# Characterisation studies of early post-medieval pottery from Moorfields, City of London (MRL98)


## *Alan Vince*


Excavations just outside the northern city walls of the City of London by Pre-Construct Archaeology produced an assemblage of 16th-century pottery waste interpreted as the products of a documented potter, Richard Dyer. Binocular microscope study of the fabric of this pottery by B. Sudds suggested that it was made in two main fabrics, one slightly coarser in texture than the other. In addition, a few unusual fabrics were noted, principally one containing organic temper and one light-bodied sand-tempered ware.

It was not certain visually whether these two fabric groups were the extreme members of a single clay with variable composition, or whether they were two separate clays, used as dug or whether they were produced using the same clay which had then undergone different preparatory treatments (such as levigation or tempering) before use. Samples were therefore taken from within the wasters to try and answer these questions.

A further set of questions concerned the origin of the raw materials used by the potter. To examine this question the data from Moorfields was compared with that from a variety of other wares produced in the locality, ranging in date from the early Roman period to the 12th or 13th centuries.

Finally, it was remarked that the pottery is visually similar to that produced in Essex (Stock and Harlow). Unfortunately, no examples of the products of these two industries were available to the author for comparison but the data were compared with samples of late 13th - to 14th-century Mill Green ware from a production site at Noak Hill, near Ingatestone, excavated and published by Pre-Construct Archaeology.

## Methodology

The samples were studied using thin sections and chemical analysis (Table 1). Because of the very fine texture of the fabric, with few inclusions over 0.3mm across and most less than 0.1mm, only four thin sections were made. They comprised a sample of the "sandy" fabric (V2139), a sample of the "fine sandy" fabric (V2133), a sample of a vessel with an organic temper (V2146) and a sample of a chafing dish with a "fine sandy" fabric which appeared from visual examination to have additional inclusions (V2145). The thin sections were prepared by Steve Caldwell at the University of Manchester and were stained using Dickson's method {Dickson #44803} 1965) which distinguished between ferroan and non-ferroan calcite and between calcite and dolomite (irrelevant in this case since no calcareous inclusions were present).

*Table 1*

| TSNO | Context | Sample | cname | Form | Action | Description | subfabric |
|---|---|---|---|---|---|---|---|

| | | Number | | | | | |
|---|---|---|---|---|---|---|---|
| V2133 | 100 | 01 | PMSRG | JUG | TS;ICPS | | FINE SANDY GROUP |
| V2134 | 100 | 02 | PMSRY | JUG | ICPS | | FINE SANDY GROUP |
| V2135 | 100 | 03 | PMRE | ?CAUL | ICPS | | FINE SANDY GROUP |
| V2136 | 100 | 04 | PMRE | CAUL | ICPS | | FINE SANDY GROUP |
| V2137 | 100 | 05 | PMR | JUG | ICPS | | FINE SANDY GROUP |
| V2138 | 100 | 06 | PMR | JUG | ICPS | | FINE SANDY GROUP |
| V2139 | 100 | 07 | PMSRG | JUG | TS;ICPS | | SANDY GROUP |
| V2140 | 100 | 08 | PMSRG | JUG | ICPS | | SANDY GROUP |
| V2141 | 100 | 09 | PMSRG | JUG | ICPS | | SANDY GROUP |
| V2142 | 100 | 10 | PMSRY | JUG | ICPS | | SANDY GROUP |
| V2143 | 100 | 11 | PMSRY | JUG | ICPS | | SANDY GROUP |
| V2144 | 100 | 12 | PMSRY | JUG | ICPS | | SANDY GROUP |
| V2145 | 100 | 13 | PMSR | CHAF | TS;ICPS | UNFINISHED VESSEL. SIMILAR FABRIC TO FINE GROUP | FINE PLUS SILT/SHELL? |
| V2146 | 100 | 14 | PMRE+ORG | | TS;ICPS | UNUSUAL FORM | FINE PLUS ORGANICS |
| V2147 | 1798 | 15 | ORG | | ICPS | UNUSUAL FORM | FINE PLUS ORGANICS+ SHELL |
| V2148 | 825 | 16 | PMRST | DISH | ICPS | | ESSEX/LOCAL? |

Sub-samples of these four samples, plus samples of a further 13 vessels were submitted to Dr J N Walsh at Royal Holloway College for chemical analysis using Inductively Coupled Plasma Spectroscopy (ICP-AES). The samples were analysed using the lab's standard routine which measures a range of major, minor and trace elements. Major elements are measured as percent oxides and the remainder as parts per million.

