

Characterisation Studies of Iron Age and Late Medieval Pottery from Southeast Bedfordshire (WIS01)

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Archaeological fieldwork undertaken by Network Archaeology on a pipeline route in southeast Bedfordshire revealed several Iron Age occupation sites and one group of late medieval pottery production waste which the ceramic specialist, Anna Slowikowski, recommended would repay examination. For the Iron Age pottery the main question posed was whether the pottery from one of the sites might have been produced on site and, secondly, whether the examples of a similar ware found on other sites might have been made at this site. For the Late Medieval ware the main question was whether it was possible to distinguish the products of this newly-discovered production site from those made at the Flitwick.

Methodology

Initial examination at x20 magnification using a binocular microscope suggested that the Late Medieval Reduced Ware samples would be too fine-textured to reveal much useful detail in thin section and therefore two samples from each group were sectioned to provide a guide to their petrological description and three samples of each were submitted for chemical analysis.

The thin sections were prepared at the Department of Earth Sciences, University of Manchester, by Mr S Caldwell and were stained using Dickson's method. This staining enables ferroan and non-ferroan calcite to be distinguished from dolomite, all of which are impossible to distinguish in thin section otherwise.

The chemical analyses were carried out on subsamples of 1-2gm from which the outer surfaces were mechanically removed and the remainder crushed to a fine powder. This procedure is more destructive than the standard sampling procedure of drilling with a tungsten carbide-tipped drill but reduces the chance of the sample being biased by the presence of single large inclusions. The fine powders were analysed at the Department of Geology, Royal Holloway College, under the supervision of Dr J N Walsh. The composition of the samples was determined using Inductively Coupled Plasma Spectroscopy using the laboratory's standard routine with the addition of lead (Pb), measured for all samples as an indicator of glaze contamination.

Analysis

Iron Age

Nine samples were thin-sectioned. These came from three different sites: 14, 23 and 52. Six of the samples had been assigned to a fabric group by Ms Slowikowski: 5 to fabric 28 and one to fabric 19. The remaining three samples, all from Site 14, were not assigned to a fabric group.

Each thin section was examined using a petrological microscope at x40 magnification with recourse to x100 magnification to examine the groundmass. The following inclusions were present:

- Well-rounded grains of quartz with a low sphericity. Some of these grains contain iron-stained veins. These grains are likely to have originated in the Lower Cretaceous Woburn Sands, which outcrop in central Bedfordshire, to the north of these sites. There were variations in the maximum size of these grains (sample V2015 contained grains up to 2.0mm across, the remainder had no grains larger than 1.0mm) and in their frequency (in most cases they were sparse but in three samples, V2012-4, they were moderately abundant).
- Well-rounded quartzose grains with a high sphericity. Many of these grains were polycrystalline, some having deformed boundaries suggesting that they originated in metamorphic rocks. These grains are similar to those found in Triassic rocks, such as the Sherwood Sandstone, and a common constituent of quaternary sands in southern and midland England. In most of the samples these grains were abundant but in two, V2015 and V2020, they were only moderately abundant. A consistent element within these grains was the presence of chert, noted in every sample. This chert consisted mainly of homogenous cryptocrystalline silica with no sign of structure, unlike the lower Cretaceous chert which was present in just one sample (V2013).
- Subangular quartz grains, less than 0.3mm across. These grains were absent in one sample (V2014) and abundant in two others (V2012-3). In the remainder they were sparse.
- Rounded opaque grains, black in reflected light, up to 1.0mm across but often much smaller. These grains were mainly sparse and were absent altogether in two samples (V2017 and V2019). They were, however, abundant in sample V2012. Such grains probably have multiple origins but the frequency of the inclusions in sample V2012 suggests that these may have originated in the Woburn Sands.
- Calcareous inclusions and voids which probably contained calcareous inclusions were mainly absent but in two samples sparse angular ferroan calcite inclusions up to 0.5mm across were present (V2012 and V2017) and in two large rounded voids, up to 1.0mm across, were present. These might have contained quartz grains, plucked from the sample during preparation, but all the remaining quartz grains in these samples were smaller (samples V2013 and V2014).
- Large, angular, brown-stained flint fragments were present in four of the samples. In most cases the fragments were several mm across and only one or two occurred in each section (samples V2014, V2015 and V2017) and in one case the largest fragment was only 0.5mm across (V2013).

