Chemical Analysis of Medieval Pottery from High Street, Perth

Alan Vince

A series of samples of medieval pottery of various types from the High Street excavations in Perth were selected by Derek Hurst and George Haggarty and submitted to Dr J N Walsh, Royal Holloway College, London, where they were analysed using the laboratory's standard ICP-AES and ICP-MS routines together with lead (listed in Appendices). This data was then submitted to the author for comparison with various reference groups.

The results indicate that wares from several areas of western Europe were present at Perth. These include, in approximate order of frequency, various wares from the London area; the lower Seine valley; Stamford, the Rhine and Meuse valleys, Lincolnshire and North Yorkshire. In addition, a group of unsourced samples may be of Low Countries origin and a large number of probable Scottish white gritty ware samples were analysed. Seven samples could not be matched.

Methodology

The comparative data were all analysed at Royal Holloway College, London, using just the ICP-AES plus Lead option. Therefore, the element frequencies determined by ICP-MS were not used in this study but are included in the appendices for future reference.

Silica is not measured by either the ICP-AES or ICP-MS methods at Royal Holloway College but was estimated by subtracting the total major element frequencies (presented as percent oxides) from 100%. This estimate will include organic matter and any other unmeasured elements but gives a reasonable impression of silica content. Much of this silica is present in the clay fraction but forms a proportion of the silt and sand fractions, often being the most common element in those fractions. There is no easy way of determining the proportion of estimated silica in these fractions without access to thin sections.

Similarly, the disposition of elements within the fabric cannot be determined using ICPS data. Iron might occur, for example, as a finely-divided oxide in the clay fraction, or could be chemically combined with other elements in clay minerals or present in clasts which were either naturally present in the clay or deliberately added as inclusions. Calcium also could occur in a number of different circumstances, from calcium rich feldspars to finely-divided, chemically precipitated calcium carbonate or shell, as could phosphorus, which could be part of the original constituents of the pottery fabric, perhaps as apatite, phosphate nodules or bone or could be present as calcium phosphate concretions within the pores of the sample, deposited after burial.

The procedure adopted for each ware was to use a restricted range of elements, including none of the most mobile elements, to make an initial comparison. All samples with values for any element lying outside one standard deviation of the mean established for the comparative group were omitted. Those Perth samples which passed this filter were then included with the

comparanda in a series of tests to try and establish differences between the Perth samples and the comparative samples. For speed, this was normally done using Factor Analysis, where a statistical program is used to try and replace the large number of individual element values by a smaller number of Factors. The software calculates what proportion of the variability in the data is accounted for by each Factor and also the contribution, negative or positive, of each element to any particular Factor. Examining these factor scores, especially using graphical presentations, is a quick method of assessing the similarity of two groups of samples. However, it is quite possible for false conclusions to be drawn from such data, since the same high or low (negative) Factor score can result from very different compositions and a Factor Analysis match is only signification if the two groups have similar means and standard deviations for all elements, or, failing that, that a reasonable case can be made to explain any differences.

It should be emphasised, however, that chemical data is incapable of proving that a sample came from a particular production site, since it is always possible that clays and tempers with similar chemical characteristics exist elsewhere. It can, however, disprove a suggested source, although even here there are numerous examples of production sites where more than one source of clay or temper were used.

London Area Wares

Forty-one samples were identified as probable imports from the lower Thames valley. These were classified as Perth London-type ware; Perth Coarse London-type ware and Perth Shelly-Sandy ware (PERTH LOND; PERTH LCOAR and PERTH SSW in Figure captions).

The lower Thames estuary was a major exporter of pottery in the 11th to 13th centuries. This trade seems not to have been important in the 10th or early 11th centuries and London Late Saxon Shelly ware, which was current from the late 9th to the early 11th century, Early Medieval Sandy ware and Early Medieval Sand and Shell ware have not been found on coastal sites around the North Sea littoral (Vince and Jenner 1991, LSS, EMS and EMSS). Similarly, the later 11th to early 12th century wares found in London are uncommon as exports, although possible examples have been recorded. These wares include London Local Greyware (Vince & Jenner 1991, LOGR). Despite the lack of evidence for coastal trade in these wares, because of suggestions that the Perth wares include 10th to mid 12th century wares, ICPS data from these types were compared with the Perth data (Table 1).

Thin section analysis of these wares suggests that the parent clay in most cases is the Tertiary London Clay, which has a silty texture, perhaps in the case of LOGR re-worked into recent alluvium, but that EMSH is likely to be made from an outcrop of the underlying Woolwich Beds, which outcrops to the south of the Thames. Potters were recorded as working at Blackheath, immediately to the south of Woolwich, in the 13th century. Potting is also likely in the Fleet valley, north of the Thames and immediately west of the City and wasters of wheelthrown greyware of later 12th or 13th-century date have been found there.

Table 1 Comparanda for Perth London Area Wares

cname	Notes	City of London	Clerkenwell	Fawkham	Islington	Sigtuna	Grand Total
EMS	1	6					6
EMSH	1	6					6
EMSS	1	6					6
LCOAR	4					1	1
LCOAR SHEL	2	1	2				3
LOGR	1	6					6
LOND	3		2		1	7	10
SSW	2	3	2	1			6
SSW?	2			1			1
Grand Total		28	6	2	1	8	45

1. Samples of vessels published by Vince and Jenner were re-analysed using ICP-AES with the aid of a grant from COLAT (Vince and Jenner 1991).
2. Samples analysed for the MoLAS Shelly-Sandy ware project, (Blackmore forthcoming).
3. Seven samples of London-type North French style jug sherds from Sigtuna, Central Sweden, were analysed for Mats Roslund, University of Lund. The Islington and Clerkenwell vessels were analysed for the MoLAS Shelly-Sandy ware project.
4. A single Coarse London-type ware jug sample from Sigtuna, Central Sweden, was analysed for Mats Roslund.

Factor analysis of the least mobile elements was carried out and three significant factors were found. A plot of the first two factors showed that the samples fell into two groups, one of which was characterised by high F2 and negative F1 scores. This group consisted solely of Perth samples. The eleven samples in this group (Perth samples 2, 3, 21, 22, 41, 54, 55, 63, 64, 65 and 73) different in several ways from the remaining samples: higher mean estimated silica content; lower mean iron; lower mean magnesium; lower mean calcium; lower mean sodium; lower mean potassium; lower mean titanium; lower mean phosphorus; lower mean manganese; lower mean barium; higher mean chromium; lower lithium; lower mean nickel; higher mean scandium; lower mean strontium; higher mean vanadium; higher mean lanthanum; higher mean cerium; higher mean neodymium; higher mean samarium; higher mean europium; higher mean dysprosium; lower mean zinc; and higher mean cobalt. The lead content is similar to that of the glazed London-type wares and higher than the shelly-sandy wares. The differences in chemical composition are so wide-ranging that it is unlikely that any post-burial alterations could explain them and it is suggested that they represent vessels from a different source and are temporality given the code Perth Unknown A.

The remaining Perth London-type wares are similar in composition to London area products of the 11th and early 12th centuries but it is notable that the shelly-sandy ware samples include examples with higher F1 and F2 scores than the Lower Thames shelly wares (EMSH and EMSS).

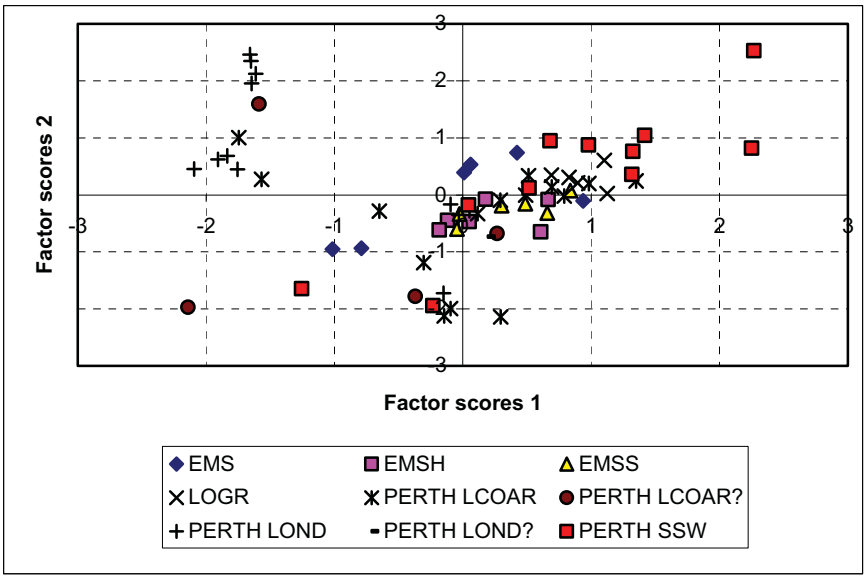


Figure 1

The Perth London-type wares were then compared with samples of London-type ware, Coarse London-type ware and Shelly-Sandy ware, both from the London area and from elsewhere (Sigtuna in central Sweden). These wares were probably made at a single centre in the immediate vicinity of London (i.e. the area now covered by Greater London). Glaze spots on some Shelly-Sandy ware vessels and the general similarity in chemical composition of the three distinct wares made at this centre (a fourth, LCALC, has not been sampled for chemical analysis) supports this view (Pearce, Vince, and Jenner 1985). Most of these wares date to the second half of the 12th century. The Shelly-Sandy ware ceased production c.1200 and the glazed wares of the early 13th century are decorated in a distinct fashion, using two different coloured slips and both copper-mottled and plain glazes. Chemically, however, the products are very similar. Four factors were found by Factor Analysis of which the third and fourth show no patterning. The plot of F1 against F2, however, shows that several of the Perth samples match extremely well with the comparanda. These consist of eleven London-type and Coarse London-type wares (Samples 17, 28-30, 33-5, 69, 71-2 and 82) and nine of the Shelly-Sandy wares (Samples 85-93).