## Results

### Petrological analysis

#### Fine Fabric (V2133)

The thin section reveals a fine-textured, completely oxidized fabric in which a single rounded quartz grain, c.0.5mm across, and rounded brown and black clay pellets of similar texture to the groundmass are the only inclusions over 0.2mm across. The groundmass consists of slightly anisotropic baked clay minerals and abundant angular quartz, moderate rounded pellets of altered glauconite, sparse biotite, sparse feldspar and sparse pleiochroic unidentified ferromagnesian minerals all up to 0.2mm across.

#### Sandy Fabric (V2139)

The thin section reveals a medium-textured, completely oxidized fabric containing moderate to abundant ill-sorted rounded quartz grains ranging from 0.3mm to 1.5mm across. In addition, sparse rounded brown clay pellets up to 1.0mm across and sparse angular flint up to 0.5mm long were noted.

The groundmass is similar to that of the fine fabric but may contain a slightly higher density of inclusions.

### Fine fabric with Silt/Shell inclusions (V2145)

The thin section reveals a fine-textured fabric, very similar to that of the fine fabric (V2133). There are two areas where the groundmass is black rather than oxidized and these are both optically isotropic. These patches might be due to higher firing or to the presence of unburnt carbon. There are, however, no sign of shell inclusions, nor the voids which burnt-out shell would leave, which must therefore imply that these inclusions are exceedingly rare.

### Fine fabric plus organics (V2146)

The thin section reveals a fine-textured fabric, similar to that of the fine fabric, V2133. The core of the vessel is black, due to the presence of carbon. The sample contains moderate linear voids, up to 3.0mm long and 0.2mm wide, some of which have dark haloes surrounding them. In one case the void has been cut transversely and is ovoid in section with carbonised organic material in the centre. The shape of these inclusions shows that they are finer than the chaff found in Anglo-Saxon chaff-tempered wares with none of the structures seen in those wares. It is likely that they represent rotting vegetable matter, perhaps including roots. Larger, rounded voids give the impression of once containing calcareous inclusions, probably from their irregular outline calcareous septarian nodules which outcrop in the London Clay. Some of these voids contained phosphate, but this is likely to be post-burial concretion rather than phosphate nodules.

## Source of the potting clay

The four thin sections show that the parent clay used in all four was the same, or similar. The nature of the inclusions suggests that they come from a deposit of glacial or more recent date. The texture is much coarser than that found in London Clay, which has a silty, micaceous facies as we as the more common silt-free clay which outcrops underneath the brickearth at the City of London. The mixed nature of the silt-sized inclusions in the groundmass is consistent with the finer fraction found in the brickearth and indeed the sandy fabric is very similar to that of brickearth samples from the London area. Most of the brickearth underlying the City of London contains too little clay to be used for potting although excellent, as the name implies, for brick-making. The presence of possible rotting vegetable matter in sample V2146 suggests possibly that the clay was obtained from the Moorfield area itself where the upper tributaries of the Walbrook were impeded in the Roman period, leading to the formation of a marshy area. It is possible that natural silting in this area might have produced a fabric similar to that observed in the sections. Another possibility is that the fabric was formed by the artificial mixture of London Clay and Brickearth by the potters. However, if so, this mixing was uncommonly effective as there are no lenses of varying texture seen in the sections. It does seem likely, however, that the sandy fabric was formed by adding quartz sand, quite possibly from the brickearth, to a silty/fine sandy clay.

## Chemical analysis

The chemical data were examined using factor analysis and scatterplots to gain insight into the main areas of variation within the chemical composition of the samples and to look for groups of elements which co-vary, which may suggest that they entered the samples by the same mechanism.

To take account of variations in the overall quantity of sand, which is composed mainly of quartz and serves to dilute the frequency of other elements measured, the measurements were all divided by the value of the Al2O3 measurement for the sample concerned. Prior to this, however, the overall quantity of sand (and organic inclusions and chemically-combined water, none of which are measured in ICPS analysis) was calculated, but summing up all the measurements and subtracting from 100%. Fig 1 shows a plot of 'silica' (as defined above) against Al2O3. It can be seen that there are indeed two clusters in this data, corresponding to the sandy and fine sandy fabrics. However, one of the fine sandy samples (V2136) actually has the highest silica context calculated. Sample V2145, classed visually and in thin section as a fine sandy fabric, has a similar silica content to the finest of the sandy fabrics. A sample thought possibly to be an Essex product by the pottery specialist has silica/Al2O3 values consistent with the fine sandy fabric group, as does V2146 (Fine fabric plus organics). The only anomalous sample is V2147, not examined in thin section. This sample was noted visually by Sudds as being very different (classed as ORG).

