Characterisation Studies of Selected Medieval Wares from Caldecote, Hertfordshire

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Excavations at Caldecote, Hertfordshire, produced several handmade and wheelthrown wares which shared similar sandy fabrics and are also similar to those found elsewhere in Hertfordshire and in Buckinghamshire and Bedfordshire. In order to try and establish the sources of clay and temper used for these wares, and how many different groups were present, a series of samples were examined by the author using a binocular microscope at x20 magnification. Following this survey, a sampling strategy was devised and 23 samples of Caldecote pottery were analysed (Appendix 1) together with comparative samples from Hitchin.

By eye, the pottery has been divided into four main groups (Medieval coarse plus chalk, Medieval sandy coarse, Hertfordshire Reduced – SHER, and Hitchin-type ware), with one submitted sample being a “one off” (Coded here as “MEDLOC”). Each of these groups at x20 magnification had a slightly different range of inclusion types and groundmass characteristics and these groups were therefore used as the basis for sampling, with one sample from each group selected for thin section analysis and six from each group selected for chemical analysis using Inductively-Coupled Plasma Spectroscopy (ICP-AES). Table 1 shows the main fabric characteristics as noted at x20.

The most common inclusion type was rounded, polished quartz grains (GSQ), some of which were coated with a red clay/iron compound (Red fe-coated GSQ). Fragments of patinated, angular flint, fine-grained calcareous inclusions and shell fragments were also noted, but were much less common.

Table 1

Fabric Group	GSQ	Red fe-coated GSQ	White ang flint	chalk?	shell	Groundmass
MED COARSE + CHALK	y	y	Y	y	n	white
MED SANDY COARSE	y	n	N	n	n	white
MEDLOC	y	y	N	n	y	fine
SHER	y	y	N	y	n	fine
HITCHIN-TYPE	y	y	N	n	y	fine

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http://www.postex.demon.co.uk/index.html

A copy of this report is archived online at
http://www.avac.uklinux.net/potcat/pdfs/avac2005120.pdf

Petrological analysis

Five thin sections were prepared by Steve Caldwell, University of Manchester, and stained using Dickson's method ({Dickson 1965 #44803}) in order to distinguish ferroan from non-ferroan calcite and dolomite.

Medieval Coarse plus Chalk (V3207)

The following inclusion types were noted in thin section:

- Quartz. Abundant rounded grains up to 0.7mm across. Some of these have the characteristic profile of lower Cretaceous quartz grains, whilst others have a very high sphericity, typical of Permo-Triassic sands formed in desert conditions. There was little evidence for a dark or opaque coating on any of the grains, and none for the presence of iron-rich veins, both characteristics of grains from the lower Cretaceous Woburn Sands.
- Feldspar. Sparse subangular fragments of altered feldspar up to 0.3mm across.
- Chert. Sparse rounded and subangular fragments of chert, up to 0.7mm across. None of these in thin section were likely to be flint or lower Cretaceous chert. Most likely, they are of Carboniferous age.
- Calcareous inclusions. Moderate rounded grains of non-ferroan calcite up to 0.5mm across.
- Clay pellets. Moderate rounded fragments with a slightly darker colour than the groundmass but with a similar texture.
- Dark brown to opaque clay/iron. Sparse rounded grains up to 0.5mm across.

The groundmass consists of isotropic light-coloured baked clay minerals and sparse angular quartz, muscovite and rounded dark brown/opaque grains up to 0.05mm across. The texture of the groundmass suggests that it might have been calcareous, although no calcareous inclusions or voids survive, suggesting that if once present they were of clay grade and had been completely replaced by a non-calcareous ceramic during firing. A single chalcedonic microfossil was noted, perhaps a sponge spicule.

The thin section evidence differs from the visual examination in that no flint or red iron-coated quartz grains were present. These must therefore be present in such small quantities that they were not present in the sectioned sample. It was not possible to confirm the identification of the calcareous inclusions as chalk, and all seemed to have been heat-affected and most are now composed of an isotropic, pink-stained mineral.

