

# It's later than you think: a statistical look at an archaeological problem

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ONE OF THE few axioms of archaeology is that a deposit is dated by the latest object in it — the terminal date of the deposit must be as late as, or later than, the date of the latest object. The question arises — yes, but how much later? The answer, as so often, is that it depends — in this case on the nature of the deposit and the nature of the dating evidence. For example, one might expect a greater timelag in the case of coins (which have a relatively long life) than in the case of coarse pottery (which has a relatively short life). To examine this question more closely, we studied evidence from three sites:—

(i) the Samian from the excavations at Toppings Wharf, 1970-72<sup>1</sup>, (ii) the Samian from the Highgate Wood excavations<sup>2</sup> (1968-71 only) and (iii) the coins from a pit at Lefevre Road, Bow<sup>3</sup>. Sites (i) and (ii) were chosen as contrasting sites — Toppings Wharf with 60cm of stratified Roman deposits, and Highgate Wood with little stratification, the features there consisting largely of pits, ditches and surface dumps. Lefevre Road was chosen because it presented a reasonably large number of coins from the same context, yet not a hoard (which would pose rather different problems).

## Samian

For both sites, only sherds which were dated to a reign (or a short span of reigns) within the 1st and 2nd centuries were studied. There were 391 such (from 161 contexts) from Toppings Wharf and 353 (from 132 contexts) at Highgate Wood. The data for Highgate Wood have been simplified, in that sherds given a date range spanning two reigns were assigned to the latter of the two, thus making the average date rather later than that originally given, but not significantly affecting the relative dating within the site. The data for Toppings Wharf were

not simplified in this way, but Samian from all deposits except well-stratified Roman layers was excluded.

Each sherd was then given a date: if there was one sherd from a period in a context, it was dated to the mid-year of the period, while if there were more than one, they were given dates spaced evenly through the period. This is the simplest statistical representation of our state of ignorance relating to the dating within the period. Each context was then given the date of the latest sherd in it, except that if a lower layer contained a later sherd, the date of that sherd was used instead. By subtracting the date of each sherd from the date of its context, we obtained the average "age at deposition" of each sherd (the latest sherd in each context generally having zero age). We then averaged these for each site, and arrived at answers of 10½ years (Toppings Wharf) and 19 years (Highgate Wood). These must be under-estimates, because of the assumption that the age of the latest sherd in each context was zero.

On a more realistic assumption that Samian does not age, i.e. that breakages were accidental and not the result of "wearing out," we proved<sup>4</sup> that the average age at deposition should be calculated by adjusting the above result by the factor "total number of sherds" DIVIDED BY ("total number of sherds" LESS "number of contents"). For example, the factor for Toppings Wharf is  $391 \div (391 - 161) = 1.70$ . This leads to average ages at deposition of 18 years (Toppings Wharf) and 29 years (Highgate Wood) — a large difference between the two sites. This difference is emphasised by the distributions of the ages at deposition (see Table 1).

The table shows that at Highgate Wood over 40% of the sherds were over 30 years old at time

**Table 1:** frequency distribution of average ages at deposition of sherds (other than the latest sherd in each context), assuming the age of the latest sherd to be zero.

Age at deposition (years)		1-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81+	total
Number of sherds	TW	79	92	42	13	1	—	3	—	—	230
	HW	50	32	44	20	37	19	9	8	2	221

1. *Trans London and Middlesex Archaeol Soc.* **25** (1974) 1-116.
2. Unpublished data. We are very grateful to Harvey Sheldon for allowing us to use data from this excavation and Toppings Wharf. Special thanks are due to Joanna Bird, who dated the Samian. This

use of the data is, however, entirely our responsibility.

3. *Trans. London and Middlesex Archaeol Soc.* **23** (1971) 42 (coin report by M. J. Hammerson).
4. This proof is not given here because of its extremely mathematical nature. It is available on request from the authors.

of deposition, nearly 20% were over 50 years old and 5% were over 70 years old, while at Toppings Wharf only just over 25% were over 20 years old at time of deposition and only 1½% were over 50 years old.

