Characterisation of medieval pottery from Thorner, West Yorkshire

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As part of the post-excavation analysis of the medieval pottery from sites near Wetherby on the A1, West Yorkshire, being carried out by Jane Young, samples of medieval pottery and other ceramics from production sites in West Yorkshire were analysed.

Pottery production at Thorner has been known of since the mid 1960s when wasters were discovered in the parish. These finds cannot now be located but were examined by Jean Le Patourel who subsequently stated that Thorner was a likely source for the gritty whiteware cooking pots found extensively in the Vale of York and beyond.

In 1998 a second, separate, production site was discovered and the finds examined and published by Chris Cumberpatch (Cumberpatch and Roberts 1998-1999). The samples come from that site (site code SLT98).

Ten samples were taken in total. Three of these were of fired clay, presumed to be part of the kiln superstructure, and the remainder were pottery. Two of these pottery samples were of a noticeably whiter fabric, extremely similar to York Gritty ware, whilst the remainder had a redder fabric. One of these contained considerably more coarse sand or gravel inclusions than the remainder.

Table 1

TSNO	cname	Form	Action	Description	subfabric
V2493	THORNER	JAR	TS;ICPS		THORNER FABRIC 1
V2494	THORNER	JAR	TS;ICPS		THORNER FABRIC 1
V2495	THORNER	SJ	TS;ICPS	SCRAPED INT;CF IPSWICH THETFORD-TYPE	THORNER FABRIC 2
V2496	THORNER	JAR	TS;ICPS		THORNER FABRIC 1
V2497	THORNER2	JAR	TS;ICPS		THORNER FABRIC 3
V2498	THORNER2	JAR	TS;ICPS		THORNER FABRIC 3
V2499	THORNER	JAR	TS;ICPS		THORNER FABRIC 1
V2500	FCLAY1	KILN WALL	TS;ICPS		THORNER FABRIC 4
V2501	FCLAY1	KILN WALL	TS;ICPS		THORNER FABRIC 4
V2502	FCLAY2	KILN WALL	TS;ICPS		THORNER

Cumberpatch and Roberts suggest an early 13th century date for the kiln products (fabrics 1 and 2) and suggest that the whiter fabric is Hillam ware (later 11th to 12th century), which they state was found both in the subsoil above the kiln and in the kiln fill. However, the vessels show many characteristics of Anglo-Scandinavian date, including the general globular body shape, the simple rolled-out rims and the removal from the wheel using a wire.

Description

The ten samples are listed in Table 1. In thin section, they were found to group into five fabric groups and these are used here in both the thin section and chemical analyses. The thin sections were produced by Steve Caldwell and stained using Dickson's method (Dickson 1965). The chemical analyses were undertaken at Royal Holloway College, London, under the supervision of Dr J N Walsh, Department of Geology, using Inductively-Coupled Plasma Spectroscopy (ICP-AES).

Thin section analysis

Fabric 1

Description

Four thin sections of Fabric 1 vessels were produced. The following inclusion types were noted in thin section:

- Angular quartz. Moderate fragments up to 1.5mm across. Most of these are monocrystalline and unstrained but include mosaic quartz and strained, polycrystalline grains. The fragments usually have flat faces, indicating overgrowth.
- Angular baryte. Sparse to moderate fragments, up to 1.5mm long and usually about 0.5mm wide, usually with a bladed outline and showing fibrous growth from the longer outer edges towards the centre. The fragments are zoned, often with a dark zone at the centre running lengthwise down the fragment.
- Organic inclusions. Sparse burnt out organic matter up to 2.0mm long surrounded by carbon-rich haloes.
- Rounded mudstone. Sparse to moderate fragments, up to 2.0mm long. Most have a darker colour than the surrounding matrix but are otherwise similar in texture, containing sparse quartz silt, sparse muscovite and abundant dark brown specks, some of which may be of biological origin.
- Muscovite. Sparse laths up to 0.5mm long.