Medieval Sandy Coarse ware (V3199)

The following inclusion types were noted in thin section:

- Quartz. Abundant grains, including lower Cretaceous and Permo-Triassic grains as in Medieval Coarse plus Chalk. In addition, subangular grains with an opaque coating are present.
- Chert. Sparse grains as in Medieval Coarse plus Chalk
- Feldspar. Sparse grains as in Medieval Coarse plus Chalk
- Dark brown/opaque grains. Moderate grains as in Medieval Coarse plus Chalk
- Clay pellets. Sparse pellets of similar colour and texture to the groundmass, in which inclusions large than 0.1mm are absent.

The groundmass consists of optically anisotropic baked clay minerals, ranging from very light grey to light brown. There are few silt-sized inclusions.

Local Medieval (V3198)

The following inclusion types were noted:

- Quartz. Abundant grains, including lower Cretaceous and Permo-Triassic grains. Subangular grains with an opaque coating are moderately common.
- Calcareous inclusions. Moderate non-ferroan and ferroan rounded calcite fragments up to 0.3mm across. Most are partially heat-altered but surviving fragments include non-ferroan micrite, possibly Chalk.
- Dark brown to opaque grains. Moderate rounded fragments up to 0.5mm across.
- Clay pellets. Moderate rounded fragments, including some off-white inclusionless grains similar to those in Medieval Sandy Coarse ware as well as brown inclusionless grains.
- Glauconite. Sparse rounded brown isotropic grains up to 0.3mm across.
- Flint. Sparse angular, unstained fragments up to 0.5mm across.

The groundmass consists of light brown optically anisotropic baked clay minerals with sparse angular quartz and dark brown specks and streaks.

Hertfordshire Reduced Ware (V3213)

The following inclusion types were noted:

- Quartz. Moderate, mostly subangular monocrystalline grains up to 0.5mm across. Sparse rounded grains with a profile typical of Lower Cretaceous deposits were also present.

- Clay Pellets. Moderate rounded pellets up to 1.5mm across, with a similar colour and texture to the groundmass, some of which show bedding laminations.

The groundmass consists of optically isotropic baked clay minerals, abundant angular quartz up to 0.1mm across, abundant muscovite laths up to 0.1mm long, abundant rounded dark brown grains, usually with a darker outer zone, up to 0.5mm across.

The groundmass of this sample is distinctive and outcrops with similar characteristics occur within the Lower Cretaceous Gault Clay. Typically, this clay forms low land at the foot of the Chalk scarp.

Hitchin-type Ware (V3209)

The following inclusion types were noted:

- Quartz. Abundant rounded grains, some with a profile characteristic of Lower Cretaceous grains and a moderate proportion with opaque coating and iron-rich veins.

- Dark Brown and Opaque grains. Sparse rounded grains, some well rounded, up to 0.5mm across.

- Clay Pellets. Sparse rounded brown pellets with moderate rounded dark brown inclusions up to 0.05mm across.

- Concretions. Sparse spherical concretions, consisting of a dark brown circular stain surrounding clay with the same colour and texture as the groundmass.

The groundmass consists of brown anisotropic baked clay minerals, abundant dark brown angular clay/iron grains up to 0.1mm across, sparse ferroan calcite specks up to 0.1mm and sparse angular quartz up to 0.1mm across.

Hitchin Ware (V3215)

A sample of a waster from the Tilehouse Street site in Hitchin was thin-sectioned for comparison with the Caldecote fabrics. The following inclusion types were noted:

- Quartz. As Medieval Coarse plus Chalk

- Clay Pellets. Moderate rounded anisotropic white clay pellets up to 1.0mm across. These are much lighter than the groundmass, and have a different texture and are therefore definitely detrital clay/mudstone pellets.

- Calcareous inclusions. Moderate rounded fragments, mostly wholly or partially heat-altered and isotropic but include some surviving non-ferroan calcite.

The groundmass is similar to that of the Medieval Coarse plus Chalk sample.

Chemical Analysis

A series of samples were taken for chemical analysis and analysed at Royal Holloway College, London, under the supervision of Dr J N Walsh. The frequency of a range of major and minor elements was determined, as percent oxides for the major elements (Appendix 2) and as parts per million for the remainder (Appendix 3).

