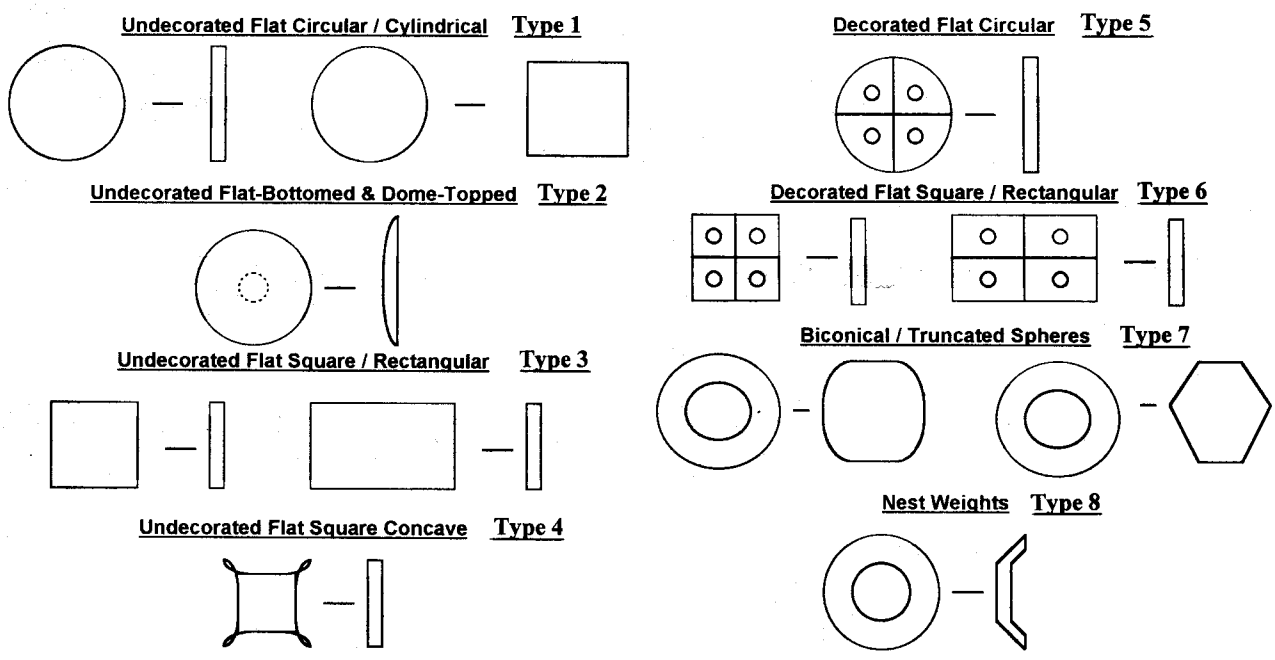


Fig. 1: diagrammatic representations of the eight weight types (illustration by Robert Drinkall)

Weighing it all up

Robert Drinkall
Judith Stevenson

THIS REPORT is a summary of a study of 115 weights from the off-site spoil of the Vintry site in the City of London, dated between the Roman and late medieval periods. The study was undertaken by Robert Drinkall and submitted as partial fulfilment of the requirements for a BA in Archaeology at University College London in 1994. The report was compiled by Judith Stevenson (Museum of London) and comments, along with the original references, are included in the footnotes, leaving the main text as a summary of the original author's study.

The aims of the dissertation were to produce a catalogue with illustrations and a comparative analysis of the literature concerning weights from sites in Britain and Ireland, and subsequently to determine if metrological systems were recognisable in the Saxon and Medieval weights: in particular whether documented standards such as the 15th century Troy weight and Henry III's 1266 standard (the Assize of Bread and Ale) were represented in the assemblage.

Archaeological investigations at the Vintry site were undertaken in three phases from 1989 to June 1991. Located on the waterfront at modern day Vintner's Place adjacent to Southwark Bridge, at 68 Upper Thames Street, the programme involved controlled excavation in the north of the site with a fairly extensive watching brief in the southern areas. In the watching brief areas, machined deposits were individually numbered before being loaded into lorries and taken to a secure dump site in Kent where each load was systematically searched with metal detectors by members of the Society of Thames Mudlarks. As a result, about one half of the total 9200 off-site finds, of Roman to post-medieval date, could be associated with specific areas of the site. As a waterfront site, those areas related to timber revetments and a predominantely vertical stratigraphy of infill between them. Extensions of the quayside ran from Roman through to the 14th century.

