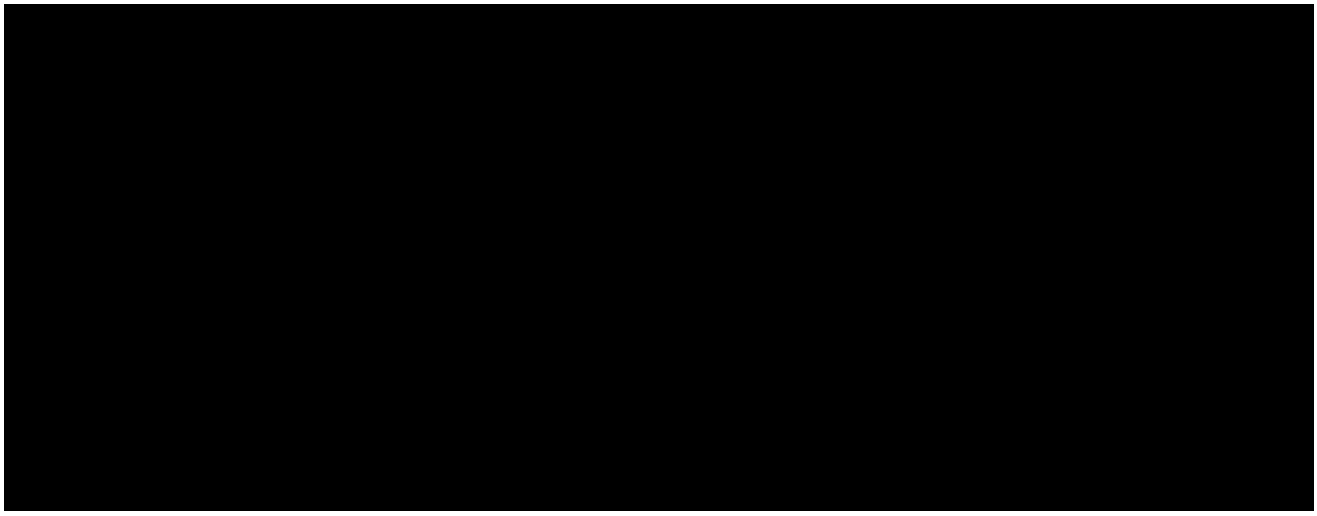

COMPARISON WITH EXCAVATED AND METAL-DETECTED FINDS IN THE WIDER REGION

By Kris Lockyear, Philippa Walton and Hella Eckardt

In this section, we compare the functional composition of the riverine assemblage with assemblages from excavations at Piercebridge, Catterick and Binchester, as well as a dataset of Roman finds recorded by the Portable Antiquities Scheme in the North-East. Catterick and Binchester were selected as comparative sites due to their military nature and proximity to Piercebridge. Although neither were excavated or published to modern standards, their finds assemblages are published in such a way that it is possible to extract data relating to functional category. Binchester is a smaller assemblage overall, and it should be noted that the Catterick[90] assemblage comprises finds from multiple sites, some with very different characters.

A further comparison is provided by a north-eastern dataset from the Portable Antiquities Scheme. It combines all Roman material (except coins) from the counties of North Yorkshire, County Durham and Tyne and Wear along with the unitary authorities of Redcar and Cleveland and Middlesborough and represents approximately 20 years of recording by the Portable Antiquities Scheme in the region. The majority of finds recorded were retrieved by metal-detector users whose recovery and selection biases may be similar to those of the Piercebridge divers. The relative paucity of material suggests low levels of metalwork acquisition, use and deposition within the region either deliberately or as rubbish. Table 22.2 summarises the composition of these assemblages.

We have employed a statistical technique known as Correspondence Analysis (CA) to compare the assemblages. CA examines the distribution of finds across the categories and sites to find patterns in the data, weighting the sites and categories by assemblage size to reduce the impact of smaller groups. The underlying assumption is that while there are taphonomic and depositional factors affecting the overall representation of certain objects, these largely relate to material and size and should affect all sites roughly equally. Therefore, any significant variations in the distribution of finds are likely to relate to patterns of activity and behaviour in the past (Cool and Baxter 1999, 73).

