Characterisation studies of Mid Saxon Pottery from Bottesford, Lincolnshire (BWA01)

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In 2001 excavations at Baldwin Avenue, Bottesford, Lincolnshire, produced a collection of Mid Saxon pottery, of the type classed as Northern Maxey ware.

This ware is found on sites in central and northern Lincolnshire and on a few sites in Yorkshire (mainly Fishergate, in York, 1993).

Thin section analysis of material from Flixborough and comparanda from elsewhere indicated that the fabric contained a shell sand derived from a shelly limestone and that almost all the shell found had the same structure as oysters (nacreous) with a cement consisting of sparry ferroan calcite. A survey of limestones in the area suggested that the most likely source was the Great Oolite formation which outcrops on the dip slope of the Jurassic ridge, above the oolitic Lincolnshire Limestone.

Chemical analysis of samples of Northern Maxey ware suggested that there was probably a single source for this ware and that variations in composition could all be explained in terms of burial conditions.

The Bottesford finds included a number of sherds from vessels which had been burnt or overfired and it was suggested that the site might be a production site. Consequently, a sample of seven vessels was selected for further analysis (Table 1). Visually, the fabric of these vessels was classified by Jane Young into four groups: Fabric E – contains sparse echinoid spines; Fabric U – atypical but unclassified, and Fabrics U.1 and U.3– atypical with specific descriptions.

Bottesford lies on the Lower Lias close to the base of the formation. The Triassic Rhaetic (Penarth Group) measures lie just to the west and the Frodingham Ironstone to the east. The Lias in this area includes numerous fossils and is probably the source of the clay used in the Roman period to produce Dales Shelly ware (contra Loughlin 1977 and Firman). However, this ware has a rather different petrological composition from Maxey ware.

Petrological analysis

The thin sections were produced at the Department of Earth Sciences, University of Manchester, and were stained using Dickson's method (Dickson 1965) in order to distinguish dolomite, non-ferroan calcite and ferroan calcite. Each section was examined systematically and the range of inclusion types in each was recorded, together with any relevant details.

The seven samples all contain a similar range of inclusions and a single description is therefore given here. Details of the occurrence of the inclusion types is given in Table 2.

Inclusions

The following inclusion types were noted in thin section:

Shelly limestone. Fragments of limestone, composed of non-ferroan calcite bivalve shell and a sparry ferroan calcite matrix were noted in four of the thin sections. They ranged up to 2.0mm across. Ferroan calcite coating on the surfaces of bivalve shells was much more common, indicating that the shell was in the main derived from the weathering of a shelly limestone.

Nacreous bivalve shell. Large fragments of nacreous bivalve shell were present in all sections. They ranged up to 1.0mm thick and 2.0mm long and often had circular borings filled either with a dark brown clay or by ferroan calcite. Several shell fragments in each section had rounded edges, indicating that they were not the result of crushing a limestone but are detrital.

Other bivalve shell. Bivalve shell with a sparry non-ferroan calcite structure were present in all sections. They tended to be thinner than the nacreous shell, ranging from c.0.1mm thick to c.1.0mm. Some show little sign of curvature but lack the prismatic structure found in inoceramic shells. Like the nacreous shells, they are often coated with ferroan calcite.

Sparry calcite. Fragments of sparry ferroan calcite were present in every sample. In most cases, the calcite crystals are less than 0.3mm across, so that the majority of the fragments are polycrystalline. Some of the fragments are subangular, again indicating a detrital origin.

Marl fragments. Fragments consisting of a mixture of fine brown clay and ferroan calcite were sparse but present in all but one of the sections. They tended to be more rounded than the sparry calcite fragments but are probably also remnants of the matrix of a limestone.

Phosphate. Fragments of brown-stained phosphate were present in four sections, but were rare, consisting of a single fragment in each case. They are of biological origin and in two cases showed the structure of fish bone and in one of a hollow spine. Such spines occur on some brachiopod shells.