Silica is not measured in this process but an estimate of silica content can be obtained by subtracting the total measured oxides from 100%. Fig 1 indicates the silica content, mean and standard deviations for the Caldecote samples. It demonstrates, as might be expected, that the Medieval Sandy Coarse ware samples have a higher mean silica content than the remainder, but that the silica contents of the different fabric groups overlap. In order to compare the chemical composition of the samples, each set of values was normalised to that of Aluminium and it is these normalised values which were then analysed and compared with a range of results from the analysis of Hertfordshire Reduced ware from sites in Bedfordshire and Buckinghamshire (consumer sites at Bedford and Grove Priory, Linslade, and production sites at Chandler's Cross, Hitchin, Little Munden and Nettleden) and of Late Medieval Reduced ware from production sites in the two counties (Brickhill, Everton, Flitwick and Riseley).

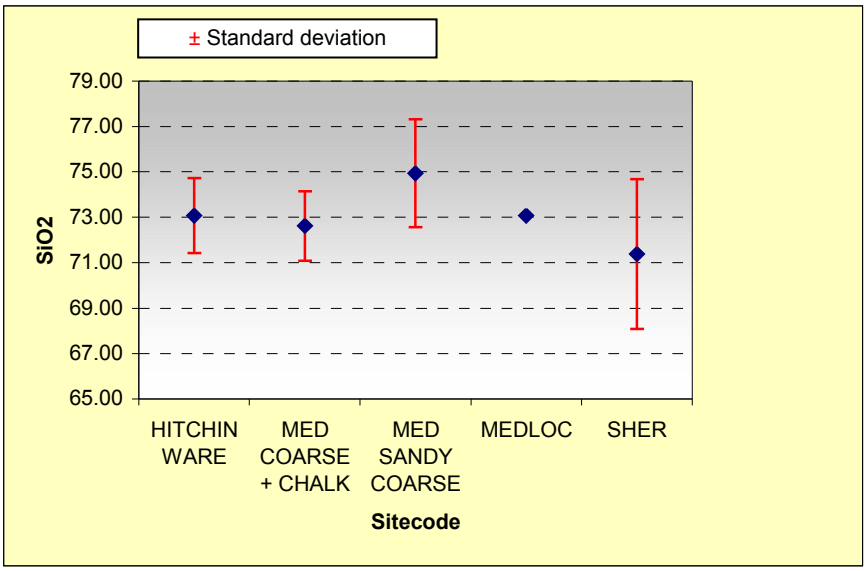

Figure 1

Factor analysis was first undertaken of all the chemical data, but it was found that the frequency of Calcium and Strontium was heavily affected by post-burial leaching and the analysis was then repeated, omitting these two elements, phosphorus (present as post-burial concretions in the pores of some samples) and the Rare Earth Elements (which bind easily to phosphorus). This analysis showed that there were four main factors which accounted for 51% of the variation in the dataset.

A plot of F1 against F2 scores (Fig 2) shows that the Caldecote samples fall into two main groups, one of which is characterised by negative F1 scores and high F2 scores and the other of which has positive F1 scores and neutral F2 scores. The Grove Priory (Linslade) and Nettleden samples form clear clusters which have strong negative F2 scores, and these two groups can therefore be discounted as parallels for the Caldecote samples.

