Characterisation Studies of Neolithic pottery from Yabsley Street, Tower Hamlets (YAB02)

Alan Vince

Excavations at Yabsley Street, Tower Hamlets, undertaken by TVAS revealed a crouched burial of Neolithic date associated with a pottery vessel. Other pottery found nearby was also identified as being of Neolithic date by Frances Raymond (Raymond 2003). Raymond classified the pottery fabrics and samples of the main groups were selected for analysis. The main aims of this analysis were to establish the characteristics of the fabrics and to determine their possible source and relationships. Ten samples were taken for thin section and chemical analysis, coded V2150 to V2158 (Table1). The same sample number was used for both analyses. In addition, a sample of the sandy soil matrix attached to the sherds was analysed chemically to form a base for comparison.

Table 1

TSNO	petrofabric	REFNO	cname	Action	Description
V2150	c	SF1024	FMS/1	TS;ICPS	
V2151	a	SF29	S/1	TS;ICPS	
V2152	b	SF1015	S/2	TS;ICPS	
V2153	b	SF25	FS/3	TS;ICPS	
V2154	b	SF77	FS/2	TS;ICPS	
V2155	d		V/1	TS;ICPS	OR VS/1
V2156	b	POT 25	FS/1	TS;ICPS	CARINATED BOWL IN SAND
V2157	a	SF3	S/1	TS;ICPS	OR S/2
V2158	b	SF3	FS/2	TS;ICPS	

Petrological Analysis

The thin sections were prepared by Steve Caldwell, University of Manchester, and stained using Dickson's method (Dickson 1965). This staining helps to distinguish ferroan and non-ferroan calcite and both calcites from dolomite. Unfortunately, although there had been calcareous inclusions in several of the fabrics these in the main had been completely leached during burial, leaving only voids.

A systematic analysis of the thin sections was made, looking in turn for each inclusion type (Table 2).

Table 2

tsno	angular flint	r brown flint	rq	rq millet grain	gsq	glauc	altered glauc	opaque fe	rounded clay	muscovite	biotite	ang q fs	ang q silt	organics	opaque specks	bivalve shell	petrofabric

V2150	s	s	s	n	n	n	n	n	s	a <0.2	n	n	a <0.2	s with black haloes	n		c
V2151	n	n	s	s	s?	m	n	n	n	s <0.2	n	n	a <0.1	n	m		a
V2152	s	n	s	n	n	n	n	s	n	s <0.2	n	n	a <0.1	n	s	m	b
V2153	s	s	s	s	n	n	n	n	n	n	n	n	a <0.2	n	n	s	b
V2154	m	s	s	n	n	n	n	n	n	s <0.2	n	n	a <0.2	n	n	n	b
V2155	n	n	s	n	n	n	n	n	n	n	n	n	n	n	n	a	d
V2156	m	n	s	n	s?	n	n	n	n	s <0.2	n	n	a <0.2	n	s	n	b
V2157	n	n	s	n	n	m	n	s	n	s <0.2	n	s	a <0.2	n	s	n	a
V2158	m	s	s	n	n	n	n	s	s	s <0.2	n	n	a <0.2	s with black haloes	s	n	b

Key: s = sparse, m = moderate, a = abundant, <0.1 = inclusions ranging up to 0.1mm across.

On the basis of this analysis the samples were assigned to four petrofabric groups, A to D. The correlation of these groups with the visually-identified fabrics is shown in table 3.

Table 3

Cname	A	B	C	D	Grand Total
FMS/1			1		1
FS/1		1			1
FS/2		2			2
FS/3		1			1
S/1	2				2
S/2		1			1
V/1				1	1
Grand Total	2	5	1	1	9

Group A (Fabric S/1, V2151 and V2157)

The defining feature of Group A is the presence of unaltered glauconite and muscovite in the groundmass. Glauconite, $(K, Na)(Al, Fe^{+3}, Mg)_2(Al, Si)_4O_{10}(OH)_2$, is a dull green mineral which gives the colour to greensand. It is extremely common in lower Cretaceous deposits, both clays and sands, but is also found in some Tertiary deposits overlying the London Clay (1996). These outcrop in southeast Essex. The opaque specks observed in the matrix are subangular at x100 magnification and might be either formed *in situ* like the iron pyrites which occurs frequently in London Clay, or as the result of biological activity, such as bacterial or faeces of micro-organisms. One quartz grain of possible lower Cretaceous origin was noted (Table 3, gsq) and one well-rounded quartz grain, probably of Permo-Triassic origin. These indicate the presence of detrital material in the fabric. This could be Thames terrace gravel.