- Rounded siltstone. Sparse fragments up to 1.0mm long.
- Subangular sandstones. Sparse fragments of sandstone of various textures. Some are composed of grains of quartz and feldspar up to 1.0mm long. The grains are mostly interlocking overgrown grains with no cement. Others have a smaller grain size, averaging c.0.3mm, and rare fragments with a similar grain size have an iron-rich cement.
- Microcline feldspar. Sparse angular fragments up to 1.5mm across.
- Plagioclase feldspar. Sparse angular fragments up to 0.5mm across.
- Perthite. Sparse angular fragments up to 0.5mm across.
- Altered limestone. Sparse angular voids up to 0.5mm across partially filled with alteration products.

The groundmass consists of optically anisotropic baked clay minerals with sparse angular quartz and muscovite laths up to 0.05mm long with abundant dark brown grains c.0.05mm across. Some of these consist of an opaque or very dark circular grain with a brown stained halo. Some occur in clusters. Sparse lenses and streaks of light-coloured clay occur.

Interpretation

The fabric consists of a weathered mudstone, probably the source of most or all of the mudstone inclusions, together with the muscovite laths. The remaining inclusions are an added sand, derived mainly from Millstone Grit sandstones, with some probable Coal Measures sandstones and siltstones. The size range of the feldspar inclusions suggests that some are probably derived from the Millstone Grit whilst others may be from the finer sandstone. The baryte inclusions are extremely unusual and are of similar size to the other coarse inclusions whilst their shape and structure indicates that they originated in veins. Presumably, therefore, they were present in the detrital sand temper. However, baryte has a low hardness (c.3 on Moh’s scale) and there is no sign of rounding on any of the fragments, suggesting that they might be present as veins within the mudstone. Against this, is the fact that no country rock is present attached to the grains.

Fabric 2

Fabric 2 is instantly recognisable by eye because of the high quantity of coarse sand temper.

Description

The following inclusions were noted in thin section:

- Subangular quartz. as in Fabric 1 but more common.
- Angular sandstone. As in Fabric 1. Only the coarser textured sandstone is present.
- Rounded mudstone. As in Fabric 1.
- Baryte. Sparse, less common than in Fabric 1.
- Rounded quartz. Sparse rounded grains, including one well-rounded grain of “millet-seed” type.
- Muscovite. As in Fabric 1.

The groundmass is the same as in Fabric 1.

Interpretation

The increased quantity of sand-sized inclusions is probably responsible for the presence of the rounded quartz grains, which are probably of Permo-Triassic origin whilst the lower quantity of baryte argues for these inclusions being present in the parent clay.

Fabric 3

The two samples were classed by Cumberpatch as Hillam Ware and are interpreted as not being products of the kiln.

Description

The following inclusions were noted in thin section:

- Coarse sandstone. Sparse fragments up to 3.0mm across composed of overgrown quartz and feldspar grains.
- Subangular quartz. Moderate overgrown fragments up to 1.5mm across.
- Rounded mudstones. Sparse rounded fragments, darker in colour than the groundmass but similar in texture.
- Opaques. Sparse tabular or bladed fragments with apparent bedding
- Plagioclase feldspar. Sparse subangular fragments up to 0.5mm across.
- Muscovite. Sparse laths, sometimes present at sheaves, up to 0.5mm long.

- Rounded opaques. Abundant rounded grains. Those in sample V2497 are spherical and include one large irregular aggregate 1.0mm long and 0.5mm wide whilst those in V2498 are mostly ovoid in outline.

The groundmass consists of optically anisotropic baked clay minerals, sparse angular quartz up to 0.1mm across, muscovite laths up to 0.1mm long and abundant spherical opaque grains, some occurring in aggregates. The clay fraction contains less iron than that in Fabrics 1 and 2 and is highly birefringent. Thin streaks of weathered mudstone are present.

Interpretation

As with Fabrics 1 and 2, there is a deliberately added temper, consisting in this case of a coarse Millstone Grit-derived gravel, in a groundmass of weathered mudstone. The differences in texture and composition confirm Cumberpatch's assignment of these sherds to a different fabric. Differences in the detail of the opaque inclusions may indicate that the two samples are from different production sites, or simply different batches of clay used at the same centre.