This analysis straightaway suggests that there are indeed two distinct fabrics used at the site and that the sandier fabric contains about 5% extra silica.

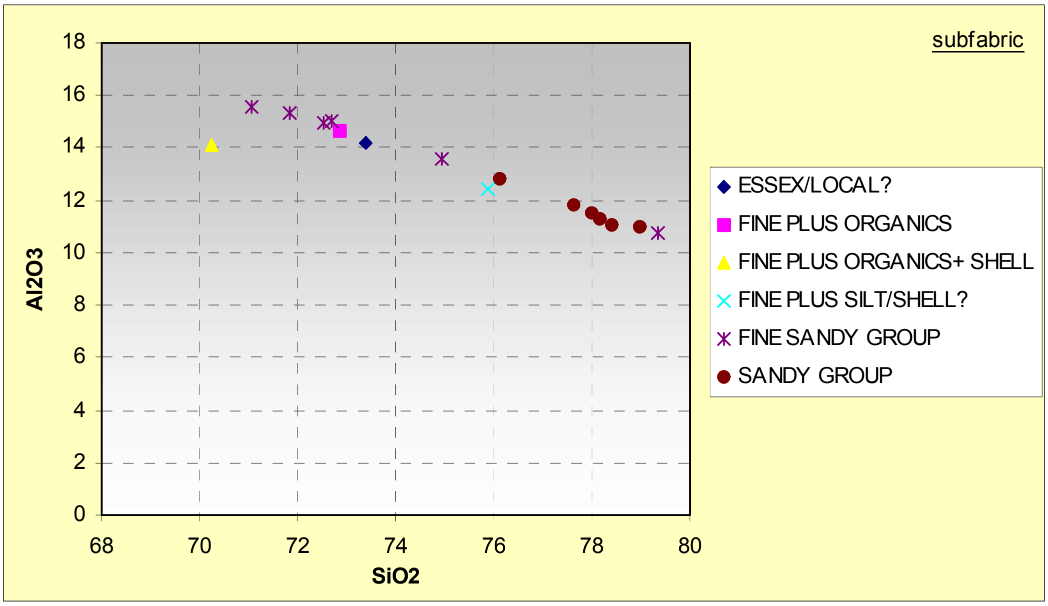


*Figure 1*

When the transformed data were analysed using factor analysis it was decided to omit the CaO and Sr values from analysis, because of the evidence from V2147 to show that calcareous inclusions may have been leached from the samples. A scatterplot of the two main factors (Fig 2) shows that sample V2146 again is chemically distinct from the remainder, which form an elongated cluster with the fine sandy samples at one end and the sandy ones at the other. The samples of the two unusual fabrics (V2145 and V2146) have similar compositions and both plot at the fine sandy end of the cluster. The putative Essex sample plots midway between the fine and sandy ends and there is one sandy sample with a composition more resembling the fine sandy samples and one fine sandy sample more resembling the sandy samples.