The principal aim of CA is one of data reduction, that is it attempts to show the major patterns in a table of data in one or two 'maps', but to do so, it has to discard some of the details (Lockyear forthcoming). Usually, the 'detail' is noise in the data caused by random variation. To do this, CA compares the rows of the table to an average of those rows, and the columns of the table to an average of the columns. The maps are an approximate graphical representation of those differences. One of the attractions of the technique is that it provides information about both the rows and the columns of the table. Greenacre (2017) provides a more detailed and technical

[90] The data used here were extracted from Cool 2002, 25, table 85 and include material from Sites 46, 240, 251, 273, 433, 434, 452, 482, Embleton, Cadbury-Schweppes, RAF Catterick 1966, Citadella and other areas at Catterick.

TABLE 22.2. A SUMMARY OF OBJECTS BY FUNCTIONAL CATEGORY FROM SITES INVESTIGATED IN THE CORRESPONDENCE ANALYSIS

Functional category	North-East (PAS)	Catterick	Binchester	Piercebridge excavations	Piercebridge river
Personal adornment	1535	748	27	805	377
Equine equipment and transport	225	58	10	47	192
Household	256	801	31	117	323
Military	33	112	15	115	165
Recreation	8	81	6	97	2
Religious	78	32	1	6	23
Textiles	29	91	8	39	36
Toilet	58	52	1	46	69
Weighing and measuring	80	9	2	7	30
Writing and communication	33	53	3	16	70
Agriculture	1	23	1	0	102
Tools	6	140	7	66	45
Building fixtures and fittings	26	119	9	33	167
TOTAL	**2368**	**2319**	**121**	**1451**	**1601**

account. For the user, we need only to be sure that the data input is of the correct form, and how to interpret the output. For the usual application of CA, the input data should be a cross-tabulated set of counts such as we have in this example. The analysis was undertaken using the ca library (Nenadić and Greenacre 2007) in the R statistical system (R Core Team 2020) in order to compare the functional composition of the riverine assemblage.

To interpret a CA one examines the maps – so-called because one unit on the *x*-axis should be the same physical size as one unit on the *y*-axis – alongside the 'decompositions of inertia', a set of figures which enables one to assess the contribution of each category or assemblage to the results. If two categories are placed close to each other on the map, then the distribution of those finds across the sites is similar. If two sites are placed close together, then the distribution of finds categories between those two sites is similar. It is important to note, however, that the distance between a finds category and a site on the map is not defined, although their relationship to the axes is. Thus, if a finds category is placed at one extreme of an axis, a site plotted at the same extreme is likely to have an above average proportion of that type of find, and vice versa.

Before offering a detailed interpretation, however, one must check the decompositions. All sites and finds categories will be plotted on the map, whether or not they fit the general pattern, and the decompositions will allow one to see any problematic data points. The column 'quality' (`qlt`) is a measure of how well an assemblage/category 'fits' the map and is expressed as a per mill. The relative contributions (columns `cor`) show how that category/site fits each individual axis. The quality for a map is the sum of the relevant relative contributions from the two axes. The coordinates for each point are given in the `k=1` etc. columns (see Tables 22.3 and 22.4).

The first analysis included all thirteen finds categories and five assemblages. The first two axes from the analysis 'explain' 86 per cent of the variation in the data set (FIG. 22.4). This is a very successful result, partly because we only have five sites. Looking at the 'quality' for the finds categories we can see that most are very well represented with values of over 900‰ accounted for (Table 22.3). Military and toilet related items are less well represented (484‰ and 505‰ respectively). For the sites, the North-East (PAS) group and the Piercebridge river finds are very well represented, with the Piercebridge excavation finds least well represented, but all are within acceptable levels.