### Coins

Two deposits were studied — (a) the pit fill and (b) beneath the clay deposit over the floor of the pit. Of the 34 coins in deposit (a), 23 could be assigned to a reign, while of the 5 in deposit (b), 4 could be assigned to a reign. Using the same method as for the Samian, deposit (a) was dated to A.D. 398 and the average age of the 23 coins was calculated as 41 years, while deposit (b) was dated to A.D. 385 and the average age of the 4 coins was 48 years. The correction factors described above increased the averages to 43 and 64 years respectively, making the estimated date of the pit A.D. 400 and of the floor deposit A.D. 401—surprisingly close results. In this particular case the results should be treated with caution, because of the scarcity of coins dating to the 5th century. The final overall age at deposition was 47 years.

### Discussion

The dangers of using coins as dating evidence are well known<sup>5</sup> and need no further discussion here. The above calculations indicate that the use of Samian carries similar, if less extreme, dangers. One might say that on this evidence the Samian is from about ⅓ to ⅔ as unreliable as the coins, although this line cannot be pursued far. The difference between the two “Samian” sites is also of interest — in our view it reflects the more rapid build-up of deposits at Toppings Wharf rather than greater care lavished on the Samian at Highgate Wood. It seems likely that some of the Highgate Wood Samian was literally “kicking about” for some years before finally coming to rest. However, Samian does have the advantage that it is more common than coins, and that there is “safety in numbers.”

Some calculations based on our “no aging” model

(see above) indicate that if the average age at deposition of Samian is (for the sake of illustration) 30 years, then if N Samian vessels are represented in a deposit, the time-lag between the date of the latest Samian and that of the deposit will be  $30 \div N$  years on average. There are always variations about an average—our best estimate so far is that in more than one third of all examples, the time-lag will be greater than the average, in about one-seventh it will be greater than twice the average, in one-twentieth it will be greater than three times the average, for example. The figures in the table do not follow this pattern because they are based on an assumption which we know to be unrealistic. However, more work is needed in this area, particularly to take account of the fact that Samian can usually be dated to a range and not to an exact date.

What are the practical implications of all this theory? What does it mean for the average excavator of a Roman site? We can best show the implications by means of a hypothetical example. Suppose a site produces Samian from five well-stratified layers (perhaps floor levels) — L1, L2, L3, L4, L5 and five pits — say P1, P2, P3, P4 and P5. The dating of this hypothetical Samian is as in Table 2.

The “likely range” is a range of dates such that there is a 10% chance of the layer being earlier than the start of the range and a 10% chance of the layer being later than the end of the range. In other words, it is probable that of these ten features, one dates to before its “likely range,” one dates to after its “likely range” and the other eight have dates within their “likely ranges.” There is no way of telling (on the basis of this information) which are which. This example brings out three main points immediately:—

(i) both the lag between the latest Samian date and the expected date of the layer, and the length of the “likely range,” decrease in direct proportion to the number of vessels represented.

(ii) both these variables are smaller for well-stratified layers than they are for pits, ditches, etc.

**Table 2:**

Layer	No. of vessels	Date(s) of Samian	Date of layer	
			“expected”	“likely range”
L1	1	60	78	62 - 101
L2	2	60, 70	79	71 - 91
L3	3	60, 70, 80	86	81 - 94
L4	5	60, 65, 70, 75, 80	84	80 - 89
L5	10	5@70, 3@75, 2@80	82	80 - 85
P1	1	60	89	63 - 127
P2	2	60, 70	84	71 - 103
P3	3	60, 70, 80	90	81 - 103
P4	5	60, 65, 70, 75, 80	86	81 - 94
P5	10	5@70, 3@75, 2@80	83	80 - 87

5. See for example, Webster in *CBA Research Report No. 10* (1973) 1.

(iii) it is only the date of the *latest* sherd that matters in this context.

Other, more surprising points also emerge. For instance, the expected date of P2 is five years earlier than that of P1, although its latest sherd is ten years later. This shows the danger of comparing features with unequal amounts of dating material.

The example is unrealistic in one sense, because we have given the Samian exact dates, while in practice it would be given ranges. The effect of this would be to widen the "likely ranges," particularly for the larger groups, but the mathematics needed to say precisely how much wider they would be is yet to be worked out. It will, in fact, form the next stage of our work. Meanwhile we can say that it appears that a minimum of five vessels is needed to date a well-stratified layer with reasonable accuracy, and a minimum of ten for less well-stratified layers.

