

WEIGHING UP THE ECONOMY OF ROMAN LONDON

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SUMMARY

There are three main types of weighing instruments from Roman London: equal balances, steelyards and dual balances. London is also exceptional in yielding more than 134 examples of balances. In addition, the distributions of 193 pan weights and 47 steelyard/dual balance weights were recorded to provide a detailed distribution of their usage across Roman London. Interestingly, in the rest of Britannia steelyards were primarily used, while London shows the opposite trend with higher usage of equal and dual balances. Within London dual balances are more common than within the rest of Britannia, suggesting that the economy of London was based around smaller quantities and/or more valuable commodities. London has the most diverse collection of figured steelyard weights from Britannia, including those of gods and goddesses, suggesting a culturally diverse origin for the city's craftspeople and traders. Contextual evidence suggests that weighing instruments within the Roman city were used in a variety of retail trades and craft activities. Much of this activity took place along the Walbrook valley. This research also makes comparisons with other object types which emphasises the industrial rather than domestic context for use. This paper demonstrates that this first corpus of a distinctive type of material culture can provide significant insights into ancient economic activities.

INTRODUCTION

One of the great attributes of the Roman empire was a comparatively well-organised system of weights and measures, which along with a standardised system of coinage facilitated a vast array of commercial transactions, such as the retail sale of food

stuffs. Before AD 79, set up in the forum of the provincial Italian town of Pompeii was a marble civic 'weights and measures table' (*mensu ponderaria*), which defined a set of measures for the sale of dry and liquid goods (Roberts 2013, 56). Weighing goods within the province of Britannia was achieved using two types of balance (*libra*) and the steelyard (*statera*). The equal balance consisted of a simple arm bearing two pans suspended from a central pivot (Fig 1). The steelyard involved a combination of a single pan or a hook and the usage of suspended weights (Fig 2). The third type was the dual balance, which is a combination of the other two types (Fig 3).

As a topic, Roman weighing instruments are markedly understudied. A small amount of research was undertaken by German scholars on steelyards in the 1980s (particularly Jenemann 1985; 1989) and in the early 1990s two typologies were proposed by Grönke and Weinlich (1992) and Franken (1993). In Britain, these objects have received little attention apart from where they make up a significant percentage of a site assemblage (eg Holbrook 1998, 303–4; Cool 2008, 154–5; Hill & Rowsome 2011, 389). The purpose of this paper is to present the objects from London as part of a wider study of Roman weighing instruments from Britannia (Smither forthcoming). This study brings together material, both published and unpublished, from site catalogues as well as the collections of the MoL (Museum of London), MOLA (Museum of London Archaeology service), LAA (Museum of London Archaeological Archive) and the

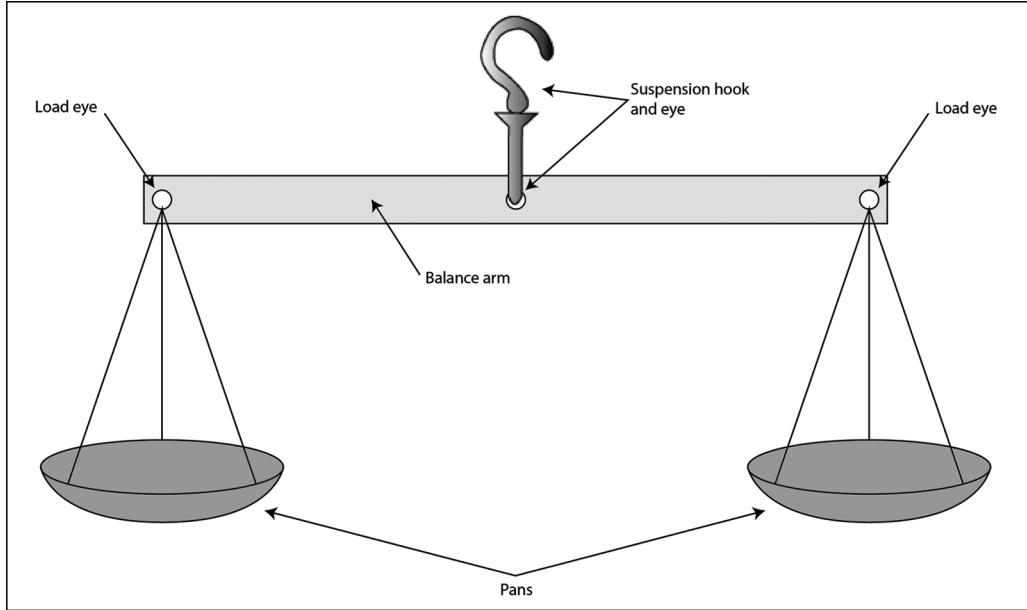


Fig 1. Schematic of an equal balance

BM (British Museum). In total, 326 items from London have been investigated. The catalogue was compiled from: excavation reports, London object catalogues, the MoL collection, LAA, MOLA and the BM. The following factors should be taken into consideration with the collections. First, not all the collections are complete or have good contextual data; particularly at the MoL

where some objects were labelled as missing. Secondly, many antiquarian finds only have a street name as their provenance. Thirdly, all objects from sites deposited with the LAA have been studied, as well as those from accessible MOLA sites.

There are some inherent biases within this assemblage. The survival rate of artefacts varies across the Roman city due

