Characterisation Studies of some Medieval Pottery from Lydd Quarry, Sussex

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Excavations at Lydd Quarry by Archaeology South East produced a collection of medieval pottery which include two wares whose origins were in doubt. Samples were therefore chosen for analysis using a combination of petrological and chemical analyses.

Shell-tempered ware

Samples of shell-tempered coarsewares were selected for analysis. Seven samples were submitted, all of which had a very similar appearance, even under x20 magnification. However, three distinct fabric subgroups were noted, and classed as shelly 1, shelly 2 and shelly 3 (Sample Nos. V1972 to V1978).

The fabrics all contain bivalve shell fragments, including ornamented shells. The fabrics were defined as follows:

Shelly 1 contains sparse small gastropod shells visible by eye

Shelly 2 does not contain small gastropods (at least not on visible surfaces or breaks) but is similar in texture and colour to Shelly 1, and is probably the same fabric.

Shelly 3 is a lighter-coloured variant of Shelly 2.

Visual examination of shell-tempered wares from various sites in the south east, mainly in Kent, by John Cooper (Natural History Museum) and John Cotter (Canterbury Archaeological Trust) suggest that there are two main origins for the shell: the first is the fossilised shell banks found in the Tertiary clays which outcrop along the north Kent coast and less extensively along the south coast and the second is the recent marine clays which formed salt marshes at several points around the coast, most extensively in the Wantsum channel and the Romney Marshes. Samples of the first ware have been examined by the author as part of Dr Gardiner's study of mid Saxon cross-channel trade in south east England (Sample Nos AG480-483 and AG486-488) but only one sample of the latter ware had been sampled, from a medieval vessel found in Canterbury (Sample No. AG477). The source of this sample is not known but is likely to be the Wantsum channel.

The Tertiary shell assemblages are composed mainly of thick-walled bivalve shells together with rare gastropod shells and fragments of calcareous worm tubes. The clay matrix is either silty and micaceous or free from any visible inclusions.

The recent shell assemblages are composed of thin-walled bivalve shells and gastropod shells, identified by Cooper as *Hydrobia.* A distinctive feature noted in the thin-sectioned sample (Sample No AG477) is that the gastropod shells are not filled with either clay or calcite.

Only one production site for shell-tempered ware has been found in the south east, at Potters Corner, Ashford. This site is remote from both the known sources of shell inclusions and was probably utilising the [add geological details here]. Samples of wasters from this site were analysed for comparison with those from Lydd Quarry (Sample Nos V1966 to V1971).

Some samples of medieval shell-tempered vessels from consumer sites in north west Kent were analysed as part of a study of the wheelthrown shell-tempered wares from the City of London. The samples came from consumer sites at Dartford and Fawkham. Some of these vessels are identical to those found in the City of London (SSW, Sample Nos. V617 and V619) but others contained scattered polished quartz grains absent from that ware and are classed here as North Kent Medieval Shelly ware (NKMS, Sample Nos. V614-616 and V618).

Finally, some vessels from Canterbury have been identified as imports from Flanders on the basis of their typology and method of manufacture (Sample Nos. AG475-6 and AG478-9).

Petrological Analysis

Samples of the Ashtead ware and of each of the three Lydd shelly subfabrics were thin sectioned (V1966, V1972, V1973 and V1975). The sections were stained using Dickson's method. The method distinguishes non-ferroan calcite (red stain) from ferroan calcite (blue stain) and dolomite (unstained).

Visually, the Ashtead samples were distinguishable from the Lydd Quarry ones because of their lower shell content, although since all of the shell was leached out this comparison may be erroneous. The following inclusions were noted in the thin section of the Ashtead sample:

- Abundant rounded quartz grains up to 0.5mm across. The grains mainly have a well rounded outline but with only moderate sphericity. This is typical of most of the sand grains from lower Cretaceous and later deposits in the south east of England.

- Moderate Rounded opaque inclusions up to 0.3mm across. These grains have a similar size and shape to the altered glauconite (below) and are possible haematite replacing glauconite.

- Sparse altered glauconite. Rounded grains up to 0.3mm across composed of a brown translucent isotropic mineral. This is likely to be altered glauconite. Glauconite, which is usually green, can be altered through oxidation during weathering or through firing.

- Sparse voids which from their shape can be seen to have originally contained bivalve shell fragments. The shells range from c.0.3mm to 0.6mm in thickness and are up to 1.0mm long and there is some slight rounding of the broken edges. No voids from gastropods were noted but are difficult to identify once the shell itself has dissolved.

- Sparse dark concretions with concentric structures up to 1.0mm across. These appear to be composed of iron-rich clay and have a rough oolitic structure. They are possibly concretionary nodules.

- Rare rounded chert fragments up to 1.0mm across. There are possible sponge spicules within the chert.

