram showing the composition of simple one-piece, T10–11, brooches

'soldatenfibeln' (for example, Böhme 1972, type 14, 13–14). However, only a few of this shape occur at Richborough and they are not all brasses.

Other simple one-piece brooches. T18–20

A number of other variants of the La Tène III form occur in Britain, but usually in contexts of the mid-first centuries BC–AD (Stead 1976b). The main, though very variable, features are mouldings on the bow, sometimes an external chord to the spring, a slight trumpet-shaped swelling at the head (T20) and usually an open catchplate. Olivier (1988) adds further examples, some of which come from later contexts. Although most of the finds are from southern Britain there are none from Richborough, which supports the view that they are mainly pre-Roman. Almost all are bronzes (Figure 108) which support this pre-Roman date.

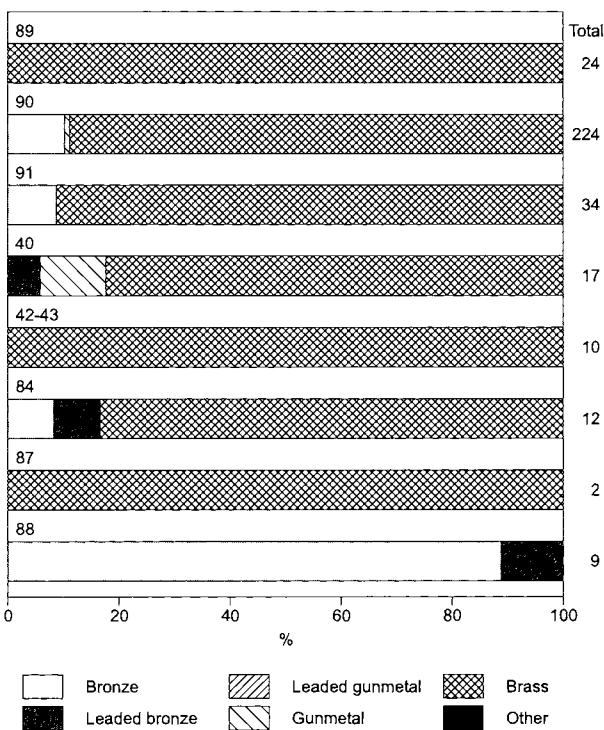
Continental one-piece brooches

More elaborate brooches also employed the one-piece construction, illustrated at Richborough by Cat 35–42 (the 'Eye', T40, 'Knick', T42, and 'Kräftig-profilierter', T84); these are likely to have come with the army since they are common in the forts of the Rhine–Danube frontier, as

are some other one-piece types occasionally found in Britain, T85–87, including the 'anchor' and 'Flügelfibel'. Virtually all examples analysed are brasses (Figure 110). In contrast to these, analysed brooches of T88, which appears to be a British variant of the Flügelfibel, are mainly bronzes. The most famous example is the Birdlip brooch (Hull forthcoming, no. 1317) which has strongly Celtic ornament, but the type includes plainer specimens (Figure 111), for example, Dragonby brooches 2–4 (Olivier with Bayley 1996, fig 11.1 and pp 231–2, where it is named the Beaked Bow type).

In Britain the continental types are relatively rare. Several Eye brooches were found at Colchester (Hawkes and Hull 1947, 320, of which no. 124 is closest to Richborough Cat 35); all were in Claudian levels. A generally similar brooch was found at Baldock (Stead and Rigby 1986, no. 49, 112). They are common in the Rhineland where the series is dated from Augustus to, at latest, Vespasian (Ettlinger 1973, type 17). The few British finds of Knickfibeln, T42 (Figure 107), are mostly from the eastern side of the country as far north as Northumberland (Appendix 3, p 243). This suggests use into the later first century, although in the Rhineland, where these too are common, the earliest are dated to Augustus.

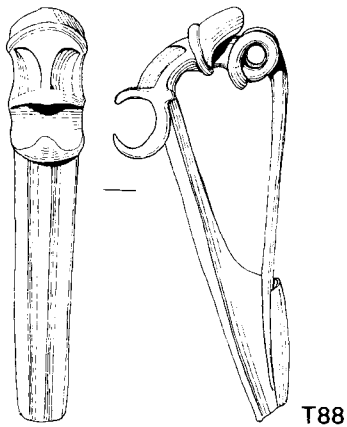
Richborough has four Kräftig-profilierter brooches (T84; Cat 39–42). The type is regarded as of Pannonian origin (Kovrig 1937, 116) and is well known in Claudian forts in the Rhine/Danube provinces, for example, Cambodunum (Kempten) (Krämer 1957, Tafel 14, nos 3–6, 76), and Hüfingen (Rieckhoff 1975, Tafel 2, nos 15–16, type 10, 42–3). Ettlinger illustrates many from Vindonissa, of which nos 4–6 are closest to ours (1973, Tafel 18, type 13). They also occur further north and east, including the region of the Elbe and Oder and in Bohemia (Peskar 1972, Tafel 9, nos 5–9 and Tafel 10, 1–4). They are far less common in Britain where again most come from the eastern side of the country, including examples from Yorkshire and Northumberland (Hull forthcoming), and are of the type with rectangular unperforated catchplate, presumably late in the series. The two analysed examples of this variant (T84C) are the only non-brasses, which suggests they may be British copies of this continental type. Simpson (1979, 330) suggests that the type came to Britain with the Ninth Legion from Pannonia.



110 Alloys used for one-piece brooches with crossbar or expanded head (T89, T90–91, T40, T42–43, T84, T87–88)

Colchester brooches

The term 'Colchester brooch' was used in the Camulodunum report to cover a large group of La Tène III brooches, common in south-eastern Britain, which, unlike the brooches discussed so far, have a small crossbar protecting the spring; the chord is external and



111 Birdlip-type brooch: T88. Scale 2:3

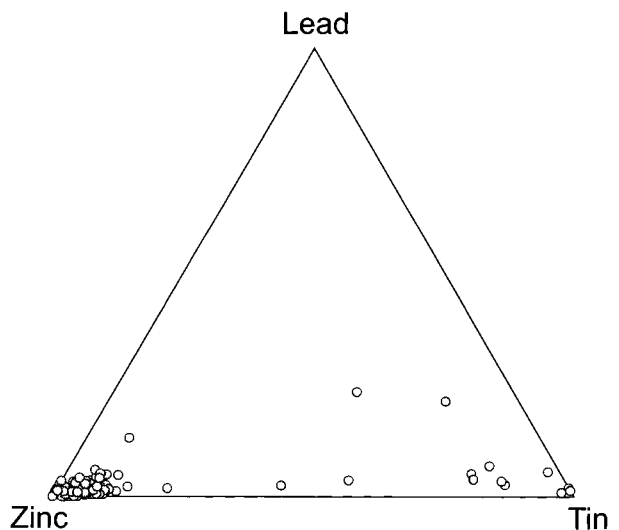
held by a short hook turned back from the top of the bow (T90–91, Figure 107; Cat 46–67; Hawkes and Hull 1947, 308–10). They were derived from a continental form (the ‘Simple Gallic’, T89: Feugère 1985, type 14a; Ettliger 1973, type 9; and Riha 1979, type 2.2) which in the Richborough catalogue is represented by group a) Cat 44–45. The typical British form is seen in group b) of the catalogue (T90; Cat 46–53). This is rare on the continent but was certainly being made in Britain: there were unfinished Colchester brooches found at Baldock (Stead and Rigby 1986, 122–3). These and the smaller brooches in T91 show a number of minor variations, such as the length of the crossbar, the angle of the bow near the head, and the perforation or decoration of the catchplate. Amongst the Richborough brooches these differences are not well defined, although some may prove to be significant, such as the association of bronze with some of those with a sharp angle at the head of the bow.

Examples from St Albans and Skeleton Green (Stead and Rigby 1989, 100–1; Mackreth 1981, 130–7), show that the typical Colchester brooch, T90, was first made before the Roman conquest of Britain, but it clearly continued in use in the middle years of the century (Hawkes and Hull 1947). It is difficult to distinguish features that may belong to the post-conquest period with any certainty, although it does appear from St Albans, for example, that the fretted catchplate was common in the earlier period; Richborough has few of these.

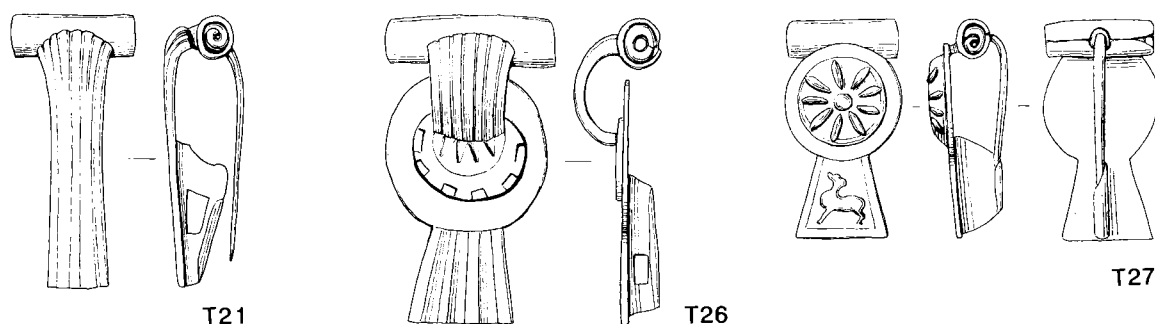
In view of the lack of pre-Roman occupation at

Richborough there is little doubt that the simple one-piece and Colchester brooches are associated with the army there. At present it is impossible to determine where they obtained these brooches, although it may be noted that Richborough provides some exceptions to the general alloy pattern: while most Colchester brooches are made of brass eight out of twenty-four from this site were of other alloys, though none are leaded (Figures 110 and 112). This is surprising, since Richborough might have been expected to show the characteristic brass of the continental brooches of this period. Brass is rare amongst the various Colchester-derivative types (see below) and it appears that much of the brass that was in use in the early to mid-first century had been removed from the pool of metal available to craftsmen by the time these later brooches were being made. Bayley (1990) suggested this was due to a shortage of brass for making coins, though recent work by Dungworth (1996) has shown that the pattern of debasement of the brass coinage does not fit this hypothesis. The lack of brass, for whatever reason, led to the use of other alloys and the non-brass Colchester brooches from Richborough may represent the early products of this period of experimentation and change.

All the one-piece brooches have been grouped together in the catalogue, rather than following Hull, whose Group 1 includes some early hinged brooches along with the Nauheim-derivatives, and who relegated the one-piece brooches with a crossbar (the Colchester



112 Ternary diagram showing the composition of Colchester, T89–91, brooches; the non-brass examples are all T90



113 Brooches with cylindrical spring-cover: T21, T26, T27. Scale 2:3

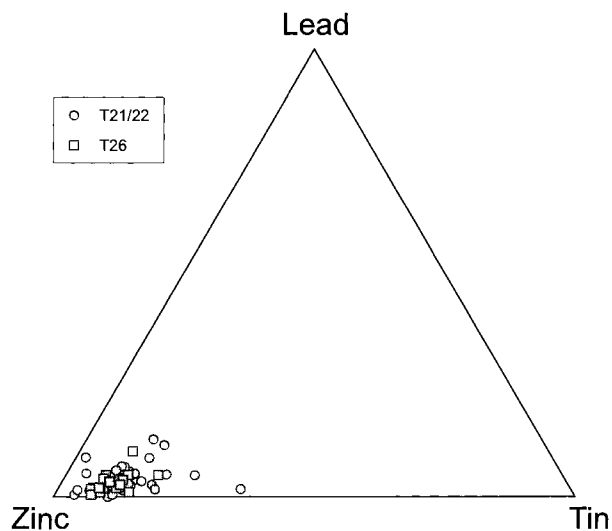
type) to form part of his Group 5, because apart from similar construction they all share the same chronological bracket: in Britain they are commonest in the middle years of the first century AD.

BROOCHES WITH CYLINDRICAL SPRING-COVER

The first-century brooches with cylindrical spring-cover (Figure 113) are hardly represented at Richborough, apart from the fragment of a Nertomarus brooch (T22A; Cat 72). This belongs to a subdivision of the Langton Down type which is rather scarce in Britain; examples come from Bagendon, Gloucestershire (Hull 1961, no. 38, p 176), St Albans, in a burial of about AD 40–60 (Stead and Rigby 1989, 95; although Mackreth (1995, 974) contends that it is earlier), and Fishbourne, from a pre-AD 75 context (Hull 1971, no. 28, p 100). On the continent the type is most abundant in eastern France and western Switzerland and is dated to the first half of the first century AD (Feugère 1985, type 14b2; Ettliger 1973, type 22; Riha 1979, type 4.3).

The principal types with cylindrical spring-cover are the Langton Down (T21, variants T22), and Thistle or Rosette brooches (T25–27, Figure 113). These are usually well-made cast brooches, some with elaborate relief decoration; they are always brasses with minor amounts of tin, though in a few cases the tin content is high enough to class the alloy as a gunmetal (Figures 114 and 117).

They have a wide distribution in Gaul and on the German frontier but are also represented in southern Britain (especially numerous in the King Harry Lane cemetery at St Albans, Stead and Rigby 1989, 101). It may be that they were going out of use by the time of the conquest, although several have been found in post-conquest deposits in Britain, for example, at Colchester (Hawkes and Hull 1947, 314–16). Perhaps the period of



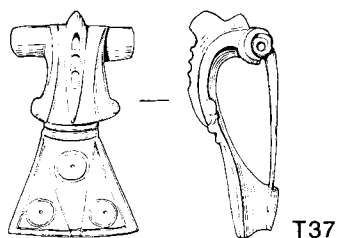
114 Ternary diagram showing the composition of brooches with cylindrical spring-cover

use of these particularly fine brooches tended to be longer because they were more carefully cherished; they have often been found in burials, for example, St Albans (see above) and cemeteries in Normandy (Dollfus 1975, 102).

HOOKE NORTON AND RELATED TYPES

The continental rosette brooch seems to have been the distant model for a number of British brooches which, because of their scattered distribution and diverse forms, seem to emanate from several workshops. These brooches (T31, T33–35, T37–38, Figure 115) include both the richly decorated Aesica brooch and some fairly plain examples. They employ several methods of

attaching the spring, all appropriate to the mid-first century, and some are hinged. The common features are some form of expansion on the upper bow and a broad, usually triangular, foot. Their composition is distinct from the true rosette brooches, with most made of leaded or unleaded bronze (see Table 7). Mackreth (1982) suggests that they represent local attempts to meet a demand for rosette brooches outside either the area or period of their distribution.



115 Hook Norton-type brooch: T37. Scale 2:3

EARLY HINGED BROOCHES

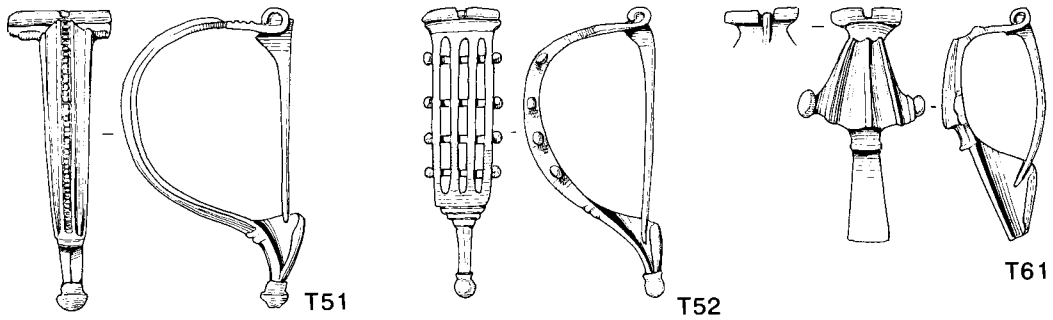
The army almost certainly brought the most distinctive brooches of the early hinged group: the Aucissa, its derivative the Bagendon, and the Hod Hill. The common feature of all these is that the pin is hinged in a narrow headtube formed from the top of the bow rolled forward above the headplate (Figure 116). Zinc-rich alloys predominate for these types (Figure 117); see further discussion below.

The Aucissa (T51, Figure 116; Cat 74–92) has a highly arched upper bow and a small plain lower bow with finial. The type is found very widely throughout the Roman Empire, and is known by the name stamped on a few of the examples from most areas. Other names are found, especially in Pannonia. From its appearance on many military sites it is plausibly supposed that it originated as a ‘soldiers’ brooch’ and that this accounts for its wide dissemination; however, it is also often found in non-military contexts and is presumed to have been copied by local manufacturers. On the continent it is found in legionary forts of the Augustan campaigns in Germany and in others of the mid-first century AD: the evidence is summarized by Ettlenger (1973, 93–4). A remarkable degree of standardization is indicated by its wide distribution in contexts covering a period of some

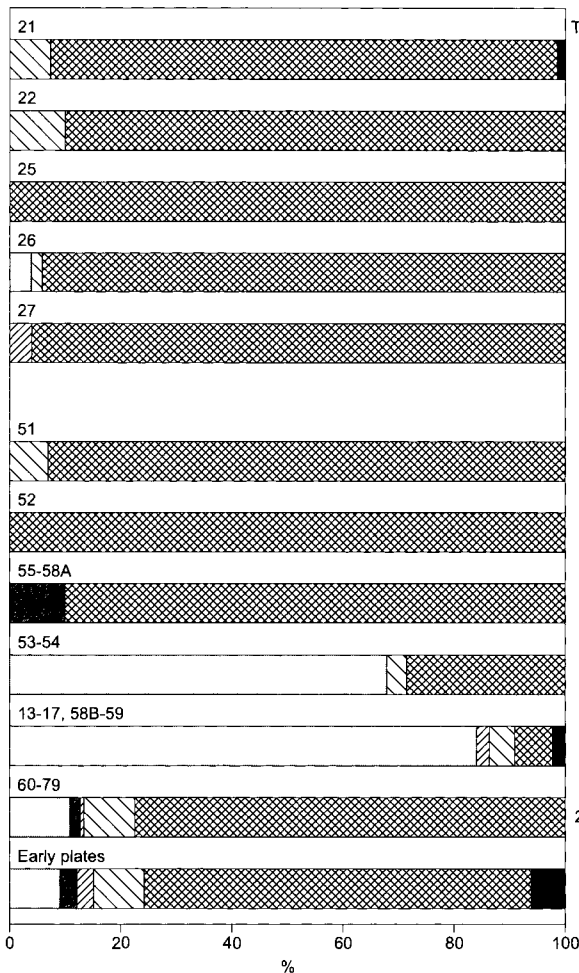
seventy years with relatively little variation of form. In Britain it seems to have arrived with the Roman army in AD 43 and to have spread over the territory conquered in the first phase (that is, to AD 70). A few are known from pre-conquest sites, for example, Skeleton Green (Mackreth 1981, 134–5), but there are more from Colchester where the examples from dated contexts are all from the period AD 43–61 (Hawkes and Hull 1947, type XVII). It is common in the South and Midlands but is rarely found north of the Humber–Severn frontier (see list in Appendix 3, pp 245–6, and Figure 166). The brooches found at Richborough are nearly all of the standard type, including one carrying the name Aucissa (Cat 74), but Cat 86 is a plainer variant which has been suggested as a later product on the continent (Rieckhoff 1975, no. 28, p 47).

The Bagendon type (T52, Figure 116) has a more gently arched and broader upper bow which in the standard type is divided into several ribs and threaded by transverse iron rods; the Richborough example, Cat 93, is merely ribbed and has side lugs imitating the ends of the rods. The type is usually treated as a variant of the Aucissa (for example, Ettlenger 1973, Tafel 9, nos 13 and 14, p 98), with a similar date range: Augustus–Nero. It is much less common although occasional examples occur in most of the western provinces. Fairly close parallels for the Richborough sub-type occur at Augst, Switzerland (Riha 1979, Tafel 28, nos 734–6, two of them with a coin of Tiberius), Mandeure, France (Lerat 1957, pl 4, no. 63), and Nijmegen, the Netherlands (van Buchem 1941, pl x, no. 7). In Britain a similar brooch was published by Hull in the Bagendon report (Clifford 1961, no. 54) with a parallel from Silchester, Hampshire. Since then it has occurred at Old Winteringham, Lincolnshire (Stead 1976a, no. 9, 198, Neronian–early Flavian), Hayling Island, Hampshire (Soffe forthcoming), and Kelvedon, Essex (Rodwell 1988, no. 27, p 57). In spite of the Tiberian coin at Augst it seems unlikely that this rather devolved sub-type begins so early as the distinctive main type; in Britain it does not occur on any of the main pre-conquest sites except Bagendon, where the early date has been questioned. A date towards the end of the Aucissa’s period, that is, in the third quarter of the first century, seems most probable.

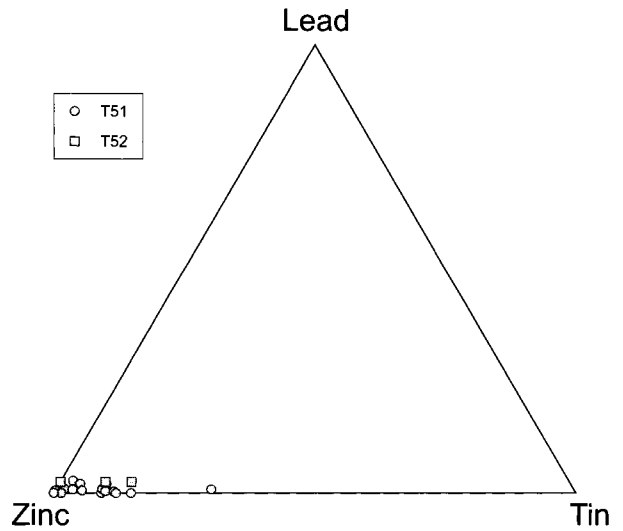
The Aucissa and Bagendon brooches are made of high zinc brass with minor amounts of tin, though a few have sufficient tin to be recategorized as gunmetals (Figures 117 and 118). A few copies of these types (T53, Figure 119) are known, combining Aucissa-like treatment of the bow with a head rolled backward (see below); they are made of both brasses and bronzes (Figure 117).



116 Early hinged brooches (continental types): T51, T52, T61. Scale 2:3



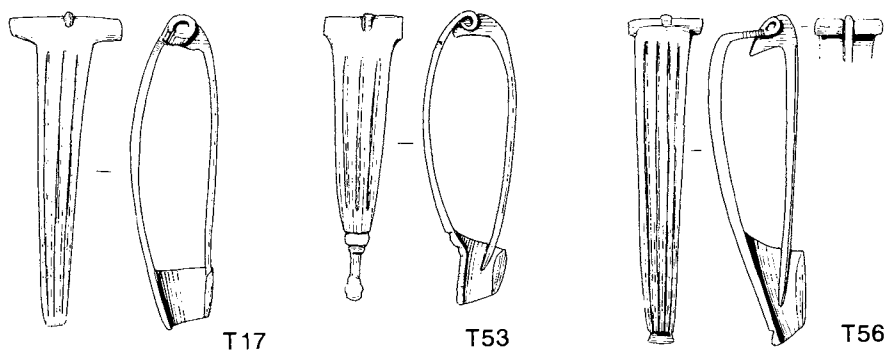
117 Alloys used for cylindrical-headed (T21-22, T25-27) and early hinged brooches (T13-17, T51-52, T55-58A, T53-54, T13-17, T58B-59, T60-79, early plates)



118 Ternary diagram showing the composition of Aucissa, T51, and Bagendon, T52, brooches

The Hod Hill group of brooches exhibits great diversity, especially in the broad view taken by Hull, who defined nearly twenty types (T60-79). The profile of the bow, either gently arched near the head or straight, with a marked angle at the head, distinguishes them from the preceding types, but like those there is usually a change of outline somewhere near the middle of the bow. Type 61 is typical (Figure 116).

The general group known as Hod Hill in Britain is more numerous on the continent and has been exhaustively classified on the basis of the large collections available there (for example, Ettliger 1973; Rieckhoff 1975; and Riha 1979). Even so the British examples do not all find close parallels in those



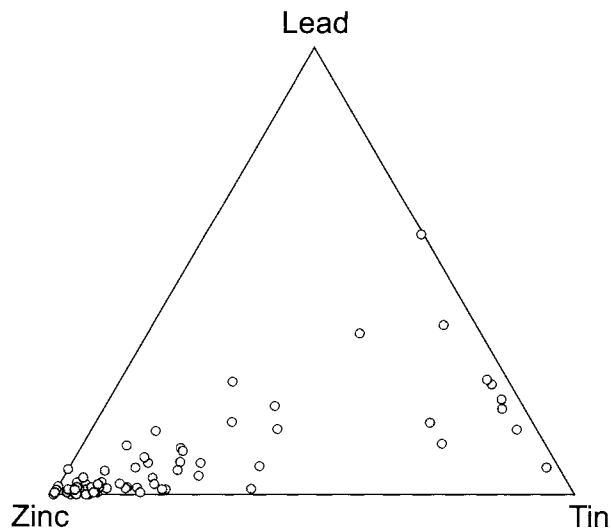
119 Early hinged brooches: strip-bow brooches (British types): T17, T53, T56. Scale 2:3

catalogues. This may be simply because of the very great diversity in manufacture or because some were being made in Britain. The groups used in classifying the Hod Hill brooches from Richborough (Cat 95–153) have been defined to correspond broadly with those of Ettlinger and Riha but do not distinguish all their types since some of these seem not to be relevant here.

There is little doubt that the Hod Hill group reached Britain in the conquest period. There are none from pre-conquest burials at the King Harry Lane cemetery of St Albans (Stead and Rigby 1989), but they are numerous at Hod Hill itself (a Dorset hillfort, Brailsford 1962), and in Claudian–Neronian contexts at Camulodunum (Colchester, Hawkes and Hull 1947, type xviii, 323–5). The middle years of the first century AD are also the *floruit* for our groups a) and e) on the continent (for example, Ettlinger 1973, type 34), but there the types corresponding to our groups b), c) and d) are all held to be later. Group b) appears at Camulodunum but not at Hod Hill, c) is lacking at Camulodunum and Hod Hill (whether because it is later here or because it is rarer remains to be seen), however, d) has been found in a context of AD 44–9 at Sheepen, Colchester (Niblett 1985, fig 75, no. 37). Only a few Hod Hill brooches have been found north of the Severn–Humber line (Figure 167) and in Britain the type is unlikely to have remained in general use after about AD 70, or possibly earlier. (Lists of parallels for the types present at Richborough are given in Appendix 3, pp 246–8).

In comparison with the Aucissas, the Hod Hill brooches are far more diverse in composition, as in form. Most were tinned, at least in part, and a few were decorated with niello or enamel. In composition they range from bronze to brass, but with a concentration at

the zinc-rich end of the spectrum (Figure 120); here the gunmetals appear to be outliers to the brass distribution while the bronzes are discrete. Despite the range of subtypes and compositions there is apparently no correlation between them. It appears that the makers' intention was to produce a brass brooch but that they were not always careful or able to use the right alloy; perhaps if the brooch was to be tinned it did not matter, as little if any of the bulk metal would show. When new some of these brooches must have had a quite striking bichrome effect – parcel-tinned brass would have looked as dramatic as parcel-gilt silver – and wire inlays gave a few a polychrome effect (see Table 15; and Cat 95, Cat 114–115).



120 Ternary diagram showing the composition of Hod Hill, T60–79, brooches

Many simple hinged brooches with strip bow (Figure 119) seem to be of British origin, to judge by their distribution. In T13–17 and T58B–59, most of which come from central southern England, the axis bar is held by rolling the head of the bow backwards (for example, Maiden Castle, Dorset, Wheeler 1943, fig 84, nos 17–27, several from contexts of about AD 25–70). Others, T55–58A, have the same formation as the Aucissa and Hod Hill brooches – the head rolled forward round the bar; there is one example at Richborough, Cat 159, which is a brass. Most of the first group are bronzes, in the older Iron Age tradition (they were also commonly made in iron) while most of the strip bows influenced by the Aucissa and Hod Hill types also share their preferred alloy, normally brass (Figure 117). This may well reflect a chronological distinction, the simple bronze strip bows of T13–17 being mainly pre-conquest (which would explain their absence from Richborough), and those influenced by brooches arriving with the Roman army being later. However, other brooches with bow form influenced by the Aucissa or Hod Hill types (T53–54) still use the older head construction. Over half are bronzes and should perhaps be seen as the products of native craftsmen copying the form but not the functional detail of the hinge on the newly introduced types.

CONQUEST-PERIOD PLATE BROOCHES

A few plate brooch types can be ascribed to the mid-first century; by style and decoration they seem related to continental bow brooch types such as the Hod Hill, and thus to ‘Roman’ influence. They are represented at Richborough by Cat 340–349. Their alloy composition also compares well with the bow brooches: see Figure 117; most are tinned, like the Hod Hill brooches.

Richborough Cat 340, T224, has a central setting of blue glass, held by an overlapping metal foil; a fragmentary example with blue glass setting attached in the same way was found in period III (AD 44–9) at Sheepen, Colchester (Niblett 1985, no. 41, p 116); a more complete example from Colchester, with repoussé decoration, has been published (Crummy 1983, no. 77, p 17). Two were found on the temple site at Hayling Island (Soffe forthcoming); one came from Rotherley, Wiltshire (Pitt-Rivers 1888, pl CII, 14). They are also known on the continent, including one from a Tiberian context at Kempton (Krämer 1957, no. 18, Tafel 15) and a Claudian context at Hofheim, Germany (Ritterling 1913, Tafel 10, 253). Richborough Cat 341, a lozenge-shaped plate, has a setting of amber glass held in the same way, but here the applied plate is in turn held by

overlapping lugs at the corners. The same construction is seen in two brooches from Essex: Sheepen (Niblett 1985, no. 42, 116, blue glass, with triangular foot, from period VI, AD 60–5) and Chelmsford (Wickenden forthcoming, no. 32, greenish glass). Another example from Chelmsford is exactly the shape of the Richborough brooch, and has similar lugs, undercut to hold the missing plate (in a pre-AD 100 votive deposit at a temple site, Butcher 1992, no. 25, pp 72–3). Several disc brooches with a central glass setting and overlapping plate have been found at Augst, one in a Claudian context (Riha 1979, no. 1574, p 185, also Tafel 59), but they do not have the lugs to clip the plate.

Richborough has four examples of T225, a thin cruciform plate with a central circular motif (Cat 342–345). These belong to a type which appears in several Roman provinces: listed in Feugère (1985, 345–7) (more recent finds do not add to the area of distribution). Some of those from Augst (for example, Riha 1979, no. 1532, p 182) are described as having red enamel in the central circular motif, as in the example from Colchester (Hawkes and Hull 1947, no. 165, p 325). None of the Richborough examples has a sinking deep enough to hold enamel but it is possible that they had studs of glass or other material, riveted in place, although all but Cat 345 seem unsuitable for this as the recess is very shallow and partly taken up with beaded decoration. Two of the Augst brooches were from deposits of the second quarter of the first century AD, that from Colchester was dated AD 50–60, and others come from Claudian and Flavian deposits.

Two small disc-shaped brooches with looped attachments (T242A; Cat 346–347) may have had enamel rather than a glass setting, though the tin-rich material surviving in the latter is more likely to be the remains of a solder. Several very similar brooches are known; in his report on Cat 346 Hull referred to one in Colchester Museum in which ‘the projections are clearly vases, with a snake rising from each and forming the loops’ (1968a, 88). This has since been published (Simpson 1979, no. 20, p 333). Similar ones from Augst were described as acorns with tendrils (Riha 1979, 197–8, notably Tafel 66, no. 1705, which looks very like the Colchester brooch; this had the remains of a metal plate in the disc, described as possibly silver). They have been found elsewhere on the Rhine–Danube frontier, several in Claudian contexts.

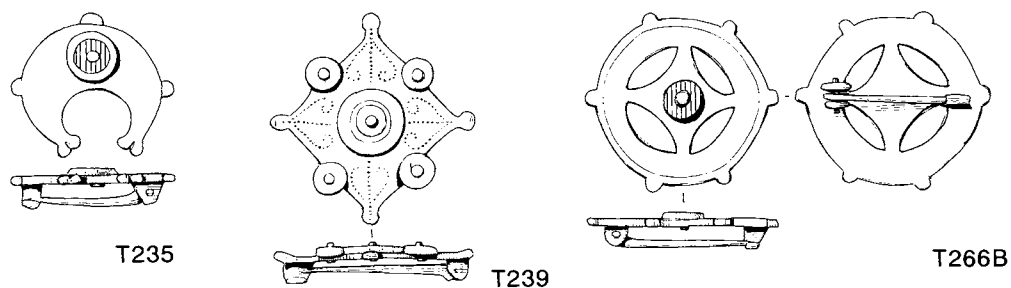
Two Richborough brooches (Cat 348–349) belong to T238, which is usually regarded as a degenerate version of the standard rosette brooch with cylinder at the head containing a spring (T27, Figure 113). Those

commonly had a highly ornate applied plate, and a few of the present type have been found with a similar plate: for example, from Normandy (Dollfus 1975, nos 260–1, pp 145–6), also one from Bingen, Germany (Behrens 1954, abb 8 no. 2, 230). Most have been found without the plate: for example, Augst no. 1583 (Riha 1979, 186, and others listed there). Apart from the Augst brooch, which was found with pottery of the second half of the first century, there is very little dating evidence, but they are presumed to follow the main rosette series and should thus belong to the middle of the first century. The use of brass to make them supports this.

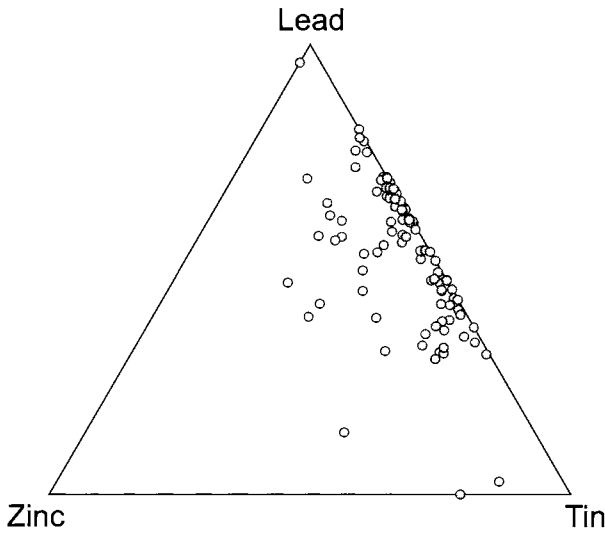
Other types (some shown on Figure 121) are T235, pelta or crescent-shaped (for example, Colchester, Hawkes and Hull 1947, pl 98, nos 170–3, from contexts AD 43–65); T239, usually rosette- or lozenge-shaped, with elaborate engraved decoration and riveted attachments (Augst, Riha 1979, Tafel 59, no. 1567; Woodcock Hall, Norfolk, Brown 1986, fig 23, no. 163); some of T266B, wheel-shaped, for example, Lockleys, Hertfordshire (Ward Perkins 1938, fig 2, no. 2, from the Belgic occupation material), Colchester (Hawkes and Hull 1947, nos 176–7), and Hod Hill (Brailsford 1962, fig 11, F4). All these are thin flat plates, tinned, usually with fine engraved decoration and sometimes with niello or studs of glass or organic material (bone where identified). Some of these studs are riveted but others are held in place by repoussé-decorated metal foils soldered on to the main plate, as on T224. True enamel is rare on these early plate brooches; it is suggested at Augst (T225 above). The distribution of these types, though sparse, is fairly general on the continent, so that there is no reason to suggest British manufacture. Dated contexts are mainly mid-first century AD; it looks as if these brooches are the ‘fore-runners’ of the major production period of Roman enamelled plate brooches in the later first to early third centuries (Spitaels 1969, 34–56).

COLCHESTER-DERIVATIVE BROOCHES

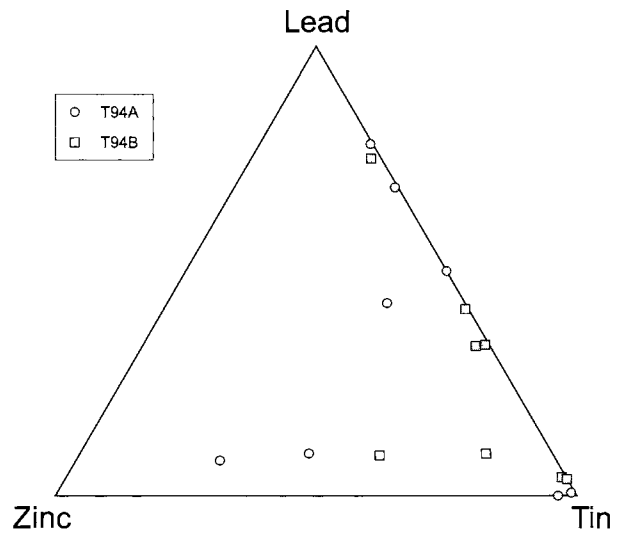
A large group of brooches that is undoubtedly British in origin is that known as ‘Colchester-Derivative’. Although the bow and crossbar often resemble those of the true Colchester (T90–91) there is a radical difference in the spring and pin assembly which is now made separately. This change is marked by a significant change in the alloy used: most one-piece Colchesters were made of brass, while the majority of the two-piece brooches were of leaded bronze (Figure 122), with a high lead content (T92–93: median value 12.1 per cent, Figure 183). The change from one-piece construction was probably a result of the reduced availability of brass. As has been mentioned above, this seems to have led to a period of experimentation with brooches that superficially looked similar but had a number of different designs for the pin and spring attachment (see Chapter 3). It is tempting to see the unleaded bronze examples as the products of the first phase of re-design and a return by native craftsmen to their traditional alloy. Nearly 16 per cent of two-piece Colchesters (T92–93) are unleaded bronzes but 60 per cent of the ‘dolphin’ brooches of T94A are unleaded bronze, suggesting that this type is the prototype of two-piece Colchesters (Figures 123–124). As development proceeded, the benefits of adding significant quantities of lead to the alloy became apparent and leaded bronze became the preferred alloy for two-piece Colchester brooches (Figure 122) and the various T-shaped brooches which are slightly later in date (Figure 125). The ready availability of lead in large quantities from the lead-silver mines on Mendip and elsewhere may have been a factor in the development of the new alloy; the economic benefits of adding up to 25 per cent of this metal to the melt would have been noticeable, and its greater fluidity would have eased the change from wrought work to casting as the main method of brooch fabrication.



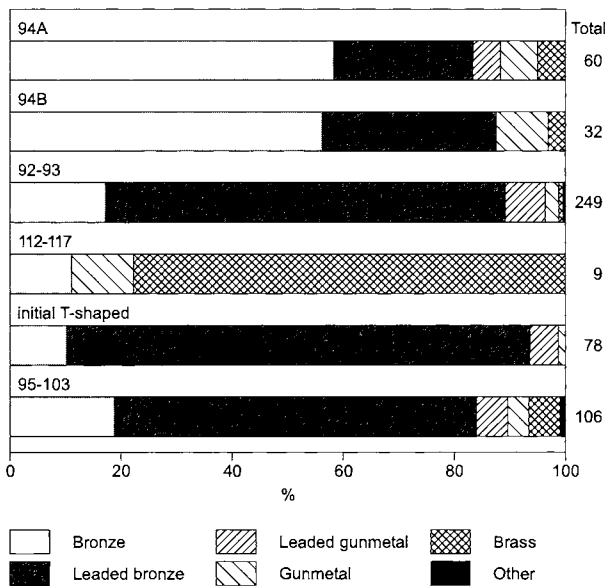
121 Early plate brooches: T235, T239, T266B. Scale 2:3



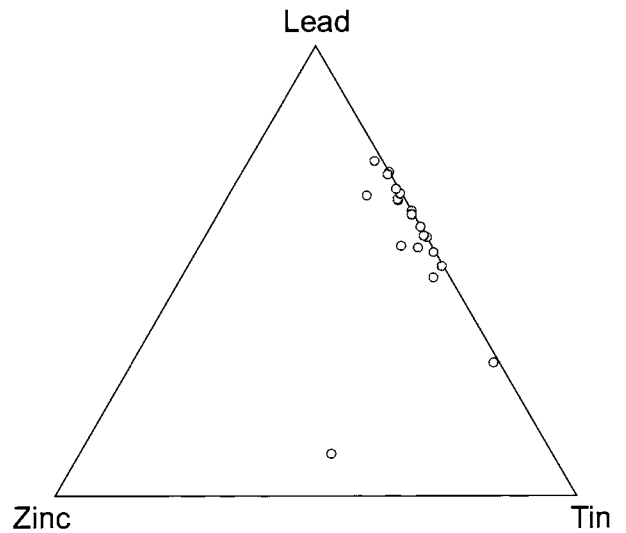
122 Ternary diagram showing the composition of Colchester-derivative, T92-93, brooches



124 Ternary diagram showing the composition of Dolphin, T94, brooches



123 Alloys used for T94A, T94B, T92-93, T112-117, initial T-shaped and T95-103 brooches



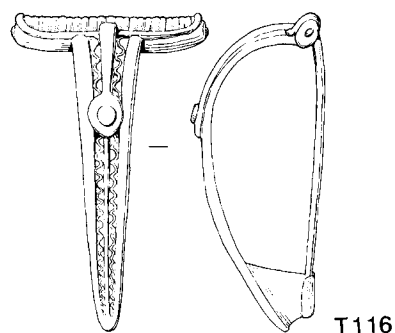
125 Ternary diagram showing the composition of 'initial' T-shaped brooches

The suggested prototype of the Colchester-Derivatives (T94A, Figure 127) had a very inefficient method of attaching the separate spring: it is only held by a hook projecting from the back of the head and consequently most examples have lost their spring (see, for example, the many brooches from Woodcock Hall, Brown 1986, figs 14–15) although one end of the spring was sometimes held by solder, possibly a repair (Mackreth 1991a, 122–3; see also Chapter 3, p 32). The type appears in post-conquest groups dated AD 49–65 at Colchester (Hawkes and Hull 1947, 311) and is most common in East Anglia where Mackreth associates it particularly with the Iceni (1996, 300). Richborough has none of these sprung examples but there are two of T94B (Cat 206–207 and Figure 127) which are very similar except that they are hinged, and these are both leaded bronzes. There are unleaded examples elsewhere, but the distribution includes more northern sites (see Appendix 3, pp 251–2) so that it is possible that this version continues rather later.

The best known Colchester-Derivative is sometimes known as the ‘two-piece Colchester’: T92–93 (Figure 127; Cat 160–201; Hawkes and Hull 1947, type IV, 310–11), in which the separate spring/pin assembly is attached to a lug behind the head; this has two holes which hold the chord of the spring and the axial bar through it and it is prolonged over the top of the bow to form a crest. Very large numbers of these brooches have been found, particularly in eastern counties of England, but they are rare north of the Humber–Severn line, which supports their mid-first-century dating. At Colchester (Hawkes and Hull 1947) they occur in the period AD 50–65, and at Richborough Cat 164 and Cat 167 were in Claudian site groups. Several were found in similar dated contexts at St Albans (Wheeler and Wheeler 1936, no. 22, p 207; Frere 1972, nos 6 and 8, p 114; Frere 1984a, no. 21, p 23). In the Richborough catalogue they have been divided into several sub-groups: a) and b), the principal groups, have a similar distribution and dating (see lists in Appendix 3, pp 249–51); there are fewer examples of c) and d) but they come from the same general area, of which Essex and Hertfordshire seem to be the core. Other sub-groups, which do not appear at Richborough, are mainly found in southern and western Britain; one exemplified at Uley, Gloucestershire (Butcher 1993b, fig 123, no. 10), has a plain tapering bow and comma-shaped profile; many of these were found at Wanborough, Wiltshire (Butcher 2001, figs 20–22, nos 68–79, 81–6). They have the same lug with two holes for the spring and chord as the standard T92 and are presumably a local product, contemporary with the main type.

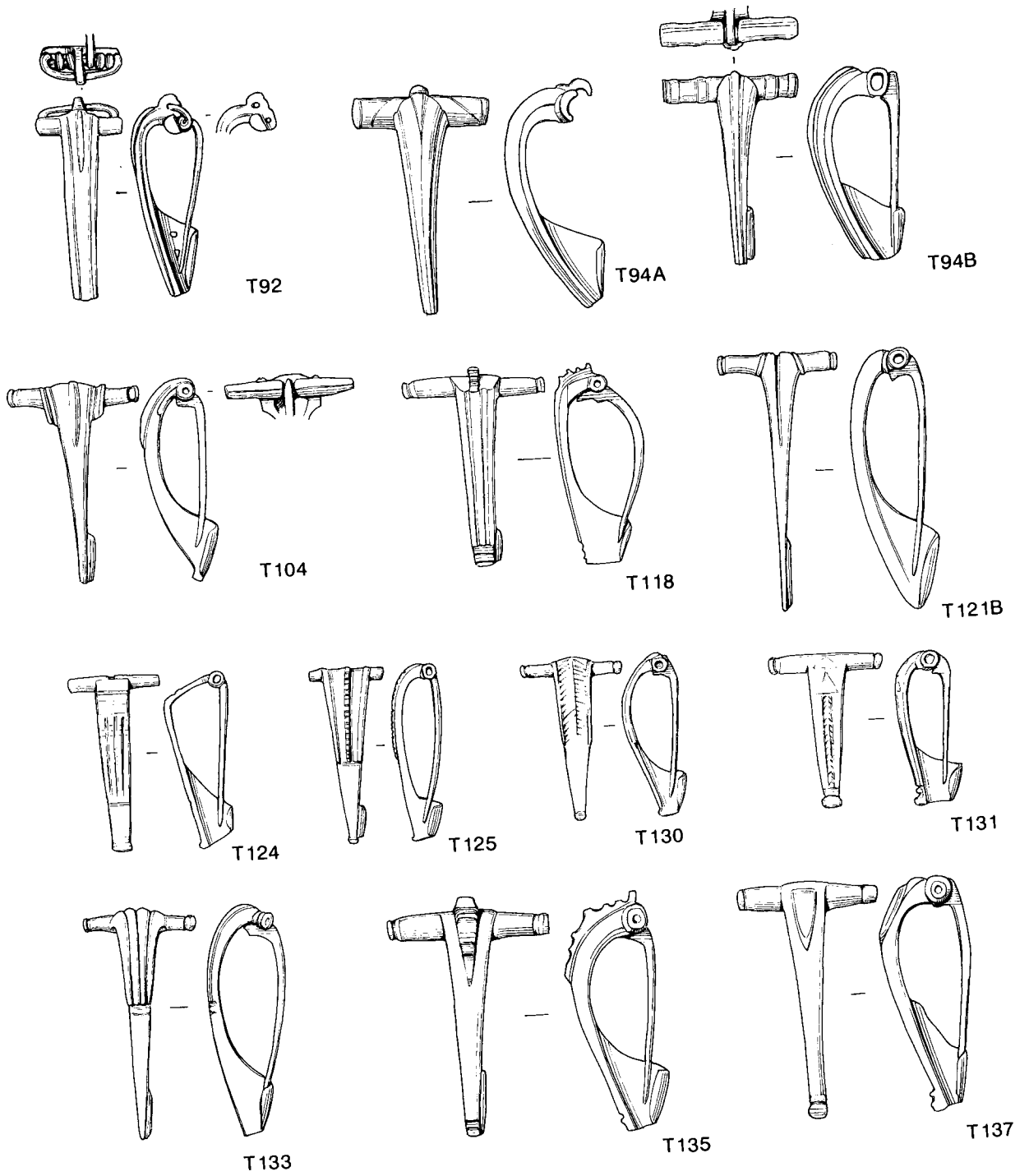
APPLIED HOOK BROOCHES

The ‘Applied Hook’ series (T112–117, Figure 126) was included by Hull in his Group 7, T-shaped brooches, but they are quite different in both form and composition from the other T-shaped brooches, which are dealt with below, and seem to fit in here as part of the initial development of British-made brooches. Usually they have a long spring (or an imitation spring when hinged) held both by the ends of the crossbar bent back and by the chord passing under a thin metal plate attached to the crossbar by one or more rivets. This attached plate is very distinctive and is present even on hinged brooches. Examples occur at Hod Hill (Brailsford 1962, fig 10, nos C100 and C101) and the type was first discussed by Hull in the Camerton report (Wedlake 1958, 219–21); more recently by Mackreth with reference to some devolved specimens at Exeter (1991b, 232). Hod Hill shows that the type had developed by the mid-first century and the Devon examples should belong to the third quarter of the century (cf Maxfield 1992, no. 1, p 81). The distribution is centred in Dorset and Somerset and it appears that the distinctive riveted plate is a local invention. Most of those analysed are brasses (Figure 123) and have very low lead contents, unlike most of the early to mid-first-century British brooch types which are normally bronzes (Figure 117).



126 *Applied Hook brooch: T116. Scale 2:3*

All the types mentioned so far occur mainly in the area of Britain occupied in the first years of the Roman conquest, that is, the south and east, up to the Humber–Severn line; few examples have been found further north and west. Many of them originate on the continent, although it remains possible that some Hod



127 Colchester-derivative brooches: T92, T94A and B; 'initial' T-shaped brooches: T104, T118, T121B, T124-125, T130-131, T133, T135, T137. Scale 2:3

Hill and other continental types may have been made in Britain also: the numerous native Colchester and Colchester-derivative brooches show that a brooch-making industry was flourishing in Britain.

BROOCHES OF THE FLAVIAN PERIOD AND THEIR SECOND-CENTURY DEVELOPMENTS

The Flavian period (AD 69–96), during which the army moved further into Wales and the northern half of the country and left the lowland South in civilian hands, brings a major development in the production of brooches in Britain. This is the period when brooches were in most general use here and were produced in the greatest variety, apparently in a number of centres, some with an almost entirely local distribution. There were still some imports, such as the enamelled descendants of the Hod Hill shape (Cat 154–157) and a few early symmetrical plate brooches (below), but the standard types imported during the previous period largely disappear. These, however, were the origin of most of the new British designs, having introduced the hinged construction and the idea of enlarging the surface of a bow brooch to accommodate decoration. As will be seen, most of the types which proliferate in the Flavian period may well have originated earlier, but the evidence for this is limited to a few dated finds.

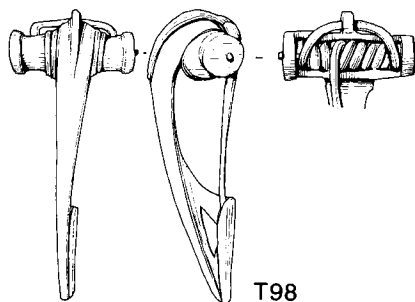
INITIAL T-SHAPED BROOCHES

The ‘Colchester-derivative’ now contributes to many different types, some of them including both sprung and hinged versions. The ‘T-shaped’ brooches, most of which appear to have been made in the West Country, form the largest group; there are only two at Richborough, Cat 223–224. Figure 127 shows a selection of these south-western T-shaped brooches. It is proposed to distinguish an ‘initial group’ from later developments as being usually hinged, not enamelled but sometimes with fine relief decoration, and lacking a headloop. In Hull’s typology they are T104, T118, T121B, T123–125, T130–131 and T133–137. Dating evidence comes from a T104 at Kingsdown Camp, Somerset, in a Flavian or earlier context (St George Gray 1930, fig 5, E3), and another at Caerleon, Monmouthshire, also Flavian (Wheeler 1928, fig 13, no. 4); a sprung T118 in a burial with Flavian samian but possibly later glass at Baldock (Stead and Rigby 1986, fig 27, no. 4), and a related hinged brooch from a late first-century burial at Neatham, Hampshire (Hull 1986, fig 70, no. 1); and T133 at Camerton, Somerset, in a context dating AD 55–90 (Wedlake 1958, fig 53, no. 43). There are several

from Nornour in the Isles of Scilly (Hull 1968b, nos 4–5, 47, 52–63, and 72–8); almost all those analysed were made of leaded bronze (Figure 125). Other types clearly related to them, but incorporating features derived from the Polden, trumpet and headstud groups will be described after those, as ‘Developed T-shaped brooches’.

POLDEN HILL BROOCHES

The series known as ‘Polden Hill’ (T95–103, Figure 128; Cat 208–215) are mainly sprung brooches. They were named after a rather exceptional brooch from the Polden Hill hoard, Somerset (Brailsford 1975, fig 6A, 228), which exhibits the distinctive method of attaching the spring: it is carried in a semi-cylindrical crossbar which has closed ends to secure the axial rod, while the chord is held by a hook or crest on the head. This ‘belt and braces’ security might be seen as a reaction from the weakness of T94A above, where the spring was only held by a hook on the head. In the Richborough catalogue the main subdivision has been made between (a) Cat 208–210, which are closely related to T94, having similar bow shape and decoration, and (b) Cat 211–215, those with a much heavier rounded head and new forms of decoration. The name ‘Dolphin type’ has sometimes been used to describe the latter, but can be confusing since Hull used the name for some brooches of his T94 (for example, Crummy 1983, fig 6, nos 56–60, p 12) which have the same profile in less developed form and this usage has been followed in this volume. Compositionally these brooches are similar to the Colchester-derivative brooches of T92–93 (Figure 123 and cf Figures 122 and 129). In contrast to T94 there is a concentration at the lead-rich end of the bronze-leaded bronze continuum (Figure 183 and cf Figures 124 and 129). The few brasses are rather purer than those of T94 but are not associated with any



128 Polden Hill brooch: T98. Scale 2:3

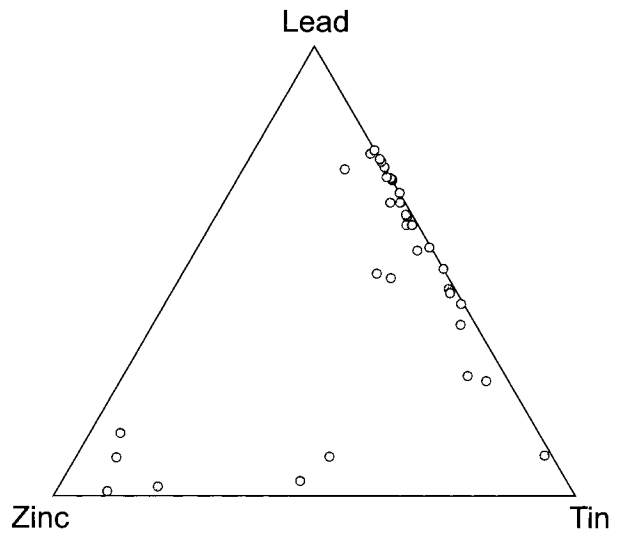
particular type. Brooches of T97, classified as 'light and slender' by Hull, appear to be mainly unleaded and these may be wrought rather than cast. The few gunmetals do not appear to be outliers of either the brasses or bronzes.

The Polden method of pin attachment had already appeared in Neronian contexts (for example, Colchester, Hawkes and Hull 1947, pl 91, nos 42–3; Bagendon, Hull 1961, no. 26, p 173; Dodderhill, Hurst forthcoming), but most context-dated examples are later (for example, one in a deposit of AD 85–105 at Verulamium, Hertfordshire, Frere 1972, no. 9, p 114). The main development of the type seems to have taken place in the West Midlands, where Bushe-Fox first published a number from Wroxeter: several from deposits of about AD 80–120 (Bushe-Fox 1914, 11). More recent finds have confirmed a concentration in this area, and the Wroxeter dating (cf Mackreth 1985a, 283, on several from Derby). The lists of parallels for the Richborough brooches (Appendix 3, pp 252–3) show small numbers in other parts of Britain, while examples less closely related to Richborough, and therefore not listed, occur in East Anglia, for example, Caister-on-Sea, Norfolk (Butcher 1993c, fig 39, no. 2), and Dorchester, Dorset (AML 8212384); very few have been noted on the continent.

TRUMPET-HEADED BROOCHES

Brooches with the very distinctive head described as trumpet-shaped are the most original products of the British brooch industry in the Roman period (T153–159, Figure 130; Cat 216–221). The head is thought to derive from some pre-Roman Aylesford brooches (cf Boon and Savory 1975, 57–60) but this plain La Tène III form with its rod bow and one-piece spring gave little else to the type apart from a moulding high up on the bow. Trumpet brooches fall into a number of different subtypes according to their construction and decoration, but they all have the moulding on the bow, which made the basis for classification by Collingwood (1930a; revised and expanded in Collingwood and Richmond 1969, Group R, 296–7). His typology was based on whether it was plain or enriched on each side with what he saw as acanthus leaves, and whether it encircled the bow fully or was flat at the back. The second-century dating then apparent for the developed form of the brooch supported his view that the moulding was a romanizing feature (he related it to the acanthus leaf motif of classical architecture) taken up by native craftsmen (Collingwood 1930b).

The type was reconsidered by Boon and Savory



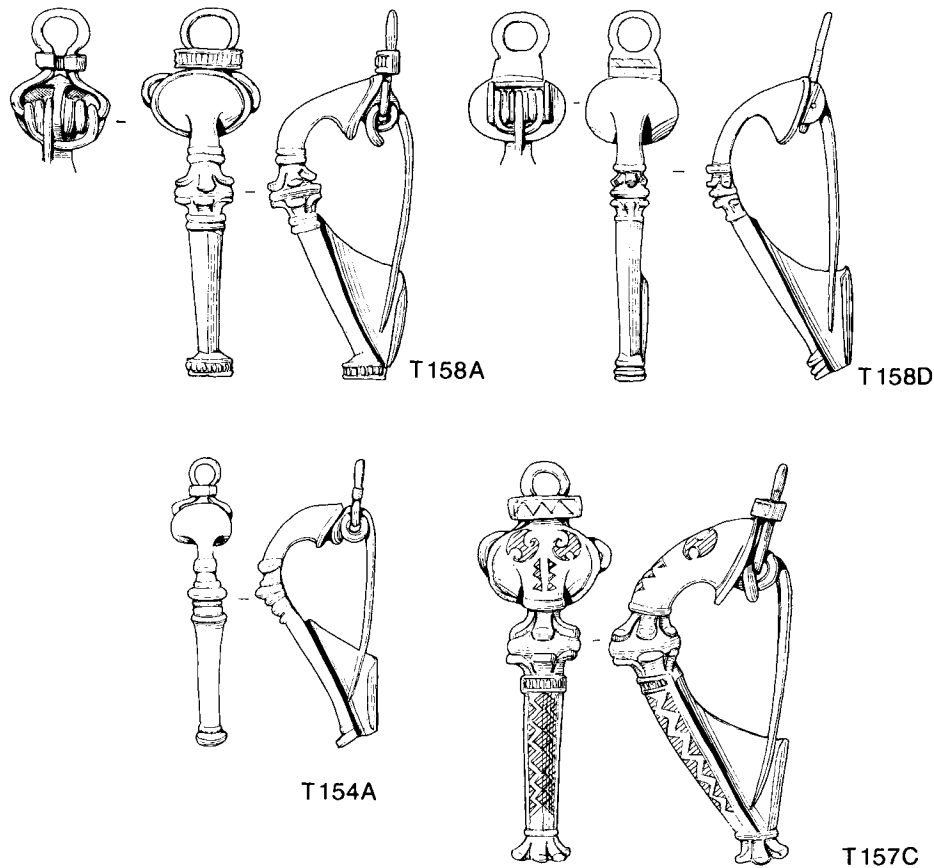
129 Ternary diagram showing the composition of Polden Hill brooches

(1975), who came to the conclusion that it developed much earlier, and that the distinctive mouldings (described as petalling rather than acanthus) derived from native art. They had the benefit of new finds, especially the magnificent gilded silver specimen from Carmarthen, and examples of fully developed trumpet brooches from first-century contexts, notably Baginton, Warwickshire, pre-AD 75 (Mackreth 1969).

Hull adopted Collingwood's classification by form of central moulding and refined it further according to decoration: his Group 8, T153–159; only a few of these types are represented at Richborough. The analytical results reported here for a number of trumpet brooches throw new light on some of the main typological groupings, which it is proposed to re-classify as A–D.

Group A

Type 153C and T158A (Figure 130 and Cat 216–217): the standard undecorated trumpet brooch with spring attached to a single lug, loose wire headloop and full-round waist-moulding (plain, T153C; 'acanthus', T158A). Over half of these are brass or gunmetal (Figure 131), but the composition is not nearly so uniform as for earlier brass types (Figure 132) and the zinc content is lower (Figure 182). The origin of this type can be dated to the first century (Baginton, Mackreth 1973a, no. 8, p 69, before AD 75; and Newstead, Curle 1911, no. 9, p 322, before AD 100). Collingwood (1931a, 81) published a spoilt casting from Brough under Stainmore, Westmorland, supporting



130 Trumpet-headed brooches of groups A (T158A), B (T158D), C (T154A) and D (T157C). Scale 2:3

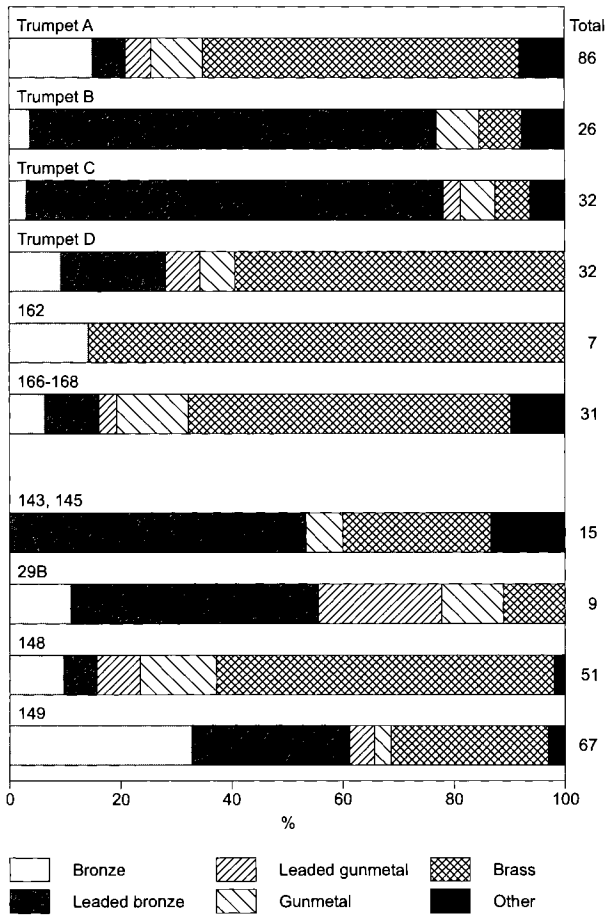
his suggestion of northern manufacture; it is like the pair from a mid-second-century deposit at Stanwix, Cumberland (Collingwood 1931b, 72). Other finds are listed in Appendix 3 (pp 253–4), including a number from the North; most of them are very similar, differing only in size and small details of the mouldings. Several have been found in Hadrianic and Antonine contexts and it seems unlikely that these are all residual, especially when they come from northern forts not occupied in the Flavian campaigns; such a ‘classic’ design might well have a long life. There are some other brooches which can hardly be described as devolved, as B and C below, because they are of the same design and similar standard of workmanship, but which differ as follows: sub-group i) T158B, has a hinged pin, and in ii) T158C the waist-moulding is not complete at the back. Richborough has one of these, Cat 218, to which the dated parallels are Antonine (Appendix 3, p 253); again analysed examples are mostly brass or gunmetal (Figure 132).

Group B

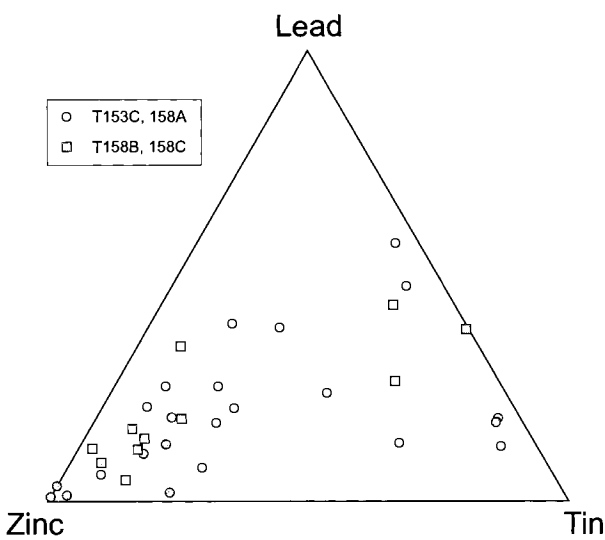
Type 153D (Cat 219), T158D (Figure 130), T158E and T158F: devolved plain trumpet brooches with waist-mouldings flat at the back and usually with headloop cast in one with the bow. Most of these are leaded bronze (Figure 133). They can be hinged or sprung but in most cases the latter have the spring attached on a bar between two lugs in a recess behind the head, whereas in the standard sprung trumpet types (Group A, above) it is held on a single loop. The sparse dating evidence suggests that these brooches belong to the second century.

Group C

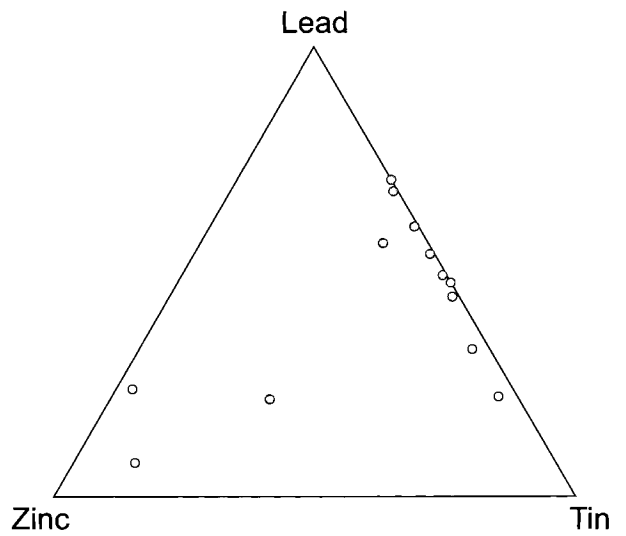
Type 154A, T154B, T155, T159 (Cat 220): as Group B but appear further devolved. They tend to be elongated and the head is usually based on a flat plate. They are also distinguished in composition. Though still mainly leaded bronzes they have lower tin and higher lead



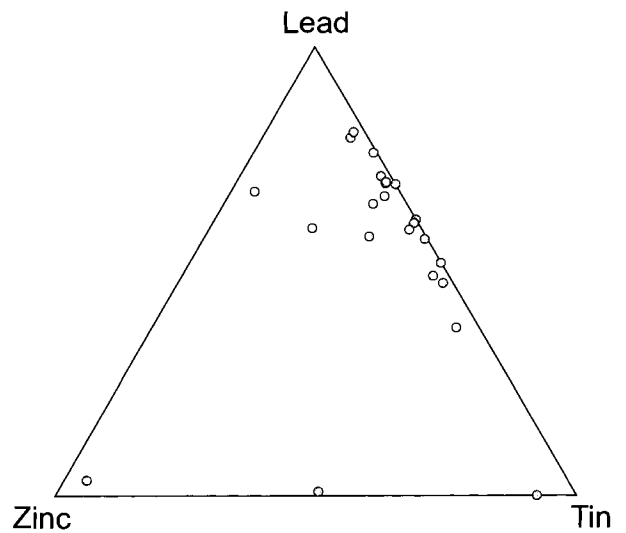
131 Alloys used for trumpet-headed (A–D, and T162, T166–168) and headstud brooches (T143, T145, T29B, T148–149)



132 Ternary diagram showing the composition of trumpet A brooches



133 Ternary diagram showing the composition of trumpet B brooches



134 Ternary diagram showing the composition of trumpet C brooches

contents on average than brooches in Group B (see Figures 134 and 183). These are also second century where datable.

The nature of the waist-moulding – whether lobed ('acanthus' or 'petalled') or with plain or leaf-shaped multiple mouldings – is not distinguished by these alloy groupings, whereas the distinction between brooches

with loose or fixed headloops and between full-round mouldings and those flat at the back is usually sustained. In addition, the leaded bronze group contains both sprung and hinged brooches.

Taken together with the pattern of distribution (Appendix 3, pp 253–4, giving parallels for the Richborough brooches, excludes the more numerous hinged examples but these follow the same pattern), the alloy results bear out a distinction between Group A, the standard undecorated trumpet brooch native to the northern military area of Britain, and Groups B and C, the devolved (sometimes degenerate) copies made in the South or West. Although the first type occurs frequently in forts it was not exclusively a soldiers' brooch since it is also found on native sites (for example, Traprain, East Lothian, Scotland, Burley 1958, nos 2–7, p 155). The imitations are very variable and could be products of the south-western workshops which also made the very diverse 'T-shaped' brooches, although the distribution favours the more accomplished West Midland makers of the Polden Hill types.

Group D, decorated

Types 153A–B, T156, T157A–F (Figure 130; Cat 221). Relatively few of the decorated trumpet brooches have been available for analysis but the results appear broadly similar to the Group A types (Figure 131). Here, although the main designs recur on many specimens, the variation of detail and the high quality of some examples suggest that they should be regarded as individual pieces of craftsmanship rather than as a standard production.

The fine silver brooch from Carmarthen was regarded by Boon and Savory (1975) as the earliest in the series; they suggest that it was the product of the western Celtic school of metalwork in the first half of the first century AD. The distribution of related copper alloy brooches of T156 falls mainly in Wales and the West Midlands. Hull distinguished these from otherwise similar brooches by the presence of the 'acanthus' waist-moulding, but the distribution of those with plain mouldings is similar (some only of his T153B). There is no independent dating evidence for any of these and in the absence of sufficient alloy analyses the arguments have so far been typological, relying on the appearance of fully developed standard trumpet brooches by AD 75 (Baginton, Mackreth 1969, 111) and on the style of decoration. The T153B and T156 brooches have curvilinear relief decoration on the head and, usually, on the lower bow, in the form of more or less complex scrolls often incorporating bosses, and beading on waist

and foot mouldings. The relief patterns appear to be echoed in niello or silver inlay on brooches of T153A, for example, found at Chester (Thompson 1976, no. 1, fig 25). Like the relief-decorated brooches these are also mainly found in the West Midlands and Wales, but there is an outlier at Traprain, East Lothian, Scotland (Burley 1958, no. 1, p 154). Some other T153A brooches have niello in less curvilinear forms, for example, Wilderspool, Cheshire (Hinchliffe and Williams 1992, no. 2, pp 155–6). These are all unlikely to date later than the third quarter of the first century, as niello seems to have gone out of favour when the use of enamel became more general.

Another group of Hull's T153B must be distinguished. Its decoration is mainly of beaded ribs, but it has rudimentary relief decoration on the head (for example, Wroxeter, Shropshire, Bushe-Fox 1913, fig 9, no. 7, from a deposit of about AD 110–30).

Enamelled trumpet brooches were all included in Hull's T157 (Figure 130), subdivided (T157B–F) according to the patterns of decoration, but these are far from standardized, except in T157F (see below). A trumpet brooch with red enamel in small cells on the head and leg was lost at Baginton by AD 75 (Mackreth 1969, no. 9, pp 110–11). This has a rather simple pattern, but two of T157B from Newstead have enamel in patterns which echo the relief-decorated series; these were in a context dated 'earlier than AD 100' (Curle 1911, nos 11 and 12, p 322). A very fine brooch from Risingham, Northumberland (T157D), has enamel in an elaborate scrolled triskele on the head (Brewis 1924, pl IX, 2) and another elaborate Celtic motif carried out in enamel appears on the head of two more brooches from Newstead (T157C, Curle 1911, nos 13 and 14, p 322, dated there to 'before AD 150', but likely to belong to the Flavian occupation). These enamelled brooches show considerable variation in size, decoration and manufacture (cf Richborough Cat 221, an unusually poor specimen), although one pattern (T157F) seems to have become standardized (for example, Hockwold, Norfolk, Mackreth 1986, fig 40, no. 3; St Albans, Frere 1984a, no. 31, p 25): this has a bold horseshoe motif on either side of the head which might be seen as a devolved version of the curvilinear patterns; it also employs enamel in larger cells than the others, although still separated by metal divisions. It is difficult to see even these most developed brooches as dating very far into the second century.

The distribution of the enamelled brooches T157B–F is much wider than that of the other decorated trumpet brooches, and together with the

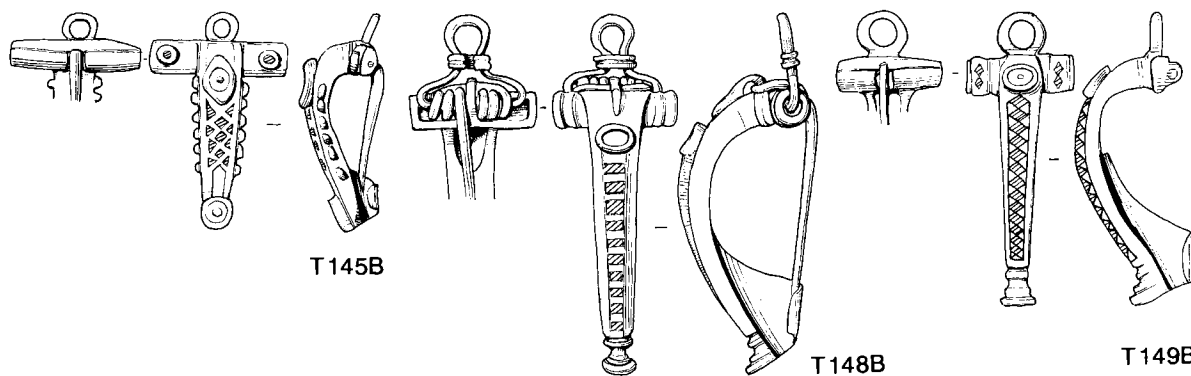
variations already mentioned suggests that they were being made in more than one workshop. One may well have been in the Mendip area of Somerset; a number come from southern sites, for example, two from Wanborough (Butcher 2001, fig 24, nos 113–14), Charterhouse, Somerset (Bristol Museum F 1865), and Paulton, Somerset (Taunton Museum 51.A38). There is also a wide distribution of other versions in the North, from both civil and military sites (for example, Rudston, Yorkshire, Stead and Pacitto 1980, no. 7, p 95; Aldborough, Yorkshire, Bishop 1996, fig 31, no. 322; Chesters, Northumberland, site museum), and in the East (see Woodcock Hall, Hockwold, and other sites in Appendix 3, pp 254–5).

HEADSTUD BROOCHES

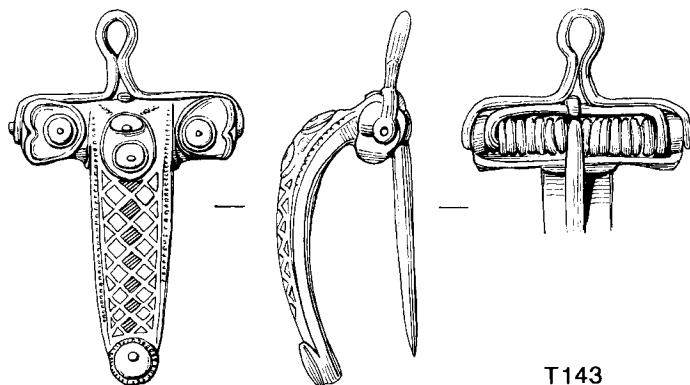
The headstud group (T147, T148A–C, T149A–B, Figure 135; Cat 228–231) is even more numerous than the

trumpet series and is found throughout Britain. Subtypes have been defined in various ways (Hull, Appendix 2, below; Painter and Sax 1970). Most, but not all, have the eponymous raised stud near the top of the bow, but other features are more variable: they can be sprung or hinged, there is usually a loop on the head but it can be loose or cast in one with the brooch, and various patterns of decoration occur, often including the use of enamel.

Like the trumpet brooches, the headstud type probably originated in high quality pieces with relief decoration in Celtic style, such as the brass T-shaped brooch (T143) from Thistleton, Rutland (Figure 136; Butcher 1977, fig 10, no. 26); this has settings for riveted studs on the wings and foot as well as two on the upper bow, together with a band of enamel in lattice cells down the bow, and has a loose wire headloop and a long spring attached in the Polden manner. A brooch



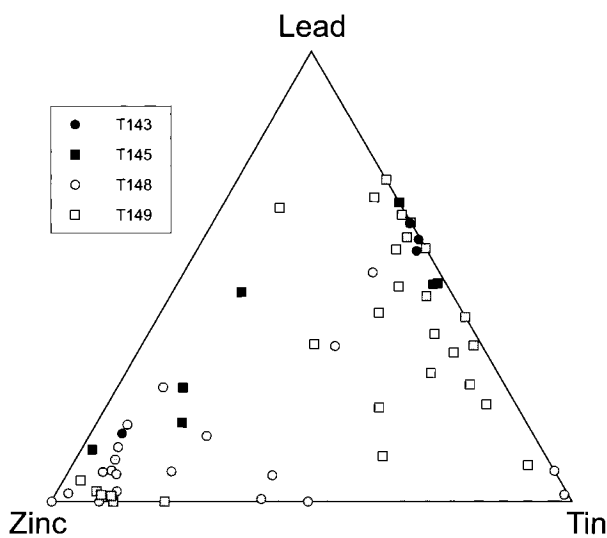
135 Headstud brooches: T145B, T148B, T149B. Scale 2:3



136 T143 brooch from Thistleton. Scale 2:3

from Threxton, Norfolk (Hull forthcoming, no. 6406/Norwich Museum no. 6.179. 950), is generally similar, except that it has a trumpet scroll in relief instead of the headstud. Another, from a mid-first-century context at Kingsdown Camp, Somerset (St George Gray 1930, fig 5, E5), has a similar spring attachment, broad band of lattice, and two sockets at the top of the bow, but the decoration is described in the report as engraved rather than relief. Most of the relief-decorated brooches of this general class are from the eastern counties, including a more standardized type (T145B; Figure 135) which has an enamelled lattice on the bow, toothed edges, settings for studs on the bow and wings usually surrounded by lobed mouldings, an enamelled toeknob, a fixed headloop and a hinged pin. One of these is from a deposit at Strutt's Park, Derby, with samian pottery of Claudius–Nero and coins of Nero and Vespasian (Brassington 1970, no. 1, p 28). Although lacking the headstud, some brooches of T145A form a closely related group: they have a crest instead of the headstud and loop, a solid metal toeknob, toothed sides, lattice panel on bow and are also hinged; there are two from Richborough, Cat 225–226; they are brass/gunmetal and brass respectively. Parallels from Baginton are from a pit dated not later than AD 75 (Mackreth 1973a, fig 19, no. 4, and 1985a, no. 21, p 287, for a similar brooch from Derby). Most of these brooches come from the Midlands and fall within the area of pre-Flavian Roman occupation, but there is also a fragment from Newstead; they are listed in Appendix 3 (pp 255–6). Another group of T145A, similar except that the crest is shaped like a dog, occurs on some western sites: Priddy, Somerset (Bristol Museum F 3722) and Wroxeter (Atkinson 1942, fig 36, H16, from a Flavian deposit). The dating of these predominantly hinged types to the pre- and early Flavian period throws doubt on the usual explanation of the origin of headstud brooches: that the stud began as a hook holding down the chord of a spring. Given the early date of the T145B brooches with headstud it seems more likely always to have been a decorative rather than a functional feature. Where analysed, these brooches are either impure brass or leaded bronze (Figures 131 and 137).

One of the main headstud types (T148C) consistently shows relief decoration, usually in the cupped surrounding of the stud and sometimes on the wings, although these more often have an enamelled design incorporating peltas; there are, for example, several from Aldborough (Bishop 1996, fig 31, nos 314–16), Derby (Mackreth 1985a, no. 25, p 289) and Hayling Island (Soffe forthcoming). These are very



137 Ternary diagram showing the composition of headstud brooches (T143, T145, T148, T149)

similar to the T148C brooches with enamelled lattice decoration, such as Richborough Cat 228, which also have cupped studs, and like this are usually of brass (Figures 131 and 137). (Other examples are listed in Appendix 3, pp 255–6). The missing Richborough brooch A8 (Appendix 4, Table 25) had a cupped stud, although its filling was enamel rather than a riveted setting; otherwise it was similar in construction. This brooch was in a pit dated about AD 75–90 (Bushe-Fox 1949, no. 35, p 114) which suggests that the typologically earlier examples with riveted studs had originated in the early Flavian period, if not before. However, the type also occurs in forts of the Hadrianic frontier: either these brooches had been kept for some thirty years or more, or they are the result of continuing production.

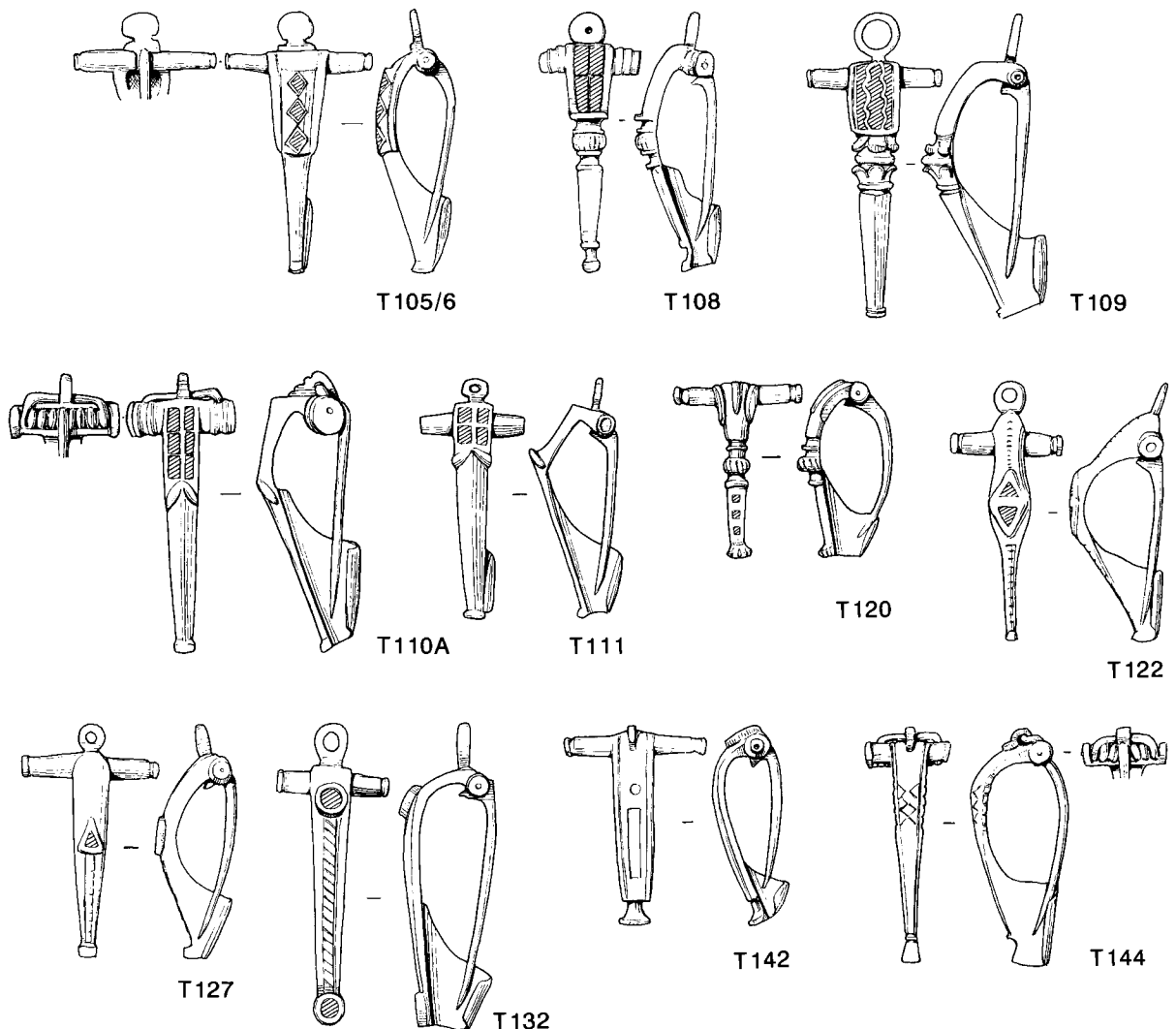
The simpler hinged headstud brooches with fixed headloop (T149, Figure 135; Cat 229–231) are found throughout Britain, and these are more often of bronze or leaded bronze though brasses are also found (Figures 131 and 137). One from the temple deposit at Chelmsford shows that they were in production before AD 100 (Butcher 1992, fig 38, no. 24). They were probably made in several workshops, one of which was in the Mendip area of south-west Britain: amongst a dump of brooch moulds found at Compton Dando, Somerset (see Table 11), was at least one for a brooch of this type with a diagonal cross on the upper bow. Brooches marked in this way have been found at Nornour (Hull 1968b, nos 99–102, with reference to

others from Charterhouse, Cirencester, Gloucestershire, Stockton and Charlton Down, Wiltshire). A number of headstud brooches were found at Castleford, Yorkshire, some in Flavian contexts, but a sub-type of the hinged T149 brooches only occurred in Antonine contexts (Cool and Philo 1998, no. 29 and pp 30–1). This suggests that these simpler headstud brooches also continued in production well into the second century.

The majority of headstud brooches with loose headloop are made of brass, while the type with fixed headloop (T149) are more usually bronze or leaded bronze, though they include a group of brasses (Figure 137). This distinction is not a simple chronological

indicator since T145B, shown above to be amongst the earliest, have fixed loops; unfortunately only one of these (Stanwick, Northamptonshire, Neal forthcoming) has been available for analysis: it is (leaded) bronze/gunmetal, while the related T145A includes brass examples. The brass and gunmetal headstuds have higher lead contents than earlier brasses (cf T148** and the top group in Figure 182), while T149 brooches have less lead and more zinc than other T-shaped leaded bronzes (Figure 183), leading a few to be re-classified as gunmetals.

The alloy distinction between brooches with loose or fixed headloop also occurs in the trumpet brooch series (see above) where similar alloys are used and



138 Developed T-shaped brooches: T105, T108–109, T110A, T111, T120, T122, T127, T132; others: T142, T144. Scale 2:3

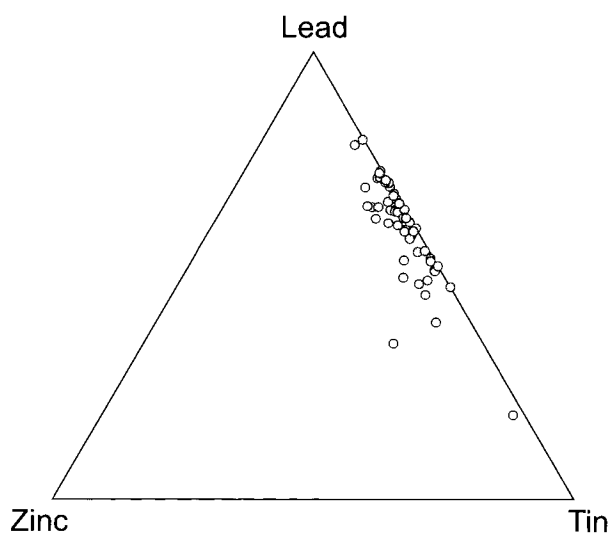
which share some patterns of decoration with the headstuds (Figure 131). They are broadly contemporary and probably developed in the same native workshops. Hinged examples occur in early as well as late sub-types of both; hinged pins had already appeared on much plainer British mid-first-century brooches such as Richborough Cat 223.

DEVELOPED T-SHAPED BROOCHES

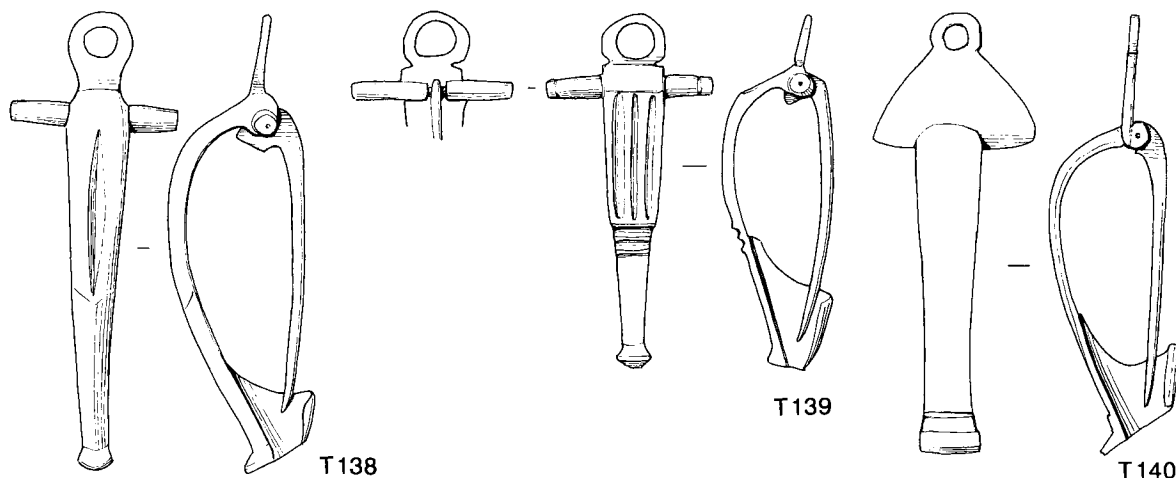
The south-western T-shaped group, discussed above, was further developed incorporating elements from the three distinctive series just described (the Polden, trumpet and headstud brooches). The new types are T105–111, T119–120, T122, T126–129, T132 and T141–142 (Figure 138). Most of these brooches are hinged, with a narrow and usually undecorated tube holding the axial bar; the few sprung examples employ the ‘Polden’ method of securing the spring and its chord. They usually have enamelled decoration in simple lozenge, rectangular or triangular cells, often on the upper bow, and a small projecting moulding at the foot. Most have a tab cast in one with the head in place of a headloop; this is by no means always perforated and therefore was not essentially functional. When analysed almost all were leaded bronzes (Figure 139), compositionally indistinguishable from the ‘initial’ group of T-shaped brooches (cf Figure 125; see also Figure 183). Dated examples are: T105 from Shakenoak, Oxfordshire, about AD 50–100 (Brodrigg *et al* 1968, fig 27 no. 2); T106 at Caerleon in a Hadrianic–Antonine

context (Brewer 1986, fig 54, no. 6); T110A Croft Ambrey, Herefordshire, from a deposit on the ‘sacred terrace’, about AD 65–160 (Mackreth 1974, no. 4, p 44); T110B Caerleon, before AD 125 (Wheeler 1928, fig 13, no. 9); Wroxeter, first half of second century (Atkinson 1942, fig 36, H40); and T111 Caerleon, with pottery dating AD 130–60 (Wheeler 1928, fig 13, no. 13). The largest published collection is from Nornour (Hull 1968b, nos 6–32, 34–46, and 84–92), but there are many in Bristol Museum from sites on the Mendips, and moulds for some types have been found at Compton Dando in that area (Bayley 1985). The distribution is distinctively south-western, clustering in Somerset, Dorset, Wiltshire, Hampshire, and extending into Devon, Cornwall, Scilly, Oxfordshire, Gloucestershire and Monmouthshire (chiefly Caerleon and Caerwent). A few reached West Midland and south-eastern sites, but virtually none come from the northern military area. An exception to this is the presence of two T109 brooches at Chesters, a fort on Hadrian’s Wall not occupied until the 120s AD (Hull forthcoming, nos 7635–6; Snape 1993, 114, group 2.3). This type and the similar T108 might be seen as rather superior in design and workmanship to most of the south-western brooches; they have a panel of decoration on the upper bow reminiscent of Hod Hill brooches but are usually enamelled in the lattice pattern common on headstud brooches, and have a waist-moulding like that of trumpet brooches. Apart from Chesters their distribution is south-western, including several from Caerwent and Caerleon (for example, Nash-Williams 1930, fig 2, nos 2 and 3, pp 239–40). Perhaps the south-western brooch industry, almost certainly centred on the Mendips, was on a more ambitious level than that indicated by the rather simple types ascribed to it because of their local distribution, with the higher quality products reaching a wider market. In that case it might be suggested that many of the British brooches with a high lead content were from this area.

Another group of T-shaped brooches with a mainly south-western distribution is difficult to relate to other types. These are T138–140 (Figure 140), large hinged brooches, all with fixed headloop and most with a large headplate. They never have enamel and are usually decorated only by shallow ribs and grooves dividing the broad bow. Most of those analysed are of leaded bronze (see Figure 141). The limited site-dating to the second century is from Nettleton, Wiltshire (Wedlake 1982, fig 53, no. 48), Chew Valley, Somerset (Rahtz and Greenfield 1978, fig 114, no. 12), and Camerton (Wedlake 1958, fig 52, no. 23). Other examples, for



139 Ternary diagram showing the composition of ‘developed’ T-shaped brooches



140 Large south-western T-shaped brooches: T138–140. Scale 2:3

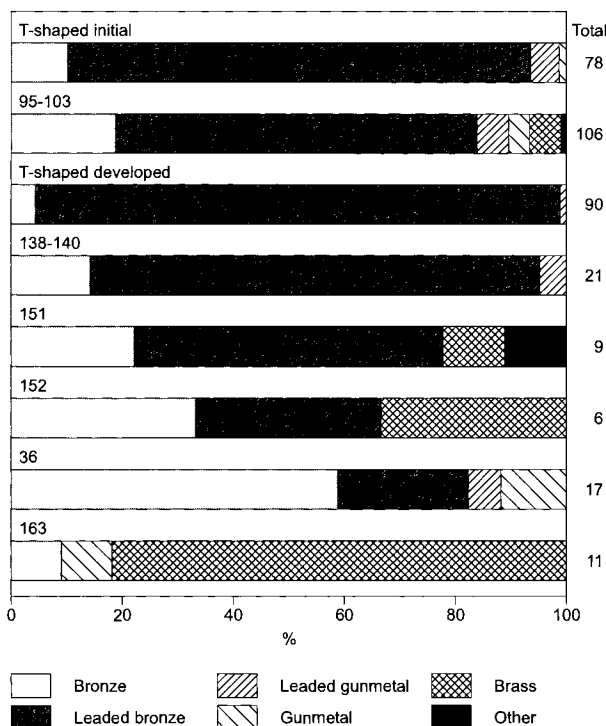
instance, at Catsgore, Somerset (Butcher 1982a, nos 10–14, 105), and two from the Chepstow hoard, Monmouthshire (British Museum 91.3–27, 19 and 20) come from possibly later contexts.

VARIOUS BROOCHES RELATED TO THE TRUMPET-HEADED AND/OR HEADSTUD SERIES

There are other distinctive types that show features of headstud, trumpet and other major groups of the first to second centuries AD without being closely related to these or to each other. Hull included these in a general ‘T-shaped’ group; in this volume they have been separated into another group which also covers T36, T150–152, T160–161 and T163–164 with a heading (Various ...) which is intended to emphasize their disparate nature. Some of them show a different distribution from the south-western types already discussed, and the alloy composition is also different. Workshops are known to have existed in areas other than Mendip (see Chapter 3); it is also possible that brooches were produced by itinerant craftsmen (cf Mackreth 1989, 87–8; and Bayley *et al* 2001).

The very uniform type which Hull called the ‘Celtic fan-tailed brooch’ (T36; Cat 238) has a head with hinged pin and fixed headloop very like that of one of the headstud types (T149B) but the foot expands to an enamelled triangular plate bearing a design in reserved metal rather like that on some trumpet brooches. These analogies and some find contexts suggest a date in the later first century. Apart from Richborough its distribution is mainly in the East Midlands, extending northwards to Corbridge and Old Penrith, Cumberland (see list in Appendix 3, p 255). Most analysed examples are of unleaded bronze (Figures 141 and 181); together with its uniformity and its limited distribution this suggests that it may be the product of a single workshop.

Two types which from their distribution appear to originate in North Wales or the Midlands are shown on



141 Alloys used for T-shaped brooches (‘initial’, ‘developed’, T138–140), Polden Hill brooches (T95–103) and brooches related to trumpet-headed and/or headstuds (T151–152, T36, T163)

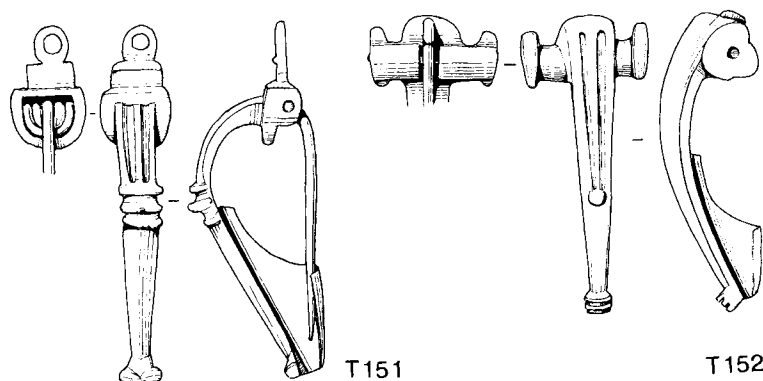
Figure 142: T151, the 'Wroxeter type', which is often sprung, usually between two lugs behind a D-shaped headplate, and T152, the 'Prestatyn type', with a decorated upper bow humped over a broad crossbar, some of which are sprung in the 'Polden' manner, though more are hinged; both types often have different colours of enamel juxtaposed in long fields. Lead patterns for T151D have been found in Poole's Cavern, Derbyshire (Bayley and Branigan 1989, 47). Contexts for T151 range from Flavian (Dodderhill, Hurst forthcoming, excavation no. S73, an early form with spring on a single lug) to forts on Hadrian's Wall, and there is even a specimen in the Chepstow hoard of about AD 200. Numbers analysed are small, but both types include leaded bronze as well as some brasses and unleaded bronzes (Figure 141).

T163 (Figure 143) has a large enamelled disc on the centre of the bow; below this the bow widens to a triangular foot, enamelled in standard patterns. The pin is usually hinged in a short plain crossbar with fixed headloop, again similar to headstud brooches of T149B. Its distribution is markedly northern, with a group in the East Midlands. Those analysed are mainly brass, unlike T149 (Figure 141). One from Leicester was in a deposit against the forum wall of about AD 130 (Hebditch and Mellor 1973, fig 18, no. 10) and the Newstead example seems to be from the Antonine occupation (Curle 1911, no. 24, p 324); however, at Castleford a similar brooch was from a context of the later first century (Cool 1998, 31). In many respects T164 is similar, but has a much smaller disc or square in the centre of the bow; there is little dating evidence and compositions are variable.

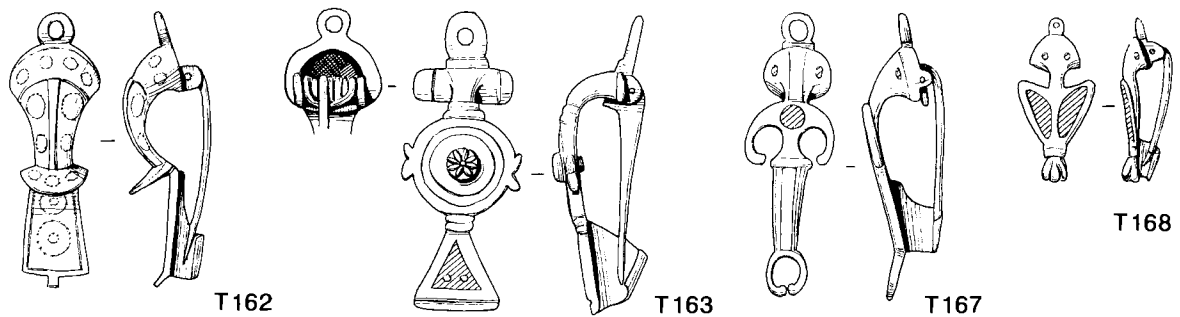
Another group has been suggested to include types with a 'trumpet head' and some form of decorative plate ('expanded decoration') on the bow: T162 and T166–168 (Figure 143); the spring is held on a bar between lugs at each side of the headshell, as in some devolved trumpet-brooches.

T162 occurs at Richborough (Cat 235); although it bears some resemblance to brooches found in Pannonia and Germany (for example, Kovrig 1937, pl VII) these have a long spring differently attached and lack the head tab which is general on British examples. The type was first discussed by Hull in the Camerton report (Wedlake 1958, 223–4) and again in Cunliffe (1968, no. 29, p 81); he cites examples widely distributed in Roman Britain, from south-east England (Canterbury, Kent) to Scotland (Newstead). Since then another has been found in Somerset, at Catsgore: it was suggested (Butcher 1982a, no. 23, p 107) that the type might be dated to the late second century because a very similar brooch, though lacking the central moulding, had been found in a burial of that period at Chichester, West Sussex (Down and Rule 1971, no. 228u, p 115). Where analysed most of the brooches have been shown to be made of brass (Figure 131); few of this type are enamelled but a common form of decoration is by applied strips and coils of beaded silver wire, for example, Corbridge (Bishop and Dore 1988, no. 12, pp 161–2), Leicester (Kenyon 1948, no. 15, p 251, from a deposit dating about AD 220), Camerton (Wedlake 1958, no. 16, p 223, from a second-century deposit) and Lydney, Gloucestershire (Wheeler and Wheeler 1932, no. 20, p 77).

Similar decoration with applied silver wire occurs on T166, the best-known type of 'pseudo-trumpet



142 Brooches of Wroxeter (T151) and Prestatyn (T152) types. Scale 2:3

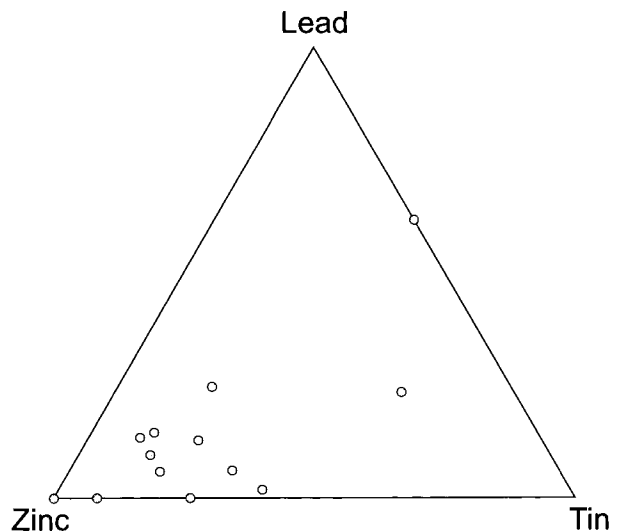


143 Brooches related to trumpet-headed and headstud types: T162, T163, T167–168. Scale 2:3

brooch', whose main feature is a large enamelled disc on the centre of the bow. Two examples occur at Richborough: Cat 236 and 237. The type was studied by Richardson (1960). Although they vary in details, mainly in the treatment of the foot, most of these brooches are sufficiently alike to be contemporary, though not necessarily all from one workshop. The distribution is fairly even throughout Britain; several are from Scottish sites: Traprain, the Outer Hebrides, Newstead; from the North: York, Corbridge, Brough under Stainmore, Westmorland; from Wales and the borders: Caerleon and Caerwent, Wroxeter; but they are also found on civil sites in the South: St Albans, Woodcuts, Dorset, London, and Springhead, Kent. Since 1960 others have been found, including: Nornour (Hull 1968b, no. 111), Scole, Norfolk (Mackreth 1977, no. 8, p 132), Woodcock Hall (Brown 1986, no. 144), and Wanborough (Butcher 2001, nos 115–16). The dating is mainly Antonine. It is fairly certain that all examples had enamel since the field in the disc is easily verified, but less certain whether decoration of applied metal foils was always present since this can be detached or overlooked in a badly preserved specimen (Figure 19 and Plate 9).