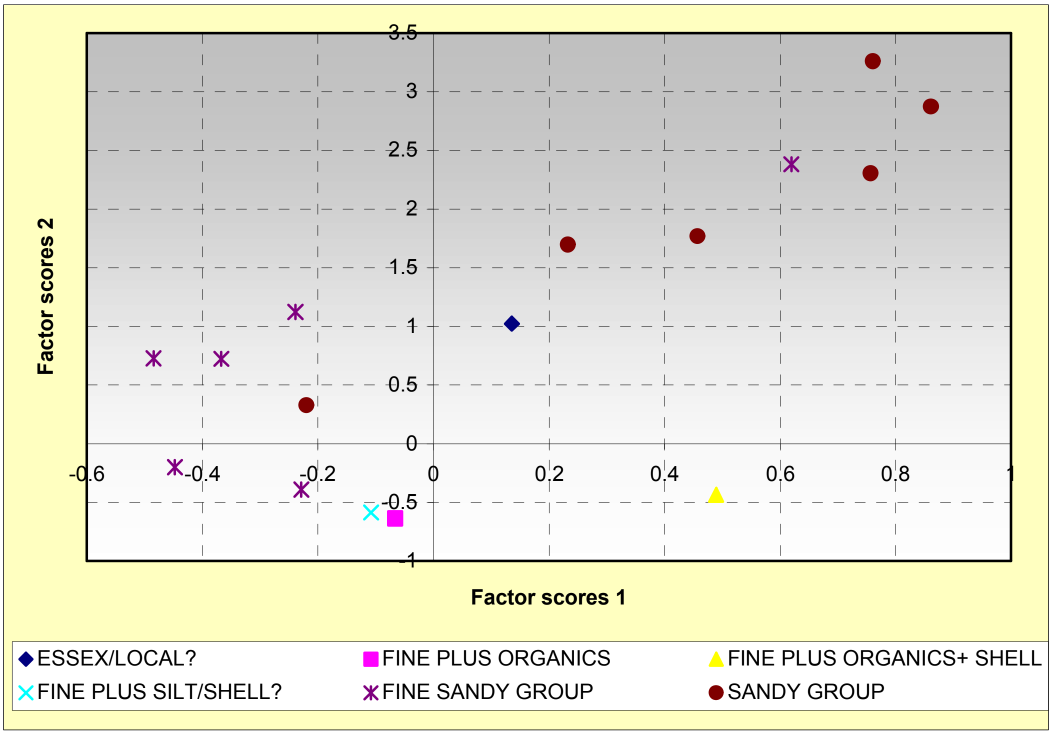


*Figure 2*

A study of the weightings given to the various elements to arrive at the Factor 1 and 2 scores shows that high Factor 1 scores depend on K2O, Sc, V, Fe2O3 and TiO2. It is possible that all these scores depend on the quantity of sand: K-rich feldspars, Ironstone pellets and Titanium oxides such as Rutile. Factor 2 scores depend mainly on rare earth elements, which are most likely concentrated in the clay fraction of the samples. However, the sandy samples not only have high F1 scores but also high F2 scores. Since there is no correlation of the rare earth elements and those giving high F1 scores it is unlikely that they are present in the sand fraction. This suggests that there is indeed a difference in the clay composition between the sandy and the fine fabrics. This may be due to the inclusion of clay with the added sand and that clay having higher frequencies of rare earth elements than the parent clay. Another possibility, however, would be that the two groups are indeed taken from separate clay deposits which vary naturally in their chemical composition but not in their petrological characteristics as seen in thin section.

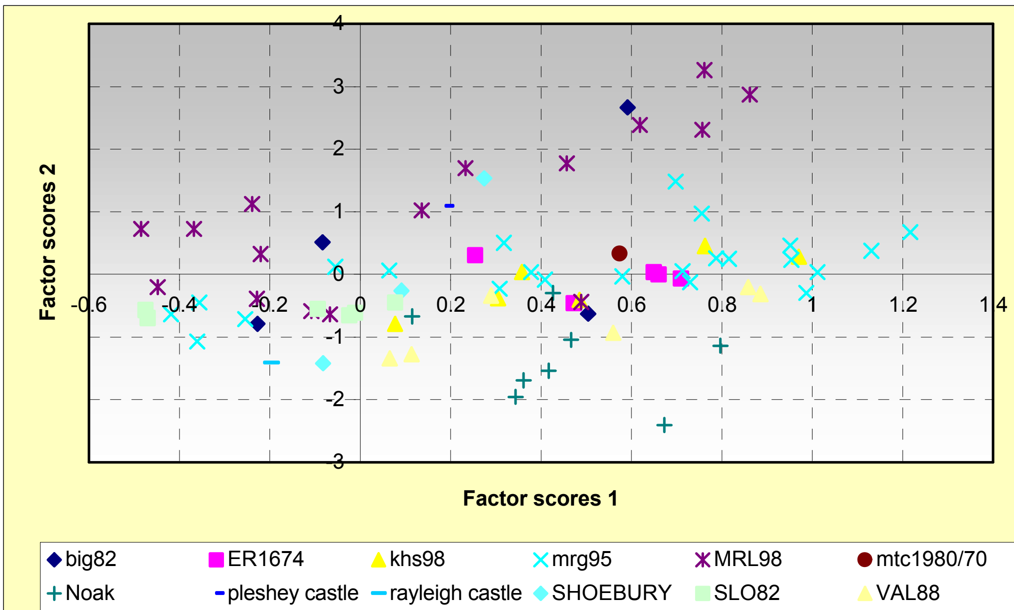


*Figure 3*

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The MRL98 fine fabric overlaps in composition, again, with London-type and Shelly-sandy wares from Billingsgate (big82) but also  with some of the wares produced in the Roman period with the City: Northgate House (mrg95) is in the upper Walbrook valley and Sugar Loaf Court (SLO82) is in the lower Walbrook valley. The latter site was definitely exploiting untempered London Clay. Both of these wares, however, have negative Factor 2 scores which distinguish them from the majority of the fine fabric samples.