The catalogue

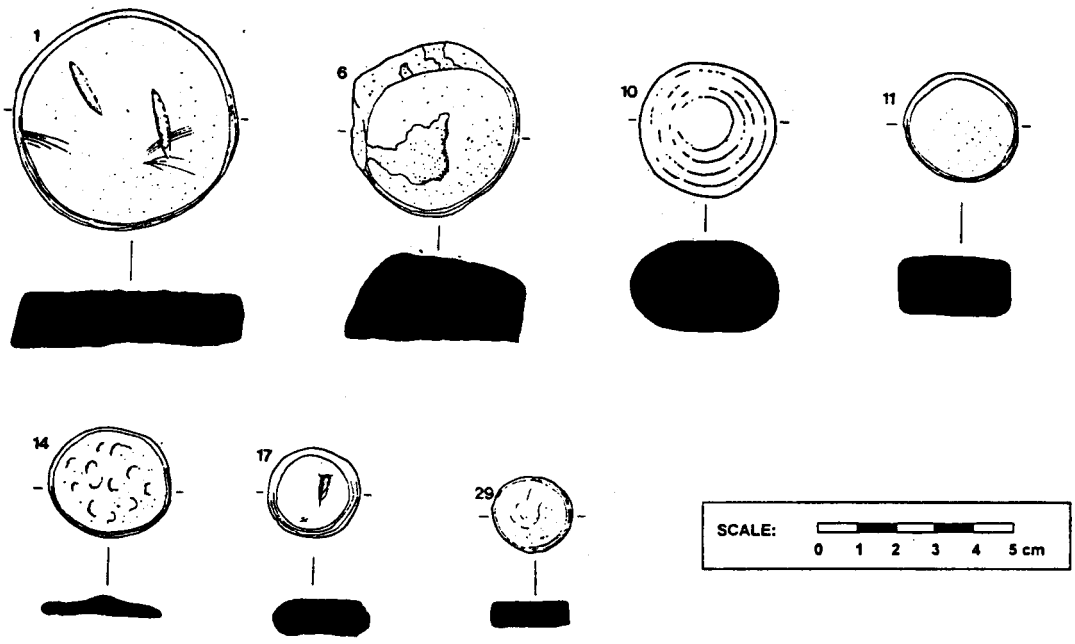
The weights selected for study included only those used in and on balance pans, and omitted all suspension weights[1]. There was one exception, a large 28lb weight (Imperial Standard measure), which may have held a suspension loop at the apex; this weight was, however, generally excluded from the analyses. Lead was the most commonly used material, with a few made in copper alloy and copper alloy with iron or lead.

The weights were divided into eight categories based on shape, material and surface decoration. Shape was the main element for the division to determine whether form correlated with specific

1. Identification of the weights was not always straightforward as lead tokens, plugs and other moulded leaden objects are very similar to some of the weight forms.

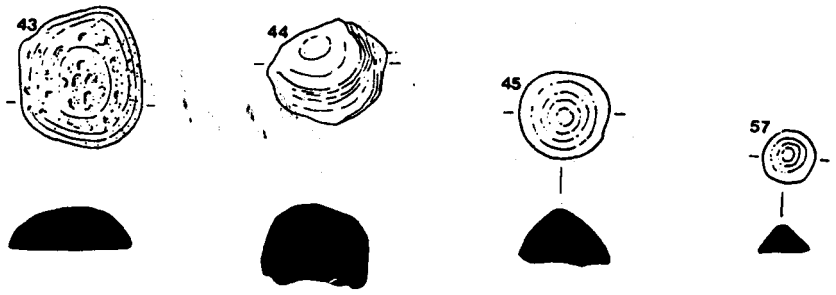
Type 1

Undecorated Flat Circular / Cylindrical



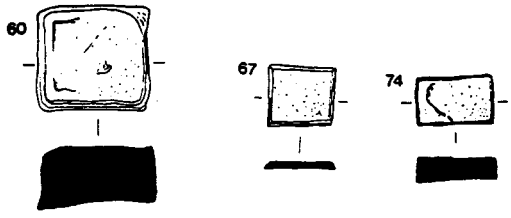
Type 2

Undecorated Flat-Bottomed & Dome-Topped



Type 3

Undecorated Flat Square / Rectangular



Type 4

Undecorated Flat Square Concave

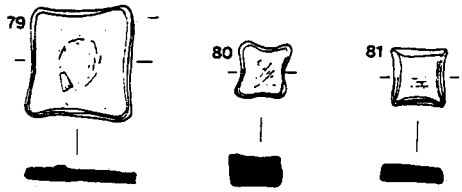


Fig. 2: a selection of weights, types 1-4. NB: the small numbers next to each weight are the catalogue numbers (illustrations by Robert Drinkall)