Type 168 (Figure 143) has a triangular plate with enamel fields suggesting the wings of a moth or fly, but the trumpet-shaped 'head' (in conventional usage) of the brooch, which contains the spring, is the tail of the insect. Examples are widely though thinly distributed in Britain, mainly south of the northern military zone, but the best context-dated specimen (AD 160–230) comes from the legionary baths at Caerleon in South Wales (Zienkiewicz 1986, no. 13, p 172).

In general T162 and T166–168 are characterized by a composition of brass or gunmetal (Figures 131 and 144), and by decoration with enamel and silver foil or wire, sometimes with both on the same brooch. It seems possible that some of these types, which appear to be mainly Antonine, may come from workshops still using the alloys favoured by the makers of the standard non-enamelled trumpet brooches of Flavian origin (Trumpet A: T153C and T158A). The alloy link and the distribution suggest that these workshops were in the north, and perhaps especially the north east, of Britain.



144 Ternary diagram showing the composition of T162–168 brooches

PLATE BROOCHES

Having taken the outline of bow brooch development into the second half of the second century it is time to relate the contemporary development of plate brooches, although as they are less numerous there are even fewer well-dated pieces; similarly the results of alloy analysis are less positive, being based on fewer specimens.

EARLY SYMMETRICAL ('EQUAL-ENDED')
CONTINENTAL BROOCHES

The plate brooches of the conquest period were imported (see p 154) and some later first-century imports are found; these include 'symmetrical' plate brooches such as Richborough Cat 357 (T229), Cat 358 (T230) and Cat 362 (T233), which belong to the Flavian development of enamelled brooches on the continent (Spitaels 1969, 117–24). In this period enamel takes over from niello as the preferred decoration and at first it is in very small cells, often with toothed edges for better retention. The Richborough brooch Cat 357, shows the transition very clearly, having both enamel and niello in small cells on a curved rectangular plate between two moulded lugs. A number of parallels to this brooch are known, from several Roman provinces; most have only enamelled cells. In Britain there are examples from Caerleon (Wheeler 1928, fig 14, no. 19) and Charterhouse (Bristol Museum, F 2374). Several generally similar brooches came from Augst (Riha 1979, Tafel 62, nos 1627–34, of which no. 1630 is a close parallel). Feugère published one from Vaison-la-Romaine and lists others from France (1985, no. 1886, p 360). They are also known in Pannonia (Sellye 1939, pl x, no. 20) and at Nijmegen (van Buchem 1941, pl xv, no. 4). At Augst and in France the type was found in contexts dated to the second half of the first century, although the Caerleon brooch was found with pottery of AD 110–40. The earlier dating is reinforced by a pair of brooches from a Flavian burial at Blicquy, Hainault, Belgium (de Laet *et al* 1972, grave 123, nos 8–9); these are more substantial versions of the same design, perhaps the origin of the type.

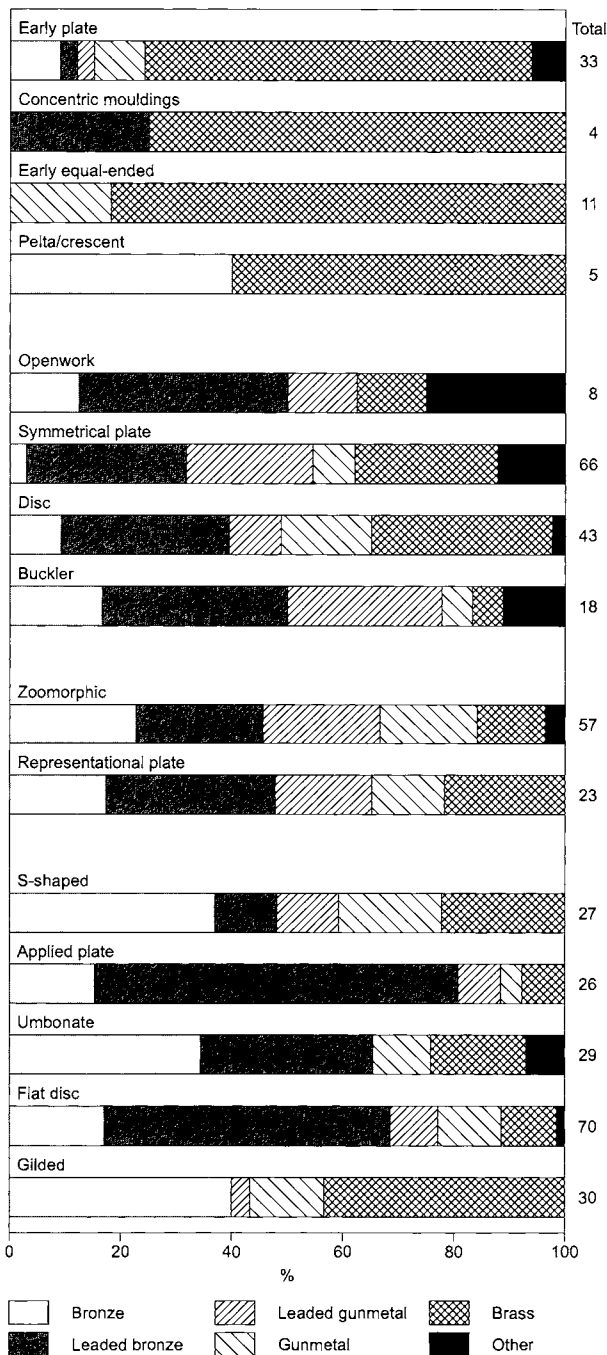
Small 'oakleaf'-shaped cells like those on Richborough Cat 358 appear on a very similar brooch from Augst, which was found with pottery of the second half of the first century (Riha 1979, Tafel 63, no. 1654). This also has the 'snakeshead' lugs at each end, which, with the plainer mouldings of Cat 357 and Cat 362, are the common terminals of large numbers of 'symmetrical' brooches, enclosing plates which can be either rectangular, circular or lozenge-shaped. Only a

few analyses of the earliest group are available, but these, which include the Richborough examples and some from Velzeke, Belgium, are mainly brasses (Figures 145–146).

Analyses show a similarity between the plate brooches discussed above and a group of continental bow brooches, T180–183, which also bear similar decoration and have a foot of the same design as the terminals of the symmetrical plate brooches. There is a preference in both groups for brass and other zinc-rich alloys (Figures 146 and 182), but the range of compositions in the bow brooches is wider and more closely matches that of the later symmetrical plate brooches (see below) which have a more developed enamel technique. Richborough has four examples regarded as a development of the Hod Hill type (see above; Cat 154–157) but they are rare in Britain, while a study of continental material catalogues over 150 from the Low Countries alone (Spitaels 1969, group I). These include more sub-types than have been found in Britain, but throughout the series the decoration parallels that of the equal-ended plate brooches (see below for the common features of most continental symmetrical plate brooches).

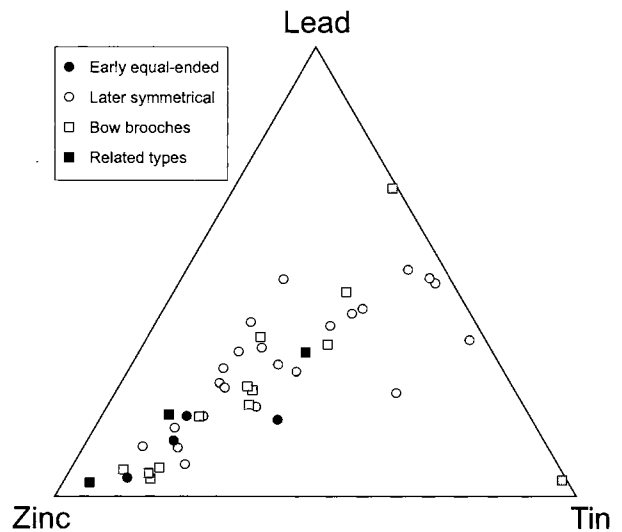
BRITISH PLATE BROOCHES

Meanwhile, as with the bow brooches, the later first century sees a remarkable development of new types in British-made plate brooches. The best known is probably the 'dragonisque' brooch, T200, of which there is one example from Richborough, Cat 350. The type has been catalogued by R W Feachem (1951, with additions, 1968); he knew of over seventy examples, most of them enamelled in a small range of patterns. Their distribution is mainly in Britain, with a marked concentration in the North where they occur on both military and native sites. H E Kilbride-Jones (1980a) divided them into schools. He grouped the Richborough brooch with three others from York, Chester and Templeborough, Yorkshire. However, the patterns are closely related to the main series and it is possible to see all these as sufficiently similar to be considered as a group as far as date and manufacture are concerned. (A list of those with similar decoration to the Richborough brooch will be found in Appendix 3, pp 259–60; this includes several from East Anglia found since Feachem's list was published.) A dragonisque brooch from Old Winteringham was in a deposit of Neronian or early Flavian date (Stead 1976a, no. 11, p 198). Other site-dated examples include Wroxeter, where the latest coin in the deposit dates to Hadrian



145 Alloys used for plate brooches, grouped as in Table 2

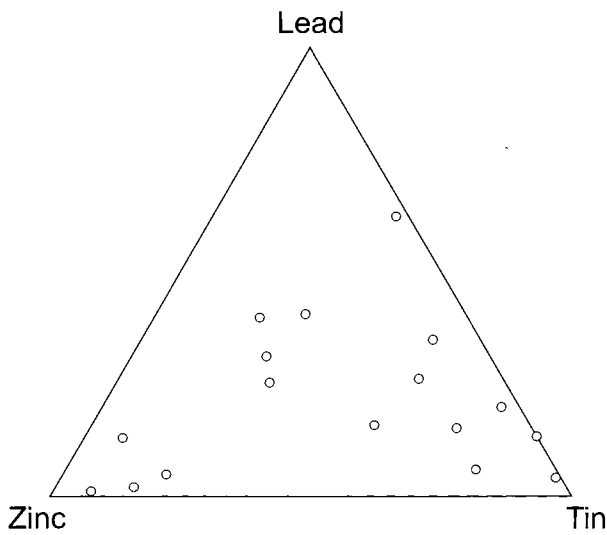
(Bushe-Fox 1916, no. 9, p 24) and Newstead (Curle 1911, no. 7, p 320), which must be from the Flavian occupation. They were presumably made in northern Britain where they are most numerous, and reached Roman military sites in the early phase of the conquest of that area. Apart from their distribution the enamel



146 Ternary diagram showing the composition of continental symmetrical plate (T226-234) and related bow brooches (T180-183)

patterns show clearly that they are a native product; a typical example such as that from Wroxeter (Feachem 1951, no. 15) has both the lattice pattern common on headstud brooches and a curvilinear motif found on trumpet brooches. They are made from a range of brasses, gunmetals and bronzes (Figure 147). The median lead content is under 3 per cent and the maximum is only 7.6 per cent.

British brooch-makers were also producing enamelled disc brooches by the end of the first century. Richborough has three examples of a handsome 'umbonate' type (T268) with a ring of small petal-shaped cells surrounding a raised central rosette, and with eight small lugs round the rim (Cat 379-381; Plate 24). The brooches of this type are of rather uniform design, which varies mainly in the shape and colour of the small concentric cells. However, they vary considerably in alloy composition with ledged bronze being the most common (Table 8 and Figure 145). A list is given in Appendix 3 (p 260); most have been found in the Midlands and South Britain (Butcher 1977, fig 5, nos 6-7, pp 51-3), but a few more recent finds come from sites further north: Watercrock, Westmorland, Carlisle, Cumberland, and Corbridge. Very few are known from the continent. A brooch of T199 (Figure 148), which is very similar to these but has one straight edge bearing a set of toilet implements, was found in a late first-century burial at Baldock (Westell 1931, fig 6, 261) and a T268 from Leicester was found with Hadrianic samian (Butcher

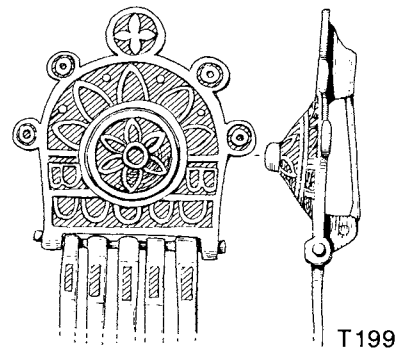


147 Ternary diagram showing the composition of dragonesque brooches

1977, fig 5, no. 6). The distribution of T199 and T268 suggests that they come from a different workshop from those making the dragonesque brooches. The design seems not to be of Celtic origin; Kilbride-Jones (1980a, 60–2) relates it to the ‘sunburst’ pattern, introduced by the Romans and adapted by local craftsmen.

Another type of umbonate disc brooch (T267) has concentric rings of small triangular enamel cells (Plate 3). A few (T267A and C) are quite large, with elaborate frilled or lugged rims. Type 267B is smaller and much more widespread. Richborough has two examples: Cat 382 and Cat 383. They occur all over romanized Britain in both military and civil sites and on ‘native’ sites such as Traprain. However, they seem to be missing from Hadrian’s Wall, and the Scottish forts in which they appear were occupied in Agricola’s advance; this suggests that they are a first-century product. An example from Wroxeter, associated with coins of Vespasian, supports this (Bushe-Fox 1913, no. 9, p 26). A few are known from the continent, for example, Augst (Riha 1979, Tafel 60, no. 1595), and Köln, Germany (Exner 1939, Tafel 17, no. 4). Analysed examples are of various alloys, unleaded bronze being the most common (Table 8 and Figure 145); this suggests that a popular style of brooch was being made in workshops in different parts of the country.

Disc brooches with an applied metal plate embossed with a triskele (T249A; Cat 373; Plate 23) offer very little context dating; therefore, they have been dated by

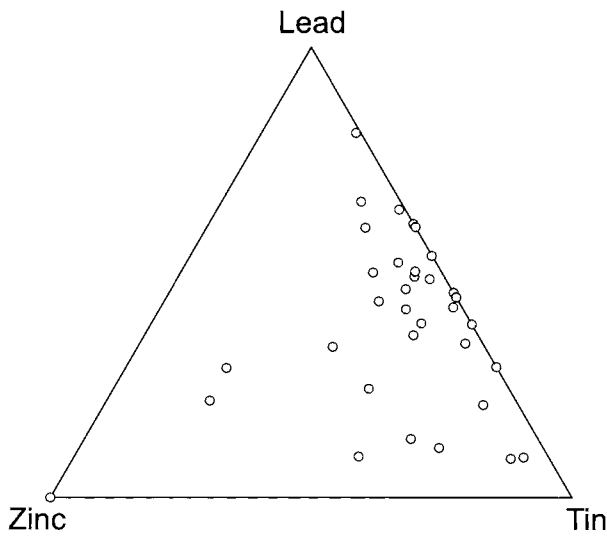


148 Plate brooch of T199. Scale 2:3

the style of ornament. This is controversial, but Kilbride-Jones’s suggestion (1980a, 85–6) of about AD 70–100 would fit the findspots (Appendix 3, p 260), and it is a period when in the north of Britain a Roman form might be adopted by native craftsmen and given a typically Celtic motif. Another design found on repoussé disc brooches (T249C) in Britain employs a scene formerly thought to be based on a Hadrianic coin type (Goodchild 1941); a more recent study has shown that the scene incorporates different elements, although it does include Roman soldiers (Hattat and Webster 1985). It has been carried out in a very Celtic manner and could well date to the Flavian period. All but one of the twelve known examples come from southern Britain, clustering in East Anglia and Wessex. Other designs of repoussé plate brooches are found on the continent (for example, Böhme 1972, type 44) and Richborough Cat 374 may have been one of these. Often only the base with fragments of the applied plate survives, the design unidentifiable. Most of the analysed examples were of this sort; they are mainly of leaded bronze (see Figures 145 and 149) though the applied sheet, where it survives, is often brass. Perhaps this was a way of producing an apparently ‘brass’ brooch while employing the possibly cheaper leaded alloy for the bulk of the object. The combination of leaded bronze and brass would fit the suggested Flavian date.

ZOOMORPHIC BROOCHES

Many of the zoomorphic brooches seem to be continental products, to judge from their widespread distribution in the mainland provinces of the Roman Empire. Richborough has examples of several of these types; the earliest is probably Cat 353 (T211), with the



149 Ternary diagram showing the composition of British disc brooches

outline of a hare, containing cells for enamel in the shape of two small hares; the few parallels are scattered widely in Europe (see list in Appendix 3, p 260); a mid-first-century date is suggested by the context of the Winchester example, and by the use of niello instead of enamel on one from London. An unfinished example was found at Nepelier in the Ardennes, France, indicating manufacture in that region (Feugère 1985, 408).

Another continental type (T203) is that showing an animal in outline, the body sometimes slightly rounded but with the head in higher relief or completely in the round: naturalistic except for the decoration of several enamel spots on the body. The Richborough horse, Cat 351, is a good example. The outline and relief of the horse are realistic and details, particularly of the head, are characteristic of a stallion of what is now known as the Arab breed.¹ This breed seems to have originated in the Middle East; examples which appear in art and sculpture show that it was known in the Roman period. Either through these representations or by importation of horses for special purposes it might have become known in the north-western provinces. The image is adapted to Celtic tastes by the addition of spots of colour and other motifs, breaking up the naturalistic effect. Unlike some other horse brooch types there is no sign that this one ever had a rider; the animal itself is clearly an object of admiration. It has been suggested that it may have a votive origin since the horse

frequently appears as a cult animal amongst the Celts (Butcher 1981a). Several very similar brooches have been found, thinly but widely scattered in Europe, including France, Germany, Switzerland, Austria and Yugoslavia (Feugère 1985, 403); to these can be added one from Hayling Island (Soffe forthcoming) and another from Tiddington (Warwickshire Museums, seen by courtesy of Nicholas Palmer). None of these objects come from well-dated contexts, but the style of decoration, with enamelling confined to small cells, and the use of zinc-rich alloys is consistent with a date in the first century.

Richborough also has a lion of this type, Cat 352; other beasts in the same style found elsewhere include leopards, boars and hippocamps. Again, none is from a well-dated context; a lion similar to Richborough's from a mid-second-century deposit at the Saalburg, Germany (Böhme 1972, Tafel 27, no. 1059) may have been made earlier.

Several other types, not present at Richborough, also have a fairly naturalistic animal outline but are completely flat, with stylized decoration, usually in enamel. Some, such as those on Figure 150 showing stags (T206) and running dogs (T210), on which most of the body is covered with different colours of enamel in juxtaposed blocks (See Plate 16) and inset spots, are clearly continental products. The more advanced enamelling techniques employed on them developed in the first half of the second century (Spitaels 1969, 125). One of these brooches from St Albans (a horse, its body covered with spots inset in a large enamelled field, a descendant of the T203 horse discussed above), was in a deposit of AD 135–45 (Goodburn 1984, no. 51, p 29). Others, in which the enamel is usually in separate cells, seem to be British products on grounds of their rarity elsewhere; the use of a short spring between two lugs is also more common on British brooches. These include a horse of different design from those already mentioned, outlined in spirited attitude and with enamel cells along its body (T205, Figure 150); examples have been found at Great Dunmow, Essex, in a context of about AD 200 (Wickenden 1988, fig 12, no. 2), Water Newton, Huntingdonshire (Butcher 1977, no. 12, p 54), York (RCHME 1962, pl 34), and Painswick, Gloucestershire (Way 1885). Analyses of these zoomorphic brooches show a variety of alloys with no clear trends (Figure 145).

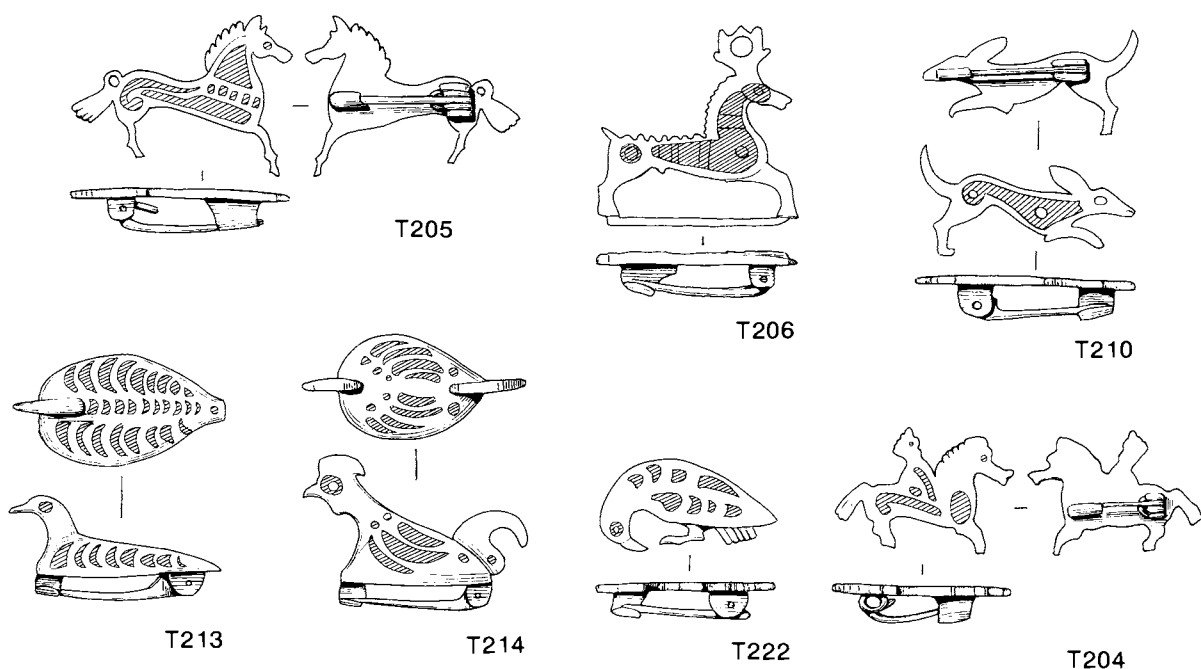
The next group, which also seems to be a British product, has little more compositional consistency. These are all birds, two main types showing ducks or hens in the round, the body and head projecting from a flat base which conceals the pin and catchplate (T213–214,

Figure 150); they are enamelled in crescent-shaped cells suggesting the wing feathers. Although several of those analysed are of gunmetal (Bayley and Butcher 1989, 30, and table 4) more recent results show bronze and other alloys as well (Figure 145). They seem to date to the later second century: one from the temple site at Springhead, Kent, was in a deposit of that period (Penn 1968, no. 2, p 184); others come from York, with 'later second-century' pottery (RCHME 1962, pl 34, H31), and Ilkley, Yorkshire, in an Antonine context (Hartley 1966, fig 14, no. 4); there are also examples from Woodcock Hall (Brown 1986, fig 25, no. 180), Watercrook (Potter 1979, no. 17, p 211), Colchester (Crummy 1983, fig 14, nos 75–6), and South Shields, Durham (Allason-Jones and Milet 1984, no. 3.133, p 115).

Another British bird brooch (T222, Figure 150) seems to be linked to those described above by the treatment of the feathers: enamel in crescent-shaped cells – but it is flat, showing the outline of an eagle with wings folded, its head bent, probably to tear at prey, since the beak is emphasized. Examples come from Nornour (Hull 1968b, no. 133), Henley Wood, Somerset (Butcher 1996, fig 88, no. 17), York (RCHME 1962, pl 34, H139c), and Aldborough, Yorkshire (Smith 1852).

This is unlike the usual Roman eagle with wings majestically spread, and, as with several representational brooch types showing an animal or a human in a very specific attitude, prompts the suggestion that it represents a story well known at the time. It has already been suggested (for example, Butcher 1981a) that such brooches are connected with religious cults. Some have been found in clearly religious or votive contexts but the majority occur on apparently secular sites, although the possibility that individuals wore them to show allegiance to a cult should be considered.

A last group of zoomorphic brooches has strong indications of a religious connection. These show a horse and rider (T204, Figure 150); the horse in a characteristic lively attitude and the rider, where details are visible, with short cloak, hair *en brosse*, sometimes holding a very short stick or sword, but others with no indication of a weapon. Some have fairly careful detail (for example, one from St Albans, Goodburn 1984, fig 9, no. 52, from a late fourth-century riverside deposit), but others are only a crude outline, with a few patches of enamel, although still clearly representing the same figure. A group of these came from a temple site on Lamyatt Beacon, Somerset, which was in use from the



150 Zoomorphic plate brooches: T205–206, T210, T213–214, T222, T204. Scale 2:3

late third century into the early fifth (the brooches are discussed by Butcher 1986, 316–19) and another group of seven came from a site at Hockwold, which contained votive material (Butcher 1977, no. 11, p 54; Gurney 1986, nos 17–23). There were also three from the temple site at Hayling Island (Soffe forthcoming) and others are listed in Ferris (1985). It seems possible that these represent some of the latest products of Romano-British brooch makers. Five of the six analysed examples were of leaded gunmetal or leaded bronze (Appendix 1).

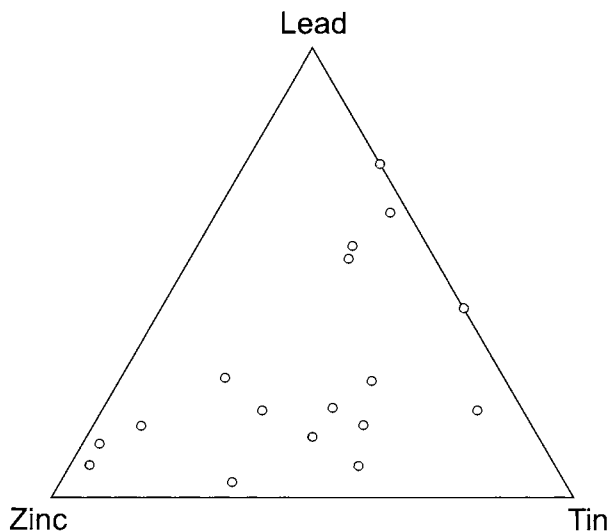
DISC AND SYMMETRICAL PLATE BROOCHES

Richborough has several examples of the enamelled disc and ‘symmetrical’ brooches widespread in most Roman provinces in the second and early third centuries. The discs are included in T250, T256, T257B, T258, T262–263, T265–266A, and the symmetrical plates in T226–234 and T240 of Hull’s typology; this covers a wide range of shapes and styles but for most of them there is a general affinity in methods of decoration, although these show developments in technical proficiency. Composition is varied, and indicates some difference between the two main groups defined above, but shows a majority of mixed alloys, which seem to be characteristic of many continental brooches after the early to mid-first century (Figures 146 and 151).

The standardization of design and decoration seen in these brooches indicates that production must have been large-scale and highly organized. Workshops have been suggested at Villa d’Anthée in Belgium (Béquet 1900) and Nornour (Dudley 1968, 17), but further examination of material from both sites has failed to find evidence for manufacture (Spitaels 1970; Butcher 1977, 43–4). By analogy with other industries of the period, for instance, glass, with which enamelling has obvious connections, the Rhineland may have been one of the main centres of production (Exner 1939, 41).

The main shapes used for the ‘symmetrical’ brooches were rectangles and lozenges; sometimes they are ‘equal-ended’: flanked by long mouldings holding the pin and catchplate (for example, Figure 152, T230, T228 and T227 – not in numerical order here because the development shown by these particular specimens seems to be in the reverse direction), but the main plate can be very large, with only small decorative projections, or with none (Figure 152, T240, T262 and T257B). This is probably to be seen as a chronological development: as enamelling techniques became more ambitious a larger surface was wanted for decoration.

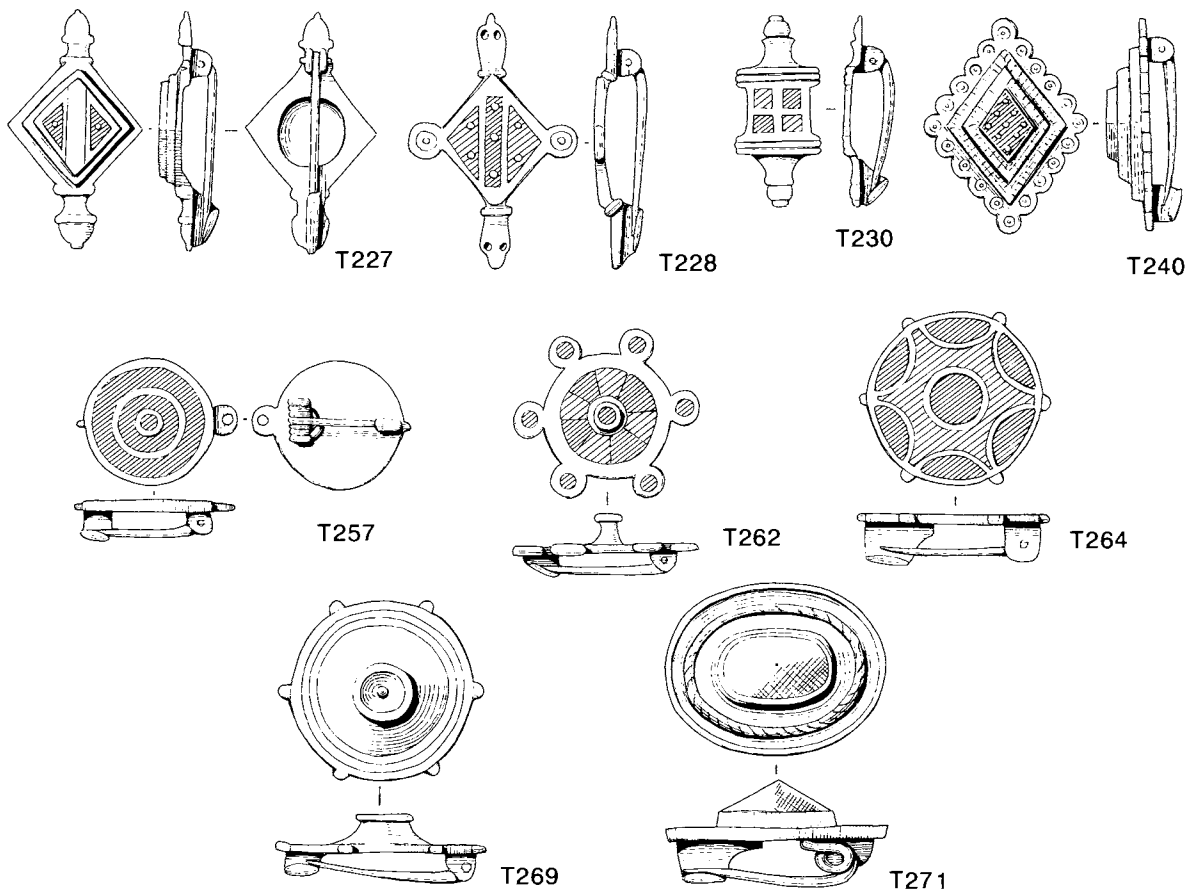
The development of symmetrical plate brooches



151 Ternary diagram showing the composition of continental disc brooches

began with the early equal-ended brooches, discussed above (p 171). The next step may have been brooches with bolder enamelled plates, still mounted between moulded projections, such as Richborough Cat 359 and 360, which are brass or brass/gunmetal. Very similar brooches to Cat 360 have been found at Nornour (Hull 1968b, nos 159–60; also probably the more fragmentary brooches nos 171–2) and Woodcock Hall (Brown 1986, fig 25, no. 182). They also occur on the continent, for example, Flavion, Namur, Belgium (Musée Archéologique) and Mandeure (Lerat 1957, pl vi, no. 131). A similar brooch to Cat 359 was found in the *vicus* at Hüfingen, a fort on the upper Danube (Rieckhoff 1975, Tafel 8, no. 138).

Larger plates are seen on Richborough Cat 363 (T234) and 366 (T228), both leaded gunmetal, which also have enamel of different colours juxtaposed, a more advanced technique than the use of separate cells. Cat 363 belongs to a very distinctive type of brooch that has been found in several Roman provinces, with only small variations: chiefly the number of rings on the main disc, and the shape, sometimes a dove, of the central projection. A few are known from Britain: Nornour (Butcher 1977, fig 8, no. 15), one from ‘East Anglia’ (British Museum), and one from Colchester (Hull forthcoming). However, Feugère (1985, 366–8) lists fifty-seven other examples, mainly from the Low Countries, France, Germany and Switzerland, with



152 Symmetrical plate brooches: T227–228, T230, T240; disc brooches: T257, T262, T264, T269, T271. Scale 2:3

outliers from Hungary, Italy and Morocco. One from Wollstein, Germany, was in a burial of about AD 150 (Exner 1939, Tafel 11, no. 15, p 94). The central disc of Cat 366 has a broad outer field of red enamel, in which 'spokes' of yellow are set without metal divisions; a very similar brooch was found at the Saalburg (Böhme 1972, Tafel 24, no. 950).

The introduction of the millefiori technique into the decoration of small metal objects was the final stage in the suggested development; plaques with intricate patterns formed of minute glass rods were either inserted into, or juxtaposed with, plain enamel, or were used as an inlay filling the whole surface of an object, as in Richborough Cat 370 (T256). This type of brooch commonly appears in most Roman provinces, varying only in size and in the pattern of the millefiori (See Plate 17). British finds include those from Kidlington, Oxfordshire (Hunter and Kirk 1954, no. 10, p 59) and

Hockwold (Norwich Castle Museum 1966–742). Exner lists numerous examples from the Rhineland (1939, group III, type 30, 107) and Sellye has one from Pannonia (1939, pl XIX, no. 1, p 55). One from Blicquy, Belgium, was in a burial dated to the last third of the second century (de Laet *et al* 1972, grave 260, no. 2); an example from Trier was in a deposit of the first half of the third century (Exner 1939). Some more elaborate millefiori brooches are those with concentric rings of decoration, T263, or in the form of a wheel, T266A. A few occur in Britain, for example, from Nornour (Hull 1968b, no. 205), but they are more numerous on the continent (for example, Exner 1939, Tafel 16); there is one from a grave-group of about AD 200 at Tongeren, Belgium (Galloromeins Museum, Tongeren, no. 633). To add to the continental evidence for the use of millefiori on brooches dating to the end of the second and early third centuries there is one from Chichester

which was in a burial with a ring containing a coin of about AD 200 (grave group, burial 3, Down 1978, fig 10.48 no. 1, p 9). The brooch was a T263 disc with large central field containing millefiori chequers set in red enamel. In contrast to this general dating of about AD 200 for millefiori on brooches it must be noted that it occurs on a disc brooch from a context that is thought to be Flavian at Castleford, Yorkshire (Cool and Philo 1998, fig 14, no. 108, p 33).

There is no evidence that millefiori was used by British manufacturers at this period although it appears on post-Roman objects made in Britain, such as hanging bowl escutcheons and ring-brooch terminals. Native versions of the completely enamelled field are seen in disc brooches of T252–255 such as Richborough Cat 384 and Cat 385. Designs like these, in which the enamel is set in large fields separated by metal divisions, and often with metal high-points, perhaps to make adhesion more secure, are found in all parts of Britain (see lists of parallels for the Richborough brooches in Appendix 3 (pp 260–1); very few are known from the continent). They are usually sprung and where well-preserved they sometimes show further decoration with applied silver foils, a technique also used on British plate-on-bow brooches such as T166, and on knee brooches (see below). Several analysed examples are of leaded bronze (Bayley and Butcher 1989, 30 and table 7), and further analyses confirm the use of tin-rich alloys for these types (Figure 149). The few dated contexts suggest that they too were current in the late second century or early third (for example, Newstead, Curle 1911, pl 89, no. 10, which is a brooch although listed as a stud, *ibid*, 331). Large-fielded plate brooches with other patterns, such as T264 (Figure 152), are also found on the continent, some in contexts dated around AD 200 (Spitaels 1969, no. 63, p 138). These too are usually sprung and it is possible that they are also a British product.

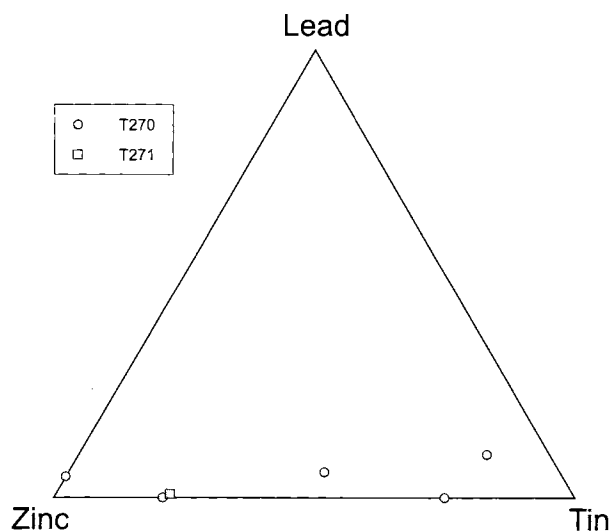
British manufacturers also used the technique of juxtaposing different enamel colours in large fields without metal divisions. This appears on some bow brooches, for example, a few of the enamelled T-shaped and headstud brooches (T100, T108–111, T120, T148B, T149B and T151–152), and also on several varieties of plate brooch, including T260, flat, of plain usually oval outline, which has a broad ring of plain or juxtaposed colours surrounding a central oval field; this is often empty now, but in a few cases contains an intaglio. There are two of these from Richborough (Cat 386–387) both with empty centres. Most examples come from southern and eastern Britain but there are a

few from the North (see list in Appendix 3, p 261); very few have been found abroad. There has been a tendency to regard these as later than most enamelled brooches (cf Boon 1959, 85, 'a barbarous intaglio'), but none are from securely dated late contexts, and one from Nettleton, Wiltshire, was with a coin of AD 141–50 (Wedlake 1982, no. 64, p 130); another from Kidlington was in a deposit not later than AD 300 (Hunter and Kirk 1954, no. 13, p 59). Fifteen of the seventeen examples analysed were of leaded bronze (Figures 145 and 149).

Another large group of disc brooches is known as the 'buckler' or 'tutulus' type, T269, with the centre usually raised in several stages and a number of small lugs round the rim. Richborough Cat 377 is not a standard pattern: these usually have the lugs attached directly to a truly circular main plate (for example, the T269 shown on Figure 152). There are several types, and they occur throughout the Roman provinces, with dates ranging from the first to third centuries. Those with enamelled centres usually also have enamelled lugs round the circumference; examples include several from the Rhineland (Exner 1939, group III, type 60; one from a burial with Antonine samian), Nijmegen (van Buchem 1941, pl xvi no. 25) and Augst (Riha 1979, Tafel 60, nos 1591–3, one brooch found with pottery of late second to early third centuries). Non-enamelled examples include the small brooch from a burial at Winchester, Hampshire, dated Flavian or earlier (Biddle 1967, fig 4, no. 14) and larger ones from Wroxeter, with a context date 'before 120' (Bushe-Fox 1916, pl xvi, no. 12), Gadebridge, Hertfordshire, from a late second- or early third-century context (Butcher 1974, fig 55, no. 29) and Blicquy, from a burial of the second half of the second century (de Laet *et al* 1972, grave 279, no. 5). Most examples are made of leaded alloys, either bronze or gunmetal (Figure 145).

A British type which appears to be datable to the third if not the fourth century is a gilded circular (T270) or oval (T271) brooch with a central setting of coloured glass (Plate 7). Richborough has a fine example of T270 (Cat 388); these are common in the South and East of Britain (see list in Appendix 3, pp 261–2) but also occur on the Northumbrian frontier (Figure 179), with outliers at Wroxeter and New Grange, Ireland (O'Kelly 1977, 53). The very similar oval variant has at least thirty-five examples in the South and East, several from the northern frontier, outliers from Yorkshire and Nornour, and a group in the East Midlands. Both are presumably British products since relatively few of either type are known from the continent: for example, the Saalburg and Zugmantel, Germany (Böhme 1972,

Tafel 29, nos 1132–4); Augst (Riha 1979, Tafel 13, no. 309); and Free Germany (Thomas 1966, 139). There are a few indications of date: Zugmantel is supposed to have been abandoned about AD 260; a round example from Uley was in a context of third to early fourth century (Butcher 1993b, no. 5, p 156); the oval brooch from Fishbourne was in a robbing trench of late third or early fourth century (Hull 1971, no. 43, p 106); another from Nettleton was found with a fourth-century coin (Wedlake 1982, no. 7, p 148). Although the German evidence should show that they had appeared well before the end of the third century and Mackreth (1996, 321) argues for an early date, there has been an emphasis on the fourth century because of associated finds, and some features are also commonest in the fourth century: for example, the use of gilding and the stamped decoration of SSS. The use of mercury gilding on these brooches necessitated low-lead alloys; quantitative analyses all show a lead content of less than 1 per cent (leaf-gilding is also found on a few of each type). It is surprising to find that while more than half of the analysed round examples (eleven out of twenty) are of bronze, most of the oval examples (eight out of ten) are brass: perhaps an indication of different workshops producing similar goods (Figures 145 and 153).



153 Ternary diagram showing the composition of T270–271

LATE BOW BROOCHES

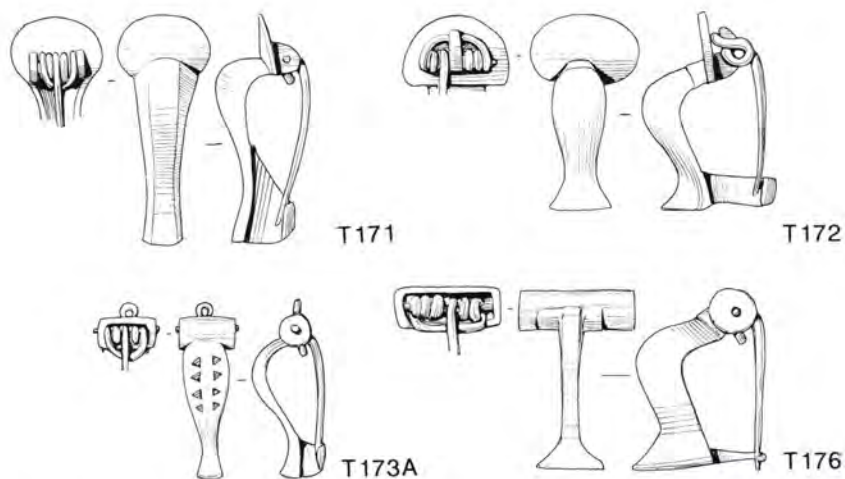
KNEE BROOCHES

Plate brooches were always less numerous than bow brooches; amongst the latter the second half of the second century sees a return of continental types after perhaps a hundred years during which the British market was supplied by locally produced brooches which hardly reached other provinces. The first of the more general types of the later Empire are the 'Knee brooches' (T171–177), best known from the forts of the German *limes* where they are regarded as 'soldatenfibeln'. In Britain they are also found in forts but have a wider distribution; some types seem to be British products and to be decorative rather than utilitarian.

Knee brooches are distinguished by the angular or S-shaped profile of the bow and can be either sprung or hinged. The most common form on the German frontier is T172 (Figure 154), which does not occur at Richborough; it has a semicircular headplate, often with engraved decoration, covering a spring held on a single central lug; the catchplate extends as a long rectangular bar from behind the plain foot. Examples can be seen from the Saalburg (Böhme 1972, Tafel 7, nos 384–91), and Augst (Riha 1979, Tafel 12, nos 291–7). A few occur in Britain, for example, Chesterholm, Northumberland (Bidwell 1985, fig 39, no. 8), London (Wheeler 1946, fig 26, no. 17), and from Newstead (Curle 1911, no. 30, p 325). The latter is presumably from the Antonine occupation; the dating given to the continental examples is second half of the second century.

Type 176 (Figure 154) which has a spring held on a rod between the ends of a cylindrical crossbar, also occurs on the *limes*, where it is abundant in the period AD 150–200 (Böhme 1972, Tafel 8–9, nos 429–62, pp 21–2). There are three at Richborough (Cat 241–243) and the type is widespread though not numerous in Britain: from the *Classis Britannica* fort at Dover and the towns of Colchester and Leicester to the northern forts of Old Penrith, Housesteads and Newstead, the last in an Antonine context (see references and other parallels in Appendix 3, p 256). Analysed examples are mainly of leaded bronze with a median lead content of 14.3 per cent (Figures 155–156).

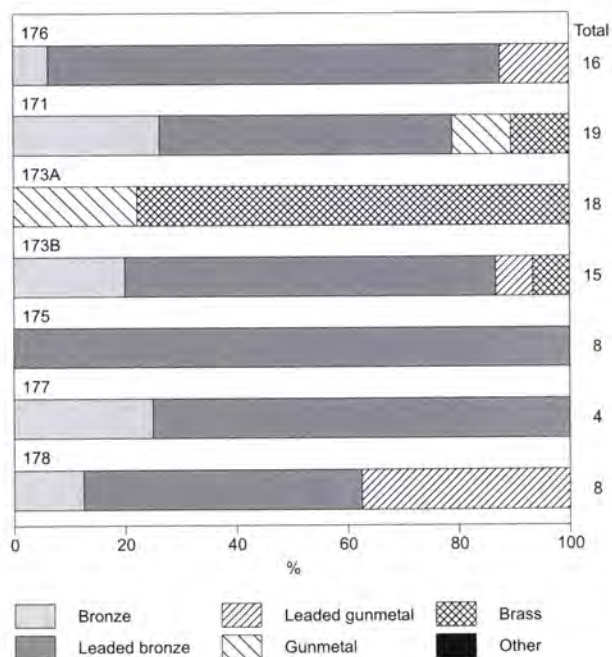
Other forms of knee brooch are more common in Britain and rare or missing on continental sites; especially those which are sometimes decorated with enamel or with applied silver strips or wires. Type 171 (Figure 154) has the semicircular headplate of the continental brooches cited under T172 (above), but the spring is held on a bar between two lugs and the



154 Knee brooches: T171–172, T173A, T176. Scale 2:3

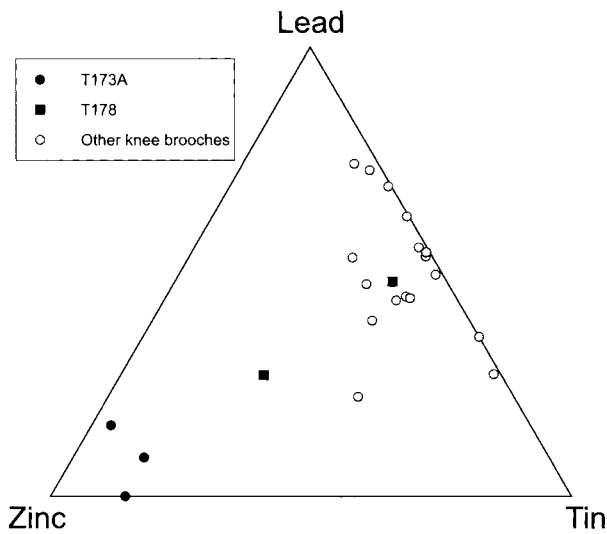
catchplate does not project in the same way, its longer axis instead running up the back of the bow; several examples have an enamelled headplate. It occurs on military sites, including South Shields (Allason-Jones and Miket 1984, 3.23–4, p 98), but also on southern civilian sites such as Kidlington (Hunter and Kirk 1954, no. 6, p 58), Rushmore, Dorset (Pitt-Rivers 1887, pl x, no. 7) and even reached Nornour (Hull 1968b, nos 259–60, p 64). The only dated examples are those from a drain in the legionary fort at Caerleon dating AD 160–230 (Zienkiewicz 1986, fig 55, nos 16 and 18) and from the Jewry Wall site at Leicester dating about AD 220 (Kenyon 1948, fig 81, no. 3). Most of the analysed examples are unleaded or lightly leaded bronzes with a median lead content of 8.5 per cent (Figures 155–156).

Type 173A, a very small brooch with a spring in a cylindrical head, often enamelled (Figure 154), is also widespread in both civil and military sites in Britain and rare on the *limes*. There is one from the temple site at Hayling Island (Soffe forthcoming), another from nearby at Fishbourne (Hull 1971, fig 39, no. 38), also St Albans (Goodburn 1984, no. 43, p 27, from a third-century pit) and several others from civil sites in the South and Midlands. They also occur on military sites, for example at Chesterholm (Bidwell 1985, fig 39, no. 4), from a context of about AD 223–5, and there are four from Camelon, Stirlingshire, in the Scottish frontier zone, three of these from Antonine contexts (Maxfield forthcoming). Unlike other knee brooches most are brasses (Figures 155–156) and in addition to enamel they are often decorated with applied silver wire or foils



155 Alloys used for knee brooches (T176, T171, T173A, T173B, T175, T177, T178)

in similar designs to the enamelled brooches of T162–8 (the Camelon brooches all had applied silver but were not enamelled). From their very small size and decorative nature it seems unlikely that these were mainly intended for military use; a civilian market is also indicated by the southern part of their distribution.



156 Ternary diagram showing the composition of knee brooches

Part of another form of knee brooch, nearest to Hull's T179, has been found in Lincolnshire with an inscription translated as 'Brooch from the Regio Lagitiensis' (Tomlin and Hassall 2001, 396). This has been linked with the suggested manufactory at Castleford (Bayley and Budd 1998; Bayley forthcoming).

The fort of Camelon also has seven examples of T173B, of similar shape but larger and undecorated, and again more common in Britain than on the continent. It seems possible that both these and the T173A brooches were being made on the site, although there is no direct evidence. Most are of leaded bronze (Figure 155), in contrast to the brass or gunmetal T173A brooches from the same site and period.

Richborough has an example of another apparently British knee brooch, T175A (Cat 240); none has been noted in several large collections of brooches from the *limes*. Parallels are listed in Appendix 3 (p 256), from which it will be seen that it occurs on both civilian and military sites. So far there are none from Scotland, which may indicate that this type is somewhat later than the others. All analysed examples are of leaded bronze and the median lead content is 13.5 per cent (Figures 155–156).

The 'pseudo-bow' brooch, T178A (Richborough Cat 245–246) also appears to be a British product. These were classified with knee brooches by Hull, and the profile suggests the relationship, but they are distinguished by the headplate, the spring arrangement, and the broad flat foot. There are several close parallels

from Britain (see list in Appendix 3, p 256), but none have been noted from continental sites. Dating evidence comes from Chesterholm, where one was found with mid-third-century material (Bidwell 1985, no. 7, p 119) and Carlisle, where a late second-century context is mentioned (Snape 1993, 48). Most are leaded, either bronze or gunmetal (Figures 155–156).

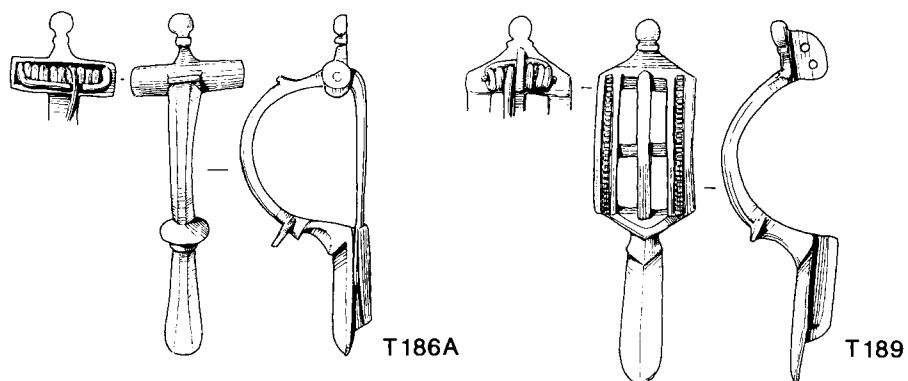
SHEATH-FOOTED BROOCHES

The latest major group of bow brooches found in Roman Britain is Hull's Group 11, which was defined to include all P-profiled brooches with sheath foot. Its best known members are the crossbow brooches, T190–192 (Figure 158); these are all hinged, while the earlier members of the group, T185–189 (Figure 157), are sprung.

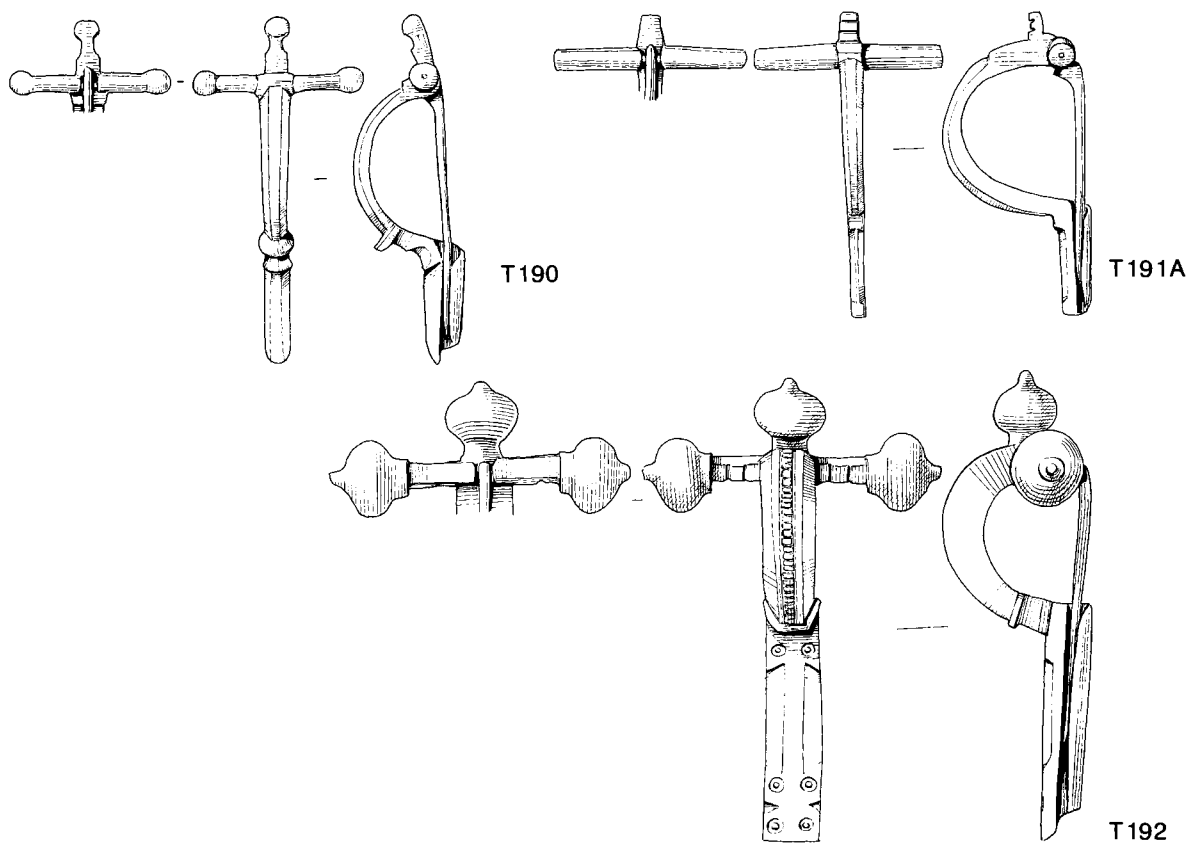
Like the knee brooches this group is continental in origin, though not necessarily always in manufacture. On the German *limes* the sprung P-shaped brooches are, again like the knee brooches, regarded as soldiers' brooches. They are well represented at Richborough, possibly reflecting its return to a military role in the third century, though somewhat earlier than the date usually given for the construction of the earth fort (see Chapter 6). Many of the sprung brooches are tinned and/or gilded; the low-lead examples on Figure 159 were probably all originally gilded, though traces of gold only survived on two of these seven examples.

Type 189 (Figure 157), which has the upper, P-profiled, bow divided into three (or occasionally two) separate ribs and the spring mounted on a lug behind the headplate, has nine representatives at Richborough, all but one of leaded bronze (Cat 258–267), a pattern found on other sites too (Figures 159–160). They are common on the German *limes* (Böhme 1972, type 27, Tafel 15–16, nos 655–97) where, unlike most of the sheath-footed and knee brooch types, they resemble the British examples very closely. Only a few have been noted from other western provinces, and some which appear similar from further east have a narrow tube for a spring at the head, for example, from Pannonia (Kovrig 1937, pl xvii, no. 179) and Dura Europos, Syria (Frisch and Toll 1949, pl xiv, nos 99 and 110). At the *limes* forts they are dated to the end of the second and early third centuries, a dating supported by the find from Carpow, Perthshire, a Severan fort abandoned under Caracalla (Birley 1965, fig 11, no. 4). As with the preceding group they are regarded as soldiers' brooches on the *limes* while the British evidence suggests that civilians also used them (see list in Appendix 3, pp 257–8).

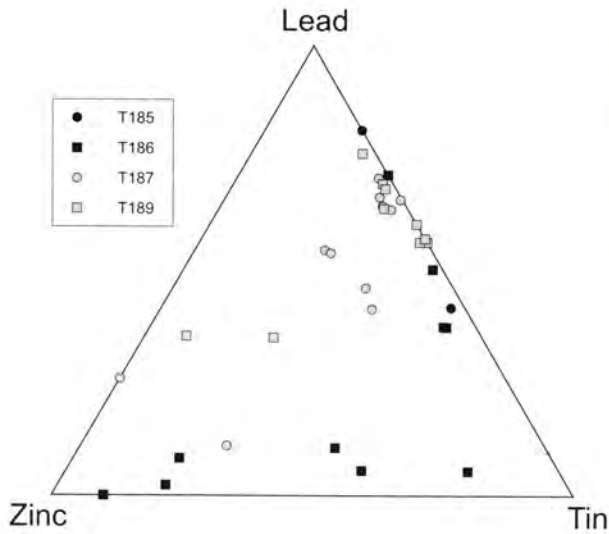
The others of this group have the spring in a cylindrical crossbar, usually open at the back. Type 187,



157 Sprung sheath-footed brooches: T186A, T189. Scale 2:3



158 Crossbow brooches: T190, T191A, T192. Scale 2:3



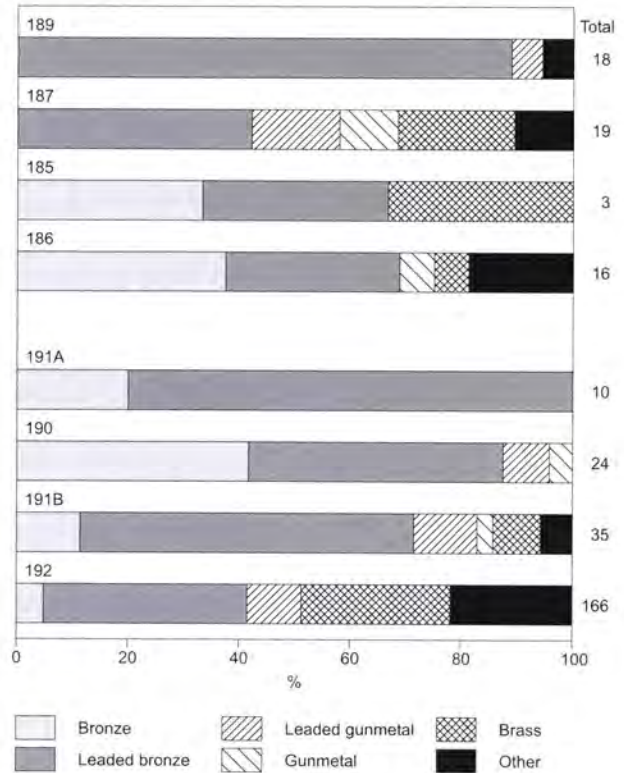
159 Ternary diagram showing the composition of sheath-footed brooches, T185–189

Richborough Cat 251–257, again have a divided upper bow; they come from much the same range of sites as the last type, including Carpow (listed in Appendix 3, p 257). The alloy composition looks less uniform: this is because of the variety of applied decoration, such as tinning on the leaded alloys and mercury gilding on the brasses and ‘coppers’ (Figures 159–160).

Type 185 and T186 (Richborough Cat 247–250; Figure 157) are rarer on the continent and may well be British products. Brooches such as Cat 247 (T185), with a knobbed plate riveted to the upper bow, have only been found at military sites so far, while Cat 248 (T186A) has most parallels from civil sites, including the temples at Woodeaton, Oxfordshire, and Uley; parallels are listed in Appendix 3 (p 257).

Crossbow brooches

The hinged brooches generally grouped under the name ‘crossbow’, T190–192 (Figure 158), succeed the foregoing sprung types as the principal brooches of the later third and fourth centuries and are common throughout much of the Empire. Within the types they are generally uniform in appearance and tend to be made of a limited range of alloys (Figures 161–163; though some of these clusters lie across alloy-name boundaries thereby making Figure 160 appear less clear cut). All this indicates large-scale manufacture and it has been suggested that these brooches, primarily the equipment of soldiers and officials, were produced in

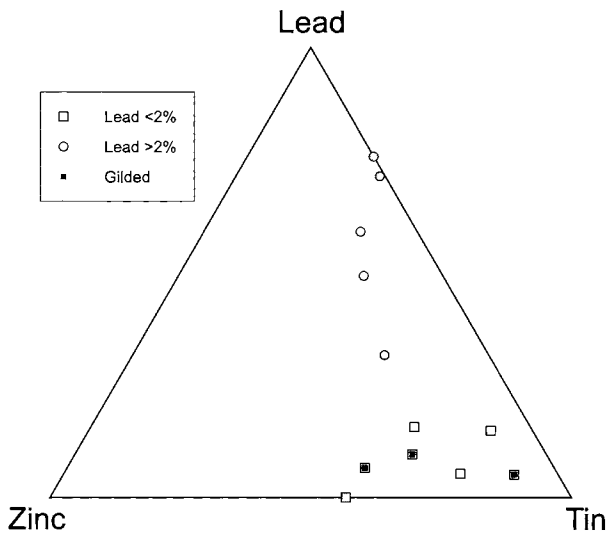


160 Alloys used for sheath-footed brooches (T189, T187, T185–186, T191A, T190, T191B, T192)

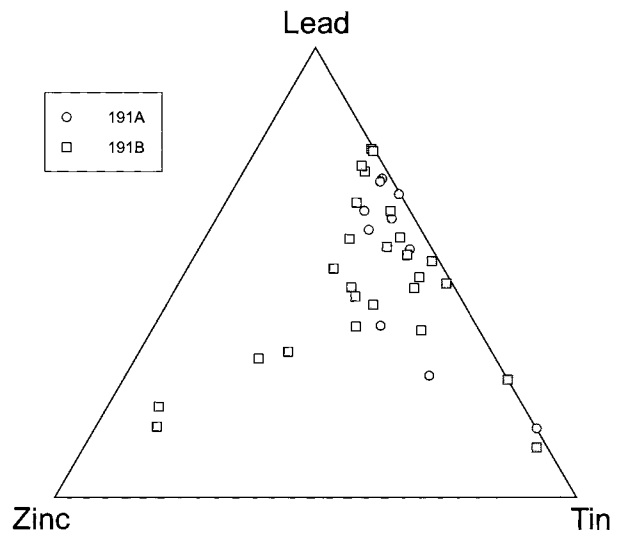
state factories in Pannonia or Illyricum (Kent and Painter 1977, 27). However, there are indications that T190 is a British product (Chapter 6, p 199); Swift (2000) has shown that there are localized distributions of sub-groups of the apparently ‘standard’ types across the Empire. Richborough has one of the biggest groups of crossbow brooches in Britain and their classification is described in detail in Chapter 4; because of their relevance to the history of the site they are discussed further in Chapter 6.

Some continental authors reserve the name crossbow for the simpler forms and call the developed type the ‘onion-knobbed’ brooch; others do not include the ‘light’ type at all and only call the developed brooch ‘crossbow’; in Britain the name has usually been applied to the whole group of T190–192.

Typologically crossbow brooches follow a clear succession from the ‘light’ types (T190 and T191A), with little decoration, which appear in the third century, through to some very ornate T192 brooches of the late fourth and fifth centuries. However, the



161 Ternary diagram showing the composition of T190 brooches



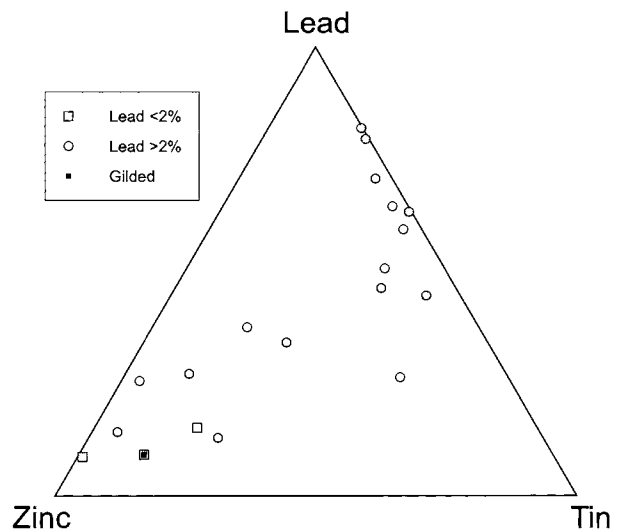
162 Ternary diagram showing the composition of T191 brooches

intermediate stages (T191B and some of T192) overlap a good deal, so far as can be seen from the few well-dated finds covering this long period.

The earliest crossbow brooches, T191A (Figure 158; Cat 269–278), appeared in the first half of the third century; some of those found in forts of the German *limes* abandoned about AD 260 are very similar to the Richborough brooches (for example, Böhme 1972, Tafel 16–19, nos 701–76). Richborough has ten of these brooches, more than all the other known examples from Britain, which are listed in Appendix 3 (p 258).

The other light crossbow brooch, T190 (Figure 158; Cat 279–287) is less common in other provinces than the preceding type and not as well dated, although one from Dura Europos, destroyed about AD 265, is a good parallel for some of the Richborough brooches (Frisch and Toll 1949, pl XII, no. 69). The list of parallels in Appendix 3 (p 258) shows that the type occurs on civilian sites in southern Britain as well as in northern forts.

According to some classifications the heavier brooches of T191B (Cat 288–311) form the beginning of the main crossbow series on the continent (Keller 1971, type 1; Riha 1979 type 6.5); they are dated by grave finds to the period AD 290–320. One from St Albans was in an occupation deposit of AD 280–360 (Goodburn 1984, fig 9, no. 54). Richborough Cat 294 was given the site dating of ‘before c275–300’ by Bushe-Fox (1949, no. 56, p 119) but Malcolm Lyne considers the deposit to include material up to AD 400+. Similar



163 Ternary diagram showing the composition of T192 brooches

brooches occur on both civil and military sites in Britain (see Appendix 3, pp 258–9), but the number found at Richborough seems to be greater than on any other single site.

The developed crossbow brooches of T192 (Figure 158; Cat 317–326) differ from the preceding types in their proportions and in decoration, sometimes very elaborate;

they always have large knobs on the head of the bow and on the crossbar and some are constructed of several pieces. They have been classified by van Buchem (1966), Keller (1971) and Pröttel (1988). Sometimes these type definitions are difficult to match in every detail, but broadly the series dates AD 340–460. Dated parallels for individual brooches from Richborough have been indicated in the catalogue. The main types are found throughout the Roman Empire. In Britain numerous examples have been found from all parts of the late Roman provinces (see list, Appendix 3, p 259).

In composition just over half of all the sheath-footed brooches, T185–192, are leaded bronzes, with the leaded gunmetals being part of the same compositional cluster (Figure 160). The remainder are those of precious metals, those intended for gilding, and a few leaded bronzes of T189 and T192, the latter a distinctive late Roman alloy type. A few brooches of solid gold or silver are known, and their high status is confirmed by monuments of the late fourth and early fifth centuries showing important personages wearing ornate crossbow brooches (van Buchem 1966; see also Kent and Painter 1977, 26–8; and Swift 2000, 108–12). Some others were gilded, usually by the mercury process; these were all low in lead and high in copper though otherwise of variable composition, and it is likely that many other of the unleaded examples were originally gilded. The sprung P-profile brooches of T185–189 are mainly leaded bronzes but there are also ‘unleaded’ examples of T186–187, both bronzes and bronzes, some with surviving gilding, and leaded bronzes of T189 (Figure 159). The light crossbows (T190 and 191A) are either leaded bronzes or ‘unleaded’ bronze for gilding, which survives on three analysed examples; note no zinc-rich alloys were found (Figures 161–162). The majority of the heavier crossbows of T191B are leaded bronzes but a few zinc-rich alloys were used (Figure 162). This trend continues with the late crossbows of T192 where there is an almost even split between leaded bronze and brass, both with and without lead (Figure 163). Gilding survives on six (of eighteen) unleaded examples which are either brass or impure copper, a metal not normally used for Roman brooches but common for gilded Romanesque metalwork (Oddy *et al* 1986).

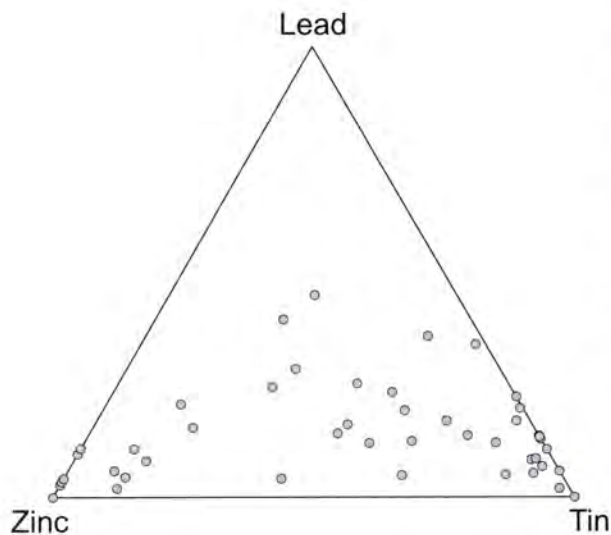
The continuing use of leaded bronze for most of these sheath-footed brooches is remarkable, especially given the two-century period when they were in use. Their composition is more consistent than for other leaded bronzes with median tin contents of about 7 per cent and lead about 12 per cent (Figure 183).

A number of separate screw terminals which may have been part of the pin-fixing mechanism of some T192 brooches have been found (Richborough Cat 327–336). Examples including the gold brooch of Childeric were cited by Behrens (1919, 14) to suggest that the main pin of the brooch was inserted into the top of the catchplate, which did not have a side slot, and was held at the head of the brooch by a pin such as Richborough Cat 327, screwed through the arm of the crossbar and forming one of its terminal knobs. All the Richborough examples were made of brass, presumably because of its malleability, and then gilded (as far as can be seen). Screw terminals could have been used on any of the gilded brooches, though no brooches seen in this study appear to have had (or lost) a screw terminal. The relatively large number of these screw terminals found at Richborough suggest this was not a very secure means of fastening brooches, though the brooch itself was probably large enough to be readily found if dropped.

PENANNULAR BROOCHES

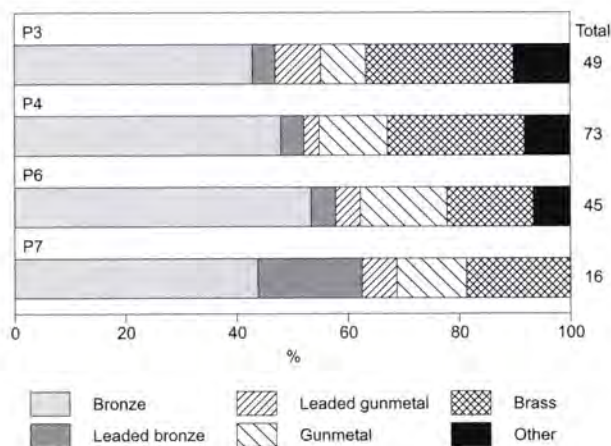
Penannular brooches (Hull types P1–15; Cat 391–445) are always dealt with as a separate group because they show so few links with the other brooches of the Roman period. They work on a different, and simpler, system: basically a metal ring on which a pin is hooked; the ring has a gap through which the pin, securing a fold of material, would be drawn. They are classified mainly by the decorative treatment of the terminals defining the gap. The form originated in the pre-Roman Iron Age, some types in Britain (Fowler 1960), others independently in various parts of the continent (Galliou 1981; Tuitjer 1986). Because they are simple in design the main types occur very widely and sometimes over a lengthy period: presumably the products of many different craftsmen. There is also a range of alloys, but because most are wrought rather than cast, and had to withstand considerable stress in use, the vast majority are unleaded (Figure 164). Of those analysed quantitatively, only 6 per cent were (leaded) and 4 per cent leaded, with a maximum content of 9 per cent lead. These examples are of relatively massive cross-section. As Figure 165 shows, there is no significant difference between the alloys used for different types. The ‘other’ alloys are almost equally split between unalloyed copper and silver – both rarely used for other brooch types.

There are not many types of penannular brooches with a sufficiently distinctive shape or decoration to



164 Ternary diagram showing the composition of penannular brooches

enable worthwhile conclusions to be drawn. The 'omega' type is one (P11; Richborough Cat 391) although few have been found in Britain and fewer still with ribbed terminals such as this example. They have been studied by Simpson (1979, 322–8) who lists examples from Germany and Iberia, where they are more numerous. She cites one from Rheingönheim (AD 40–74) as similar to the Richborough brooch, which was from a Claudian site context; it is brass.



165 Alloys used for penannular brooches (P3, P4, P6 and P7)

Richborough also has representatives of the most common types, demonstrating that these 'native' brooches were taken up by romanized communities, although some speculate that they were worn by native workers or even prisoners (Simpson 1979, 329). The largest group is P3 (Cat 393–415), with terminals coiled back over the ring. Dated British parallels come mainly from first-century sites and the distribution seems to be entirely south of the Humber. Fowler has distinguished a sub-group with flat decorated rings (1983, 18–19) and several of the Richborough brooches may belong to this fourth-century group (Cat 409–412).

Another common type is P4 (Chapter 4, pp 140–1, Cat 416–427). The parallels for these come from all parts of Roman Britain, and from contexts of first to fourth centuries, but Cat 424 has terminals of a shape which is sometimes regarded as the forerunner of the elaborate post-Roman brooches with zoomorphic terminals. There is considerable controversy over the origins and dating of these brooches (Savory 1956; Fowler 1963; Kilbride-Jones 1980b) but parallels for the Richborough brooch show that they belong to the later Roman period in Britain: Lydney, Birdoswald, Cumberland, in a deposit of about AD 369–83; Brancaster, Norfolk, in a third-fourth-century deposit (references in Appendix 3, p 262).

CONCLUSION

This survey has sought to show that where sufficient well-provenanced examples of a distinctive type are known, brooches usually fall into significant groupings, whether of composition, distribution or date. An attempt is made in Chapter 6 to relate these groups to the history of Richborough, and it should be possible, as accurate technological information accumulates, to study them in relation to the industries, trade, and even society of Roman Britain.

An example of the sort of information that could be pursued is based on the use of zinc-rich alloys for some types of brooch through the late first and second centuries. In the earlier first century brass was used for all brooches, but about AD 50 it was replaced by bronze for many British types, though not for all. Within the broad 'trumpet' and 'headstud' groups of the later first century there is a contrast between the brasses and gunmetals of types with loose headloops and the leaded bronze of those with fixed headloops (see above). Dated finds show that this is not simply a chronological division but seems more likely to represent the products of different workshops. Brass was also used for some types that are definitely later, for example, the pseudo-

trumpet and other brooches of T162–168 and the enamelled knee brooches, T173A. These may be the products of a continuing tradition of brooch-making in northern Britain, contrasting with the numerous leaded-bronze brooches coming from the South-West; many of the latter are T-shaped and follow the Colchester-derivative tradition. There is also a difference of quality between the ‘brasses’ with their decoration in fine relief and applied silver, in addition to enamel, and the leaded bronzes, many of which are rather crude, with simple patches of colour as their only decoration. The distribution of the products of the two industries could be studied in detail to see which markets they reached: civil or military, rural or urban, wealthy or poor, as well as the geographical extent of their trade.

There are changes too in the alloys used for brooches made on the continent. The high-zinc brasses of the early to mid-first century give way to the mixed alloys of the Flavian period and later, typified by Figures 146 and 151, and later still leaded brass makes its

appearance. Leaded bronze is used too, for knee and sheath-footed brooches, but not until nearly a century after it first became common in Britain.

The variations in composition of brooches of known date shows that different alloys were in use at the same time in different parts of the Empire. This suggests that there was no overall, centralized control of manufacturing, but that local entrepreneurs chose their own resources. It should be possible to extend this work by analysing other, less well-dated types of artefacts; their composition may suggest periods or areas where they are most likely to have been made. For this to work on an Empire-wide basis, more extensive programmes of analyses of brooches and other objects from other provinces will be necessary.

NOTE

- 1 Information from Ann Greenwood, a breeder of Arab horses.

CHAPTER 6

THE HISTORICAL CONTEXT OF THE BROOCHES FOUND AT RICHBOROUGH

The brooches found at Richborough are reviewed here in relation to the history of the site and its place in Romano-British history. For this purpose the examples considered as parallels to the Richborough brooches are not all those of the same morphological type but only those within it which also have similar, though not often identical, secondary characteristics such as decoration, and which are therefore likely to come from the same or related sources. Appendix 3 lists the examples on which the survey is based and their distribution is shown on the maps illustrating this chapter.

A study of the distribution of brooches similar to those found at Richborough may suggest for each period a) the geographical links, and whether these were the result of military dispositions, official organization, or of trade, and b) the origin of the brooches and hence a source of supplies used at the site, although such portable objects may have come indirectly by trade or other means. Obviously where there are numerous specimens of a type at Richborough the interpretation is more plausible than with small numbers of brooches.

Given the uncertainties that must attend an attempt of this sort, the results should be treated with caution: the selection of parallels for such variable objects is necessarily subjective, while their discovery and recording is fortuitous. However, it does appear that the method produces some results consistent with other evidence; as more finds are published and more scientific criteria become available they will no doubt need revision.

Richborough was probably the landing site chosen by the invading Roman army in AD 43 and it certainly

continued in military use as a supply base during the first stages of the conquest (Cunliffe 1968; Frere and Fulford 2001). It seems unlikely to have been so useful to the army once campaigning had moved to northern Britain from about AD 70 onwards, but may well have had an official role in the transport of supplies in both directions, as well as the outward conveyance of the taxes levied by the Imperial administration. Its geographical advantage as a port on the trunk route through south-eastern Britain to the Rhineland and the heart of the Empire could have continued throughout the Roman period since the gradual silting of its access to the sea seems not to have become critical until later.

Some of the military store buildings were already being replaced before AD 70, but a large-scale clearance was made for the building of the Great Monument in about AD 80–5. This probably marks the end of Richborough's role as an official supply-base, although the continuance of what looks very like a *mansio* suggests that some official business continued to take this route. New buildings, including shops, of the late first and early second century indicate that the port continued to flourish, presumably in the hands of private traders and their suppliers (Cunliffe 1968).

Brooches were part of the regular equipment of the Roman soldier, used for fastening the military cloak; but they were certainly also used by civilians. The large numbers of mid-first-century types of continental origin found at Richborough must be associated with the invading army, and the distribution of parallels within Britain can be seen as the spreading of Roman influence (which had begun before the invasion, probably through trade).



166 Distribution map of parallels to the Aucissa brooches, T51, from Richborough

There are twenty Aucissa brooches from Richborough (T51; Cat 74–92 and A1–2); with its very standardized design, found in all the Roman provinces in the mid-first century AD, the type is clearly associated with the army. Elsewhere in Britain most examples have been found within the primary area of Roman conquest: the South and Midlands, although within this area some come from sites of native origin with no known military occupation (Appendix 3, pp 245–6; Figure 166). A few reached northern sites, but the authors have no note of any from Scotland.

The various forms of Hod Hill brooch (T60–79; Cat 95–153) make up the largest typological group on the site, emphasizing its military connection which is well known on the continent, although like the Aucissa they are by no means confined to such sites. In Britain the same pattern emerges: they are most numerous in the areas conquered first, rare in the North and in Wales and missing from Scotland (Appendix 3, pp 246–9; Figure 167). It seems clear that even where brooch-types arrived in Britain with the army they were soon adopted by the natives.

The simple one-piece brooches of the type often called the Nauheim derivative (T10–11; Cat 1–30) and the Colchester type (T90–91; Cat 46–67) are other mid-first-century brooches which are abundant at Richborough. Although these are found on the continent they were also being made in Britain and some at least must have been obtained locally (but see Chapter 5, alloy results for Colchester brooches, p 149). Their distribution is mainly in the area of primary Roman conquest but may be due to native cultural affinities rather than to the army (Appendix 3, pp 241–5; Figures 168–169). However, the rod-bow type of the Nauheim derivative ((b) in catalogue), known as a soldier's brooch in Germany, is found on some northern military sites.

The two-piece Colchester brooch (T92–93; Cat 160–201) again shows the army adopting British-made brooches: it is unlikely that all these belonged to civilians since they come from what was probably still the military area of the site. This type flourished in the period AD 50–65 (see Chapter 5, under Colchester-derivative brooches) and there are forty-two examples from Richborough; the great majority of parallels are from south-east England and East Anglia (Appendix 3, pp 249–51; Figure 170). Another Colchester-derivative, T94B (Cat 206–207), reached Corbridge and also has more midland and western examples (Appendix 3, pp 251–2; Figure 171).

In the later first century most of the brooches found on the site were of British origin (Chapter 5); the

distribution of parallels presumably reflects the site's connection with the various stages of the Roman advance into western and northern Britain, and the subsequent growth of communications and trade. The following are the principal types of this period present, some probably running into the early second century:

- Parallels for the eight Richborough Polden Hill brooches (T96–97, T100, T103; Cat 208–215) are mainly in the West Midlands, where the type seems to have developed (Appendix 3, pp 252–3; Figure 172). Several are from military sites of the early phase; for example, Kingsholm, Dodderhill and Baginton. Very few similar brooches appear in southern or eastern sites other than Richborough, though some other varieties of the Polden Hill are more common in these areas. The type begins in the 60s but seems most numerous at Wroxeter in the period AD 80–120, a dating which is reflected in its appearance at some northern forts.
- The classic undecorated trumpet brooch (Richborough has two of the standard type, A, T158A, Cat 216–217) has a distinctively military distribution, occurring mainly in the North, with few examples elsewhere and none in the South-West (Appendix 3, pp 253–4; Figure 173), whereas its devolved forms (of which there are many variations, represented at Richborough only by Cat 219 (B, T153D) and Cat 220 (C, T159A); Chapter 4), are frequent in the West Midlands and the South; excavated contexts indicate a slightly later date.
- The version of the dragoesque brooch found at Richborough (only one, Cat 350; T200) occurs on some northern forts and quite frequently in non-military contexts in the North, Midlands and East Anglia; there are few in the South.
- The small enamelled brooches with toothed edges, of which Richborough has three examples (Cat 225–227; T145A), occur mainly in the Midlands, although one comes from Newstead (Appendix 3, p 255; Figure 174). These may be the forerunners of the headstud type (T148–149; Chapter 5), most of which have a general distribution throughout Britain. A related type (T146; Cat 234), possibly to be dated later, that is, to the mid-second century, is found mainly in the north and east of Britain (Appendix 3, pp 255–6; Figure 174).
- Others with a northern and eastern distribution pattern are the enamelled fan-tail (T36; Cat 238; Appendix 3, p 255) and the disc brooch with an applied triskele-decorated plate (T249A; Cat 373; Appendix 3, p 260; the distribution of both types is shown on Figure 174).



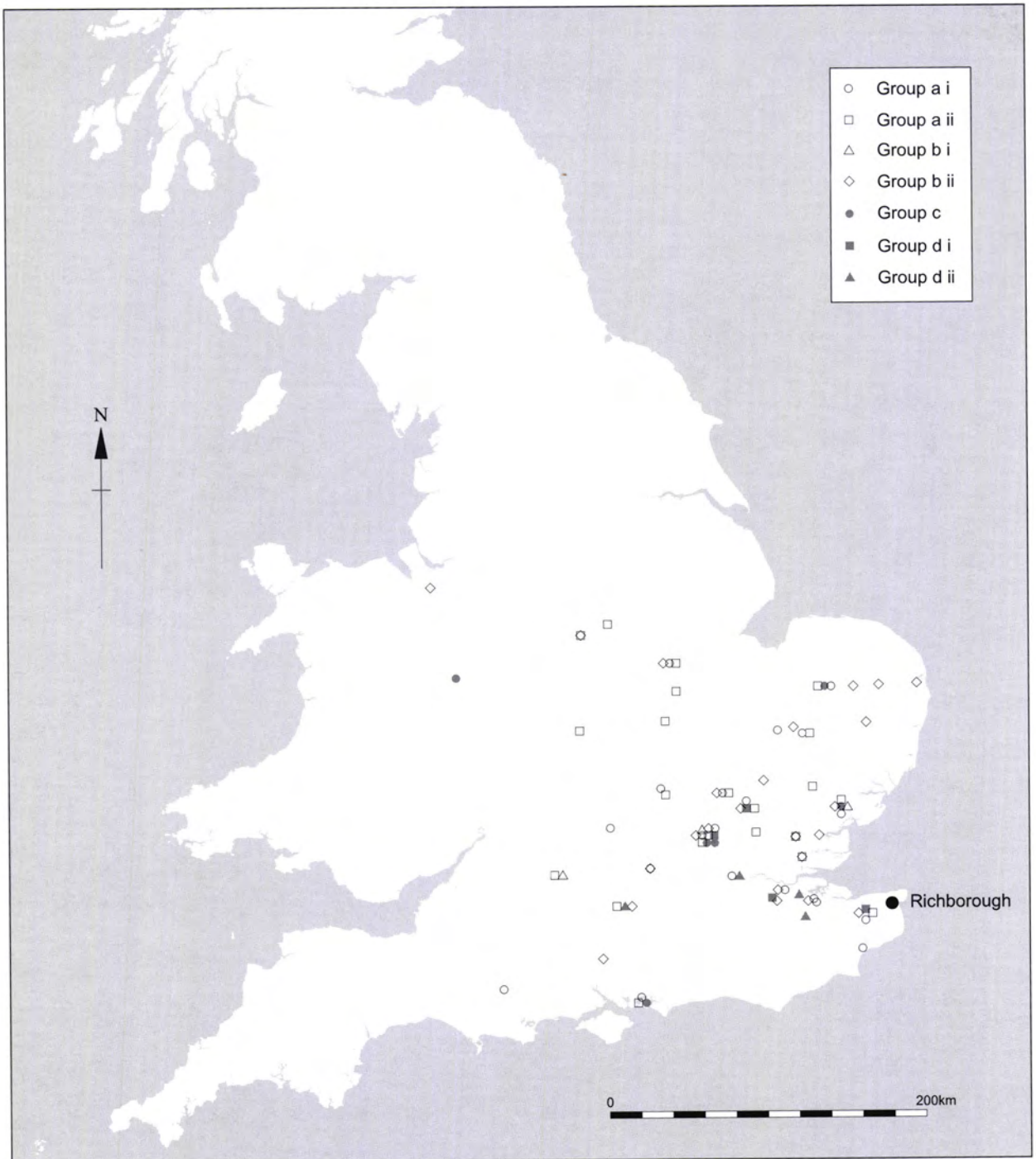
167 Distribution map of parallels to the Hod Hill brooches, groups a-e, T60-69, from Richborough



168 Distribution map of parallels to the simple one-piece or 'Nauheim derivative' brooches, with flat bows and rod or wire bows, T10-11, from Richborough



169 Distribution map of parallels to the Simple Gallic and one-piece Colchester brooches, large, small and miniature, T89–91, from Richborough



170 Distribution map of parallels to the two-piece Colchester brooches, T92-93, groups ai-ii, bi-ii, c, di-ii, from Richborough



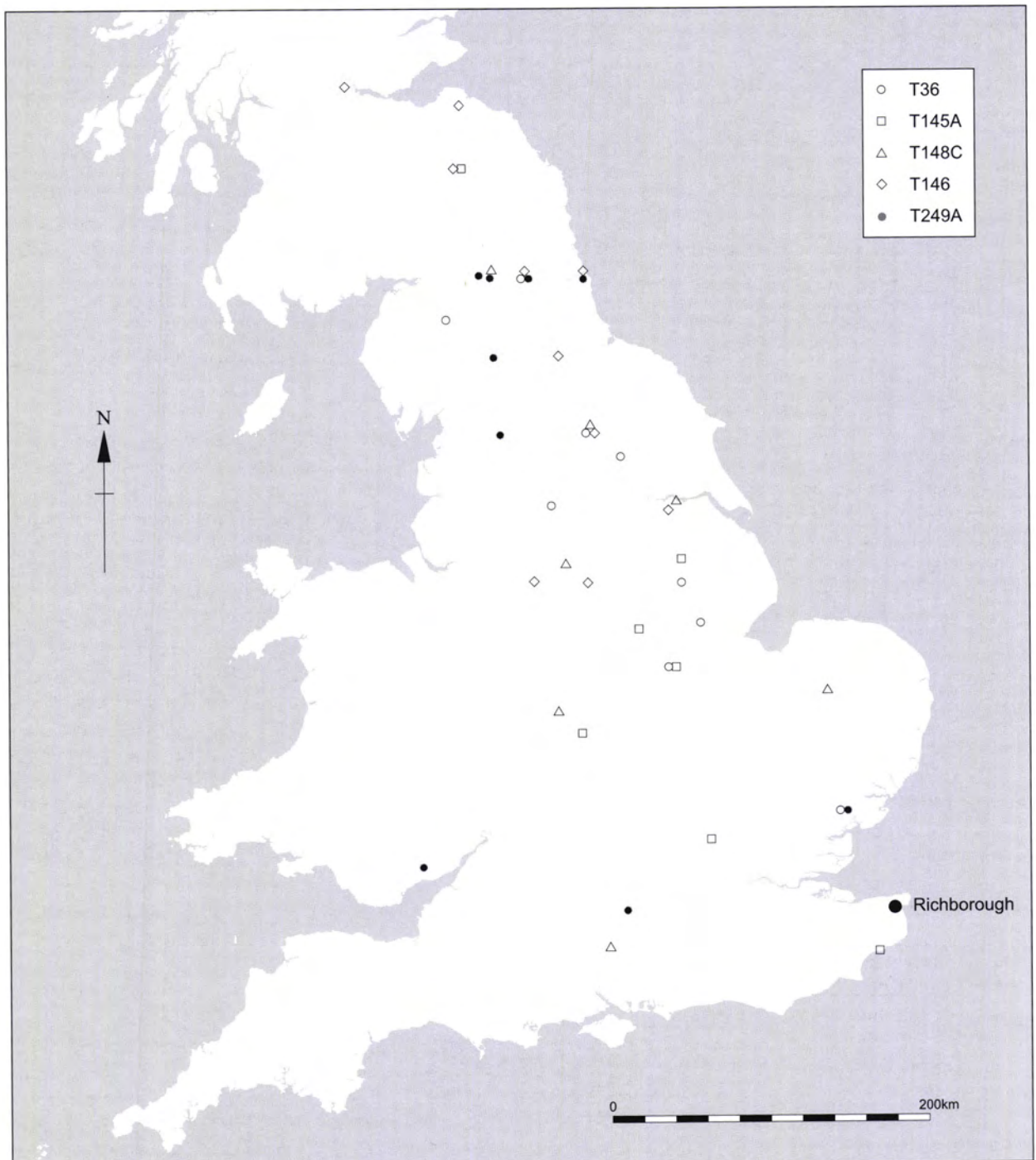
171 Distribution map of parallels to the hinged dolphin brooches, T94B, from Richborough



172 Distribution map of parallels to the Polden Hill brooches, small light, T96–97, T103, and larger developed, T100C, from Richborough



173 Distribution map of parallels to the trumpet-headed brooches, groups A, Aii, B–D, T153–159, from Richborough



174 *Distribution map of parallels to the T-shaped, headstud and disc brooches with applied triskele-decorated repoussé plate from Richborough*

- Some other British products of the late first and early second century have a general distribution like the principal headstud types already mentioned. These include the following types occurring at Richborough: the umbonate enamelled disc brooches of T267 (Cat 382–383), and the enamelled trumpet brooches (T157, Group D; Cat 221; Appendix 3, pp 254–5; Figure 173).

Thus in the period when Richborough seems to have been mainly a trading centre the brooches demonstrate its connections with most parts of Britain, including probable links with military sites. Its overseas connections are shown by a number of plate brooches from the continent of types which rarely occur elsewhere in Britain: for example, Cat 357, 358, 362, and, especially, Cat 363, which is abundant in the mainland provinces.

The later second and early third centuries were thought of as a period of decline at Richborough 'marked not only by lack of evidence for building activity, but also by roads and buildings falling into disuse. ... With the growth of towns and communication much of the trade originally passing through Richborough must have been captured by centres able to deal direct with the continent' (Cunliffe 1968, 243). But the brooches datable to this period suggest that there was still a certain amount of cross-Channel contact, because most of them are of types that originate on the continent and are not common in southern Britain. This, taken with the retention of the *mansio*-like building, might suggest that some official traffic was still using the route, and the military associations of many of them indicate the possibility of some form of garrison at this period:

- The 'knee' brooches of Type 176 (Cat 241–243) are held to be soldiers' brooches on the German *limes* in the second half of the second century, and there are parallels for those found at Richborough on North British sites with military connections, but there are also quite a number from civil locations (Appendix 3, p 256; Figure 175). The pelta-shaped plate brooch Cat 356 (T241) has similar dating and distribution.
- Richborough has more than any other site in Britain of the sprung P-shaped brooches with sheathed foot (T185–189; Cat 247–267): nine of T189 with divided bow, six of T187, and four of the others. Elsewhere they are most numerous on northern military sites, with a scattering in the eastern and central southern counties (Appendix 3, pp 256–8; Figure 176). The pseudo-bow brooches of T178 (Cat 245–246) belong

to a type apparently found only in Britain and again mainly in the northern frontier zone.

- There are also some enamelled plate brooches which probably date to the later second and early third century, and which are continental products with few parallels in Britain. These are the lozenge-shaped brooch Cat 364 (T227), and the disc brooches with millefiori decoration, Cat 369–371.
- Three other enamelled disc brooches which are almost certainly British products also probably belong to this period since one was found at Newstead: Richborough Cat 384–385 and A11, (T252B and C). These are more generally distributed in the rest of Britain, including several from the South (Appendix 3, pp 260–1; Figure 177).

These (with single specimens of other types) amount to quite a significant collection of brooches for the period held to be of least importance in Richborough's history. No doubt this is partly due to continued occupation of the civil settlement but it seems possible that some of them reflect the resumption of its military or official role, perhaps as part of the defences against seaborne raiders or as an aspect of Caracalla's suggested reorganization of the army in Britain. The P-shaped group is closely associated with the army on the German *limes*, where they are dated to the late second and early third centuries; in Britain two of them were found at Carpow (a Severan fort abandoned under Caracalla) so it is difficult to date them all as late as the mid-third century, the date usually given to the building of the earth fort, the precursor of the Saxon Shore base. However, there may have been an earlier military presence, perhaps in connection with the *Classis Britannica*, which seems to have left Dover in the early third century (Philp 1981).

The large collection of crossbow brooches, of several forms, must be connected with the presence of the army at Richborough in the third and fourth centuries. The 'fore-runners' (Cat 269–278; T191A), are common on the German *limes* where they are dated before about AD 260, from the forts that were abandoned at that date. There are ten of them at Richborough and only a few from the rest of Britain. The other 'light' crossbow brooch (Cat 279–287; T190), is more difficult to parallel abroad but is common in Britain, especially on the northern frontier. There are nine of these from Richborough. There are no well-dated finds but it is tempting to see this as a type produced for the army in Britain (Appendix 3, p 258; Figure 178).



175 Distribution map of parallels to the knee brooches from Richborough



176 Distribution map of parallels to the sheath-footed, P-profiled sprung brooches from Richborough



177 Distribution map of parallels to the flat enamelled disc brooches from Richborough



178 Distribution map of parallels to the sheath-footed, P-profiled hinged brooches (the crossbow series) from Richborough

The developed crossbow brooch is found throughout the Empire and its typological phases have been dated by grave finds. The fifteen examples from Richborough listed as T191B (Cat 288–302) belong to the first phase, dated to AD 290–320 under Keller's system (1971). No other British site has so many; there are a few from the northern frontier, but other parallels are from the South and East (Appendix 3, pp 258–9; Figure 178), including several from Silchester and London, and one from Verulamium (in a context dated AD 280–360, Frere 1984a, no. 54, pp 29–31).

Some examples of T192 (Cat 320–323, 325) fall within Keller type 4, AD 350–80, which occurs in most parts of Britain, though chiefly in towns or forts and on religious sites. Several close parallels for Cat 320 come from the cemetery of the late Roman coastal fort at Oudenburg, Belgium (Mertens and van Impe 1971), and one from the site at Ickham, on the route from Richborough to Canterbury, which has been suggested as a supply base for the Saxon Shore forts (Young 1981, fig 4, no. 1, p 37). Perhaps this type was standard equipment for some units of the army, or their officers, in the mid-fourth century.

For the most elaborate crossbow brooches, there are only Cat 324 and some separate knobs and pins from

Richborough (Cat 327–336); in Britain the parallels have been found mainly in the towns and shrines of the southern part of the country (see parallels for Cat 324, Chapter 4, p 118). This tallies with their suggested use by relatively high officials, while their absence from the North may support Keller's dating to the very end of the fourth century and beyond.

In view of the flexibility necessary in dating brooches – how long to allow for retention in use or as an heirloom, as well as our ignorance of the time a given type was in production – it is probably risky to relate the various crossbow groups to the phases of occupation of late Roman Richborough. But certain groups do fit almost too neatly with known events: the large group of T191B with the stone-built fort of the late third century; the developed crossbows of the mid-fourth century might be related to the period when it is known that expeditionary forces made their landings there (Lupicinus landed his troops in AD 360 and Count Theodosius in AD 367), while the parallels on the continent and scattered through Britain may show a renewal of its importance as a centre of communications at this time. The ornate brooch Cat 324 could belong to the very end of Roman occupation, a period attested at Richborough by the abundance of coins of the house of Theodosius.



179 Distribution map of parallels to the gilded disc brooches with central glass setting, T270, from Richborough

CHAPTER 7

RESULTS AND INTERPRETATION

The preceding chapters have set out the detailed results of this study of Romano-British brooches from both technological and typological aspects. Here, an overall survey of the results in broader terms is presented, with suggestions of ways in which this approach might assist interpretation of the industry, trade, and society of Britain in the Roman period.

The brooches from Richborough have been studied in relation to nearly 3,000 others, mainly from recent excavations and thus partly unpublished, which have been available for inspection and analysis, and to published examples, which, together with Hull's Corpus (Hull forthcoming), take the total to about 10,000. The evidence from this large body of material is not of uniform quality: the older finds were often ill described, lacking any note or drawing of important details such as the method of pin attachment or the nature of any decoration, while many finds, no matter how well-recorded, have not survived in good enough condition for significant details to be visible. However, as shown, the material has yielded some useful results.

The correlation between alloy composition and type of brooch has been emphasized because this seems one of the most promising ways to extend the information that the study of brooches may produce. Until the majority of extant brooches has been analysed any interpretation must be tentative, but it is remarkable how generally consistent the results are so far.

In studying Roman brooches there is always uncertainty as to how to group the material: almost every piece differs to some extent from others with a generally similar appearance and typological judgements are inevitably subjective. The alloy groupings

offer more objective criteria but even here it is necessary to make a judgement as to where to fix the percentages which distinguish one alloy type from another. However, from the results detailed in the foregoing chapters it can be suggested that in both aspects the broad generalizations seem to work: that is, the main types of brooch are found to consist mainly of one alloy type.

The differences that exist within these 'main' groupings may suggest the conditions under which brooches were manufactured in Roman Britain, even though the material examined must be only a small proportion of what was produced. An estimated 20,000 brooches survive from the whole period AD 40–410 (although the number is rapidly increasing through metal-detector finds, most of which lack a sound provenance). In the first 150 years of Roman occupation the population of Britain is conservatively estimated to have been between one and two million, and at this time brooches were a standard part of everyday costume: thus most individuals would have had at least one. Consequently, what survives is a small sample of what must have been quite a large production.

CHRONOLOGY AND SOURCE AREA

Richborough is a good starting point since it was occupied throughout the period of Roman rule in Britain, and neither before or since; the brooches found there include most, though not all, of the main range of types current in Britain from the first to fourth centuries AD.

The initial period of the Roman occupation of Britain, AD 43–69, was a time when the wearing of brooches by both men and women was a general fashion in western Europe. Richborough has many representatives of the standard types that were common throughout this area, such as the Aucissa and Hod Hill, and of those that seem to have been British products such as the one-piece Colchester type. These and the other types found in southern Britain in the first half of the first century were usually made of brass, replacing the traditional bronze of Iron Age brooches. There are usually a few brooches of another alloy within these types, and minor differences between types in the alloys used, but in general there was more standardization of alloy than at any other time. However, a major change occurs within this period with the introduction of leaded bronze. This is associated with another change: that from the one-piece spring of the (wrought) Colchester brooch to the separate spring assembly of brooches which, though of similar shape, could now be cast in the probably cheaper and more plentiful alloy.

The Flavian period (AD 69–96) sees the virtual disappearance of imported brooches and the proliferation of types produced in Britain. From the abundance of finds this is evidently a time when the wearing of brooches was general and functional: many are very simple. The alloys used are now more diverse and each is associated with only some of the many types.

Distribution patterns vary, suggesting that different types were being produced in different areas, but direct evidence for manufacture is sparse (see below). Very broadly, the native types of the Flavian period might be divided as follows: the Colchester-derivatives, hinged T-shaped and Polden Hill brooches, together with the more simple or devolved forms of headstud and trumpet brooches, are usually made of bronze, often leaded, and are most common in southern and western Britain, while the finer versions of the trumpet (A) and headstud brooches (T148C, with loose wire headloop), together with the Dragonisque plate brooches, are usually of brass or gunmetal and are commonest in northern and eastern Britain. The distinction between sprung or hinged pins does not follow the same division at all closely: some types in each group may be mainly sprung or hinged (for example, Polden Hill from the first group and Trumpet A from the second, which are both sprung, while headstuds of T148C are hinged) but there is some bias towards springs for the more elaborate and hinges for the simplest.

Manufacture of some of the above types probably continued into the second century, particularly those

found on sites not occupied until then, such as the forts of Hadrian's Wall, while the T-shaped brooches continued to develop. During the Antonine period (AD 138–92) new types appear, including the knee brooches, probably the first major type to be imported from the continent since about AD 60–70. However, British manufacture continued, including local versions of the knee brooch, the T-shaped brooches of T138–140, and the various brooches with expanded decoration on the bow (T162–168). The association of alloy with type also continues, notably the use of brass or gunmetal for the more decorative products such as T162–168 and of leaded bronze for the plainer types, as T138–140. There is also the same association of the finer, mainly brass, products with a northern and eastern distribution and of the plainer leaded bronze types with the South-West, suggesting continuity of manufacture from the Flavian period – perhaps an indication that there were some well-established specialized workshops.

By the third century the wearing of brooches had become much less general and there is a tendency to regard all types of the later Roman period as 'soldiers' brooches'. Certainly their distribution in Britain includes a large proportion from military sites but there is also quite a number from contexts which are not military and seem unlikely to have the 'official' connection which is also suggested for these brooches. The majority of third- and fourth-century brooches are made of leaded bronze and show less variation than in the main period of British brooch manufacture. The standard types of crossbow brooch, found throughout the western Empire, are thought to be the product of Imperial factories but it seems possible that some of the existing British workshops might have produced their own versions (cf T190, Chapter 6, p 199). A few distinctive brooches were still being produced in Britain in the third century, possibly continuing into the fourth: for example, the gilded disc brooches of T270–271 (some of which were brass) and the crude 'horse and rider' brooches (see Chapter 5, pp 175–6 and p 178).