However, eight of the Perth samples neither match the London-type ware comparanda nor the previously identified group. They consist of samples 12, 32, 39, 40, 67, 68, 95 and 96. These samples are more similar to the Saxo-Norman wares from the Lower Thames than to Perth Unknown A but can be distinguished from these wares (Fig 3). This group is here termed Perth Unknown B but the general similarity to Lower Thames wares does not preclude a Lower Thames source.

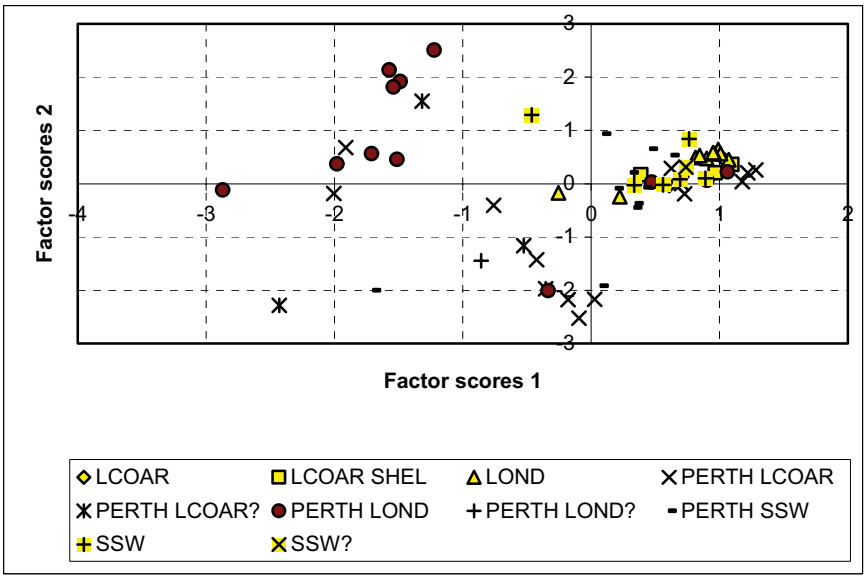


Figure 2

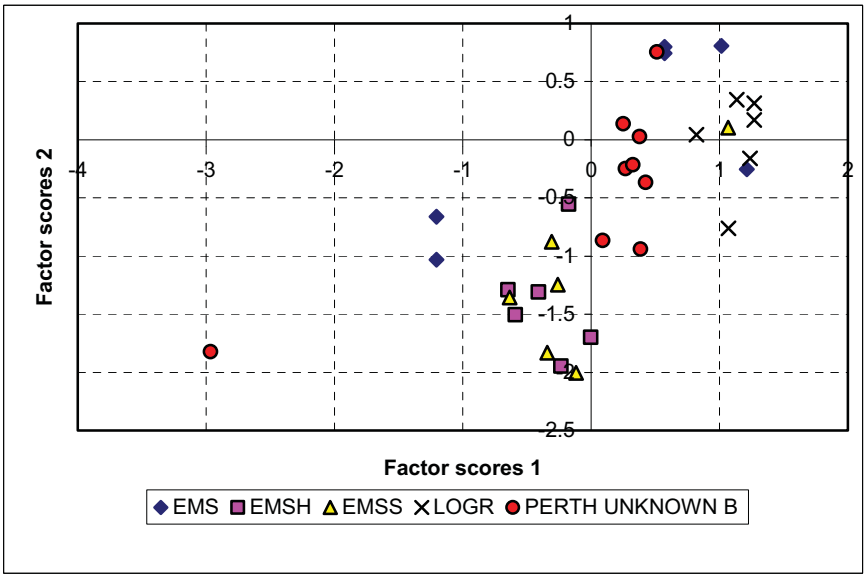


Figure 3

The Perth data were compared with samples of Beverley ware from the mid 12th to 14th century production site in Beverley and from consumer sites in Yorkshire and Lincoln and with samples of Tyler Hill ware, from the similarly-dated production centre to the northwest of Canterbury and from consumer sites in Kent. Two of the Unknown A group samples were visually identified as Beverley ware (Samples 67 and 68) whilst Tyler Hill ware is visually extremely similar to Coarse London-type ware and the range of forms and decoration found is also comparable. However, no good matches were found using Factor Analysis, enabling both centres to be discounted as sources for any of the Perth samples.

The two unknown Perth groups were compared with a range of samples of Low Countries origin: Flemish highly decorated ware of the later 13th and 14th centuries (AARD); Dutch Red Earthenware of the later 14th century (DUTR) and post-medieval Low Countries-type redware

from Gateshead (DUTRT). Factor analysis of this data shows that the Unknown A group is more similar to the Low Countries wares than to the Thames Valley wares but that Unknown B is different. However, only four of the Perth Unknown A samples have comparable F1 and F2 scores to the Low Countries wares, and these are matched by Dutch Red Earthenware rather than the Flemish wares. This suggests that a source in the present-day Netherlands is likely. However, wares which are visually similar to London-type ware were being produced at Castle Hedingham, in northern Essex, and these might well have a similar chemical composition of Low Countries wares, given the similarity in surface geology. Therefore, an east Anglian source should also be investigated.

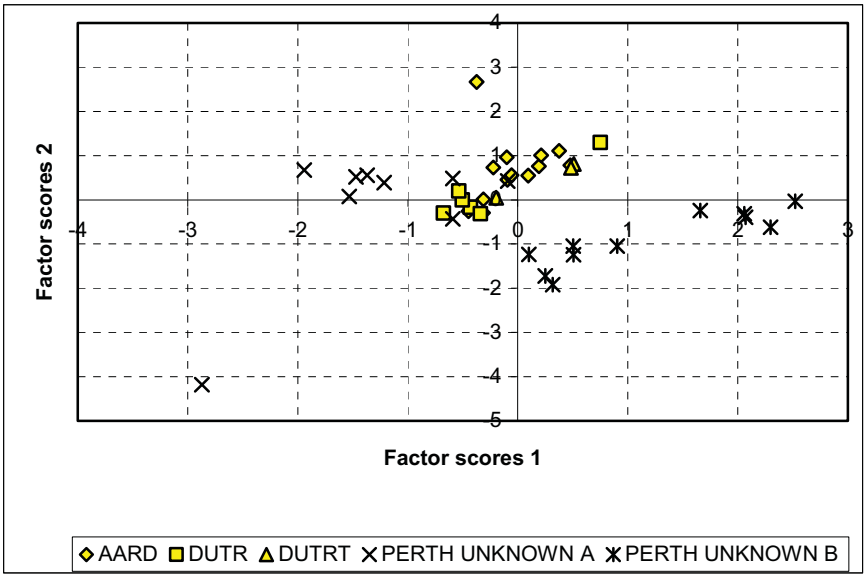


Figure 4

Finally, the two unknown groups were compared with samples from Jutland and Belgium. Factor analysis was carried out but since some of the comparanda were collected using ICP-MS for the Scottish Greywares project (REF), both titanium and magnesium had to be omitted, since they were not measured in that project. Factor analysis confirmed that Perth Unknown B was not similar to any of the comparanda and the analysis was carried out again omitting this group. In this second run, two of the Perth Unknown A samples have compositions similar to the Flemish samples (Perth Samples 40 and 96) whilst the remainder are similar but not identical to southern Jutish samples. Southern Jutland did not have a wheelthrown glazed ware tradition until it was introduced from Flanders in the 13th century and this similarity, if it has any meaning, would again point to the Netherlands, which has a similar surface geology to southern Jutland, as a potential source.

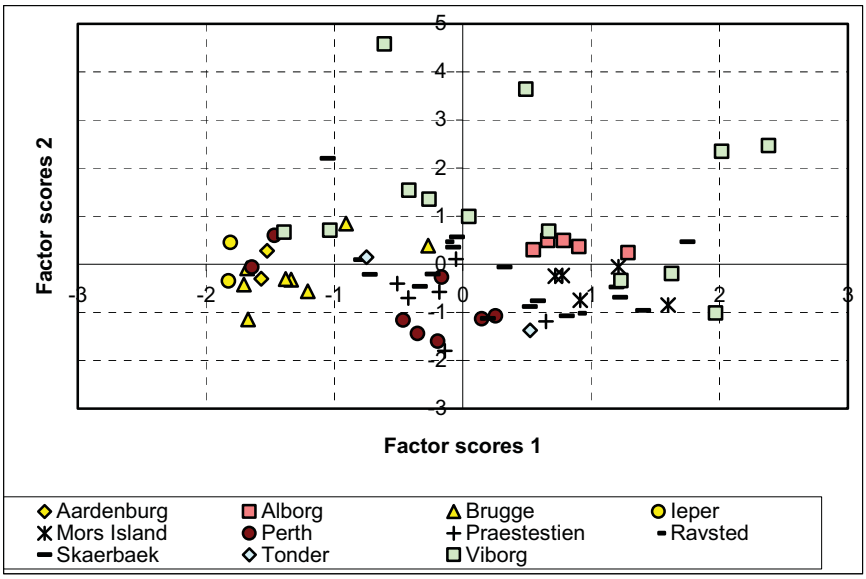


Figure 5

To summarise, none of the Perth samples are Saxo-Norman Lower Thames products. Twenty of the Perth samples are almost certainly London-type ware and include examples of the three main fabrics produced in that industry: Fine London-type ware (LOND); Coarse London-type ware (LCOAR) and Shelly-Sandy ware (SSW). Nine samples form a chemically-distinguishable group which, nevertheless, has close parallels with Lower Thames valley wares. This group, Perth Unknown B, includes two shelly-sandy ware vessels and eight glazed wares and is probably either from a separate source within the Lower Thames estuary or perhaps even from the same source and the London-type and Shelly-Sandy wares but using a slightly different clay. Finally, eleven of the samples form a chemical composition group which is clearly not a Lower Thames product and which is close, but not identical, to the composition of Dutch Red Earthenware. A Low Countries, and specifically Netherlands, source or possibly one in East Anglia are suggested for these samples which may come from two sources, one in Flanders and the other further north.