Echinoid spines. Echinoid spines were noted in three sections, and in each case were single examples. The spines were composed of non-ferroan calcite with ferroan calcite infilling of pores.

Diatoms. Two silicious microfossils, consisting of two chambers, were noted.

Subangular quartz. Moderate subangular to rounded quartz grains were present in each section. The quartz was in the main monocrystalline with no distinguishing features.

Rounded quartz grains. Rounded quartz grains were noted in three sections although they were sparse in each case (3 or 4 per section).

Gastropod shell. A single fragment of gastropod shell was noted, c.1.0mm across. It was composed of non-ferroan calcite with a filling of ferroan calcite and marl in the test.

Echinoid shell. A single fragment of echinoid shell c.0.5mm across was noted. It was encased in ferroan calcite and was itself composed of ferroan calcite.

Punctate brachiopod. A single fragment of punctate brachiopod shell was noted. The shell was composed of non-ferroan calcite and was c.0.5mm across.

Groundmass

The groundmass consists of optically anisotropic baked clay minerals and moderate rounded brown inclusions less than 0.05mm across. These are interpreted as faecal pellets or bacteria colonies with enriched iron content.

Chemical Analysis

Samples of each vessel were prepared by Peter Hill and sent to Royal Holloway College, London, where they were subjected to Inductively-Coupled Plasma Spectroscopy under the supervision of Dr J N Walsh, Department of Geology.

The analyses reveal the frequency, by weight, of a range of major, minor and trace elements. The major elements were measured as percent oxides (Table 3) and the remainder as parts per million (Table 4).

The frequency of silica (present mainly in quartz and clay minerals) was estimated by subtraction of the measured oxides from 100% and established as 52-59%. This compares well with the figure estimated for other Northern Maxey wares of 55.3 +/- 2.1% and is lower than that found in Dales shelly ware, and higher than that of Southern Maxey ware and Maxey Fabric Q (a locally-made variant found at Quarrington).

The data were examined first to see if there were any outlying values (i.e. more than four SD from the mean value. There were not. Means and standard deviations for each element were then calculated (Tables 3 and 4).

The data were then transformed, to take account of differences in silica content, by dividing each value by that of Al_2O_3. This data was then examined alongside that from other Northern Maxey, Southern Maxey, Dales Shelly ware and Maxey Fabric Q samples.

A range of elements were excluded from this study because they are almost certainly affected strongly by burial conditions (principally the leaching of calcite and its replacement by calcium phosphate). These elements are: CaO, P_2O_5, Ba, Sr and all the rare earth elements (all of which have an affinity for phosphate). The remaining data were then examined using factor analysis. This analysis found four factors which between them accounted for 58% of the variation in the dataset.

A plot of F1 against F2 shows that the Bottesford samples have an identical composition to that of the other Northern Maxey wares (including Maxey Fabric Q) but that the Southern Maxey and Dales Shelly ware samples have different compositions (Fig 1). High F1 scores depend on high weightings for Vanadium (V), Chromium (Cr), Lithium (Li) and Iron (Fe_2O_3). High F2 scores (which distinguish the Southern Maxey wares) depend on Cobalt (Co), Nickel (Ni), Scandium (Sc) and Iron (Fe_2O_3).