In the foregoing summary a distinction has been emphasized between types of brooch made in Britain and those apparently imported from the continent. As very few can be related to workshops this must be regarded as conjectural, but for most types the distribution provides a clear indication. However, it seems possible that some major types of continental origin were also produced in Britain. Hod Hill brooches may be one of these groups, since they show much minor diversity of form and decoration, and of alloy

composition. Not many analyses of brooches found on the continent have been published, and only a few more have been available for inclusion in our programme.

PATTERNS OF ALLOY USE

The data on alloy composition from Appendix 1 has been summarized in Tables 7–9 (Chapter 2) and has been used in plotting the histograms in Chapter 5 which display the data for related types of brooches and show clearly that for most types there was a preferred alloy which was used to make a high proportion of the analysed examples. Once this pattern had been identified, which happened early on in this project (Bayley *et al* 1980; Bayley and Butcher 1981), it led to a re-examination of the typological groupings of brooches whose compositions did not show this sort of correlation; composition was considered more objective than typology. While many of the typological groupings used are well-established (for example, Collingwood and Richmond 1969; Hull forthcoming), new groupings have been suggested to take account of the extra data now available on alloy composition and methods of decoration. This is reflected in the detailed discussion of which alloys were used to make which types of brooch in Chapter 5. The overall pattern (Figure 180) shows that plate brooches have the highest proportion of leaded alloys while the penannulars, not surprisingly, have the lowest. Brass is used most commonly for bow brooches and bronze for penannulars.

The numbers of analysed brooches of particular types vary greatly which means that the discussion of the patterns of alloy use has to proceed at a number of levels, not all of which can be applied to all types. Any inferences drawn must be tentative when there are only a few analyses of a particular type. With somewhat larger numbers, patterns of preferred alloy use begin to emerge and with large groups statistical inter-comparisons become viable. There are no absolute numbers of analyses necessary for the different levels of discussion as the homogeneity of the group and the proportion of quantitative analyses both affect what can be said.

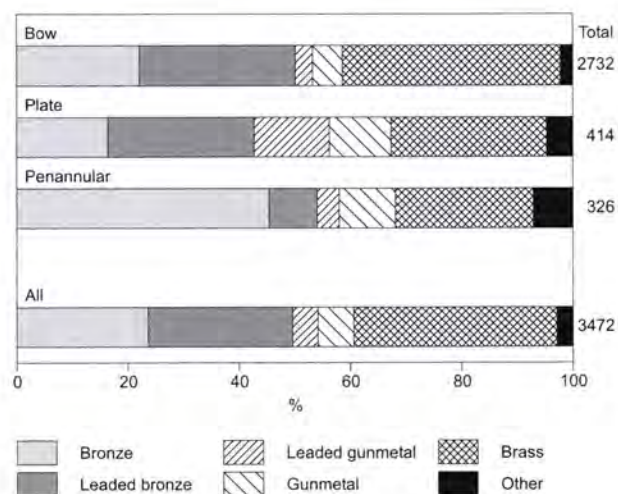
Table 6 (Chapter 2) shows that just over 33 per cent of the brooches analysed were brasses and about 20 per cent each leaded bronzes and bronzes, blanket terms which each cover a range of compositions. Different brooch types, however, do have somewhat different compositions within these defined ranges, as shown by the differing distributions of points on the ternary diagrams in Chapter 5. In order to quantify and

compare these differences numerical measures of the average value and the spread (dispersion) of the results is required. The ones chosen are the median and inter quartile range (IQR); see the discussion in Chapter 2 for the reasons for this choice.

BRONZE

Bronze was the normal copper alloy in use in pre-Roman Iron Age Britain so its use for Nauheim (T9), Nauheim derivative (T10–11), strip bow (T13–17) and other brooch types that were current before and around the time of the Claudian conquest, is no surprise. Some British copies (T53–54) of Aucissa and Bagendon brooches date to the same period and they too have similar compositions, with high tin (10–12 per cent) and low zinc and lead contents (Figure 181); the head is rolled backwards as in the plainer T13–17, while other strip bows (T55–58A) have the Aucissa head construction and are more often brass. This correlation of the method of construction with alloy suggests British craftsmen were copying the general form of the brass brooches in bronze, while at the same time retaining the hinge technology with which they were familiar.

More unexpected is the use of this type of bronze for many Dolphin brooches (T94) which may date from the change-over period from brass to leaded bronze in the later first century (see Chapter 5 for a full discussion). The later bronzes (T36 and T190) have lower tin contents (4–7 per cent) and higher zinc or lead levels; a more mixed composition that has already been noted above as typical of later Roman metalwork.



180 Proportions of bow, plate and penannular brooches made of different alloys

Although most Celtic fan-tailed brooches (T36) are bronzes, the few quantitative analyses include some leaded bronzes which are the reason for the large lead IQR. Despite the use of bronze for nearly 20 per cent of all plate brooches (Figure 180), its use is not predominant in any one type. This, and the relatively small proportion of plate brooches with quantitative analyses, mean that bronze plate brooches do not appear in Figure 181.

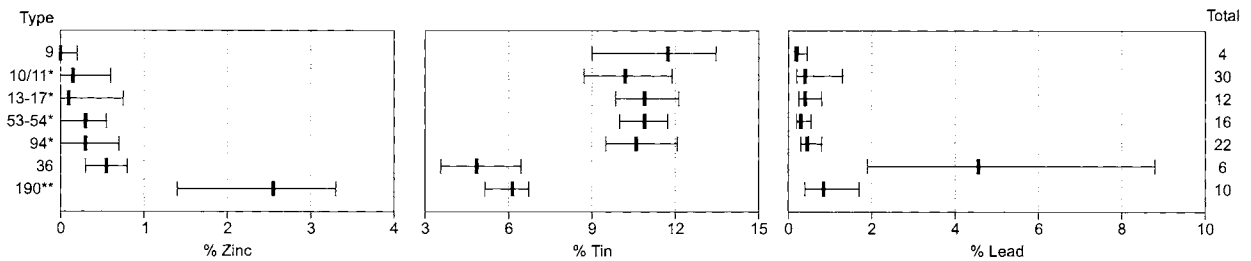
BRASS

Many different brooch types were preferentially made of brass but quantitative analyses show their median compositions are rather different, though all lie within the limits defined as brass in Chapter 2. These values are plotted in Figure 182.

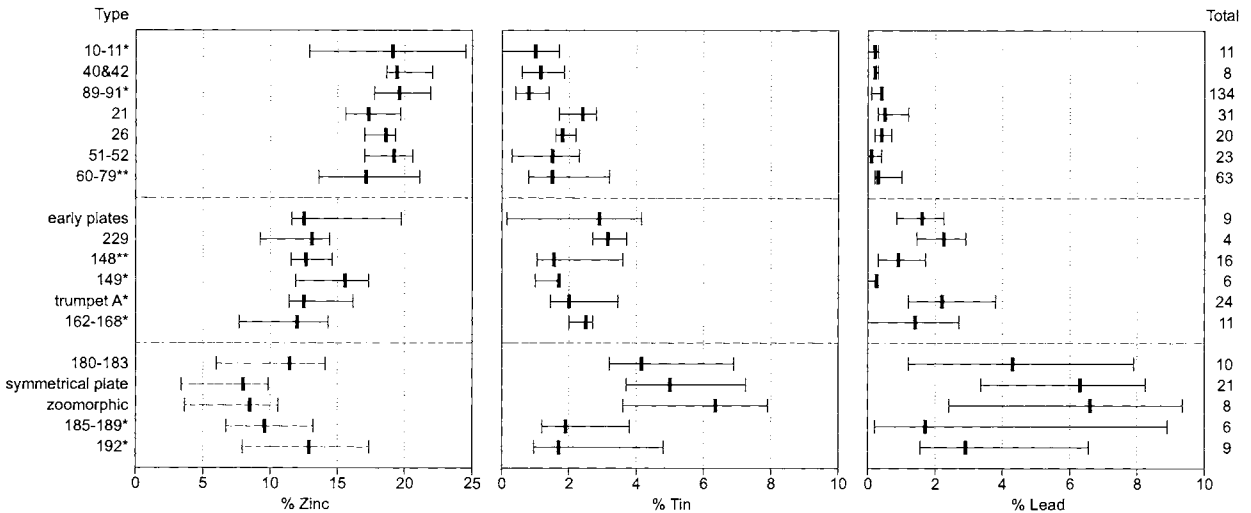
The compositions of the early to mid-first-century brass brooches (the top section of Figure 182) are

clearly different from the later brass types. Median values for zinc are high (17–20 per cent), tin low (typically 1.0–2.5 per cent) and lead very low (not more than 0.5 per cent). Even within this group there is some variation. Simple Gallic and one-piece Colchester types (T89–91) have lower and Langton Down and Rosettes (T21 and T26) have higher median tin contents than other types, suggesting that the brass used for making brooches had multiple sources. The early plate brooches belong here chronologically but their composition has closer parallels with that of the later first-century brasses (the middle section of Figure 182) which have lower median values for zinc (typically 11–13 per cent) coupled with higher tin and lead values (1–3 per cent).

Most of these early to mid-first-century types are of continental origin so it is clear that brass was the normal brooch-making alloy in use on the continent at this period. This is borne out by the analyses of



181 Medians and inter quartile ranges for brooches made of bronze. * = bronzes only, ** = excluding leaded bronzes. The figures at the right show the number of analyses for each type



182 Medians and inter quartile ranges for brooches made of brass. The top seven lines are early-mid-first-century types, the middle group are mainly later first century and the bottom group less pure brasses, some of still later dates. * = bronzes only, ** = omitting bronzes. The figures at the right show the number of analyses for each type

brooches of the same types from sites in France and Germany (for example, Rabeisen and Menu 1985; Guerra *et al* 1990; Riederer 1993; Chardon-Picault and Pernot 1999; Boelike and Rehren 2002). The one-piece Colchester brooches (T90–91) are an anomaly in this group as most of them are considered to be British-made as continental examples are rare. Part-made examples have been found at Baldock (Stead and Rigby 1986, 122) which supports their British origin, and a pre-conquest date seems certain for at least some of these examples. There is, however, no evidence for the manufacture or melting of brass in Britain before the Claudian conquest (Bayley 1990), therefore, the metal for these (wrought) brooches is likely to have been imported, even though they were fabricated here. Brass ingots of mid-first-century date are known on a number of sites (Bayley 1990) so the metal may well have been imported in this form.

The brass brooch types that originated in the Flavian period include the British-made headstud (T148 and some of T149; the latter is more often made of bronze or leaded bronze), trumpet-headed (trumpet A, T162 and T166–168) and related (T163–164) brooches, as well as the initial equal-ended (T229 etc) brooches of continental origin. As already noted, the average zinc content of these types is lower than in earlier ones, suggesting the metal used to make them was not all newly made cementation brass but some, at least, was recycled metal.

Other broadly contemporary brooches such as some zoomorphic types, the early symmetrical plate brooches and the related bow brooches with tubular hinge-covers which all have simple enamel and are of continental origin, have a range of zinc-rich compositions which

have much larger inter quartile ranges (the top three rows of the bottom section of Figure 182) showing less careful control or selection of alloys; zinc levels are low (medians 8–12 per cent). These types include a number of gunmetals that also tend to contain some lead, which explains the high median tin and lead levels.

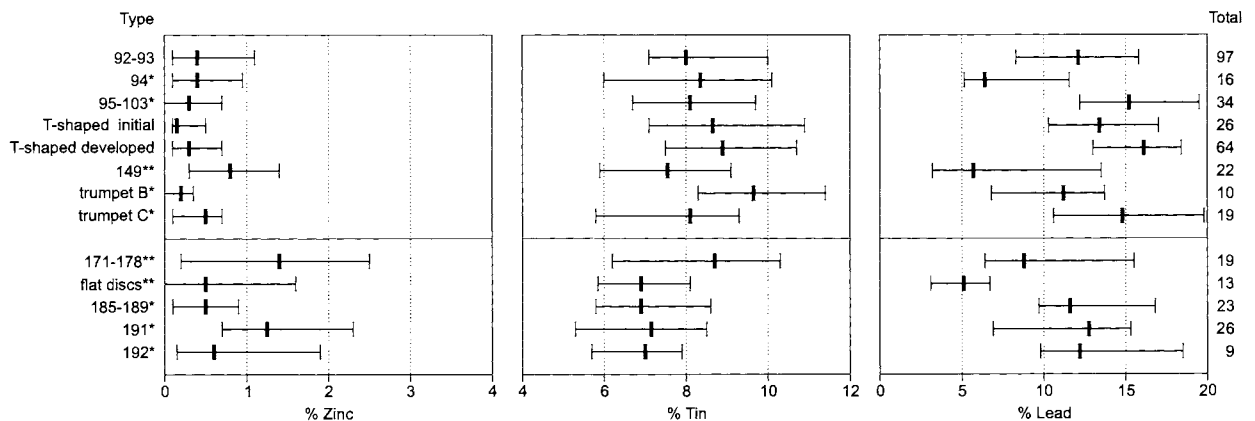
In the late first to second century the continental brooches tend to have more varied compositions than the British ones (cf Figure 146 with Figures 139 and 144) but the number of quantitative analyses is too small for detailed comparison to be made.

Although the median values of the third- and fourth-century brasses (the bottom two rows in Figure 182) are similar to those of the later first century, the far larger lead IQRs show the presence of some leaded brasses which are unknown at earlier periods. These changes to increasingly less pure brasses mirror the increasing proportion of mixed alloys noted in later Roman objects other than brooches (Bayley 1994).

LEADED BRONZE

A similar inter-comparison exercise can be undertaken for the leaded bronzes. The impression given by Figure 183 is of greater consistency than among the brasses though there are some noteworthy variations.

Leaded bronze is a very characteristic British alloy in the later first and earlier second century, being used for two-piece Colchester (T92–93), Dolphin (T94) and T-shaped types as well as for some headstud (T149) and trumpet-headed (trumpet B and C) brooches. In most cases the intention of the alloy maker probably was to produce a bronze with a roughly consistent tin content (8–10 per cent) and then add to it 12–15 per cent lead,



183 Medians and inter quartile ranges for brooches made of leaded bronze. The upper group are later first-century types, the lower date to the later second century and later. * = leaded bronzes only, ** = omitting brasses. The figures at the right show the number of analyses for each type

though occasionally nearly twice this amount was added. The actual amount was not critical as the only effect of additional lead at these levels is to lower the melting point of the alloy. Most T94 and T149 brooches have compositions that fall within a bronze-leaded bronze continuum (see Figures 124 and 137, Chapter 5). Even when the unleaded bronzes are removed from the groups (as with the data plotted in Figure 183) the lead distributions are bottom-heavy so the IQRs are very asymmetric and the medians are lower than for the rest of the leaded bronzes.

The lower section of Figure 183 includes later second-century and later types. The knee brooches (T171–178) show distinctly higher (though still low) median zinc contents than the other leaded bronzes, mainly because the range extends to include a few leaded gunmetals; the inclusion of some unleaded bronzes produces an asymmetric IQR and a low median value for lead. At least some of the knee brooches were probably made on the continent (see Chapter 5). This implies that from the late second century leaded bronze was being used on the continent for brooch making though its introduction there appears to be a century or more later than in Britain. The authors know of no analyses of continental examples of these later brooches that could be used to confirm this suggestion. The British-made flat disc brooches (T252–255, T257A and T260) have lower tin and lead medians than the earlier types. The lead IQR is relatively small showing the median represents a distinct intermediate composition rather than a mix of bronzes and leaded bronzes. The low tin median has parallels with T185–192, supporting the late date suggested for the oval discs (T260). A possible reason for these low tin contents is that from the third century the major tin sources in Spain had almost been worked out, therefore, tin may have been less readily available or more expensive than previously.

The third- and fourth-century sheath-footed types (T185–192) are distinct from the rest of the leaded bronzes as their median tin content is only 7 per cent. Zinc levels are higher than average in T191–192. This enhancement may be a further manifestation of the drift towards more mixed alloys in the later Roman period or may, as for the knee brooches, just be an indicator of their continental origins.

DECORATION

The various methods of decorating brooches also show a chronological pattern and a similar relation to type and alloy to that outlined above. Most of the mid-first-

century brooches, which are mainly brasses, carry relief decoration produced by engraving or punching and often have perforated catchplates. The quality of this workmanship is usually high. There are three main groups of brooches that also have applied decoration: the Hod Hill series, some of the group with cylindrical spring-covers, and the early plate brooches. On Hod Hill brooches a bichrome or polychrome effect was achieved by tinning part or all of the surface and, less often, by adding metal inlays or niello. A few of the cylindrical-headed brooches had tin inlays, applied repoussé-decorated brass plates, or opaque red glass beads or spheres. The plate brooches of this period were normally tinned and had either glass cabochons held in place by a repoussé-decorated foil, or riveted-on decoration that does not normally survive.

In the Flavian period most of the brooches are cast and relief decoration was produced in the mould rather than by subsequent engraving; the decoration is bolder but lacks the fine detail seen on earlier types. Tinning is almost absent but polychrome effects are still produced – by the introduction of *champlevé* enamelling on trumpet, headstud and some T-shaped brooches.

The new types introduced in the Antonine period are also often enamelled and some of them also have applied silver foils or wires, a type of decoration not seen earlier. The crossbow brooches of the third and fourth centuries were decorated in a number of ways. Some early ones (T190) often originally had a bichrome appearance as they were tinned on the head and foot and gilded on the bow; these are the earliest gilded brooches. Later crossbows tend to be plain, though some have a little crudely cut or punched relief decoration and were occasionally tinned or gilded. The latest crossbows (T192) are more often gilded, and these examples are of unleaded alloys, unlike the majority of the type.

ENAMELLING

Enamel was the most frequently applied form of decoration (Figure 23, Chapter 3). Most enamels were simple, that is, they had only a single colour of enamel in each field, but more complex forms of polychrome enamel, described and illustrated in Chapter 3, are sometimes found.

There is a clear correlation between brooch type and the types of enamel used to decorate them (see Table 18). Among both bow and plate brooches, enamel is only rarely found on early to mid-first-century types, showing that it had not come into use as a common decorative technique until later in the first century. All these early enamels have small fields containing simple enamelling.

Table 18 Types of enamelling on brooches grouped as in Tables 1–3

<i>Brooch group</i>	<i>No. of brooches</i>	<i>No. of enamels</i>	<i>Es</i>	<i>Et</i>	<i>Ec</i>	<i>Ej</i>	<i>Em</i>	<i>E?</i>	<i>% enamelled</i>
Early to mid-first-century bow brooches									
Hook Norton and related types	14	1	1	–	–	–	–	–	7.1
Hod Hill	272	1	–	–	–	–	–	1	0.4
Dolphin	94	3	3	–	–	–	–	0	3.2
Flavian and later bow brooches									
Toothed edge	6	5	4	–	–	–	–	1	83.3
Polden Hill	114	2	1	–	–	–	–	1	1.8
Trumpet-headed	110	17	15	1	–	–	–	1	15.5
T-shaped	93	16	13	–	–	2	–	1	17.2
Headstud	106	91	71	–	–	4	–	16	85.8
Developed T-shaped	110	69	55	–	–	6	–	8	62.7
Trumpet-headed with expanded bow	35	22	19	–	–	–	–	3	62.9
Trumpet/headstud related	51	40	26	–	–	8	–	6	78.4
Tubular hinge-cover	31	30	20	–	5	2	1	2	96.8
Knee	85	14	13	–	–	–	–	1	16.5
Plate brooches									
Early plate	36	3	–	–	–	–	–	3	8.3
Symmetrical: initial	10	10	10	–	–	–	–	–	100.0
Zoomorphic	47	42	30	4	4	3	–	1	89.4
Representational	17	14	4	–	8	1	–	1	82.4
Peltate/crescent	5	5	4	–	–	–	–	1	100.0
Openwork	6	1	–	–	1	–	–	–	16.7
S-shaped	10	9	4	–	–	–	–	5	90.0
Buckler	16	1	–	–	1?	–	–	–	6.3
Umbonate	28	27	27	–	–	–	–	–	96.4
Flat disc	57	57	48	–	–	7	–	2	100.0
Symmetrical: later	57	49	18	1	20	4	4	2	86.0
Disc	68	31	3	–	4	9	14	1	45.6
Complex symmetrical	2	2	1	–	1	–	–	–	100.0
Penannular brooches	230	2	2	–	–	–	–	–	0.9
Total		564	392	6	43	46	19	57	
Percentage of each type of enamel			69.8	1.1	7.7	8.2	3.4	10.1	

Key:

Es = simple enamel; Et = two-colour enamel; Ec = inset circles; Ej = juxtaposed blocks of enamel; Em = millefiori; E? = enamel lost, type uncertain

The new British brooch types that appeared in the later first century were more often enamelled. It occurs rarely on Polden Hill and the initial T-shaped types, but over 80 per cent of the headstud brooches and their precursors are enamelled, as are over 60 per cent of trumpet-headed and related types. On all of these brooch types simple enamel is the norm, with occasional examples of more complex enamelling, usually juxtaposed blocks (see Table 18). The contemporary continental bow brooches include some of those with a tubular hinge-cover, developed from the Hod Hill series; these also normally have simple enamel. However, on some of the later examples (T182–183) the fields are as large as on the related later symmetrical plate brooches, allowing complex enamelling, most usually inset spots, to appear alongside simple enamelling.

Plate brooches presented enamellers with far greater opportunities, which they certainly exploited: it is on these brooches that the majority of complex enamelling occurs, as there was the space available. Table 18 shows that most common groups of plate brooches had enamel on over 80 per cent of the examples in Appendix 1. The early groups (early plate and initial symmetrical (equal-ended) brooches) have only small fields of simple enamel. Some zoomorphic brooches belong with these early plate brooches, but others have large fields like the other representational plate brooches, and some of them complex enamel as well, demonstrating again that Hull's typology can confuse as much as illuminate when aspects of the design of these brooches, such as the types of enamelling, were ignored by him. For patterns to be visible in the data, the early and later continental examples have to be separated from the British-made ones. On the latter, as on British bow brooches, most of the enamel is simple, while a mix of simple and complex enamelling is found on some of the later continental examples, both zoomorphic and representational.

Other British-made plate brooches are the S-shaped, umbonate and flat disc groups. Most of these have only simple enamelling, though a few flat discs have juxtaposed blocks. By comparison the disc and later symmetrical brooches are of continental origin and complex enamel of all types is found on more than half the examples. Both millefiori and inset spots seem to have been continental techniques that were never used in Roman Britain, though millefiori was used here in later centuries. It may be that the reserved metal spots in the enamel fields that were a frequent feature of British plate brooches are a pseudomorph of the spots seen on imported brooches.

The overall pattern of brooch decoration is one of detailed, high quality craftsmanship in the mid-first century when wrought working was the norm. Later there appears to be a move to techniques that were less dependent on individual craftsmen's skills and that were suitable for larger-scale production, though individual pieces of high quality were still made. The continuing popularity of polychromy is notable and perhaps unexpected as we are not generally aware of the original, sometimes striking, appearance of most of the brooches we find. The changes in methods of manufacturing and decorating to those that could be mass-produced is strange as it is during the early period that brooches were most common; perhaps the 'de-skilling' of manufacture and the cost-cutting that we are familiar with today is not such a new phenomenon.

BROOCH MANUFACTURE AND DISTRIBUTION

The very limited surviving evidence for brooch manufacture consists of a few unfinished brooches, lead patterns and moulds. However, too much should not be read into the paucity of this evidence as that for the manufacture of other specific types of object is even less abundant, while there is plenty of evidence for non-ferrous metalworking on sites of all types all over this country. There are crucibles and waste metal from forts, towns, smaller settlements and villas; it is only precious metal working that appears to have been concentrated in larger centres. There is a similar pattern in other parts of the Roman Empire. Because of the poor survival of clay moulds, which are the main class of finds that can be used to prove the manufacture of particular types of brooch, we cannot usually say where brooches were made. Their production was not difficult, so we can expect it to have been carried out anywhere or everywhere, perhaps by itinerant craftsmen; the area they were prepared to travel over may define the area in which a certain type of brooch was made and used. On the other hand there may have been large manufactories in particular places, turning out dozens if not hundreds of similar brooches, flooding the local markets and providing a surplus that could be traded further afield. Metal analyses provide evidence of at least one example of this larger scale of manufacture. The composition of Aucissa brooches (T51) varies little (Figures 118, Chapter 5, and 182) which suggests they may be one such example. Recent analyses by Ponting have shown that this uniformity of composition is not restricted to Britain or the Western Roman Empire. Aucissa brooches from Masada in Israel

have almost identical compositions to those from Britain (Ponting and Segal 1998, table 2), reinforcing the hypothesis of widespread distribution from a single, large manufacturing centre.

The small sample of brooches that survives from what must originally have been a far larger number has already been mentioned and, because of this, the almost complete lack of exact duplicates need not constrain our discussion of the mechanisms of manufacture. At the moment all that can be said definitely is that in a few cases this or that type of brooch was made at a given place. They were probably also made in other places, though no evidence has yet been found. There are many other types for which there is no manufacturing evidence at all, and for these only the distribution of findspots can be used to define the area in which they were used and thus, presumably, manufactured. It is anticipated that future excavations will provide more data and allow the refinement of some of the patterns suggested.

It is possible that the differences seen amongst brooches of the same general type may be the result of production in many small workshops, most of which would be producing their own versions of the currently fashionable styles of brooch.

The distribution of most types of brooch shows regional groupings, which is consistent with a large market: there would be no commercial need to take or to send the product long distances. Some of the commonest types do occur in all parts of romanized Britain, but where they have been studied in detail they show variations which may well correspond to regional production; for example, the trumpet-headed brooches of T149B (Chapter 5, p 163).

FUNCTION AND FINDSPOT

If more detailed studies can be made to distinguish the products and areas of distribution of individual workshops these may provide more information on the market for particular types of brooch: in social and economic as well as geographical terms. The site contexts of brooches have not so far been very informative on these aspects. Comparatively few Romano-British brooches are known to have come from burials, though many older finds in museums possibly did; there is an important group of crossbow brooches from the Lankhills cemetery at Winchester,

with male burials where the sex could be established (Clarke 1979). When the complete contents are recorded, burials are a good source of information on the status and even the occupation of the individual. In Britain most excavated brooches have come from rubbish deposits in sites of all types: towns, villas and rural settlements, also from forts and *vici*, and from temples. However, there is more evidence from elsewhere in the Empire where it can be seen from burials that, especially in the first and second centuries, brooches were worn by both men and women, while statues of the fourth and fifth centuries show that disc and crossbow brooches were then worn by men of high rank. On a more everyday level we can only guess that the larger simple bow brooches were functional, probably used to pin together an outer garment, while the small decorated types of both bow and plate brooch were ornamental. It seems likely that the mainly British types of bow brooch with a loop at the head were worn in pairs linked by a chain, but there were also many where the headtab is solid and so has no function.

Brooches from religious sites have been studied in an attempt to determine whether they were used as votives, and if so, whether some types were produced for this purpose. So far the conclusion must be that while brooches, along with other personal items, were used as votives these were usually types in general use (cf Butcher 1993b, 157). An exception has been suggested for a few figurative types, which might also be seen as the 'badge' of a cult: for example, the continental zoomorphic brooches such as Cat 351 and Cat 352 (Butcher 1981a), and the British horse and rider brooches (Butcher 1986, 316–19).

The nature and connections of a site might be clarified by study of its brooches if the comparative material were better known. Even the broad approach to the parallels for Richborough outlined in Chapter 6 has yielded some significant results, such as its continuing connection with the army in the late first century and renewed military activity early in the third, while the brooches duly conform to the site's known history in other periods.

For all the above reasons it is to be hoped that alloy analysis will become more generally practised, and that all new finds of brooches will be published in detail, since the familiar phrase 'and another similar' or a description, especially when limited to a type name, may well hide diagnostic information.

APPENDIX 1

ANALYTICAL RESULTS

The data for the brooches from Richborough has mostly been incorporated into the catalogue (Chapter 4) and is given in full in Table 22, below. It has also been included in Table 23 (on the CD) for ease of comparison with that for brooches from other sites; see the editorial notes on page xii for details of the contents of the CD. Table 19 summarizes the data in Table 23, indicating the total numbers of quantitative and qualitative analyses of brooches from each site and including references to the publications that cite the brooches.

Each entry in this appendix contains the following information: a four-letter site code (Table 19 provides a key), a site number (which is usually a small finds number), an English Heritage Ancient Monuments Laboratory (AML) inventory number (where one exists), a publication reference (if the brooch has been published – either a catalogue number or a figure number), a Hull type number (see Appendix 2; if no type can be positively identified, then the Hull group number is given, eg Gp=4), codes describing any applied decoration (Table 20 provides a key), codes describing

any enamel colours (Table 21 provides a key), the percentages of copper (Cu), zinc (Zn), tin (Sn), lead (Pb) and silver (Ag) present (where quantitative analyses have been carried out), and the alloy name assigned as described in Chapter 2. Where it has not been possible to assign a brooch to one of Hull's types, either because it is incomplete or because it is of an undefined type, it has usually been allocated to one of Hull's groups (defined in Appendix 2) and the group number is given instead of the type number. Brooches that are clearly variants of a particular type have a + added to the type number; ++ indicates a more distantly related brooch. Question marks denote uncertainty.

In plotting some of the figures in Chapter 5, and Figures 181–183, use has also been made of approximately 300 quantitative analyses of brooches from Camerton (Cowell 1990), South Cadbury (Northover 2000), Usk (Webster with Jones 1995), various sites in northern Britain (Dungworth 1995, 1997) and the Ashmolean Museum's collection (Bateson and Hedges 1975), particularly for types for which the total number of analyses in this appendix is low.

Table 19 Summary of all brooch analyses

<i>Site code</i>	<i>Site name</i>	<i>Number of quantitative analyses</i>	<i>Number of qualitative analyses</i>	<i>Reference to publication of the brooches</i>
ALDB	Aldborough, Yorkshire		4	Bishop 1996
ASHT	Ashton, Northamptonshire		34	unpublished
BALD	Baldock, Hertfordshire	52	92	Stead 1986
BANT	Bantham, Devon		1	Butcher 1981b
BEES	Beeston Castle, Cheshire	1		Butcher 1993a
BIRD	Birdoswald, Cumberland		16	Summerfield <i>et al</i> 1997
BRAN	Brancaster, Norfolk		1	Mackreth 1985b
BRAU	Braughing, Hertfordshire	33	43	Olivier 1988
BROU	Brougham, Westmorland	2	2	Cool forthcoming
CABY	Caistor-on-Sea, Norfolk	13	7	Butcher 1993c
CAME	Camelon, Stirlingshire	3	13	Butcher forthcoming a
CARL	Carlisle, Cumberland	3	26	BLA: Mackreth 1990; CS: McCarthy 1991; ANN: Caruana forthcoming
CARV	Carvossa, Cornwall	6	11	Butcher 1987a
CAST	Castleford, Yorkshire	18	80	Cool 1998
CATS	Catsgore, Somerset	22	13	Butcher 1982a
CATT	Catterick, Yorkshire	3	38	Sites 46, 273 and 240: Butcher 2002; Sites 433 and 434: Mackreth 2002
CHEL	Chelmsford, Essex	18	47	1: Butcher with Bayley 1988a; 2: Butcher 1992; 3: Butcher forthcoming b
CHES	Chesterfield, Derbyshire		1	–
CHIC	Chichester, West Sussex		10	1: Butcher 1978a; 2: Mackreth 1979
CIRE	Cirencester, Gloucestershire		2	–
CLEE	Cleeve Abbey, Somerset		1	unpublished
COLC	Colchester, Essex		61	Crummy 1983; CS: Crummy 1992a; GBS: Crummy 1992b
COLE	Coleshill, Warwickshire		29	Lloyd-Morgan in prep
CORB	Corbridge, Northumberland		22	Bishop and Dore 1989
COSG	Cosgrove, Northamptonshire		2	Butcher 1991a
DEEP	Deepdale, Derbyshire		3	in Buxton Museum
DERB	Derby		5	Mackreth 1985a
DODD	Dodderhill, Worcestershire		7	Butcher forthcoming c
DORC	Dorchester, Dorset		22	CP: Butcher 1982b; AA: Henig and Morris 2002; WH: unpublished
DOVE	Dover, Kent		2	Parfitt 1989
DRAG	Dragonby, Lincolnshire	13	83	Olivier with Bayley 1996
GARD	Garden Hill, Kent		3	–

<i>Site code</i>	<i>Site name</i>	<i>Number of quantitative analyses</i>	<i>Number of qualitative analyses</i>	<i>Reference to publication of the brooches</i>
GDUN	Great Dunmow, Essex		2	Butcher and Bayley 1988b
GEST	Gestingthorpe, Essex		12	Butcher 1985a
GLOU	Gloucester		7	Pitts 1985
GORH	Gorhambury, Hertfordshire	20	27	Butcher 1990a
HAYL	Hayling Island, Hampshire	33	89	Butcher forthcoming d
HENL	Henley Wood, Somerset		23	Butcher 1996
HEYB	Heybridge, Essex		2	Wickenden 1986
HOUS	Housesteads, Northumberland	3	17	Allason-Jones 1988a
ICKH	Ickham, Kent		13	Riddler <i>et al</i> forthcoming
ILCH	Ilchester, Somerset		7	Butcher 1994; Leach and Ellis 1991
INWO	Inworth, Essex		1	–
KEST	Keston, Kent		12	Philp <i>et al</i> 1991
KILH	Kilhaddon, Cornwall		1	Butcher 1982c
LAMY	Lamyatt Beacon, Somerset		3	Butcher 1986
LANC	Lancaster		2	–
LECH	Lechlade, Gloucestershire	3	6	Allen <i>et al</i> 1993
LEIC	Leicester: various sites	4	7	Hebditch and Mellor 1973; Mackreth and Butcher 1994
LOND	London: various sites		336	in Museum of London
LULL	Lullingstone, Kent		1	Meates 1987a
MAGI	Magiovinium, Buckinghamshire	5	15	Butcher 1987b
MAXE	Maxey, Northamptonshire		5	Crummy 1985
NORN	Nornour, Isles of Scilly	124	20	Hull 1968b; Butcher forthcoming e
OLDW	Old Windsor, Berkshire		1	–
OPEN	Old Penrith, Cumberland		18	Butcher 1991b
OUDE	Oudenaarde, Belgium	4	3	–
PAPC	Papcastle, Cumberland		10	–
PIER	Piercebridge, Durham	18	29	Scott and Fitzpatrick in prep
POOL	Poole's Cavern, Derbyshire		28	Mackreth 1983; Bayley and Branigan 1989
POUN	Poundbury, Dorset		5	Davies 1987
PRES	Prestatyn, Flint	18	6	Mackreth 1989
REDC	Redcliff, Yorkshire	5	5	Crowther and Didsbury 1988
RICH	Richborough, Kent	340	103	Bushe-Fox 1926, 1928; Radford 1932; Henderson 1949; Hull 1968a
SALF	Salford, Bedfordshire		8	Dawson forthcoming
SAND	Sandy, Bedfordshire		49	in Bedford Museum
SEAM	Sea Mills, Bristol		12	Butcher 1987c
SEAT	Seaton, Devon		3	Miles 1977
SEWN	Sewingshields, Northumberland	2		Allason-Jones 1984
SHEP	Colchester: Sheepen, Essex	22	20	Bayley and Butcher 1985

<i>Site code</i>	<i>Site name</i>	<i>Number of quantitative analyses</i>	<i>Number of qualitative analyses</i>	<i>Reference to publication of the brooches</i>
SHOR	Shortlanesend, Cornwall	1		Butcher in Harris 1980
SNET	Snettisham, Norfolk		33	Mackreth 2001
STAL	St Albans, Hertfordshire	107	69	Stead and Rigby 1989
STAN	Stanwick, Northamptonshire		141	Neal <i>et al</i> forthcoming
SWIN	Swindon Hill, Wiltshire	2	5	–
TARH	Tarrant Hinton, Dorset	8	20	–
TATT	Tattershall Thorpe, Lincolnshire		1	unpublished
THIS	Thistleton, Rutland	19	51	unpublished
THOR	Thorpe by Newark, Nottinghamshire		2	–
TIDD	Tiddington, Warwickshire	26	43	Palmer in prep
TRET	Trethury, Cornwall		2	Quinnell in prep
ULEY	Uley, Gloucestershire	18	19	Butcher with Bayley 1993
VELZ	Velzeke, Belgium	16	12	–
VIND	Vindolanda, Northumberland		6	Allason-Jones <i>et al</i> 1985
WAKE	Wakerley, Northamptonshire		9	Jackson and Ambrose 1978
WALL	Walls, Dorset		12	Butcher 1985b
WANB	Wanborough, Wiltshire	45	91	Butcher 2001
WEEK	Weekley, Northamptonshire		17	Jackson and Dix 1987
WELT	Welton Wold, Yorkshire	4	7	–
WHIT	Whitcombe, Dorset	2	1	Butcher 1990b
WICF	Wickford, Essex	9	16	Rodwell in prep
WICL	Wicklewood, Norfolk		49	–
WIGG	Wigginton, Oxfordshire		1	–
WILD	Wilderspool, Cheshire		1	Hinchliffe <i>et al</i> 1992
WINC	Winchester, Hampshire		25	Crummy, Ottaway and Rees in prep
WITC	Witcombe, Gloucestershire		5	Butcher 1998
WNEW	Water Newton, Huntingdonshire		1	–
WORC	Worcester		31	Mackreth 1992
WPER	Wharram Percy, Yorkshire		1	Bayley <i>et al</i> 1981
WROX	Wroxeter, Shropshire	18	56	in EH store
XXXX	Other/unknown		1	–
YORK	York: various sites		15	in The Yorkshire Museum
		1063	2360	

Table 20 Codes used to describe applied decoration (in Decor column, Tables 22 and 23)

<i>Decoration</i>	<i>Code</i>	<i>Description</i>
Gilding	G	No information on type of gilding
	Gm	Mercury gilding
	Gl	Leaf gilding (no mercury detected)
Tinning	T	Surface coating meant to be visible
	Ts	Tinning definitely/probably originally covered by solder
	S	Lead-tin solder survives (see also M below)
Metal	M	Sheet metal and/or wire applied (soldered) to surface
	Mc	Applied metal is copper or one of its alloys
	Mb	Applied metal is brass
	Ms	Applied metal is silver
	Mt	Applied metal is tin
Inlay	Ic	Inlaid metal is copper
	Is	Inlaid metal is silver
	Ii	Inlaid metal is iron
	It	Inlaid metal is tin or tin-lead alloy
	Il	Inlaid metal is lead
Niello	N	
Enamel	E	Type of enamel uncertain/unknown
	Es	Simple enamel: one colour per field
	Et	Two-colour: some fields contain more than one colour
	Ec	Circles/spots of second colour in field
	Ecc	Spots are ends of cylinders
	Ech	Spots are hemispheres
	Ece	Spots are 'eyes' with two concentric colours
	Ej	Field contains juxtaposed blocks of different colours
	Em	Some or all of the blocks are millefiori
Attachment	A	
	Ac	Glass cabochon, cone or intaglio
	As	Glass sphere
	Am	Metal (copper alloy) cone
Riveted	R	Decoration riveted on
	Rb	Bone plate
	Rg	Annular glass bead
	Rs	Enamelled stud
?	Following a code indicates uncertainty	
()	Round a code indicates the decoration is now lost	

Table 21 Codes used to describe enamel colours (in Enamel column, Tables 22 and 23)

<i>Code</i>	<i>Colour</i>
R	Red
O	Orange
Y	Yellow
N	Golden brown
G	Green
T	Turquoise
B	Blue
P	Purple
K	Black
W	White
X	Now appears greenish, original colour uncertain
.	Codes following a full stop are the colours of the millefiori rods

Table 22 Analytical results for the Richborough brooches (Pub no. is Chapter 4 Catalogue no.)

<i>AML No.</i>	<i>Site No.</i>	<i>Pub No.</i>	<i>Type</i>	<i>Decor</i>	<i>Enamel</i>	<i>Cu%</i>	<i>Zn%</i>	<i>Sn%</i>	<i>Pb%</i>	<i>Ag%</i>	<i>Alloy</i>
7351581	3469	1	10A			88.8	0.0	11.2	2.6	0.1	bronze
7350094	1649	2	10B			70.9	24.5	0.0	0.3	0.1	brass
7351501	4978	3	10A			86.4	0.0	10.1	2.4	0.1	bronze
7351585	2556	4	10								bronze
7350776	845	5	10/11								bronze
7351506	4201	6	10/11								bronze
7350068	2367	7	10B			90.2	0.3	4.4	3.0	0.0	bronze
7351548	4076	8	10B			91.5	1.7	10.2	1.0	0.1	bronze
7350077		9	10B			84.3	5.1	5.3	0.0	0.0	gunmetal
7350092	862	10	10B			85.3	2.8	6.7	1.2	0.0	bronze/gunmetal
7350071	1272	11	10/11								gunmetal
7350102	667	12	Gp=1			86.1	1.8	6.0	3.5	0.1	bronze
7351529	4326	13	10G								bronze
7351873		14	10								bronze
7351883		15	10								bronze
7351048	2573	16	11			84.5	1.1	6.0	0.0	0.3	bronze
7350772	835	17	10/11								bronze
7351751	1049	18	10C			72.5	27.3	0.0	0.0	0.1	brass
7351038	4957	19	10C								bronze
7350107	1846	20	10/11			90.4	0.0	8.8	0.2	0.1	bronze
7350074	2747	21	10/11			76.2	20.7	0.6	0.0	0.1	brass
7351503	4996	22	11C			84.1	15.0	1.8	0.2	0.1	brass
7350096	1860	23	10C			87.2	12.3	1.0	0.3	0.1	brass
7351525	4806	24	10C			80.6	19.1	0.0	0.2	0.0	brass
7351510	4167	25	11C			95.1	0.4	8.3	0.7	0.1	bronze
7351758	2260	26	11C			89.0	12.9	1.0	0.4	0.1	brass
7350050	1979	27	11			91.5	2.6	7.2	1.1	0.0	bronze/gunmetal
7350063	917	28	11			77.5	19.4	1.6	0.2	0.0	brass

<i>AML No.</i>	<i>Site No.</i>	<i>Pub No.</i>	<i>Type</i>	<i>Decor</i>	<i>Enamel</i>	<i>Cu%</i>	<i>Zn%</i>	<i>Sn%</i>	<i>Pb%</i>	<i>Ag%</i>	<i>Alloy</i>
7351885		29	10/11								copper/bronze
7351884		30	10/11								bronze
7351178	4400	31	11A			89.6	11.3	1.7	0.6	0.0	brass
7351753	1265A	32	3C			79.5	16.7	1.5	0.3	0.0	brass
7350293	999	33	3C			77.5	19.2	1.2	0.2	0.0	brass
7351547	5006	34	3C			82.3	17.7	2.8	0.3	0.0	brass
7351745	1496	35	40B			78.2	17.8	1.1	0.3	0.0	brass
7350742	611	36	42			78.1	18.6	2.0	0.2	0.0	brass
7351582	2648	37	42			82.0	18.8	2.1	0.4	0.0	brass
7351574	1260	38	42			74.0	22.4	0.0	0.2	0.0	brass
7350804	4563	39	84B			79.3	18.0	0.0	0.1	0.0	brass
7350971	5056	40	84B			76.9	19.0	0.3	0.1	0.0	brass
7350386	4977	41	84B			80.9	14.2	1.4	0.1	0.0	brass
7350695	2590	42	84B			84.7	16.1	0.5	0.1	0.0	brass
7351449		43	87?			82.1	20.1	0.0	0.9	0.0	brass
7350299	1574	44	89			85.8	14.7	0.0	0.0	0.1	brass
7350387	4242	45	89			80.6	16.8	1.5	0.1	0.1	brass
7351705	62	46	90A			76.6	22.5	0.5	0.0	0.1	brass
7351513	3626	47	90A			78.4	24.8	0.0	0.0	0.0	brass
7350051	3028	48	90A			78.6	22.3	0.2	0.2	0.0	brass
7350091	854	49	90B			74.2	20.0	1.2	0.8	0.1	brass
7351573	2589	50	90			78.7	8.4	2.3	0.2	0.0	brass/gunmetal
7350109	725	51	90			86.8	0.2	8.3	0.5	0.1	bronze
7351577	2473	52	90B			93.9	0.0	6.9	0.1	0.1	bronze
7350902	720	53	90B								bronze
7351505	4729	54	90A			85.3	17.0	0.0	0.3	0.0	brass
7351766		55	90			93.9	3.1	4.8	2.4	0.1	bronze/gunmetal
7351539		56	90								brass/gunmetal
7350807	2542	57	90			88.6	0.2	10.2	0.1	0.1	bronze
7350800	5310	58	90			87.7	1.4	6.4	2.1	0.0	bronze
7350291	990	59	91B			87.2	10.5	0.8	0.6	0.2	brass
7350786	2789	60	90								brass
7351664		61	90B			75.0	2.0	9.1	0.6	0.0	bronze
7350280	2391	62	90A			80.7	17.5	1.2	0.4	0.2	brass
7350274	2372	63	90			77.9	19.4	1.5	0.3	0.5	brass
7351524	4923	64	90A			70.9	16.0	12.4	0.7	0.1	gunmetal
96005013	5189	65	90								brass
7351533		66	91B			79.3	27.0	0.0	0.0	0.1	brass
7351526	4366	67	91B			81.9	15.8	0.8	0.6	0.1	brass
7350081	1575	68	Gp=1			89.8	5.6	9.8	0.2	0.1	bronze/gunmetal
7350559	2029	69	Gp=1								brass/gunmetal
7351876		70	Gp=1								bronze
7351887		71	Gp=1								bronze
7351522	4502	72	22A			78.4	16.6	4.2	1.1	0.0	brass/gunmetal
7351886		73	25/26?	Mc							brass
7351176	4337	74	51B			75.0	16.7	1.7	0.4	0.1	brass
7351521	4860	75	51B			77.2	22.8	2.9	0.1	0.1	brass
7351715	2354	76	51B			73.9	23.7	0.8	0.2	0.1	brass

ROMAN BROOCHES IN BRITAIN

<i>AML No.</i>	<i>Site No.</i>	<i>Pub No.</i>	<i>Type</i>	<i>Decor</i>	<i>Enamel</i>	<i>Cu%</i>	<i>Zn%</i>	<i>Sn%</i>	<i>Pb%</i>	<i>Ag%</i>	<i>Alloy</i>
7351584	1023	77	51B			78.5	20.4	2.0	0.2	0.1	brass
7351515	4869	78	51B			78.1	20.6	0.0	0.0	0.0	brass
7351098		79	51B			81.2	15.5	2.7	0.0	0.0	brass
7350972	5462	80	51B			80.5	18.4	0.8	0.4	0.0	brass
7351097	1548	81	51B			77.6	20.1	2.0	0.0	0.1	brass
7351516		82	51B			80.1	21.7	0.3	0.0	1.4	brass
7351386	2486	83	51B			83.6	16.7	0.9	0.1	0.0	brass
7351403	1851	84	51								gunmetal
7351541	4717	85	51B			74.5	17.7	7.6	0.2	0.0	gunmetal
7350214	4917	86	51C			80.4	19.3	0.0	0.0	0.0	brass
7351030	4778	87	51B								brass
7350070	1251	88	51								brass
7350890		89	51B								brass
7350901	1648	90	51B								brass
7351507	4701	91	51								brass
7351771	1123	92	51			82.1	19.4	0.3	0.2	0.3	brass
7350066	2528	93	52C			72.9	17.7	1.5	0.5	0.0	brass
7351763	??232	94	52++			87.6	0.6	5.0	0.7	0.1	bronze
7351586	1594	95	61	lcli		70.5	16.0	2.5	0.3	0.0	brass
7350329	2530	96	61			76.0	22.5	0.8	0.3	0.2	brass
7351538	3422	97	61			77.6	21.2	0.0	0.4	0.0	brass
7350770		98	61			88.5	0.5	10.7	1.9	0.0	bronze
7350065	2043	99	61			83.1	13.4	3.6	0.2	0.1	brass/gunmetal
7351768	3016	100	61	T							bronze?
7350691	1974	101	61	T		88.9	0.5	8.8	2.2	0.0	bronze
7350978	4536	102	61			77.9	12.9	2.2	2.5	0.0	brass
7351792		103	63B								gunmetal?
7351757	5627	104	63B								brass
7351726		105	71B			78.5	16.9	0.7	0.7	0.0	brass
7350296	2654	106	63			84.2	1.6	5.2	1.3	0.2	bronze
7350560	5663	107	71B?			72.0	22.6	0.0	0.1	0.1	brass
7350909		108	61	T		77.6	20.2	0.7	0.0	0.0	brass
7350093	1556	109	63B			81.4	16.1	1.4	0.5	0.1	brass
7350279		110	63B			80.9	17.9	0.6	0.5	0.2	brass
7350210	4879	111	63B			76.9	23.7	0.0	0.0	0.1	brass
7351512	4779	112	Gp=4B			85.5	13.4	0.0	0.0	0.1	brass
7351708	711	113	63B			75.3	18.7	2.0	0.3	0.1	brass
7350340	739	114	65	Tlcli		81.3	16.7	1.4	0.1	0.1	brass
7351737		115	60	Tlc		85.7	14.8	1.2	0.9	0.0	brass
7351650		116	60								brass/gunmetal
7350504	184	117	60			80.8	2.1	7.3	1.2	0.1	bronze
7350506	701	118	60			89.2	0.2	7.6	0.5	0.2	bronze
7351035	5580	119	60								brass
7351583	1599	120	60			85.7	21.1	0.5	0.1	0.1	brass
7351572	2529	121	60	T		85.5	9.5	2.6	1.4	0.1	brass/gunmetal
7350060	672	122	60	TN		79.7	9.0	5.7	1.0	0.1	gunmetal
7350062	905	123	71B	T(N)		81.5	14.2	2.4	1.5	0.1	brass
7350204	5058	124	75	T		84.3	12.9	3.7	1.3	0.1	brass/gunmetal

AML No.	Site No.	Pub No.	Type	Decor	Enamel	Cu%	Zn%	Sn%	Pb%	Ag%	Alloy
7350277	3068	125	74	N		79.0	16.1	1.7	2.2	0.1	brass
7351891		126	75?								brass
7350206	5134	127	78			79.2	18.5	1.5	0.1	0.1	brass
7350103	710	128	78			80.9	9.3	3.8	4.4	0.1	(lead) gunmetal
7350211	5016	129	70E			81.8	14.5	2.7	1.3	0.1	brass
7351096	1080	130	64?								brass
7350384	4854	131	64			79.2	20.9	0.5	0.1	0.0	brass
7351580	1975	132	79			82.3	10.2	7.3	3.0	0.1	gunmetal
7350977	3705	133	79			80.7	10.1	3.7	0.6	0.0	brass/gunmetal
7350505		134	Gp=4B			85.4	2.6	8.0	3.9	0.1	bronze
7350744	1549	135	74			82.1	0.6	10.7	3.9	0.0	bronze
7351546	4666	136	74								brass
7350900	1357	137	74								brass
7350509	1602	138	74			86.0	0.4	8.9	2.5	0.1	bronze
7350473	785	139	74	T		81.4	11.6	3.3	1.6	0.1	brass/gunmetal
7350773	2554	140	74	T		79.7	13.6	3.5	0.2	0.0	brass/gunmetal
7351738	1375	141	70C			75.7	16.4	3.0	0.3	0.0	brass
7351724		142	62/74			80.5	19.2	0.0	0.2	0.0	brass
7351093	904	143	80			85.1	10.5	4.6	0.3	0.1	gunmetal
7351076	1805	144	77			80.2	16.9	1.2	0.3	0.0	brass
7350099	3402	145	77+			79.5	14.8	2.3	1.1	0.1	brass
7350802	3742	146	Gp=4B	T		75.0	8.1	5.8	6.1	0.1	(lead) gunmetal
7351778		147	Gp=4B?								brass/gunmetal
7351544	4557	148	60+			78.5	3.5	6.1	5.4	0.1	(lead) bronze/gunmetal
7350474	2108	149	60/61?								brass
7351791	299	150	Gp=4B								gunmetal
7351874		151	60/62?	T							brass
7351877		152	60?								brass
7351764		153	Gp=4B			81.2	14.7	1.5	0.4	0.1	brass
7351748	875	154	180	Es	R	76.7	6.0	6.9	6.6	0.0	(lead) gunmetal
7350788	5077	155	180	Es	R	74.1	18.5	3.6	1.2	0.0	brass
7351576	5603	156	180	Es	X	71.1	10.6	5.5	5.0	0.0	(lead) gunmetal
7350218	4137	157	180	Es	R	81.4	14.1	2.9	0.7	0.0	brass
7351769	4240	158	181	T		77.5	4.5	7.0	9.6	0.0	lead bronze/gunmetal
7351754	3266	159	58A			77.8	16.8	2.8	1.7	0.0	brass
7350743	740	160	92			78.4	3.3	7.7	10.9	0.1	lead bronze/gunmetal
7350105	927	161	92			85.5	4.8	6.5	1.8	0.2	gunmetal
7350503	234	162	92			74.1	0.0	7.1	16.0	0.2	lead bronze
7350213	4823	163	92			77.2	0.0	7.8	13.7	0.1	lead bronze
7351571	2513	164	92			76.1	0.4	8.7	14.3	0.0	lead bronze
7351570	2632	165	92			81.9	0.9	7.6	13.1	0.1	lead bronze
7350501	1079	166	92			73.7	0.5	7.1	14.9	0.1	lead bronze
7351036	5561	167	92			83.2	0.5	7.4	5.0	0.0	(lead) bronze
7350205	5057	168	92			79.9	5.4	5.3	7.0	0.0	(lead) gunmetal
7350100	31	169	92			80.7	0.2	10.7	7.6	0.1	(lead) bronze
7351520	5061	170	92			82.7	0.2	10.0	9.6	0.1	lead bronze
7350290	1277	171	92			75.3	3.3	4.8	14.9	0.1	lead gunmetal
7351519	4889	172	92			87.6	0.1	7.9	6.2	0.0	(lead) bronze

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7351078	2064	173	92			77.2	0.9	8.2	11.6	0.1	lead	bronze
7350095	1832	174	92			76.2	0.8	9.0	13.4	0.1	lead	bronze
7350298	2034	175	92			78.8	0.0	10.1	9.2	0.1	lead	bronze
7351545	4497	176	93			74.8	0.2	8.0	15.7	0.1	lead	bronze
96005012	5170	177	92								lead	bronze
7351523	4664	178	92			79.8	3.1	5.9	14.0	0.1	lead	bronze/gunmetal
7351094	1047	179	92			82.1	0.1	11.6	5.3	0.1	(lead)	bronze
7351773	5529	180	93C			73.1	0.0	7.5	17.8	0.0	lead	bronze
7350106	1037	181	92			77.6	0.0	8.1	16.9	0.1	lead	bronze
7351578	2482	182	93			79.9	3.7	3.4	16.7	0.1	lead	gunmetal
7351579		183	93A			81.9	3.4	5.3	11.3	0.1	lead	bronze/gunmetal
7350476	297	184	93			78.3	0.2	8.8	15.5	0.1	lead	bronze
7350073	2395	185	93A			86.4	0.6	8.0	11.5	0.1	lead	bronze
7351759	5472	186	93			81.9	0.3	7.6	6.6	0.1	(lead)	bronze
7351075	1914	187	93A			76.7	2.3	8.1	12.1	0.2	lead	bronze
7351091		188	93A			81.1	0.0	8.4	9.1	0.2	lead	bronze
7350288		189	93A			69.0	0.1	11.4	16.5	0.1	lead	bronze
7351767	1581	190	93A			80.0	0.2	4.2	14.0	0.1	lead	bronze
7350479	59	191	93A								(lead)	bronze
7351092	700	192	93B			83.0	0.1	7.0	10.9	0.1	lead	bronze
7350741	3240	193	92			72.3	0.8	5.4	20.1	0.2	lead	bronze
7351575	1369	194	92			77.5	0.5	8.6	10.0	0.1	lead	bronze
7350385	4820	195	93B			75.9	0.1	8.5	13.5	0.1	lead	bronze
7350076	3009	196	92			81.9	0.5	8.0	7.7	0.2	(lead)	bronze
7350328		197	92			83.8	0.2	6.8	8.3	0.1	lead	bronze
7351527	4318	198	92								lead	bronze/gunmetal
7351889		199	92/93								bronze	
7351870		200	92/93								lead	bronze/gunmetal
7351911	5347	201	92/93								bronze	
7351890		202	92/94?								brass	
7351517	1131	203	Gp=5								lead	bronze
7351777		204	Gp=5?			67.8	2.6	5.5	23.6	0.2	lead	bronze/gunmetal
7351875		205	92/94?								(lead)	bronze
7350276	2754	206	94B			78.2	0.4	4.6	15.0	0.1	lead	bronze
7350061	928	207	94B			87.3	0.4	9.4	4.9	0.1	(lead)	bronze
7350692		208	95			67.5	0.4	7.1	23.8	0.0	lead	bronze
7350217	4010	209	103			77.7	0.3	8.8	15.2	0.1	lead	bronze
7350502	530	210	96			91.2	4.4	5.0	0.9	0.1	gun	metal
7350209	3946	211	100			73.7	0.0	6.9	20.6	0.1	lead	bronze
7351774		212	100			71.4	2.1	5.2	19.4	0.2	lead	bronze/gunmetal
7351706	2866	213	100			81.9	0.5	8.2	13.2	0.1	lead	bronze
7350694	2385	214	100			76.0	0.0	11.9	12.2	0.1	lead	bronze
7351518	2038	215	100			84.4	15.4	3.7	0.4	0.1	brass	
7350472	3900	216	158A			82.7	9.8	3.8	1.1	0.0	brass/gun	metal
7350976	175	217	158A			91.7	2.0	4.7	1.0	0.0	bronze/gun	metal
7350388	4202	218	158C			77.0	19.2	2.9	1.1	0.0	brass	
7351709		219	153D			59.2	1.0	12.1	0.0	0.1	bronze	
7350207	5430	220	154B			75.7	0.2	9.3	14.6	0.1	lead	bronze

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7350212	4847	221	157	Es	R	76.2	18.1	2.6	1.3	0.0	brass
7350696	2466	222	Gp=8			71.2	0.0	6.2	21.0	0.0	leaded bronze
7350745	4239	223	Gp=7	T		82.6	1.2	7.8	7.9	0.2	(leaded) bronze
7350477	146	224	121+			83.9	1.3	8.2	0.7	0.2	bronze
7351747	3426	225	145A	Es	RX	80.4	11.3	2.8	3.0	0.0	brass/gunmetal
7350203	5095	226	145A	Es	R	79.3	20.2	0.5	2.7	0.0	brass
7350101	377	227	145	Es	R	83.9	0.2	8.0	7.9	0.1	(leaded) bronze
7351716	1048	228	148C	EsRg	RB	82.1	12.6	1.0	2.8	0.1	brass
7350475	1813	229	149B	Es	RB						copper
7350089	1812	230	149B	Es	R	88.9	1.7	4.4	4.4	0.1	(leaded) bronze/gunmetal
7350208	4545	231	149A			84.4	3.7	7.3	2.9	0.2	bronze/gunmetal
7350098	2773	232	148A			85.6	7.5	7.3	0.0	0.0	gunmetal
7351142	101	233	151?	Es	T						leaded bronze
7351090	1050	234	146			87.4	0.3	7.2	5.3	0.1	(leaded) bronze
7350805	4800	235	162B	Ts(E)		80.9	14.1	2.3	2.8	0.0	brass
7351701	903	236	166A	TEs	RT	78.3	9.5	3.0	4.1	0.1	(leaded) brass/gunmetal
7351734	4727	237	166D	Es	B	80.0	7.7	2.5	1.5	0.0	copper/brass
7350906	63	238	36	Es	R	91.0	0.3	4.9	0.6	0.1	bronze
7351917		239	36+								gunmetal
7351736		240	175A	T		77.6	0.3	8.5	10.9	0.0	leaded bronze
7351741	3522	241	176B			81.1	2.7	5.5	9.3	0.0	leaded bronze/gunmetal
7351743		242	176A	T		75.9	0.6	6.2	18.0	0.1	leaded bronze
7350908		243	176A			79.8	1.5	7.9	7.4	0.1	(leaded) bronze
7350287		244	186?	Gm		92.5	6.7	1.8	0.2	0.1	copper/brass
7351719	2677	245	178A			84.1	1.4	5.6	6.4	0.1	(leaded) bronze
7351713	5346	246	178A			62.6	8.1	4.9	4.8	0.0	(leaded) gunmetal
7351731	717	247	185	T		68.8	0.0	5.6	24.4	0.0	leaded bronze
7350283	1078	248	186A			87.5	3.4	5.1	0.5	0.1	bronze/gunmetal
7350286		249	186B	GmT		86.1	10.9	1.2	0.0	0.2	brass
7351079	2112	250	186	GmT		93.1	6.0	1.7	0.7	0.1	copper/brass
7351174	4237	251	187B	T		85.9	5.4	0.0	1.9	0.1	copper/brass
7350108		252	187A	T		77.8	0.9	6.4	14.4	0.1	leaded bronze
7351744	293	253	187A	T		73.8	0.5	6.2	16.1	0.1	leaded bronze
7350698	703	254	187A			82.6	8.3	3.8	1.5	0.0	gunmetal
7350215	4022	255	187B			81.2	0.8	5.6	11.6	0.0	leaded bronze
7351742	949	256	187B			76.0	4.3	5.8	11.8	0.1	leaded gunmetal
96003514	1104	257	187								brass
7350699	531	258	189	T		68.2	0.6	8.6	19.8	0.1	leaded bronze
7351511	4921	259	189	T		76.0	0.0	9.4	14.3	0.1	leaded bronze
7350284	1164	260	189	T		78.9	0.0	8.2	10.6	0.0	leaded bronze
96005011	5105	261	189	T							leaded bronze
7351775	3531	262	189			73.6	0.5	6.9	16.8	0.2	leaded bronze
7350905	298	263	189			81.4	0.7	4.8	9.7	0.0	leaded bronze
7351500	4696	264	189	T		70.5	0.0	13.4	17.9	0.2	leaded bronze
7351772	257	265	187/189			65.9	0.5	5.1	9.8	0.3	leaded bronze
7350907		266	189	T		78.3	0.3	8.7	11.6	0.0	leaded bronze
7351752	301	267	189			66.4	13.2	8.2	11.6	0.1	leaded gunmetal
7351718	1880	268	189+	T		69.0	0.7	5.8	20.7	0.2	leaded bronze

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7350104	915	269	191A			74.0	1.1	8.5	15.7	0.1	lead bronze
7350278	2243	270	191A			74.2	2.3	7.0	13.7	0.1	lead bronze
7350903	828	271	191A			65.6	0.1	10.6	22.2	0.4	lead bronze
7350904	682	272	191A			72.4	2.3	7.3	16.9	0.1	lead bronze
7350777	4441	273	191A			70.4	0.7	7.5	19.3	0.1	lead bronze
7350471	3477	274	191A			70.8	0.5	7.9	20.5	0.1	lead bronze
7350806	1442	275	191A			90.2	0.0	7.2	1.3	0.0	bronze
7350775	546	276	191A			73.3	1.0	9.4	12.8	0.1	lead bronze
7351502	4077	277	191A			86.8	2.8	6.6	5.8	0.2	(lead) bronze/gunmetal
7351095	1162	278	191A			90.1	1.5	6.0	2.8	0.3	bronze
7350080	1392	279	190	T		73.1	0.3	8.0	20.7	0.0	lead bronze
7350470	3231	280	190	GmT		91.6	3.3	5.2	0.6	0.0	bronze/gunmetal
7351703	124	281	190	Gl		97.1	0.5	5.1	0.3	0.1	bronze
7351725	3000	282	190	T		82.7	2.3	5.4	7.5	0.0	(lead) bronze/gunmetal
7350508	3887	283	190	GT		87.4	2.7	6.8	1.0	0.1	bronze/gunmetal
7351912		284	190								lead bronze
7351914		285	190								lead bronze
7351895		286	190								bronze
7351893		287	190	T							(lead) bronze
7350272	2334	288	191B			83.0	0.1	3.6	12.7	0.1	lead bronze
7351206	5249	289	191B			84.2	11.4	1.6	3.3	0.2	brass
7351702	3971	290	191B	T		83.3	0.9	5.0	15.6	0.1	lead bronze
7350052	4533	291	191B			68.5	1.4	7.4	24.8	0.0	lead bronze
7350273	2335	292	191B			90.3	0.0	7.6	2.7	0.1	bronze
7350975	3763	293	191B			75.0	2.1	5.7	14.9	0.1	lead bronze/gunmetal
7350297	3080	294	191B	T		85.7	3.4	5.7	5.6	0.1	(lead) bronze/gunmetal
7350069	2914	295	191B			76.5	4.3	7.3	10.2	0.2	lead bronze/gunmetal
7350500	1719	296	191B			75.7	0.1	5.7	19.4	0.4	lead bronze
7350690	2447	297	191B			86.2	1.6	7.5	5.4	0.3	(lead) bronze
7351704	305	298	191B			79.2	0.3	9.8	11.2	1.0	lead bronze
7350281	2448	299	191B			75.2	2.1	8.9	13.9	0.2	lead bronze
7350294	1624	300	191B			71.1	1.6	12.9	13.9	0.1	lead bronze
7350219	145	301	191B			72.0	0.9	7.8	15.3	0.1	lead bronze
7350693		302	191B			87.8	3.0	5.3	6.7	0.1	(lead) bronze/gunmetal
7351549		303	191B?			80.1	1.1	8.5	13.2	0.1	lead bronze
7351077	2101	304	191B?	T							bronze
7351915		305	191B?								lead bronze
7351894		306	191B?								lead bronze
7351765	673	307	191B?			82.1	0.9	5.2	5.3	0.1	(lead) bronze
7351689		308	191B?			68.8	0.2	9.6	8.9	0.1	lead bronze
7351892		309	191B?								gunmetal
7351879		310	191B?								brass
7350618	4546	311	191B?			75.6	8.2	6.0	6.8	0.2	(lead) gunmetal
7350285	1267	312	191B?			81.7	3.6	4.8	8.7	0.2	lead gunmetal
7350075	2913	313	191B?			88.7	0.7	5.2	6.9	0.1	(lead) bronze
7350292	1015	314	191B?			80.3	3.0	5.7	11.8	0.1	lead bronze/gunmetal
7350271	1675	315	191B?	T		87.5	2.2	5.0	5.4	0.4	(lead) bronze/gunmetal
7350270	1328	316	191B?			28.9	3.7	0.6	0.8	64.9	silver

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7350478	143	317	192			84.7	0.6	6.2	9.9	0.1	leaded bronze
7350275	2670	318	192			76.2	0.2	5.4	21.6	0.1	leaded bronze
7350097	1874	319	192			84.2	12.5	5.0	2.6	0.0	brass/gunmetal
7351700	3375	320	192			76.1	18.9	0.2	1.8	0.0	brass
7351707	2840	321	192			66.3	1.6	11.8	10.7	0.1	leaded bronze
7350090	296	322	192	T		71.8	12.9	5.3	10.9	0.2	leaded gunmetal
7351790	3186	323	192			85.0	6.5	4.6	5.7	0.1	(leaded) gunmetal
7351227	274	324	192			93.8	5.6	1.7	1.3	0.1	copper/brass
7350697	295	325	192			71.2	18.2	0.9	6.5	0.0	(leaded) brass
7350970	5502	326	192	Ts		77.3	0.1	7.0	12.2	0.1	(leaded) bronze
7350348	286	327	192	Gl							brass
7351723	5244	328	192	Gl		87.1	9.4	1.5	1.1	0.1	brass
7350072	2342	329	192								brass
7351353		330	192								brass/gunmetal
7351335		331	192	G							copper
7351793		332	192								(leaded) gunmetal
7351919		333	192	Gm							brass
96003512	4156	334	192	G							brass
96003507		335	192								
96003532		336	192								
7350282	2689	337	193?			62.5	8.1	1.8	0.4	29.4	silver
7351018	5306	338	196?			76.0	16.3	0.0	0.1	0.1	brass
7351871		339	Gp=?								brass
7351587	2527	340	224	Ac							(leaded) brass
7351321	1010	341	224	Ac							brass/gunmetal
7350898	3171	342	225			77.8	12.0	4.2	2.0	0.0	brass/gunmetal
7351349	2505	343	225			86.8	11.5	0.0	0.8	0.0	brass
7351318	2816	344	225			83.2	11.7	1.5	1.6	0.0	brass
7350803	4017	345	225			81.1	12.5	4.1	2.5	0.0	brass/gunmetal
7351181	5308	346	242A	(E)??		80.8	14.9	2.9	0.9	0.0	brass
7351342	1844	347	242A	S?		76.5	7.6	7.8	3.9	0.1	gunmetal
7350801	3996	348	238			73.1	18.4	3.6	1.4	0.0	brass
7351082	1011	349	238			77.8	21.6	0.0	0.1	0.0	brass
7351712	641	350	200B	Es	OW	62.1	15.3	1.2	0.2	0.0	brass
7351711	1130	351	203	Es	TX	60.8	14.9	1.4	4.4	0.1	(leaded) brass
7351528	3012	352	203	Es(As)	RT	64.1	6.1	7.5	11.8	0.1	leaded gunmetal
7351735	2844	353	211+	TEs	X	82.4	8.7	3.7	2.3	0.1	gunmetal
7351749	3945	354	203			71.2	12.4	5.5	8.8	0.2	leaded gunmetal
7350295	3872	355	203			85.3	0.0	10.1	0.5	0.1	bronze
7350347	304	356	241	T		69.4	0.6	6.7	18.8	0.1	leaded bronze
7350892	2183	357	229	NEs	X	79.3	13.7	3.2	2.4	0.0	brass
7351357	992	358	230	(E)							brass?
7351085	2068	359	230	(E)		80.6	14.6	2.1	2.1	0.0	brass
7351669	874	360	231A	Es?	T	81.7	11.2	3.5	3.2	0.1	brass/gunmetal
7351542	4472	361	232			81.3	0.5	10.0	5.6	0.1	(leaded) bronze
7350789	4152	362	233	Es	RT	79.2	6.0	4.2	2.1	0.5	gunmetal
7350891	7	363	234	EsEj	ROWX	74.1	7.2	4.4	10.8	0.0	leaded gunmetal
7350067	2338	364	227	(E)		79.5	1.5	9.0	10.7	0.0	leaded bronze

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<i>AML No.</i>	<i>Site No.</i>	<i>Pub No.</i>	<i>Type</i>	<i>Decor</i>	<i>Enamel</i>	<i>Cu%</i>	<i>Zn%</i>	<i>Sn%</i>	<i>Pb%</i>	<i>Ag%</i>	<i>Alloy</i>
7351319	4873	365	228	(E)							copper
7351087	85	366	228?	EsEm	RO.YP						lead
7350893	589	367	231B	Es	T	75.8	9.1	4.8	6.9	0.0	(lead)
7351776	2629	368	278+								gunmetal?
7351727	2997	369	250	Em	X.RTKW						lead
7351728	2978	370	256	Em	.RBW	71.5	3.5	6.4	11.2	0.0	lead
7350899	2393	371	256	Em	.RTBW	75.6	15.7	0.6	2.2	0.0	brass
7351543	3956	372	252/256	(E)		83.6	1.6	5.7	14.0	0.1	lead
7351733	3906	373	249A	Mc							gunmetal
7351300	4697	374	249	TMb		72.4	4.7	10.3	6.1	0.1	(lead)
7351209	3798	375	249?	T							(lead)
7350086		376	249?	T		84.1	1.8	4.9	5.2	0.1	(lead)
7350525	3250	377	269A	Ece?	T	79.2	8.3	3.1	4.6	0.3	(lead)
7350611	2638	378	Gp=?								(lead)
7351739	823	379	268	Es	RT						lead
7351201	4479	380	268	Es	RYT	85.9	10.9	3.7	4.0	0.0	(lead)
7350083	2414	381	268	Es	R						lead
7351730	26	382	267B	Es	T						bronze?
7351714		383	267B	Es	RB						(lead)
7350088		384	252B	TEs	X	84.1	1.3	6.7	6.9	0.3	(lead)
7351746	2792	385	252C	TEs	B	86.8	0.7	7.9	0.8	0.0	bronze
7351081	1573	386	260	TEs	T	82.6	1.6	6.9	6.1	0.0	(lead)
7351080	1694	387	260	TEj	T	79.0	0.5	9.3	5.1	0.0	(lead)
7351729	1872	388	270	GmTAc		85.4	10.2	0.0	0.5	0.0	brass
7351717		389	270	GlTAc		88.5	1.0	6.5	0.8	0.1	bronze
7351086	208	390	270	G(Ac)		85.7	4.7	5.1	0.6	0.0	gunmetal
7351770	4932	391	P11C			78.1	24.7	0.0	0.0	0.1	brass
7350895	3781	392	P2			88.7	3.8	4.7	1.4	0.0	gunmetal
7351760	1329	393	P3								brass/gunmetal
7351756	302	394	P3			88.5	15.1	2.1	0.8	0.0	brass
7351083	943	395	P3								silver
7350507		396	P3			80.1	16.4	0.0	2.0	0.1	brass
7350082	2337	397	P3			92.7	0.0	7.0	2.0	0.0	bronze
7351072	153	398	P3			75.3	8.4	5.5	4.5	0.1	(lead)
7351070	376	399	P3			86.1	0.0	9.7	1.5	0.6	bronze
7350550	1468	400	P3			87.9	2.4	3.8	2.1	0.4	bronze/gunmetal
7351722	79	401	P3			87.2	3.9	6.4	1.4	0.1	bronze/gunmetal
7351099	3808	402	P3			76.1	21.6	0.0	2.3	0.0	brass
7351074	148	403	P3			92.6	0.1	3.4	1.8	0.0	bronze
7351880		404	P3								bronze
7351881		405	P3								bronze
7350964	404	406	P3								lead
96003509	3737	407	P3								iron
96003571	2091	408	P3								brass
7350084	3191	409	P3			89.1	1.3	6.9	1.3	0.1	bronze
7351720	3194	410	P3			90.5	1.5	6.3	1.6	0.1	bronze
7351732	3079	411	P3			80.7	14.0	0.0	0.6	0.1	brass
7351299		412	P3			88.2	9.1	2.0	2.9	0.0	brass

<i>AML No.</i>	<i>Site No.</i>	<i>Pub No.</i>	<i>Type</i>	<i>Decor</i>	<i>Enamel</i>	<i>Cu%</i>	<i>Zn%</i>	<i>Sn%</i>	<i>Pb%</i>	<i>Ag%</i>	<i>Alloy</i>
7351419		413	P3								silver
7351762	2814	414	P3								silver
7350974	5171	415	P3								silver
7351910		416	P4								brass
7350598	5668	417	P4			89.0	0.3	8.3	0.8	0.1	bronze
7351589	4630	418	P4			86.2	1.7	3.9	1.7	0.1	bronze/gunmetal
7350894	4190	419	P4			77.9	16.3	2.9	1.7	0.1	brass
7351710	15	420	P4			70.4	1.5	8.0	5.3	0.1	(leaded) bronze
7350897	3617	421	P4			70.6	3.8	8.0	0.6	0.0	bronze/gunmetal
7351750		422	P4								silver
7351588	1081	423	P4								silver
7351740	3241	424	P4			87.8	0.5	10.5	1.0	0.0	bronze
7351089	178	425	P4			88.0	11.1	0.0	0.4	0.0	brass
7351882		426	P4								gunmetal
7351913		427	P4								bronze/gunmetal
7350774	25	428	P7			91.5	0.2	6.6	0.5	0.0	bronze
7351376	4875	429	P6C			95.0	0.4	6.8	0.4	0.1	bronze
7351084	1850	430	P6			79.2	5.1	5.2	8.4	0.0	leaded gunmetal
7351073	151	431	P6A			84.8	0.1	14.5	3.6	0.1	bronze
7351163	147	432	Gp=penan			69.4	8.2	5.6	9.0	0.1	leaded gunmetal
7350778	360	433	Gp=penan	Es	K?	81.9	0.5	15.2	3.2	0.1	bronze
7351755	303	434	P12			99.0	0.2	0.5	0.1	0.0	copper
7350896	3325	435	Gp=penan			77.0	17.7	2.3	0.4	0.0	brass
7351761		436	Gp=annul			85.5	5.2	4.1	2.4	0.1	gunmetal
7351721	152	437	Gp=annul	Gm							gunmetal
7350601	1628	438	Gp=penan			102.0	0.0	0.5	0.0	0.1	copper
7350595	3985	439	Gp=penan								copper
7351004	5295	440	Gp=penan			82.4	0.0	15.2	2.4	0.1	bronze
7351623	944	441	Gp=penan			70.2	18.5	2.4	2.5	0.1	brass
7351071	154	442	Gp=penan			83.2	1.9	4.8	1.6	0.1	bronze/gunmetal
7350984	1499	443	Gp=penan			86.6	3.3	4.5	1.5	0.1	gunmetal
7351918		444	P4?								bronze/gunmetal
7351916		445	Gp=penan								brass

APPENDIX 2

M R HULL'S TYPOLOGY OF ROMAN BROOCHES

Before his death in 1976 Rex Hull had completed his corpus of ancient brooches in Britain. Its main element was a catalogue of approximately 10,000 brooches, most of which were illustrated, arranged by a numbered typological scheme. The first part, dealing with the pre-Roman bow brooches, has been published (Hull and Hawkes 1987) and the part dealing with brooches of the Roman period is under preparation for publication at the time of writing (Hull forthcoming). Hull's typology was the starting-point of the present study and his numbered types have been retained although the grouping has been modified: see the typological summary in Chapter 1.

The type numbers are listed here with Hull's brief descriptions and a cross reference to further description and illustration in the Richborough catalogue (Chapter 4) or discussion of typology (Chapter 5). Square brackets denote authors' amendments or amplifications.

BOW BROOCHES

GROUP 1: LA TÈNE III AND ROMAN BROOCHES WITH NO HOOK AND NO ARMS

The pre-Roman types 1–8 have been published in Hull and Hawkes (1987).

[Some of T3 appear in Roman contexts in Britain: see Cat 32–34 and Chapter 5, pp 145–7]

- | | | | |
|---|----------------------------------------------------------------------------------------------------------|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3 | La Tène II brooches
C – with short spring, internal chord, no arms, and foot ending wrapped round bow | 9 | The Nauheim type (see Chapter 5, pp 145–7)
A – bow moderately wide
B – narrow bow
C – narrow or wire bow |
| | | 10 | Nauheim-derivative brooches with reverse curve and (usually) solid catchplate. [Simple one-piece brooches: see Cat 1–30 and Chapter 5, pp 147–8]
A – wide flat bow
B – narrow bow
C – round (wire) bow
D – upper part of bow wide, narrowing abruptly to a knife-edge foot
E – bow of round section, usually with terminal knob
F – bow of round section; knobbed foot
G – with flat or nearly flat foot, sharply turned off from bow; a) sharply angled bow; b) rounded angle
H – disc-like expansion on bow |
| | | 11 | Nauheim-derivative brooches with single curve in the bow and solid foot. [Simple one-piece brooches: see Cat 1–30 and Chapter 5, pp 147–8]
A – wide or leaf-shaped bow
B – narrow bow
C – bow of round or square section
D – stout bow of round section |
| | | 11 | <i>bis</i> [Simple one-piece] brooches with the foot turned down almost at a right angle; the body with notched decoration |

- 12 Simple iron [one-piece] brooches with bilateral spring of (usually) four turns, and bow of round or flat section, the foot sometimes open
A – with flat bow
B – with rounded or square bow
- [Simple hinged brooches, types 13–17: see Chapter 5, p 154]
- 13 Hinged brooches of iron or bronze, with reverse curve
- 14 Hinged brooches of iron or bronze, with single curve
- 15 Hinged brooches with flat tapered bow, which is turned down at the head to hold the axis pin
- 16 Similar to type 15 but with expanded head and more heavily built
- 17 The Maiden Castle type
A – with narrow foot
B – with bow projecting over catchplate
- 18 [One-piece sprung] Brooches with button near the middle of the bow
- 19 [One-piece sprung] Brooches with button near the head, where the bow is usually sharply bent
- 19+ Related brooches
- 20 The Aylesford type. [Expanded head covering one-piece spring; mouldings near top of bow]
- GROUP 2: BROOCHES WITH CYLINDRICAL SPRING COVER (see Chapter 5, p 150)
- 21 The Langton Down type
A – large
B – small
- 22 Bow curved elliptically
A – with cast decoration on the cylinder (see Cat 72)
B – with niello decoration on the bow
C – without decoration
- 23 Broad bow much constricted at the button and widening out to a spade-shaped foot
- 24 With narrow bow and spade-shaped foot
- 25 The primitive rosette type
A – without wings or arms
B – with arms
C – with more or less cylindrical head
- 26 The rosette or thistle type
A – plate and bow usually separate pieces
B – plate and bow cast in one piece
- 27 Simple rosette brooches
A – standard type
B – large examples, usually of thinner metal
- 28 The Kragenfibel [disc or half-disc at angle of bow, with broad bow above]
A – with triangular bow
B – with spade-shaped bow
C – variant, hinged
- GROUP 3: FAN-TAILED BROOCHES
(see Chapter 5, pp 150–1)
- 29 With a slender moulded waist
A – with cylindrical spring cover
B – with crossbar and hinged pin
- 30 With long crossbar, thin bow and large foot
- 31 With hinged pin in long crossbar, and bow of double peltate form
- 32 Sprung; foot short and flared
- 33 With crossbar, disc on bow, and wide short fan-tail
- 34 With rearward hook
- 35 With trumpet head
- 36 The Celtic fan-tailed brooch (see Cat 238 and Chapter 5, pp 168–9)
- 37 The Aesica brooch and its allies
- 38 Collingwood type P 38
- 39 Vacant

GROUP 4A: EYE BROOCHES

[One-piece spring of several turns, usually with crossbar; bow broad, with angle and moulding above centre] (see Chapter 5, p 148)

- 40 Eye brooch
 - A – with pierced eyes
 - B – with stamped eyes (see Cat 35)
 - C – without eyes and the bow less curved
- 41 With sharp angle at the button, reverse curve and square toe
- 42 With sharp angle at the button which is high up, and with a long pointed leg with reverse curve ('Knickfibel') (see Cat 36–38)
- 43 Devolved, with the general characteristics of types 40 and 42
- 44 The Pymont type [bow of P-profile]
 - A – without arms
 - B – with arms

GROUP 4B: EARLY HINGED BROOCHES: THE AUCISSA, HOD HILL AND ALLIED SERIES (see Chapter 5, pp 151–4)

- 45 Hooped, thin, leaf-shaped bow, tapering to a knife-edge foot
- 46 Similar to the Aucissa but with stout bow, usually of square section
- 47 Iron brooches with affinities to the Aucissa and Bagendon types
- 48 P-shaped, with some resemblance to type 46
- 49 P-shaped, with Aucissa-style decoration but having a cross-moulding in the centre of the bow
- 50 Of Aucissa shape but having a rod bearing two knobs through the centre of the bow
- 51 The Aucissa type (see Cat 74–92 and Chapter 5, p 151)
 - A – with flat bow
 - B – bow with bold central rib
 - C – bow stout and of rounded section
- 52 The Bagendon type (see Cat 93 and Chapter 5, p151)

- A – with divided bow, pierced by horizontal rods
- B – undivided bow, pierced by horizontal rods
- C – with knobs at side of bow in place of rods
- D – undivided bow, without knobs or rods

52bis Brooches with two pins

- 53 Copies of Aucissa or Bagendon brooches (see Chapter 5, p 151)
 - A – with toeknob
 - B – with flat foot, expanding downwards
- 54 With broad expansion upper part of bow
[Types 55–58: see Chapter 5, p 154]
- 55 Strip bow, with ribbed bow and wide short terminal knob
- 56 Strip bow; lighter brooches with grooved bow and small terminal knob
- 57 Strip bow; very small brooches with stout central rib and small terminal knob
- 58 Strip bow, without terminal knob (see Cat 159)
 - A – bow curved, catchplate triangular
 - B – bow less curved, catchplate nearer square
- 59 With wide head and broad bow expanding downwards, catchplate square
- 60–79 The Hod Hill series (see Cat 95–153 and Chapter 5, pp 152–154)
- 60 With parallel-sided bow and usually flat tapering foot
- 61 With lateral lugs at base of panel on bow
- 62 With lateral lugs set in the middle of each side of panel on bow
- 63 With lateral lugs set in the middle of each side of the panel on bow
 - A – bow triangular, broad at the top, and with iron rods through foot
 - B – similar brooches without iron rods
- 64 With ribbed bow tapering in unbroken line to the foot

- 65 With an opening on each side of the bow formed by a curved limb
- 66 With triangular opening on each side of the bow
- 67 With triangular open bow, narrow at the top and broad at the bottom, where the two lateral knobs are placed
- 68 With two round holes in the bow
- 69 With open bows of various patterns
- 70 With lugs and no button
A – the shoulder knobs mounted on an iron bar
B – the shoulder knobs cast in one with the bow, the lower ones mounted on iron bars
C – all knobs cast in one with the bow
D – only one pair of knobs, at top of bow
E – no side knobs
- 71 With narrow bow and bold cross-mouldings at head and at base of bow
A – with iron rods through bow
B – without iron rods
- 72 Large brooch with iron rods through the bow
- 73 With discoid bow
- 74 With multiple cross-mouldings
- 75 With one or two square panels on the bow
- 76 With square panel on bow
- 77 With rhomboid bow
- 78 Small with smooth bow
- 79 With tapering bow of flat V-section and no button
- 79+ Miscellaneous brooches of Hod Hill type
- 80 With bow tapered from head to foot, slight offset at button and with terminal knob
- 81 With flat oblong bow
- 82 With flat bow tapering to a point
- 83 Pincer brooches
- GROUP 5: EARLY SPRUNG BROOCHES
- 84 Almgren's Kräftig-profilierete type (see Cat 39–42 and Chapter 5, p 148)
A – with long foot and squarish perforations on the catchplate
B – with long foot and round perforations, or none
C – with almost square catchplate [two-piece spring]
- 85 The Wallingford type: generally similar to type 84 but with two buttons
- 86 The anchor type
- 87 The Pannonian horned brooch or Flügelfibel
- 88 The Birdlip type [with horned moulding projecting from bow] (see Chapter 5, p 148)
A – with zoomorphic mask and fine decorative work
B – with cruder or simpler decoration
- 89 The continental form of the Colchester type (see Cat 44–45 and Chapter 5, p 149)
- 90 The Colchester type (Colchester A) (see Cat 46–67 and Chapter 5, pp 148–9)
A – large, undecorated or with groove down bow
B – undecorated
C – variant
D – iron variants
- 91 Variant of the Colchester type
A – short, 'dumpy'
B – with bow tapering to a point
- 92 Two-piece Colchester type (Colchester B) (see Cat 160–201 and Chapter 5, pp 155–7)
- 93 The Colchester BB type
A – with groove on upper part of bow
B – smooth bow
C – bow ridged
D – variant
- 94 The Dolphin type. [Comma-shaped bow]
A – with sprung pin (see Chapter 5, pp 155–7)
B – with hinged pin (see Cat 206–207 and Chapter 5, p 157)
C – variant with deep notches on the bow

GROUP 6: THE POLDEN HILL SERIES
(see Cat 208–215 and Chapter 5, pp 159–60)

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| <p>95 Brooches intermediate between Dolphin and Polden Hill types
A – with astragaloid decoration on the crossbar
B – with less elaborate decoration
C – small short brooches</p> <p>96 Small brooches</p> <p>97 Light and slender brooches
A – decorated
B – normal</p> <p>98 Heavier brooches</p> <p>99 With embossed decoration
A – decoration curvilinear
B – decoration of raised chevrons
C – decoration of raised bars set horizontally or obliquely</p> <p>100 The developed Polden Hill brooch
A – enamelled
B – with a raised chevron in middle of bow
C – all other developed brooches</p> <p>101 Large and heavy brooches, mostly decorated with longitudinal ridges and rows of small bosses, the terminal knob large and obconical</p> <p>102 Hinged brooches with Polden Hill affinities</p> <p>103 With widened, more or less flat head. Pin sprung</p> | <p>109 South-western enamelled brooches with acanthus leaves at the button</p> <p>110 South-western enamelled brooches, sprung</p> <p>111 Similar to type 110 but hinged</p> <p>112– Applied Hook series (see Chapter 5, pp 157–9)
119</p> <p>112 Almost semicircular brooches with hollow bow</p> <p>113 With strongly curved and heavily cast bow; sprung</p> <p>114 Hinged version of type 113</p> <p>115 Imitating types 113 and 114 but with the ‘plate’ cast in one piece with the bow</p> <p>116 Sprung, with thin bow and triangular catchplate</p> <p>117 Simple T-shaped brooches with hook-plate</p> <p>118 With prominent crest and very straight bow; hinged</p> <p>119 Similar to type 118 but with headloop</p> |
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- | | |
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| <p>GROUP 7: T-SHAPED BROOCHES
(see Chapter 5, pp 159, 167–8)</p> <p>104 Hinged T-shaped brooches derived from type 103</p> <p>105 With enamelled lozenges on the bow</p> <p>106 Similar to type 105 but the lozenges smaller and cross-knurled</p> <p>107 With appendages at the head and one lozenge on the bow</p> <p>108 South-western enamelled brooches with ornamental button</p> | <p>122 With lozenge in centre of the bow</p> <p>123 The sides decorated with volutes</p> <p>124 With longitudinal grooving on bow, stopping short of foot</p> <p>125 With beaded rib down middle of bow</p> <p>126 With triangle on upper half of bow</p> <p>127 With long T-shaped head and triangle lower on bow</p> <p>128 With large triangle on bow</p> |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

- 129 With stud on bow
- 130 With no stud, but many incised chevrons on bow
- 131 Of the same general design as type 130, with finely incised decoration and no stud or button
- 132 The Nornour type: two studs or cups for enamel on the bow
A – with rib down bow
B – without rib on bow
- 133 With upper half of the bow reeded
- 134 The Pitton type: with knobbed crossbar and incised curved lines on head
- 135 With large notched crest
- 136 With decoration on a flattened area on head
- 137 A – with triangle on head
B – with beaded ridge on bow
C – with wide bow and fantail
- [Types 138–140: see Chapter 5, p 167]
- 138 Usually of large size and with a large fixed headloop
- 139 Generally similar to type 138 but different profile and other details
- 140 With large more or less spade-shaped headplate
- 141 Heavy brooches with enamelled decoration and straight terminal knob which is not turned forward
- 142 With narrow enamelled panel running down bow
- 143 Stout, usually enamelled
- 144 Sawfish brooches, usually with sprung pin
- 145 With serrated edges (see Cat 225–227 and Chapter 5, p 165)
A – with crest in form of a dog, or vestiges of it
B – with headstud and no crest, i) with settings for stones in the arms; ii) with decorated arms
- 146 The Thealby Mine type. [Plain hinged brooches with fixed headloop and footknob] (see Cat 234)
- 147– The Lamberton Moor series. [‘Headstud brooches’; see Chapter 5, pp 164–7]
- 147 The Kinvaston type: enamelled, with headstud and a terminal knob which faces forward
- 148 With loose headloop
A – bow not enamelled, pin sprung or hinged
B – bow enamelled, pin sprung or hinged
C – pin hinged, bow usually enamelled, with cupped settings (see Cat 228 and Chapter 5, p 165)
- 149 With fixed headloop (see Cat 229–231 and Chapter 5, pp 165–6)
A – with little or no enamel
B – with enamelled bow
- 150 The Neath type. [Spring between two lugs, fixed headloop, lateral ribs on bow]
- 151 The Wroxeter type (see Chapter 5, p 169)
A – with raised zigzag ornament on bow
B – with long, round decorated crossbar
C – with flat decorated crossbar
D – with D-shaped head and enamelled bow
E – anomalous brooches
- 152 The Prestatyn type (see Chapter 5, p 169)
- GROUP 8: TRUMPET-HEADED AND ALLIED BROOCHES
- 153– The Backworth series (see Cat 216–221 and Chapter 5, pp 160–4)
- 153 Collingwood’s type Ri and Riii, ie, without acanthus moulding at button
A – with niello or enamel on bow or leg
B – with zoomorphic or other decoration in high relief
C – with no decoration
D – with half-round button and/or fixed headloop
- 154 The Chester type. [Small light brooches; the waist-moulding never full round]
A – with loose headloop
B – with fixed headloop
- 155 Devolved Backworth brooches

- 156 Collingwood's type Rii and Riv, ie, with acanthus moulding, decorated in the Welsh style
 B – foot ending in a moulded, more or less pointed knob
 C – foot with annular or penannular terminal
- 157 Decorated Backworth brooches with acanthus moulding at the button
 D – foot ending with double cross-moulding or similar
 E – brooches unassigned because the foot is missing
 A – elaborate, usually without enamel
 B – with zoomorphic decoration in enamel
 C – enamelled; complex curvilinear pattern on head, repeated either side
 D – enamelled; leaf decoration on head
 E – enamelled; various unclassified patterns
 F – head enamelled in standard pattern; matching triangles and lunettes on either side
- 158 Backworth brooches with no enamelled or relief decoration
 167 Trumpet-headed brooches with straight bow and pelta-shaped plate which is usually enamelled
 A – with ornamental terminal knob
 B – with penannular terminal knob
 C – terminal knob a hollow disc or ring
 A – with full-round acanthus moulding; sprung
 B – with full-round acanthus moulding; hinged
 C – with half-round acanthus moulding; sprung
 D – with fixed headloop
 E – fixed headloop and lower edge of head cut off straight
 F – fixed headloop, acanthus moulding and wide angular head
- 159 A – similar to type 154 but with acanthus moulding
 B – with volutes on head
- 160 Large square-headed brooches (see Chapter 5, p 168)
- 161 With long spring and upturned terminal knob
- 161A Similar to Backworth type, with large headplate
- [Types 162–168: see Chapter 5, pp 168–70]
- 162 The Alcester type (see Cat 235)
 A – disc full-round
 B – head and disc half-round, the latter domed
 C – disc half-round, thin and flat
- 163 Fantail brooch with large disc on bow
- 164 Fantail brooches with small disc or square on bow
- 165 Vacant
- 166 Brooches with trumpet head, enamelled disc on bow and tapering foot ending in a knob or ring (see Cat 236–237)
 A – foot ending in an obconical knob, deeply cupped for stone
- 168 With trumpet head, the body shaped as a fly
 A – large examples
 B – small examples
- 169 With swan-necked bow
- 170 With lobed projection on the bow
- GROUP 9: KNEE BROOCHES (see Chapter 5, pp 179–81)
- 171– Bow of rounded outline, the catch longitudinal
- 173
- 171 Semicircular headplate, the catchplate of normal length
- 172 Semicircular headplate, the catchplate narrow but projecting further than usual
- 173 Cylindrical head
 A – very small examples with narrow head
 B – larger examples
- 174– Bow rounded in profile but front view angular, catchplate transverse
- 174 Semicircular headplate, bow thin, flat, broad, with S-curve in profile
- 175 Bow as type 174, with cylindrical head
 A – with single bow (see Cat 240)
 B – with double bow
- 176 Bow of rectangular section, expanding to square foot (see Cat 241–243)
 A – bow narrow
 B – bow broad

- 177 Heavy, with transverse catch and rectangular profile
B – with terminal knobs on crossbar; the knobs small, scarcely exceeding the diameter of the bar (see Cat 288–302)
- 178 Knee-fantail brooches
A – with broad bow (see Cat 245–246; also Chapter 5, p 181)
B – spiral on head, foot ornamentally shaped
C – narrow bow
- 179 The bow formed of two straight bars
- 192 The heavy crossbow brooch (see Cat 317–336)
- 193 The Osztrapataka type
- 194 P-shaped brooches without crossbar
- 195 With openwork decoration on the bow
- 196 With bow of triangular section (see Cat 338)
- 197 The bow divided by cross-mouldings
- 198 The West Stow type
- GROUP 10: VARIOUS ENAMELLED BROOCHES
(see Chapter 4, p 81)
- 180 Bow almost parallel-sided (see Cat 154–157)
- 181 T-shaped, with oblong bow and astragaloid foot
- 182 Bow a flat triangular plate, the foot zoomorphic or astragaloid
- 183 With lozenge-shaped central plate, the pin hinged in crossbar
- GROUP UT: UNCLASSIFIED T-SHAPED BROOCHES
- GROUP U: UNCLASSIFIED BOW BROOCHES
- PLATE BROOCHES
- GROUP 11: SHEATH-FOOTED AND CROSSBOW BROOCHES
(see Chapter 5, pp 181–5)
- 184 With returned foot
- 185 The Corbridge type (see Cat 247)
- 186 Late P-shaped brooches: the South Shields type (see Cat 248–250)
A – with central knob on head
B – without central knob on head
C – with rounded or pointed toe
- 187 With cylindrical head and divided bow (see Cat 251–257)
A – with notched ridge on cylinder
B – without notched ridge
- 188 Triple-bowed brooches with notched ridge on head
- 189 Sheath-footed brooches with multiple bow and usually triangular headplate (see Cat 258–267)
- 190 The light crossbow brooch (see Cat 279–287)
- 191 [The middle-weight crossbow brooch]
A – with no terminal knobs on crossbar (see Cat 269–278)
- 200 Dragonisque brooches (see Cat 350 and Chapter 5, pp 171–2)
A – enamelled, with circular central motif
B – enamelled, with latticed central motif
C – enamelled, the central motif composed of squares
D – enamelled, the central ornament a narrow band
E – without enamel
- 201 S-shaped brooches
- 202 S-shaped brooches made of wire
- 203 Brooches of animal shape, fully or partly in the round (see Cat 351–352 and Cat 354 and Chapter 5, p 174)
- 204 Brooches in the form of a horse and rider (see Chapter 5, pp 175–6)
- 205 Flat brooches in the form of a horse (see Chapter 5, p 174)
- 206 Brooches in the form of a stag (see Chapter 5, p 174)
- 207 Brooches in the form of a bear

- 208 Brooches in the form of a boar or stag
- 209 Brooches in the form of a lion
- 210 Brooches in the form of a dog (see Chapter 5, p 174)
- 211 Brooches in the form of a hare (see Cat 353 and Chapter 5, pp 173–4)
- 212 Brooches in the form of an eel
- 213 Brooches in the form of a bird (see Chapter 5, pp 174–5)
- 214 Brooches in the form of a sitting cock or hen (see Chapter 5, pp 174–5)
- 215 Vacant
- 216 Small brooches in the form of a duck
- 217 Brooches in the form of a dove
- 218 Brooches in the form of a dove with extended wings
- 219 Brooches in the form of a bird with expanded tail
- 220 Bird brooches more or less in the round
- 221 Brooches in the form of a fly
- 222 Flat brooches in the form of a bird
- 223 Brooches in the form of a fish (see Figures 18 and 26, Plates 8 and 13)
- 224 Early plate brooches set with glass (see Cat 340–341 and Chapter 5, p 154)
- 225 Flat cruciform brooches (see Cat 342–345 and Chapter 5, p 154)
- 226 Flat lozenge-shaped brooches with no lugs at the angles (see Chapter 5, p 176)
- 227 Lozenge, square or rhomboid-shaped brooches with ornamental projections at the angles (see Cat 364 and Chapter 5, p 176)
- 228 Similar to type 227 but with zoomorphic lugs (see Cat 365–366 and Chapter 5, pp 176–7)
- 229 Brooches with a wide flat bow, curved or arched between two small matching terminals (see Cat 357 and Chapter 5, pp 171, 176)
- 230 Equal-ended brooches with square, oval or round central plate between horizontal bars (see Cat 358–359 and Chapter 5, pp 171, 176)
- 231 Equal-ended brooches with rectangular centre (see Chapter 5, p 176)
A – with lugs at each corner of central panel (see Cat 360)
B – with lugs at centre of each side of central panel (see Cat 367)
- 232 Equal-ended brooches, humped, with a narrow rectangular plate set at a right angle across the centre (see Cat 361)
- 233 Equal-ended brooches with a rectangular enamelled central plate, which has extended matching ends (see Cat 362 and Chapter 5, p 176)
- 234 Equal-ended, enamelled, with raised central disc and two matching projections incorporating lunettes (see Cat 363 and Chapter 5, p 176)
- 235 Early lunular brooches (see Chapter 5, p 155)
A – with lunular openings
B – with kidney-shaped openings
C – simple lunette shape
- 236 Pelta and lunular-shaped brooches with enamel
A – peltate
B – lunate
- 237 Flat enamelled crescent-shaped brooches
- 238 Flat brooches of thistle or key-hole shape (see Cat 348–349 and Chapter 5, pp 154–5)
- 239 Flat brooches of various shapes, tinned and bearing riveted buttons and engraved decoration (see Chapter 5, p 155)
- 240 Brooches with frilled edges (see Chapter 5, pp 176–7)
- 241 With lunular head and straight leg (see Cat 356)

- 242 Disc with attachments
A – disc flanked by two bowls, from each of which a snake rises (see Cat 346–347 and Chapter 5, p 154)
B – disc with small lugs and an openwork tail
- 243 Vacant
- 244 Vacant
- 245 Flat brooches with four round openings
- 246 Pierced or openwork brooches
A – small, openwork in rather thick metal, tinned
B – larger, openwork in regular patterns
C – disc with four openings and four lugs; enamelled stud in centre
- 247 Openwork brooches in curvilinear patterns
- 248 Disc brooches decorated mainly by mouldings
- 249 Disc brooches with applied embossed plate (see Cat 373–376 and Chapter 5, p 173)
A – with Celtic ornament
B – with animal designs
C – with human beings
D – with insets in the embossed plate
E – unclassified
- 250 Disc brooches with a central stud and a small loop over the hinge (see Cat 369 and Chapter 5, p 176)
- 251 Large disc brooch with central stud in the form of a dolphin
- 252 Small flat disc brooches decorated with enamel (see Chapter 5, p 178)
A – field undivided
B – pattern of spots on enamelled ground (see Cat 384 and A11)
C – field divided by a zigzag circle, with spot in each point (see Cat 385)
D – various unclassified patterns
- 253 Small flat disc brooches enamelled in a pattern of six spots linked by curved lines (see Chapter 5, p 178)
- 254 Small flat disc brooches with many small, usually rectangular, lugs (see Chapter 5, p 178)
- 255 Flat disc brooches enamelled with a triskele pattern (see Chapter 5, p 178)
- 256 Disc brooches with chequered pattern in mosaic enamel (see Cat 370–371 and Chapter 5, p 177)
- 257 Disc brooches with concentric bands of enamel and a central stud (see Chapter 5, p 176)
- 258 Disc brooches with open centre (see Chapter 5, p 176)
- 259 Flat disc brooch bearing a central target with smaller targets round it
- 260 Flat oval brooches with central stone or intaglio and enamelled surround (see Cat 386–387 and Chapter 5, p 178)
- 261 Flat disc brooch with six small lugs
- 262 Flat disc brooch with central stud and several lugs (see Chapter 5, p 176)
- 263 Disc brooches with raised centre, usually with four or more lugs, sometimes with central stud (see Chapter 5, pp 176–8)
- 264 Disc brooches with widely spaced lugs
A – with small lugs
B – with large lugs
- 265 Disc brooches with scalloped edges (see Chapter 5, p 176)
- 266 Brooches in the form of a wheel (see Chapter 5, pp 176–7)
A – with lugs round the edge
B – without projections on the edge
- 267 Umbonate disc brooches, enamelled, and with lugs (see Chapter 5, p 173)
A – with two lugs
B – with four lugs (see Cat 382–383)
C – brooches with more than four lugs
- 268 Enamelled disc brooches with rosette centre (see Cat 379–381 and Chapter 5, pp 172–3)

- 269 Disc brooches with a conical centre surmounted by a knob or button (see Cat 377 and Chapter 5, p 178)
 A – high centre projection and large lugs
 B – lower centre and small lugs
- 270 Circular bronze-gilt brooches with stone or intaglio in centre (see Cat 388–390 and Chapter 5, pp 178–9)
- 271 Oval bronze-gilt brooches with stone or intaglio in centre (see Chapter 5, pp 178–9)
- 272 Plate brooches in cloisonné enamel
- 273 Fusiform brooches
- 274 Brooches in the form of an axe
- 275 Brooches in the form of a sandal (Figure 33)
- 276 Brooches in the form of a swastika
- 277 Brooches in the form of a shield
- 278 Flat oblong brooches
- 279 Brooches in the form of a star, or surrounded by scalloped rays
- GROUP UD: UNCLASSIFIED PLATE BROOCHES
- PENANNULAR BROOCHES
- P1 Brooches with no enlargement of the terminals
 A – ring very stout in relation to its diameter
 B – lighter construction
 C – ring flat
- P2 With terminal spirals turned outwards in the same plane as that of the ring (see Cat 392)
- P3 Terminals flattened and rolled in a spiral at right angles to the plane of the ring (see Cat 393–415)
- P4 Terminals reflexed (see Cat 416–427)
- P5 Zoomorphic terminals
- P6 Knobbed terminals (see Cat 428–431)
 A – very small knobs
 B – larger knobs without collar
 C – writhen knobs
 D – large round knobs with collar
- P7 Multiple-knobbed terminals
- P8 Flat discoid terminals
- P9 Terminals in the form of a large ornamental knob in the same line as the ring
- P10 Terminals of twisted wire
- P11 ‘Omega’ brooches (see Cat 391 and Chapter 5, p 186)
 A – terminals in the form of snakeheads
 B – melon-shaped terminals
 C – drum-shaped terminals
 D – terminals knobbed, in various forms
- P12 Terminals extended upwards and variously shaped
- P13 Terminals returned round a dumb-bell shaped bolt, or cast to represent this
- P14 Penannular brooches in which the opening is bridged
- P15 Brooches with a stop mounted on the ring

APPENDIX 3

PARALLELS FOR THE RICHBOROUGH BROOCHES

Notes

This is not a comprehensive list but is intended to show the general trend of distribution of types found at Richborough. In some cases the conventionally understood 'Type' includes variables which are not present at Richborough and these are not included.

