Petrological Analysis of some Iron Age pottery from Kent

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Method

Samples of fifteen Iron Age pottery vessels from sites in Kent were submitted for analysis. Thin-sections were prepared and stained using Dickson's method. The thin-sections have been given the codes AG106 to AG120 and are at present part of the author's reference collection. Ultimately, they will be deposited in the Department of Scientific Research at the British Museum. Sub samples were then prepared by having their surfaces and broken edges removed and the remaining sample was then crushed and submitted to Royal Holloway College London for Inductively Coupled Plasma Spectroscopic analysis (ICPS). A qualitative analysis of the thin-sections was carried out and the results recorded in a Microsoft Access database. The ICPS data was analysed using WinBASP (the Bonn Archaeological Statistics Package) using both cluster analysis and principal components analysis.

TS NO	site name	locality	Fabric	Sitecode	Context	Group
AG106	Archers Low	Sandwich		als-87-67	T22	1
AG107	Folkestone 1988	Folkestone	FPF FABRIC F172	ct f25a 88	207	2
AG108		Whitfield	DPF FABRIC 13	web95/2	223	3
AG109		Whitfield	DPF FABRIC 13	web95/2	311	3
AG110	Dover Spine Main	Dover	DPF FABRIC 55	dsm96	2	1
AG111		Whitfield	DPF FABRIC 24	web95/2	256	4
AG112	Dover Spine Main	Dover	DPF FABRIC 54	dsm96	2	5
AG113		Whitfield	DPF FABRIC 21	web95/2	249	2
AG114		Whitfield	DPF FABRIC 26	web95/2	3	1
AG115	Folkestone 1988	Folkestone	FPF FABRIC 74	ct f25a 88	1	1
AG116	Folkestone 1988	Folkestone	FPF FABRIC 76	ct f25a 88	1	1
AG117		Whitfield	DPF FABRIC 23	web95/2	256	2
AG118		Whitfield	DPF FABRIC 26	web95/2	260	2
AG119	Folkestone 1988	Folkestone	FPF FABRIC 75	ct f25a 88	1	1
AG120	Dover Spine Main	Dover	DPF FABRIC 26 (VARIATION)	dsm96	2	1

Results

Petrological analysis allowed the pottery to be divided into several distinct fabric groups, based on their major inclusions. These are described below.

Group One - Quartz sand tempered (AG106, AG110, AG114, AG115, AG116, AG119, AG120)

Seven samples contained fine quartzose sand, composed of subangular quartz grains between 0.2 and 0.4mm across, often with iron stained veins. Rounded chert grains, up to .04mm across, are a minor component of this sand. The clay matrix contains moderate quartz silt and is optically anisotropic.
In the hand specimen some of these samples contained large calcareous inclusions but none were seen in the thin-sections. In one sample, AG106, the vessel had been overfired, giving rise to voids surrounded by yellowish reaction rims.

Group Two - Glauconite tempered (AG107, AG113, AG117, AG118)

Four samples were tempered with a glauconitic sand, composed almost entirely of round grains of brownish, altered glauconite, with a small quantity of rounded quartz, both up to 0.2mm across. The clay matrix was free of visible inclusions.

Group Three - Limestone tempered (AG108, AG109)

Two samples contained abundant rounded fragments of micrite composed of non-ferroan calcite. This limestone had a heterogeneous texture and was not typical of chalk as found in pottery fabrics, much of which contains spherulitic microfossils. The inclusions in this case are derived from a calcite mudstone. One of the samples, AG108, contained sparse rounded quartz grains absent from the other sample. The clay matrix of this group was anisotropic and contained moderate quartz silt.

Group Four - Calcareous chert tempered (AG111)

A single sample contained moderate angular fragments of a chert, interleaved with ferroan calcite. Chalk is typically composed of non-ferroan calcite and thus this chert is unlikely to be flint cortex. The sample also contained sparse subangular quartz and had an anisotropic clay matrix containing moderate quartz silt.

Group Five - Grog tempered (AG112)

A single sample contained abundant fragments of grog, together with sparse subangular quartz grains with iron stained veins and rounded and angular flint fragments. The anisotropic clay matrix contained sparse to moderate quartz silt.

ICPS Analysis

Various clustering techniques were used to analyse the data, varying the methods of similarity calculation (Euclidian, average and Chi Square) and the methods of treating the frequency data (unchanged, square root and standardised). Few consistent clusters could be seen, with the exception of the grog-tempered AG112 which never clustered with any other sample. In most cases, however, three of the four Group 2 samples clustered together, as in Fig 1 below.