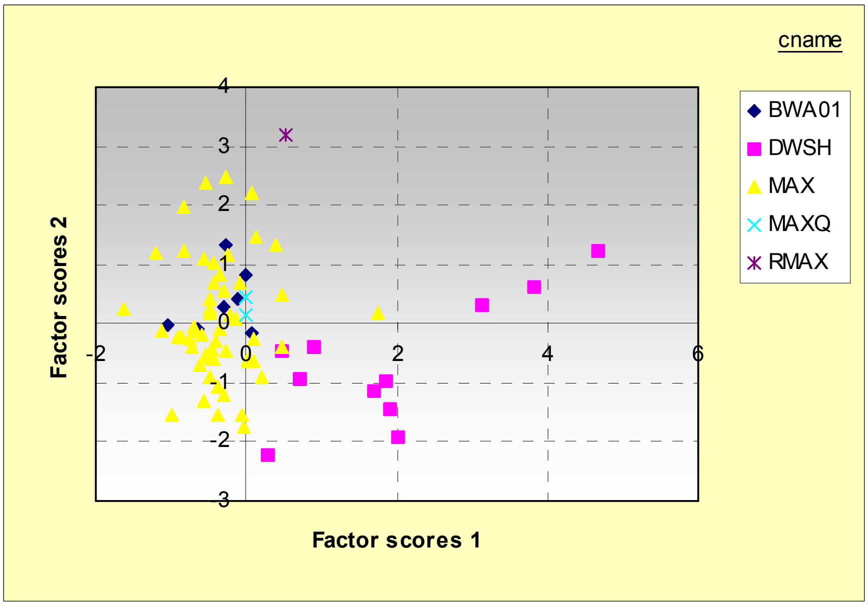

Figure 1

Factors 3 and 4, however, do not distinguish the various shelly fabric groups, although the Bottesford samples have high F4 scores which are not shared by three of the Dales Shelly wares (subfabric S), and some of the Northern Maxey wares (Fig 2). High F4 scores depend on high weightings for MgO, K2O and MnO.

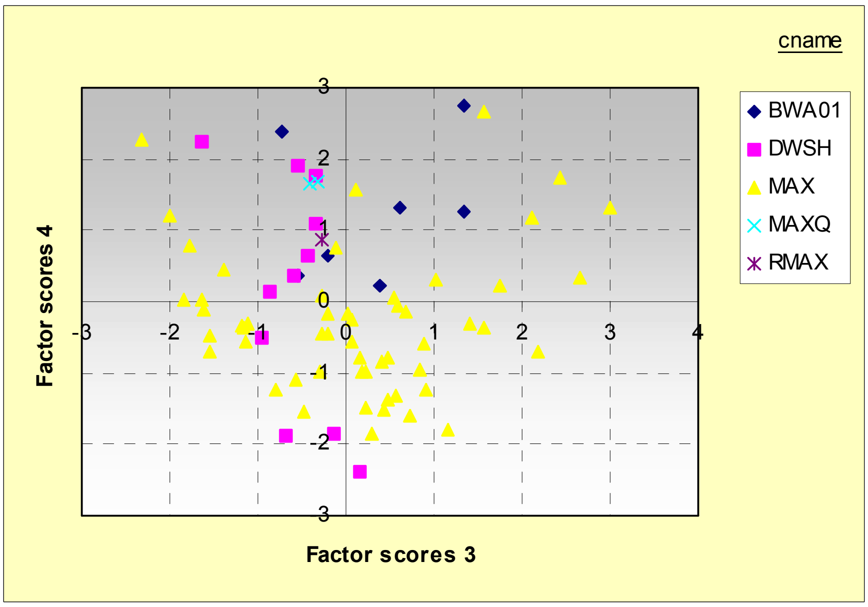

Figure 2

To investigate the significance of these differences in F4, the F4 scores for Northern Maxey ware samples were plotted findspot by findspot (Fig 3). This established that there is a group of sites with high F4 scores (Barton-upon-Humber, Belton, Bottesford) and one with low F4 scores (Goltho, Holton-le-Clay, Normanby-le-Wold, Riby, Thornton-le-Moor and York. Flixborough produced samples of both groups although most belong to the second group.