Scottish White Gritty Ware

In their major study of Scottish White Gritty ware, Jones et al determined that the majority of the white gritty ware found on sites in Scotland originated in southeast and East Scotland, which includes the known production site of Colstoun, Haddington (Jones et al. 2002). Differences between the various groups of samples analysed may be due to differences in source or chronology. In addition, however, they concluded that other centres supplied sites in central and west Scotland and Elgin. The Perth samples were compared with those from sites in Yorkshire and northeast England and only one match was found (see below, North Yorkshire Whiteware). Similarly, the dataset was compared with whitewares from Stamford and France and where good matches were found these too are discussed below. This leaves a residual group which consists of either Scottish or unsampled Northern English origin. This group consisted of 23 samples.

Factor analysis of these 23 samples indicates a broad split into two groups, differentiated by iron content. The higher iron group also has higher magnesium, sodium, potassium, manganese, scandium, nickel, cobalt and the Rare Earth Elements, especially Europium.

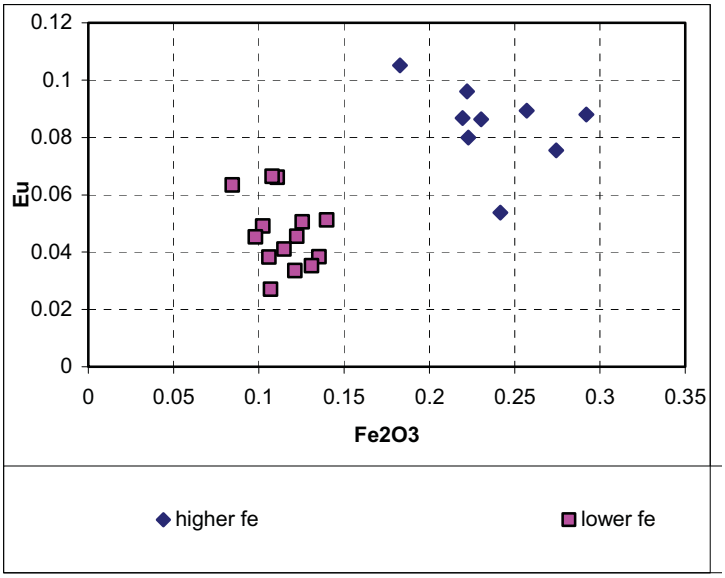


Figure 6

These two groups were compared with data from the Scottish White Gritty Ware project, looking at the data by regional groups.

Looking first at samples from the Tweed Valley (Jones et al. 2002, Table 3), the factor analysis found only one factor. This distinguished the two local clays (Jedburgh and W Morrison clay) but otherwise showed that the lower iron group matched the samples from Coldingham, Kelso and Berwick-on-Tweed whilst the higher iron group had higher F1 scores. Fig 7 plots these F1 scores against estimated silica content, which indicates a similar silica content for the Tweed and Perth samples apart from one sample from Coldingham with an anomalously low silica value.

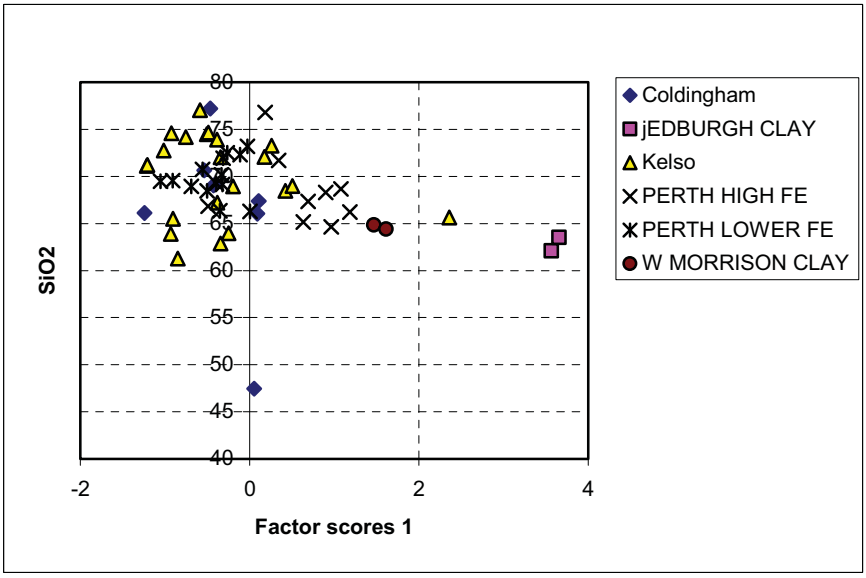


Figure 7

Comparison with the Scottish White Gritty data from sites in East Lothian produced a more complex pattern. Here, samples of clay from the site varied in iron content (Colstoun Clay – High Iron and Colstoun Clay in Fig 8) and factor analysis indicates that both of these clays have higher F1 scores than any of the pottery. Three groups were visible in a plot of the two factors found by factor analysis (Fig 8). The first consists of the Perth samples with the higher iron context, which have higher F2 scores than the remainder; the second consists of samples of some samples of white gritty ware from Colstoun, some samples with a higher iron content (Colstoun red in Fig 8) and the white gritty ware from Dunbar. The second group consists of the Perth samples with a lower iron content, those from Archerfield, Berwick and Haddington and some of the Colstoun white gritty ware samples. Just one of the Perth samples fell into the first group.

It seems clear that the Colstoun potters were using several different clays although none of these match well with the pottery. Interestingly, there are clays and pottery at Colstoun with comparable iron content to those from Perth but they do not match in other aspects of their chemical composition and are distinguished in Fig 8.

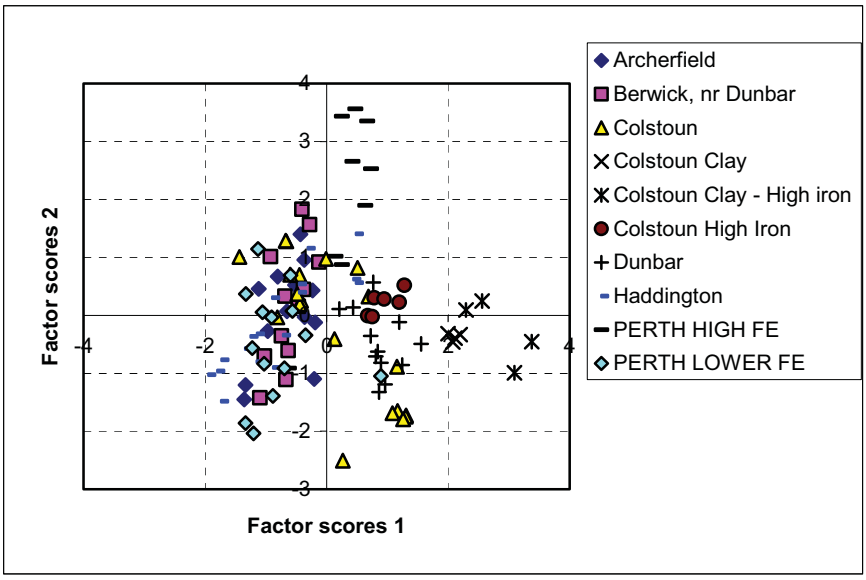


Figure 8

The Scottish White Gritty project samples from the Forth Valley were then compared with the Perth data and three factors were found. These show a strong overlap between the Perth and the Forth Valley samples, including the Perth samples with higher iron. These matching samples come from all four of the Forth Valley sampled localities: Edinburgh, Leith, Linlithgow and Stirling.