Fabric 4

Description

The following inclusion types were noted in thin section:

- Rounded sandstones and siltstones. Variable quantities of micaceous sandstone and micaceous siltstone fragments up to 2.0mm long and mainly with a tabular outline. The rocks are composed of quartz, muscovite and probably altered biotite (dark brown, almost opaque laths) up to 0.2mm long.

- Subangular quartz. Sparse fragments similar to those in Fabrics 1 and 2.

- Plagioclase feldspar. Sparse fragments up to 0.5mm across.

- Muscovite. Sparse laths up to 0.3mm long.

- Rounded opaques. Sparse fragments up to 1.0mm across.

The groundmass is variegated with lenses of light-coloured clay containing abundant angular quartz , muscovite and altered biotite laths up to 0.1mm alternating with lenses of darker brown clay of similar character to the groundmass of Fabrics 1 and 2.

Interpretation

This fabric seems to have been produced by the mixture of a weathered mudstone, presumably the same as in Fabrics 1, 2 and 5, and a weathered siltstone/fine sandstone, not otherwise seen in the Thorner sections. The remaining inclusions are probably derived from the same source as the sand temper seen in Fabrics 1 and 2. No Baryte inclusions were noted.

Fabric 5

Description

The following inclusion types were noted in thin section:

- Baryte. Moderate angular fragments, identical to those noted in Fabrics 1 and 2 but including fragments up to 3.0mm long and 1.0mm wide.

- Subangular quartz. Sparse fragments as in Fabrics 1 and 2.

- Rounded Mudstone. as in Fabrics 1 and 2.

The groundmass is variegated. The majority is similar in colour and texture to that of Fabrics 1 and 2. The Baryte fragments are concentrated in this part of the groundmass. Lenses and streaks of a light-coloured clay, similar to that noted in much smaller quantities in Fabric 1, were the next most common. A few lenses of weathered siltstone-derived clay as in Fabric 4 were noted and finally some pores contain abundant subangular quartz grains and rounded mudstone fragments up to 0.3mm across in a blocky highly birefringent brown clay groundmass, possibly not fired.

Interpretation

The majority of the clay in this fabric is probably the parent clay used for Fabrics 1 and 2, confirming that the majority of the large inclusions in those fabrics are added temper and demonstrating that baryte is present in the clay. The clay is probably a weathered Carboniferous mudstone mixed with a Carboniferous paleosol, from which iron has been leached. Slight admixture with the clay which forms the bulk of Fabric 4 is evident whilst the sand- and mudstone-rich material is probably the local subsoil, which may have entered cracks in the clay after firing.

Chemical analysis

Samples for chemical analysis were produced by Peter Hill who took an offcut and removing the outer surfaces mechanically, leaving a lump weighing approximately 1gm. This was crushed to a fine powder and sent to RCHL for ICP-AES analysis. A range of major elements were measured as percent oxides (Appendix 1) and a range of minor and trace elements were measured as parts per million (Appendix 2). The extremely high barium counts in some samples, due to the presence of vein baryte, may actually be too low (J N

Walsh, pers comm) and in this method zirconium is not completely dissolved so that this element is also under-represented in the data.

Silica is not directly measured and was estimated by the subtraction of the total measured oxides from 100%. Fig 1 shows the estimated silica values for the five fabrics. That of Fabric 1, which approximates to the untempered parent clay of Fabrics 1 and 2, is 64.5%, although this estimate will include an appreciable amount of sulphur, present in the baryte inclusions. The tempered wares contain between 0.8% and 2.0% extra silica, due to the sand temper. Fabric 4, which contains siltstone and weathered siltstone, has appreciably more silica, between 3.6% and 6.6% extra. This higher silica content would have made the clay more suitable for use in the kiln structure, where it would have been subjected to repeated firings. The Fabric 3 samples contain 2.2% to 2.3% less silica than Fabric 5, perhaps an indication of the sulphur present in Fabric 5.

