Characterisation Studies of Fired Clay from the A4146 Stoke Hammond and Linslade Western Bypass

Alan Vince

Samples of Iron Age and medieval fired clay from excavations on the line of the A4146 Stoke Hammond and Linslade Bypass were selected for thin section and chemical analysis (Table 1).

Table 1

TSNO	Action	Site	Context	subfabric	Form
V3380	DR;TS;ICPS	Site B	32214	FAB2	Loomweight
V3381	DR;TS;ICPS	Site B	22019	FAB2	Loomweight
V3615	ICPS	Site D Tr 5	4138	FAB1	Daub?
V3616	ICPS	Site D Tr 5	4135	FAB1	Daub?
V3617	ICPS	Site D Tr 5	4136	FAB1	Daub?
V3618	ICPS	Site D Tr 5	4011	FAB2	Daub?
V3619	ICPS	Site D Tr 5	4001	FAB2	Daub?
V3620	ICPS	Site B	22030	FAB1	Daub?
V3621	ICPS	Site B	22025	FAB1	Daub?
V3622	ICPS	Site B	22034	FAB1	Daub?
V3623	ICPS	Site B	22050	FAB2	Daub?

The main aims of this study were:

- to establish the character of the locally-available clay resources, for comparison with the analysis of Iron Age and medieval pottery from the same sites.
- to determine whether or not there are differences in fabric or chemical composition between fired clay from two separate sites
- to compare the fabric of loom weights, which it has been suggested might in some cases have been an item of trade, with that of daub, which was almost certainly obtained from the closest available source of clay.

Thin Section Analysis

Samples of two Iron Age loomweights were thin sectioned by Steve Caldwell, University of Manchester, and stained using Dickson's method (Dickson 1965). Both had a similar fabric. Unfortunately, it was not possible to thin section the Iron Age or medieval daub for comparison.

The Alan Vince Archaeology Consultancy, 25 West Parade, Lincoln, LN1 1NW

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Description

The following inclusion types were noted:

- Rounded quartz. Abundant grains, up to 0.5mm across, several of which have an opaque coating and/or brown-stained veins.
- Ferruginous sandstone. Sparse subangular fragments up to 4.0mm across consisting of rounded quartz grains in an opaque matrix.
- Flint. Sparse subangular fragments up to 1.5mm long.

The groundmass consisted of poorly-sorted, optically anisotropic baked clay. Some lenses of clay contained sparse angular quartz up to 0.1mm across but the majority contained few visible inclusions. Some lenses of clay had a light colour, indicating low iron content. However, in contrast with other light-firing clays observed in A4146 thin sections these were optically anisotropic and owe their colour to the lack of iron in the clay (i.e. probably kaolinite) rather than the presence of finely-divided calcareous inclusions.

Interpretation

The inclusions are mostly derived from a Lower Cretaceous sand, although the flint is probably derived from the chalk. The groundmass suggests the presence of a fossil deltaic soil. The most likely source for this clay in the Stoke Hammond/Linslade area is the Whitchurch sand, which consists in its lower levels of sandy ironstone masses within unconsolidated quartz sands together with lenses of clay showing seatearth characteristics (1996, 65). It is likely that this is the source of both the quartz and ironstone sand and the clay matrix.

Chemical analysis

Eleven samples of fired clay were analysed using Inductively Coupled Plasma Spectroscopy. The analysis was carried out under the supervision of Dr J N Walsh at Royal Holloway College, London. A range of major elements was measured as percent oxides (App 1) and a range of trace elements was measured in parts per million (App 2).

The silica content was not measured directly but was estimated by subtracting the total oxide count from 100%. All the samples have similar estimated silica contents, ranging from 67.7% to 74.9%, and the mean values for the loom weights, other Iron Age fired clay and medieval fired clay samples were 73.5%, 70.32% and 71.65%.

The data were then normalised to aluminium and analysed using factor analysis using the winstat for excel add-in (Fitch 2001). Five factors were found and the first two of these distinguish the Iron Age from the medieval samples (Fig 1). Factor 5 also partially distinguishes the two groups whilst Factors 3 and 4 did not. Examination of the element weightings ascribed to each element by the analysis suggests that the differences between the two groups are due to higher metal weightings for the Site B clay and loom weights and higher rare earth element weightings for the Trench 5 samples.

These differences could easily be due to post-burial alteration and when a factor analysis was carried out of the least mobile elements only two factors were found, which did not distinguish between the different sites (Fig 2).

