

## Finds from the fortress: artefacts, buildings and correspondence analysis

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### 25.1 Introduction

The full integration of structural evidence, artefacts and environmental evidence from an excavation is the holy grail to which all archaeologists aspire but few achieve. It is desirable because it would facilitate the process of comparing and contrasting by which a site is interpreted and set in a local, regional or national context. It is difficult because the artefactual and environmental data which need to be incorporated are so disparate. They include complete objects, ones that are virtually always found broken, and categories such as the by-products of craft or industrial processes where the concepts of complete or broken are irrelevant. The broken material itself can vary from objects such as a pottery vessel where all the fragments are likely to be discarded at once, to material such as animal bones from butchery which are likely to be discarded differentially. A major barrier to full integration is, therefore, the lack of methods of quantification that enable a potsherd or an animal bone to be counted in such a way that it can be directly compared to a bead. A promising start has been made by the development of the pie-slice program (Orton & Tyers 1992) that allows pottery data to be transformed into a form where it can be treated statistically as categorical data. This has the potential for being extended to other types of broken finds such as animal bones and building materials, and to allow direct comparison with unbroken finds (Orton & Tyers 1992, pp. 180–181).

Though total integration remains the goal, it is clearly going to be some time before it can be achieved. In this paper we wish to outline an approach to integrating the small find data with the structural evidence in a way which can be easily implemented and which has the potential to be a useful tool in exploring the nature of the activities that took place within a building. In summary this approach involves tabulating the artefacts by function and building or area of the site, and investigating the resulting table by correspondence analysis (CA, Greenacre 1984). This appears to be the first time that such an approach has been used to investigate function, although contingency tables and CA have been used to explore the chronological and spatial distribution of artefacts found during the excavations in the medieval city of Winchester (Barclay *et al.* 1990).

In this paper the specific archaeological problem that prompted the development of the approach will first be outlined, followed by the proposed solution. The correspondence analysis is then described, and the final section deals with the light this cast on the initial problem and the potential value of the approach outlined here.

### 25.2 The problem

In 1976 excavations were carried out at 9 Blake Street, York (Hall forthcoming), a site which lays in the *praetentura* of the Roman legionary fortress. The Roman sequence consisted of a short-lived phase of activity (Period 1) prior to building dated to *c.* AD 70/1. This was followed by two phases of timber buildings (Periods 2 and 3) dated to *c.* AD 71/79 – *c.* 100 and AD 100–160 respectively. A rebuilding in stone then took place (Period 4A). Working across the site from west to east, this consisted of the ends of two barrack blocks, a street, a narrow building, a passageway and a large building with courtyard. In the following discussions the last mentioned unit will be referred to as the main building. The Period 4A occupation lasted until *c.* AD 160–280. At that point the buildings were demolished and levelling with a dump of clay took place over the eastern part of the site (Period 4B). Occupation of an indeterminate nature took place over the western part of the site during the rest of the Roman period (Period 4C).

The interpretation of this site was beset with various problems. The rebuilding in stone and post-Roman intrusions had damaged and removed the evidence of the timber buildings to such an extent that it was not possible to reconstruct a coherent plan for them. In many fortress sites there is often a direct replacement of timber buildings by stone re-buildings following the same plan, and it was assumed that this had happened at Blake Street. Further problems arose with interpreting the complex composed of the narrow building and the main building. It is often possible to use the plans of one legionary fortress to help interpret another, but this was not a viable option here as the excavation had taken place in an area of the *praetentura* that had not been commonly investigated, and none of the other fortresses had produced complexes with similar plans. It was known from the study of the pottery and the animal bone that the narrow building probably had a different function to that of the main building, with the former probably acting as the service range for the latter (Monaghan 1993, p. 740). It was also known from the pottery, animal bone and small finds that there had been a change in rubbish disposal habits when the Period 4A structures were built as these were kept much cleaner than the timber buildings which had preceded them.

There were three questions to be asked of the small finds found during the excavation. The first was whether they could cast any light on the nature of the occupation in general. The second was whether there was a difference between the assemblage of the finds from the timber and stone phases, and the third was whether they reflected a



functional difference between the narrow building and the main building of Period 4A.

### 25.3 The solution

It was felt that the best way to approach these problems was to compare the small finds assemblages from the different periods and areas of sites with assemblages from buildings of known function within contemporary legionary fortresses in Britain. In defining the data sets we followed Crummy's (1983, p. 3) definition of a small find as being "an excavated object which needs more detailed initial recording, more detailed description in publication and possibly a more detailed environment for storage." Objects such as broken fragments of glass and metal vessels were excluded, as were structural finds such as iron nails. The occurrence of industrial waste such as slag in the assemblage from Blake Street was so small as to be negligible, and this category of find was also absent from the assemblages chosen for comparison. The assemblages so defined therefore consisted of categorical or counted data.