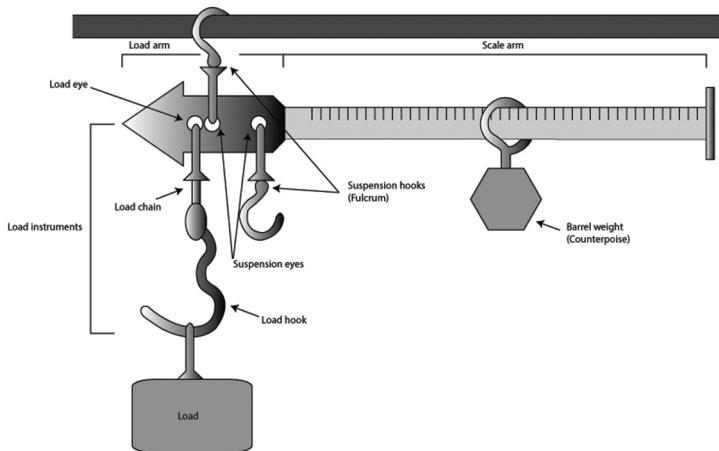


Fig 2. Schematic of a steelyard balance

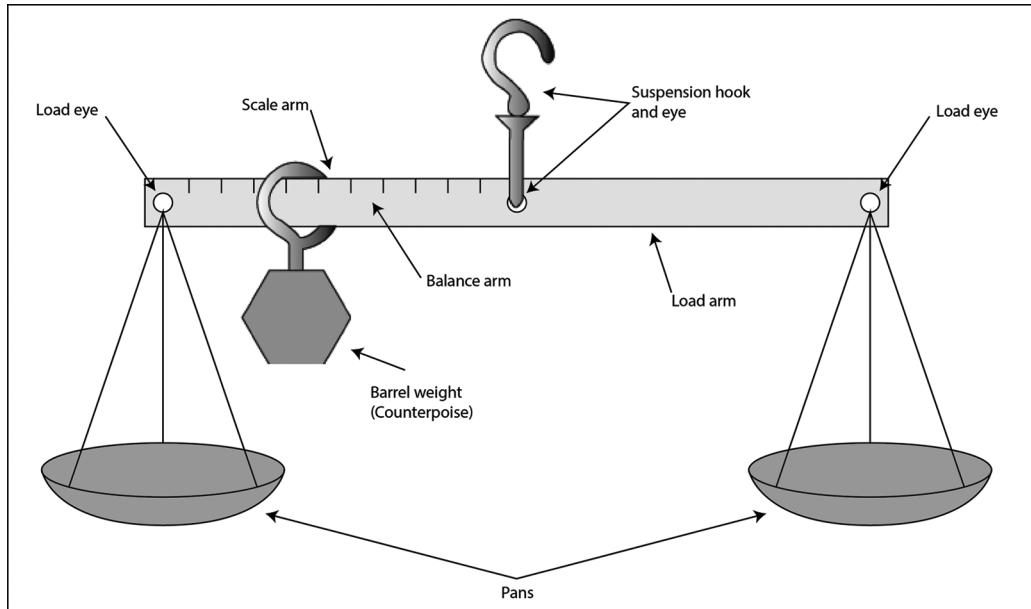


Fig 3. Schematic of a dual balance

to soil conditions. Metal artefacts found in waterlogged areas, such as the Roman waterfront and the Walbrook valley are well-preserved and the latter locality has produced more artefacts than other locations. The recovery rate of small objects like lead weights is obviously much better on controlled excavations incorporating the systematic metal detecting of deposits, compared with the collections of metalwork retrieved during watching briefs and salvage recording carried out on various Walbrook sites between 1927 and 1960 (Wilmott 1991, 168–72; Wardle 2011, 506). Also, some areas of London are largely inaccessible due to existing buildings, such as St Paul's Cathedral and the Tower of London. In many cases, deep post-medieval basements have truncated the upper portion of the Roman deposits, destroying much of the 3rd–4th century AD evidence. Since the London material has a distribution biased towards the later 1st century AD, it is unlikely that this is a phenomenon purely representative of London's chronology, but tells us something about the proportion of datable deposits in the archive.

A typological catalogue has been compiled based up on the existing typology for

steelyards (Grönke & Weinlich 1992). As this only categorises steelyards, the typology has been further developed to include all balance types. Chronological, spatial and social analyses consider the contexts of the finds to identify patterns of usage and discard across Roman London.

THE TYPOLOGICAL RANGE OF LONDON FINDS

Due to the extensive exploration of London's Roman archaeology over the past 200 years the capital has produced a large proportion of the weighing instruments discovered within Britannia (Fig 4; for details see Appendix 1). London accounts for 134 (27.7%) of all the objects studied (Smither forthcoming). This is twice the total from the *civitas capitals*, more than all military sites and more than all rural sites. It is also unique as the only settlement to produce more equal balances (44) than steelyards (30), as well as the most dual balances (7); accounting for 81 (46.4%) of all balances in Britannia.

London also produced the largest and most varied collection of figured weights (16). This is significant as only 13 plain steelyard weights have been positively identified in London.

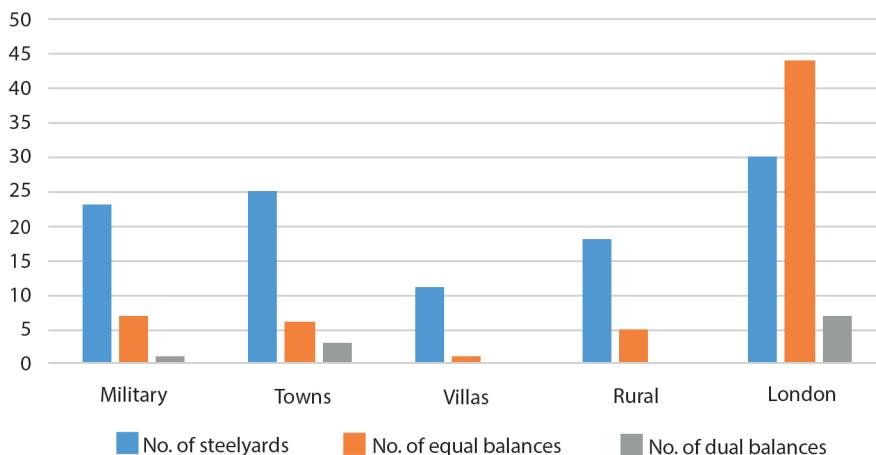


Fig 4. All balances by site type and from London (No=181)

However, it is possible that many more weights might be identified from London sites where the assemblages were either inaccessible or the finds unidentified. Where this is the case, the balances have only been distinguished as equal or steelyard types. It has also not been possible to distinguish pan weights from steelyard weights derived from these sites. Where this is the case, the weights have only been quantified as a number from the particular site. London has produced the most varied range of balances. In the following I examine each group in terms of its typology, material, chronology and spatial distribution.

Equal Balances

The 44 equal balances from London are in various states of preservation and only 13 have all four elements of the typology (Fig 5).

Apart from those examples where the design of the fulcrum loop is uncertain, which make up 41% of the objects, the most common fulcrum loop type in London is type 'II', which has it moulded to the centre of the balance. This mirrors the rest of Britannia as being the most common type. However, the London corpus is much more varied than the rest of Britannia: London is the only city with the more complex types 'VA' (Fig 6) and 'VB' on equal balances, which use a stirrup to suspend the arm from

the centre. (For further details concerning the typology of balances see Appendix 1.)

The most common type of load suspension loop is type 'a', confirmed on 14 examples and possible on a further 14. Types 'b'–'d' are also possible on these examples.

Only 16 examples could be identified where the combination of the fulcrum hook and load instruments could be confirmed. The corpus shows that the 'λ' type (with a stirrup), with 12 examples (75%), is much more common than the 'Θ' type (without a stirrup), with 4 examples (25%).

