Characterisation Studies of Some Romano-British and Anglo-Saxon Pottery from Quarry Farm, Ingleby Barwick, Cleveland

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Samples of two Romano-British coarseware fabrics and one Anglo-Saxon fabric were submitted for thin section and chemical analysis (Table 1).

Table 1

TSNO	Sitecode	Context	REFNO	cname
V4008	QF03	641		G11
V4009	QF03	1007		G11
V4010	QF03	271		G41
V4011	QF03	719 AND 711		G41
V4012	QF03	U/S?		Z11
V4013	QF03	U/S?		Z11
V4014	QF03	114		Z11
V4015	QF03	136		Z11

Thin Section Analysis

Thin sections of each sample were produced by Steve Caldwell, University of Manchester, and stained using Dickson's method (Dickson 1965).

Fabric G11 (V4008 and V4009)

The two sections show a fabric containing ill-sorted inclusions varying in type, size and roundness.

The following inclusion types were noted:

- Quartz. Abundant grains ranging from c.0.2mm to 1.0mm across. The majority are between c.0.2mm and 0.3mm across and are subangular. Sparse well-rounded grains ranging from c.0.2mm to 1.0mm across are present and the majority of these have a high sphericity. Grains with one or more straight faces, indicative of overgrowth are also present but sparse and range from c.0.3mm to 1.0mm across.
- Sandstone. Moderate angular and subangular fragments, ranging from c.0.3mm to 4.0mm across. The inclusions are well-sorted, c.0.2mm to 0.3mm, and consist of quartz with a small quantity of fresh plagioclase feldspar and muscovite laths up to

0.3mm long and c.0.05mm wide. The grains are mostly interlocking with no visible cement but pores within the rock are partially filled with kaolinite. The remainder of the pore is either a void or filled with brown clay minerals, possibly after burial.

- Muscovite. Sparse laths up to 0.3mm long and 0.05mm wide.
- Clay/iron. Sparse rounded dark brown to opaque inclusionless grains up to 1.0mm long.
- Chert. Sparse rounded grains up to 0.5mm across.
- Igneous rock. Moderate rounded grains varying in composition but mostly of basic igneous character. One consists of a dark brown amorphous groundmass and euhedral plagioclase laths up to 0.2mm long. Another consists of interlocking altered plagioclase feldspar and sparse quartz grains and several consist of a groundmass of plagioclase laths up to 0.1mm long and altered glass.
- Plagioclase feldspar. Sparse fresh angular grains up to 0.5mm long.
- Siltstone. Sparse rounded grains up to 1.0mm across consisting of quartz and amorphous brown grains in a silica cement.
- Organics. Sparse carbonised inclusions up to 1.5mm long and 0.2mm wide.

The groundmass consists of optically anisotropic baked clay minerals, sparse angular quartz up to 0.1mm across and sparse muscovite laths up to 0.1mm long.

The inclusions clearly include detrital grains, such as the coarser overgrown quartz and chert (both probably from Carboniferous sources), rounded quartz (Permo-Triassic) and igneous rock (Erratics of glacial origin). However, the majority of the inclusions are probably derived from the sandstone. The lack of rounding of some of the sandstone fragments and the frequency of these inclusions suggests that this rock was closest to the source of the fabric. A fluvio-glacial source is evident and this places the source of the sand or boulder clay to the south or west of the Permian outcrop. All of these features could be found in the local boulder clay.

A similar fabric has been recorded in the Roman period at Piercebridge, where it was used in the 3rd century to produce coarse handmade jars (Cooper and Vince forthcoming, Nos. 7 and 12, Samples V1459 and V1461).

Fabric G41 (V4010 and V4011)

The two samples of Fabric G41 have the same ill-sorted texture as Fabric G11 but the inclusions are clear different.