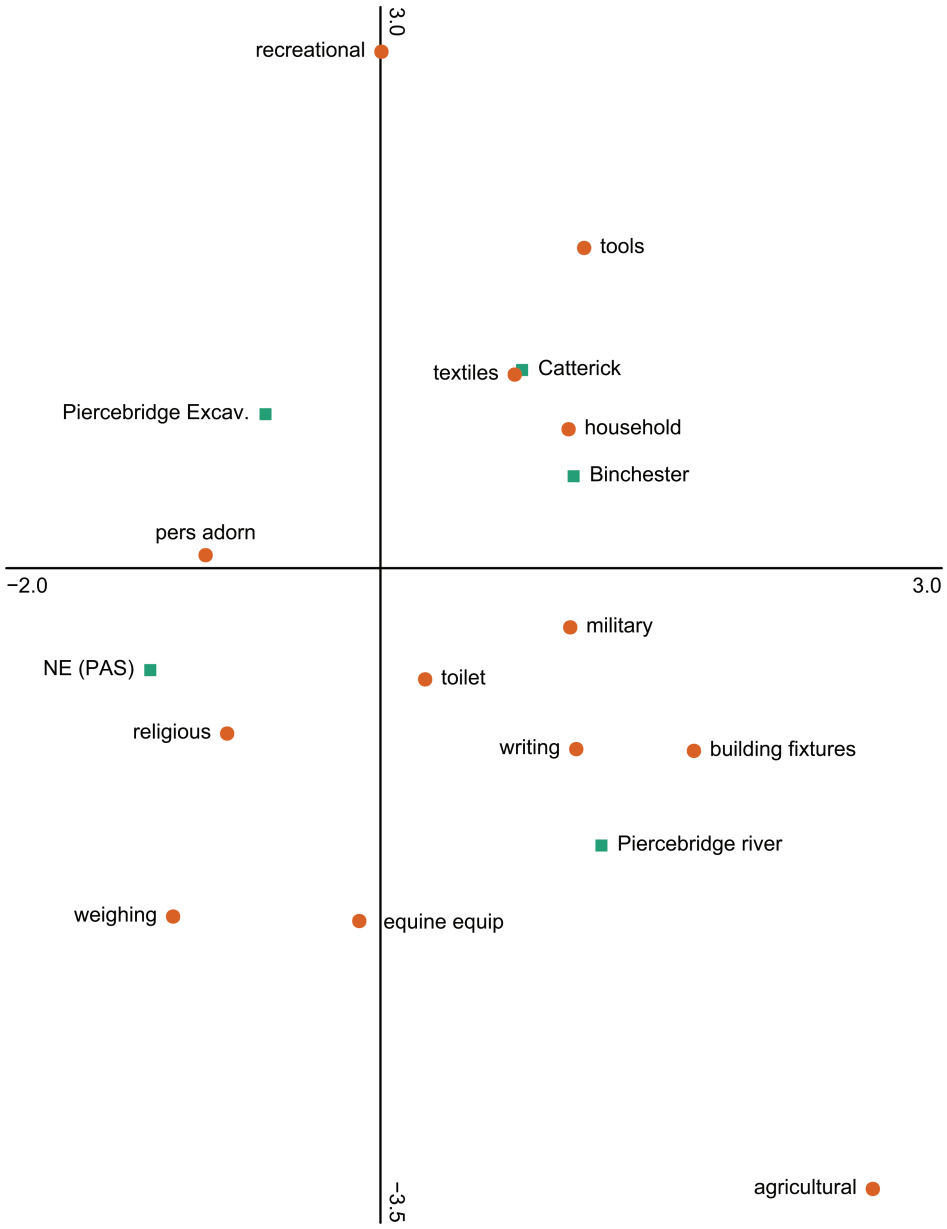

FIG. 22.4. Correspondence Analysis of assemblages from the river and excavations at Piercebridge and the excavations at Binchester and Catterick as well as PAS data for the North-East region. First (horizontal) and second (vertical) axes of inertia; sites in green, find categories in red

