

## Wawne, East Yorkshire (OSA02EX02)

### Ceramic Building Material

#### *Alan Vince*

Seventy-five fragments of ceramic building material were recovered. Following visual examination at x20 magnification the fabrics were divided into six sub-fabrics, CBM1 to CBM6. Samples of each subfabric were examined in thin section and using chemical analysis (Appendix two). The results of this study were that the daub, CBM1, could have been obtained locally as used “as dug” with no additional cleaning or tempering. The remaining fabrics all bore a similarity to products of the Beverley pottery or brick and tile industries although each fabric was distinguishable either by its petrological characteristics or its chemical composition, or both.

#### Methodology

Each of the fragments was examined under x20 magnification and its fabric characteristics noted. On the basis of this survey a number of fabric groups were assigned. These have been given site-specific subfabric codes starting with CBM1 and have been assigned to one of two ware codes: FCLAY or MTIL. Metrical data was recorded for all bricks and hearth tiles (Table 1).

*Table 1 Dimensions in mm of bricks and hearth tiles*

context		subfabric	Form	L	B	TH
Context	group					
1013	1021	CBM3	HEARTH			33
1019	1021	CBM3	HEARTH			21
1013	1021	CBM3	HEARTH?			31
1176	1177	CBM4	BRICK		126	44
1178	1179	CBM4	BRICK	240	130	39
1001	1001	CBM4	BRICK		108	60
1001	1001	CBM4	BRICK		116	50
1001	1001	CBM4	BRICK	221	113	54

## Description

### **Fired Clay (FCLAY)**

#### Sub-Fabric CBM1.

A single fragment of burnt clay was recovered from context 1156, the fill of Pit 1158. The fragment is tempered with a coarse, mixed quartzose gravel and abundant organic matter. The latter seems to be chaff rather than straw but could have been added either as chaff or in dung. The fragment was burnt after breakage and before the decay of the organic matter, which has left a black, carbon-rich core to the fragment. Thin section analysis confirms that a local boulder clay was probably utilised for the daub.

The fragment has one flat face and no sign of wattle impressions. It may therefore either be from a wattle and daub structure or the infilling of a lath-filled panel in a timber-framed building.

### **Medieval (and post-medieval?) tile (MTIL)**

#### Sub-fabric CBM2

Twenty fragments of ceramic building material had a fine-textured, micaceous fabric with some evidence for the mixing together of clays of different textures and a variable amount of added quartzose sand. Visually, the fabric of these fragments is very similar to that of Beverley ware pottery. Thin section and chemical analysis suggest that this fabric and CBM4 may be calcareous and non-calcareous products of the same tiliary.

Most of the fragments were from flat tiles, of which one had a rounded peg hole with a raised surround (Fig 00 No. 2). Fragments of brick were also found and one piece of a possible hip tile.

All of these fragments were in contexts associated with Humber ware or were stratigraphically later than such contexts.

#### Sub-fabric CBM3

Fifteen fragments were found which had a similar matrix to that of CBM2 but contained moderate amounts of a coarse quartzose sand. This sand included grains of quartz, chert and flint as well as sparse rounded calcareous grains.

Most of these fragments came from flat tiles including one with a triangular nib (Fig 00 No.4) and one with a square peg hole (Fig 00 No.3). In addition, there were three fragments of hearth tiles, with sooting on their upper surfaces, two fragments which were probably from

hearth tiles but where the upper surface did not survive and a single fragment of a louver (Fig 00 No. 1) with sooting on the interior surface.

One of the flat tiles came from context 1201, the fill of ditch 1202, associated with Beverley glazed ware and no later types but given the lack of other tile or brick fragments in the large groups of 12<sup>th</sup>/13<sup>th</sup>-century date from the site it is most likely that the tile dates context 1201 to the later medieval period than that the context dates the tile earlier. Consequently, Ditch 1202 is assigned to Phase 2.

#### Sub-fabric CBM4

Thirty-two fragments of ceramic building material were made from a calcareous clay. This could be seen both on the surfaces of the objects, which often had a creamy/yellow coating ('salt-surfacing') caused by the interaction of salt, clay minerals and calcium carbonate, and by the presence of abundant yellow spots visible in the body. Few larger inclusions were present. Thin section and chemical analysis suggest that this fabric is the calcareous equivalent of CBM2 and could be produced at the same tiliary.

The fragments were mainly flat tiles (20 in total) and bricks (12 fragments). The latter included some large fragments from context 1001 which suggest that a brick structure survived on the site to the end of its period of occupation. Many, however, were stratified in deposits associated with Humber ware and no definite post-medieval wares.

Some of the brick fragments had straw impressions on their bases and sides indicating that straw was used to line the mould as opposed to the quartz sand found on CBM2 and CBM3.

#### Sub-fabric CBM5

A single fragment of a flat tile with a calcareous body and a quartz sand temper was found in an unstratified context.

