Provenancing Roman Mortaria and Coarsewares from Stanwick, Northamptonshire using ICP Analysis

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Summary

ICP analysis was used to determine the origins of second century mortaria recovered from the Roman settlement at Stanwick. The mortaria were thought to have been produced in either the Upper or Lower Nene valley, in Northamptonshire and Cambridgeshire, or Mancetter / Hartshill, in Warwickshire. Some coarseware fabric types identified amongst the Stanwick assemblage, the majority thought to be Nene valley products, were also analysed. The results showed that the Nene valley mortaria and many of the coarsewares were made using the Upper Estuarine Series (UES) clay. Products of the Upper and Lower Nene valley were therefore compositionally similar but could be distinguished using trace elements. The Mancetter / Hartshill mortaria were made from a mica-rich clay that was compositionally distinct from the Nene valley UES clay products.

Analysis showed that although the mortaria produced at Ecton in the Upper Nene valley were made from the UES clay, a different type of clay was used to make greywares at the same site. Further research is required to determine the origins the C4 coarseware fabric identified at Stanwick, which was compositionally similar to the Ecton greywares but not identical. The coarseware fabric A2 was probably made from calcareous Oxford Clay. Previous research has shown that this clay was utilised by potters in the Lower Nene valley but it would also be available to potters in the region of Milton Keynes and the distribution of the wares suggests that this is probably where the A2 fabric was produced.

Keywords

Roman, pottery, analysis

Introduction

The Nene valley in Northamptonshire and Cambridgeshire was one of the prime pottery producing areas of Roman Britain and the products from the area were widely distributed (Storey, 1988). Amongst the pottery recovered during excavations of the Roman settlement at Stanwick, in Northamptonshire, were mortaria and coarsewares that were thought to have been produced in the Nene valley. However, mortaria types of the second century produced in the Lower and Upper Nene valley, were so similar in terms of their fabric and form to each other, and to the mortaria produced in Mancetter / Hartshill, Warwickshire, that it was very difficult to differentiate between them. Some subtle differences between the wares were apparent in the hand specimen, and were used tentatively to distinguish between the wares, but a way of testing these criteria was needed. ICP (inductively coupled plasma spectrometry) analysis and petrology were used, to see if compositional or mineralogical differences could be found between the wares that would confirm the validity of the macroscopically defined groupings. However petrological examination of selected mortaria by David Williams (2001) revealed that all were made of fine clays with few visible mineral inclusions save for the quartz grains added as temper. Although similarities were observed between fabrics believed to originate from the same areas, these observations were based upon the methods of clay preparation and the types of temper used, rather than on the clay types. Therefore the remainder of the study concentrated on the potential of the ICP technique.

Control Groups

It was first necessary to establish control groups consisting of pottery samples known to derive from each region, ideally from kiln sites or stamped by potters known to have worked in those areas. The known potters for the three regions of interest are summarised in table 1. Details of the samples analysed are given in tables 4 to 18, including the provenance, fabric type, form, fabric and the suspected source of the wares.

Table 1: The potters associated with each region of interest

Region	**Upper Nene valley**	**Lower Nene valley**	**Mancetter/Hartshill**
Potters	]VNICO ANCO[T]TREVS DATICVS MEVICVS CAMVLACVS [..]D(or O)IV[..]/CVN[..] Possibly VEDIACVS Possibly DOBALLVS Herringbone pattern	CVONARDA VARINNA VIATOR CONRILVS SABINVS Possibly SIMILIS ETAVICOMVS	DOBALLVS GRATINVS IVNIVS MOSSIVS BRVSCIVS MAVRIVS RVICCOC(O/VS) ICOTASGVS SARRIVS VITALIS SIMILIS

Mortaria, including stamped vessels, have been excavated from Mancetter / Hartshill kilns and this control group, comprising both kiln finds and stamped mortaria, was the most reliable. The Lower and Upper Nene valley control groups comprised samples of stamped vessels thought to be products of each region on the basis of the known production areas of certain potters or the distribution of their products. In the Upper Nene valley, there is some suggestion that mortaria may have been made at Ecton, which was a large production site for coarse quartz-tempered greywares in the second century (Johnston, 1969, 90). In addition the potter VEDIACVS is thought to have produced stamped mortaria in the Upper Nene valley, sometimes combining a grog-tempered bowl with a quartz-tempered flange and rim and at other times making fully grog-tempered vessels. There are no known Lower Nene valley mortaria kilns dating to the second century, but the potter CVONARDA is known to have worked in the area. Also the distribution of some subtly different stamped, and unstamped, mortaria suggests that these may have been produced in the region. Literature data on the composition of clay samples from near Roman kiln sites at Sulehay (near Yarwell), Stibbington, Water Newton, Sibson and Stanground in the Lower Nene valley are provided by Storey (1988).

Tested groups

Samples were taken from 54 mortaria from Stanwick, which had been provisionally assigned to the Lower or Upper Nene valley or Mancetter / Hartshill according to the slight differences apparent in hand specimen. By comparing the ICP compositional data for the mortaria control groups with the data for these tentatively sourced mortaria, the reliability of the characteristics used to assign fabric groups to different regions could be tested. The primary aims were to distinguish Nene valley pottery from Mancetter / Hartshill pottery, and also to distinguish between the wares of the Lower and Upper Nene valley.

If sourcing of the mortaria using ICP was successful, then attempts would also be made to establish the likely origins of coarseware fabrics identified at Stanwick, including fabrics A1 and A3 (both grog-tempered), D6/9 (self-coloured), C4 (grey) and D2 (very fine, cream fabric). Fabric D2 was thought to be linked to lower Nene valley creamwares (Perrin, 1999, 108-111). Fabrics A1, A3, D6/9 and C4 were thought to be products of the Upper Nene valley, specifically the Ecton kiln site in the cases of fabrics D6/9 and C4. However kilns producing material to fabric D6/9 have recently been discovered at Godmanchester, Cambridgeshire (Evans, forthcoming), emphasising the need to investigate these assumptions further. The ICP data would also be used to confirm whether the potter VEDIACVS worked in the Upper, rather than the Lower, Nene valley as suspected, and whether the quartz tempered flanges of his mortaria were made from the same clay as his grog-tempered pots. The source of Fabric A2 (soft, pink, grog-tempered), the soft pink grog tempered ware described by Tomber and Dore (1998, 210), remains unknown. However the distribution of this fabric suggests a source in the Towcester / Milton Keynes region and this was investigated in this study. It should be noted that the rare examples of this fabric from Stanwick were largely restricted to 4th century contexts.

A summary of the ceramic groups analysed is given in table 2 and details of each sample are given in the appendices.

Table 2: Descriptions and suspected source of the different types of ware sampled

Group	Suspected source	Description
Quartz-tempered mortaria control groups	UNV	Quartz-tempered flanges of VEDIACVS stamped and VEDIACVS-type mortaria
	LNV	Distribution of finds suggests LNV provenance plus potter CVONARDA
	MH	Found at various sites but are thought to derive from MH by recognition of the potters stamp or the form of the mortaria
Other mortaria	UNV	Quartz-tempered stamped, not including the VEDIACVS stamped or VEDIACVS-type mortaria. Distribution of finds suggests UNV provenance
	Ecton, UNV	Thought to include kiln samples
	UNV	Grog-tempered VEDIACVS and VEDIACVS-type
	Various	Un-sourced, quartz-tempered mortaria from Stanwick
Coarsewares	Ecton, UNV	Greywares, thought to include kiln samples
	MH	Kiln finds
	Milton Keynes	A2 soft pink grog-tempered wares
Stanwick Coarsewares	UNV	A1 hard cream, grog-tempered
	UNV	A3 hard cream, grog-tempered
	Ecton, UNV	C4 pale cored greyware
	Ecton, UNV	D6/9 buff, gritty self-coloured
	NV	D2 very fine cream / white fabric

ICP Methodology

219 sherds were sampled for analysis by drilling several widely spaced holes into a cleaned portion of sherd surface using a tungsten carbide drill bit and collecting the powdered residue. The holes were scattered over the available surface to obtain a representative sample, regardless of the heterogeneity of the ceramic. However museum objects were sampled over smaller areas because of cosmetic constraints. A minimum of ten samples was taken for each fabric, as this was statistically sufficient to characterise the different groups. 0.2g of each 0.5g sample was processed and dissolved, during which the silica in the sample was lost as a volatile fluoride. The samples were analysed using ICP emission spectrometry for a suite of 25 major and trace elements, by Nick Walsh at Royal Holloway and Bedford New College, University of London using methods described by Thompson and Walsh (1989). Analytical precision and error for ICP is usually quoted at 2-5% (Walsh pers. comm).

Results

The results of the analyses are given in the appendices. The values for silica have been calculated by subtracting the total for all of the other elements from 100 (i.e. calculated by difference).

The following discussion of the analytical results is supplemented by plots comparing the concentrations of elements in the different groups of wares. In some figures, coarseware fabrics and control group quartz-tempered mortaria have been compared. However, the silica content of quartz-tempered fabrics will be higher than for grog-tempered wares made from the same clay. As the silica will effectively dilute the concentrations of other elements in the quartz-tempered wares, the data for quartz-tempered and grog-tempered groups has not been directly compared. Instead, ratios of different elements or normalised element concentrations were plotted. (The normalised concentrations were calculated by ignoring the calculated value for silica and normalising the remaining data to 100).

Distinguishing the Nene valley and Mancetter / Hartshill wares

In figures 1 and 2 the data for the mortaria control groups from the Upper Nene valley (UNV), Mancetter / Hartshill (MH) and the Lower Nene valley (LNV) are plotted together. The quartz-tempered VEDIACVS-stamped and VEDIACVS-type mortaria flanges, which form one group, have also been plotted.

The Lower and Upper Nene valley mortaria had similar compositions, except for variations in the concentrations of titanium oxide and some trace elements. The type of clay used to produce these wares was identified as the Upper Estuarine Series (UES) clay, by comparing the Nene valley mortaria ICP data with literature data (Storey, 1988; Anderson et al, 1982). Storey (1988) sampled and analysed a variety of clays in the Nene valley and Anderson et al (1982) analysed hunt cups produced in the Nene valley. The ICP data for certain elements has been plotted in figures 1 and 2. The samples in the UNV mortaria control group (excluding the VEDIACVS-stamped and VEDIACVS-type mortaria) were quite scattered, with three of the samples (numbers 58, 4 and 59) plotting with the Mancetter / Hartshill mortaria group, which suggests that they have been mis-assigned. The implication of this result is discussed in the next section on Distinguishing the Upper and Lower Nene valley wares. The VEDIACVS-stamped mortaria plotted closely together, as would be expected for the products of one potter, with the other Nene valley wares.

The Mancetter / Hartshill mortaria were made from clay containing higher concentrations of potassium oxide and magnesium oxide (figure 2) than the Nene valley UES clay. This was consistent with the petrological findings for samples from Mancetter / Hartshill, which had comparatively high mica contents (Williams, 2001). The Mancetter / Hartshill mortaria could therefore be clearly distinguished from the Nene valley mortaria made from the UES clay.

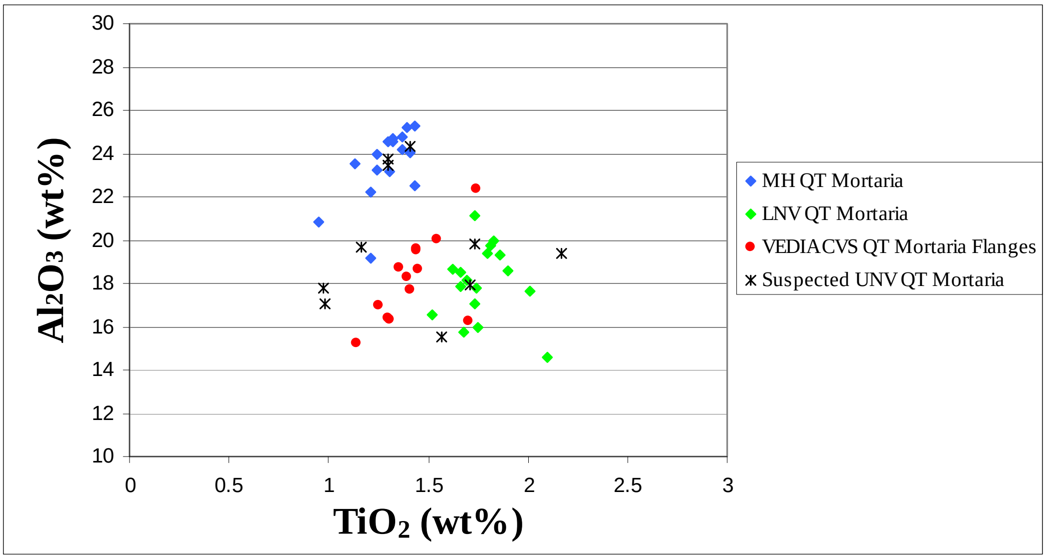

Figure 1: Aluminium oxide versus titanium oxide for the quartz-tempered mortaria control groups from Mancetter / Hartshill (MH), the Lower Nene valley (LNV) and the Upper Nene valley (UNV). The VEDIACVS-stamped and VEDIACVS-type mortaria have also been plotted.

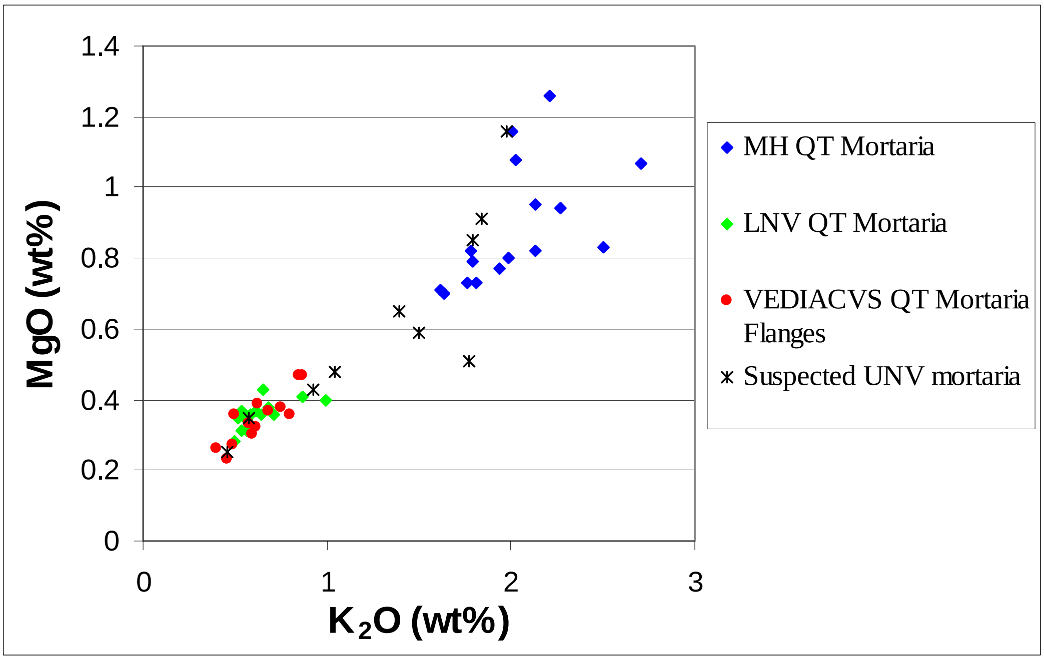

Figure 2: Magnesium oxide versus potassium oxide for the quartz-tempered mortaria control groups from Mancetter / Hartshill (MH), the Lower Nene valley (LNV) and the Upper Nene valley (UNV). The VEDIACVS-stamped and VEDIACVS-type mortaria have also been plotted.

Distinguishing the Upper and Lower Nene valley wares

As the Upper and Lower Nene valley mortaria were all made from the UES clay, they have very similar compositions except for the concentrations of titanium oxide and some trace elements. As the titanium oxide content varied inconsistently between sites in each region, it could not be used to distinguish UNV from LNV products. However the UNV and LNV groups could be separated using the concentrations of different trace elements, including niobium (Nb), cerium (Ce), neodymium (Nd), dysprosium (Dy), barium (Ba) and lithium (Li). In this report lithium and barium have been plotted against each other (figure 3) to illustrate differences between groups. The Lower Nene valley wares contained approximately three times the amount of lithium and slightly more barium than the Upper Nene valley products.

The Lower Nene valley compositional group included vessels stamped by the potter SIMILIS (samples 1 and 36), demonstrating that this potter worked in the Lower Nene valley, as well as at Mancetter / Hartshill and Carlisle, as shown by other research (Hartley, in McCarthy, 1990, 262-3).