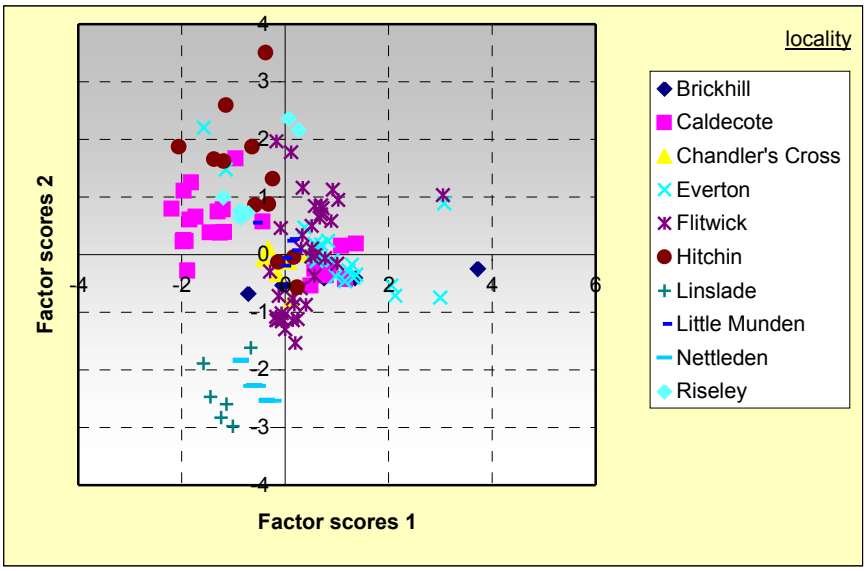

Figure 2

Fig 3 shows the same data, excluding the two outlying groups, grouped by fabric group. This shows that the samples with negative F1 and high F2 scores are Medieval Coarse plus Chalk and Medieval Sandy Coarse, the single local medieval sample, the Riseley and Hitchin Tilehouse Street wasters; clay samples from Flitwick Wood and Riseley and two samples from Everton.

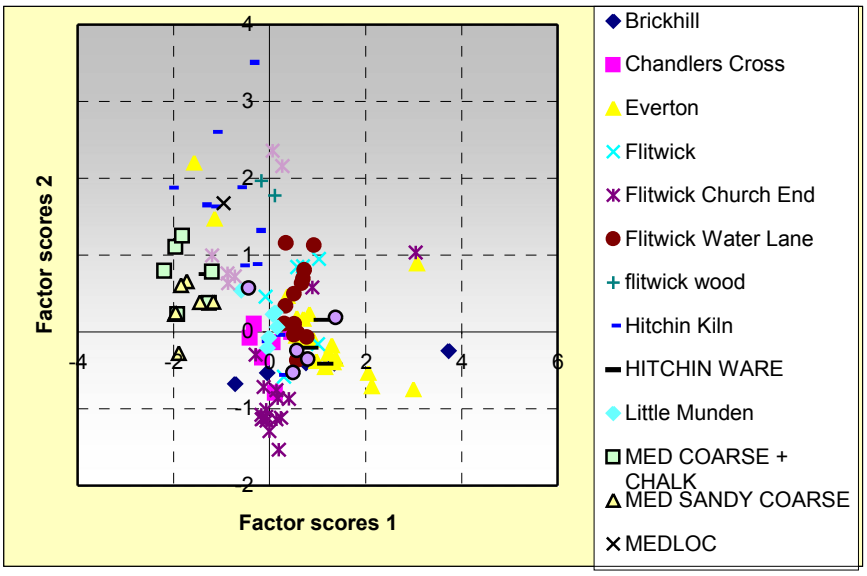

Figure 3

Within this grouping, however, it is possible to distinguish the two main Caldecote fabrics from the remainder, and it therefore seems that these two Caldecote groups were made with raw different materials from any of the comparanda. The local medieval sample, however, is indistinguishable from the Hitchin waster samples.

The second group of samples, with high F1 and neutral F2 scores, includes the Caldecote Hitchin-type ware samples, the Caldecote Hertfordshire Reduced ware samples and the Brickhill, Chandler's Cross, Everton, Little Munden and Flitwick samples. One group, however, the Flitwick Church End samples, has a stronger negative F2 scores than any of the remainder and can therefore be excluded as a possible source for the two Caldecote fabrics.