#### Sub-fabric CBM6

Four fragments were found with a poorly mixed fabric which includes lenses and streaks of light-firing and red-firing clays. These clays vary in texture from being almost inclusionless (apart from very fine mica) to containing abundant quartz sand.

Three of the fragments were from bricks, all from the subsoil and therefore quite likely to be of post-medieval date. The fourth fragment was a flat tile from context 1161, path 1151, which is associated with late 12<sup>th</sup> to 13<sup>th</sup>-century pottery.

## Interpretation

### Chronology

It is clear than in the first phase of medieval occupation on the Wawne site the main use of ceramic building material was for daub (CBM1, from Pit 1158). It is not possible to say how exactly the daub was used but it is clear that it was only fired accidentally, either due to the demolition and clearance of a structure or through an accidental fire.

Flat roof tiles, of subfabrics CBM2 and CBM6, were found in one Phase 1 deposit (path 1152). However, it is likely that these are intrusive finds, since the only other fragments of subfabric CBM6 are from late deposits.

The remaining tiles and bricks were all used on the site in Phase 2. The majority of the CBM used in this period was of two fabric groups: a micaceous silty clay with or without additional tempering (CBM2 and CBM3) and a calcareous clay, rarely with additional tempering (CBM4 and CBM5). In most cases the two groups were found in the same contexts and although it is likely that they indicate two or more separate building episodes it is not possible from this site to establish the order in which they were used whilst the thin section and chemical analysis suggests that they are all the products of the Beverley tiliary.

The pottery suggests, though, that the final activity on the site, Phase 3, took place in the later 16<sup>th</sup> to mid 17<sup>th</sup> centuries. It is likely that CBM6 bricks were first used on the site at this period.

### Function

[insert Fig 00 here]

*Fig 00. 1. CBM3 Louver, 2. CBM2 Flat roof tile with round peg hole, 3. CBM3 Flat roof tile with square peg hole, 4. CBM3 Flat roof tile with triangular nib (Scale 1:4).*

The main use of CBM on the Wawne site was as roofing. There are no crest tiles in the collection, but given the small size of the assemblage this is not surprising. It is likely, however that the roofs included hipped roofs. The presence of tiles of different fabrics and with different methods of fastening (pegs of two shapes and nibs, Fig 00 Nos 2-4), suggests that several different roofing episodes took place. These might indicate different structures, additions to a single structure or replacement of broken tiles. Without further data it is impossible to decide which of these options is correct.

The hearth tiles could have been used either in a centrally-placed hearth or in a fireplace. The former is more likely if taken in conjunction with the single fragment of louver (Fig 00 No. 1). These structures were placed on the crest of the roof and were shaped so as to draw

smoke up through the roof. They would only work, therefore, in a central hall open to the roof.

The bricks include no mortared examples and it is known that bricks were sometimes used in late medieval structures to form a shallow sill on which a timber frame was placed. Two large fragments of brick come from late medieval deposits, 1176, the fill of ditch 1177, and 1178, the foundation for the putative barn 1179. Both are quite broad and thin which may indicate an earlier date (Table 1). The three measurable bricks in CBM4 fabric from subsoil 1001 are noticeably narrower and taller. In the late 16<sup>th</sup> century the use of brick increased considerably through the introduction of chimney stacks, although these would certainly have been mortared. This is, however, a possible context for the CBM6 bricks.

## Appendix One

context	Form	subfabric	Nosh	NoV	Weight	Description	Action
machining	FLAT	CBM4	1	1	19		
machining	FLAT	CBM5	1	1	40		
1210	FLAT	CBM3	1	1	147	TRIANGULAR NIB	DR
1000	BRICK	CBM6	1	1	138		
1001	BRICK	CBM4	1	1	1157		
1001	BRICK	CBM4	1	1	1045		
1001	BRICK	CBM4	1	1	1443		
1001	FLAT	CBM3	1	1	9		
1001	FLAT	CBM2	1	1	61		
1001	BRICK	CBM4	1	1	19		
1003	BRICK	CBM6	2	1	39		
1003	FLAT	CBM4	1	1	29		
1003	FLAT	CBM2	1	1	1	VABR	
1013	HEARTH?	CBM3	1	1	145		

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1013	FLAT	CBM4	3	3	361	
1013	FLAT	CBM2	1	1	22	
1013	HEARTH	CBM3	1	1	221	SOOTED UPPER SURFACE
1013	BRICK	CBM4	1	1	188	SOME STRAW IMPRESSIONS BASE AND SIDE
1019	HEARTH	CBM3	2	2	53	SOOTED UPPER SURFACE
1019	BRICK	CBM4	3	3	158	
1019	FLAT	CBM3	1	1	45	
1019	FLAT	CBM2	5	5	116	
1019	FLAT	CBM2	1	1	73	ROUND PEGHOLE WITH RAISED RIM AROUND HOLE
1019	FLAT	CBM4	10	10	244	
1037	FLAT	CBM4	1	1	23	
1037	FLAT	CBM3	1	1	43	
1041	FLAT	CBM3	1	1	159	
1055	HEARTH?	CBM3	1	1	401	
1057	FLAT	CBM2	2	2	169	
1057	BRICK	CBM2	3	3	409	
1057	BRICK	CBM4	1	1	50	
1057	BRICK	CBM2	1	1	6	
1057	FLAT	CBM3	2	2	47	
1057	HIP?	CBM2	1	1	192	
1057	FLAT	CBM4	4	4	784	
1057	BRICK	CBM4	2	2	90	