The compositional data confirms that VEDIACVS worked in the Upper, rather than the Lower, Nene valley, although two of the VEDIACVS-stamped mortaria, samples 57 and 60, are outliers due to unusually high barium contents (figure 3).

Samples 58, 4 and 59, which were produced by the potter DOBALLVS and are in the Upper Nene valley control group, in fact plotted with the Mancetter / Hartshill fabrics. Therefore, although two of these samples were found in the Nene valley (sample 58 is from excavations at Mancetter / Hartshill), all of them were produced at Mancetter / Hartshill. Two vessels stamped by DOBALLVS have also been recovered from kiln sites at Mancetter / Hartshill (Hartley, 1973). Petrology found that these samples had high mica contents and contained pieces of siltstone, fine-grained sandstone and a little opaque iron oxide (Williams, 2001).

Samples 9, 6 and 62, which are part of the Upper Nene valley control group, have higher potassium and magnesium oxide and lower titanium oxide contents than the majority of the Nene valley wares. However the trace elements suggest that these samples probably are Nene valley products. Two of these samples have potters stamps: VNIVO and MEVICVS, and the other has a herringbone pattern. Petrology identified a higher concentration of mica and some iron oxide in the former sherd, accounting for the compositional discrepancies observed.

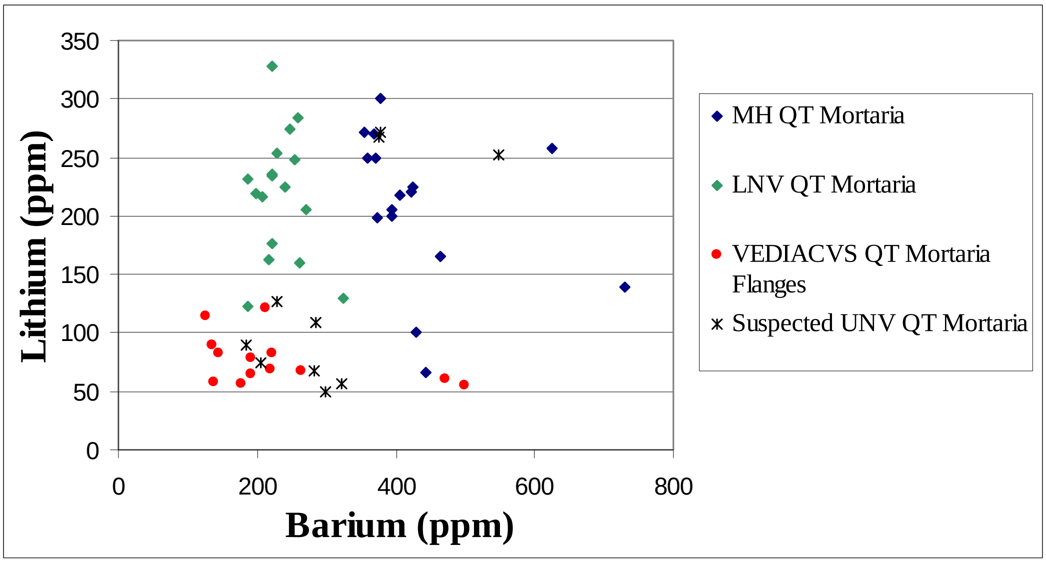

Figure 3: Lithium versus barium for the quartz-tempered mortaria control groups from Mancetter / Hartshill (MH), the Lower Nene valley (LNV) and the Upper Nene valley (UNV). The VEDIACVS-stamped and VEDIACVS-type mortaria have also been plotted.

As three samples from Mancetter / Hartshill, stamped by the potter DOBALLVS, were mis-assigned to the Upper Nene Valley control group, the group containing quartz-tempered VEDIACVS-stamped and VEDIACVS-type mortaria flanges has instead been used as the UNV control group for the remainder of this report, to avoid confusion. These control group samples are shown as red, green and blue data points in the remaining figures.

Grog-tempered bodies of VEDIACVS stamped and VEDIACVS type mortaria

These wares (grog-tempered VEDIACVS-stamped and VEDIACVS-type mortaria) were compared to the quartz-tempered control groups. The grog-tempered VEDIACVS-type wares plotted with the Upper Nene valley control group and so both the quartz-tempered flanges and the grog-tempered bodies of the wares (as well as the grog itself) were made from the UES clay (figure 4).

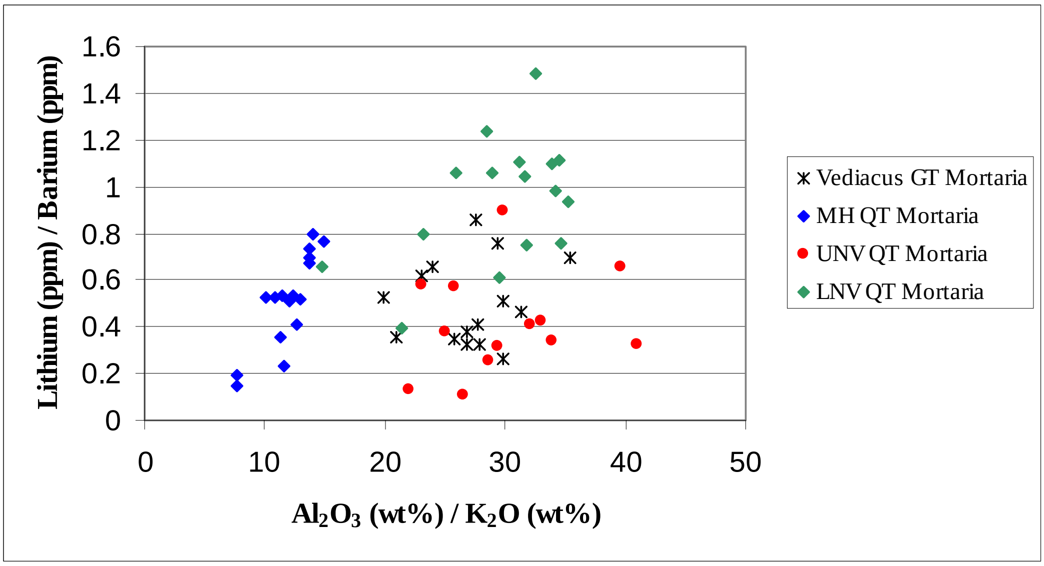

Figure 4: Lithium / barium versus aluminium oxide / potassium oxide for the grog-tempered VEDIACVS and VEDIACVS type mortaria compared to the MH, LNV and UNV control groups.

Ecton quartz-tempered mortaria

The quartz-tempered mortaria from Ecton, a kiln site in the Upper Nene valley, consistently plotted with the Upper Nene valley control group and so were made from the UES clay (figure 5).

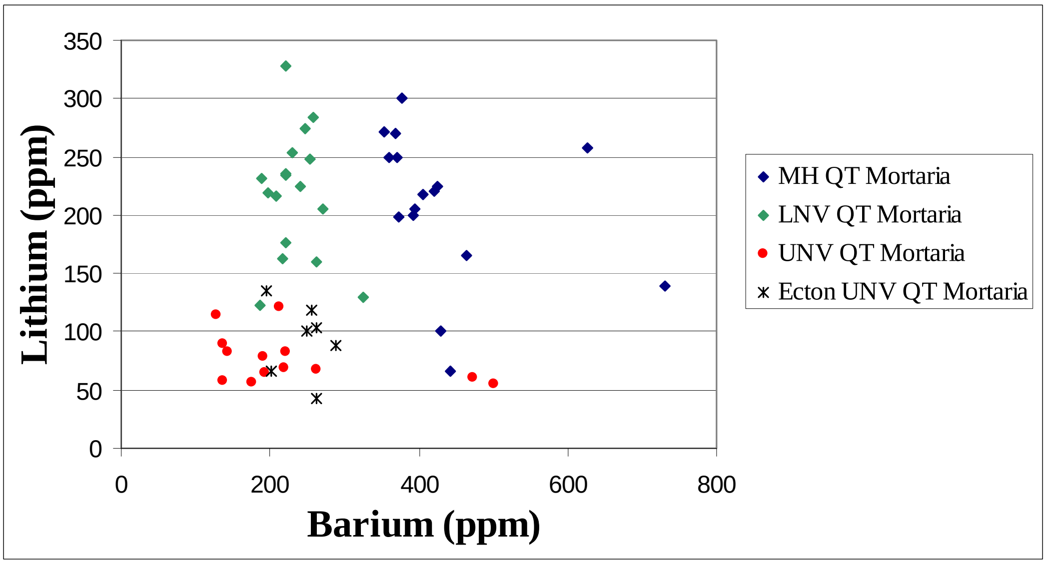

Figure 5: Lithium versus barium for the Ecton quartz-tempered mortaria compared to the MH, LNV and UNV control groups.

Un-sourced quartz-tempered mortaria recovered from Stanwick

In figure 6 the ICP data for the un-sourced mortaria have been plotted against the control group samples. All but one (number 179) of the 54 Stanwick mortaria appear to have been correctly assigned, confirming the validity of the criteria used to differentiate the regional products. Sample 179 was probably from the Lower, rather than the Upper, Nene valley.

Samples 152, 153, 154 and 209 were outliers in this group as they contained unusually high concentrations of potassium, magnesium, calcium and iron oxides. Petrological examination (Williams, 2001) of these samples detected frequent small flecks of mica, some plagioclase feldspar, opaque iron oxide, a small amount of cryptocrystalline limestone in sample 154 and some white limestone in sample 153, consistent with the atypical compositions of these wares. However the concentrations of barium and lithium distinguished these outliers from the Mancetter / Hartshill wares and grouped them with the Upper Nene valley products, although the barium content was towards the high end of the range. The compositions of these four samples are similar to the outliers of fabric group A3 (figure 11) discussed later, also thought to derive from the Upper Nene valley.

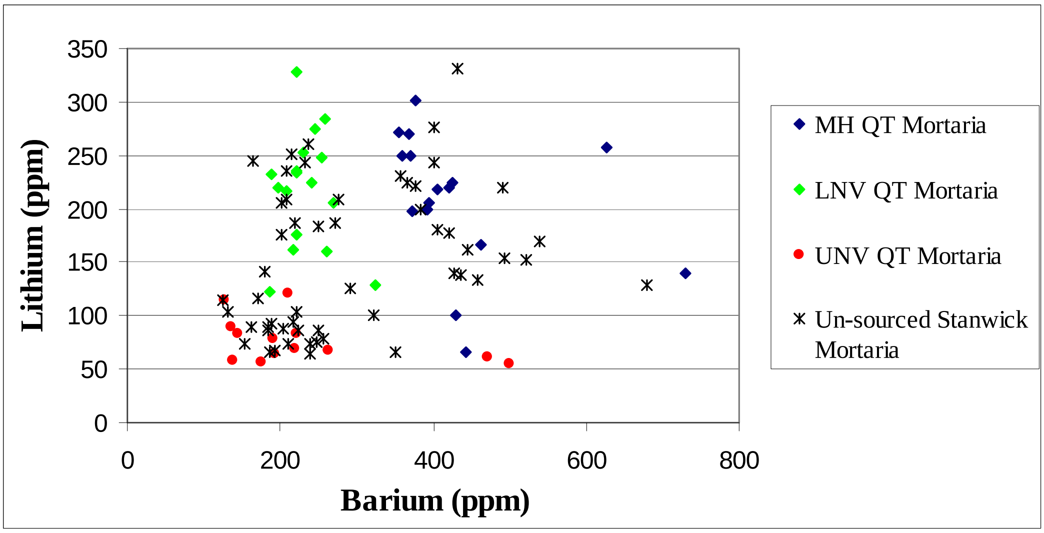

Figure 6: Lithium versus barium for the un-sourced Stanwick mortaria compared to the MH, LNV and UNV control groups.

Ecton greywares

This group comprises greyware kiln finds from Ecton in the Upper Nene valley. Sample 48 is made from the UES clay and groups with the Ecton-produced mortaria. However the rest differ compositionally from the Nene valley control groups (figures 7 and 8), and so are not made from the UES clay. Therefore potters at Ecton selected different types of clay depending on the pottery type being produced, perhaps because of the different colours of the clays when fired. The Ecton greywares are compositionally similar to the Mancetter / Hartshill control group but can be differentiated using the trace elements, in particular the levels of barium and lithium (figure 9).

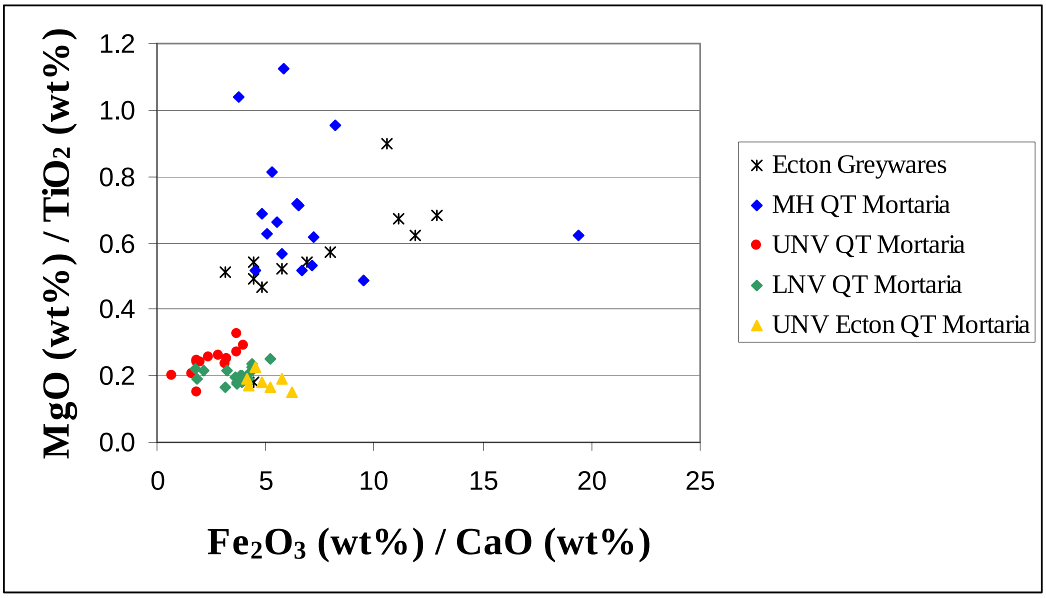

Figure 7: Magnesium oxide / titanium oxide versus iron oxide / calcium oxide for the Ecton greywares compared to the Ecton quartz-tempered mortaria and the MH, LNV and UNV quartz-tempered mortaria control groups.

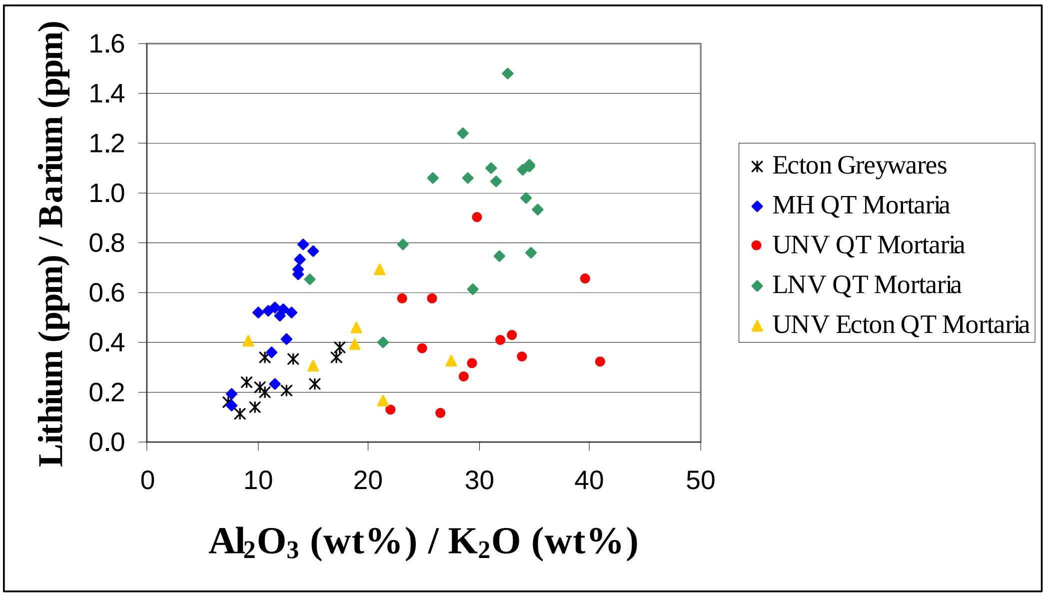

Figure 8: Lithium / barium versus aluminium oxide / potassium oxide for the Ecton greywares compared to the Ecton quartz-tempered mortaria and the MH, LNV and UNV quartz-tempered mortaria control groups.