The following inclusion types were noted:

- Quartz. Abundant subangular grains, ranging from c.0.1mm to 1.0mm across. The finer grains are extremely angular.
- Feldspar. Sparse microcline and perthite ranging from c.0.2mm to 0.5mm across.
- Chert. Sparse rounded grains ranging from c.0.1mm to 1.0mm across.
- Sandstone. Sparse subangular fragments of sandstone, ranging from c.0.3mm to 1.5mm across. The sandstones vary in texture but including some with a similar texture to the dominant type in G11 as well as coarser-grained sandstones with an ill-sorted sand and a mixture of amorphous brown cement and kaolinite.
- Muscovite. Sparse laths up to 0.2mm long.
- Siltstone. Sparse rounded fragments varying in texture and having a brown fine-grained groundmass and abundant angular quartz silt. Examples with mean grain sizes of c.0.05mm and c.0.1mm are present.
- Voids. Sparse subangular voids, probably originally holding calcareous inclusions.
- Organics. Sparse carbonised inclusions up to 1.0mm long and c.0.2mm wide.

The groundmass consists of optically anisotropic baked clay minerals, mostly masked by carbon except at the oxidized margins, sparse angular quartz and sparse dark brown clay/iron grains up to 0.1mm across. Isotropic pale brown phosphate fills some laminae and voids (including probably pores within some of the sandstone fragments) and is probably a post-burial concretion.

As with Fabric G41, the inclusions in this fabric are probably from a detrital sand of fluvio-glacial origin. There are numerous differences in the suite of rocks and minerals present and in particular no rounded igneous erratic grains. The sandstone and siltstones include examples which are probably of Coal Measures origin but the coarser quartz grains and feldspars are probably from the Millstone Grit. The lack of obvious Permo-Triassic quartz means that a source north or west of the Permian outcrop is possible, although many of the coarse gravel-tempered samples found in the Vale of York, and probably made in that area, also contain no Permo-Triassic quartz, or at best rare grains.

The petrographic composition of the fabric therefore distinguishes it from Fabric G11 and is less clearly tied to the Tees valley area. Nevertheless, a local source is still possible.

Fabric Z11 (V4012-15)

Two fabrics are present in the four thin sections. The first (V4012, V4013 and V4015) contains abundant angular quartzose sand with the majority of grains ranging from c.1.0mm to c.3.0mm across whilst the other, V4014, contains a fine quartz sand with sparse larger subangular and rounded inclusions.

Subfabric 1 (V4012, V4013 and V4015)

The following inclusion types were noted:

- Quartz/Sandstone. Moderate subangular grains ranging from c.0.3mm to 2.0mm across. Several are polycrystalline and strained. Most have one or more straight facets and several have kaolinite cement adhering.
- Feldspar. Sparse altered feldspar, similar in size and character to the quartz grains described above.
- Acid igneous rock. A single angular fragment 0.5mm across composed of a opaque accessory mineral, biotite and quartz. Also some rock fragments consisting of quartz and altered feldspar, of similar size and shape to the quartz/sandstone grains described above.
- Quartz. Moderate subangular to rounded grains c.0.1mm to 0.2mm across.
- Chert. Sparse light brown angular grains up 1.0mm across.
- Muscovite. Sparse laths up to 0.3mm long.
- Biotite. Sparse laths up to 0.3mm long, partially altered to a dark brown/opaque material around the edges.
- Organics. Sparse carbonised inclusions up to 1.0mm long and 0.2mm wide.

The groundmass consists of optically anisotropic baked clay, mostly obscured by carbon except at the oxidized surfaces, abundant angular quartz up to 0.1mm across, moderate muscovite laths up to 0.1mm long.

These three sections have a very similar composition to early Anglo-Saxon vessels from various sites in the Vale of York, ranging from Piercebridge in the north to Heslington Hill, near York, in the south. It is suggested that the texture is due to the use of a late glacial/post-glacial lacustrine silt with coarse fluvio-glacial gravel added. The larger inclusions probably all originated to the north and west of the Vale of York: the sandstone is probably an arkose (feldspathic sandstone) whilst the biotite and acid igneous rock fragment is probably from southwest Scotland or the Lake District, brought south by ice crossing the Stainmore gap.