Looking at the relative contributions (Table 22.3, column `cor`), if we use an arbitrary cut-off value of 500‰ we can see that the first axis is principally contrasting agricultural/fishing equipment, building fixtures, writing and communication items and household items with items of personal adornment. If we look at the figures for the Piercebridge river assemblage (Table 22.2) we can see this in the data: that assemblage has the highest proportion of those four categories, and the second lowest proportion of items of personal adornment, the lowest proportion coming from Binchester. In contrast, the PAS data have the highest proportion of items of personal adornment. The large assemblage of fishing weights (which was grouped with agricultural equipment) from the Tees clearly has an impact here. Another possibility is that the first axis is contrasting assemblages with a high proportion of iron objects with those made in other materials. Indeed, the well-preserved iron assemblage from the river was analysed in detail, while similar material from excavations is often too corroded for identification, especially

if it is not x-rayed (Cool 2008, 242). It may also be that the corrosion processes of iron artefacts contributed to the formation of the 'crud' which the divers recognised as rich in artefacts and therefore targeted. Conversely, metal-detector users tend not to retrieve or record iron objects meaning that few are present in the PAS assemblage.

The second axis (FIG. 22.4) draws a contrast between assemblages with equine equipment and weighing items compared to recreational items and tools. The Piercebridge river and the PAS assemblages have the highest proportions of the first two categories, whereas Catterick and the Piercebridge excavations have the highest proportions of the latter two. Gaming pieces of bone, clay and glass are clearly quite common on the three excavated sites but absent from the Tees and PAS assemblages, perhaps because they would have floated away in the river and because naturally metal-detectorists do not normally recover these materials.

In this analysis, the Piercebridge river assemblage is shown to be quite different in composition to both the excavated assemblages and the PAS finds. However, the three excavated assemblages are relatively similar to each other.

CA can be strongly impacted by unusual outlying assemblages, although less severely than is claimed (Greenacre 2013). Usually, removing the offending categories or assemblages results in a rescaling of the maps, but substantive interpretation remains similar. To check this, a CA was run omitting the two outlying categories of agriculture and fishing items, and recreational items. A comparison between the two sets of results using the Procrustes Stress Index (PSI; Sibson 1978) shows almost no difference in the results.

The PAS dataset, which forms just over 30 per cent of the total, will have an influence on the results. As the PAS dataset is less controlled than the other four assemblages, it is worth removing it. A comparison was made between a CA of the remaining four assemblages with all the finds categories, and a CA omitting agricultural and recreational items. As before, there is very little difference as measured by the PSI, so we will examine the version with all the finds categories.