The inclusions in the Ashtead fabric are consistent with the sand being a detrital sand derived from lower Cretaceous strata. The absence of flint might be significant. It is not possible to say whether the shell was present in the parent clay or as detrital fragments in the sand although the low degree of rounding would suggest that the shell had not travelled far from the original outcrop.

The sample of Shelly 1 subfabric (V1972) has almost exactly the same characteristics as the Ashford sample, with the following exceptions:

- There are no rounded opaque inclusions

- The quartz sand is possibly slightly finer-textured than the Ashford sample and (consequently?) has less well-rounded grains.

- Some shell is still present. The shell is stained a light purple colour.

- No chert was noted.

The section of Shelly 2 subfabric (V1973) has a similar composition to Shelly 1 with the following differences:

- There is a single large round opaque grain, 2.0mm long

- There are more shell fragments than in Shelly 1 and they are from thin-walled bivalves (c.0.2-0.4mm thick)

- There is a single gastropod with a void chamber, total length 0.6mm

- There are several ferroan calcite microfossils up to 0.1mm across

The section of Shelly 3 subfabric (V1975) has a similar composition to the Ashford sample with the following differences:

- the shell fragments survive. They include some thinner than the voids seen in the Ashford sample but are otherwise comparable. Most of the fragments have rounded edges.

- No chert was noted.

From the thin section analysis one might conclude that Shelly 3 was an Ashford product but that Shelly 2, containing a gastropod with a void chamber, suggests a possible recent age for the shell. The similarity of Shelly 1 to Shelly 2 would suggest that these two subfabrics have the same source. The lack of microfossils in three of the four sections is probably simply due to differences in preservation.

Chemical Analysis

Samples of the Ashford and Lydd Quarry shell-tempered wares were analysed using Inductively Coupled Plasma Spectroscopy at Royal Holloway College London. The samples were prepared by mechanically removing up to 1.0mm of the sherd surfaces to remove contamination and then crushing the resulting lump until it formed a fine powder. The amount of various major, minor and trace elements was recorded. For the major elements, the values were recorded as percent oxides and for the remainder the values were recorded as parts per million.

Before any further analysis was carried out, the dataset was examined to look for rogue values, which were more than two standard deviations from the mean value. Two such values were present, both in samples from Lydd Quarry. V1972 has an abnormally high Zinc content and V1973 has an abnormally high Barium content. Excluding these two samples, Zinc is correlated most strongly with P_2O_5 and Barium with Ca_2O_3 and Sr but in these two cases the values are not matched by correspondingly high values for other elements.

The data were then normalised to Al_2O_3 values and a factor analysis was carried out, omitting those elements likely to be strongly associated with the shell inclusions themselves, since there was wide variation in the preservation of the shell, and in the Ashford samples virtually no calcite remained at all. Fig 1 shows a plot of the two main factors, F1 and F2, for this dataset. The Flemish shelly wares are the least similar to the rest, as one might hope given their supposed origin. The Lydd Quarry and Ashford samples form a discrete cluster characterised by negative values for both factors. Within this cluster the Ashford samples tend to have stronger negative values for both factors than the Lydd Quarry ones although there is not a clear separation between the two groups. One can conclude, therefore, that the Ashford and Lydd samples are clearly distinguished from those from north and east Kent and from the Flemish ware but that it would be possible for some of the Lydd samples to have been made at Ashford, although it is most likely that the Lydd samples come from a separate source. Interestingly, the Hydrobia-containing shelly ware from Canterbury forms a stray in this analysis.

