Characterisation of the Fired Clay and Medieval Pottery from Manor Road, Easingwold, North Yorkshire (EAS06)

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Excavations at Manor Road, Easingwold, conducted by Fern Archaeology, revealed an unusual circular structure which was clearly associated with an industrial process. The feature was circular and cut about 0.2 m into the sandy subsoil. Subsequent ploughing and topsoil development may have truncated the feature somewhat but it was probably no more than 0.4 m deep when in use.

The feature has a circular wattle-lined chamber, about 2.7m in diameter and an entrance on the eastern side marked on either side by post pads. A curving gully, C1027 and C1028, joins the entrance at its southeastern corner. The chamber's floor was partially vitrified and the lowest fill of the chamber and entrance consists of charcoal, C1016, overlain by sandy fills, blue-grey clayey sand at the bottom and dark brown sand at the top. Although the feature was cut through orange sand, fragments of clay, both burnt and unburnt, were present in the fills. Other finds were scarce but a smashed pottery jar was found at the entrance, at the junction with the curved gully. A few other sherds of similar vessels were present in the gully and fills. These vessels are wheelthrown, gritty in texture and made from a light-firing clay. At first glance they could be mistaken for York Gritty ware, the main coarseware used in York between the mid 11th and the mid 13th centuries (Holdsworth 1995; 1978; Jennings 1992), but a closer examination shows that they are different. Similarly, the fabric is close to that of York Glazed ware, which has recently been shown by chemical and thin section analysis to be a product of the same general area as the Brandsby-type pottery industry (Alan Vince 2004).

The excavator has suggested that the feature is a clamp kiln, for production of pottery, and cited as comparanda the description of features excavated at Potter Brompton and Staxton by T C M Brewster (Brewster 1952). To test this hypothesis, fragments of the fired and unfired clay lumps were sampled, together with a sample of the smashed jar and other similar sherds (Table 1).

Methodology

Samples of the clay and pottery were taken for thin section (TS) and chemical analysis (ICPS). In addition, two of the clay samples were re-fired at 1000 degrees by Andrew Macdonald without any preparation.

The thin sections were prepared by Steve Caldwell, University of Manchester, and were stained using Dickson's method. This staining method distinguishes different types of carbonate minerals (Dickson 1965). The chemical analyses were carried out at Royal

Holloway College, London, under the supervision of Dr J N Walsh. A series of major elements were measured as percent oxides (App 1) and a series of minor elements were measured in parts per million (App 2). Silica was not measured but was estimated by subtracting the total measured oxides from 100%.

Table 1

TSNO	Context	REFNO	cname	Form	Action	Description	subfabric
V4041	C1014	23A	YORK	JAR	TS;ICPS;DR		LEP1
V4043	C1014		CLAY	SAMP	TS;ICPS		
V4056	C1015		CLAY	SAMP	ICPS		
V4057	C1015		CLAY	SAMP	ICPS		
V4058	C1015		CLAY	SAMP	TS;ICPS		
V4059	C1014		CLAY	SAMP	ICPS		
V4060	C1015		CLAY	SAMP	ICPS		
V4061	C1014		FCLAY	DAUB?	TS;ICPS	REDUCED GREY WITH ONE FLAT SURFACE	
V4062	C1015		YORK	JAR	ICPS		LEP1
V4063	C1015		YORK	JAR	ICPS		LEP1
V4064	C1015		YORK	JAR	ICPS		LEP1
V4065	C1015		YORK	JAR	ICPS		LEP1
V4066	C1015		YORK	JAR	ICPS		LEP1

Thin Section Analysis

Three thin sections were prepared in total. One was of the unfired clay (V4058), one of the fired clay (V4061) which appeared to have one original flat surface, and one sample of the smashed pot, V4041. The two clay samples were fired at 1000 degrees before sectioning. The two clay samples have such a similar appearance in thin section that they are described together whereas the pot sample is different.

Clay (V4058 and V4061)

The sections reveal a variegated fabric with lenses of different colours and textures. The following inclusion types were noted:

- Quartz. Variable quantities of subangular quartz, ranging from 0.2mm to 0.4mm. Larger, sub-rounded grains up to 0.6mm across also occur but are less common.
- Microcline Feldspar. Sparse subangular grains up to 0.4mm across.
- Chert. Sparse rounded grains up to 0.3mm across.
- Mudstone. Sparse rounded dark brown mudstone fragments up to 1.0mm across, similar in colour to the darker lenses in the groundmass. However, these occur both within the sandy lenses and the sand-free lenses.