weights or if sets of weights could be identified. The eight categories can be seen diagramatically represented in Fig. 1.

The first four types are undecorated and made of lead; their forms are discoid or cylindrical, domed, flat quadrilateral (i.e. square or rectangular) and flat quadrilateral with concave sides. The next two categories are the decorated forms of the disc and flat quadrilateral weights, and are also made in lead. The decoration on these forms mostly favours a cross and pellets or simple pelleted design. The seventh group, that of biconical/truncated spherical weights, were mostly formed from either a lead or iron interior with a copper alloy coating, three and six examples respectively, whilst two were made entirely from lead. Examples of such weights where copper alloy coats a lead interior are usually Roman in date and those with an iron interior tend to be from late Saxon or Viking-age contexts[2].

Category	Description	quantity	weight range
1	Flat circular or cylindrical, undecorated	41	332–449.12g
2	Flat-bottomed, dome-topped, undecorated	16 (1)	657–202.97g (28lb)
3	Flat square or rectangular, undecorated	20	317–174.97g
4	Flat square with concave sides, undecorated	6	438–276.9g
5	Flat circular, decorated	11	464–439g
6	Flat square or rectangular, decorated	4	919–306.4g
7	Biconical/truncated spheres	11	545–558g
8	Nest weights	5	369–752g
Total		114 (115)	

Table 1: quantity and weight range for each type of weight

The eighth and final category are the nest weights which have the capacity to slot into or on top of each other, in the same way as Russian dolls. Four were formed in copper alloy and one in lead, and several exhibit a characteristic ring and dot design around the edge of the rim or foot[3].

The quantities represented in each category of weight are shown in Table 1, whilst Figs. 2 and 3 show a selection of illustrations of the weights from the original catalogue.

Many of the lead weights were irregular and very crudely formed[4], whilst others had been damaged or deliberately tampered with and several had been cut in half. These factors were noted in the archive catalogue as they may have a bearing on the type category assigned to individual items as well as their weight, in particular when damage or corrosion were in evidence.

Some parallels to the Vintry weights

Many of the forms from the Vintry waterfront spoil can be paralleled to examples from 10th-11th century contexts in Dublin, where over 200 weights have been recovered[5]. The general basic unit for these Dublin weights has been calculated to be around 26.6g[6]. Several late Saxon weights, for example from Coppergate (York), Ipswich, Thetford and St. Neots[7], show a similar range of forms to the Vintry types 1 and 2; and Viking-age truncated spheres – Vintry type 7 – come from Coppergate, Norfolk, Dublin and Haithabu in Scandinavia[8]. These truncated spheres have weights that concentrate around 24g[9]. Truncated spheres of Roman date, have been found at such places as Cambridge, Dorchester, Templeborough, Neath, Stragleath, Melandra Castle (Derbyshire) and Richborough[10].

2. S. Kruse 'Late Saxon Balances and Weights from England' *Medieval Archaeol* 36 (1992) 80. The iron or lead presumably supplied the bulk weight, with a copper alloy coating providing a durable and decorative outer shell; indeed three of these weights were also ornamented with incised decoration.

3. A further three examples of this form of weight were unavailable at the time of the original study and were omitted from the original catalogue and analyses.

4. It should be noted that variation of form within each category was wide, inevitably several examples did not fall easily into any one group. A number of the weights could therefore be placed in alternative categories.

5. P. F. Wallace 'The Economy and Commerce of Viking-Age Dublin' in K. Duwel *et al* (eds.) *Unterschungen zu Handel und Verkehr der vor- und fruhgeschictlichen Zeit in Mittel- und Nordeuropa*, IV, Der Handel der Karolinger-und Wikingerzeit, Abhandlungen der Akademie der Wissenschaften in Gottingen Philologisch-Historiche Classe, Dritte Folge, Nr. 156 (1987) 200-245; Kruse 1992, 86.