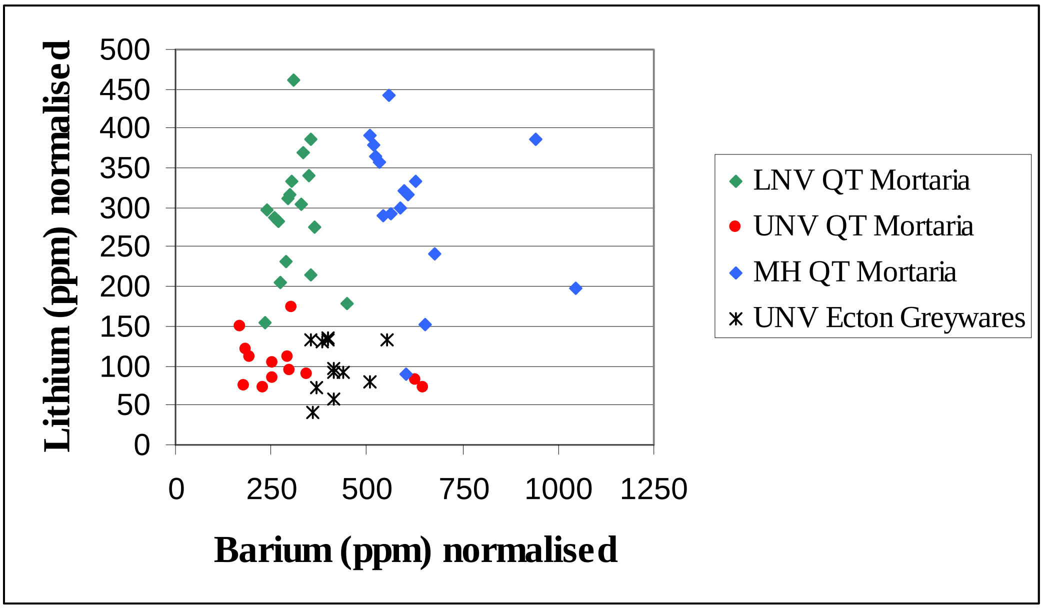

Figure 9: Normalised lithium and barium contents of the Ecton quartz-tempered mortaria and the MH, LNV and UNV quartz-tempered mortaria control groups.

Mancetter / Hartshill coarsewares

The majority of these coarseware kiln finds are compositionally similar to the Mancetter / Hartshill mortaria (figure 10). The coarseware group included a range of fabric types and so the data points are more scattered than for the mortaria control group. Samples 75, 86, 88, 76 and 79 had particularly high potassium and magnesium oxide contents, whereas samples 89, 77, 92, 91 and 85 had slightly lower potassium and magnesium oxide contents. Some of the outlying samples contained larger concentrations of iron oxide and so tended to be red / orange in colour. However the redder fabric appeared to be less common on consumption sites than the cream / white fabric suggesting that the higher-iron clay was used less commonly.

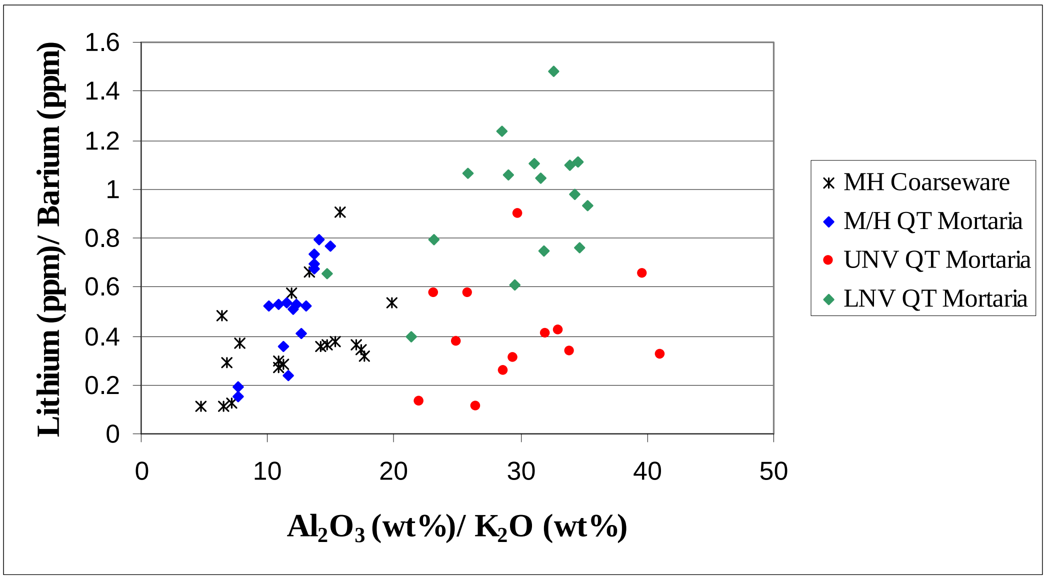

Figure 10: Lithium / barium versus aluminium oxide / potassium oxide for the MH coarsewares compared to the MH, LNV and UNV quartz-tempered mortaria control groups.

Stanwick coarseware fabrics A1 (grog-tempered), A3 (grog-tempered), D6/9 and D2

The ICP data showed that fabric D6/9 (a buff-coloured, gritty fabric) was made from the UES clay and, on the basis of the trace element concentrations (figure 11), was an Upper Nene valley product. Sample 124 was an outlying sample containing abnormally low concentrations of potassium oxide and barium and cannot be confidently sourced.

Fabric D2 (a fine, hard, smooth cream / white fabric) was originally thought to originate in the Lower Nene Valley or Midlands. However the ICP data suggests that these wares were also made in the Upper Nene valley using the UES clay. However 3 samples in the region of overlap between the Upper and Lower Nene valley control groups (figure 11) cannot be sourced confidently.

The ICP data indicated that fabrics A1 (a grog-tempered fabric) and A3 (a hard, cream grog-tempered fabric) are also from the Upper Nene valley (figure 11). These two fabric groups are very similar, although the latter group is less well defined having been identified largely on the basis of the increased hardness of the fabric. This is consistent with the higher concentrations of the fluxes calcium (in seven samples) and iron (in two samples) in some of the A3 fabric wares, which would result in increased vitrification of the clay for a given firing temperature. These samples have a similar colour to the rest of the group as the higher calcium content, which causes a paler fired colour, has compensated for the elevated iron content, which can cause a redder colour. Reddish coloured grog was identified during the petrological examination of the A1 fabric group whereas light-coloured grog was identified in the examination of fabric group A3 (Williams, 2001). If the grog used in either fabric was made from a different type of clay to the matrix, the overall measured composition for the fabric will be somewhere between the grog and matrix clay compositions.

Three samples, 110, 107 and to some extent 111, from fabric group A3 are outliers, containing higher concentrations of iron, calcium, potassium and magnesium oxides and lower concentrations of titanium oxide. These outlying samples cannot be confidently assigned to a production region although they are compositionally similar to the outliers from the un-sourced mortaria group from Stanwick. These outliers were thought to derive from the Upper Nene valley.

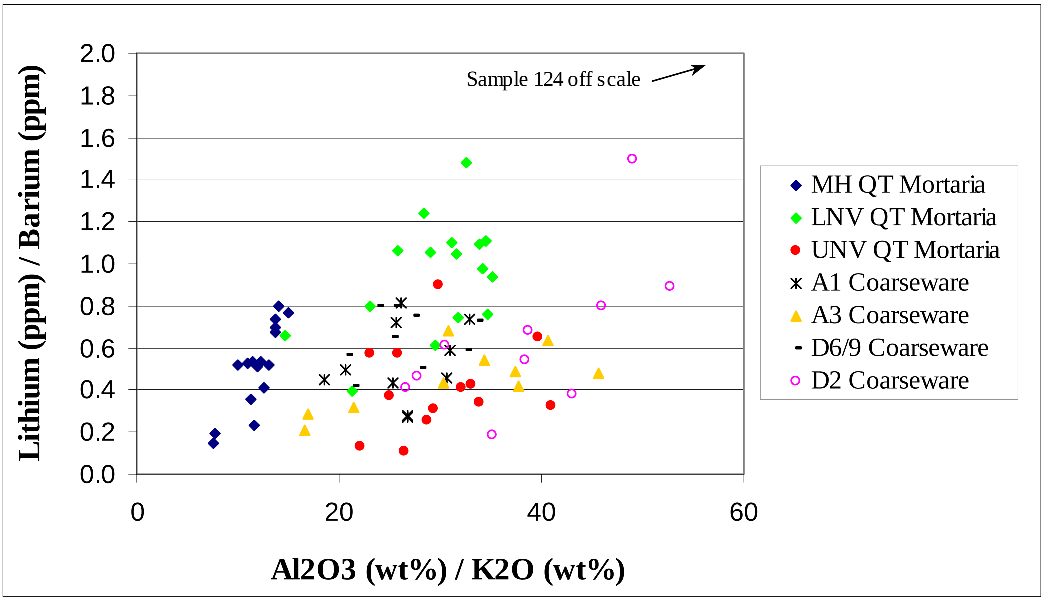

Figure 11: Lithium / barium versus aluminium oxide / potassium oxide for Stanwick coarseware fabrics A1, A3, D6/9 and D2 compared to the MH, LNV and UNV quartz-tempered mortaria control groups.

Stanwick coarseware fabric C4

The ICP data showed that the C4 fabric coarsewares differed compositionally from the Lower Nene valley and Upper Nene valley control groups. The C4 wares contained high concentrations of potassium, magnesium and iron oxides, comparable to the concentrations observed in the Mancetter / Hartshill mortaria and the Ecton greywares (figures 12 and 13) and were therefore not made from the UES clay. Consequently no control groups were available with which to compare in order to assign the group to a production region confidently. However the trace elements, such as barium and lithium, distinguished the C4 fabric from the Mancetter / Hartshill control group (figure 14). The wares are compositionally similar, although not identical, to the greywares from Ecton in the Upper Nene valley. Further research is required to investigate whether these wares are Upper Nene valley products.

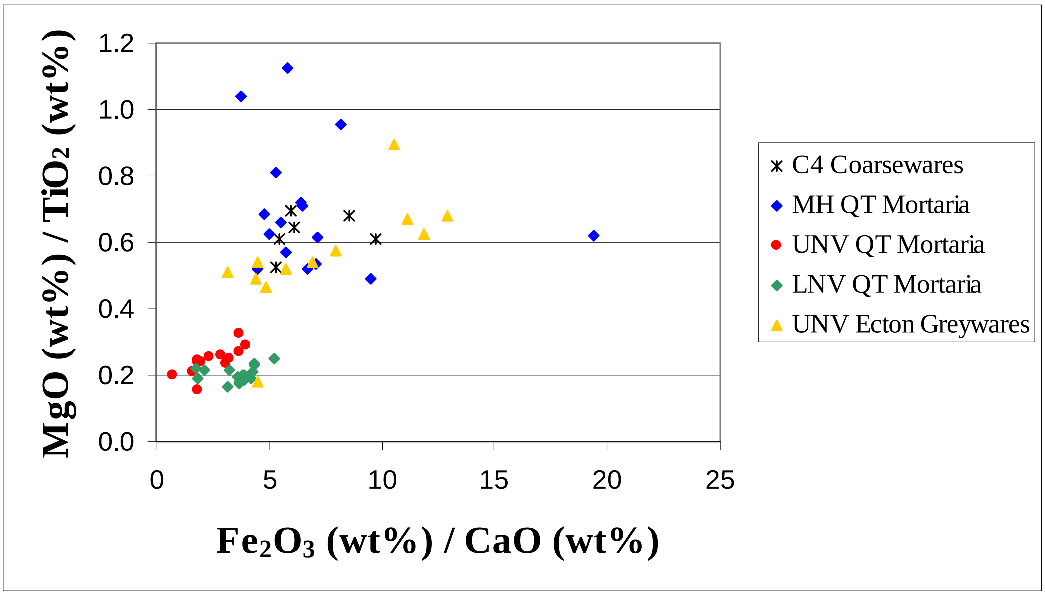

Figure 12: Magnesium oxide / titanium oxide versus iron oxide / calcium oxide for Stanwick coarseware fabric C4 compared to the MH, LNV and UNV quartz- tempered mortaria control groups and the UNV Ecton greywares.

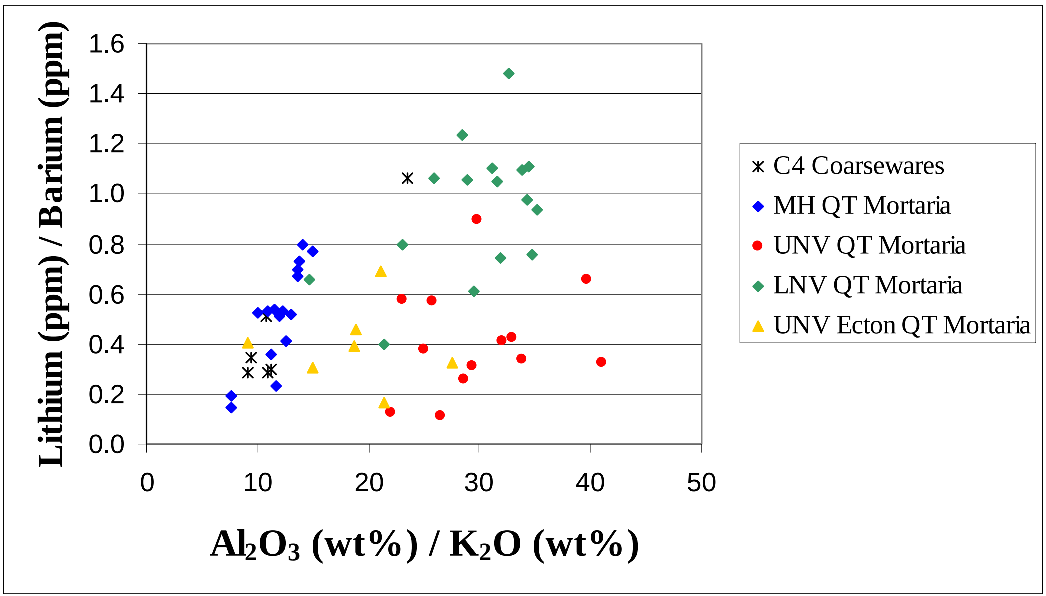

Figure 13: Lithium / barium versus aluminium oxide / potassium oxide for Stanwick coarseware fabric C4 compared to the MH, LNV and UNV quartz-tempered mortaria control groups and the UNV Ecton greywares.

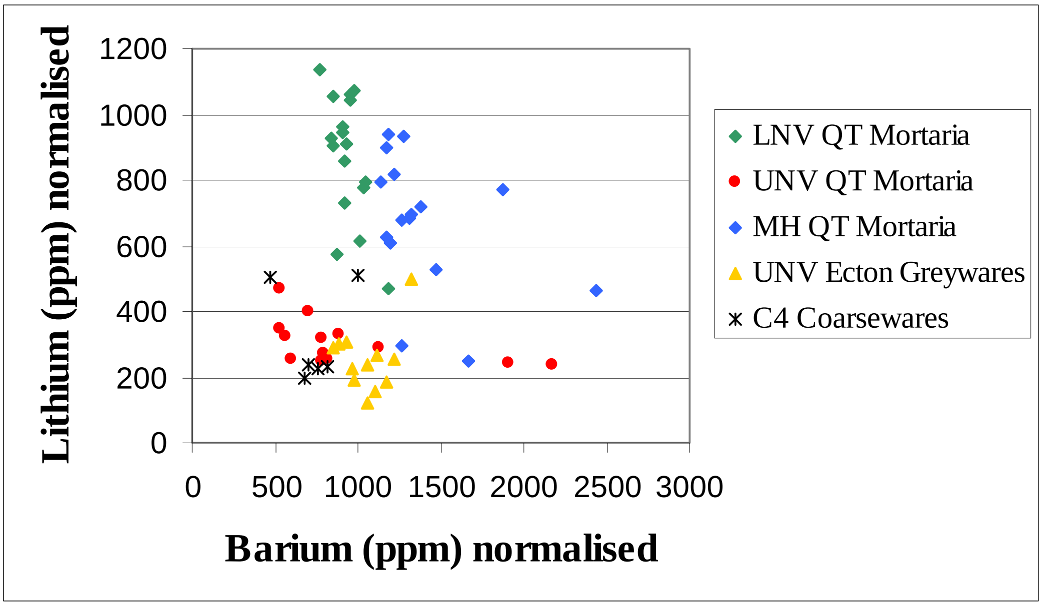

Figure 14: Normalised lithium and barium contents of the Stanwick coarseware fabric C4 and the MH, LNV and UNV quartz-tempered mortaria control groups and the UNV Ecton greywares.