Group B (FS/1, FS/2, FS/3, S/2. V2152, V2153, V2154, V2156, V2158)

The distinguishing feature of Group B is the presence of angular fresh flint, with grains up to 2.0mm across, and a groundmass containing an ill-sorted quartzose sand. The group can be subdivided into samples containing sparse angular flint and the voids from the presence of thin-walled shell (V2152, V2153) and those with moderate flint and no shell (V2154, V2156, V2158). The thin-walled shell probably comes from freshwater molluscs and is a feature of fabrics made from the Thames alluvium. The quartzose inclusions include rounded brown-stained flint grains, which indicates a Tertiary or later age for the sand. Similar textures, without the flint inclusions, have been observed in fabrics thought to have been made from Thames alluvium and containing brickearth and terrace sand, either through deliberate addition or through erosion of these deposits.

Group C (FMS/2, V2150)

The distinguishing feature of Group C is the quantity of muscovite present in the groundmass. It too contains fresh angular flint which has probably been deliberately added as temper. Muscovite is common in the upper London Clay deposits which outcrop extensively in Essex and consequently is also common in quaternary deposits derived from the erosion of these strata. With the exception of the muscovite, however, the range of inclusions and the texture of the fabric is very similar to Group B and it is likely that this fabric too was made from silty alluvial clay rather than Tertiary clay with added sand.

Group D (V/1, V2155)

The distinguishing features of Group D are the presence of abundant voids from thick-walled bivalve shells and the lack of silt-sized inclusions in the groundmass. These features are paralleled in the Woolwich Beds, which overlie the London Clay and outcrop in a narrow band along the south bank of the Thames and the north Kent coast. The same beds do outcrop north of the Thames east of London and it is possible that this fabric group too was made from raw materials available locally.

Discussion

The thin section analysis suggests that two main sources of clay were utilised by the Neolithic potters. The most common was alluvial clay which in this part of the Thames valley includes sufficient silt and sand inclusions to require no further temper to be workable. However, in most cases fresh angular flint has been added to the clay. This was probably not necessary for practical purposes and is therefore a cultural trait. Some of the flint chips are extremely thin wedges in section and it is more likely that they represent flint debitage rather than calcined flint, broken up by fire cracking. However, no experimental work has taken place and so the exact form in which the flint entered the pots can only be surmised. Sharp, angular flint flakes, even of this size, are likely to cut the skin and there must have been a strong positive reason to add them to the potting clay.

The second source of clay is the Woolwich Beds, probably utilising a local outcrop. So far as can be seen in thin section this clay received no extra preparation and was probably quarried and used as dug. The depth to which the potters would have had to dig is unknown but it is possible that a weathered riverbank or similar outcrop was used.

Chemical analysis

Samples of each sherd were prepared for chemical analysis by removing a layer about 1.0mm thick from the sample to eliminate contamination as far as possible and then crushing the remaining 1-2gm of sample to a fine powder which was then submitted to Dr J N Walsh, Royal Holloway College London, for analysis using Inductively Coupled Plasma Spectroscopy. A range of elements were measured. These include major constituents, measured as percent oxides and minor and trace elements measured as parts per million.

The dataset was transformed by dividing every element frequency by that of Al2O3. This effectively removes much of the variation in composition introduced by variations in the quantity of quartz sand and silt. Table 4 shows an estimate of the average silica content for each fabric/petrofabric group made by subtracting the sum of the measured major elements from 100%. It takes no account of chemically combined water nor of organic matter. This shows that in most cases the samples have a quartz content which is similar to that of the adhering soil. The one exception, as might be expected, is the shell-tempered fabric, Group D.