6. Wallace 1987, 212.

7. Kruse 1992, 79 and table 1, 87; A. Rogerson and C. Dallas 'Excavations in Thetford 1948-59 and 1973-80' *East Anglian Archaeol* 22, Norfolk Archaeological Unit, Norfolk Museums Service (1984) 74, fig 113.

8. H. Steuer 'Geswichtsgeldwirtschaften im fruhgeschichtlichen Europa-Feinwaagen und gewichte als Quellen zur Wahrungsgeschichte' in K. Duwel *et al* (eds.) *Unterschungen zu Handel und Verkehr der vor- und fruhgeschictlichen Zeit in Mittel- und Nordeuropa* IV, Der Handel der Karolinger-und Wikingerzeit, Abhandlungen der Akademie der Wissenschaften in Gottingen Philologisch-Historiche Classe, Dritte Folge, Nr. 156 (1987) 415.

9. Wallace 1987, 212; Kruse 1992, 86.

10. R. G. Collingwood and R. P. Wright *The Roman Inscriptions of Britain, Vol. II, Instrumentum Domesticum: Fascicule 2*, edited by S. S. Frere and R. S. O. Tomlinson, Stroud: Alan Sutton Publishing Ltd (1991), 2412.30, .39-43, .53, .64, .84, .85 and .96.

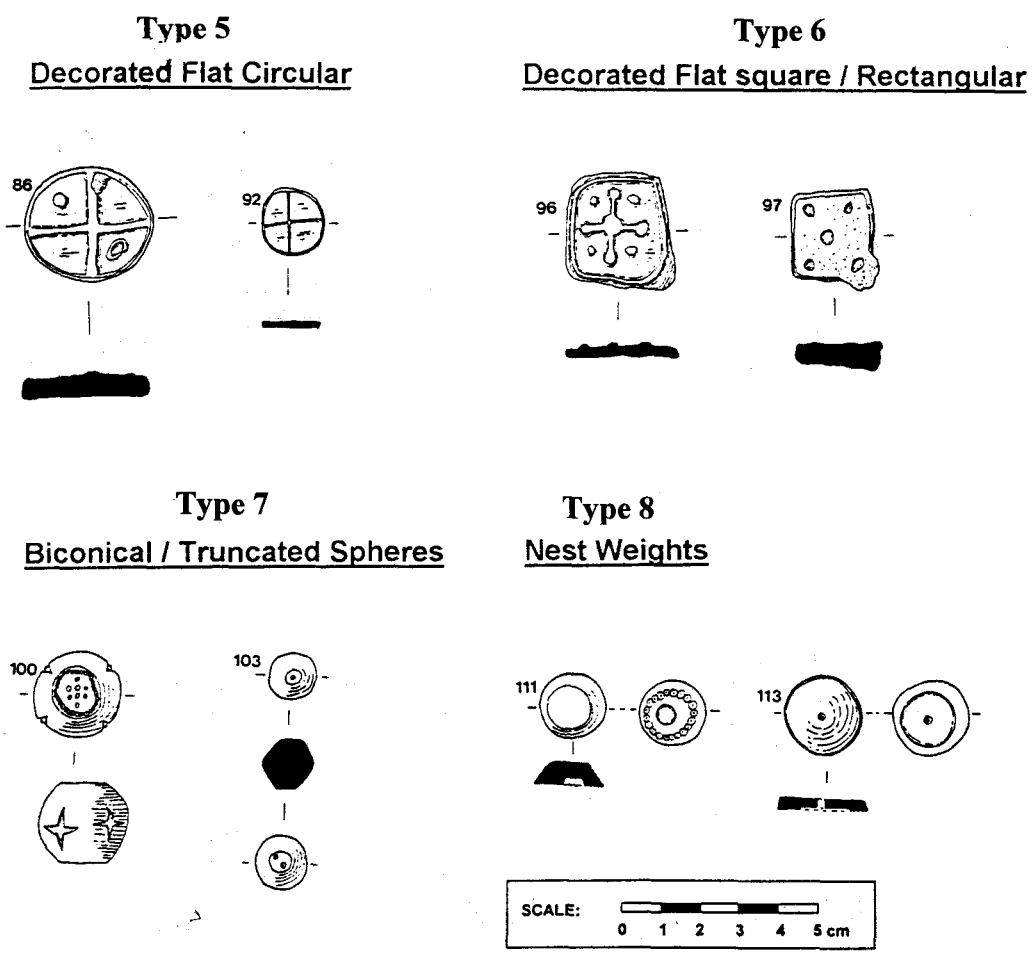


Fig. 3: a selection of weights, types 5-8: NB: the small numbers next to each weight are the catalogue numbers (illustrations by Robert Drinkall)