Assemblages for comparison were selected from elsewhere in the fortress at York, and from the fortress of the *legio II Augusta* at Caerleon. The only other contemporary legionary fortress in Britain is that of the *legio XX Valeria Victrix* at Chester, but no suitable assemblages of artefacts were available for comparison.

The excavations in the Prysge Field in the north-western corner of the *praetentura* at Caerleon (Nash-Williams 1931; 1932) provided several different sorts of assemblages. Parts of a series of buildings thought to be stores or workshops were excavated between the rampart and the *via sagularis* as well as parts of eight barrack blocks. The rampart buildings consisted of two successive phases. The earliest (Period IA) were thought to have been occupied between c. AD 120 and the late 2nd century. The second set of buildings (Period III) were built c. AD 200 and remained in full use until late in the 3rd century. They appear to have been finally destroyed towards the middle of the 4th century when they were, perhaps, already in disuse (Nash-Williams 1931, pp. 122–133). The excavator's interpretation of the Period IA buildings was that they were intended for administration rather than residential purposes (Nash-Williams 1931, p. 124). The succeeding Period III buildings were thought to be store rooms (Nash-Williams 1931, p. 131). The barracks were also of two phases. Timber barracks occupied between c. AD 75 and 105 were replaced by stone barracks intensively occupied until c. AD 200 (Nash-Williams 1931, pp. 135–155). It is possible to identify material from both centurions' quarters and the *conturburnae* of the ordinary legionaries.

Three assemblages from legionary bathhouses were also extracted from published records. Two came from the *frigidarium* drain deposit at Caerleon which incorporated items lost and discarded by people using the baths. The material in drain deposit 1 was derived from activity between c. AD 75–110 and that in drain deposit 4 between c. AD 160–230 (Zienkiewicz 1986, p. 13). A similar, but less closely dated, assemblage came from the Church Street sewer in York (MacGregor 1976).

Two other assemblages from York were included for comparison, though the nature of the buildings the assemblages came from was unknown. These were a small group of material from trial excavations and watching briefs at the Purey Cust Nuffield hospital in the *retentura* of the fortress (Frere 1987, p. 319), and a slightly larger group from Trenches 2 and 3 at 14 Little Stonegate, 18 Back Swinegate and 12–18 Swinegate (Frere 1991, p. 241). The latter excavation was in the *praetentura* of the fortress in the vicinity of the legionary bathhouse at St. Sampson's Square (*Eburacum* 42), and possibly formed part of the bathhouse complex. Full details of all the artefacts from these two sites and from 9 Blake Street are available in Cool *et al.* (forthcoming).

All of the assemblages chosen for this analysis were ones where the preservation conditions were broadly similar with the exception of the Church Street sewer where ironwork did not survive. Organic material like bone survived at all sites, but as none were waterlogged, objects made of leather and wood were absent. All the assemblages were, therefore, directly comparable and no complications were introduced by differential survival.

The artefacts in an assemblage were assigned to a functional group broadly following the categories introduced by Crummy (1983). These were further refined by dividing the military equipment category into two separate ones of weapons and armour. The personal ornaments and equipment were also divided into two separate functional groups. One consisted of those that were likely to have been used by both sexes such as brooches, finger-rings and hobnails, and those that were likely to be used only by females. Into this category were placed hairpins, bracelets and small beads. It was felt that the latter division might be helpful as, in theory at least, the only females in a fortress should be those in the households of the senior officers. Ten functional categories were present in the assemblage and these were as follows:

- 1 weapons
- 2 armour
- 3 writing equipment
- 4 fittings from furniture etc.
- 5 tools
- 6 personal ornaments and equipment suitable for both sexes
- 7 weighing equipment
- 8 personal ornaments and equipment suitable for females
- 9 objects associated with recreation
- 10 toilet and medical equipment.

The small number of artefacts that could not be identified and the objects such as rings which could have served a number of purposes were omitted.