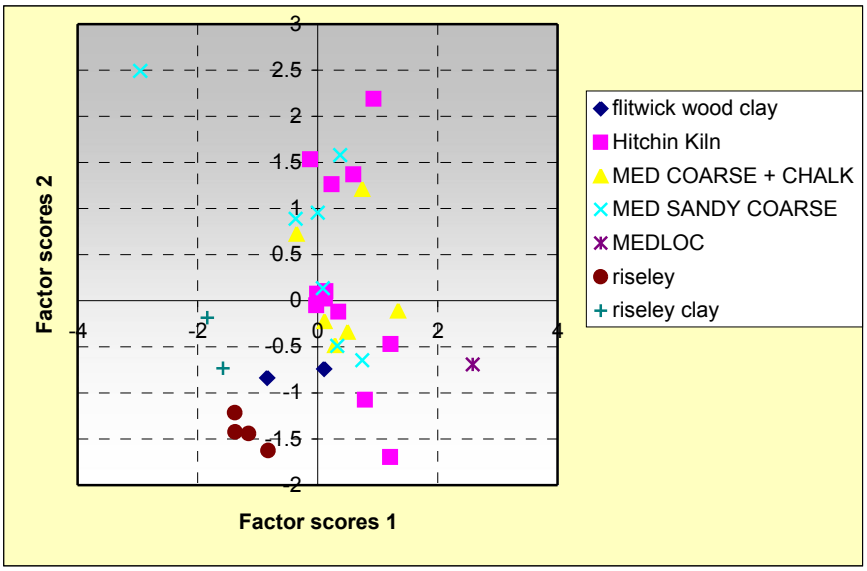

Figure 4

A factor analysis of the first group of samples, on their own, shows that plotting the new F1 and F2 scores the Riseley and Riseley clay samples can be distinguished, as can the Caldecote medieval local sample, whilst the Hitchin kiln, and Medieval Coarse plus Chalk and Medieval Sandy Coarse samples form one cluster (Fig 4). Plotting the new F3 and F4 scores, however, shows that the two main Caldecote fabrics can be distinguished from the Hitchin and Riseley samples, which are themselves separate clusters (Fig 5).

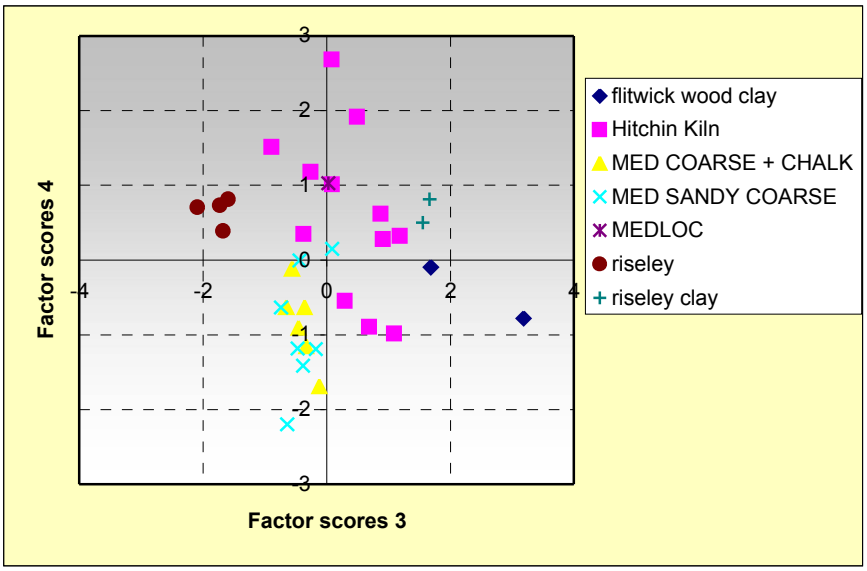

Figure 5

A factor analysis of the second group, which includes the Caldecote Hitchin-type ware and Hertfordshire Reduced samples, shows that there are three main factors. A plot of F2 against F3 scores (Fig 6) is the most informative and indicates that the Flitwick Church End samples, the Everton fired clay samples, one Brickhill sample and one of the Caldecote Hertfordshire Reduced samples form a group, as do the Little Munden and Chandler's Cross samples. The remainder form a third cluster, consisting of the Caldecote samples at one end (distinguished by higher F2 scores) with the Brickhill, Everton and Flitwick Water Lane samples at the other.