Samples from other production sites in the central London area have compositions which do not overlaps with the MRG98. These include the majority of the samples from Northgate House (mrg95), and all those from Copthall Close (ER1674) and a second group of samples from Northgate House (khs98) (all three sites in the upper Walbrook valley) and a group of medieval sandy greyware wasters from the Fleet Valley (VAL88).

Finally, the 13th/14th-century Mill Green ware samples from Noak Hill, which include both pottery and tile samples, form a clearly separate cluster from both the MRL98 samples and the remaining City of London wares.

Two further Factors were calculated by the factor analysis and scatterplots of these further elucidate the relationship of the various wares. Fig 4 shows a scatterplot of Factors 3 and 4 for the different fabric groups at MRL98. It too finds two clusters, one composed mainly of the sandy samples and the other mainly of the fine ones. In this case, however, two of the fine samples plot with the sandy ones, together with sample V2146 (fine plus organics) whilst the ?Essex sample clearly belongs to the fine fabric cluster. There are two outliers, samples V2147 and V2145.

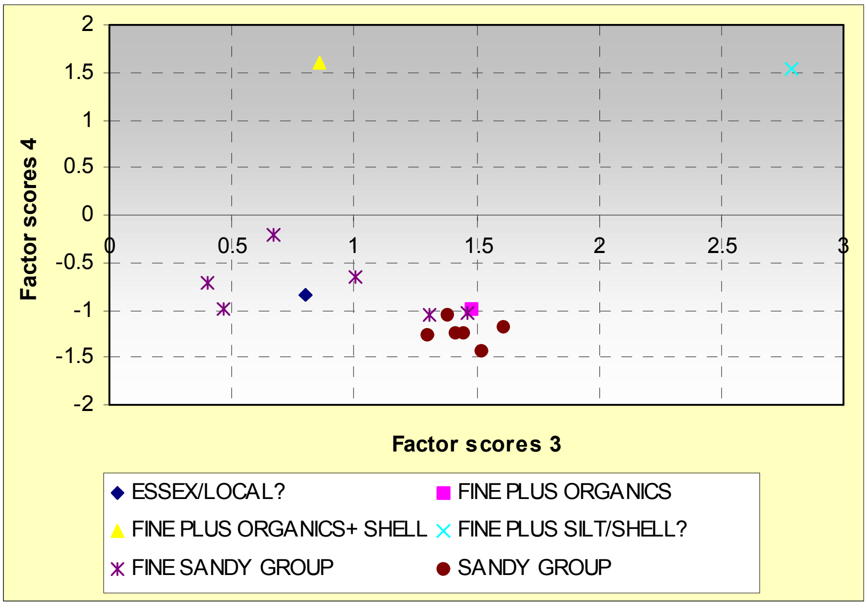


*Figure 4*

In Fig 5 these MRL98 samples are compared with those from other kiln groups. In this plot, the overlap with the Sugar Loaf Court samples seen in Fig 3, is not present and the samples from that site plot with those from Copthall Close and the Fleet Valley whilst the Noak Hill samples form a group distinguished from MRL98 by their higher Factor 3 scores.  In this plot, only one Roman sample, from MRG95, has a similar composition to fine the MRL98 samples.