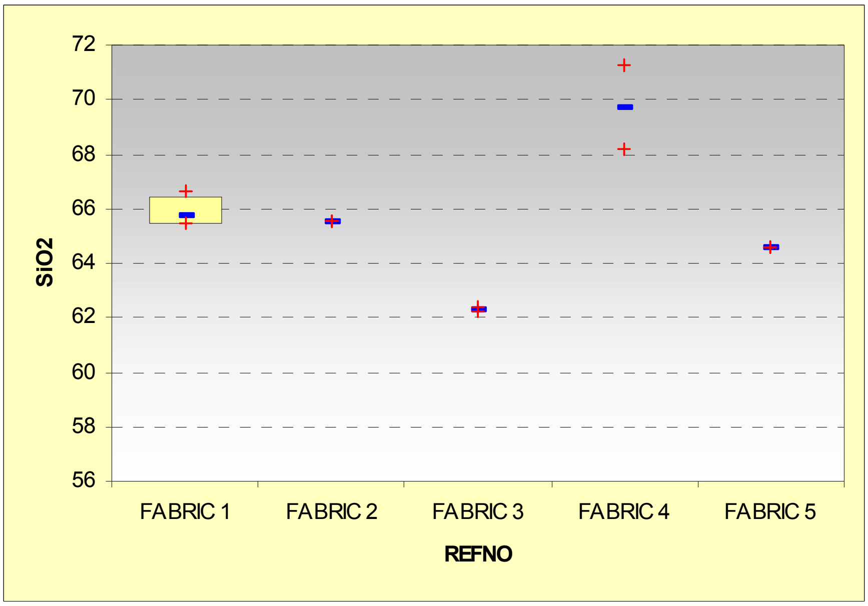

Figure 1

Factor analysis of the ICPS data, normalised to aluminium to take account of the variable silica (and sulphur) content), indicated that there were six significant factors.

A plot of F1 versus F2 (Fig 2) shows that the four Fabric 1 samples, the Fabric 2 sample and the Fabric 5 sample are all very similar in composition, all having positive F2 scores and negative F1 scores. The two Fabric 3 samples have negative F2 scores and positive F1 scores whilst the Fabric 4 samples have positive F2 and F2 scores. The weightings which produce these scores show that high F1 scores are due to rare earth elements. Negative F1 scores are due to copper. High F2 scores are due to potassium, scandium, magnesium, titanium and calcium whilst negative F2 scores are due mainly to the low quantities of these elements rather than to any element being more common. This, together with the colour of the fired clay, suggests that Fabric 3 is a kaolinitic clay, from which elements have been leached during pedogenesis.