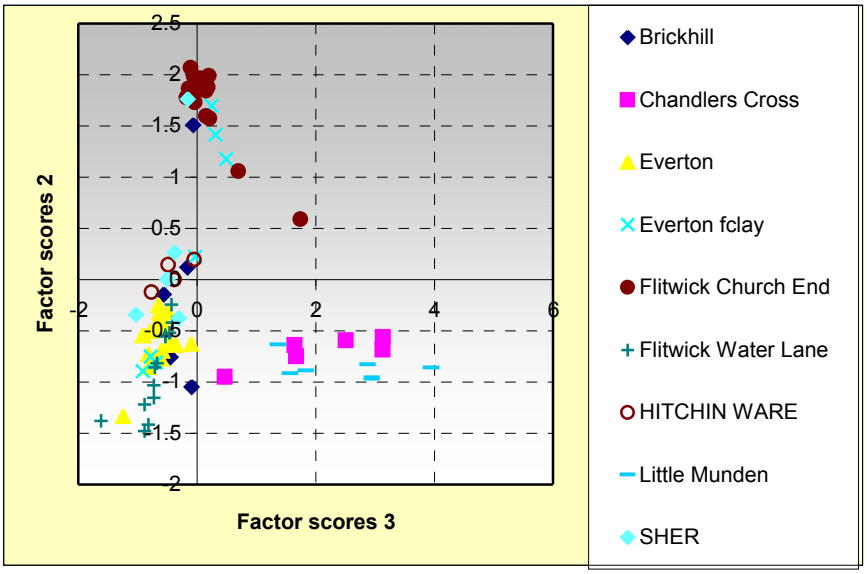

Figure 6

A factor analysis of this dataset omitting Little Munden and Chandlers Cross confirms that the Caldecote samples are chemically similar to those from Flitwick Church End and Everton and can be distinguished from the Brickhill samples.

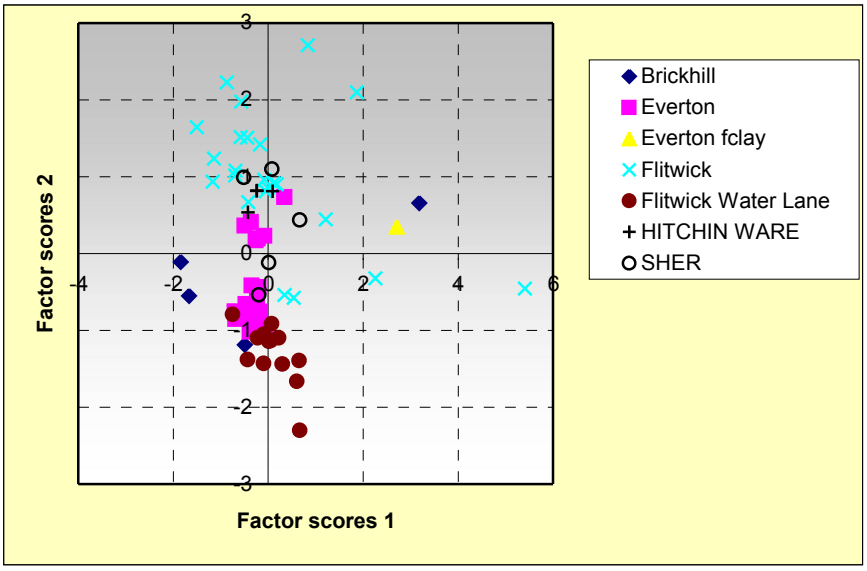

Figure 7

Integration of Petrological and Chemical Analyses

There is a coincidence of petrological and chemical evidence which both group the Medieval Coarse plus Chalk, the Medieval Sandy Coarse, and the Hitchin waster fabrics together. Petrologically, all contain a mixture of Permo-Triassic and Lower Cretaceous quartz grains which indicates the presence of a Quaternary sand or boulder clay whilst chemically they form one of the two main chemical groups present in the comparative data. Both petrological and chemical analyses, however, indicate that the three groups have different compositions and this probably can be interpreted to say that the three groups come from different sources, one of which is Hitchin. Given the proximity of Hitchin to Caldecote, it is likely that the Medieval Coarse plus Chalk and Medieval Sandy Coarse wares are “local” to the site, although it would require a detailed study of the Quaternary geology of the area to see if the actual source of the clay and temper could be identified and therefore the sources localised. Turning back to the petrology, the groundmass of the Medieval Sandy ware indicates a clay low in iron and with few inclusions. Such clays outcrop within the Jurassic sequence, as do calcareous clays, and since these Jurassic clays do not outcrop close to Caldecote, it is likely that the parent clays are boulder clays composed in the main of redeposited Jurassic clays.