Very similar fabrics occur from sites at the northern and southern extremes of this distribution and thin sectioning cannot determine whether they come from a single source or were made in several centres.

Subfabric 2 (V4014)

The following inclusions were noted:

- Basic igneous rock. Moderate subangular fragments ranging from c.0.3mm to 2.0mm across. The fragments all have a similar texture and lithology and include light green, slightly pleiochroic pyroxene crystals up to 1.0mm long in a groundmass of laths of plagioclase feldspar, euhedral opaque grains and amorphous brown material.
- Quartz. Abundant angular to subangular grains ranging from c.0.05mm to 0.2mm across.
- Clay/iron. Sparse rounded dark brown grains up to 1.0mm across.

The groundmass consists of optically anisotropic dark brown baked clay minerals and sparse angular quartz up to 0.1mm across.

Unlike basic igneous rock-tempered vessels of prehistoric and early Roman date, the basic rock inclusions in this fabric are clearly weathered, albeit only slightly, and are therefore detrital grains. Such rocks occur as erratics in boulder clays throughout the Vale of York and even occur in isolated patches of boulder clay in the Trent valley. Nevertheless, they are more common on sites in the Tees valley, Vale of Pickering and East Yorkshire and have not been noted on early Anglo-Saxon sites in the Vale of York south of Catterick where fabrics similar to Subfabric 1 predominate.

Chemical Analysis

Off-cuts of c.1-2gm were taken from each submitted vessel and the outer surfaces mechanically removed. The remainder of the sample was crushed to a fine powder and submitted to Royal Holloway College, London, where the chemical composition was determined using Inductively-Coupled Plasma Spectroscopy (ICPS). A range of major elements was measured and expressed in percent oxides (App 1) and a range of minor and trace elements was measured and expressed as parts per million (App 2). Silica was estimated by subtracting the total percent oxides from 100%. The various fabric groups have mean silica contents ranging from 72.9% (Z11 subfabric 2) to 74.8% (Z11 subfabric 1) but all are within the 95% confidence level of the mean value, 73.78+/- 0.98%.

The elemental data was then normalised to aluminium and the various fabric groups compared. The normalised data were then examined visually and in eleven cases there are differences in the ranges of the elements between fabric groups. However, with no more than 3 samples in any group, and only one in one group, such differences would be expected if the samples all came from the same statistical population with element values having a normal distribution within that group. It may be for this reason that Z11 subfabric 2, with only one sample, has the greatest number of differences between its composition and the remainder.

Table 2

Element	G11	G41	Z11 1	Z11 2

CaO	Higher than remainder			
Na2O				Higher than remainder
K2O				Lower than remainder
TiO				Higher than remainder
P2O5	Higher than remainder			
Ba	Higher than remainder			Lower than remainder
Cr	Lower than remainder			
Cu				Higher than remainder
Li				Higher than remainder
Zr		Lower than remainder		Higher than remainder
Ce	Higher than remainder			

The data were then examined using factor analysis, omitting calcium, phosphorous and strontium, all of which are affected by leaching and post-burial concretion. The analysis was carried out using WinStat for Excel (Fitch 2001) and five factors with eigenvalues over 1.0 were found. A bi-plot of the first two factors (Fig 1) indicates that the F2 score of Z11 subfabric 2 distinguishes it from the remainder whilst there is no difference in either F1 or F2 scores between the other fabrics. A bi-plot of the F3 and F4 scores (not illustrated) shows no differences between the various groups. Factor 5 separates Z11 subfabric 1 from Z11 subfabric 2 and both of these groups from G11 and G41. Fig 3 shows the weightings of the various elements contributing to the F2 and F5 scores. This factor analysis therefore confirms the distinctive character of the Z11 subfabric 1 sample and suggests that Z11 subfabric 1, Z11 subfabric 2 and G11/G41 were made from different raw materials.