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1057	LOUVER	CBM3	1	1	65	SOOTED INT;THUMB IMPRESSIONS EXT;COIL BUILT	DR
1057	FLAT	CBM3	1	1	15		
1135	FLAT	CBM2	1	1	14		
1161	FLAT	CBM2	3	3	43		
1161	FLAT	CBM6	1	1	77		
1156	DAUB	CBM1	3	3	32	BURNT WITH CARBON-RICH CORE AND OXID SURFACE	
1176	BRICK	CBM4	1	1	710	STRAW IMPRESSIONS	
1201	FLAT	CBM3	1	1	232	SQUARE PEG HOLE	

## Appendix Two: Characterisation Studies of Ceramic Building Material from Wawne, East Yorkshire

### Alan Vince

The medieval and post-medieval ceramic building materials from the On-Site Archaeology excavations at Wawne were divided by the author into six fabrics, given the subfabric codes of CBM1 to CBM6 (Table 1). Samples of each fabric were then selected for petrological and chemical analysis. (Table 2). Where sufficient material was available five samples were taken for chemical analysis of each fabric. In addition, three “one-off” fabrics were sampled (CBM1, CBM5 and CBM6).

*Table 2*

Sub-Fabric	No of samples	Description	Form
CBM1	1	Fired clay	Wattle and daub
CBM2	5	Micaceous untempered clay	Flat roof tiles, brick
CBM3	5	Sand-tempered micaceous clay	Flat roof tiles, hearth tiles, louver
CBM4	5	Untempered Calcareous clay	Flat roof tiles and bricks
CBM5	1	Sand-tempered Calcareous clay	Flat roof tile

CBM6	1	Mixed white- and red-firing clays	Bricks and flat roof tile. Post-medieval?
Grand Total	18		

*Table 3*

TSNO	Context	cname	Form	Action	Description	subfabric
V1102		BEVO	FLAT	ICPS		bevo
V1109		BEVO	FLAT	ICPS		bevo
V1106		BEVO	FLAT	ICPS		bevo
V1105		BEVO	FLAT	ICPS		bevo
V1103		BEVO	FLAT	ICPS		bevo
V1104		BEVO	FLAT	ICPS		bevo
V2182	1001	MTIL	BRICK	ICPS		CBM4
V0792		misc	brick	pts;icps	Buff mottled body (more calcareous version of F1?)	F2
V0791		misc	brick	pts;icps	Red mottled body (calcareous?) with red clay pellets	F1
V0795		misc	brick	pts;icps	Stoneware-fired version of F1?	F5
V0793		misc	brick	pts;icps	Red body. Coarser version of F1?	F3
V0794		misc	brick	pts;icps	yellow brick; calcareous body but does not look like F2;imported?	F4
V2183	1001	MTIL	FLAT	ICPS		CBM2
V2184	1041	MTIL	FLAT	ICPS		CBM3
V2185	1057	MTIL	BRICK	ICPS		CBM2
V2186	1019	MTIL	FLAT	ICPS		CBM2
V2187	1178	MTIL	BRICK	ICPS		CBM4
V2188	1201	MTIL	FLAT	DR;ICPS	SQUARE PEG HOLE	CBM3
V2189	1019	MTIL	FLAT	DR;TS;ICPS	ROUND PEGHOLE WITH RAISED RIM	CBM2



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AROUND HOLE						
V2190	1210	MTIL	FLAT	DR;TS;ICPS	TRIANGULAR NIB	CBM3
V2191	1001	MTIL	BRICK	ICPS		CBM4
V2192	1013	MTIL	HEARTH	ICPS	SOOTED UPPER SURFACE	CBM3
V2193	1176	MTIL	BRICK	TS;ICPS	STRAW IMPRESSIONS	CBM4
V2194	1156	FCLAY	DAUB	TS;ICPS	BURNT WITH CARBON-RICH CORE AND OXID SURFACE	CBM1
V2195	1000	MTIL	BRICK	TS;ICPS		CBM6
V2196	MACHINING	MTIL	FLAT	TS;ICPS		CBM5
V2197	1057	MTIL	HIP?	ICPS		CBM2
V2198	1057	MTIL	FLAT	ICPS		CBM4
V2199	1057	MTIL	LOUVER	DR;ICPS	SOOTED INT;THUMB IMPRESSIONS EXT;COIL BUILT	CBM3

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### Petrological Analysis

The thin sections were prepared by Steve Caldwell at the Department of Earth Sciences, University of Manchester. They were stained using Dickson's method (Dickson 1965) to help distinguish between ferroan and non-ferroan calcite and dolomite although in the event no calcareous material survived in the samples.