It is interesting to note that of the three main types of dating evidence for this period — coins, fine and coarse pottery, (i) coins can usually be

accurately dated, but have a high average age at deposition, (ii) fine pottery can be fairly accurately dated, and has a lower average age at deposition and (iii) coarse pottery can be least accurately dated, but has (presumably) the lowest age at deposition. It would be tempting (but highly speculative) to suggest that the aggregate effect of the two sources of error is about the same in each case — a sort of archaeological "Uncertainty Principle."

### Postscript

This was by no means a new problem. The use of Samian as dating evidence was discussed by Sir George Macdonald in 1935<sup>6</sup>, in reply to a paper by Pryce and Birley<sup>7</sup>. Hawkes and Hull<sup>8</sup> took the argument a stage further with a comparison of dating based on Samian and other evidence. We have really only tried to deal with half the problem — how long elapses between the manufacture of Samian and its deposition? The other half — how closely can the manufacture of Samian be dated? — is an even more difficult question to try and answer.

6. Sir George Macdonald, "The Dating Value of Samian Ware" *J. Roman Stud* 25 (1935) 187-200.

7. T. Davies Pryce and E. Birley, "The First Roman Occupation of Scotland" *ibid.*, 59-66.

8. C. Hawkes and M. Hull, *Camulodunum* (1947).

## Excavations

**City**, by Guildhall Museum, Department of Urban Archaeology. A series of long term excavations. Enquiries to Brian Hobley, Chief Urban Archaeologist, Guildhall Museum, 55 Basinghall Street, E.C.2 (01-606 3030 ext. 2217).

**Egham**, Petter's Sports Field, by Surrey Archaeological Society Motorway Rescue Group. Enquiries to Bernard Johnson, S.A.E.C., Montague Chambers, Montague Close, S.E.1. (01-407 1989).

**Enfield**, Lincoln Road, by Enfield Archaeological Society and DoE. An attempt is being made to pick up the line of Ermine Street; finds to date include ditches, clay floors, burials, etc. Full time excavation directed by Anne Gentry. Enquiries to John Ivens, 120 Hedge Lane, N.13 (01-886 1375).

**Fulham Pottery**, by Fulham and Hammersmith Historical Society. Excavation of 17th salt-glaze stoneware factory. Enquiries to V. R. Christophers, 86 St. James, Brighton, Sussex.

**Fulham**, by Fulham Archaeological Rescue Group. A site in the grounds of Fulham Palace, and other sites in Fulham or Hammersmith. Enquiries to Keith Whitehouse, 56 Tamworth Street, S.W.6. (01-385 6038).

**Hendon**, by Hendon and District Archaeological Society. Several sites in the coming months. Enquiries to Mrs. B. Grafton-Green, 88 Temple Fortune Lane, NW11 7TX (01-455 9040).

**Kingston**, by Kingston-upon-Thames Archaeological Society. Rescue sites in town centre. Further enquiries to Marion Smith, Kingston Museum, Fairfield Road, Kingston (01-546 5386).

**Line of M11**. Full-time work is taking place along the route of the proposed M11 in the Redbridge-Chigwell-Theydon Bois area. Enquiries to the M11 Field Officer, T. Betts, 3 The Green, Palmerstone Road, Buckhurst Hill, Essex (01-504 6708).

**Putney**, by Wandsworth Historical Society. Site off Gwendolen Avenue behind the police station, directed by Pat and Joan Loobey. Work on a north/south Roman road. Enquiries to 157 Longcliffe House, Arndale Walk, S.W.18 (01-874 9369).

**Southwark**, by Southwark Archaeological Excavation Committee. Several sites from the Roman period onwards. Enquiries to Harvey Sheldon, S.A.E.C., Montague Chambers, Montague Close, S.E.1 (01-407 1989).

**Staines**, by London and Middlesex Archaeological Society. A Roman site at the Friends' Burial Ground, Thames Street. Enquiries to Kevin Crouch (01-560 3880 day or 09-328 62874 eve).

**Wimbledon**, by John Evelyn Society. A series of excavations on the site of a Tudor manor house. Enquiries to Norman Plastow (01-947 2825).

### GENERAL EXCAVATIONS

The Council for British Archaeology produces a monthly *Calendar of Excavations* from March to September, with an extra issue in November and a final issue in January summarising the main results of fieldwork. The *Calendar* gives details of extra-mural courses, summer schools, training excavations and sites where volunteers are needed. The annual subscription is £1.25, post-free, which should be made payable to C.B.A., 7 Marylebone Road, N.W.1.