Where very few parallels are available some with more general resemblance are cited; these are indicated by square brackets – [].

Only a few continental parallels are given; these are intended to indicate those types that are not confined to Britain but are by no means representative of the distribution in other provinces.

Hull: references with this prefix are taken from the corpus of brooches (Hull forthcoming). (Where several examples from Colchester have been published these are cited rather than the numerous examples in the corpus.) 'Hull T000' is Hull's type-number: see Appendix 2.

AML: Numbers assigned to brooches that have been submitted to the Ancient Monuments Laboratory.

Location of parallels: OS National Grid reference precedes site name and county. Historical county names are used to avoid the confusion caused by revisions since 1974.

Distribution maps based on these lists appear in Chapter 6 where their relevance to the Richborough brooches is discussed.

Order of sites quoted: Site names where parallels have been found are grouped geographically (starting with those nearest to Richborough and continuing either westwards or northwards) in order to give a general indication of distribution.

ONE-PIECE SPRUNG BROOCHES

SIMPLE ONE-PIECE BROOCHES, OFTEN KNOWN AS 'NAUHEIM DERIVATIVES': NO CROSSBAR, BILATERAL FOUR-COIL SPRING, INFERIOR CHORD, SOLID CATCHPLATE. HULL T10-11 (FIGURE 168)

a) *with bow of flat cross-section, sometimes decorated as Cat 1-2 (in form, decoration differs), bow tapers to narrow foot but not shouldered or leaf-shaped; reverse curve*

- TR 3141 Dover, Kent, Philp 1981, no. 92, p 153
- SU 7201 Hayling Island, Hampshire, Soffe excavation no. SF 223
- SU 6262 Silchester, Hampshire, Hull 4279, not in Reading Museum
- ST 8510 Hod Hill, Dorset, Brailsford 1962, C22-5, p 7
- SU 5482 Lowbury Hill, Berkshire, Atkinson 1916, nos 6-7, 11-12, 14-15, p 33
- SU 1153 Casterley Camp, Wiltshire, Hull 5480, Devizes Museum
- TL 2434 Baldock, Hertfordshire, Stead and Rigby 1986, fig 40, nos 19 and 25, p 109
- SP 0201 Cirencester, Gloucestershire, Hull 5795, Corinium Museum
- ST 7898 Uley, Gloucestershire, Woodward and Leach 1993, fig 123, no. 3
- SP 9566 Rushden, Northants, Woods and Hastings 1984, fig 10, no. 2, p 107

As Cat 4: simple curve, bow tapers, relief decoration down centre

- SU 8304 Fishbourne, West Sussex, Cunliffe 1971, no. 4, p 100, pre-AD 75
 TL 2434 Baldock, Hertfordshire, Stead and Rigby 1986, fig 40, no. 18, p 109
 SP 8880 Weekley, Northants, Jackson and Dix 1987, fig 22, no. 6

As Cat 6: broad flat bow, relief decoration down each side

- TL 9925 Colchester, Essex, Crummy 1983, no. 1, p 8
 TF 8902 Woodcock Hall, Norfolk, Brown 1986, no. 57, p 21
 SU 2082 Wanborough, Wiltshire, Anderson *et al* 2001, fig 16, nos 10–11, p 41
 SU 1153 Casterley Camp, Wiltshire, Cunnington and Goddard 1934, pl XXIX, no. 4, p 104
 SU 7201 Hayling Island, Hampshire, Soffe excavation no. SF 3443, 2927

As Cat 7–9; reverse curve, flat but narrow bow

- TL 9925 Colchester, Essex, Sheepen, Niblett 1985, no. 1, p 110
 TL 2434 Baldock, Hertfordshire, Stead and Rigby 1986, fig 41, nos 28 and 33, p 109
 TL 7388 Hockwold, Norfolk, Gurney 1986, fig 40, no. 2, p 63
 SU 7201 Hayling Island, Hampshire, Soffe excavation nos SF 65, 5, 68

with flat bow; simple shapes

- TL 3924 Braughing, Hertfordshire, Potter and Trow 1988, fig 17, no. 4, p 36
 TL 9925 Colchester, Essex, Camulodunum, Hawkes and Hull 1947, pl XCII, no. 55, p 312
 TM 0320 Fingringhoe, Essex, Hull 5014, Colchester Museum
 TL 8138 Gestingthorpe, Essex, Draper 1985, fig 8, no. 1, p 27
 SU 8304 Fishbourne, West Sussex, Cunliffe 1971, nos 7–8, p 100
 SU 0255 Easterton, Wiltshire, Cunnington and Goddard 1934, pl 65, no. 3, p 209
 SU 0052 West Lavington, Wiltshire, Cunnington and Goddard 1934, pl 65, no. 5, p 209
 SU 2277 Upper Upham, Wiltshire, Cunnington and Goddard 1934, pl LXXI, no. 4, p 221

b) with rod or wire bow

As Cat 18 (reversed curve)

- TR 1457 Canterbury, Kent, Hull 8598, Royal Museum
 TL 1507 St Albans, Hertfordshire, Verulamium, Frere 1984a, fig 5, nos 10–11, p 21
 TL 2434 Baldock, Hertfordshire, Stead and Rigby 1986, fig 41, nos 39–41, p 109
 TL 3924 Braughing, Hertfordshire, Potter and Trow 1988, fig 17, no. 10, p 37
 TQ 3281 London, Hull 7202–3, 6921, 7199
 SU 3346 Portway, Hampshire, Cook and Dacre 1985, grave 22, no. 3, p 29
 SU 7201 Hayling Island, Hampshire, Soffe excavation no. SF 1400
 SU 2069 Mildenhall, Wiltshire, Cunnington and Goddard 1934, pl LXXI, no. 3, p 221
 ST 7816 Hinton St Mary, Dorset, Hull 6587, British Museum
 SP 0201 Cirencester, Gloucestershire, Hull 5794, 5790
 SJ 5608 Wroxeter, Shropshire, Bushe-Fox 1916, pl xv, no. 1, p 22
 SJ 5608 Wroxeter, Shropshire, AML 721369
 TM 1579 Scole, Norfolk, Rogerson 1977, fig 54, no. 6, p 131
 SK 9117 Thistleton, Rutland, Greenfield excavation no. BH 760
 SE 9423 Old Winteringham, Lincolnshire, Stead 1976a, fig 98, nos 1–2, p 195
 SK 3871 Chesterfield, Derbyshire, Ellis 1989, no. 1 (no fig), p 85
 NY 9964 Corbridge, Northumberland, Bishop and Dore 1988, fig 76, no. 4, p 159
 SE 4066 Aldborough, Yorkshire, Bishop 1996, fig 30, no. 303, p 49
 NY 3955 Carlisle, Cumberland, Hull 4389 Carlisle Museum
 NX 9776 Dumfries, National Museum Scotland, Hull 8747–8
 Straubing, Germany, Walke 1965, Tafel 93, no. 2
 Bad Pyrmont, Germany, Brunnenfund, Andraschko and Teegen 1988, Abb 10d

with simple curve or nearly straight rod bows

- TR 1457 Canterbury, Kent, Hull 1450–1
 TR 3141 Dover, Kent, Philp 1981, fig 34, no. 89
 TL 9925 Colchester, Essex, Camulodunum, Hawkes and Hull 1947, pl XCII, nos 56–9, p 312

- TL 7006 Chelmsford, Essex, Wickenden 1992, fig 37, nos 3–5, p 71
- SU 7201 Hayling Island, Hampshire, Soffe excavation nos SF 2975, 159, 2953, 1398, 562, 1006
- SU 2082 Wanborough, Wiltshire, Anderson *et al* 2001, fig 17, no. 23, p 44
- ST 8510 Hod Hill, Dorset, Brailsford 1962, fig 7, C 18, p 7
- SU 0010 Gussage All Saints, Dorset, Wainwright 1979, fig 86, nos 3014, 3032, 3046, 3055, 3057, pp 111–12
- ST 4401 Waddon Hill, Dorset, Webster 1965, fig 6, no. 1, p 10
- ST 9311 Tarrant Hinton, Dorset, Giles excavation no. 216
- SY 6989 Maumbury Rings, Dorset, Bradley 1976, fig 20, no. 7, p 67
- TL 2434 Baldock, Hertfordshire, Stead and Rigby 1986, nos 27, 31, 38, p 109
- TL 1507 St Albans, Hertfordshire, Verulamium, Frere 1984a, fig 5, no. 13, p 21
- TL 1507 St Albans, Hertfordshire, Verulamium, Frere 1972, fig 29, no. 1, p 114
- TL 3924 Braughing, Hertfordshire, Potter and Trow 1988, fig 17, nos 9 and 11, p 37
- TL 1107 Gorhambury, Hertfordshire, Neal *et al* 1990, fig 121, nos 3–4, 6–7, p 115
- SP 8833 Magiovinium, Dropshort, Buckinghamshire, Neal 1987, fig 23, no. 3, p 41
- SP 3474 Baginton, Warwickshire, Hobley 1969, no. 8, p 111
- SP 2255 Tiddington, Warwickshire, excavation nos SF 236, 644
- SP 1998 Coleshill, Warwickshire, excavation nos 1081 and 1088
- SE 9318 Winterton, Lincolnshire, Stead 1976a, no. 24, p 199
- NZ 3666 South Shields, Durham, Allason-Jones and Miket 1984, 3.15, p 96
- NT 5734 Newstead, Roxburghshire, Scotland, Curle 1911, pl LXXXV, no. 1, p 318
- ONE-PIECE, THE UPPER BOW SHARPLY RAISED
IN PROFILE, SPRING OF SEVERAL TURNS
WITH SUPERIOR CHORD, HOOK FOR CHORD,
SHORT CROSSBAR, MOULDING IN CENTRE OF BOW
- a) *The 'Eye' brooch; Hull T40B – with 'eyes', Cat 35*
- TL 9925 Colchester, Essex, Camulodunum, Hawkes and Hull 1947, no. 124, pp 320–1, Claudian context
- TQ 3281 London Hull 2696, 5333
- SU 6262 Silchester, Hampshire, Hull 3815
- Vindonissa, Switzerland, Ettliger 1973, Tafel 6, no. 5, pp 68–9
- Augst, Switzerland, Riha 1979, nos 194–7, with more pronounced waist-moulding, nos 203–4, moulding flat at back, pp 68–9
- Others of general type but lacking 'eyes'*
- [TL 2434 Baldock, Hertfordshire, Stead and Rigby 1986, nos 48–9, p 112]
- [SU 1430 Salisbury, Wiltshire Hull 3819]
- [ST 4716 Ham Hill, Somerset, Hull 2517]
- [TF 8902 Woodcock Hall, Norfolk, Brown 1986, no. 29, p 20]
- [SP 2255 Tiddington, Warwickshire, excavation no. TR82, SF 82]
- [SO 9063 Dodderhill, Worcestershire, Hurst forthcoming, fig 17, no. 185 (Neronian fort)]
- [SK 7550 Ad Pontem, Thorpe by Newark, Nottinghamshire, AML 852996]
- [NZ 3666 South Shields, Durham, Allason-Jones and Miket 1984, no. 3.68, p 104]
- b) *The 'Knickfibel', Hull T42, Cat 36–38*
- TQ 3281 London, 48–50 Cannon St, Boddington 1979, no. 60, p 22, where Mackreth quotes parallels from Lincoln (SK 9771, Hildyard 1945, no. 3, p 156) and Ditchley, Oxfordshire (SP 3921, Radford 1936, no. 3, p 56)
- TM 0320 Fingringhoe, Essex, Hull 5024
- TF 0746 Old Sleaford, Lincolnshire, Hull 5239
- SE 8151 Ousethorpe, Yorkshire, Hull 7055
- NY 5964 Nether Denton, Cumberland, Hull 7682
- Kempton, Germany, Krämer 1957, Tafel 13, no. 9
- Baden, Switzerland, Ettliger 1973, Tafel 6, no. 13
- Augst, Switzerland, Riha 1979, Tafel 8, nos 215–19, p 71
- The 'Kräftig-profilierter' brooch. Hull T84B: (triangular catchplate with 1–3 round perforations), Cat 39–42*
- TL 9925 Colchester, Essex, Crummy 1983, no. 37, p 10
- [NY 5964 Nether Denton, Cumberland, Hull 7684]
- [TL 7174 Mildenhall, West Suffolk, Wild Street, Hull 1671]
- Hüfingen, Germany, Rieckhoff 1975, Tafel 2, nos 15–16, pp 42–3
- Kempton, Germany, Krämer 1957, Tafel 14, nos 3–7
- Vindonissa, Switzerland, Ettliger 1973, Tafel 5, no. 5, and Tafel 18, 4–6

'SIMPLE GALLIC' AND 'COLCHESTER' TYPES: ONE-PIECE
BROOCHES WITH SHORT PLAIN CROSSBAR AND SPRING
WITH EXTERNAL CHORD HELD BY REARWARD HOOK.

HULL T89–91 (FIGURE 169)

a) *Bow straight or with reversed curve; usually with
fretted catchplate. Hull T89, Cat 44–45*

- TL 9925 Colchester, Essex, Camulodunum, Hawkes
and Hull 1947, nos 34–5, p 310
TL 9640 Boxford, West Suffolk, White Street Green,
Clarke 1940, pl x and p 54
TL 1507 St Albans, Hertfordshire, King Harry Lane,
Stead and Rigby 1989, B1–2, p 89
TL 1107 Gorhambury, Hertfordshire, Neal *et al* 1990,
nos 23–4, p 118
TL 3924 Braughing, Hertfordshire, Potter and Trow
1988, fig 18, no. 23
SU 7201 Hayling Island, Hampshire, Soffe excavation
no. 2446
SP 0106 Bagendon, Gloucestershire, Clifford 1961,
no. 20, p 171
SU 2199 Lechlade, Gloucestershire, Allen *et al* 1993,
fig 92, no. 2
Nijmegen, The Netherlands, van Buchem 1941, pl v,
nos 2–4
Besançon, France, Lerat 1956, no. 60
Mandeure, France, Lerat 1957, no. 23
Berthouville, Normandy, France, Dollfus 1975, no. 94, p 88
Magalas, France, Feugère 1985, no. 1193, p 262
Augst, Switzerland, Riha 1979, nos 183–4, p 67

b) *Large brooches (over 50mm length); bow with simple
curve. Hull T90, Cat 46–53*

- TR 1457 Canterbury, Kent, Frere *et al* 1987, fig 65, no. 6
TR 1457 Canterbury, Kent, Frere *et al* 1987,
undecorated examples: fig 65, nos 4–5
TQ 7958 Detling, Kent, Hull 8613, Maidstone Museum
TL 9925 Colchester, Essex, Camulodunum, Hawkes
and Hull 1947, nos 6–8, 10, 14–15, 20, p 310
TL 9925 Colchester, Essex, Sheepen, Niblett 1985, fig 73,
nos 2, 10; contexts: 2, Neronian; 10, AD 44–61
TL 7006 Chelmsford, Essex, Wickenden forthcoming,
no. 11 (excavation no. CHV 72, no. 5)
TM 0320 Fingringhoe, Essex, Hull 5015–16, Colchester
Museum
TL 4509 Harlow, Essex, Hull 7299, France and Gobel
1985, no. 41, p 78
TF 8800 Threxton, Norfolk, Hull 6426, Norwich
Museum

- TL 1507 St Albans, Hertfordshire, Wheeler and
Wheeler 1936, no. 20, p 207
TL 1507 St Albans, Hertfordshire, King Harry Lane,
Stead and Rigby 1989, C37, C69, pp 90–1
TL 3924 Braughing, Hertfordshire, Potter and Trow
1988, fig 18, nos 29–30, p 42
SP 8833 Magiovinium, Dropshort, Buckinghamshire,
Neal 1987, fig 23, no. 9, p 43
SP 8243 Haversham, Buckinghamshire, Hull 3437
(R Harris excavation 1962)
SU 8604 Chichester, West Sussex, Hull 2548, 4446
SU 6262 Silchester, Hampshire, Hull 4708–10, 4712,
4723, Reading Museum
SU 5093 Sutton Courtenay, Berkshire, Hull 5250,
5252, British Museum
SU 0337 Hanging Langford, Wiltshire, Hull 5935,
Salisbury Museum
ST 8438 Cold Kitchen Hill, Wiltshire, Nan Kivell 1927,
pl 2, A, p 327
ST 8510 Hod Hill, Dorset, Brailsford 1962, fig 6, C1–3,
C5, p 7
SY 6688 Maiden Castle, Dorset, Wheeler 1943, nos
14–15, p 258
SZ 1790 Hengistbury Head, Dorset, Cunliffe 1987,
no. 10, p 147
ST 4401 Waddon Hill, Dorset, Hull 3780, Bridport
Museum
ST 9419 Rotherley, Wiltshire, Pitt-Rivers 1888, pl 97,
no. 4
ST 9518 Rushmore, Wiltshire, Pitt-Rivers 1887, pl 13,
no. 11
ST 4716 Ham Hill, Somerset, Hull 1371–2, Taunton
Museum
SP 0106 Bagendon, Gloucestershire, Clifford 1961,
nos 13–15, p 169
SO 9726 Haymes, Gloucestershire, Rawes 1986, nos
4–5, p 80
SP 2255 Tiddington, Warwickshire, excavation no.
M608, 19/17
SK 5804 Leicester, Leicestershire Museum 316.1962,
no. 92
SK 9117 Thistleton, Rutland, Greenfield excavation
nos THZ 1755, THY 9
SE 9423 Old Winteringham, Lincolnshire, Stead 1976a,
nos 4 and 6, p 198, with reference to others from
North Lincolnshire: South Ferriby, Thealby, Dragonby
SE 9724 Redcliff, Yorkshire, 1986 excavation no. 75
SE 5951 York, Yorkshire Museum, Hull 1035
SC 2467 Close ny Collagh, Isle of Man, Gelling 1958,
no. 1, p 94
Augst, Switzerland, Riha 1979, no. 192, p 67

c) *Small brooches (30–50mm length), usually undecorated*

Various profiles. Hull T90 and T91, Cat 54–65

- TQ 5774 Stone, Kent, Cotton and Richardson 1941, fig 5, no. 1
- TL 9925 Colchester, Essex, Camulodunum, Hawkes and Hull 1947, nos 9, 11–13, 16–19, p 310
- TL 9925 Colchester, Essex, Sheepen, Niblett 1985, nos 4–5, 6 (iron), 7–8, p 116; contexts: 4, about AD 61; 5, AD 44–61; 6, AD 44–9; 7 and 8, Neronian
- TQ 7493 Wickford, Essex, Rodwell excavation no. 251
- TL 1507 St Albans, Hertfordshire, Verulamium, Frere 1972, nos 3–4, p 114
- TL 1507 St Albans, Hertfordshire, Verulamium, Frere 1984a, no. 18, p 21
- TL 2434 Baldock, Hertfordshire, Stead and Rigby 1986, nos 60–3, p 112
- TL 1107 Gorhambury, Hertfordshire, Neal *et al* 1990, nos 25, 27, p 118
- SP 8833 Magiovinium, Dropshort, Buckinghamshire, Neal 1987, nos 10–11, p 43
- TF 8902 Woodcock Hall, Norfolk, Brown 1986, fig 9, nos 13–15, p 20
- SP 8880 Weekley, Northants, Jackson and Dix 1987, fig 23, no. 11
- SU 7201 Hayling Island, Hampshire, Soffe excavation nos 1824, 1672, 2758
- ST 7151 Kingsdown Camp, Somerset, St George Gray 1930, no. E10, p 82
- SP 0106 Bagendon, Gloucestershire, Clifford 1961, nos 16–19, p 171
- SO 6102 Lydney, Gloucestershire, Wheeler and Wheeler 1932, no. 13, p 76
- ST 7898 Uley, Gloucestershire, Woodward and Leach 1993, fig 123, no. 8
- SE 9423 Old Winteringham, Lincolnshire, Stead 1976a, no. 3, p 195
- SE 9724 Redcliff, Yorkshire, 1986 excavation, no. 46
- SE 9861 Garton Slack, Yorkshire, Stead 1971, no. 3, p 39, with reference to the only others known from Yorkshire at Rudston and Watton
- d) *Miniature brooches – under 30mm in length. Hull T91, Cat 66–67*
- TL 9925 Colchester, Essex, Camulodunum, Hawkes and Hull 1947, nos 26–30, p 310
- TL 9925 Colchester, Essex, Sheepen, Niblett 1985, no. 9, p 116, context: Neronian
- TL 1507 St Albans, Hertfordshire, Verulamium, Frere 1972, no. 5, p 114, context about AD 49
- TL 1507 St Albans, Hertfordshire, Verulamium, Frere 1984a, fig 5, nos 17 and 19, pp 21–3
- TL 3924 Braughing, Hertfordshire, Potter and Trow 1988, fig 19, nos 34–6, p 42
- ST 8510 Hod Hill, Dorset, Brailsford 1962, fig 6, C9, p 7
- SU 7201 Hayling Island, Hampshire, Soffe excavation nos 484, 1529
- SK 5804 Leicester, Leicestershire Museum 316.1962, no. 41

EARLY HINGED BROOCHES

THE PIN HINGED IN A NARROW TUBE FORMED FROM THE TOP OF THE BOW ROLLED UPWARD

Type 51 The Aucissa type (Figure 166), Cat 74–92

Standard examples, including those inscribed Aucissa but not other names

- ST 8510 Hod Hill, Dorset, Brailsford 1962, fig 8, nos C47–8, C50, p 8
- SY 6688 Maiden Castle, Dorset, Wheeler 1943, fig 85, no. 31, p 262
- ST 4401 Waddon Hill, Dorset, Bridport Museum, Hull nos 3782 and 3784
- ST 9211 Tarrant Hinton, Dorset, Giles excavation SF no. 415
- SU 2082 Wanborough, Wiltshire, Anderson *et al* 2001, fig 18, no. 46, fig 19, no. 47, p 46
- SU 2074 Ogbourne St George, Wiltshire, Hull 5446
- ST 4816 Ham Hill, Somerset, St George Gray 1910, no. 10, p 55
- ST 5222 Ilchester, Somerset, Leach and Ellis 1991, fig 13, no. 3
- ST 5026 Catsgore, Somerset, Leech 1982, fig 76, no. 1, p 105
- ST 6856 Camerton, Somerset, Wedlake 1958, fig 52, no. 28, p 226, mid-first century
- ST 5056 Charterhouse, Somerset, Bristol Museum
- ST 5883 Cattybrook, Gloucestershire, Bennett 1980, fig 14, no. 5, p 181
- SP 0201 Cirencester, Gloucestershire, Wachter and McWhirr 1982, fig 25, nos 9–11, p 92
- TQ 3281 London, Hull 6688 and 6904
- TL 9925 Colchester, Essex, Camulodunum, Hawkes and Hull 1947, pls xcvi–xcvii, nos 129–38, pp 321–3
- TL 4509 Harlow, Essex, Hull 6028

- TL 1507 St Albans, Hertfordshire, Wheeler and Wheeler 1936, fig 43, no. 12, p 206, with finds of about AD 50–75
- TL 3823 Skeleton Green, Hertfordshire, Partridge 1981, fig 71 nos 50–1, p 134
- TL 1107 Gorhambury, Hertfordshire, Neal *et al* 1990, no. 17, p 118
- TL 3924 Braughing, Hertfordshire, Potter and Trow 1988, fig 20, nos 53–4
- TL 2434 Baldock, Hertfordshire, Stead and Rigby 1986, fig 46, no. 104, p 113
- SP 0957 Alcester, Warwickshire, Cracknell and Mahany 1994, fig 80, nos 65–6, p 168
- SJ 5608 Wroxeter, Shropshire, AML 721730
- SJ 5608 Wroxeter, Shropshire, Bushe-Fox 1913, fig 9, no. 5, pp 24–6
- SO 9063 Dodderhill, Worcestershire, Hurst forthcoming, brooch report no. 2
- SO 3700 Usk, Monmouthshire, Manning *et al* 1995, fig 22, nos 10–11, p 67
- SK 9117 Thistleton, Rutland, Greenfield excavation nos BH 705 and 822
- SK 9771 Lincoln, Hull 3551
- SE 9115 Dragonby, Lincolnshire, May 1996, fig 11.6, nos 66–7, p 248
- SE 9423 Old Winteringham, Lincolnshire, Stead 1976a, fig 99, no. 8, p 198
- SE 9820 South Ferriby, Lincolnshire, Hull 3600–1
- SE 4066 Aldborough, Yorkshire, Bishop 1996, fig 30, no. 304, p 49
- TA 0967 Rudston, Yorkshire, Stead 1980, fig 59, no. 2, p 95
- Hüfingen, Germany, Rieckhoff 1975, Tafel 3, no. 28, p 47
- Kempton, Germany, Krämer 1957, Tafel 15, nos 1–5
- Vindonissa, Switzerland, Ettliger 1973, Tafel 9, nos 6–8, pp 93–4
- Dura Europos, Syria, Frisch and Toll 1949, pl x, nos 6–15, pp 47–9
- HOD HILL BROOCHES (FIGURE 167)
- a) *The upper bow a distinct panel with side wings, often with lugs – Hull T61–63, T65–69. Cat 95–114*
- T61: With lugs on lower edge of panel on upper bow; not including those with multiple mouldings on lower bow since Richborough has none (unless amongst fragments). (Richborough has none of standard type 62: with lugs in middle of short panel, although Cat 142 in group f) was classed as type 62 by Hull.)*
- SU 7201 Hayling Island, Hampshire, Soffe excavation no. 2306
- ST 8510 Hod Hill, Dorset, Brailsford 1962, fig 9, nos C68, C72, C74, p 9
- ST 4401 Waddon Hill, Dorset, Webster 1965, no. 2, p 10
- ST 4401 Waddon Hill, Dorset, Hull 8076, Bridport Museum
- SZ 1790 Hengistbury Head, Dorset, Cunliffe 1987, no. 22, p 150
- ST 7464 Combe Down, Somerset, Hull 3924, Scarth 1864, pl 50, 8
- ST 4816 Ham Hill, Somerset, Hull 2521, Taunton Museum
- SU 0337 Hanging Langford, Wiltshire, Hull 5931, Salisbury Museum
- ST 9419 Rotherley, Wiltshire, Pitt-Rivers 1888, pl c, no. 5
- SU 2082 Wanborough, Wiltshire, Anderson *et al* 2001, fig 19, no. 57, p 48
- SU 5794 Dorchester-on-Thames, Oxfordshire, Frere 1984b, no. 4, p 137
- SP 0201 Cirencester, Gloucestershire, Wachter and McWhirr 1982, fig 25, no. 14, p 92
- TL 9925 Colchester, Essex, Crummy 1983, no. 25, p 10
- TL 4509 Harlow, Essex, temple, Hull 6037
- TQ 7493 Wickford, Essex, Rodwell excavation no. 252
- TL 1507 St Albans, Hertfordshire, Hull 2064, Verulamium Museum
- TL 1507 St Albans, Hertfordshire, Verulamium, Frere 1972, no. 15, p 116, context AD 75–105
- TL 1507 St Albans, Hertfordshire, Verulamium, Frere 1984a, no. 38, p 27, context AD 55–75
- TL 1507 St Albans, Hertfordshire, Verulamium, Frere 1984a, no. 39, p 27, context AD 170–225
- SU 7886 Hambleden, Buckinghamshire, Cocks 1921, fig 24, p 192
- SP 2255 Tiddington, Warwickshire, excavation no. M16
- SJ 5608 Wroxeter, Shropshire, Atkinson 1942, H3, p 202, ‘pre-Flavian’
- SK 9117 Thistleton, Rutland, Greenfield excavation nos THZ 2214 and THZ 2707
- SE 9318 Winterton, Lincolnshire, Stead 1976a, no. 25, p 199
- SK 9843 Ancaster, Lincolnshire, Hull 9187, Scunthorpe Museum
- Colleville, Normandy, France, Dollfus 1975, no. 419, p 194
- Kempton, Germany, Krämer 1957, Tafel 15, no. 12, p 77
- Augst, Switzerland, Riha 1979, Tafel 32, nos 850, 853, 862, 863, p 129

T63B Lateral lugs at top of panel

- TR 1241 Stowting, Kent, Hull 6524, British Museum
 ST 8510 Hod Hill, Dorset, Brailsford 1962, fig 9, C63, p 9
 ST 4401 Waddon Hill, Dorset, Hull 3790, Bridport Museum
 SY 6688 Maiden Castle, Dorset, Wheeler 1943, no. 28, p 262
 ST 6856 Camerton, Somerset, Wedlake 1958, no. 30, p 226
 ST 4716 Ham Hill, Somerset, Hull 2523, Taunton Museum
 SU 6262 Silchester, Hampshire, Hull 4777, Reading Museum
 TL 9925 Colchester, Essex, Camulodunum, Hawkes and Hull 1947, nos 143, 146, p 324
 TL 9925 Colchester, Crummy 1983, no. 32, p 10
 TL 9925 Colchester, Sheepen, Niblett 1985, nos 35-6, p 116 (period IV, AD 48–61)
 TF 8902 Woodcock Hall, Norfolk. Brown 1986, nos 104 and 109, p 26
 TL 3924 Braughing, Hertfordshire, Potter and Trow 1988, fig 20, nos 62–4, p 48
 ST 7898 Uley, Gloucestershire, Woodward and Leach 1993, fig 123, no. 6
 SP 0201 Cirencester, Gloucestershire, Hull 1378, 5709, 5710, Corinium Museum
 SO 9063 Dodderhill, Worcestershire, Hurst forthcoming, brooch no. 7
 SK 5804 Leicester, Jewry Wall, Kenyon 1948, no. 13, p 251
 SP 4788 High Cross, Leicestershire, Hull 3929
 SK 9117 Thistleton, Rutland, Greenfield excavation no. TH 11
 SE 9013 Dragonby, Lincolnshire, May 1996, fig 11.7, no. 82, p 249, Hull 9160
 SK 5242 Broxtowe, Nottinghamshire, Hull 4498, Nottingham Museum
 Augst, Switzerland, Riha 1979, nos 836–7, 845, p 128
- Parallels for Cat 113*
- TF 0600 Thornhaugh, Northamptonshire, Hull 8496, Peterborough Museum
 TL 5042 Great Chesterford, Essex, Hull 1599, British Museum
 Augst, Switzerland, Riha 1979, nos 819–20, p 127
- b) *Narrow panel on upper bow, without side wings; Hull T60, Cat 115–122. NB none at Hod Hill – supports later date*
- TL 9925 Colchester, Essex, Camulodunum, Hawkes and Hull 1947, nos 140–2, p 323, one from period VI, about AD 61–5, the others unstratified
 TL 9925 Colchester, Essex, Crummy 1983, no. 23, p 10
 TL 4509 Harlow, Essex, France and Gobel 1985, no. 28, p 77
 TL 5438 Saffron Walden, Essex, Hull 5032
 TL 5042 Great Chesterford, Essex, Hull 0439
 TQ 7493 Wickford, Essex, Rodwell excavation no. 346
 TL 7006 Chelmsford, Essex, temple site, Wickenden 1992, fig 37.6–9, p 71
 TL 1507 St Albans, Hertfordshire, Verulamium, Wheeler and Wheeler 1936, nos 10–11, 14–16, p 206
 TL 1507 St Albans, Hertfordshire, Verulamium, Frere 1972, fig 30, no. 13, p 116, context AD 49–60
 TL 1507 St Albans, Hertfordshire, Verulamium, Frere 1984a, nos 36–7, p 27, context: 36, AD 80–100
 TL 1507 St Albans, Hertfordshire, King Harry Lane, Stead and Rigby 1989, nos 26–7, p 17
 TL 3924 Braughing, Hertfordshire, Potter and Trow 1988, fig 20, nos 56, 59–60, p 48
 SP 8833 Magiovinium, Dropshort, Buckinghamshire, Neal 1987, nos 5–6, p 43
 SP 7260 Duston, Northamptonshire, Hull 8336, Northampton Museum
 TF 8902 Woodcock Hall, Norfolk, Brown 1986, fig 17, nos 92 and 98, p 26
 TG 2720 Coltishall, Norfolk, Hull 6431, Norwich Museum
 SE 9013 Dragonby, Lincolnshire, May 1996, fig 11.7, nos 71–3, pp 248–9
 ST 8438 Cold Kitchen Hill, Wiltshire, Nan Kivell 1927, pl III, G, p 327
 SU 2082 Wanborough, Wiltshire, Anderson *et al* 2001, fig 19, nos 52 and 55, p 48
 SU 0037 Wylve, Wiltshire, Mackreth 1973b, no. 24, p 24
 ST 9419 Rotherley, Wiltshire, Pitt-Rivers 1888, pl C, 1, 7
 SU 0010 Gussage All Saints, Dorset, Wainwright 1979, fig 86, no. 3038, p 112
 ST 6856 Camerton, Somerset, Wedlake 1958, no. 33, p 227
 ST 7151 Kingsdown Camp, Somerset, St George Gray 1930, nos E15 and E23, p 81
 SU 7201 Hayling Island, Hampshire, Soffe excavation no. 726
 SX 9292 Exeter, Devon, Fox 1952, fig 8, no. 2
 SP 0201 Cirencester, Gloucestershire, Hull 5713, Corinium Museum
 SP 3474 Baginton, Warwickshire, Hobley 1969, no. 7, pp 109–10

- SJ 5608 Wroxeter, Shropshire, Bushe-Fox 1916, pl xv, no. 3, p 22
- SJ 5608 Wroxeter, Shropshire, AML 721366, site museum
- SJ 5608 Wroxeter, Shropshire, Atkinson 1942, no. H10, p 201
- SK 3871 Chesterfield, Derbys, Ellis 1989, nos 2–3
- SK 5242 Broxtowe, Nottinghamshire, Hull 4488, Nottingham Museum
- NY 9964 Corbridge, Northumberland, Bishop and Dore 1988, no. 1, p 159
- Besançon, France, Lerat 1956, pl LX, no. 187
- St Bertrand-de-Comminges, France, Feugère 1985, pl 139, no. 1746
- Nijmegen, The Netherlands, van Buchem 1941, pl x, 22
- Augst, Switzerland, Riha 1979, nos 1013, 1038, 1050, 1068, 1101, 1111, pp 139–42
- Sisak, Croatia, Patek 1942, pl XII, no. 13
- c) *With one or more small panels, often square, bearing either recessed circles or niello decoration. Hull T71, T75–76, Cat 123–125*
- TM 1579 Scole, Norfolk, Rogerson 1977, fig 54, no. 7, p 132
- TF 8902 Woodcock Hall, Norfolk, Brown 1986, fig 18, no. 108, p 26
- TM 2281 Needham, Norfolk, Clarke 1938, no. 13
- TG 2303 Caistor St Edmund, Norfolk, Hull 6390, Norwich Museum
- TQ 3281 London, Bucklersbury, Hull 5351, Museum of London
- SU 7201 Hayling Island, Hampshire, Soffe excavation nos SF 3121 and 263
- SU 2082 Wanborough, Wiltshire, Anderson *et al* 2001, fig 19, no. 59, p 48
- ST 6856 Camerton, Somerset, Wedlake 1958, no. 36, p 227
- SY 6890 Dorchester, Dorset, Aitken and Aitken 1982, fig 8, no. 3
- ST 5576 Sea Mills, Bristol, Boon 1945, fig 2, no. 3
- Besançon, France, Lerat 1956, no. 253
- St Bertrand-de-Comminges, France, Feugère 1985, pl 143, no. 1285
- Moux, France, Feugère 1985, pl 146, no. 1825
- Bolards, France, Fauduet et Pommeret 1985, nos 158, 163, p 72
- Bièsme, Belgium, Brulet 1969, fig 10, no. 4, p 62, second-century burial
- Hüfingen, Germany, Rieckhoff 1975, nos 117–23, 125–7, p 92
- Sulz, Germany, Rieckhoff-Pauli 1977, nos 68–9, 75–9, p 26
- Augst, Switzerland, Riha 1979, nos 1263–8, 1301–4, 1327–31, 1336–41, pp 150–4
- [Type 73] *Not represented at Richborough*
- [TL 9925 Colchester, Essex, Camulodunum, Hawkes and Hull 1947, pl 98, no. 162]
- [TQ 7493 Wickford, Essex, Rodwell, excavation no. 260]
- [TF 8902 Woodcock Hall, Norfolk, Brown 1986, fig 18, no. 110, p 26]
- [SK 9771 Lincoln, Hull 6259, British Museum]
- [ST 8510 Hod Hill, Dorset, Richmond 1968, no. 3, p 113, Roman pit]
- d) *Upper and lower bow not distinguished: a strip-bow brooch but with the head, foot and profile of the Hod Hill series; it usually has cross-mouldings at the head, often with a sharp angle. Hull T64, T70, T77–79, Cat 127–133*
- TL 9925 Colchester, Essex, Sheepen, Niblett 1985, no. 37, p 116, pit AD 44–9
- TL 9925 Colchester, Essex, Camulodunum, Hawkes and Hull 1947, no. 54, p 312
- TL 3924 Braughing, Hertfordshire, Potter and Trow 1988, no. 58, p 48
- SU 7201 Hayling Island, Hampshire, Soffe excavation no. SF 1505
- SU 6262 Silchester, Hampshire, Hull 4806, Reading Museum 03172
- SU 2082 Wanborough, Wiltshire, Anderson *et al* 2001, fig 19, no. 58, p 48
- SY 6982 Jordan Hill, Dorset, Hull 7326, British Museum
- SY 6982 Jordan Hill, Dorset, Hull 9064, Dorchester Museum, with punched lines
- ST 7718 Marnhull, Dorset, Williams 1950, fig 23, 4
- ST 6856 Camerton, Somerset, Wedlake 1958, no. 37, p 227, Fosseyway ditch, Claudius/Nero
- SP 5312 Woodeaton, Oxfordshire, Hull 7015, Ashmolean Museum
- SK 5804 Leicester, High St, Hull 7413, Leicestershire Museum
- Bolards, France, Fauduet et Pommeret 1985, nos 171–6, p 73
- Hüfingen, Germany, Rieckhoff 1975, Tafel 6, nos 88–94, p 92
- Sulz, Germany, Rieckhoff-Pauli 1977, Abb 4, nos 60–7, p 16, ‘Flavian’
- Augst, Switzerland, Riha 1979, nos 946–64, pp 134–5

e) *With several crossribs on upper bow, and sometimes also on lower bow (excluding those which also have a prominent panel). Hull T74; also a few in T62, T71, T79, Cat 135–140*

TR 2136 Folkestone, Kent, Bushe Fox 1925, pl 14, no. 11

TR 1457 Canterbury, Kent, Frere *et al* 1982, fig 59, no. 8, p 121

SY 6890 Dorchester, Dorset, Aitken and Aitken 1982, no. 5

SU 8304 Fishbourne, West Sussex, Cunliffe 1971, no. 25, p 100, pre-AD 75

SU 7201 Hayling Island, Hampshire, Soffe excavation no. SF 312

SU 6262 Silchester, Hampshire, Hull 4790, Reading Museum 03161c

TL 9925 Colchester, Essex, Hull 0494, BM 52.6–26.35

SP 2255 Tiddington, Warwickshire, excavation no. 246 Bolards, France, Fauduet et Pommeret 1978, nos 154–5, p 72

Hüfingen, Germany, Rieckhoff 1975, nos 95–101, p 92

Sulz, Germany, Rieckhoff-Pauli 1977, nos 49–55, p 16

Augst, Switzerland, Riha 1979, nos 765–810, pp 123–5

f) *Unclassified: single brooches outside the above groups; also fragments. Parallels for individual brooches, cited by Richborough catalogue number*

Cat 141

ST 5222 Ilchester, Somerset, Leach 1982, no. 20, p 245 Pitres, Normandy, France, Dollfus 1975, nos 416–17, pp 193–4

Blicquy, Belgium, de Laet *et al* 1972, pl 59, no. 6, p 110, grave 210, Flavian

Kempton, Germany, Krämer 1957, fig 15, no. 10, p 77

Cat 142

TL 2434 Baldock, Hertfordshire, Stead and Rigby 1986, no. 120, p 120, foot plain but with iron rods through it

ST 8510 Hod Hill, Dorset, Brailsford 1962, C58 and 60, p 9

Vienne, France (museum), Feugère 1985, pl 146, no. 1823, pp 33–4

Augst, Switzerland, Riha 1979, nos 933–42, Tafel 34, p 133

Cat 143

TL 9925 Colchester, Essex, Crummy 1983, no. 36, p 10

SU 2082 Wanborough, Wiltshire, Anderson *et al* 2001, fig 19, no. 60, p 49; site context AD 65–75

Hüfingen, Germany, Rieckhoff 1975, Tafel 6, no. 82, p 91 Augst, Switzerland, Riha 1979, nos 1282–9, p 151

Cat 144

TL 3924 Braughing, Hertfordshire, Potter and Trow 1988, no. 57, p 48

SP 8833 Magiovinium, Dropshort, Buckinghamshire, Neal 1987, no. 8, p 43

TF 8902 Woodcock Hall, Norfolk, Brown 1986, fig 18, no. 106, p 26

Augst, Germany, Riha 1979, Tafel 37, nos 1008–9, p 137

Cat 145

Hüfingen, Germany, Rieckhoff 1975, nos 65–6, p 52

Augst, Switzerland, Riha 1979, Tafel 39, eg nos 1114, 1125, p 137

Cat 146

St Bertrand-de-Comminges, Feugère 1985, pl 142, no. 1773, p 332

Augst, Germany, Riha 1979, Tafel 45, no. 1351, p 154

COLCHESTER-DERIVATIVE BROOCHES WITH SEPARATE SPRING

TWO-PIECE COLCHESTER BROOCHES. HULL T92–93;
CAMULODUNUM TYPE IV (HAWKES AND HULL 1947)
(FIGURE 170)

a) *Central rib down whole length of bow. i) large: over 45mm length; usually with pierced catchplate. Hull T92 and 93C (the latter not always clearly distinct from T92), Cat 160–166*

TR 1457 Canterbury, Kent, Hull 1485, Royal Museum

TQ 8364 Hartlip, Kent, Hull 8627, Maidstone Museum

TR 1235 Lympne, Kent, Hull 6812, British Museum

TQ 8165 Rainham, Kent, Hull 3315, Rochester Museum

TQ 6172 Springhead, Kent, Penn 1959, fig 9, no. 3

TQ 3281 London, Hull 5389, Museum of London

TL 9925 Colchester, Essex, Camulodunum, Hawkes and Hull 1947, nos 41, 43–5, p 311

TL 9925 Colchester, Essex, Crummy 1983, no. 48, p 12

TL 7006 Chelmsford, Essex, Wickenden forthcoming, excavation nos site V 1975, no. 21, AG 1975, no. 30

- TL 1107 Gorhambury, Hertfordshire, Neal *et al* 1990, no. 31, p 118
- TL 2434 Baldock, Hertfordshire, Stead and Rigby 1986, no. 79, p 112
- TL 1507 St Albans, Hertfordshire, Verulamium, Wheeler and Wheeler 1936, no. 22, p 207, mid-first-century context
- TL 3924 Braughing, Hertfordshire, Hull 2314, St Albans Museum
- TL 5974 Soham, Cambridgeshire, Hull 1576, British Museum
- SP 8537 Milton Keynes, Buckinghamshire, Mynard 1987, fig 41, no. 10, p 129
- SU 7886 Hambleton, Buckinghamshire, Cocks 1921, fig 29
- TL 7772 Icklingham, West Suffolk, Hull 2311, Bury St Edmunds Museum
- TF 8902 Woodcock Hall, Norfolk, Brown 1986, fig 19, no. 119, p 26
- SK 9117 Thistleton, Rutland, Greenfield excavation no. BH 699
- SP 5312 Woodeaton, Oxfordshire, temple site, Hull 7107
- SU 7201 Hayling Island, Hampshire, Soffe excavation no. 1362
- ST 8510 Hod Hill, Dorset, Brailsford 1962, C10, p 7
- a ii) small: under 46mm length, Cat 167–180*
- TR 1457 Canterbury, Kent, Frere *et al* 1982, no. 3, p 121; no. 1, p 143
- TL 9925 Colchester, Essex, Camulodunum, Hawkes and Hull 1947, nos 36–40, p 311
- TL 9925 Colchester, Essex, Crummy 1983, fig 6, nos 50 and 52, p 12
- TL 7006 Chelmsford, Essex, *mansio*, Drury 1988, fig 62 nos 6–8
- TL 7006 Chelmsford, Essex, temple site, Wickenden 1992, fig 37 nos 11–16
- TL 7006 Chelmsford, Essex, Wickenden forthcoming, excavation site Ag 1975, nos 27–8
- TL 8138 Gestingthorpe, Essex, Draper 1985, no. 8, p 27
- TQ 7493 Wickford, Essex, Rodwell excavation nos 253–6, 258
- TL 4509 Harlow, Essex, temple site, France and Gobel 1985, nos 50, 52, p 78
- TL 1507 St Albans, Hertfordshire, Verulamium, Frere 1972, fig 29, nos 6 (AD 49–60), 8 (AD 60–75), p114
- TL 1507 St Albans, Hertfordshire, Verulamium, Frere 1984a, nos 21, 23–4, p 23
- TL 1507 St Albans, Hertfordshire, King Harry Lane, Stead and Rigby 1989, nos 17–18, p 17
- TL 1107 Gorhambury, Hertfordshire, Neal *et al* 1990, nos 32, 35, p 118
- TL 2434 Baldock, Hertfordshire, Stead and Rigby 1986, nos 69–73, 76–7, p 112
- TL 3924 Braughing, Hertfordshire, Potter and Trow 1988, fig 19, no. 47, p 46
- SP 8833 Magiovinium, Dropshort, Buckinghamshire, Neal 1987, no. 12, p 43
- SU 6262 Silchester, Hampshire, Hull 4828, Reading Museum
- SU 7201 Hayling Island, Hampshire, Soffe excavation no. 3041
- SU 2082 Wanborough, Wiltshire, Anderson *et al* 2001, fig 20, nos 64–6, p 49
- SP 9599 Wakerley, Northamptonshire, Jackson and Ambrose 1978, no. 4, p 218
- SP 8880 Weekley, Northants, Jackson excavation 1975, AML nos 781371, 781389
- SP 3474 Baginton, Warwickshire, Hopley 1969, no. 6, p 109
- TL 7772 Icklingham, West Suffolk, Hull 6604, British Museum
- TF 8902 Woodcock Hall, Norfolk, Brown 1986, nos 116–18, p 26
- SK 9117 Thistleton, Rutland, Greenfield excavation nos THZ 1451, 2705 and THV 53, 83
- SK 3535 Derby, Mackreth 1985a, no. 1, p 281
- SK 5242 Broxtowe, Nottinghamshire, Hull nos 4496 and 4500, Nottingham Museum
- b) Crest or groove on the upper bow only*
- i) large: over 45mm length, Cat 183–186*
- TL 9925 Colchester, Essex, Camulodunum, Hawkes and Hull 1947, pl xci, no. 42, p 311
- TL 9925 Colchester, Essex, Sheepen, Niblett 1985, no. 38, p 116
- TL 1107 Gorhambury, Hertfordshire, Neal *et al* 1990, no. 34, p 118
- SU 2082 Wanborough, Wiltshire, Anderson *et al* 2001, fig 21, no. 81, p 52
- ii) small: under 46mm length; Hull T93A, Cat 187–191*
- TR 1457 Canterbury, Kent, ‘Burgate St’, Hull 1490
- TQ 6172 Springhead, Kent, Hull 3460, 3472, Gravesend Museum
- TQ 5865 Fawkham Green, Kent, Eastwood Farm, Philp 1963, fig 3, no. 3
- TQ 8165 Rainham, Kent, Hull 3318, Rochester Museum

- SU 6262 Silchester, Hampshire, Hull 4814, Reading Museum
- SU 4829 Winchester, Hampshire, Hull 6323, Winchester Museum
- SU 7886 Hambleden, Buckinghamshire, Hull 3303–4, Aylesbury Museum
- TL 1507 St Albans, Hertfordshire, Verulamium, Wheeler and Wheeler 1936, no. 25, p 207
- TL 1107 Gorhambury, Hertfordshire, Neal *et al* 1990, nos 33–4, 36, p 120
- TL 2434 Baldock, Hertfordshire, Stead and Rigby 1986, no. 74, p 112
- TL 3924 Braughing, Hertfordshire, Potter and Trow 1988, fig 20, no. 49, p 46
- TL 9925 Colchester, Essex, Hull 0155, 0158–9
- TL 8507 Heybridge, Essex, Hull 0156, Colchester Museum
- TQ 7493 Wickford, Essex, Rodwell excavation nos 102, 348
- TL 7006 Chelmsford, Essex, temple site, Wickenden 1992, fig 37, no. 17
- TL 5042 Great Chesterford, Essex, Hull 0160, Brinson excavation
- TL 6976 Mildenhall, West Suffolk, Hull 6726, British Museum
- TG 4704 Burgh Castle, East Suffolk, Hull 2323
- TG 2303 Caistor St Edmund, Norfolk, Hull 6430, 6437, Norwich Museum
- TM 1579 Scole, Norfolk, Rogerson 1977, no. 3, p 131
- TG 0702 Wicklewood, Norfolk, Norwich Museum 117
- SK 9117 Thistleton, Rutland, Greenfield excavation no. THZ 3993
- SK 3535 Derby, Mackreth 1985a, no. 1, p 281
- SJ 4066 Chester, Cheshire, amphitheatre, Thompson 1976, fig 25, no. 2, p 189
- c) Bow plain. Hull T93B, Cat 192*
- TL 1507 St Albans, Hertfordshire, King Harry Lane, Stead and Rigby 1989, no. 16, p 17
- TL 1403 Park Street, Hertfordshire, O'Neil 1945, fig 8, no. 2
- SU 7201 Hayling Island, Hampshire, Soffe excavation no. 2
- TL 9925 Colchester, Essex, Hull 0118, 0164, 0166
- TF 8902 Woodcock Hall, Norfolk, Brown 1986, no. 120, p 27
- SJ 5608 Wroxeter, Shropshire, Hull 0911, Shrewsbury Museum
- d) Rounded bow, plain except for side flanges the whole length*
- i) without footknob, Cat 193–195*
- TR 1457 Canterbury, Kent, Gasworks, Hull 4308
- TQ 5567 Farningham, Kent, Franks Hall villa, Hull 5904
- TL 3924 Braughing, Hertfordshire, Potter and Trow 1988, fig 20, no. 48, p 46
- TL 1507 St Albans, Hertfordshire, Verulamium, Frere 1984a, fig 6, no. 22, p 23
- ii) with footknob, Cat 196–197*
- TQ 7655 Maidstone, Kent, Hull 8624
- TQ 7269 Strood, Kent, Hull 8625, 'Roman cemetery'
- TQ 3281 London, Hull 6854, British Museum
- SU 6262 Silchester, Hampshire, Hull 4834
- COLCHESTER-DERIVATIVE BROOCHES: THE HINGED VERSION OF THE 'DOLPHIN' BROOCH. HULL T94B, CAT 206–207 (FIGURE 171)
- TQ 9462 Radfield, Kent, Hull 8981
- TL 9925 Colchester, Essex, Crummy 1983, nos 58, 60, p 12
- TL 9925 Colchester, Essex, Hull 0199, 0200
- TL 7006 Chelmsford, Essex, temple site, Wickenden 1992, fig 38.22
- TM 1579 Scole, Norfolk, Rogerson 1977, no. 5, p 131
- TM 1644 Ipswich, East Suffolk, Hull 8156
- TL 7772 Icklingham, West Suffolk, Hull 3446, Ashmolean Museum
- TG 0702 Wicklewood, Norfolk, Norwich Museum number 93
- TG 0904 Kimberley, Norfolk, Hull 6411, Norwich Museum
- TL 8783 Thetford, Norfolk, Hull 4501
- TM 2281 Needham, Norfolk, Hull 6369, Norwich Museum
- SP 7260 Duston, Northants, Hull 8332, Northampton Museum
- SP 2255 Tiddington, Warwickshire, 1981 excavation no. 226, 1982 no. 230
- SK 9117 Thistleton, Rutland, Greenfield excavation no. BH 855
- SK 7041 East Bridgford, Nottinghamshire, Hull 3452 (this may have been sprung, but more likely hinged as Thistleton BH 855, and is very like Cat 206)
- SK 3871 Chesterfield, Derbyshire, Ellis 1989, fig 14, no. 4

- SE 9423 Old Winteringham, Lincolnshire, Stead 1976a, no. 17, p 198
- SE 9013 Dragonby, Lincolnshire, Hull 9183, 9235, Scunthorpe Museum
- SE 9702 Hibaldstow, Lincolnshire, *Journ Roman Stud*, 38, 1948, fig 17, p 88
- SE 9326 Brough, Yorkshire, Corder 1938, fig 9, 2
- SJ 8398 Manchester, Lancashire, Jones 1974, fig 43, no. 5, p 120
- NY 9964 Corbridge, Northumberland, Hull 5090, Corstopitum Museum
- SU 5020 Winchester, Hampshire, Ashley Park, Hull 8681, Winchester Museum
- SU 3715 Nursling, Hampshire, Hull 8568, Southampton Museum
- SU 2068 Marlborough, Wiltshire, Hull 5510, Devizes Museum
- SP 0201 Cirencester, Gloucestershire, Hull 5804, Corinium Museum
- ST 4690 Caerwent, Monmouthshire, Hull 9275, Newport Museum
- ST 8510 Hod Hill, Dorset, Brailsford 1962, C11, C12, p 7
- SU 0010 Gussage All Saints, Dorset, Wainwright 1979, no. 3027, p 112
- SY 5387 Walls, Dorset, Bailey 1985, no. 12, p 78
- ST 4401 Waddon Hill, Dorset, Hull 9008, Dorset Museum
- SX 9192 Exeter, Devon, Bidwell 1979, fig 72, nos 1–2, p 232
- SW 9148 Carvossa, Cornwall, Carlyon 1987, no. 21, p 123
- POLDEN HILL BROOCHES: THE SPRING IS CARRIED IN A SEMI-CYLINDRICAL CROSSBAR, WHICH HAS CLOSED ENDS TO HOLD THE AXIAL ROD; THE CHORD IS HELD BY A HOOK OR LUG ON THE HEAD. HULL GROUP 6, T95–103 (FIGURE 172)
- a) *With long tapering bow, decoration usually confined to a crest and flanges on the upper part; the crossbar often ribbed and beaded; sometimes a triangular opening in the catchplate; occasionally a footknob. Hull T95–97, T103, Cat 208–210*
- SU 2082 Wanborough, Wiltshire, Anderson *et al* 2001, fig 23, no. 101, p 56
- SU 6262 Silchester, Hampshire, Hull 4475, Reading Museum
- SP 3921 Ditchley, Oxfordshire, Radford 1936, pl IX, 5, p 55
- ST 5576 Sea Mills, Bristol, Ellis 1987, no. 8, p 46
- ST 5659 Chew Valley, Somerset, Rahtz and Greenfield 1978, no. 7, p 292
- ST 5056 Charterhouse, Somerset, Hull 8276, Bristol Museum
- ST 6856 Camerton, Somerset, Wedlake 1958, no. 8, p 218
- SP 0201 Cirencester, Gloucestershire, Hull 5864, 5752, 5754–6, Corinium Museum
- SO 8318 Gloucester, Cracknell 1990, nos 2–4, p 199
- SO 9726 Haymes, Gloucestershire, Rawes 1986, nos 6–7, p 80
- ST 7898 Uley, Gloucestershire, Woodward and Leach 1993, fig 123, no. 9
- SO 6324 Bollitree, Herefordshire, Hull 1284, Gloucester Museum
- ST 3390 Caerleon, Monmouthshire, Hull 8807, National Museum Wales
- ST 4690 Caerwent, Monmouthshire, Hull 8849, Newport Museum
- SP 3475 Baginton, Warwickshire, The Lunt, Hobley 1969, nos 2, 10, p 108, 111
- SP 3475 Baginton, Warwickshire, The Lunt, Hobley 1973, no. 7, p 66
- SP 1989 Coleshill, Warwickshire, 1979 excavation nos 850, 1087
- SP 2255 Tiddington, Warwickshire, excavation nos M8, M9, M588
- SO 9063 Dodderhill, Worcestershire, Hurst forthcoming, report no. 3
- SJ 5608 Wroxeter, Shropshire, Hull 0915, Shrewsbury Museum, AML 721380
- SJ 0682 Prestatyn, Flint, Blockley 1989, no. 2, p 88
- SP 7260 Duston, Northants, Hull 8361, Northamptonshire Museum
- SK 5804 Leicester, Museum excavation no. 316–1962 17
- NY 4938 Old Penrith, Cumberland, Austen 1991, no. 615, p 179
- NT 5734 Newstead, Roxburghshire, Scotland, Curle 1911, pl 85, no. 4, p 318
- [Colchester, Essex, Camulodunum, Hawkes and Hull 1947, no. 43, p 311]
- [Exeter, Bidwell 1979, fig 72, no. 3, p 323]
- [Chew Valley, Somerset, Rahtz and Greenfield 1978, fig 114, no. 6, p 292]
- [Corbridge, Northumberland, Bishop and Dore 1988, no. 5, p 161]

- b) *Heavier brooches, usually large, the upper bow humped forward over the crossbar; often disc-shaped flanges beside head. The tapering lower bow is usually plain but the upper half can have a range of engraved or moulded decoration, sometimes enamelled. A few have footknobs and some have cutouts in the catchplate. Hull T100C, Cat 211–215*
- TL 1507 St Albans, Hertfordshire, Verulamium, Frere 1972, no. 10, p 116
- TF 8902 Woodcock Hall, Norfolk, Brown 1986, nos 127–8, p 27
- SK 5804 Leicester, Museum excavation no. 316.1962, 138
- SK 3535 Derby, Mackreth 1985a, nos 4–6, 8, 10, p 283
- SP 5312 Wood Eaton, Oxfordshire, Hull 7011, Ashmolean Museum
- SP 3713 Shakenoak, Oxfordshire, Brodribb *et al* 1971, no. 70, p 110
- SP 0201 Cirencester, Gloucestershire, Hull 1408, 1416, Corinium Museum
- SO 8318 Gloucester, Cracknell 1990, no. 1, p 199
- SO 4466 Croft Ambrey, Herefordshire, Stanford 1974, nos 1–2, 5, p 144
- SP 1989 Colehill, Warwickshire, 1979 excavation no. 967
- SJ 5608 Wroxeter, Shropshire, Bushe-Fox 1914, no. 1, p 11
- SJ 5608 Wroxeter, Shropshire, Bushe-Fox 1916, nos 6–7, p 23
- SJ 5608 Wroxeter, Shropshire, site museum, AML 721372, /78
- SJ 5608 Wroxeter, Shropshire, Hull nos 0925–8, 0932, 0934–5, 4559
- SJ 9010 Water Eaton, Staffordshire, Pennocrucium Hull 3606
- SK 1006 Wall, Staffordshire, Gould 1967, fig 7, no. 7
- ST 3390 Caerleon, Monmouthshire, Zienkiewicz 1986, no. 5, p 170
- ST 3390 Caerleon, Monmouthshire, Nash-Williams 1932, fig 31, 2
- SH 4862 Caernarfon, Caernarfonshire, Wheeler 1924, no. 2, p 133
- SJ 8397 Manchester, Lancashire, Jones 1974, fig 43, no. 4, p 120
- NY 6325 Kirkby Thore, Westmorland, Hull 4190, British Museum
- NY 9964 Corbridge, Northumberland, Hull 5091, 5536, Corstopitum Museum
- NT 5734 Newstead, Roxburghshire, Scotland, Curle 1911, pl 85, no. 5, p 318
- SV 9414 Nornour, Isles of Scilly, Hull 1968b, no. 243, p 62
- SV 9414 Nornour, Isles of Scilly, Butcher forthcoming e, brooch no. 300, 1969 excavation no. 55
- others with similar shape but different decoration, or incomplete
- [Dorchester, Dorset, CEU 8212384]
- [Baldock, Hertfordshire, Stead and Rigby 1986, no. 83, p 113]
- [Tiddington, Warwickshire, excavation no. M10]
- [Wroxeter, Shropshire, Hull 0929, Shrewsbury Museum]
- [Poole's Cavern, Derbyshire, Bramwell 1983, no. 1, p 53]
- [Wall turret 34a, Northumberland, Allason-Jones 1988c, fig 1, p 208]
- [Straubing, Germany, Walke 1965, Tafel 94, 14]
- TRUMPET-HEADED OR BACKWORTH BROOCHES
- Instead of a crossbar these have an expanded head, likened to the bell of a trumpet; this covers either a short spring or a hinge for the pin attachment. Nearly all have a moulding at the waist. Hull Group 8, T153–9 (Figure 173)
- A) *As Cat 216. Plain; spring on single lug; lobed waist-moulding continuous round back of bow. Hull T158A*
- TR 1457 Canterbury, Kent, Hull 1455
- TL 9925 Colchester, Essex, Hull 0516, British Museum
- TG 5212 Caister-on-Sea, Norfolk, Darling and Gurney 1993, fig 39, no. 2
- TF 7844 Brancaster, Norfolk, Hinchliffe and Green 1985a, fig 28, no. 4, pp 42–4
- TM 2281 Needham, Norfolk, Hull 6419, Norwich Museum
- SP 3475 Baginton, Warwickshire, The Lunt, Hobley 1973, no. 8, p 66
- SP 9728 Welton Wold, Yorkshire, excavation no. MA 148b, 162
- TA 0967 Rudston, Yorkshire, Stead 1980, no. 6, p 95
- SE 8564 Wharram Percy, Yorkshire, AML 7310666
- SE 4066 Aldborough, Yorkshire, Bishop 1996, fig 31, nos 323–4, p 55
- SE 4225 Castleford, Yorkshire, Cool and Philo 1998, fig 11, no. 68, p 47
- SE 2299 Catterick, Yorkshire, Wilson 2002, II, fig 306, nos 3–7
- NZ 2015 Piercebridge, Durham, Scott and Fitzpatrick forthcoming, ER 80, 4323
- NY 9964 Corbridge, Northumberland, Bishop and Dore 1988, no. 11, p 161

- NZ 3666 South Shields, Durham, Allason-Jones and Miket 1984, 3.32, 3.35–6, p 98
- SD 5190 Watercreek, Westmorland, Potter 1979, no. 9, p 209
- NY 6366 Poltross Burn, Cumberland, Hull 4382, Gibson and Simpson 1911, fig 20, no. 1
- NY 4057 Stanwix, Cumberland, Collingwood 1931b, fig 3, p 72
- NY 4938 Old Penrith, Cumberland, Austen 1991, fig 88, no. 617
- NT 5874 Traprain Law, East Lothian, Scotland, Burley 1958, nos 2–7, p 155
- NT 5734 Newstead, Roxburghshire, Scotland, Curle 1911, nos 8–9, 15–16, pp 321–3
- NS 9197 Mumrills, Stirlingshire, Scotland, MacDonald and Curle 1929, fig 115, no. 1, p 553
- SJ 0682 Prestatyn, Flint, Blockley 1989, no. 17, pp 94–5
- A ii) As Cat 218: bow flat at back; Hull T158C*
- TQ 6172 Springhead, Kent, Hull 8719, Gravesend Museum
- TL 9925 Colchester, Essex, Hull 0519, Colchester Museum
- TL 1507 St Albans, Hertfordshire, Verulamium, Frere 1984a, no. 30, p 25, AD 145–50
- TG 2303 Caistor St Edmund, Norfolk, Hull 6378, Norwich Museum
- ST 4690 Caerwent, Monmouthshire, Hull 8891, Newport Museum
- SO 3700 Usk, Monmouthshire, Manning *et al* 1995, fig 26, nos 54–5, p 86
- SE 9318 Winterton, Lincolnshire, Stead 1976a, no. 28, p 201, Antonine
- SE 4225 Castleford, Yorkshire, Cool and Philo 1998, fig 12, no. 74, p 49
- SE 4066 Aldborough, Yorkshire, Bishop 1996, fig 32, no. 325, p 55
- NZ 3666 South Shields, Durham, Hull 3876
- NY 9964 Corbridge, Northumberland, Snape 1993, fig 8, no. 34, p 41
- SD 5190 Watercreek, Westmorland, Potter 1979, no. 6, p 208
- NY 4938 Old Penrith, Cumberland, Austen 1991, fig 88, no. 620
- B) As Cat 219. Waistmoulding flat at back, fixed headloop, spring held between two lugs; some of Hull T153D, but spring fixing not clear in most examples. (Only those with the spring attachment as described are included here; many otherwise similar brooches are hinged; definite identification from the drawings is often difficult)*
- TQ 7493 Wickford, Essex, Rodwell excavation no. 186
- ST 3390 Caerleon, Monmouthshire, Zienkiewicz 1986, no. 4, p 170, Hadrian/Antonine
- C) As Cat 220. As B above but more elongated and the head a flat plate. Hull T154A–B, T159*
- SU 5482 Lowbury Hill, Berkshire, Atkinson 1916, pl x, no. 53
- SP 0201 Cirencester, Gloucestershire, Hull 5687, Corinium Museum
- ST 7898 Uley, Gloucestershire, Woodward and Leach 1993, fig 124, no. 11
- SO 6102 Lydney, Gloucestershire, Wheeler and Wheeler 1932, no. 18, p 77
- SJ 4054 Holt, Denbigh, Grimes 1930, fig 55, no. 9
- SK 0472 Poole's Cavern, Derbyshire, Derby Museum 5139
- SE 5951 York Minster, Phillips and Heywood 1995, fig 156, no. 2, p 391
- D) Enamelled, Hull T157B–F. There are no close parallels for the Richborough brooch Cat 221; the following examples have generally similar shape and decoration*
- [TQ 4401 Newhaven, East Sussex, Bell 1976, fig 39, no. 3, p 290]
- [TQ 1450 Ranmore, Surrey, Alexander and Bird 1981, fig 5, no. 1, p 266]
- [TQ 3281 London, Wheeler 1946, nos 29–30, p 96]
- [TL 1507 St Albans, Hertfordshire, Verulamium, Frere 1984a, no. 31, p 25]
- [TL 7174 Mildenhall, West Suffolk, Hull 6775, British Museum]
- [TL 9267 Pakenham, West Suffolk, Hull 7892, Ashmolean Museum]
- [TL 7388 Hockwold, Norfolk, Gurney 1986, no. 3, pp 63–4]
- [TF 8902 Woodcock Hall, Norfolk, Brown 1986, no. 141, p 27]
- [SU 6262 Silchester, Hampshire, Hull 4858, Reading Museum]
- [SU 5794 Dorchester-on-Thames, Oxfordshire, Frere 1984b, no. 7, p 137]
- [SO 7621 Tibberton, Gloucestershire, Hull 1301–2, Gloucester Museum]
- [ST 5056 Charterhouse, Somerset, Hull 1172, Bristol Museum]

- [SE 5951 York, Hull 1045, Yorkshire Museum]
 [NZ 3666 South Shields, Durham, Allason-Jones and Page 1988, no. 5, pp 245–7]
 [NY 7914 Brough, Westmorland, Hull 4160, Ashmolean Museum]
 [NT 5874 Traprain Law, East Lothian, Scotland, Hull 2966, Burley 1958, no. 13, p 156]
 [NT 5734 Newstead, Roxburghshire, Scotland, Curle 1911, nos 11–12, p 322]

HINGED BROOCHES WITH FLARED FOOT AND FIXED HEADLOOP; CURVILINEAR ENAMEL FIELDS ON FOOT. HULL T36, CAT 238 (FIGURE 174)

The head construction links this type with the 'hinged T-shape brooches' although Hull grouped them with other types on the shape of the flared foot (his Group 3)

- TL 9925 Colchester, Essex, St Mary's hospital, Hull 1626, Colchester Museum
 – Wickham, 'Berks or Hampshire', BM Roman Britain 1958, no. 34, p 20, Hull 1624
 SK 9117 Thistleton, Rutland, Butcher 1977, no. 29, p 64
 TF 0945 Sleaford, Lincolnshire, Whitwell 1964, p 67
 SK 9771 Lincoln, Eastgate, Hull 1629
 SE 5951 York, Tanner Row, Hull 1075, Yorkshire Museum
 SE 4066 Aldborough, Yorkshire, Bishop 1996, fig 30, no. 312
 SE 1520 Huddersfield, Yorkshire, Hull 1632, British Museum
 NY 9964 Corbridge, Northumberland, Haverfield 1911, no. 29, p 185, Hull 1628
 NY 4938 Old Penrith, Cumberland, Austen 1991, fig 88, no. 616

HINGED T-SHAPED BROOCHES

WITH TOOTHED EDGE TO BOW, PLAIN CREST ON UPPER BOW AND PANEL OF TRIANGLE-AND-LOZENGE-DECORATION. HULL T145A, CAT 225–227 (FIGURE 174)

- TR 2136 Folkestone, Kent, Hull 1585, British Museum
 TL 1507 St Albans, Hertfordshire, Verulamium, Frere 1972, no. 12, p 116
 SP 3475 Baginton, Warwickshire, The Lunt, Hobley 1973, no. 4, p 65
 SK 9117 Thistleton, Rutland, Greenfield excavation no. THZ 2101
 SK 9786 Owmbly, Lincolnshire, Whitwell 1966, fig 4b, no. 11

- SK 7041 East Bridgford, Nottinghamshire, Oswald 1941, no. 8, p 62 (Hull drawing 2352)
 NT 5734 Newstead, Roxburghshire, Scotland, Curle 1911, no. 23, p 323
 Nijmegen, The Netherlands, van Buchem 1941, pl xiv, no. 3
 Dalheim, Luxembourg, Spitaels 1969, catalogue no. 684

HEADSTUD BROOCHES

- a) *T148C: With loose wire headloop although the pin is hinged; cupped headstud; the bow and crossbar enamelled (Figure 174)*

As Cat 228

- SU 5139 Micheldever, Hampshire, Painter and Sax 1970, no. 14
 SP 1989 Coleshill, Warwickshire, excavation no. 284
 TF 8902 Woodcock Hall, Norfolk, Brown 1986, fig 22, no. 147, p 27
 SE 9423 Old Winteringham, Lincolnshire, Stead 1976a, fig 99, no. 12
 SK 2483 Robin Hood's Cave, Derbyshire, Branigan and Dearne 1992, no. 3
 SE 4066 Aldborough, Yorkshire, Bishop 1996, fig 31, no. 317, p 53
 NY 7868 Housesteads, Northumberland, site museum, AML 79208026
 Tongeren, Belgium, Galloromeins Museum no. 1374

Related to the headstud group: plain brooches with fixed headloop; Hull's T146, the 'Thealby Mine type', Cat 234 (Figure 174)

- SK 0472 Poole's Cavern, Derbyshire, Bramwell *et al* 1983, no. 2, p 52
 SK 3871 Chesterfield, Derbyshire, Ellis 1989, no. 6
 SE 8917 Thealby, Lincolnshire, Hull 2361, Scunthorpe Museum
 SE 4066 Aldborough, Yorkshire, Bishop 1996, fig 30, nos 305–6, p 52
 NZ 2015 Piercebridge, Durham, Scott and Fitzpatrick forthcoming, excavation nos 2367, 4814
 NZ 3666 South Shields, Durham, Allason-Jones and Miket 1984, 3.69–70, p 104
 NY 9964 Corbridge, Northumberland, Hull 5142, site museum
 NS 8686 Camelon, Stirlingshire, Scotland, Maxfield forthcoming, excavation no. 76.94; from Antonine ditch-fill

- NT 5734 Newstead, Roxburghshire, Scotland, Curle 1911, nos 17–18, p 323
 NT 5874 Traprain Law, East Lothian, Scotland, Burley 1958, no. 26, p 158

KNEE BROOCHES (FIGURE 175)

BOW WIDE AND FLAT IN SECTION BUT WITH S-SHAPED PROFILE; SPRING IN CYLINDER OPEN AT THE BACK; TRANSVERSE CATCHPLATE. HULL T175A, CAT 240

- TQ 8165 Rainham, Kent, Hull 3321, Rochester Museum
 TL 9925 Colchester, Essex, St Mary's hospital, Hull 0622
 TL 7006 Chelmsford, Essex, Drury 1972 excavations, site T, 1
 SU 8214 Chilgrove, West Sussex, Down 1979, fig 43, no. 5, p 145
 SP 5312 Woodeaton, Oxfordshire, Kirk 1949, no. 21, p 11
 SE 9326 Brough, Yorkshire, Wachter 1969, no. 35, pp 93–4
 NZ 2015 Piercebridge, Durham, Scott and Fitzpatrick forthcoming, excavation nos BB79, 1; PB73, CVW
 SE 7971 Malton, Yorkshire, Malton Museum
 NY 9964 Corbridge, Northumberland, Haverfield 1909, fig 18, p 402
 NY 7914 Brough, Westmorland, Hull 6639, British Museum
 NY 6326 Kirkby Thore, Westmorland, Hull 7599, Chesters Museum
 NY 7466 Winshields, Northumberland, Hull 7605, Chesters Museum
 NY 7766 Chesterholm, Northumberland, Vindolanda, Bidwell 1985, no. 6, p 119
 Zugmantel, Germany, Böhme 1972, no. 468, pp 21–2

BOW OF RECTANGULAR SECTION, EXPANDING TOWARDS FOOT. SPRING IN CYLINDER OPEN AT BACK; SQUARE FOOT WITH TRANSVERSE CATCHPLATE. HULL T176, CAT 241–243

- TR 3141 Dover, Kent, Philp 1981, no. 74, p 151
 TL 9925 Colchester, Essex, Crummy 1983, no. 70, p 15
 SU 6262 Silchester, Hampshire, Hull 4874, Reading Museum
 SU 3194 Chingham, Berkshire, Hull 7045, Ashmolean Museum
 SK 5804 Leicester, Peacock Lane, Hull 7486, Leicestershire Museum

- SE 5951 York, Hull 1076–8, Yorkshire Museum
 NZ 2015 Piercebridge, Durham, Scott and Fitzpatrick forthcoming, find no. 4766
 NY 7868 Housesteads, Northumberland, site museum, AML 811550
 NY 7066 Chesters, Northumberland, Hull 7613, 7647, Chesters Museum
 NY 9964 Corbridge, Northumberland, Snape 1993, fig 8, no. 44, p 44
 NY 5964 Nether Denton, Cumberland, Snape 1993, fig 18, nos 243–4, p 86
 NY 4938 Old Penrith, Cumberland, Austen 1991, fig 89 nos 623–4
 NT 5734 Newstead, Roxburghshire, Scotland, Curle 1911, no. 33, p 326
 SJ 4054 Holt, Denbigh, Grimes 1930, fig 55, no. 11
 Hague, The, Netherlands, Waasdorp 1989, fig 7, e
 Saalburg, Germany, Böhme 1972, nos 429–62, p 20
 Dura Europos, Syria, Frisch and Toll 1949, nos 20–2, pp 49–50

PSEUDO-BOW BROOCHES

Large flat semicircular headplate; the short spring held on a rod between two lugs behind this. The bow is P-shaped in profile: the highly arched upper bow joins a flat expanding footplate. Hull T178A, Cat 245–246

- ST 3390 Caerleon, Monmouthshire, Wheeler 1928, no. 18, 164
 SY 9117 Thistleton, Rutland, Greenfield excavation no. THV 25
 NY 7766 Chesterholm, Northumberland, Vindolanda, Bidwell 1985, no. 7, p 119, with mid-third-century material
 NY 9964 Corbridge, Northumberland, Haverfield 1911, no. 25, 184
 NY 9964 Corbridge, Northumberland, Snape 1993, fig 9, 57–60
 NY 5439 Lazonby, Cumberland, Haverfield 1919, no. 1, p 3
 NY 4938 Old Penrith, Cumberland, Austen 1991, no. 627, p 183
 NY 3955 Carlisle, Cumberland, Snape 1993, no. 266.8, p 92, in late second-century context

SHEATH-FOOTED, P-PROFILED SPRUNG BROOCHES (FIGURE 176)

SHEATH-FOOTED, P-PROFILED BROOCHES WITH SPRING IN CYLINDER. HULL T185–7

- a) *with knobbed plate on upper bow, Hull T185, Cat 247*
- NY 5328 Brougham, Westmorland, AML 671681
 NY 6326 Kirkby Thore, Westmorland, Hull 7784, Carlisle Museum
 NZ 3666 South Shields, Durham, Allason-Jones and Miket 1984, 3.18, p 96
 NY 9964 Corbridge, Northumberland, Haverfield 1911, figs 20–1, p 184
 ST 3390 Caerleon, Monmouthshire, Wheeler 1928, no. 17, p 164
 Zugmantel, Germany, Böhme 1972, no. 611, p 24
 Niederbieber, Germany, Gechter 1980, no. 42, p 604
- b) *with narrow upper bow, flanged near waist, Hull T186*
As Cat 248, with headknob (T186A)
- SU 2082 Wanborough, Wiltshire, Anderson *et al* 2001, fig 25, no. 120, p 60
 SP 5312 Woodeaton, Oxfordshire, Kirk 1949, no. 23, p 12
 TF 4302 Coldham, Cambridgeshire, Potter 1981, no. 8, p 95
 TF 7844 Brancaster, Norfolk, Hinchliffe and Green 1985a, fig 86, no. 9
 TG 5212 Caister-on-Sea, Norfolk, Darling and Gurney 1993, fig 39, no. 4
 NZ 2015 Piercebridge, Durham, Scott and Fitzpatrick forthcoming, 1974 excavation no. 45
 NZ 3666 South Shields, Durham, Allason-Jones and Miket 1984, 3.67, p 104
 NY 7066 Chesters, Northumberland, Hull 7617, site museum
 ST 3390 Caerleon, Monmouthshire, Nash-Williams 1932, fig 32, no. 10, p 80
- As Cat 249, without headknob (T186B)*
- TR 3141 Dover, Kent, Philp 1981, no. 80, p 151
 SU 6262 Silchester, Hampshire, Hull 4891, Reading Museum
 ST 8276 Nettleton, Wiltshire, Wedlake 1982, no. 109, p 135
 TL 9925 Colchester, Essex, Hull 0635, British Museum
 TF 7844 Brancaster, Norfolk, Hinchliffe and Green 1985a, fig 86, no. 8
 SE 5951 York, Hull 1081, Yorkshire Museum
 NZ 2015 Piercebridge, Durham, Scott and Fitzpatrick forthcoming
- NZ 1055 Ebchester, Durham, Maxfield and Reed 1975, no. 13, p 72
 NZ 3666 South Shields, Durham, Allason-Jones and Miket 1984, 3.59–60, 3.79, p 106
 NY 9964 Corbridge, Northumberland, Haverfield 1911, no. 24, p 184
 NY 6326 Kirkby Thore, Westmorland, Hull 7785, Carlisle Museum
 SJ 4066 Chester, Cheshire, Hull 4553, Grosvenor Museum
- c) *with divided bow, Hull T187*
As Cat 251–252
- TQ 7493 Wickford, Essex, Rodwell excavation no. 257
 SE 4066 Aldborough, Yorkshire, Jones 1971, no. 4
 NY 6326 Kirkby Thore, Westmorland, Haverfield 1919, 5b, pp 7–8
 NY 3955 Carlisle, Cumberland, Haverfield 1919, 5a
 Saalburg, Germany, Böhme 1972, no. 654, p 25
- As Cat 253–256*
- SU 6262 Silchester, Hampshire, Hull 4881–2, Reading Museum
 TL 9925 Colchester, Essex, Crummy 1983, no. 72, p 15
 TL 7789 Weeting, Norfolk, Hull 6373, Norwich Museum
 TG 2303 Caistor St Edmund, Norfolk, Hull 6363, Norwich Museum
 SE 4066 Aldborough, Yorkshire, Jones 1971, no. 1
 NZ 2015 Piercebridge, Durham, Scott and Fitzpatrick forthcoming, 1974 excavation no. 113, 1977 no. 1
 NZ 3666 South Shields, Durham, Allason-Jones and Miket 1984, 3.27, p 98
 NY 7766 Chesterholm, Northumberland, Vindolanda, Bidwell 1985, no. 5, p 119
 NY 7868 Housesteads, Northumberland, Charlton 1934, no. 3, pp 195–6
 NY 9964 Corbridge, Northumberland, Haverfield 1909, fig 19, p 402
 NO 2017 Carpow, Perthshire, Scotland, Birley 1965, no. 3, p 206
 Hague, The, Netherlands, Waasdorp 1989, fig 7, b
 Augst, Switzerland, Ettlinger 1973, Tafel 17, no. 11, p 137
- Sheath-footed, P-profiled brooches with spring on single lug behind headplate; the upper bow consisting of three, or occasionally two, separate ribs. Hull T189, Cat 258–267*

- SU 8604 Chichester, West Sussex, Down 1978, no. 53, p 286
 SU 6262 Silchester, Hampshire, Hull 4883, Reading Museum
 SP 6948 Towcester, Northants, Brown and Woodfield 1984, no. 2, p 104
 SE 5951 York, Hull 1079, Yorkshire Museum
 SE 4066 Aldborough, Yorkshire, Jones 1971, no. 2, p 71; Bishop 1996, fig 32, nos 334–5, p 56
 NY 4938 Old Penrith, Cumberland, Austen 1991, fig 89, no. 626
 NO 2017 Carpow, Perthshire, Birley 1965, no. 4, p 206
 ST 5393 Chepstow, Monmouthshire, 1861 hoard, Hull 6641, British Museum
 Hague, The, Netherlands, Waasdorp 1989, fig 7, c
 Saalburg, Germany, Böhme 1972, type 27, pp 25–6

SHEATH-FOOTED P-PROFILED HINGED BROOCHES;
 THE CROSSBOW SERIES (FIGURE 178)

Light crossbow brooches

- a) *with highly arched upper bow, very narrow, of rectangular section; usually lacks knobs on the ends of the narrow rounded crossbar; the central knob set slightly back from the crossbar, but still flat at the back or completely rectangular; very slight mouldings at the top and bottom of the upper bow; the sheath foot narrow and plain, or slightly faceted. Hull T191A, Cat 269–278*
- TR 1760 Sturry, Kent, Hull 8595, Royal Museum, Canterbury
 TL 9925 Colchester, Essex, Crummy 1983, no. 73, p 15
 TL 1507 St Albans, Hertfordshire, Wheeler and Wheeler 1936, no. 32, p 209
 TL 1507 St Albans, Hertfordshire, Verulamium, Frere 1984a, no. 53, p 29
 TQ 3281 London, Hull 5373, Museum of London
 SP 0201 Cirencester, Gloucestershire, Hull 1375, Corinium Museum
 NZ 3666 South Shields, Durham, Allason-Jones and Miket 1984, nos 3.46, 3.48, p 100
 Saalburg and Zugmantel, Germany, Böhme 1972, nos 701–76, pp 26–8
- b) *with small collared knobs on each end of a narrow rounded crossbar; central knob, flat at back, standing on square moulding on the crossbar itself; the arched upper bow of D-section, with large flange and small volute moulding where it joins the lower bow. Usually undecorated. Hull T190, Cat 279–287*
- TR 3141 Dover, Kent, Philp 1981, no. 81, p 151
 TQ 3281 London, Spital Sq, Hull 7244, Museum of London
 SU 7440 Neatham, Hampshire, Millett and Graham 1986, no. 81, p 106
 SU 0061 Devizes, Wiltshire, Tan Hill, Hull 5987, Salisbury Museum
 ST 9518 Rushmore, Dorset, Hull 2563, Pitt-Rivers 1887, pl x, 1
 TL 9925 Colchester, Essex, Hull nos 0636–8, British Museum and Colchester Museum
 TL 5042 Chesterford, Essex, Hull 0639, Cambridge Univ Museum
 TG 5212 Caister-on-Sea, Norfolk, Darling and Gurney 1993, fig 39, nos 5–6
 NZ 2015 Piercebridge, Durham, Scott and Fitzpatrick forthcoming, excavation nos 3653, 4818
 NZ 3666 South Shields, Durham, Allason-Jones and Miket 1984, nos 3.51–2, p 100
 NY 3955 Carlisle, Cumberland, Blackfriars St, McCarthy 1990, fig 101, no. 18
 NY 8571 Carrawburgh, Northumberland, Coventina's well, Allason-Jones and Mackay 1985, no. 49, p 25
 NY 7766 Chesterholm, Northumberland, Vindolanda, Bidwell 1985, no. 9, p 119
 NY 7066 Chesters, Northumberland, Hull 7660, Chesters Museum
 NY 7914 Brough, Westmorland, Haverfield 1919, no. 8B, p 9
 Vienne, France, Feugère 1985, no. 2020, p 424
 Dura Europos, Syria, Frisch and Toll 1949, no. 69, p 54
- Crossbow brooches with three fairly small knobs and little decoration. The pin is hinged in a crossbar of square or hexagonal section. The central knob is on the upper part of the bow itself rather than on the head as in b) above; the knobs are fully round, sometimes collared and/or faceted. The upper and lower bows are usually of about equal length, or the upper longer; this is highly arched and has a sub-triangular cross-section, the front edge very narrow. The lower bow often has alternately chamfered and reserved zones; some have chip-carved decoration. Hull T191B, Cat 288–311*
- TR 1241 Stowting, Kent, Hull 6849, British Museum
 TL 9925 Colchester, Essex, Hull nos 0640–1, Colchester Museum
 TL 1507 St Albans, Hertfordshire, Verulamium, Frere 1984a, no. 54, pp 29–31, deposit AD 280–360
 TQ 3281 London, London Wall, Hull 5368, Museum of London

- SU 6262 Silchester, Hampshire, Hull 4892–4, Reading Museum
- SU 4513 Bitterne, Hampshire, Cotton and Gathercole 1958, fig 12, 1
- SU 0320 Woodyates, Dorset, Pitt-Rivers 1892, pl 182, 19
- SP 9166 Irchester, Northants, Hull 8365, Northants Museum
- TG 5212 Caister-on-Sea, Norfolk, Darling and Gurney 1993, fig 40, no. 8
- NZ 2015 Piercebridge, Durham, Scott and Fitzpatrick forthcoming, excavation no. 3127
- NZ 3666 South Shields, Durham, Allason-Jones and Miket 1984, no. 3.45, p 100, no. 3.78, p 106
- NY 9964 Corbridge, Northumberland, Hull 5072, Corstopitum Museum
- NY 6366 Poltross Burn, Cumberland, Gibson and Simpson 1911, fig 20, 6
- ST 3390 Caerleon, Monmouthshire, Hull 6951, National Museum Wales
- ST 4690 Caerwent, Monmouthshire, Hull 8898, Newport Museum
- Augst, Switzerland, Riha 1979, nos 1450–6, pp 172–3
- The developed crossbow brooch. The highly arched upper bow is usually shorter than the lower, and in section much deeper than wide. The long lower bow splays towards the foot and is sometimes elaborately decorated. There are always knobs on the ends of the crossbar and another on the upper bow; these are all large, often 'onion-shaped'. Sometimes the knobs are separate pieces, and the most elaborate brooches are made up from a number of separate pieces. Hull T192, Cat 320–325*
- TR 2258 Ickham, Kent, Young 1981, no. 1, p 37
- TR 1241 Stowting, Kent, BM Roman Britain 1958, no. 29, p 20
- TQ 3281 London, Ratcliff Highway, Hull 4009, Ashmolean Museum
- TQ 3281 London, Hull 5369–70, Museum of London
- TL 9925 Colchester, Essex, Hull nos 0652, 5075, 6719
- TQ 7493 Wickford, Essex, Rodwell excavation no. 28
- TM 3034 Felixstowe, East Suffolk, Hull no. 6732, BM; nos 8159–60, Ipswich Museum
- TL 1507 St Albans, Hertfordshire, Verulamium, Wheeler and Wheeler 1936, no. 33, p 209
- SP 6948 Towcester, Northants, Brown and Woodfield 1984, no. 3, p 104
- TL 7772 Icklingham, West Suffolk, Hull no. 7177, Ashmolean Museum
- TG 5212 Caister-on-Sea, Norfolk, Darling and Gurney 1993, fig 41, nos 9–11
- TF 8902 Woodcock Hall, Norfolk, Brown 1986, no. 153, p 35
- SU 6262 Silchester, Hampshire, Hull 5207
- SU 4829 Winchester, Hampshire, Lankhills, Clarke 1979, no. 74, p 260, burial AD 350–70
- SU 5989 Wallingford, Berkshire, Hull 4012, Reading Museum
- SP 0201 Cirencester, Gloucestershire, Hull 1391, Corinium Museum
- ST 7898 Uley, Gloucestershire, Woodward and Leach 1993, fig 125, no. 1
- SO 6102 Lydney, Gloucestershire, Wheeler and Wheeler 1932, nos 26–7, p 78
- ST 4690 Caerwent, Monmouthshire, Hull nos 9256–7, Newport Museum
- SE 4066 Aldborough, Yorkshire, Hull 4332, site museum
- SE 5951 York, Hull nos 1086–7, Yorkshire Museum
- NZ 3666 South Shields, Durham, Allason-Jones and Miket 1984, 3.44, p 100, 3.85–6, p 106
- NY 9964 Corbridge, Northumberland, Snape 1993, nos 84–6, pp 54–5
- NY 7066 Chesters, Northumberland, Hull nos 7661–2, Chesters Museum
- NY 8571 Carrawburgh, Northumberland, Coventina's well, Allason-Jones and Mackay 1985, no. 48, p 25
- Oudenburg, Belgium, Mertens and van Impe 1971, graves 27 no. 2, 59 no. 7, 72 no. 2, 114 no. 2
- Augst, Switzerland, Riha 1979, nos 1467, 1470–2, 1479, p 174
- Lauriacum, Austria, Jobst 1975, nos 248–50, pp 187–8
- Ljubljana, Slovenia, Kujundzic 1982, Tafel 31, nos 2–3, 9

PLATE BROOCHES

DRAGONESQUE TYPE

An S-shaped plate; each terminal takes the form of a head with curved snout and large ears, and has a circular sinking representing an eye. The centre of the plate bears conventional decoration, usually enamelled; the pin is looped round one of the necks and secured by that at the opposite end. Hull T200. The list includes only those of similar design to the Richborough example Cat 350 (but none is identical): central panel of lozenges flanked by curvilinear panels; full catalogue in Feachem 1951 and 1968

- TR 0161 Faversham, Kent, Feachem 1951, nos F4, F5, p 38
- TL 2098 Fengate, Huntingdonshire, Feachem 1968, 46, p 102

- TQ 7493 Wickford, Essex, Couchman 1979, no. 2, p 46
 TM 1579 Scole, Norfolk, Rogerson 1977, fig 55, nos 10–11
 TF 8902 Woodcock Hall, Norfolk, Brown 1986, no. 173, p 39
 SJ 5608 Wroxeter, Shropshire, Feachem 1951, no. 15, p 40
 SJ 4066 Chester, Deanery Field, Feachem 1951, no. F1, p 36
 SK 4191 Templeborough, Yorkshire, Feachem 1951, no. F6, p 40
 ? York, Feachem 1951, G3, F2, 20, p 40
 NZ 3666 South Shields, Durham, Feachem 1951, no. 16, p 36
 NY 9964 Corbridge, Northumberland, Feachem 1951, G2, 33, p 38
 NT 5874 Traprain Law, East Lothian, Scotland, Feachem 1951, F3, p 36
 Cobern am Berge, Germany, Feachem 1951, no. 26, p 42
- ZOOMORPHIC BROOCHES; THE ANIMAL IN OUTLINE, FLAT EXCEPT FOR THE HEAD AS CAT 353, HARE, WITH TWO SMALL HARES IN ENAMEL (HULL T211, UNTYPICAL)
- SU 4829 Winchester, Hampshire, Cunliffe 1964, no. 5, p 90; context about AD 60
 TQ 3281 London, Wheeler 1946, no. 39, p 98
 Alesia, Côte d'Or, Lerat 1979, fig 1, 478
 Nepelier, Ardennes, France, unfinished, quoted by Feugère 1985, p 408
 Asciburgium, Nordrhein-Westfalen, Germany, Bechert 1973, 94
 Kleinwinterheim, near Mainz, Germany, Lindenschmitt 1885–1911, II, heft vii, Tafel 4, no. 19
 Belgrade, Yugoslavia, Bojovic 1983, 291
- DISC BROOCHES
- With attached repoussé plate. Hull T249A (Figure 174)*
Triskele design as Cat 373
- TL 9925 Colchester, Essex, Hull 1958, no. 7, p 118
 SU 6262 Silchester, Hampshire, Kilbride-Jones 1980a, fig 4, no. 2
 SD 8365 Victoria Cave, Settle, Yorkshire, Kilbride-Jones 1980a, fig 4, no. 3
 NY 9964 Corbridge, Northumberland, Haverfield 1909, fig 22, p 406
 NZ 3666 South Shields, Durham, Allason-Jones and Miket 1984, 3.148, p 118
 NY 7766 Chesterholm, Northumberland, Vindolanda, Bidwell 1985, nos 1–2, p 39
- NY 7066 Chesters, Northumberland, Hull 7609, Chesters Museum
 NY 7914 Brough, Westmorland, Hull 3384, 6485, 6511, Kilbride-Jones 1980a, fig 4, no. 4
 ST 3390 Caerleon, Monmouthshire, Zienkiewicz 1986, no. 9, p 170
- Disc brooches with raised centres and concentric rings of enamel in small cells*
- As Cat 379–381, Hull T268*
- ST 9917 Sixpenny Handley, Dorset, Hull 9001, Dorset County Museum
 ST 5056 Charterhouse, Somerset, Hull 1180, Bristol Museum F 1968
 ST 3390 Caerleon, Monmouthshire, Hull 4084, National Museum Wales
 TL 1507 St Albans, Hertfordshire, King Harry Lane, Stead and Rigby 1989, fig 12, no. 32 (triangular cells)
 TM 3034 Felixstowe, East Suffolk, Hull 8151, Ipswich Museum
 TG 0702 Wicklewood, Norfolk, Norwich Castle Museum, site no. 15
 TL 1999 Peterborough, Cambridgeshire, Hull 4086, Peterborough Museum
 SK 5804 Leicester, Redcross Street, Butcher 1977, no. 6 (crescent-shaped cells)
 SJ 4066 Chester, Northgate Brewery, Grosvenor Museum
 SE 9820 South Ferriby, Lincolnshire, Hull 6286
 NY 9964 Corbridge, Northumberland, Snape 1993, no. 101, p 58
 NY 3955 Carlisle, Cumberland, Blackfriars Street, McCarthy 1990, fig 101, no. 21, p 112
 SD 5190 Watercrook, Westmorland, Potter 1979, fig 84, no. 16
- Enamelled disc brooches, flat (Figure 177)*
- As Cat 384, Hull T252B; with spring on single lug*
- SY 6890 Dorchester, Dorset, Colliton Park, Hull 9040, Dorset Museum
 ST 5561 Chew Stoke, Somerset, Hull 1918
 ST 5562 Pagans Hill, Somerset, Hull 8277
 ST 3390 Caerleon, Monmouthshire, Hull 6959, National Museum Wales
 SJ 5608 Wroxeter, Shropshire, Hull 1010, Shrewsbury Museum

- TL 1507 St Albans, Hertfordshire, Verulamium, Kenyon 1935, fig 12, no. 13, p 259
- TL 9925 Colchester, Essex, Crummy 1983, no. 80, p 17
- TL 9267 Pakenham, West Suffolk, Hull 7159, Ashmolean Museum
- TG 0702 Wicklewood, Norfolk, Norwich Museum no. 43
- SK 3535 Derby, Mackreth 1985a, no. 40, p 297
- SK 0472 Poole's Cavern, Derbyshire, Derby Museum no. 5257
- With spring held between two lugs*
- SE 2299 Catterick, Yorkshire, Wilson 2002, fig 307, no. 13, pp 159–61
- Saalburg, Germany, Böhme 1972, no. 998, p 38
- As Cat 385, Hull T252C (Figure 177)*
- TQ 7268 Rochester, Kent, Harrison 1973, fig 20, no. 8
- TQ 0940 Rapsley, Ewhurst, Surrey, Hanworth 1968, fig 14, 4
- TG 0702 Wicklewood, Norfolk, Norwich Museum no. 49
- SK 5804 Leicester, Hull 7474, Leicestershire Museum
- SE 2299 Catterick, Yorkshire, Wilson 2002, fig 305, no. 25, pp 155–6
- NY 7766 Chesterholm, Northumberland, Vindolanda, Bidwell 1985, no. 3, p 117
- NT 5734 Newstead, Roxburghshire, Scotland, Curle 1911, no. 10, p 331; described as stud but Hull 3338 confirms that it is a brooch
- ST 8438 Cold Kitchen Hill, Wiltshire, Nan Kivell 1925, pl II, F, p 181
- SP 3903 Standlake, Oxfordshire, Hull 4119, Ashmolean Museum
- ST 7898 Uley, Gloucestershire, Woodward and Leach 1993, fig 125, no. 3
- SV 9414 Nornour, Isles of Scilly, Hull 1968b, nos 191–2, p 52
- Flat oval brooches with broad outer band of enamel*
- As Cat 386–387, Hull T260*
- SU 4829 Winchester, Hampshire, Victoria Road, excavation no. 5461
- SU 3716 Nursling, Hampshire, Hull 8559, Southampton Museum
- SU 6262 Silchester, Hampshire, Boon 1957, fig 17, 3; with intaglio
- SU 5482 Lowbury Hill, Berkshire, Atkinson 1916, no. 34, p 35; with intaglio
- SP 4401 Appleton, Oxfordshire, Hull 3486, Ashmolean Museum
- SU 2082 Wanborough, Wiltshire, Anderson *et al* 2001, fig 26, nos 134–5, p 64
- SU — Rushall Down, Wiltshire, Cunnington and Goddard 1934, pl 66, no. 9
- ST 8276 Nettleton, Wiltshire, Wedlake 1982, fig 54, no. 64
- SV 9414 Nornour, Isles of Scilly, Hull 1968b, fig 22, no. 196, p 54
- SP 4913 Kidlington, Oxfordshire, Hunter and Kirk 1954, fig 26, no. 1
- TL 3924 Braughing, Hertfordshire, Potter and Trow 1988, fig 21, no. 71, p 50
- TL 9383 Brettenham, Norfolk, Clarke 1938, fig 2, no. 2
- SK 9117 Thistleton, Rutland, Greenfield excavation no. TH2
- SK 3535 Derby, Mackreth 1985a, fig 129, no. 41, p 297
- SJ 6186 Wilderspool, Cheshire, Thompson 1965, fig 20, no. 10
- SJ 6186 Chesterholm, Northumberland, Vindolanda, Snape 1993, no. 214
- NY 7766 Housesteads, Northumberland, site museum, AML 79208643
- NY 7066 Chesters, Northumberland, Hull 7626, site museum
- Disc brooches with central glass 'stone' and outer bands of fine relief decoration, sometimes gilt. Hull T270 (Figure 179). As Cat 388 but pattern of decoration and size varies; sometimes only one band, and 'stone' often missing*
- TR 3141 Dover, Kent, Philp 1981, fig 32, no. 72
- SU 6262 Silchester, Hampshire, Hull 4966, Reading Museum
- SU 5482 Lowbury Hill, Berkshire, Atkinson 1916, pl 9, no. 35
- SU 2082 Wanborough, Wiltshire, Anderson *et al* 2001, fig 26, no. 138, p 64
- 'South Wiltshire', Hull 6679, British Museum
- ST 4716 Ham Hill, Somerset, St George Gray 1910, fig 4
- ST 4464 Henley Wood, Yatton, Somerset, Watts and Leach 1996, fig 88, no. 21, p 82
- SP 0201 Cirencester, Gloucestershire, Hull 5791, Corinium Museum
- ST 7898 Uley, Gloucestershire, Woodward and Leach 1993, fig 125, nos 5–7
- SP 5005 Hinksey, Oxfordshire, Hull 4113, Ashmolean Museum

- SP 7940 Stony Stratford, Buckinghamshire, Hull 7368, British Museum
- TL 1197 Water Newton, Huntingdonshire, Greenfield excavation no. CH 25
- TL 7772 Icklingham, West Suffolk, Hull 7171, Ashmolean Museum
- TL 7388 Hockwold, Norfolk, Gurney 1986, fig 40, no. 8
- TF 8902 Woodcock Hall, Norfolk, Brown 1986, fig 25, no. 184, p 39
- TG 5212 Caister-on-Sea, Norfolk, Darling and Gurney 1993, fig 42, no. 13
- SJ 5608 Wroxeter, Shropshire, Bushe-Fox 1913, fig 9, no. 1
- NZ 3666 South Shields, Durham, Allason-Jones and Miket 1984, nos 138–9, p 116
- NY 9964 Corbridge, Northumberland, Hull nos 5120 and 5178, site museum
- NY 7868 Housesteads, Northumberland, site museum, AML 79208663
- NY 7066 Chesters, Northumberland, Hull 7663, site museum
- New Grange, Co Meath, Eire, O’Kelly 1977, pl VIIA
- Saalburg, Germany, Böhme 1972, Tafel 29, no. 1134
- TL 9925 Colchester, Essex, Crummy 1983, nos 95–6, 18
- SY 6688 Maiden Castle, Dorset, Wheeler 1943, fig 86, no. 2, p 264, in deposit dated middle or second half of first century AD
- SE 2299 Catterick, Yorkshire, Baines Farm, Wilson 2002, fig 307, no. 16, p 161, in Flavian to late Antonine deposit
- TA 0967 Rudston, Yorkshire, Stead 1980, no. 23, 95, with Antonine samian
- NY 9964 Corbridge, Northumberland, Bishop and Dore 1988, nos 15–16, p 163

As Cat 429, Hull type P6C, Fowler 1960 type A2. Additions to examples listed by Fowler (1960, 174)

PENANNULAR BROOCHES

As Cat 424, Hull type P4

- SO 6102 Lydney, Gloucestershire, Wheeler and Wheeler 1932, fig 14, no. 38, p 79
- TF 7844 Brancaster, Norfolk, Hinchliffe and Green 1985a, fig 28, no. 2, 42, in a third–fourth-century deposit
- NY 6166 Birdoswald, Cumberland, Richmond 1931, fig 4, no. 3D; in a deposit of about AD 369–83
- As Cat 428, Hull type P7, Fowler 1960 type A3. Additions to examples listed by Fowler (1960, 174)*
- TR 1457 Canterbury, Kent, Frere *et al* 1982, no. 6, p 144
- TL 7006 Chelmsford, Essex, excavation no. CHV 75, 208
- SU 2082 Wanborough, Wiltshire, Anderson *et al* 2001, fig 26, no. 143, p 65
- SK 3535 Derby, Mackreth 1985a, nos 43–4, p 299
- SK 0472 Poole’s Cavern, Derbyshire, AML DERSB 5141
- SE 9318 Winterton, Lincolnshire, Stead 1976a, fig 100, no. 20, fig 102, no. 33, ‘third or fourth century’
- TA 0967 Rudston, Yorkshire, Stead 1980, no. 24, p 95
- SE 2299 Catterick, Yorkshire, Wilson 2002, fig 307, no. 14, p 161
- SE 4066 Aldborough, Yorkshire, Bishop 1996, fig 33, nos 347–8, 350–1
- NZ 3666 South Shields, Durham, Allason-Jones and Miket 1984, nos 3.113–14, p 110
- NZ 2015 Piercebridge, Durham, Scott and Fitzpatrick forthcoming, excavation nos PB73, 225; HS 79, 3151
- NY 9964 Corbridge, Northumberland, Bishop and Dore 1988, no. 14, p 163; Snape 1993, fig 13, no. 142, fig 14, no. 145, p 67
- NY 4938 Old Penrith, Cumberland, Austen 1991, no. 632, p 184
- NS 8680 Camelton, Stirlingshire, Scotland, Maxfield forthcoming, excavation no. 76.10

APPENDIX 4

MISSING RICHBOROUGH BROOCHES AND THE SITE'S NUMBERING SYSTEMS

There are several number series that are associated with some or all of the Richborough brooches and which appear in the catalogue entries in Chapter 4. The notes below outline the correlations between these different sets of numbers.