Stanwick coarseware fabric A2

Fabric A2 is a soft, pink fabric with sparse, small to large grog (Williams, 2001) and iron-rich mineral inclusions, which was used to make storage jars. The ICP data shows that this group can be differentiated from the Mancetter / Hartshill and Nene valley wares as it contains very high concentrations of calcium oxide, high concentrations of iron, potassium and magnesium oxides and consequently lower levels of titanium and aluminium oxides (figures 15, 16 and 17). The composition of fabric A2 is very similar to that of the Oxford Clay, sampled from the Lower Nene valley by Storey (1988) and also to greywares from the stoke-holes of kilns at Stanground in the Lower Nene valley (table 3). However the Oxford clay could also be obtained elsewhere including in the region of Milton Keynes, which is the suspected source of these wares on the basis of their distribution.

Table 3: Comparison of the ICP analyses of a sample of Oxford Clay and the average composition of a calcareous fabric from Stanground (Storey, 1988) with the average composition of Stanwick fabric A2

Sample	**Al_2O_3**	**Fe_2O_3**	**MgO**	**CaO**	**Na_2O**	**K_2O**	**TiO_2**	**P_2O_5**
Oxford Clay (Storey, 1988)	18.6	6.6	1.7	13.0	0.3	3.0	0.8	0.1
Stanground 2 wares (Storey, 1988)	18.1	5.5	1.4	11.4	0.4	2.9	0.8	0.2
Average Stanwick A2 fabric	19.5	7.2	2.1	10.5	0.3	3.0	0.9	0.4

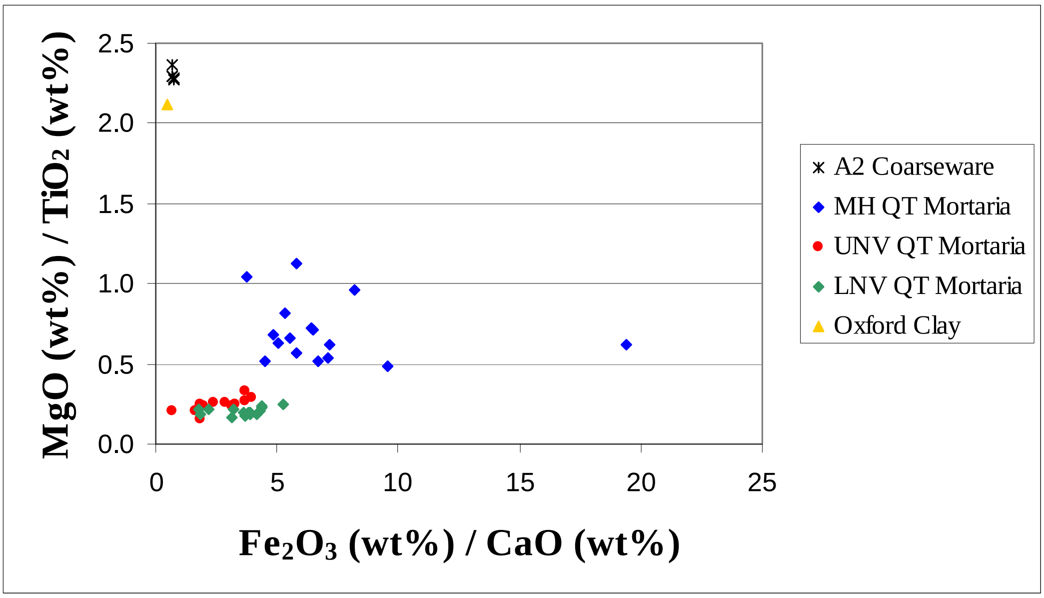

Figure 15: Magnesium oxide / titanium oxide versus iron oxide / calcium oxide for Stanwick coarseware fabric A2 compared to the MH, LNV and UNV quartz-tempered mortaria control groups and the Oxford Clay (Storey, 1988).

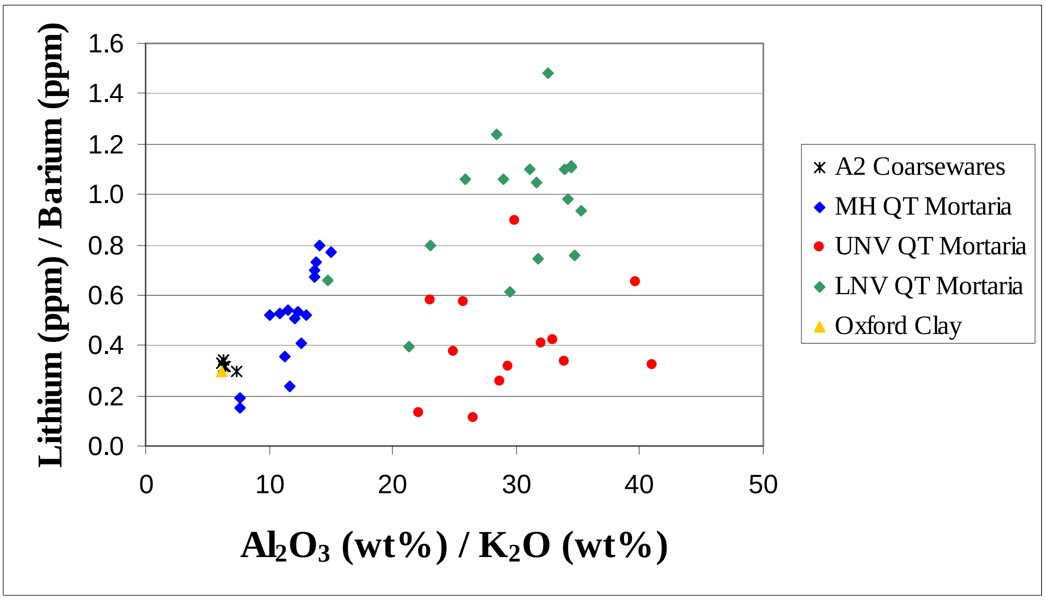

Figure 16: Lithium / barium versus aluminium oxide / potassium oxide for Stanwick coarseware fabric A2 compared to the MH, LNV and UNV quartz-tempered mortaria control groups and the Oxford Clay (Storey, 1988).

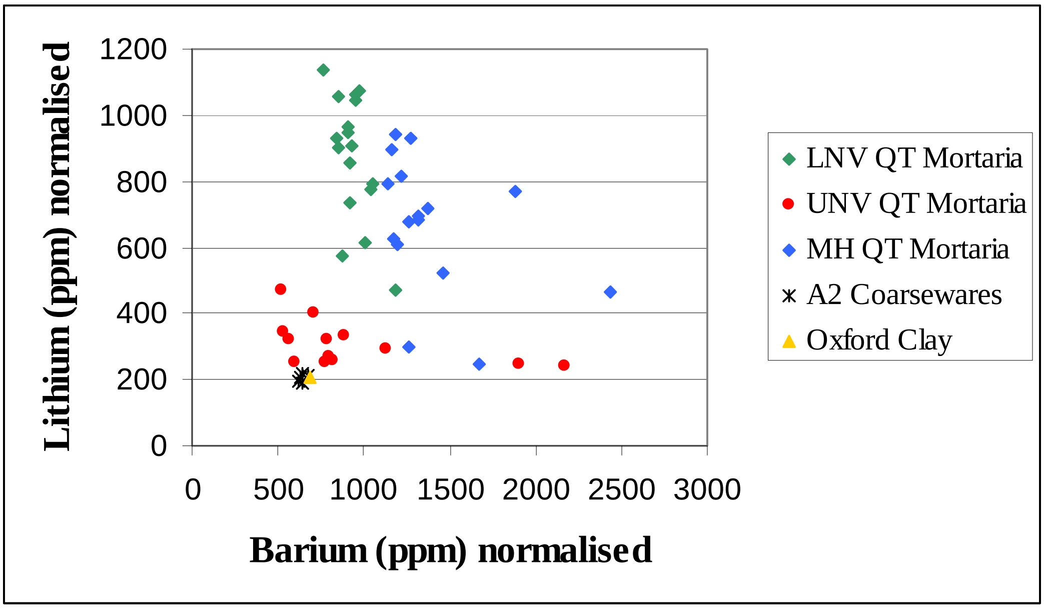

Figure 17: Lithium normalised versus barium normalised for Stanwick coarseware fabric A2 compared to the MH, LNV and UNV quartz-tempered mortaria control groups and the Oxford Clay (Storey, 1988).

Conclusions

ICP analysis was successful in identifying the production regions of second century mortaria recovered from the Roman settlement at Stanwick, Northamptonshire as the Upper or Lower Nene valley, in Northamptonshire and Cambridgeshire, or Mancetter / Hartshill, in Warwickshire. The Upper and Lower Nene valley mortaria were made from the Upper Estuarine Series (UES) clay and were therefore compositionally similar, but could be differentiated by the concentrations of trace elements in the samples. The results were also consistent with literature data on the Nene valley UES clay for both ceramics and clay samples, for example a UES clay sample from Stanground in the Lower Nene valley plotted with the Lower Nene valley wares analysed in this study (Storey, 1988). Potentially ICP data from other studies could also be interpreted further using this information, for example Nene valley hunt cups (Anderson et al, 1982), also made from the UES clay, could also be assigned to Upper or Lower Nene valley production sites. The Mancetter / Hartshill mortaria were made from a mica-rich clay containing higher concentrations of potassium, magnesium and iron oxides, which could be clearly distinguished from the Nene valley UES clay products.

The ICP data confirmed that the production regions of the un-sourced Stanwick mortaria had been accurately identified on the basis of the slight differences in their fabrics and form with one exception. Therefore the parameters used to differentiate between the wares were reliable. The data also demonstrated that the mortaria made by DOBALLVS were produced at Mancetter / Hartshill, rather than the Upper Nene valley as was previously thought, and that the potter VEDIACVS worked in the Upper Nene valley and used the UES clay to make both the flanges and the bodies of his mortaria. Analysis showed that the UES clay was used to produce quartz-tempered mortaria at Ecton in the Upper Nene valley but that a different type of clay was used to make greywares at the same site.

As many of the coarseware fabric types identified amongst the Stanwick assemblage (fabrics A1, A3, D6/9 and D2) appear to have been made using the UES clay, these could also be assigned to production areas. Products of the Upper and Lower Nene valley could be distinguished using the trace elements, as with the mortaria. Although fabrics A1 and A3 were compositionally similar, there was greater variation in the composition of fabric A3 with seven of the samples containing more calcium oxide than typical. Other coarsewares were made from different clay types, for which no control groups were available, and so these could not be assigned to production regions. The C4 fabric was iron-rich and compositionally similar to the greywares produced at Ecton in the Upper Nene valley. Comparisons with literature data on clay samples from the Nene valley (Storey, 1988) indicated that the Oxford Clay may have been used to produce coarseware fabric A2. Although this clay was utilised by potters in the Lower Nene valley (Storey, 1988), the Oxford clay could probably also be obtained elsewhere including in the region of Milton Keynes, which is where these wares are thought to have been produced.

Although parameters were established for determining the origins of Nene valley wares made from the UES clay, the same parameters cannot be used to assign wares made from different clay types. Some of the clay types from the Nene valley that were sampled and analysed by Storey (1988) also had higher contents of potassium, magnesium, barium and lithium, reminiscent of the MH mortaria. These observations stress the importance of establishing control groups for each clay type before wares can be confidently assigned to production regions.

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Appendices

Sample Details

Table 4: UNV quartz-tempered VEDIACVS-stamped or VEDIACVS-type mortaria flanges

Sample No.	Provenance	Mus/Site ID	Fabric	Stamp	Suspected Source
25	Stanwick Ex	331 9041/73933	Q-T	VEDIACVS	UNV
26	Stanwick Ex	479 45101/40669	Q-T	VEDIACVS	UNV
57	Wallsend Ex	WAL N4 11 178	Q-T	VEDIACVS	UNV
60	Verulanium Ex	VER 56 MI l	Q-T	VEDIACVS	UNV
67	Northampton Mus, Higham Ferrers Ex	HF 160 M2 29	Q-T	VEDIACVS	UNV
68	Northampton Mus, Higham Ferrers Ex	HF 518 M7 58	Q-T	VEDIACVS	UNV
72B	Piddington Ex	164 PidH/F W/31 L4Rm44(N)	Q-T	VEDIACVS	UNV
73B	Piddington Ex	159 512 Dr 56	Q-T		UNV
158	Stanwick Ex	63 8014/94824	Q-T		UNV
160	Stanwick Ex	609 47296/73940	Q-T		UNV
162	Stanwick Ex	391 10048/4716	Q-T		UNV
164	Stanwick Ex	117 8074/94661	Q-T		UNV
168	Stanwick Ex	876 81479/70929	Q-T		UNV

Table 5: UNV quartz-tempered mortaria (excluding VEDIACVS-stamped and VEDIACVS-type)

Sample No.	Provenance	Mus/Site ID	Fabric	Stamp	Suspected Source
4	Northampton Mu, Cowper Collection	Y638.2/7A1267	Q-T	DOBALLVS	UNV
6	Northampton Mus, Towcester Ex	Tow 76 212/3	Q-T	]VNICO	UNV
9	Northampton Mus, Towcester Ex	TGS Q13 AB3	Q-T	Herringbone	UNV
24	Stanwick Ex	605, 73941/46796	Q-T	ANCO[T]RETVS	UNV
38	Northampton Mus	Charlton D33/56-7	Q-T	DATICVS	UNV
58	Mancetter Ex	W71 22 106 666 1	Q-T	DOBALLVS	UNV or M/H
59	Verulanium Ex	VER 57 WII 1l	Q-T	DOBALLVS	UNV
62	Northampton Mus, Duston SS	Y6391 8A 1428 214	Q-T	MEVICVS	UNV
69	Northampton Mus, Rushden	RBA C20 B3/B24	Q-T	CAMVLACVS	UNV
74	Wellingborough Ex	Hardwick Park 70 W’Boro+	Q-T	[..]D(or O)IV[..]/CVN[..]	UNV

Table 6: LNV quartz-tempered mortaria

Sample No.	Provenance	Mus/Site ID	Fabric	Stamp	Suspected Source
1	Oakham Mus	OSM 23 OS 431	Q-T	SIMILIS	LNV (M/H?)
3	Mus of Antiquities, Newcastle	(box) South Shields 1956.128.115 A	Q-T	CVNOARDA	LNV
5	Northampton Mus, Cowper Collection		Q-T	VARINNA	Prob LNV
8	Northampton Mus, Ashley Ex	ASH 66 H 7	Q-T	CVNOARDA	LNV
11	Peterborough Mus, Normangate Field Ex	Ng I I 3	Q-T	VIATOR	LNV
12	Peterborough Mus, Castor Ex	CastorIII Pit 1.8(157)+Pit 1.5(152)	Q-T	VIATOR	LNV
13	Peterborough Mus, Wyman Abbott Collection	GWA 95 Stibbington Kiln	Q-T	CVNOARDA	LNV
14	Peterborough Mus, Noramngate Field Ex	Ng 1 20	Q-T	CONRILVS	LNV
15	Peterborough Mus, Mortaria type Series	CH 7977 M131	Q-T	SABINVS	LNV
19	Peterborough Mus, Mortaria type Series	CH 7406 M120	Q-T	VARINNA	LNV
21	Peterborough Mus, Chesterton Ex	WN 1181 M1	Q-T	VIATOR	LNV
34	Peterborough Mus,	T/DMW	Q-T	ETAVICOMVS	LNV
36	Peterborough Mus, Mortaria type Series	CH 7315 M117	Q-T	SIMILIS	LNV
37	Peterborough Mus, Chesterton Ex	CH 9168 M163	Q-T	VIATOR	LNV
61	Market Deeping Ex	MAD 91 048	Q-T	ETAVICOMVS	LNV
71	Mr A Challands	Sibson cum Stibbington TL0910 0809	Q-T	VARINNA	LNV
217	West Deeping Ex	WED 94 08-10008 1	Q-T	VARINNA	LNV