#### CBM1 (V2194)

The thin section of this sample reveals a light brown clay with a dark grey or black core and one large rounded inclusion (an orthoquartzite with grains c.0.2-3mm across and some opaque grains of similar size with opaque matter marking the original grain boundaries) and one large opaque inclusion, a fragment of tabular ironstone 3.0mm long and 0.5mm wide, a rounded fragment of fine-grained basic igneous rock 1.0mm across, a fragment of a sandstone with rounded grains up to 0.5mm across and an opaque matrix 1.0mm across and a fragment of subangular flint, 1.0mm long. Several irregular voids are present which are either due to poor wedging or the inclusion of organic matter. The groundmass consists of abundant subangular and rounded quartz grains up to 0.5mm across, sparse carbonised roots and sparse muscovite laths up to 0.1mm long.

With the exception of the organic inclusions and voids these features can all be paralleled in samples of boulder clay from sites in East Yorkshire and northeast Lincolnshire and from

this we can infer that the daub was made from clay “as dug” and not tempered or cleaned in any way.

### CBM2 (V2189)

The thin section reveals that this fabric contains no inclusions larger than 0.2mm except for rare subangular quartz grains up to 0.3mm across and a single possible subangular rhyolite fragment of similar size. The groundmass consists of abundant quartz and moderate muscovite silt up to 0.1mm long in a groundmass of anisotropic baked clay minerals. There are abundant opaque spherical inclusions in the matrix, c.0.05mm across and some of these occur as clumps and lenses. There is also moderate black staining some of which appears to have spread out from the opaque inclusions. The groundmass texture and colour is variable, suggesting that the parent clay included laminations of different colour and texture.

The characteristics of this sample suggest that it was derived from a silty clay. Locally, the most likely sources for such a clay would be either estuarine clays on either side of the Humber or perhaps lacustrine deposits filling post-glacial lakes and ponds overlying the boulder clay. The texture is certainly less silty than that of objects made from silt at the junction of the Trent and the Humber which would imply a source further downriver. The microscopic opaque spheres are probably of bacterial origin and presumably present in the parent clay whereas the black staining may be secondary.

### CBM3 (V2190)

The thin section reveals an oxidized fabric containing abundant rounded sand-grade inclusions. This sand occurs as strings and lenses indicating either that it was added and poorly mixed or that the parent clay has a variable sand content.

The following inclusion types were present in the sand fraction:

- Rounded voids up to 1.5mm
- Angular flint, some with a brown-stained core up to 1.0mm. This includes one fragment with an echinoid shell fossil preserved as a black stain
- Rounded quartz, including grains of lower Cretaceous origin up to 1.0mm
- Rounded inclusionless clay pellets with black staining up to 1.0mm
- Rounded white siltstone up to 1.0mm
- Rounded fine-grained basic igneous rock up to 0.5mm
- Rounded sandstone with grains up to .03mm

- Rounded sandstone with grains including biotite up to 0.3mm and opaque cement up to 1.5mm

The groundmass contains sparse angular quartz silt and muscovite laths up to 0.1mm long in a matrix of isotropic baked clay minerals.

The sand fraction in this fabric is clearly dominated by material of Cretaceous age. The rounded voids, therefore, probably once held chalk. There is a small erratic element present, however, suggesting that the same is actually of fluvioglacial or recent origin.

#### CBM4 (V2193)

The thin section of this fabric reveals a very poorly mixed clay in which large areas have the silty, black-stained appearance of CBM2 interleaved with lenses containing abundant rounded and subangular quartz sand, up to 0.3mm across. Lenses which once has a high calcareous content are recognisable at x20 magnification with reflected light but no calcareous material remains in the sample.

The once-calcareous lenses have a silt content similar to that of the non-calcareous areas suggesting that the parent clay was a estuarine silt with a variable carbonate content.

#### CBM5 (V2196)

The thin section of CBM5 reveals a poorly mixed silty clay, similar to that seen in CBM2 and CBM4, with moderate rounded quartz sand inclusions up to 1.0mm and one rounded quartzite pebble 2.0mm across. There are also a few rounded voids up to 4.0mm across. Some of the quartz grains may be of lower Cretaceous origin. As with CBM4, although calcareous clay was identified by eye there is no calcite remaining in the fabric.

#### CBM6 (V2195)

The thin section reveals that the pellets and lenses of light-firing clay in this fabric are the result of a high calcareous content in the parent clay rather than the presence of kaolinitic clay (the latter would give rise to highly birefringent clays in thin section whereas these are optically isotropic). The only large inclusions present are rounded red clay pellets with black staining and rounded light-coloured marl pellets. The groundmass contains moderate rounded quartz grains up to 0.5mm across and quartz and muscovite silt.