### 25.4 The analysis

The data from the various assemblages are presented in Table 25.1 in the Appendix. By arranging the rows (assemblages) and columns (functions) of the table so that buildings which have similar assemblages are grouped together, some features become immediately apparent. The assemblage from the period III rampart building at the Prysge

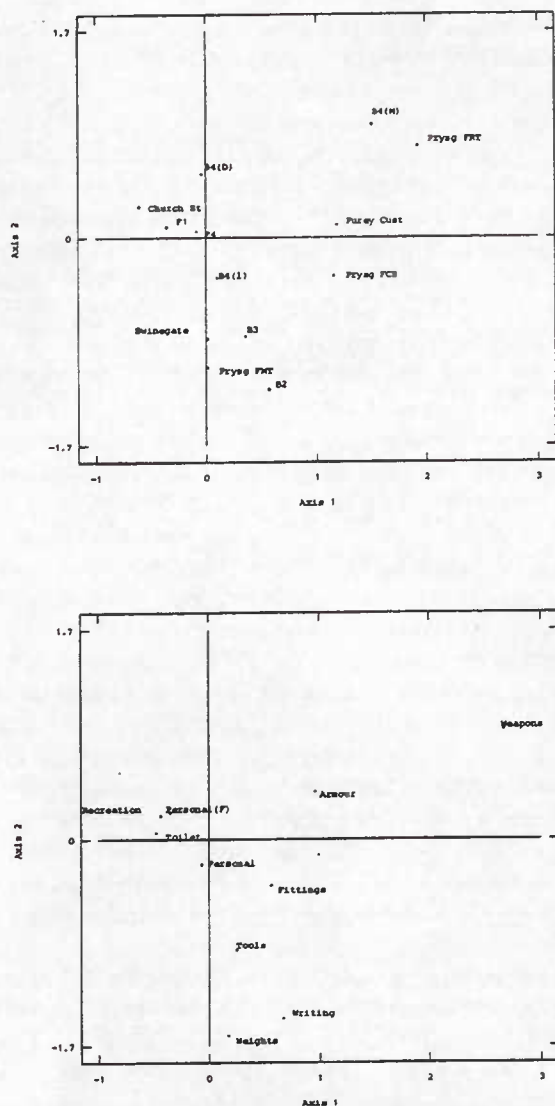


Figure 25.1: Correspondence analysis for the data of Table 25.1. The upper plot is of the sites and the lower plot of the functions. Site identification in the upper plot, where not self evident, is given in the appendix; in the lower plot "Personal" and "Personal (F)" refer to personal ornaments worn by both sexes and personal ornaments worn by females respectively; other function identifications are given in full in the appendix.

field, Caerleon is extraordinary. No other assemblage is dominated in this way by finds belonging to a single function. Weapons storage, repair and possibly manufacture were certainly taking place in this building, and it has been suggested that it was an *armamentarium* (Bishop and Coulston 1993, p. 200). The table also shows how similar the drain deposits from the bathhouses are, and how they stand in opposition to some of the assemblages from barracks and stores. It will be noted that some of the assemblages had a very small number of artefacts. It was decided to exclude the smallest assemblages from the statistical analysis because of their potential influence on the results and, a little arbitrarily, assemblages with five or fewer artefacts were omitted. It was also clear that the assemblage

from the Period III rampart building at the Prysog Field would clearly form an outlier in any analysis, so it would be sensible to exclude that assemblage as well.

The data presented in Table 25.1 can be presented graphically by the statistical technique of Correspondence Analysis (Greenacre 1984, Baxter 1994). Put simply, CA is a technique for representing tables of categorical data in pictorial form, allowing a quick visual appreciation of the similarities between one row and another and one column and another. The output is presented here as two adjacent plots (Fig. 25.1). For the rows, the raw data are converted to function profiles and the row plot shows which sites are relatively similar to each other in relation to their function profile.

Columns are similarly processed and the column plot shows which functions are relatively similar to each other in relation to their site profile. Away from the origin a group of sites in one area of the site plot, will generally have a more than usually high proportion of artefacts belonging to the functions plotted in the same position, relative to the origin, on the function plot.

Correspondence analysis has been applied to archaeological problems since the mid 1970s, most frequently by French and Scandinavian scholars, and often for the purpose of seriation. It is only since the late 1980s, however, that it has received wider usage as evidenced, among other things, by presentations at CAA conferences and journal publication. Methodological details, and a comprehensive bibliography, are given in Baxter (1994). The analysis here was carried out using the statistical package MINITAB with macros written by the second author. Coordinates were saved and read into the STATGRAPHICS package to produce the graphs, using the superior graphics facilities of that package.

A CA on the data in Table 25.1 was carried out excluding the assemblages from the Prysog Field Period III rampart building, the timber phase of the centurions' and the stone phase of the men's barracks at Prysog Field, and the narrow building from Period 4A at Blake Street. The result is given in Fig. 25.1, which shows the plot of the first axis against the second axis.