Possible flat circular weights or tokens of medieval date have been excavated from a mid-14th century context at Southampton[11] and from St. Peter's Street in Northampton[12]. Two large examples of these disc weights come from Winchester and date to the 15th-16th century, which are unusually late[13]. Copper alloy medieval nest weights have been found at Winchester[14] as well as from a mid-13th-early 15th century phase at Northampton[15].

The map in Fig. 4 shows the distribution of early Saxon, late Saxon and late medieval weights in England[16]. There is little published evidence for middle Saxon weights. Early Saxon weights, usually found in burials, seem to be located near rivers or coastal areas, and late Saxon and medieval weights appear to be recovered mostly from centres of economic importance, royal sites and ports.

Some notes on metrology

Standards of measure in use in Britain throughout the Roman, Saxon and medieval periods, are rarely agreed upon by current metrologists and appear to have been only loosely adhered to by users of the weights themselves, shown by the variety of actual values in archaeologically recovered weights.

11. Y. Harvey 'Other metals' in C. Platt and R. Coleman (eds.) *Excavations at Medieval Southampton 1953-1969. Volume 2: The Finds* Leicester University Press (1975) no. 1899, 269-270, fig. 246.
12. G. E. Oakley & B. W. Spencer 'The Lead Alloy Objects' in J. H. Williams (ed.) *St. Peters Street, Northampton: Excavations 1973-1976* Northampton Development Association (1979), nos.12-13, 265-266, fig. 115.
13. M. Biddle (ed.) *Object and Economy in Medieval Winchester* Vol. II, Clarendon Press, Oxford (1990) 920, fig. 281.
14. Biddle 1990, 922, fig. 282.
15. G. W. Oakley & L. E. Webster 'The Copper Alloy Objects' in J. H. Williams 1979, no. 93, 257-258, fig. 111.
16. Part of this map is based on C. Scull 'Saxon Scales and Weights' *Archaeol J* 147 (1990) 183-216, p. 206, Fig. 9.

The Roman weight standard based on 12 ounces (*unciae*) to the pound (*libra*) is widely accepted as 327.45g for a pound and 27.28g for an ounce[17]. For the Saxon period the fluctuations evidenced in coin weight make calculating equivalents for ounces and pounds very difficult, although it has been suggested by several scholars[18] that an average standard of 22.5 grains (1.46g) for one silver penny may have been established by Offa (AD 757-796)[19]. Viking-age weights may have been based around a standard of 24g[20].

After the Norman conquest, from the late 11th century, the penny appears to have stabilised at the level of 22.5 grains (1.46g)[21]. Specific values however are not mentioned in documentary sources until Henry III's Assize of Bread and Ale in 1266, which according to Skinner[22] allows values to be determined for both coinage and mercantile pounds. Using this, 1 silver penny weighed 22.5 grains (1.46g), 20 pennies equalled 1 ounce (29.16g), 12 ounces equalled 1 coinage pound (349.92g) and 15 ounces equalled 1 merchant pound (437.39g)[23].

Although the Troy weight system is believed to be traceable to at least the 13th century[24], if not as far back as the early Saxon period according to some scholars[25], it may not have been fully established until the 15th century, and Henry VIII abolished use of the so-called 'Tower pound' in favour of the Troy weight system in 1527. In this latter system 20 pennyweights equal 1 ounce and 12 ounces equal 1 pound, where a pound was 373.24g and 1 ounce was 31.10g.

