Characterisation Studies of some Iron Age and Romano-British Pottery from Stainton, South Yorkshire (Arcus 121D)

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Six samples of Iron Age or Romano-British pottery from Stainton were selected for analysis by Ruth Leary. One of the main aims of the project was to investigate the source of the Iron Age pottery, since South Yorkshire has proved to be an area in which little Iron Age pottery has been found, and which may not have supported a local pottery tradition, instead of which pottery was imported from surrounding areas. For the Roman period, the main purpose of the analysis was to investigate the source of a wheelthrown coarseware which visually appeared distinctive.

The samples were given sample numbers, V2863 to V2868, and thin sections and chemical analyses were carried out (Table 1). As a result of these studies, the samples have been placed into three groups, whose characteristics are described below.

Table 1

TSNO	Context	cname	Action
V2863	100	Gp 1	TS;ICPS
V2864	117	Gp 1	TS;ICPS
V2865	126	Gp 1	TS;ICPS
V2866	208	Gp 1	TS;ICPS
V2867	252	Gp 2	TS;ICPS
V2868	282	Gp 3	TS;ICPS

Thin Section Analysis

Group 1 (V2863, V2864, V2865, V2866)

These four samples all contain fragments of bivalve shell or voids where such shells have leached out, together with a variable quantity of rounded quartz sand. The groundmass contains a moderate quantity of fine angular quartz, of fine sand or coarse silt grade. The following inclusion types were noted in thin section:

- Shell. Moderate angular and subangular fragments of non-ferroan calcite bivalve shell, up to 1.0mm long and 0.5mm thick. The shell has an nacreous structure and rare fungal boreholes are filled with sparry ferroan calcite.

- Sparry Calcite. Moderate fragments of sparry ferroan calcite, ranging from c.0.1mm to 0.3mm across.
- Quartz. Sparse rounded grains c.0.2 to 0.4mm across and moderate angular and subangular grains ranging from c.0.1mm to 0.2mm across.
- Mudstone. Present only in one section, V2863, these show strong bedding and in one case appear to be organic whilst another is lower in iron content than the groundmass. Otherwise, the colour and texture are similar to the clay groundmass
- Clay pellets. Sparse rounded dark brown clay pellets, usually with no visible inclusions, up to 0.3mm across are present. Some pellets with concentric dark brown staining up to 2.0mm across are also present.
- Sandstone. Sparse rounded grains of fine-grained sandstone up to 0.4mm across.
- Chert. Sparse rounded fragments up to 0.4mm across.
- Feldspar. Sparse rounded fragments of altered plagioclase feldspar up to 0.4mm across.

The groundmass consists of optically anisotropic baked clay minerals, sparse angular quartz, sparse muscovite laths up to 0.2mm long, dark brown to opaque grains and clay pellets.

The ferroan calcite is probably remains of a cement indicating that the shell fragments are derived from a limestone. However, in some shell beds within mudstones the shells are coated with ferroan calcite, as a result of chemical precipitation, replacement of the original shell and through coatings deposited by calcareous worms. The rounding of the shell fragments might have occurred in the original parent clay/mudstone (for example, if the shell was derived from a band of winnowed shell fragments) or may be evidence for more recent erosion and abrasion.

Group 2 (V2867)

The petrological characteristics of this sample are similar to those of Group 1 but the sparse calcareous inclusions, which have leached out, have outlines which lack the clear tabular shape characteristic of bivalve shell fragments. The quartzose sand is also slightly coarser with, consequently, a higher proportion of chert and fine-grained sandstone to quartz.

The groundmass is identical to Group 1.

Group 3 (V2868)

The distinctive feature of this sample is the rounded mixed gravel temper, in which a high proportion of the inclusions are well-rounded opaque ironstone and ferruginous sandstone pellets. The following inclusion types were noted in thin section:

- Quartz. Abundant well-rounded grains up to 1.0mm across, some of which are cracked. and subsequently subjected to further abrasion. Sparse angular fragments up to 1.5mm across with one or more straight faces. These are overgrown quartz grains from a sandstone of Millstone Grit type.

- Chert. Sparse rounded fragments up to 1.0mm across.

- Sandstone. Sparse rounded fragments up to 1.0mm across.

- Ferruginous sandstone. Moderate rounded fragments up to 1.5mm across containing varying proportions of angular quartz grains up to 0.2mm across and opaque cement.