The column or function plot clearly shows that even with the Period III occupation of the Caerleon rampart building excluded, sites with a more than usually high proportion of weapons should be clearly distinguished from other sites. The row or site plot suggests three clusters of sites with similar function profiles. The first group consists of the Period IA occupation of the rampart building at Prysog Field and the occupation of the main building at Blake Street. Reference to the column plot shows that these contain a more than usually high proportion of weapons. The second group consists of the three bathhouse drain deposits which, unsurprisingly, show a more than usually high proportion of items associated with recreation and females. The third group consists of the assemblages from Swinegate, the timber phase of the occupation at the men's barracks at Prysog Field and the Period 3 occupation at Blake Street. In the column plot, items associated with writing and weighing occur in the same relative position. As these two function categories were the ones with the smallest number of



individual items, however, their influence has to be viewed with caution. The presence of the Swinegate assemblage in this position is interesting given the position of the site in the vicinity of the bathhouse at St. Sampson's Square. It clearly does not have a function profile similar to that derived from inside a bathhouse.

When the row plot is inspected in relation to the function profiles of the different areas and periods of occupation at Blake Street, interesting differences emerge. Those of Periods 2 and 3 are the most similar and they are in marked opposition to that of the Period 4A main building. The profile of the finds from the Period 4B dump and from the Period 4C activity are different from both those groups and from each other. It can be suggested that the Period 2 and 3 function profiles accord well with what can be expected in a building or buildings where a variety of activities were taking place, such as a barrack. The occupation in the main building, by contrast, appears to have been far more specialised. The function profile associated with the activity is closest in this data set to that for buildings which, it has been suggested, were used for administrative purposes although this profile is poorly represented on the plot (see below). The assemblage from the narrow building is so small that it was excluded from the correspondence analysis but as can be seen from Table 25.1 it does appear to be markedly different from that of the main building and to those of Periods 2 and 3.

The quality of the plots is reasonable, though not perfect, with 69% of the total inertia accounted for by the first two axes. It is also possible to measure the quality with which individual points are represented on the plots; for example "weapons" in the lower plot in Fig. 25.1 is almost perfectly represented with quality 0.97. Sites and functions that are poorly represented by the plots are the Caerleon baths drain deposit 4 (0.22) and the Blake Street Period 4C activity (0.11) in the upper plot, and personal ornaments (both sexes) (0.27), weighing equipment (0.29) and toilet and medical equipment (0.28) in the lower plot. No other point had a quality of representation less than 0.41 and most were well in excess of this. Caveats concerning interpretation of the plots associated with the poor representation of these points do not affect the broad interpretation given above.

## 25.5 Conclusions

In the section on "The problem" above, three questions were asked of the small finds assemblage from 9 Blake Street. Could the small finds cast any light on the nature of the occupation in general; did they reveal a difference between the timber and stone phases; did they reflect a functional difference between the narrow building and the main building of Period 4A? The analysis described above produced useful answers to the first two questions and a partial answer to the third.

The analysis made it clear that the small finds assemblages from the timber periods and from each of the three different phases of Period 4 were different from each other. This presumably reflects the fact that different activities were being pursued at different times. In such cir-

cumstances it is clear that the first question was poorly posed as a general overview is not appropriate.

There is a very clear distinction between the assemblages from the timber and the stone buildings. This strongly suggests that the nature of the activities carried out in the buildings changed between Period 3 and Period 4. Given that different sorts of activities in legionary fortresses are often reflected in the different types of buildings present, the evidence of the small finds suggests that it would be most unwise to assume that the timber buildings of Periods 2 and 3 had the same form as the stone buildings of Period 4A. This evidence from the small finds cannot be judged in isolation but must be viewed alongside that from other classes of material culture found on the site. The most useful of these are the pottery and, to a lesser extent, the glass vessels. The data from both of these suggest that there may have been a break in occupation during the second half of Period 3. The evidence from the small finds and the vessels can be set within the historical context of the change of the York garrison that is known to have taken place during the second century. The first garrison at York was the *Legio IX Hispana* which is known to have been present as late as AD 107-108. At an unknown, later time within the second century the *Legio VI Victrix* became the garrison of the fort (*Eburacum* 6). It is not unreasonable to suggest that a degree of re-planning may have taken place in the peripheral areas of the fortress as the new garrison established itself at York, especially if the fortress had been run on a care and maintenance basis for a number of years. As the vessel evidence would seem to indicate.

The answer to the third question relating to a difference in function between the narrow and main buildings was ambiguous. Given that the buildings were deliberately kept clean, the amount of data available for interrogation was small. Indeed, the assemblage from the narrow building was too small to be included in the correspondence analysis. Inspection of Table 25.1 suggests that there was a difference in the nature of the small find assemblages of the two buildings, but it is far less clear-cut than the evidence of the pottery and animal bone.