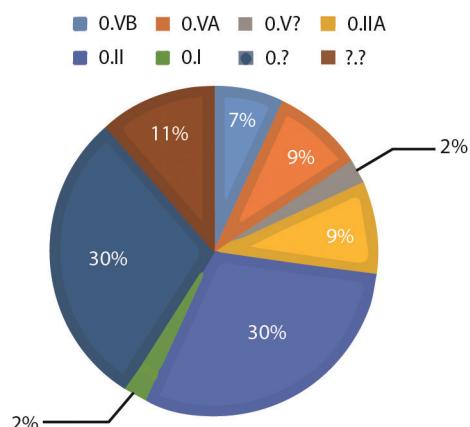


Fig 5. Percentage of equal balances from London by fulcrum loop type (No.=44)



Fig 6. Example of fulcrum loop type VA from London (MoL. Inv.A10184) (Table 6: LONI3*) (scale 1:2)

However, these are the only types which have been identified on equal balances, which is surprising as the ‘λ’ type is only associated with balances of fulcrum types ‘IIA’, ‘VA’ and ‘VB’, while the ‘Θ’ type is only used with fulcrum types ‘I’ and ‘II’. With type ‘II’ more common in London, more ‘Θ’ types presumably existed on examples where the load instrument type could not be confirmed. It is therefore probable that more ‘Θ’ types existed but do not survive. Even so, it cannot be ruled out that type ‘δ’ could also be used on equal balances.

The common occurrence of equal balances is confirmed by the prevalence of pan weights. From 19 sites, 194 weights make up a corpus of either pan weights or unconfirmed pan or steelyard weights. Of these, 69 were confirmed as pan weights. Although this is problematic, the quantity of pan and steelyard weights can be compared on some sites. At 1 Poultry (ONE94), 31 pan weights were discovered, compared to five steelyard weights and from excavations on Cheapside and Queen’s Street (CID90) 28 pan weights were found, compared to just one steelyard weight. Although it is possible that these pan weights could each be from between c.3–28 sets of different weights for equal balances, as opposed to a single weight for steelyards, the evidence supports the prevalence of equal balance use in London.

Steelyards

Steelyards are less common in London than equal balances (Fig 7). In many cases at least two parts of the typology could be applied to the steelyards and the full four-point

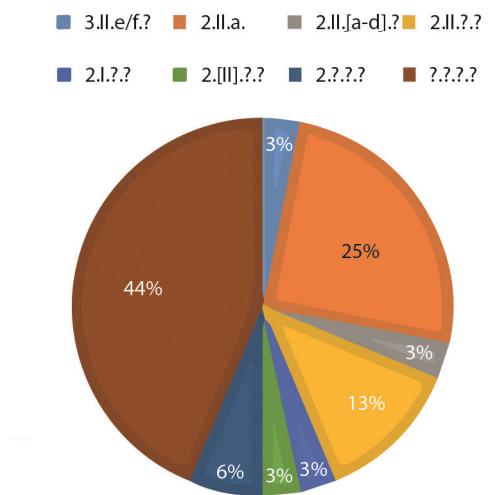


Fig 7. Percentage of London steelyards by type (No.=30)

typology could be applied to eight examples.

Similarly, in the rest of Britannia, the most common steelyard is type ‘2II’ with the full ‘2II_a’ type accounting for half of these. In contrast to equal balances, the steelyards are not as mechanically complex. Only type ‘II’ of forged fulcrum loops were identified and no riveted types; however, riveted types are not common in Britain. According to Franken’s study (1993), finds of this moulded type of steelyard are common in the north-western provinces of the Roman empire, whereas the riveted type is more common within the Mediterranean region.

One find purportedly from London is the terminal of a steelyard scale arm decorated with a wolf’s head: this item is unique in



Fig. 9. Terminus of a steelyard with a ?wolf's head (Mol. Inv. 79.1165) (Table 6: LON26), dated to the 3rd–5th centuries and most commonly found in the Eastern Mediterranean (scale 1:2)

Britannia. According to Franken's (1993, 89–94) typology, it is a much later type, which is associated with Byzantine style weights produced from the 4th century AD (Fig 9). Unfortunately, there is no find spot associated with this object.

Dual Balances

Dual balances are more common in London than anywhere else in Britannia (Fig 10), accounting for seven of the 11 examples.¹ Four examples incorporate a single scale on one side of the central fulcrum, whereas three have two scales for measurement. Of these three, two are like the traditional steelyard



Fig. 8. Type 2 IIaα, the most common type in Britain and the north-western provinces (Mol. Inv. 21956) (Table 6: LON04) (scale 1:2)*

with scales on opposite planes of the arm and one has two scales, both along the same planes either side of the fulcrum. These balances follow the pattern of appearing on highly 'Romanised' sites, as other examples were found at Silchester (Boon 1974, 292, fig 34, no. 1), Colchester (Crummy 1983, 99, fig 102, 2507), Aldborough (Bishop 1996, 44, fig 25, no. 261) and Catterick (Wilson 2003, 69, fig 262, no. 248).

Typologically, of the seven examples, all four points are identifiable on five of these. All scale types are present on dual balances '1', '2' and '2a'. All the balances have type 'II' fulcrum loops and none use the types associated with the stirrup hanger. Each balance also uses type 'c' 'Omega'-shaped hooks, unlike the equal balances which use type 'a'. Finally, all the examples use type 'δ' for the load instruments and fulcrum hook.

In this way, the types of dual balance are different to those of the equal balances. The equal balances from London use the stirrup hanger fulcrum loop/hook type, whereas dual balances do not. The number of examples appears disproportionate to those across the entirety of Britannia. It is possible that within London there was more