- Opaques. Sparse rounded grains up to 0.3mm across, concentrated in the sandy lenses.
- Muscovite. Variable quantities up to 0.4mm long.
- Biotite. Possible biotite was present but was not pleiochroic, possibly due to alteration during firing. The laths were much less common than the muscovite and ranged up to 0.3mm long.
- Voids. Sparse rounded and subangular voids up to 1.5mm long (angular) and 0.5mm diameter (rounded). Some of the voids contain some amorphous material which has stained pink using Dickson's method. This suggests that limestone may have been present.
- Clay pellets. Sparse opaque-stained subangular clay pellets up to 1.0mm across. The pellets sometimes contain quartz grains.

The groundmass consists of lenses of dark brown isotropic clay containing moderate rounded dark brown clay/iron concretions and light brown to cream anisotropic clay. Both clays contain sparse angular quartz, muscovite and possible heat-altered biotite laths up to 0.1mm long.

Interpretation

It is clear that the clays consist of quartz sand mixed with a variegated clay which contains micas and a little quartz silt and sparse red-firing mudstone fragments. The clay is clearly derived from the Middle Jurassic which outcrops to the north east and east of Easingwold. In all probability the clay has been redeposited as boulder clay. Manor Road is shown on the 1:50 000 geological map of Harrogate (sheet 62) as being situated on boulder clay over lower Jurassic Staithes sandstone and it is more than likely that the clay in that area is composed mainly of Middle Jurassic material. The quartzose sand is likely to have originated as a blown sand deposit, and this too is likely to be mainly of Jurassic origin. Sandstones outcrop throughout the Middle Jurassic in this area and also form the majority of the Upper Jurassic strata (the Lower, Middle and Upper Calcareous grits). No obvious erratics are present.

Pot (V4041)

The following inclusion types were noted:

- Organic mudstone. Abundant rounded fragments of mudstone with a variable organic content up to 2.0mm across. Some pellets are completely opaque and others contain no organic matter, and have an off-white colour. The mudstone contains no visible inclusions.

- Sandstone. Sparse fragments of quartz sandstone with slight dark cement, up to 0.5mm across. The grains range from c.0.2mm to 0.4mm across.
- Quartz. Abundant fragments of subangular and subrounded quartz up to 0.5mm. The larger grains tend to be more rounded than the smaller and some show signs of overgrowth and a dark cement.
- Chert. Rare rounded fragments up to 0.4mm across.
- Organics. Rare carbonised inclusions up to 0.5mm across, surrounded by a darkened halo.
- Muscovite. Sparse laths up to 0.3mm long and between 0.1mm and 0.2mm wide.
- Microcline feldspar. Sparse subrounded fragments up to 0.4mm across.
- Voids. Sparse rounded voids up to 1.5mm across. Some of these may be "plucked" mudstone fragments.

The groundmass consists of optically anisotropic light grey clay minerals together with sparse angular quartz and muscovite laths up to 0.1mm long.

Interpretation

This fabric contains similar inclusions in a similar groundmass to the clays. However, the details show numerous differences which demonstrate that the pot could not have been produced using the clay found on the site. The low level of iron in the groundmass and the organic nature of the mudstones indicate that the parent clay was an organic mudstone, probably outcropping below a coal, since the sub-tropical deltaic conditions which lead to the formation of coal also lead to the leaching of iron and other elements from the underlying seatearths. This would lead not only to a lighter-firing clay but also one containing less muscovite. The thickness of the muscovite laths in the pottery suggest that most of these were a component of the quartzose sand rather than being present in the parent clay. Two bands of coal outcrop in the Middle Jurassic in this area, within the Long Nab member of the Ravenscar Group and it is possible that a deposit of this seatearth was redeposited closer to Easingwold. However, it is very likely that the process of redeposition would have led to this white-firing clay being mixed with more iron-rich clay, as well as being weathered, which would have led to the loss of the organic content. It is therefore much more likely that this fabric was produced close to the outcrop, at least 5 miles to the east or north-east of Easingwold. It is interesting, with this in mind, to note that the quartzose sand is slightly coarser than that in the fired clay and includes sandstone fragments. Given the loosely-cemented nature of these Middle and Upper Jurassic sandstones it is likely that they would not survive wind erosion and that this mechanical erosion is partly responsible for the difference in texture between the fired clay sand and that in the pottery.