- Organic inclusions were present in all but two of the samples (V2014 and V2015). In most cases they were moderately abundant but in two they were only sparse (V2012 and V2018). In some cases a charred cellular structure remains but in most the inclusions are present as linear voids about 0.2mm wide, sometimes containing an amorphous opaque remnant. These inclusions do not look identical to those in Anglo-Saxon chaff-tempered ware, which were probably produced by including animal dung in the potting clay.
- The only other inclusions noted were a fragment of lower Cretaceous chert in V2013, moderate subangular fragments of a sandy grog in V2015 (these were isotropic, suggesting that they had been fired at a temperature in excess of 900 degrees centigrade, unlike the remainder of the vessel), moderate altered glauconite in sample V2012 and sparse laths of muscovite up to 0.1mm in sample V2020.
- The groundmass of these samples was anisotropic, suggesting a low firing temperature, and contained varying quantities of angular quartz silt. In four samples this was sparse (V2012, V2014, V2018 and V2020). In one case it was moderately abundant (V2019) and in four instances it was abundant (V2013, V2015-7).

It is difficult to interpret these results. There are no obvious groups present and in most cases a variation in frequency or presence in one inclusion type is not matched by variations in any other inclusion types. It is clear, in any case, that the samples were all tempered with a mixed sand, of Quaternary or recent origin, which contains a mixture of Triassic and Cretaceous material. The organic inclusions have not been identified and might have been deliberately added or the result of selecting an organic clay (such as might occur in ponds or riverbanks).

Three samples of clays and sands from the area of Site 52 were collected by Mark Ward of Network Archaeology. The site lies on an area of alluvium and head but is close to areas of Greensand, the Ampthill clays and glacial sands and gravels. There is no evidence from the thin sections for the use of either the Greensand or the Ampthill clay (which is glauconitic) apart from, possibly V2012, where the quantity of iron-rich pellets and altered glauconite suggests the presence of Woburn sands.

Sample 1 is a sandy clay, Sample 2 is a clay and Sample 3 a loosely-cemented clayey sand. Rounded calcareous inclusions up to 1.0mm across are present only in the clay whereas polished quartz grains and rounded spherical grains are present in all three samples. No samples contained angular flint fragments, and rounded black iron-rich pellets were only noted in the clay (and were not common). All three samples showed signs of poor mixture of materials of different colour and texture, including a haematite-rich clay. The clay included lenses and pellets of quartz-free clay, apparently containing calcareous shell fragments about 0.3mm across and less than 0.1mm thick. These were not seen in any of the thin sectioned samples.

In conclusion, whilst a number of the traits noted in the pottery samples occur locally in the three samples there are also some differences. Only two of the samples are sufficiently different to warrant

having a separate fabric groupings, V2012 (because of the abundant opaque pellets and glauconite) and V2014, which contains no subangular quartz and therefore has a finer texture. However, even these two samples contain the same mixed quartzose sand and given the evidence from the clay and sand samples for variability in the local resources even these differences may be insignificant in terms of locating the place or places of manufacture.

Table 1

TSNO	GSQ	RQ	SAQ	RFE	Ca	Flint	Organics	Silt	Others
M V2012	>1.0MM	A	A	A	S FERROAN ANG	NONE	S	S	M RED glauconite
M V2013	>1.0MM	A	A	S	ROUND VOIDS >1.0MM	S >0.5MM ANG	M	A	CHERT MICROFOSSIL
M V2014	>1.0MM	A	NONE	S	ROUND VOIDS >1.0MM	S	NONE	S	
S V2015	>2.0MM	M	S	S	NONE	S	NONE	A	ISOTROPIC SANDY GROG >1.0MM
S V2016	>1.0MM	A	S	S	NONE	NONE	M	A	
S V2017	>1.0MM	A	S	NONE	S FERROAN ANG	S	M	A	
S V2018	>1.0MM	A	S	S	NONE	NONE	S	S	
S V2019	>1.0MM	A	S	NONE	NONE	NONE	M	M	
S V2020	>1.0MM	M	S	S	NONE	NONE	M	S	S MUSCOVITE >0.1MM

Medieval

Samples from a 1984 waster dump at Flitwick were analysed alongside those from Site 76.

The petrological analysis revealed a similar range of inclusions as those noted in the Iron Age samples (Table 2). The only differences were the absence of organic inclusions and the fact that the calcareous inclusions had been heat altered, leaving behind an amorphous material in the resulting voids (absent from pores and laminae in the fabric). The main difference between the fabrics were that there was no subangular quartz and less quartz silt in the 1984 Flitwick samples than in the samples from Site 76. This textural difference may be sufficient to distinguish the two groups in the hand specimen.