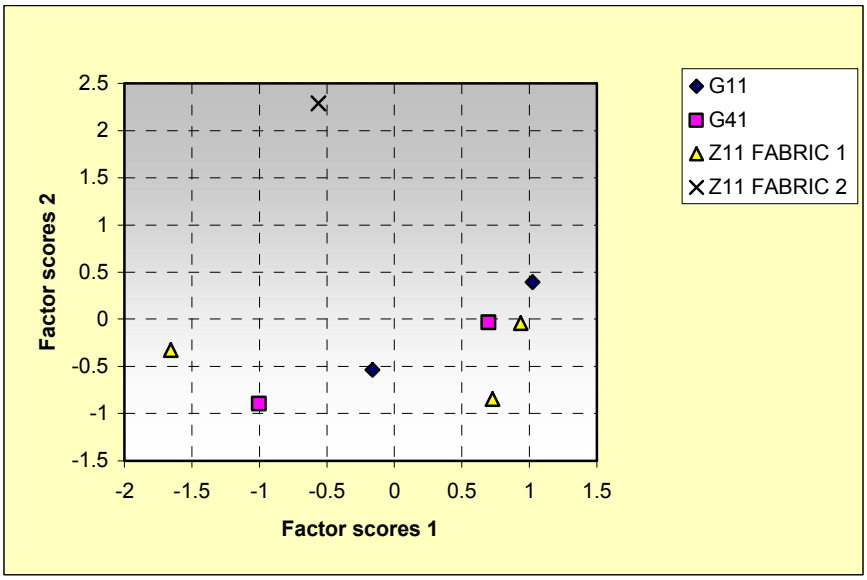

Figure 1

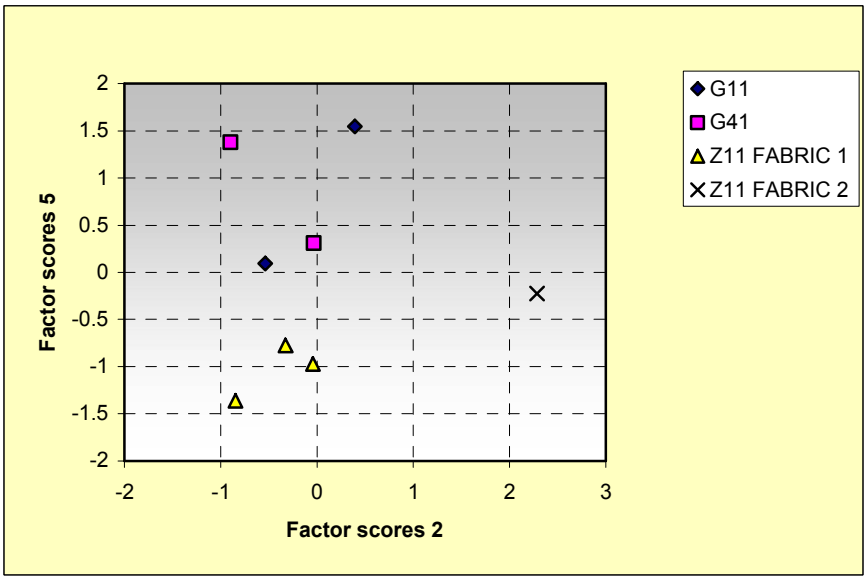

Figure 2

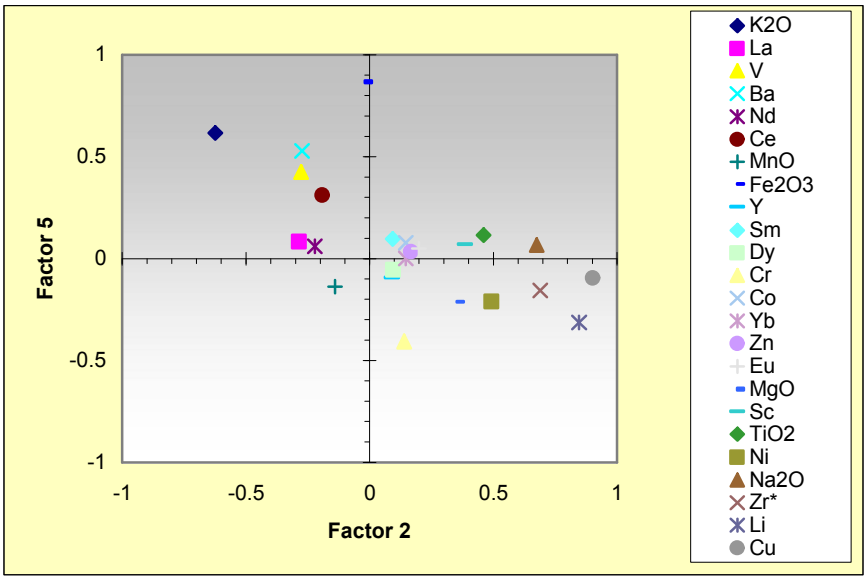

Figure 3

The Ingleby Barwick samples were then compared with the two Piercebridge Roman “native ware” samples which contain similar sandstone inclusions to those in G11. Again, factor analysis found 5 significant factors, but bi-plots of F1 against F2, and F3 against F4 showed no obvious patterning. Factor 5, however, distinguished the Z11 subfabric 2 sample from the remainder. This analysis is consistent with the Piercebridge and Ingleby Barwick G11 samples coming from the same source (or at least exploiting chemically indistinguishable raw materials).