None of the inclusions or features of this fabric can be used to definitely tie this fabric down to East Yorkshire, and in fact the presence of marl pellets might even suggest the use of a Triassic clay, or a boulder clay derived from Triassic clays.

## Chemical Analysis

The samples were submitted to Dr J N Walsh, Royal Holloway College, London, for analysis using Inductively Coupled Plasma Spectroscopy (ICP-AES). A range of major, minor and traced elements were measured. The major elements were measured as percent oxides and the remainder as parts per million. The percentage of silica in the samples was not measured directly but was estimated by subtracting all the measured major elements from 100%. This estimate will also include organic matter, such as unburnt carbon, and chemically-combined water. Table 3 shows the number of silica content in 5% bands and indicates that the daub, CBM1 has a higher content than the tiles but that there is only a slight difference in silica content between the other fabrics, even though some are tempered with sand and some are not. This is probably a result of the high silt content of the samples.

*Table 4*

subfabric	60-65%	65-70%	70-75%	75-80%	Grand Total
CBM1				1	1
CBM2	1	3	1		5
CBM3	2		3		5
CBM4	2	2	1		5
CBM5		1			1
CBM6			1		1
Grand Total	5	6	6	1	18

The data were normalised by dividing each set of values by the Al<sub>2</sub>O<sub>3</sub> frequency. This should minimise the dilution effect of the variable silica content. Factor analysis was then carried out on the resulting dataset. Fig 1 shows a scatterplot of the sample scores for the two main factors, F1 and F2. The CBM3 samples plot in the northwest half of the graph, indicating higher F2 and lower F1 scores than the remaining samples. The main elements giving rise to this separation are low values for Cr, Sc and V. Since all three elements are likely to be present in the clay fraction of the sample, this difference is unlikely to be due to the sand inclusions found in CBM3. There is no clear distinction in this graph between the remaining fabrics.

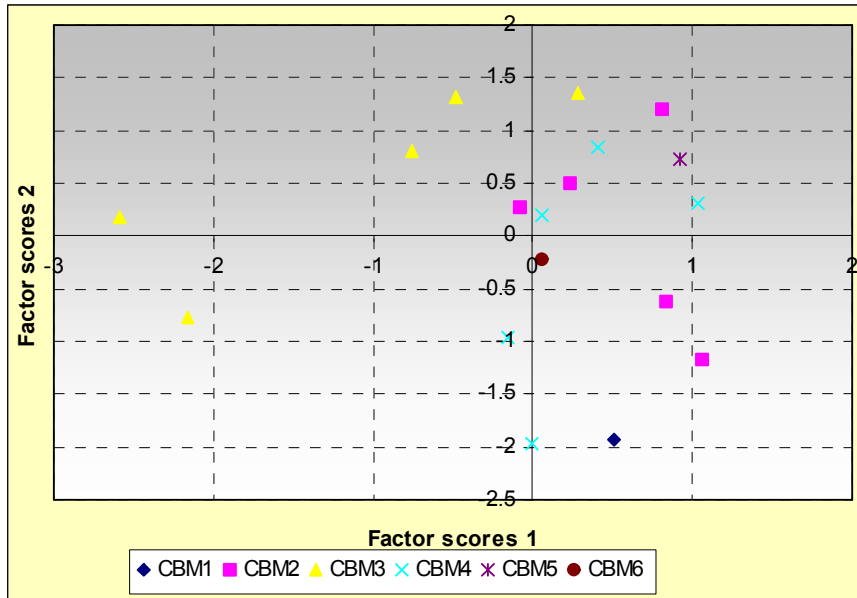


Figure 1

A plot of F3 and F4 (not illustrated) shows no separation of the majority of the subfabrics but does indicate that CBM6 has a strong negative F4 score. This is likely to be due to a lack of K<sub>2</sub>O and Fe<sub>2</sub>O<sub>3</sub> (consistent with the presence of light-firing clay) and a higher Li content than the other samples.

The data were then reanalysed alongside samples of ceramic building materials from Beverley (*bevo* in Fig 2) and Hull (F1 to F5 in Fig 2).