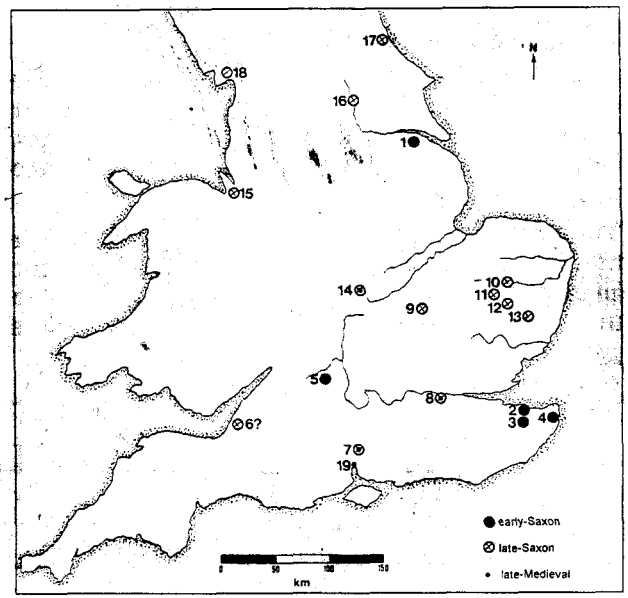


Fig. 4: map showing the distribution of weights from early Saxon, late Saxon and late medieval contexts in England. Key: 1, Barton-on-Humber; 2, Sarre; 3, Gilton; 4, Ozengell; 5, Watchfield; 6, Cheddar; 7, Winchester; 8, London (The Vintry); 9, St. Neots; 10, Thetford; 11, Mildenhall; 12, Ixworth; 13, Ipswich; 14, Northampton; 15, Chester; 16, York; 17, Whitby 18, Furness; 19, Southampton
(illustration by Robert Drinkall)

Metrology of the Vintry weights

The changes in actual weight due to damage and corrosion, coupled with the normal variation in range about an ideal weight and uncertainty about which (if any) standard system is represented, create many pitfalls for metrological analysis on weights themselves[26]. Furthermore, as Kruse noted for Anglo-Saxon weights and measures, no unbroken tradition can be demonstrated and there is a high possibility of concurrent standards and variations due to differences in region or commodities being weighed[27].

In the light of these factors it was decided that metrological analysis of the Vintry weights would not attempt to fit each artefact to a particular documented standard until after the initial analyses. Although the ounce weight has not been proven to have been used between AD 450 and the early medieval period, its use as a term in the Roman period (and weighing about 27.28g) and again in the 15th century (at 31.1g), along with a current understanding of the term, provided a useful interpretative measure for the study[28]. The analysis involved proposing an ideal weight (such as 1/20z or 20z) for each item and calculating the value of the ounce represented by that weight: for example, artefact weight = 14.58g, proposed value = 1/20z, therefore value of ounce =29.2g.

17. Collingwood and Wright 1991, i.
18. E.g. F. G. Skinner *Weights and Measures: Their Ancient Development in Britain up to AD1855* HMSO: Norwich (1967) 89.
19. A system of 20 pennies to the ounce and 12 ounces (240 pennies) to the pound was probably used at least by the late 8th century, if not all through the Saxon period, but the weight of a penny, whilst possibly aiming at an average of 22.5 grains (1.46g), in actuality varied between 16-27 grains (barley or Troy grains) which is 1.04g to 1.75g. Thus the weight of an ounce may have ranged from 20.8g to 35g (R. D. Connor *The Weights and Measures of England* HMSO, London (1987) 107-109, and Fig. 26).
20. Wallace 1987, 212; Kruse 1992, 86.
21. Connor 1987, 109.
22. Skinner 1967, 92.
23. Skinner 1967, 92.
24. Kruse 1992, 88.
25. In particular Connor 1987, 119-121.
26. Biddle 1990, 910.
27 Kruse 1992, 86.
28. Variation in actual weight of the objects result in only a handful weighing the same, which hinders analysis and interpretation. By pulling them into groups based upon the ounce a certain level of interpretation, or at least a simple comprehension, can be allowed.

For the Vintry weights, a value was proposed for each item using a range of 26.6g (Wallace's Dublin lead weight unit[29] to 31.1g (the Troy ounce) as a guide for estimating an ounce unit. However, for the biconical/truncated spheres a lower range of 24.4g to 31.1g, was allowed, the Dublin weights of this type providing the lower value[30]. It is not practicable in this article to illustrate the full metrological analysis: the proposed values for the 115 weights or resulting estimated values of ounces. Fig. 5 shows a simple exponential chart of the actual weights, in grams, of the entire assemblage. From this, groupings within say the hypothetical ounce range of 26.6 to 31.1g can be seen.