Table 7: Mancetter / Hartshill quartz-tempered mortaria

Sample No.	Provenance	Mus/Site ID	Fabric	Stamp	Suspected Source
7	Northampton Mus, Ashley Ex	ASH 63 AII 12	Q-T	MOSSIVS	M/H
17	Peterborough Mus, Mortaria Type series	CH1350 M23	Q-T	IVNIVS	M/H
22	Peterborough Mus, Chesterton Ex	Ch5175 M70	Q-T	GRATINVS	M/H
23	Stanwick Ex	563 46104/10235	Q-T	BRVSCIVS	M/H
27	Stanwick Ex	1250 098(3?)0/94629	Q-T	MAVRIVS	M/H
28	Stanwick Ex	45 4264/94623	Q-T	MAVRIVS	M/H
29	Stanwick Ex	1202 1991/86449	Q-T	MAVRIVS	M/H
30	Stanwick Ex	341/341a 9173 10077	Q-T	RVICCOC(O/VS)	M/H
31	Stanwick Ex	406 94759 38781	Q-T	ICOTASGVS	M/H
32	Peterborough Mus	L 1091	Q-T	GRATINVS	M/H
33	Peterborough Mus, Fengate Ex	ENG 76 CW IV 65 2 3151	Q-T	SARRIVS	M/H
35	Peterborough Mus	T/DMW	Q-T	GRATINVS	M/H
63	Northampton Mus, Cowper Collection, Duston	Y658	Q-T	MOSSIVS	M/H
64	Northampton Mus, Cowper Collection	Y1714	Q-T	VITALIS	M/H
65	Northampton Mus, Cowper Collection	Y1715	Q-T	VITALIS	M/H
66	Northampton Mus, Cowper Collection	Y1716	Q-T	VITALIS	M/H

Table 8: Grog-tempered VEDIACVS-stamped and VEDIACVS-type mortaria bodies

Sample No.	Provenance	Mus/Site ID	Form	Stamp
70	Northampton Mus, Gt Weldon Ex	GW 662	Mort	VEDIACVS
72A	Piddington Ex	Pid H/F W/31 L4 Rm44 (N) 164	Mort-body	
73A	Piddington Ex	512 159 Dr 56	Mort-body	
157	Stanwick Ex	63 8104/94824	Mort	
159	Stanwick Ex	609 47296/73940	Mort	
161	Stanwick Ex	391 10048/9716	Mort	
163	Stanwick Ex	117 8074/04661	Mort	
167	Stanwick Ex	876 81479/70928	Mort	
169	Stanwick Ex	4714505/94703	Mort	
170	Stanwick Ex	144 8084/9963	Mort	
171	Stanwick Ex	540 45745/94727	Mort	
172	Stanwick Ex	517 45515/10198	Mort	
173	Stanwick Ex	15 3619/94790	Mort	
174	Stanwick Ex	61 8013/10043	Mort	
175	Stanwick Ex	61 8013/10043	Mort	

Table 9: UNV Ecton quartz-tempered mortaria (kiln finds in bold, remainder from field walking)

Sample No.	Mus/Site ID	Form	Stamp
2	**ENL 62.87 9**	**Mort**	**Herringbone**
49	Ecton North Lodge 19	Mort	
52	Ecton North Lodge 18	Mort	
53	Ecton North Lodge 24	Mort	
54	Ecton North Lodge 23	Mort	
55	**ENL 62.1 21**	**Mort**	
56	Ecton North Lodge 17	Mort	

Table 10: Un-sourced quartz-tempered mortaria recovered from Stanwick

Sample No.	Site ID	Fabric	Stamp / Duplication	Suspected source
10	796 66928/77126	Q-T	GERMANVS 2	E Midl
16	Chesterton Ex, CH 7239 M113	Q-T		M/H or LNV
18	Chesterton Ex, CH 7463 M133	Q-T	????VRDS	M/H
20	41 4188/1444	Q-T	Unidentified	E Midl/Cambs
151	1228 89738/94644	Q-T		?UNV
152	143 8084/9909	Q-T		?UNV
153	812 67434/77204	Q-T		?UNV
154	483 45229/10206	Q-T		?UNV
155	775 66325/77127	Q-T		?UNV
165	685 77037/65446	Q-T		?UNV
166	695 77037/65446	Q-T		?UNV
176	445 45028/10184	Q-T		?UNV
177	1203 87528/94562	Q-T		?UNV
178	694 77032/65444	Q-T		?UNV
179	442 45027/10156	Q-T		?UNV
180	462 45038/10156	Q-T		?M/H
181	519 45515/94717	Q-T		?UNV
182	372 9336/93934	Q-T		?M/H
183	698 94754/5512	Q-T		?LNV
184	359 9297/10101	Q-T		?M/H
185	170 8094/9912	Q-T	Same as sample 195	?M/H
186	420 45004/94689	Q-T		?LNV
187	528 45519/73936	Q-T	Same as sample 190	?UNV
188	640 65080/77038	Q-T		?M/H
189	742 66203/77078	Q-T		?LNV
190	527 45519/73935	Q-T	Same as sample 187	?UNV
191	70 8019/9937	Q-T		?M/H
192	196 8203/10010	Q-T		?M/H
193	769 66314/77138	Q-T		?LNV
194	385 9454/94883	Q-T		?M/H
195	1001 84156/73858	Q-T	Same as sample 185	?M/H
196	611/612 47332/94748	Q-T		?LNV
197	207 8244/94836	Q-T		?LNV
198	1140 85233/94571	Q-T		?LNV
199	1128 85207/73884	Q-T		?M/H
200	1240 0970/1030	Q-T		?M/H
201	1041 84298/73296	Q-T	Same as sample 203	?M/H
202	777 77158/66327	Q-T		?M/H
203	1028 84285/73837	Q-T	Same as sample 201	?M/H
204	95 8058/94655	Q-T		?LNV
205	529 45519/94719	Q-T		?M/H
206	787 77055/66455	Q-T		?M/H
207	1209 89161/94552	Q-T		?UNV
208	535 45571/10212	Q-T		?LNV
209	272 8719/10074	Q-T		?UNV
210	554 94729/46066	Q-T		?UNV
211	222 8303/9926	Q-T		?UNV
212	521 45519/10171	Q-T		?UNV
213	986 83404/70978	Q-T		?UNV
214	169 8093/10142	Q-T		?LNV
215	395 9818/10079	Q-T		?UNV
216	502 45351/94712	Q-T		?UNV

Table 11: UNV Ecton greywares (kiln finds in bold, remainder from field walking)

Sample No.	Mus/Site ID	Form
39	D66. 1971.15	
40	Ecton North Lodge Field OS8	
41	**ENL 62 8**	
42	Ecton North Lodge	
43	**ENL 62 8**	
44	**ENL 62 6**	
45	**ENL 62 7**	
46	**ENL 62 7**	
47	**ENL 62 8**	
48	**ENL 62 4**	
50	D.88.1959/60.1+.2	Flag
51	D.88.1959/60.1+.2	Flag

Table 12: Mancetter / Hartshill coarsewares

Sample No.	Provenance	Mus/Site ID	Fabric	Stamp / Duplication	Suspected Source
75	M/H Fabric Type Series, with KF Hartley	4 W71 22 127 711	10		M/H
76	M/H Fabric Type Series, with KF Hartley	37 W69 7 1 1084	11		M/H
77	M/H Fabric Type Series, with KF Hartley	8 H61 31 2	6		M/H
78	M/H Fabric Type Series, with KF Hartley	8 H60+ 346	8		M/H
79	M/H Fabric Type Series, with KF Hartley	2 H60 A3 137	12		M/H
80	M/H Fabric Type Series, with KF Hartley	2 W77 17/23 148	3		M/H
81	M/H Fabric Type Series, with KF Hartley	17 H61 28 1	2		M/H
82	M/H Fabric Type Series, with KF Hartley	95 H61 56 10	13		M/H
83	M/H Fabric Type Series, with KF Hartley	13 H61 14A 1 + 11 H61 14/14A 4	1		M/H
84	M/H Fabric Type Series, with KF Hartley	65 H61 31 4	1		M/H
85	M/H Fabric Type Series, with KF Hartley	9 H61 31 4	4		M/H
86	M/H Fabric Type Series, with KF Hartley	127 H61 31 1	5	Same pot as sample 88	M/H
87	M/H Fabric Type Series, with KF Hartley	8 H61 31 3	4		M/H
88	M/H Fabric Type Series, with KF Hartley	H61 31 5	5	Same pot as sample 86	M/H
89	M/H Fabric Type Series, with KF Hartley	H61 31 1	4		M/H
90	M/H Fabric Type Series, with KF Hartley	26 H61 14 3	13		M/H
91	M/H Fabric Type Series, with KF Hartley	19 H61 14A 1	13		M/H
92	M/H Fabric Type Series, with KF Hartley	28 H61 14 2	13		M/H
93	M/H Fabric Type Series, with KF Hartley	45 H60 A 5	3		M/H

Table 13: Grog-tempered coarseware fabric A1 recovered from Stanwick

Sample No.	Provenance	Mus/Site ID	Stanwick Fabric TS No.	Form
94	Stanwick Ex	9011	TS A1	Flag
95	Stanwick Ex	9383	TS A1	Jar
96	Stanwick Ex	45745	TS A1	Jar
97	Stanwick Ex	65157	TS A1	Bowl
98	Stanwick Ex	65446	TS A1	Jar
99	Stanwick Ex	65446	TS A1	Jar
100	Stanwick Ex	65452	TS A1	Jar
101	Stanwick Ex	65452	TS A1	Bowl
102	Stanwick Ex	9723	TS A1	Jar
103	Stanwick Ex	82321	TS A1	Jar

Table 14: Grog-tempered coarseware fabric A3 recovered from Stanwick

Sample No.	Provenance	Mus/Site ID	Stanwick Fabric TS No.	Form
104	Stanwick Ex	0990/1020	TS A3	Jar
105	Stanwick Ex	9811	TS A3	Jar
106	Stanwick Ex	45522	TS A3	Jar
107	Stanwick Ex	46208	TS A3	Lid
108	Stanwick Ex	65606	TS A3	Jar
109	Stanwick Ex	65630	TS A3	Jar
110	Stanwick Ex	65630	TS A3	Jar
111	Stanwick Ex	66839	TS A3	Jar
112	Stanwick Ex	86244	TS A3	Bowl
113	Stanwick Ex	88371	TS A3	Jar

Table 15: Buff gritty fabric D6/9 recovered from Stanwick

Sample No.	Provenance	Mus/Site ID	Stanwick Fabric TS No.	Form
124	Stanwick Ex	66845	TSD69	Flag
125	Stanwick Ex	66449	TSD69	Flag
126	Stanwick Ex	66449	TSD69	Bowl
127	Stanwick Ex	9811	TSD69	Jar
128	Stanwick Ex	66305	TSD69	Flag
129	Stanwick Ex	65939	TSD69	Jar
130	Stanwick Ex	65630	TSD69	Jar
131	Stanwick Ex	65299	TSD69	Jar
132	Stanwick Ex	45745	TSD69	Jar
133	Stanwick Ex	4139	TSD69	Jar

Table 16: Fine cream fabric D2 recovered from Stanwick

Sample No.	Provenance	Context	Dr No.	Stanwick Fabric TS No.	Suspected Source
114	Stanwick ex	9053	Dr No 91	TSD2	?UNV
115	Stanwick ex	45153	Dr No 92	TSD2	?UNV
116	Stanwick ex	46583	Dr No 93	TSD2	?UNV
117	Stanwick ex	46653	Dr No 94	TSD2	?UNV
118	Stanwick ex	60099	Dr No 95	TSD2	?UNV
119	Stanwick ex	46608	Dr No 96	TSD2	?UNV
120	Stanwick ex	60015	Dr No 97	TSD2	?UNV
121	Stanwick ex	65606	Dr No 98	TSD2	?UNV
122	Stanwick ex	88370	Dr No 99	TSD2	?UNV
123	Stanwick ex	Unknown	Unknown	TSD2	?UNV

Table 17: Coarseware pale-cored greyware fabric C4 recovered from Stanwick

Sample No.	Provenance	Mus/Site ID	Stanwick Fabric TS No.	Form
145	Stanwick Ex	65518	TS C4	Bowl
146	Stanwick Ex	9383	TS C4	Bowl
147	Stanwick Ex	0970/1070	TS C4	Bowl
148	Stanwick Ex	60099	TS C4	Jar
149	Stanwick Ex	4329	TS C4	Jar
150	Stanwick Ex	82321	TS C4	Mort

Table 18: Coarseware soft pink grog-tempered fabric A2 recovered from Stanwick

Sample No.	Provenance	Context	Dr No.	Fabric	Suspected Source
140	Stanwick ex	9033	Dr No 115	TSA2	?UNV
141	Stanwick ex	65092	Unknown	TSA2	?UNV
142	Stanwick ex	66310	Unknown	TSA2	?UNV
143	Stanwick ex	84984	Dr No 117	TSA2	?UNV
144	Stanwick ex	84986	Dr No 118	TSA2	?UNV

ICP Data

ICP sample numbers are given in the first column. The major element concentrations are in weight percent and the minor element concentrations are in parts per million. Silica has been calculated by difference.

Table 19: UNV quartz-tempered VEDIACVS-stamped or VEDIACVS-type mortaria flanges

Sample	**Al_2O_3**	**Fe_2O_3**	**MgO**	**CaO**	**Na_2O**	**K_2O**	**TiO_2**	**P_2O_5**	**MnO**	**Ba**	**Co**	**Cr**	**Cu**	**Li**	**Nb**	**Ni**	**Sc**	**Sr**	**V**	**Y**	**Zn**	**Zr**	**La**	**Ce**	**Nd**	**Sm**	**Eu**	**Dy**	**Yb**	**SiO_2**
25	20.06	2.46	0.37	1.31	0.216	0.682	1.54	0.35	0.01	219.8	21	94	44	69	30	37	20	147	163	22	38	102	47	87	39	7.2	1.1	3.1	2	73.0
26	17.01	2.35	0.3	1.2	0.228	0.594	1.25	0.33	0.01	263.2	13	92	37	68	25	34	18	134	147	20	47	77	44	78	36	6.8	1	3	1.7	76.7
57	17.71	2.46	0.36	1.03	0.192	0.803	1.41	0.78	0.02	471.8	82	149	39	61	28	38	19	171	141	18	72	88	46	82	37	8.1	1.1	2.9	1.7	75.2
60	16.34	2.29	0.32	1.23	0.156	0.616	1.31	0.76	0.01	499.8	220	153	40	55	29	33	18	158	130	17	48	80	43	77	33	9.9	1	2.6	1.5	77.0
67	16.23	2.38	0.26	1.28	0.18	0.396	1.7	0.18	0.01	176.4	21	88	29	57	31	31	16	127	131	19	38	96	42	73	31	5.5	0.8	2.6	1.7	77.4
68	18.66	2.41	0.38	0.84	0.456	0.748	1.45	0.18	0.01	221.2	22	147	37	83	29	35	18	136	170	17	42	83	54	92	39	6.8	1	2.4	1.5	74.9
158	16.41	2.69	0.27	1.67	0.156	0.484	1.3	1.01	0.05	192	10	77	33	65	24	34	17	152	113	22	57	79	51	91	40	7.1	1.1	3.3	1.7	76.0
160	15.24	1.95	0.23	2.78	0.144	0.462	1.14	0.98	0.02	137	8	71	30	58	21	31	16	131	108	22	53	72	52	84	42	7.2	1.2	3.2	1.6	77.1
162	19.63	2.6	0.36	0.8	0.144	0.495	1.44	0.22	0.01	136	13	88	32	89	27	32	19	129	151	18	45	77	53	90	36	6.4	1	2.4	1.4	74.3
164	18.72	2.35	0.39	0.59	0.096	0.627	1.35	0.14	0.02	127	17	111	32	114	25	33	19	116	163	15	47	63	48	88	37	6.7	1.1	2.2	1.1	75.7
168	19.56	2.49	0.47	0.67	0.156	0.847	1.44	0.1	0.01	144	27	124	34	83	27	34	21	110	146	21	77	85	51	94	41	7.6	1.2	3.1	1.7	74.3
72B	18.32	2.59	0.33	0.83	0.156	0.572	1.39	0.1	0.01	190.4	15	143	38	78	27	39	18	116	162	16	36	79	47	84	34	6.2	1	2.2	1.5	75.7
73B	22.4	3.15	0.47	0.85	0.456	0.869	1.74	0.12	0.01	211.4	26	133	41	121	34	44	21	134	221	21	45	94	59	107	48	8.7	1.2	3.2	1.7	69.9

Table 20: UNV quartz-tempered mortaria (excluding VEDIACVS-stamped and VEDIACVS-type)