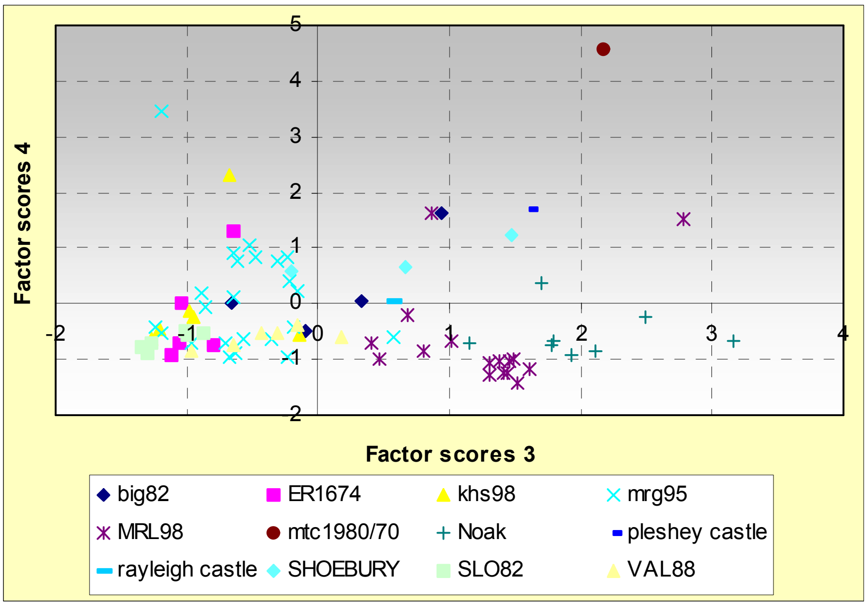


*Figure 5*

The sample of white-slipped, light-bodied sandy ware was quite different in chemical composition to the remaining MRL98 and comparative samples and was therefore omitted from the analysis above. It was then compared with samples from the Eden Street kiln in Kingston and with Kingston-type ware wasters from the south bank of the Thames (Fig 6).

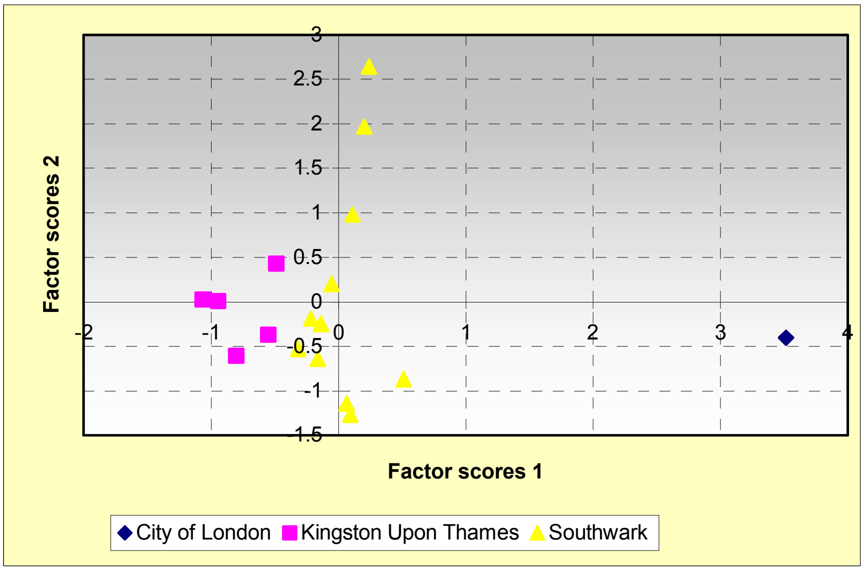


*Figure 6*

This analysis shows clearly that the fabric of the MRL98 sample (marked "City of London" in Fig 6) is quite different from that of the Kingston-type wares too. Visually, the sample looks like a group of light-bodied, sandy glazed wares with a white slip and copper-stained lead glaze found in 13th and 14th-century deposits in the City. In the 1980s these were termed Kingston-type Slipped ware (KING SLIPPED) and assumed to be a Surrey whiteware product. The presence of two joining sherds which have been fired in different conditions is not sufficient evidence to prove that this group was actually made in the vicinity of the City of London but does suggest that the attribution to Surrey requires further proof.

## Discussion

Combining the results from both analytical methods, it is clear that there are two distinct fabric groups present at MRL98 and on balance it seems likely that these represent difference clay sources rather than the tempering of the fine ware with brickearth-derived sand, which would be more likely to produce a continuous range of compositions with fine samples at one end and coarse at the other. Nevertheless, both of these fabric groups are more similar to each other than to other groups of London or Essex manufacture. The thin section analysis makes it clear that both fabrics include the same mixture of Cretaceous-, Tertiary- and Erratic-derived rocks and minerals which originated in the brickearth. It is probably the presence of brickearth which causes the MRL98 samples to have similar compositions to the shelly-sandy and London-type wares in Fig 3 whilst further factors (Fig 5) separate these groups.

Of the oddities, the putative Essex-made sherd is clearly an MRL98 product. Sample V2146 has a slightly-different chemical composition from the two main fabric groups and samples V2147 and V2145 have more markedly different compositions. No characteristics in the thin section of V2145 can explain this difference whilst there is no corresponding thin section of V2147 for comparison.