Interpretation

Several examples fitted or were close to the various specific values previously outlined, such as the AD 1266 and the Troy ounce values, but considering the range of values demonstrated in the assemblage, such matches hold little true significance. No single value for an ounce could be determined within one particular type and/or date range from the site. Even a small group such as the Type 4 flat square concave weights exhibited different ounce values, from 27.7g to 31.1g, despite their reasonable condition and their mostly being from areas 8-10 of the site (late 11th- early 13th century)[31].

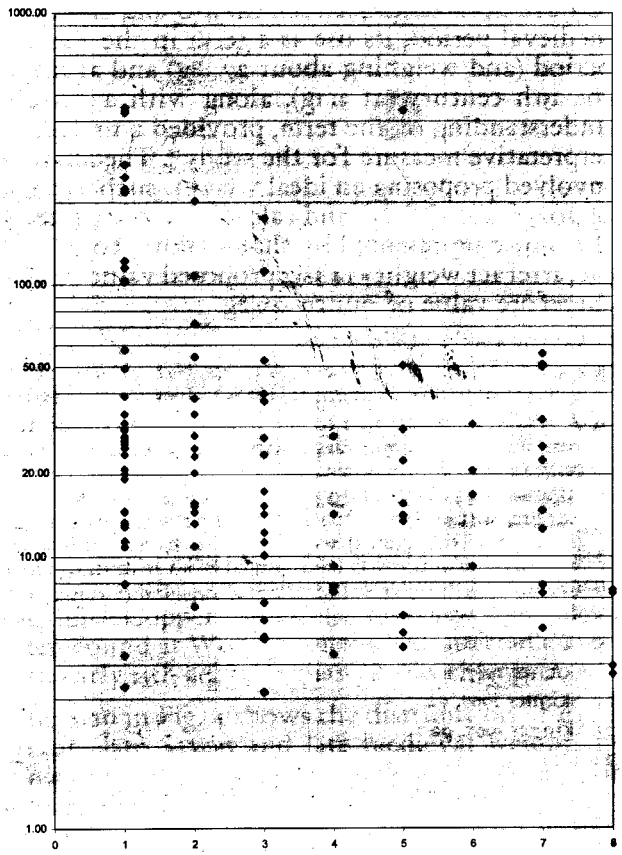


Fig. 5: exponential chart showing weight in grams (y axis), by type (x axis), for each item. A large group such as Type 1, shows significant clustering around certain values as 26g-31g, 102g-122g, 220-276g and 430g-450g, which may be interpreted as 1oz, 4oz, 8-10oz and 15oz (1lb) equivalents (chart by Judy Stevenson)

It appears there were no set values for individual shapes or decorative features. Wallace also found a lack of correlation between shape/decoration and weight in the Dublin examples[32]. Further, it would seem there was no one obvious standard system of weight values in operation between the late 10th and the late 14th century in London. As already noted, this may be due to weight standards being dependent on commodity or place of origin, or both. As a busy port, the Vintry must have been visited by merchants from various countries, regions and towns with their own systems of weights, possibly trading goods over time, with individual and changing systems of weighing.

Denominations of both 12 ounces and 15 ounces were noted amongst the weights, which may suggest that use of both the 12oz and the 15oz pounds are represented.

Due to the variation in weight values, no sets of weights were identified, except for the nest weight group which would be expected to form sets. Of the five originally catalogued, three weighed about 3.5g and two about 7.00g, and can be seen to be representative of 1/8oz and 1/4oz weights[33]. A set of five weights may therefore be envisaged, to include 1/16, 1/8, 1/4, 1/2 and 1oz[34]. Only three of the recovered weights came from datable assemblages, from areas 8-9 which were predominately of 11th to 12th century date.

The largest weight of the assemblage, of dome or bun shape, and which has not been included in the analyses, weighed approximately 12,700g, or 28 lb in the modern Imperial Standard measure (where

29. Wallace 1987, 212.
30. *Ibid.*
31. The difference between the estimated values of the ounce for Type 4 weights, amounts to 3.4g from the lowest to the highest. In real terms this may not be considered such a vast gap, especially if the commodity being weighed is relatively large. Alternatively as the Type 4 weights are all small, the largest weighing 27.69g, they may have been used for weighing light commodities where small divisions in weight sizes were required. If such were the case then the values proposed may have been better related to pennyweights or even grains rather than ounces.
32. Wallace 1987, 212.
33. One of the three uncatalogued weights (see fn. 3) weighed 28.4g and another weighed 13.97g, which would fit well into these groupings as 1oz and 1/2oz weights respectively. The weight of the third item was not recorded.