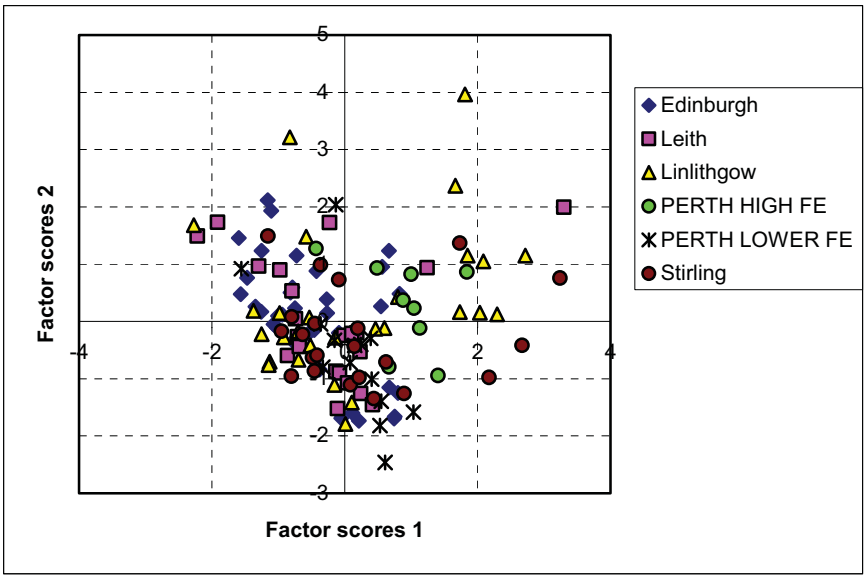


Figure 9

Samples from the Tay Valley and St Andrews were then compared. Factor analysis found three factors and a plot of the first two (Fig 10) reveals that the majority of the samples from Dundee and St Andrews match the Perth lower iron group but that some from St Andrews match the higher group. The Dundee samples form a subgroup within the main cluster. The third factor distinguishes some of the St Andrews samples from the remainder, mainly as a result of their higher lithium values. There therefore appear to be at least three different groups of whiteware on the Tay valley sites: the two groups found at Perth and a third group with higher lithium, found mainly at St Andrews (with one Dundee sample). Assuming that these differences are due to original variations in the composition and not burial conditions, then St Andrews appears to have received all three groups.

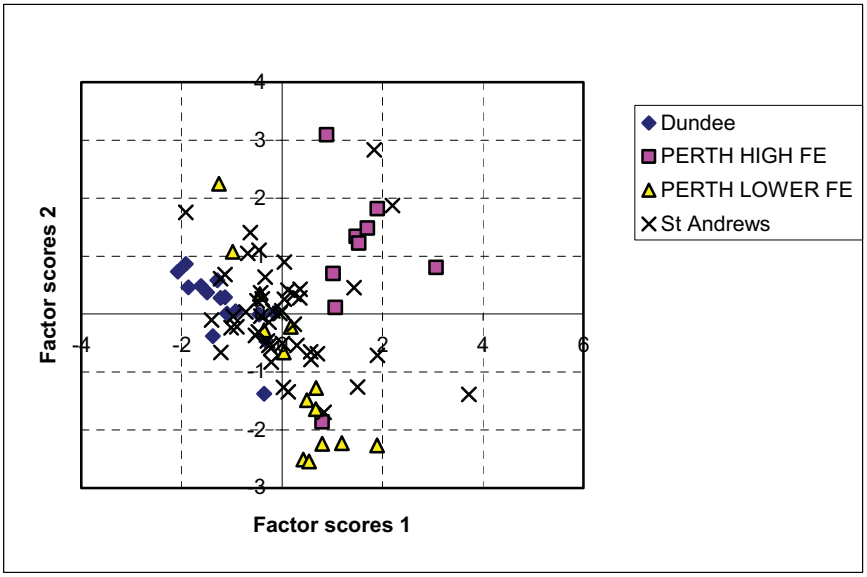


Figure 10

Samples of Scottish White Gritty ware from sites in North Forth were then compared. Factor found three factors and a plot of the first two (Fig 11) indicates that the lower iron group from

Perth matches samples from the three sites of Balchristie, Dunfermline and Kilrenny whilst the high iron group matches none of these.

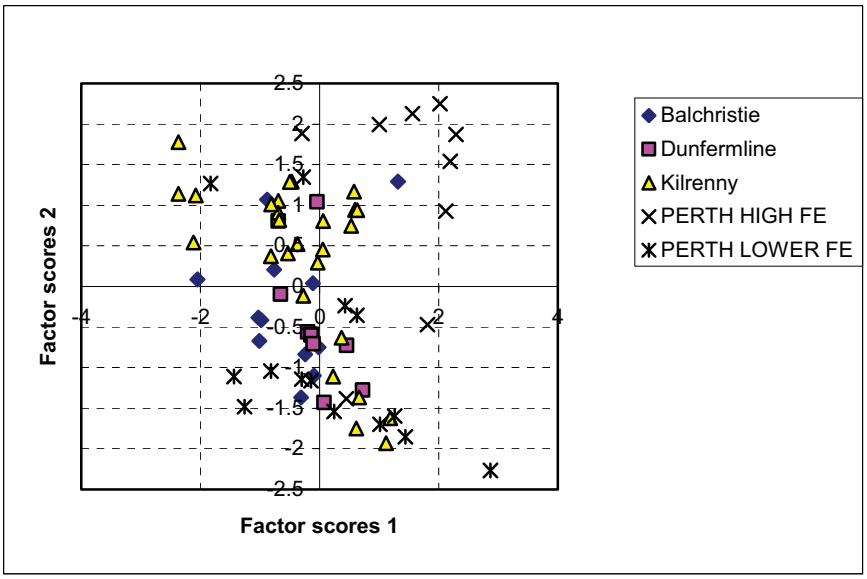


Figure 11

Comparison of the Perth data with that from the Scottish White Gritty ware project from sites in Northeast Scotland (Elgin and Aberdeen) found only one Factor. Samples with high F1 scores had high weightings for iron, magnesium, sodium, and potassium. A plot of iron again europium content (Fig 12) indicates that most of the Aberdeen samples match the lower iron group from Perth whilst the Elgin samples are more similar to the high iron group. Two samples from Aberdeen stand out from the remainder. Factor analysis of just the Elgin and Perth high iron group, however, reveals four factors and a plot of the first two shows that the two groups are distinct, differing in their barium, potassium, sodium, and vanadium contents (Fig 13).

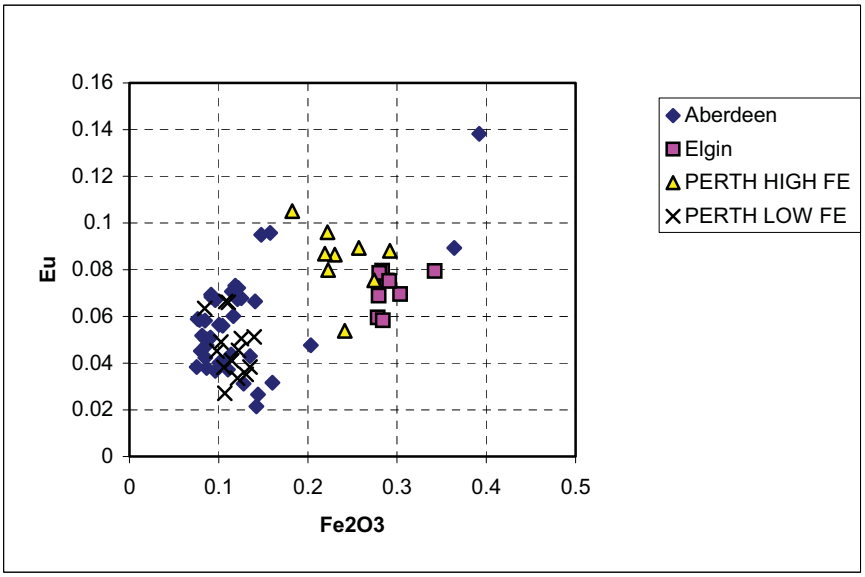


Figure 12

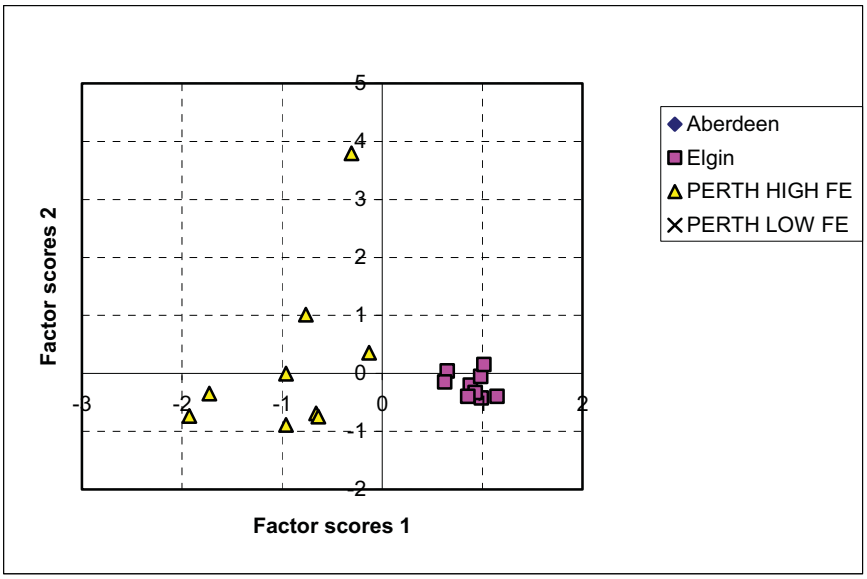


Figure 13

The Scottish White Gritty ware samples from the Clyde valley come from Dumbarton, Glasgow, Lanark and Rothesay. Four of these samples have compositions which suggest they are abnormal (GC3, GC13, GCG5, GS18) and these were omitted. Factor analysis of the remaining data alongside that from Perth finds three factors. None of the three factors, or combinations of them, clearly distinguishes distinct groups within this data (Fig 14 shows the plot with the greatest separation by locality). However, neither Perth group matches samples from Rothesay whilst the high iron group only matches samples from Lanark and Glasgow (and a single outlier at Dumbarton).