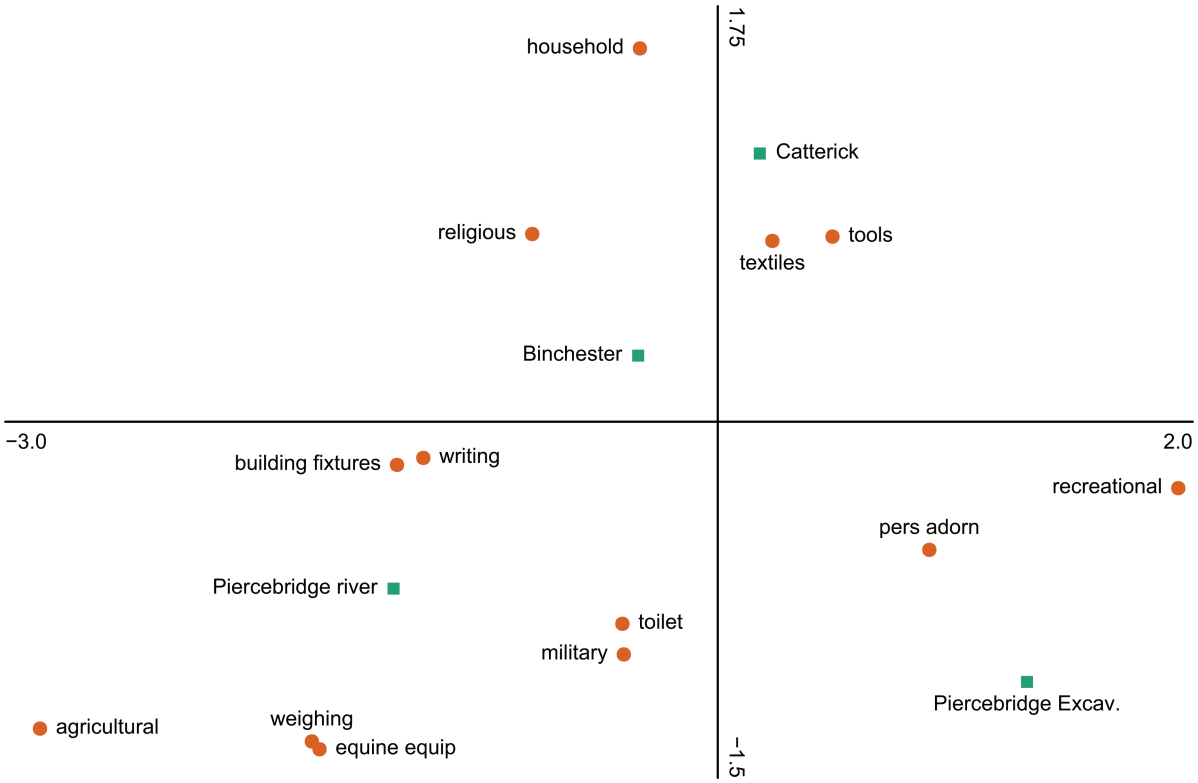

FIG. 22.5. Correspondence Analysis with obvious outliers removed. First (horizontal) and second (vertical) axes of inertia; sites in green, finds categories in red

The map of the first two axes from this analysis (FIG. 22.5) explains 98 per cent of the variation in the data, not altogether surprising given that we only have four assemblages. An examination of the figures for the sites shows that Binchester is very poorly represented in this analysis (Table 22.3, quality is 121‰). It is also the smallest assemblage with less than 2 per cent of the total number of finds. Of the finds categories, however, all are very well represented with only two falling below a quality of 900‰, textiles (683‰) and toilet items (871‰). Taking our arbitrary cut-off point of 500‰ once more, we can see that the first axis is contrasting recreational and personal adornment items with equine equipment, religious items, objects associated with weighing and measuring, writing and communication and agricultural/fishing items. The Piercebridge excavation assemblage is principally associated with the former, and the riverine assemblage with the latter. We have addressed the dominance of fishing weights already but another striking feature of the riverine assemblage is the emphasis on objects associated with communication, namely the 46 lead sealings, which represent the second largest assemblage from Britain. As discussed in Chapter 8, their presence in the river may reflect the huge volume of trade along Dere Street and their deliberate deposition, but could also be the result of the survival of these delicate lead objects in waterlogged contexts, much as has been suggested for medieval lead pilgrim badges (Lee 2014).

The second axis is contrasting military equipment and toilet items against household equipment, textiles and tools. The two Piercebridge assemblages are associated with the former, and Catterick with the latter. As expected, Binchester is the only site represented by the third axis. This is related to the presence of textile items, showing that Binchester has a slightly higher percentage (6.6%) than the other three sites, although it seems unlikely this is especially significant.

CONCLUSION

Ongoing work will examine how widespread deposition in rivers was in the Roman period (Eckardt and Walton forthcoming), but haphazard recovery and poor recording are clearly factors affecting many sites. The finds made by the Piercebridge divers at Catterick Bridge and Corbridge are fewer in number, and generally not as high status as those at Piercebridge, but they indicate that metal artefacts have found their ways into rivers in the wider region.