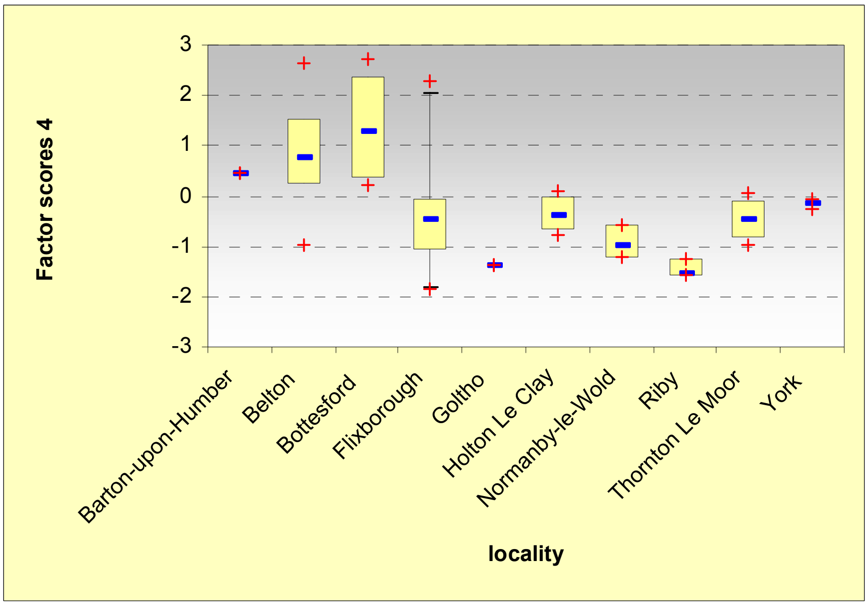

Figure 3

The variations in Factor 4 scores also correlate with the subfabric groups defined by Jane Young (Table 00). Those with a central Lincolnshire distribution (A, B, C and G) have negative F4 scores whereas those found mainly in northern Lincolnshire (E and U) have higher scores.

Discussion

The thin section analysis indicates that, like the other Northern Maxey ware samples which have been studied in thin section, the Bottesford vessels were tempered with a detrital shell sand and that this sand was derived primarily from a shelly limestone containing nacreous and other bivalve shells, sparse echinoid shell and spines and rare gastropod shell. There are no oolitic limonite pellets in the limestone and the matrix consists mainly of sparry calcite rather than marl. These features distinguish the fabric from that of Dales Shelly ware and suggest that the source of this sand, like that of the other Northern Maxey wares, lies to the east of the Jurassic ridge rather than in the Bottesford area. Nevertheless, the quantity of non-nacreous bivalve shell and the echinoid, gastropod and punctate brachiopod shell fragments, although rare, do distinguish the Bottesford samples from the main Northern Maxey ware (fabrics A, B, C and G). This indicates that Young's subfabrics E and U are indeed likely to come from a different source and this conclusion gains support from the chemical differences found within the Northern Maxey wares.

It is likely, given the distributional bias of the two fabric groups, that subfabrics E and U, were produced to the north of the source of Subfabrics A to C and G, probably using a Middle Jurassic clay tempered with a shell sand perhaps obtained quite close to the outcrop of the parent limestone (since there is such a small admixture with non-local inclusions, such as the quartz sand). Suitable locations occur on the dip slope of the Jurassic ridge and from the distribution evidence (Isle of Axholme, Bottesford, Flixborough, Barton-upon-Humber) we might postulate that the source lies between Brigg and the Humber.

Tables

Table 1

TSNO	Sitecode	Context	REFNO	Form	Action	subfabric
V2351	bwa01	37		LARGE VESSEL	TS;ICPS	E
V2352	bwa01	36		MEDIUM TO LARGE VESS	TS;ICPS	U.3
V2353	bwa01	36		MEDIUM VESS	TS;ICPS	U.3
V2354	bwa01	37	DR4	MEDIUM TYPE VIA BOWL	TS;ICPS	U.1
V2355	bwa01	37	DR5	LARGE LUGGED IA JAR	TS;ICPS	U.3
V2356	bwa01	37	DR6	LARGE LUGGED JAR	TS;ICPS	U.3
V2357	bwa01	37		BOWL/JAR	TS;ICPS	U