The catalogue numbers used in Chapter 4 have been allocated to brooches that still exist. There are other brooches from Richborough that for one reason or another do not appear in the catalogue; these are listed below and their status is indicated.

Each of the 445 extant brooches or fragments now has an English Heritage inventory number (often referred to as an Ancient Monuments Laboratory or AML number), most of which have seven digits (735****) and were allocated as the brooches were re-conserved in the early 1970s; a few numbers allocated more recently have eight digits (9600****). This total excludes brooch pins and spring fragments not associated with a brooch, of which there are about fifty.

As they were excavated, all the brooches and other finds were allocated a Small Find (SF) number. These were recorded in a series of registers, together with a brief description of the object and sometimes a sketch (of variable quality). There is usually some indication of where the object was found and for a few objects published parallels are quoted. Table 24 shows which numbers were allocated in which season's excavations. The highest SF number now associated with a brooch is 5668.

A total of 206 brooches that were published in the five volumes of Richborough excavation reports (Bushe-Fox 1926 (RI), 1928 (RII), 1932 (RIII) and 1949 (RIV); Cunliffe 1968 (RV)) acquired what is described here as a

report number. In these publications the catalogue number is the same as the illustration number and can be referred to as, for example, IV No. 57, that is, No. 57 in Richborough Vol IV (Bushe-Fox 1949). Table 28 provides a concordance for the report number and the catalogue number as assigned in Chapter 4. Other brooches were mentioned in Vols II–IV but were not fully catalogued (see below). Every brooch catalogued in Vols I–IV was illustrated but not all those in Vol V were. There are no SF numbers published in Vols I–IV but most of the brooches in Vol V have an associated SF number, though in a few cases it can be shown to be incorrect.

There are various ways of correlating the different numbers and varying degrees of certainty in these correlations. The two absolute and one-to-one relationships are those of surviving brooches with AML numbers and with the catalogue numbers assigned in Chapter 4 of this volume.

For those objects that were illustrated in the reports, a visual comparison can be made between the illustrations and the extant brooches, and in most cases a definite link made. Report numbers can therefore be associated with AML numbers and the corresponding catalogue numbers. There are a few illustrated brooches that can no longer be identified and are thus thought to be lost; these are listed in Table 25 and illustrated in Figure 184. Four further brooches that were published are also thought to be lost, but there is less certainty as they were not illustrated; they are also listed in Table 25 and one (Cat A14) is illustrated in Figure 185. A further group of thirty-one brooches were briefly described in the published reports but not individually catalogued or illustrated. Some of these descriptions can be tied to

Table 24 Concordance for small find numbers used in each season's excavations

<i>Excavation</i>	<i>SF No.</i>	<i>Publication Report</i>
1922	1-61	RI
1923	62-128	RI
1924	129-286	RII
Winter 1924-5	287-524	RII
Summer 1925	525-613	RII
Summer 1926	600 bis-776	RIII
Summer 1927	777-900	RIII
1928	901-1265C	RIV
1929	1266-1851	RIV
Winter 1929-30	1852-2367	RIV
Summer 1930	2368-2773	RIV
Winter 1930-31	2772 bis-3913	RIV
Summer 1931	3914-4611	RV
Summer 1932	4612-5065	RV
Summer 1933	5066-5194	RV
Summer 1934	5195-5371	RV
Summer 1935	5372-5494	RV
Summer 1936	5495-5598	RV
Summer 1937	5599-5661	RV
Summer 1938	5662-5671	RV
1939 and later	5672-5677	RV

Note: RV also includes a small number of finds from seasons before 1931.

extant brooches by the methods outlined below but others cannot; they are all listed in Table 26.

Some of the brooches had attached labels with SF numbers on them when they came to the Ancient Monuments Laboratory in 1973. It was assumed that these labels were correctly associated with the objects. The descriptions and sketches in the SF registers were checked against the objects and this identified some obviously mis-labelled brooches. Some unlabelled brooches could be more or less positively identified from the sketches in the SF registers and the corresponding SF numbers were therefore re-associated with them.

Because each report relates to a specific period of the excavations, the brooches published in it came from those years' excavations and thus will have SF numbers that fall within a limited range (see Table 24). This information was used in checking the SF numbers associated with published brooches, and in attempting to re-assign SF numbers to those brooches that had lost them. Further help was provided by the findspot recorded in the SF registers which could be correlated with the published one as SF numbers were only

included in the final excavation report (Cunliffe 1968).

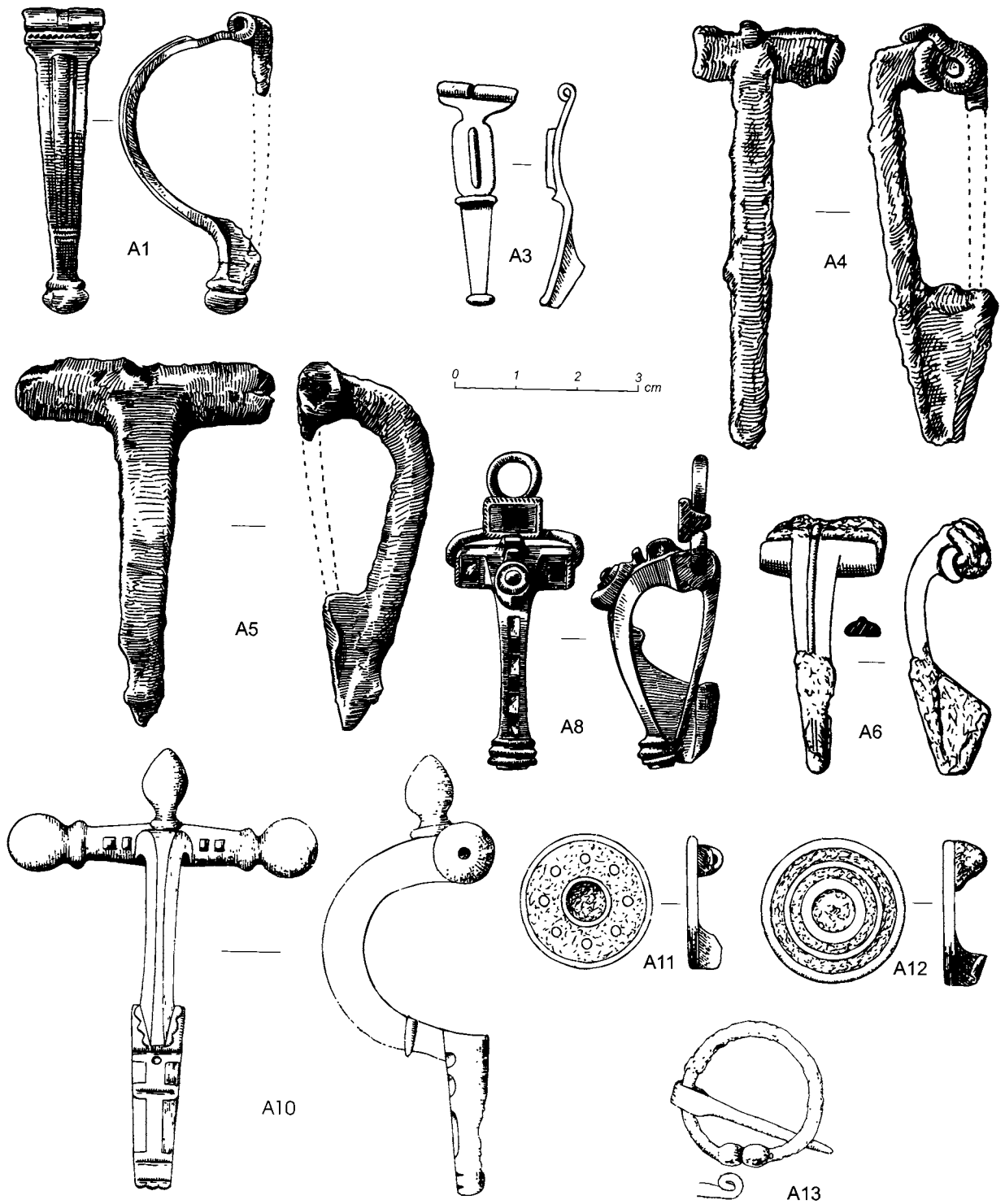
Generally, the identification of finds in the SF registers as brooches is good, though there are a few finds described as brooches that are not. These are SF numbers 738 1096, 2422, 2433 (AML 7350794), 2465, 2504, 2707 and 4851.

Despite all the efforts made, there are eighty-two of the surviving Richborough brooches which have no associated SF number. There are also eighty-four SF numbers which cannot be associated with any extant brooch as the descriptions in the SF registers (reproduced in Table 27) are insufficiently detailed. Some of these register entries are accompanied by illustrations (reproduced in Figure 185) but their quality is sometimes too poor to allow positive or negative correlation with the extant brooches. However, some of the sketches in the SF registers are clearly not of any of the surviving brooches; these uncatalogued brooches now thought to be lost are included in Table 27.

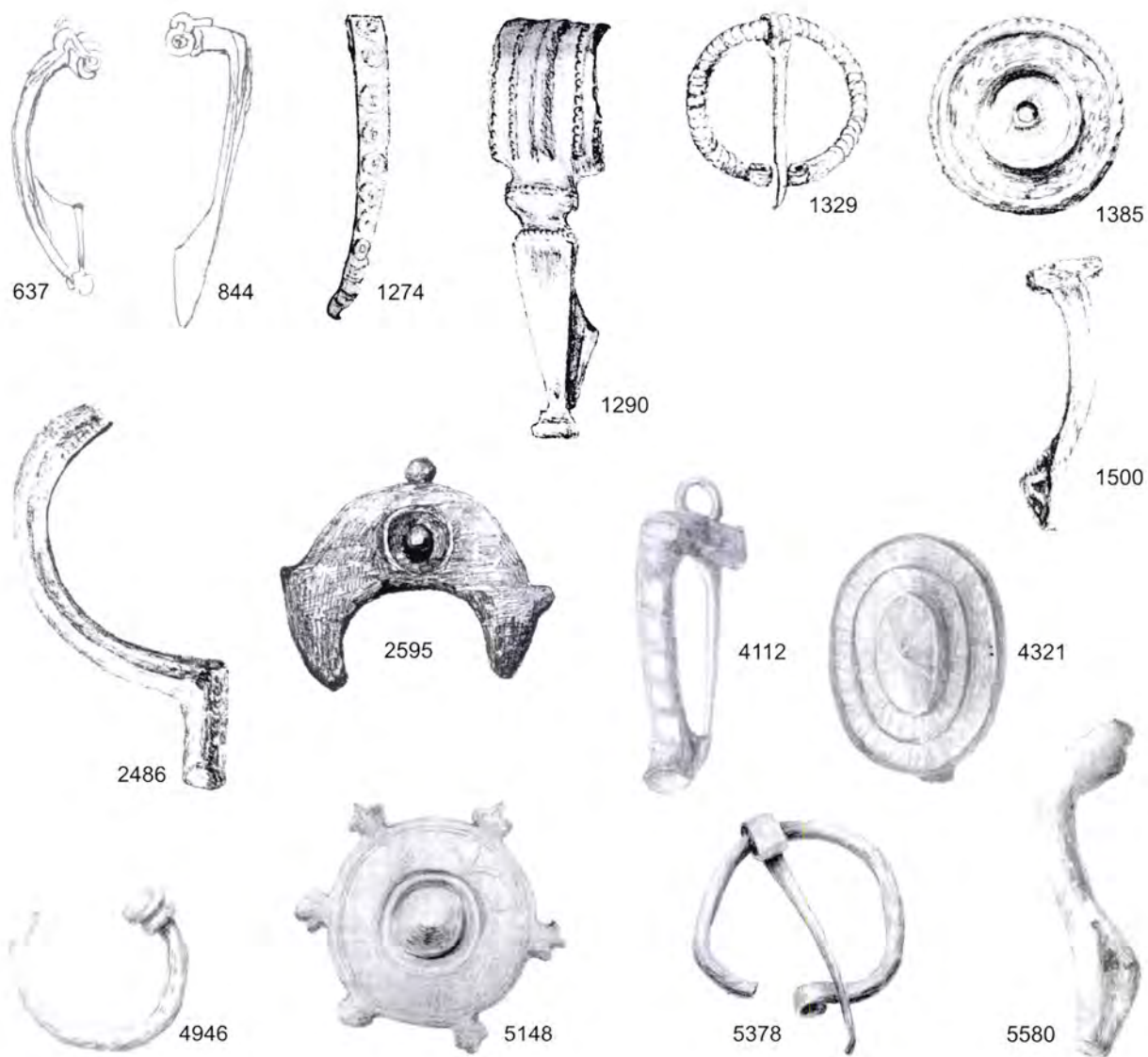
Table 28 is a concordance for the brooch report numbers published in reports I-V and catalogue numbers assigned in Chapter 4.

Table 25 Published brooches now lost or unidentifiable

<i>Cat</i>	<i>Report</i>	<i>Description</i>
A1	RIII, No. 1	'Uninscribed brooch of Aucissa type' (R III, p 76). Section 33. 'In filling of small channel cut in natural soil, with coin of Claudius.'
A2	RV, No. 46 (not illustrated)	'Bow only [of Aucissa], strongly ridged, exactly like RV, No. 44 [?Cat 80]' (RV, p 85). SF 3895. 'Car park site.'
A3	RV, No. 52	'A small and insignificant Hod Hill brooch, almost flat, with a bold ridge on the bow' (RV, p 85). No site provenance.
A4	RIII, No. 9	Iron brooch related to Colchester type. 'Bilateral spring, held by a hook; bow straight, making a right angle at its junction with the head; solid catchplate.' SF 741? 'West of site 1. In a deposit mostly of late first century' (RIII, p 77).
A5	RIV, No. 39	Heavy iron hinged brooch; solid catchplate. SF 1362. 'Area XVI AD 80–100 with a few later pieces' (RIV, p 115).
A6	RV, No. 23	'Rather stout example [of Colchester-derivative], the bow unusually wide, of D-section with median rib' (RV, p 79). SF 5006 is incorrect. No site provenance.
A7	RV, No. 21 (not illustrated)	'So corroded that it can only be attributed to this type [two-piece Colchester] on probability' (RV, p 79).
A8	RIV, No. 35	A brooch of very similar construction to Cat 228 but with different decoration. It is described as having enamelled studs at the head of the bow and under the foot; the panels of enamel on the head and bow are described as rectangular insets of blue, green and yellow, the clip for the headloop as green. 'Pit 222 AD 75–90' (RIV, p 114).
A9	RV, No. 78 (not illustrated)	'Bow and part of head only, tinned and very corroded. This is part of a light crossbow like Cat 294.' SF 4313. 'Surface, south-west area' (RV, p 91).
A10	RV, No. 80	'A complete brooch, but not typical, for the knobs are comparatively small, the crossbar long, solid, and the foot short.' This brooch is generally similar to Cat 317, Cat 318 and Cat 319 but the drawing shows two rectangular insets on each side of the crossbar, possibly for niello, and a scalloped moulding at the base of the upper bow. SF 5135. Pit 293. SF 5249 is incorrect (RV, p 91).
A11	RV, No. 63	Similar but slightly larger than Cat 384 and with eight metal spots. The central ring is larger and 'probably held a stud'. The enamel was 'white or colourless' (RV, p 88). SF 4506.
A12	RV, No. 65	Flat 'enamelled disc brooch, the field divided into two bands and a central disc. Enamel in outer band uncertain, in inner band blue; central space vacant ... Pin hinged' (RV, p 88). SF 4805. 'South of west wall in trench IV, above upper pebble layer'.
A13	RV, No. 85	'Penannular brooch, the ends flattened and rolled upwards; ring of round section, corroded.' SF 4233. 'Surface, south-west area' (RV, p 92).
A14	RV, No. 86 (not illustrated)	Penannular 'similar to A13, one end missing; pin much curved' (RV, p 92). SF 5378. (Illustrated in Figure 185)



184 Brooches now lost, after illustrations in Bushe-Fox (1932, 1949) and Cunliffe (1968). The numbering refers to Table 25



185 Brooches now lost, after sketches in the excavation small finds registers, labelled by small find number. Scale variable; see Table 27 for dimensions

Table 26 Brooches mentioned in reports but not fully catalogued

Those brooches that have been identified have catalogue numbers and also appear in Chapter 4; their entries here are only for completeness. The others cannot now be positively identified among the surviving brooches. The two for which there are good quality sketches in the small find registers (reproduced in Figure 185) are probably now lost. Question marks denote increasing degrees of uncertainty.

	<i>Cat</i>	<i>Description</i>
RII, p 41	–	Two-piece Colchester similar to Cat 184, 'with a semi-cylindrical spring cover and a single opening in the catchplate. Topsoil.'
	–	Two-piece Colchester similar to Cat 184, 'with a semi-cylindrical spring cover and a single opening in the catchplate. Low level W of site III.' SF 529.
	–	Two-piece Colchester similar to Cat 184, 'with a semi-cylindrical spring cover and a solid catchplate. Topsoil.'
RII, p 43	267	Divided bow similar to Cat 258.
	–	Crossbow brooch similar to Cat 298 'but with the head missing'.
RIII, p 89	–	Nauheim derivative like Cat 9, 'Section 45 low level'.
	–	Hod Hill similar to Cat 122, 'W of site I low level'.
	–	Two-piece Colchester like Cat 169. 'Area IX'. SF 844. (Figure 185)
	–	Two-piece Colchester similar to Cat 169 'but heavier and with a pierced catchplate. W of site I low level'.
	–	Two-piece Colchester similar to Cat 191 'but larger and heavier. Site V low level'.
	–	Small Hod Hill like Cat 128 'but the hinge is replaced by a spring of eight coils with a semi-cylindrical spring cover. Pit 33, 18ft [5.5m].' SF 700??
	254	Divided bow like Cat 253 'but the foot ends in two transverse mouldings. Section 19, upper filling of outer ditch'. SF 703?? Note that this correlation is correct only if 'Tr I S of Watling St 130–135 on datum line' is the same as 'Section 19 ...'
	271	Crossbow like Cat 298. 'Area V unstratified'. SF 828.
	–	Crossbow like Cat 298. 'Unstratified'. SF 546??
RIV, p114	–	Headstud 'identical' to Cat 229 'but with broken headloop'. Pit 127, 16ft [4.9m]
RIV, p 122	–	Nauheim derivative similar to Cat 2. 'Inner ditch of Saxon Shore fort'.
	–	Knee cf. Cat 241. 'Inner ditch stone fort, bottom layer'.
	–	Screw terminal from crossbow like Cat 329. 'Unstratified'.
	–	Screw terminal from crossbow like Cat 329. 'Unstratified'.
	–	Aucissa like Cat A1. 'Area XVI'.
	77	Aucissa like Cat A1. 'Pit 86'. SF 1023.
	84	Aucissa like Cat A1. 'Pit 140'. SF 1851.
	–	Hod Hill type as Cat 118. 'Claudian ditch filling'. SF 1290. (Figure 185)
	120	Hod Hill like Cat 118. 'W of section 47'. SF 1599.
	121	Hod Hill like Cat 118. 'Area XVI'. SF 2529.
	38	Knickfibel like Cat 36. 'Section 47, Claudian ditch filling'. SF 1260.
	37	Knickfibel like Cat 36. 'Area XVIII, on floor XVI'. SF 2648.
	164	Two-piece Colchester like Cat 160. 'Pit 179'. SF 2513.
	–	Two-piece Colchester like Cat 184 and Cat 162. 'Section 35'.
	194	Two-piece Colchester like Cat 184 and Cat 162. 'Section 53'. SF 1369.
	–	cf Swarling (pl XII, 4 and xv, 14). 'Area XVI low level'.
	–	cf Swarling (pl XII, 4 and xv, 14). 'Area XVI low level'.

Table 27 Information from small find registers for small find numbers that cannot be associated with extant brooches

For those brooches with drawings in the small find register, these are reproduced in Figure 185. Additions within square brackets are by Justine Bayley. Abbreviations: [D=> type] means the brooch is probably of that type, based on the drawing; question marks denote uncertainty; L length; W width; Diam diameter.

<i>SF No.</i>	<i>Description</i>	<i>Findspot</i>
<i>1922</i>		
50	Part of brooch	Site unknown
60	Brooch	Room 4 Layer 2
<i>1923</i>		
81	Part of a fibula	E of Site 1
<i>1924</i>		
144	L 2 ¹ / ₄ " [57mm]	Top 3' [0.9m] NE Corner
170	Top 3' [0.9m] NE Corner	
176	Much twisted L 1 ¹ / ₂ " [38mm]	Top 3' [0.9m] NE Corner
177	Much corroded L 1 ¹ / ₄ " [32mm]	Top 3' [0.9m] NE Corner
240	Penannular Diam ⁷ / ₈ " [22mm]	Top stuff N of platform
282	Penannular	N of platform
<i>Winter 1924–5</i>		
294	Pin missing L 2 ³ / ₅ " [66mm] plain	
300	Plain twisted L 2" [51mm]	
306	Bow in 2 parts with rib with spring. Point of pin in catchplate	
375	Small round brooch, hole in middle complete with pin Defaced ornamentation	
408	[AML No 7351809 silver penannular; now lost]	
453	Penannular turned up end. Diam ³ / ₄ " [19mm]	
<i>Summer 1925</i>		
529	Pin missing. Hole in catchplate L 2" [51mm] [mentioned in RII]	Low level W of S III
600	One bar pin missing hole in catchplate remains of spring [probably Colchester]	End of apse 2' [0.6m] down
603	Twisted and bent. Remains of catchplate Pin broken. L 2 ¹ / ₂ " [64mm]	
<i>Summer 1926</i>		
637	Single bar pin missing. L 1 ⁵ / ₈ " [41mm], W ³ / ₄ " [19mm] [D=>Colchester ?one-piece; Figure 185]	Trench A or B
738	L 1 ⁵ / ₈ " [41mm]	Red layer site low level
741	Iron fibula [? RIII 9]	

<i>SF No.</i>	<i>Description</i>	<i>Findspot</i>
<i>Summer 1927</i>		
844	Pin, part head and catchplate missing [D=>two-piece Colchester mentioned in RIII; Figure 185; now lost]	Area IX
893	Aucissa type	Trench 3 S Wat[ling St] 68'-69' 5'6" [20.7-21.0m 1.7m] below
<i>1929</i>		
1274	Incomplete and decorated with circles L 2" [51mm] [D=>T-shaped or strip bow; Figure 185]	Tip outside N wall
1290	L 2 3/10" [58mm] [D=>Hod Hill mentioned in RIV; Figure 185; now lost]	Claudian ditch W gate
1301	Pin unattached and much mutilated	Surface
1329	Penannular. Complete [Figure 185; now lost]	Area XI-16 Trial ditch south
1362	Iron fibula [? IV 39] [published as RIV, no. 39; Cat A5; Figure 184]	N guardchamber above burnt layer in unstratified soil
1385	Circular brooch with rivet hole for pin and part of catchplate Diam 1 1/2" [38mm] [Figure 185; now lost]	Tip
1500	[D=>?Hod Hill; Figure 185; now lost]	E of Section 53 rubbish under yellow road
1558	Broken and pin missing	West gate road section 15'-20' [4.6-6.1m] from S end of section, 2 1/2' [0.7m] from grass
1814	Fragment L 1" [25mm]	
<i>Winter 1929-30</i>		
1958	Penannular pin missing	Inner ditch middle layer
1999	Circular in bad condition	Pit 141 5' [1.5m] down
2263	Penannular Diam 9/10" [23mm]	Tip 2 outside N wall
2290	L 1 1/2" [38mm]	Outside W gate inner ditch bottom layer
<i>Summer 1930</i>		
2371	2 fragment of fibula	2nd trench for Claudian ditch outside S wall 2'-3' [0.6-0.9m] down
2486	Incomplete. Pin missing [Figure 185; now lost]	Area XVI in rubbish deposit W of road over Claudian ditches
2504	Frag of fibula [Hod Hill] or buckle	Trench IV Pit 179 S motor road
2595	[D=>lunate plate brooch; Figure 185; now lost]	Area XVI in rubbish deposit E of road. Low level
2630	Fragment L 2 1/2" [64mm]	Area XI outer ditch in clay
2651	3 bits Hod Hill type [probably means Nauheim derivative]	Area XVIII platform trench over black floor
2762	Fragment of head	Stray

<i>SF No.</i>	<i>Description</i>	<i>Findspot</i>
2768	Head of brooch early type with spring	Area XVI stone filled gully E-W in NW corner
<i>Winter 1930-1</i>		
2806	Complete with pin, silver plated catchplate entire, bow ribbed, decorated with lines of punctured dots	In E-W gully, car park
3027	Aucissa type, worn	Unstratified
3070	Dog chasing hare [now lost]	Ditches 0-3' [0.0-0.9m]
3081	Fibula	Middle triple ditch 3' [0.9m]
3165	Rich 2 [possibly RI, 2]	Berm S wall
3233	Possibly part of fibula	Inner ditch N side fill
3247	Fibula	Outer ditch S side fill
3250	6 pointed each angle rounded. Conical centre with setting for a jewel [probably cf Cat 340; now lost]	Outer ditch S side fill
3306	Part of fibula	Inner ditch S side bottom
3379	No pin	Dark surface earth S of site I
3401	Broken	Inner triple ditch surface
3445	With loop for chain. cf Newstead [Curle 1911] pl LXXXVI, 15	Inner triple ditch, clay
3548	Part of fibula, RXII, no 9 [RI, 9]	Tip 1
3550	2.9" [74mm] long, perforated catchplate cf RII, 2-5	Tip 1
3582	No pin, catchplate with sockets for enamel. L 1.7" [43mm] Rich pl XII, 2, 3 [RI, 2-3; Colchester-derivative]	Tip 1
3592	Screw from crossbow type	Outer ditch N side 3' [0.9m]
3594	Enamelled	Surface
3717	Trumpet shaped	Above Pit 221
3807	Diamond shaped, bad condition	S motor road
3895	Bow of fibula	Car park
<i>Summer 1931</i>		
4038	Broken silver penannular, no pin	SW area inside fort, surface
4112	1 7/10" [43mm] long [D=>headstud; Figure 185; now lost]	SW area inside stone fort
4233	Penannular, complete	Surface SW area inside fort
4234	?brooch fragment L 1 1/2" [38mm]	Surface SW area inside fort
4313	L 1/2" [13mm], incomplete	SW area inside stone fort
4321	With traces of gold and green glass centre. Pin missing [D=>T271; Figure 185; now lost]	SW area inside stone fort
4499	Encased in sand	Area XXI in hearth 4" [0.1m] below mixing floors
<i>Summer 1932</i>		
4636	Broken penannular	Surface XVII - 32
4728	Penannular, pin missing S of chalk house. Surface	Area XVII/32 W extension
4737	Fragment L 1 7/10" [43mm]	Area XVII/32 W extension above level of concrete house N of burnt hollow
4747	Diam 4/5" [20mm], pin and catchplate missing	Area XVII/32 W extension S of chalk house. 2nd layer inner ditch mound

<i>SF No.</i>	<i>Description</i>	<i>Findspot</i>
4946	Incomplete [AML No 7351920; now lost; Figure 185]	Pit 269. 4' [1.2m]
4953	Ring or penannular?	S of Section 19. 1st layer
5036	cf RIII pl VIII Hod Hill [RIII, 2-6] 1.45" [37mm]	Pit 244
<i>Summer 1933</i>		
5135	Fibula L 2 7/8" [73mm]. Complete [published as RV, No. 80; Cat A10; Figure 184]	Pit 293
5148	Brooch complete with pin with traces of silver plate and enamel? [D=>disc brooch; Figure 185; now lost]	Outer triple ditch between sections 46-20. 4'4"-5'0" [1.3-1.5m]
<i>Summer 1934</i>		
5347	Fibula fragment	Inner Q triple ditch between 44 and 46A
<i>Summer 1935</i>		
5378	Penannular brooch incomplete 1 1/5" [30mm] across [published as RV, No. 86; Cat A14; Figure 185]	Stray
<i>Summer 1936</i>		
5580	Fibula L 1 3/4" [44mm]. Incomplete and much corroded [Figure 185]	Unstratified Area VI
<i>1939 and later</i>		
5672	Pin of penannular brooch	Stray

Table 28 Concordance for brooches listed by published report brooch number and catalogue number (in Chapter 4)

<i>Report</i>	<i>Cat</i>	<i>Report</i>	<i>Cat</i>	<i>Report</i>	<i>Cat</i>	<i>Report</i>	<i>Cat</i>	<i>Report</i>	<i>Cat</i>
I 1	46	III 11	128	IV 38	225	V 12	54	V 55	148
I 2	169	III 12	350	IV 39	A5	V 13	?56	V 56	136
I 3	191	III 13	247	IV 40	236	V 14	64	V 57	112
I 4	238	III 14	379	IV 41	219	V 15	58	V 58	97
I 5	233	III 15	360	IV 42	377	V 16	67	V 59	124
I 6	366	III 16	154	IV 43	359	V 17	178	V 60	127
I 7	382			IV 44	353	V 18	168	V 61	158
I 8	363	IV 1	33	IV 45	385	V 19	172	V 62	354
I 9	281	IV 2	32	IV 46	369	V 20	176	V 62a	344
I 25	422	IV 3	2	IV 47	370	V 21	A7	V 62b	345
I 26	401	IV 4	18	IV 48	386	V 22	198	V 63	A11
		IV 5	349	IV 49	364	V 23	A6	V 64	372
II 1	9	IV 6	342	IV 50	352	V 24	195	V 65	A12
II 2	117	IV 7	341	IV 51	245	V 24a	170	V 65a	346
II 3	184	IV 8	35	IV 52	241	V 25	163	V 66	380
II 4	162	IV 9	42	IV 53	268	V 26	223	V 67	365
II 5	224	IV 10	340	IV 54	248	V 27	211	V 68	157
II 6	432	IV 11	93	IV 55	282	V 28	209	V 69	155
II 7	425	IV 12	115	IV 56	294	V 29	235	V 70	362
II 8	434	IV 13	135	IV 57	337	V 30	217	V 71	361
II 9	390	IV 14	123	IV 58	249	V 31	221	V 72	259
II 10	356	IV 15	105	IV 59	288	V 32	218	V 73	264
II 11	252	IV 16	109	IV 60	316	V 33	220	V 74	255
II 12	253	IV 17	95	IV 61	314	V 34	237	V 75	251
II 13	258	IV 18	96	IV 62	313	V 35	231	V 76	293
II 14	298	IV 19	142	IV 63	388	V 36	226	V 77	290
II 15	?302	IV 20	141	IV 64	321	V 37	41	V 78	A9
II 16	317	IV 21	159	IV 65	320	V 38	39	V 79	?273
II 17	325	IV 22	143	IV 66	329	V 39	40	V 80	A10
II 18	322	IV 23	144	IV 170	373	V 40	72	V 81	289
II 19	324	IV 24	125	IV 210	347	V 41	348	V 82	328
II 20	327	IV 25	213	IV 229	351	V 42	74	V 83	334
II 21	367	IV 26	59			V 43	86	V 84	246
		IV 27	181	V 1	34	V 44	?80	V 85	A13
III 1	A1	IV 28	206	V 2	25	V 45	85	V 86	A14
III 2	113	IV 29	355	V 3	13	V 46	A2	V 87	391
III 3	114	IV 30	44	V 4	6	V 47	75	V 88	418
III 4	122	IV 31	207	V 5	8	V 48	78	V 89	429
III 5	?103	IV 32	130	V 6	24	V 49	91		
III 6	118	IV 33	232	V 7	22	V 50	131		
III 7	36	IV 34	228	V 8	31	V 51	129		
III 8	139	IV 35	A8	V 9	3	V 52	A3		
III 9	A4	IV 36	229	V 10	45	V 53	102		
III 10	160	IV 37	234	V 11	47	V 54	111		

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Table 19 **Summary of all brooch analyses**

<i>Site code</i>	<i>Site name</i>	<i>Number of quantitative analyses</i>	<i>Number of qualitative analyses</i>	<i>Reference to publication of the brooches</i>
ALDB	Aldborough, Yorkshire		4	Bishop 1996
ASHT	Ashton, Northamptonshire		34	unpublished
BALD	Baldock, Hertfordshire	52	92	Stead 1986
BANT	Bantham, Devon		1	Butcher 1981b
BEES	Beeston Castle, Cheshire	1		Butcher 1993a
BIRD	Birdoswald, Cumberland		16	Summerfield <i>et al</i> 1997
BRAN	Brancaster, Norfolk		1	Mackreth 1985b
BRAU	Braughing, Hertfordshire	33	43	Olivier 1988
BROU	Brougham, Westmorland	2	2	Cool forthcoming
CABY	Caistor-on-Sea, Norfolk	13	7	Butcher 1993c
CAME	Camelon, Stirlingshire	3	13	Butcher forthcoming a
CARL	Carlisle, Cumberland	3	26	BLA: Mackreth 1990; CS: McCarthy 1991; ANN: Caruana forthcoming
CARV	Carvossa, Cornwall	6	11	Butcher 1987a
CAST	Castleford, Yorkshire	18	80	Cool 1998
CATS	Catsgore, Somerset	22	13	Butcher 1982a
CATT	Catterick, Yorkshire	3	38	Sites 46, 273 and 240: Butcher 2002; Sites 433 and 434: Mackreth 2002
CHEL	Chelmsford, Essex	18	47	1: Butcher with Bayley 1988a; 2: Butcher 1992; 3: Butcher forthcoming b
CHES	Chesterfield, Derbyshire		1	–
CHIC	Chichester, West Sussex		10	1: Butcher 1978a; 2: Mackreth 1979
CIRE	Cirencester, Gloucestershire		2	–
CLEE	Cleeve Abbey, Somerset		1	unpublished
COLC	Colchester, Essex		61	Crummy 1983; CS: Crummy 1992a; GBS: Crummy 1992b
COLE	Coleshill, Warwickshire		29	Lloyd-Morgan in prep
CORB	Corbridge, Northumberland		22	Bishop and Dore 1989
COSG	Cosgrove, Northamptonshire		2	Butcher 1991a
DEEP	Deepdale, Derbyshire		3	in Buxton Museum
DERB	Derby		5	Mackreth 1985a

DODD	Dodderhill, Worcestershire		7	Butcher forthcoming c
DORC	Dorchester, Dorset		22	CP: Butcher 1982b; AA: Henig and Morris 2002; WH: unpublished
DOVE	Dover, Kent		2	Parfitt 1989
DRAG	Dragonby, Lincolnshire	13	83	Olivier with Bayley 1996
GARD	Garden Hill, Kent		3	–
GDUN	Great Dunmow, Essex		2	Butcher and Bayley 1988b
GEST	Gestingthorpe, Essex		12	Butcher 1985a
GLOU	Gloucester		7	Pitts 1985
GORH	Gorhambury, Hertfordshire	20	27	Butcher 1990a
HAYL	Hayling Island, Hampshire	33	89	Butcher forthcoming d
HENL	Henley Wood, Somerset		23	Butcher 1996
HEYB	Heybridge, Essex		2	Wickenden 1986
HOUS	Housesteads, Northumberland	3	17	Allason-Jones 1988a
ICKH	Ickham, Kent		13	Riddler <i>et al</i> forthcoming
ILCH	Ilchester, Somerset		7	Butcher 1994; Leach and Ellis 1991
INWO	Inworth, Essex		1	–
KEST	Keston, Kent		12	Philp <i>et al</i> 1991
KILH	Kilhallon, Cornwall		1	Butcher 1982c
LAMY	Lamyatt Beacon, Somerset		3	Butcher 1986
LANC	Lancaster		2	–
LECH	Lechlade, Gloucestershire	3	6	Allen <i>et al</i> 1993
LEIC	Leicester: various sites	4	7	Hebditch and Mellor 1973; Mackreth and Butcher 1994
LOND	London: various sites		336	in Museum of London
LULL	Lullingstone, Kent		1	Meates 1987a
MAGI	Magiovinium, Buckinghamshire	5	15	Butcher 1987b
MAXE	Maxey, Northamptonshire		5	Crummy 1985
NORN	Nornour, Isles of Scilly	124	20	Hull 1968b; Butcher forthcoming e
OLDW	Old Windsor, Berkshire		1	–
OPEN	Old Penrith, Cumberland		18	Butcher 1991b
OUDE	Oudenaarde, Belgium	4	3	–
PAPC	Papcastle, Cumberland		10	–
PIER	Piercebridge, Durham	18	29	Scott and Fitzpatrick in prep
POOL	Poole's Cavern, Derbyshire		28	Mackreth 1983; Bayley and Branigan 1989
POUN	Poundbury, Dorset		5	Davies 1987
PRES	Prestatyn, Flint	18	6	Mackreth 1989
REDC	Redcliff, Yorkshire	5	5	Crowther and Didsbury 1988
RICH	Richborough, Kent	340	103	Bushe-Fox 1926, 1928; Radford

				1932; Henderson 1949; Hull 1968a
SALF	Salford, Bedfordshire		8	Dawson forthcoming
SAND	Sandy, Bedfordshire		49	in Bedford Museum
SEAM	Sea Mills, Bristol		12	Butcher 1987c
SEAT	Seaton, Devon		3	Miles 1977
SEWN	Sewingshields, Northumberland	2		Allason-Jones 1984
SHEP	Colchester: Sheepen, Essex	22	20	Bayley and Butcher 1985
SHOR	Shortlanesend, Cornwall	1		Butcher in Harris 1980
SNET	Snettisham, Norfolk		33	Mackreth 2001
STAL	St Albans, Hertfordshire	107	69	Stead and Rigby 1989
STAN	Stanwick, Northamptonshire		141	Neal <i>et al</i> forthcoming
SWIN	Swindon Hill, Wiltshire	2	5	–
TARH	Tarrant Hinton, Dorset	8	20	–
TATT	Tattershall Thorpe, Lincolnshire		1	unpublished
THIS	Thistleton, Rutland	19	51	unpublished
THOR	Thorpe by Newark, Nottinghamshire		2	–
TIDD	Tiddington, Warwickshire	26	43	Palmer in prep
TRET	Trethurgy, Cornwall		2	Quinnell in prep
ULEY	Uley, Gloucestershire	18	19	Butcher with Bayley 1993
VELZ	Velzeke, Belgium	16	12	–
VIND	Vindolanda, Northumberland		6	Allason-Jones <i>et al</i> 1985
WAKE	Wakerley, Northamptonshire		9	Jackson and Ambrose 1978
WALL	Walls, Dorset		12	Butcher 1985b
WANB	Wanborough, Wiltshire	45	91	Butcher 2001
WEEK	Weekley, Northamptonshire		17	Jackson and Dix 1987
WELT	Welton Wold, Yorkshire	4	7	–
WHIT	Whitcombe, Dorset	2	1	Butcher 1990b
WICF	Wickford, Essex	9	16	Rodwell in prep
WICL	Wicklewood, Norfolk		49	–
WIGG	Wigginton, Oxfordshire		1	–
WILD	Wilderspool, Cheshire		1	Hinchliffe <i>et al</i> 1992
WINC	Winchester, Hampshire		25	Crummy, Ottaway and Rees in prep
WITC	Witcombe, Gloucestershire		5	Butcher 1998
WNEW	Water Newton, Huntingdonshire		1	–
WORC	Worcester		31	Mackreth 1992
WPER	Wharram Percy, Yorkshire		1	Bayley <i>et al</i> 1981
WROX	Wroxeter, Shropshire	18	56	in EH store
XXXX	Other/unknown		1	–
YORK	York: various sites		15	in The Yorkshire Museum

1063

2360

Table 20 **Codes used to describe applied decoration** (in Decor column, Tables 22 and 23)

<i>Decoration</i>	<i>Code</i>	<i>Description</i>
Gilding	G	No information on type of gilding
	Gm	Mercury gilding
	Gl	Leaf gilding (no mercury detected)
Tinning	T	Surface coating meant to be visible
	Ts	Tinning definitely/probably originally covered by solder
	S	Lead-tin solder survives (see also M below)
Metal	M	Sheet metal and/or wire applied (soldered) to surface
	Mc	Applied metal is copper or one of its alloys
	Mb	Applied metal is brass
	Ms	Applied metal is silver
	Mt	Applied metal is tin
Inlay	Ic	Inlaid metal is copper
	Is	Inlaid metal is silver
	Ii	Inlaid metal is iron
	It	Inlaid metal is tin or tin-lead alloy
	Il	Inlaid metal is lead
Niello	N	
Enamel	E	Type of enamel uncertain/unknown
	Es	Simple enamel: one colour per field
	Et	Two-colour: some fields contain more than one colour
	Ec	Circles/spots of second colour in field
	Ecc	Spots are ends of cylinders
	Ech	Spots are hemispheres
	Ece	Spots are 'eyes' with two concentric colours
	Ej	Field contains juxtaposed blocks of different colours
	Em	Some or all of the blocks are millefiori
	Attachment	A
Ac		Glass cabochon, cone or intaglio
As		Glass sphere
Am		Metal (copper alloy) cone
Riveted	R	Decoration riveted on

Rb Bone plate
Rg Annular glass bead
Rs Enamelled stud

? Following a code indicates uncertainty
() Round a code indicates the decoration is now lost

Table 21 Codes used to describe enamel colours (in Enamel column, Tables 22 and 23)

<i>Code</i>	<i>Colour</i>
R	Red
O	Orange
Y	Yellow
N	Golden brown
G	Green
T	Turquoise
B	Blue
P	Purple
K	Black
W	White
X	Now appears greenish, original colour uncertain
.	Codes following a full stop are the colours of the millefiori rods

Site,AML No,Site No,Pub No,Type,Decor,Enamel,Cu%,Zn%,Sn%,Pb%,Ag%,Alloy

KEST,841269,,91,1,,,,,,,,,bronze
THIS,,THZ624,,1B,,,,,,,,,bronze
STAN,8700081,,,2,,,,,,,,,bronze
RICH,7350293,999,33,3,,,77.5,19.2,1.2,0.2,0.0,brass
RICH,7351547,5006,34,3,,,82.3,17.7,2.8,0.3,0.0,brass
HAYL,,145b,,3,,,86.5,1.1,14.0,1.7,0.1,bronze
HAYL,,2356,,3,,,83.3,0.1,11.4,6.7,0.0,(lead) bronze
HAYL,,1960,,3,,,,,,,,,bronze
SWIN,770328,112,,3?,,,,,,,,,bronze
ILCH,,17,1,3A,,,,,,,,,bronze
DODD,8515510,,,3B,,,,,,,,,brass
RICH,7351753,1265A,32,3C,,,79.5,16.7,1.5,0.3,0.0,brass
HAYL,,3388,,5,,,79.2,0.2,9.7,0.6,0.3,bronze
LECH,,1959-9,1,9,,,,,,,,,bronze
HAYL,,1420,,9,,,,,,,,,bronze
HAYL,,1729,,9,,,81.3,0.2,13.1,0.2,0.1,bronze
HAYL,,1023,,9,,,,,,,,,bronze
HAYL,,3325,,9,,,,,,,,,bronze
HAYL,,825,,9?,,,76.3,0.0,7.4,0.2,0.1,bronze
HAYL,,2813,,9?,,,77.7,0.0,10.6,0.1,0.1,bronze
HAYL,,2029,,9?,,,97.7,0.0,14.1,0.7,0.1,bronze
HAYL,,30,,9?,,,,,,,,,bronze/gunmetal
HAYL,,93,,9?,,,,,,,,,bronze
HAYL,,530,,9?,,,,,,,,,bronze
HAYL,,1662,,9?,,,,,,,,,bronze
HAYL,,3014,,9?,,,,,,,,,bronze
HAYL,,3222,,9?,,,,,,,,,bronze
HAYL,,2909,,9?,,,,,,,,,bronze
BALD,,1,9A,,,,,,,,,bronze
WANB,,,1,9A,,,,,,,,,brass/gunmetal
SALF,,2,,9B,,,,,,,,,bronze
TARH,,259,,9C,,,,,,,,,bronze
TARH,,197,,9/10/11,,,,,,,,,bronze
WEEK,781378,21,3,10,,,,,,,,,bronze
WEEK,781396,76,4/5?,10,,,,,,,,,bronze
MAGI,,15,10,,,,,,,,,bronze
SHEP,,1,10,,,,,,,,,brass
GEST,777260,BR59,1,10,,,,,,,,,bronze
WANB,,,2,10,,,,,,,,,brass?
WANB,,,5,10,,,,,,,,,bronze
WANB,,,6,10,,,,,,,,,gunmetal
WANB,,707353,,7,10,,,,,,,,,gunmetal
WANB,,,9,10,,,,,,,,,bronze
WANB,,,10,10,,,,,,,,,(lead) bronze
WANB,,,12,10,,,,,,,,,bronze
WANB,,,21,10,,,,,,,,,(lead) bronze
WANB,,,24,10,,,,,,,,,brass
WANB,684356,,25,10,,,,,,,,,brass
WANB,692708,,26,10,,,,,,,,,brass
HAYL,,1400,,10,,,81.0,0.0,10.4,0.4,0.2,bronze
HAYL,,87,,10,,,82.8,5.5,4.7,3.2,0.1,gunmetal
ASHT,835122,542,,10,,,,,,,,,gunmetal

ASHT,835108,680,,10,,,,,,,,,brass
THIS,610986,BH760,,10,,,,,,,,,brass
THIS,610987,BH761,,10,,,,,,,,,brass
THIS,610990,BH794,,10,,,,,,,,,brass
HAYL,,5,,10,,,,,,,,,brass
HAYL,,65,,10,,,,,,,,,brass
HAYL,,68,,10,,,,,,,,,brass
HAYL,,1932,,10,,,,,,,,,brass
CARL,,BLAAe138,15,10,,,,,,,,,gunmetal
RICH,7351873,,14,10,,,,,,,,,bronze
RICH,7351883,,15,10,,,,,,,,,bronze
LOND,,GPO188,,10,,,,,,,,,brass
LOND,,LCT1302,,10,,,,,,,,,gunmetal
WEEK,781382,30,47,10?,,,,,,,,,bronze
WANB,,,16,10?,,,,,,,,,bronze
GORH,820266,2338,1,10?,,,,,,,,,bronze
GORH,820031,26,2,10?,,,,,,,,,bronze
HAYL,,378,,10?,,,,,,,,,bronze
HAYL,,1996,,10?,,,,,,,,,bronze
WEEK,781401,87,6,10A,,,,,,,,,bronze
BALD,,19,10A,,,,,,,,,bronze/gunmetal
WANB,681065,,8,10A,,,,,,,,,bronze
RICH,7351501,4978,3,10A,,,86.4,0.0,10.1,2.4,0.1,bronze
RICH,7351581,3469,1,10A,,,88.8,0.0,11.2,2.6,0.1,bronze
WINC,,VR-449,,10A,,,,,,,,,bronze
STAN,8700352,,,10A,,,,,,,,,bronze/gunmetal
WEEK,781411,190,7,10B,,,,,,,,,gunmetal
OUDE,,6,,10B,,,,,,,,,gunmetal
RICH,7350077,,9,10B,,,84.3,5.1,5.3,0.0,0.0,gunmetal
RICH,7350068,2367,7,10B,,,90.2,0.3,4.4,3.0,0.0,bronze
RICH,7350092,862,10,10B,,,85.3,2.8,6.7,1.2,0.0,bronze/gunmetal
RICH,7350094,1649,2,10B,,,70.9,24.5,0.0,0.3,0.1,brass
RICH,7351548,4076,8,10B,,,91.5,1.7,10.2,1.0,0.1,bronze
STAL,670417,,A1,10B,,,,,,,,,bronze
ICKH,746632,388,,10B,,,,,,,,,bronze
LOND,,97,,10B,,,,,,,,,gunmetal?
SAND,,267,,10B,,,,,,,,,bronze
SAND,,1171,,10B,,,,,,,,,bronze
SAND,,3928,,10B,,,,,,,,,bronze
SALF,,1,,10B,,,,,,,,,bronze
STAN,8800924,,,10B,,,,,,,,,bronze
STAL,670468,,A4,10B?,,,,,,,,,brass
BALD,,,25,10C,,,,,,,,,bronze
BALD,,,32,10C,,,,,,,,,bronze
BALD,,,33,10C,,,,,,,,,bronze
BALD,,,40,10C,,,,,,,,,brass
BALD,,,41,10C,,,,,,,,,brass
TIDD,,82-236,,10C,,,,,,,,,bronze
TIDD,,82-200,,10C,,,,,,,,,bronze
COLE,,1018,1,10C,,,,,,,,,(leaded) bronze
COLE,,1088,2,10C,,,,,,,,,bronze
RICH,7351038,4957,19,10C,,,,,,,,,bronze
RICH,7350096,1860,23,10C,,,87.2,12.3,1.0,0.3,0.1,brass
RICH,7351525,4806,24,10C,,,80.6,19.1,0.0,0.2,0.0,brass

RICH,7351751,1049,18,10C,,,72.5,27.3,0.0,0.0,0.1,brass
BALD,7211100,,23,10C,,,83.8,2.5,11.0,2.0,0.1,bronze
BALD,7211230,,39,10C,,,73.5,27.7,0.9,0.1,0.0,brass
ASHT,835123,638,,10C,,,,,,,,,bronze
ALDB,78108256,,303,10C,,,,,,,,,bronze/gunmetal
CARL,,BLAAe217,7,10C,,,,,,,,,gunmetal
STAL,670523,,A3,10C,,,,,,,,,bronze
STAL,682695,,A2,10C,,,,,,,,,gunmetal
CAST,,15-680,1,10C,,,,,,,,,gunmetal
LOND,,A28337,,10C,,,,,,,,,bronze
SAND,,512,,10C,,,,,,,,,bronze
ULEY,,3605,Fig123:2,10D,,,,,,,,,brass
ULEY,,3717,Fig123:1,10D,T,,,,,,,,,bronze
ULEY,,6062,Fig123:3,10D,,,,,,,,,bronze/gunmetal
DRAG,,DR68VG,,10D,,,,,,,,,bronze
STAN,8701776,,10D,,,,,,,,,bronze
WROX,721368,,10F,,,84.5,15.1,1.9,0.0,0.1,brass
CAST,,1-508,3,10F,,,,,,,,,brass
LOND,,A22346,,10F+,,,,,,,,,bronze
OUDE,,9,,10G,,,,,,,,,bronze
OUDE,,10,,10G,,,,,,,,,bronze
RICH,7351529,4326,13,10G,,,,,,,,,bronze
OUDE,,7,,10G,,,87.8,1.8,11.0,0.3,0.1,bronze
OUDE,,8,,10G,,,87.9,0.4,17.0,0.4,0.1,bronze
WINC,,VR-1030,,10G,,,,,,,,,bronze
LOND,,98,,10G,,,,,,,,,bronze
LOND,,13861,,10G,,,,,,,,,brass/gunmetal
LOND,,19280,,10G,,,,,,,,,brass/gunmetal
LOND,,A28562,,10G,,,,,,,,,brass
BRAU,,496,15,10H,,,,,,,,,brass
SALF,,8,,10H,,,,,,,,,bronze
SALF,,9,,10H,,,,,,,,,bronze
BALD,,,20,10/11A,,,,,,,,,gunmetal
BALD,,,22,10/11A,,,,,,,,,bronze
SWIN,770764,92,,10/11,,,,,,,,,bronze
MAXE,,2800/7658,3,10/11?,,,,,,,,,,bronze
MAXE,,M80-41-2740,5,10/11,,,,,,,,,bronze/gunmetal
WANB,,,11,10/11,,,,,,,,,bronze
WANB,,,13,10/11,,,,,,,,,brass
WANB,,,27,10/11,,,,,,,,,brass
RICH,7350776,845,5,10/11,,,,,,,,,bronze
RICH,7351506,4201,6,10/11,,,,,,,,,bronze
RICH,7350772,835,17,10/11,,,,,,,,,bronze
RICH,7350071,1272,11,10/11,,,,,,,,,gunmetal
RICH,7350074,2747,21,10/11,,,76.2,20.7,0.6,0.0,0.1,brass
RICH,7350107,1846,20,10/11,,,90.4,0.0,8.8,0.2,0.1,bronze
GORH,820348,3295,8,10/11,,,,,,,,,bronze
THIS,,THZ2233,,10/11,,,,,,,,,bronze/gunmetal?
HAYL,,3030,,10/11?,,,,,,,,,,brass
DRAG,,DR65EG,35,10/11,,,,,,,,,brass
HAYL,,KP4,,10/11?,,,,,,,,,,gunmetal
RICH,7351884,,30,10/11,,,,,,,,,bronze
RICH,7351885,,29,10/11,,,,,,,,,bronze/copper
LOND,,CASS61,,10/11,,,,,,,,,bronze

LOND,,GPO105,,10/11,,,,,,bronze
LOND,,GPO3758,,10/11,,,,,,bronze
LOND,,LEA320,,10/11,,,,,,brass
LOND,,18158,,10/11,,,,,,bronze
LOND,,O.1817B,,10/11,,,,,,bronze
STAN,8701531,,10/11,,,,,,brass
STAN,8800722,,10/11?,,,,,,bronze
STAN,8612948,,10/11,,,,,,bronze
WORC,,3899-7004,,10/11,,,,,,gunmetal
SALF,,4,,10/11,,,,,,bronze
STAN,9002036,,10/11,,,,,,bronze
BALD,,,3,10/11?,,,,,,bronze
BALD,,,2,10/11?,,,,,,brass
BALD,,,4,10/11?,,,,,,bronze
BALD,,,5,10/11?,,,,,,bronze
BALD,,,6,10/11?,,,,,,bronze
BALD,,,7,10/11?,,,,,,bronze
BALD,,,8,10/11?,,,,,,bronze
BALD,,,9,10/11?,,,,,,bronze/gunmetal
BALD,,,10,10/11?,,,,,,bronze/gunmetal
BALD,,,11,10/11?,,,,,,bronze
BALD,,,12,10/11?,,,,,,bronze
BALD,,,21,10/11,,,,,,bronze
BALD,,,30,10/11,,,,,,bronze
BALD,,,42,10/11,,,,,,bronze
BALD,,,43,10/11,w,,,,,,brass
WINC,,VR-236,,10/11,,,,,,brass
RICH,7350559,2029,69,10/11,,,,,,brass/gunmetal
BRAU,,106,14,11,,,,,,bronze/gunmetal
BRAU,,225,4,11,,,,,,bronze
BRAU,,356,9,11,,,,,,bronze
DORC,,,CP4,11,,,,,,brass
MAGI,779208,,3,11,,,,,,bronze
WICF,,259,,11,,,,,,bronze
WANB,,,3,11,,,,,,bronze
WANB,,,4,11,,,,,,brass
WANB,,,14,11,,,,,,brass
WANB,,,15,11,,,,,,copper
WANB,,,17,11,,,,,,copper
WANB,,,18,11,,,,,,bronze/gunmetal
WANB,,,19,11,,,,,,bronze
WANB,,,22,11,,,,,,(leaded) gunmetal
WANB,,,23,11,,,,,,gunmetal
KEST,841268,,87bis,11,,,,,,bronze
KEST,841237,,86,11,,,,,,bronze
KEST,841270,,87bis,11,,,,,,bronze
BRAU,,1036,2,11,,,,,,brass
BRAU,,453,3,11,,,,,,bronze
BRAU,,433,5,11,,,,,,bronze
BRAU,,774,8,11,,,,,,bronze
BRAU,,564,10,11,,,,,,brass
BRAU,,904,11,11,,,,,,brass
BRAU,,1025,13,11,,,,,,bronze
RICH,7350050,1979,27,11,,,91.5,2.6,7.2,1.1,0.0,bronze/gunmetal

RICH,7350063,917,28,11,,,77.5,19.4,1.6,0.2,0.0,brass
RICH,7351048,2573,16,11,,,84.5,1.1,6.0,0.0,0.3,bronze
HAYL,,1398,,11,,,51.9,0.0,6.4,0.7,0.0,bronze
HAYL,,2975,,11,,,84.1,0.1,9.6,0.1,0.0,bronze
WROX,721365,,,11,,,89.6,0.4,8.3,1.3,0.5,bronze
GORH,811385,,3,11,,,83.9,0.2,16.2,1.4,0.1,bronze
GORH,811389,,6,11,,,88.3,0.0,12.5,0.0,0.1,bronze
TIDD,,81-644,,11,,,87.7,3.5,6.8,0.5,0.0,bronze/gunmetal
GORH,820284,2514,4,11,,,,,,bronze
GORH,820227,1546,5,11,,,,,,bronze
GORH,820334,2967,7,11,,,,,,bronze
WITC,732331,bz93,1,11,,,,,,bronze
HAYL,,1,,11,,,,,,brass
HAYL,,159,,11,,,,,,bronze
HAYL,,223,,11,,,,,,bronze
HAYL,,562,,11,,,,,,bronze
HAYL,,1006,,11,,,,,,bronze/gunmetal
HAYL,,2068,,11,,,,,,bronze
HAYL,,2303,,11,,,,,,bronze
HAYL,,2386,,11,,,,,,bronze
HAYL,,2927,,11,,,,,,bronze
HAYL,,2953,,11,,,,,,bronze
HAYL,,58,,11,,,,,,bronze
CHEL,,CHAG29,,11,,,,,,bronze
CHEL,,CHN14,,11,,,,,,brass
CHEL,,CHKAe207,2:4,11,,,,,,gunmetal
CHEL,,CHMAe275,2:2?,11,,,,,,bronze
CHEL,,CHKAe206,2:5,11,,,,,,bronze
CHEL,,CHKAe209,2:3,11,,,,,,bronze
LOND,,GPO325,,11,,,,,,brass
LOND,,LCT1154,,11,,,,,,bronze
LOND,,LYD793,,11,,,,,,brass
LOND,,MC20,,11,,,,,,brass
LOND,,3422,,11,,,,,,bronze
SNET,,Cat28,,11,,,,,,bronze
SAND,,1354,,11,,,,,,bronze
SAND,,2289,,11,,,,,,bronze
SAND,,3573,,11,,,,,,bronze
HAYL,,1015,,11?,,,,,,bronze
HAYL,,2152,,11?,,,,,,bronze
HAYL,,3443,,11?,,,,,,bronze
CHEL,,CHAG33,,11?,,,,,,bronze
CHEL,,CHV7,,11?,,,,,,bronze
BALD,,,15,11A,,,,,,bronze
BALD,,,16,11A,,,,,,bronze/gunmetal
BALD,,,17,11A,,,,,,bronze
BALD,,,18,11A,,,,,,bronze
RICH,7351585,2556,4,11A,,,,,,bronze
RICH,7351178,4400,31,11A,,,89.6,11.3,1.7,0.6,0.0,brass
WINC,,VR-1013,,11A,,,,,,bronze/gunmetal
LOND,,A24066,,11A,,,,,,bronze
LOND,,16978,,11A,,,,,,bronze
LOND,,16980,,11A,,,,,,bronze
LOND,,16979,,11A,,,,,,brass

STAN,8700812,,11A?,,,,,,,,,,gunmetal
BALD,,29,11B,,,,,,,,,bronze
BALD,,37,11B,,,,,,,,,brass
BALD,,38,11B,,,,,,,,,bronze/gunmetal
BALD,715557,,31,11B,,92.8,0.0,5.6,1.3,0.3,bronze
TARH,,795,,11B,,,,,,,,,bronze
COLC,,1.81-229,CS1,11B,,,,,,,,,brass
COLC,,1.81-2298,CS2,11B,,,,,,,,,bronze
COLC,,1.81-2619,CS3,11B,,,,,,,,,bronze/gunmetal
DRAG,,DR66JL,26,11B,,,,,,,,,brass
WINC,,VR-1043,,11B,,,,,,,,,bronze/gunmetal
WINC,,VR-3176,,11B,,,,,,,,,gunmetal
ICKH,,2039,,11B,,,,,,,,,gunmetal
LOND,,20372,,11B,,,,,,,,,bronze
LOND,,19559,,11B,,,,,,,,,bronze/gunmetal
LOND,,13091,,11B,,,,,,,,,gunmetal
STAN,8516932,,11B,,,,,,,,,bronze
STAN,8612939,,11B,,,,,,,,,(leaded) bronze
STAN,8700404,,11B,,,,,,,,,brass/gunmetal
SAND,,1576,,11B,,,,,,,,,bronze
BALD,,28,11C,,,,,,,,,bronze
BALD,,34,11C,,,,,,,,,bronze
HEYB,,Ae405,10.1,11C,,,,,,,,,bronze
RICH,7351503,4996,22,11C,,84.1,15.0,1.8,0.2,0.1,brass
RICH,7351510,4167,25,11C,,95.1,0.4,8.3,0.7,0.1,bronze
RICH,7351758,2260,26,11C,,89.0,12.9,1.0,0.4,0.1,brass
BALD,7210306,,26,11C,,84.6,1.7,10.2,0.6,0.5,bronze
BALD,715590,,24,11C,,87.6,0.9,1.5,0.4,0.6,copper
BALD,7210363,,35,11C,,86.8,0.1,11.6,2.3,0.1,bronze
BALD,7210420,,27,11C,,87.3,0.4,6.6,2.3,0.1,bronze
BALD,7211174,,36,11C,,78.7,7.3,6.9,8.2,0.1,leaded gunmetal
TARH,,216,,11C,,,,,,,,,brass
COLC,,1.81-5092,CS6,11C,,,,,,,,,bronze/gunmetal
COLC,,1.81-4186,CS7,11C,,,,,,,,,brass
COLC,,1.81-595,CS4,11C,,,,,,,,,brass/gunmetal
COLC,,1.81-620,CS5,11C,,,,,,,,,bronze
DRAG,,DR63HQ,27,11C,,,,,,,,,gunmetal
DRAG,,DR70BZP,25,11C,,,,,,,,,brass
STAN,8516930,,11C,,,,,,,,,bronze
SAND,,1533,,11C,,,,,,,,,bronze
STAN,8901905,,11C,,,,,,,,,brass
GORH,811365,924,9,11+?,,,,,,,,,,bronze
HENL,734858,711,6,13,,,,,,,,,bronze
BRAU,,974,7,13,,,,,,,,,bronze
HAYL,,3007,,13,,90.0,0.1,11.4,0.9,0.2,bronze
BRAU,,886,52,13,,85.7,0.8,9.3,0.7,0.2,bronze
GORH,820259,2149,10,13,,,,,,,,,bronze
TARH,,743,,13,,,,,,,,,bronze
CARV,,33,13?/17?,,,,,,,,,,copper
DORC,7816092,,WH,14?,,,,,,,,,,bronze
TIDD,,82-242,,14?,,,,,,,,,,brass
SALF,,6,,15,,,,,,,,,bronze
LOND,,WIV525,,16?,,,,,,,,,,bronze
DORC,,CP12,17,,,,,,,,,bronze

BALD,,126,17,,,,,,brass
HENL,734859,712,7,17,,,,,,bronze
CLEE,830090,,17,,,,,,bronze
WANB,,41,17,,,,,,brass
WANB,,41,17,,,,,,bronze
TARH,,803,,17,,,,,,bronze
TARH,,380,,17,,,,,,bronze
TARH,,874,,17,,,,,,bronze
POUN,,Ae18,12,17,,,,,,gunmetal
TARH,,127,,17?,,,,,,(lead) gunmetal
WALL,,5,17A,,,,,,bronze
WALL,,6,17A,,,,,,bronze/gunmetal
WROX,721374,,17A?,,,89.7,0.0,7.6,1.3,0.0,bronze
WALL,,8,17A?,,,,,,bronze/gunmetal
TIDD,,M600,,17B,(R) ,,,,,,bronze
WALL,,2,17B,,,,,,bronze/gunmetal
WALL,,7,17B,,,,,,bronze
DORC,7816710,,WH,17B?,,,,,,bronze
BRAU,,71/342,1,18,,76.4,0.1,10.2,0.4,0.0,bronze
BALD,,13,18?,,,,,,bronze
BALD,7211214,,14,18?,,,81.1,2.0,5.6,6.7,0.1,(lead) bronze/gunmetal
WEEK,781374,12,1,19,,,,,,bronze
WEEK,781376,19,2,19,,,,,,bronze
LOND,,81.279/1,,19,,,,,,bronze
SALF,,3,,19,,,,,,bronze
SALF,,10,,19,,,,,,bronze
ICKH,746476,1616,,20,,,,,,bronze
HAYL,,3167,,20?,,,,,,bronze
BRAU,,341,,Gp=1,,,,,,bronze
BRAU,,954,17,Gp=1,,,,,,bronze
WICF,,351,,Gp=1,,,,,,bronze
WICF,,283,,Gp=1,,,,,,bronze
MAXE,,2680/7667,1,Gp=1,,,,,,bronze
WANB,,20,Gp=1,,,,,,bronze/gunmetal
BRAU,,1103,16,Gp=1,,,,,,bronze
RICH,7350102,667,12,Gp=1,,86.1,1.8,6.0,3.5,0.1,bronze
CHEL,,CHAA2,1:13,Gp=1,,87.8,2.6,8.6,4.4,0.1,(lead) bronze
ASHT,835148,,Gp=1,,,,,,bronze
STAL,670495,,A6,Gp=1,,,,,,brass
STAL,670453,,A5,Gp=1,,,,,,bronze
RICH,7351876,,70,Gp=1,,,,,,bronze
RICH,7351887,,71,Gp=1,,,,,,bronze
RICH,7350081,1575,68,Gp=1,,89.8,5.6,9.8,0.2,0.1,bronze/gunmetal
BRAU,,276,6,Gp=1?,,,,,,bronze
GORH,820150,,Gp=1?,,,85.9,0.2,12.1,1.3,0.1,bronze
WALL,,4,Gp=1?,,,,,,bronze
LOND,,WIV233,,Gp=1?,,,,,,bronze
STAN,9191233,,Gp=1?,,,,,,bronze
WANB,684406,,35,Gp=1?,,,,,,bronze
WANB,,36,Gp=1?,,,,,,bronze/gunmetal
WANB,,37,Gp=1?,,,,,,bronze
WANB,,147,Gp=1/4?,,,,,,bronze
WANB,,61,Gp=1/5?,,,,,,brass
BALD,,88,21,,,,,,brass

BALD,,91,21,It,,,,,,brass
BALD,,92,21,,,,,,brass/gunmetal
BALD,,93,21,T,,,,,,brass
BALD,,94,21,,,,,,brass
BALD,,95,21,,,,,,brass
MAGI,7711196,,2,21,,,,,,brass/gunmetal
WAKE,745074,124,1,21,T,,,,,,gunmetal
TIDD,,82-73,,21,,,,,,(leaded) brass
TIDD,,M18,,21,,,,,,brass/gunmetal
WANB,,43,21,,,,,,brass
BRAU,,396,40,21,,,,,,brass
BRAU,,921,41,21,,,,,,gunmetal
SHEP,,13,21,T,,75.0,18.1,4.0,0.6,0.0,brass
SHEP,,15,21,T,,81.5,14.3,2.6,1.6,0.1,brass
SHEP,722212,,14,21,,78.6,14.5,2.4,0.7,0.1,brass
SHEP,722214,,16,21,,71.2,18.9,1.5,0.1,0.0,brass
THIS,,THZ1179,,21,,66.3,15.6,2.6,0.7,0.0,brass
HAYL,,674,,21,,,,,,brass
HAYL,,182,,21,T,,67.9,10.3,3.6,0.7,0.0,brass/gunmetal
BALD,7211143,,87,21,,71.2,17.1,1.9,0.2,0.1,brass
BALD,707054,,90,21,,73.5,24.5,0.5,2.4,0.0,brass
BALD,7211139,,89,21,,72.9,21.8,3.5,0.4,3.0,brass
TIDD,,M589,,21,,76.1,16.9,2.1,0.5,0.2,brass
GORH,811383,,11,21,,79.1,17.3,2.8,0.5,0.2,brass
GORH,820252,,12,21,,77.7,17.5,2.7,0.6,0.1,brass
BRAU,,824,39,21,T,,82.5,16.3,2.0,0.3,0.2,brass
BRAU,,514,38,21,,72.1,17.9,2.6,0.3,0.1,brass
BRAU,,1045,43,21,,79.2,20.8,1.4,0.3,0.1,brass
BRAU,,434,37,21,,78.0,22.9,0.9,0.1,0.1,brass
BRAU,,1069,42,21,,87.5,15.3,1.7,0.3,0.1,brass
PRES,,1924,22,21,,,,,,brass
REDC,8650620,1007,,21,T,,15.2,1.8,1.1,0.0,brass
REDC,8650619,1000,,21,It,,16.1,2.3,1.1,0.0,brass
THIS,611047,BH1665,,21,,,,,,brass
STAN,8800718,,21,,,,,,brass
SAND,,1686,,21,It,,,,,,brass
SAND,,3930,,21,It,,,,,,brass
WICL,,46,,21?,,,,,,gunmetal
STAL,682718,,E18,21?,,,,,,brass
STAL,,E27,21?,,,,,,brass
WAKE,745080,136,2,21A,T,,,,,,gunmetal
STAL,670491,,E12,21A,,75.3,22.6,0.9,1.3,0.1,brass
STAL,670296,,E2,21A,,82.6,12.4,1.7,0.3,0.0,brass
STAL,670420,,E1,21A,,81.9,16.6,3.1,0.7,0.1,brass
STAL,670490,,E13,21A,,79.6,16.1,2.0,1.3,0.1,brass
STAL,670439,,E14,21A,,76.7,20.7,1.9,1.0,0.0,brass
DRAG,,DR67PY,54,21A,,,,,,brass
STAL,682724,,E6,21A/B,,78.1,19.7,2.4,0.5,0.0,brass
STAL,670421,,E19,21A/B,,76.0,19.4,0.8,0.3,0.1,brass
STAL,682676,,E29,21A/B,,85.6,11.0,6.1,0.3,0.0,gunmetal
STAL,682671,,E15,21A/B,,77.9,16.4,3.5,2.6,0.0,brass
STAL,4520,,E8/E9,21A/B,,77.8,18.9,3.0,1.2,0.7,brass
STAL,682673-4,,E23,21A/B,,,,,,brass
STAL,682711,,E25,21A/B,,,,,,brass

STAL,670487,,E17,21A/B,,,,,,,,,brass
STAL,4520,,E8/E9,21A/B?,,,77.0,16.3,2.8,2.8,0.1,brass
STAL,682682,,E24,21A/B?,,,,,,,,,brass
STAL,670426,,E7,21B,,,79.3,19.7,2.3,1.6,0.1,brass
STAL,682684,,E4,21B,,,89.7,10.2,2.4,0.2,0.0,brass
STAL,4535,,E11,21B,,,76.1,20.7,1.9,0.4,0.0,brass
STAL,682678,,E28,21B,,,,,,,,,brass
STAL,682688,,E26,21B,,,,,,,,,brass
STAL,682677,,E16,21B,,,,,,,,,brass
STAL,4579,,E10,21B,,,,,,,,,brass
DRAG,,DR67TA,53,21B,T,,,,,,,,,brass
STAN,8800687,,,21B,,,,,,,,,brass
STAL,670484,,E21,21B?,,,,,,,,,brass
STAL,4518,,L3,22,Ic,,,,,,,,,brass
GEST,,,3,22?,,,,,,,,,gunmetal
RICH,7351522,4502,72,22A,,,78.4,16.6,4.2,1.1,0.0,brass/gunmetal
STAL,4542,,J1,22A,,,79.8,19.5,2.2,1.0,0.0,brass
BALD,777938,,86,22A,,,74.8,17.9,1.8,0.9,0.1,brass
WANB,,,44,22A,,,79.0,14.7,1.7,0.0,0.0,brass
STAL,670637,,J2,22A?,,,80.4,16.0,1.7,1.1,0.1,brass
STAL,682708,,K2,22C,,,75.6,19.2,2.4,0.1,0.0,brass
STAL,670485,,L4,22C,,,,,,,,,brass
STAL,670434,,K1,22C?,,,,,,,,,brass
STAL,4531,,L6,23,Mc,,,,,,,,,brass
BALD,7210439,,102,23?,S,,78.5,15.7,2.7,6.1,0.1,(lead) brass
SHEP,,,17,23/24/29A,T,,73.9,15.3,2.3,3.4,0.0,brass
STAN,8800083,,,24,S(M),,,,,,,,,brass
SHEP,722333,,18,24/29A?,T,,,,,,,,,brass
BALD,,,96,25,,,,,,,,,brass
BALD,,,97,25,,,,,,,,,brass
HAYL,,1843,,25,,,,,,,,,brass
LOND,,84.306/11,,25,,,,,,,,,brass
DRAG,,DR70ZE,57,25B,,,,,,,,,brass
SNET,,Cat27,,25C,,,,,,,,,brass
RICH,7351886,,73,25/26?,Mc,,,,,,,,,brass
SHEP,722336,,21,26,,,,,,,,,brass
GORH,820084,,13,26,,,74.3,19.0,2.7,1.1,0.1,brass
GORH,820106,626,14,26,,,,,,,,,bronze/gunmetal?
HAYL,,145a,,26,T,,,,,,,,,brass
HAYL,,2677,,26,,,,,,,,,brass
STAL,4552,,F16,26A,,,,,,,,,brass
STAL,4553,,F12,26A,,,,,,,,,brass
STAL,4554,,F17,26A,,,,,,,,,brass
STAL,4581,,F5,26A,,,,,,,,,brass
STAL,4582,,F14,26A,,,,,,,,,brass
BALD,,,98,26A,,,,,,,,,brass
SHEP,722203,,19,26A,,,,,,,,,brass
GEST,777258,BR6,4,26A,,,,,,,,,bronze and gunmetal
SHEP,722215,,20,26A,,,76.1,18.6,1.5,0.2,0.1,brass
STAL,682689,,F21,26A,,,78.1,16.3,2.2,0.7,0.0,brass
STAL,682696,,F20,26A,,,78.5,16.5,2.1,2.1,0.1,brass
STAL,670462,,F8,26A,,,76.7,17.1,2.0,0.5,0.1,brass
STAL,670520,,H6,26A,,,81.8,17.0,2.8,0.2,0.0,brass
STAL,670652,,F25,26A,,,78.2,18.2,2.3,0.4,0.0,brass

STAL,670653,,F13,26A,,,80.7,21.0,4.8,1.3,0.0,brass
STAL,682672,,F23,26A,,,73.6,19.8,1.7,1.1,0.1,brass
STAL,682669,,F9,26A,,,79.8,19.3,1.8,0.6,0.0,brass
STAL,682707,,F7,26A,,,74.0,18.6,1.7,0.2,0.1,brass
STAL,682680,,F22,26A,,,77.1,18.9,1.8,0.4,0.0,brass
STAL,682655,,F6,26A,,,79.8,19.8,1.7,0.9,0.0,brass
STAL,4541,,F1,26A,,,81.7,16.2,1.5,0.2,0.0,brass
STAL,4532,,H5,26A,,,79.0,16.4,2.2,0.5,0.1,brass
BRAU,,1059,44,26A,,,77.8,18.2,1.9,0.7,0.1,brass
STAL,670488,,F3,26A,,,,,,brass
STAL,682705,,H1,26A,,,,,,brass
STAL,682706,,H3,26A,,,,,,brass
STAL,682713,,F24,26A,,,,,,brass
STAL,682683,,F29,26A,,,,,,brass
STAL,682698,,F11,26A,,,,,,brass
STAL,4556,,F28,26A,,,,,,brass
STAL,682701,,H2,26A,,,,,,brass
DRAG,,DR71TD,58,26A,,,,,,brass
DRAG,,DR70APM,59,26A,It,,,,,,brass
LOND,,A17718,,26A,,,,,,brass
STAL,4583,,F4,26A?,,,,,,brass
STAL,670489,,F19,26A?,,,74.7,17.3,1.6,0.2,0.0,brass
STAL,682714,,F15,26A?,,,75.9,21.8,1.5,0.4,0.0,brass
STAL,670515,,F2,26A?,,,,,,brass
STAL,670512,,H4,26A?,,,,,,brass
WAKE,745055,1,3,26B,,,,,,brass?
WICL,,10,,26B,,,,,,gunmetal
STAL,4526,,F31,26B,,,75.9,22.4,1.7,0.1,0.1,brass
LOND,,C990,,26B,,,,,,brass
STAL,4561,,F30,26B?,,,77.5,18.6,1.6,0.4,0.1,brass
WINC,,VR5105,,26/27,,,,,,brass
HAYL,,2837,,26/27?,,,,,,brass/gunmetal
BALD,,100,27,S(M) ,,,,,,brass
SHEP,722201,,22,27,As,R,,,,,brass?
SHEP,722205,,23,27,As,R,,,,,brass
THIS,,THZ650,,27,,,,,,brass
THIS,610743,TH2,,27,,,,,,brass
HAYL,,1648,,27,S(M) ,,,,,,brass
COLC,,GBS-965,GBS2,27,,,,,,brass
STAL,682693,,G4,27,(As) ,,,,,,brass
STAL,682694,,G3,27,(As) ,,,,,,brass
SAND,,1116,,27,Mb,,,,,,brass
STAL,4521,,G2,27?(As) ,,,,,,brass
STAL,4521,,G1,27?,As,,,,,,brass
SHEP,722332,,24,27?,,,,,,lead
HAYL,,1564,,27?,,,,,,brass
BALD,,99,27A,Mc,,,,,,brass
ASHT,835150,673,,27A,Mc,,,,,,brass
ULEY,,5839,Fig123:4,27A,As,,,,,,brass
DRAG,,DR66KK,61,27A,,,,,,brass
DRAG,,DRBG,63,27A?,,,,,,brass
LOND,,440,,27B,,,,,,brass
LOND,,439,,27B,T,,,,,,brass
DRAG,,DR70AG,62,27B?,T,,,,,,brass

STAN,8701480,,27+,,,,,,,,brass
HAYL,,799,,28?,,,,,,,,brass
DRAG,,DR66BC,56,28A,,,,,,,,brass
STAL,4521,,L1,Gp=2,TMs,,,,,,,,brass
ASHT,835073,,Gp=2,,,,,,,,brass
COLC,,1.81-4971,CS8,Gp=2,,,,,,,,brass
STAL,682664,,F33,Gp=2,,,,,,,,brass
STAL,4530,,H7,Gp=2,,,,,,,,brass
STAL,670298,,G5,Gp=2,(As) ,,,,,,brass
STAL,670514,,L2,Gp=2,,,,,,,,brass
HAYL,,KP12,,Gp=2,,,,,,,,brass
BALD,,101,Gp=2?,T,,,,,,,,leaded bronze
TIDD,,82-260,,Gp=2/3,,,,,,,,gunmetal
TIDD,,81-1059,,29,T,,77.0,15.9,2.4,1.5,0.2,brass
TIDD,,82-154,,29?,,,,,,,,leaded gunmetal
STAN,8900629,,29?,,,,,,,,leaded bronze
STAL,670461,,L5,29A,,78.4,15.8,2.2,0.8,0.0,brass
GORH,820113,678,15,29A,,,,,,,,brass
STAN,8612947,,29A,T,,,,,,,,brass
WICL,,20,,29B,,,,,,,,leaded bronze
THIS,611046,BH1664,,29B,,,,,,,,(leaded) bronze
SNET,,Cat23,,29B,,,,,,,,(leaded) bronze
STAN,8901001,,29B,T,,,,,,,,brass
SNET,,Cat11,,34,,,,,,,,(leaded) bronze
WICL,,50,,34+,,,,,,,,gunmetal
NORN,620654,,48,35,,84.1,0.2,10.2,0.4,0.0,bronze
NORN,621139,,49,35?,,94.1,0.2,7.0,9.7,0.0,leaded bronze
MAXE,,M80-1638-27,2,36,T,,,,,,,,leaded bronze
RICH,7350906,63,238,36,Es,R,91.0,0.3,4.9,0.6,0.1,bronze
GORH,820104,,16,36,T,,70.6,1.0,13.7,13.2,0.1,leaded bronze
ALDB,78108243,,312?,36,Es,R?,,,,,,,,gunmetal?
THIS,,THZ326,,36,Es,RB,,,,,bronze
OPEN,7815599,,616,36,Es,B,,,,,bronze
CAST,,1-40,50,36,(E) ,,,,,,bronze/gunmetal?
CAST,,1-402,51,36,Es,B,,0.6,3.0,2.4,0.0,bronze
CAST,,1-514,52,36,(E) ,,,,,,bronze
CAST,,1-515,53,36,Es,B,,,,,bronze
CAST,,10-1350,55,36,Es,X,,0.8,6.5,8.8,0.0,leaded bronze
CAST,,10-120,56,36,Es,X,,,,,bronze?
CAST,,10-962,57,36,Es,B,,0.1,3.6,1.9,0.0,bronze
CAST,,16-264,48,36,Es,X,,,,,bronze
LULL,,56,36,T,,,,,leaded gunmetal
RICH,7351917,,239,36+,,,,,,,,gunmetal
WICL,,33,,37,,,,,,,,brass
WANB,,45,37,Mb,,,,,leaded bronze
TIDD,,81-857,,37,,71.3,0.6,7.7,19.6,0.0,leaded bronze
TIDD,,M12,,37,,73.3,0.0,8.2,18.5,0.2,leaded bronze
TIDD,,M13,,37,,,,,,,,leaded bronze
THIS,,THZ2122,,37,,,,,,,,leaded bronze/gunmetal
THIS,,THZ2706,,37,T,,,,,leaded gunmetal
CAST,,12-37,119,37,,,,,bronze
HAYL,,1848,,37?,,,,,,,,brass
POOL,,5129,13,37?,Es,RB,,,,,gunmetal
DRAG,,DR67TY,114,37+?,,,,,0.7,7.4,4.0,0.0,bronze

BALD,,143,Gp=3?,T,,,,,,brass/gunmetal
BALD,,48,40,,,,,,brass
THIS,,THY66,,40,,,,,,brass
HOUS,811591,,40?,,,,,,(lead) bronze
LOND,,13048,,40A,,,,,,brass
LOND,,453,,40A,,,,,,brass
LOND,,A24941,,40B,,,,,,brass
RICH,7351745,1496,35,40B,,78.2,17.8,1.1,0.3,0.0,brass
TIDD,,82-82,,40C,,,,,,gunmetal
THOR,852996,17,,40C,,,,,,brass/gunmetal
DRAG,,DR65CU,36,40C,,,,,,brass
LOND,,A2406,,40C,,,,,,brass
STAN,9190750,,40C,,,,,,gunmetal
BALD,7210433,,49,40C,,75.6,23.7,1.2,0.3,0.0,brass
BALD,,45,40C+,,,,,,bronze
BALD,,46,40C+,,,,,,bronze
BALD,7210319,,47,40C+,,73.5,23.5,0.7,1.0,0.1,brass
RICH,7351574,1260,38,42,,74.0,22.4,0.0,0.2,0.0,brass
VELZ,,3,,42,,82.6,18.7,1.7,0.1,0.0,brass
LOND,,CS1,,42,,,,,,brass
LOND,,106,,42,,,,,,brass
LOND,,105,,42,,,,,,brass
LOND,,104,,42,,,,,,brass
RICH,7350742,611,36,42,,78.1,18.6,2.0,0.2,0.0,brass
RICH,7351582,2648,37,42,,82.0,18.8,2.1,0.4,0.0,brass
DODD,8515485,,43,,,,,,brass
CAST,,9-1396,4,43,,,,,,brass/gunmetal
COLC,,1.81-2493,CS9,43?,,,,,,brass
PAPC,,84-012,,44?,,,,,,brass
DRAG,,DR65ABV,119,44+,,0.0,15.5,0.5,0.4,bronze
LOND,,O.1800,,45,,,,,,brass
LOND,,81.629/1,,45+,,,,,,bronze
LOND,,O.1813,,46?,,,,,,brass
LOND,,84.240/2,,48,T,,,,,,brass
LOND,,O.1814,,50,,,,,,brass
SHEP,722216,,25,51,,,,,,brass
WROX,787180,,51,,,,,,brass
WANB,,46,51,,,,,,brass
WANB,,47,51,,,,,,brass
WANB,,48,51,,,,,,brass
COLE,,595,3,51,,,,,,brass
COLE,,93,4,51,,,,,,gunmetal
RICH,7350070,1251,88,51,,,,,,brass
RICH,7351030,4778,87,51,,,,,,brass
RICH,7351403,1851,84,51,,,,,,gunmetal
RICH,7351507,4701,91,51,,,,,,brass
BRAU,,862,54,51,,,,,,brass
BRAU,,625,55,51,,,,,,brass
RICH,7351771,1123,92,51,,82.1,19.4,0.3,0.2,0.3,brass
SHEP,,26,51,,67.0,20.6,0.5,0.6,0.0,brass
BRAU,,512,53,51,,77.6,17.6,0.0,0.1,0.0,brass
ASHT,835113,551,,51,,,,,,brass
ASHT,835117,536,,51,,,,,,brass
SEAM,,67-90,2,51,,,,,,brass

ILCH,,75,3,51,,,,,,brass
THIS,,THVbag81,,51,,,,,,brass
THIS,610969,BH705,,51,,,,,,brass
THIS,611005,BH822,,51,,,,,,brass
COLC,,1.81-3800,CS9a,51,,,,,,brass
COLC,,GBS-761,GBS4,51,,,,,,brass
COLC,,GBS-696,GBS3,51,,,,,,brass
LOND,,LCT1391,,51,,,,,,brass
LOND,,TRM52,,51,,,,,,brass
WANB,,,49,51?,,,,,,,brass
STAN,8901081,,,51?,,,,,,,brass
BALD,,,105,51A,,,,,,brass
BALD,,,106,51A,T,,,,,,brass/gunmetal
STAL,4540,,M1,51A,,,,,,brass
STAL,4573,,M2,51A,,,,,,brass
STAN,8700410,,,51A/52D,,,,,,brass
STAN,8701138,,,51A/52D,,,,,,brass
CATS,,,1,51B,,,,,,brass
RICH,7350890,,89,51B,,,,,,brass
RICH,7350901,1648,90,51B,,,,,,brass
RICH,7350972,5462,80,51B,,,80.5,18.4,0.8,0.4,0.0,brass
RICH,7351097,1548,81,51B,,,77.6,20.1,2.0,0.0,0.1,brass
RICH,7351098,,79,51B,,,81.2,15.5,2.7,0.0,0.0,brass
RICH,7351386,2486,83,51B,,,83.6,16.7,0.9,0.1,0.0,brass
RICH,7351515,4869,78,51B,,,78.1,20.6,0.0,0.0,0.0,brass
RICH,7351584,1023,77,51B,,,78.5,20.4,2.0,0.2,0.1,brass
RICH,7351521,4860,75,51B,,,77.2,22.8,2.9,0.1,0.1,brass
RICH,7351541,4717,85,51B,,,74.5,17.7,7.6,0.2,0.0,gunmetal
RICH,7351516,,82,51B,,,80.1,21.7,0.3,0.0,1.4,brass
RICH,7351176,4337,74,51B,,,75.0,16.7,1.7,0.4,0.1,brass
RICH,7351715,2354,76,51B,,,73.9,23.7,0.8,0.2,0.1,brass
STAL,670457,,M3,51B,,,77.7,18.6,2.0,0.1,0.0,brass
BALD,7211175,,104,51B,,,73.5,24.1,3.1,0.1,0.4,brass
WROX,721370,,,51B,,,79.5,17.0,2.3,0.0,0.0,brass
GORH,820365,2387,17,51B,,,,,,brass
TARH,,415,,51B,,,,,,brass
ALDB,78108251,,304,51B,,,,,,brass
DODD,8515479,,,51B,,,,,,gunmetal
DRAG,,DR70BEM,68,51B,,,,,,brass
DRAG,,DR72BWS,66,51B,,,,,,brass
DRAG,,DR68KO,67,51B,,,,,,brass
WROX,7410181,,,51B,,,,,,brass
LOND,,442,,51B,,,,,,brass
LOND,,3427,,51B,,,,,,brass
LOND,,TRM52,,51B,,,,,,brass
LOND,,29.201/1,,51B,,,,,,brass
GORH,820234,1717,18,51B?,,,,,,,brass
RICH,7350214,4917,86,51C,,,80.4,19.3,0.0,0.0,0.0,brass
WORC,907219,3899-c17889,,51C,,,,,,brass
CARL,,BLAAe226,16,51C?,,,,,,,gunmetal
WEEK,781385,35,8,52,,,,,,brass
SHEP,,,30,52,,,,,,brass
TIDD,,M15,,52,,,,,,brass/gunmetal
SHEP,722210,,29,52A,,,,,,brass

HAYL,,193,,52A,,83.3,13.5,2.2,0.4,0.1,brass
LEIC,,316-135,2:19,52A,,,,,,brass
DRAG,,DR66OL,70,52A,,,,,,brass
STAN,8700055,,52A,T,,,,,,brass
WORC,,3899-8505,,52A,,,,,,brass
STAN,8612496,,52B,,,,,,brass
RICH,7350066,2528,93,52C,,72.9,17.7,1.5,0.5,0.0,brass
HAYL,,1655,,52C,,69.7,19.2,0.0,0.5,0.1,brass
ASHT,835101,303,,52D,,,,,,brass
ASHT,835067,53,,52D,,,,,,brass
GORH,820326,2907,19,52D,,,,,,brass
HAYL,,264,,52D,,,,,,brass
ICKH,746630,833,,52D/60,,,,,,brass
LOND,,O.1816,,52/54,,,,,,brass
RICH,7351763,2232?,94,52+,,87.6,0.6,5.0,0.7,0.1,bronze
ILCH,,69,5,53,,,,,,bronze
ICKH,741690,2867,,53,,,,,,brass
CAST,,15-140,5,53,,,,,,bronze
ILCH,,LP65/57,,53?,,,,,,bronze
DRAG,,DR65LR,69,53A,,,,,,brass
DRAG,,DR73MW,83,53A,It,,,,,,brass
SAND,,1543,,53A,,,,,,brass
GORH,820129,987,20,54,,,,,,brass
VELZ,,17,,55,,,,,,brass
LOND,,A13821,,55,T,,,,,,brass
MAGI,7711042,,1,56/57,,,,,,brass
OUDE,,5,,56,,79.1,1.9,10.4,9.5,0.0,leaded bronze
WROX,721375,,56+?,,80.5,14.4,3.2,0.0,0.0,brass
TIDD,,81-944,,57,,,,,,brass
WANB,,50,58,It,,,,,,brass
SEAM,,65-108,3,58,,,,,,brass
LOND,,A13824,,58A,,,,,,brass
LAMY,,409,1,58B,T,,,,,,bronze
RICH,7351754,3266,159,58A,,77.8,16.8,2.8,1.7,0.0,brass
ULEY,,5732,Fig123:5,58/59?,T,,,,,,bronze
BALD,,107,60,T,,,,,,brass
BALD,,108,60,T,,,,,,brass
BALD,,109,60,T,,,,,,brass
BALD,,110,60,T,,,,,,bronze
BALD,,111,60,T,,,,,,brass
MAGI,7711176,,14,60,T,,,,,,brass/gunmetal
CARV,,28,60,,,,,,bronze
GEST,777257,BR60,5,60,T,,,,,,gunmetal
VELZ,,1,,60,,,,,,gunmetal
TIDD,,82-54,,60,TN,,,,,,brass
TIDD,,81-648,,60,T,,,,,,brass
CORB,831205,,1,60,,,,,,brass
WINC,,60,T,,,,,,gunmetal
WANB,,51,60,T,,,,,,bronze
WANB,,55,60,T,,,,,,brass
RICH,7351650,,116,60,,,,,,brass/gunmetal
BRAU,,556,56,60,T,,,,,,brass
BRAU,,401,60,60,,,,,,gunmetal
RICH,7350504,184,117,60,,80.8,2.1,7.3,1.2,0.1,bronze

RICH,7350506,701,118,60,,89.2,0.2,7.6,0.5,0.2,bronze
RICH,7351572,2529,121,60,T,,85.5,9.5,2.6,1.4,0.1,brass/gunmetal
RICH,7351583,1599,120,60,,85.7,21.1,0.5,0.1,0.1,brass
RICH,7351737,,115,60,Tic,,85.7,14.8,1.2,0.9,0.0,brass
BALD,7211075,,117,60,,68.2,26.8,1.4,0.7,0.0,brass
WROX,721376,,60,,81.9,17.7,1.3,0.0,0.0,brass
BRAU,,64,59,60,T,,82.2,18.0,1.1,0.2,0.2,brass
ASHT,835075,166,,60,T,,,,,brass
TIDD,,81-856,,60,,,,,brass/gunmetal
THIS,,THVbag182,,60,,,,,bronze
THIS,,THVbag183,,60,,,,,brass
THIS,611070,BH1792,,60,,,,,gunmetal
HAYL,,598,,60,T,,,,,brass
COLC,,1.81-3535,CS11,60,,,,,brass
COLC,,GBS-414,GBS6,60,T,,,,,brass
COLC,,GBS-534,GBS7,60,T,,,,,gunmetal
COLC,,GBS-469,GBS5,60,,,,,brass
HAYL,,726,,60,TIci,,,,,brass
COLC,,1.81-1219,CS10,60,,,,,brass/gunmetal
CHEL,,CHKAe216,2:6,60,T,,,,,brass
CHEL,,CHKAe239,2:7,60,,,,,brass
DRAG,,DR68LB,71,60,T,,,,,brass
DRAG,,DR65AAH,72,60,,,,,bronze
HAYL,,KP9,,60,T,,,,,brass/gunmetal
CAST,,10-2167,8,60,TN,,,,,brass/gunmetal
CAST,,16-323,7,60,,,,,brass
LOND,,ATR267,,60,T,,,,,gunmetal
LOND,,FEN192,,60,,,,,brass
LOND,,GPO263,,60,,,,,brass/gunmetal
LOND,,GPO3626,,60,,,,,gunmetal
LOND,,GPO5669,,60,,,,,gunmetal
LOND,,LCT1381,,60,,,,,brass
LOND,,LEA29,,60,,,,,brass/gunmetal
LOND,,447,,60,,,,,brass
LOND,,448,,60,T,,,,,brass
LOND,,446,,60,,,,,brass
LOND,,445,,60,,,,,brass
LOND,,20084,,60,,,,,brass
LOND,,84.453/3,,60,T,,,,,brass
LOND,,81.282/7,,60,,,,,brass
STAN,8610966,,60,T,,,,,brass
STAN,8612504,,60,T,,,,,bronze/gunmetal
LOND,,21047,,60,T,,,,,brass
LOND,,454,,60,T,,,,,brass
LOND,,19754,,60,T,,,,,brass
WORC,,3899-c17042,,60,,,,,brass
SNET,,Cat29,,60,,,,,brass
SNET,,Cat30,,60,T,,,,,brass/gunmetal
SNET,,Cat31,31,60,,,,,bronze/gunmetal
SAND,,1563,,60,T,,,,,bronze
SAND,,1792,,60,T,,,,,brass
STAN,8701202,,60,,,,,brass
STAN,8701763,,60,T,,,,,bronze/gunmetal
STAN,8901671,,60,,,,,brass

STAN,8901367,,60,,,,,,,,brass
RICH,7351035,5580,119,60,,,,,,,,brass
RICH,7350060,672,122,60,TN,,79.7,9.0,5.7,1.0,0.1,gunmetal
WANB,,,52,60?,,,,,,,,brass/gunmetal
WANB,,,56,60?,,,,,,,,brass
CHEL,,CHAG25,,60?,,,,,,,,brass
CHEL,,CHAJ17,,60?,,,,,,,,brass
CHEL,,CHDAe308,2:9,60?,T,,,,,,,,brass
DRAG,,DR69IN,73,60?,,,,,,,,gunmetal
DRAG,,DR66FM,,60?,T,,,,,,,,brass
HAYL,,KP1,,60?,T,,,,,,,,brass
HAYL,,KP6,,60?,,,,,,,,brass
CAST,,10-1756,10,60?,,,,,,,,gunmetal
RICH,7351877,,152,60?,,,,,,,,brass
WINC,,VR9734,,60/61,,,,,,,,gunmetal
RICH,7350474,2108,149,60/61?,,,,,,,,brass
RICH,7351874,,151,60/62?,T,,,,,,,,brass
CHEL,,CHV3,,60/63,,,,,,,,bronze/gunmetal
CHEL,,CHAL12,,60/63,,,,,,,,brass
THIS,611026,BH872,,60/63?,T,,,,,,,,brass
CHEL,,CHKAe243,2:8,60/71B,,,,,,,,brass
WANB,,,53,60/74,,,,,,,,brass
WANB,,,54,60/74,T?,,80.8,0.1,9.5,13.3,0.1,lead
ed bronze
RICH,7351544,4557,148,60+,,78.5,3.5,6.1,5.4,0.1,(lead
ed) bronze/gunmetal
TARH,,887,,60+,T,,,,,,,,brass
DORC,,CP9,61,T,,,,,,,,bronze
BALD,,,112,61,T,,,,,,,,brass
BALD,,,113,61,T,,,,,,,,gunmetal
BALD,,,114,61,T,,,,,,,,bronze
BALD,,,115,61,,,,,,,,brass/gunmetal
WICF,,252,,61,T,,,,,,,,brass
WICL,,25,,61,,,,,,,,gunmetal?
TIDD,,M16,,61,T,,,,,,,,bronze?
TIDD,,82-149,,61,T,,,,,,,,brass
WANB,,,57,61,T,,,,,,,,brass
RICH,7351768,3016,100,61,T,,,,,,,,bronze?
RICH,7350065,2043,99,61,,83.1,13.4,3.6,0.2,0.1,brass/gunmetal
RICH,7350329,2530,96,61,,76.0,22.5,0.8,0.3,0.2,brass
RICH,7350691,1974,101,61,T,,88.9,0.5,8.8,2.2,0.0,bronze
RICH,7350770,,98,61,,88.5,0.5,10.7,1.9,0.0,bronze
RICH,7350909,,108,61,T,,77.6,20.2,0.7,0.0,0.0,brass
RICH,7350978,4536,102,61,,77.9,12.9,2.2,2.5,0.0,brass
RICH,7351538,3422,97,61,,77.6,21.2,0.0,0.4,0.0,brass
RICH,7351586,1594,95,61,IcLi,,70.5,16.0,2.5,0.3,0.0,brass
ULEY,,5723,Fig123:7,61,T,,79.7,0.6,11.7,4.0,0.1,(lead
ed) bronze
BALD,7211202,,116,61,T,,70.8,28.3,0.0,1.7,0.0,brass
THIS,,THZ2214,,61,T,,,,,,,,brass
THIS,,THZ2707,,61,T,,,,,,,,brass/gunmetal
HAYL,,2306,,61,T,,,,,,,,brass
COLC,,GBS-33,GBS8,61,,,,,,,,brass/gunmetal
CHEL,,CHV4,,61,T,,,,,,,,brass
DRAG,,DR72SV,,61,T,,,,,,,,brass
WINC,,VR-1018,,61,,,,,,,,brass
LOND,,OLC40,,61,,,,,,,,gunmetal

LOND,,26393,,61,,,,,,,,brass/gunmetal
STAN,8612487,,61,,,,,,,,brass
LOND,,449,,61,,,,,,,,brass
COSG,,217,1,62,T,,,,,,,,brass
SHEP,722204,,32,62,T,,,,,,,,brass
SHEP,,33,62,,,,,,,,brass
SHEP,,34,62,,,,,,,,brass
BRAU,,697,61,62,,,,,,,,brass
SHEP,722219,,31,62,,75.9,22.2,1.0,0.3,0.0,brass
BALD,7211119,,120,62,T(R) ,,75.3,21.1,0.8,0.1,0.0,brass
BALD,7210336,,119,62,T,,73.7,28.3,0.0,0.1,0.2,brass
GORH,811371,1090,21,62,,,,,,,,brass
GORH,820112,675,22,62,,,,,,,,brass/gunmetal?
STAN,8516944,,62,,,,,,,,brass
COLC,,GBS-837,GBS9,62,T,,,,,,,,brass
CHEL,,CHV22,,62,T,,,,,,,,brass
DRAG,,DR69HE,78,62,T,,,,,,,,brass
DRAG,,DR66HR,80,62,,,,,,,,brass
DRAG,,DR70BBQ,79,62,,,,,,,,bronze?
CATT,8310557,,Site240:1,62,T,,,,,,,,brass
WROX,743350,,62,,,,,,,,bronze?
LOND,,452,,62,,,,,,,,brass
LOND,,24764,,62,T,,,,,,,,gunmetal
SAND,,1000,,62,,,,,,,,brass
SAND,,1872,,62,,,,,,,,brass
STAN,8901071,,62,,,,,,,,brass
RICH,7351724,,142,62/74,,80.5,19.2,0.0,0.2,0.0,brass
RICH,7350296,2654,106,63,,84.2,1.6,5.2,1.3,0.2,bronze
BALD,7211122,,118,63,T,,71.1,28.4,1.2,0.2,0.0,brass
BRAU,,659,63,63,,76.7,18.2,1.2,0.0,0.0,brass
BRAU,,585,62,63,,80.1,18.9,2.9,0.3,0.3,brass
THIS,610742,TH11,,63,,,,,,,,brass
ULEY,,77,Fig123:6,63,T,,,,,,,,brass
COLC,,1.81-3948,CS12,63,,,,,,,,brass
COLC,,GBS-836,GBS11,63,T,,,,,,,,brass
COLC,,GBS-455,GBS10,63,T,,,,,,,,brass
HAYL,,1976-18,,63,T,,,,,,,,brass
LOND,,3425,,63,T,,,,,,,,brass
BRAU,,348,64,63?,T,,,,,,,,bronze
LOND,,A13820,,63A,,,,,,,,brass
RICH,7351757,5627,104,63B,,,,,,,,brass
RICH,7351792,,103,63B,,,,,,,,gunmetal?
RICH,7350279,,110,63B,,80.9,17.9,0.6,0.5,0.2,brass
RICH,7350093,1556,109,63B,,81.4,16.1,1.4,0.5,0.1,brass
RICH,7350210,4879,111,63B,,76.9,23.7,0.0,0.0,0.1,brass
RICH,7351708,711,113,63B,,75.3,18.7,2.0,0.3,0.1,brass
SHEP,722207,,35,63B,T,,78.0,21.3,1.9,0.1,0.0,brass
SHEP,722211,,36,63B,T,,76.7,17.1,1.5,0.3,0.1,brass
DODD,8515494,,63B,,,,,,,,brass
DRAG,,DR69EL,,63B,,,,,,,,brass
DRAG,,DR69ADK,82,63B,,,,,,,,brass
LOND,,FEN406,,63B,,,,,,,,brass
LOND,,FMO244,,63B,,,,,,,,brass
RICH,7350384,4854,131,64,,79.2,20.9,0.5,0.1,0.0,brass