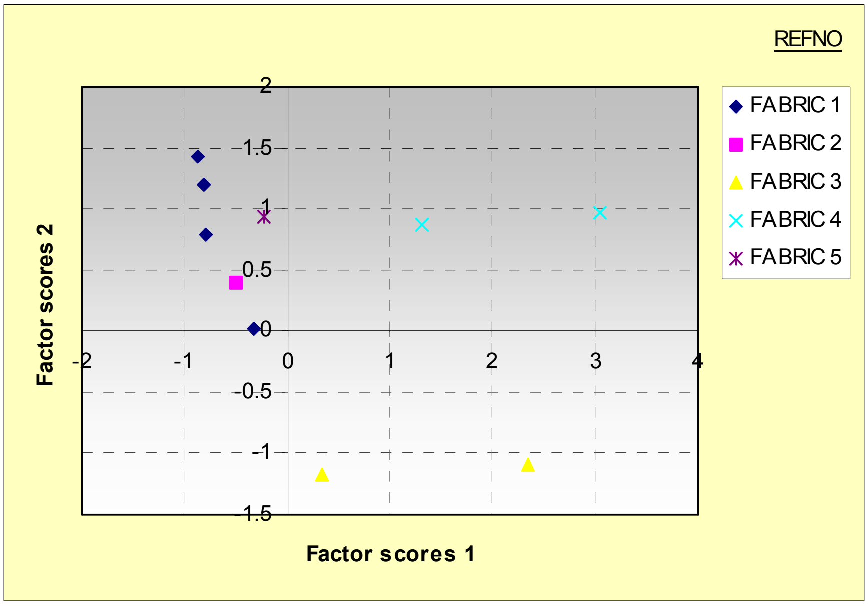

Figure 2

Factors 3 and 4 separate the Fabric 4 samples from the rest, with one of the Fabric 3 samples grouping with the remainder and the other forming an outlier, as a result of high F3 and F4 scores (Fig 3). High F3 scores are due primarily to manganese, sodium, lead and vanadium and high F4 scores are due to strontium and phosphorus. Since no phosphatic minerals were noted in thin section V2498 and no phosphate-filled pores were noted it is likely that the phosphate and strontium are present is some isotropic streaks in the clay matrix and are therefore part of the original clay composition.

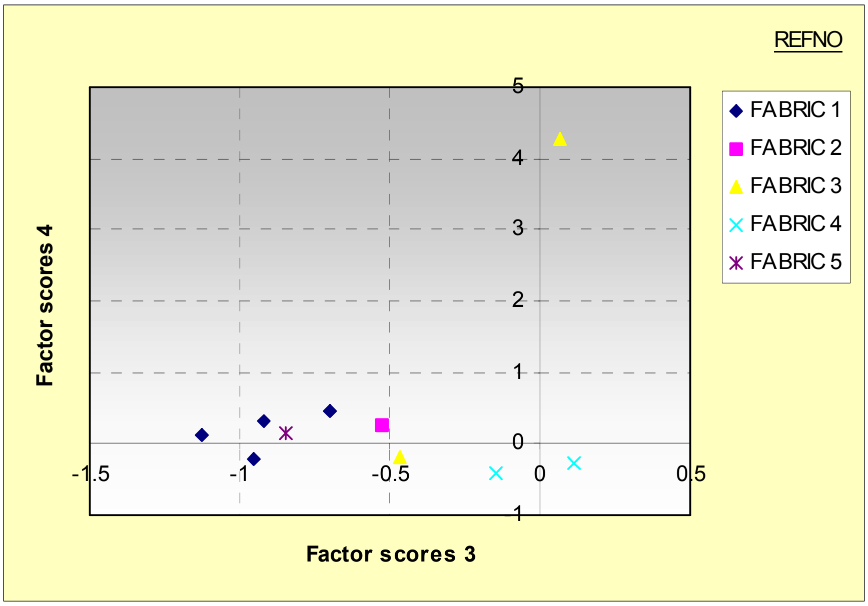

Figure 3

Discussion and conclusions

The village of Thorner is located at the foot of the Permian limestone west-facing scarp on a Millstone Grit bedrock. The Thorner Beck flows northeast and then north parallel with the scarp with the village situated between the two. The two areas of potting waste discovered to date are on the outskirts of the village. The 1966 find being west of the beck and the 1998 site being well to the east of Main Street, close to the foot of the scarp.

The two sites are therefore situated on Carboniferous rocks, but with the possibility of Quaternary deposits occurring close to the Beck. Cumberpatch and Roberts note, however, that mudstone and shale outcrop at the eastern end of the site, and it is likely that these are of Carboniferous date and are the source of both of the clays used by the potters.

The baryte fragments noted in Fabrics 1, 2 and 5 are highly distinctive and their absence from Fabric 3, and the consequent low Ba values for these two samples, is confirmation that these sherds are not kiln products. The difference in petrological characteristics and chemical composition also indicates that the clay used to produce the kiln lining, Fabric 4, was not used to produce pots. The siltstone found within it is, however, likely to occur within the Millstone Grit outcrop and could be present on the site.

The Ba value for sample V2502, over 29,000 ppm, suggests that the sample included a fragment of baryte whilst there is no corresponding rise in any other element, which would suggest that the barium was present as a result of substitution in, for example, gypsum. Furthermore, there is no corresponding increase in the quantity of strontium, which can form a series with barium whose end members are baryte and celestite. Strontium is present in relatively high quantities in one of the Thorner samples, V2498, Fabric 4, but shows no correlation with barium and is instead correlated with phosphorus.