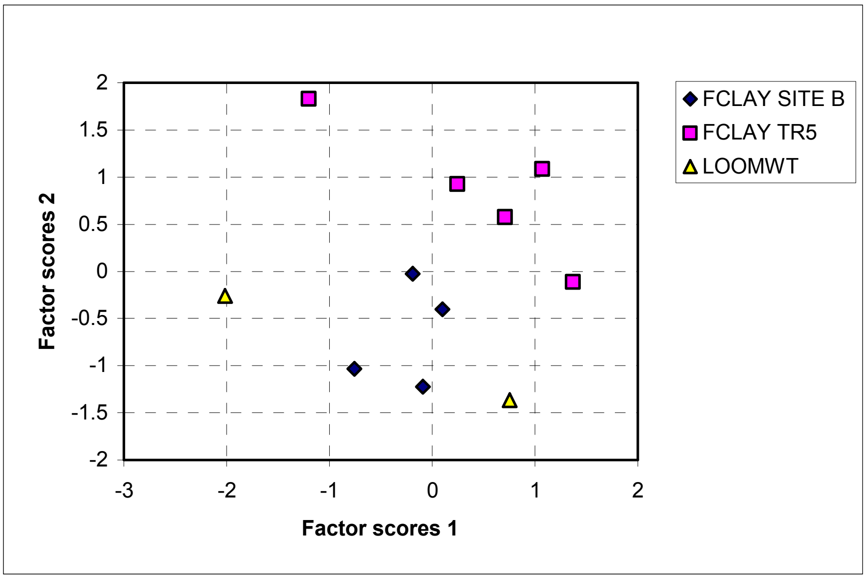

Figure 1

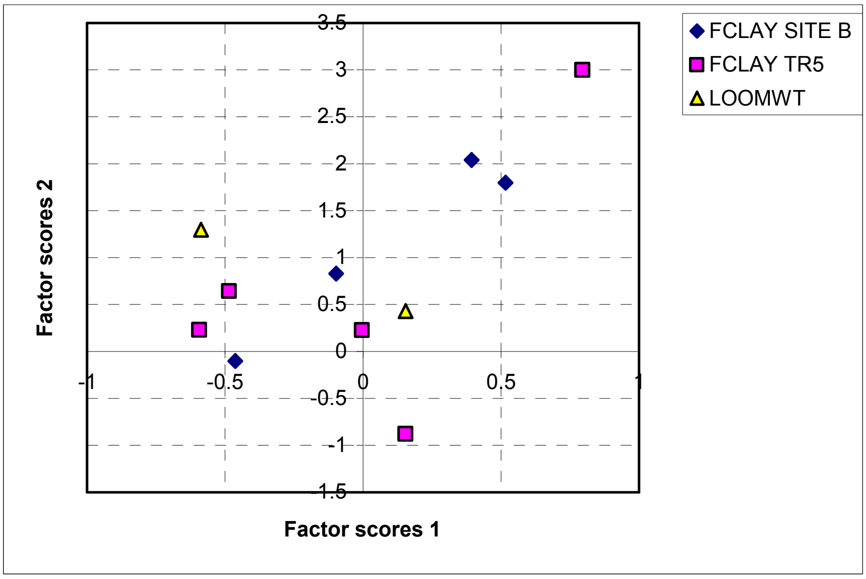

Figure 2

The factor analysis using this restricted set of elements was then repeated for a dataset consisting of the fired clay samples and selected groups of Iron Age and medieval pottery. Again only two factors were found but the bi-plot of their two sets of scores reveals a difference in composition between the two sites (Fig 2). The fired clay from Trench 5 has a higher mean F2 than any of the other samples. High F2 scores are the result of high weightings for vanadium, chromium and iron and suggest that the quantity of ferruginous sandstone fragments in the Trench 5 samples may be higher than in the Site B samples.