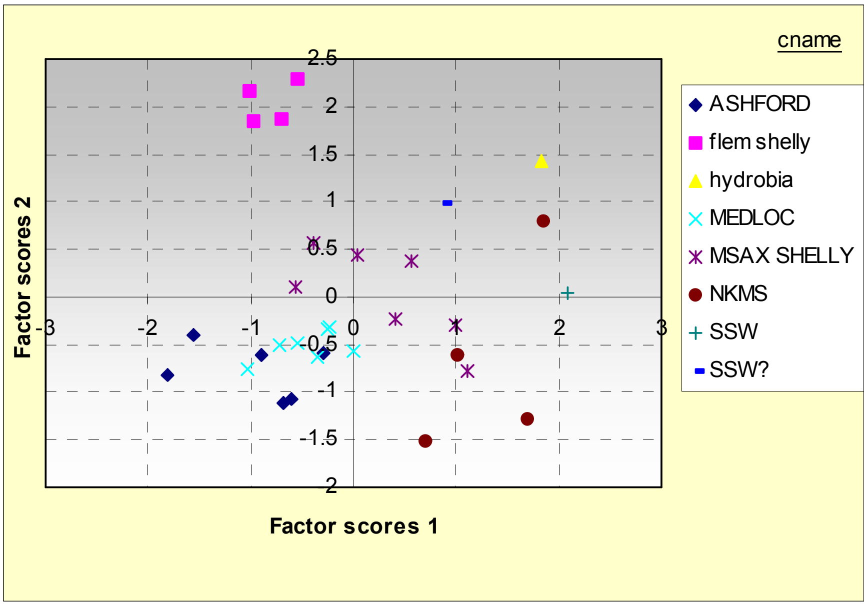

Figure 1 Lydd Quarry = MEDLOC

To further test the similarity of the Ashford and Lydd Quarry samples Factors 3 and 4 were plotted (Fig 2). No clear clustering of the samples was visible but the Lydd Quarry samples tended to have higher values for both F3 and F4 than the Ashford samples, as indicated by the line in Fig 2.

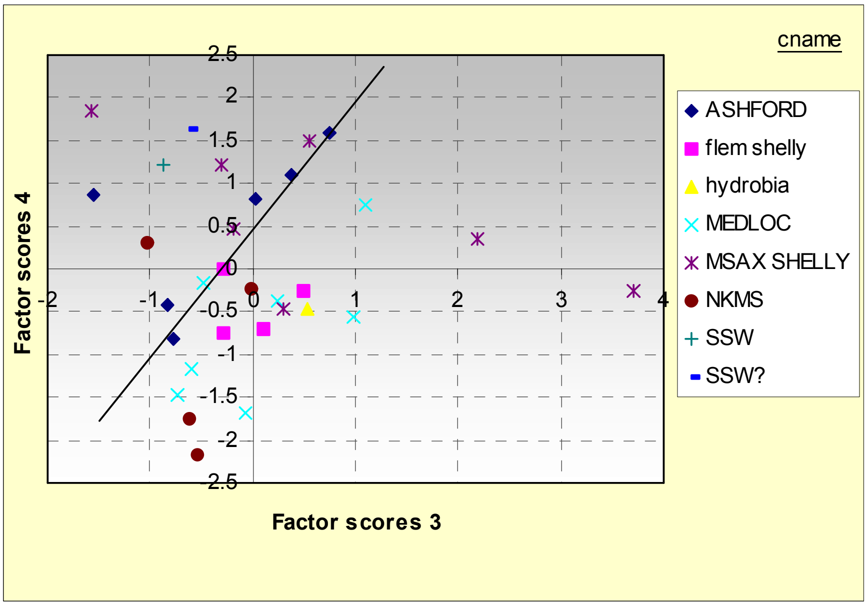

Figure 2 Lydd Quarry = MEDLOC

Finally, the fifth and sixth factors were plotted (Fig 3). Again, no clear clusters were present but here too the Hydrobia sample was an outlier as were the two London SSW samples. The Lydd Quarry and Ashford samples are shown to have very similar compositions but with slightly differing median values.