Table 4

cname	a	B	c	d	yab matrix	Grand Total
FMS/1			77.947			77.947
FS/1		81.355				81.355
FS/2		79.0955				79.0955
FS/3		76.932				76.932
S/1	80.7505					80.7505
S/2		80.191				80.191
SOIL SAMPLE					78.85	78.85
V/1				69.684		69.684
Grand Total	80.7505	79.3338	77.947	69.684	78.85	78.4651

The transformed data were analysed using factor analysis. A series of factors are calculated which, in descending order starting with Factor 1, account for the variation in the dataset. Five factors with eigenvalues over 1 were calculated. A high F1 score indicates mainly high frequencies for a range of

Rare Earth Elements and low values for Zircon. High F2 scores indicate high frequencies for CaO and Sr (i.e. a high calcareous content). A high F3 score indicates high TiO, Cr, Sc and Zr (such as might be expected in detrital sands and silts). High F4 scores indicate high Ni and Co and low Fe2O3. Finally, high F5 scores depend on MgO and V and low TiO.

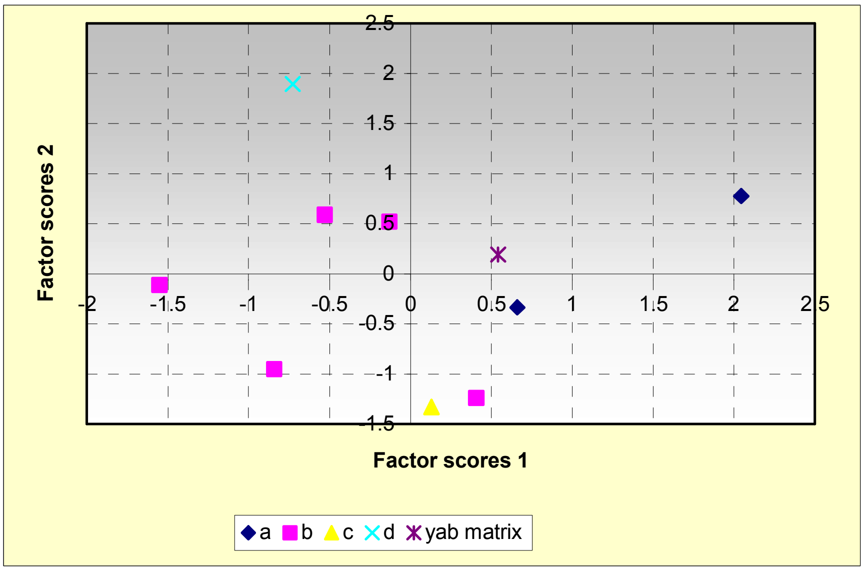

Figure 1

Fig 1 shows a scatterplot of F1 against F2 and indicates that Group D is separated from the remainder by its F2 score (which is consistent with the calcareous content and perhaps indicates that this part of the sample had some shell remaining). Group A and the soil matrix have high F1 scores which might indicate that this group was produced close to the site. Groups B and C have similar chemical compositions. The chemical compositions therefore not only confirm the petrological groups recognised in thin section but also indicate relationships between the groups. A plot of F3 against F4 (not illustrated) shows no groupings except for Group C which had a slightly higher F3 score than the remainder.

The Tower Hamlets data were then compared with wares of later date from other sites in the Thames basin (Fig 6). In this analysis, the Group D sample has a negative F1 score and a high F2 score, similar to samples of two medieval fabrics from the Abbey Retail Park, Barking, which are thought to have been made from Woolwich Beds clay (ARP97 Woolwich?). Other shelly wares from the same site, thought to have been made from upper London clay tempered with recent beach shell sand have higher F1 scores, as do samples of chaff-tempered wares from the same site (ARP97 echaf). The Group B and C samples have a discrete composition similar to that of medieval production waste from a site at Noak Hill, Ingatestone where the micaceous upper London clay was used. Finally, the Group A samples have a composition similar to that of wares made in the Moorfields area immediately north of the City of London from a silty clay containing brickearth