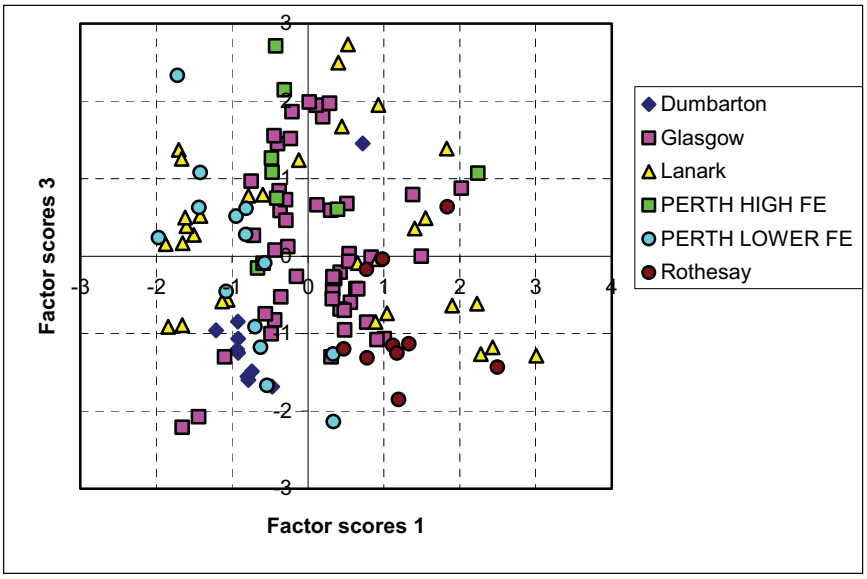


Figure 14

Finally, the data from two localities in West Scotland were compared (Ayr and Buittle Bailey). Factor analysis found only one factor, which distinguished the Ayr and Perth high iron samples from the Buittle Bailey and Perth lower iron group. Titanium values distinguish the Perth high iron group from the Ayr samples (being higher in the Ayr samples). Lithium values

in the Buittle Bailey samples are higher than in the Perth low iron group although factor analysis found four factors and only the third and fourth factors separate the two groups (a high manganese value in one case and high lithium values in the other.
Summarising the results of these regional comparisons, there is clearly a large amount of similarity between the Perth low iron group and that produced in East Lothian. The similarity to samples from the Borders region and north of the Forth could be due to the fact that these sites too received their whiteware from East Lothian although in each case there are other potential sources of white clay. The most likely sources of white-firing clays in this area are the seatearths which underlie coal beds. This not only includes the Coal Measures which outcrop around Portobello and Dalkeith but also thin seams of coal which outcrop in the Limestone Coal and Upper Limestone deposits which underlie the coal measures and outcrop in a zone around them. Finally, the Upper Oil-Shale group which underlies the Lower Limestone includes thin coals. It is this Dinantian strata which forms the bedrock at Colstoun. No similar deposits are noted by the Geological Survey in the Tweed Basin, where the Carboniferous strata consist of limestone. Extensive outcrops of Coal Measures and similar Carboniferous rocks which might include useful white-firing clay occur around Airdrie and Motherwell as well as north of the Forth and these may have been utilised as well.
The second group of white gritty wares at Perth, characterised by its higher iron content, has no parallels in the Borders or East Lothian, nor north of the Forth. The closest parallels occur in the Clyde valley and the Firth of Forth although examples were also present in the St Andrews samples. The relative scarcity of this group at both Perth and St Andrews does not suggest that the possible production site at Ceres is their source and they probably come from somewhere in the midland valley, with access to both the Clyde and Forth valleys.

Lower Seine, Stamford and Andenne-type wares

A number of fine-textured light-firing wares were traded up and down the east coast of England and Scotland in the medieval period. The first of these was produced in the Lower Seine valley and four distinct groups can be identified: La Londe ware (Adrian and Roy 1998;Hodges 1991;Vince 2005a); early glazed ware, probably the identity of the majority of the early glazed ware from Coppergate, York, and isolated other finds from southern and Eastern England (Mainman 1990; Vince and Jenner 1991); Rouen ware and North French Monochrome ware. the last two groups are distinguished mainly by their study of decoration and typology and there is every likelihood that some North French Monochrome ware was produced in the same potteries as Rouen ware, but probably not all. Green-glazed jugs with a hollow, rod handle, for example, are said to be produced in the Paris area whilst jugs with a plain glaze and applied brown strips are thought to have been produced in Picardy (Hillewaert 1992). In addition, a small number of whiteware vessels from Dublin have been tentatively identified by McCutcheon as products of Western France, south of the Loire (McCutcheon 2006; Vince 2006).

The second group was produced at Stamford, South Lincolnshire. Several distinct fabrics were produced at a number of centres located around the periphery of the Late Saxon and medieval town. Products from three of these sites have been sampled: the Castle, a late 9th-century kilnsite found on the site of Stamford Castle (Kilmurry 1977); Wharf Road, dating to the late 11h to early 12th-century century (Mahany and Simpson 1982 and Pantiles, Kilmurry 1980, 49-53, Fig.11, datable from its typology to the mid/late 12th century. In addition, examples of Developed Stamford ware from consumer sites at Viborg, Jutland, and Tewkesbury Abbey, Gloucestershire, were also sampled. The latter ware is thought to date to the second half of the 12th century or first part of the 13th century and is visibly finer in texture than the earlier Stamford wares.

The third group, produced in the Meuse valley, is Andenne-type ware. The fabric of this ware usually has a higher iron content than the first two wares but individual vessels can be confused, especially if only featureless body sherds are present. Unfortunately, no comparative chemical analyses of Andenne-type ware, or its earlier predecessor, Huy-type ware, are available, but samples of Langewehe stoneware, produced in the Rhineland, 75 miles to the east of Andenne, were compared instead.

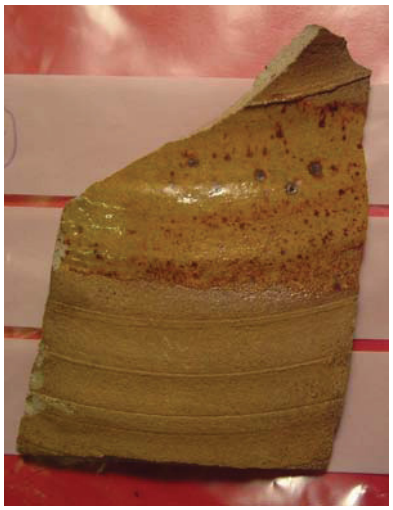


Figure 15 Sample 97

Figure 16 Sample 15

The various Perth fine whitewares were first compared with the Stamford comparanda. Factor analysis of this data revealed three factors and a bi-plot of the first two factors indicates that

the Perth Developed Stamford ware samples match the Pantiles samples, and the Developed Stamford ware samples from consumer sites and have higher F2 scores than the Castle and Wharf Road samples. A single Perth yellow-glazed sample, 23, has an F2 score which was midway between these later Stamford wares and the earlier Stamford wares. The other Perth samples (Andenne-type and possible northern French wares) do not match the Stamford comparanda although one of the Perth Rouen ware samples was more similar to the Stamford ware comparanda than to the other whiteware samples (Perth Sample 42). This analysis suggests that Perth samples 19, 20, 53, 60 and 61 are Developed Stamford ware, dating to the later 12th to early 13th centuries.

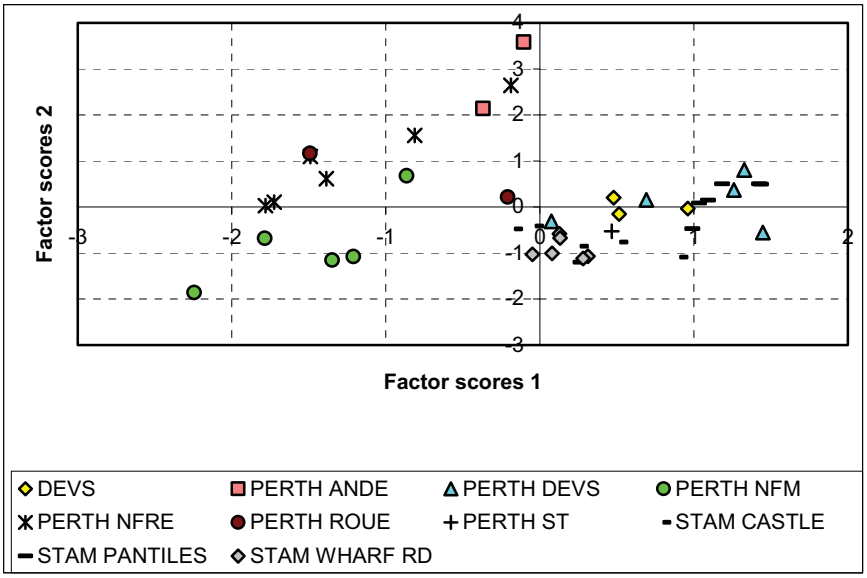


Figure 17

The same Perth data were then run against various Northern and Western French whitewares. Two factors were found and a plot of these two factors found that the Perth Stamford wares and Andenne-type wares did not match with these comparanda but the remaining Perth wares matched those from the Lower Seine valley rather than the French whiteware samples from Dublin, for which a western French source is suggested.