Table 2

tsno	shelly lst	nacreous bivalve	thin sparry shell	sparry ferr	marl (ferr)	phosphate	echinoid spine	diatoms	sa q <0.2	rq <0.5mm	r brown specks <0.05mm	gastrodpod	echinoid shell (ferr)	punctate brachiopod
v2351	s	a r	m	m	m	s	s	s	m	n	a	n	n	n
v2352	n	a r	m	m	n	n	n	n	m	n	m	n	n	n
v2353	n	a r	m	m	s	n	s	n	m	n	m	n	n	n
v2354	s	a r	m	m	m	spine	n	s	m	n	m	n	n	n

v2355	s	a r	m	m	s	bone?	n	n	m	s	m	n	n	n
v2356	s	a r	m	m	s	bone?	s	n	m	s	m	s	n	n
v2357	n	a r	m	m	m	n	n	n	m	s	m	n	s	s

Table 3

TSNO	Al2O3	Fe2O3	MgO	CaO	Na2O	K2O	TiO2	P2O5	MnO
V2351	9.91	4.87	0.86	25.62	0.1425	1.39	0.42	2.07	0.151
V2352	10.11	4.51	0.83	26.14	0.2185	1.37	0.43	2.06	0.088
V2353	8.46	3.83	0.71	31.06	0.133	0.93	0.36	1.5	0.108
V2354	11.83	6.91	0.8	17.41	0.1995	1.77	0.52	2.56	0.151
V2355	9.12	5.45	0.81	25.9	0.133	1.4	0.38	2.34	0.204
V2356	9.9	5.2	0.86	24.4	0.1425	1.08	0.43	1.66	0.208
V2357	12.79	7.41	1.07	12.85	0.38	2.28	0.5	3.46	0.183
Mean	10.3029	5.45429	0.84857	23.34	0.19271	1.46	0.43429	2.23571	0.15614
SD	1.50926	1.28322	0.11006	6.13078	0.08941	0.44915	0.05827	0.65141	0.04603

Table 4

TSNO	Ba	Cr	Cu	Li	Ni	Sc	Sr	V	Y	Zr*	La	Ce	Nd	Sm	Eu	Dy	Yb	Pb	Zn	Co
V2351	529	58	21	48	62	9	430	61	17	58	25	63	102	2.74	0.91	4	2	75.23	153	20
V2352	504	58	27	35	61	9	420	63	17	59	24	57	102	2.25	0.85	3	1	65.73	121	18
V2353	472	46	22	34	51	8	475	54	16	51	21	51	108	2.75	0.82	3	1	29.85	98	15
V2354	770	74	27	39	57	12	398	85	20	73	32	86	108	4.53	1.31	4	2	54.43	146	25
V2355	690	53	23	38	57	9	451	57	17	56	22	51	97	2.87	0.76	4	2	70.2	203	20
V2356	572	58	33	40	62	9	420	68	19	62	24	60	97	2.64	0.88	4	2	63.25	170	19
V2357	838	80	28	83	50	13	314	87	21	74	33	79	81	3.28	1.16	4	2	50.03	133	17
Mean	625	61	26	45	57	10	415	68	18	62	26	64	99	3	1	4	2	58	146	19
SD	142	12	4	17	5	2	51	13	2	9	5	14	9	1	0	0	0	15	34	3

Table 5

Factor scores 4	A	B	C	E	G	U	U.1	U.3	Grand Total

-2--1.5	2	1	1		1				5
-1.5--1	1	1	2		1	1			6
-1--0.5	2	5		1		4			12
-0.5-0	1	5		4		5			15
0-0.5	1	1				6		2	10
0.5-1						2	1		3
1-1.5				2		2		1	5
1.5-2						2			2
2-2.5						2			2
2.5-3						1		1	2
Grand Total	7	13	3	7	2	25	1	4	62

Bibliography

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