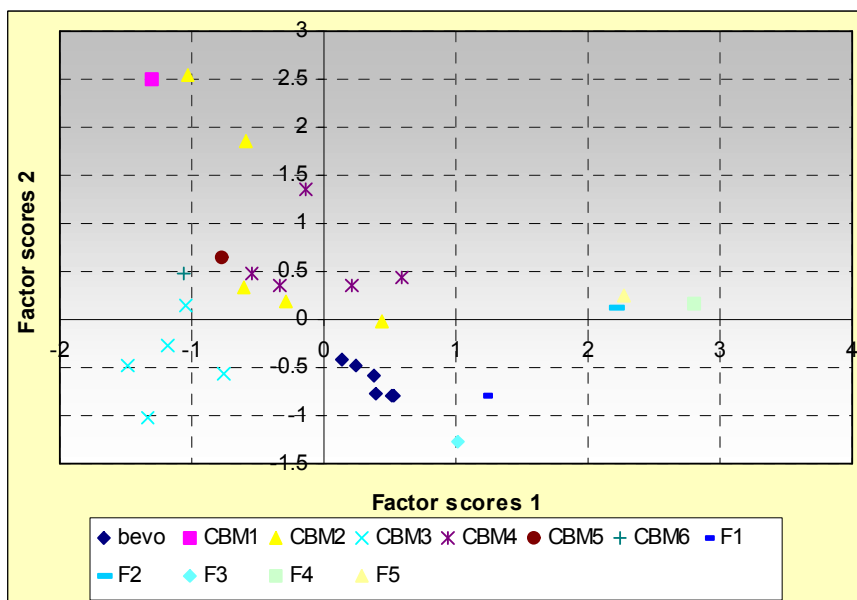
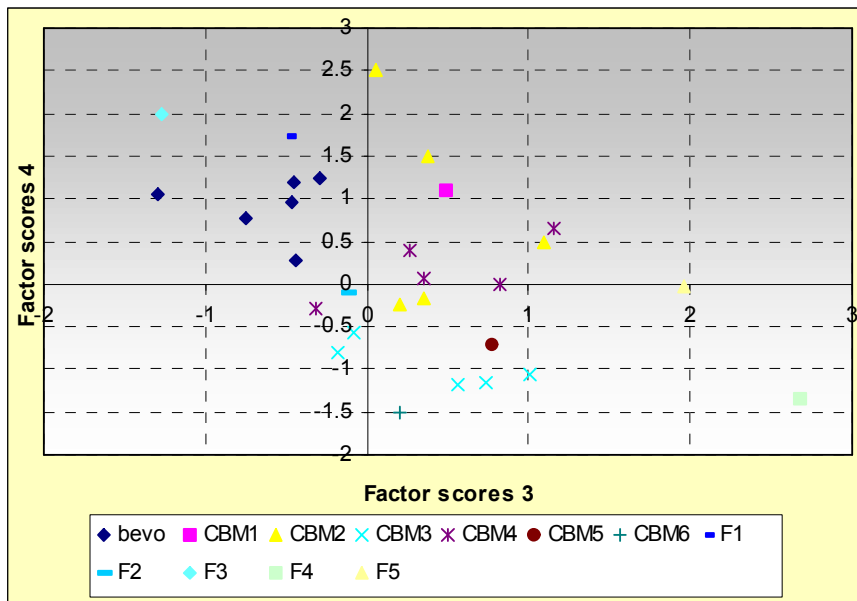


Figure 2

The plot of F1 against F2 for this dataset showed that the samples from Wawne, Beverley and Hull were chemically distinct and that the separation of CBM3 from the remainder was still visible. However, it also suggests that there may be two composition groups within the CBM2 samples, one midway between CBM4 and the Beverley samples and the other closer to the daub, CBM1. A plot of F3 against F4 for this dataset (Fig 3) shows that CBM3 can also be separated from the remaining Wawne samples by its strong negative F4 score, again due to a combination of low Cr, V and Sc values. Here too the Beverley and Hull samples can be separated from the Wawne ones, although in this case the two factors separate the Hull samples, Fabrics 1 and 3 having high F4 scores and Fabrics 4 and 5 having high F3 scores and F2 plotting in the centre of the graph, alongside Wawne samples.



**Figure 3**

Finally, the data for the Wawne CBM samples was analysed alongside data for Beverley pottery and tile. Fig 4 shows a plot of F1 against F2 for this dataset. Wawne CBM1, CBM2 and CBM4 have high F1 scores whilst the Beverley tile samples also have a high F1 score, but lower F2 scores. CBM3, however, has a similar composition to the Beverley pottery samples, as do the CBM5 and CBM6 samples. High F1 scores are due to Na<sub>2</sub>O, CaO, Sr and MgO values, indicating firstly that it is the calcareous groundmass which separates these fabrics, secondly that the Na<sub>2</sub>O in this case is likely to come from the formation of a sodium-calcium-aluminium silicate through the presence of brine and calcareous clay during firing and thirdly, that the groundmass may have contained dolomite as well as calcite.