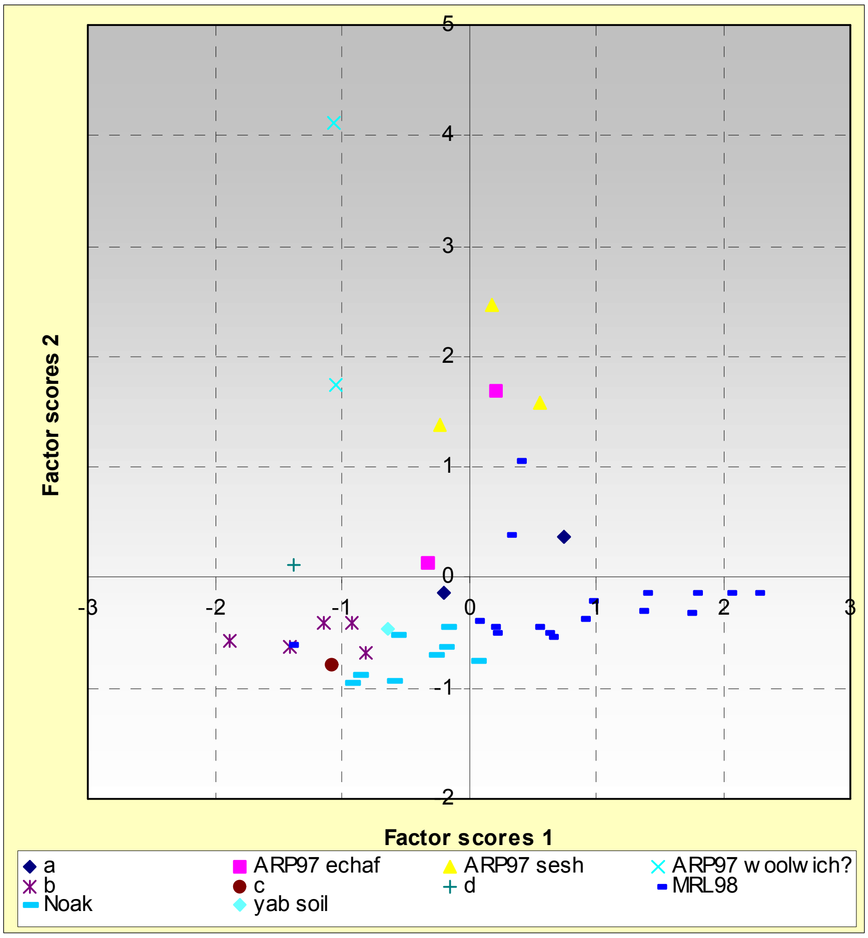

Figure 2

A plot of F3 against F4 scores for the same dataset shows that the Tower Hamlets samples have higher F4 and/or F3 scores than the comparanda, most of which have a similar composition and plot in the centre of the graph.

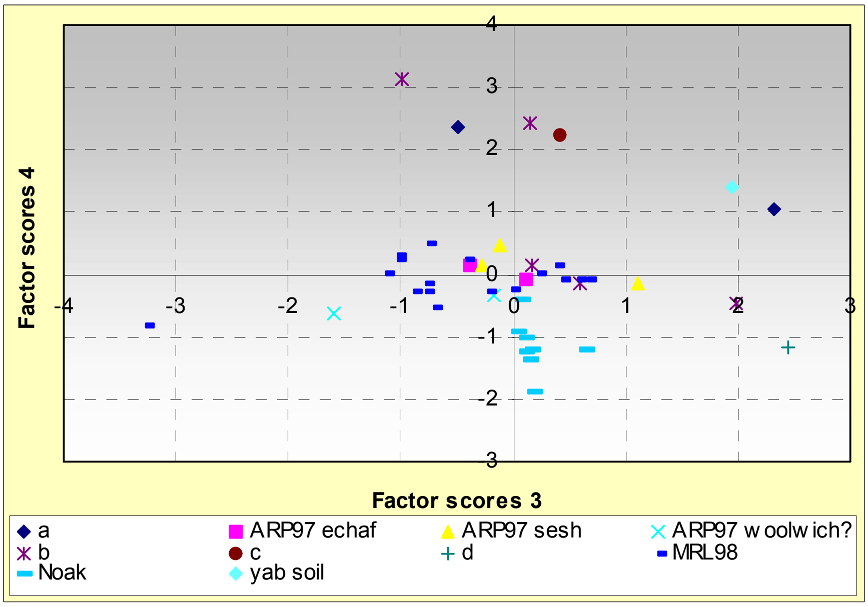

Figure 3

Discussion

The chemical analysis indicates that Group A and D can be distinguished from Group B and C using their chemical composition whilst the Group C sample is invariably plotted close to those of Group B. This may suggest that the higher mica content of Group C is insufficient evidence for suggesting a separate source for these two groups. The comparative study of the chemical composition of the Tower Hamlets sherds and later pottery known or believed to have been made in south Essex or the Thames valley shows that there is little difference in composition between these two groups of samples and that their relative similarities as portrayed in Figs 1 to 3 are consistent with the interpretation of their sources put forward on the basis of thin section analysis.