In thin section the quartz grains with iron-veins and an opaque coating are probably derived from the Woburn Sands and are only present in quantity in the Caldecote Hitchin-type ware sample. Chemical analysis indicates that this ware and the Caldecote Hertfordshire

Reduced ware (which thin section analysis indicates was made from Gault Clay, or perhaps boulder clay composed mostly of redeposited Gault Clay) have similarities with the products of the Everton and Flitwick production centres. The former site is about 13 miles north of Caldecote and the latter about 17 miles west. In both cases, the sites are probably overlying earlier geological deposits than those at Caldecote itself.

Despite the tentative visual identification of chalk in Medieval Coarse plus Chalk ware, chalk and flint were only noted in thin section in the medieval local ware sample, although it is likely that flint, in small quantities, is present in the Quaternary sands and clays suggested as the probable raw materials from the Medieval Coarse plus Chalk and Medieval Sandy Coarse ware, derived from outcrops of chalk to the north and northeast of Caldecote rather than from the local chalk outcrop.

Appendix 1

TSNO	Sitecode	Context	cname	Form	Action
V3198	546cpx	E2526	MEDLOC	JAR	ICPS;TS
V3199	546cpx	E2512	MED SANDY COARSE		ICPS;TS
V3200	546cpx	E2512	MED SANDY COARSE		ICPS
V3201	546cpx	D1557	MED SANDY COARSE		ICPS
V3202	546cpx	A119	MED COARSE + CHALK		ICPS
V3203	546cpx	D1633	MED COARSE + CHALK		ICPS
V3204	546cpx	A119	MED COARSE + CHALK		ICPS
V3205	546cpx	A119	MED COARSE + CHALK		ICPS
V3206	546cpx	A119	MED COARSE + CHALK		ICPS
V3207	546cpx	A119	MED COARSE + CHALK		ICPS;TS
V3208	546cpx	A119	HITCHIN-TYPE WARE	JAR	ICPS
V3209	546cpx	A119	HITCHIN-TYPE WARE	PANC	ICPS;TS
V3210	546cpx	E2534	SHER	JAR	ICPS
V3211	546cpx	D1633	SHER	JAR	ICPS
V3212	546cpx	D1560	SHER		ICPS
V3213	546cpx	D1560	SHER		ICPS;TS
V3214	546cpx	D1560	SHER		ICPS
V3218	546cpx	A119	HITCHIN-TYPE WARE?		ICPS
V3219	546cpx	A137	MED SANDY COARSE		ICPS
V3220	546cpx	A111	MED SANDY COARSE		ICPS
V3221	546cpx	B502	MED SANDY COARSE		ICPS
V3222	546cpx	D1633	MED SANDY COARSE		ICPS

TSNO	Sitecode	Context	cname	Form	Action
V3223	546cpx	A119	SHER	JAR	ICPS

Appendix 2

TSNO	Al2O3	Fe2O3	MgO	CaO	Na2O	K2O	TiO2	P2O5	MnO
V3198	14.8313	6.35	0.85	1.99	0.26	1.56	0.67	0.38	0.031
V3199	15.7625	4.13	0.91	0.72	0.22	1.43	0.6	0.1	0.017
V3200	15.9953	4.02	0.92	0.74	0.24	1.49	0.61	0.09	0.014
V3201	15.8983	4.71	0.95	1.17	0.19	1.32	0.61	0.09	0.013
V3202	17.2175	4.83	0.92	2.07	0.27	1.49	0.74	0.12	0.049
V3203	15.3163	4.67	0.91	0.74	0.22	1.89	0.66	0.2	0.035
V3204	15.9565	5.04	0.89	2.38	0.3	1.45	0.63	0.29	0.025
V3205	18.8083	4.68	1.1	1.89	0.26	1.62	0.68	0.18	0.022
V3206	16.4706	4.35	0.93	3.07	0.29	1.66	0.67	0.34	0.055
V3207	15.7237	5.27	1	2.7	0.25	2.1	0.68	0.14	0.031
V3208	13.5218	4.58	1.08	7.31	0.16	1.75	0.58	0.32	0.044
V3209	13.4539	6.68	1.06	2.31	0.13	2.05	0.65	0.21	0.03
V3210	14.9283	7.37	0.87	1.47	0.25	1.9	0.73	0.14	0.024
V3211	15.1029	7.43	1.2	2.92	0.17	2.94	0.82	0.72	0.076
V3212	13.7546	6.64	1.11	1.07	0.24	2.06	0.69	0.13	0.026
V3213	13.8322	6.05	1.41	0.93	0.22	2.17	0.85	0.08	0.015
V3214	15.8013	6.94	1.26	4.9	0.19	2.6	0.75	0.28	0.04
V3218	13.4248	6.55	1.05	2.03	0.13	1.99	0.65	0.13	0.037
V3219	14.8022	4.14	0.76	0.89	0.23	1.35	0.67	0.12	0.014
V3220	15.3551	4.89	1.13	5.76	0.17	2.09	0.62	0.17	0.041
V3221	14.6761	5.28	0.78	1.04	0.23	1.44	0.63	0.12	0.023
V3222	15.4618	4.81	0.96	0.73	0.21	1.91	0.67	0.26	0.032
V3223	13.4248	6.3	1.02	2.13	0.14	1.98	0.63	0.15	0.026