Chemical analysis

The mean values for estimated silica were calculated for the fired clay and pot samples. It was found that both groups have similar means but that the range and standard deviations are higher for the clay than the pottery fabrics:

Clay: 68.51% +/- 5.73% (range: 62% to 78%)

Pot: 68.45% +/- 3.22% (range: 63% to 72%)

Because of the variable mixture with quartz sand, which dilutes the frequency of most of the measured elements, the chemical data were normalised to aluminium. The normalised data were then analysed using factor analysis, which is used in situations where a large number of independent variables are present and seeks to replace these variables with a smaller, more manageable, number of Factors. Four factors were found in this dataset and two graphs were prepared, plotting Factor 1 scores against Factor 2 scores and Factor 3 scores against F4 scores for each sample. Only the first of these groups shows any difference between the pot and clay samples (Fig 1). The combination of the two factors separates the two groups. Examination of the data indicates that the main differences are in the following element concentrations:

- Iron, magnesium, sodium, zinc – higher in the clays
- Titanium, manganese, chromium, lithium, – higher in the pottery

In addition, there is less variability in the element frequencies in the pottery than in the clays.

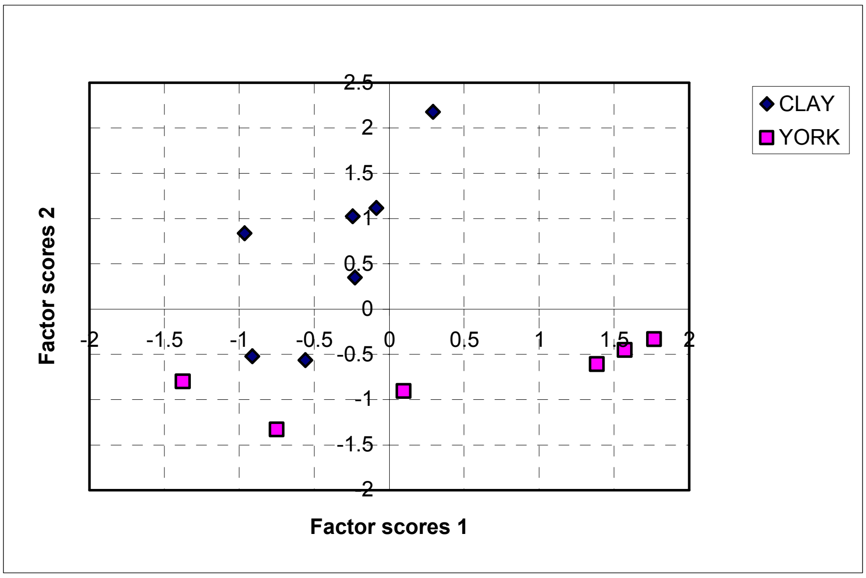

Figure 1

The chemical data therefore support the suggestion that the pottery was made from a different set of raw materials from the clays and that for the elements noted above even the ranges of the elements do not overlap, and so there is no possibility that one could have produced the pottery fabric by selecting just the lighter-coloured clays (assuming that the laminae were thick enough to do that).

The pottery samples were then compared with analyses of whiteware vessels produced in the North Yorkshire Moors area (such as Brandsby and Ruswarp Bank, near Whitby, Scarborough ware, and, for contrast, coarse gritted whitewares produced in West Yorkshire (York Gritty ware). Of these, the York gritty ware and Scarborough ware samples come from consumer sites and the remainder are from production sites.

Factor analysis of this data found three factors and a plot of F1 against F2 (Fig 2) indicates that the Factor 1 scores separate the Easingwold clay and pot samples (high scores) from samples from the eastern side of the moors (Ruswarp and Scarborough wares, with moderate F1 scores) and York Gritty and Brandsby wares, both of which have negative F1 scores.

A plot of F1 against F3 shows that, in addition, the Factor 3 scores distinguish the York Gritty from the Brandsby samples. The Easingwold pot samples clearly, therefore, were made from different raw materials from the Brandsby vessels.