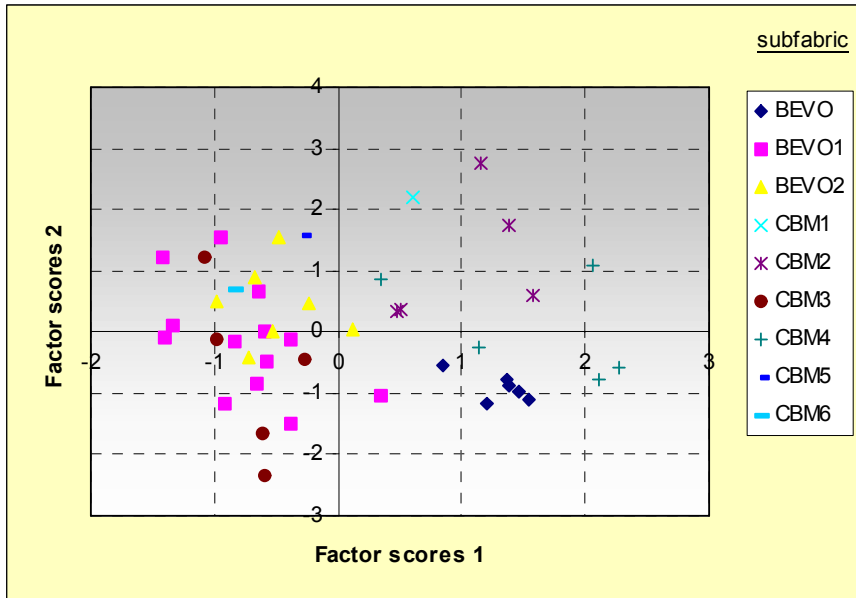
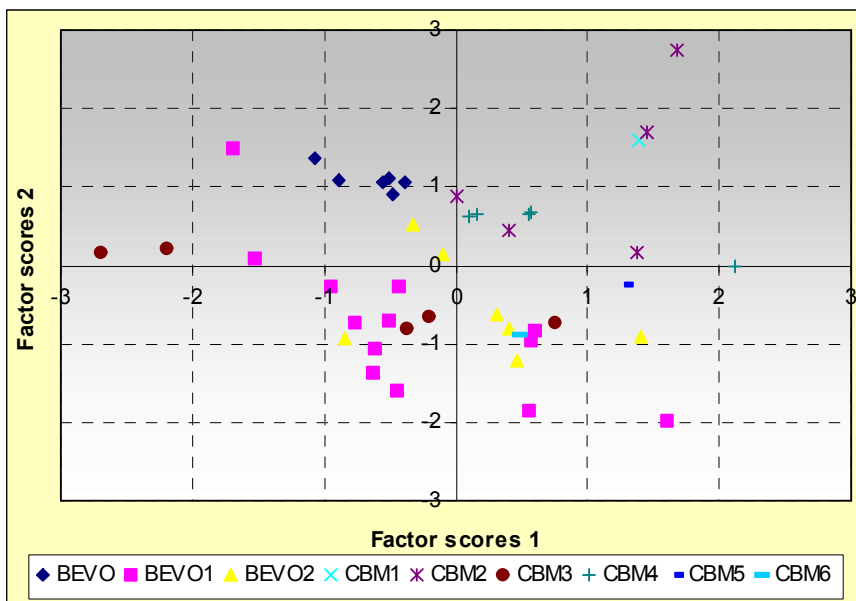


Figure 4

A plot of F3 against F4 (not illustrated) shows all the samples forming one large cluster, with two outlying Beverley 1 glazed ware samples forming outliers.

The same dataset was re-analysed omitting the suite of elements which are likely to be present in the calcareous groundmass (Na<sub>2</sub>O, CaO, Sr and MgO). Fig 5 shows the F1/F2 plot for this analysis and indicates that the separation into two groups is still visible, mainly as a result of high La and Ce values in the non-calcareous fabrics. In this analysis the Beverley tiles still form a coherent group whilst CBM2 and CBM4, CBM5 and CBM1 form a loose cluster, within which the CBM4 samples occupy a small area, indicating that it is mainly variations in the carbonate content which distinguish the samples.



## *Figure 5*

### Conclusion

The petrological and chemical analysis confirm that the six fabrics identified visually in the Wawne CBM collection can be differentiated, either petrologically or chemically or both. The analyses also show that none of the Wawne samples have chemical composition identical to that of ceramic building materials from Beverley or Hull but that CBM3 has a composition indistinguishable from that of Beverley pottery. Despite this, it is quite possible that all the fabrics (except for CBM1) were produced at Beverley but from batches of clay which have yet to be analysed.

The daub, which must have been prepared on site and probably dug locally, has a similar chemical composition to that of CBM2 and CBM4 although these two fabrics are clearly distinguished from CBM1 by their petrological characteristics and these differences probably outweigh the chemical similarity.

The thin sections of fabrics CBM2 and CBM4 clearly suggest that these two fabrics are calcareous and non-calcareous clays from the same tiliary and that the two clays were being exploited contemporaneously. It is quite possible that the difference in composition was accidental and that both fabrics occurred in the same batch of tiles.

Only one of the fabrics, CBM6, could not be shown by thin section analysis to have a local origin although it too contained no rock or mineral types which could not occur locally. It was not separated from the remainder by chemical analysis except in one analysis. Nevertheless, should samples of bricks made from marly Mercian Mudstone become available it might be worth re-running the analysis to include those samples.