- Opaques. Moderate rounded fragments up to 1.5mm long. These fragments are usually tabular in outline.

- Clay Pellets. Moderate subangular fragments up to 1.5mm across. Of similar colour and texture to the groundmass but often with dendritic iron staining.

The groundmass consists of optically anisotropic baked clay minerals and abundant dark brown and opaque grains up to 0.05mm across.

A visually similar Romano-British coarseware found at Elloughton, East Yorkshire, can be distinguished in thin section because of the presence of rounded fragments of Jurassic and Cretaceous rocks, and angular flint, all absent from this Stainton sample, although that fabric too contains rounded opaque and ferruginous sandstone pellets and has an inclusionless groundmass (Samples V2112, V2113, V2120, V2124). On the basis of its petrological characteristics, the Elloughton coarseware was provenanced to an area of Jurassic clay immediately west or south of the Wolds (which includes the Elloughton area)

Chemical Analysis

Sub-samples of each vessel were prepared by Peter Hill and submitted to Royal Holloway College, London, for analysis using Inductively Coupled Plasma Spectroscopy (ICP-AES).

This technique calculates the frequency (relative to sample weight) of a range of major and minor elements. The major elements are measured as percent oxides (App.1) and the minor elements as parts per million (App.2).

Silica is not measured and is present in both the groundmass and in the quartzose inclusions. It can be calculated by subtracting the total measured oxides from 100%, although this will also include carbon and chemically combined water, for example. The estimated silica content is similar for all the samples (ranging from 65% to 69%), except for one of the Group 1 samples, V2864, which has an estimated silica content of 77%.

The data were normalised to Aluminium, to take account of this variation in silica. With only five samples in total, the data were examined visually to see if there were any obvious correlations between petrological group and chemical composition.

Group 1 had a slightly lower Iron content than the other two groups and a slightly higher Titanium content.

Group 2 had a slightly higher Potassium, Manganese and Dysprosium content and a slightly lower Copper content.

Group 3 had a lower Calcium, Barium, Lithium and Zirconium content.

The Group 1 and 2 samples have a similar range of inclusion types to some shell- and sand-tempered wares from Collingham, Nottinghamshire, and the ICPS results were therefore compared with those from the Collingham samples (grouped for convenience into a shell-tempered group, FLF GP1-5, and a sandy group, FLF GP4, and with the following shell-tempered wares from various sites and periods in the East Midlands and Yorkshire:

- Iron Age shell-tempered ware from Ferrybridge (FERRYBRIDGE IASH).
- Iron Age/Early Roman limestone-tempered ware from Elloughton, East Yorkshire (LOOL)
- Mid Roman Dales-type Shelly ware from Elloughton and Doncaster (DWSH).
- 11th/12th century shelly ware found on sites in Yorkshire and thought to have been produced in west-central or northwestern Lincolnshire (LFS)
- 7th to 9th-century shelly ware, Northern Maxey-type ware, from sites in Northern Lincolnshire and Yorkshire (MAX). These are thought to have been produced in the same areas of Lincolnshire as the later LFS ware.

The resulting dataset was then studied using Factor Analysis (Winstat for Excel, ;). This found six factors, F1 to F6. A plot of F1 against F2 values (Fig 1) shows that the Stainton samples have similar scores to those from Collingham, but also with some Dales-type shelly ware and some of the Cambridgeshire Iron-Age samples. However, most of the Dales-type shelly ware and Cambridgeshire Iron Age ware, and all of the Northern Maxey and LFS samples were distinguishable, having either higher F1 scores (Cambs IASH), higher F2 scores (DWSH) or lower F2 scores (LFS and MAX).

The remaining factors showed only slight differentiation between the various groups. It is likely that the reason for the poor discrimination between these fabrics, given that they are in some cases clearly distinguishable in thin section, is because of the leaching of the shell inclusions and the subsequent partial filling of the shell voids with phosphate or the soil matrix in which the sherds were buried. It may also be that the pores created by the leached shell make much more of the sample susceptible to reaction with groundwater than would be the case with a fine-textured fabric.