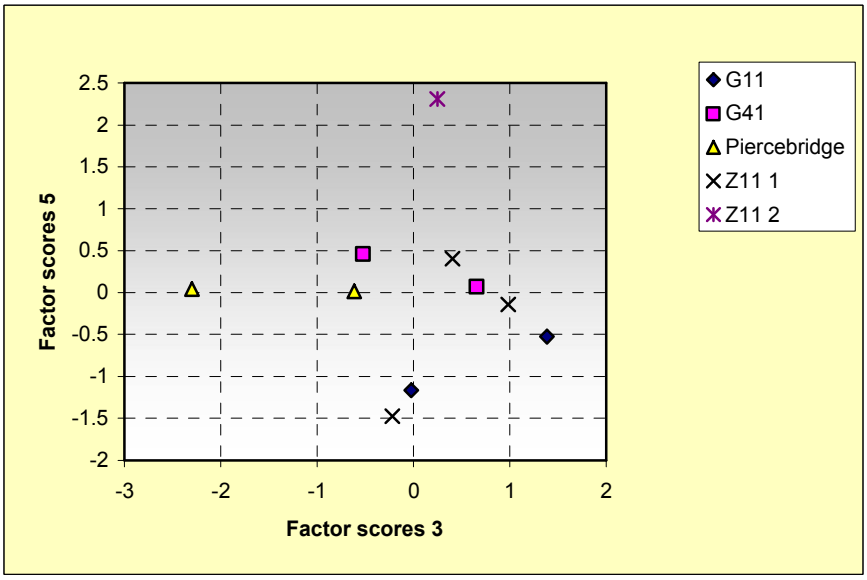

Figure 4

The Ingleby Barwick data were finally compared with a series of analyses of sandstone-sand tempered early Anglo-Saxon vessels of similar character to Z11 subfabric 1 (Table 2). Factor analysis found five significant factors and a bi-plot of the first two factors (Fig 5) indicates that

the F2 scores separate a group of Piercebridge vessels from the remainder and that three of the Ingleby Barwick samples also have high F2 scores. However, in general the Piercebridge samples are so variable in composition that they mask any other detail. Consequently the analysis was repeated omitting the Piercebridge data.