RICH,7351096,1080,130,64?,,,,,,,,,brass
BALD,,121,65,T,,,,,,,,brass
RICH,7350340,739,114,65,TiCl,,81.3,16.7,1.4,0.1,0.1,brass
BALD,,122,66,T,,,,,,,,brass
DRAG,,DR72ID(2) ,76,67,T,,,,,,,,brass
SAND,,457,,68,,,,,,,,brass
WELT,,SF7,,70,,75.4,23.0,0.9,0.4,0.0,brass
LOND,,GPO308,,70,,,,,,,,brass
RICH,7351738,1375,141,70C,,75.7,16.4,3.0,0.3,0.0,brass
LOND,,20.085,,70C,T,,,,,,,,brass
LOND,,3426,,70D,,,,,,,,brass
RICH,7350211,5016,129,70E,,81.8,14.5,2.7,1.3,0.1,brass
VELZ,,33,,70E,,79.5,1.0,9.0,6.1,0.3,(lead) bronze
WALL,,9,70E,,,,,,,,brass/gunmetal
SAND,,946,,70E,T,,,,,,,,brass
WANB,,58,70E/78,T,,,,,,,,bronze
VELZ,,32,,70E+,,80.4,13.5,9.2,5.6,0.3,(lead) gunmetal
BALD,,123,71,,,,,,,,brass
BALD,7211121,,124,71,T,,75.0,23.9,1.1,0.0,0.0,brass
ILCH,,27,6?,71,T,,,,,,,,brass
COLC,,1.81-4814,CS13,71,T,,,,,,,,gunmetal?
HAYL,,475,,71?,T,,,,,,,,brass
RICH,7350062,905,123,71B,T(N) ,,81.5,14.2,2.4,1.5,0.1,brass
RICH,7350560,5663,107,71B,,72.0,22.6,0.0,0.1,0.1,brass
RICH,7351726,,105,71B,,78.5,16.9,0.7,0.7,0.0,brass
ASHT,835094,274,,71B,T,,,,,,,,bronze
SEAM,,65-135,4,71B,,,,,,,,brass
LOND,,BWB276,,71B,T,,,,,,,,brass
LOND,,GPO244,,71B,,,,,,,,brass
LOND,,ORG108,,71B,,,,,,,,gunmetal
LOND,,A16572,,71B,N,,,,,,,,brass
LOND,,456A,,71B,,,,,,,,bronze
LOND,,18.121,,71B,,,,,,,,brass
GEST,,BR124,6,71B+,,,,,,,,gunmetal
VELZ,,29,,71+,,76.1,18.7,0.7,0.2,0.2,brass
WICF,,260,,73,,,,,,,,brass
WORC,907218,3899-c17727,,73,E(R),,,,,,,,gunmetal
HAYL,,3147,,73?,T,,,,,,,,brass
DORC,,CP2,73/75,T,,,,,,,,brass
HAYL,,KP11,,73/75,T,,,,,,,,brass/gunmetal
DORC,,CP5,74,T,,,,,,,,brass
TIDD,,82-246,,74,,,,,,,,brass
RICH,7350277,3068,125,74,N,,79.0,16.1,1.7,2.2,0.1,brass
HAYL,,312,,74,T,,,,,,,,brass
WINC,,VR-3245,,74,,,,,,,,brass
LOND,,LCT1045,,74,T,,,,,,,,brass
LOND,,19603,,74,,,,,,,,brass
WORC,,3899-7018,,74,,,,,,,,brass
SNET,,Cat32,32,74,T,,,,,,,,brass/gunmetal
SAND,,3292,,74,,,,,,,,bronze
RICH,7350773,2554,140,74,T,,79.7,13.6,3.5,0.2,0.0,brass/gunmetal
RICH,7351546,4666,136,74,,,,,,,,brass
RICH,7350900,1357,137,74,,,,,,,,brass
RICH,7350509,1602,138,74,,86.0,0.4,8.9,2.5,0.1,bronze

RICH,7350473,785,139,74,T,,81.4,11.6,3.3,1.6,0.1,brass/gunmetal
RICH,7350744,1549,135,74,,82.1,0.6,10.7,3.9,0.0,bronze
SWIN,770498,105,,74?,T,,,,,,brass
DORC,,,CP6,74/71,T,,,,,,brass
VELZ,,27,,75,,,,,,brass
WANB,,,59,75,T,,,,,,brass
RICH,7350204,5058,124,75,T,,84.3,12.9,3.7,1.3,0.1,brass/gunmetal
HAYL,,3121,,75,T,,77.6,13.6,3.9,1.0,0.0,brass/gunmetal
LOND,,18122,,75,N,,,,,,brass
LOND,,21067,,75,T,,,,,,brass
RICH,7351891,,126,75?,,,,,,brass
HAYL,,263,,76,T,,,,,,bronze
MAGI,7711088,,17,77,T,,,,,,brass/gunmetal
RICH,7351076,1805,144,77,,80.2,16.9,1.2,0.3,0.0,brass
BRAU,,1105,57,77,T,,83.7,17.9,2.4,0.5,0.0,brass
LOND,,19179,,77,,,,,,brass
RICH,7350099,3402,145,77+,,79.5,14.8,2.3,1.1,0.1,brass
RICH,7350103,710,128,78,,80.9,9.3,3.8,4.4,0.1,(leaded) gunmetal
RICH,7350206,5134,127,78,,79.2,18.5,1.5,0.1,0.1,brass
VELZ,,28,,78,,75.8,18.3,3.6,0.1,0.0,brass
HAYL,,1505,,78,T,,,,,,brass
DRAG,,DR70BOR,84,78,T,,14.8,3.2,0.7,0.0,brass
SHEP,,,37,78?,,77.5,26.4,0.6,0.3,0.0,brass
BRAU,,943,58,78?,,80.2,12.7,4.6,1.3,0.0,brass/gunmetal
VELZ,,26,,78+,,77.0,16.0,1.3,0.4,0.1,brass
TARH,,295,,78+,T,,,,,,brass
HAYL,,3476,,78/79,T,,,,,,brass
RICH,7350977,3705,133,79,,80.7,10.1,3.7,0.6,0.0,brass/gunmetal
RICH,7351580,1975,132,79,,82.3,10.2,7.3,3.0,0.1,gunmetal
WROX,721379,,79,,81.3,10.4,4.7,2.9,0.3,gunmetal
LOND,,84.279/2,,79,,,,,,brass
LOND,,456B,,79,T,,,,,,brass
VELZ,,14,,79+,,80.0,13.6,3.1,0.4,0.2,brass
VELZ,,30,,79+,,75.2,9.4,5.7,0.2,0.2,gunmetal
COLC,,1.81-5122,CS16,79+,T,,,,,,bronze
LOND,,435,,79+,Es,X,,,,,,brass
COLC,,1.81-1640,CS14,79+?,TN,,,,,,gunmetal
LOND,,85.108/7,,79+?,T,,,,,,brass
WANB,,,60,80,TN?,,,,,,brass
RICH,7351093,904,143,80,,85.1,10.5,4.6,0.3,0.1,gunmetal
BRAU,,409,65,80,T,,71.6,21.4,0.7,0.2,0.0,brass
PRES,,1585,14,80,,93.8,1.0,6.0,0.9,0.0,bronze
RICH,7351791,299,150,Gp=4B,,,,,,gunmetal
RICH,7351764,,153,Gp=4B,,81.2,14.7,1.5,0.4,0.1,brass
RICH,7351512,4779,112,Gp=4B,,85.5,13.4,0.0,0.0,0.1,brass
RICH,7350505,,134,Gp=4B,,85.4,2.6,8.0,3.9,0.1,bronze
RICH,7350802,3742,146,Gp=4B,T,,75.0,8.1,5.8,6.1,0.1,(leaded) gunmetal
COLC,,CF-63,,Gp=4B,1,,,,,,brass
POUN,,Ae50,16,Gp=4B,T,,,,,,brass
ASHT,835086,,Gp=4B,,,,,,brass
ASHT,835145,,Gp=4B,,,,,,brass
BALD,7211191,,125,Gp=4B,T,,73.1,25.5,0.6,0.2,0.0,brass
COLC,,1.81-364,CS15,Gp=4B,,,,,,bronze
STAL,670511,,M4,Gp=4B,,,,,,brass

SHEP,722331,,28,Gp=4?,,,,,,bronz
LOND,,WIV325,,Gp=4B?,,,,,,brass
RICH,7351778,,147,Gp=4B?,,,,,,brass/gunmetal
STAL,682648,,N1,Gp=4??,,71.6,24.9,1.5,0.1,0.0,brass
WROX,78000944,,Gp=4/5,,,,,,brass
BALD,7211083,,50,Gp=4/5,,71.9,23.0,1.3,0.1,0.0,brass
COLC,,GBS-1026,GBS12,84,,,,,,brass
LOND,,A2388,,84A,,,,,,brass
LOND,,A2390,,84A,,,,,,brass
LOND,,A11962,,84A,,,,,,brass
LOND,,A2389,,84A,,,,,,brass
RICH,7350386,4977,41,84B,,80.9,14.2,1.4,0.1,0.0,brass
RICH,7350695,2590,42,84B,,84.7,16.1,0.5,0.1,0.0,brass
RICH,7350804,4563,39,84B,,79.3,18.0,0.0,0.1,0.0,brass
RICH,7350971,5056,40,84B,,76.9,19.0,0.3,0.1,0.0,brass
LOND,,92,,84B,,,,,,brass
CABY,,948?,1,84C,,70.3,0.1,8.5,16.1,0.1,lead
LOND,,A21462,,84C,,,,,,bronz
LOND,,A22303,,85,,,,,,gunmetal
HAYL,,444,,87?,,83.0,13.9,1.4,1.2,0.1,brass
CAST,,10-2340,46,88?,,,,,,lead
RICH,7351449,,43,88B,,82.1,20.1,0.0,0.9,0.0,brass
THIS,,THZ1178,,88B,,79.5,0.1,10.2,0.1,0.0,bronz
DRAG,,DR68OH,4,88B,,0.0,13.4,0.2,0.0,bronz
DRAG,,DR68AAL,2,88B,,,,,,bronz
LOND,,90,,88B,,,,,,bronz
STAN,8900812,,88B,,,,,,bronz
STAN,8901736,,88B,,,,,,bronz
BALD,,51,89,,,,,,brass
BALD,,52,89,,,,,,brass
BALD,,53,89,,,,,,brass
BRAU,,1099,18,89,,,,,,brass
BRAU,,1027,19,89,,,,,,brass
BRAU,,1117,20,89,,,,,,brass
BRAU,,1029,21,89,,,,,,brass
RICH,7350299,1574,44,89,,85.8,14.7,0.0,0.0,0.1,brass
STAL,670294,,B10,89,,76.7,18.2,0.7,0.3,0.0,brass
STAL,670423,,B8,89,,78.1,18.9,0.4,0.1,0.1,brass
STAL,682659,,B9,89,,78.7,16.3,1.3,0.5,0.0,brass
STAL,682644,,B2,89,,77.2,21.0,1.1,0.2,0.0,brass
STAL,670469,,B1,89,,76.8,23.3,1.3,0.4,0.1,brass
STAL,4576,,B5,89,,78.3,19.5,1.7,0.1,0.1,brass
BRAU,,1052,22,89,,68.8,20.0,0.7,0.2,0.2,brass
HAYL,,1838,,89,,,,,,brass
COLC,,GBS-676,GBS13,89,,,,,,brass
HAYL,,2981,,89,,,,,,brass
STAL,4588,,B6,89,,,,,,brass
STAN,8800700,,89,,,,,,brass
RICH,7350387,4242,45,89,,80.6,16.8,1.5,0.1,0.1,brass
STAL,670274,,B4,89?,,78.8,19.1,1.5,0.2,0.0,brass
STAL,682717,,B3,89?,,82.9,21.3,2.1,0.3,0.0,brass
HAYL,,2824&2982,,89?,,,,,,brass
BRAU,,114,24,89/90,,70.3,19.4,0.0,0.1,0.0,brass
BRAU,,388,25,89/90,,73.9,21.6,0.0,0.4,0.0,brass

HAYL,,2656,,89/90,,66.0,18.9,2.1,0.4,0.0,brass
BRAU,,1043,23,89/90,,83.4,16.4,0.8,0.4,0.2,brass
LECH,,1959-10,2,90,,,,,,brass
WEEK,781418,222,11,90,,,,,,brass
WEEK,781500,204,9,90,,,,,,brass
BALD,,,57,90,,,,,,brass
MAGI,779004,,8,90,,,,,,brass
MAGI,7711152,,10,90,,,,,,brass
MAGI,779377,,11,90,,,,,,brass
MAGI,,,12,90,,,,,,brass
SHEP,722202,,7,90,,,,,,brass
WICF,,249,,90,,,,,,brass
WICF,,251,,90,,,,,,brass
TIDD,,M608,,90,,,,,,brass
GORH,811381,,30,90,,,,,,bronze
KEST,841233,,88,90,,,,,,brass
BRAU,,1030,27,90,,,,,,bronze
RICH,7350274,2372,63,90,,77.9,19.4,1.5,0.3,0.5,brass
RICH,7351573,2589,50,90,,78.7,8.4,2.3,0.2,0.0,brass/gunmetal
SHEP,,,5,90,,72.9,22.6,0.3,0.5,0.1,brass
SHEP,,,4,90,,75.7,25.6,0.4,0.3,0.0,brass
SHEP,,,3,90,,77.3,16.8,0.9,0.5,0.1,brass
SHEP,,,2,90,,75.9,23.7,0.1,0.3,0.0,brass
SHEP,722217,,8,90,,75.3,19.1,0.6,0.6,0.1,brass
SHEP,722209,,11,90,,63.8,22.7,1.4,0.2,0.0,brass
STAL,670463,,B7,90,,79.7,16.9,1.4,0.4,0.0,brass
ULEY,,5824,Fig123:8,90,,74.3,19.6,0.9,0.2,0.0,brass
THIS,,THZ1755,,90,,71.4,17.7,0.6,0.8,0.0,brass
THIS,,THY9,,90,,74.5,15.3,1.2,0.7,0.0,brass
HAYL,,200,,90,,82.5,19.4,0.0,0.7,0.1,brass
HAYL,,1824,,90,,88.0,2.3,10.4,0.5,0.1,bronze
BALD,7210449,,54,90,,81.6,21.9,1.4,0.3,0.1,brass
BALD,7211079,,56,90,,71.1,20.5,0.6,0.1,0.0,brass
BALD,7211239,,61,90,,81.9,14.2,1.7,0.8,0.4,brass
BALD,7210313,,62,90,,71.3,20.7,1.6,0.2,0.0,brass
BALD,7210361,,60,90,,78.4,19.1,0.0,0.0,0.0,brass
BALD,7210448,,55,90,,80.3,18.9,0.0,0.2,0.0,brass
GORH,811382,,23,90,,76.9,22.8,0.6,0.3,0.1,brass
GORH,811374,,24,90,,73.3,16.6,1.5,0.3,0.0,brass
GORH,820264,,25,90,,89.2,1.8,13.0,0.4,0.0,bronze
GORH,820225,,28,90,,78.8,20.3,0.0,0.0,0.0,brass
BRAU,,1166,29,90,,73.6,25.0,0.6,0.0,0.0,brass
BRAU,,874,30,90,,78.1,22.6,0.4,0.1,0.1,brass
BRAU,,369,26,90,,79.9,19.7,0.7,0.0,0.2,brass
ASHT,835130,444,,90,,,,,,brass
ASHT,835076,178,,90,,,,,,brass
ASHT,835137,481,,90,,,,,,brass
ASHT,835119,535,,90,,,,,,brass
ASHT,835120,537,,90,,,,,,brass
ASHT,835134,473,,90,,,,,,brass
GORH,826326,4030,26,90,,,,,,brass/gunmetal
GORH,820300,2675,27,90,,,,,,brass
GORH,820125,927,29,90,,,,,,brass
REDC,8650618,75,,90,,19.7,0.1,0.5,0.0,brass

REDC,,8650616,46,,90,,,,,20.5,0.4,0.2,0.0,brass
LEIC,,316-41,2:21,90,,,,,,brass
LEIC,,316-92,2:20,90,,,,,,brass
THIS,,THZ701,,90,,,,,,brass
THIS,610737,TH27,,90,,,,,,bronze?
HAYL,,2446,,90,,,,,,brass
COLC,,GBS-662,GBS15,90,,,,,,bronze
COLC,,GBS-713,GBS14,90,,,,,,brass
COLC,,GBS-1012,GBS16,90,,,,,,brass
CHEL,,CHV5,,90,,,,,,brass
BALD,,160,90,,,,,,brass
BALD,,161,90,,,,,,brass
BALD,,162,90,,,,,,brass
LOND,,LCT1317,,90,,,,,,bronze
STAN,8612473,,90,,,,,,brass
STAN,8612481,,90,,,,,,brass
SAND,,1290,,90,,,,,,brass
SAND,,1380,,90,,,,,,brass
SAND,,1495,,90,,,,,,brass
SAND,,1702,,90,,,,,,brass
SAND,,1766,,90,,,,,,bronze
SAND,,1877,,90,,,,,,brass
SAND,,3702,,90,,,,,,brass
SAND,,3706,,90,,,,,,brass
STAN,8901149,,90,,,,,,brass
RICH,96005013,5189,65,90,,,,,,brass
RICH,7351539,,56,90,,,,,,brass/gunmetal
RICH,7350800,5310,58,90,,87.7,1.4,6.4,2.1,0.0,bronze
RICH,7350807,2542,57,90,,88.6,0.2,10.2,0.1,0.1,bronze
RICH,7351766,,55,90,,93.9,3.1,4.8,2.4,0.1,bronze/gunmetal
RICH,7350786,2789,60,90,,,,,,brass
COLC,,0874CEH,,90?,,,,,,brass
STAL,4524,,C20/C29,90?,,81.2,18.5,1.6,0.2,0.1,brass
STAL,4524,,C20/C29,90?,,83.8,14.9,1.6,0.2,0.0,brass
BRAU,,272,28,90?,,73.0,22.1,0.4,0.1,0.1,brass
BRAU,,798,31,90?,,81.8,18.9,1.9,0.5,0.1,brass
BALD,,65,90/91,,,,,,brass
HAYL,,2758,,90/91,,71.4,6.7,8.9,0.6,0.2,gunmetal
HAYL,,1672,,90/91,,,,,,bronze
STAL,682729,,C76,90/91?,,,,,,brass
STAL,670513,,C75,90/91?,,,,,,brass
STAL,4538,,C63,90/91?,,,,,,brass
STAL,4522,,C73,90/91?,,,,,,brass
BALD,715549,,58,90/91?,,82.5,0.0,9.7,0.2,0.2,bronze
RICH,7350280,2391,62,90A,,80.7,17.5,1.2,0.4,0.2,brass
RICH,7350051,3028,48,90A,,78.6,22.3,0.2,0.2,0.0,brass
RICH,7351505,4729,54,90A,,85.3,17.0,0.0,0.3,0.0,brass
RICH,7351524,4923,64,90A,,70.9,16.0,12.4,0.7,0.1,gunmetal
RICH,7351513,3626,47,90A,,78.4,24.8,0.0,0.0,0.0,brass
RICH,7351705,62,46,90A,,76.6,22.5,0.5,0.0,0.1,brass
SHEP,722206,,10,90A,,77.4,27.2,0.3,0.1,0.0,brass
STAL,682653,,C11,90A,,77.1,29.9,0.3,0.2,0.0,brass
STAL,670451,,C14,90A,,77.9,20.6,0.6,0.3,0.0,brass
STAL,670436,,C17,90A,,77.2,21.1,1.4,0.3,0.0,brass

STAL,682697,,C22,90A,,,75.6,17.2,1.6,0.2,0.0,brass
STAL,682668,,C13,90A,,,74.6,21.1,0.0,0.6,0.1,brass
STAL,682662,,C18,90A,,,78.2,18.0,0.2,0.1,0.0,brass
STAL,682642,,C8,90A,,,76.2,24.1,0.6,0.3,0.0,brass
STAL,4557,,C15,90A,,,79.9,19.0,1.4,0.1,0.0,brass
STAL,670486,,C12,90A,,,80.0,20.2,1.0,0.1,0.0,brass
STAL,4574,,C10,90A,,,77.8,23.2,1.0,0.1,0.0,brass
STAL,4575,,C9,90A,,,72.6,23.5,1.5,0.1,0.0,brass
STAL,670447,,C16,90A,,,77.2,16.9,1.6,0.2,0.0,brass
STAL,670427,,C25,90A,,,,,,brass
DRAG,,DR71BHB,44,90A,,,,,,brass
DRAG,,DR66IP,,90A,,,,,,brass
DRAG,,DR70RE,43,90A,,,,,,brass
ICKH,746660,1227,,90A,,,,,,brass
LOND,,A28330,,90A,,,,,,brass
STAN,8516915,,90A,,,,,,brass
LOND,,100,,90A,,,,,,brass
SNET,,Cat1,1,90A,,,,,,brass
STAL,682712,,C21,90A?,,,72.2,23.9,0.9,0.1,0.1,brass
STAL,670483,,C19,90A?,,,,,,brass
RICH,7350109,725,51,90A/92,,,86.8,0.2,8.3,0.5,0.1,bronze
STAL,4527,,C56,90B,,,,,,brass
RICH,7350902,720,53,90B,,,,,,brass
RICH,7350091,854,49,90B,,,74.2,20.0,1.2,0.8,0.1,brass
RICH,7351577,2473,52,90B,,,93.9,0.0,6.9,0.1,0.1,bronze
RICH,7351664,,61,90B,,,75.0,2.0,9.1,0.6,0.0,bronze
STAL,682704,,C39,90B,,,76.6,18.3,0.8,0.1,0.0,brass
STAL,682660,,C44,90B,,,80.2,18.2,0.1,0.2,0.1,brass
STAL,670452,,C30,90B,,,75.4,19.8,0.3,0.2,0.0,brass
STAL,670440,,C33,90B,,,81.3,16.8,0.7,0.5,0.0,brass
STAL,670506,,C43,90B,,,78.7,18.6,0.8,0.4,0.0,brass
STAL,670504,,C6,90B,,,78.9,17.6,1.3,0.3,0.1,brass
STAL,670649,,C54,90B,,,74.3,23.1,1.1,0.2,0.1,brass
STAL,670466,,C37,90B,,,70.7,21.3,1.0,0.3,0.0,brass
STAL,670435,,C26,90B,,,81.3,17.5,0.7,0.2,0.0,brass
STAL,670464,,C58,90B,,,78.5,22.1,0.8,0.2,0.0,brass
STAL,682661,,C45,90B,,,77.4,17.5,1.2,0.1,0.0,brass
STAL,682654,,C31,90B,,,79.1,17.8,1.0,0.3,0.0,brass
STAL,682700,,C59,90B,,,80.8,20.5,1.2,0.2,0.0,brass
STAL,682685,,C3,90B,,,82.0,17.8,1.8,0.5,0.1,brass
STAL,682686,,C4,90B,,,79.8,15.8,2.5,0.4,0.3,brass
STAL,4516,,C66,90B,,,81.6,16.7,1.0,0.3,0.2,brass
STAL,4551,,C71,90B,,,82.4,17.4,1.5,0.2,0.1,brass
STAL,670443,,C5,90B,,,78.9,19.3,1.2,0.1,0.1,brass
STAL,670444,,C40,90B,,,78.2,18.6,1.3,0.9,0.1,brass
STAL,4545,,C41,90B,,,79.0,19.6,1.6,0.1,0.0,brass
STAL,4567,,C7,90B,,,79.8,19.3,1.3,0.1,0.0,brass
STAL,682702,,C42,90B,,,79.2,18.8,1.5,0.3,0.0,brass
STAL,4544,,C28,90B,,,80.5,17.5,1.6,0.2,0.0,brass
STAL,670458,,C55,90B,,,77.2,21.7,2.9,0.3,0.0,brass
COLC,,1.81-4048,CS18,90B,,,,,,brass
STAL,4533,,C36,90B,,,,,,brass
STAL,4527,,C56,90B,,,,,,brass
DRAG,,DR66HV,50,90B,,,,,,brass

DRAG,,DR67NX,40,90B,,,,,,brass
DRAG,,DR66EE,52,90B,,,,,,brass
DRAG,,DR68GL,46,90B,,,,,,brass
DRAG,,DR65YS,39,90B,,,,,,brass
DRAG,,DR67AFC,48,90B,,,21.8,0.4,0.0,0.0,brass
DRAG,,DR72KH,51,90B,,,,,,brass
DRAG,,DR70AAK,47,90B,,,,,,brass
DRAG,,DR71BFJ,42,90B,,,,,,brass
DRAG,,DR72AJA,41,90B,,,,,,brass
LOND,,122,,90B,,,,,,brass
LOND,,A22966,,90B,,,,,,brass/gunmetal
STAN,8516903,,,90B,,,,,,brass
STAN,8516931,,,90B,,,,,,brass
STAN,8516937,,,90B,,,,,,brass
STAN,8516938,,,90B,,,,,,brass
STAN,8612544,,,90B,,,,,,brass
STAN,8612936,,,90B,,,,,,brass
STAN,8612994,,,90B,,,,,,brass
STAN,8700575,,,90B,,,,,,brass
STAN,8701457,,,90B,,,,,,brass
STAN,8800681,,,90B,,,,,,brass/gunmetal
STAN,8800685,,,90B,,,,,,brass
STAN,8800762,,,90B,,,,,,brass
LOND,,20369,,90B,,,,,,brass
STAL,670449,,C1,90B?,,,79.9,19.5,0.6,0.4,0.1,brass
STAL,670467,,C38,90B?,,,76.2,20.7,1.9,0.3,0.3,brass
STAL,682687,,C2,90B?,,,81.0,17.5,1.6,0.4,0.1,brass
STAL,670427,,C25,90B?,,,71.4,27.3,1.3,0.3,0.0,brass
WROX,721364,,90B?,,,85.1,1.4,9.7,0.4,0.0,bronze
STAL,682727,,C52,90B/91,,,78.2,18.2,0.4,0.2,0.0,brass
STAL,670275,,C23,90B/91,,,84.3,15.1,0.9,1.0,0.0,brass
STAL,682667,,C53,90B/91,,,73.9,22.1,1.1,0.0,0.0,brass
STAL,682666,,C57,90B/91,,,76.0,21.3,0.5,0.1,0.0,brass
STAL,4534,,C51,90B/91,,,73.9,23.6,1.0,0.0,0.1,brass
STAL,4571,,C69,90B/91,,,,,,brass
STAL,670419,,C32,90B/91,,,,,,brass
STAL,4539,,C65,90B/91?,,,84.0,17.1,1.2,0.3,0.2,brass
STAL,670507,,C50,90B/91?,,,71.9,16.8,1.9,0.3,0.0,brass
STAL,670521,,C60,90B/91?,,,76.3,21.9,1.0,0.3,0.0,brass
WEEK,781422,231,10,90/92,,,,,,brass
WANB,,63,90/92?,,,,,,bronze
TARH,,744,,90/117,,,,,,brass/gunmetal
BRAU,,26,32,91,,,,,,brass
BRAU,,511,35,91,,,,,,brass/gunmetal
BALD,,64,91,,,,,,brass/gunmetal
BRAU,,541,34,91,,,,,,brass
STAL,682703,,C71,91,,,73.4,20.1,0.5,0.7,0.1,brass
STAL,670505,,C49,91,,,78.9,20.4,1.2,0.2,0.0,brass
STAL,670518,,C62,91,,,89.6,20.1,2.1,0.1,0.0,brass
STAL,670437,,C46,91,,,81.0,19.6,1.8,1.1,0.0,brass
STAL,682670,,C64,91,,,76.8,20.2,0.8,0.3,0.0,brass
STAL,682675,,C48,91,,,78.7,18.5,0.3,0.3,0.1,brass
STAL,682690,,C47,91,,,78.1,19.6,1.3,0.2,0.0,brass
BRAU,,516,36,91,,,73.8,14.5,1.5,2.4,0.4,brass

HAYL,,1529,,91,,,81.3,20.7,0.0,0.3,0.0,brass
BALD,715561,,63,91,,,85.4,20.0,2.1,0.3,0.0,brass
STAL,670481,,C34,91,,,,,,brass/gunmetal
STAL,4562,,C67,91,,,,,,brass
STAL,682731,,C70,91,,,,,,brass
STAL,670438,,C61,91,,,,,,brass
WINC,,VR-309,,91,,,,,,brass
WROX,7410166,,91,,,,,,bronze
STAL,682652,,C74,91?,,,76.6,17.6,1.7,0.1,0.1,brass
STAL,670650,,C72,91?,,,78.6,18.3,0.6,0.2,0.0,brass
STAL,670519,,C77,91?,,,73.2,19.5,1.0,0.4,0.0,brass
HAYL,,484,,91?,,,,,,brass
STAN,8610963,,91A,,,,,,bronze
STAN,8612538,,91A,,,,,,brass
SAND,,523,,91A,,,,,,brass
SAND,,1375,,91A,,,,,,brass
SAND,,3713,,91A,,,,,,brass
RICH,7350291,990,59,91B,,,87.2,10.5,0.8,0.6,0.2,brass
RICH,7351526,4366,67,91B,,,81.9,15.8,0.8,0.6,0.1,brass
RICH,7351533,,66,91B,,,79.3,27.0,0.0,0.0,0.1,brass
LECH,,1959-5,3,92,,,,,,(lead) gunmetal
LECH,,1982(1438),4,92,,,,,,(lead) bronze
WEEK,781370,2,12,92,,,,,,lead gunmetal
BALD,,,69,92,,,,,,brass
MAGI,7711177,,4,92,,,,,,lead bronze
GEST,,BR157,7,92,,,,,,lead gunmetal
WICF,,27,,92,,,,,,lead bronze
WICF,,102,,92,,,,,,lead bronze
WICF,,253,,92,,,,,,lead bronze
WICF,,348,,92,,,,,,lead bronze
GARD,,ME11,,92,,,,,,lead bronze
COLC,,CF-54,,92,,,,,,lead gunmetal
WANB,,,70,92,,,,,,lead bronze
WANB,,,65,92,,,,,,(lead) bronze?
WANB,,,66,92,,,,,,lead bronze
WANB,692664,,74,92,,,,,,(lead) bronze
WANB,,,77,92,,,,,,lead bronze
RICH,7351527,4318,198,92,,,,,,lead bronze/gunmetal
KEST,841234,,101,92,,,,,,lead bronze
KEST,841267,,96,92,,,,,,lead gunmetal
KEST,841271,,97,92,,,,,,lead bronze
KEST,841238,,98,92,,,,,,lead bronze
BRAU,,368,49,92,,,,,,lead bronze/gunmetal
RICH,7350503,234,162,92,,,74.1,0.0,7.1,16.0,0.2,lead bronze
RICH,7350105,927,161,92,,,85.5,4.8,6.5,1.8,0.2,gunmetal
RICH,7350205,5057,168,92,,,79.9,5.4,5.3,7.0,0.0,(lead) gunmetal
RICH,7350076,3009,196,92,,,81.9,0.5,8.0,7.7,0.2,(lead) bronze
RICH,7350106,1037,181,92,,,77.6,0.0,8.1,16.9,0.1,lead bronze
RICH,7350741,3240,193,92,,,72.3,0.8,5.4,20.1,0.2,lead bronze
RICH,7350328,,197,92,,,83.8,0.2,6.8,8.3,0.1,lead bronze
RICH,7350100,31,169,92,,,80.7,0.2,10.7,7.6,0.1,(lead) bronze
RICH,7350095,1832,174,92,,,76.2,0.8,9.0,13.4,0.1,lead bronze
RICH,7350298,2034,175,92,,,78.8,0.0,10.1,9.2,0.1,lead bronze
RICH,7350290,1277,171,92,,,75.3,3.3,4.8,14.9,0.1,lead gunmetal

RICH,7350213,4823,163,92,,,77.2,0.0,7.8,13.7,0.1,leaded bronze
RICH,7350501,1079,166,92,,,73.7,0.5,7.1,14.9,0.1,leaded bronze
RICH,7350743,740,160,92,,,78.4,3.3,7.7,10.9,0.1,leaded bronze/gunmetal
RICH,7351036,5561,167,92,,,83.2,0.5,7.4,5.0,0.0,(leaded) bronze
RICH,7351078,2064,173,92,,,77.2,0.9,8.2,11.6,0.1,leaded bronze
RICH,7351094,1047,179,92,,,82.1,0.1,11.6,5.3,0.1,(leaded) bronze
RICH,7351519,4889,172,92,,,87.6,0.1,7.9,6.2,0.0,(leaded) bronze
RICH,7351571,2513,164,92,,,76.1,0.4,8.7,14.3,0.0,leaded bronze
RICH,7351575,1369,194,92,,,77.5,0.5,8.6,10.0,0.1,leaded bronze
RICH,7351520,5061,170,92,,,82.7,0.2,10.0,9.6,0.1,leaded bronze
RICH,7351523,4664,178,92,,,79.8,3.1,5.9,14.0,0.1,leaded bronze/gunmetal
RICH,7351570,2632,165,92,,,81.9,0.9,7.6,13.1,0.1,leaded bronze
BRAU,,459,48,92,,,72.2,0.2,6.7,13.7,0.1,leaded bronze
BRAU,,251,47,92,,,76.8,0.2,8.8,4.6,0.1,(leaded) bronze
SWIN,770237,57,,92,T,,76.9,0.7,10.3,8.1,0.1,leaded bronze
THIS,,THZ2705,,92,,,80.5,0.5,10.6,6.0,0.1,(leaded) bronze
HAYL,,1362,,92,,,91.9,0.1,4.7,3.2,0.1,bronze
HAYL,,1039,,92,,,74.7,2.0,12.5,6.7,0.1,(leaded) bronze
HAYL,,2,,92,,,63.7,0.2,7.7,16.3,0.1,leaded bronze
HAYL,,3041,,92,,,73.1,0.2,12.5,12.4,0.0,leaded bronze
BALD,715586,,77,92,,,78.5,0.1,6.4,11.2,0.0,leaded bronze
BALD,7211150,,68,92,,,74.5,4.0,8.7,10.5,0.1,leaded bronze/gunmetal
BALD,,,70,92,,,78.4,0.3,9.1,8.3,0.6,leaded bronze
BALD,7210432,,72,92,,,74.5,7.5,5.4,11.5,0.9,leaded gunmetal
BALD,7211141,,76,92,,,77.3,1.8,8.0,12.2,0.1,leaded bronze
BALD,7211120,,73,92,,,75.0,0.5,9.6,17.9,0.1,leaded bronze
BALD,715558,,79,92,,,85.5,0.7,5.0,8.0,0.0,(leaded) bronze
WICF,,255,,92,,,78.4,0.0,12.1,11.0,0.0,leaded bronze
WICF,,254,,92,,,73.6,0.4,12.4,26.0,0.0,leaded bronze
WICF,,258,,92,,,83.7,0.0,6.7,10.1,0.0,leaded bronze
WICF,,256,,92,,,82.5,3.8,6.8,14.2,0.1,leaded bronze/gunmetal
WANB,,,71,92,,,84.5,0.0,7.7,13.3,0.0,leaded bronze
WANB,707303,,76,92,,,68.9,0.0,8.9,18.6,0.1,leaded bronze
WANB,,,73,92,,,65.9,0.0,12.5,19.3,0.1,leaded bronze
WANB,,,72,92,,,82.3,0.0,11.0,6.5,0.0,(leaded) bronze
WANB,,,68,92,,,73.3,0.5,12.3,10.6,0.0,leaded bronze
WANB,,,75,92,,,90.1,1.1,11.3,7.8,0.1,(leaded) bronze
WANB,684102,,82,92,,,80.8,0.4,7.3,14.8,0.1,leaded bronze
WANB,,,86,92,,,75.6,0.2,8.1,19.9,0.0,leaded bronze
WANB,,,84,92,,,75.9,0.1,9.8,15.8,0.1,leaded bronze
WANB,684373,,83,92,,,76.8,0.5,13.1,16.0,0.1,leaded bronze
WANB,,,69,92,,,80.5,0.4,9.6,11.8,0.1,leaded bronze
WANB,,,79,92,,,78.3,0.2,9.0,15.7,0.1,leaded bronze
WANB,,,64,92,,,72.7,1.0,8.4,19.4,0.1,leaded bronze
WANB,,,85,92,,,79.7,0.7,15.3,14.7,0.1,leaded bronze
WANB,,,78,92,,,72.3,0.2,11.1,13.4,0.1,leaded bronze
MAGI,7711248,,9,92,,,76.9,4.3,10.5,9.6,0.0,leaded bronze/gunmetal
CHEL,,CHAK7,1:6,92,,,80.6,1.7,7.8,4.7,0.1,(leaded) bronze
CHEL,,CHS73,1:7,92,,,83.9,3.4,7.3,5.0,0.1,(leaded) bronze/gunmetal
GORH,820030,,,92,,,82.2,0.5,13.1,9.9,0.1,leaded bronze
GORH,820073,,31,92,,,73.8,0.0,7.6,18.2,0.1,leaded bronze
GORH,820037,,34,92,,,81.1,1.8,12.4,6.5,0.1,(leaded) bronze
GORH,811373,,33,92,,,76.9,2.4,12.9,6.6,0.0,(leaded) bronze
GORH,820270,,39,92,,,87.9,1.3,9.6,5.3,0.1,(leaded) bronze

GORH,811384,,36,92,,,76.5,0.0,8.7,16.3,0.2,leaded bronze
CHEL,,CHDAe333,2:18,92,,,71.1,1.4,6.4,20.8,0.0,leaded bronze
CHEL,,CHMAe288,2:17,92,,,68.4,0.0,12.3,9.4,0.0,leaded bronze
CHEL,,CHKAe232,2:12,92,,,82.7,1.0,7.7,5.2,0.0,(leaded) bronze
CHEL,,CHKAe267,2:13,92,,,86.5,1.4,7.6,5.0,0.0,(leaded) bronze
CHEL,,CHKAe247,2:21,92,,,80.3,0.3,6.9,15.4,0.0,leaded bronze
CHEL,,CHKAe238,2:10,92,,,78.1,0.1,4.7,17.6,0.0,leaded bronze
CHEL,,CHKAe241,2:11,92,,,88.1,0.0,8.0,6.7,0.1,(leaded) bronze
CHEL,,CHKAe217,2:15,92,,,67.9,5.0,7.5,20.4,0.0,leaded bronze/gunmetal
CHEL,,CHKAe196,2:14,92,,,84.9,0.9,8.5,5.4,0.1,(leaded) bronze
CHEL,,CHKAe246,2:16,92,,,65.6,0.0,10.1,20.4,0.0,leaded bronze
ASHT,835146,402,,92,,,,,,bronze
GORH,811379,1851,32,92,,,,,,leaded bronze
GORH,820305,2718,37,92,,,,,,leaded bronze
GORH,820368,3973,,92,,,,,,leaded bronze
SEAM,,67-104,6,92,,,,,,bronze
SEAM,,66-59,5,92,,,,,,leaded bronze
WITC,673591,bz50,2,92,,,,,,leaded bronze
THIS,,THZ1451,,92,,,,,,leaded bronze
THIS,,THZ3993,,92,,,,,,(leaded) bronze
THIS,,THVbag53,,92,,,,,,bronze/gunmetal
THIS,,THVbag83,,92,,,,,,gunmetal
THIS,610967,BH699,,92,,,,,,bronze
COLC,,GBS-1093,GBS18,92,,,,,,bronze
COLC,,GBS-714,GBS17,92,,,,,,bronze
COLC,,1.81-686,CS20,92,,,,,,leaded bronze
COLC,,1.81-1703,CS19,92,,,,,,leaded bronze
CHEL,,CHV1,,92,,,,,,leaded bronze
CHEL,,CHV6,,92,,,,,,leaded bronze
CHEL,,CHV21,,92,,,,,,leaded bronze
CHEL,,CHAG30,,92,,,,,,bronze
CHEL,,CHN15,,92,,,,,,bronze/gunmetal
CHEL,,CHAG27,,92,,,,,,leaded bronze
CHEL,,CHAG28,,92,,,,,,leaded bronze
CHEL,,CHKAe213,2:19,92,,,,,,bronze
CHEL,,CHKAe190,2:20,92,,,,,,leaded bronze
STAL,670525,,D1,92,,,,,,bronze
ICKH,,2080,,92,,,,,,leaded bronze
HAYL,,KP10,,92,,,,,,bronze?
CAST,,10-1778,15,92,,,,,,(leaded) bronze
OLDW,886270,,92,,,,,,leaded bronze/gunmetal
LOND,,A12034,,92,,,,,,leaded gunmetal?
LOND,,A21461,,92,,,,,,bronze
LOND,,3423,,92,,,,,,bronze
LOND,,130,,92,,,,,,bronze
LOND,,89,,92,,,,,,bronze
LOND,,81.629/3,,92,,,,,,bronze
LOND,,12665,,92,,,,,,leaded bronze
LOND,,A10375,,92,,,,,,leaded bronze
LOND,,18130,,92,,,,,,(leaded) gunmetal
STAN,8612486,,92,,,,,,(leaded) bronze
STAN,8611728,,92,,,,,,bronze
STAN,8611730,,92,,,,,,bronze
STAN,8610972,,92,,,,,,leaded gunmetal

LOND,,20371,,92,,,,,,brass
LOND,,19228,,92,,,,,,bronze
LOND,,20761,,92,,,,,,bronze
LOND,,3424,,92,,,,,,gunmetal
SNET,,Cat5,5,92,,,,,,bronze
SNET,,Cat17,,92,,,,,,leaded bronze
SAND,,559,,92,,,,,,leaded bronze?
SAND,,1432,,92,,,,,,leaded bronze
SAND,,1711,,92,,,,,,leaded gunmetal
SAND,,3725,,92,,,,,,leaded bronze/gunmetal
SAND,,3755,,92,,,,,,bronze
STAN,8800051,,,92,,,,,,leaded bronze
STAN,8900533,,,92,,,,,,leaded bronze
STAN,8900768,,,92,,,,,,(leaded) bronze
STAN,8901195,,,92,,,,,,leaded bronze
STAN,8901300,,,92,,,,,,bronze
STAN,8901637,,,92,,,,,,(leaded) bronze
STAN,8901750,,,92,,,,,,leaded bronze/gunmetal
STAN,8901844,,,92,,,,,,(leaded) bronze
RICH,96005012,5170,177,92,,,,,,leaded bronze
WICF,,187,,92?,,,,,,leaded bronze
WICF,,301,,92?,,,,,,leaded bronze
WANB,684375,,88,92?,,,,,,(leaded) bronze
WANB,,,90,92?,,,,,,leaded bronze
WANB,,,91,92?,,,,,,leaded bronze
WANB,,,89,92?,,,76.5,0.0,9.9,11.6,0.0,leaded bronze
TIDD,,TA1,,92?,,,87.8,2.1,14.5,0.5,0.1,bronze
HAYL,,179,,92?,,,,,,(leaded) bronze
CHEL,,CHAG26,92?,,,,,,leaded bronze
CATT,8310556,,Site240:2,92?,,,,,,leaded bronze
BRAU,,987,51,92+,,,,,,leaded bronze
WANB,,,67,92+,,,,,,leaded bronze
WANB,,,87,92+,T,,67.4,0.2,10.2,22.2,0.1,leaded bronze
WROX,721371,,,92+,,,81.8,0.0,5.9,12.5,0.3,leaded bronze
GARD,,ME12,,92/93,,,,,,leaded bronze
TIDD,,M2,,92/93,,,,,,leaded bronze/gunmetal
COLC,,CF-55,,92/93,,,,,,leaded gunmetal
COLC,,CF-33,,92/93,,,,,,leaded bronze
BALD,7210429,,75,92/93,,,78.1,6.0,6.8,9.4,0.1,leaded gunmetal
RICH,7351870,,200,92/93,,,,,,leaded bronze/gunmetal
RICH,7351889,,199,92/93,,,,,,bronze
RICH,7351911,5347,201,92/93,,,,,,bronze
LOND,,ACE78,,92/93,,,,,,bronze/gunmetal
LOND,,ALG29,,92/93,,,,,,leaded bronze
LOND,,AST137,,92/93,,,,,,bronze
LOND,,CRU47,,92/93,,,,,,(leaded) bronze
LOND,,DMT185,,92/93,,,,,,leaded bronze
LOND,,ER702-1,,92/93,,,,,,bronze
LOND,,FEN222,,92/93,,,,,,leaded bronze
LOND,,GPO419,,92/93,,,,,,(leaded) bronze
LOND,,GPO1003,,92/93,,,,,,leaded bronze
LOND,,GPO4366,,92/93,,,,,,leaded bronze
LOND,,GPO3934,,92/93,,,,,,bronze
LOND,,GPO4660,,92/93,,,,,,(leaded) bronze

LOND,,LCT1294,,92/93,,,,,,leded bronze
LOND,,LCT1383,,92/93,,,,,,leded bronze
LOND,,LCT1384,,92/93,,,,,,leded bronze
LOND,,LCT1494,,92/93,,,,,,bronze
LOND,,LCT1517,,92/93,,,,,,(leded) bronze
LOND,,MGT135,,92/93,,,,,,leded bronze
LOND,,OPT650,,92/93,,,,,,bronze
LOND,,ORG87,,92/93,,,,,,(leded) bronze
LOND,,OST89,,92/93,,,,,,leded bronze
LOND,,POM610,,92/93,,,,,,(leded) bronze
LOND,,SLO87,,92/93,,,,,,leded bronze
LOND,,18649,,92/93,,,,,,gunmetal
SNET,,Cat18,18,92/93,,,,,,leded bronze
BALD,,78,92/93?,,,,,,leded bronze
BALD,,80,92/93?,,,,,,leded bronze
BALD,263,,71,92/93?,,,80.9,4.2,4.9,12.3,0.1,leded gunmetal
LOND,,ORG91,,92/93?,,,,,,bronze
CHEL,,CHAJ18,,92/94?,,,,,,leded bronze
CHEL,,CHAJ19,,92/94?,,,,,,(leded) bronze
RICH,7351875,,205,92/94?,,,,,,(leded) bronze
RICH,7351890,,202,92/94?,,,,,,brass
SEAM,,65-276,7,92/95?,,,,,,gunmetal?
CHEL,,CHAG31,,92/96?,,,,,,brass?
WEEK,781371,3,14,93,,,,,,bronze
WICL,,39,,93,,,,,,leded bronze/gunmetal
RICH,7350476,297,184,93,,,78.3,0.2,8.8,15.5,0.1,leded bronze
RICH,7351578,2482,182,93,,,79.9,3.7,3.4,16.7,0.1,leded gunmetal
RICH,7351759,5472,186,93,,,81.9,0.3,7.6,6.6,0.1,(leded) bronze
WANB,,80,93,,,89.8,2.5,9.3,0.0,0.1,bronze
WANB,,81,93,,,76.4,0.4,7.7,18.8,0.1,leded bronze
COLC,,1.81-4968,CS22,93,,,,,,leded bronze
COLC,,1.81-965,CS21,93,,,,,,leded gunmetal
LOND,,101,,93,,,,,,gunmetal
RICH,7351545,4497,176,93,,,74.8,0.2,8.0,15.7,0.1,leded bronze
ULEY,,2286,Fig123:10,93?,,,58.1,0.0,7.1,30.5,0.1,leded bronze
RICH,7350288,,189,93A,,,69.0,0.1,11.4,16.5,0.1,leded bronze
RICH,7350073,2395,185,93A,,,86.4,0.6,8.0,11.5,0.1,leded bronze
RICH,7351767,1581,190,93A,,,80.0,0.2,4.2,14.0,0.1,leded bronze
RICH,7351579,,183,93A,,,81.9,3.4,5.3,11.3,0.1,leded bronze/gunmetal
SHEP,722338,,38,93A,,,82.6,2.4,6.2,9.9,0.1,leded bronze/gunmetal
BALD,7210333,,74,93A,,,61.3,0.3,7.5,30.0,0.0,leded bronze
LOND,,81.370/1,,93A,,,,,,bronze
LOND,,20655,,93A,,,,,,bronze
LOND,,20779,,93A,,,,,,bronze
RICH,7350479,59,191,93A,,,,,,(leded) bronze
RICH,7351075,1914,187,93A,,,76.7,2.3,8.1,12.1,0.2,leded bronze
RICH,7351091,,188,93A,,,81.1,0.0,8.4,9.1,0.2,leded bronze
RICH,7350385,4820,195,93B,,,75.9,0.1,8.5,13.5,0.1,leded bronze
WROX,721363,,,93B,,,89.9,0.3,0.0,7.2,0.0,(leded) copper
LOND,,LCT1132,,93B,,,,,,leded bronze
RICH,7351092,700,192,93B,,,83.0,0.1,7.0,10.9,0.1,leded bronze
WEEK,781389,,13,93C,,,,,,gunmetal
WAKE,745063,50,4,93C,,,,,,leded bronze
GEST,777259,BR110,8,93C,,,,,,leded bronze

RICH,7351773,5529,180,93C,,,73.1,0.0,7.5,17.8,0.0,leaded bronze
STAN,8516926,,,93C,,,,,,leaded gunmetal
SHEP,722337,,40,94,,,74.4,0.0,10.9,2.8,0.1,bronze
ASHT,835070,66,,94,,,,,,leaded bronze
REDC,8650617,83,,94,,,9.6,4.4,0.2,0.0,gunmetal
COLC,,1.81-5195,CS23,94,T,,,,,,bronze/gunmetal
COLC,,1.81-2415,CS24,94,,,,,,bronze
WICL,,7,,94?,,,,,,leaded bronze/gunmetal
ASHT,835138,666,,94?,,,,,,leaded bronze
PRES,,204,1,94+,,,,,,leaded gunmetal
WICL,,8,,94A,,,,,,bronze
WICL,,36,,94A,,,,,,bronze
WICL,,47,,94A,,,,,,leaded bronze
WICL,,48,,94A,,,,,,bronze/gunmetal
SHEP,,,39,94A,,,75.9,1.7,4.8,4.9,0.1,(leaded) bronze/gunmetal
THIS,611004,BH817,,94A,,,81.1,9.1,3.9,1.1,0.0,gunmetal
THIS,610975,BH718,,94A,T,,73.8,0.1,4.8,17.7,0.1,leaded bronze
THIS,,THZ328,,94A,,,83.3,0.1,5.4,12.0,0.1,leaded bronze
THIS,,THZ2104,,94A,T,,83.6,0.1,13.6,0.1,0.0,bronze
THIS,,THZ4117,,94A,,,81.8,5.4,5.1,1.1,0.1,gunmetal
WANB,,,92,94A,,,83.3,0.0,10.4,10.4,0.0,leaded bronze
WANB,,,94,94A,,,93.8,0.4,10.7,0.0,0.1,bronze
WANB,,,93,94A,,,95.6,2.6,4.5,0.7,0.1,bronze/gunmetal
THIS,,THZ2704,,94A,,,,,,brass?
DRAG,,DR65VG,88,94A,,,,,,brass
DRAG,,DR67MU,87,94A,,,,,,bronze
CAST,,16-337,13,94A,,,,,,bronze
LOND,,WIV234,,94A,,,,,,gunmetal
LOND,,C985,,94A,,,,,,bronze
LOND,,26374,,94A,,,,,,bronze
LOND,,26379,,94A,,,,,,(leaded) bronze
LOND,,7001,,94A,,,,,,leaded bronze
LOND,,26399,,94A,,,,,,bronze
LOND,,26406,,94A,,,,,,brass?
STAN,8516905,,,94A,,,,,,(leaded) bronze
SNET,,Cat2,,94A,,,,,,bronze
SNET,,Cat3,,94A,,,,,,bronze
SNET,,Cat4,4,94A,,,,,,bronze
SNET,,Cat6,,94A,,,,,,bronze
SNET,,Cat7,,94A,,,,,,bronze
SNET,,Cat9,,94A,,,,,,(leaded) bronze
SNET,,Cat10,10,94A,,,,,,bronze
SNET,,Cat12,,94A,,,,,,gunmetal
SNET,,Cat14,14,94A,,,,,,bronze
SNET,,Cat15,15,94A,,,,,,bronze
SAND,,1270,,94A,,,,,,bronze
SAND,,1586,,94A,,,,,,bronze
SAND,,3477,,94A,S,,,,,,bronze/gunmetal
SAND,,3724,,94A,S,,,,,,bronze
STAN,8800009,,,94A,,,,,,leaded bronze
LECH,,1957-2,5,94A,,,74.8,0.9,12.3,7.8,0.1,(leaded) bronze
BALD,7210426,,82,94A,,,87.5,6.0,7.5,0.8,0.1,gunmetal
BRAU,,610,50,94A,,,90.8,0.0,10.6,0.8,0.1,bronze
BRAU,,685,45,94A,,,88.1,1.0,7.7,2.5,0.2,bronze

BRAU,,655,46,94A,,,87.5,0.7,9.6,2.1,0.0,bronze
TIDD,,M3,,94A,,,,,,bronze/gunmetal
HAYL,,1779,,94A,,,,,,(lead) bronze
WICL,,9,,94A?,,,,,,bronze
STAN,8700083,,94A?,,,,,,bronze
SNET,,Cat8,8,94A?,,,,,,bronze
TRET,,118,,94A?,,,,,,lead bronze
WICL,,18,,94B,T,,,,,,lead gunmetal
WICL,,19,,94B,,,,,,lead bronze
WICL,,32,,94B,T,,,,,,bronze
WICL,,51,,94B,,,,,,lead gunmetal
RICH,7350061,928,207,94B,,,87.3,0.4,9.4,4.9,0.1,(lead) bronze
RICH,7350276,2754,206,94B,,,78.2,0.4,4.6,15.0,0.1,lead bronze
THIS,611018,BH855,,94B,,,84.9,0.1,8.0,4.1,0.0,(lead) bronze
THIS,,THZ1557,,94B,,,83.7,0.1,11.4,0.5,0.0,bronze
CHEL,,CHKAe189,2:22,94B,,,84.5,0.1,9.3,6.7,0.1,(lead) bronze
WALL,,,12,94B,,,,,,bronze
CHEL,,CHAF10,,94B,,,,,,bronze
CHEL,,CHAF11,,94B,,,,,,bronze
DRAG,,DR68HC,96,94B,,,,,,gunmetal
DRAG,,DR69LX,99,94B,,,1.5,9.2,1.1,0.0,bronze
DRAG,,DR69YH,97,94B,,,,,,brass
DRAG,,DR67BQ,98,94B,,,,,,bronze
DRAG,,DR67XL,91,94B,,,0.0,10.3,0.4,0.0,bronze
DRAG,,DR66FC,93,94B,,,,,,gunmetal
WINC,,VR-9676,,94B,,,,,,bronze
STAN,8800704,,,94B,,,,,,(lead) bronze
SNET,,Cat19,19,94B,,,,,,lead bronze
SNET,,Cat20,20,94B,,,,,,bronze
SNET,,Cat21,,94B,,,,,,(lead) bronze
SNET,,Cat22,,94B,,,,,,bronze
CARV,,,19,94B,,,82.0,1.5,12.5,2.6,0.1,bronze
MAGI,779678,,7,94B,,,85.1,2.3,13.5,5.4,0.0,(lead) bronze
WEEK,781402,90,16,94B,,,,,,lead bronze
TIDD,,81-226,,94B,,,,,,(lead) bronze
PRES,851060,148,10,94B/152,,,84.3,2.3,6.2,7.2,0.2,(lead) bronze/gunmetal
CAST,,15-511,17,94B?,,,,,,bronze
PRES,,61,8,94B+,,,86.7,1.0,10.3,0.3,0.0,bronze
PRES,851058,76,9,94B+,,,77.3,12.6,2.3,4.3,0.3,(lead) brass
YORK,,M831,,94C,Es,NTX,,,,,,lead bronze
TIDD,,82-230,,94C,,,,,,lead bronze/gunmetal
DRAG,,DR68QF,89,94C,Es,T?X,,,,,,bronze/gunmetal
DRAG,,DR66BH,90,94C,Es,X,,,,,,gunmetal
TIDD,,81-165,,Gp=5,,,,,,lead bronze/gunmetal
RICH,7351517,1131,203,Gp=5,,,,,,lead bronze
THIS,,BH37,,Gp=5,T,,75.0,0.1,9.8,12.7,0.1,lead bronze
ASHT,835142,,,Gp=5,,,,,,brass
ASHT,835077,,,Gp=5,,,,,,gunmetal
LOND,,LCT2214,,Gp=5,,,,,,bronze
SWIN,,387,,Gp=5?,T,,,,,,lead bronze
RICH,7351777,,204,Gp=5?,,,67.8,2.6,5.5,23.6,0.2,lead bronze/gunmetal
LOND,,FNC43,,Gp=5?,,,,,,bronze?
LOND,,ABS407,,Gp=5?,,,,,,(lead) bronze
SNET,,Cat13,,Gp=5?,,,,,,bronze

SNET,,Cat25,25,Gp=5?,,,,,(lead) bronze
CAST,,15-779,18,Gp=5?,,,,,bronze
BALD,,7211125,,67,Gp=5?,,,78.1,1.7,7.6,10.2,0.1,lead bronze
BRAU,,359,33,Gp=5?,,,,,brass
LOND,,CASS141,,Gp=5/6,,,,,(lead) bronze
LOND,,FCS56,,Gp=5/6,,,,,?
LOND,,FEN151,,Gp=5/6,,,,,?
LOND,,FEN269,,Gp=5/6,,,,,bronze
LOND,,GPO3933,,Gp=5/6,,,,,bronze
LOND,,GPO3759,,Gp=5/6,,,,,(lead) bronze
LOND,,GPO4292,,Gp=5/6,,,,,lead bronze
LOND,,LCT1501,,Gp=5/6,,,,,bronze
WORC,,3899-c17035,,Gp=5/6,,,,,bronze
WORC,,907217,3899-c11453,,Gp=5/6,,,,,brass
SNET,,Cat24,24,Gp=5/6,,,,,(lead) bronze
LOND,,LCT1175,,Gp=5/6?,,,,,bronze
LOND,,LCT2009,,Gp=5/6?,,,,,(lead) bronze?
LOND,,WIV520,,Gp=5/6/7,,,,,brass
STAN,,8516840,,Gp=5/6/7,,,,,lead bronze
STAN,,8516877,,Gp=5/6/7,,,,,lead bronze
STAN,,8611706,,Gp=5/6/7,,,,,lead bronze
DRAG,,DR68HF,117,Gp=5/7?,,,,,bronze
TIDD,,M8,,95,,,,,(lead) bronze?
COLE,,1087,10,95,,,,,lead bronze
TIDD,,M9,,95,,89.6,0.2,13.0,1.3,0.3,bronze
TIDD,,M588,,95,,86.3,0.1,10.6,8.0,0.1,lead bronze
COLC,,1.81-2197,CS25,95,,,,,lead bronze
DODD,,8515472,,95,,,,,(lead) bronze
SNET,,Cat16,,95,,,,,(lead) bronze
RICH,,7350692,,208,95,,67.5,0.4,7.1,23.8,0.0,lead bronze
POOL,,5137,12,95?,,,,,gunmetal
COLE,,461,9,95/100C,,,,,lead bronze
CARV,,21,95A,,,,,bronze
THIS,,THV178,,95A,,84.5,0.7,6.4,2.6,0.1,bronze
THIS,,THV17,,95A,,68.1,0.8,8.7,17.8,0.1,lead bronze
ULEY,,8222,Fig123:9,95A,,70.5,0.0,9.4,19.5,0.0,lead bronze
THIS,,THVbag185,,95A,T,,,,,(lead) bronze
LOND,,29.94/2,,95A,,,,,bronze
STAN,,8516955,,95A,,,,,bronze
THOR,,852995,13,,95B,,,,,bronze
CARL,,BLAAe238,1,95B,,,,,lead bronze
WORC,,774,,95B,,,,,(lead) bronze
LOND,,O.1811,,95B,,,,,lead bronze
COLE,,850,7,95C,,,,,bronze
COLE,,791,8,95C,,,,,lead bronze
LECH,,1957-1,6,95C,,69.4,0.1,10.9,13.6,0.1,lead bronze
GORH,,820253,,42,95C,,74.4,0.4,12.0,20.3,0.1,lead bronze
THIS,,THVbag184,,95C,,,,,lead bronze
THIS,,THVbag35,,95C,,,,,lead bronze/gunmetal
STAN,,8611856,,95C,,,,,bronze
WORC,,784,,95C,,,,,(lead) bronze
STAN,,9002166,,95C,,,,,lead bronze
CATT,,594695,,Site433:1,95C,,,,,lead bronze
LOND,,79.16/2,,95C,,,,,lead bronze

COLE,,1085,12,96,,,,,,bronze
COLE,,91,13,96,,,,,,leaded bronze
WANB,,,97,96,,,75.7,0.0,7.6,17.9,0.1,leaded bronze
WROX,721380,,,96,,,72.1,0.0,6.8,18.5,0.3,leaded bronze
WITC,635032,bz32,3,96,,,,,,leaded bronze
LEIC,,316-17,2:22,96,,,,,,leaded gunmetal
OPEN,7814429,,615,96,,,,,,leaded bronze
LOND,,84.341/4,,96,,,,,,leaded bronze
WORC,,620,,96,,,,,,leaded bronze
RICH,7350502,530,210,96,,,91.2,4.4,5.0,0.9,0.1,gunmetal
WANB,,,98,96?,,,81.1,0.0,5.2,12.4,0.1,leaded bronze
WROX,781666,,,96?,,,,,,leaded bronze
SEAM,,65/6-4,8,96/103,,,,,,leaded gunmetal
PRES,851059,231,2,97,,,64.7,0.0,8.6,25.0,0.0,leaded bronze
LOND,,128,,97A,,,,,,brass
CAST,,14-340,11,97B,,,,,,brass
CORB,831173,,5,98,,,,,,leaded bronze
LOND,,A7733,98,,,,,,bronze
COLE,,1086,5,98?,,,,,,copper
COLE,,110,6,98?,,,,,,leaded bronze
WROX,840568,,,98?,,,,,,bronze
STAN,8901785,,,98?,,,,,,bronze
LOND,,ABC165,,98/100?,,,,,,(leaded) bronze
BALD,715556,,83,99,N,,81.8,19.6,1.8,2.0,0.1,brass
TIDD,,M10,,99,,,79.9,0.5,9.9,6.4,0.2,(leaded) bronze
DORC,8212384,,WH,99,,,,,,bronze
CAST,,10-416,14,99,,,,,,(leaded) bronze
CAST,,1-763,45,99?,,,,,,brass
WORC,,783,,99A,,,,,,leaded gunmetal
WORC,,3899-c11977,,99B,,,,,,gunmetal
WORC,,3899-c17407,,99B,,,,,,leaded bronze
GLOU,,69/49-49,E1,99C,,,,,,leaded bronze
WROX,80000320,,,99C,,,,,,(leaded) bronze
LOND,,18128,,99C,,,,,,(leaded) gunmetal
RICH,7350694,2385,214,100,,,76.0,0.0,11.9,12.2,0.1,leaded bronze
POOL,,5166,1,100,,,,,,bronze
RICH,7350209,3946,211,100,,,73.7,0.0,6.9,20.6,0.1,leaded bronze
RICH,7351518,2038,215,100,,,84.4,15.4,3.7,0.4,0.1,brass
RICH,7351706,2866,213,100,,,81.9,0.5,8.2,13.2,0.1,leaded bronze
RICH,7351774,,212,100,,,71.4,2.1,5.2,19.4,0.2,leaded bronze/gunmetal
WROX,801377,,,100?,,,,,,(leaded) bronze
LOND,,LCT1520,,100?,,,,,,bronze
NORN,620703,,2,100A,Es,RX,,,,,leaded gunmetal
WORC,,3899-7002,,100A,E,,,,,leaded bronze
COLE,,967,14,100B,,,,,,leaded bronze
NORN,621169,,3,100B,,,79.5,0.2,8.8,7.7,0.0,(leaded) bronze
WROX,721372,,,100B,,,75.2,0.3,11.0,9.3,0.3,leaded bronze
WROX,781660,,,100B,,,,,,(leaded) bronze
DERB,,035/1270,,100B?,,,,,,leaded bronze
NORN,733378,,,100C,,,72.9,0.7,9.7,12.5,0.0,leaded bronze
WROX,721373,,,100C,,,71.3,0.0,5.9,19.7,0.0,leaded bronze
WROX,721378,,,100C,,,85.2,0.5,8.2,3.0,0.3,bronze
LEIC,,316-138,2:23,100C,,,74.8,3.2,9.0,12.0,0.0,leaded bronze/gunmetal
NORN,,,243,100C,,,,,,(leaded) bronze/gunmetal

WROX,814477,,100C,,,,,,,,,leded bronze
WROX,856848,,100C,,,,,,,,,leded bronze
LOND,,A11063,,100C,,,,,,,,,leded bronze
WORC,,901,,100C,,,,,,,,,leded bronze
WORC,907221,3899-c18181,,100C,,,,,,,,,(leded) bronze
TIDD,,82-203,,100C?,,,,,,,,,leded bronze
CABY,,2808,2,101,,73.6,2.2,8.0,9.6,0.1,leded bronze
WORC,,3899-c17035,,102,,,,,,,,,bronze
WORC,,3899-c16867,,102,,,,,,,,,bronze
TARH,,50,,102/94,,81.7,13.8,1.0,2.4,0.0,brass
WICL,,26,,103,T,,,,,,,,,bronze
TIDD,,M17,,103,,,,,,,,,leded gunmetal
RICH,7350217,4010,209,103,,77.7,0.3,8.8,15.2,0.1,leded bronze
NORN,650094,,262,103,,70.6,0.2,7.2,13.9,0.0,leded bronze
WANB,,99,103,,66.2,0.0,9.4,22.7,0.0,leded bronze
TIDD,,82-98,,103,,70.6,9.3,8.3,0.6,0.0,gunmetal
TIDD,,M11,,103,,69.2,0.2,8.0,20.0,0.2,leded bronze
WANB,,100,103?,,,,,,,,,(leded) bronze
LECH,,1957-6,8,Gp=6,,,,,,,,,leded bronze
LECH,,1957-21,7,Gp=6,,74.5,16.4,1.8,0.2,0.1,brass
LOND,,LCT1312,,Gp=6,,,,,,,,?
HOUS,811554,,Gp=6?,,,,,,,,,gunmetal
COLE,,1008,11,Gp=6?,,,,,,,,,leded bronze
COLE,,87,27,Gp=6?,,,,,,,,,leded bronze
COLE,,2012,16,Gp=6?,,,,,,,,,leded bronze
TIDD,,TA2,,Gp=6?,,73.2,0.4,12.9,20.2,0.1,leded bronze
POOL,,5255,10,Gp=6?,,,,,,,,,bronze
CAST,,1-738,12,Gp=6?,,,,,,,,,brass
LOND,,BRL89,,Gp=6?,,,,,,,,,bronze/gunmetal
WORC,,3899-c20425,,Gp=6?,,,,,,,,,brass
LAMY,,160,2,104,,,,,,,,,bronze
NORN,621099,,4,104,,44.7,0.1,5.3,13.4,0.0,leded bronze
NORN,621107,,5,104,,67.6,0.4,9.2,18.2,0.0,leded bronze
PIER,,3557,,104,,77.5,0.0,8.5,12.6,0.0,leded bronze
GORH,811369,,40,104,,72.4,0.0,12.6,17.0,0.2,leded bronze
GORH,811393,2921,41,104,,,,,,,,,leded bronze
HOUS,803051,,104,,,,,,,,,leded bronze
LOND,,20738,,104,,,,,,,,,bronze
LOND,,PIC31,,104,,,,,,,,,leded bronze
LOND,,3428,,104,,,,,,,,,bronze
WINC,,VR-9912,,104?T,,,,,,,,,bronze
TARH,,635,,104-133,T,,82.1,0.5,7.6,7.6,0.1,(leded) bronze
TARH,,637,,104-133,,81.0,0.0,6.6,11.3,0.1,leded bronze
DORC,7816057,,WH,105,Es,TX,,,,,,,,,leded bronze
CARV,,27,105,Es,TX,,,,,,,,,leded bronze
SEAT,,1,,105?,Es,O,,,,,,,,,leded bronze
CATS,,3,105/126,Es,N,,,,,,,,,leded bronze
CATS,,17,105/141,Es,R,,,,,,,,,leded bronze
CATS,,16,105/141,Es,RB,77.9,1.0,8.6,8.1,0.1,leded bronze
NORN,620693,,6,106,,75.0,0.3,8.9,17.9,0.0,leded bronze
SEAM,,65-380,9,106,,,,,,,,,leded gunmetal
STAN,8701137,,106,,,,,,,,,leded bronze
HAYL,,3460,,106?,,60.8,0.1,9.2,21.7,0.1,leded bronze
NORN,940417,,107,Es,X,,,,,,,,,leded bronze

NORN,940415,,,107,Es,OT,,,,,led bronze
NORN,620704,,9,108,Es,W?,71.7,1.1,5.5,15.3,0.0,led bronze
ULEY,,5683,Fig124:3,108,T,,78.6,1.2,5.8,13.3,0.1,led bronze
ULEY,,2276,Fig124:1,108,Es,X,61.5,1.4,9.9,18.3,1.0,led bronze
ULEY,,2339,Fig124:2,108,T,,69.4,0.6,13.2,20.6,0.1,led bronze
LOND,,POM483,,108,Ej,XX,,,,,(led) bronze
NORN,621100,,10,109,Es,X,64.9,0.6,10.1,16.2,0.0,led bronze
DORC,,W98797,AA,109,Es,TX,,,,,bronze
DORC,,W98798,AA,109,Es,TX,,,,,bronze
NORN,620723,,11,110,Es,X,66.6,1.8,8.4,17.2,0.0,led bronze
WANB,,,103,110,TEs,X,73.9,0.0,7.5,18.3,0.0,led bronze
TIDD,,81-631,,110,Ej,OG?,78.8,0.4,8.9,13.3,0.1,led bronze
WROX,781663,,,110,E,,,,,led bronze
LOND,,84.272/3,,110,Es,RT,,,,,bronze
WORC,,828,,110,E,,,,,led bronze
WORC,,3899-7001,,110,E,,,,,led bronze
WANB,,,105,111,Es,T?,,,,,,led bronze
WANB,,,107,111,Es,TX,,,,,led bronze/gunmetal
NORN,621137,,28,111,Es,T?,114.0,0.4,15.1,16.2,0.0,led bronze
NORN,620714,,18,111,Es,W?,93.7,0.1,10.9,23.9,0.0,led bronze
NORN,620647,,31,111,Es,X,38.9,0.5,6.5,6.7,0.0,(led) bronze
NORN,620682,,32,111,Es,?,138.5,0.7,16.3,31.9,0.0,led bronze
NORN,620733,,29,111,Es,R,68.4,0.1,9.9,15.4,0.0,led bronze
NORN,620705,,21,111,Ej,RB,55.0,0.4,3.2,13.8,0.0,led bronze
NORN,620720,,19,111,Ej,RB,65.4,0.8,9.2,18.4,0.0,led bronze
NORN,620725,,24,111,Es,?,82.5,0.2,7.7,13.4,0.0,led bronze
NORN,620718,,14,111,(E) ,,65.7,0.1,7.4,18.8,0.0,led bronze
NORN,621112,,13,111,(E) ,,73.9,0.6,8.8,14.0,0.0,led bronze
NORN,621097,,12,111,(E) ,,72.2,0.5,9.1,11.9,0.0,led bronze
NORN,620727,,22,111,(E) ,,67.1,2.0,10.7,12.5,0.0,led bronze
NORN,620700,,26,111,Es,?,68.9,0.2,8.9,16.4,0.0,led bronze
NORN,,,273,111,E,,63.8,0.3,10.8,16.4,0.0,led bronze
NORN,733357,,,111,(E) ,,73.1,0.8,9.1,15.7,0.0,led bronze
WANB,692728,,106,111,Es,G?T,63.4,0.1,8.9,25.1,0.1,led bronze
CATS,,,24,113,,,73.5,18.3,0.0,0.0,0.1,brass
WALL,,,1,116,,,,,brass
NORN,621114,,33,117,,81.9,15.5,2.2,0.7,0.0,brass
WANB,,,96,117,,78.5,8.9,0.3,0.0,0.0,brass
CATS,,,2,117,,,77.5,11.3,5.6,0.5,0.0,gunmetal
LOND,,A2466,,117,,,,,brass
WANB,,,95,117?,,,75.6,19.8,0.0,0.0,0.0,brass
CARV,,16,118,,,,,led bronze
ALDB,78108254,,307,118,,,,,led bronze
HAYL,,3,,118,,,,,led bronze/gunmetal
HENL,734860,713,8,118++,,,,,,led bronze
BALD,680508,,81,118B,,87.6,5.0,5.7,1.1,0.0,gunmetal
LOND,,441,,119,,,,,(led) bronze
CATS,,,4,120,Ej,RB,74.5,1.4,8.7,19.2,0.1,led bronze
CATS,,,5,120,,,70.0,1.8,12.4,16.3,0.1,led bronze
TARH,,839,,120,Es,RB,82.2,2.9,8.1,5.9,0.1,(led) bronze/gunmetal
TARH,,656,,120,Es,RB,80.8,0.1,7.7,9.1,0.1,led bronze
DORC,8212380,,WH,120,,,,,led bronze
TARH,,837,,120(?+) ,,85.6,0.3,10.9,2.6,0.1,bronze
ILCH,,36,4,121,,,,,led bronze/gunmetal

DORC,,CP7,121?,,,,,,,,,,led bronze
RICH,7350477,146,224,121+,,,83.9,1.3,8.2,0.7,0.2,bronze
STAN,8612520,,121A,,,,,,,,,bronze
WICL,,29,,121B,,,,,,,,,led bronze
WICL,,38,,121B,,,,,,,,,led bronze/gunmetal
WICL,,41,,121B,,,,,,,,,led gunmetal
WHIT,,2,1,121B,,85.3,0.2,12.2,5.2,0.0,(led) bronze
CATS,,6,121B,,66.5,0.5,7.5,23.0,0.1,led bronze
STAN,8611712,,121B,,,,,,,,,led bronze
STAN,8612534,,121B,,,,,,,,,bronze
STAN,8612929,,121B,,,,,,,,,led bronze
STAN,8701503,,121B,,,,,,,,,led bronze
STAN,8800689,,121B,,,,,,,,,led bronze
STAN,8901753,,121B?,,,,,,,,,,led bronze
CARV,,24,122,Es,OT,,,,,,,,,led bronze
NORN,620721,,40,122,Es,RX,79.5,0.7,11.6,17.1,0.0,led bronze
NORN,621084,,43,122,Es,X,105.7,0.2,15.6,18.4,0.0,led bronze
NORN,620699,,37,122,Es,RB,63.9,0.5,7.5,20.5,0.0,led bronze
NORN,620702,,38,122,,70.0,0.5,7.8,15.0,0.0,led bronze
NORN,620711,,39,122,Es,R,68.2,0.4,8.5,16.1,0.0,led bronze
NORN,733374,,122,Es,OT,61.4,0.1,7.2,30.0,0.0,led bronze
CATS,,8,122,Es,WX,72.3,0.0,10.4,16.0,0.0,led bronze
CATS,,7,122,(E) ,,63.8,0.3,7.1,19.2,0.1,led bronze
ULEY,,5444,Fig124:4,122,Es,OT,68.0,0.2,9.8,17.1,0.0,led bronze
WALL,,3,122,Es,G?B,,,,,,,,,led bronze
NORN,,297,122,Es,T,,,,,,,,,led bronze
LOND,,GPO134,,122,,,,,,,,,led bronze
NORN,620712,,47,123,,74.3,0.1,13.2,13.8,0.0,led bronze
DORC,,CP1,124,,,,,,,,,led bronze
NORN,733361,,124/125,T,,70.4,1.6,10.5,15.1,0.0,led bronze
CATS,,25,125,,,,,,,,,led bronze
TIDD,,82-182,,125,,,,,,,,,(led) bronze
WANB,,104,125,,,,,,,,,led bronze
HOUS,803051,,125,,66.1,0.7,10.4,13.6,0.0,led bronze
HAYL,,KP7 and 13,,125,,,,,,,,,led bronze
CARV,,18,125?,T(R) ,,,,,,,led bronze
NORN,,64,126,Es,X,34.3,0.0,4.0,7.4,0.0,(led) bronze
NORN,621081,,66,126,(E) ,,61.9,0.3,6.7,14.0,0.0,led bronze
NORN,621135,,68,126,Es,?,72.9,0.2,6.8,19.0,0.0,led bronze
NORN,620735,,94,127,,72.8,0.2,11.0,14.0,0.0,led bronze
NORN,620646,,116,128,Es,X,68.5,0.1,7.7,16.1,0.0,led bronze
NORN,620706,,117,128,(E) ,,70.5,1.8,7.3,17.4,0.0,led bronze
NORN,620722,,69,129,Es,?,30.4,0.1,4.5,11.3,0.0,led bronze
NORN,620683,,71,129,Es,?,75.0,0.1,9.6,19.1,0.0,led bronze
NORN,620649,,70,129,Es,X,120.0,0.4,13.1,23.1,0.0,led bronze
NORN,733379,,129,As,,73.1,0.3,11.9,12.7,0.0,led bronze
CARV,,17,129,Es,X,81.7,0.0,11.5,10.4,0.1,led bronze
NORN,620695,,72,130,,65.6,0.1,11.3,15.6,0.0,led bronze
NORN,621119,,77,130,,76.8,0.5,10.9,21.8,0.0,led bronze
NORN,620701,,73,130,,67.0,0.1,8.6,17.6,0.0,led bronze
WROX,840600,,130,,,,,,,,,bronze
SEAT,,2,1,131,(E) ,,,,,,,led bronze/gunmetal
NORN,620692,,80,131,,76.9,0.1,6.2,11.7,0.0,led bronze
NORN,621134,,83,131,,71.7,0.1,8.7,14.6,0.0,led bronze

NORN,621148,,82,131,,,77.0,0.1,5.3,11.5,0.0,leaded bronze
NORN,733354,,,131,,,73.9,0.1,11.3,13.4,0.0,leaded bronze
HAYL,,835&3472,,131,,,69.4,0.0,7.1,18.1,0.1,leaded bronze
DORC,,,CP8,131+,,,,,,,,,leaded bronze
NORN,733350,,,131/134,,,69.1,2.0,7.6,19.1,0.0,leaded bronze
WANB,684391,,108,132,(E),,,,,,,,,leaded bronze
NORN,620650,,84,132,Es,X,72.7,0.1,8.1,13.4,0.0,leaded bronze
NORN,620684,,85,132,Es,R?,68.5,0.2,9.9,15.1,0.0,leaded bronze
NORN,,,242,132,Es,OT,,,,,,,,,leaded bronze
CATS,,,9,132A,Es,G,,,,,,,,,leaded bronze
NORN,621120,,87,132A,Es,?,67.5,0.6,8.0,17.2,0.0,leaded bronze
NORN,,,232,132A,Es,R,65.4,1.1,8.8,6.5,0.0,(leaded) bronze
NORN,621078,,88,132B,Es,?,70.1,0.2,9.3,16.1,0.0,leaded bronze
NORN,620698,,59,135,,,73.0,0.5,8.2,12.3,0.0,leaded bronze
NORN,621141,,58,135,,,77.8,0.4,10.2,9.9,0.0,leaded bronze
NORN,620716,,53,135,,,63.9,0.2,10.5,6.0,0.0,(leaded) bronze
CATS,,,21,135,,,72.7,1.2,13.3,13.8,0.1,leaded bronze
NORN,620730,,98,135+,Es,RB,73.1,0.2,10.2,9.0,0.0,leaded bronze
TRET,,13,,135/136,,,,,,,,,leaded bronze
NORN,620743,,50,136,,,81.0,1.3,6.8,8.3,0.0,leaded bronze
HENL,734845,578,9,136+,,,,,,,,,(leaded) bronze
CARV,,,20,137,,,74.0,0.5,11.5,10.9,0.1,leaded bronze
THIS,610988,BH764,,137,,,75.6,2.6,7.6,9.2,0.1,leaded bronze/gunmetal
HENL,730943,484,10,137?,,,,,,,,,(leaded) bronze
THIS,611053,BH1679,,137?,,,,,,,,,leaded bronze
THIS,,THZ1756,,137A,,,76.2,1.3,9.0,9.7,0.1,leaded bronze
ASHT,835110,679,,137A,,,,,,,,,bronze
ASHT,835115,557,,137A,,,,,,,,,bronze
TIDD,,M14,,137A,,,,,,,,,(leaded) gunmetal
STAN,8516894,,137A,,,,,,,,,leaded gunmetal
STAN,8701636,,137A,,,,,,,,,leaded gunmetal
STAN,8800232,,137A,,,,,,,,,leaded bronze
WEEK,781400,86,15,137B,,,,,,,,,leaded bronze
STAN,8516848,,137C,,,,,,,,,(leaded) bronze
STAN,8701382,,137C,,,,,,,,,leaded bronze
CATS,,,10,138,,,73.4,1.9,8.4,14.0,0.1,leaded bronze
CATS,,,13,138/139,,,71.6,0.3,7.5,19.8,0.1,leaded bronze
CATS,,,12,138/139,,,67.2,1.4,9.7,22.2,0.1,leaded bronze
CATS,,,11,138/139,,,69.6,3.0,8.4,16.3,0.1,leaded bronze/gunmetal
SEAM,,65-267,11,138/140?,,,,,,,,,bronze
HENL,642035,113,11,139,,,,,,,,,leaded gunmetal
CATS,,,14,139,,,74.3,0.2,9.1,13.3,0.1,leaded bronze
TARH,,169,,139,,,,,,,,,bronze
TARH,,877,,139,,,,,,,,,(leaded) bronze
TARH,,170,,139,,,,,,,,,leaded bronze/gunmetal
TARH,,16,,139,,,,,,,,,leaded bronze/gunmetal
CATS,,,29,139?,,,,,,,,,bronze
HENL,734841,503,12,139?,,,,,,,,,leaded bronze
TARH,,838,,139?,,,,,,,,,(leaded) bronze
HAYL,,1014,,139?,,,,,,,,,leaded bronze/gunmetal
DORC,8212339,,WH,139?,,,,,,,,,leaded bronze
DORC,,,CP3,139++,,,,,,,,,leaded bronze
CATS,,,26,139+,,,,,,,,,leaded bronze
CATS,,,27,139+,,,,,,,,,leaded bronze

CATS,,28,139+?,,,,,,,,,,led bronze
CATS,,15,140,,65.7,0.5,7.8,17.4,0.1,led bronze
THIS,,THV52,,143A,EsRg,XX,76.0,15.6,1.2,3.0,0.0,brass
NORN,650093,,261,143B,Ej,R?O?,68.3,0.1,11.1,15.6,0.0,led bronze
NORN,733397,,143B,Es,X,73.0,0.1,12.1,19.7,0.0,led bronze
NORN,733343,,143B,Ej,XX,77.7,0.4,8.2,10.8,0.0,led bronze
ULEY,,2272,Fig124:5,144,(E) ,,66.9,0.2,11.2,13.0,0.1,led bronze
WANB,,101,144,,74.4,0.1,7.4,18.8,0.1,led bronze
MAGI,779677,,18,144,Es,X,71.0,0.2,10.2,22.1,0.0,led bronze
CHEL,,CHKAe208,2:23,144,Es,,76.6,0.0,10.9,11.9,0.1,led bronze
WIGG,681207,154,,144,Es,X,,,,,led bronze
WANB,684121,,102,144?,TEs,N,72.3,1.2,9.8,10.2,0.0,led bronze
RICH,7350101,377,227,145,Es,R,83.9,0.2,8.0,7.9,0.1,(led) bronze
NORN,,231,145,,64.9,0.0,8.0,15.8,0.0,led bronze
LOND,,LCT1499,,145,Es,XX,,,,,gunmetal
WICL,,6,,145+,Es,T?,,,,,brass
RICH,7350203,5095,226,145A,Es,R,79.3,20.2,0.5,2.7,0.0,brass
RICH,7351747,3426,225,145A,Es,RX,80.4,11.3,2.8,3.0,0.0,brass/gunmetal
THIS,,THZ2101,,145A,Es,RB,74.8,10.3,2.1,4.2,0.0,(led) brass
DRAG,,DR66DN,103,145A,TEs,X,,5.8,1.9,6.7,0.0,(led) brass/gunmetal
DRAG,,DR68CY,102,145A,TEs,OX,,0.3,5.8,5.7,0.0,(led) bronze
CAST,,10-1640,16,145A,Es,X,,,,,led bronze
STAN,8800195,,145B,Es,X,,,,,(led) bronze/gunmetal
RICH,7351090,1050,234,146,,87.4,0.3,7.2,5.3,0.1,(led) bronze
CAME,,76-94,,146,,88.3,0.4,8.1,6.3,0.0,(led) bronze
PIER,,4814,,146,,83.0,0.0,5.9,9.3,0.1,led bronze
PIER,,2367,,146,,87.6,1.0,6.2,3.4,0.0,bronze
ALDB,78108252,,305,146,,,,,led bronze
ALDB,78108253,,306,146,,,,,gunmetal
POOL,,5167,2,146,,,,,bronze
DRAG,,DR68VK,100,146,,6.3,4.0,2.6,0.0,gunmetal
CAST,,1-117,44,146,,,,,?
CATT,594701,,Site433:2,146,,,,,gunmetal
LOND,,83,,147,Es,X,,,,,brass
LOND,,A10123,,147,Es,RT,,,,,gunmetal
CORB,822130,,41,148,,,,,gunmetal
WELT,,205,,148,Es,R,,,,,bronze
ALDB,78108232,,320,148,Es,W,,,,,gunmetal
ULEY,,2162,Fig124:6,148/149,Es,R,,,,,(led) bronze
COLE,,64,20,148A,TEs(Rg) ,BX,,,,,(led) gunmetal
RICH,7350098,2773,232,148A,,85.6,7.5,7.3,0.0,0.0,gunmetal
PIER,,2357,,148A,,88.1,12.5,0.0,0.0,0.0,brass
ALDB,78108255,,321,148A,Es,W,,,,,brass/gunmetal
DRAG,,DR71APZ,105,148A,EsRg,,,,,brass
DRAG,,DR69SL,104,148A,,,,,brass
CAST,,1-524,32,148A,,0.1,12.9,0.2,0.0,bronze
CAST,,10-2287,41,148A,Es,X,,,,,gunmetal
CAST,,14-455,24,148A,Es,RTX,,,,,brass
CAST,,14-299,43,148A,,,,,brass
CATT,594686,,Site433:3,148A,,,,,brass
CAST,,1-605,31,148A?,,15.0,2.0,0.4,0.0,brass
CAST,,10-1666,42,148A+,,,,,bronze
LOND,,32.2/13,,148A+?,,,,,brass
COLE,,860,18,148B,Es,W?X,,,,,led bronze

TIDD,,80-61,,148B,Ej,R?,78.9,11.0,7.4,0.1,0.0,gunmetal
PRES,851071,404,15,148B,Ej,X,87.5,7.8,2.1,0.7,0.0,copper/brass
CAST,,14-98,22,148B,Es,XX,,,,,brass
CAST,,14-311,23,148B,Es,R,,,,,brass
CAST,,16-195,26,148B,Es,R,Y,,,,,brass
LOND,,GPO4291,,148B,Es,XX,,,,,brass
LOND,,25871,,148B,E,,,,,brass
LOND,,87,,148B,Ej,X,,,,,brass
WORC,,786,,148B,E,,,,,brass
SNET,,Cat26,26,148B,Es,XX,,,,,bronze
COLE,,284,19,148C,Es(Rg) ,BX,,,,,(lead) gunmetal
RICH,7351716,1048,228,148C,EsRg,RB,82.1,12.6,1.0,2.8,0.1,brass
NORN,,,235,148C,,,80.1,12.5,1.4,0.9,0.0,brass
HAYL,,3129,,148C,TEs(Rg) ,BX,79.5,12.7,1.7,4.9,0.1,(lead) brass
PIER,,4273,,148C,Es,RB,80.4,16.7,1.7,0.0,0.1,brass
HOUS,79208026,,148C,EsRg,RB,93.3,4.1,5.4,5.0,0.0,(lead) gunmetal
ALDB,78108230,,317,148C,(E) ,,,,,,brass
ALDB,78108226,,314,148C,EsRg,BX,,,,,brass
ALDB,78108231,,318,148C,Es,W?X,,,,,brass
ALDB,78108228,,313?,148C,(Rg) ,,,,,,brass
ALDB,78108227,,315,148C,EsRg,B,,,,,brass
ALDB,78108229,,316,148C,EsRg,RB,,,,,brass
CARL,,BLAAe148,6,148C,EsRg,B,,14.5,1.1,1.1,0.0,brass
CAST,,10-1916,33,148C,Es(Rg) ,BX,,,,,gunmetal
WROX,743369,,148C,Es(Rg) ,BX,,,,,brass
LOND,,3418,,148C,MsE,,,,,brass
CATT,594449,,Site433:4,148C,Es,BX,,,,,brass
CATS,,,19,148C/159,Es,YB,85.9,0.0,10.2,0.0,0.0,bronze
CARV,,,31,149,,,,,bronze
HENL,684631,364,13,149,,,,,lead gunmetal
CARV,,,22,149,Es,RB,85.9,6.0,2.9,16.7,0.0,lead gunmetal
PIER,,1903,,149,(E) ,,89.6,6.1,1.7,0.0,0.0,copper/brass
TIDD,,81-814,,149,Es,X,83.2,4.4,8.2,1.4,0.1,bronze/gunmetal
TARH,,159,,149,,83.0,11.9,1.0,0.3,0.1,brass
ULEY,,2165,Fig124:7,149,(E) ?,90.2,0.9,4.1,2.0,0.0,bronze
CARL,,BLAAe264,4,149,Ej,RB,,,,,brass
CARL,,BLAAe268,5,149,Es,,,,,bronze
COLC,,1.81-893,CS26,149?,E,,,,,brass
COLE,,285,17,149A,,,,,lead bronze
RICH,7350208,4545,231,149A,,84.4,3.7,7.3,2.9,0.2,bronze/gunmetal
NORN,733366,,149A,Es,X,82.7,0.9,9.1,3.5,0.0,bronze
CAST,,1-396,30,149A,(E) ,,,,,,bronze
CAST,,15-30,25,149A,E?,,,,,brass
LOND,,A25083,,149A,,,,,(lead) bronze
WORC,,710,,149A,,,,,bronze
WORC,,747,,149A,(E) ,,,,,,bronze
WICL,,11,,149B,(E) ,,,,,,brass
WICL,,13,,149B,Es,R?T,,,,,bronze
WICL,,30,,149B,Es,?,,,,,,bronze
WICL,,34,,149B,(E) ,,,,,,brass
RICH,7350475,1813,229,149B,Es,RB,,,,,copper
RICH,7350089,1812,230,149B,Es,R,88.9,1.7,4.4,4.4,0.1,(lead) bronze/gunmetal
NORN,620707,,104,149B,Es,R?,72.4,1.3,5.9,6.6,0.0,(lead) bronze
NORN,621170,,99,149B,(E) ,,63.3,0.5,8.5,12.8,0.0,lead bronze

NORN,620713,,103,149B,Es,BX,64.5,0.0,9.2,11.8,0.0,leded bronze
NORN,620651,,101,149B,Es,W,63.7,0.0,10.8,17.6,0.0,leded bronze
CAME,,76-78,,149B,Es,RB,75.9,18.5,2.5,0.0,0.0,brass
WHIT,,4,2,149B,Es,X,77.8,1.4,9.2,13.5,0.1,leded bronze
PRES,851070,438,16,149B,Es,TX,89.6,0.0,4.9,3.4,0.0,bronze
CHEL,,CHK2/60,2:24,149B,Es,RB,91.7,3.3,3.4,3.6,0.1,gunmetal
ASHT,835093,332,,149B,Es,BX,,,,,brass
WELT,,507,,149B,Es,X,,,,,bronze
ALDB,78108233,,319,149B,Es,Y,,,,,bronze
NORN,620713,,105,149B,Es,B,,,,,(leded) gunmetal
DRAG,,DR65MW,106,149B,Es,R,,1.1,7.7,5.2,0.0,(leded) bronze
DRAG,,DR65HG,107,149B,Es,X,,0.6,5.9,3.2,0.0,bronze
CIRE,,StMF20,,149B,Es,R,,,,,(leded) bronze
CAST,,1-637,28,149B,Es,X,,,,,brass/gunmetal
CAST,,1-551,29,149B,(E) ,,,,,,(leded) bronze
CAST,,10-2071,34,149B,Es,WX,,17.3,1.7,0.3,0.0,brass
CAST,,10-1985,35,149B,Es,YX,,0.7,6.7,6.2,0.0,(leded) bronze
CAST,,10-1601,36,149B,Es,GT,,,,,leded bronze
CAST,,10-1409,37,149B,Es,X,,,,,bronze
CAST,,10-2078,38,149B,(E) ,,,,,,bronze
CAST,,10-2135,39,149B,Es,TX,,,,,bronze/gunmetal
CAST,,10-1232,40,149B,Es,B,,,,,bronze
CAST,,12-9,20,149B,Es,X,,,,,bronze/gunmetal
CAST,,13-139,21,149B,Es,X,,,,,leded bronze
CAST,,16-213,27,149B,Es(Rg) ,RB,,13.8,1.7,0.2,0.1,brass
LOND,,RAG99,,149B,Es,X,,,,,leded bronze
LOND,,32.2/10,,149B,Es,RX,,,,,brass/gunmetal
LOND,,79.351,,149B,Es,BX,,,,,brass
LOND,,81-282/6,,149B,E,,,,,brass
LOND,,A20599,,149B,Es,XX,,,,,brass
LOND,,19925,,149B,Es,R,,,,,brass
LOND,,84,,149B,Es,TX,,,,,brass
LOND,,86,,149B,Es,RB,,,,,brass
LOND,,A1263,,149B,Es,RW,,,,,brass
CATT,594706,,Site433:5,149B,Es,X,,,,,leded bronze
NORN,620689,,106,149B?(E) ,,62.9,0.0,8.5,21.3,0.0,leded bronze
ASHT,835111,510,,151,Ej,T,,,,,bronze
RICH,7351142,101,233,151?,Es,T,,,,,leded bronze
WROX,721377,,151?,,80.1,18.4,1.3,0.0,0.2,brass
POOL,,5205,126,151?,,,,,lead
TIDD,,M6,,151C,(Rg) ,,79.8,12.5,2.0,6.0,0.3,(leded) brass
ULEY,,7669,Fig124:8,151D,Ej,ROT,73.5,0.0,6.6,16.3,0.1,leded bronze
TIDD,,81-757,,151D,MtEj,X,75.9,0.7,13.7,14.3,0.1,leded bronze
POOL,,5099,128,151D,,,,,lead
DODD,8515493,,151D,EsRg,X,,,,,leded bronze
DRAG,,DR68BS,111,151D,Ej,RO,,,,,bronze
POOL,,5206,127,151D?,,,,,lead
LOND,,LBT68,,151E,Es,B,,,,,leded bronze
WROX,721381,,152,,86.1,1.2,9.2,2.4,0.0,bronze
PRES,851066,93,6,152,Ej,YX,77.4,0.0,7.9,14.0,0.3,leded bronze
PRES,851068,427,4,152,Ej,RyB,85.3,11.0,2.4,1.0,0.0,brass
PRES,851086,284,7,152,Ej,RB,89.3,0.0,9.8,0.6,0.0,bronze
PRES,,1316,5,152,Ej,OT/KW,76.0,0.0,12.1,11.5,0.0,leded bronze
PRES,851069,437,3,152++,EsEchRs,RGT,76.7,20.0,2.3,0.2,0.0,brass

RICH,7350745,4239,223,Gp=7,T,,82.6,1.2,7.8,7.9,0.2,(lead) bronze
NORN,620691,,52,Gp=7,,68.6,0.0,10.6,12.7,0.0,lead bronze
NORN,621151,,57,Gp=7,,80.7,1.1,8.0,4.9,0.0,(lead) bronze
NORN,,34,Gp=7,Es,N?,80.2,0.0,9.4,3.6,0.0,bronze
NORN,620731,,51,Gp=7,,66.0,0.6,10.1,24.7,0.0,lead bronze
NORN,620690,,55,Gp=7,,70.3,0.3,10.2,15.7,0.0,lead bronze
NORN,621128,,60,Gp=7,,68.1,0.1,6.9,21.8,0.0,lead bronze
NORN,620652,,120,Gp=7,(E) ,,71.9,0.7,10.3,13.8,0.0,lead bronze
NORN,620744,,229crest,Gp=7,,84.4,0.1,5.6,4.7,0.0,(lead) bronze
NORN,620744,,229bow,Gp=7,,85.6,0.1,4.2,3.8,0.0,bronze
NORN,621146,,228,Gp=7,(E) ,,73.3,0.7,5.7,16.7,0.0,lead bronze
NORN,620729,,119,Gp=7,(E) ,,76.7,0.0,2.7,10.1,0.0,lead copper
NORN,621103,,96,Gp=7,,68.2,0.3,10.2,13.1,0.0,lead bronze
CARV,,25,Gp=7,,67.7,0.1,12.1,16.5,0.1,lead bronze
HAYL,,3449,,Gp=7,,,,,,lead bronze
WANB,,109,Gp=7,Ej,BX,81.0,0.6,9.5,1.4,0.1,bronze
TIDD,,M21,,Gp=7,Es,X,75.7,0.1,12.3,12.5,0.2,lead bronze
ASHT,835126,,Gp=7,,,,,,lead bronze
SEAM,,66-55,10,Gp=7,Es,X,,,,,,lead bronze
THIS,,BH415,,Gp=7,,,,,,lead bronze
DRAG,,DR67AAY,95,Gp=7,,,,,,bronze/gunmetal
DRAG,,DR68NV,94,Gp=7,,,,,,bronze
CIRE,,StMF200,,Gp=7,T(E) ,,,,,,lead bronze
VELZ,,24,,Gp=7,(E) ,,75.0,12.3,2.3,0.8,0.2,brass
WALL,,10,Gp=7,EsEch,X,,,,,,lead bronze
COLC,,0862CEH,,Gp=7?,,,,,,,brass
CATS,,30,Gp=7?,,,65.3,1.5,12.0,15.8,0.1,lead bronze
DORC,8212370,,WH,Gp=7?,,,,,,,bronze
DRAG,,DR70ABI,118,Gp=7?,,,,0.0,13.9,0.4,0.1,bronze
TIDD,,M4,,Gp=7/8,,,,,,lead bronze
TIDD,,82-148,,Gp=7/8,,,,,,lead bronze
CORB,831672,,6,Gp=7/8,,,,,,bronze
BRAU,,361,76,Gp=7/8,,78.5,4.2,8.5,0.1,0.0,bronze/gunmetal
CATS,,31,Gp=7/8?,,,74.2,0.0,9.8,19.0,0.1,lead bronze
VELZ,,31B,,Gp=7/8?,,,75.4,12.6,3.6,6.9,0.2,(lead) brass/gunmetal
VELZ,,31A,,Gp=7/8?,,,74.7,12.6,3.7,6.6,0.3,(lead) brass/gunmetal
PRES,,1376,12,Gp=7/8?,Es,?,84.2,3.0,6.9,1.0,0.0,bronze/gunmetal
WILD,761066,,4,153A,N,,,,,,bronze
DERB,,DLC79AYA49,27,153A?,X,,,,,,lead bronze
POOL,,5102,98,153A/B/C,,,,,,gunmetal
POOL,,5140,60,153A/B/C,,,,,,gunmetal
POOL,,5258,59,153A/B/C,,,,,,bronze
COLE,,120,23,153B,,,,,,lead bronze
COLE,,303,24,153B,,,,,,lead bronze
WROX,843006,,153B,Ms,,,,,,brass
WROX,840571,,153B,G,,,,,,bronze
DERB,,CHB/EO122,26,153B,,,,,,lead bronze
BEES,819158,,Fig37.2,153C,,81.1,16.9,0.0,0.6,0.0,brass
CORB,868601,,10,153C,,,,,,brass
DRAG,,DRBF,109,153C,,,,,,brass/copper?
CAST,,9-1214,62,153C,,,,,,brass
DERB,,DLC79EXH111,28,153C?,,,,,,,bronze
TIDD,,M1,,153D,,81.4,0.2,8.3,6.8,0.2,(lead) bronze
TIDD,,M20,,153D,,63.6,0.3,11.4,24.8,0.0,lead bronze