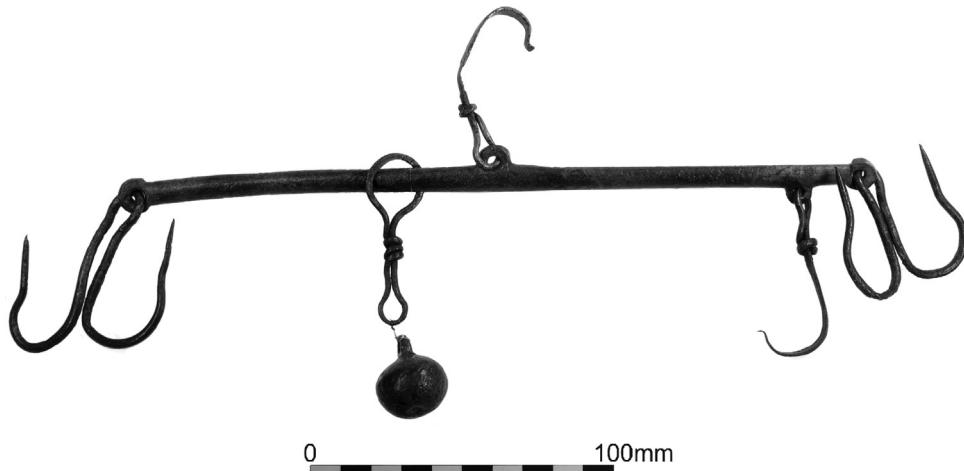


Fig 10. Example of a steelyard balance (Mol. Inv. 1036), type 2aIIcδ (Table 6: LON26) (scale 1:2.5)

commerce and craft activity, such as fine metalworking like jewellery manufacture, that might have involved the usage of small dual balances than in other British urban centres (Wardle 2011, 503). However, proportionally much more excavation has taken place within London, and on other sites which produce dual balances, such as Silchester and Colchester. Nevertheless, other towns in Britain show a high level of fine metalworking with which these balances might be associated.

Weights

Each steelyard or dual balance incorporates a suspended barrel weight, made from lead and usually coated in copper-alloy or iron, which slid along the arm of the scales. Of these there are 22 examples, 17 of which are figured (Table 1). On steelyards with a fulcrum hook and load instrument, type 'α' is often found as a counterweight. Of these there are six. For further details concerning the London weights and their finds spots see Appendix 2.

The barrel weights possess various shapes and the 'bi-conical' and 'spherical/subspherical' examples can be associated with the most common type of steelyard from London. As well as this, all the counterweights can be associated with the most common type of steelyard from London.

Table 1. Number of steelyard and dual balance lead weights from London by type

Type	Subtype	Quantity
Barrel weight	bi-conical	2
	cylindrical	1
	spherical/subspherical	3
	figured	17
Counterweight	bi-conical	3
	spherical/subspherical	3
Uncertain	spherical	1

The typology for the figured or ornamental weights is largely based on that of Franken's (1994) study of figured barrel weights from across the Roman Empire. The 17 figured weights are varied and include most of Franken's types (Table 2). The most prevalent are the 'gods and heroes', 'goddesses and other women' types (Fig 11), plus a new type not identified by Franken, named 'Flora'. These are the most common types in Britannia and are associated with the most 'Romanised' areas of the province, such as the *civitas capitals* and military sites. The wide range of figured weights present in London is an indication of its commercial diversity and prosperity, and shows an awareness of Roman divinities. Durham (2010, 305–37) demonstrated that Roman copper-alloy

Table 2. Number of figured lead barrel weights from London by type

Type	Subtype	Quantity
Bearded male	classical	1
Flora	acorn	2
Goddesses and other women with idealised hairstyles	Cybele	3
	Isis	2
	uncertain	1
Gods and heroes	Bacchus	1
	Mercury	1
	Sileneus	1
Women with fashionable hairstyles	Flavian	1
Zoomorphic	wolf/dog	1
Uncertain	?	3

figurines from Britannia are equally diverse with exotic gods and goddesses making up a large proportion of the assemblage. Cybele and Isis are the most common goddesses from Britannia and of the gods, Bacchus and his entourage are the most frequent.

Up until recently, Mercury was the most common of the gods represented in the other provinces, but was not in Britain. The only known Mercury weight from Britannia was found at the Bloomberg site (BZY10) (Michael Marshall, pers comm 2014). Another, not included in the table above, represents the Rape of Ganymede, which is unparalleled in the Roman Empire (Marshall & Wardle in prep.).

Additionally, not all balances were functional like those above. From the Bloomberg excavations two exceptionally small steelyards were found (*ibid*). Other miniature balances were found at Elms Farm, Heybridge, Essex (Atkinson & Preston 2015, fig 560.7) as well as in graves at Cologne (Pirling & Siepen 2006, 419). Like other objects in miniature form, these represent votive depositions of ‘functional’ objects. Since steelyards are functional objects and are also not found in Roman graves, the deposition of these might be in lieu of depositing the actual object still in use or passed on to the next generation.

PRODUCTION

There is also evidence for the possible production of steelyards in London. Five early examples, three of which are from London (MoL Acc. Nos. 1051, 1052, and 81.282/9) (Fig 12) show striking similarity, and if not produced in London, may have come to the city from the same production centre. On one of these (1052), Scale A measures between 1–6 *libra* and Scale B measures 6–30.² Although the others are not clear, they most likely measured similar masses. These steelyards are like those found at South Shields (Miket 1983, 117, 76.140) and Housesteads forts (Rushworth 2009, 442, 14.6.59) which have the same weighing ranges. However, it is probable that this type of balance with these measurements was a standard type produced, traded and transported across the north-western provinces.

MATERIALS

Roman weighing instruments were mostly made of copper-alloy or iron, with lead weights. Of the 81 balances from London, 79 are made of copper-alloy and only one is made of iron (BZY10 <10566>). One of the more unusual objects in the corpus is a bone steelyard from an unknown site (MoL Inv. No. 1057), unfortunately this item is missing. All 17 figured steelyard weights are made from copper-alloy and of the 13 plain weights, eight have copper-alloy shanks through the centre and two have iron shanks; the materials of the remaining three are uncertain. The wider study of weighing



Fig 11. Examples of figured weights: (a) Sileneus (MoL Inv. 83.678) (Table 6: LON21); (b) Isis (MoL Inv. A17640) (Table 6: LON26) (scale 1:2)



Fig 12. Three steelyards from London which are similar in type, appearance and weighing capacity: (a) Mol Inv. 1051 (Table 6: LON26); (b) 1052 (Table 6: LON10); (c) 81.282/9 (Table 6: LON26) (scale 1:2)

instruments from Britannia has concluded that, when produced, the material of the balance matched the material of the weights' shank (Smither forthcoming). In Britannia, finds of copper-alloy balances and weights with a bronze shank are far more common in towns than on rural sites. However, although iron balances corrode more rapidly than copper-alloy, the iron shanks from weights suggest that iron balances were more common on rural sites. The balance arms from London examples are primarily of copper-alloy as are the shanks in the steelyard weights. This would suggest that in London copper-alloy balances were used more commonly than iron ones and this trend is repeated in other urban centres across Britannia. However, it should be noted that as balances are composed of several component parts, repairs could easily be made. Some 80% of the British examples of balances with complete arms have component parts all made of the same material. In some cases, a weight with an iron shank has been found attached to a copper-alloy arm, demonstrating repairs to steelyards. As there is a standardisation of the weight attached to an arm, for it to be calibrated correctly, these repairs are easily done and have little or no effect on the functionality of the balance.