Near Neighbour Clustering of Kentish IA
Distance Measure: Average Distance of square rooted frequencies
Number of Neighbours considered: 8

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       Number of shared near neighbours

              8     7     6     5     4     3     2     1     0
AG108  3 *****+
AG106  1 *****|*****+
AG109  3 *****+*****|*****+
AG111  4 *****|           |
AG114  1 ***********+     |
AG115  1 ***********|     |
AG120  1 ***********|*****+
AG107  2 ***********|     |***********************************+
AG110  1 ***********+     |                                   |
AG116  1 *****|***********+                                   |
AG119  1 *****+           |                                   |
AG113  2 ***********+     |                                   |**
AG117  2 ***********|*****+                                   |
AG118  2 ***********+                                         |
AG112  5 *****************************************************+
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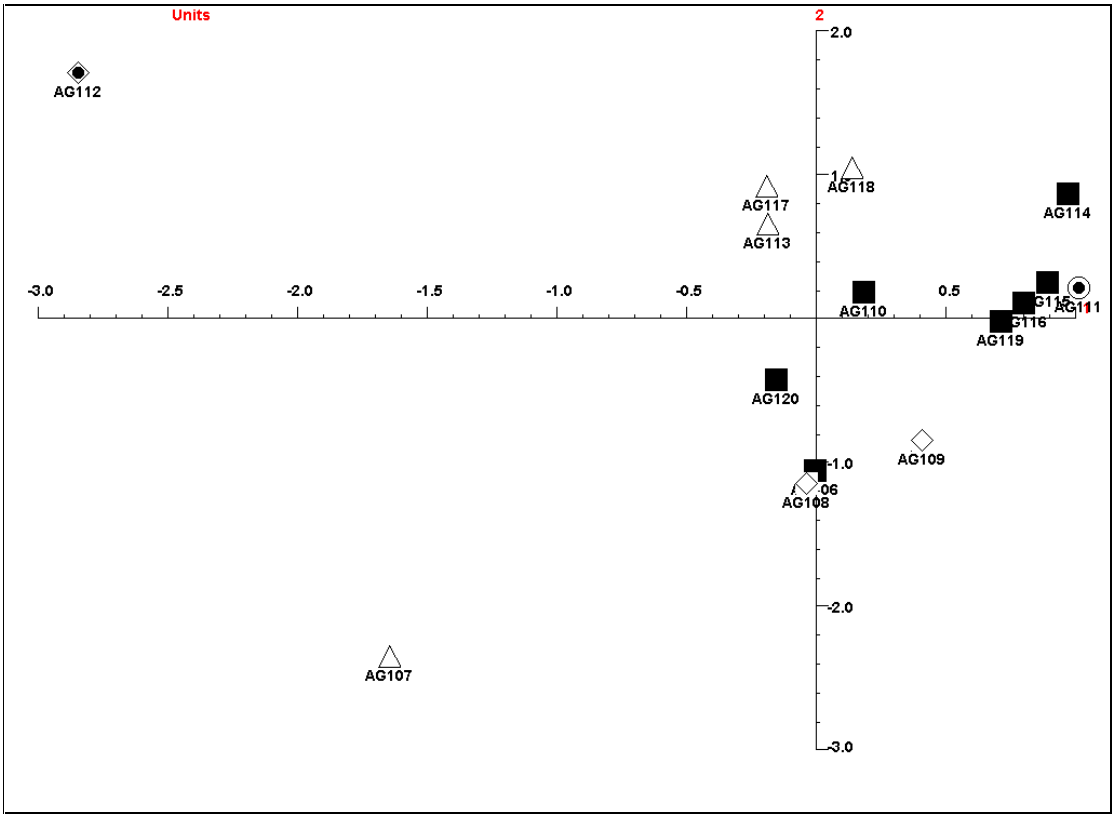
Fig 1. Typical Dendrogram resulting from cluster analysis of ICPS data

A similar pattern is seen when the data is examined using Principal Components Analysis. This was carried out on the raw data and on a limited dataset, excluding CaO and P2O5, which might be expected to merely follow the distribution of calcareous and glauconitic inclusions. The results, however, were very similar in both cases.



The Group 5 sample is placed well away from the remaining samples whilst the remaining samples do cluster, but not into discrete groups. In particular, Groups 3 and 4 overlap with Group 1. Group 2 does, however, form a discrete cluster, albeit with one sample, AG107, well separated from the remaining three.

Detailed interpretation of this data would require access to comparative data for clays and fired clays of known origin. Nevertheless, it seems likely that we are looking here at three separate clay types: that used for Group 5 being very different from the other two, used for the glauconitic wares of Group 2 and the combined Groups 1, 3 and 4. The similarity in chemical composition between the limestone tempered Group 3 and the sandy Group 1 is quite remarkable since the wares have very different textures. Nevertheless, in thin-section their clay matrices are indeed similar in containing moderate quartz silt, absent from Group 2 and less common in Group 5.