Sample	**Al_2O_3**	**Fe_2O_3**	**MgO**	**CaO**	**Na_2O**	**K_2O**	**TiO_2**	**P_2O_5**	**MnO**	**Ba**	**Co**	**Cr**	**Cu**	**Li**	**Nb**	**Ni**	**Sc**	**Sr**	**V**	**Y**	**Zn**	**Zr**	**La**	**Ce**	**Nd**	**Sm**	**Eu**	**Dy**	**Yb**	**SiO_2**
4	23.45	2.47	1.16	0.44	0.24	1.98	1.3	0.1	0.02	378	43	93	40	272	21	65	20	66	140	19	39	70	35	59	25	5	0.7	2	1.6	68.8
6	19.67	3.1	0.59	0.58	0.108	1.496	1.16	0.34	0.01	322	39	85	34	57	21	39	20	167	95	31	49	63	51	100	49	9.7	1.4	4.8	2.4	72.9
9	17.76	3.3	0.65	0.49	0.168	1.397	0.97	0.21	0.02	284.2	27	100	35	109	22	56	18	85	129	30	77	75	50	89	45	9	1.3	4.2	1.9	75.0
24	17.94	2.17	0.35	0.57	0.132	0.572	1.71	0.11	0.01	184.8	31	102	38	90	33	29	19	115	154	19	35	86	50	90	37	7	1	2.7	1.6	76.4
38	19.83	2.94	0.48	1.37	0.276	1.045	1.73	0.35	0.01	282.8	17	161	39	67	33	47	21	148	170	23	60	99	55	100	47	8.5	1.3	3.6	2.1	72.0
58	24.35	2.89	0.85	0.34	0.192	1.793	1.41	0.46	0.05	548.8	18	164	32	252	22	87	19	72	130	17	52	70	35	63	29	5	0.8	1.9	1.4	67.7
59	23.78	2.13	0.91	0.43	0.216	1.837	1.3	0.08	0.03	375.2	24	159	40	267	21	66	20	67	131	16	39	69	32	61	24	4.4	0.6	1.6	1.4	69.3
62	17.04	3.4	0.51	0.41	0.204	1.771	0.98	0.12	0.01	299.6	21	76	38	49	22	58	16	76	123	40	88	88	54	90	51	10.2	1.5	5.4	2.6	75.6
69	15.5	1.97	0.25	0.84	0.132	0.462	1.57	0.22	0.01	204.4	23	130	31	74	31	34	16	113	107	19	34	84	47	84	40	7.4	1.1	3.2	1.7	79.0
74	19.36	3.26	0.43	0.8	0.156	0.924	2.17	0.16	0.01	228.2	22	163	42	127	42	50	21	124	187	29	56	107	64	123	59	11.1	1.6	4.8	2.2	72.7

Table 21: LNV quartz-tempered mortaria

Sample	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	P_2O_5	MnO	Ba	Co	Cr	Cu	Li	Nb	Ni	Sc	Sr	V	Y	Zn	Zr	La	Ce	Nd	Sm	Eu	Dy	Yb	SiO_2
1	19.38	2.95	0.36	0.76	0.324	0.55	1.8	0.09	0.01	240.8	31	89	46	225	26	42	18	86	155	27	33	97	63	116	55	10.1	1.5	4	2	73.8
3	17.63	2.76	0.38	0.66	0.132	0.682	2.01	0.09	0.01	221.2	43	96	43	235	35	40	19	76	148	28	31	104	55	101	49	9.5	1.3	4.3	2.1	75.6
5	15.97	2.51	0.31	0.68	0.132	0.561	1.75	0.09	0.01	187.6	74	94	43	232	33	44	18	69	134	26	39	95	53	105	50	10.5	1.4	4.2	2.1	78.0
8	18.48	3.08	0.36	1.42	0.204	0.638	1.66	0.1	0.01	221.2	55	100	51	234	28	39	20	94	145	31	38	103	64	117	56	11.5	1.7	4.9	2.3	74.0
11	17.8	2.75	0.33	0.71	0.168	0.572	1.74	0.11	0.01	229.6	23	110	50	253	31	39	19	87	131	23	33	71	68	132	64	11.9	1.8	4.2	1.5	75.8
12	19.34	2.7	0.34	0.69	0.168	0.561	1.86	0.11	0.01	246.4	30	106	55	274	35	46	21	92	135	27	42	85	73	144	70	13.1	2	4.8	1.9	74.2
13	15.75	1.8	0.28	0.57	0.168	0.495	1.68	0.11	0.01	217	24	88	36	162	27	33	17	72	110	20	23	72	54	100	47	8.7	1.2	3.1	1.4	79.1
14	17.03	2.44	0.31	0.66	0.132	0.539	1.73	0.1	0.01	207.2	20	102	48	217	31	33	18	76	131	21	25	73	61	118	56	10.7	1.6	3.7	1.5	77.0
15	19.95	3.34	0.36	0.92	0.168	0.583	1.83	0.16	0.01	253.4	45	110	66	248	35	39	23	131	169	26	34	94	70	134	62	12.3	1.8	4.4	1.8	72.7
19	18.17	2.76	0.37	1.56	0.228	0.616	1.69	0.56	0.02	261.8	30	101	44	160	32	38	17	102	135	26	39	97	65	120	58	11	1.6	4.4	2.1	74.0
21	19.74	2.79	0.36	0.73	0.204	0.583	1.81	0.24	0.01	259	21	107	54	284	34	45	19	97	152	24	59	86	65	131	64	12.2	1.8	4.5	1.7	73.5
34	14.56	1.93	0.4	1.05	0.144	0.99	2.1	0.08	0.01	186.2	15	99	37	122	35	38	18	68	137	25	39	90	56	109	55	9.9	1.5	4.1	1.9	78.7
36	17.82	2.4	0.35	0.56	0.144	0.517	1.66	0.08	0.01	197.4	25	141	41	219	31	42	19	74	126	19	36	77	55	108	50	9.2	1.3	3.3	1.7	76.5
37	16.53	3.62	0.36	0.83	0.216	0.715	1.52	0.22	0.02	221.2	59	135	48	176	30	38	19	91	106	23	38	83	61	119	57	11.7	1.7	4.1	1.7	76.0
61	18.57	3.63	0.41	1.13	0.204	0.869	1.9	0.8	0.02	324.8	37	92	38	129	35	40	20	119	161	22	63	98	44	79	38	7	1	3.2	1.9	72.5
71	21.15	3.88	0.43	0.74	0.144	0.649	1.73	0.14	0.01	221.2	30	157	45	328	34	48	19	85	162	24	36	81	66	123	59	11	1.7	4	1.7	71.1
217	18.69	3.34	0.37	0.77	0.192	0.539	1.62	0.28	0.01	270.2	19	91	45	205	30	44	21	90	163	27	45	96	64	119	54	10.9	1.7	4.3	1.9	74.2

Table 22: Mancetter / Hartshill quartz-tempered mortaria

Sample	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	P_2O_5	MnO	Ba	Co	Cr	Cu	Li	Nb	Ni	Sc	Sr	V	Y	Zn	Zr	La	Ce	Nd	Sm	Eu	Dy	Yb	SiO_2
63	19.13	1.98	0.83	0.41	0.288	2.508	1.21	0.11	0.02	442.4	16	72	54	66	21	40	18	76	118	34	37	57	73	156	81	15.5	2.5	6.5	2.4	73.5
64	23.23	5.24	0.77	0.27	0.156	1.936	1.24	0.13	0.01	393.4	27	122	26	200	20	58	21	64	141	15	49	68	31	56	21	4.1	0.5	1.6	1.3	67.0
65	22.53	2.1	0.7	0.22	0.204	1.639	1.43	0.11	0.01	368.2	25	109	23	270	23	71	17	56	134	14	47	71	25	47	21	3.8	0.5	1.3	1.3	71.1
66	20.84	3.48	1.07	0.6	0.228	2.706	0.95	0.1	0.04	730.8	58	103	49	139	16	48	19	103	149	21	82	47	45	87	39	8.1	1.1	3	1.5	70.0
27	24.55	2.5	0.95	0.39	0.24	2.134	1.32	0.09	0.04	406	19	101	30	218	20	69	21	75	134	20	32	72	41	72	30	5.1	0.8	2	1.6	67.8
28	23.95	2.5	0.82	0.45	0.264	2.134	1.24	0.18	0.06	463.4	14	95	27	166	19	58	22	82	129	23	31	100	38	66	26	4.4	0.7	2.4	2.1	68.4
29	25.26	2.55	1.16	0.48	0.336	2.002	1.43	0.09	0.04	625.8	13	95	44	257	22	72	20	74	172	22	48	82	42	73	32	5.5	0.9	2.3	1.8	66.7
30	25.2	2.08	0.79	0.36	0.24	1.793	1.39	0.09	0.02	378	19	97	33	301	22	80	21	69	134	25	33	123	37	66	27	4.9	0.7	2.6	2.3	68.0
31	23.51	5.09	1.08	0.62	0.3	2.024	1.13	0.16	0.05	429.8	21	138	57	101	18	63	22	77	128	25	44	60	54	102	45	9	1.4	3.9	2	66.0
32	24.52	2.37	0.8	0.33	0.216	1.991	1.3	0.08	0.02	372.4	36	98	46	198	21	57	22	67	153	16	34	62	36	64	29	5.4	0.7	1.8	1.4	68.4
33	24.68	2.27	0.94	0.35	0.3	2.266	1.32	0.16	0.03	425.6	19	87	42	225	21	58	22	77	153	18	38	72	35	65	28	5.1	0.7	2.1	1.6	67.7
22	24.17	1.76	0.71	0.39	0.228	1.617	1.37	0.08	0.01	354.2	30	104	38	272	21	72	19	64	125	18	32	72	33	57	24	4.4	0.6	1.6	1.4	69.7
23	23.16	2.16	0.82	0.43	0.24	1.782	1.31	0.14	0.01	394.8	15	116	33	205	20	64	20	66	118	18	40	72	32	56	24	4.2	0.6	1.7	1.4	69.9
17	22.22	2.59	1.26	0.69	0.3	2.211	1.21	0.1	0.03	421.4	28	102	28	220	19	60	19	75	131	16	57	60	36	61	26	4.5	0.7	1.8	1.3	69.4
7	24.74	2.2	0.73	0.31	0.252	1.815	1.37	0.08	0.01	359.8	33	115	50	250	21	78	21	64	137	17	44	67	32	56	24	4.3	0.6	1.6	1.4	68.5
35	24.01	1.94	0.73	0.29	0.264	1.76	1.41	0.08	0.01	371	23	99	24	249	22	73	20	65	128	15	31	67	30	54	23	3.9	0.6	1.5	1.3	69.5

Table 23: Grog-tempered VEDIACVS-stamped and VEDIACVS-type mortaria bodies

Sample	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	P_2O_5	MnO	Ba	Co	Cr	Cu	Li	Nb	Ni	Sc	Sr	V	Y	Zn	Zr	La	Ce	Nd	Sm	Eu	Dy	Yb	SiO_2
169	17.78	2.35	0.34	0.98	0.156	0.638	1.37	0.42	0.01	231	18	105	33	75	26	40	19	120	127	20	48	85	53	94	39	6.6	1.1	3	1.6	76.0
170	20.91	2.94	0.44	1.47	0.156	1.001	2.07	0.35	0.03	243.6	21	167	44	87	39	51	22	139	151	27	69	109	70	123	57	9.8	1.6	4.2	2	70.6
171	19.73	2.71	0.38	1.03	0.192	0.66	1.49	0.31	0.1	239.4	11	98	35	63	29	49	20	136	136	22	57	88	55	96	41	7.6	1.2	3.5	1.7	73.4
172	18.62	2.75	0.39	0.68	0.132	0.693	1.47	0.12	0.03	194.6	14	89	33	73	28	43	20	118	132	20	66	83	54	97	39	6.9	1.1	3	1.5	75.1
173	24.17	3.98	0.52	0.89	0.156	0.902	2.03	0.27	0.03	253.4	8	160	49	82	38	48	26	131	198	28	85	113	69	131	59	10.7	1.8	4.5	2.2	67.1
174	15.78	2.63	0.39	0.6	0.108	0.792	1.33	0.1	0.01	176.4	21	74	34	93	16	31	15	89	138	23	51	104	49	90	39	7.3	1.2	3.4	1.8	78.3
175	16.75	2.46	0.35	0.72	0.144	0.649	1.29	0.18	0.02	189	13	74	32	66	21	43	19	111	126	20	58	76	49	86	35	6.5	1.1	3	1.5	77.4
167	25.01	3.23	0.57	0.86	0.18	1.045	1.78	0.14	0.01	186	9	136	42	122	34	42	25	143	192	24	49	100	61	113	48	8.4	1.3	3.2	1.8	67.2
163	24.86	3.62	0.53	0.98	0.132	0.902	1.83	0.23	0.01	172	19	137	41	147	34	45	24	156	219	21	62	93	63	116	50	8.9	1.4	3.2	1.7	66.9
161	24.87	3.66	0.48	0.95	0.228	0.704	1.81	0.28	0.01	176	9	164	43	123	34	44	23	163	197	22	64	95	66	114	48	8.6	1.3	3.1	1.7	67.0
159	20.01	2.89	0.33	1.67	0.192	0.638	1.6	0.96	0.02	174	4	149	35	81	30	40	21	154	157	25	60	92	59	110	50	8.7	1.4	3.7	2	71.7
157	20.7	3.16	0.38	1.62	0.18	0.693	1.63	0.78	0.01	184	6	119	41	94	30	42	21	173	164	26	61	97	60	109	50	8.6	1.4	3.8	2	70.8
70	23.26	2.97	0.45	0.75	0.588	0.792	2.01	0.12	0.01	215.6	22	141	40	163	39	42	23	154	239	25	48	129	67	115	47	8.1	1.1	3.7	2.2	69.1
72A	23.51	3.11	0.46	1.11	0.192	0.847	1.81	0.14	0.01	250.6	10	176	39	103	35	43	23	151	207	22	45	107	63	110	49	8.3	1.2	3.3	2	68.8
73A	24.39	4	0.57	0.95	0.492	1.056	1.91	0.14	0.01	236.6	11	179	44	147	37	46	23	139	249	22	53	101	64	115	51	8.7	1.3	3.2	1.8	66.5

Table 24: UNV Ecton quartz-tempered mortaria

Sample	**Al_2O_3**	**Fe_2O_3**	**MgO**	**CaO**	**Na_2O**	**K_2O**	**TiO_2**	**P_2O_5**	**MnO**	**Ba**	**Co**	**Cr**	**Cu**	**Li**	**Nb**	**Ni**	**Sc**	**Sr**	**V**	**Y**	**Zn**	**Zr**	**La**	**Ce**	**Nd**	**Sm**	**Eu**	**Dy**	**Yb**	**SiO_2**
52	18.32	2.55	0.34	0.53	0.192	0.858	1.87	0.33	0.02	263.2	66	157	28	43	36	38	19	109	141	22	51	104	52	94	39	7.6	1	3	1.8	75.0
53	17.37	2.73	0.37	0.65	0.18	1.155	2.19	0.36	0.02	288.4	42	132	34	88	43	38	18	105	163	29	45	118	56	106	51	9.7	1.4	4.3	2.4	75.0
54	18.29	2.78	0.5	0.61	0.264	2.002	2.22	0.27	0.02	249.2	77	160	26	101	44	41	19	91	170	31	75	114	58	112	54	11	1.4	4.8	2.4	73.0
55	17.29	3.46	0.41	0.6	0.108	0.924	2.16	0.19	0.02	263.2	88	153	34	103	42	35	18	108	157	26	42	100	59	111	53	11.2	1.4	4.2	2	74.8
56	16.36	2.37	0.32	0.38	0.108	0.594	2.13	0.19	0.01	201.6	17	150	28	66	39	33	17	85	141	22	41	89	54	97	43	7.8	1.1	3.1	1.5	77.5
49	17.88	2.89	0.42	0.7	0.12	0.946	2.19	0.13	0.02	256.2	145	114	36	118	38	36	18	116	165	30	44	120	56	108	50	11.1	1.4	4.7	2.5	74.7
2	16	2.52	0.31	0.48	0.276	0.759	1.88	0.1	0.01	194.6	55	81	48	135	28	40	18	97	143	23	46	93	48	88	38	7.6	1.1	3.4	1.8	77.7