The barytes was probably deposited in veins in the mudstone as a result of the reaction of sulphur-rich clays and barium-rich groundwater (BGS 1996). What may be baryte veins can be observed cutting Millstone Grit sandstones at Thorner (Fig 4) where they varied from masses of crystals, several tens of cm across to narrow veins, some lenticular and with a maximum thickness of less than 1.0mm. These sandstones are exposed at the base of the scarp formed by the Permian sands and limestones.

Figure 4. Veins of baryte partially filling joints in ?Millstone Grit sandstones exposed at Thorner, West Yorkshire.

The coarse sand temper includes relatively few composite sandstone fragments, which suggests that the local sandstone was not used directly as a temper but that instead a detrital sand was used, despite the fact that the Permian scarp with its loosely-cemented basal sands bounds the site on the east side.

Within northern England, the only other pottery known to the author to have similar high barium values are all of Anglo-Scandinavian York A ware, including samples from York and from Beverley. Factor analysis of the Thorner and York A ware samples (below) makes it clear that there are slight differences in chemical composition between the two wares whilst the petrological evidence suggests a nearby source. It is interesting to note that Potterton, known by this name at the time of the Domesday Book, lies just to the southwest of Thorner, although most of the parish lies on the Coal Measures and one might therefore expect that pottery made there would have a different character to that produced at Thorner.

The Fabric 3 samples are visually similar to York Gritty ware and their light-coloured matrix is much more likely to be due to the use of weathered Coal Measures (or, Millstone Grit) white-firing mudstone or shale.

Fig 4 shows the results of a factor analysis carried out on the Thorner data together with:

- Samples of York A ware from York, Newcastle-upon-Tyne and Beverley (YORKA)
- Samples of a white gritty ware from Doncaster with roller-stamped decoration and probably of 12th-century date (DONC G)
- Samples of York Gritty ware from York and Doncaster (YG)

The DONCG samples are clearly separated from the remainder by their F1 scores whilst the Thorner Fabric 4 samples have higher F2 scores than the remainder (except for one Thorner Fabric 3 sample). All the remaining samples form a single cluster in Fig 4.