## Conclusions

Thin section and chemical analysis of samples from the MRL98 site shows that the 16$^{th}$-century potter(s) probably used two distinct but local clays and that these clays both contain brickearth. The chemical analysis also demonstrates that the MRL98 products are distinguishable from other wares produced in the vicinity of the City. They are, however, more similar to late 12$^{th}$ and 13$^{th}$-century London-type and Shelly-sandy ware samples although these too can be distinguished from the MRL98 samples using factor analysis. A greater test would be to compare the MRL98 wares with those produced at a slightly later date to the south of the Thames, at places like Vauxhall, (Guys ware) and those produced in the late 15$^{th}$ and earlier 16$^{th}$ century (Tudor Brown wares). If they can indeed be distinguished then this short-lived pottery could be a useful chronological indicator for sites in central London.

## Acknowledgements

The thin sections were produced by Steve Caldwell, Department of Earth Sciences, University of Manchester. The ICP-AES analysis was carried out by Dr J N Walsh, Department of Geology, Royal Holloway College, London. Peter Hill undertook initial sample preparation in both cases. Frank Meddens kindly supplied ICP-AES data from his and Dr Walsh's study of the Noak Hill pottery.

*Table 2 ICP-AES Analysis. Major Elements measured as percent oxides*

| TSNO | Al2O3 | Fe2O3 | MgO | CaO | Na2O | K2O | TiO2 | P2O5 | MnO |
|---|---|---|---|---|---|---|---|---|---|
| V2133 | 14.99 | 6.55 | 1.45 | 0.65 | 0.38 | 2.48 | 0.69 | 0.1 | 0.035 |
| V2134 | 15.34 | 6.99 | 1.46 | 0.57 | 0.39 | 2.57 | 0.74 | 0.08 | 0.04 |
| V2135 | 15.54 | 7.11 | 1.48 | 0.69 | 0.42 | 2.68 | 0.75 | 0.22 | 0.046 |
| V2136 | 10.77 | 5.34 | 0.93 | 0.47 | 0.33 | 2.12 | 0.6 | 0.08 | 0.021 |
| V2137 | 14.93 | 6.75 | 1.41 | 0.59 | 0.41 | 2.49 | 0.74 | 0.1 | 0.032 |
| V2138 | 13.55 | 6.22 | 1.23 | 0.48 | 0.41 | 2.36 | 0.7 | 0.08 | 0.028 |
| V2139 | 11 | 5.58 | 0.92 | 0.38 | 0.32 | 2.09 | 0.65 | 0.07 | 0.017 |
| V2140 | 11.26 | 5.78 | 0.97 | 0.5 | 0.33 | 2.22 | 0.63 | 0.11 | 0.022 |
| V2141 | 11.81 | 5.89 | 0.98 | 0.41 | 0.36 | 2.21 | 0.62 | 0.07 | 0.017 |
| V2142 | 12.79 | 6.21 | 1.03 | 0.45 | 0.37 | 2.27 | 0.65 | 0.08 | 0.023 |
| V2143 | 11.49 | 5.88 | 0.97 | 0.38 | 0.35 | 2.24 | 0.63 | 0.06 | 0.018 |
| V2144 | 11.06 | 5.81 | 0.97 | 0.46 | 0.34 | 2.22 | 0.61 | 0.09 | 0.025 |
| V2145 | 12.42 | 6.09 | 0.91 | 0.8 | 0.38 | 2.28 | 0.62 | 0.61 | 0.018 |
| V2146 | 14.63 | 6.61 | 1.35 | 0.68 | 0.41 | 2.53 | 0.76 | 0.15 | 0.027 |
| V2147 | 14.1 | 6.08 | 1.78 | 2.58 | 0.31 | 2.88 | 0.74 | 1.24 | 0.036 |
| V2148 | 14.19 | 6.62 | 1.43 | 0.68 | 0.39 | 2.4 | 0.73 | 0.12 | 0.035 |
| V2149 | 15.17 | 3.83 | 1.13 | 0.39 | 0.24 | 2 | 0.65 | 0.1 | 0.013 |