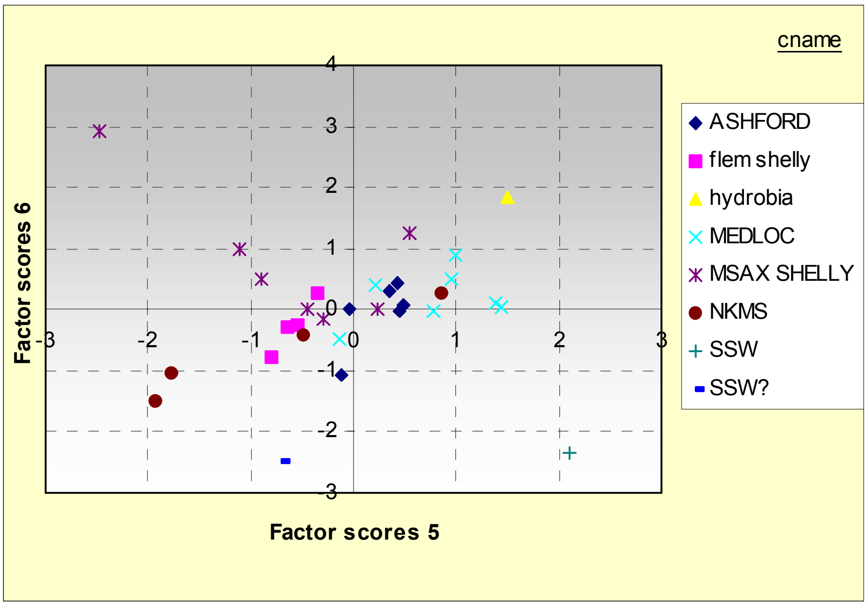

Figure 3 Lydd Quarry = MEDLOC

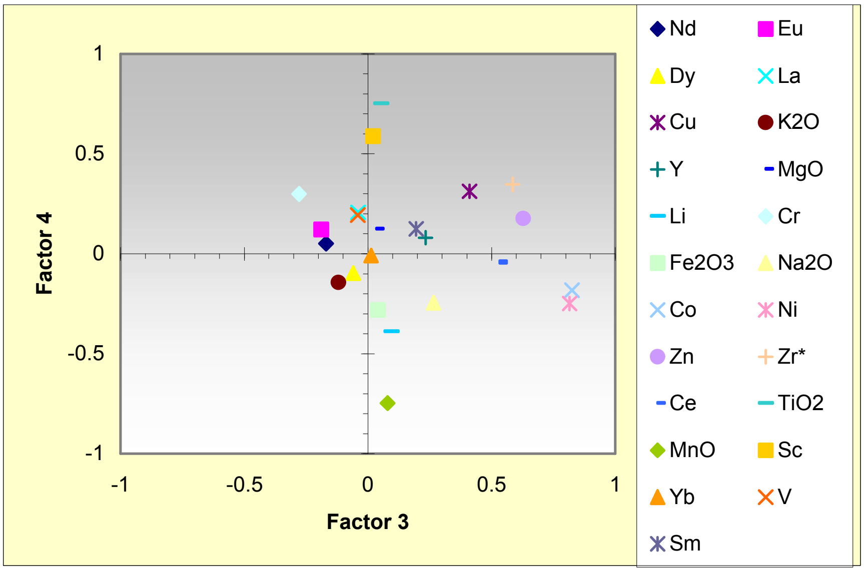

Figure 4

Conclusions

The overall conclusion of the chemical analysis is that the Lydd Quarry and Ashford shell-tempered wares have very similar compositions and can be distinguished from other shell-tempered ware samples from the south east. However, the two groups are themselves subtly different and this is shown most clearly by the plot of F3 and F4. Fig 4 shows the contribution of each of the measured elements to Factors 3 and 4. By comparing this diagram with Fig 3 we can see that the significant elements are Cr, Sc and TiO, all of which contribute to high F4 and negative F3 values and MnO, Ni and Co, all of which contribute to high F3 and negative F4 values. It must be emphasised, however, that the differences between the two groups are very slight and might be due to burial conditions rather than original differences in composition.

The possible petrological differences between Ashford/Shelly 3 on the one hand and Shelly 1 and Shelly 2 on the other are not reflected in their chemical compositions. This would imply that the second group (Shelly 1 and Shelly 2) are simply variants of a fabric which is petrologically identical to that produced at Ashford. However, visually, there were small gastropods in Shelly 1 and one such shell was noted in the section of Shelly 2. If these shells really are the modern species, *Hydrobia ulvae*, then this would suggest that at least this shelly 1 and 2 group is made from recent salt marsh clay. However, the chemical composition is quite distinct from that of the Canterbury *Hydrobia* sample, which incidentally has by far the highest Na_2O content of any of the shelly wares. Petrological and chemical analyses, therefore, have neither disproved nor proved the link between the Lydd Quarry sherds and the Ashtead kiln. The next step should therefore be to identify the precise species of shell present.

Sand-tempered glazed wares

Samples of sand-tempered glazed ware from Lydd Quarry were selected for analysis. Visually, they were similar to those made in the nearby production centre at Rye. However, under x20 magnification several different subfabrics were recognised. Samples of each of four subfabrics were thin sectioned and a chemical analysis obtained. In addition, a second chemical analysis was obtained for the most common subfabric, Fabric 2 (Sample Nos. V1979 to V1983).

Samples from two locations in Rye were examined. One of these was a single sherd from Leopold Vidler's 1930s excavations but this was too small to sample and in any case was not matched by any of the four Lydd Quarry subfabrics. The remaining samples came from a waster dump excavated in 2001 (Site Code FAR01). The pottery from this dump could be divided into three subfabrics, Fabrics 5 to 7. None of these were precisely the same as any of the Lydd Quarry samples (Sample Nos V1984 to V1988).

Both the Lydd Quarry and Rye samples could be grouped into red-firing (Fabrics 1, 2, 3, 5 and 7) and light-firing (Fabrics 4 and 6) groups.

For comparison, forty-two samples of sand-tempered glazed wares from south east England have been examined by the author. Two of these are products of the Tyler Hill industry, located immediately to the northwest of Canterbury. Samples of floor tiles from production sites (TYLER HILL FT (K)) and consumer sites (TYLER HILL FT), samples of roof tiles from production sites (TYLER HILL CBM (K)) and samples of pottery from the production site (TYLER HILL (K)) and from consumer sites (TYLER HILL) were all examined using thin sections and chemical analysis. In addition, three tiles of possible Tyler Hill origin from St Gregory's Priory, Canterbury were sampled (TYLER HILL FT?).

A smaller group of samples came from a kiln site at Maidstone produced glazed jugs (MAIDSTONE-TYPE (K)) together with four samples from consumer sites which were thought possibly to be products of this industry.