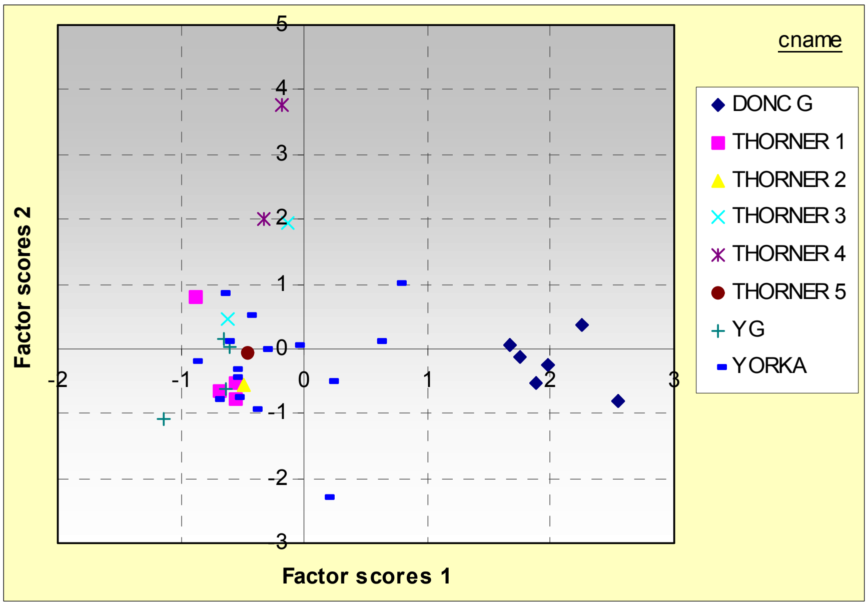

Figure 5

Fig 5, however, shows a plot of F3 against F4 for the same data. It shows that the YG samples and the Thorner Fabric 3 samples form a cluster, defined by negative F3 and F4 scores. The DONCG samples have higher F4 scores and form a cluster, with the exception of a single YORKA sample (a Beverley sample). The Thorner Fabrics 1, 2 and 5 samples form a cluster with the Thorner Fabric 4 samples separated from them by slightly higher F3 scores whilst the York A samples form another cluster, with a second outlier, from Coppergate distinguished by its high F3 score and negative F4 score. High F3 scores are due to calcium and phosphorus, both of which are likely to be affected by burial. If the analysis is repeated, omitting these two elements and other elements with a strong affinity to them (such as strontium, barium and the rare earth elements) then the difference between the YORKA and Thorner fabrics becomes much more difficult to see. The main differences are due to potassium and magnesium. Fig 6 shows a biplot of these two oxides (relative to aluminium) and indicates that there are two main groups. One with low K/Mg (YG and Thorner Fabric 3) and one with higher K/Mg and that whilst some YORKA samples have comparable values to the Thorner (and Doncaster) samples some have higher values for both. Since both are likely to be present in the coarse fraction rather than the clay matrix (as demonstrated by the difference between Thorner Fabric 5 and Fabrics 1 and 2) this might simply indicate a higher amount of temper in the York A ware.

These comparisons demonstrate that there are chemical differences between the York A and Thorner fabrics 1, 2 and 5, although they may be due to the amount of tempering, but that the Thorner Fabric 3 samples are indistinguishable in their chemical composition from samples of York Gritty ware.