Comparison with excavated and metal-detected assemblages from north-eastern Britain has proven a more fruitful avenue here. Statistical and qualitative study have demonstrated significant differences in the composition of the excavated and riverine assemblages at Piercebridge. It is also evident that while the composition of the excavation assemblage from Piercebridge is broadly comparable with two excavated sites in the region, the assemblage from the river is not. Furthermore, the riverine assemblage is not similar to the profile for Portable Antiquities finds in the region.

This suggests that the riverine assemblage was accumulated through a different process or processes of deposition to other sites in the region, and/or that it was affected by very different taphonomic processes. Although there may be some refuse amongst the finds recovered from the river, the majority are clearly not part of a wider pattern of rubbish deposition evidenced in the excavated portions of Piercebridge. Of course, it is possible that the riverine assemblage represents rubbish associated with an as yet unexcavated settlement, a particular clearance event (the construction of the third-century fort?) or with transient populations crossing the bridge. However, it seems likely that the deliberate deposition of high-value or exotic metal objects also took place. This deposition is very different in scale and character to deposition on land on the kinds of sites explored by metal-detectorists. A better understanding of the taphonomic process affecting river finds is highly desirable but can only be achieved when other *entire* assemblages from rivers are published.

TABLES

TABLE 22.3. DECOMPOSITIONS OF INERTIA FOR THE FIRST ANALYSIS

	mass	qlt	inr	k=1	cor	ctr	k=2	cor	ctr
Categories									
Personal adornment	448	996	220	−385	993	391	21	3	2
Equine equipment	68	983	74	−47	7	1	−568	976	243
Household	196	753	190	414	583	198	224	170	108
Military	56	484	70	418	460	58	−95	24	6
Recreation	25	656	86	2	0	0	832	656	190
Religious	18	538	20	−338	331	12	−266	206	14
Textiles	26	907	17	296	429	13	312	478	28
Toilet	29	505	8	98	117	2	−179	388	10
Weighing and measuring	16	866	33	−457	345	20	−561	521	57
Writing and communication	22	998	20	431	685	25	−291	313	21
Agriculture	16	963	121	1084	520	113	−1000	442	179
Tools	34	963	54	448	415	40	516	549	99
Building fixtures and fittings	45	982	86	690	831	127	−294	151	43
Sites									
North-East (PAS)	303	937	303	−507	848	460	−164	89	90
Catterick	297	886	220	312	433	170	319	454	334
Binchester	16	561	18	425	500	17	148	61	4
Piercebridge excavations	179	469	158	−253	239	67	248	230	121
Piercebridge river	205	979	301	486	531	286	−447	448	451

TABLE 22.4. DECOMPOSITIONS OF INERTIA FOR THE SECOND ANALYSIS

	mass	qlt	inr	k=1	cor	ctr	k=2	cor	ctr
Categories									
Personal adornment	360	991	220	336	825	286	−151	166	105
Equine equipment	56	995	139	−632	725	159	−385	269	108
Household	234	999	218	−124	73	25	439	926	579
Military	75	901	36	−149	206	12	−274	695	72
Recreation	34	979	85	731	968	129	−78	11	3
Religious	11	969	7	−294	620	7	221	349	7
Textiles	32	683	11	87	97	2	213	585	19
Toilet	31	871	13	−151	251	5	−238	620	22
Weighing and measuring	9	977	22	−644	729	26	−376	248	16
Writing and communication	26	996	26	−467	988	40	−43	8	1
Agriculture	23	986	135	−1076	886	189	−361	100	39
Tools	47	987	17	182	406	11	218	580	29
Building fixtures and fittings	60	999	71	−509	990	110	−51	10	2
Sites									
Catterick	427	999	199	67	43	13	315	956	545
Binchester	22	121	18	−126	88	2	78	33	2
Piercebridge excavations	256	1000	384	491	720	435	−306	280	308
Piercebridge river	295	1000	400	−514	873	549	−196	127	146