16 ounces equals one pound). Interestingly this weight is similar in appearance to several shown on a large balance pan weighing bales of an unknown commodity in the early 15th century Nuremberg Hausbuch manuscript[35].

Conclusion

The group of weights recovered from the off-site tips of the Vintry investigations represents the largest collection of weights so far extracted from a single site in England, and not including those recovered from the controlled excavations on the site. The Vintry collection therefore provided an excellent opportunity to study the different forms and features of weights used in London between the Roman and late medieval periods[36]. It was also possible to undertake a metrological analysis of the weights, with a view to establishing whether specific standards were represented and whether particular sets of weights could be detected.

As a result of the study it has been noted that on the whole shape and decoration bear little relation to weight or date, that no obvious sets of weights could be identified apart from the 'nest weights' and no precise ounce value was determined for any one period. On account of the latter observation it is argued that a number of different ounce standards were in use, and this range of ounce values probably reflects different commodities and regional variation, a view widely expressed by other authors[37]. Attempts to rectify these variations in weight values such as we have seen, were made by the introduction of systems of weights and measures like the AD 1266 Assize of Bread and Ale and by the establishment of the Troy weight system in the 15th and 16th centuries.

The types of weight and measure standards in use in any one period is often a source of heated debate, likewise the use of the term 'ounce' and any associated weight range. The Vintry weights have done little to alter the debate and if anything have added fuel to the fire. More definitive statements concerning the use of weight standards may have been possible if the assemblage had been recovered under controlled excavation with precise context and dating parameters, from which a typology with weight forms, values and dates may have been established. Perhaps using decorated weights to lead the way, future metrological studies should be directed towards the creation of such a typology. Certainly such an interesting and important subject still requires much further research.

Acknowledgments

Thanks are due to Roz Sherris and John Clark, at the Museum of London, for commenting on the text, and to Professor James Graham-Campbell and Gustav Milne of University College London for supervising the dissertation. The summary was published with the support of the London Archaeological Research Facility, and the City of London Archaeological Trust.

34. As one of the 1/40z weights and two of the 1/8 oz weights are the smallest of their sets, alternative set values may be more likely represented here, such as a 1/4, 1/2, 1 and 20z set, or a 1/8, 1/4, 1/2 and 10z set. From the Vintry evidence it seems that various nest weight sets were in operation.

35. W. Treue et al (eds) *Das Hausbuch der Mendelschen Zwolfbruderstiftung zu Nurnberg* (1965), Munich. Absence of other similarly large weights and a lack of significant quantities of even 120z and 150z weights suggests these were probably recycled for their metal content. Thus the archaeological record is left with the smaller denominations of measure, which probably cause a skewing affect on any analysis.

36. The Vintry site lay adjacent to the early 10th century trading establishment of Queenhithe, which from the late Saxon/early conquest period developed as an important centre of sea and river borne trade, and became renowned in the 12th and 13th centuries specifically as a centre for the wine trade.

37. Considering the site was a dock and a centre for trade, the number of foreign ships, merchants and merchandise in the vicinity would have been quite high. Inevitably some of the material found at the site may have been associated with this local activity and may therefore represent as much foreign or alien material, and in this case foreign or alien weights, as it would 'natively' produced or used weights and other artefacts.

Annual Lecture and General Meeting

THE TWENTY-SEVENTH A.G.M. of the *London Archaeologist* was held on Tuesday 14 May in the Lecture Theatre of the Institute of Archaeology. The following officers were elected – Editor, Clive Orton; Secretary, Nesta Caiger; Advertising and Promotion, Betsey Kentish; Subscriptions, Shiela Broomfield; Managing Editor, Nicholas Fuentes. The auditor, Tony Snitter, was thanked and re-elected. Representatives from the following local societies were elected to serve on the Publication Committee: Croydon, Erith & District, London & Middlesex, Orpington, Plumstead, and the Institute for the Study of Interdisciplinary Sciences. The accounts for the year showed a surplus of about £1200, most of which had been invested in a fresh stock of binders. After the close of business, Peter Rowsome spoke on the excavations at No. 1, Poultry.