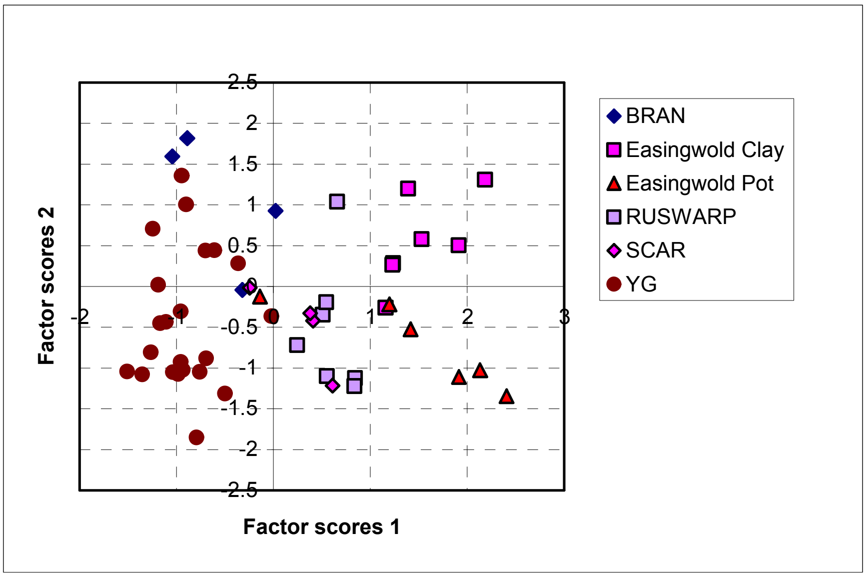

Figure 2

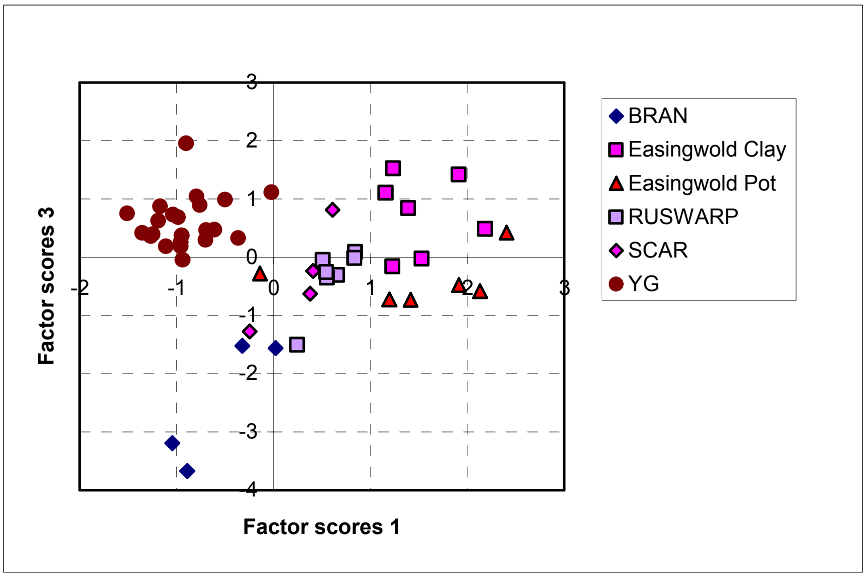

Figure 3

Discussion and Conclusions

The thin section and chemical analysis of samples of clay and pottery from the Manor Road, Easingwold, site, make it clear that the clay was not left over from pottery production, or at least that no pots which could have been made from that clay were present on the site. The limited quantity of clay, the fact that some of it was unfired and the lack of evidence for wattle impressions, suggests that the clay was not part of a kiln superstructure, plastered onto the wattles which line the chamber and a distinct possibility is that they are unworked subsoil accidentally included in turf. The presence of turf would explain the clayey nature of the lower fill of the feature, the low quantity of clay fragments and their lack of evidence for working. Since the feature itself did not cut into clay this would indicate that turf was brought from elsewhere (although probably not from any great distance, according to the excavator a brook lies within 100m of the site and the turf could have been collected from nearby).

The pot, therefore, is likely to have been used on the site and this is consistent with the sooting patterns found on the sherds and on the smashed vessel. Such sooting, perhaps counter-intuitively, is rare on pottery waste from production sites, either where the pottery was produced in a permanent kiln or a temporary clamp.

If we accept that there is no evidence for production of pottery on the Manor Road site, and certainly not in the structure, this raises two further questions. Firstly, what was the function of the structure? And, secondly, where was the pottery made? The first of these questions is not a matter which can be addressed here but the second question is certainly solvable. Following its recognition as a distinct type of pottery in 2006, at a manorial site at Leppington, excavated by Fern Archaeology, it has been confirmed that this type occurs at Byland Abbey, Clifton, and Thirsk. A single example has also been found at Bardsey, amongst a large group of York Gritty and other West Yorkshire wares. This distribution is consistent with an origin in the same area as the later North Yorkshire Whiteware industry and it is likely that this ware is one of the earliest products of that industry, not only pre-dating the late 13th century and later Brandsby-type industry but also perhaps predating the use of North Yorkshire whitewares in York and, from there, into York's hinterland.