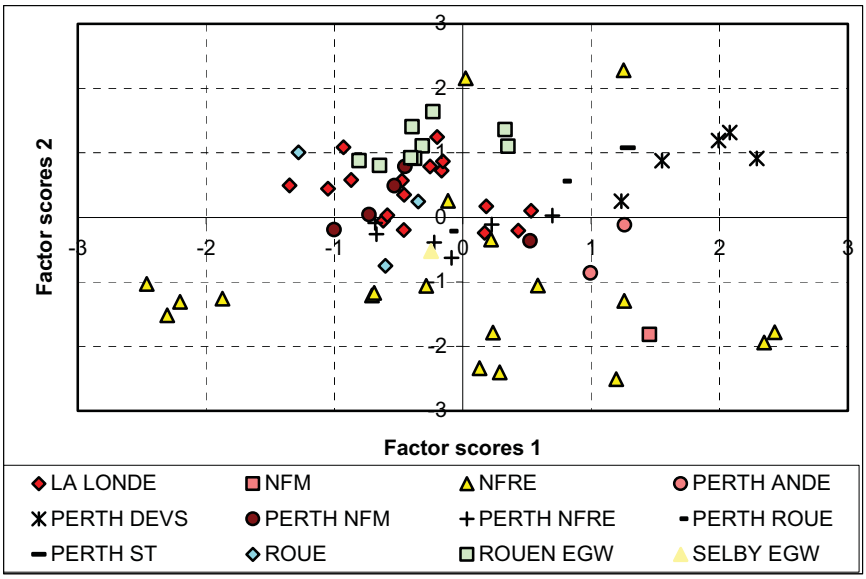


Figure 18

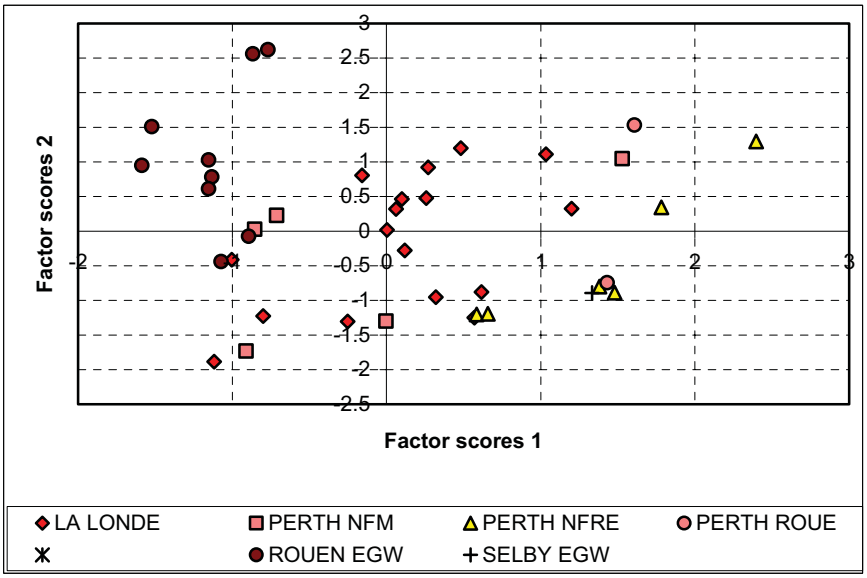


Figure 19

This analysis was repeated omitting all the non-matching samples and this revealed that the early glazed wares from Rouen can be distinguished from the remainder by their higher F2 and lower F1 scores and that the Perth samples. This analysis suggests that the lower Seine valley is the source of these Perth whitewares. There is, however, an apparent difference in composition between the copper-mottled green glazed wares (Perth NFM) and the plain lead glazed and unglazed samples (Perth ROUE and NFRE respectively). However, all of the samples match samples from the La Londe kilns, which are located on the left bank of the Seine, on the opposite side of the river from Rouen. This suggests that they may have been produced in a suburban pottery in a similar area to the earlier la Londe wares whilst the $10^{th}/11^{th}$ century glazed ware found in Rouen may have been produced elsewhere (although quite possibly still in the Lower Seine).

Sample 59 was thought visually to be a French ware and appears to be a jug rim with a thick glossy green glaze. It has abnormally high levels of zinc, copper and chromium, presumably as a result of contamination of the sample by glaze and consequently the sample failed to group with any French comparanda in factor analysis. Omitting these elements, the sample is comparable to Lower Seine valley products.

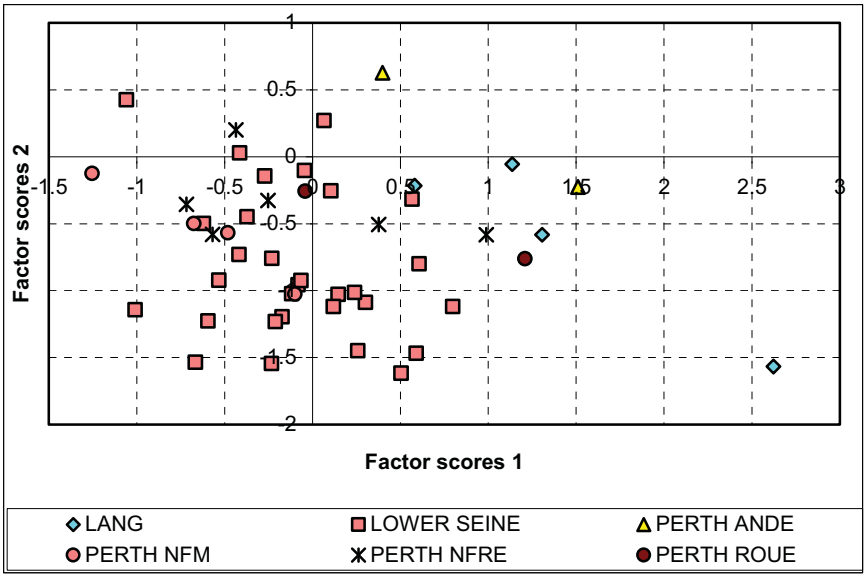


Figure 20

Finally, the Perth whiteware data were compared with samples from Langewehe. Two factors were found and Fig 9 shows a bi-plot of their scores. The two Perth Andenne-type ware samples and the Langewehe samples plot on the periphery of the Lower Seine group. This seems to be mainly due to lower titanium values. The potassium values for the Langewehe samples also distinguish them from the Lower Seine samples, as is shown in Fig. 10.

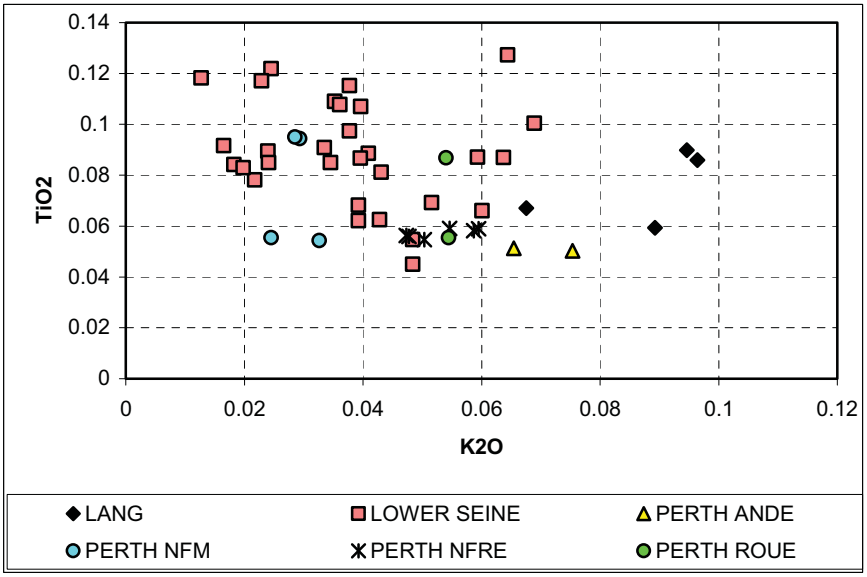


Figure 21

To summarise, 5 samples of Developed Stamford ware have been identified (Perth samples 19, 20, 53, 60 and 61), together with one possibly slightly earlier Stamford ware, sample 23,

although this could be of mid/late 12th century date since it is close in composition to the Pantiles samples. Thirteen samples are probably of Lower Seine origin and these may be divided into two groups: the five green-glazed samples (NFM, samples 14, 16, 56, 66 and 78) and the unglazed and plain-glazed samples (Samples 5, 6, 7, 8, 9, 18, 24, and 42). Finally, two samples are probably Andenne-type ware since they are closer in composition to Langewehe stoneware than they are to Lower Seine and Stamford comparanda.

Low Countries Wares

A number of Perth samples are from wheelthrown red earthenwares which have chemical analyses which distinguish them from Lower Thames wares and other English east coast red earthenwares. A group of these were distinguished only after comparison with Lower Thames comparanda (Perth Unknown A). One other group was identified and given the temporary code of Perth Unknown C. All of these wares were compared with a range of northwestern European and Scandinavian redwares.

Initial factor analysis indicated no comparison with samples from Mors Island (DEN3 1-5) and Aalborg (DEN4 1-5), analysed for the Scottish Greywares project, nor with samples of Flemish floor tiles from Kingston-upon-Hull, Launceston Castle and Barton-upon-Humber. Similarly, samples of post-medieval glazed red earthenware from Hussum and samples of greyware from Viborg were unmatched. These samples were therefore omitted from the dataset and the analysis repeated.

This analysis found three factors and a bi-plot of the first two of these shows that Unknown A samples have high F1 scores, similar to those of Jutish wares and, perhaps more archaeologically significantly, samples from Lubeck. It was suggested above (see London Area wares) that these samples were produced somewhere to the south of Jutland and north of Flanders and this is indeed the most likely source. However, the similarity with Lubeck raises the possibility of a German source, associated with the Hanse. Most of the potteries associated with the 12th and 13th century colonisation of the north European plain, however, was unglazed proto-stoneware and Kugeltopf-style coarsewares, quite different traditions, but Lubeck itself was more cosmopolitan. Nevertheless, despite this evidence a Netherlands source is preferred.