Table 25: Un-sourced quartz-tempered Stanwick mortaria

Sample	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	P_2O_5	MnO	Ba	Co	Cr	Cu	Li	Nb	Ni	Sc	Sr	V	Y	Zn	Zr	La	Ce	Nd	Sm	Eu	Dy	Yb	SiO_2
151	18.63	3.69	0.42	1.75	0.12	0.528	1.25	0.46	0.01	154	14	134	38	73	23	36	20	90	149	21	57	90	42	73	29	5.8	1	2.7	1.7	73.1
152	15.84	6.43	1.26	3.35	0.396	2.387	0.81	0.28	0.05	256	25	83	21	79	16	64	16	126	135	26	105	57	48	74	33	7.1	1.1	3.4	1.5	69.2
153	17.14	6.81	1.36	5.62	0.348	2.431	0.89	0.42	0.09	250	26	92	23	86	17	81	17	169	145	28	122	55	52	82	36	7.1	1.1	3.3	1.5	64.9
154	15.39	8.56	1.23	3.25	0.432	2.288	0.79	0.42	0.06	248	26	115	24	75	16	61	15	122	132	26	101	53	48	74	31	6.7	1.1	3.3	1.4	67.6
155	19.42	5.85	0.53	0.8	0.18	1.045	1.44	0.16	0.03	162	19	113	33	89	28	33	19	127	148	20	66	80	54	93	38	7.1	1.1	2.8	1.2	70.5
156	22.32	6.9	0.44	0.87	0.18	0.627	1.38	0.22	0.08	179	33	124	44	141	26	53	21	144	202	26	84	81	60	115	45	9.2	1.4	4	1.8	67.0
166	15.96	2.85	0.4	0.62	0.12	0.858	1.41	0.1	0.01	132	17	72	40	104	28	25	15	85	138	18	36	77	47	91	41	7.8	1.2	2.8	1.3	77.7
165	18.41	2.57	0.33	0.62	0.132	0.451	2.05	0.11	0.01	125	21	106	33	114	38	37	20	107	134	18	51	82	55	99	41	6.7	1	2.4	1.2	75.3
176	17.59	2.15	0.34	0.53	0.12	0.572	1.43	0.09	0	184.8	17	74	28	87	10	34	19	113	120	19	40	88	51	88	35	6	1	2.7	1.6	77.2
177	19.44	2.65	0.36	0.63	0.228	0.77	1.91	0.24	0.04	217	24	94	27	94	35	43	20	111	151	22	44	100	58	100	40	7	1.1	3.1	1.6	73.7
178	16.99	5.03	0.43	0.59	0.132	0.88	1.57	0.14	0.01	210	24	93	29	73	7	36	19	111	140	25	52	88	56	96	39	7.4	1.1	3.7	1.6	74.2
179	18.75	3.09	0.35	0.65	0.216	0.572	1.67	0.18	0.01	271.6	25	88	42	187	31	41	19	86	146	22	60	83	63	124	55	10.2	1.6	3.7	1.5	74.5
180	25.77	2.35	1.01	0.34	0.276	2.387	1.18	0.13	0.03	520.8	30	62	54	153	15	65	25	64	168	23	81	71	47	94	40	7.4	1.3	3	1.5	66.5
181	18.8	3.57	0.36	0.58	0.228	0.671	1.81	0.17	0.05	221.2	27	98	34	104	34	43	20	120	109	23	52	109	55	97	36	6.3	1	3.2	1.8	73.8
182	25.05	2.84	0.78	0.37	0.3	1.958	1.27	0.2	0.04	383.6	22	92	21	199	19	72	21	73	131	19	43	90	35	61	21	3.5	0.6	1.8	1.5	67.2
183	21.14	3.85	0.38	0.71	0.216	0.572	1.98	0.26	0.03	250.6	12	96	55	184	37	47	25	91	168	31	47	124	72	139	63	11.8	1.9	5.1	2.4	70.9
184	22.21	3.88	1.28	0.55	0.288	2.541	1.05	0.12	0.05	457.8	77	90	36	133	18	65	21	78	144	19	81	62	42	75	29	6.3	0.9	2.4	1.4	68.0
185	24.45	2.98	1.31	0.66	0.312	1.705	1.29	0.23	0.04	400.4	13	90	26	243	20	76	17	68	122	16	80	66	35	61	23	4	0.6	1.4	1.1	67.0
186	24.51	3.13	0.38	0.6	0.168	0.572	2.09	0.13	0.06	163.8	17	121	32	245	38	60	21	63	157	24	55	101	68	144	62	11.3	1.8	4.1	1.9	68.4
187	17.32	4.19	0.35	0.65	0.12	0.495	1.46	0.21	0.02	183.4	19	86	31	89	28	38	17	109	132	16	55	74	48	84	30	5.9	0.9	2.3	1.1	75.2
188	21.22	3.15	1.03	0.4	0.288	2.409	1.03	0.12	0.03	427	47	73	43	140	16	48	19	78	130	15	60	58	37	66	23	4.8	0.7	1.7	1.2	70.3
189	17.1	2.61	0.35	0.73	0.156	0.539	2.1	0.29	0.03	275.8	10	106	48	208	38	42	21	94	136	24	62	93	77	147	66	12.1	1.9	4.4	1.6	76.1

Table 25: Continued

Sample	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	P_2O_5	MnO	Ba	Co	Cr	Cu	Li	Nb	Ni	Sc	Sr	V	Y	Zn	Zr	La	Ce	Nd	Sm	Eu	Dy	Yb	SiO_2
190	17.76	4.67	0.36	0.64	0.12	0.506	1.49	0.15	0.02	187.6	13	89	32	92	28	39	19	110	143	19	55	85	49	85	30	5.8	0.9	2.6	1.3	74.3
191	20.88	2.58	0.69	0.32	0.18	1.804	1.09	0.11	0.03	679	11	53	33	128	15	83	16	76	158	16	37	58	36	73	30	6.2	1	2.1	1.1	72.3
192	21.8	3.58	1.09	0.34	0.36	2.453	1.05	0.08	0.04	435.4	32	83	46	138	16	57	20	75	132	18	115	67	36	64	22	4.5	0.7	1.9	1.2	69.2
193	22.28	2.83	0.41	0.72	0.204	0.616	1.94	0.12	0	232.4	15	105	51	244	37	47	19	98	154	29	46	116	80	153	68	12.7	1.9	4.7	2	70.9
194	20.13	3.86	2.01	0.76	0.36	2.299	1.04	0.17	0.11	491.4	26	85	23	219	16	81	16	71	115	16	76	51	36	73	25	5.1	0.8	2.2	1	69.3
195	24.05	2.63	1.31	0.7	0.276	1.892	1.21	0.11	0.03	400.4	14	90	22	277	18	74	17	66	127	14	69	58	34	59	23	3.8	0.7	1.3	1	67.8
196	19.41	3.25	0.37	0.57	0.168	0.583	1.62	0.09	0.01	208.6	16	86	46	236	28	44	17	83	132	23	45	82	66	137	59	11.3	1.8	4.1	1.7	73.9
197	16.95	3.67	0.34	0.61	0.156	0.539	1.58	0.1	0.01	201.6	11	88	55	176	18	44	15	78	116	23	52	89	62	117	50	9.4	1.5	3.6	1.6	76.0
198	18.13	2.95	0.37	0.58	0.156	0.583	1.77	0.12	0.02	201.6	8	86	35	205	32	42	16	72	127	20	32	81	59	112	48	9.2	1.3	3.2	1.3	75.3
199	23.08	1.72	0.76	0.38	0.252	1.738	1.14	0.08	0.01	378	12	84	35	222	17	59	19	65	121	18	46	87	32	55	18	2.8	0.5	1.4	1.5	70.8
200	23.68	3.04	0.7	0.62	0.24	2.519	1.07	0.31	0.03	539	11	82	20	170	17	59	19	100	138	22	68	69	47	88	39	7.3	1.1	2.7	1.5	67.8
201	24.53	2.27	0.71	0.26	0.252	1.881	1.26	0.08	0.02	357	15	90	20	231	19	76	20	65	134	17	45	74	32	55	20	3.6	0.6	1.4	1.3	68.7
202	25.74	1.97	0.73	0.37	0.312	2.332	1.31	0.1	0.01	406	6	94	15	180	20	62	21	62	145	19	56	85	34	58	23	4.2	0.6	1.7	1.6	67.1
203	22.79	2.31	0.81	0.38	0.288	1.914	1.16	0.1	0.03	366.8	12	89	20	225	18	72	19	66	124	17	38	73	32	55	21	4.2	0.6	1.6	1.3	70.2
204	19.79	2.87	0.34	0.73	0.168	0.517	1.8	0.25	0.04	219.8	4	91	47	187	27	45	20	85	127	30	41	105	72	134	60	11.6	1.8	4.9	2.2	73.5
205	24.13	2.23	0.87	0.25	0.24	2.178	1.09	0.09	0.02	421.4	10	80	39	177	10	60	23	71	139	21	117	62	42	73	30	5.8	0.9	2.4	1.6	68.9
206	22.11	2.32	0.96	0.5	0.24	2.156	1.05	0.16	0.02	445.2	23	78	24	162	13	56	20	77	132	18	39	61	37	61	23	4.5	0.7	1.9	1.3	70.5
207	20.14	2.66	0.42	0.62	0.192	1.364	1.36	0.15	0.01	322	15	86	31	101	11	44	20	130	134	24	59	78	57	102	44	8.3	1.3	3.6	1.7	73.1
208	18.29	5.27	0.33	0.74	0.132	0.517	1.13	0.11	0.02	215.6	25	99	61	251	5	46	21	125	109	26	52	65	70	127	53	11.2	1.7	4.6	1.6	73.5
209	15	6.45	1.16	3.06	0.444	2.266	0.77	0.24	0.05	350	19	74	28	66	15	69	15	117	128	26	108	57	46	72	28	6.6	1	3.4	1.2	70.6
210	22.79	4.65	0.51	0.68	0.156	0.836	1.54	0.13	0.01	222.6	22	98	38	87	28	45	25	142	122	29	73	118	58	104	40	7.9	1.3	3.8	2.1	68.7
211	15.99	7.08	0.41	0.57	0.132	0.814	1.44	0.25	0.29	193.2	29	189	146	67	21	107	17	98	135	30	66	123	52	96	9	7.6	1	5	0.5	73.0

Table 25: Continued

Sample	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	P_2O_5	MnO	Ba	Co	Cr	Cu	Li	Nb	Ni	Sc	Sr	V	Y	Zn	Zr	La	Ce	Nd	Sm	Eu	Dy	Yb	SiO_2
212	17.28	4.95	0.35	0.72	0.132	0.539	1.39	0.27	0.02	203	28	83	33	88	25	45	18	116	141	21	47	82	46	80	27	5.9	0.8	2.6	1.2	74.3
213	17.69	5.41	0.41	0.78	0.18	0.869	1.47	0.21	0.02	238	30	86	33	64	28	43	18	112	146	24	68	95	50	88	34	7.2	1.1	3.3	1.5	73.0
214	15.78	2.52	0.3	0.62	0.132	0.539	1.66	0.22	0.02	208.6	11	75	50	208	30	35	21	76	121	22	32	70	63	122	56	10.9	1.7	3.7	1.4	78.2
215	18.68	2.5	0.35	1.21	0.192	0.638	1.41	0.38	0.01	239.4	13	83	34	73	26	43	19	132	153	21	72	86	52	92	37	7.2	1	2.9	1.6	74.6
216	17.32	3.8	0.31	0.64	0.132	0.451	1.55	0.13	0.02	186.2	34	87	32	66	15	40	18	100	87	19	101	78	50	92	33	6.6	1	2.8	1.4	75.6
134	22.19	2.88	0.5	0.82	0.12	0.913	1.63	0.11	0.01	171	18	110	44	116	31	37	24	132	190	29	44	103	63	119	57	10.4	1.6	4.5	2.3	70.8
10	17.89	3.02	0.37	0.65	0.156	0.671	1.65	0.13	0.01	236.6	42	93	47	260	32	36	18	83	131	23	42	80	60	118	56	11	1.6	4	1.7	75.5
16	25.99	2.73	1.3	0.73	0.3	1.958	1.36	0.15	0.05	432.6	17	105	26	331	21	75	21	80	140	24	42	114	36	62	26	4.5	0.6	2.3	2	65.4
18	21.14	3.29	0.86	0.4	0.24	2.068	1.06	0.13	0.03	494.2	61	106	30	154	17	59	19	75	134	20	38	56	37	65	29	6.5	0.8	2.5	1.4	70.8
20	25.31	4.07	0.52	1.01	0.12	0.825	1.81	0.31	0.04	291.2	29	128	52	126	35	47	25	165	210	30	52	139	64	115	49	9	1.4	4	2.6	66.0

Table 26: UNV Ecton greywares

Sample	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	P_2O_5	MnO	Ba	Co	Cr	Cu	Li	Nb	Ni	Sc	Sr	V	Y	Zn	Zr	La	Ce	Nd	Sm	Eu	Dy	Yb	SiO_2
39	16.4	4.12	0.8	0.37	0.3	1.936	1.19	0.18	0.01	267.4	38	117	24	31	26	27	15	84	138	16	47	82	36	63	23	5.2	0.7	2.1	1.2	74.7
40	18.74	4.06	0.77	0.71	0.18	1.848	1.48	0.29	0.02	298.2	57	138	29	66	35	34	16	114	163	31	50	153	49	84	37	8.1	1.2	4.1	2.5	71.9
41	21.42	3.76	0.71	0.85	0.168	1.617	1.45	0.13	0.01	280	68	142	45	93	36	53	18	120	178	24	51	97	55	101	47	9.8	1.5	3.5	1.8	69.9
42	20.92	6.45	1.13	0.61	0.204	2.321	1.26	0.24	0.02	369.6	31	144	28	89	27	55	19	109	150	31	78	80	58	96	44	8.7	1.3	3.9	1.7	66.8
43	21.41	4.51	0.88	0.38	0.168	2.002	1.41	0.08	0.01	274.4	59	143	41	93	32	49	20	99	176	22	61	84	49	90	41	8.8	1.3	3.3	1.5	69.2
44	17.43	4.64	0.82	0.58	0.168	1.782	1.43	0.3	0.02	301	35	127	28	43	31	42	17	100	155	19	58	80	42	75	33	6.7	1	2.6	1.5	72.8
45	19.41	3.32	0.72	0.48	0.192	1.815	1.33	0.08	0.01	266	34	108	34	53	31	37	17	98	156	28	46	79	56	108	51	10.4	1.6	4.3	1.7	72.6
46	22.41	2.93	0.69	0.93	0.156	1.474	1.35	0.16	0.01	289.8	68	148	46	68	34	63	19	116	177	31	53	95	68	156	72	14.7	2.3	5.6	2.6	69.9
47	19.25	5.16	0.98	0.4	0.228	2.607	1.44	0.1	0.01	354.2	127	145	20	56	33	42	18	108	166	20	60	88	43	79	35	8.7	1	2.9	1.5	69.8
48	15.47	2.01	0.33	0.45	0.12	0.891	1.81	0.07	0.01	278.6	30	123	31	105	32	35	17	99	140	23	39	84	49	92	45	8.7	1.3	3.7	1.8	78.8
50	22.54	3.79	0.72	0.78	0.168	1.32	1.55	0.23	0.01	263.2	94	156	45	90	39	52	21	122	179	43	51	108	70	155	70	14.4	2.2	6.3	2.8	68.9
51	18.58	3.36	0.64	0.75	0.12	1.474	1.18	0.37	0.02	323.4	32	140	27	67	23	37	19	182	134	22	44	64	56	110	58	11.3	1.7	4.1	1.6	73.5