Petrology

The sample of Fabric 1 (V1979) contains the following inclusions:

- Abundant rounded quartzose sand. Abundant rounded grains up to 0.5mm across. Almost all of the grains are monocrystalline quartz with rare polycrystalline quartz and plagioclase feldspar.

- Moderate rounded red mudstone/clay fragments up to 1.5mm across. One of these fragments, with visible bedding, has been cracked suggesting that they are mudstone rather than clay. They contain no visible inclusions.

- Moderate rounded altered glauconite up to 0.2mm across (ie smaller than the grains seen in the shell-tempered wares).

- Sparse muscovite laths up to 0.3mm long.

- Sparse rounded opaque grains up to 0.2mm across.

The groundmass consists of a fine-textured red-firing clay with abundant rounded brown clay inclusions up to 0.1mm across.

The sample of Fabric 2 (V1980) contains the following inclusions:

- Abundant subangular quartz grains up to 0.3mm across. The larger grains are rounded and all are monocrystalline.

- Moderate rounded altered glauconite, as in Fabric 1.

- Sparse oolitic dark clay pellets up to 1.0mm across

The sample has an anisotropic clay matrix with sparse quartz silt up to 0.1mm and moderate rounded opaque and brown inclusions, probably faecal pellets.

The sample of Fabric 3 (V1982) contains the following inclusions:

- Abundant subangular quartz grains up to 0.3mm across.

- Sparse rounded quartz grains up to 0.5mm across

- Sparse angular opaque inclusions up to 1.0mm long

- Sparse organic inclusions (voids with a black, carbon-rich and reduced, halo) up to 2.0mm long

The sample has an oxidized anisotropic clay matrix except for an isotropic light grey reduced core with sparse quartz silt up to 0.1mm and moderate rounded opaque and brown inclusions, probably faecal pellets. It also has a single lens of clay with a different colour (slightly darker) and texture (fewer quartz inclusions).

The sample of Fabric 4 (V1983) contains the following inclusions:

- Abundant subangular quartzose grains up to 0.5mm. Mostly monocrystalline quartz grains.

- Sparse rounded calcareous inclusions up to 0.2mm. Stained pink and therefore non-ferroan calcite. There is no visible structure and they might therefore be detrital micrite (e.g. chalk) or microfossils. There are also a number of subangular and rounded voids, up to 0.7mm across but in the main these have similar outlines to the quartzose grains and are likely to be plucked quartz grains.

- Sparse oolitic dark brown clay pellets up to 0.5mm across

- Sparse dark brown clay pellets up to 0.5mm across.

The sample has an anisotropic clay matrix of light brown clay containing sparse quartz silt and abundant rounded brown and opaque inclusions up to 0.1mm across.

The sample of Fabric 5 (V1984) contains the following inclusions:

- Abundant subangular quartz grains up to 0.2mm across

- Sparse muscovite laths up to 0.2mm long.

- Sparse oolitic dark brown clay pellets up to 1.0mm across

- Rare rounded chert up to 1.0mm across

- Rare heat-altered calcareous inclusions up to 0.5mm across.

The sample has an anisotropic clay matrix except for an isotropic reduced light grey core and contains sparse quartz silt, muscovite laths and abundant dark brown and opaque brown inclusions, probably faecal pellets.

The sample of Fabric 6 (V1985) contains the following inclusions:

- Abundant subangular quartz grains up to 0.5mm. Mostly monocrystalline grains.

- Sparse rounded quartz grains up to 0.7mm. Some of these have the well-rounded outlines typical of quartz grains from lower Cretaceous and later deposits.

- Sparse oolitic brown clay pellets up to1.0mm across

- Sparse rounded brown clay pellets up to 1.0mm across

- Sparse subangular chert up to 0.3mm across. The chert contains abundant silt-sized inclusions with high relief (possibly gas?)

The sample has an anisotropic light brown clay matrix with moderate quartz silt and sparse muscovite up to 0.1mm long, moderate brown and opaque inclusions, probably faecal pellets.

The sample of Fabric 7 (V1987) contains the following inclusions:

Abundant subangular quartz grains up to 0.2mm across.

Sparse oolitic dark brown clay pellets up to 1.5mm across.

Sparse dark brown rounded mudstone grains up to 0.5mm across.

Rare rounded chert up to 2.0mm across. The chert contains numerous silt-sized inclusions, some are rounded and opaque.

The sample has a reduced, light grey isotropic core and anisotropic, oxidized margins. The groundmass contains sparse quartz silt, muscovite laths and rounded opaque and dark brown inclusions, probably faecal pellets.

There is a clear division into a red-firing group and a light-firing group (fabrics 4 and 6) but the characteristics of both the inclusions and the groundmass of both groups are similar, suggesting that the light-firing clay was formed in similar conditions. The light-firing clays of the south east of England were formed by pedogenesis in tropical deltaic environments and it is likely that this is true of the Rye examples.