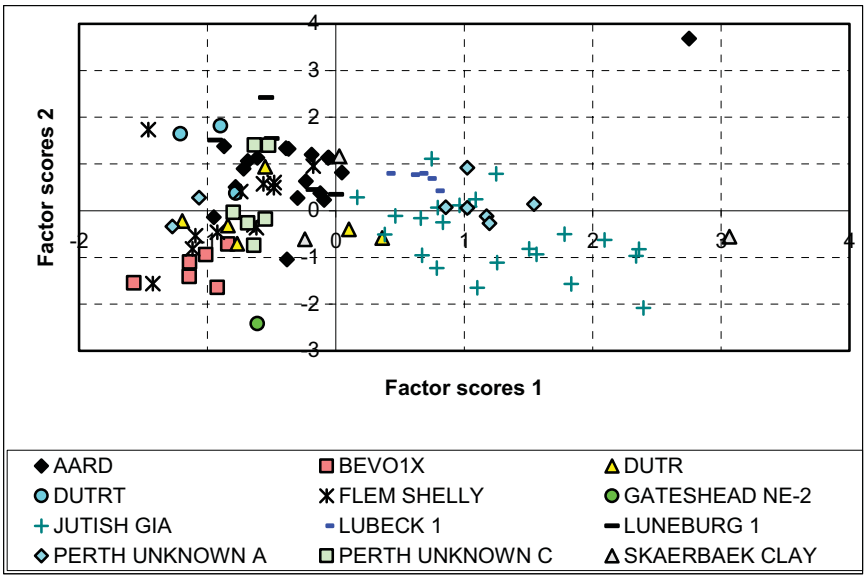


Figure 22

Perth Unknown C in this analysis has similar factor scores to both German and Flemish wares: post-medieval redwares from Luneburg; shelly wares from southern Flanders (Routier 2004); Dutch Red Earthenware; post-medieval Low Countries Redwares from Gateshead; Beverley “X” ware, thought at one time to be a distinct product of the Beverley pottery industry but perhaps actually an import; and Flemish highly decorated ware from Bruges, Aardenburg and Ieper (Ypres).

Factor analysis of just these comparanda and the Unknown C group reveals three factors and a plot of the first against the third factors shows that the Beverley “X” samples have lower F1 scores; the Luneburg samples have both high F1 and F3 scores and the Flemish shelly wares have higher F3 scores. However there is a good match between these Unknown samples and the highly-decorated Flemish wares, the Dutch Red Earthenware samples and the post-medieval Dutch Red Earthenware types (AARD, DUTR and DUTRT in Fig 12). It therefore seems that these samples are indeed early Flemish wares, predating the classic Aardenburg-type highly decorated glazed wares produced at Bruges and, perhaps, elsewhere (as described in Dunning 1968).

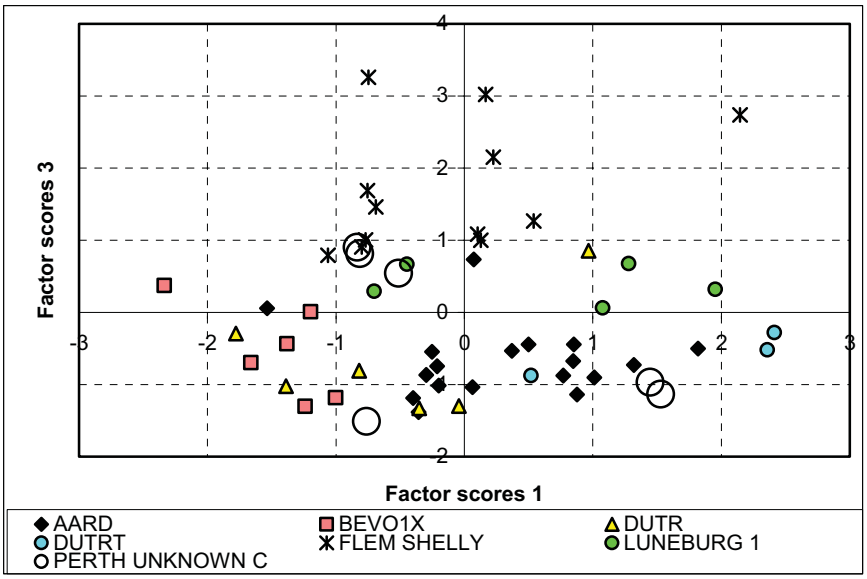


Figure 23

Rhenish and Meuse Valley Wares

Four samples were identified as Pingsdorf ware (2 samples) and Paffrath ware (2 samples), both products of the Vorgebirge region on the west side of the Rhine, between Bruhl and Bonn. A fifth sample appears to be a Rhenish product but from its description and photograph its precise type is indeterminate. These five wares, together with the to Andenne-type ware and a series of comparative samples, all of probable Rhenish or Meuse valley wares but from consumer sites in England.

Factor analysis of this dataset found three factors and a bi-plot of the first and third factors indicates that the Perth Andenne-type ware samples have lower F1 scores than any of the comparanda whilst the Perth Paffrath ware samples have similar compositions to the two comparative samples (Fig 13 BLGR and PERTH BLGR). The two Perth Pingsdorf ware samples have similar compositions to the Paffrath ware samples but not to the comparative sample, which was from a later medieval site at Boston, Lincolnshire (Vince 2005b). That Boston sample has a higher F3 score than the definite Rhenish wares, a trait shared by samples of Langewehe stoneware and proto-stonewares from Boston (EGSW). Red painted wares of Pingsdorf type were produced in the Meuse valley, for example at Brunssum-Schinveld in the Dutch Limburg, about 15 miles northwest of Aachen. Possibly, therefore, the Perth samples are of Vorgebirge origin whilst the Boston sample is of Limburg origin. The possible Perth Rhenish sherd, sample 74, described as a small high-fired pot, has a very similar composition to one of the Perth Pingsdorf samples and is probably another Vorgebirge product.

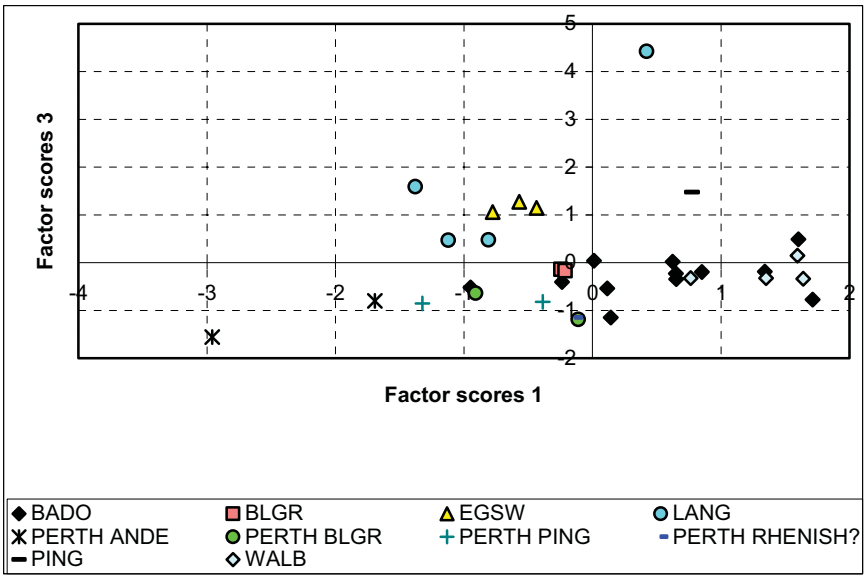
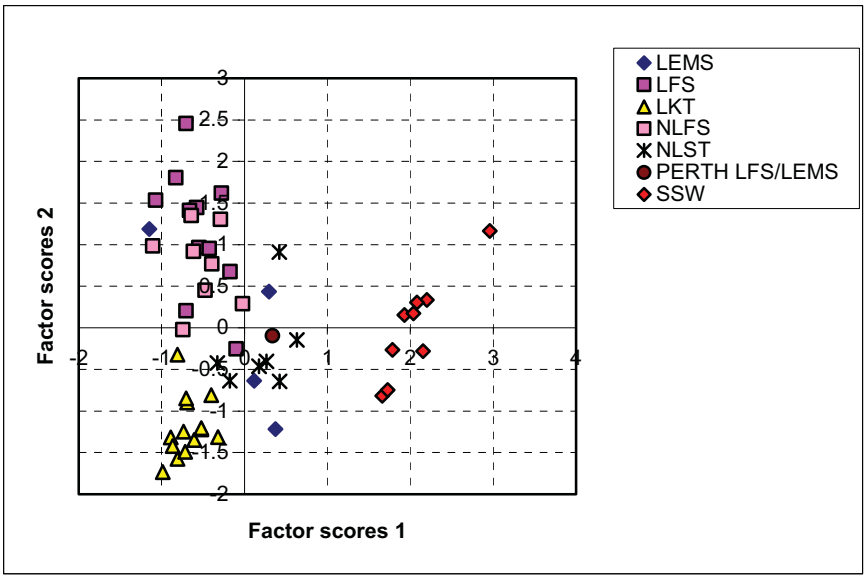


Figure 24

Lincolnshire Shelly Ware

A single sample of shell-tempered ware, Sample 84, was identified visually by Jane Young as being a Lincolnshire shelly ware, perhaps Lincolnshire Fine-Shelled ware (Young and Vince 2006, LFS). All the Perth samples which contained abundant shell inclusions (i.e. the London Shelly-Sandy ware sherds and this sample) were compared with analyses of Lincolnshire Shell-Tempered wares from production sites at Lincoln and consumer sites in Yorkshire. In chronological order, these comparanda consist of Lincoln Kiln Type shelly ware (Young and Vince 2006, LKT) a ware produced in Lincoln and its suburbs from the late 9th to the early 11th centuries; Lincolnshire Fine-Shelled ware, produced at an unknown centre to the north or east of Lincoln between the late 10th and the early 13th centuries (Young and Vince 2006, LFS); North Lincolnshire Fine-Shelled ware, probably produced at the same site as LFS, but containing slightly more quartz sand and probably slightly later in date (12th to early 13th centuries?, NLFS); Lincolnshire Early Medieval Shelly ware, produced at a separate site from LFS and NLFS from the mid 12th to the early 13th centuries (Young and Vince 2006, LEMS) and North Lincolnshire Shell-Tempered ware, again produced to the north or east of Lincoln but distinguished from LEMS by its coarser shell and the range of jar forms, which is ancestral to the Potterhanworth industry of the mid 13th to 15th centuries (Young and Vince 2006, POTT).