*Table 3 ICP_AES Analysis. Minor and Trace elements measured as ppm*

| TSNO | Ba | Cr | Cu | Li | Ni | Sc | Sr | V | Y | Zr* | La | Ce | Nd | Sm | Eu | Dy | Yb | Pb | Zn | Co |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| V2133 | 377 | 105 | 31 | 81 | 57 | 16 | 81 | 132 | 28 | 61 | 45 | 84 | 47.094 | 9.3 | 1.7725 | 5.1 | 2.5 | 639.11 | 87 | 22 |
| V2134 | 378 | 107 | 29 | 82 | 59 | 16 | 79 | 138 | 29 | 58 | 46 | 95 | 47.94 | 9.2 | 1.7505 | 5 | 2.6 | 564.96 | 82 | 24 |
| V2135 | 412 | 110 | 35 | 75 | 65 | 17 | 89 | 122 | 31 | 69 | 46 | 118 | 48.316 | 9.6 | 1.8445 | 5.4 | 2.9 | 1167.06 | 121 | 28 |
| V2136 | 352 | 85 | 24 | 47 | 40 | 12 | 70 | 96 | 23 | 46 | 38 | 86 | 39.668 | 8.1 | 1.533 | 4.2 | 2.1 | 398.03 | 62 | 16 |
| V2137 | 382 | 105 | 32 | 71 | 52 | 15 | 79 | 126 | 23 | 61 | 40 | 79 | 41.642 | 8.2 | 1.5625 | 4.3 | 2.4 | 1956.07 | 92 | 22 |
| V2138 | 356 | 97 | 27 | 66 | 41 | 14 | 75 | 119 | 20 | 55 | 36 | 80 | 37.318 | 7 | 1.289 | 3.7 | 2 | 731.85 | 76 | 16 |
| V2139 | 332 | 76 | 26 | 49 | 38 | 12 | 63 | 99 | 22 | 50 | 37 | 85 | 38.446 | 7.6 | 1.421 | 3.9 | 2 | 302.9 | 60 | 13 |
| V2140 | 376 | 92 | 26 | 50 | 41 | 13 | 75 | 108 | 25 | 47 | 42 | 96 | 43.804 | 9.2 | 1.611 | 4.6 | 2.3 | 440.14 | 66 | 15 |
| V2141 | 367 | 91 | 25 | 51 | 39 | 13 | 72 | 106 | 23 | 47 | 40 | 92 | 41.548 | 8 | 1.5055 | 4.2 | 2.1 | 423.09 | 64 | 15 |
| V2142 | 355 | 95 | 26 | 58 | 40 | 13 | 72 | 116 | 21 | 50 | 38 | 89 | 39.386 | 6.6 | 1.2895 | 3.9 | 2 | 657.91 | 65 | 18 |
| V2143 | 351 | 94 | 24 | 50 | 41 | 13 | 69 | 114 | 25 | 47 | 40 | 99 | 41.83 | 8.5 | 1.506 | 4.5 | 2.2 | 791.71 | 60 | 16 |

| TSNO | Ba | Cr | Cu | Li | Ni | Sc | Sr | V | Y | Zr* | La | Ce | Nd | Sm | Eu | Dy | Yb | Pb | Zn | Co |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| V2144 | 370 | 91 | 28 | 49 | 43 | 12 | 72 | 107 | 25 | 45 | 43 | 104 | 44.932 | 8.8 | 1.6095 | 4.8 | 2.3 | 781.74 | 64 | 15 |
| V2145 | 428 | 89 | 47 | 47 | 42 | 13 | 97 | 90 | 19 | 58 | 32 | 75 | 33.276 | 6.5 | 1.1955 | 3.4 | 2 | 856.58 | 282 | 11 |
| V2146 | 411 | 108 | 40 | 71 | 46 | 16 | 88 | 129 | 22 | 55 | 38 | 77 | 39.198 | 7.7 | 1.3695 | 3.7 | 2.1 | 575.77 | 99 | 14 |
| V2147 | 597 | 103 | 95 | 62 | 54 | 16 | 152 | 147 | 24 | 72 | 36 | 78 | 37.788 | 6.7 | 1.396 | 4.2 | 2.5 | 73.3 | 149 | 18 |
| V2148 | 396 | 109 | 56 | 71 | 56 | 15 | 87 | 132 | 29 | 57 | 42 | 92 | 44.274 | 8.7 | 1.669 | 5.1 | 2.6 | 1762.01 | 84 | 19 |
| V2149 | 368 | 85 | 48 | 53 | 29 | 13 | 100 | 94 | 14 | 53 | 34 | 67 | 34.498 | 4.5 | 0.9085 | 2.7 | 1.6 | 1744.93 | 67 | 12 |