To conclude, there is one sample, Group D, which was made from Woolwich Beds clay, a group of flint-tempered silty wares made from local clay, probably alluvial in origin but derived in the main from reworked Tertiary strata and two samples, Group A, which are petrologically and chemically distinct from Group B/C (even though the texture of the groups is very similar) and contain no flint temper. These samples are similar in composition to wares made in the Thames valley from Quaternary or recent alluvial clays and their glauconite content suggests a source downriver from London, which matches their chemical composition which is midway between that of samples from the city of London and Barking.

These characterisation studies give no reason to suppose that the vessels were not all made within a few miles of the site where they were found, indeed in two instances (Group A) a case could be made for the samples being very local since they are similar in composition to the soil matrix on the site. Given the widespread distribution of the rock and mineral inclusions in the samples it is not possible to prove local production but neither is there any reason to doubt it.

Appendix 1

Major elements (percent oxides)

TSNO	Al2O3	Fe2O3	MgO	CaO	Na2O	K2O	TiO2	P2O5	MnO
V2150	12.12	4.98	1.15	0.86	0.12	1.88	0.64	0.29	0.013
V2151	11.76	3.36	0.72	0.84	0.46	2.01	0.7	0.32	0.011
V2152	11.85	3.53	0.86	0.88	0.34	1.6	0.6	0.14	0.009
V2153	13.8	3.52	0.75	1.19	0.33	2.04	0.82	0.61	0.008
V2154	13.61	2.84	0.96	0.77	0.23	1.89	0.77	0.51	0.004
V2155	17.51	5.37	0.73	1.19	0.13	2.75	1.33	1.3	0.006
V2156	11.59	2.67	0.87	0.79	0.2	1.64	0.61	0.27	0.005
V2157	9.94	3.61	0.6	0.58	0.39	2.1	0.66	0.43	0.008
V2158	11.97	3.12	0.94	0.83	0.16	2.09	0.77	0.34	0.005
V2166	11.84	3.93	0.91	1.02	0.22	2.03	0.78	0.41	0.01

Minor and trace elements (ppm)

TSNO	Ba	Cr	Cu	Li	Ni	Sc	Sr	V	Y	Zr*	La	Ce	Nd	Sm	Eu	Dy	Yb	Pb	Zn	Co
V2150	318	102	25	57	93	13	60	127	14	62	24	61	25.004	4.2	0.951	2.6	1.7	38.78	189	40
V2151	376	93	29	85	68	10	68	90	15	65	26	64	27.26	4.8	0.932	3	1.7	39.14	355	17
V2152	313	86	26	81	69	11	64	110	13	66	20	48	20.774	3.4	0.7235	2.1	1.5	32.35	934	22
V2153	314	113	29	64	50	16	71	124	15	78	23	58	24.346	4.6	0.924	2.9	1.9	37.2	92	12

TSNO	Ba	Cr	Cu	Li	Ni	Sc	Sr	V	Y	Zr*	La	Ce	Nd	Sm	Eu	Dy	Yb	Pb	Zn	Co
V2154	330	109	35	49	61	14	52	134	14	77	19	39	20.022	3.1	0.658	2.3	1.7	23.89	108	13
V2155	499	142	44	50	53	23	67	169	18	120	25	64	26.884	5.7	1.1315	3.6	2.5	29.79	98	11
V2156	313	95	27	49	92	12	52	110	17	61	23	63	24.534	4.2	0.9665	3.1	1.8	31.11	160	32
V2157	425	94	32	65	49	12	69	92	15	65	26	63	27.26	4.8	0.9195	3	1.7	37.06	108	13
V2158	391	116	29	51	40	15	62	120	14	71	23	47	24.064	4.1	0.844	2.6	1.7	33.13	75	11
V2166	346	120	26	61	65	13	64	124	16	73	24	59	25.192	4.5	0.9035	2.8	1.8	42.86	236	23

Bibliography

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

Raymond, F. (2003) "Pottery." in S. Coles, S. Ford, and A. Taylor, eds., *White Swan Public House, Yabsley Street, Blackwall, Tower Hamlets*, TVAS Reports 02/54c TVAS, Reading, 5-7

Sumbler, M. G. (1996) *London and the Thames Valley*, HMSO, London.