Factor analysis of this dataset revealed two factors and a bi-plot of the factor scores clearly shows that the Perth SSW samples have higher F1 scores from sample 84. The plot also clearly shows that the LKT samples have lower F1 and F2 scores than sample 84, which plots in an area of the graph also occupied by NLST and LEMS samples. NLST can be discounted because it has coarser shell and therefore it is a LEMS vessel. This ware is first found in assemblages in Lincoln of early to mid 12th century date but is at its height of popularity in the late 12th and early 13th centuries.



North Yorkshire Whiteware

Three samples were identified by eye as being possible Yorkshire whitewares. Two of these have chemical compositions which clearly show that they are Scottish products although one of these, Sample 58, is the strap handle of a jug with three columns of short comb impressions, a decorative technique typical of Developed Stamford ware and of certain Yorkshire industries in the late 12th century which were presumably influenced by the Stamford vessels.

The remaining sample, 77. comes from a copper-green glazed jug with horizontal bands of grooves/combing with applied “butterflies”. The glaze is glossy and probably applied as a suspension glaze. A Yorkshire source is likely and the sample does not match with the Scottish whitewares. It was therefore compared with samples of York glazed ware (YORK, Jennings 1992); Brandsby-type ware, including samples from the Brandsby kiln; Scarborough ware, from consumer sites at York, Hartlepool and Ingmanthorpe, nr Wetherby; Ruswarp Bank ware from the production site at Ruswarp Bank, nr Whitby. Two West Yorkshire glazed wares were also included, Winksley (Bellamy and Le Patourel 1970) and Lumley Farm, Grantley, which is in the neighbouring parish to the south of Winksley.

A group of coarse whitewares, here called YORK COARSE, were also included. These were probably produced in the same area as York Glazed ware and Brandsby-type ware but probably pre-date the production of glazed ware.

Factor analysis of this dataset reveals two factors. Factor 2 scores separate the West Yorkshire wares (low F2) and the York Coarseware (High F2), leaving a central area in which most of the York Glazed and Brandsby-type ware samples have low F1 scores whilst the Ruswarp Bank and Scarborough wares have higher F2 scores, although there is considerable overlap. Sample 77 has a high F1 score and is therefore more likely to be a Scarborough product than a York Glazed or Brandsby-type ware vessel.

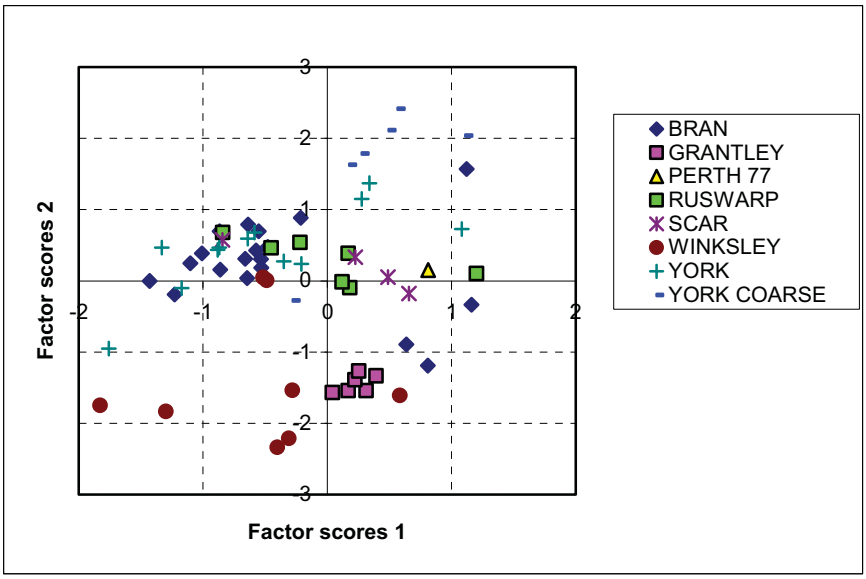

Factor scores 2
Factor scores 1
3
2
1
0
-1
-2
-3
-2
-1
0
1
2
BRAN
GRANTLEY
PERTH 77
RUSWARP
SCAR
WINKSLEY
YORK
YORK COARSE

Figure 25

Bibliography

Adrian, Y.-M. and Roy, N. (1998) "Typologie et proposition de datation de l'atelier de céramique de La Londe (Seine-Maritime)."*La Datation des objets et structures du Haut Moyen Age. Actes des XVe Journées d'Archéologie mérovingienne, Rouen, 4-6 Février 1994*,

Bellamy, C. V. and Le Patourel, H. E. J. (1970) "Four Medieval Pottery Kilns on Woodhouse Farm,Winksley Near Ripon,W.Riding of Yorkshire."*Medieval Archaeol*, XIV, 104-119

Dunning, G. C. (1968) "The Trade in Medieval Pottery around the North Sea." in J. G. N. Renaud, ed., Rotterdam Papers, A Contribution to Medieval Archaeology 1 Rotterdam,

Hillewaert, B. (1992) "An English lady in Flanders: reflections on a head in Scarborough ware." in D. Gaimster and M. Redknap, eds., *Everyday and Exotic Pottery from Europe: Studies in honour of John G. Hurst*, Oxbow Books, Oxford, 76-82

Hodges, R. (1991) "The 8th-century pottery industry at La Londe, near Rouen, and its implications for cross-channel trade with Hamwic, Anglo-Saxon Southampton."*Antiquity*, 65(249), 882-887

Jennings, Sarah (1992) *Medieval Pottery in the Yorkshire Museum*. York, The Yorkshire Museum

Jones, R., Will, R., Haggarty, G., Hall, D., with contributions by Walsh, J., and Marchand, A. (2002) "Sourcing Scottish White Gritty Ware."*Medieval Ceramics*, 26-27, 45-84

Kilmurry, K. (1977) "The production of red-painted pottery at Stamford, Lincs."*Medieval Archaeol*, XXI, 180-6

Kilmurry, K (1980) *The pottery industry of Stamford, Lincs, c AD 850-1250*. Brit Archaeol Rep 84

Mahany, C Burchard A and Simpson, G (1982) *Excavations in Stamford Lincolnshire 1963-1969*. Soc Medieval Archaeol Monogr Ser 9 Soc Medieval Archaeol

Mainman, A J (1990) *Anglo-Scandinavian Pottery from 16-22 Coppergate*. The Archaeology of York 16/5 London, Council British Archaeol

McCutcheon, Clare (2006) *Medieval Pottery from Wood Quay, Dublin: The 1974-6 Waterfront Excavations*. Series B 7 Dublin, Royal Irish Academy

Pearce, J E, Vince, A G, and Jenner, M A (1985) *A Dated Type-series of London Medieval Pottery: Part 2, London-type Ware*. London Middlesex Archaeol Soc Spec Pap 6 London, London Middlesex Archaeol Soc

Routier, J.-C. (2004) "Chapitre V. Le Site médiéval de Brouckerkque. Présentation, étude de structures et du mobilier céramique."*Revue du Nord*, 9, 111-134

Vince, A. G. and Jenner, M. A. (1991) "The Saxon and Early Medieval Pottery of London." in A. G. Vince, ed., *Aspects of Saxo-Norman London: 2, Finds and Environmental Evidence*, London Middlesex Archaeol Soc Spec Pap 12 London Middlesex Archaeol Soc, London, 19-119

Vince, Alan (2005a) *Characterisation of Carolingian Pottery from La Londe, Normandy, using Chemical Analysis*. AVAC Reports 2005/83 Lincoln,

Vince, Alan (2005b) *The Imported Medieval Pottery from Boston (BSE01)*. AVAC Reports 2005/111 Lincoln, Alan Vince Archaeology Consultancy

Vince, A. (2006) "Appendix E: Comments on the chemical analysis of medieval whitewares from Wood Quay." in C. McCutcheon, ed., *Medieval Pottery from Wood Quay, Dublin: The 1974-6 Waterfront Excavations*, Series B 7 Royal Irish Academy, Dublin, 156-162

Young, Jane and Vince, Alan (2006) *A Corpus of Anglo-Saxon and Medieval Pottery from Lincoln*. Lincoln Archaeological Reports Oxford, Oxbow