### Bibliography

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



Appendix. ICPS Data

Major elements measured as percent oxides

cname	TSNO	Al2O3	Fe2O3	MgO	CaO	Na2O	K2O	TiO2	P2O5	MnO
MTIL	V2182	13.17	5.24	2.26	5.69	0.8455	2.52	0.58	0.15	0.082
MTIL	V2183	16.62	6.97	2.12	1.52	0.7695	2.93	0.8	0.16	0.098
MTIL	V2184	17.48	6.15	1.32	1.08	0.437	2.37	0.77	0.12	0.062
MTIL	V2185	14.18	6.68	1.73	2.43	0.779	2.57	0.68	0.51	0.239
MTIL	V2186	16.5	6.64	2.87	6.17	0.9785	2.85	0.89	0.18	0.117
MTIL	V2187	12.97	5.18	1.8	3.96	0.8835	2.54	0.61	0.69	0.092
MTIL	V2188	19.82	6.98	1.85	5.3	0.456	2.8	0.91	0.16	0.071
MTIL	V2189	16.17	7.86	1.87	2.28	0.7505	2.72	0.78	0.54	0.472
MTIL	V2190	20.43	7.64	1.67	1.28	0.475	2.75	0.9	0.11	0.108
MTIL	V2191	13.82	5.74	2.36	6.32	0.8835	2.54	0.77	0.18	0.101
MTIL	V2192	16.83	6.48	1.38	0.38	0.551	3.3	0.76	0.13	0.04
MTIL	V2193	18.44	7.43	2.42	1.46	0.874	3.31	0.84	0.28	0.185
FCLAY	V2194	11.98	4.88	0.78	0.91	0.6175	2.13	0.56	0.46	0.226
MTIL	V2195	17.99	5.27	1.13	1.5	0.5225	1.96	0.79	0.27	0.087
MTIL	V2196	16.41	6.44	1.66	3.13	0.57	2.3	0.74	0.19	0.064
MTIL	V2197	17.23	7.37	2.1	1.02	1.026	3.34	0.77	0.2	0.094
MTIL	V2198	17.31	7.48	2.26	4.84	0.7695	2.96	0.83	0.31	0.132
MTIL	V2199	16.52	6.44	1.29	0.89	0.494	2.59	0.71	0.14	0.053

Minor and trace elements measured as parts per million

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TSNO	Ba	Cr	Cu	Li	Ni	Sc	Sr	V	Y	Zr*	La	Ce	Nd	Sm	Eu	Dy	Yb	Pb	Zn	Co
V2182	456	81	20	73	38	11	176	73	21	53	34	50	35.72	6.9	1.076	4	1.9	52.196	89	12
V2183	479	109	26	91	51	15	131	106	25	78	45	71	46.812	8.8	1.403	4.8	2.4	78.256	115	16
V2184	472	109	19	106	49	15	114	125	25	75	45	66	46.154	8.1	1.185	4.1	2.3	78.024	83	18
V2185	540	87	24	79	46	12	157	96	21	66	40	61	42.394	7.9	1.132	5.1	2.1	41.184	119	18
V2186	458	107	25	97	50	15	190	117	28	79	45	70	47.47	8.7	1.336	5.5	2.8	29.8	106	18
V2187	549	89	19	64	38	11	204	73	20	60	35	53	36.848	7	1.082	4.2	1.9	54.136	84	11
V2188	430	125	24	122	59	18	196	145	27	94	51	78	52.922	9	1.402	5.3	2.8	38.716	89	20
V2189	724	90	28	76	62	14	143	96	24	75	45	69	48.034	8.8	1.314	6.1	2.4	42.596	127	24
V2190	551	127	27	126	62	18	128	149	28	91	57	85	58.938	10.6	1.636	5.7	2.9	52.684	95	24
V2191	470	86	23	77	40	12	191	91	25	69	39	59	41.172	7.6	1.126	4.8	2.4	15.116	81	16
V2192	365	107	18	99	46	15	90	108	15	78	40	60	40.42	5.6	0.752	3	1.8	38.004	86	12
V2193	517	113	25	101	59	17	144	126	27	83	51	76	53.204	9.8	1.557	5.6	2.6	47.872	127	20
V2194	589	72	19	57	41	10	107	69	17	58	34	51	35.72	6.3	0.912	4	1.7	52.424	94	17
V2195	574	110	29	104	48	16	126	111	26	75	49	76	50.76	8.8	1.373	5	2.4	59.412	121	19
V2196	632	101	24	90	55	15	140	110	28	70	46	71	47.752	8.8	1.356	4.8	2.4	52.508	83	23
V2197	459	109	23	87	55	15	131	115	24	70	46	67	47.846	9.4	1.363	4.9	2.4	48.524	115	19
V2198	580	110	26	97	51	16	187	111	26	77	46	68	48.128	8.7	1.452	5.2	2.4	38.328	124	16
V2199	423	101	27	86	46	14	116	106	16	73	39	57	39.668	6.4	0.856	3.2	1.8	48.676	83	15