There is a second major division within these samples, based on the texture and size distribution of the quartzose inclusions. Fabrics 2 and 5 have fine sand grade inclusions, mainly up to 0.2mm across, fabrics 3 and 7 have medium sand grade inclusions, up to 0.5mm across, and Fabrics 4 and 6 have slightly coarse grade inclusions including more rounded grains. Fabric 1 has the coarsest grade inclusions, but still within the medium sand grade.

Since the differences in colour and texture are found in both the Lydd and Rye samples this suggests that the majority of the Lydd samples could have been made at Rye. Fabric 1 is the only Lydd Quarry sample not to have a close match in the Rye samples but, even there, every inclusion type present is also found in other Rye or Lydd Quarry samples.

Chemical Analysis

Samples of the Lydd Quarry and Rye-type wares were prepared in the same way as those of the shell-tempered wares.

The data for the Rye and Lydd Quarry samples was first examined to see if any outlying results were present. Only one abberant result was present, the Cu value for a Fabric 6 sample from Rye. This is probably the result of contamination from copper colourant used in the glaze. This sample had a Pb value of over 2000 ppm, compared with 2-300 ppm in the majority of these glazed samples and only 30-60ppm for the unglazed shelly wares. The data were then normalised to Al2O3.

The normalised data for the Rye and Lydd Quarry samples were then examined using factor analysis along with all the ICPS data for sandy glazed wares in south east England. The results of this were that there is a fundamental split into samples made north of the North Downs and those produced south of them. In other words this is a split into Tertiary and Lower Cretaceous clays. The main elements responsible for this division, all with high F1 weightings, are listed in Table 1. A plot of F1 against F2 for this dataset is shown in Fig 5. In this and following diagrams the Rye and Lydd Quarry samples are grouped according to body colour and material from the kiln site is distinguished by a (K) after the type.

Table 1

Element	Factor 1 weighting
MgO	0.930488516
V	0.929060841
Sc	0.897109081
Cr	0.893159192
K2O	0.854686797
Fe2O3	0.82143575

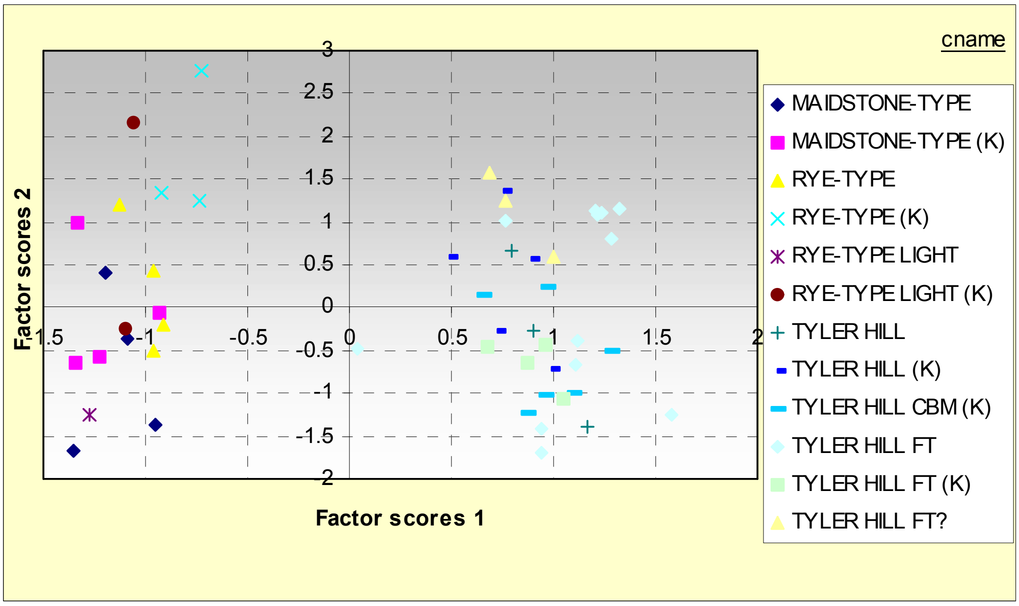

Figure 5

Since there is such a clear split into Tyler Hill and other samples, the Tyler Hill samples were then omitted from the analysis and a second factor analysis carried out on just the Rye-type and Maidstone-type samples. This analysis produced two distinct clusters, separated by their F2 values. The main cluster contained both the Rye and Lydd Quarry samples, together with two Maidstone-type samples, from Ash Green and Faversham. The second cluster contained the samples from the Maidstone wasters together with the two Maidstone-type samples from Iwade (Fig 6). The Rye-type cluster itself has some structure, in that the red-firing samples from Rye itself have higher F1 values than the remainder and the 'Maidstone-type' samples have lower F1 values than most of the remainder, apart from the sample of light-firing Rye-type ware from Lydd Quarry.