STAN,8612518,,153D,,,,,,leded bronze
RICH,7351709,,219,153D,,,59.2,1.0,12.1,0.0,0.1,bronze
COLE,,460,21,154,,,,,,leded bronze
COLE,,810,22,154,,,,,,leded bronze
WANB,707308,,111,154,,89.6,0.5,8.1,8.2,0.1,leded bronze
WANB,,,110,154,,,70.8,1.2,6.1,28.6,0.1,leded bronze
LEIC,,316-47,2:25,154,,,68.0,0.7,5.5,26.3,0.0,leded bronze
LEIC,,316-34,2:24,154,,,76.6,0.0,7.6,17.1,0.1,leded bronze
ULEY,,3607,Fig124:10,154A,T,,77.0,0.1,3.9,12.9,0.1,leded bronze
ULEY,,5327,Fig124:9,154A,,,71.7,0.1,8.4,11.3,0.1,leded bronze
SWIN,770871,117,,154A,,,71.3,1.7,7.5,17.0,0.1,leded bronze
WROX,721367,,154A,,,75.2,0.0,9.3,14.8,0.0,leded bronze
GLOU,,69/49-21,E2,154A,,,,,,leded bronze
YORK,,M710,,154B,,,,,,leded bronze
RICH,7350207,5430,220,154B,,,75.7,0.2,9.3,14.6,0.1,leded bronze
NORN,621138,,108,154B,,,78.5,0.5,4.5,10.0,0.0,leded bronze
TIDD,,81-949,,154B,,,69.1,0.6,9.2,24.2,0.0,leded bronze
WANB,684167,,112,154/159,,,76.8,0.5,8.2,19.8,0.1,leded bronze
PIER,,16B7,,155?,,,,,,leded gunmetal
RICH,7350212,4847,221,157,Es,R,76.2,18.1,2.6,1.3,0.0,brass
WANB,,,113,157,Es,G?T,69.4,0.1,9.2,21.4,0.0,leded bronze
PRES,851061,286,18,157A,IcorN,,88.2,0.1,8.2,0.2,0.0,bronze
CAST,,RonJeffries,,157A,Ms,,,,,,brass
LOND,,A11925,,157A,,,,,,brass
LOND,,A23484,,157B,Es,R,,,,,brass
CAST,,10-2180,82,157B?,Ms,,,,,,brass/gunmetal
LOND,,82,,157C,Es,B,,,,,brass
LOND,,32.2/12,,157C,Es,R,,,,,brass
CAST,,15-141,66,157B,Es,R,,,,,gunmetal
LOND,,A1264,,157D,Es,BX,,,,,brass
TIDD,,81-209,,157E,Es,X,82.5,3.2,8.5,8.5,0.1,leded bronze/gunmetal
ALDB,78108234,,322,157E,Es,R,,,,,brass
CAST,,15-592,67,157E,Es,X,,,,,brass/gunmetal
CAST,,1-737,73,157E?,Es,B,,,,,brass
LOND,,A20228,,157F,Es,R,,,,,brass
WORC,,3899-1048,,157F,E,,,,,gunmetal
WELT,,435,,158,,78.5,10.3,1.5,6.2,0.0,(leded) brass
OPEN,7815770,,618,158,,,,,,gunmetal
PAPC,,84-132,,158,,,,,,bronze
POOL,,5096,11,158+?,,,,,,brass
WICF,,248,,158A,,,,,,leded gunmetal
CORB,831676,,11,158A,,,,,,bronze
CATT,723733,,Site434:6,158A,,,,,,brass/gunmetal
RICH,7350472,3900,216,158A,,,82.7,9.8,3.8,1.1,0.0,brass/gunmetal
RICH,7350976,175,217,158A,,,91.7,2.0,4.7,1.0,0.0,bronze/gunmetal
CABY,,836,3,158A,,,70.1,10.2,3.6,9.0,0.1,leded brass/gunmetal
PIER,,4323,,158A,,,78.9,16.4,2.0,4.9,0.0,(leded) brass
PRES,851064,434,17,158A,,,77.0,11.8,1.8,4.7,0.3,(leded) brass
WELT,,162,,158A,,,86.1,0.8,5.0,5.3,0.1,(leded) bronze
WELT,,420,,158A,,,78.7,12.5,5.0,3.7,0.0,brass/gunmetal
WPER,7310666,,158A,,,,,,brass/gunmetal
ALDB,78108235,,323,158A,,,,,,brass
ALDB,78108236,,324,158A,,,,,,brass
CHEL,,CHV20,,158A,,,,,,brass

CATT,8111875,,Site46:4,158A,,,,,,,,,bronze/gunmetal
CATT,8111931,,Site46:3,158A,,,,,,,,,brass
CATT,8111280,,Site46:6,158A,,,,,,,,,brass
CATT,8111866,,Site46:5,158A,,,,,,,,,brass?
CATT,8111900,,Site46:7,158A,,,,,0.9,10.6,1.6,0.0,bronze
OPEN,7710108,,617,158A,,,,,,,,,brass/gunmetal
CAST,,10-1600,75,158A,,,,,0.5,7.5,1.7,0.0,bronze
CAST,,12-5,63,158A,,,,,,,,,brass
CAST,,15-580,68,158A,,,,,,,,,brass
LOND,,C995,,158A,,,,,,,,,gunmetal
LOND,,18648,,158A,,,,,,,,,brass
CARL,,BLAAe222,9,158A?,,,,,,,,,lead
CARL,,BLAAe178,10,158A?,,,,,4.7,5.7,3.3,0.0,gunmetal
CAST,,14-238,64,158A/C,,,,,,,,,bronze
CAST,,14-230,65,158A/C,,,,,,,,,brass
COLE,,2013,25,158A(+),,,,,,,,,,lead
OPEN,7813570,,619,158B,,,,,,,,,lead
RICH,7350388,4202,218,158C,,,,,77.0,19.2,2.9,1.1,0.0,brass
ALDB,78108237,,325,158C,,,,,,,,,bronze
OPEN,7814431,,620,158C,,,,,,,,,copper/bronze
DRAG,,DR70AF,108,158C,,,,,,,,,gunmetal
CAST,,1-409,60,158C,,,,,,,,,gunmetal
CAST,,10-2148,74,158C,,,,,,,,,brass
CAST,,10-1849,76,158C,,,,,0.3,0.8,0.4,0.2,copper
CAST,,10-1277,77,158C,,,,,,,,,bronze
CAST,,10-1486,78,158C,,,,,,,,,brass/gunmetal
CAST,,10-1319,79,158C,,,,,16.7,0.5,2.3,0.1,brass
CAST,,15-159,69,158C,,,,,,,,,brass
CAST,,15-294,70,158C,,,,,,,,,bronze
CAST,,16-284,71,158C,,,,,,,,,bronze
CAST,,16-329,72,158C,,,,,,,,,bronze
LOND,,RAG155,,158C,,,,,,,,,brass
WROX,78000527,,158C,,,,,,,,,brass
THIS,,THVbag179,,158D,,,,,,,,,lead
GLOU,,69/49-66,E3,158D,,,,,,,,,lead
HENL,684638,406,14,158D?,,,,,,,,,lead
CARL,,BLAAe13,8,158D?,,,,,,,,,lead
HAYL,,2348,,158E,,,,,72.1,0.2,10.8,12.9,0.1,lead
WANB,,114,158E,Et,GT,75.2,0.2,10.5,16.1,0.1,lead
CATT,8413512,,Site273:9,158E,,,,,,,,,lead
NORN,620694,,109,158F,,,,,76.5,0.0,8.8,8.0,0.0,lead
CATS,,18,158F,,,,,76.1,2.1,8.5,13.7,0.1,lead
TIDD,,81-780,,158F,,,,,75.0,0.2,12.6,12.4,0.1,lead
ILCH,,21,2,158F,,,,,,,,,(lead) bronze
STAN,8900619,,158/9,,,,,,,,,lead
POOL,,5139,9,159?,,,,,,,,,(lead) bronze
BALD,,85,159+,EsRg,BX,,,,,,,,,brass/gunmetal
NORN,621142,,110,159+,Es,R,77.4,0.3,8.3,7.7,0.0,(lead) bronze
DERB,,026/649,,159+,Es,X,,,,,,,,,lead
WORC,,709,,159+?,,,,,,,,,lead
ULEY,,378,Fig124:11,159A,,,,,73.7,0.7,11.0,16.9,0.0,lead
WICF,,186,,159A,,,,,68.9,0.6,11.4,27.7,0.0,lead
TIDD,,80-96,,159A,,,,,59.9,0.0,15.6,16.7,0.0,lead
WROX,842998,,159A,,,,,,,,,lead

LOND,,O.1815,,159A,,,,,,leded bronze
CATS,,20,160,,,,,,bronze
TARH,,756,,160,,75.4,0.1,10.5,11.6,0.1,leded bronze
CORB,868598,,12,162,TMs,,,,,,brass
LOND,,RIV40,,162,Ms,,,,,,brass
CAST,,10-1303,81,162A,(E) ,,,,,,bronze/gunmetal
WROX,840545,,162A,Ms,,,,,,brass
SAND,,3287,,162A,S(Ms) Is,,,,,,gunmetal
RICH,7350805,4800,235,162B,Ts(E) ,,80.9,14.1,2.3,2.8,0.0,brass
CATS,,23,162C,T,,84.5,15.5,2.0,2.7,0.1,brass
OPEN,7813157,,621,162C,TMs,,,,,,brass
TIDD,,82-229,,163,(E) ,,,,,,brass
LEIC,,365-95,1:Fig18.10,163,(E) ,,,,,,brass
ALDB,78108244,,311,163,Es,RX,,,,,,brass
THIS,,THZ2212,,163,(E) ,,,,,,brass
OPEN,7815488,,622,163,EsRg,RG,,,,,,bronze
STAN,8901240,,163?,Es,T,,,,,,brass
DRAG,,DRCX,112,163A,,,,,,brass
DRAG,,DR70BEM,113,163A,Es,BX,,14.4,2.6,1.8,0.0,brass
CAST,,16-322,49,163A,Es,O,,10.5,2.4,0.8,0.0,brass
GLOU,751162,Greyfr.sf102,GF,163A,E,,,,,,brass
CAST,,1-112,54,163B,Es,RB,,,,,,gunmetal
CORB,831211,,9,164,Es,KX,,,,,,bronze
CORB,822128,,8,164,Es,RW,,,,,(leaded) bronze
PRES,,1291,21,164,Es,X,74.6,0.0,9.5,15.3,0.2,leded bronze
CAST,,10-1585,58,164,Es,RTX,,,,,gunmetal
CAST,,10-326,59,164,Es,B,,,,,brass
CAST,,15-408,47,164,Es,BX,,,,,gunmetal
LOND,,432,,164+,It,,,,,,brass
PIER,,(66) ,,166,Es,TX,,,,,brass
WICL,,37,,166,,,,,,gunmetal
COLE,,145,26,166,,,,,,(leaded) gunmetal
WANB,,115,166,TMsEs,B,87.1,2.4,6.1,2.6,0.0,bronze/gunmetal
WANB,,116,166,TMs,,82.0,7.6,2.7,0.0,0.0,copper/brass
LOND,,CRU8,,166,Ms,,,,,,brass
RICH,7351701,903,236,166A,TEs,RT,78.3,9.5,3.0,4.1,0.1,(leaded) brass/gunmetal
WROX,80000311,,166B,E,,,,,bronze/gunmetal
NORN,620717,,111,166C,TMsEs,X,,,,,leded bronze/gunmetal
LOND,,19229,,166C,MsEs,X,,,,,brass
BIRD,8905593,,56,166C,TMsEs,R/O,,,,,gunmetal
RICH,7351734,4727,237,166D,Es,B,80.0,7.7,2.5,1.5,0.0,copper/brass
WROX,781667,,166D,,,,,,gunmetal
LOND,,A10124,,166E,MsEs,OT,,,,,(leaded) bronze
CORB,822108,,26,167,MsEs,X,,,,,brass/gunmetal
WORC,,3899-6312,,167,TMs,,,,,brass
PIER,,TF-16-A,,167A,TMs,,82.1,14.3,1.3,0.0,0.0,brass
LOND,,19227,,167A,Ms,,,,,,brass
WORC,,750,,167B,Ms,,,,,,?
CAME,,79-8,,167C,TMsEs,W,,,,,brass/gunmetal
HAYL,,1367,,167C,TMsEs,B?,,,,,brass
WANB,,117,168,TMsEs,G?B,,,,,brass
TIDD,,81-497,,168,Es,B,80.4,14.3,7.1,1.4,0.0,gunmetal
ULEY,,3880,Fig124:12,168,TEs,RT,,,,,leded bronze
LOND,,A27196,,168A,MsEs,RB,,,,,brass

WROX,743370,,168A?,Es,BX,,,,,brass
LOND,,ASQ8,,168B,MsE,,,,,brass
LOND,,HTP10,,168B,MsEs,TX,,,,,brass
RICH,7350696,2466,222,Gp=8,,71.2,0.0,6.2,21.0,0.0,lead
WALL,,11,Gp=8,,,,,lead
POOL,,5101,5,Gp=8,,,,,gun
POOL,,5212,68,Gp=8,,,,,br
LOND,,79-16/3,,Gp=8,,,,,gun
STAN,8701128,,Gp=8,TMs,,,,,br
CAST,,10-2129,80,Gp=8?,,,,,,br
CATT,723724,,Site434:7,Gp=8,,,,,br
CORB,831185,,27,171,TMs(E) ,,,,,br
SEWN,810678,355,1,171,,,0.1,9.3,15.5,0.0,lead
MAGI,7711243,,19,171,MsEs,X,75.2,7.3,11.7,5.4,0.0,(lead) br
ALDB,78108249,,310,171,,,,,(lead) br
POOL,,5138,7,171,Es,B,,,,,br
CARL,,BLAAe86,13,171,,,4.2,9.5,8.8,0.0,lead br/gun
CARL,,BLAAe133,106?,171,,,,,br
DRAG,,DR67SY,116,171,,,,,br
CAST,,10-523,84,171,,,,,lead
CAST,,15-673,83,171,,,,,lead
PIER,,77,,171,,,,,br
LOND,,PIC436,,171,,,,,lead
LOND,,82.345,,171,SMsEs,X,,,,,br
STAN,8901875,,171,Gm,,,,,gun
CATT,594678,,Site433:9,171,,,,,br
CATT,594690,,Site433:11,171,,,,,(lead) br
CATT,594712,,Site433:12,171,,,,,br/gun
CATT,594676,,Site433:13,171,,,,,br
CATT,723732,,Site434:14,171,,,,,lead
CATT,593775,,Site433:23,171,,,,,lead
CORB,868612,75-3917,28,171?,Es,B,,,,,gun
LOND,,A23483,,172,,,,,(lead) br
BALD,,103,173,T(M?) ,,,,,br/gun
POOL,,5095,3,173,,,,,br
HAYL,,1446,,173,TMsEs,R,,,,,br
LOND,,ELD17,,173,,,,,br
CAME,,75-4,,173?,T,,,,,(lead) br
WROX,840630,,173?,,,,,,br
CAME,,76-44,,173A,TMs,,,,,br/gun
CAME,,76-109,,173A,TMs,,,,,br/gun
CAME,,76-85,,173A,TMs,,,,,br
CAME,,76-49,,173A,TMs,,,,,gun?
CATS,,22,173A,Es,B,,,,,gun
PIER,,2625,,173A,TMsEs,B,86.8,12.5,2.1,0.0,0.0,br
CHEL,,CHAD,1:11,173A,,83.7,10.8,1.9,1.2,0.0,br
ALDB,78108248,,309,173A,Es,R,,,,,br?
PAPC,,84-547?,173A,TMsEs,X,,,,,gun
WINC,,VR-5263,,173A,,,,,br
WROX,743487,,173A,TMs,,,,,br
WROX,781659,,173A,TMs,,,,,br
WROX,781662,,173A,TMsE,,,,,br
STAN,8701116,,173A,TMs,,,,,gun
CAME,,76-15,,173B,,,,,br

CAME,,76-250,,173B,,,,,,leded bronze
CAME,,76-141,,173B,,,,,,leded bronze
CAME,,75-27,,173B,,,,,,leded bronze
HENL,734844,511,15,173B,,,,,,leded bronze
CORB,831688,,29,173B,,,,,,leded bronze
CAME,,75-21,,173B,T,,88.7,0.0,7.3,4.0,0.0,(leded) bronze
GORH,820076,491,43,173B,,,,,,bronze
CARL,,BLAAe176,11,173B,,,,,,bronze
CARL,,BLAAe205,12,173B,,,,,,leded gunmetal
OPEN,7814948,,625,173B,,,,,,leded bronze
PAPC,,84-074,,173B,,,,,,leded bronze
WROX,8000340,,173B,,,,,,bronze
WROX,781661,,173B,T,,,,,(leded) bronze
CAME,,76-162,,173B?,,,,,,leded bronze
CATT,594709,,Site433:17,174,,,,,,bronze/gunmetal
CATT,594696,,Site433:18,174,T,,,,,,bronze
VIND,819169,,6,175,,,,,,leded bronze
PIER,,BB791,,175A,T,,,,,,leded bronze
RICH,7351736,,240,175A,T,,77.6,0.3,8.5,10.9,0.0,leded bronze
PIER,,CVW,,175A,,,,,,leded bronze
STAN,8901282,,175A,,,,,,leded bronze
NORN,640017,,115,175B,,70.5,0.3,11.5,13.5,0.0,leded bronze
NORN,733382,,175B,,65.2,0.2,14.1,17.0,0.0,leded bronze
ULEY,,4767,Fig124:13,175B,,,,,,leded bronze
VIND,819188,,8,176,,,,,,leded gunmetal
HOUS,811550,,176B,T,,74.8,1.4,6.6,22.8,0.0,leded bronze
COLC,,1.81-4842,CS27,176,,,,,,leded gunmetal
OPEN,7813594,,623/4,176,T,,,,,,leded bronze
OPEN,7813581,,623/4,176,T,,,,,,leded bronze/gunmetal
PAPC,,84-055,,176,T,,,,,,leded bronze
CATT,594700,,Site433:16,176,T,,,,,,leded bronze
PIER,,4766,,176A,T,,,,,,leded bronze
RICH,7350908,,243,176A,,79.8,1.5,7.9,7.4,0.1,(leded) bronze
RICH,7351743,,242,176A,T,,75.9,0.6,6.2,18.0,0.1,leded bronze
WROX,78000174,,176A,,,,,,(leded) bronze
LOND,,24670,,176A,,,,,,bronze
RICH,7351741,3522,241,176B,,81.1,2.7,5.5,9.3,0.0,leded bronze/gunmetal
CHEL,,CHT1,1:12,176B,,73.9,0.3,10.6,10.6,0.1,leded bronze
LANC,,sf3306,,177,,,,,,leded bronze
GORH,820349,3310,44,177+,,,,,,leded bronze
PAPC,,84-051,,177+,T,,,,,,leded bronze
LOND,,ACW30,,177++,T(N/E) ,,,,,,bronze
VIND,819174,,7,178,,,,,,leded bronze
OPEN,7813569,,627,178,,,,,,leded gunmetal
RICH,7351713,5346,246,178A,,62.6,8.1,4.9,4.8,0.0,(leded) gunmetal
RICH,7351719,2677,245,178A,,84.1,1.4,5.6,6.4,0.1,(leded) bronze
THIS,,THVbag25,,178A,,,,,,leded gunmetal
HOUS,855040,,103,178A,,,,,,leded bronze
CATT,594680,,Site433:19,178A,,,,,,(leded) bronze/gunmetal
PIER,,HS7722-3AP,,178A?,,,,,,leded bronze
LOND,,SM73,,178D,Es,R,,,,,bronze/gunmetal
WROX,82000239,537,,179,TE,,,,,,leded bronze
WROX,811092,,Gp=9,,,,,,leded bronze
BRAU,,88,67,Gp=9?,,,,,,brass

VELZ,,13,,180,Es,T,,,,,(lead) brass
VELZ,,23,,180,Es,RT,,,,,brass
WICL,,12,,180,Es,T,,,,,lead) gunmetal
RICH,7350218,4137,157,180,Es,R,81.4,14.1,2.9,0.7,0.0,brass
RICH,7350788,5077,155,180,Es,R,74.1,18.5,3.6,1.2,0.0,brass
RICH,7351576,5603,156,180,Es,X,71.1,10.6,5.5,5.0,0.0,(lead) gunmetal
RICH,7351748,875,154,180,Es,R,76.7,6.0,6.9,6.6,0.0,(lead) gunmetal
LOND,,84.453/4,,180,(E) ,,,,,,(lead) gunmetal
LOND,,C988,,180,Es,RT,,,,,brass
VELZ,,19,,180+,Es,X,,,,,(lead) bronze
SHOR,,107.ZE13,Fig31,29/180,Es,TX,26.9,0.1,10.6,0.4,0.1,bronze
NORN,733396,,29B/180++,EsEj,GBKW,75.0,9.9,4.8,4.8,0.0,(lead) gunmetal
VELZ,,2,,29B/180++,Ecc,RTK,77.2,10.3,5.3,4.0,0.0,gunmetal
BRAU,,687,66,180/183,Ec,YT,80.6,9.5,4.8,7.9,0.0,(lead) gunmetal
RICH,7351769,4240,158,181,T,,77.5,4.5,7.0,9.6,0.0,lead) bronze/gunmetal
NORN,621136,,128,181,Es,T?,64.4,0.3,8.9,20.1,0.0,lead) bronze
LOND,,84.382,,183+/230,Ec,RT,,,,,brass/gunmetal
COLC,,1.81-991,CS28,182,EsEc,X,,,,,lead) gunmetal
WANB,,118,182,TEs,?,75.3,12.5,3.7,3.5,0.1,brass/gunmetal
VELZ,,11,,182,Es,RT/B,76.6,14.5,3.2,1.2,0.4,brass
VELZ,,34,,182,Es,RB,81.7,14.1,1.7,1.0,0.3,brass
LOND,,TRM13,,182,Ej,TX,,,,,(lead) brass
MAGI,,16,183,Es,K,,,,,(lead) gunmetal
VELZ,,22,,183,Es,TK,,,,,(lead) brass
VELZ,,21,,183,Es,TX,,,,,brass
LOND,,A17716,,183,Es,T,,,,,brass
LOND,,84.240/1,,183,Es,TB,,,,,brass
VELZ,,20,,183+,Ec,RT,,,,,gunmetal
LOND,,MLK399,,183+,EsEtEm,RTB.WK,,,,,lead) gunmetal
SAND,,3504,,Gp=10,Es,BX,,,,,lead) gunmetal
HOUS,803024,,185,,,,,brass
RICH,7351731,717,247,185,T,,68.8,0.0,5.6,24.4,0.0,lead) bronze
BROU,671681,236,,185,,0.4,8.1,6.1,0.0,bronze
HEYB,,Ae415,10.3,186,GIT,,,,,gunmetal
PIER,,1646,,186,T,,,,,bronze
WANB,684123,,120,186,T,,82.6,0.3,7.4,7.8,0.0,(lead) bronze
RICH,7351079,2112,250,186,GmT,,93.1,6.0,1.7,0.7,0.1,copper/brass
PIER,,3854,,186?,,,,,bronze
RICH,7350287,,244,186?,Gm,,92.5,6.7,1.8,0.2,0.1,copper/brass
CABY,,540,12,186?,,86.1,1.9,2.3,0.5,0.4,copper
ULEY,,4955,Fig124:14,186/190,GIT,,80.5,1.3,5.7,0.4,0.1,bronze
YORK,,M775,,186+,,,,,bronze/gunmetal
RICH,7350283,1078,248,186A,,87.5,3.4,5.1,0.5,0.1,bronze/gunmetal
CABY,,2298,4,186A,,81.6,0.9,8.1,5.4,0.1,(lead) bronze
PIER,,45,,186A,T,,82.6,0.8,7.9,5.2,0.0,(lead) bronze
STAN,9191232,,186A,T,,,,,lead) bronze
RICH,7350286,,249,186B,GmT,,86.1,10.9,1.2,0.0,0.2,brass
PIER,,-,186B,T,,73.6,0.0,6.7,16.7,0.0,lead) bronze
BIRD,8702694,,58,186B,GT,,,,,bronze
TATT,,33882,,187,,,,,gunmetal
VIND,819168,,5,187,GmT,,,,,brass
WICF,,257,,187,T,,76.3,4.6,10.4,10.6,0.6,lead) bronze/gunmetal
PIER,,1,,187,T,,80.0,3.1,6.8,8.5,0.0,lead) bronze/gunmetal
PIER,,2310,,187,,78.3,3.8,4.6,10.1,0.0,lead) gunmetal

ALDB,78108245,,333,187,,,,,,(lead) gunmetal
PIER,,-,187,,,,,,(lead) bronze
PIER,,2B113,,187,,,,,,lead bronze
LOND,,BWB3513,,187,,,,,,brass?
RICH,96003514,1104,257,187,,,,,,brass
CARL,,81ANNAe552,,187?,GmT,,,,,,brass
RICH,7350108,,252,187A,T,,77.8,0.9,6.4,14.4,0.1,lead bronze
RICH,7351744,293,253,187A,T,,73.8,0.5,6.2,16.1,0.1,lead bronze
WICF,,250,,187A,T,,75.7,0.1,9.8,19.1,0.0,lead bronze
RICH,7350698,703,254,187A,,,82.6,8.3,3.8,1.5,0.0,gunmetal
RICH,7350215,4022,255,187B,,,81.2,0.8,5.6,11.6,0.0,lead bronze
RICH,7351742,949,256,187B,,,76.0,4.3,5.8,11.8,0.1,lead gunmetal
ALDB,78108246,,332,187B,,,,,,brass
RICH,7351174,4237,251,187B,T,,85.9,5.4,0.0,1.9,0.1,copper/brass
RICH,7351772,257,265,187/189,,,65.9,0.5,5.1,9.8,0.3,lead bronze
CARL,,81ANNAe311,,187/189?,GmT,,,,,,copper
RICH,7350284,1164,260,189,T,,78.9,0.0,8.2,10.6,0.0,lead bronze
RICH,7350699,531,258,189,T,,68.2,0.6,8.6,19.8,0.1,lead bronze
RICH,7350907,,266,189,T,,78.3,0.3,8.7,11.6,0.0,lead bronze
RICH,7351500,4696,264,189,T,,70.5,0.0,13.4,17.9,0.2,lead bronze
RICH,7351511,4921,259,189,T,,76.0,0.0,9.4,14.3,0.1,lead bronze
RICH,7351775,3531,262,189,,,73.6,0.5,6.9,16.8,0.2,lead bronze
RICH,7351752,301,267,189,,,66.4,13.2,8.2,11.6,0.1,lead gunmetal
PIER,,4123,,189,T,,74.8,14.2,2.0,8.9,0.0,lead brass
ALDB,78108242,,334,189,GT,,,,,,(lead) bronze
ALDB,78108247,,330,189,T,,,,,,(lead) bronze
OPEN,7815806,,626,189,T,,,,,,lead bronze
CATT,8310110,,Site240:10,189,,,,,,lead bronze
LOND,,LCT208,,189,,,,,,lead bronze
BIRD,8905687,,59,189,T,,,,,,lead bronze
RICH,96005011,5105,261,189,T,,,,,,lead bronze
RICH,7350905,298,263,189,,,81.4,0.7,4.8,9.7,0.1,lead bronze
PIER,,3364,,189?,T,,,,,,lead bronze
PIER,,4818,,190,,,,,,bronze
XXXX,,K810035,,190,,,,,,lead gunmetal
RICH,7350470,3231,280,190,GmT,,91.6,3.3,5.2,0.6,0.0,bronze/gunmetal
RICH,7350080,1392,279,190,T,,73.1,0.3,8.0,20.7,0.0,lead bronze
RICH,7350508,3887,283,190,GT,,87.4,2.7,6.8,1.0,0.1,bronze/gunmetal
RICH,7351703,124,281,190,Gl,,97.1,0.5,5.1,0.3,0.1,bronze
RICH,7351725,3000,282,190,T,,82.7,2.3,5.4,7.5,0.0,(lead) bronze/gunmetal
CABY,,2643,5,190,,76.0,2.1,5.8,11.4,0.1,lead bronze/gunmetal
CABY,,128,6,190,,82.9,2.4,6.7,1.7,0.1,bronze/gunmetal
PIER,,44,,190,,86.0,5.2,6.8,0.0,0.0,gunmetal
PIER,,3653,,190,T,,81.5,3.0,7.3,4.8,0.0,(lead) bronze/gunmetal
BROU,671676,95,,190,,,1.4,5.7,0.4,0.0,bronze
CARL,,BLAAe59,18,190,,,,,,lead bronze
CAST,,10-190,85,190,,,0.7,6.7,1.3,0.0,bronze
LOND,,ER1168-2,,190,,,,,,bronze
LOND,,24467,,190,T,,,,,,lead bronze
LOND,,36.132/4,,190,,,,,,lead gunmetal
LANC,,sf4449,,190,,,,,,bronze
RICH,7351895,,286,190,,,,,,bronze
RICH,7351912,,284,190,,,,,,lead bronze
RICH,7351914,,285,190,,,,,,lead bronze

RICH,7351893,,287,190,,,,,(leaded) bronze
CATT,594681,,Site433:20,190,T,,,,,(leaded) bronze
WICF,,112,,190?,,,,,leaded bronze
CABY,,3185,8,191,,,66.8,12.5,6.5,8.5,0.2,leaded gunmetal
PIER,,3127,,191,T,,88.5,0.2,8.6,1.1,0.3,bronze
WROX,721382,,191,,,,,silver
BROU,676810,6,,191,,,,,silver
ICKH,7411767,1756,,191,,,,,leaded bronze
ICKH,,2579,,191,,,,,leaded bronze
LOND,,13860,,191,,,,,leaded bronze
LOND,,85.108/2,,191,Gm,,,,,copper
CATT,593641,,Site433:22,191,,,,,(leaded) bronze
RICH,7350278,2243,270,191A,,,74.2,2.3,7.0,13.7,0.1,leaded bronze
RICH,7350104,915,269,191A,,,74.0,1.1,8.5,15.7,0.1,leaded bronze
RICH,7350777,4441,273,191A,,,70.4,0.7,7.5,19.3,0.1,leaded bronze
RICH,7350775,546,276,191A,,,73.3,1.0,9.4,12.8,0.1,leaded bronze
RICH,7350903,828,271,191A,,,65.6,0.1,10.6,22.2,0.4,leaded bronze
RICH,7351095,1162,278,191A,,,90.1,1.5,6.0,2.8,0.3,bronze
RICH,7351502,4077,277,191A,,,86.8,2.8,6.6,5.8,0.2,(leaded) bronze/gunmetal
RICH,7350471,3477,274,191A,,,70.8,0.5,7.9,20.5,0.1,leaded bronze
RICH,7350806,1442,275,191A,,,90.2,0.0,7.2,1.3,0.0,bronze
RICH,7350904,682,272,191A,,,72.4,2.3,7.3,16.9,0.1,leaded bronze
CATT,594683,,Site433:21,191A,,,,,bronze
RICH,7350500,1719,296,191B,,,75.7,0.1,5.7,19.4,0.4,leaded bronze
RICH,7350690,2447,297,191B,,,86.2,1.6,7.5,5.4,0.3,(leaded) bronze
RICH,7350693,,302,191B,,,87.8,3.0,5.3,6.7,0.1,(leaded) bronze/gunmetal
RICH,7350052,4533,291,191B,,,68.5,1.4,7.4,24.8,0.0,leaded bronze
RICH,7350273,2335,292,191B,,,90.3,0.0,7.6,2.7,0.1,bronze
RICH,7350281,2448,299,191B,,,75.2,2.1,8.9,13.9,0.2,leaded bronze
RICH,7350975,3763,293,191B,,,75.0,2.1,5.7,14.9,0.1,leaded bronze/gunmetal
RICH,7351206,5249,289,191B,,,84.2,11.4,1.6,3.3,0.2,brass
RICH,7351702,3971,290,191B,T,,83.3,0.9,5.0,15.6,0.1,leaded bronze
RICH,7351704,305,298,191B,,,79.2,0.3,9.8,11.2,1.0,leaded bronze
LOND,,438,,191B,,,,,(leaded) gunmetal
LOND,,85.108/3,,191B,,,,,bronze?
LOND,,85.108/1,,191B,,,,,silver and brass
LOND,,O.1812,,191B,,,,,brass
RICH,7350297,3080,294,191B,T,,85.7,3.4,5.7,5.6,0.1,(leaded) bronze/gunmetal
RICH,7350069,2914,295,191B,,,76.5,4.3,7.3,10.2,0.2,leaded bronze/gunmetal
RICH,7350294,1624,300,191B,,,71.1,1.6,12.9,13.9,0.1,leaded bronze
RICH,7350219,145,301,191B,,,72.0,0.9,7.8,15.3,0.1,leaded bronze
RICH,7350272,2334,288,191B,,,83.0,0.1,3.6,12.7,0.1,leaded bronze
RICH,7351894,,306,191B?,,,,,leaded bronze
RICH,7350618,4546,311,191B?,,,75.6,8.2,6.0,6.8,0.2,(leaded) gunmetal
RICH,7351549,,303,191B?,,,80.1,1.1,8.5,13.2,0.1,leaded bronze
RICH,7351765,673,307,191B?,,,82.1,0.9,5.2,5.3,0.1,(leaded) bronze
RICH,7351689,,308,191B?,,,68.8,0.2,9.6,8.9,0.1,leaded bronze
RICH,7351892,,309,191B?,,,,,gunmetal
RICH,7351915,,305,191B?,,,,,leaded bronze
RICH,7350270,1328,316,191B?,,,28.9,3.7,0.6,0.8,64.9,silver
RICH,7350271,1675,315,191B?T,,87.5,2.2,5.0,5.4,0.4,(leaded) bronze/gunmetal
RICH,7351077,2101,304,191B?T,,,,,bronze
RICH,7350285,1267,312,191B?,,,81.7,3.6,4.8,8.7,0.2,leaded gunmetal
RICH,7350292,1015,314,191B?,,,80.3,3.0,5.7,11.8,0.1,leaded bronze/gunmetal

RICH,7350075,2913,313,191B?,,,88.7,0.7,5.2,6.9,0.1,(lead) bronze
RICH,7351879,,310,191B?,,,,,,,brass
CARL,,BLAAe65,20,191/192,,,,,,lead) gunmetal
RICH,7351335,,331,192,G,,,,,,copper
RICH,7351353,,330,192,,,,,,brass/gunmetal
RICH,7351793,,332,192,,,,,,(lead) gunmetal
RICH,7350072,2342,329,192,,,,,,brass
RICH,7350348,286,327,192,Gl,,,,,,brass
RICH,7350478,143,317,192,,84.7,0.6,6.2,9.9,0.1,lead) bronze
RICH,7350697,295,325,192,,71.2,18.2,0.9,6.5,0.0,(lead) brass
RICH,7350090,296,322,192,T,,71.8,12.9,5.3,10.9,0.2,lead) gunmetal
RICH,7350097,1874,319,192,,84.2,12.5,5.0,2.6,0.0,brass/gunmetal
RICH,7350275,2670,318,192,,76.2,0.2,5.4,21.6,0.1,lead) bronze
RICH,7350970,5502,326,192,Ts,,77.3,0.1,7.0,12.2,0.1,lead) bronze
RICH,7351227,274,324,192,,93.8,5.6,1.7,1.3,0.1,copper/brass
RICH,7351700,3375,320,192,,76.1,18.9,0.2,1.8,0.0,brass
RICH,7351723,5244,328,192,Gl,,87.1,9.4,1.5,1.1,0.1,brass
RICH,7351707,2840,321,192,,66.3,1.6,11.8,10.7,0.1,lead) bronze
RICH,7351790,3186,323,192,,85.0,6.5,4.6,5.7,0.1,(lead) gunmetal
CABY,,2301,7,192,,81.9,3.0,7.7,3.8,0.3,bronze/gunmetal
CABY,,2386,9,192,,65.7,0.7,7.8,15.4,0.1,lead) bronze
CABY,,980,11,192,,69.9,14.8,3.0,6.6,0.1,(lead) brass
CABY,,1039,10,192,,76.2,16.5,1.0,2.9,0.0,brass
ULEY,,1219,Fig125:1,192,,75.2,0.6,4.9,13.2,0.1,lead) bronze
WICF,,28,,192,,73.3,0.1,6.0,27.6,0.2,lead) bronze
WANB,692714,,121,192,,82.4,2.2,7.3,9.7,0.2,lead) bronze
ULEY,,1156,Fig125:2,192,,,,,,brass
CARL,,BLAAe165,19,192,,,,,,lead) bronze
ICKH,746273,51,,192,,,,,,lead) bronze
RICH,7351919,,333,192,Gm,,,,,,brass
WROX,781665,,192,,,,,,lead) bronze
WROX,78000943,,192,,,,,,lead) bronze
WROX,781664,,192,,,,,,copper/bronze
WROX,78000942,,192,G,,,,,,copper/bronze
LOND,,13073,,192,Gm,,,,,,bronze
LOND,,15083,,192,,,,,,lead) bronze
LOND,,10372,,192,,,,,,brass
LOND,,84.451,,192,,,,,,silver
LOND,,451,,192,II?,,,,,,(lead) brass
LOND,,458,,192,,,,,,brass
BIRD,8702645,,60,192,,,,,,lead) gunmetal
BIRD,8702653,,61,192,,,,,,lead) bronze
STAN,8901477,,192,,,,,,lead) bronze/gunmetal
RICH,96003512,4156,334,192,G,,,,,,brass
RICH,96003507,,335,192,,,,,,
RICH,96003532,,336,192,,,,,,
DOVE,,K810254,,192?,Gm,,,,,,copper/bronze
RICH,7350282,2689,337,193?,,,62.5,8.1,1.8,0.4,29.4,silver
HENL,730948,454,16,194?,,,,,,silver
RICH,7351718,1880,268,196,T,,69.0,0.7,5.8,20.7,0.2,lead) bronze
RICH,7351018,5306,338,196?,,,76.0,16.3,0.0,0.1,0.1,brass
WICF,,44,,197,,71.6,0.7,9.1,22.0,0.0,lead) bronze
WANB,,122,199,Es,RT,,,,,,bronze
CHES,,T1,,199,,,,,,gunmetal

CAST,,9-1221,101,200,Es,X,,,,,brass
CAST,,16-51,103,200,(E) ?,,,,,bronze?
WINC,,VR7312,,200?,E,,,,,leaded gunmetal
WINC,,VR7381,,200?,E,,,,,leaded gunmetal
WPER,757958,,200A?,Es,TX,,,,,gunmetal
RICH,7351712,641,350,200B,Es,OW,62.1,15.3,1.2,0.2,0.0,brass
CATT,723730,,Site434:8,200B,T,,,,,leaded bronze
LOND,,81,,200D,Es,BX,,,,,brass
CATT,8111962,,Site46:11,201,Mc?(E) ,,4.4,5.5,1.2,,gunmetal
PIER,,1520,,202,,,,,bronze
RICH,7350295,3872,355,203,,,85.3,0.0,10.1,0.5,0.1,bronze
RICH,7351528,3012,352,203,Es(As) ,RT,64.1,6.1,7.5,11.8,0.1,leaded gunmetal
RICH,7351711,1130,351,203,Es,TX,60.8,14.9,1.4,4.4,0.1,(leaded) brass
RICH,7351749,3945,354,203,,,71.2,12.4,5.5,8.8,0.2,leaded gunmetal
NORN,620624,,130,203,Et,BW,76.3,1.2,8.3,9.6,0.0,leaded bronze
TIDD,,82-80,,203,Es,BX,70.3,8.3,7.2,9.1,0.0,leaded gunmetal
LOND,,431,,203,Es,X,,,,,(leaded) gunmetal
LAMY,4774,,9,204,Es,B,,,,,leaded gunmetal
WICL,,42,,204,T(E) ,,,,,,leaded bronze
DOVE,,K831206,43,204,T,,,,,bronze
HAYL,,3316,,204,TEs,TB,86.5,0.9,5.9,6.5,0.1,(leaded) bronze
HAYL,,2077,,204,Es,RT,,,,,leaded gunmetal
HAYL,,172,,204,TEs,RB,,,,,leaded gunmetal
GDUN,,Cat621,2,205,TEs,X,,,,,leaded bronze/gunmetal
YORK,,H139b,,205,TEs,TBX,,,,,bronze
WNEW,5421,285,,205,TEs,R?T,,,,,bronze/gunmetal
NORN,940418,,205,Es,B,,,,,bronze
LOND,,LEA9,,206,EsEj,RB,,,,,leaded gunmetal
ALDB,876223,,338,208,TEsEsEt,RGB,,,,,gunmetal
THIS,610982,BH747,,210,Ec,YB,,,,,leaded bronze/gunmetal
LOND,,3419,,210,Ech,BW,,,,,gunmetal?
SAND,,3385,,210,TEt,RT,,,,,bronze
CATT,8111834,,Site46:12,211,Ece,ROTKW,,,,,leaded gunmetal
RICH,7351735,2844,353,211,TEs,X,82.4,8.7,3.7,2.3,0.1,gunmetal
LOND,,A21459,,211,TEs,,,,,brass/gunmetal
LOND,,CO^308,,211,TN,,,,,leaded gunmetal
CHIC,,CHW88-84,,211,E,,,,,bronze
CORB,868600,,7,211+,EsEc,BX,,,,,bronze
BALD,7210447,,152,211+,TN,,,,,brass
PIER,,122-R10,,211++,T,,79.8,2.1,7.8,9.9,0.0,leaded bronze
LOND,,20382,,212,EsEj,RT,,,,,brass
YORK,,H31,,213,Es,RG?T,,,,,gunmetal
YORK,,H31,,213,Es,RG?T,,,,,gunmetal
YORK,,B3.H139a,,214,Es,RY,,,,,gunmetal
ASHT,835074,159,,214,Es,G/BT?,,,,,gunmetal
CAST,,16-220,112,214,Es,OTBX,,,,,bronze
LOND,,A16426,,214,Es,XX,,,,,bronze
STAN,8700072,,214,Es,TBX,,,,,leaded bronze/gunmetal
CAST,,10-857,113,216,Es,BX,,,,,gunmetal
WANB,,124,216?,Es?,W,,,,,leaded bronze/gunmetal
LOND,,19230,,219,TEsEj,TX,,,,,brass
TIDD,,M7,,220,,,,,leaded bronze
STAN,8901592,,220,TEs,,,,,leaded gunmetal
YORK,,H139c,,222,TEs,R,,,,,brass/gunmetal

HENL,730941,469,17,222,TEsEt,RB,,,,,(lead) brass/gunmetal
NORN,620615,,133,222,TEs,RB,,,,,gunmetal
WANB,,,123,222+,TEs,GT,,,,,bronze
CHIC,,CM/82/EP234,85,223,TEs,GX,,,,,lead) gunmetal
CHIC,800131,79/CM583,86,223,TEs,TX,,,,,lead) bronze
LOND,,A19537,,223,MsEs,O,,,,,bronze
BALD,,,144,224,T,,,,,brass
BALD,,,145,224,T,,,,,brass
BALD,,,146,224,TMcAc,,,,,bronze/gunmetal
RICH,7351321,1010,341,224,Ac,,,,,brass/gunmetal
RICH,7351587,2527,340,224,Ac,,,,,(lead) brass
HAYL,,1795,,224,Ac,,,,,brass
HAYL,,3313,,224,TMc(Ac) ,,,,,,lead) brass/gunmetal
HAYL,,1078,,224,TMcAc,,,,,brass
SHEP,722218,,41,224?,MAc,,,,,(lead) gunmetal
BRAU,,149,69,225,T,,,,,brass
BRAU,,646,68,225,T,,,,,gunmetal
RICH,7350803,4017,345,225,,81.1,12.5,4.1,2.5,0.0,brass/gunmetal
RICH,7350898,3171,342,225,,77.8,12.0,4.2,2.0,0.0,brass/gunmetal
RICH,7351318,2816,344,225,,83.2,11.7,1.5,1.6,0.0,brass
RICH,7351349,2505,343,225,,86.8,11.5,0.0,0.8,0.0,brass
COLC,,1.81-5046,CS30,225,TE,,,,,brass/gunmetal
COLC,,1.81-5045,CS29,225,TE,,,,,brass/gunmetal
DRAG,,DR68OD,125,225,,,,,gunmetal
CAST,,14-453,99,225,T,,21.1,0.3,1.7,,brass
BRAU,,606,70,225/227,T,,,,,brass
TIDD,,M599,,226,E?,,,,,lead) bronze
WANB,,,125,226,Ec,RYG?,,,,,brass
NORN,,,253,226,Ec,KW,76.4,9.7,3.3,4.4,0.0,(lead) brass/gunmetal
NORN,621144,,140,226,Ec,BW,73.5,11.4,4.5,7.6,0.0,(lead) brass/gunmetal
WROX,840612,,226,Mc,,,,,lead) bronze
LOND,,11631,,226,Es,B,,,,,gunmetal
STAN,8700080,,226,TMc,,,,,lead) bronze
SWIN,771823,50,,227,Ec,OTX,,,,,lead) bronze
CARV,,,23,227,Em,T.RKW,,,,,lead) bronze
PIER,,4795,,227,Et,BW,,,,,lead) gunmetal
WANB,,,126,227,Es,X,,,,,lead) bronze
COLE,,520,28,227,T,,,,,bronze
RICH,7350067,2338,364,227,(E) ,,79.5,1.5,9.0,10.7,0.0,lead) bronze
NORN,621154,,145,227,Em,R.BW,70.6,9.2,3.9,8.3,0.0,lead) gunmetal
NORN,621150,,143,227,Es,B?,69.5,3.9,6.3,7.0,0.0,(lead) bronze/gunmetal
NORN,,,151,227,Ec,W,71.1,10.5,3.9,4.6,0.0,(lead) brass/gunmetal
NORN,620633,,146,227,Ec,RBW,72.6,8.0,6.5,5.6,0.0,(lead) gunmetal
OUDE,,4,,227,EsEch,O,78.8,9.1,6.0,6.3,0.0,(lead) gunmetal
ASHT,835072,165,,227,,,,,copper
HAYL,,2750,,227,Es,?,,,,,brass
POUN,,Ae34,19,227,Ej?Ece,GTKW,,,,,lead) bronze
ICKH,,2589,,227,,,,,brass
LOND,,A17717,,227,Es,T,,,,,brass
SAND,,856,,227,EchEcc=m,RBX.RBW,,,,,(lead) brass
LOND,,84.193/2,,227,Es,T,,,,,brass
NORN,733356,,227,Es,T,,,,,lead) bronze
SEAT,,20,,227?,Ece,RBW,,,,,lead) gunmetal
HAYL,,3322,,227?,N,,,,,brass

CHEL,,CHKAe215,2:25,227+,,,,,,,,,gunmetal
NORN,620626,,150stud,227+,Es,,74.3,12.2,2.7,2.7,0.0,brass
NORN,620626,,150plate,227+,EsEj,RO?K,69.6,13.4,2.7,3.6,0.0,brass
LOND,,84.341/2,,227/267B,Es,X,,,,,brass
VELZ,,18,,228,Es,OX,,,,,(lead) bronze
RICH,7351319,4873,365,228,(E) ,,,,,,copper
NORN,621089,,152,228,Es,K?W,48.0,7.8,2.0,1.2,0.0,brass
LOND,,A10127,,228,Es,RX,,,,,brass
LOND,,88,,228,Es,RX,,,,,lead brass/gunmetal
LOND,,20126,,228,EsEj,OTX,,,,,brass
RICH,7351087,85,366,228?,EsEm,RO.YP,,,,,lead gunmetal
VELZ,,25,,229,(E/N) ,,,,,,(lead) brass
VELZ,,15,,229,Es,T,,,,,brass
WANB,,,119,229,(E) ,,,,,,brass
RICH,7350892,2183,357,229,NEs,X,79.3,13.7,3.2,2.4,0.0,brass
VELZ,,12,,229,Es,YT,78.4,12.5,3.1,3.4,0.3,brass/gunmetal
VELZ,,16,,229,Es,T,77.3,16.3,2.3,0.8,0.2,brass
LOND,,WIV216,,229+,Es,TX,,,,,brass
GLOU,,81/73-76,Fig36.5,230,Es,TK,,,,,lead gunmetal
RICH,7351357,992,358,230,(E) ,,,,,,brass?
CHIC,794756,79/CM579,89,230,MsEch,RTW,,,,,lead gunmetal?
RICH,7351085,2068,359,230,(E) ,,80.6,14.6,2.1,2.1,0.0,brass
NORN,733364,,230,Es,TX,76.4,6.1,7.3,8.2,0.0,lead gunmetal
NORN,733360,,230,(E) ,,77.5,3.8,7.2,7.9,0.0,(lead) bronze/gunmetal
NORN,621126,,168,230,Es,X,,,,,lead bronze
LOND,,BWB1329,,230,Es,KW,,,,,lead bronze
NORN,733398,,230,Es,KX,,,,,(lead) gunmetal
LOND,,450,,230+,Es,X,,,,,brass
STAN,8700933,,230+,EsEch,ROTK,,,,,gunmetal
STAN,8901459,,230+,Es,TW?,,,,,brass
NORN,620637,,173,230+,Es,KW,72.3,8.0,2.7,4.3,0.0,(lead) brass/gunmetal
HAYL,,1936,,231,T(R) ,,,,,,gunmetal
WANB,,,127,231+,,,,,,lead bronze
RICH,7351669,874,360,231A,Es?,T,81.7,11.2,3.5,3.2,0.1,brass/gunmetal
NORN,620635,,171,231A,Es,RT,,,,,lead gunmetal
NORN,620636,,172,231A,Es?,X,,,,,lead bronze
COLC,,1.81-616,CS31,231B,N,,,,,lead bronze
RICH,7350893,589,367,231B,Es,T,75.8,9.1,4.8,6.9,0.0,(lead) gunmetal
NORN,,,231B,,,,,,(lead) gunmetal
LOND,,MLK176,,231B,(E) ,,,,,,gunmetal
CHIC,,80/CM1188,88,232,(E) ,,,,,,(lead) gunmetal
RICH,7351542,4472,361,232,,81.3,0.5,10.0,5.6,0.1,(lead) bronze
NORN,621122,,156,232,Es,K?,71.5,0.8,11.6,11.2,0.0,lead bronze
MAGI,,21,233,Es,RB,,,,,lead gunmetal
RICH,7350789,4152,362,233,Es,RT,79.2,6.0,4.2,2.1,0.5,gunmetal
RICH,7350891,7,363,234,EsEj,ROWX,74.1,7.2,4.4,10.8,0.0,lead gunmetal
NORN,733358,,234,EsEj,OTKXX,77.5,0.7,8.6,8.8,0.0,lead bronze
CHEL,,CHKAe245,2:26,235C,,,,,,brass
BALD,,149,236,Es,YBX,,,,,bronze
YORK,,,236,Es,W,,,,,brass
LOND,,29.59/1,,236B,E,,,,,brass
LOND,,A16844,,236B,Es,RT,,,,,bronze
CAST,,10-1239,118,237,Es,BX,,,,,brass/gunmetal
BALD,,142,238,TMcAc,,,,,,brass

RICH,7350801,3996,348,238,,73.1,18.4,3.6,1.4,0.0,brass
RICH,7351082,1011,349,238,,77.8,21.6,0.0,0.1,0.0,brass
CHEL,,CHAG32,,238,McAc,,,,,,brass
STAL,4563,,P1,238,,,,,,brass
DRAG,,DRBH,,238,T,,,,,,brass/gunmetal
SHEP,722335,,42,238?,TMAc,,,,,,led bronze/gunmetal
CHEL,,CR10,,238+,TN,,,,,,brass
CAST,,14-97,98,239,Rb,,,,,,brass/gunmetal
BALD,,151,240,Ece,BW,,,,,brass
RICH,7350347,304,356,241,T,,69.4,0.6,6.7,18.8,0.1,led bronze
HAYL,,1859,,242+,T,,,,,,brass
RICH,7351181,5308,346,242A,(E) ??,,80.8,14.9,2.9,0.9,0.0,brass
RICH,7351342,1844,347,242A,E??,,76.5,7.6,7.8,3.9,0.1,gunmetal
SHEP,722347,,43,246,Rb,,,,,,brass
HAYL,,3489,,246,T(R) ,,,,,,led gunmetal
CAST,,1-675,111,246?,Ecc,BWX,,,,,led brass
OPEN,7826162,,628,247,,,,,,led bronze/gunmetal
COLC,,GBS-254,GBS19,247?,T,,,,,brass
RICH,7351300,4697,374,248,TMc,,72.4,4.7,10.3,6.1,0.1,(led) bronze/gunmetal
ASHT,835125,650,,248,,,,,,brass
SEAM,,67-541,13,248,T,,,,,,brass/gunmetal
WANB,,129,248?,,,,,,brass/gunmetal
COSG,,233,2,249,Gl?Mc,,,,,,led bronze
WICF,,119,,249,,,,,,led gunmetal
HENL,734847,523,18,249,M,,,,,,led bronze
VIND,819165,,1,249,,,,,,led bronze/gunmetal
HAYL,,1402,,249,TMc,,,,,,(led) gunmetal
HAYL,,141,,249,T(M) ,,,,,,led bronze
CORB,868628,,25,249,T,,,,,,brass/gunmetal
CHEL,,CHV2,,249,TMc,,,,,,led bronze/gunmetal
NORN,621111,,184,249,TMc,,,,,,led bronze
RICH,7350086,,376,249,T,,84.1,1.8,4.9,5.2,0.1,(led) bronze/gunmetal
CATT,594692,,Site433:27,249,[T],,,,,,(led) bronze
CATT,594685,,Site433:28,249,M,,,,,,led bronze
BALD,,147,249?,,,,,,brass
HOUS,79208989,,249?,,,,,,brass
SEWN,810666,,2,249?,T(M) ,,1.2,9.5,10.3,,led bronze
WANB,,128,249?,T(Mc) ,,,,,,led bronze
RICH,7351209,3798,375,249?,T,,,,,(led) bronze/gunmetal
THIS,610979,BH751,,249?,,,,,,(led) bronze
STAL,682679,,P3,249?,Mc,,,,,,brass
RICH,7351733,3906,373,249A,Mb,,,,,,gunmetal
PAPC,,84-105,,249C,Mb?,,,,,(led) bronze
YORK,,B2,,250,EsEj,RBW,,,,,brass
RICH,7351727,2997,369,250,Em,X.RTKW,,,,,led gunmetal
WROX,843142,,250,Em,R.RYTBKW,,,,,led gunmetal
CHIC,,78/CM115,83,252B,Es,B,,,,,brass
WICL,,43,,252B,TEs,B,,,,,led bronze
RICH,7350088,,384,252B,TEs,X,84.1,1.3,6.7,6.9,0.3,(led) bronze
POOL,,5257,18,252B,Es,R,,,,,gunmetal
LOND,,CAP68,,252B,Es,R,,,,,brass
WROX,78000529,,252B,Ms(E) ,,,,,,led bronze
CATT,8111064,,Site46:13,252B/259,TMs(E) ,,8.2,4.3,3.2,,(led) brass/gunmetal
WICL,,49,,252C,Es,X,,,,,led gunmetal

RICH,7351746,2792,385,252C,TEs,B,86.8,0.7,7.9,0.8,0.0,bronze
ULEY,,2046,Fig125:3,252C,TEs,RT,,,,,brass
CATT,594679,,Site433:25,252C,TEs,RB,,,,,leaded bronze
STAN,8516942,,252C,TEsAm,RB,,,,,bronze/gunmetal
WICL,,16,,252C+,TEs,T,,,,,leaded bronze
WICL,,17,,252C+,TEs,B,,,,,leaded bronze
WICL,,40,,252C+,TEs,BK,,,,,leaded gunmetal
RICH,7351543,3956,372,252/256,(E) ,,83.6,1.6,5.7,14.0,0.1,leaded bronze
WANB,,130,252+/270+,TEs,T,,,,,brass/gunmetal
PIER,,(63) ,,253,TEs,RG,,,,,leaded bronze
WICL,,14,,253,TMsEs,T,,,,,leaded bronze
HOUS,816576,,253,TEs,RK,,,,,leaded bronze/gunmetal
WANB,,131,253,Es,RK,,,,,bronze
KEST,841247,,Fig52.95,253,TEs,RB,,,,,leaded bronze
TARH,,211,,253,Es,RT,,,,,gunmetal
PIER,,3249,,253,Es,RG,,,,,leaded bronze
GLOU,,69/49-22,E4,253,TsEs,RB,,,,,leaded bronze
STAN,8901710,,253,Es,RK,,,,,leaded gunmetal
GLOU,,81/73-79,Fig36.4,254,Es,RGB,,,,,bronze
THIS,,THZ2213,,254,Es?,R,,,,,bronze
NORN,621088,,298,254,Es,TK,,,,,bronze
TIDD,,M591,,254,Es,BW,,,,,gunmetal
WANB,,132,255,TEs,RT?,,,,,brass
NORN,,257,255,Es,RY?,77.6,0.0,5.6,6.5,0.0,(leaded) bronze
HAYL,,3096,,255,TMsEs,G?B,,,,,brass
OPEN,7813885,,629,255,TEs,RK,,,,,bronze
YORK,,B1,,255+,Es,RTB,,,,,brass/gunmetal
RICH,7351728,2978,370,256,Em,.RBW,71.5,3.5,6.4,11.2,0.0,leaded bronze/gunmetal
RICH,7350899,2393,371,256,Em,.RTBW,75.6,15.7,0.6,2.2,0.0,brass
WINC,,VR-223,,257,TEsAm,TX,,,,,leaded bronze
WROX,78000518,,257,E,,,,,bronze
WROX,775220,,257,E,,,,,leaded bronze
STAN,8701576,,257,TEs?,R,,,,,bronze
WICL,,22,,257A,Es,T,,,,,leaded bronze
WICL,,45,,257A,TEs,GK,,,,,leaded gunmetal
CORB,831686,,21,257A,Es,RB,,,,,gunmetal
HOUS,811565,,257A,TEs,RB,,,,,gunmetal
POOL,,5092,17,257A,TMsEs,RB,,,,,bronze
CORB,868604,75-3916,20,257A,TEs,BX,,,,,gunmetal
HENL,730937,452,19,257B,E,K,,,,,leaded bronze/gunmetal
NORN,620601,,194,257B,EsEm,X.BW,69.6,4.8,7.7,2.4,0.0,bronze/gunmetal
HOUS,753011,,257B,TEs,RK,,,,,leaded bronze
LOND,,PIC42,,257B,EsEcEm,ROTX.BW,,,,,brass/gunmetal
HOUS,825165,,257B,Es,OT,,,,,leaded bronze
NORN,733359,,257B,EsEj,RNTX,75.3,3.2,6.6,12.5,0.0,leaded bronze/gunmetal
WANB,,133,257B,TEsEj,RW,,,,,leaded bronze
LOND,,84.261/1,,257B,EsEj,BWX,,,,,brass
NORN,620608,,187,257C,Ece?,BW?,57.7,8.7,10.6,4.8,0.0,(leaded) gunmetal
NORN,621109,,200,258,Ece,RBW,70.1,14.6,0.6,1.2,0.0,brass
HAYL,(none) ,,259,Es,G?B,73.4,1.5,8.5,10.9,0.1,leaded bronze
ULEY,,1569,Fig125:4,259,Es,RT,,,,,leaded bronze
BANT,,82,Fig7.17,259?,Es,RG,,,,,leaded bronze
HOUS,79208643,,260,Ej,RB,,,,,leaded bronze
WANB,,134,260,TEj,R,,,,,gunmetal

WANB,,135,260,TEs,T,,,,,leded bronze
BRAU,,283,71,260,Ej,RK,,,,,leded gunmetal
RICH,7351080,1694,387,260,TEj,T,79.0,0.5,9.3,5.1,0.0,(leded) bronze
RICH,7351081,1573,386,260,TEs,T,82.6,1.6,6.9,6.1,0.0,(leded) bronze
NORN,621132,,196,260,Ej,RB,71.0,0.0,7.3,11.3,0.0,leded bronze
THIS,610736,TH2,,260,Ej,RB,,,,,leded bronze
WINC,,VR77-5461,,260,Es,R,,,,,leded bronze/gunmetal
WINC,,VR-5461,,260,Es,R,,,,,(leded) bronze
STAN,8800141,,260,TEsR,B,,,,,leded bronze
CHIC,,ES90-2742,,260,E,,,,,leded bronze
WINC,,VR225,,260?,TE,,,,,leded bronze
YORK,,,,262,EsEjRs,T?BW,,,,,brass/gunmetal
NORN,620620,,199,262,Es,TX,,,,,gunmetal
THIS,,THZ1752,,262+,TNEs,R,,,,,brass
WAKE,745075,125,5,263,Ej,RK,,,,,leded gunmetal
NORN,620612,,204,263,EsEc,OKW,75.6,0.6,5.8,11.0,0.0,leded bronze
ALDB,78108250,,340,263,Em,B.KW,,,,,brass
HAYL,,2976,,263,Em,.YK,,,,,leded bronze/gunmetal
CAST,,1-665,108,263,Em,.RYBKW,,9.6,3.6,4.8,,brass/gunmetal
WICL,,31,,263+,TMs,,,,,brass
BIRD,9014037,,65,264A,TMsEs,TBX,,,,,bronze
CAST,,1-395,110,265?,EsEc,BW,,13.1,2.5,3.4,,brass
NORN,620600,,205,266A,EsEm,BX.RBW,72.5,9.3,4.8,0.5,0.0,gunmetal
WANB,692162,,136,266A,,78.9,0.0,5.5,15.8,0.0,leded bronze
BRAU,,120,72,266A,EsEcEm,ROBW.Y,83.3,15.5,1.9,3.3,0.0,brass
STAN,8800248,,266A,,,,,brass
GEST,,BR76,9,266A,EsEm,R.RBW,,,,,leded bronze
BALD,,148,266A,EsEj,OTBP,,,,,bronze?
POOL,,5169,20,266B,,,,,bronze/gunmetal?
POOL,,5090,19,266B,,,,,leded gunmetal
BIRD,8909083,,66,266B,Em.YT,,,,,leded bronze
CARL,,BLAAe227,22,267,Es,B?X,,,,,leded bronze
WICL,,21,,267B,Es,RB,,,,,leded bronze
RICH,7351714,,383,267B,Es,RB,,,,,(leded) bronze
RICH,7351730,26,382,267B,Es,T,,,,,bronze?
NORN,621153,,206,267B,Es,RB,91.1,0.0,2.0,1.6,0.0,copper
STAN,8516921,,267B,Es,RB,,,,,bronze
LOND,,LCT1304,,267B,Es,BX,,,,,bronze
LOND,,12538,,267B,Es,X,,,,,brass/gunmetal
LOND,,A1918,,267B,Es,B,,,,,bronze
BIRD,8812209,,64,267B,TEs,B,,,,,bronze
SAND,,1489,,267B,Es,RB,,,,,bronze
THIS,,THZ4600,,267C,Es,RB,,,,,bronze
CAST,,1-541,107,267C,Es,RB,,0.2,6.9,5.2,,(leded) bronze
CAST,,1-420,105,267C,Es,B,,,,,bronze
LOND,,A17331,,267C,TEs,RX,,,,,brass?
LOND,,81.629/2,,267C,Es,B,,,,,gunmetal?
LOND,,A26490,,267C,Es,YBX,,,,,brass/gunmetal
WICL,,15,,268,Es,YB,,,,,brass/gunmetal
RICH,7350083,2414,381,268,Es,R,,,,,leded bronze?
RICH,7351739,823,379,268,Es,RT,,,,,leded bronze
RICH,7351201,4479,380,268,Es,RYT,85.9,10.9,3.7,4.0,0.0,(leded) brass/gunmetal
LEIC,,316-193,2:27,268,Es,RYT,,,,,brass
CAST,,9-895,106,268,Es,RX,,,,,bronze

BIRD,8905735,,63,268,Es,R?YB,,,,,(lead) bronze
CARL,,BLAAe146,21,268,Es,YT,,,,,lead bronze
LOND,,26538,,268/199,Es,YB,,,,,gunmetal?
WAKE,745057,29,6,269,,,,,,bronze
WICL,,23,,269,,,,,,lead gunmetal
HENL,684636,375,20,269,,,,,,(lead) brass/gunmetal
CORB,822060,,24,269,,,,,,lead gunmetal
POOL,,5308,15,269,,,,,,lead gunmetal
POOL,,5168,14,269,,,,,,bronze/gunmetal
DEEP,,3631,,269,,,,,,(lead) bronze
DEEP,,3632,,269,,,,,,lead gunmetal
DEEP,,3853,,269,,,,,,lead bronze
NORN,620602,,296,269,GmAc,,,,,bronze
OPEN,7815595,,630,269,,,,,,gunmetal
RICH,7350525,3250,377,269A,Ece?,T,79.2,8.3,3.1,4.6,0.3,(lead) brass/gunmetal
WROX,743478,,269B,,,,,,lead bronze
STAN,8611866,,269B,,,,,,lead bronze
SAND,,540,,269B,,,,,,lead gunmetal
LOND,,85.108/5,,269B+,,,,,,brass
WICL,,5,,270,Gm,,,,,bronze
WICL,,24,,270,G,,,,,bronze
HENL,642023,1,21,270,GmT,,,,,gunmetal
HOUS,79208663,,270,GmTAc,,,,,bronze
HOUS,811598,,270,GIT,,,,,bronze
WANB,,137,270,GIAc,,,,,bronze
WANB,,138,270,GITAc,,,,,bronze
RICH,7351086,208,390,270,G(Ac) ,,85.7,4.7,5.1,0.6,0.0,gunmetal
RICH,7351717,,389,270,GITAc,,88.5,1.0,6.5,0.8,0.1,bronze
RICH,7351729,1872,388,270,GmTAc,,85.4,10.2,0.0,0.5,0.0,brass
ULEY,,7810,Fig125:6,270,GmAc,,92.3,1.9,5.7,0.0,0.0,bronze
ULEY,,7814,Fig125:7,270,GmAc,,85.4,8.3,2.2,0.0,0.0,brass/gunmetal
ULEY,,5270,Fig125:5,270,GI,,,,,bronze
HOUS,855044,,10,270,GmT,,,,,bronze
WROX,78000516,,270,Gm,,,,,bronze
LOND,,23479,,270,G(Ac) ,,,,,brass
CHIC,,ES88-6,,270,GTAc,,,,,gunmetal
STAN,8900758,,270,GmT,,,,,brass
WROX,743499,,270?,T,,,,,gunmetal
INWO,,(1971) ,,270+?,GmT,,,,,brass
WICL,,28,,271,GIT,,,,,brass
WICL,,52,,271,G,,,,,brass
HENL,642026,36,22,271,GIAc,,,,,(lead) gunmetal
NORN,,237,271,,87.5,9.2,2.6,0.1,0.0,brass/gunmetal
WINC,,VR-5381,,271,GmTAc,,,,,brass
WINC,,VR-5577,,271,GITAc,,,,,brass
SAND,,3904,,271,GmTAc,,,,,brass
STAN,8800694,,271,GI,,,,,brass
STAN,8900757,,271,GmT(Ac) ,,,,,brass
MAXE,801274,M801991,6,271,GmAc,,,,,bronze
WINC,,VR-9700,,274,TEsEj,BX,,,,,brass
GDUN,,Cat837,1,275,Ech,R,,,,,lead gunmetal
KILH,,1,275,Mc,,,,,lead bronze
CHIC,,79/CM332,84,275,Ech,T,,,,,(lead) gunmetal
NORN,621090,,218,275,Ec,YK,74.1,0.8,4.5,6.7,0.0,(lead) bronze

NORN,620679,,217,275,Es,R,67.6,0.4,7.4,16.4,0.0,lead
NORN,621115,,219,275,Es,R,73.6,2.8,5.6,8.3,0.0,lead
CAST,,10-1731,117,275,Ech,B,,,,,lead
LOND,,RAG92,,275,Ecc,YGT,,,,,brass
LOND,,MSL^684,,275,Ech,YB,,,,,lead
LOND,,20780,,275,Ech,BW,,,,,brass/gunmetal
CHIC,,CH86-31,,275,E,,,,,brass
WINC,,VR-29,,275,TE,X,,,,,lead
HENL,730947,,22a,276,,,,,silver
GEST,,BR108,10,277,Es,RG?B,,,,,brass
CAST,,1-240,115,277,Es,TX,,,,,gunmetal
LOND,,POM269,,277,TEc,BX,,,,,brass
LOND,,19108,,277,,,,,gunmetal
RICH,7351776,2629,368,278,,,,,gunmetal?
NORN,621133,,210,279,Es,BW,74.3,8.1,4.4,2.2,0.0,gunmetal
LOND,,3429,,279,TS,,,,,gunmetal
CAST,,1-676,116,279?,Es,RB,,11.9,3.0,4.4,,(lead) brass/gunmetal
LOND,,19839,,279+?(E) ,,,,,,brass
MAGI,,20,280+,EsEc,TBW,78.7,17.9,1.0,0.6,0.0,brass
GORH,811388,,45,280+,Es,OBX,76.7,15.1,2.8,4.0,0.2,brass
BRAU,,760,73,300+,Rb,,,,,brass
SHEP,,44,Gp=plate,,,,,gunmetal
PIER,,2375,,Gp=plate,T,,,,,lead
COLC,,CF-34,,Gp=plate,T,,,,,(lead) brass
COLC,,CF-53,,Gp=plate,T,,,,,lead
NORN,,201,Gp=plate,EsR,X,67.9,0.7,8.6,12.9,0.0,lead
NORN,,236,Gp=plate,Et,RBW,77.3,5.8,5.2,5.2,0.0,(lead) gunmetal
BALD,7211096,,150,Gp=plate,,73.7,21.4,2.7,0.7,0.0,brass
PRES,851067,381,23,Gp=plate,Ech,RGBK,,,,,lead
GORH,820294,2626,46,Gp=plate,,,,,brass/gunmetal
PAPC,,84-078,,Gp=plate,Es,?,,,,,brass
PIER,,RSS6,,Gp=plate,Mc?,,,,,lead
WROX,78000103,,Gp=plate,,,,,brass
WORC,,3899-8509,,Gp=plate,M,,,,,brass
DORC,,W98237,AA,Gp=plate,Em,T.BW,,,,,gunmetal
DRAG,,DR68ABQ,37,Gp=plate?,,,,,,brass
STAN,8800686,,Gp=plate?,Es,B,,,,,brass
BIRD,8905595,,P1?,,,,,,(lead) brass
RICH,7350895,3781,392,P2,,88.7,3.8,4.7,1.4,0.0,gunmetal
LOND,,464,,P2,,,,,brass
LOND,,A20819,,P2,,,,,copper
LOND,,A13830,,P2,,,,,brass
LOND,,460,,P2,,,,,brass
WEEK,781416,216,17,P3,,,,,brass
BALD,,153,P3,,,,,brass
BALD,,154,P3,,,,,brass
MAGI,7711300,,23,P3,,,,,(lead) gunmetal
SHEP,722208,,45,P3,,,,,brass
WAKE,745058,33,9,P3,,,,,brass
WAKE,745059,34,8,P3,,,,,brass
WAKE,745069,87,7,P3,,,,,copper
GEST,,BR90,11,P3,,,,,brass
GARD,,ME13,,P3,,,,,brass
RICH,7350964,404,406,P3,,,,,lead

RICH,7351083,943,395,P3,,,,,,silver
RICH,7351419,,413,P3,,,,,,silver
RICH,7351760,1329,393,P3,,,,,,brass/gunmetal
RICH,7351762,2814,414,P3,,,,,,silver
RICH,7350974,5171,415,P3,,,,,,silver
RICH,7350082,2337,397,P3,,,92.7,0.0,7.0,2.0,0.0,bronze
RICH,7350084,3191,409,P3,,,89.1,1.3,6.9,1.3,0.1,bronze
RICH,7350507,,396,P3,,,80.1,16.4,0.0,2.0,0.1,brass
RICH,7351070,376,399,P3,,,86.1,0.0,9.7,1.5,0.6,bronze
RICH,7351072,153,398,P3,,,75.3,8.4,5.5,4.5,0.1,(lead) gunmetal
RICH,7351074,148,403,P3,,,92.6,0.1,3.4,1.8,0.0,bronze
RICH,7351299,,412,P3,,,88.2,9.1,2.0,2.9,0.0,brass
RICH,7351732,3079,411,P3,,,80.7,14.0,0.0,0.6,0.1,brass
RICH,7350550,1468,400,P3,,,87.9,2.4,3.8,2.1,0.4,bronze/gunmetal
RICH,7351099,3808,402,P3,,,76.1,21.6,0.0,2.3,0.0,brass
RICH,7351720,3194,410,P3,,,90.5,1.5,6.3,1.6,0.1,bronze
RICH,7351722,79,401,P3,,,87.2,3.9,6.4,1.4,0.1,bronze/gunmetal
RICH,7351756,302,394,P3,,,88.5,15.1,2.1,0.8,0.0,brass
CABY,,106A,15,P3,,,75.6,14.0,4.1,3.3,0.5,brass/gunmetal
ASHT,835116,556,,P3,,,,,,bronze
WITC,615021,bz1,5,P3,,,,,,bronze
TIDD,,80-7,,P3,,,,,,lead) gunmetal
CABY,,1470,16,P3,,,,,,gunmetal
CABY,,2268,14,P3,,,,,,bronze
THIS,,THZ10,,P3,,,,,,brass
THIS,,THZ351,,P3,,,,,,bronze/gunmetal
THIS,,THZ356,,P3,,,,,,bronze/gunmetal
THIS,,THVbag180,,P3,,,,,,bronze
THIS,611021,BH863,,P3,,,,,,lead) bronze
ULEY,,5853,Fig125:8,P3,,,,,,gunmetal
STAN,8516895,,P3,,,,,,(lead) bronze
DRAG,,DR66HR,133,P3,,,,,,brass
DRAG,,DR70AAX,137,P3,,,,,,bronze/gunmetal
DRAG,,DR69WS,141,P3,,,,,,bronze
DRAG,,DR70AC,135,P3,,,,,,bronze/gunmetal
DRAG,,DR70AB,138,P3,,,,,,gunmetal
DRAG,,DR67LN,146,P3,,,,,,brass
DRAG,,DR72KI,134,P3,,,,,,gunmetal
DRAG,,DR72ALJ,142,P3,,,,,,bronze
DRAG,,DR70BBP,145,P3,,,,,,bronze/gunmetal
DRAG,,DR(I) ,,P3,,,,,,bronze
RICH,7351880,,404,P3,,,,,,bronze
RICH,7351881,,405,P3,,,,,,bronze
LOND,,A5749,,P3,,,,,,bronze
STAN,8800118,,P3,,,,,,bronze
STAN,8701793,,P3,,,,,,(lead) bronze
STAN,8701777,,P3,,,,,,brass
STAN,8700801,,P3,,,,,,bronze/gunmetal
STAN,8700084,,P3,,,,,,brass/gunmetal
STAN,8612987,,P3,,,,,,bronze
STAN,8612988,,P3,,,,,,brass
STAN,8612492,,P3,,,,,,bronze
LOND,,467,,P3,,,,,,gunmetal?
SNET,,Cat33,33,P3,,,,,,brass/gunmetal

SAND,,3656,,P3,,,,,,brass
STAN,8516908,,P3,,,,,,brass
STAN,8612991,,P3,,,,,,brass
STAN,8900685,,P3,,,,,,bronze
STAN,8901344,,P3,,,,,,bronze
STAN,9191231,,P3,,,,,,bronze/gunmetal
RICH,96003571,2091,408,P3,,,,,,brass
RICH,96003509,3737,407,P3,,,,,,iron
DORC,,CP28,P4,,,,,,bronze
BALD,,155,P4,,,,,,brass/gunmetal
HENL,642037,130,23,P4,,,,,,gunmetal
HENL,734862,446,24,P4,,,,,,copper
HENL,734846,518,25,P4,,,,,,gunmetal
TIDD,,M587,,P4,,,,,,brass
TIDD,,82-65,,P4,,,,,,brass
TIDD,,82-147,,P4,,,,,,bronze/gunmetal
CORB,822079,,17,P4,,,,,,(lead) gunmetal
WANB,,139,P4,,,,,,brass
WANB,,140,P4,,,,,,copper
WANB,,141,P4,,,,,,lead) bronze
WANB,,142,P4,,,,,,bronze/gunmetal
COLE,,771,29,P4,,,,,,bronze
COLE,,395,30,P4,,,,,,copper
KEST,841257,,99,P4,,,,,,brass
BALD,715540,,156,P4,,81.7,17.3,1.8,1.2,0.1,brass
WROX,760638,,P4,,90.8,0.0,4.7,0.7,0.0,bronze
PRES,851065,655,26,P4,,76.2,9.2,7.6,6.7,0.0,(lead) gunmetal
PRES,851063,433,27,P4,,,,,,bronze
PRES,851062,426,28,P4,,,,,,bronze
WITC,615026,bz6,6,P4,,,,,,bronze
LEIC,,316-48,2:28,P4,,,,,,gunmetal
ALDB,78108240,,345,P4,,,,,,brass
TIDD,,81-863,,P4,,,,,,copper
POOL,,5259,27,P4,,,,,,(lead) bronze
POOL,,5171,23,P4,,,,,,gunmetal
ULEY,,292,Fig125:11,P4,,,,,,brass
ULEY,,3647,Fig125:9,P4,,,,,,bronze
ULEY,,5858,Fig125:10,P4,,,,,,gunmetal
CARL,,BLAAe266,28,P4,,,,,,gunmetal
DRAG,,DR72AA,154,P4,,,,,,bronze
DRAG,,DR70AD,155,P4,,,,,,brass
DRAG,,DR69DV,151,P4,,,,,,bronze
RICH,7351882,,426,P4,,,,,,gunmetal
RICH,7351910,,416,P4,,,,,,brass
RICH,7351913,,427,P4,,,,,,bronze/gunmetal
WROX,82000288,,P4,,,,,,bronze
WROX,78001037,,P4,,,,,,bronze
WROX,7312123,,P4,,,,,,bronze
WROX,8405523,,P4,,,,,,bronze
WROX,775296,,P4,,,,,,brass
LOND,,3431,,P4,,,,,,gunmetal
LOND,,A123,,P4,,,,,,bronze
LOND,,463,,P4,,,,,,bronze
LOND,,3430,,P4,,,,,,bronze

LOND,,20384,,P4,,,,,,bronze
LOND,,20383,,P4,,,,,,bronze
LOND,,A5087,,P4,,,,,,bronze
LOND,,461,,P4,,,,,,brass
STAN,8612547,,P4,,,,,,gunmetal
STAN,8611716,,P4,,,,,,brass
BIRD,8905539,,69,P4,,,,,,bronze
SAND,,3630,,P4,,,,,,bronze
RICH,7350598,5668,417,P4,,89.0,0.3,8.3,0.8,0.1,bronze
RICH,7350894,4190,419,P4,,77.9,16.3,2.9,1.7,0.1,brass
RICH,7350897,3617,421,P4,,70.6,3.8,8.0,0.6,0.0,bronze/gunmetal
RICH,7351089,178,425,P4,,88.0,11.1,0.0,0.4,0.0,brass
RICH,7351589,4630,418,P4,,86.2,1.7,3.9,1.7,0.1,bronze/gunmetal
RICH,7351710,15,420,P4,,70.4,1.5,8.0,5.3,0.1,(lead) bronze
RICH,7351750,,422,P4,,,,,,silver
RICH,7351588,1081,423,P4,,,,,,silver
RICH,7351740,3241,424,P4,,87.8,0.5,10.5,1.0,0.0,bronze
LOND,,LCT1309,,P4,,,,,,bronze
CATS,,33,P4,,,,,,brass
CARV,,67,P4,,,,,,bronze
CARV,,61,P4,,,,,,bronze
CATS,,34,P4,,95.1,0.0,5.4,0.0,0.1,bronze
DRAG,,DR68OY,153,P4,,,,,,brass
CATS,,32,P4,,75.7,13.6,0.0,0.0,0.1,brass
HENL,734863,474,26,P4?,,,,,,bronze/gunmetal
WANB,,146,P4?,,,,,,bronze
RICH,7351918,,444,P4?,,,,,,bronze/gunmetal
PIER,,4433,,P5,,,,,,silver
PIER,,4451,,P5,,,,,,bronze
HENL,684633,369,27,P5,,,,,,bronze
ALDB,78108238,,344,P5,,,,,,bronze/gunmetal
BRAN,774116,3227,2,P5,T,,,,,,bronze?
BIRD,8905553,,71,P5,,,,,,lead bronze
BIRD,8905561,,72,P5,,,,,,(lead) bronze
STAN,9191451,,P5,,,,,,bronze
DORC,7816535,,WH,P5/P4,,,,,,bronze
GEST,,BR119,12,P6,,,,,,gunmetal
PIER,,3151,,P6,,,,,,brass
PIER,,2363,,P6,,,,,,bronze/gunmetal
PIER,,225,,P6,,,,,,bronze
PIER,,3780,,P6,Es,R?,,,,gunmetal
CORB,834922,,15,P6,,,,,,gunmetal
HOUS,803032,,P6,,,,,,bronze?
RICH,7351084,1850,430,P6,,79.2,5.1,5.2,8.4,0.0,lead gunmetal
PRES,851067,1708,24,P6,,89.3,0.0,9.8,0.6,0.0,bronze
ALDB,78108240,,349,P6,,,,,,brass
CORB,868624,,16,P6,,,,,,brass/gunmetal
LOND,,11308,,P6,,,,,,brass/gunmetal
CATT,594698,,Site433:33,P6,,,,,,bronze/gunmetal
RICH,7351073,151,431,P6,,84.8,0.1,14.5,3.6,0.1,bronze
OPEN,7813684,,631,P6,,,,,,bronze
YORK,,M204,,P6,,,,,,bronze
CORB,831684,,14,P6,,,,,,bronze/gunmetal
CAME,,76-10,,P6,,,,,,bronze

WANB,,143,P6,,,,,,copper
RICH,7351376,4875,429,P6,,95.0,0.4,6.8,0.4,0.1,bronze
WELT,,SF34,,P6,,,,,,bronze
ALDB,78108240,,348,P6,,,,,,bronze
ALDB,78108240,jb34,,P6,,,,,,gunmetal
ALDB,78108240,jb35,,P6,,,,,,gunmetal
ALDB,78108240,jb36,,P6,,,,,,copper/bronze
ALDB,78108240,jb37,,P6,,,,,,bronze
ALDB,78108240,,353,P6,,,,,,copper/bronze
POOL,,5141,26,P6,,,,,,bronze
CHEL,,CHV23,,P6,,,,,,brass/gunmetal
CARL,,BLAAe256,27,P6,,,,,,lead^{ed} gunmetal
CATT,8111013,,Site46:14,P6,,,,,,brass/gunmetal
OPEN,7815332,,632,P6,,,,,,bronze
PAPC,,84-064,,P6,,,,,,bronze
PAPC,,84-102,,P6,,,,,,bronze/gunmetal?
WROX,7312364,,P6,,,,,,bronze
LOND,,459,,P6,,,,,,bronze
LOND,,A2393,,P6,,,,,,bronze
LOND,,A2392,,P6,,,,,,brass
STAN,8612556,,P6,,,,,,bronze/gunmetal
BIRD,8812082,,68,P6,,,,,,(lead^{ed}) bronze
ALDB,78108240,,352,P6,,,,,,lead^{ed} bronze/gunmetal
CARL,,BLAAe127,25,P6?,,,,,,bronze
CARL,,BLAAe132,26,P6?,,,,,,gunmetal
CARL,,BLAAe145,23,P6?,,,,,,gunmetal
CARL,,BLAAe202,24,P6?,,,,,,bronze
WROX,80000243,,P6?,,,,,,bronze/gunmetal
PIER,,60,,P6/P7,,,,,,lead^{ed} gunmetal
MAGI,7711346,,24,P7,,,,,,(lead^{ed}) bronze/gunmetal
CATS,,35,P7,,,,,,bronze
YORK,,M367,,P7,,,,,,bronze
TIDD,,M5,,P7,,,,,,bronze/gunmetal
TIDD,,83-1,,P7,,,,,,bronze/gunmetal
RICH,7350774,25,428,P7,,91.5,0.2,6.6,0.5,0.0,bronze
BALD,7211149,,157,P7,,81.2,1.5,11.8,0.7,0.0,bronze
PRES,,1238,25,P7,,,,,,lead^{ed} bronze
WELT,,468,,P7,,,,,,brass
WELT,,2,,P7,,,,,,gunmetal
WELT,,212,,P7,,,,,,gunmetal
THIS,,THZ1323,,P7,,,,,,brass
CHEL,,CHAG24,,P7,,,,,,bronze
WROX,78001000,,P7,,,,,,lead^{ed} bronze
LEIC,,316-202,2:29,P7?,,79.8,17.3,0.0,0.5,0.0,brass
WANB,,144,P9,,,,,,brass
ALDB,78108239,,P9,,,,,,brass
TIDD,,82-119,,P10,,,,,,bronze
RICH,7351770,4932,391,P11C,,78.1,24.7,0.0,0.0,0.1,brass
PIER,,2335,,P12,,,,,,brass
PIER,,4694,,P12,,,,,,brass
WELT,,416,,P12,,,,,,bronze
DRAG,,DR71AUG,140,P12,,,,,,brass
BIRD,8812073,,74,P12,,,,,,iron
BIRD,8905533,,73,P12,,,,,,bronze

SEAM,,?-105,12,P13,,,,,,leded gunmetal
BRAU,,914,74,Gp=penan,,,,,,gunmetal
BALD,,159,Gp=penan,,,,,,bronze
YORK,,M451,,Gp=penan,,,,,,leded gunmetal
WHIT,,I,,Gp=penan,,,,,,bronze
RICH,7350595,3985,439,Gp=penan,,,,,,copper
BRAU,,72/342,75,Gp=penan,,,,,,bronze
RICH,7350601,1628,438,Gp=penan,,102.0,0.0,0.5,0.0,0.1,copper
RICH,7350778,360,433,Gp=penan,Es,K?,81.9,0.5,15.2,3.2,0.1,bronze
RICH,7350896,3325,435,Gp=penan,,77.0,17.7,2.3,0.4,0.0,brass
RICH,7350984,1499,443,Gp=penan,,86.6,3.3,4.5,1.5,0.1,gunmetal
RICH,7351071,154,442,Gp=penan,,83.2,1.9,4.8,1.6,0.1,bronze/gunmetal
RICH,7351163,147,432,Gp=penan,,69.4,8.2,5.6,9.0,0.1,leded gunmetal
RICH,7351004,5295,440,Gp=penan,,82.4,0.0,15.2,2.4,0.1,bronze
RICH,7351623,944,441,Gp=penan,,70.2,18.5,2.4,2.5,0.1,brass
RICH,7351755,303,434,Gp=penan,,99.0,0.2,0.5,0.1,0.0,copper
BALD,7211176,,158,Gp=penan,T,,82.5,0.0,10.9,1.3,0.1,bronze
CABY,,1933,,Gp=penan,,,,,,gunmetal
CABY,,182,17,Gp=penan,,,,,,brass
CABY,,2709,19,Gp=penan,,,,,,brass
CABY,,470,18,Gp=penan,,,,,,bronze
POOL,,5093,29,Gp=penan,,,,,,leded bronze
POOL,,5226,28,Gp=penan,,,,,,bronze
STAN,8516873,,Gp=penan,,,,,(leded) bronze
COLC,,1.81-3699,CS35,Gp=penan,,,,,,copper/brass?
COLC,,GBS-736,GBS21,Gp=penan,,,,,,bronze
COLC,,1.81-459,SC33,Gp=penan,,,,,,brass
COLC,,1.81-790,CS34,Gp=penan,,,,,,brass
ULEY,,5526,Fig125:12,Gp=penan,,,,,,brass
ULEY,,4662,-,Gp=penan,,,,,,brass
POUN,,Ae52,22,Gp=penan,,,,,,bronze
CATT,8111161,,Site46:18,Gp=penan,,,,,,bronze
CATT,8111613,,Site46:16,Gp=penan,,,,,,bronze
DRAG,,DR73LM,129,Gp=penan,,,,,,bronze
ICKH,,Gp=penan,,,,,,brass/copper
ICKH,746396,910,,Gp=penan,,,,,,gunmetal?
CATT,8111233,,Site46:15,Gp=penan,,,,,,gunmetal
RICH,7351916,,445,Gp=penan,,,,,,brass
LOND,,LCT1133,,Gp=penan,,,,,,bronze
STAN,8611738,,Gp=penan,,,,,,bronze
WORC,,740,,Gp=penan,,,,,,gunmetal
GEST,,BR5,14,Gp=annul,,,,,,leded bronze
WANB,,145,Gp=annul,,,,,,bronze
RICH,7351721,152,437,Gp=annul,Gm,,,,,,gunmetal
RICH,7351761,,436,Gp=annul,,85.5,5.2,4.1,2.4,0.1,gunmetal
CHEL,,CHN16,,Gp=annul,,,,,,brass
CHEL,,CHN13,,Gp=annul,R,,,,,,brass
DODD,8515488,,Gp=annul,,,,,,bronze
LECH,,1958-1,-,?,,,,,,,bronze
CAME,,76-237,,?,T,,,,,,leded bronze
CARV,,29,?,,,,,,,bronze
WICL,,27,,?,,,,,,,leded gunmetal
WICL,,35,,?,,,,,,,leded bronze
WICL,,53,,?,,,,,,,leded bronze

WICL,,54,,?,,,,,,,,,,brass
VIND,819177,,4,?,TMs,,,,,,,,,gunmetal?
KEST,841266,,94,?,,,,,,,,,,bronze
SHEP,722213,,27,?,,,78.1,0.2,14.3,0.8,0.0,bronze
BALD,7211183,,84,?,,,90.3,0.4,14.6,0.0,0.1,bronze
BROU,671624,36,,?,,,,,,,,,,bronze
TARH,,228,,?,,,,,,,,,,bronze
CABY,,871,,?,,,,,,,,,,bronze/gunmetal
CHEL,,CHV9,,?,,,,,,,,,,brass
CHEL,,CHV8,,?,,,,,,,,,,brass
CHEL,,CHMAe277,2:,?,,,,,,,,,,bronze
CARL,,BLAAe209,17,?,,,,,,,,,,brass
CARL,,BLAAe265,2,?,,,,,,,,,,bronze
STAL,682663,,N2,?,,,,,,,,,,brass
POUN,,Ae16,9,?,,,,,,,,,,bronze
RICH,7351871,,339,?,,,,,,,,,,brass
PIER,,106D189,,?,,,,,,,,,,lead bronze/gunmetal
LOND,,DMT134,,?,,,,,,,,,,lead bronze
LOND,,GPO4364,,?,,,,,,,,,,bronze
LOND,,LCT587,,?,,,,,,,,,,lead bronze/gunmetal
LOND,,RAG49,,?,,,,,,,,,,(lead) bronze
WROX,78001024,,?,,,,,,,,,,(lead) bronze
WROX,78001170,,?,T,,,,,,,,,lead bronze
RICH,7350611,2638,378,?,,,,,,,,,,(lead) gunmetal

Site	AML No	Site No	Pub No	Type	Decor	Enamel	Cu%	Zn%	Sn%	Pb%	Ag%	Alloy
STAN	8700352			10A								bronze/gunmetal
WEEK	781411	190	7	10B								gunmetal
OUDE		6		10B								gunmetal
RICH	7350077		9	10B			84.3	5.1	5.3	0.0	0.0	gunmetal
RICH	7350068	2367	7	10B			90.2	0.3	4.4	3.0	0.0	bronze
RICH	7350092	862	10	10B			85.3	2.8	6.7	1.2	0.0	bronze/gunmetal
RICH	7350094	1649	2	10B			70.9	24.5	0.0	0.3	0.1	brass
RICH	7351548	4076	8	10B			91.5	1.7	10.2	1.0	0.1	bronze
STAL	670417		A1	10B								bronze
ICKH	746632	388		10B								bronze
LOND		97		10B								gunmetal?
SAND		267		10B								bronze
SAND		1171		10B								bronze
SAND		3928		10B								bronze
SALF		1		10B								bronze
STAN	8800924			10B								bronze
STAL	670468		A4	10B?								brass
BALD			25	10C								bronze
BALD			32	10C								bronze
BALD			33	10C								bronze
BALD			40	10C								brass
BALD			41	10C								brass
TIDD		82-236		10C								bronze
TIDD		82-200		10C								bronze
COLE		1018	1	10C								(lead) bronze
COLE		1088	2	10C								bronze
RICH	7351038	4957	19	10C								bronze
RICH	7350096	1860	23	10C			87.2	12.3	1.0	0.3	0.1	brass
RICH	7351525	4806	24	10C			80.6	19.1	0.0	0.2	0.0	brass
RICH	7351751	1049	18	10C			72.5	27.3	0.0	0.0	0.1	brass
BALD	7211100		23	10C			83.8	2.5	11.0	2.0	0.1	bronze
BALD	7211230		39	10C			73.5	27.7	0.9	0.1	0.0	brass
ASHT	835123	638		10C								bronze
ALDB	78108256		303	10C								bronze/gunmetal
CARL		BLAAe217	7	10C								gunmetal
STAL	670523		A3	10C								bronze
STAL	682695		A2	10C								gunmetal
CAST		15-680	1	10C								gunmetal
LOND		A28337		10C								bronze
SAND		512		10C								bronze
ULEY		3605	Fig123:2	10D								brass
ULEY		3717	Fig123:1	10D	T							bronze
ULEY		6062	Fig123:3	10D								bronze/gunmetal
DRAG		DR68VG		10D								bronze
STAN	8701776			10D								bronze
WROX	721368			10F			84.5	15.1	1.9	0.0	0.1	brass
CAST		1-508	3	10F								brass
LOND		A22346		10F+								bronze
OUDE		9		10G								bronze
OUDE		10		10G								bronze
RICH	7351529	4326	13	10G								bronze
OUDE		7		10G			87.8	1.8	11.0	0.3	0.1	bronze
OUDE		8		10G			87.9	0.4	17.0	0.4	0.1	bronze
WINC		VR-1030		10G								bronze
LOND		98		10G								bronze
LOND		13861		10G								brass/gunmetal
LOND		19280		10G								brass/gunmetal
LOND		A28562		10G								brass
BRAU		496	15	10H								brass
SALF		8		10H								bronze
SALF		9		10H								bronze
BALD			20	10/11A								gunmetal
BALD			22	10/11A								bronze
SWIN	770764	92		10/11								bronze
MAXE		2800/7658	3	10/11?								bronze
MAXE		M80-41-2740	5	10/11								bronze/gunmetal
WANB			11	10/11								bronze
WANB			13	10/11								brass
WANB			27	10/11								brass
RICH	7350776	845	5	10/11								bronze
RICH	7351506	4201	6	10/11								bronze
RICH	7350772	835	17	10/11								bronze
RICH	7350071	1272	11	10/11								gunmetal
RICH	7350074	2747	21	10/11			76.2	20.7	0.6	0.0	0.1	brass
RICH	7350107	1846	20	10/11			90.4	0.0	8.8	0.2	0.1	bronze
GORH	820348	3295	8	10/11								bronze
THIS		THZ2233		10/11								bronze/gunmetal?