Turning now to the wider applications of the approach outlined in this paper. We believe that it is a useful way of exploring small find data as it is a relatively quick way of carrying out intra- and inter-site comparisons. The data set we have explored has been a relatively small one easily presented in a table of 17 rows and 10 columns. It could be argued that with experience the inspection of Table 25.1, especially if presented as row percentages, would be sufficient to suggest many of the conclusions that were drawn from the full CA. We agree with this conclusion, but would suggest two reasons why it is useful to conduct the CA. The first is that Table 1 is relatively small. In many cases a similar table of data would be much larger and consequently more difficult to interpret by eye. The second reason is that CA can be used to suggest an ordering of rows and columns in tabular form that assists in presentation and interpretation. The original table of data was not arranged in this way, but was reordered using the result of a CA on that table. The reordering of the functions was done by projecting the points on the column plot onto the horizontal axis,

SITE	FUNCTION										n
	1	2	3	4	5	6	7	8	9	10	
1	119	6	0	0	0	0	0	1	0	0	126
2	1	3	0	0	0	1	0	0	0	0	5
3	4	16	0	6	0	0	0	1	0	0	27
4	2	3	0	1	0	0	0	1	2	0	9
5	1	4	0	3	0	4	0	0	0	0	12
6	4	6	1	3	5	11	0	0	0	0	30
7	0	1	1	3	3	2	0	0	1	0	11
8	0	4	3	11	5	9	1	2	7	1	43
9	0	0	1	1	0	2	0	0	0	0	4
10	0	2	0	0	0	1	0	2	3	0	8
11	0	1	0	1	2	0	0	2	2	0	8
12	0	0	0	3	4	9	0	0	1	3	20
13	0	0	0	1	2	5	1	1	1	0	11
14	0	41	2	28	13	88	1	116	53	15	357
15	0	4	0	4	3	43	0	49	28	2	133
16	0	0	0	1	0	0	0	1	1	1	4
17	0	0	0	2	3	10	0	27	44	12	98

Table 25.1: Summary of the assemblages from York and Caerleon

and then rearranging the columns in the order shown on that axis. The reordering of the sites was done by treating the row plot in the same way, and then rearranging the rows. This proved to be a far quicker way of reordering a table than any mechanical method.

From a statistical point of view the application of CA in this paper has been a routine one. It was originally suggested by the second author as an approach to questions of the kind addressed in this paper posed by the first author, and has proved fruitful. If only a relatively small number of contexts are of unknown function one possible extension would be to plot them as supplementary points on a plot determined by contexts of known function (Greenacre 1984). Another useful extension — not yet generally available — to assess the stability of the plots, particularly for contexts with few artefacts, would be bootstrapping (Ringrose 1992).

This approach to the analysis of small finds data also has the potential for easy integration with the analysis of broken data such as pottery fragments, which have been transformed using the pseudo-count transformation of the pie-slice program (Orton & Tyers 1992, p. 170). Together they promise to be a very powerful aid to integrating the different classes of material found in excavations and thus of interpreting sites.

## Appendix — The data

Key to table 25.1.

### Function

- 1 Weapons
- 2 Armour
- 3 Writing equipment
- 4 Fittings
- 5 Tools
- 6 Personal ornaments (both sexes)
- 7 Weighing equipment
- 8 Personal ornaments (female)
- 9 Recreation equipment
- 10 Toilet and medical equipment

Sites (and identification used in Figure 25.1)

- 1 Prysge Field Rampart buildings Period III
- 2 Prysge Field Men's barracks — stone phase
- 3 Prysge Field Rampart buildings — timber phase (Prysge FRT)
- 4 Blake Street Period 4 Main Building (B4(M))
- 5 Purey Cust
- 6 Prysge Field Centurions' Barracks — stone phase (Prysge FCS)
- 7 Blake Street Period 2 (B2)
- 8 Blake Street Period 3 (B3)
- 9 Prysge Field Centurion's Barracks — timber phase
- 10 Blake Street Period 4 — dumped material (B4(D))
- 11 Blake Street Late Period 4 activity (B4(L))
- 12 Swinegate Trenches 2 and 3
- 13 Prysge Field Men's Barracks — timber phase (Prysge FMT)
- 14 Fortress Baths Drain Deposit 4 (F4)
- 15 Fortress Baths Drain Deposit 1 (F1)
- 16 Blake Street Period 4 — Narrow range
- 17 Church Street sewer

## Abbreviations

Eburacum. *An inventory of the historical monuments in the city of York*. Volume I. Eburacum Roman York Royal Commission on Historical Monuments England, HMSO, 1962.

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