Appendix 3

TSNO	Ba	Cr	Cu	Li	Ni	Sc	Sr	V	Y	Zr*	La	Ce	Nd	Sm	Eu	Dy	Yb	Pb	Zn	Co
V3198	530	110	32	63	58	16	136	144	27	105	39	78	41	7	1	4	3	55	160	16
V3199	290	109	29	89	49	15	74	137	27	81	39	84	41	8	2	5	3	64	81	18
V3200	284	112	30	88	50	15	73	138	31	72	44	96	47	9	2	6	3	80	74	22
V3201	284	112	29	106	61	16	76	145	24	80	42	94	44	7	2	5	3	63	108	20
V3202	300	117	28	93	52	16	93	152	25	75	42	89	44	8	2	5	3	58	88	19
V3203	446	110	25	67	53	15	79	136	24	77	43	82	45	7	1	5	3	53	74	19
V3204	536	116	36	79	54	17	135	148	33	81	45	92	48	9	2	6	3	42	98	16
V3205	406	131	44	117	62	20	106	175	39	93	52	109	56	12	3	7	4	62	107	20
V3206	585	113	40	73	52	16	153	140	31	84	44	102	47	8	2	6	3	43	92	17

TSNO	Ba	Cr	Cu	Li	Ni	Sc	Sr	V	Y	Zr*	La	Ce	Nd	Sm	Eu	Dy	Yb	Pb	Zn	Co
V3207	350	112	29	77	55	16	104	138	33	79	43	88	45	8	2	5	3	57	104	18
V3208	429	78	25	76	60	12	280	88	19	75	30	67	31	6	1	3	2	42	74	14
V3209	404	114	25	49	51	13	119	147	20	104	36	72	37	5	1	3	3	36	90	18
V3210	370	106	29	58	51	14	92	132	25	69	42	73	43	7	1	4	3	52	119	19
V3211	592	130	35	50	54	15	174	157	22	115	39	83	40	5	1	4	3	36	110	20
V3212	285	108	21	62	43	13	123	136	17	82	34	65	35	4	1	3	2	46	76	20
V3213	303	102	23	85	49	14	91	118	15	89	31	78	32	6	1	3	2	48	70	22
V3214	334	131	21	68	52	15	198	168	20	94	36	80	37	5	1	4	3	48	92	22
V3218	656	115	23	48	53	13	110	144	20	104	34	73	35	5	1	3	3	59	92	21
V3219	370	103	19	65	38	14	85	122	18	79	31	63	32	4	1	3	2	46	57	13
V3220	310	89	26	153	56	13	249	106	16	61	31	69	32	5	1	3	2	58	73	18
V3221	341	105	24	72	48	14	78	128	22	67	34	69	35	6	1	4	2	50	84	16
V3222	473	114	22	69	52	16	84	141	25	81	43	82	45	6	2	5	3	36	76	17
V3223	411	114	26	47	51	13	108	143	18	94	34	69	35	5	1	3	2	45	89	19