Site	AML No	Site No	Pub No	Type	Decor	Enamel	Cu%	Zn%	Sn%	Pb%	Ag%	Alloy
HAYL		799		28?								brass
DRAG		DR66BC	56	28A								bronze
STAL	4521		L1	Gp=2	TMs							brass
ASHT	835073			Gp=2								brass
COLC		1.81-4971	CS8	Gp=2								brass
STAL	682664		F33	Gp=2								brass
STAL	4530		H7	Gp=2								brass
STAL	670298		G5	Gp=2	(As)							brass
STAL	670514		L2	Gp=2								brass
HAYL		KP12		Gp=2								brass
BALD			101	Gp=2?	T							lead bronze
TIDD		82-260		Gp=2/3								gunmetal
TIDD		81-1059		29	T		77.0	15.9	2.4	1.5	0.2	brass
TIDD		82-154		29?								lead gunmetal
STAN	8900629			29?								lead bronze
STAL	670461		L5	29A			78.4	15.8	2.2	0.8	0.0	brass
GORH	820113	678	15	29A								brass
STAN	8612947			29A	T							brass
WICL		20		29B								lead bronze
THIS	611046	BH1664		29B								(lead) bronze
SNET		Cat23		29B								(lead) bronze
STAN	8901001			29B	T							brass
SNET		Cat11		34								(lead) bronze
WICL		50		34+								gunmetal
NORN	620654		48	35			84.1	0.2	10.2	0.4	0.0	brass
NORN	621139		49	35?			94.1	0.2	7.0	9.7	0.0	lead bronze
MAXE		M80-1638-27	2	36	T							lead bronze
RICH	7350906	63	238	36	Es	R	91.0	0.3	4.9	0.6	0.1	brass
GORH	820104		16	36	T		70.6	1.0	13.7	13.2	0.1	lead bronze
ALDB	78108243		312?	36	Es	R?						gunmetal?
THIS		THZ326		36	Es	RB						brass
OPEN	7815599		616	36	Es	B						brass
CAST		1-40	50	36	(E)							brass/gunmetal?
CAST		1-402	51	36	Es	B		0.6	3.0	2.4	0.0	brass
CAST		1-514	52	36	(E)							brass
CAST		1-515	53	36	Es	B						brass
CAST		10-1350	55	36	Es	X		0.8	6.5	8.8	0.0	lead bronze
CAST		10-120	56	36	Es	X						brass?
CAST		10-962	57	36	Es	B		0.1	3.6	1.9	0.0	brass
CAST		16-264	48	36	Es	X						brass
LULL			56	36	T							lead gunmetal
RICH	7351917		239	36+								gunmetal
WICL		33		37								brass
WANB			45	37	Mb							lead bronze
TIDD		81-857		37			71.3	0.6	7.7	19.6	0.0	lead bronze
TIDD		M12		37			73.3	0.0	8.2	18.5	0.2	lead bronze
TIDD		M13		37								lead bronze
THIS		THZ2122		37								lead bronze/gunmetal
THIS		THZ2706		37	T							lead gunmetal
CAST		12-37	119	37								brass
HAYL		1848		37?								brass
POOL		5129	13	37?	Es	RB						gunmetal
DRAG		DR67TY	114	37+?				0.7	7.4	4.0	0.0	brass
BALD			143	Gp=3?	T							brass/gunmetal
BALD			48	40								brass
THIS		THY66		40								brass
HOUS	811591			40?								(lead) bronze
LOND		13048		40A								brass
LOND		453		40A								brass
LOND		A24941		40B								brass
RICH	7351745	1496	35	40B			78.2	17.8	1.1	0.3	0.0	brass
TIDD		82-82		40C								gunmetal
THOR	852996	17		40C								brass/gunmetal
DRAG		DR65CU	36	40C								brass
LOND		A2406		40C								brass
STAN	9190750			40C								gunmetal
BALD	7210433		49	40C			75.6	23.7	1.2	0.3	0.0	brass
BALD			45	40C+								brass
BALD			46	40C+								brass
BALD	7210319		47	40C+			73.5	23.5	0.7	1.0	0.1	brass
RICH	7351574	1260	38	42			74.0	22.4	0.0	0.2	0.0	brass
VELZ		3		42			82.6	18.7	1.7	0.1	0.0	brass
LOND		CS1		42								brass
LOND		106		42								brass
LOND		105		42								brass
LOND		104		42								brass
RICH	7350742	611	36	42			78.1	18.6	2.0	0.2	0.0	brass

Site	AML No	Site No	Pub No	Type	Decor	Enamel	Cu%	Zn%	Sn%	Pb%	Ag%	Alloy
COLC		GBS-469	GBS5	60								brass
HAYL		726		60	Tlci							brass
COLC		1.81-1219	CS10	60								brass/gunmetal
CHEL		CHKAe216	2:6	60	T							brass
CHEL		CHKAe239	2:7	60								brass
DRAG		DR68LB	71	60	T							brass
DRAG		DR65AAH	72	60								bronze
HAYL		KP9		60	T							brass/gunmetal
CAST		10-2167	8	60	TN							brass/gunmetal
CAST		16-323	7	60								brass
LOND		ATR267		60	T							gunmetal
LOND		FEN192		60								brass
LOND		GPO263		60								brass/gunmetal
LOND		GPO3626		60								gunmetal
LOND		GPO5669		60								gunmetal
LOND		LCT1381		60								brass
LOND		LEA29		60								brass/gunmetal
LOND		447		60								brass
LOND		448		60	T							brass
LOND		446		60								brass
LOND		445		60								brass
LOND		20084		60								brass
LOND		84.453/3		60	T							brass
LOND		81.282/7		60								brass
STAN	8610966			60	T							brass
STAN	8612504			60	T							bronze/gunmetal
LOND		21047		60	T							brass
LOND		454		60	T							brass
LOND		19754		60	T							brass
WORC		3899-c17042		60								brass
SNET		Cat29		60								brass
SNET		Cat30		60	T							brass/gunmetal
SNET		Cat31	31	60								bronze/gunmetal
SAND		1563		60	T							bronze
SAND		1792		60	T							brass
STAN	8701202			60								brass
STAN	8701763			60	T							bronze/gunmetal
STAN	8901671			60								brass
STAN	8901367			60								brass
RICH	7351035	5580	119	60								brass
RICH	7350060	672	122	60	TN		79.7	9.0	5.7	1.0	0.1	gunmetal
WANB			52	60?								brass/gunmetal
WANB			56	60?								brass
CHEL		CHAG25		60?								brass
CHEL		CHAJ17		60?								brass
CHEL		CHDAe308	2:9	60?	T							brass
DRAG		DR69IN	73	60?								gunmetal
DRAG		DR66FM		60?	T							brass
HAYL		KP1		60?	T							brass
HAYL		KP6		60?								brass
CAST		10-1756	10	60?								gunmetal
RICH	7351877		152	60?								brass
WINC		VR9734		60/61								gunmetal
RICH	7350474	2108	149	60/61?								brass
RICH	7351874		151	60/62?	T							brass
CHEL		CHV3		60/63								bronze/gunmetal
CHEL		CHAL12		60/63								brass
THIS	611026	BH872		60/63?	T							brass
CHEL		CHKAe243	2:8	60/71B								brass
WANB			53	60/74								brass
WANB			54	60/74	T?		80.8	0.1	9.5	13.3	0.1	leaded bronze
RICH	7351544	4557	148	60+			78.5	3.5	6.1	5.4	0.1	(leaded) bronze/gunmetal
TARH		887		60+	T							brass
DORC			CP9	61	T							bronze
BALD			112	61	T							brass
BALD			113	61	T							gunmetal
BALD			114	61	T							bronze
BALD			115	61								brass/gunmetal
WICF		252		61	T							brass
WICL		25		61								gunmetal?
TIDD		M16		61	T							bronze?
TIDD		82-149		61	T							brass
WANB			57	61	T							brass
RICH	7351768	3016	100	61	T							bronze?
RICH	7350065	2043	99	61								brass/gunmetal
RICH	7350329	2530	96	61			76.0	22.5	0.8	0.3	0.2	brass
RICH	7350691	1974	101	61	T		88.9	0.5	8.8	2.2	0.0	bronze

Site	AML No	Site No	Pub No	Type	Decor	Enamel	Cu%	Zn%	Sn%	Pb%	Ag%	Alloy
LOND		456B		79	T							brass
VELZ		14		79+			80.0	13.6	3.1	0.4	0.2	brass
VELZ		30		79+			75.2	9.4	5.7	0.2	0.2	gunmetal
COLC		1.81-5122	CS16	79+	T							bronze
LOND		435		79+	Es	X						brass
COLC		1.81-1640	CS14	79+?	TN							gunmetal
LOND		85.108/7		79+?	T							brass
WANB			60	80	TN?							brass
RICH	7351093	904	143	80			85.1	10.5	4.6	0.3	0.1	gunmetal
BRAU		409	65	80	T		71.6	21.4	0.7	0.2	0.0	brass
PRES		1585	14	80			93.8	1.0	6.0	0.9	0.0	bronze
RICH	7351791	299	150	Gp=4B								gunmetal
RICH	7351764		153	Gp=4B			81.2	14.7	1.5	0.4	0.1	brass
RICH	7351512	4779	112	Gp=4B			85.5	13.4	0.0	0.0	0.1	brass
RICH	7350505		134	Gp=4B			85.4	2.6	8.0	3.9	0.1	bronze
RICH	7350802	3742	146	Gp=4B	T		75.0	8.1	5.8	6.1	0.1	(lead) gunmetal
COLC		CF-63		Gp=4B	1							brass
POUN		Ae50	16	Gp=4B	T							brass
ASHT	835086			Gp=4B								brass
ASHT	835145			Gp=4B								brass
BALD	7211191		125	Gp=4B	T		73.1	25.5	0.6	0.2	0.0	brass
COLC		1.81-364	CS15	Gp=4B								bronze
STAL	670511		M4	Gp=4B								brass
SHEP	722331		28	Gp=4?								bronze
LOND		WIV325		Gp=4B?								brass
RICH	7351778		147	Gp=4B?								brass/gunmetal
STAL	682648		N1	Gp=4??			71.6	24.9	1.5	0.1	0.0	brass
WROX	78000944			Gp=4/5								brass
BALD	7211083		50	Gp=4/5			71.9	23.0	1.3	0.1	0.0	brass
COLC		GBS-1026	GBS12	84								brass
LOND		A2388		84A								brass
LOND		A2390		84A								brass
LOND		A11962		84A								brass
LOND		A2389		84A								brass
RICH	7350386	4977	41	84B			80.9	14.2	1.4	0.1	0.0	brass
RICH	7350695	2590	42	84B			84.7	16.1	0.5	0.1	0.0	brass
RICH	7350804	4563	39	84B			79.3	18.0	0.0	0.1	0.0	brass
RICH	7350971	5056	40	84B			76.9	19.0	0.3	0.1	0.0	brass
LOND		92		84B								brass
CABY		948?	1	84C			70.3	0.1	8.5	16.1	0.1	lead bronze
LOND		A21462		84C								bronze
LOND		A22303		85								gunmetal
HAYL		444		87?			83.0	13.9	1.4	1.2	0.1	brass
CAST		10-2340	46	88?								lead bronze
RICH	7351449		43	88B			82.1	20.1	0.0	0.9	0.0	brass
THIS		THZ1178		88B			79.5	0.1	10.2	0.1	0.0	bronze
DRAG		DR68OH	4	88B				0.0	13.4	0.2	0.0	bronze
DRAG		DR68AAL	2	88B								bronze
LOND		90		88B								bronze
STAN	8900812			88B								bronze
STAN	8901736			88B								bronze
BALD			51	89								brass
BALD			52	89								brass
BALD			53	89								brass
BRAU		1099	18	89								brass
BRAU		1027	19	89								brass
BRAU		1117	20	89								brass
BRAU		1029	21	89								brass
RICH	7350299	1574	44	89			85.8	14.7	0.0	0.0	0.1	brass
STAL	670294		B10	89			76.7	18.2	0.7	0.3	0.0	brass
STAL	670423		B8	89			78.1	18.9	0.4	0.1	0.1	brass
STAL	682659		B9	89			78.7	16.3	1.3	0.5	0.0	brass
STAL	682644		B2	89			77.2	21.0	1.1	0.2	0.0	brass
STAL	670469		B1	89			76.8	23.3	1.3	0.4	0.1	brass
STAL	4576		B5	89			78.3	19.5	1.7	0.1	0.1	brass
BRAU		1052	22	89			68.8	20.0	0.7	0.2	0.2	brass
HAYL		1838		89								brass
COLC		GBS-676	GBS13	89								brass
HAYL		2981		89								brass
STAL	4588		B6	89								brass
STAN	8800700			89								brass
RICH	7350387	4242	45	89			80.6	16.8	1.5	0.1	0.1	brass
STAL	670274		B4	89?			78.8	19.1	1.5	0.2	0.0	brass
STAL	682717		B3	89?			82.9	21.3	2.1	0.3	0.0	brass
HAYL		2824&2982		89?								brass
BRAU		114	24	89/90			70.3	19.4	0.0	0.1	0.0	brass
BRAU		388	25	89/90			73.9	21.6	0.0	0.4	0.0	brass

Site	AML No	Site No	Pub No	Type	Decor	Enamel	Cu%	Zn%	Sn%	Pb%	Ag%	Alloy
SAND		3706		90								brass
STAN	8901149			90								brass
RICH	96005013	5189	65	90								brass
RICH	7351539		56	90								brass/gunmetal
RICH	7350800	5310	58	90			87.7	1.4	6.4	2.1	0.0	bronze
RICH	7350807	2542	57	90			88.6	0.2	10.2	0.1	0.1	bronze
RICH	7351766		55	90			93.9	3.1	4.8	2.4	0.1	bronze/gunmetal
RICH	7350786	2789	60	90								brass
COLC		0874CEH		90?								brass
STAL	4524		C20/C29	90?			81.2	18.5	1.6	0.2	0.1	brass
STAL	4524		C20/C29	90?			83.8	14.9	1.6	0.2	0.0	brass
BRAU		272	28	90?			73.0	22.1	0.4	0.1	0.1	brass
BRAU		798	31	90?			81.8	18.9	1.9	0.5	0.1	brass
BALD			65	90/91								brass
HAYL		2758		90/91			71.4	6.7	8.9	0.6	0.2	gunmetal
HAYL		1672		90/91								bronze
STAL	682729		C76	90/91?								brass
STAL	670513		C75	90/91?								brass
STAL	4538		C63	90/91?								brass
STAL	4522		C73	90/91?								brass
BALD	715549		58	90/91?			82.5	0.0	9.7	0.2	0.2	bronze
RICH	7350280	2391	62	90A			80.7	17.5	1.2	0.4	0.2	brass
RICH	7350051	3028	48	90A			78.6	22.3	0.2	0.2	0.0	brass
RICH	7351505	4729	54	90A			85.3	17.0	0.0	0.3	0.0	brass
RICH	7351524	4923	64	90A			70.9	16.0	12.4	0.7	0.1	gunmetal
RICH	7351513	3626	47	90A			78.4	24.8	0.0	0.0	0.0	brass
RICH	7351705	62	46	90A			76.6	22.5	0.5	0.0	0.1	brass
SHEP	722206		10	90A			77.4	27.2	0.3	0.1	0.0	brass
STAL	682653		C11	90A			77.1	29.9	0.3	0.2	0.0	brass
STAL	670451		C14	90A			77.9	20.6	0.6	0.3	0.0	brass
STAL	670436		C17	90A			77.2	21.1	1.4	0.3	0.0	brass
STAL	682697		C22	90A			75.6	17.2	1.6	0.2	0.0	brass
STAL	682668		C13	90A			74.6	21.1	0.0	0.6	0.1	brass
STAL	682662		C18	90A			78.2	18.0	0.2	0.1	0.0	brass
STAL	682642		C8	90A			76.2	24.1	0.6	0.3	0.0	brass
STAL	4557		C15	90A			79.9	19.0	1.4	0.1	0.0	brass
STAL	670486		C12	90A			80.0	20.2	1.0	0.1	0.0	brass
STAL	4574		C10	90A			77.8	23.2	1.0	0.1	0.0	brass
STAL	4575		C9	90A			72.6	23.5	1.5	0.1	0.0	brass
STAL	670447		C16	90A			77.2	16.9	1.6	0.2	0.0	brass
STAL	670427		C25	90A								brass
DRAG		DR71BHB	44	90A								brass
DRAG		DR66IP		90A								brass
DRAG		DR70RE	43	90A								brass
ICKH	746660	1227		90A								brass
LOND		A28330		90A								brass
STAN	8516915			90A								brass
LOND		100		90A								brass
SNET		Cat1	1	90A								bronze
STAL	682712		C21	90A?			72.2	23.9	0.9	0.1	0.1	brass
STAL	670483		C19	90A?								brass
RICH	7350109	725	51	90A/92			86.8	0.2	8.3	0.5	0.1	bronze
STAL	4527		C56	90B								brass
RICH	7350902	720	53	90B								bronze
RICH	7350091	854	49	90B			74.2	20.0	1.2	0.8	0.1	brass
RICH	7351577	2473	52	90B			93.9	0.0	6.9	0.1	0.1	bronze
RICH	7351664		61	90B			75.0	2.0	9.1	0.6	0.0	bronze
STAL	682704		C39	90B			76.6	18.3	0.8	0.1	0.0	brass
STAL	682660		C44	90B			80.2	18.2	0.1	0.2	0.1	brass
STAL	670452		C30	90B			75.4	19.8	0.3	0.2	0.0	brass
STAL	670440		C33	90B			81.3	16.8	0.7	0.5	0.0	brass
STAL	670506		C43	90B			78.7	18.6	0.8	0.4	0.0	brass
STAL	670504		C6	90B			78.9	17.6	1.3	0.3	0.1	brass
STAL	670649		C54	90B			74.3	23.1	1.1	0.2	0.1	brass
STAL	670466		C37	90B			70.7	21.3	1.0	0.3	0.0	brass
STAL	670435		C26	90B			81.3	17.5	0.7	0.2	0.0	brass
STAL	670464		C58	90B			78.5	22.1	0.8	0.2	0.0	brass
STAL	682661		C45	90B			77.4	17.5	1.2	0.1	0.0	brass
STAL	682654		C31	90B			79.1	17.8	1.0	0.3	0.0	brass
STAL	682700		C59	90B			80.8	20.5	1.2	0.2	0.0	brass
STAL	682685		C3	90B			82.0	17.8	1.8	0.5	0.1	brass
STAL	682686		C4	90B			79.8	15.8	2.5	0.4	0.3	brass
STAL	4516		C66	90B			81.6	16.7	1.0	0.3	0.2	brass
STAL	4551		C71	90B			82.4	17.4	1.5	0.2	0.1	brass
STAL	670443		C5	90B			78.9	19.3	1.2	0.1	0.1	brass
STAL	670444		C40	90B			78.2	18.6	1.3	0.9	0.1	brass
STAL	4545		C41	90B			79.0	19.6	1.6	0.1	0.0	brass

Site	AML No	Site No	Pub No	Type	Decor	Enamel	Cu%	Zn%	Sn%	Pb%	Ag%	Alloy
SAND		1375		91A								brass
SAND		3713		91A								brass
RICH	7350291	990	59	91B			87.2	10.5	0.8	0.6	0.2	brass
RICH	7351526	4366	67	91B			81.9	15.8	0.8	0.6	0.1	brass
RICH	7351533		66	91B			79.3	27.0	0.0	0.0	0.1	brass
LECH		1959-5	3	92								(lead) gunmetal
LECH		1982(1438)	4	92								(lead) bronze
WEEK	781370	2	12	92								lead gunmetal
BALD			69	92								brass
MAGI	7711177		4	92								lead bronze
GEST		BR157	7	92								lead gunmetal
WICF		27		92								lead bronze
WICF		102		92								lead bronze
WICF		253		92								lead bronze
WICF		348		92								lead bronze
GARD		ME11		92								lead bronze
COLC		CF-54		92								lead gunmetal
WANB			70	92								lead bronze
WANB			65	92								(lead) bronze?
WANB			66	92								lead bronze
WANB	692664		74	92								(lead) bronze
WANB			77	92								lead bronze
RICH	7351527	4318	198	92								lead bronze/gunmetal
KEST	841234		101	92								lead bronze
KEST	841267		96	92								lead gunmetal
KEST	841271		97	92								lead bronze
KEST	841238		98	92								lead bronze
BRAU		368	49	92								lead bronze/gunmetal
RICH	7350503	234	162	92			74.1	0.0	7.1	16.0	0.2	lead bronze
RICH	7350105	927	161	92			85.5	4.8	6.5	1.8	0.2	gunmetal
RICH	7350205	5057	168	92			79.9	5.4	5.3	7.0	0.0	(lead) gunmetal
RICH	7350076	3009	196	92			81.9	0.5	8.0	7.7	0.2	(lead) bronze
RICH	7350106	1037	181	92			77.6	0.0	8.1	16.9	0.1	lead bronze
RICH	7350741	3240	193	92			72.3	0.8	5.4	20.1	0.2	lead bronze
RICH	7350328		197	92			83.8	0.2	6.8	8.3	0.1	lead bronze
RICH	7350100	31	169	92			80.7	0.2	10.7	7.6	0.1	(lead) bronze
RICH	7350095	1832	174	92			76.2	0.8	9.0	13.4	0.1	lead bronze
RICH	7350298	2034	175	92			78.8	0.0	10.1	9.2	0.1	lead bronze
RICH	7350290	1277	171	92			75.3	3.3	4.8	14.9	0.1	lead gunmetal
RICH	7350213	4823	163	92			77.2	0.0	7.8	13.7	0.1	lead bronze
RICH	7350501	1079	166	92			73.7	0.5	7.1	14.9	0.1	lead bronze
RICH	7350743	740	160	92			78.4	3.3	7.7	10.9	0.1	lead bronze/gunmetal
RICH	7351036	5561	167	92			83.2	0.5	7.4	5.0	0.0	(lead) bronze
RICH	7351078	2064	173	92			77.2	0.9	8.2	11.6	0.1	lead bronze
RICH	7351094	1047	179	92			82.1	0.1	11.6	5.3	0.1	(lead) bronze
RICH	7351519	4889	172	92			87.6	0.1	7.9	6.2	0.0	(lead) bronze
RICH	7351571	2513	164	92			76.1	0.4	8.7	14.3	0.0	lead bronze
RICH	7351575	1369	194	92			77.5	0.5	8.6	10.0	0.1	lead bronze
RICH	7351520	5061	170	92			82.7	0.2	10.0	9.6	0.1	lead bronze
RICH	7351523	4664	178	92			79.8	3.1	5.9	14.0	0.1	lead bronze/gunmetal
RICH	7351570	2632	165	92			81.9	0.9	7.6	13.1	0.1	lead bronze
BRAU		459	48	92			72.2	0.2	6.7	13.7	0.1	lead bronze
BRAU		251	47	92			76.8	0.2	8.8	4.6	0.1	(lead) bronze
SWIN	770237	57		92	T		76.9	0.7	10.3	8.1	0.1	lead bronze
THIS		THZ2705		92			80.5	0.5	10.6	6.0	0.1	(lead) bronze
HAYL		1362		92			91.9	0.1	4.7	3.2	0.1	bronze
HAYL		1039		92			74.7	2.0	12.5	6.7	0.1	(lead) bronze
HAYL		2		92			63.7	0.2	7.7	16.3	0.1	lead bronze
HAYL		3041		92			73.1	0.2	12.5	12.4	0.0	lead bronze
BALD	715586		77	92			78.5	0.1	6.4	11.2	0.0	lead bronze
BALD	7211150		68	92			74.5	4.0	8.7	10.5	0.1	lead bronze/gunmetal
BALD			70	92			78.4	0.3	9.1	8.3	0.6	lead bronze
BALD	7210432		72	92			74.5	7.5	5.4	11.5	0.9	lead gunmetal
BALD	7211141		76	92			77.3	1.8	8.0	12.2	0.1	lead bronze
BALD	7211120		73	92			75.0	0.5	9.6	17.9	0.1	lead bronze
BALD	715558		79	92			85.5	0.7	5.0	8.0	0.0	(lead) bronze
WICF		255		92			78.4	0.0	12.1	11.0	0.0	lead bronze
WICF		254		92			73.6	0.4	12.4	26.0	0.0	lead bronze
WICF		258		92			83.7	0.0	6.7	10.1	0.0	lead bronze
WICF		256		92			82.5	3.8	6.8	14.2	0.1	lead bronze/gunmetal
WANB			71	92			84.5	0.0	7.7	13.3	0.0	lead bronze
WANB	707303		76	92			68.9	0.0	8.9	18.6	0.1	lead bronze
WANB			73	92			65.9	0.0	12.5	19.3	0.1	lead bronze
WANB			72	92			82.3	0.0	11.0	6.5	0.0	(lead) bronze
WANB			68	92			73.3	0.5	12.3	10.6	0.0	lead bronze
WANB			75	92			90.1	1.1	11.3	7.8	0.1	(lead) bronze
WANB	684102		82	92			80.8	0.4	7.3	14.8	0.1	lead bronze

Site	AML No	Site No	Pub No	Type	Decor	Enamel	Cu%	Zn%	Sn%	Pb%	Ag%	Alloy
SAND		1432		92								leaded bronze
SAND		1711		92								leaded gunmetal
SAND		3725		92								leaded bronze/gunmetal
SAND		3755		92								bronze
STAN	8800051			92								leaded bronze
STAN	8900533			92								leaded bronze
STAN	8900768			92								(leaded) bronze
STAN	8901195			92								leaded bronze
STAN	8901300			92								bronze
STAN	8901637			92								(leaded) bronze
STAN	8901750			92								leaded bronze/gunmetal
STAN	8901844			92								(leaded) bronze
RICH	96005012	5170	177	92								leaded bronze
WICF		187		92?								leaded bronze
WICF		301		92?								leaded bronze
WANB	684375		88	92?								(leaded) bronze
WANB			90	92?								leaded bronze
WANB			91	92?								leaded bronze
WANB			89	92?			76.5	0.0	9.9	11.6	0.0	leaded bronze
TIDD		TA1		92?			87.8	2.1	14.5	0.5	0.1	bronze
HAYL		179		92?								(leaded) bronze
CHEL		CHAG26		92?								leaded bronze
CATT	8310556		Site240:2	92?								leaded bronze
BRAU		987	51	92+								leaded bronze
WANB			67	92+								leaded bronze
WANB			87	92+	T		67.4	0.2	10.2	22.2	0.1	leaded bronze
WROX	721371			92+			81.8	0.0	5.9	12.5	0.3	leaded bronze
GARD		ME12		92/93								leaded bronze
TIDD		M2		92/93								leaded bronze/gunmetal
COLC		CF-55		92/93								leaded gunmetal
COLC		CF-33		92/93								leaded bronze
BALD	7210429		75	92/93			78.1	6.0	6.8	9.4	0.1	leaded gunmetal
RICH	7351870		200	92/93								leaded bronze/gunmetal
RICH	7351889		199	92/93								bronze
RICH	7351911	5347	201	92/93								bronze
LOND		ACE78		92/93								bronze/gunmetal
LOND		ALG29		92/93								leaded bronze
LOND		AST137		92/93								bronze
LOND		CRU47		92/93								(leaded) bronze
LOND		DMT185		92/93								leaded bronze
LOND		ER702-1		92/93								bronze
LOND		FEN222		92/93								leaded bronze
LOND		GPO419		92/93								(leaded) bronze
LOND		GPO1003		92/93								leaded bronze
LOND		GPO4366		92/93								leaded bronze
LOND		GPO3934		92/93								bronze
LOND		GPO4660		92/93								(leaded) bronze
LOND		LCT1294		92/93								leaded bronze
LOND		LCT1383		92/93								leaded bronze
LOND		LCT1384		92/93								leaded bronze
LOND		LCT1494		92/93								bronze
LOND		LCT1517		92/93								(leaded) bronze
LOND		MGT135		92/93								leaded bronze
LOND		OPT650		92/93								bronze
LOND		ORG87		92/93								(leaded) bronze
LOND		OST89		92/93								leaded bronze
LOND		POM610		92/93								(leaded) bronze
LOND		SLO87		92/93								leaded bronze
LOND		18649		92/93								gunmetal
SNET		Cat18	18	92/93								leaded bronze
BALD			78	92/93?								leaded bronze
BALD			80	92/93?								leaded bronze
BALD	263		71	92/93?			80.9	4.2	4.9	12.3	0.1	leaded gunmetal
LOND		ORG91		92/93?								bronze
CHEL		CHAJ18		92/94?								leaded bronze
CHEL		CHAJ19		92/94?								(leaded) bronze
RICH	7351875		205	92/94?								(leaded) bronze
RICH	7351890		202	92/94?								brass
SEAM		65-276	7	92/95?								gunmetal?
CHEL		CHAG31		92/96?								brass?
WEEK	781371	3	14	93								bronze
WICL		39		93								leaded bronze/gunmetal
RICH	7350476	297	184	93			78.3	0.2	8.8	15.5	0.1	leaded bronze
RICH	7351578	2482	182	93			79.9	3.7	3.4	16.7	0.1	leaded gunmetal
RICH	7351759	5472	186	93			81.9	0.3	7.6	6.6	0.1	(leaded) bronze
WANB			80	93			89.8	2.5	9.3	0.0	0.1	bronze
WANB			81	93			76.4	0.4	7.7	18.8	0.1	leaded bronze

Site	AML No	Site No	Pub No	Type	Decor	Enamel	Cu%	Zn%	Sn%	Pb%	Ag%	Alloy
COLC		1.81-4968	CS22	93								leaded bronze
COLC		1.81-965	CS21	93								leaded gunmetal
LOND		101		93								gunmetal
RICH	7351545	4497	176	93			74.8	0.2	8.0	15.7	0.1	leaded bronze
ULEY		2286	Fig123:10	93?			58.1	0.0	7.1	30.5	0.1	leaded bronze
RICH	7350288		189	93A			69.0	0.1	11.4	16.5	0.1	leaded bronze
RICH	7350073	2395	185	93A			86.4	0.6	8.0	11.5	0.1	leaded bronze
RICH	7351767	1581	190	93A			80.0	0.2	4.2	14.0	0.1	leaded bronze
RICH	7351579		183	93A			81.9	3.4	5.3	11.3	0.1	leaded bronze/gunmetal
SHEP	722338		38	93A			82.6	2.4	6.2	9.9	0.1	leaded bronze/gunmetal
BALD	7210333		74	93A			61.3	0.3	7.5	30.0	0.0	leaded bronze
LOND		81.370/1		93A								bronze
LOND		20655		93A								bronze
LOND		20779		93A								bronze
RICH	7350479	59	191	93A								(leaded) bronze
RICH	7351075	1914	187	93A			76.7	2.3	8.1	12.1	0.2	leaded bronze
RICH	7351091		188	93A			81.1	0.0	8.4	9.1	0.2	leaded bronze
RICH	7350385	4820	195	93B			75.9	0.1	8.5	13.5	0.1	leaded bronze
WROX	721363			93B			89.9	0.3	0.0	7.2	0.0	(leaded) copper
LOND		LCT1132		93B								leaded bronze
RICH	7351092	700	192	93B			83.0	0.1	7.0	10.9	0.1	leaded bronze
WEEK	781389		13	93C								gunmetal
WAKE	745063	50	4	93C								leaded bronze
GEST	777259	BR110	8	93C								leaded bronze
RICH	7351773	5529	180	93C			73.1	0.0	7.5	17.8	0.0	leaded bronze
STAN	8516926			93C								leaded gunmetal
SHEP	722337		40	94			74.4	0.0	10.9	2.8	0.1	bronze
ASHT	835070	66		94								leaded bronze
REDC	8650617	83		94				9.6	4.4	0.2	0.0	gunmetal
COLC		1.81-5195	CS23	94	T							bronze/gunmetal
COLC		1.81-2415	CS24	94								bronze
WICL		7		94?								leaded bronze/gunmetal
ASHT	835138	666		94?								leaded bronze
PRES		204	1	94+								leaded gunmetal
WICL		8		94A								bronze
WICL		36		94A								bronze
WICL		47		94A								leaded bronze
WICL		48		94A								bronze/gunmetal
SHEP			39	94A			75.9	1.7	4.8	4.9	0.1	(leaded) bronze/gunmetal
THIS	611004	BH817		94A			81.1	9.1	3.9	1.1	0.0	gunmetal
THIS	610975	BH718		94A	T		73.8	0.1	4.8	17.7	0.1	leaded bronze
THIS		THZ328		94A			83.3	0.1	5.4	12.0	0.1	leaded bronze
THIS		THZ2104		94A	T		83.6	0.1	13.6	0.1	0.0	bronze
THIS		THZ4117		94A			81.8	5.4	5.1	1.1	0.1	gunmetal
WANB			92	94A			83.3	0.0	10.4	10.4	0.0	leaded bronze
WANB			94	94A			93.8	0.4	10.7	0.0	0.1	bronze
WANB			93	94A			95.6	2.6	4.5	0.7	0.1	bronze/gunmetal
THIS		THZ2704		94A								brass?
DRAG		DR65VG	88	94A								brass
DRAG		DR67MU	87	94A								bronze
CAST		16-337	13	94A								bronze
LOND		WIV234		94A								gunmetal
LOND		C985		94A								bronze
LOND		26374		94A								bronze
LOND		26379		94A								(leaded) bronze
LOND		7001		94A								leaded bronze
LOND		26399		94A								bronze
LOND		26406		94A								brass?
STAN	8516905			94A								(leaded) bronze
SNET		Cat2		94A								bronze
SNET		Cat3		94A								bronze
SNET		Cat4	4	94A								bronze
SNET		Cat6		94A								bronze
SNET		Cat7		94A								bronze
SNET		Cat9		94A								(leaded) bronze
SNET		Cat10	10	94A								bronze
SNET		Cat12		94A								gunmetal
SNET		Cat14	14	94A								bronze
SNET		Cat15	15	94A								bronze
SAND		1270		94A								bronze
SAND		1586		94A								bronze
SAND		3477		94A	S							bronze/gunmetal
SAND		3724		94A	S							bronze
STAN	8800009			94A								leaded bronze
LECH		1957-2	5	94A			74.8	0.9	12.3	7.8	0.1	(leaded) bronze
BALD	7210426		82	94A			87.5	6.0	7.5	0.8	0.1	gunmetal
BRAU		610	50	94A			90.8	0.0	10.6	0.8	0.1	bronze

Site	AML No	Site No	Pub No	Type	Decor	Enamel	Cu%	Zn%	Sn%	Pb%	Ag%	Alloy
NORN	621169		3	100B			79.5	0.2	8.8	7.7	0.0	(lead) bronze
WROX	721372			100B			75.2	0.3	11.0	9.3	0.3	lead bronze
WROX	781660			100B								(lead) bronze
DERB		035/1270		100B?								lead bronze
NORN	733378			100C			72.9	0.7	9.7	12.5	0.0	lead bronze
WROX	721373			100C			71.3	0.0	5.9	19.7	0.0	lead bronze
WROX	721378			100C			85.2	0.5	8.2	3.0	0.3	bronze
LEIC		316-138	2:23	100C			74.8	3.2	9.0	12.0	0.0	lead bronze/gunmetal
NORN			243	100C								(lead) bronze/gunmetal
WROX	814477			100C								lead bronze
WROX	856848			100C								lead bronze
LOND		A11063		100C								lead bronze
WORC		901		100C								lead bronze
WORC	907221	3899-c18181		100C								(lead) bronze
TIDD		82-203		100C?								lead bronze
CABY		2808	2	101			73.6	2.2	8.0	9.6	0.1	lead bronze
WORC		3899-c17035		102								bronze
WORC		3899-c16867		102								bronze
TARH		50		102/94			81.7	13.8	1.0	2.4	0.0	brass
WICL		26		103	T							bronze
TIDD		M17		103								lead gunmetal
RICH	7350217	4010	209	103			77.7	0.3	8.8	15.2	0.1	lead bronze
NORN	650094		262	103			70.6	0.2	7.2	13.9	0.0	lead bronze
WANB			99	103			66.2	0.0	9.4	22.7	0.0	lead bronze
TIDD		82-98		103			70.6	9.3	8.3	0.6	0.0	gunmetal
TIDD		M11		103			69.2	0.2	8.0	20.0	0.2	lead bronze
WANB			100	103?								(lead) bronze
LECH		1957-6	8	Gp=6								lead bronze
LECH		1957-21	7	Gp=6			74.5	16.4	1.8	0.2	0.1	brass
LOND		LCT1312		Gp=6								?
HOUS	811554			Gp=6?								gunmetal
COLE		1008	11	Gp=6?								lead bronze
COLE		87	27	Gp=6?								lead bronze
COLE		2012	16	Gp=6?								lead bronze
TIDD		TA2		Gp=6?			73.2	0.4	12.9	20.2	0.1	lead bronze
POOL		5255	10	Gp=6?								bronze
CAST		1-738	12	Gp=6?								brass
LOND		BRL89		Gp=6?								bronze/gunmetal
WORC		3899-c20425		Gp=6?								brass
LAMY		160	2	104								bronze
NORN	621099		4	104			44.7	0.1	5.3	13.4	0.0	lead bronze
NORN	621107		5	104			67.6	0.4	9.2	18.2	0.0	lead bronze
PIER		3557		104			77.5	0.0	8.5	12.6	0.0	lead bronze
GORH	811369		40	104			72.4	0.0	12.6	17.0	0.2	lead bronze
GORH	811393	2921	41	104								lead bronze
HOUS	803051			104								lead bronze
LOND		20738		104								bronze
LOND		PIC31		104								lead bronze
LOND		3428		104								bronze
WINC		VR-9912		104?	T							bronze
TARH		635		104-133	T		82.1	0.5	7.6	7.6	0.1	(lead) bronze
TARH		637		104-133			81.0	0.0	6.6	11.3	0.1	lead bronze
DORC	7816057		WH	105	Es	TX						lead bronze
CARV			27	105	Es	TX						lead bronze
SEAT		1		105?	Es	O						lead bronze
CATS			3	105/126	Es	N						lead bronze
CATS			17	105/141	Es	R						lead bronze
CATS			16	105/141	Es	RB	77.9	1.0	8.6	8.1	0.1	lead bronze
NORN	620693		6	106			75.0	0.3	8.9	17.9	0.0	lead bronze
SEAM		65-380	9	106								lead gunmetal
STAN	8701137			106								lead bronze
HAYL		3460		106?			60.8	0.1	9.2	21.7	0.1	lead bronze
NORN	940417			107	Es	X						lead bronze
NORN	940415			107	Es	OT						lead bronze
NORN	620704		9	108	Es	W?	71.7	1.1	5.5	15.3	0.0	lead bronze
ULEY		5683	Fig124:3	108	T		78.6	1.2	5.8	13.3	0.1	lead bronze
ULEY		2276	Fig124:1	108	Es	X	61.5	1.4	9.9	18.3	1.0	lead bronze
ULEY		2339	Fig124:2	108	T		69.4	0.6	13.2	20.6	0.1	lead bronze
LOND		POM483		108	Ej	XX						(lead) bronze
NORN	621100		10	109	Es	X	64.9	0.6	10.1	16.2	0.0	lead bronze
DORC		W98797	AA	109	Es	TX						bronze
DORC		W98798	AA	109	Es	TX						bronze
NORN	620723		11	110	Es	X	66.6	1.8	8.4	17.2	0.0	lead bronze
WANB			103	110	TEs	X	73.9	0.0	7.5	18.3	0.0	lead bronze
TIDD		81-631		110	Ej	OG?	78.8	0.4	8.9	13.3	0.1	lead bronze
WROX	781663			110	E							lead bronze
LOND		84.272/3		110	Es	RT						bronze

Site	AML No	Site No	Pub No	Type	Decor	Enamel	Cu%	Zn%	Sn%	Pb%	Ag%	Alloy
WORC		828		110	E							lead bronze
WORC		3899-7001		110	E							lead bronze
WANB			105	111	Es	T?						lead bronze
WANB			107	111	Es	TX						lead bronze/gunmetal
NORN	621137		28	111	Es	T?	114.0	0.4	15.1	16.2	0.0	lead bronze
NORN	620714		18	111	Es	W?	93.7	0.1	10.9	23.9	0.0	lead bronze
NORN	620647		31	111	Es	X	38.9	0.5	6.5	6.7	0.0	(lead) bronze
NORN	620682		32	111	Es	?	138.5	0.7	16.3	31.9	0.0	lead bronze
NORN	620733		29	111	Es	R	68.4	0.1	9.9	15.4	0.0	lead bronze
NORN	620705		21	111	Ej	RB	55.0	0.4	3.2	13.8	0.0	lead bronze
NORN	620720		19	111	Ej	RB	65.4	0.8	9.2	18.4	0.0	lead bronze
NORN	620725		24	111	Es	?	82.5	0.2	7.7	13.4	0.0	lead bronze
NORN	620718		14	111	(E)		65.7	0.1	7.4	18.8	0.0	lead bronze
NORN	621112		13	111	(E)		73.9	0.6	8.8	14.0	0.0	lead bronze
NORN	621097		12	111	(E)		72.2	0.5	9.1	11.9	0.0	lead bronze
NORN	620727		22	111	(E)		67.1	2.0	10.7	12.5	0.0	lead bronze
NORN	620700		26	111	Es	?	68.9	0.2	8.9	16.4	0.0	lead bronze
NORN			273	111	E		63.8	0.3	10.8	16.4	0.0	lead bronze
NORN	733357			111	(E)		73.1	0.8	9.1	15.7	0.0	lead bronze
WANB	692728		106	111	Es	G?T	63.4	0.1	8.9	25.1	0.1	lead bronze
CATS			24	113			73.5	18.3	0.0	0.0	0.1	brass
WALL			1	116								brass
NORN	621114		33	117			81.9	15.5	2.2	0.7	0.0	brass
WANB			96	117			78.5	8.9	0.3	0.0	0.0	brass
CATS			2	117			77.5	11.3	5.6	0.5	0.0	gunmetal
LOND		A2466		117								brass
WANB			95	117?			75.6	19.8	0.0	0.0	0.0	brass
CARV			16	118								lead bronze
ALDB	78108254		307	118								lead bronze
HAYL		3		118								lead bronze/gunmetal
HENL	734860	713	8	118++								lead bronze
BALD	680508		81	118B			87.6	5.0	5.7	1.1	0.0	gunmetal
LOND		441		119								(lead) bronze
CATS			4	120	Ej	RB	74.5	1.4	8.7	19.2	0.1	lead bronze
CATS			5	120			70.0	1.8	12.4	16.3	0.1	lead bronze
TARH		839		120	Es	RB	82.2	2.9	8.1	5.9	0.1	(lead) bronze/gunmetal
TARH		656		120	Es	RB	80.8	0.1	7.7	9.1	0.1	lead bronze
DORC	8212380		WH	120								lead bronze
TARH		837		120(?+)			85.6	0.3	10.9	2.6	0.1	bronze
ILCH		36	4	121								lead bronze/gunmetal
DORC			CP7	121?								lead bronze
RICH	7350477	146	224	121+			83.9	1.3	8.2	0.7	0.2	bronze
STAN	8612520			121A								bronze
WICL		29		121B								lead bronze
WICL		38		121B								lead bronze/gunmetal
WICL		41		121B								lead gunmetal
WHIT		2	1	121B			85.3	0.2	12.2	5.2	0.0	(lead) bronze
CATS			6	121B			66.5	0.5	7.5	23.0	0.1	lead bronze
STAN	8611712			121B								lead bronze
STAN	8612534			121B								bronze
STAN	8612929			121B								lead bronze
STAN	8701503			121B								lead bronze
STAN	8800689			121B								lead bronze
STAN	8901753			121B?								lead bronze
CARV			24	122	Es	OT						lead bronze
NORN	620721		40	122	Es	RX	79.5	0.7	11.6	17.1	0.0	lead bronze
NORN	621084		43	122	Es	X	105.7	0.2	15.6	18.4	0.0	lead bronze
NORN	620699		37	122	Es	RB	63.9	0.5	7.5	20.5	0.0	lead bronze
NORN	620702		38	122			70.0	0.5	7.8	15.0	0.0	lead bronze
NORN	620711		39	122	Es	R	68.2	0.4	8.5	16.1	0.0	lead bronze
NORN	733374			122	Es	OT	61.4	0.1	7.2	30.0	0.0	lead bronze
CATS			8	122	Es	WX	72.3	0.0	10.4	16.0	0.0	lead bronze
CATS			7	122	(E)		63.8	0.3	7.1	19.2	0.1	lead bronze
ULEY		5444	Fig124:4	122	Es	OT	68.0	0.2	9.8	17.1	0.0	lead bronze
WALL			3	122	Es	G?B						lead bronze
NORN			297	122	Es	T						lead bronze
LOND		GPO134		122								lead bronze
NORN	620712		47	123			74.3	0.1	13.2	13.8	0.0	lead bronze
DORC			CP1	124								lead bronze
NORN	733361			124/125	T		70.4	1.6	10.5	15.1	0.0	lead bronze
CATS			25	125								lead bronze
TIDD		82-182		125								(lead) bronze
WANB			104	125								lead bronze
HOUS	803051			125			66.1	0.7	10.4	13.6	0.0	lead bronze
HAYL		KP7 and 13		125								lead bronze
CARV			18	125?	T(R)							lead bronze
NORN			64	126	Es	X	34.3	0.0	4.0	7.4	0.0	(lead) bronze

Site	AML No	Site No	Pub No	Type	Decor	Enamel	Cu%	Zn%	Sn%	Pb%	Ag%	Alloy
NORN	621081		66	126	(E)		61.9	0.3	6.7	14.0	0.0	lead bronze
NORN	621135		68	126	Es	?	72.9	0.2	6.8	19.0	0.0	lead bronze
NORN	620735		94	127			72.8	0.2	11.0	14.0	0.0	lead bronze
NORN	620646		116	128	Es	X	68.5	0.1	7.7	16.1	0.0	lead bronze
NORN	620706		117	128	(E)		70.5	1.8	7.3	17.4	0.0	lead bronze
NORN	620722		69	129	Es	?	30.4	0.1	4.5	11.3	0.0	lead bronze
NORN	620683		71	129	Es	?	75.0	0.1	9.6	19.1	0.0	lead bronze
NORN	620649		70	129	Es	X	120.0	0.4	13.1	23.1	0.0	lead bronze
NORN	733379			129	As		73.1	0.3	11.9	12.7	0.0	lead bronze
CARV			17	129	Es	X	81.7	0.0	11.5	10.4	0.1	lead bronze
NORN	620695		72	130			65.6	0.1	11.3	15.6	0.0	lead bronze
NORN	621119		77	130			76.8	0.5	10.9	21.8	0.0	lead bronze
NORN	620701		73	130			67.0	0.1	8.6	17.6	0.0	lead bronze
WROX	840600			130								bronze
SEAT		2	1	131	(E)							lead bronze/gunmetal
NORN	620692		80	131			76.9	0.1	6.2	11.7	0.0	lead bronze
NORN	621134		83	131			71.7	0.1	8.7	14.6	0.0	lead bronze
NORN	621148		82	131			77.0	0.1	5.3	11.5	0.0	lead bronze
NORN	733354			131			73.9	0.1	11.3	13.4	0.0	lead bronze
HAYL		835&3472		131			69.4	0.0	7.1	18.1	0.1	lead bronze
DORC			CP8	131+								lead bronze
NORN	733350			131/134			69.1	2.0	7.6	19.1	0.0	lead bronze
WANB	684391		108	132	(E)							lead bronze
NORN	620650		84	132	Es	X	72.7	0.1	8.1	13.4	0.0	lead bronze
NORN	620684		85	132	Es	R?	68.5	0.2	9.9	15.1	0.0	lead bronze
NORN			242	132	Es	OT						lead bronze
CATS			9	132A	Es	G						lead bronze
NORN	621120		87	132A	Es	?	67.5	0.6	8.0	17.2	0.0	lead bronze
NORN			232	132A	Es	R	65.4	1.1	8.8	6.5	0.0	(lead) bronze
NORN	621078		88	132B	Es	?	70.1	0.2	9.3	16.1	0.0	lead bronze
NORN	620698		59	135			73.0	0.5	8.2	12.3	0.0	lead bronze
NORN	621141		58	135			77.8	0.4	10.2	9.9	0.0	lead bronze
NORN	620716		53	135			63.9	0.2	10.5	6.0	0.0	(lead) bronze
CATS			21	135			72.7	1.2	13.3	13.8	0.1	lead bronze
NORN	620730		98	135+	Es	RB	73.1	0.2	10.2	9.0	0.0	lead bronze
TRET		13		135/136								lead bronze
NORN	620743		50	136			81.0	1.3	6.8	8.3	0.0	lead bronze
HENL	734845	578	9	136+								(lead) bronze
CARV			20	137			74.0	0.5	11.5	10.9	0.1	lead bronze
THIS	610988	BH764		137			75.6	2.6	7.6	9.2	0.1	lead bronze/gunmetal
HENL	730943	484	10	137?								(lead) bronze
THIS	611053	BH1679		137?								lead bronze
THIS		THZ1756		137A			76.2	1.3	9.0	9.7	0.1	lead bronze
ASHT	835110	679		137A								bronze
ASHT	835115	557		137A								bronze
TIDD		M14		137A								(lead) gunmetal
STAN	8516894			137A								lead gunmetal
STAN	8701636			137A								lead gunmetal
STAN	8800232			137A								lead bronze
WEEK	781400	86	15	137B								lead bronze
STAN	8516848			137C								(lead) bronze
STAN	8701382			137C								lead bronze
CATS			10	138			73.4	1.9	8.4	14.0	0.1	lead bronze
CATS			13	138/139			71.6	0.3	7.5	19.8	0.1	lead bronze
CATS			12	138/139			67.2	1.4	9.7	22.2	0.1	lead bronze
CATS			11	138/139			69.6	3.0	8.4	16.3	0.1	lead bronze/gunmetal
SEAM		65-267	11	138/140?								bronze
HENL	642035	113	11	139								lead gunmetal
CATS			14	139			74.3	0.2	9.1	13.3	0.1	lead bronze
TARH		169		139								bronze
TARH		877		139								(lead) bronze
TARH		170		139								lead bronze/gunmetal
TARH		16		139								lead bronze/gunmetal
CATS			29	139?								bronze
HENL	734841	503	12	139?								lead bronze
TARH		838		139?								(lead) bronze
HAYL		1014		139?								lead bronze/gunmetal
DORC	8212339		WH	139?								lead bronze
DORC			CP3	139++								lead bronze
CATS			26	139+								lead bronze
CATS			27	139+								lead bronze
CATS			28	139+?								lead bronze
CATS			15	140			65.7	0.5	7.8	17.4	0.1	lead bronze
THIS		THV52		143A	EsRg	XX	76.0	15.6	1.2	3.0	0.0	brass
NORN	650093		261	143B	Ej	R?O?	68.3	0.1	11.1	15.6	0.0	lead bronze
NORN	733397			143B	Es	X	73.0	0.1	12.1	19.7	0.0	lead bronze
NORN	733343			143B	Ej	XX	77.7	0.4	8.2	10.8	0.0	lead bronze

Site	AML No	Site No	Pub No	Type	Decor	Enamel	Cu%	Zn%	Sn%	Pb%	Ag%	Alloy
HENL	684631	364	13	149								leaded gunmetal
CARV			22	149	Es	RB	85.9	6.0	2.9	16.7	0.0	leaded gunmetal
PIER		1903		149	(E)		89.6	6.1	1.7	0.0	0.0	copper/brass
TIDD		81-814		149	Es	X	83.2	4.4	8.2	1.4	0.1	bronze/gunmetal
TARH		159		149			83.0	11.9	1.0	0.3	0.1	brass
ULEY		2165	Fig124:7	149	(E) ?		90.2	0.9	4.1	2.0	0.0	bronze
CARL		BLAAe264	4	149	Ej	RB						brass
CARL		BLAAe268	5	149	Es							bronze
COLC		1.81-893	CS26	149?	E							brass
COLE		285	17	149A								leaded bronze
RICH	7350208	4545	231	149A			84.4	3.7	7.3	2.9	0.2	bronze/gunmetal
NORN	733366			149A	Es	X	82.7	0.9	9.1	3.5	0.0	bronze
CAST		1-396	30	149A	(E)							bronze
CAST		15-30	25	149A	E?							brass
LOND		A25083		149A								(leaded) bronze
WORC		710		149A								bronze
WORC		747		149A	(E)							bronze
WICL		11		149B	(E)							brass
WICL		13		149B	Es	R?T						bronze
WICL		30		149B	Es	?						bronze
WICL		34		149B	(E)							brass
RICH	7350475	1813	229	149B	Es	RB						copper
RICH	7350089	1812	230	149B	Es	R	88.9	1.7	4.4	4.4	0.1	(leaded) bronze/gunmetal
NORN	620707		104	149B	Es	R?	72.4	1.3	5.9	6.6	0.0	(leaded) bronze
NORN	621170		99	149B	(E)		63.3	0.5	8.5	12.8	0.0	leaded bronze
NORN	620713		103	149B	Es	BX	64.5	0.0	9.2	11.8	0.0	leaded bronze
NORN	620651		101	149B	Es	W	63.7	0.0	10.8	17.6	0.0	leaded bronze
CAME		76-78		149B	Es	RB	75.9	18.5	2.5	0.0	0.0	brass
WHIT		4	2	149B	Es	X	77.8	1.4	9.2	13.5	0.1	leaded bronze
PRES	851070	438	16	149B	Es	TX	89.6	0.0	4.9	3.4	0.0	bronze
CHEL		CHK2/60	2:24	149B	Es	RB	91.7	3.3	3.4	3.6	0.1	gunmetal
ASHT	835093	332		149B	Es	BX						brass
WELT		507		149B	Es	X						bronze
ALDB	78108233		319	149B	Es	Y						bronze
NORN	620713		105	149B	Es	B						(leaded) gunmetal
DRAG		DR65MW	106	149B	Es	R		1.1	7.7	5.2	0.0	(leaded) bronze
DRAG		DR65HG	107	149B	Es	X		0.6	5.9	3.2	0.0	bronze
CIRE		StMF20		149B	Es	R						(leaded) bronze
CAST		1-637	28	149B	Es	X						brass/gunmetal
CAST		1-551	29	149B	(E)							(leaded) bronze
CAST		10-2071	34	149B	Es	WX		17.3	1.7	0.3	0.0	brass
CAST		10-1985	35	149B	Es	YX		0.7	6.7	6.2	0.0	(leaded) bronze
CAST		10-1601	36	149B	Es	GT						leaded bronze
CAST		10-1409	37	149B	Es	X						bronze
CAST		10-2078	38	149B	(E)							bronze
CAST		10-2135	39	149B	Es	TX						bronze/gunmetal
CAST		10-1232	40	149B	Es	B						bronze
CAST		12-9	20	149B	Es	X						bronze/gunmetal
CAST		13-139	21	149B	Es	X						leaded bronze
CAST		16-213	27	149B	Es(Rg)	RB		13.8	1.7	0.2	0.1	brass
LOND		RAG99		149B	Es	X						leaded bronze
LOND		32.2/10		149B	Es	RX						brass/gunmetal
LOND		79.351		149B	Es	BX						brass
LOND		81-282/6		149B	E							brass
LOND		A20599		149B	Es	XX						brass
LOND		19925		149B	Es	R						brass
LOND		84		149B	Es	TX						brass
LOND		86		149B	Es	RB						brass
LOND		A1263		149B	Es	RW						brass
CATT	594706		Site433:5	149B	Es	X						leaded bronze
NORN	620689		106	149B?	(E)		62.9	0.0	8.5	21.3	0.0	leaded bronze
ASHT	835111	510		151	Ej	T						bronze
RICH	7351142	101	233	151?	Es	T						leaded bronze
WROX	721377			151?			80.1	18.4	1.3	0.0	0.2	brass
POOL		5205	126	151?								lead
TIDD		M6		151C	(Rg)		79.8	12.5	2.0	6.0	0.3	(leaded) brass
ULEY		7669	Fig124:8	151D	Ej	ROT	73.5	0.0	6.6	16.3	0.1	leaded bronze
TIDD		81-757		151D	MtEj	X	75.9	0.7	13.7	14.3	0.1	leaded bronze
POOL		5099	128	151D								lead
DODD	8515493			151D	EsRg	X						leaded bronze
DRAG		DR68BS	111	151D	Ej	RO						bronze
POOL		5206	127	151D?								lead
LOND		LBT68		151E	Es	B						leaded bronze
WROX	721381			152			86.1	1.2	9.2	2.4	0.0	bronze
PRES	851066	93	6	152	Ej	YX	77.4	0.0	7.9	14.0	0.3	leaded bronze
PRES	851068	427	4	152	Ej	RYB	85.3	11.0	2.4	1.0	0.0	brass
PRES	851086	284	7	152	Ej	RB	89.3	0.0	9.8	0.6	0.0	bronze

Site	AML No	Site No	Pub No	Type	Decor	Enamel	Cu%	Zn%	Sn%	Pb%	Ag%	Alloy
PRES		1316	5	152	Ej	OT/KW	76.0	0.0	12.1	11.5	0.0	leaded bronze
PRES	851069	437	3	152++	EsEchRs	RGT	76.7	20.0	2.3	0.2	0.0	brass
RICH	7350745	4239	223	Gp=7	T		82.6	1.2	7.8	7.9	0.2	(leaded) bronze
NORN	620691		52	Gp=7			68.6	0.0	10.6	12.7	0.0	leaded bronze
NORN	621151		57	Gp=7			80.7	1.1	8.0	4.9	0.0	(leaded) bronze
NORN			34	Gp=7	Es	N?	80.2	0.0	9.4	3.6	0.0	bronze
NORN	620731		51	Gp=7			66.0	0.6	10.1	24.7	0.0	leaded bronze
NORN	620690		55	Gp=7			70.3	0.3	10.2	15.7	0.0	leaded bronze
NORN	621128		60	Gp=7			68.1	0.1	6.9	21.8	0.0	leaded bronze
NORN	620652		120	Gp=7	(E)		71.9	0.7	10.3	13.8	0.0	leaded bronze
NORN	620744		229crest	Gp=7			84.4	0.1	5.6	4.7	0.0	(leaded) bronze
NORN	620744		229bow	Gp=7			85.6	0.1	4.2	3.8	0.0	bronze
NORN	621146		228	Gp=7	(E)		73.3	0.7	5.7	16.7	0.0	leaded bronze
NORN	620729		119	Gp=7	(E)		76.7	0.0	2.7	10.1	0.0	leadedcopper
NORN	621103		96	Gp=7			68.2	0.3	10.2	13.1	0.0	leaded bronze
CARV			25	Gp=7			67.7	0.1	12.1	16.5	0.1	leaded bronze
HAYL		3449		Gp=7								leaded bronze
WANB			109	Gp=7	Ej	BX	81.0	0.6	9.5	1.4	0.1	bronze
TIDD		M21		Gp=7	Es	X	75.7	0.1	12.3	12.5	0.2	leaded bronze
ASHT	835126			Gp=7								leaded bronze
SEAM		66-55	10	Gp=7	Es	X						leaded bronze
THIS		BH415		Gp=7								leaded bronze
DRAG		DR67AAY	95	Gp=7								bronze/gunmetal
DRAG		DR68NV	94	Gp=7								bronze
CIRE		StMF200		Gp=7	T(E)							leaded bronze
VELZ		24		Gp=7	(E)		75.0	12.3	2.3	0.8	0.2	brass
WALL			10	Gp=7	EsEch	X						leaded bronze
COLC		0862CEH		Gp=7?								brass
CATS			30	Gp=7?			65.3	1.5	12.0	15.8	0.1	leaded bronze
DORC	8212370		WH	Gp=7?								bronze
DRAG		DR70ABI	118	Gp=7?				0.0	13.9	0.4	0.1	bronze
TIDD		M4		Gp=7/8								leaded bronze
TIDD		82-148		Gp=7/8								leaded bronze
CORB	831672		6	Gp=7/8								bronze
BRAU		361	76	Gp=7/8			78.5	4.2	8.5	0.1	0.0	bronze/gunmetal
CATS			31	Gp=7/8?			74.2	0.0	9.8	19.0	0.1	leaded bronze
VELZ		31B		Gp=7/8?			75.4	12.6	3.6	6.9	0.2	(leaded) brass/gunmetal
VELZ		31A		Gp=7/8?			74.7	12.6	3.7	6.6	0.3	(leaded) brass/gunmetal
PRES		1376	12	Gp=7/8?	Es	?	84.2	3.0	6.9	1.0	0.0	bronze/gunmetal
WILD	761066		4	153A	N							bronze
DERB		DLC79AYA49	27	153A?		X						leaded bronze
POOL		5102	98	153A/B/C								gunmetal
POOL		5140	60	153A/B/C								gunmetal
POOL		5258	59	153A/B/C								bronze
COLE		120	23	153B								leaded bronze
COLE		303	24	153B								leaded bronze
WROX	843006			153B	Ms							brass
WROX	840571			153B	G							bronze
DERB		CHB/EO122	26	153B								leaded bronze
BEES	819158		Fig37.2	153C			81.1	16.9	0.0	0.6	0.0	brass
CORB	868601		10	153C								brass
DRAG		DRBF	109	153C								brass/copper?
CAST		9-1214	62	153C								brass
DERB		DLC79EXH111	28	153C?								bronze
TIDD		M1		153D			81.4	0.2	8.3	6.8	0.2	(leaded) bronze
TIDD		M20		153D			63.6	0.3	11.4	24.8	0.0	leaded bronze
STAN	8612518			153D								leaded bronze
RICH	7351709		219	153D			59.2	1.0	12.1	0.0	0.1	bronze
COLE		460	21	154								leaded bronze
COLE		810	22	154								leaded bronze
WANB	707308		111	154			89.6	0.5	8.1	8.2	0.1	leaded bronze
WANB			110	154			70.8	1.2	6.1	28.6	0.1	leaded bronze
LEIC		316-47	2:25	154			68.0	0.7	5.5	26.3	0.0	leaded bronze
LEIC		316-34	2:24	154			76.6	0.0	7.6	17.1	0.1	leaded bronze
ULEY		3607	Fig124:10	154A	T		77.0	0.1	3.9	12.9	0.1	leaded bronze
ULEY		5327	Fig124:9	154A			71.7	0.1	8.4	11.3	0.1	leaded bronze
SWIN	770871		117	154A			71.3	1.7	7.5	17.0	0.1	leaded bronze
WROX	721367			154A			75.2	0.0	9.3	14.8	0.0	leaded bronze
GLOU		69/49-21	E2	154A								leaded bronze
YORK		M710		154B								leaded bronze
RICH	7350207	5430	220	154B			75.7	0.2	9.3	14.6	0.1	leaded bronze
NORN	621138		108	154B			78.5	0.5	4.5	10.0	0.0	leaded bronze
TIDD		81-949		154B			69.1	0.6	9.2	24.2	0.0	leaded bronze
WANB	684167		112	154/159			76.8	0.5	8.2	19.8	0.1	leaded bronze
PIER		16B7		155?								leaded gunmetal
RICH	7350212	4847	221	157	Es	R	76.2	18.1	2.6	1.3	0.0	brass
WANB			113	157	Es	G?T	69.4	0.1	9.2	21.4	0.0	leaded bronze

Site	AML No	Site No	Pub No	Type	Decor	Enamel	Cu%	Zn%	Sn%	Pb%	Ag%	Alloy
PRES	851061	286	18	157A	IcorN		88.2	0.1	8.2	0.2	0.0	bronze
CAST		RonJeffries		157A	Ms							brass
LOND		A11925		157A								brass
LOND		A23484		157B	Es	R						brass
CAST		10-2180	82	157B?	Ms							brass/gunmetal
LOND		82		157C	Es	B						brass
LOND		32.2/12		157C	Es	R						brass
CAST		15-141	66	157B	Es	R						gunmetal
LOND		A1264		157D	Es	BX						brass
TIDD		81-209		157E	Es	X	82.5	3.2	8.5	8.5	0.1	leaded bronze/gunmetal
ALDB	78108234		322	157E	Es	R						brass
CAST		15-592	67	157E	Es	X						brass/gunmetal
CAST		1-737	73	157E?	Es	B						brass
LOND		A20228		157F	Es	R						brass
WORC		3899-1048		157F	E							gunmetal
WELT		435		158			78.5	10.3	1.5	6.2	0.0	(leaded) brass
OPEN	7815770		618	158								gunmetal
PAPC		84-132		158								bronze
POOL		5096	11	158+?								brass
WICF		248		158A								leaded gunmetal
CORB	831676		11	158A								bronze
CATT	723733		Site434:6	158A								brass/gunmetal
RICH	7350472	3900	216	158A			82.7	9.8	3.8	1.1	0.0	brass/gunmetal
RICH	7350976	175	217	158A			91.7	2.0	4.7	1.0	0.0	bronze/gunmetal
CABY		836	3	158A			70.1	10.2	3.6	9.0	0.1	leaded brass/gunmetal
PIER		4323		158A			78.9	16.4	2.0	4.9	0.0	(leaded) brass
PRES	851064	434	17	158A			77.0	11.8	1.8	4.7	0.3	(leaded) brass
WELT		162		158A			86.1	0.8	5.0	5.3	0.1	(leaded) bronze
WELT		420		158A			78.7	12.5	5.0	3.7	0.0	brass/gunmetal
WPER	7310666			158A								brass/gunmetal
ALDB	78108235		323	158A								brass
ALDB	78108236		324	158A								brass
CHEL		CHV20		158A								brass
CATT	8111875		Site46:4	158A								bronze/gunmetal
CATT	8111931		Site46:3	158A								brass
CATT	8111280		Site46:6	158A								brass
CATT	8111866		Site46:5	158A								brass?
CATT	8111900		Site46:7	158A				0.9	10.6	1.6	0.0	bronze
OPEN	7710108		617	158A								brass/gunmetal
CAST		10-1600	75	158A				0.5	7.5	1.7	0.0	bronze
CAST		12-5	63	158A								brass
CAST		15-580	68	158A								brass
LOND		C995		158A								gunmetal
LOND		18648		158A								brass
CARL		BLAAe222	9	158A?								leaded gunmetal
CARL		BLAAe178	10	158A?				4.7	5.7	3.3	0.0	gunmetal
CAST		14-238	64	158A/C								bronze
CAST		14-230	65	158A/C								brass
COLE		2013	25	158A(+)								leaded gunmetal
OPEN	7813570		619	158B								leaded bronze/gunmetal
RICH	7350388	4202	218	158C			77.0	19.2	2.9	1.1	0.0	brass
ALDB	78108237		325	158C								bronze
OPEN	7814431		620	158C								copper/bronze
DRAG		DR70AF	108	158C								gunmetal
CAST		1-409	60	158C								gunmetal
CAST		10-2148	74	158C								brass
CAST		10-1849	76	158C				0.3	0.8	0.4	0.2	copper
CAST		10-1277	77	158C								bronze
CAST		10-1486	78	158C								brass/gunmetal
CAST		10-1319	79	158C				16.7	0.5	2.3	0.1	brass
CAST		15-159	69	158C								brass
CAST		15-294	70	158C								bronze
CAST		16-284	71	158C								bronze
CAST		16-329	72	158C								bronze
LOND		RAG155		158C								brass
WROX	78000527			158C								brass
THIS		THVbag179		158D								leaded bronze
GLOU		69/49-66	E3	158D								leaded bronze
HENL	684638	406	14	158D?								leaded bronze
CARL		BLAAe13	8	158D?								leaded bronze
HAYL		2348		158E			72.1	0.2	10.8	12.9	0.1	leaded bronze
WANB			114	158E	Et	GT	75.2	0.2	10.5	16.1	0.1	leaded bronze
CATT	8413512		Site273:9	158E								leaded bronze/gunmetal
NORN	620694		109	158F			76.5	0.0	8.8	8.0	0.0	leaded bronze
CATS			18	158F			76.1	2.1	8.5	13.7	0.1	leaded bronze
TIDD		81-780		158F			75.0	0.2	12.6	12.4	0.1	leaded bronze
ILCH		21	2	158F								(leaded) bronze

Site	AML No	Site No	Pub No	Type	Decor	Enamel	Cu%	Zn%	Sn%	Pb%	Ag%	Alloy
STAN	8900619			158/9								lead
POOL		5139	9	159?								lead
BALD			85	159+	EsRg	BX						brass
NORN	621142		110	159+	Es	R	77.4	0.3	8.3	7.7	0.0	brass/gunmetal
DERB		026/649		159+	Es	X						lead
WORC		709		159+?								lead
ULEY		378	Fig124:11	159A			73.7	0.7	11.0	16.9	0.0	lead
WICF		186		159A			68.9	0.6	11.4	27.7	0.0	lead
TIDD		80-96		159A			59.9	0.0	15.6	16.7	0.0	lead
WROX	842998			159A								lead
LOND		0.1815		159A								lead
CATS			20	160								brass
TARH		756		160			75.4	0.1	10.5	11.6	0.1	lead
CORB	868598		12	162	TMs							brass
LOND		RIV40		162	Ms							brass
CAST		10-1303	81	162A	(E)							brass/gunmetal
WROX	840545			162A	Ms							brass
SAND		3287		162A	S(Ms) ls							gunmetal
RICH	7350805	4800	235	162B	Ts(E)		80.9	14.1	2.3	2.8	0.0	brass
CATS			23	162C	T		84.5	15.5	2.0	2.7	0.1	brass
OPEN	7813157		621	162C	TMs							brass
TIDD		82-229		163	(E)							brass
LEIC		365-95	1:Fig18.10	163	(E)							brass
ALDB	78108244		311	163	Es	RX						brass
THIS		THZ2212		163	(E)							brass
OPEN	7815488		622	163	EsRg	RG						brass
STAN	8901240			163?	Es	T						brass
DRAG		DRCX	112	163A								brass
DRAG		DR70BEM	113	163A	Es	BX		14.4	2.6	1.8	0.0	brass
CAST		16-322	49	163A	Es	O		10.5	2.4	0.8	0.0	brass
GLOU	751162	Greyfr.sf102	GF	163A	E							brass
CAST		1-112	54	163B	Es	RB						gunmetal
CORB	831211		9	164	Es	KX						brass
CORB	822128		8	164	Es	RW						lead
PRES		1291	21	164	Es	X	74.6	0.0	9.5	15.3	0.2	lead
CAST		10-1585	58	164	Es	RTX						gunmetal
CAST		10-326	59	164	Es	B						brass
CAST		15-408	47	164	Es	BX						gunmetal
LOND		432		164+	It							brass
PIER		(66)		166	Es	TX						brass
WICL		37		166								gunmetal
COLE		145	26	166								lead
WANB			115	166	TMsEs	B	87.1	2.4	6.1	2.6	0.0	brass/gunmetal
WANB			116	166	TMs		82.0	7.6	2.7	0.0	0.0	copper/brass
LOND		CRU8		166	Ms							brass
RICH	7351701	903	236	166A	TEs	RT	78.3	9.5	3.0	4.1	0.1	lead
WROX	80000311			166B	E							brass/gunmetal
NORN	620717		111	166C	TMsEs	X						lead
LOND		19229		166C	MsEs	X						brass
BIRD	8905593		56	166C	TMsEs	R/O						gunmetal
RICH	7351734	4727	237	166D	Es	B	80.0	7.7	2.5	1.5	0.0	copper/brass
WROX	781667			166D								gunmetal
LOND		A10124		166E	MsEs	OT						lead
CORB	822108		26	167	MsEs	X						brass/gunmetal
WORC		3899-6312		167	TMs							brass
PIER		TF-16-A		167A	TMs		82.1	14.3	1.3	0.0	0.0	brass
LOND		19227		167A	Ms							brass
WORC		750		167B	Ms							?
CAME		79-8		167C	TMsEs	W						brass/gunmetal
HAYL		1367		167C	TMsEs	B?						brass
WANB			117	168	TMsEs	G?B						brass
TIDD		81-497		168	Es	B	80.4	14.3	7.1	1.4	0.0	gunmetal
ULEY		3880	Fig124:12	168	TEs	RT						lead
LOND		A27196		168A	MsEs	RB						brass
WROX	743370			168A?	Es	BX						brass
LOND		ASQ8		168B	MsE							brass
LOND		HTP10		168B	MsEs	TX						brass
RICH	7350696	2466	222	Gp=8			71.2	0.0	6.2	21.0	0.0	lead
WALL			11	Gp=8								lead
POOL		5101	5	Gp=8								gunmetal
POOL		5212	68	Gp=8								brass/gunmetal
LOND		79-16/3		Gp=8								gunmetal
STAN	8701128			Gp=8	TMs							brass/gunmetal
CATT	723724		Site434:7	Gp=8								brass/gunmetal
CAST		10-2129	80	Gp=8?								brass
CORB	831185		27	171	TMs(E)							brass
SEWN	810678	355	1	171				0.1	9.3	15.5	0.0	lead

Site	AML No	Site No	Pub No	Type	Decor	Enamel	Cu%	Zn%	Sn%	Pb%	Ag%	Alloy
CARL		81ANNAe552		187?	GmT							brass
RICH	7350108		252	187A	T		77.8	0.9	6.4	14.4	0.1	leaded bronze
RICH	7351744	293	253	187A	T		73.8	0.5	6.2	16.1	0.1	leaded bronze
WICF		250		187A	T		75.7	0.1	9.8	19.1	0.0	leaded bronze
RICH	7350698	703	254	187A			82.6	8.3	3.8	1.5	0.0	gunmetal
RICH	7350215	4022	255	187B			81.2	0.8	5.6	11.6	0.0	leaded bronze
RICH	7351742	949	256	187B			76.0	4.3	5.8	11.8	0.1	leaded gunmetal
ALDB	78108246		332	187B								brass
RICH	7351174	4237	251	187B	T		85.9	5.4	0.0	1.9	0.1	copper/brass
RICH	7351772	257	265	187/189			65.9	0.5	5.1	9.8	0.3	leaded bronze
CARL		81ANNAe311		187/189?	GmT							copper
RICH	7350284	1164	260	189	T		78.9	0.0	8.2	10.6	0.0	leaded bronze
RICH	7350699	531	258	189	T		68.2	0.6	8.6	19.8	0.1	leaded bronze
RICH	7350907		266	189	T		78.3	0.3	8.7	11.6	0.0	leaded bronze
RICH	7351500	4696	264	189	T		70.5	0.0	13.4	17.9	0.2	leaded bronze
RICH	7351511	4921	259	189	T		76.0	0.0	9.4	14.3	0.1	leaded bronze
RICH	7351775	3531	262	189			73.6	0.5	6.9	16.8	0.2	leaded bronze
RICH	7351752	301	267	189			66.4	13.2	8.2	11.6	0.1	leaded gunmetal
PIER		4123		189	T		74.8	14.2	2.0	8.9	0.0	leaded brass
ALDB	78108242		334	189	GT							(leaded) bronze
ALDB	78108247		330	189	T							(leaded) bronze
OPEN	7815806		626	189	T							leaded bronze
CATT	8310110		Site240:10	189								leaded bronze
LOND		LCT208		189								leaded bronze
BIRD	8905687		59	189	T							leaded bronze
RICH	96005011	5105	261	189	T							leaded bronze
RICH	7350905	298	263	189			81.4	0.7	4.8	9.7	0.1	leaded bronze
PIER		3364		189?	T							leaded bronze
PIER		4818		190								bronze
XXXX		K810035		190								leaded gunmetal
RICH	7350470	3231	280	190	GmT		91.6	3.3	5.2	0.6	0.0	bronze/gunmetal
RICH	7350080	1392	279	190	T		73.1	0.3	8.0	20.7	0.0	leaded bronze
RICH	7350508	3887	283	190	GT		87.4	2.7	6.8	1.0	0.1	bronze/gunmetal
RICH	7351703	124	281	190	Gl		97.1	0.5	5.1	0.3	0.1	bronze
RICH	7351725	3000	282	190	T		82.7	2.3	5.4	7.5	0.0	(leaded) bronze/gunmetal
CABY		2643	5	190			76.0	2.1	5.8	11.4	0.1	leaded bronze/gunmetal
CABY		128	6	190			82.9	2.4	6.7	1.7	0.1	bronze/gunmetal
PIER		44		190			86.0	5.2	6.8	0.0	0.0	gunmetal
PIER		3653		190	T		81.5	3.0	7.3	4.8	0.0	(leaded) bronze/gunmetal
BROU	671676	95		190				1.4	5.7	0.4	0.0	bronze
CARL		BLAAe59	18	190								leaded bronze
CAST		10-190	85	190				0.7	6.7	1.3	0.0	bronze
LOND		ER1168-2		190								bronze
LOND		24467		190	T							leaded bronze
LOND		36.132/4		190								leaded gunmetal
LANC		sf4449		190								bronze
RICH	7351895		286	190								bronze
RICH	7351912		284	190								leaded bronze
RICH	7351914		285	190								leaded bronze
RICH	7351893		287	190								(leaded) bronze
CATT	594681		Site433:20	190	T							(leaded) bronze
WICF		112		190?								leaded bronze
CABY		3185	8	191			66.8	12.5	6.5	8.5	0.2	leaded gunmetal
PIER		3127		191	T		88.5	0.2	8.6	1.1	0.3	bronze
WROX	721382			191								silver
BROU	676810	6		191								silver
ICKH	7411767	1756		191								leaded bronze
ICKH		2579		191								leaded bronze
LOND		13860		191								leaded bronze
LOND		85.108/2		191	Gm							copper
CATT	593641		Site433:22	191								(leaded) bronze
RICH	7350278	2243	270	191A			74.2	2.3	7.0	13.7	0.1	leaded bronze
RICH	7350104	915	269	191A			74.0	1.1	8.5	15.7	0.1	leaded bronze
RICH	7350777	4441	273	191A			70.4	0.7	7.5	19.3	0.1	leaded bronze
RICH	7350775	546	276	191A			73.3	1.0	9.4	12.8	0.1	leaded bronze
RICH	7350903	828	271	191A			65.6	0.1	10.6	22.2	0.4	leaded bronze
RICH	7351095	1162	278	191A			90.1	1.5	6.0	2.8	0.3	bronze
RICH	7351502	4077	277	191A			86.8	2.8	6.6	5.8	0.2	(leaded) bronze/gunmetal
RICH	7350471	3477	274	191A			70.8	0.5	7.9	20.5	0.1	leaded bronze
RICH	7350806	1442	275	191A			90.2	0.0	7.2	1.3	0.0	bronze
RICH	7350904	682	272	191A			72.4	2.3	7.3	16.9	0.1	leaded bronze
CATT	594683		Site433:21	191A								bronze
RICH	7350500	1719	296	191B			75.7	0.1	5.7	19.4	0.4	leaded bronze
RICH	7350690	2447	297	191B			86.2	1.6	7.5	5.4	0.3	(leaded) bronze
RICH	7350693		302	191B			87.8	3.0	5.3	6.7	0.1	(leaded) bronze/gunmetal
RICH	7350052	4533	291	191B			68.5	1.4	7.4	24.8	0.0	leaded bronze
RICH	7350273	2335	292	191B			90.3	0.0	7.6	2.7	0.1	bronze

Site	AML No	Site No	Pub No	Type	Decor	Enamel	Cu%	Zn%	Sn%	Pb%	Ag%	Alloy
RICH	7350281	2448	299	191B			75.2	2.1	8.9	13.9	0.2	lead bronze
RICH	7350975	3763	293	191B			75.0	2.1	5.7	14.9	0.1	lead bronze/gunmetal
RICH	7351206	5249	289	191B			84.2	11.4	1.6	3.3	0.2	brass
RICH	7351702	3971	290	191B	T		83.3	0.9	5.0	15.6	0.1	lead bronze
RICH	7351704	305	298	191B			79.2	0.3	9.8	11.2	1.0	lead bronze
LOND		438		191B								(lead) gunmetal
LOND		85.108/3		191B								bronze?
LOND		85.108/1		191B								silver and brass
LOND		0.1812		191B								brass
RICH	7350297	3080	294	191B	T		85.7	3.4	5.7	5.6	0.1	(lead) bronze/gunmetal
RICH	7350069	2914	295	191B			76.5	4.3	7.3	10.2	0.2	lead bronze/gunmetal
RICH	7350294	1624	300	191B			71.1	1.6	12.9	13.9	0.1	lead bronze
RICH	7350219	145	301	191B			72.0	0.9	7.8	15.3	0.1	lead bronze
RICH	7350272	2334	288	191B			83.0	0.1	3.6	12.7	0.1	lead bronze
RICH	7351894		306	191B?								lead bronze
RICH	7350618	4546	311	191B?			75.6	8.2	6.0	6.8	0.2	(lead) gunmetal
RICH	7351549		303	191B?			80.1	1.1	8.5	13.2	0.1	lead bronze
RICH	7351765	673	307	191B?			82.1	0.9	5.2	5.3	0.1	(lead) bronze
RICH	7351689		308	191B?			68.8	0.2	9.6	8.9	0.1	lead bronze
RICH	7351892		309	191B?								gunmetal
RICH	7351915		305	191B?								lead bronze
RICH	7350270	1328	316	191B?			28.9	3.7	0.6	0.8	64.9	silver
RICH	7350271	1675	315	191B?	T		87.5	2.2	5.0	5.4	0.4	(lead) bronze/gunmetal
RICH	7351077	2101	304	191B?	T							bronze
RICH	7350285	1267	312	191B?			81.7	3.6	4.8	8.7	0.2	lead gunmetal
RICH	7350292	1015	314	191B?			80.3	3.0	5.7	11.8	0.1	lead bronze/gunmetal
RICH	7350075	2913	313	191B?			88.7	0.7	5.2	6.9	0.1	(lead) bronze
RICH	7351879		310	191B?								brass
CARL		BLAAe65	20	191/192								lead gunmetal
RICH	7351335		331	192	G							copper
RICH	7351353		330	192								brass/gunmetal
RICH	7351793		332	192								(lead) gunmetal
RICH	7350072	2342	329	192								brass
RICH	7350348	286	327	192	Gl							brass
RICH	7350478	143	317	192			84.7	0.6	6.2	9.9	0.1	lead bronze
RICH	7350697	295	325	192			71.2	18.2	0.9	6.5	0.0	(lead) brass
RICH	7350090	296	322	192	T		71.8	12.9	5.3	10.9	0.2	lead gunmetal
RICH	7350097	1874	319	192			84.2	12.5	5.0	2.6	0.0	brass/gunmetal
RICH	7350275	2670	318	192			76.2	0.2	5.4	21.6	0.1	lead bronze
RICH	7350970	5502	326	192	Ts		77.3	0.1	7.0	12.2	0.1	lead bronze
RICH	7351227	274	324	192			93.8	5.6	1.7	1.3	0.1	copper/brass
RICH	7351700	3375	320	192			76.1	18.9	0.2	1.8	0.0	brass
RICH	7351723	5244	328	192	Gl		87.1	9.4	1.5	1.1	0.1	brass
RICH	7351707	2840	321	192			66.3	1.6	11.8	10.7	0.1	lead bronze
RICH	7351790	3186	323	192			85.0	6.5	4.6	5.7	0.1	(lead) gunmetal
CABY		2301	7	192			81.9	3.0	7.7	3.8	0.3	bronze/gunmetal
CABY		2386	9	192			65.7	0.7	7.8	15.4	0.1	lead bronze
CABY		980	11	192			69.9	14.8	3.0	6.6	0.1	(lead) brass
CABY		1039	10	192			76.2	16.5	1.0	2.9	0.0	brass
ULEY		1219	Fig125:1	192			75.2	0.6	4.9	13.2	0.1	lead bronze
WICF		28		192			73.3	0.1	6.0	27.6	0.2	lead bronze
WANB	692714		121	192			82.4	2.2	7.3	9.7	0.2	lead bronze
ULEY		1156	Fig125:2	192								brass
CARL		BLAAe165	19	192								lead bronze
ICKH	746273	51		192								lead bronze
RICH	7351919		333	192	Gm							brass
WROX	781665			192								lead bronze
WROX	78000943			192								lead bronze
WROX	781664			192								copper/bronze
WROX	78000942			192	G							copper/bronze
LOND		13073		192	Gm							bronze
LOND		15083		192								lead bronze
LOND		10372		192								brass
LOND		84.451		192								silver
LOND		451		192	Il?							(lead) brass
LOND		458		192								brass
BIRD	8702645		60	192								lead gunmetal
BIRD	8702653		61	192								lead bronze
STAN	8901477			192								lead bronze/gunmetal
RICH	96003512	4156	334	192	G							brass
RICH	96003507		335	192								
RICH	96003532		336	192								
DOVE		K810254		192?	Gm							copper/bronze
RICH	7350282	2689	337	193?			62.5	8.1	1.8	0.4	29.4	silver
HENL	730948	454	16	194?								silver
RICH	7351718	1880	268	196	T		69.0	0.7	5.8	20.7	0.2	lead bronze
RICH	7351018	5306	338	196?			76.0	16.3	0.0	0.1	0.1	brass

Site	AML No	Site No	Pub No	Type	Decor	Enamel	Cu%	Zn%	Sn%	Pb%	Ag%	Alloy
WICF		44		197			71.6	0.7	9.1	22.0	0.0	leaded bronze
WANB			122	199	Es	RT						bronze
CHES		T1		199								gunmetal
CAST		9-1221	101	200	Es	X						brass
CAST		16-51	103	200	(E) ?							bronze?
WINC		VR7312		200?	E							leaded gunmetal
WINC		VR7381		200?	E							leaded gunmetal
WPER	757958			200A?	Es	TX						gunmetal
RICH	7351712	641	350	200B	Es	OW	62.1	15.3	1.2	0.2	0.0	brass
CATT	723730		Site434:8	200B	T							leaded bronze
LOND		81		200D	Es	BX						brass
CATT	8111962		Site46:11	201	Mc?(E)			4.4	5.5	1.2		gunmetal
PIER		1520		202								bronze
RICH	7350295	3872	355	203			85.3	0.0	10.1	0.5	0.1	bronze
RICH	7351528	3012	352	203	Es(As)	RT	64.1	6.1	7.5	11.8	0.1	leaded gunmetal
RICH	7351711	1130	351	203	Es	TX	60.8	14.9	1.4	4.4	0.1	(leaded) brass
RICH	7351749	3945	354	203			71.2	12.4	5.5	8.8	0.2	leaded gunmetal
NORN	620624		130	203	Et	BW	76.3	1.2	8.3	9.6	0.0	leaded bronze
TIDD		82-80		203	Es	BX	70.3	8.3	7.2	9.1	0.0	leaded gunmetal
LOND		431		203	Es	X						(leaded) gunmetal
LAMY	4774		9	204	Es	B						leaded gunmetal
WICL		42		204	T(E)							leaded bronze
DOVE		K831206	43	204	T							bronze
HAYL		3316		204	TEs	TB	86.5	0.9	5.9	6.5	0.1	(leaded) bronze
HAYL		2077		204	Es	RT						leaded gunmetal
HAYL		172		204	TEs	RB						leaded gunmetal
GDUN		Cat621	2	205	TEs	X						leaded bronze/gunmetal
YORK		H139b		205	TEs	TBX						bronze
WNEW	5421	285		205	TEs	R?T						bronze/gunmetal
NORN	940418			205	Es	B						bronze
LOND		LEA9		206	EsEj	RB						leaded gunmetal
ALDB	876223		338	208	TMsEsEt	RGB						gunmetal
THIS	610982	BH747		210	Ec	YB						leaded bronze/gunmetal
LOND		3419		210	Ech	BW						gunmetal?
SAND		3385		210	TEt	RT						bronze
CATT	8111834		Site46:12	211	Ece	ROTKW						leaded gunmetal
RICH	7351735	2844	353	211	TEs	X	82.4	8.7	3.7	2.3	0.1	gunmetal
LOND		A21459		211	TEs							brass/gunmetal
LOND		CO*308		211	TN							leaded gunmetal
CHIC		CHW88-84		211	E							bronze
CORB	868600		7	211+	EsEc	BX						bronze
BALD	7210447		152	211+	TN							brass
PIER		122-R10		211++	T		79.8	2.1	7.8	9.9	0.0	leaded bronze
LOND		20382		212	EsEj	RT						brass
YORK		H31		213	Es	RG?T						gunmetal
YORK		H31		213	Es	RG?T						gunmetal
YORK		B3.H139a		214	Es	RY						gunmetal
ASHT	835074	159		214	Es	G/BT?						gunmetal
CAST		16-220	112	214	Es	OTBX						bronze
LOND		A16426		214	Es	XX						bronze
STAN	8700072			214	Es	TBX						leaded bronze/gunmetal
CAST		10-857	113	216	Es	BX						gunmetal
WANB			124	216?	Es?	W						leaded bronze/gunmetal
LOND		19230		219	TEsEj	TX						brass
TIDD		M7		220								leaded bronze
STAN	8901592			220	TEs							leaded gunmetal
YORK		H139c		222	TEs	R						brass/gunmetal
HENL	730941	469	17	222	TEsEt	RB						(leaded) brass/gunmetal
NORN	620615		133	222	TEs	RB						gunmetal
WANB			123	222+	TEs	GT						bronze
CHIC		CM/82/EP234	85	223	TEs	GX						leaded gunmetal
CHIC	800131	79/CM583	86	223	TEs	TX						leaded bronze
LOND		A19537		223	MsEs	O						bronze
BALD			144	224	T							brass
BALD			145	224	T							brass
BALD			146	224	TMcAc							bronze/gunmetal
RICH	7351321	1010	341	224	Ac							brass/gunmetal
RICH	7351587	2527	340	224	Ac							(leaded) brass
HAYL		1795		224	Ac							brass
HAYL		3313		224	TMc(Ac)							leaded brass/gunmetal
HAYL		1078		224	TMcAc							brass
SHEP	722218		41	224?	MAc							(leaded) gunmetal
BRAU		149	69	225	T							brass
BRAU		646	68	225	T							gunmetal
RICH	7350803	4017	345	225			81.1	12.5	4.1	2.5	0.0	brass/gunmetal
RICH	7350898	3171	342	225			77.8	12.0	4.2	2.0	0.0	brass/gunmetal
RICH	7351318	2816	344	225			83.2	11.7	1.5	1.6	0.0	brass

Site	AML No	Site No	Pub No	Type	Decor	Enamel	Cu%	Zn%	Sn%	Pb%	Ag%	Alloy
RICH	7351349	2505	343	225			86.8	11.5	0.0	0.8	0.0	brass
COLC		1.81-5046	CS30	225	TE							brass/gunmetal
COLC		1.81-5045	CS29	225	TE							brass/gunmetal
DRAG		DR68OD	125	225								gunmetal
CAST		14-453	99	225	T			21.1	0.3	1.7		brass
BRAU		606	70	225/227	T							brass
TIDD		M599		226	E?							lead ed bronze
WANB			125	226	Ec	RYG?						brass
NORN			253	226	Ec	KW	76.4	9.7	3.3	4.4	0.0	(lead ed) brass/gunmetal
NORN	621144		140	226	Ec	BW	73.5	11.4	4.5	7.6	0.0	(lead ed) brass/gunmetal
WROX	840612			226	Mc							lead ed bronze
LOND		11631		226	Es	B						gunmetal
STAN	8700080			226	TMc							lead ed bronze
SWIN	771823	50		227	Ec	OTX						lead ed bronze
CARV			23	227	Em	T.RKW						lead ed bronze
PIER		4795		227	Et	BW						lead ed gunmetal
WANB			126	227	Es	X						lead ed bronze
COLE		520	28	227	T							bronze
RICH	7350067	2338	364	227	(E)		79.5	1.5	9.0	10.7	0.0	lead ed bronze
NORN	621154		145	227	Em	R.BW	70.6	9.2	3.9	8.3	0.0	lead ed gunmetal
NORN	621150		143	227	Es	B?	69.5	3.9	6.3	7.0	0.0	(lead ed) bronze/gunmetal
NORN			151	227	Ec	W	71.1	10.5	3.9	4.6	0.0	(lead ed) brass/gunmetal
NORN	620633		146	227	Ec	RBW	72.6	8.0	6.5	5.6	0.0	(lead ed) gunmetal
OUDE		4		227	EsEch	O	78.8	9.1	6.0	6.3	0.0	(lead ed) gunmetal
ASHT	835072	165		227								copper
HAYL		2750		227	Es	?						brass
POUN		Ae34	19	227	Ej?Ece	GTKW						lead ed bronze
ICKH		2589		227								brass
LOND		A17717		227	Es	T						brass
SAND		856		227	EchEcc=m	RBX.RBW						(lead ed) brass
LOND		84.193/2		227	Es	T						brass
NORN	733356			227	Es	T						lead ed bronze
SEAT		20		227?	Ece	RBW						lead ed gunmetal
HAYL		3322		227?	N							brass
CHEL		CHKAe215	2:25	227+								gunmetal
NORN	620626		150stud	227+	Es		74.3	12.2	2.7	2.7	0.0	brass
NORN	620626		150plate	227+	EsEj	RO?K	69.6	13.4	2.7	3.6	0.0	brass
LOND		84.341/2		227/267B	Es	X						brass
VELZ		18		228	Es	OX						(lead ed) bronze
RICH	7351319	4873	365	228	(E)							copper
NORN	621089		152	228	Ec	K?W	48.0	7.8	2.0	1.2	0.0	brass
LOND		A10127		228	Es	RX						brass
LOND		88		228	Es	RX						lead ed brass/gunmetal
LOND		20126		228	EsEj	OTX						brass
RICH	7351087	85	366	228?	EsEm	RO.YP						lead ed gunmetal
VELZ		25		229	(E/N)							(lead ed) brass
VELZ		15		229	Es	T						brass
WANB			119	229	(E)							brass
RICH	7350892	2183	357	229	NEs	X	79.3	13.7	3.2	2.4	0.0	brass
VELZ		12		229	Es	YT	78.4	12.5	3.1	3.4	0.3	brass/gunmetal
VELZ		16		229	Es	T	77.3	16.3	2.3	0.8	0.2	brass
LOND		WIV216		229+	Es	TX						brass
GLOU		81/73-76	Fig36.5	230	Ec	TK						lead ed gunmetal
RICH	7351357	992	358	230	(E)							brass?
CHIC	794756	79/CM579	89	230	MsEch	RTW						lead ed gunmetal?
RICH	7351085	2068	359	230	(E)		80.6	14.6	2.1	2.1	0.0	brass
NORN	733364			230	Es	TX	76.4	6.1	7.3	8.2	0.0	lead ed gunmetal
NORN	733360			230	(E)		77.5	3.8	7.2	7.9	0.0	(lead ed) bronze/gunmetal
NORN	621126		168	230	Es	X						lead ed bronze
LOND		BWB1329		230	Ec	KW						lead ed bronze
NORN	733398			230	Ecc	KX						(lead ed) gunmetal
LOND		450		230+	Es	X						brass
STAN	8700933			230+	EsEch	ROTK						gunmetal
STAN	8901459			230+	Ecc	TW?						brass
NORN	620637		173	230++	Ec	KW	72.3	8.0	2.7	4.3	0.0	(lead ed) brass/gunmetal
HAYL		1936		231	T(R)							gunmetal
WANB			127	231+								lead ed bronze
RICH	7351669	874	360	231A	Es?	T	81.7	11.2	3.5	3.2	0.1	brass/gunmetal
NORN	620635		171	231A	Ecc	RT						lead ed gunmetal
NORN	620636		172	231A	Es?	X						lead ed bronze
COLC		1.81-616	CS31	231B	N							lead ed bronze
RICH	7350893	589	367	231B	Es	T	75.8	9.1	4.8	6.9	0.0	(lead ed) gunmetal
NORN				231B								(lead ed) gunmetal
LOND		MLK176		231B	(E)							gunmetal
CHIC		80/CM1188	88	232	(E)							(lead ed) gunmetal
RICH	7351542	4472	361	232			81.3	0.5	10.0	5.6	0.1	(lead ed) bronze
NORN	621122		156	232	Ec	K?	71.5	0.8	11.6	11.2	0.0	lead ed bronze

Site	AML No	Site No	Pub No	Type	Decor	Enamel	Cu%	Zn%	Sn%	Pb%	Ag%	Alloy
MAGI			21	233	Es	RB						leaded gunmetal
RICH	7350789	4152	362	233	Es	RT	79.2	6.0	4.2	2.1	0.5	gunmetal
RICH	7350891	7	363	234	EsEj	ROWX	74.1	7.2	4.4	10.8	0.0	leaded gunmetal
NORN	733358			234	EsEj	OTKXX	77.5	0.7	8.6	8.8	0.0	leaded bronze
CHEL		CHKAe245	2:26	235C								brass
BALD			149	236	Es	YBX						bronze
YORK				236	Es	W						brass
LOND		29.59/1		236B	E							brass
LOND		A16844		236B	Es	RT						bronze
CAST		10-1239	118	237	Es	BX						brass/gunmetal
BALD			142	238	TMcAc							brass
RICH	7350801	3996	348	238			73.1	18.4	3.6	1.4	0.0	brass
RICH	7351082	1011	349	238			77.8	21.6	0.0	0.1	0.0	brass
CHEL		CHAG32		238	McAc							bronze
STAL	4563		P1	238								brass
DRAG		DRBH		238	T							brass/gunmetal
SHEP	722335		42	238?	TMAc							leaded bronze/gunmetal
CHEL		CR10		238+	TN							brass
CAST		14-97	98	239	Rb							bronze/gunmetal
BALD			151	240	Ece	BW						brass
RICH	7350347	304	356	241	T		69.4	0.6	6.7	18.8	0.1	leaded bronze
HAYL		1859		242+	T							brass
RICH	7351181	5308	346	242A	(E) ??		80.8	14.9	2.9	0.9	0.0	brass
RICH	7351342	1844	347	242A	E??		76.5	7.6	7.8	3.9	0.1	gunmetal
SHEP	722347		43	246	Rb							brass
HAYL		3489		246	T(R)							leaded gunmetal
CAST		1-675	111	246?	Ecc	BWX						leaded brass
OPEN	7826162		628	247								leaded bronze/gunmetal
COLC		GBS-254	GBS19	247?	T							bronze
RICH	7351300	4697	374	248	TMc		72.4	4.7	10.3	6.1	0.1	(leaded) bronze/gunmetal
ASHT	835125	650		248								brass
SEAM		67-541	13	248	T							brass/gunmetal
WANB			129	248?								brass/gunmetal
COSG		233	2	249	Gl?Mc							leaded bronze
WICF		119		249								leaded gunmetal
HENL	734847	523	18	249	M							leaded bronze
VIND	819165		1	249								leaded bronze/gunmetal
HAYL		1402		249	TMc							(leaded) gunmetal
HAYL		141		249	T(M)							leaded bronze
CORB	868628		25	249	T							bronze/gunmetal
CHEL		CHV2		249	TMc							leaded bronze/gunmetal
NORN	621111		184	249	TMc							leaded bronze
RICH	7350086		376	249	T		84.1	1.8	4.9	5.2	0.1	(leaded) bronze/gunmetal
CATT	594692		Site433:27	249	[T]							(leaded) bronze
CATT	594685		Site433:28	249	M							leaded bronze
BALD			147	249?								brass
HOUS	79208989			249?								bronze
SEWN	810666		2	249?	T(M)			1.2	9.5	10.3		leaded bronze
WANB			128	249?	T(Mc)							leaded bronze
RICH	7351209	3798	375	249?	T							(leaded) bronze/gunmetal
THIS	610979	BH751		249?								(leaded) bronze
STAL	682679		P3	249?	Mc							brass
RICH	7351733	3906	373	249A	Mb							gunmetal
PAPC		84-105		249C	Mb?							(leaded) bronze
YORK		B2		250	EsEj	RBW						brass
RICH	7351727	2997	369	250	Em	X.RTKW						leaded gunmetal
WROX	843142			250	Em	R.RYTBKW						leaded gunmetal
CHIC		78/CM115	83	252B	Es	B						brass
WICL		43		252B	TEs	B						leaded bronze
RICH	7350088		384	252B	TEs	X	84.1	1.3	6.7	6.9	0.3	(leaded) bronze
POOL		5257	18	252B	Es	R						gunmetal
LOND		CAP68		252B	Es	R						bronze
WROX	78000529			252B	Ms(E)							leaded bronze
CATT	8111064		Site46:13	252B/259	TMs(E)			8.2	4.3	3.2		(leaded) brass/gunmetal
WICL		49		252C	Es	X						leaded gunmetal
RICH	7351746	2792	385	252C	TEs	B	86.8	0.7	7.9	0.8	0.0	bronze
ULEY		2046	Fig125:3	252C	TEs	RT						brass
CATT	594679		Site433:25	252C	TEs	RB						leaded bronze
STAN	8516942			252C	TEsAm	RB						bronze/gunmetal
WICL		16		252C+	TEs	T						leaded bronze
WICL		17		252C+	TEs	B						leaded bronze
WICL		40		252C+	TEs	BK						leaded gunmetal
RICH	7351543	3956	372	252/256	(E)		83.6	1.6	5.7	14.0	0.1	leaded bronze
WANB			130	252+/270+	TEs	T						brass/gunmetal
PIER		(63)		253	TEs	RG						leaded bronze
WICL		14		253	TMsEs	T						leaded bronze
HOUS	816576			253	TEs	RK						leaded bronze/gunmetal

Site	AML No	Site No	Pub No	Type	Decor	Enamel	Cu%	Zn%	Sn%	Pb%	Ag%	Alloy
WANB			131	253	Es	RK						bronze
KEST	841247		Fig52.95	253	TEs	RB						leaded bronze
TARH		211		253	Es	RT						gunmetal
PIER		3249		253	Es	RG						leaded bronze
GLOU		69/49-22	E4	253	TsEs	RB						leaded bronze
STAN	8901710			253	Es	RK						leaded gunmetal
GLOU		81/73-79	Fig36.4	254	Es	RGB						bronze
THIS		THZ2213		254	Es?	R						bronze
NORN	621088		298	254	Es	TK						bronze
TIDD		M591		254	Es	BW						gunmetal
WANB			132	255	TEs	RT?						brass
NORN			257	255	Es	RY?	77.6	0.0	5.6	6.5	0.0	(leaded) bronze
HAYL		3096		255	TMsEs	G?B						brass
OPEN	7813885		629	255	TEs	RK						bronze
YORK		B1		255+	Es	RTB						brass/gunmetal
RICH	7351728	2978	370	256	Em	.RBW	71.5	3.5	6.4	11.2	0.0	leaded bronze/gunmetal
RICH	7350899	2393	371	256	Em	.RTBW	75.6	15.7	0.6	2.2	0.0	brass
WINC		VR-223		257	TEsAm	TX						leaded bronze
WROX	78000518			257	E							bronze
WROX	775220			257	E							leaded bronze
STAN	8701576			257	TEs?	R						bronze
WICL		22		257A	Es	T						leaded bronze
WICL		45		257A	TEs	GK						leaded gunmetal
CORB	831686		21	257A	Es	RB						gunmetal
HOUS	811565			257A	TEs	RB						gunmetal
POOL		5092	17	257A	TMsEs	RB						bronze
CORB	868604	75-3916	20	257A	TEs	BX						gunmetal
HENL	730937	452	19	257B	E	K						leaded bronze/gunmetal
NORN	620601		194	257B	EsEm	X.BW	69.6	4.8	7.7	2.4	0.0	bronze/gunmetal
HOUS	753011			257B	TEs	RK						leaded bronze
LOND		PIC42		257B	EsEcEm	ROTX.BW						brass/gunmetal
HOUS	825165			257B	Es	OT						leaded bronze
NORN	733359			257B	EsEj	RNTX	75.3	3.2	6.6	12.5	0.0	leaded bronze/gunmetal
WANB			133	257B	TEsEj	RW						leaded bronze
LOND		84.261/1		257B	EsEj	BWX						brass
NORN	620608		187	257C	Ece?	BW?	57.7	8.7	10.6	4.8	0.0	(leaded) gunmetal
NORN	621109		200	258	Ece	RBW	70.1	14.6	0.6	1.2	0.0	brass
HAYL		(none)		259	Es	G?B	73.4	1.5	8.5	10.9	0.1	leaded bronze
ULEY		1569	Fig125:4	259	Es	RT						leaded bronze
BANT		82	Fig7.17	259?	Es	RG						leaded bronze
HOUS	79208643			260	Ej	RB						leaded bronze
WANB			134	260	TEj	R						gunmetal
WANB			135	260	TEs	T						leaded bronze
BRAU		283	71	260	Ej	RK						leaded gunmetal
RICH	7351080	1694	387	260	TEj	T	79.0	0.5	9.3	5.1	0.0	(leaded) bronze
RICH	7351081	1573	386	260	TEs	T	82.6	1.6	6.9	6.1	0.0	(leaded) bronze
NORN	621132		196	260	Ej	RB	71.0	0.0	7.3	11.3	0.0	leaded bronze
THIS	610736	TH2		260	Ej	RB						leaded bronze
WINC		VR77-5461		260	Es	R						leaded bronze/gunmetal
WINC		VR-5461		260	Es	R						(leaded) bronze
STAN	8800141			260	TEsR	B						leaded bronze
CHIC		ES90-2742		260	E							leaded bronze
WINC		VR225		260?	TE							leaded bronze
YORK				262	EsEjRs	T?BW						brass/gunmetal
NORN	620620		199	262	Es	TX						gunmetal
THIS		THZ1752		262+	TNEs	R						brass
WAKE	745075	125	5	263	Ej	RK						leaded gunmetal
NORN	620612		204	263	EsEc	OKW	75.6	0.6	5.8	11.0	0.0	leaded bronze
ALDB	78108250		340	263	Em	B.KW						brass
HAYL		2976		263	Em	.YK						leaded bronze/gunmetal
CAST		1-665	108	263	Em	.RYBKW		9.6	3.6	4.8		brass/gunmetal
WICL		31		263+	TMs							brass
BIRD	9014037		65	264A	TMsEs	TBX						bronze
CAST		1-395	110	265?	EsEc	BW		13.1	2.5	3.4		brass
NORN	620600		205	266A	EsEm	BX.RBW	72.5	9.3	4.8	0.5	0.0	gunmetal
WANB	692162		136	266A			78.9	0.0	5.5	15.8	0.0	leaded bronze
BRAU		120	72	266A	EsEcEm	ROBW.Y	83.3	15.5	1.9	3.3	0.0	brass
STAN	8800248			266A								brass
GEST		BR76	9	266A	EsEm	R.RBW						leaded bronze
BALD			148	266A	EsEj	OTBP						bronze?
POOL		5169	20	266B								bronze/gunmetal?
POOL		5090	19	266B								leaded gunmetal
BIRD	8909083		66	266B	Em	.YT						leaded bronze
CARL		BLAAe227	22	267	Es	B?X						leaded bronze
WICL		21		267B	Es	RB						leaded bronze
RICH	7351714		383	267B	Es	RB						(leaded) bronze
RICH	7351730	26	382	267B	Es	T						bronze?

Site	AML No	Site No	Pub No	Type	Decor	Enamel	Cu%	Zn%	Sn%	Pb%	Ag%	Alloy
NORN	621153		206	267B	Es	RB	91.1	0.0	2.0	1.6	0.0	copper
STAN	8516921			267B	Es	RB						bronze
LOND		LCT1304		267B	Es	BX						bronze
LOND		12538		267B	Es	X						brass/gunmetal
LOND		A1918		267B	Es	B						bronze
BIRD	8812209		64	267B	TEs	B						bronze
SAND		1489		267B	Es	RB						bronze
THIS		THZ4600		267C	Es	RB						bronze
CAST		1-541	107	267C	Es	RB		0.2	6.9	5.2		(lead) bronze
CAST		1-420	105	267C	Es	B						bronze
LOND		A17331		267C	TEs	RX						brass?
LOND		81.629/2		267C	Es	B						gunmetal?
LOND		A26490		267C	Es	YBX						brass/gunmetal
WICL		15		268	Es	YB						brass/gunmetal
RICH	7350083	2414	381	268	Es	R						lead) bronze?
RICH	7351739	823	379	268	Es	RT						lead) bronze
RICH	7351201	4479	380	268	Es	RYT	85.9	10.9	3.7	4.0	0.0	(lead) brass/gunmetal
LEIC		316-193	2:27	268	Es	RYT						brass
CAST		9-895	106	268	Es	RX						bronze
BIRD	8905735		63	268	Es	R?YB						(lead) bronze
CARL		BLAAe146	21	268	Es	YT						lead) bronze
LOND		26538		268/199	Es	YB						gunmetal?
WAKE	745057	29	6	269								bronze
WICL		23		269								lead) gunmetal
HENL	684636	375	20	269								(lead) brass/gunmetal
CORB	822060		24	269								lead) gunmetal
POOL		5308	15	269								lead) gunmetal
POOL		5168	14	269								bronze/gunmetal
DEEP		3631		269								(lead) bronze
DEEP		3632		269								lead) gunmetal
DEEP		3853		269								lead) bronze
NORN	620602		296	269	GmAc							bronze
OPEN	7815595		630	269								gunmetal
RICH	7350525	3250	377	269A	Ece?	T	79.2	8.3	3.1	4.6	0.3	(lead) brass/gunmetal
WROX	743478			269B								lead) bronze
STAN	8611866			269B								lead) bronze
SAND		540		269B								lead) gunmetal
LOND		85.108/5		269B+								brass
WICL		5		270	Gm							bronze
WICL		24		270	G							bronze
HENL	642023	1	21	270	GmT							gunmetal
HOUS	79208663			270	GmTAc							bronze
HOUS	811598			270	GI							bronze
WANB			137	270	GIAc							bronze
WANB			138	270	GIAc							bronze
RICH	7351086	208	390	270	G(Ac)		85.7	4.7	5.1	0.6	0.0	gunmetal
RICH	7351717		389	270	GIAc		88.5	1.0	6.5	0.8	0.1	bronze
RICH	7351729	1872	388	270	GmTAc		85.4	10.2	0.0	0.5	0.0	brass
ULEY		7810	Fig125:6	270	GmAc		92.3	1.9	5.7	0.0	0.0	bronze
ULEY		7814	Fig125:7	270	GmAc		85.4	8.3	2.2	0.0	0.0	brass/gunmetal
ULEY		5270	Fig125:5	270	GI							bronze
HOUS	855044		10	270	GmT							bronze
WROX	78000516			270	Gm							bronze
LOND		23479		270	G(Ac)							brass
CHIC		ES88-6		270	GTAc							gunmetal
STAN	8900758			270	GmT							brass
WROX	743499			270?	T							gunmetal
INWO		(1971)		270+?	GmT							brass
WICL		28		271	GI							brass
WICL		52		271	G							brass
HENL	642026	36	22	271	GIAc							(lead) gunmetal
NORN			237	271			87.5	9.2	2.6	0.1	0.0	brass/gunmetal
WINC		VR-5381		271	GmTAc							brass
WINC		VR-5577		271	GIAc							brass
SAND		3904		271	GmTAc							brass
STAN	8800694			271	GI							brass
STAN	8900757			271	GmT(Ac)							brass
MAXE	801274	M801991	6	271	GmAc							bronze
WINC		VR-9700		274	TEsEj	BX						brass
GDUN		Cat837	1	275	Ech	R						lead) gunmetal
KILH			1	275	Mc							lead) bronze
CHIC		79/CM332	84	275	Ech	T						(lead) gunmetal
NORN	621090		218	275	Ec	YK	74.1	0.8	4.5	6.7	0.0	(lead) bronze
NORN	620679		217	275	Es	R	67.6	0.4	7.4	16.4	0.0	lead) bronze
NORN	621115		219	275	Es	R	73.6	2.8	5.6	8.3	0.0	lead) bronze/gunmetal
CAST		10-1731	117	275	Ech	B						lead) gunmetal
LOND		RAG92		275	Ecc	YGT						brass

Site	AML No	Site No	Pub No	Type	Decor	Enamel	Cu%	Zn%	Sn%	Pb%	Ag%	Alloy
WANB			145	Gp=annul								bronze
RICH	7351721	152	437	Gp=annul	Gm							gunmetal
RICH	7351761		436	Gp=annul			85.5	5.2	4.1	2.4	0.1	gunmetal
CHEL		CHN16		Gp=annul								brass
CHEL		CHN13		Gp=annul	R							brass
DODD	8515488			Gp=annul								bronze
LECH		1958-1	-	?								bronze
CAME		76-237		?	T							leaded bronze
CARV			29	?								bronze
WICL		27		?								leaded gunmetal
WICL		35		?								leaded bronze
WICL		53		?								leaded bronze
WICL		54		?								brass
VIND	819177		4	?	TMs							gunmetal?
KEST	841266		94	?								bronze
SHEP	722213		27	?			78.1	0.2	14.3	0.8	0.0	bronze
BALD	7211183		84	?			90.3	0.4	14.6	0.0	0.1	bronze
BROU	671624	36		?								bronze
TARH		228		?								bronze
CABY		871		?								bronze/gunmetal
CHEL		CHV9		?								brass
CHEL		CHV8		?								brass
CHEL		CHMAe277	2:	?								bronze
CARL		BLAAe209	17	?								brass
CARL		BLAAe265	2	?								bronze
STAL	682663		N2	?								brass
POUN		Ae16	9	?								bronze
RICH	7351871		339	?								brass
PIER		106D189		?								leaded bronze/gunmetal
LOND		DMT134		?								leaded bronze
LOND		GPO4364		?								bronze
LOND		LCT587		?								leaded bronze/gunmetal
LOND		RAG49		?								(leaded) bronze
WROX	78001024			?								(leaded) bronze
WROX	78001170			?	T							leaded bronze
RICH	7350611	2638	378	?								(leaded) gunmetal