CHRONOLOGY

Datable examples of Roman weighing instruments from stratified deposits in London are relatively limited (Table 3). Many examples in the MoL collection lack a stratified context or are donations with a doubtful provenance. Of the 134 objects, only nine, from three sites, had reliable dating evidence. This figure does not include finds from Bloomberg Place (BZY10), which were still being analysed when this research was undertaken.

Most of the dates span the late 1st to late 2nd centuries AD, with no pre-Boudican finds of either balances or steelyard weights. However, there are two pre-Boudican pan weights from BGH95. The three sites which yielded datable objects are: 1 Poultry (ONE94) in the Walbrook valley; Leadenhall Court (LCT84) at the north-eastern corner of the forum-basilica and Billingsgate Buildings (TR74) on the waterfront. Of these sites, 1 Poultry with the most examples is also the most recently and extensively excavated (Wardle 2011, 505–6).

Of the nine objects, six can be securely dated prior to the 3rd century AD, the majority of which are Flavian-Hadrianic. Typologically, both equal balances and steelyards were being used during this

Table 3. Dateable Roman weighing equipment from London

No.	Object (Part)	Site	Context	Landuse	Date (AD)
285	steelyard	LCT84	(9722)	B14/midden 14	c.75
306	barrel weight	ONE94	(12556)	B34	65/70–90
290	equal arm	LCT84	(4246)	B12/midden 15	95–100
297	pan	ONE94	(12787)	B40	95–125
292	equal arm	ONE94	(18089)	OA45	95–125
288	equal arm	TR74	(412a)	waterfront dumping	100–125
293	equal arm	ONE94	(18008)	OA77	170–220
300	barrel weight	ONE94	(8270)	OA66	200–220+
301	barrel weight	ONE94	(12499)	R1	4th century

Key to landuse entities: B = Building; OA = Open Area and R = road

period. The present data for Britannia suggests that steelyards were more common than equal balances in the 1st and 2nd centuries AD. As equal balances are depicted as being associated with metalworking and trading of valuable objects, such activities may have been largely restricted to a small number of early urban centres, particularly the large towns, during the early Roman period. Another reason is the introduction of these balances by the Roman army. Equal balances and their weight sets are far less portable and not functional for the day-to-day life of the army (*ie* weighing rations). It is therefore possible that, for the most part, equal balances were used far more frequently by urban traders and manufacturers.

Steelyards are more functional for weighing bulk items, such as meat and grain, which would have been required for measuring military rations from immediately after the Roman invasion. While these nine objects cannot be described as a representative sample of Roman weighing equipment from London, it is worth considering what they might tell us about the character of London's economy. All these objects are from sites which were part of the rapid expansion of London, which started during the Flavian period (Hill & Rowsome 2011, 309–20, 389; Perring 1991, 22–53). Leadenhall Court began to develop an urban character from AD 75 onwards (Milne & Wardle 1993, 33–4, 91). The equal arm from Billingsgate Buildings, which dates no later than AD 125, was from

with the second phases of terracing linked with the construction of riverside revetments (Chapman 1980, 88, no. 464; Jones 1980, 5). Finally, at 1 Poultry, during the same period activity on site was characterised by various commercial and industrial activities (Hill & Rowsome 2011, 389–403).

SPATIAL DISTRIBUTION

Of the 326 London weighing objects, the locations of 57 objects from the core corpus could be plotted, as could those of all 193 other weights. The sites in and around the Walbrook valley (BZY10, CID90, ONE94) have produced far more weights than other locations. It should be remembered that these pan weights would have belonged to sets and where more than one weight is found within a context it is difficult to establish if they belonged to the same or different sets.

Placing Hall's (2008, 170, fig 4.0.1) map of 'London zones' based upon the evolution of the walled Roman city, over the distribution of weighing finds (Fig 13) shows that most objects are concentrated along the Walbrook valley (zone 1). There are also a significant number of finds from the two adjoining eastern and western zones (2 & 3). This finds distribution is quite like the evidence for the Boudican fire within London (Wallace 2014, fig 36). Wallace (*ibid*, 155) has argued that London was founded by 'Romano-Gallic citizens with official permission from the procurator' in about AD 49. So, craftsmen

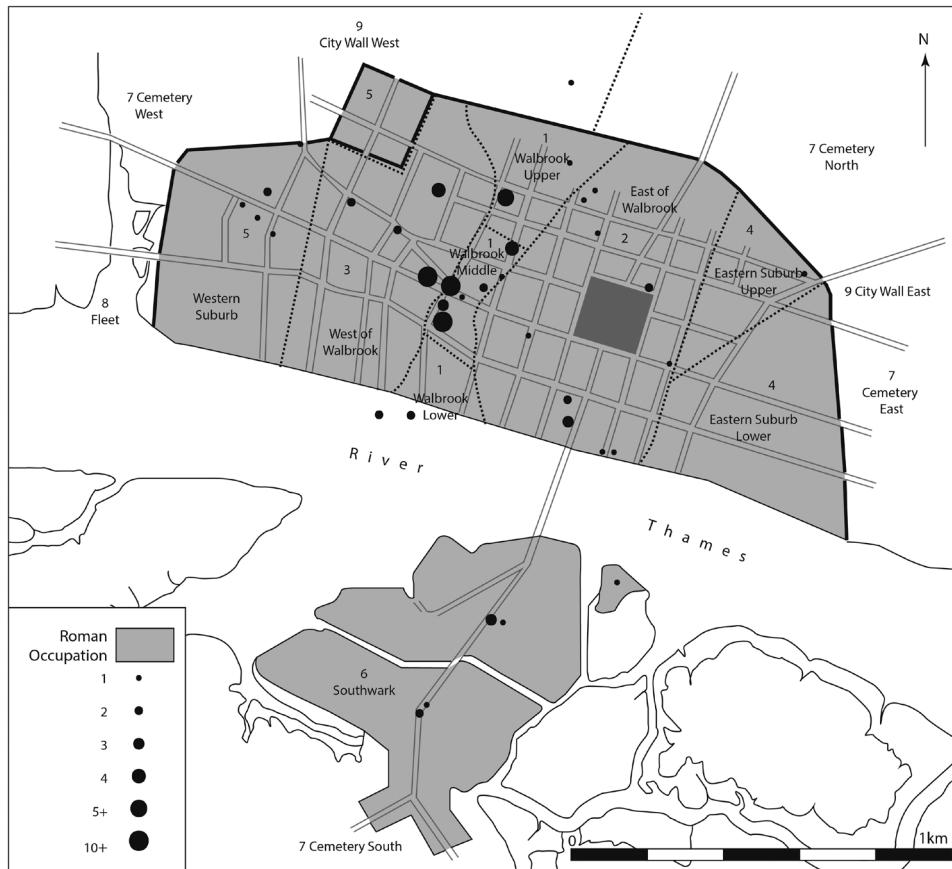


Fig 13. Distribution of all weighing instruments from London overlain with London's 'zones of occupation' (after Hall 2008, 170, fig 4.0.1) (scale 1:20,000)

and traders from 'Gaul, Germania and Spain' with a knowledge of Roman weights and measures are likely to have been a significant presence within this new community (*ibid*, 154–5). It is quite possible that pre-Boudican London was the nucleus for the 'central business district' of the Flavian boom town. With only two confirmed pre-Boudican pan weights from BGH95, it appears that the demand for weighing equipment in London increased from the Flavian period onwards.