Table 3

locality	Site Name	Sitecode	Total
Catterick	Catterick Bridge 1983	5128	7
	Catterick Triangle 1987-8	5563	8
Norton	Norton A.S. Cemetery	norton	4
Piercebridge		HH69	2
		HH70	3
		HS76	6
		HS77	4
		HS78	3
		HS80	1
Scorton	Scorton Quarry	hbs98	11
West Lilling		OSA99EX03	11
York	46-54 Fishergate	1985-6.9	13
	Blue Bridge Lane	YBB01	8
	Heslington Hill	yhs 02	6

Factor analysis again found five significant factors, none of which clearly separated any of the groups apart from Z11 subfabric 2, which has a higher F3 score than any of the remainder. In bi-plots of F1 against F2, and F3 against F4 and F3 against F5 (of which the latter is published here, Fig 5), the Ingleby Barwick samples mainly occupy the same areas of the plot, indicating that the Roman and Anglo-Saxon Ingleby Barwick sherds are more similar to each other than to the early Anglo-Saxon sandstone-tempered sherds from other sites. Examination of Fig 5, suggests that the West Lilling, Catterick and Scorton samples have discrete sources whilst the Norton samples have similar scores to Scorton. However, in this graph the various Ingleby Barwick samples fall centrally, an area of the graph occupied by samples from York and Scorton.