TSNO	GSQ	RQ	SAQ	R Q	R CHERT	R FE	Ca	LARGE BROWN- STAINED FLINT	ORGANICS	Q SILT	GLAUCONITE
V2011S	>1.0MM	A	A	S	S	S	BURNT	NONE	NONE	M	NONE
V2010S	>1.0MM	A	A	NONE	M	S	BURNT	S	NONE	M	S

V2006S >1.0MM	A	NONES	S	NONE	NONE	NONE	S	NONE
S >1.0MM								
V2007FESTAINEDA		NONES	M	S BURNT	NONE	NONE	S	NONE

The chemical data were analysed using factor analysis, having first excluded any elements which might be affected by firing, leaching and subsequent deposition in the voids (CaO, P₂O₅, Ba and Sr) and normalising the data to Al₂O₃. There was no evidence for glaze contamination, all samples having local Pb values between 31 and 58 ppm, well within the range found in unglazed pots. Four major factors were found. A plot of F1 against F2 showed that the 1984 samples have negative F2 scores whilst the 2001 samples have positive F2 scores. The F3 and F4 scores, however, show no correlation with site. Negative F2 scores are mainly due to Cr and Zn whilst positive scores are due to Ni, Sc, TiO₂, Co and Zr. This suggests the subangular quartz sand and silt in the Site 76 samples is rich in Zircon and Titanium-rich minerals. Nickel and Cobalt are likely to be present in the latter minerals, substituting for titanium. Of the four excluded elements, three show a strong difference between the two groups: CaO, P₂O₅ and Sr, all being higher in the 1984 samples. This, however, is likely to be due at least in part to differences in burial conditions and the thin sections suggest that originally the two groups had similar quantities of calcareous inclusions.

Given the observed variability in the Iron Age pottery and the local clay and sand samples, larger samples would be needed to test whether these observed differences in petrology and chemistry are indeed typical of the entire production at these two sites but the present study does at least indicate that both methods of analysis have the potential to differentiate between the products of the two production sites.

Appendix One: List of samples

TSNO	locality	Sitecode	Context	cname	AS Fabric Group	Action
V2020	Flitwick	wis01s52	10228	IASANDY	F19	TS
V2019	Flitwick	wis01s52	10323	IASANDY	F28	TS
V2018	Flitwick	wis01s52	10311	IASANDY	F28	TS
V2017	Wilstead	wis01s23	3020	IASANDY	F28	TS
V2016	Wilstead	wis01s23	3097	IASANDY	F28	TS
V2015	Wilstead	wis01s23	3217	IASANDY	F28	TS
V2014	Wilstead	wis01s14	2070	IASANDY		TS
V2013	Wilstead	wis01s14	2022	IASANDY		TS
V2012	Wilstead	wis01s14	2106	IASANDY		TS
V2011	Flitwick	wis01s76	10614	LMRW		TS;ICPS
V2010	Flitwick	wis01s76	10408	LMRW		TS;ICPS
V2009	Flitwick	wis01s76	10410	LMRW		ICPS
V2008	Flitwick	1984/3	3	LMRW	BEDFORDSHIRE E01	ICPS
V2007	Flitwick	1984/3	3	LMRW	BEDFORDSHIRE E01	TS;ICPS
V2006	Flitwick	1984/3	3	LMRW	BEDFORDSHIRE E01	TS;ICPS

Appendix Two: ICPS Analyses. Major elements, measured as percent oxides

TSNO	Al2O3	Fe2O3	MgO	CaO	Na2O	K2O	TiO2	P2O5	MnO
V2010	13.7	5.5	1.1	0.62	0.18	1.93	0.65	0.15	0.018
V2011	11.62	6.1	0.56	0.62	0.16	1.35	0.79	0.13	0.085
V2008	13.89	6.76	1.06	1.23	0.2	1.88	0.67	0.69	0.12
V2009	12.78	6.96	1.02	0.6	0.24	1.71	0.8	0.2	0.047
V2007	13.67	7.14	1.04	1.66	0.25	2.03	0.65	0.8	0.064
V2006	13.48	8.18	0.95	0.94	0.17	1.78	0.62	1.01	0.04

Appendix Three: ICPS Analyses. Minor and Trace elements, measured as parts per million

TSNO	Ba	Cr	Cu	Li	Ni	Sc	Sr	V	Y	Zr*	La	Ce	Nd	Sm	Eu	Dy	Yb	Pb	Zn	Co
V2006	491	104	26	41	67	13	135	147	20	75	41	93	42.394	6.746	1.491	4.1	2.4	58.12	129	18
V2007	383	106	18	47	55	13	163	141	17	70	37	72	37.976	5.758	1.243	3.4	2.1	54.43	105	21
V2008	419	104	18	46	55	13	153	147	14	73	35	85	35.814	4.972	1.062	3.1	1.9	39.51	105	21
V2009	359	90	25	56	96	13	81	124	15	138	29	82	30.362	5.612	1.152	3.3	2.1	47.72	82	25

TSNO	Ba	Cr	Cu	Li	Ni	Sc	Sr	V	Y	Zr*	La	Ce	Nd	Sm	Eu	Dy	Yb	Pb	Zn	Co
V2010	266	106	23	105	96	13	68	117	16	85	34	89	34.874	5.55	1.125	3.1	1.9	40	81	25
V2011	282	79	21	42	75	12	77	117	18	117	34	78	35.532	5.67	1.295	3.8	2.2	31.98	78	22