Source

Most of the inclusions found in these fifteen samples are of types which could be found widely in southeastern England and beyond. Nevertheless, there are features in all but one of the samples which suggest a local Kentish origin for the vessels (though they do not preclude importation from surrounding regions. The iron-staining of some of the quartz grains found in the sand tempered wares, and in some of the other fabrics, are typical of sands derived from iron-cemented sandstones in and around the Weald. They are, for example, a feature of the sands used in medieval Surrey whitewares. Glauconite is particularly common as a tempering material in Kentish Iron Age pottery, as demonstrated by Ian Freestone some years ago, but is also found throughout the south and central parts of Britain, as far west as Dorset (eg Gussage All Saints). It is likely that the Glauconite was naturally present in the clay rather than being added by the potters as temper.

The limestone found in Group 3 could not be identified, but the remaining characteristics of this group, especially the chemical similarity of the clays suggest that this too is a local product, probably utilising the same clay source as used for the sand tempered wares, as probably was the chert tempered Group 4. Whether the grog-tempered Group 5 sample is actually an import to Kent or simple made locally using different clay sources cannot be decided on present evidence but the ICPS result does show that this technique has the power to characterise a ware which using ceramic petrology alone would be impossible to source, since it contains so few inclusions except for grog.

Appendix One: ICPS Data - Major elements (percentage)

TSNO	Al2O3	Fe2O3	MgO	CaO	Na2O	K2O	TiO2	P2O5	MnO
AG106	14.81	5.35	1.26	2.79	1.01	2.89	0.63	0.38	0.03
AG107	18.16	8.13	1.5	1.45	0.16	2.47	0.73	1.42	0.12
AG108	15.6	5.12	0.82	13.13	0.14	1.81	0.7	0.82	0.04
AG109	13.78	4.53	1.07	16.42	0.16	1.6	0.62	0.33	0.03
AG110	13.61	7.32	0.63	2.1	0.12	1.33	0.7	2.19	0.14
AG111	11.92	5	1	9.04	0.16	1.25	0.59	0.31	0.05
AG112	17.44	10.08	1.49	2.02	0.17	1.67	0.66	1.65	0.42
AG113	12.62	11.04	0.97	1.72	0.12	1.59	0.62	0.75	0.07
AG114	11.87	5.74	0.75	1.21	0.2	1.54	0.67	0.46	0.05
AG115	12.42	4.72	0.79	0.75	0.21	1.5	0.53	2.25	0.14
AG116	13.49	5.15	0.59	1	0.23	1.52	0.55	2.8	0.04
AG117	13.39	11	0.68	1.56	0.11	0.97	0.72	1.14	0.02
AG118	12.36	10.98	1.11	1.89	0.11	1.07	0.68	0.87	0.03
AG119	12.9	5.23	0.82	0.73	0.19	1.52	0.63	1.58	0.02
AG120	14.98	8.73	0.81	1.49	0.21	1.85	0.7	1.92	0.1

Appendix Two: ICPS Data - Minor and Trace elements (PPM)

TSNO	Ba	Co	Cr	Cu	Li	Nb	Ni	Sc	Sr	V	Y	Zn	Zr*	La	Ce	Nd	Sm	Eu	Dy	Yb
AG106	371	24	98	25	112	17	77	15	135	135	16	86	53	43	98	34	6.1	1	2.4	1
AG107	877	25	139	30	106	16	130	19	161	160	26	283	86	49	95	38	7.8	1.4	3.6	1.9
AG108	399	17	111	23	72	16	67	15	204	133	18	86	65	36	73	31	5.5	0.9	2.2	1.3
AG109	351	19	97	22	91	19	66	13	202	117	18	86	84	27	67	27	4.8	0.7	2.2	1.4
AG110	509	16	111	44	65	16	72	15	125	122	27	127	80	47	88	34	7	1.2	3.6	1.9
AG111	289	14	96	23	77	16	59	11	198	110	18	91	74	35	63	26	4.7	0.8	2.2	1.3
AG112	730	25	128	92	73	14	127	21	136	170	130	344	85	111	134	111	23.7	4.2	16.9	8
AG113	413	35	174	28	64	16	124	18	79	152	40	131	88	56	95	47	11	1.9	5.7	2.2
AG114	314	14	111	38	34	12	51	13	111	116	24	80	58	39	67	29	6.3	1.1	3.5	1.6
AG115	843	25	85	24	62	12	77	12	153	107	16	163	52	32	87	22	4.9	0.9	2.2	1.2
AG116	806	11	96	29	55	12	66	13	172	99	19	82	48	39	70	27	5.7	0.9	2.6	1.2
AG117	287	31	191	25	55	18	109	19	68	162	37	103	87	63	110	55	12.1	2	5.7	1.9
AG118	277	31	173	25	75	17	123	18	78	133	34	111	85	62	108	54	11.8	2	5.7	1.9
AG119	653	10	88	27	73	15	61	13	114	118	17	143	66	34	72	27	5.4	0.9	2.5	1.3
AG120	583	17	128	31	74	16	75	17	121	151	23	123	65	46	81	33	6.9	1.2	3.1	1.5