In Figures 14 and 15 the object distribution is displayed as a comparison between balance types and their corresponding weights, to see if there is any distinction to be made between the type of weighing activity in different parts of the city. Unfortunately, only one dual balance find could be plotted on a distribution map. These maps therefore

show the different distributions of steelyards and weights and for equal/dual balances and pan weights.

A distribution of finds by material proved fruitless. Of 134 objects, only one is an iron steelyard, found recently at Bloomberg Place (BZY10). Two steelyard weights with iron shanks from 1 Poultry (ONE94) suggest the use of iron steelyards; however, without an associated arm, it can be argued that these weights were used to replace a lost weight on a copper-alloy arm, like the example from Gestingthorpe (Draper *et al* 1985, 41, fig 17, no. 136).

Some of the possible reasons for the high concentration of finds of weighing equipment within the Walbrook valley were discussed earlier, but there are other factors to be considered. For instance,

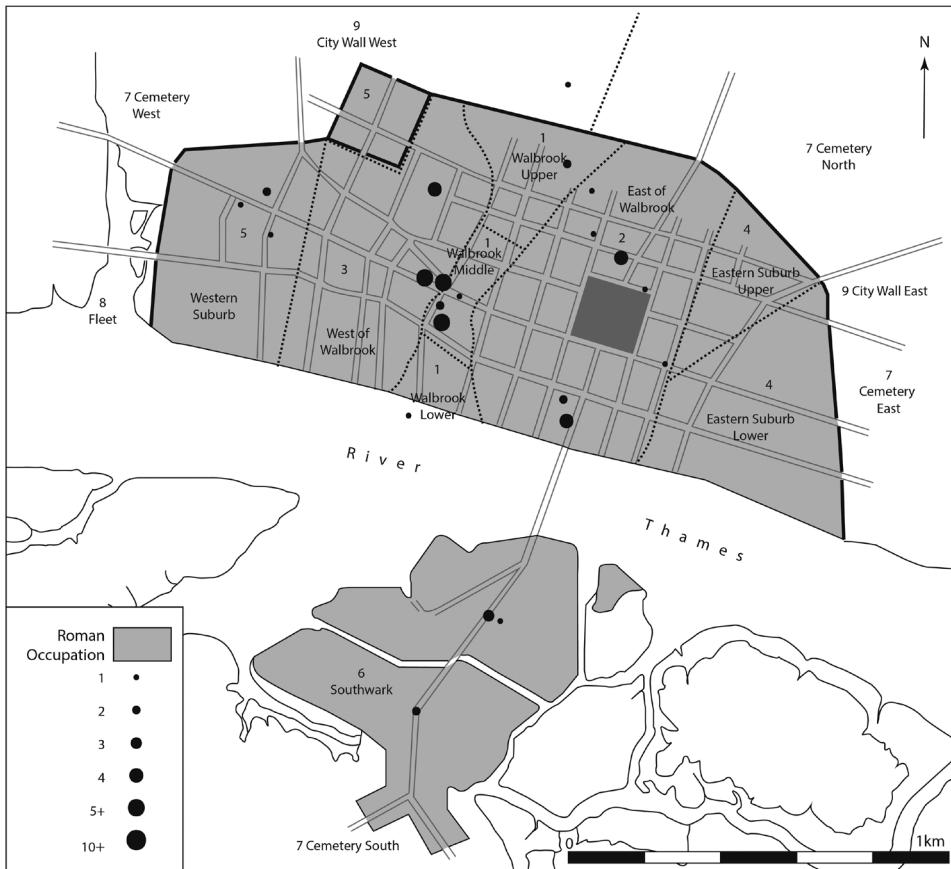


Fig 14. Distribution of all equal balances and pan weights overlain with London's 'zones of occupation' (after Hall 2008, 170, fig 4.0.1) (scale 1:20,000)

during the 1st and 2nd centuries AD large amounts of waste material were dumped into the Walbrook stream and on its banks as part of a process of reclamation (Wilmott 1991, 175). Exactly where all this refuse was derived from is uncertain, while much of it could have been produced locally, some of it might have been transported from more distant parts of the city (Wilmott 1991, 61–7, 168–71). Therefore, it cannot be proven that all these finds were used within the vicinity of the Walbrook. However, Merrifield (1995) suggested that many metal objects might have been ritually deposited within the Walbrook, so some of the weighing equipment finds might be votive. Equal balances are found primarily along the Walbrook valley and its environs. This might indicate a wider spread of weighing activity using equal balances

and a localised use of steelyards around the Walbrook. Unfortunately, due to the lack of locational data, only one dual balance (from the Bank of England) could be plotted. Another comes from this general area (recorded as from Queen Victoria Street) and a third example from London Wall. Along with these, only two figured weights from 1 Poultry, both of which are acorns, could be plotted.