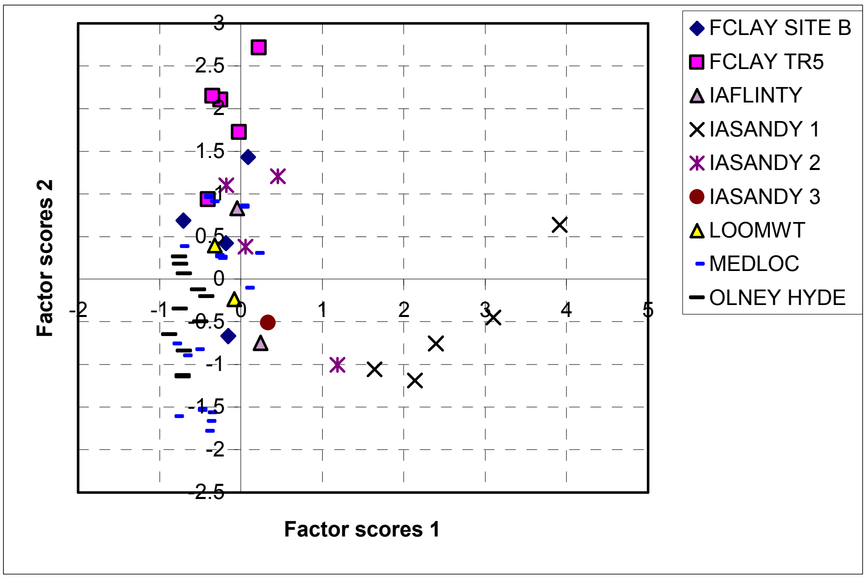

Figure 3

Conclusion

Thin section analysis of two loomweights indicates that they were probably made from a clay composed mainly of Lower Cretaceous clay and sand, perhaps from the Whitchurch Sand formation, which is at the base of the Lower Cretaceous sequence in the Leighton Buzzard area. Since the other fired clay samples from Site B have identical chemical compositions this indicates that the loomweights were probably made from local clay and that they too were made from raw materials derived from the Whitchurch Sand formation. The distinction between the fired clay from Trench 5 and that from Site B seems to be due to a higher quantity of ironstone inclusions. However, there are other differences in composition between the two groups of fired clay which are possibly due to differences in burial conditions between the sites. Nevertheless, it is interesting to note that some of the medieval sand-tempered pottery (MEDLOC in Fig 3) has a similar composition to the Site B samples but that the Iron Age sandy pottery does not. This confirms the non-local origin of the Iron Age pottery but cannot be taken to indicate a local origin for the medieval sandy ware since the same figure also shows that this MEDLOC/Site B group also includes the samples of medieval shelly ware, which thin section analysis makes clear were made from a different raw materials.

Bibliography

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

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

Appendix 1

TSNO	Al2O3	Fe2O3	MgO	CaO	Na2O	K2O	TiO2	P2O5	MnO
V3380	13.62	8.26	0.76	0.78	0.22	2.02	0.55	1.47	0.091
V3381	12.62	8.50	0.75	0.71	0.19	1.44	0.53	0.24	0.096
V3615	11.33	10.81	0.85	0.78	0.44	2.16	0.50	1.25	0.279
V3616	12.28	8.74	0.71	0.59	0.41	1.97	0.58	1.26	0.244
V3617	12.78	8.54	0.78	0.65	0.43	2.05	0.58	0.82	0.183
V3618	12.68	10.02	0.82	1.06	0.34	2.00	0.53	2.04	0.472
V3619	13.62	8.44	0.71	0.85	0.26	2.28	0.64	2.75	0.235
V3620	13.83	8.26	0.83	3.21	0.28	1.85	0.60	1.47	0.082
V3621	13.11	9.26	0.57	0.41	0.21	1.68	0.55	1.40	0.033
V3622	12.44	12.00	0.63	0.65	0.26	2.03	0.53	2.61	0.092
V3623	15.24	10.70	0.75	0.48	0.18	1.25	0.54	0.71	0.019

Appendix 2

TSNO	Ba	Cr	Cu	Li	Ni	Sc	Sr	V	Y	Zr*	La	Ce	Nd	Sm	Eu	Dy	Yb	Pb	Zn	Co
V3380	455	113	23	39	77	14	85	149	34	80	46	66	49	8	2	6	3	40	130	16
V3381	360	110	22	25	73	13	59	155	11	89	21	47	23	3	1	4	2	36	142	12
V3615	588	105	25	51	87	13	102	135	35	116	40	118	48	10	1	6	3	45	145	29
V3616	568	98	26	58	66	13	101	120	29	95	38	92	48	8	1	5	3	36	129	27
V3617	460	100	25	67	74	13	102	127	31	103	39	97	48	9	1	6	3	38	133	24
V3618	797	100	29	52	84	13	172	136	34	91	43	92	47	10	1	7	3	36	155	31
V3619	768	111	22	48	57	14	195	123	22	95	38	116	37	7	1	4	2	39	126	23
V3620	624	106	24	47	58	12	141	103	21	73	40	79	41	8	1	4	3	32	120	17
V3621	302	113	28	44	91	13	50	146	22	67	40	75	41	8	1	4	2	47	127	17
V3622	544	104	32	40	110	12	82	113	30	67	49	92	47	9	1	4	3	49	171	28
V3623	217	142	32	39	48	16	45	134	17	98	34	68	34	7	1	3	2	60	110	16