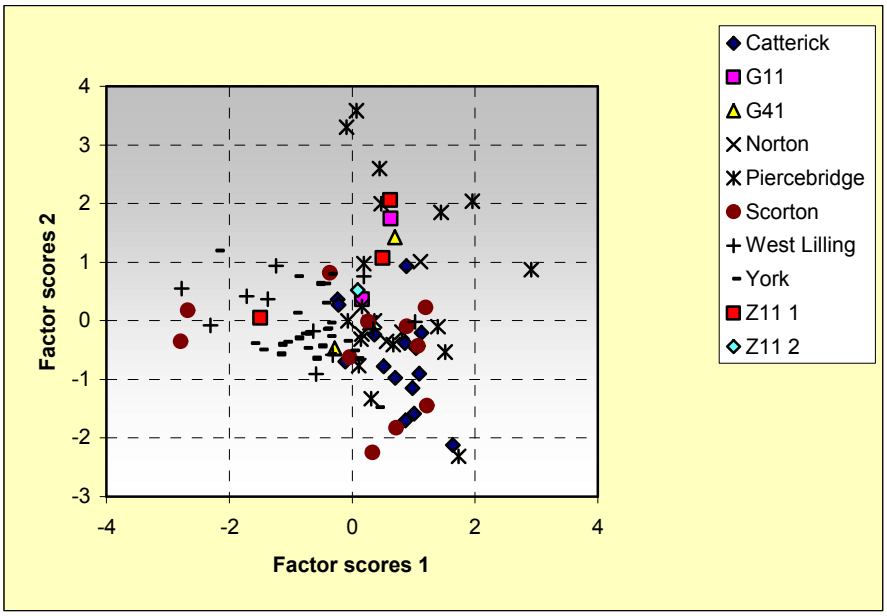

Figure 5

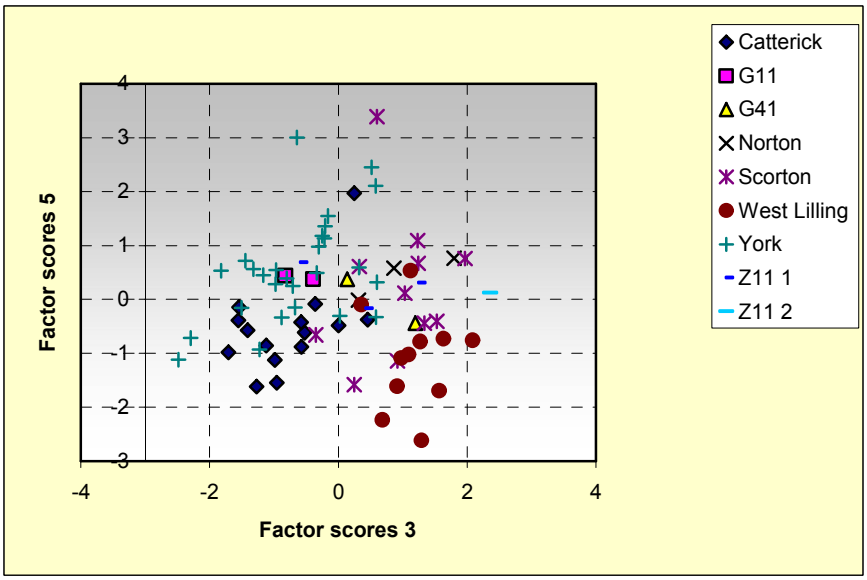

Figure 6

Conclusions

Thin section analysis confirms that G11 and G41 are separate fabric groups, although chemical analysis indicates that both have similar compositions. Thin sectioning also reveals that one of the Z11 samples has a quite different fabric from the remaining three and is also distinguished chemically from the remaining Ingleby Barwick samples. The range of inclusion types in G11 and Z11 subfabric 2 includes moderate detrital basic igneous rock, which outcrops as dykes extensively north of the Tees and is common in fluvioglacial sands and later sands along the east coast. It also occurs in boulder clays in the Vale of York and

further south, but is not commonly found in pottery which might have a local origin in those areas and so points to a local origin without proving one. The combined petrological and chemical evidence therefore points to a local source for G11, G41 and Z11 subfabric 2. It is likely that Z11 subfabric 1 was also made locally, although both petrological and chemical evidence points to parallels with vessels from sites in the Vale of York and a more southerly origin is also possible.

Appendix 1

TSNO	Al2O3	Fe2O3	MgO	CaO	Na2O	K2O	TiO2	P2O5	MnO
V4008	17.11	3.97	1.21	1.1	0.44	1.98	0.59	1.65	0.106
V4009	13.74	4.27	1.02	1.19	0.49	1.62	0.46	1.75	0.036
V4010	15.67	5.49	0.84	0.46	0.4	2.31	0.73	1.09	0.039
V4011	14.67	4.33	1.06	0.94	0.48	1.77	0.52	1.29	0.063
V4012	15.77	3.53	1.03	0.97	0.6	1.91	0.51	1.22	0.041
V4013	16.83	3.77	1.06	0.85	0.43	1.67	0.64	1.17	0.021
V4014	16.99	4.46	1.17	1.07	0.67	1.51	0.84	0.34	0.034
V4015	16.45	3.92	1.33	0.89	0.42	1.8	0.63	0.17	0.128

Appendix 2

Ba	Cr	Cu	Li	Ni	Sc	Sr	V	Y	Zr*	La	Ce	Nd	Sm	Eu	Dy	Yb	Pb	Zn	Co
880	80	21	94	41	16	159	87	26	67	48	103	50	10	2	5	3	20	171	18
807	76	23	67	42	14	154	75	28	60	42	87	44	10	2	5	3	22	176	10
691	90	23	59	28	13	110	112	15	52	40	79	40	7	1	3	2	24	95	11
590	88	32	83	45	14	111	84	29	46	44	86	46	10	2	5	3	21	149	13
609	113	15	81	34	13	192	83	16	59	36	66	37	6	1	3	2	18	177	12
603	101	30	76	42	15	118	97	32	63	51	91	52	10	2	5	3	27	154	10
547	105	75	120	51	16	115	95	24	82	41	79	42	9	2	4	3	22	150	14
792	123	33	92	60	17	105	93	31	70	48	99	50	11	2	6	3	17	147	13

Bibliography

Cooper, N. and Vince, A. (forthcoming) "The Roman and Early Anglo-Saxon Pottery." in H. Cool, ed., *Excavations at Piercebridge, County Durham*,