Some areas of the Roman city appear to have no weights at all. Geographically these areas are the south-eastern and south-western corners of the Roman city, the Cripplegate fort and the area between the Walbrook and the forum (zones 4 & 5). These are potentially areas of the Roman city which were less densely settled during the late 1st and 2nd centuries AD than the Walbrook

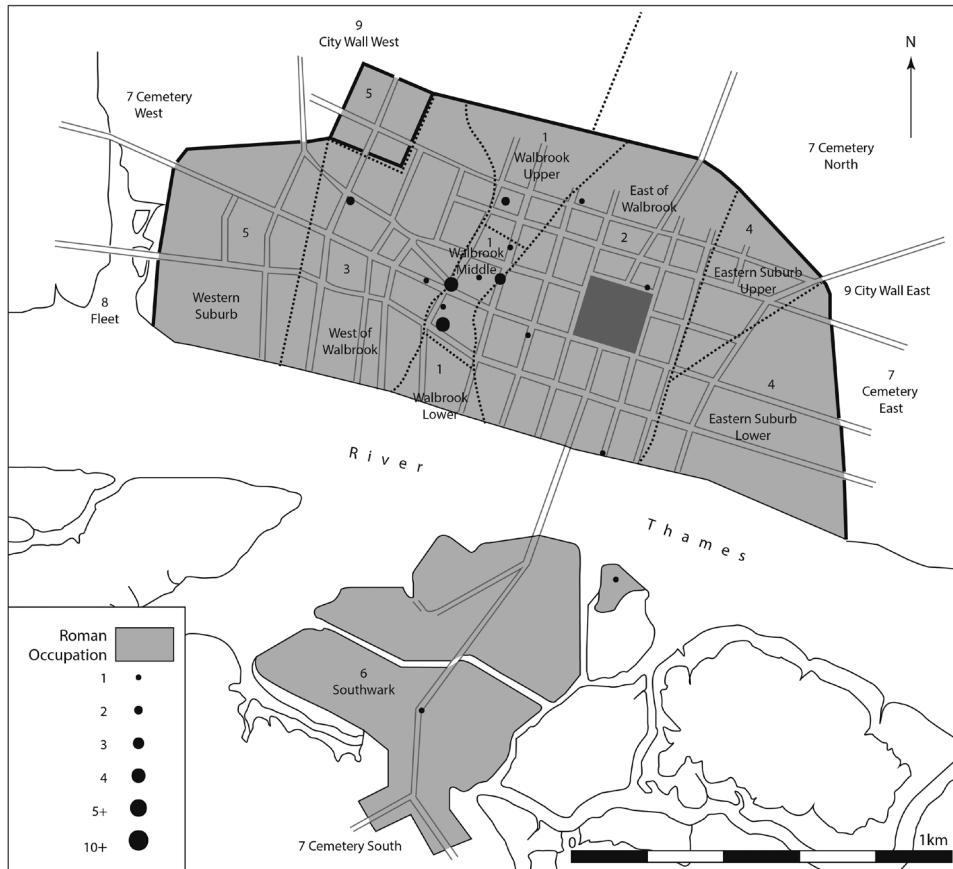


Fig 15. Distribution of all steelyards and steelyard weights overlain with London's 'zones of occupation' (after Hall 2008, 170, fig 4.0.1) (scale 1:20,000)

valley and its environs (Perring 1991, fig 15). In Southwark, equal balances and weights appear on three sites close to the bridge approach road (zone 6). The distribution of steelyards is in some ways like equal balances. There is evidence of commercial activity along the bridge approach road (Drummond-Murray *et al* 2002, 67–95).

Another area with relatively few finds of weighing instruments is the Thames waterfront. Two finds are from the western or upstream side of the Roman bridge (TEX88 & VHA89) and two from the eastern side (TR74 & LON08). Given the extent of the early Roman port facility and its associated warehouses (Brigham 1998), it might be surprising to see few weighing finds from this zone. For this scarcity, there are two possible explanations. First, the port

handled goods in bulk, so there was no need for commodities to be weighed on arrival, this happened later at other locations prior to retail. Secondly, weighing was possibly carried out in the port using large wooden scales with bronze or iron fittings. In the north-western provinces evidence for this sort of wooden balance is found along rivers and at ports (Franken 1993, 100–2, fig 18). In the MoL collection (Inv. No A51) is a suspension hook for a large wooden steelyard, like those published by Garbsch (1992). A hook from Fishbourne palace (Cunliffe 1971, 112, fig 46, no. 110) has been identified by Garbsch (1992, 236, no. 31) as half of a double hook attached to the load loop of a large wooden balance. There is also an iron terminus from Richborough (*ibid*, 256, no. 22). While it is possible that

wooden balances were used in the Roman port of London, to date none have been identified. However, two substantial timbers (both of which were at least 3m long) have been tentatively identified as the base of a possible 3rd-century dockside crane and adjacent working platform for unloading heavy cargo at Billingsgate (Brigham 1990, 171–2, fig 17). This unique structure could possibly be re-interpreted as the base of a large wooden balance with a counterweight. Although large Roman balances are known to have existed, the Billingsgate beams seem unusually large to have served as the base of a wooden balance. The largest known metal fitting for a wooden balance is 32mm long (Garbsch 1992, 249–50). A relief from Trier in Germany shows a man adjusting a large balance weighing a catch of fish (Franken 1994, 218, D8). However, this is hung from a ceiling, rather than on a scaffold. It is possible that it was the base for a large equal balance, as depicted on the Tomb of Eurisace (Eurysaces the Baker) in Rome (Corti 2001, 162, fig 94).

Another area of Roman London where no weighing equipment has been found is that of the extra-mural cemeteries (Fig 13, zone 7). In general, weighing equipment is very rarely found in Roman graves in Britannia, in contrast to the Anglo-Saxon period (Scull 1990; Kruse 1992). If within Britannia weighing instruments were closely linked with crafts and retail activity, then it is quite possible they were deemed useful and valuable items which were retained within the family. In Britannia, Roman balances have been found in doctors' graves (Künzl *et al* 1982, 61); possibly this practice only occurred when no one in their families had taken up this profession.

In comparison to finds of Roman keys within London (Rimell 2015, 123, fig 89), the infrequent and localised use of weighing instruments becomes apparent. The city's keys are found within most areas suggesting their widespread usage (*ibid*, 160). However, with little datable evidence, as well as the change of site usage over time, it is difficult to be sure of the context of their use (*ie* commercial or domestic) (*ibid*, 169).

LONDON'S TRADE AND INDUSTRY

During the 1st and 2nd centuries AD, London

was a hub of craft and retail activities potentially associated with weighing (Hill & Rowsome 2011, 291–305). This section addresses areas of weighing zonally: the Walbrook valley, the east and west of the Walbrook, the eastern and western suburbs, the waterfront area and Southwark (Fig 13).

At 1 Poultry (ONE94) there was evidence of iron smithing, copper-alloy and silver working, plus grain processing, leather and bone working, textile manufacture, dyeing, and butchery (Hill & Rowsome 2011, 389–99). A number of these crafts and activities could have involved weighing commodities. For instance, a 1st-century AD marble plaque from the Italian town of Pompeii depicts a bronze or coppersmith's workshop. One of the men depicted on the plaque is weighing out raw materials using a large equal arm balance suspended from the ceiling (Beard 2008, 167–8, plate 62).³ Though weighing instruments at 1 Poultry only made up 3% of the overall finds assemblage, this is greater than the percentages cited by Wilmott (1991, 169, fig 116) for artefacts of all types from Walbrook contexts. It may be significant that objects associated with writing (seal boxes, writing tablets, styli and inkwells) from 1 Poultry, which might relate to commercial activity or administrative functions, comprised 9% of the identified finds (Hill & Rowsome 2011, 389). Similarly, Bloomberg Place has produced a relatively large number of weighing instruments: at this site, there is evidence for a similar range of craft activities and industries to those identified at 1 Poultry (Michael Marshall, pers comm 2014). Previous fieldwork in the Walbrook valley has revealed evidence of millstones and a donkey-mill, implying the commercial production of flour (Perring 1991, 53).