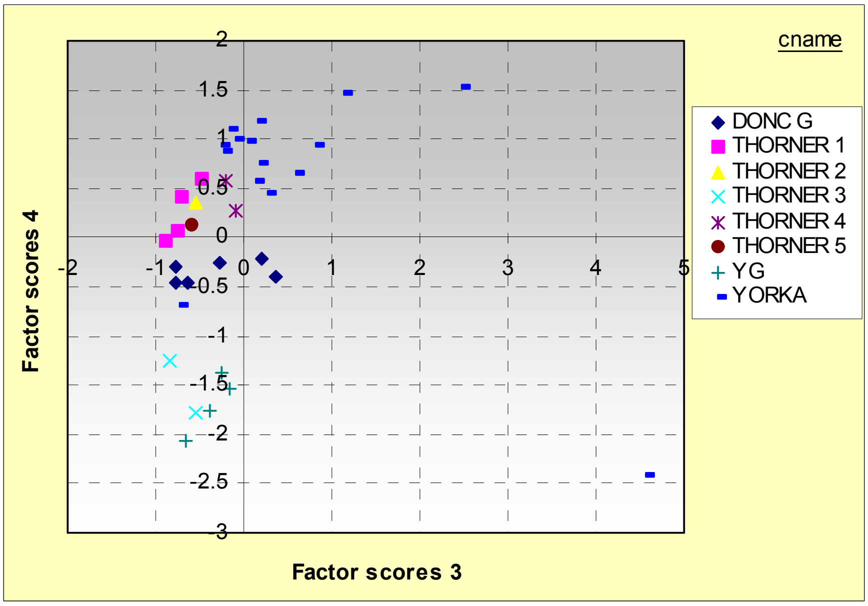

Figure 6

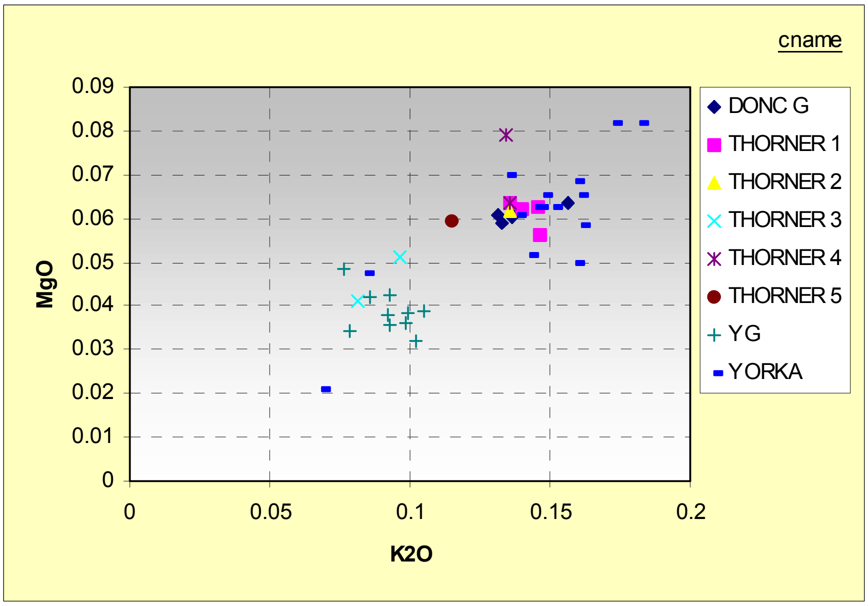

Figure 7

Appendices

Appendix 1

TSNO	Al2O3	Fe2O3	MgO	CaO	Na2O	K2O	TiO2	P2O5	MnO
V2493	22.3	5.73	1.25	0.46	0.15	3.27	0.83	0.17	0.006
V2494	21.34	5.94	1.34	0.54	0.16	3.11	0.79	0.13	0.01
V2495	22.14	6.39	1.37	0.45	0.14	3.01	0.82	0.12	0.008
V2496	22.23	6.07	1.38	0.61	0.14	3.11	0.82	0.19	0.009
V2497	25.39	6.94	1.3	0.32	0.18	2.45	0.94	0.1	0.026
V2498	26.07	6.59	1.07	0.43	0.12	2.13	0.86	0.43	0.025
V2499	22.01	6.27	1.4	0.56	0.16	2.98	0.79	0.17	0.009
V2500	17.14	6.48	1.09	0.32	0.52	2.33	0.77	0.1	0.016
V2501	19.45	6.35	1.54	0.44	0.47	2.61	0.86	0.06	0.021
V2502	22.66	7.16	1.35	0.51	0.13	2.6	0.86	0.12	0.014

Appendix 2

TSNO	Ba	Cr	Cu	Li	Ni	Sc	Sr	V	Y	Zr*	La	Ce	Nd	Sm	Eu	Dy	Yb	Pb	Zn	Co
V2493	29139	115	37	167	38	17	434	100	13	48	45	87	45	7	1	2	2	88	50	15
V2494	2249	98	68	152	38	17	136	87	12	47	45	85	45	6	1	2	2	50	53	9
V2495	4210	107	36	147	36	19	354	106	11	46	58	116	56	8	1	2	2	55	36	8
V2496	8740	136	71	156	42	18	193	98	12	48	46	86	45	7	1	2	2	63	55	13
V2497	739	123	14	125	93	20	99	90	41	57	72	147	74	13	2	7	3	77	76	21

V2498	1898	129	13	97	51	19	1319	125	27	77	63	124	63	9	1	4	3	51	54	10
V2499	2138	123	80	160	41	18	171	93	13	57	46	92	46	6	1	3	2	54	67	12
V2500	1613	100	13	85	47	14	98	58	19	42	49	96	49	8	1	3	2	51	61	15
V2501	1693	120	15	135	54	16	101	70	34	48	69	136	71	13	2	6	3	96	81	17
V2502	8459	142	40	149	42	19	117	98	17	57	51	98	51	8	1	3	2	50	52	10

Bibliography

BGS (1996) *Regional Geochemistry of North-East England*, British Geological Survey, Keyworth, Nottingham.

Cumberpatch, C. and Roberts, I. (1998-1999) "A medieval pottery kiln from Stead Lane, Thorner, Leeds." *Medieval Ceram*, 22-23, 145-7.

Dickson, J. A. D. (1965) "A modified staining technique for carbonates in thin section." *Nature*, 205, 587.