Table 27: Mancetter / Hartshill coarsewares

Sample	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	P_2O_5	MnO	Ba	Co	Cr	Cu	Li	Nb	Ni	Sc	Sr	V	Y	Zn	Zr	La	Ce	Nd	Sm	Eu	Dy	Yb	SiO_2
75	16.26	6.95	3.53	0.95	0.456	3.432	0.85	0.57	0.13	799.4	26	112	53	92	15	69	15	83	99	22	115	49	43	80	34	7.1	1.1	3.4	1.5	66.9
76	18.88	5.63	3.22	0.31	0.408	2.981	1.01	0.15	0.06	449.4	43	117	44	218	7	88	17	59	119	19	77	56	27	49	22	4.7	0.7	2.5	1.4	67.4
77	21.98	2.25	0.46	0.25	0.132	1.265	1.41	0.1	0.02	630	18	130	34	217	21	54	18	56	122	19	70	66	33	62	28	5	0.7	2.3	1.5	72.1
78	19.48	4.66	2.45	0.63	0.3	2.486	1.05	0.3	0.1	446.6	26	137	37	165	18	67	17	65	114	22	110	77	37	65	28	5.7	0.9	2.8	1.7	68.5
79	21.05	5.26	2.07	0.33	0.372	3.135	1.06	0.13	0.12	581	40	109	27	170	16	71	20	64	127	17	67	54	33	64	23	4.5	0.6	2	1.3	66.5
80	32.43	3.58	0.79	0.09	0.204	2.057	1.32	0.18	0.01	492.8	21	113	52	445	20	67	27	87	241	20	75	87	48	88	35	5.8	0.8	2	1.7	59.3
81	25.9	2.16	0.89	0.22	0.168	2.167	1.31	0.09	0.02	424.2	10	94	49	244	20	63	23	69	156	17	59	62	37	64	27	4.5	0.7	1.7	1.5	67.1
82	25.46	6.48	0.91	0.29	0.144	1.661	1.27	0.25	0.04	466.2	19	84	69	176	18	73	25	55	106	27	110	75	43	79	34	7	1.2	3.5	2	63.5
83	22.48	3.11	0.85	0.18	0.18	2.068	1.2	0.15	0.04	707	36	72	62	210	18	47	19	66	178	18	93	50	41	80	34	6.9	0.9	2.4	1.2	69.7
84	27.2	2.61	0.92	0.17	0.132	2.42	1.44	0.13	0.02	830.2	15	83	59	234	21	47	22	73	208	23	102	78	42	81	35	6.1	1	2.5	1.7	65.0
85	21.74	4.58	0.53	0.24	0.132	1.474	1.2	0.11	0.04	515.2	16	97	34	189	18	50	19	60	119	18	63	54	39	78	34	6.8	1	2.6	1.3	70.0
86	25.3	5.77	1.99	0.38	0.228	3.52	0.91	0.24	0.08	624.4	32	95	45	78	14	77	24	102	139	25	117	58	52	93	40	7.7	1.2	3.1	1.8	61.6
87	24.19	4.96	0.71	0.26	0.168	2.233	1.22	0.15	0.07	568.4	25	117	49	154	19	67	22	75	151	26	64	65	47	95	42	8.5	1.4	3.8	1.9	66.0
88	24.09	5.39	1.87	0.41	0.288	3.729	0.84	0.23	0.08	732.2	42	93	49	83	14	76	23	111	138	24	119	56	48	87	37	7.5	1.1	3.1	1.8	63.1
89	23.26	2.39	0.49	0.26	0.132	1.177	1.42	0.12	0.03	460.6	19	108	29	247	21	52	19	58	127	20	149	75	31	59	26	4.7	0.7	2.1	1.6	70.7
90	26.54	7.97	0.89	0.16	0.156	1.87	1.33	0.11	0.05	485.8	15	131	55	173	21	66	26	61	115	31	76	93	44	79	28	5.4	0.9	3.4	2.2	60.9
91	22.45	6.74	0.35	0.09	0.096	1.32	1.18	0.41	0.03	390.6	6	89	57	142	19	58	21	24	151	26	136	93	26	52	17	3.9	0.7	2.8	2	67.3
92	23.03	7	0.41	0.1	0.096	1.309	1.18	0.65	0.05	438.2	7	91	55	138	19	52	22	24	153	28	184	102	19	40	11	3	0.6	2.9	2.2	66.2
93	26.71	2.1	0.75	0.3	0.18	2.013	1.39	0.12	0.01	387.8	11	107	17	257	21	78	21	61	127	18	40	81	33	58	25	3.8	0.6	1.5	1.6	66.4

Table 28: Stanwick grog-tempered coarseware fabric A1

Sample	**Al_2O_3**	**Fe_2O_3**	**MgO**	**CaO**	**Na_2O**	**K_2O**	**TiO_2**	**P_2O_5**	**MnO**	**Ba**	**Co**	**Cr**	**Cu**	**Li**	**Nb**	**Ni**	**Sc**	**Sr**	**V**	**Y**	**Zn**	**Zr**	**La**	**Ce**	**Nd**	**Sm**	**Eu**	**Dy**	**Yb**	**SiO_2**
94	21.78	3.24	0.45	1.72	0.18	0.814	1.69	0.6	0.02	333.2	13	155	43	91	33	41	22	175	180	28	52	108	64	116	51	9	1.4	4.2	2.3	69.5
95	23.91	3.59	0.54	1.06	0.156	0.946	1.81	0.27	0.05	273	33	130	35	119	35	56	24	163	154	33	74	126	66	128	60	11.3	1.7	5.3	2.8	67.7
96	21.5	3.81	0.42	1.39	0.228	0.803	1.79	0.74	0.05	299.6	15	109	50	84	35	39	23	171	181	27	74	117	61	108	49	8.9	1.4	4	2.3	69.3
97	18.4	2.97	0.49	0.96	0.132	0.891	1.96	0.23	0.03	208.6	11	98	35	104	37	44	20	120	146	28	59	105	57	110	51	9.8	1.5	4.8	2.5	73.9
98	20.06	3.36	0.51	0.85	0.168	1.078	1.99	0.14	0.02	242.2	18	105	38	109	39	44	23	126	174	28	58	123	61	116	53	9.9	1.5	4.4	2.3	71.8
99	23.72	4.13	0.54	1.1	0.18	0.924	1.71	0.28	0.03	170	22	139	47	123	33	50	24	152	179	28	79	117	62	114	47	8.8	1.4	4	2.3	67.4
100	23.89	3.42	0.54	1.04	0.18	0.913	1.79	0.16	0.01	164	34	119	44	134	34	40	24	143	190	27	53	126	61	112	46	8.5	1.3	3.8	2.3	68.1
101	22.45	3.72	0.49	0.98	0.156	0.682	1.79	0.29	0.02	164	20	113	42	121	35	46	22	134	198	34	63	118	65	121	57	10.5	1.7	5.3	2.9	69.4
102	23.58	3.73	0.47	1.56	0.18	0.77	1.69	0.66	0.04	251	17	105	45	114	32	50	24	179	166	29	64	115	64	122	54	9.8	1.6	4.5	2.6	67.3
103	22.46	3	0.42	1.47	0.276	0.726	2.03	0.71	0.04	196	3	112	53	116	38	46	24	186	179	27	52	112	66	119	53	8.9	1.5	4.1	2.2	68.9

Table 29: Stanwick grog-tempered coarseware fabric A3

Sample	**Al_2O_3**	**Fe_2O_3**	**MgO**	**CaO**	**Na_2O**	**K_2O**	**TiO_2**	**P_2O_5**	**MnO**	**Ba**	**Co**	**Cr**	**Cu**	**Li**	**Nb**	**Ni**	**Sc**	**Sr**	**V**	**Y**	**Zn**	**Zr**	**La**	**Ce**	**Nd**	**Sm**	**Eu**	**Dy**	**Yb**	**SiO_2**
104	21.07	2.58	0.32	2.18	0.18	0.462	1.53	0.86	0.02	203	12	104	36	97	29	46	21	143	152	25	47	114	55	96	41	7.5	1.2	3.5	2.3	70.8
105	21.45	2.54	0.32	2.24	0.18	0.572	1.55	0.77	0.01	214	6	95	50	105	30	38	22	154	156	28	55	115	63	112	51	9.1	1.5	4.1	2.5	70.4
106	24.71	3.07	0.39	2.22	0.24	0.814	1.58	1.17	0.01	178	4	113	54	77	27	45	27	192	182	24	67	104	57	98	47	8.1	1.4	3.5	2.1	65.8
107	27.06	3.32	0.65	2.48	0.228	1.265	0.79	0.83	0.01	168	16	78	57	54	23	61	22	147	128	22	73	94	44	92	49	10.6	1.9	4.4	2.2	63.4
108	22.38	3.17	0.34	1.44	0.192	0.55	1.88	0.42	0.01	187	4	108	44	119	36	43	24	120	181	30	65	118	65	122	57	10.8	1.7	5	2.7	69.6
109	21.74	2.62	0.3	1.92	0.18	0.704	1.73	0.59	0.01	205	4	103	37	140	33	43	22	113	161	25	62	121	55	98	42	7.2	1.2	3.3	2.2	70.2
110	22.47	5.05	0.84	3.62	0.192	1.331	0.99	0.35	0.01	213	20	78	52	61	29	68	20	142	137	20	78	109	53	81	33	5.8	0.9	2.6	1.8	65.1
111	18.66	4.06	0.55	1.92	0.312	1.122	1.45	1.05	0.1	315	9	98	36	67	22	52	19	156	120	26	71	101	50	90	43	7.7	1.2	3.8	2.3	70.8
112	23.85	3.1	0.44	1.24	0.132	0.693	1.94	0.24	0.02	197	10	129	41	107	36	50	25	152	181	27	59	114	65	118	52	9.2	1.5	4.2	2.3	68.3
113	21.16	3.04	0.32	1.43	0.168	0.561	2.05	0.77	0.04	256	5	123	29	107	38	49	22	138	134	29	79	121	63	116	52	9.4	1.4	4.3	2.5	70.5

Table 30: Stanwick buff, gritty fabric D6/9

Sample	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	P_2O_5	MnO	Ba	Co	Cr	Cu	Li	Nb	Ni	Sc	Sr	V	Y	Zn	Zr	La	Ce	Nd	Sm	Eu	Dy	Yb	SiO_2
124	17.44	2.05	0.18	0.62	0.096	0.154	2.6	0.1	0.01	59	12	115	27	123	47	51	18	36	119	33	75	111	59	119	53	9.2	1.3	4.6	2.7	76.8
125	24.12	2.91	0.45	0.77	0.132	0.715	1.69	0.2	0.01	172	15	106	39	125	32	42	22	122	182	24	49	111	59	108	44	8	1.2	3.2	2.1	69.0
126	22.37	4.44	0.49	0.85	0.156	0.814	1.6	0.16	0.03	160	28	118	42	120	31	43	22	137	182	27	58	106	61	115	48	9.3	1.5	4.1	2.2	69.1
127	17.78	2.72	0.34	0.71	0.132	0.704	1.95	0.18	0.01	159	23	96	42	104	37	42	20	116	139	26	47	100	56	104	46	8.5	1.2	4	2	75.5
128	13.28	5.85	0.28	0.66	0.108	0.407	1.62	0.23	0.06	145	29	90	29	85	30	40	17	95	124	23	64	83	47	90	36	7.6	1.1	3.7	1.6	77.5
129	20.55	2.98	0.47	1.3	0.216	0.99	1.47	0.22	0.01	197	33	100	29	112	28	40	21	155	162	24	51	97	57	102	44	8.3	1.2	3.4	2	71.8
130	17.55	2.49	0.34	0.89	0.12	0.737	1.92	0.14	0.01	158	19	105	34	126	36	41	19	109	139	26	72	102	55	103	45	8.4	1.3	4	2.1	75.8
131	22.56	3.02	0.48	1.11	0.132	0.803	1.6	0.23	0.04	176	20	108	36	89	31	40	24	152	159	30	87	115	63	121	55	10.6	1.7	4.8	2.6	70.0
132	22.09	3.1	0.52	1.08	0.132	0.869	2.05	0.18	0.01	161	27	116	39	129	39	43	23	139	190	29	57	123	61	111	49	9.3	1.4	4.5	2.4	70.0
133	20.06	3.02	0.43	0.8	0.12	0.935	1.66	0.26	0.04	200	20	107	34	83	32	38	19	159	164	22	51	103	55	96	39	7.1	1	3	1.9	72.7

Table 31: Stanwick fine cream fabric D2

Sample	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	P_2O_5	MnO	Ba	Co	Cr	Cu	Li	Nb	Ni	Sc	Sr	V	Y	Zn	Zr	La	Ce	Nd	Sm	Eu	Dy	Yb	SiO_2
114	17.29	1.9	0.33	0.57	0.108	0.451	2.39	0.21	0.01	141	9	97	34	77	43	26	22	99	94	29	59	116	58	108	50	8.8	1.3	4.1	2.4	76.7
115	16.16	1.79	0.3	0.57	0.12	0.418	2.11	0.1	0.01	131	46	91	29	89	37	38	18	90	121	32	46	113	53	101	47	8.9	1.3	4.7	2.7	78.4
116	18.74	2.74	0.21	1.47	0.156	0.407	1.84	0.41	0.01	215	3	94	35	171	34	35	16	96	131	26	36	108	61	110	52	9	1.4	3.9	2.2	74.0
117	24.4	2.66	0.51	1.03	0.18	0.88	1.86	0.17	0.01	194	24	116	35	90	35	40	26	148	126	30	88	126	64	115	52	9.3	1.4	4.1	2.5	68.3
118	18.36	2.59	0.33	0.64	0.12	0.374	2.15	0.13	0.01	139	4	96	45	208	39	37	18	71	104	26	36	104	69	135	63	11.4	1.8	4.3	2	75.3
119	22.29	2.92	0.39	0.56	0.096	0.836	1.96	0.11	0.01	155	7	104	26	64	35	26	17	112	136	25	31	105	63	115	45	7.9	1.2	3.4	2	70.8
120	15.66	2.61	0.1	1.44	0.096	0.297	1.75	0.7	0.03	161	4	91	26	144	31	51	13	93	106	27	91	108	57	106	49	9	1.4	4.1	2.2	77.3
121	17.43	1.88	0.25	1	0.144	0.572	2.05	0.39	0	182	0	90	32	112	38	37	19	79	100	24	43	110	54	106	47	8.1	1.3	3.5	2.2	76.3
122	17.81	2.57	0.27	1.25	0.132	0.506	1.44	0.73	0.02	427	11	93	31	78	16	28	20	181	141	26	67	68	59	108	48	7.9	1.2	3.6	2	75.3
123	21.77	3.57	0.35	1.32	0.18	0.506	1.84	0.91	0.05	334	15	118	42	127	34	39	23	171	168	27	81	129	59	107	44	8	1.3	4	2.4	69.5

Table 32: Stanwick coarseware pale-cored greyware fabric C4

Sample	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	P_2O_5	MnO	Ba	Co	Cr	Cu	Li	Nb	Ni	Sc	Sr	V	Y	Zn	Zr	La	Ce	Nd	Sm	Eu	Dy	Yb	SiO_2
145	17.15	4.44	0.87	0.52	0.156	1.881	1.28	0.22	0.03	218	22	72	28	62	26	41	16	89	136	20	58	74	43	80	34	7.1	1.1	3	1.4	73.5
146	18.04	3.96	0.79	0.73	0.18	1.65	1.29	0.1	0.01	182	35	74	30	52	20	41	16	116	149	35	80	88	56	94	44	9.2	1.5	4.7	2	73.3
147	18.72	4.59	0.89	0.47	0.168	1.98	1.46	0.14	0.01	198	33	83	31	68	27	40	18	97	158	22	54	96	46	78	33	6.7	1	3	1.6	71.6
148	23.81	4.59	0.64	0.77	0.144	1.012	0.92	0.14	0.01	152	28	84	30	161	21	44	16	78	172	25	67	74	52	95	39	8.2	1.3	3.3	1.7	68.0
149	17.18	3.42	0.55	0.56	0.18	1.584	0.85	0.09	0.01	245	25	69	25	125	18	33	15	82	129	16	60	51	38	71	30	6.5	1	2.3	1	75.6
150	16.89	2.96	0.68	0.56	0.156	1.496	1.3	0.16	0.02	184	29	86	33	55	28	41	15	102	141	20	45	77	46	82	37	7.2	1.1	2.9	1.4	75.8

Table 33: Stanwick coarseware soft pink grog-tempered fabric A2

Sample	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	P_2O_5	MnO	Ba	Co	Cr	Cu	Li	Nb	Ni	Sc	Sr	V	Y	Zn	Zr	La	Ce	Nd	Sm	Eu	Dy	Yb	SiO_2
140	19.22	6.94	2.04	10.22	0.324	3.135	0.89	0.48	0.07	275	22	130	30	90	19	71	18	256	164	25	102	62	48	84	39	7.4	1.1	3.4	1.5	56.7
141	18.95	7.03	2.13	10.59	0.336	3.036	0.9	0.33	0.08	268	21	129	20	85	19	60	18	252	163	26	108	64	48	84	39	7.4	1.2	3.5	1.7	56.6
142	19.29	7.1	2.08	9.8	0.348	3.025	0.91	0.36	0.08	289	24	130	29	91	19	70	18	241	162	26	102	63	50	86	39	7.7	1.2	3.6	1.7	57.0
143	20.4	7.86	2.16	10.86	0.336	2.761	0.95	0.33	0.09	296	24	136	26	87	20	72	19	261	171	29	110	72	50	88	39	8.1	1.3	3.8	1.9	54.3
144	19.62	7.16	2.09	10.91	0.324	3.124	0.91	0.3	0.07	288	22	99	26	98	20	69	18	256	165	27	100	68	48	85	38	7.6	1.2	3.6	1.8	55.5