There is also evidence of commercial activity on many sites to the east of the Walbrook valley and around the forum, including bread ovens (Perring 1991, 53). At Leadenhall Court (LCT84), some areas dating from the late 1st century AD have been interpreted as a residence for those working on the construction of the new forum-basilica (Milne & Wardle 1993, 36–7). Along with weighing instruments, seal boxes and styli were recovered. Food stores were also identified, which would require

weighing instruments for dispensing food (*ibid.*, 36). While many of the sites close to the forum have produced weighing instruments, there are no finds from inside it. However, this may be a reflection on the relative lack of modern investigation of sites within the forum-basilica complex with good survival of deposits. Although weighing is key to retailing some commodities, such as foodstuffs like meat, other goods such as ceramics, glassware, jewellery, shoes and textiles, to name but a few, do not require weighing during retail sales. Even some foodstuffs such as loaves of bread (if produced to a standard weight or size) might not have required weighing when retailed. This argument raises two possibilities. First, within the forum there was perhaps only limited trade in commodities that required weighing. Secondly, the stalls or shops within the forum may have been temporary and traders would therefore have carried their balances and unsold stock away when they packed up at the end of the day.

In the 'western suburb' most of the finds associated with weighing have been discovered along or near the axial street. In this area, it appears that the main streets were lined with shops (Perring *et al* 1991, 119). At the General Post Office (GPO75), strip buildings dating from AD 90–120 demonstrate that commercial or retail activity took place along the street frontage and to the rear were situated residential accommodation and craft workshops (Perring *et al* 1991, 13). The amphitheatre (GYE92) site also produced a single weighing find, which might suggest the presence of market stalls on games days.

In Southwark, an area of metalworking consisting mainly of iron smithing and smelting has been identified on the north-western edge of the main settlement (Hammer 2003, 30–44). Apart from one outlier, all the Southwark weighing instrument finds are from sites along the bridge approach road. In particular, STU92 and BGH95 revealed possible evidence from the late 1st to early 2nd centuries for a butcher's shop, a blacksmith's workshop, a bakery, a *macellum*, and an open market (Drummond-Murray *et al* 2002, 10), all activities and locations where weights would be expected. From BGH95 there are two pre-Boudican pan weights making up 3.5% of the accessioned finds

from this period (Drummond-Murray *et al* 2002, 213–5). From the site periods 4, 5 and 6 (AD 62–160) weighing instruments make up 2.6% of the accessioned finds, while those from period 7 (AD 60–400) make up 4.6%. However, although it is possible weighing activity continued in Southwark to AD 400, many of the weighing instruments could well be residual. BGH95 also produced a comparable number, although a slightly larger percentage than at Leadenhall Court (LCT84), a site close to the forum (LCT84 2.2%, BGH95 2.9%). Also, unlike LCT84, BGH95 produced metalworking waste and fewer recreational objects, suggesting more utilitarian activity (Drummond-Murray *et al* 2002, 215). The pre-Boudican pan weights are few and do not immediately suggest early crafts and trade associated with weighing.

The impression is that within early Roman London, retail activity, residential accommodation (possibly situated upstairs in some properties) and craft activity probably all took place within close proximity of each other (Hill & Rowsome 2011, 313–19, 411; Perring *et al* 1991, 119). However, as most of the weighing finds are from the commercial or industrial areas of Roman London, it is unlikely that weighing instruments were used in a domestic context.

CONCLUSIONS

This paper has analysed 324 finds from Roman London, of all types of balances and weights. It has sought to demonstrate a typology, chronology and distribution as well as the meaning and range of activities for which weighing instruments were used in Roman London. It has also demonstrated that the London assemblage of weighing equipment possesses both striking similarities as well as marked differences when compared with other parts of Britannia. While most of the finds of weighing equipment from Britannia are steelyards, the London finds, in complete contrast to the rest of the province, show a higher proportion of equal and dual balances, plus more examples of less common types. London also shows more variety in figured weight types than the rest of the province, suggesting a more culturally diverse population. Significant are the acorn weights which are mainly found

on military sites, or those which can be linked to military activity. The Bacchic and Mother Goddess weights from London are represented elsewhere in Britain. However, the only Mercury weight from Britain, which are numerous in other provinces (Franken 1994), is from London. This is surprising as Mercury is considered the god of traders. These weights also tend to be smaller than the plain weights, which suggests they were used to weigh items in smaller quantities and possibly of higher value. The symbol of a god or other figure can also suggest the reliability of the weight and therefore the merchant and the protection of trade by a deity (*eg* Bacchus, Cybele and Isis all protecting agriculture).

Most of the datable examples of London weighing finds are from the late 1st and early 2nd centuries AD, a time of rapid urban development which predominates in the archaeological record. The spatial distribution of finds of Roman weighing equipment is focused on the Walbrook valley, but it is difficult to assess what this means in terms of commercial activity, as the entire London metalwork assemblage is heavily biased towards this area. The most striking feature of the weighing equipment finds from London is their sheer number and diversity; clearly the population of Londinium engaged with new ways of measuring and weighing to an exceptionally high level when compared to other parts of the province.

ACKNOWLEDGEMENTS

I would like to thank Dr John Creighton and Dr Hella Eckardt for supervising this work as part of my MRes dissertation. Thanks to Martin Dearne, Hella, and Ellen Swift, and Bruce Watson for commenting on earlier drafts of this article. I would also like to thank the staff at MOLA and the Museum of London; particularly Michael Marshall, Dan Nesbitt and Caroline MacDonald for giving me access to and advice on the various collections during my research.

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ONLINE APPENDICES

(The following are available from the LAMAS website as a PDF file.)

Appendix 1: typology of weighing equipment from Britannia

Appendix 2: the sites and objects from London

NOTES

¹ It should be noted that the Mol. Inv. No. 1036 is only for the arm. The weight and pans do not belong to the arm and were possibly an addition based upon the find spot.

² The *libra* (0.329kg) was the basic Roman unit of weight used in all commercial transactions.

³ National Archaeological Museum, Naples, MANN 6575.

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