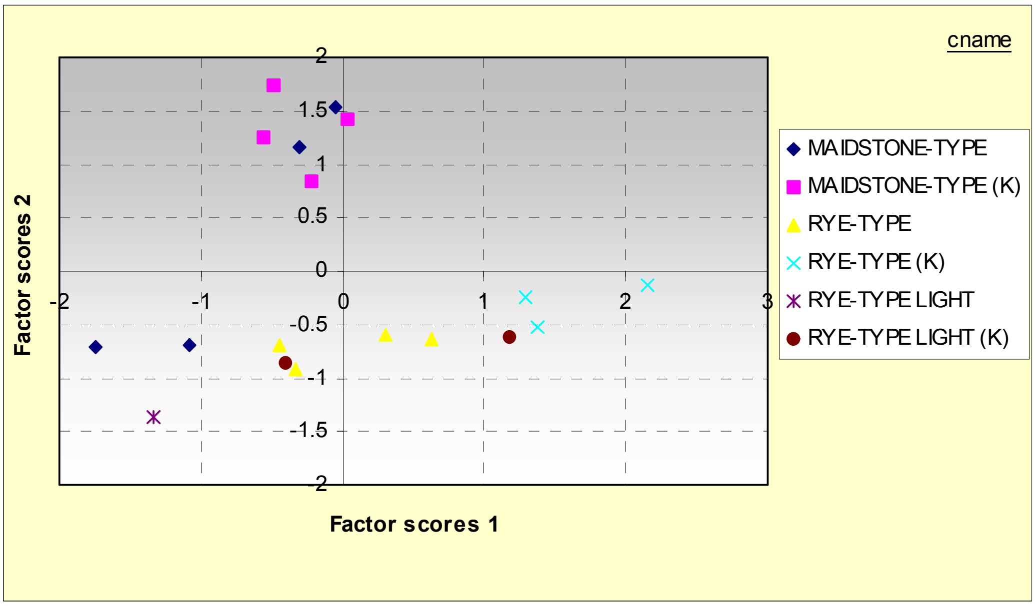

Figure 6

Neither F3 nor F4 show any structure and a plot of one against the other produces a single nebulous cluster. A plot of F1 against F2 grouped by subfabric shows that one of the two Maidstone-type samples was in fact of dubious attribution (Canterbury Arch Trust Fabric M38A or M4). There is, however, no clear correlation of the Rye-type subfabrics or their textural groups, with their chemical content.

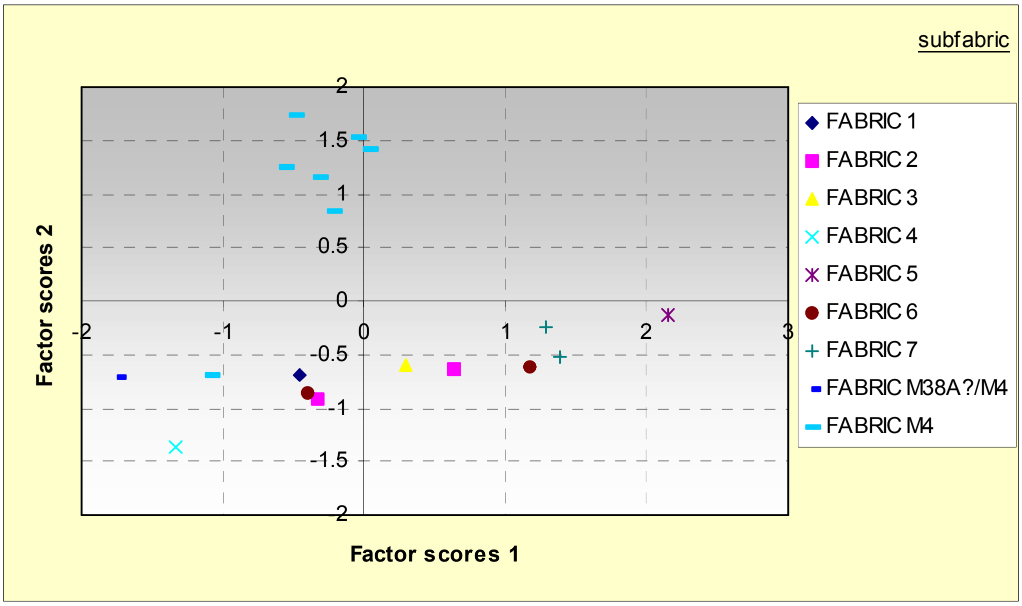

Figure 7

Conclusions

The petrological and chemical analyses of the Lydd Quarry samples suggests that they are indeed products of the Rye industry and that there are variations in the fabric of the products of this industry based on both the texture of the sand temper and in the colour of the fired clay matrix. Despite these variations, there is no clear patterning in the chemical composition, confirming the conclusion of the petrological analysis, that the light-firing and red-firing variants were made from basically similar clays but in which some of the clay minerals had been converted to kaolinite through intense weathering soon after deposition.