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Appendix 1

TSNO	Al2O3	Fe2O3	MgO	CaO	Na2O	K2O	TiO2	P2O5	MnO
Clay									
V4041	26.14	4.58	1.20	0.37	0.28	3.01	1.25	0.28	0.022
V4043	19.96	8.40	1.23	0.43	0.78	2.56	0.92	0.30	0.214
V4056	18.79	9.52	1.16	0.54	0.79	2.46	0.86	0.45	0.101
V4057	12.02	5.54	0.72	0.39	0.50	1.58	0.56	0.33	0.126
V4058	22.26	8.14	1.87	0.38	0.46	2.90	1.00	0.26	0.057
V4059	20.97	5.74	1.62	0.23	0.39	2.72	0.92	0.19	0.048
V4060	21.62	5.68	1.27	0.48	0.73	2.65	1.05	0.28	0.098
V4061	15.93	4.24	0.89	0.36	0.69	1.99	0.73	0.22	0.104
Mean	19.71	6.48	1.25	0.40	0.58	2.48	0.91	0.29	0.10
SD	4.27	1.94	0.37	0.09	0.19	0.48	0.21	0.08	0.06
Pot									
V4062	18.74	4.20	1.14	0.28	0.54	3.16	1.54	0.19	0.013
V4063	19.21	3.52	0.97	0.40	0.55	2.87	1.73	0.18	0.011
V4064	18.20	3.47	0.95	0.37	0.53	2.73	1.66	0.17	0.011
V4065	22.31	3.34	1.16	0.57	0.20	3.08	1.56	0.19	0.014
V4066	21.85	3.92	1.21	0.65	0.36	2.52	1.41	0.46	0.015
Mean	20.06	3.69	1.09	0.45	0.44	2.87	1.58	0.24	0.013
SD	1.88	0.36	0.12	0.15	0.15	0.26	0.12	0.12	0.002

Appendix 2

TSNO	Ba	Cr	Cu	Li	Ni	Sc	Sr	V	Y	Zr*	La	Ce	Nd	Sm	Eu	Dy	Yb	Pb	Zn	Co
Clay																				
V4041	399	140	26	119	48	22	102	196	24	74	55	92	56	7	2	5	3	38	77	17
V4043	468	131	39	101	62	20	88	194	22	106	39	80	41	7	1	4	3	29	116	15
V4056	566	151	30	101	39	19	101	178	22	100	38	77	40	6	1	4	3	42	96	17
V4057	420	101	19	63	30	13	77	158	16	89	27	58	28	5	1	3	3	38	86	11
V4058	472	128	32	146	45	22	133	154	14	45	53	94	40	8	1	3	2	18	124	19
V4059	386	153	25	120	36	20	106	128	16	98	44	80	44	4	1	3	3	20	93	14
V4060	591	138	28	127	38	22	112	261	17	70	45	94	46	10	2	4	3	48	91	16
V4061	450	125	23	88	32	16	87	167	19	97	36	79	38	7	1	4	3	30	87	12
Mean	469	133	28	108	41	19	101	180	19	85	42	82	42	7	1	4	3	33	96	15
SD	75	17	6	26	10	3	17	40	4	20	9	12	8	2	0	1	0	11	16	3
Pot																				
V4062	503	159	25	37	30	20	100	147	18	73	57	100	57	9	2	4	2	81	60	15
V4063	566	167	26	54	30	19	123	176	15	75	64	125	64	10	2	4	2	36	50	16
V4064	530	169	25	55	29	19	115	170	16	81	61	117	61	10	2	4	2	53	47	16
V4065	403	172	30	56	46	23	79	185	28	88	62	117	64	11	3	6	3	33	95	22
V4066	431	186	42	41	39	25	78	183	23	89	48	81	49	8	2	4	2	27	83	16
Mean	487	171	30	49	35	21	99	172	20	81	58	108	59	10	2	5	2	46	67	17

SD	68	10	7	9	7	3	20	15	5	7	6	18	6	1	0	1	0	22	21	3