The possibility that two vessels from north Kent, identified visually as being products of the Maidstone industry, are in fact Rye products, is also suggested through this analysis.

Appendix 1a. Major elements (measured as percent oxides)

TSNO	Al2O3	Fe2O3	MgO	CaO	Na2O	K2O	TiO2	P2O5	MnO
V1972	13.21	4.52	0.83	2.51	0.28	1.72	0.57	0.67	0.019
V1973	14.06	6.35	0.95	3.28	0.22	1.94	0.54	0.45	0.087
V1974	12.66	5.46	0.78	2.83	0.27	1.73	0.52	0.96	0.115
V1975	14.14	5.21	1	3.88	0.38	2.15	0.53	0.27	0.086
V1976	13.68	5.63	0.93	2.94	0.25	1.88	0.56	0.29	0.039
V1977	12.57	4.81	1.03	5.49	0.28	1.73	0.53	0.32	0.085
V1978	14.93	5.37	0.98	1.27	0.32	2.19	0.57	0.62	0.069
V1979	17.67	5.2	0.84	0.51	0.35	1.96	0.8	0.25	0.031
V1980	14.45	5.33	0.77	0.48	0.18	1.72	0.61	0.48	0.068
V1981	18.76	5.71	0.85	0.28	0.22	2.1	0.94	0.15	0.041
V1982	15.21	5.28	0.83	0.41	0.2	1.85	0.66	0.2	0.052
V1983	19.02	3.75	0.71	0.28	0.25	1.87	0.8	0.21	0.017
V1984	14.75	6.46	1.01	0.62	0.16	2.12	0.75	0.26	0.096
V1985	16.78	3.44	0.81	0.38	0.31	2.11	0.84	0.08	0.078
V1986	19.42	3.79	0.75	0.31	0.32	2.25	0.83	0.09	0.033
V1987	16.23	6.49	1.02	0.45	0.18	2.25	0.82	0.1	0.046
V1988	14.47	5.04	0.74	0.89	0.17	1.77	0.77	0.56	0.045

Appendix 1b. 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
V1987	337	101	27	49	53	14	80	111	28	84	46	82	48.222	9.951	1.7808	5.3	2.6	205.27	96	16
V1986	375	121	60	68	54	18	74	124	20	82	44	84	45.308	9.621	1.6968	4.2	2.1	2675.28	77	14
V1985	353	106	32	63	60	16	77	111	26	73	57	107	58.468	12.156	2.2248	5.2	2.3	338.12	102	21
V1984	369	94	28	43	51	14	92	106	29	79	52	102	53.58	10.454	1.7832	5	2.4	260.15	102	18
V1988	485	90	30	38	49	13	134	87	23	89	42	80	43.24	7.796	1.3968	4	2.3	2809	92	14
V1981	377	114	35	89	49	17	101	129	19	72	44	88	44.838	9.129	1.5432	3.7	1.9	584.74	96	26
V1973	21178.47557	90	23	101	61	12	550	148	15	72	27	56	28.2	5.965	0.992	3	2	32.44	91	17
V1974	689	80	17	87	56	12	234	113	15	63	26	67	27.166	5.354	0.8632	2.9	1.8	38.14	86	19
V1975	488	89	22	119	63	13	240	128	17	63	31	59	31.96	5.779	0.9832	3	1.8	41.36	87	16
V1976	538	86	18	131	57	13	187	148	16	77	27	55	27.824	5.537	0.8496	2.6	1.9	48.72	89	17
V1977	528	75	25	80	65	12	283	108	16	94	28	61	28.952	5.519	0.9152	2.8	1.9	52.83	89	18
V1978	911	97	30	97	75	14	162	133	15	87	30	69	30.832	5.763	0.9704	2.8	1.8	48.67	93	21
V1972	413	80	28	86	75	13	206	136	19	77	29	62	30.08	6.148	1.0384	3	2	51.59	148	18
V1980	413	92	30	46	64	13	106	92	20	68	38	90	39.292	7.967	1.2736	3.8	2	166.85	93	21
V1982	321	93	28	51	58	14	78	96	20	69	38	71	39.292	7.572	1.2776	3.8	2	223.29	93	21
V1983	313	118	34	60	56	16	65	97	17	75	35	64	35.72	6.125	1	3	1.8	882.28	77	14
V1979	396	105	32	71	40	16	119	104	16	73	42	75	42.206	7.28	1.284	2.9	1.7	736.03	89	15