A small number of elements were eventually found whose variation in frequency between the fabric groups was greater than the probable effect of post-burial alteration. These included Chromium, Lithium, Titanium, Vanadium and Zirconium. A plot of Chromium versus Lithium (Fig 2, both relative to Aluminium) shows that the Stainton samples have similar frequencies to those from Collingham whereas Dales-type shelly ware has higher Lithium and Maxey-type ware and LFS both have lower values, for both elements. A plot of Titanium versus Vanadium values (Fig 3) shows again that the Dales-type shelly ware is different, having higher Vanadium (one of the Ferrybridge samples is almost certainly actually a Dales-type shelly ware rather than an Iron Age vessel). Finally, a plot of Zirconium against estimated silica content indicates that the highest Zirconium values occur in the Ferrybridge, LFS and Maxey-type ware samples and not in the Dales-type shelly ware and the Collingham and Stainton samples, all of which have a higher silica content.

These element distributions indicate that there are three chemical groupings, each of which includes some vessels of Iron Age or early Roman date:

- Stainton and Collingham (ARCUS GP1, GP2, GP3; FLF GP1-5; GP4)
- North-West Lincolnshire (LOOL, DWSH)
- Central to North-West Lincolnshire (MAX, LFS, FHM IASH)

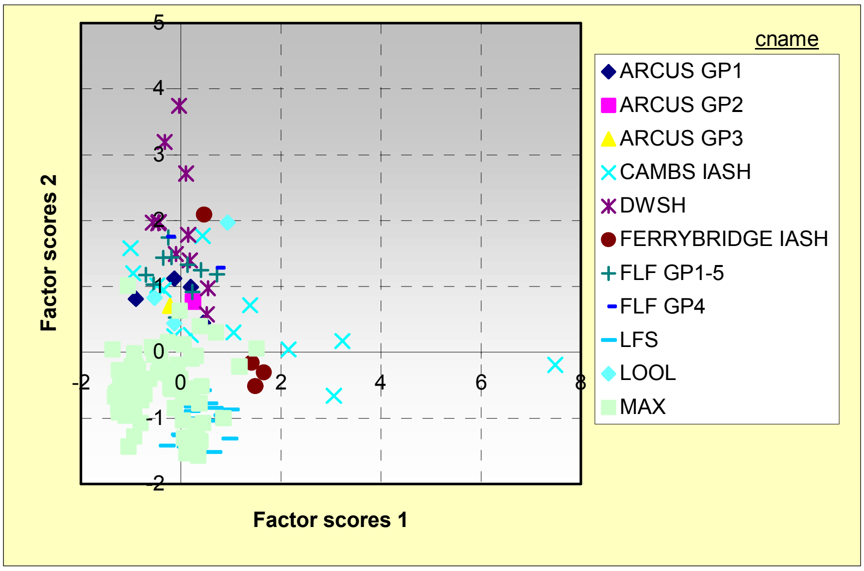

Figure 1

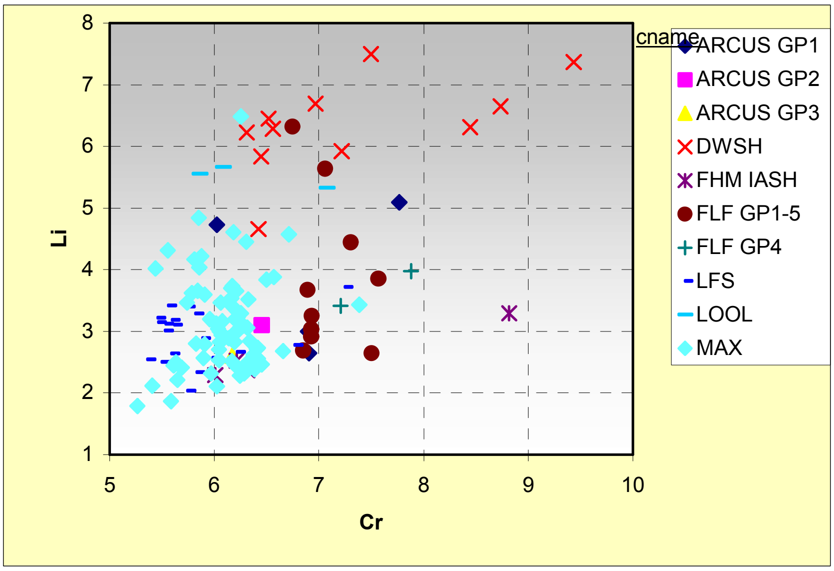

Figure 2

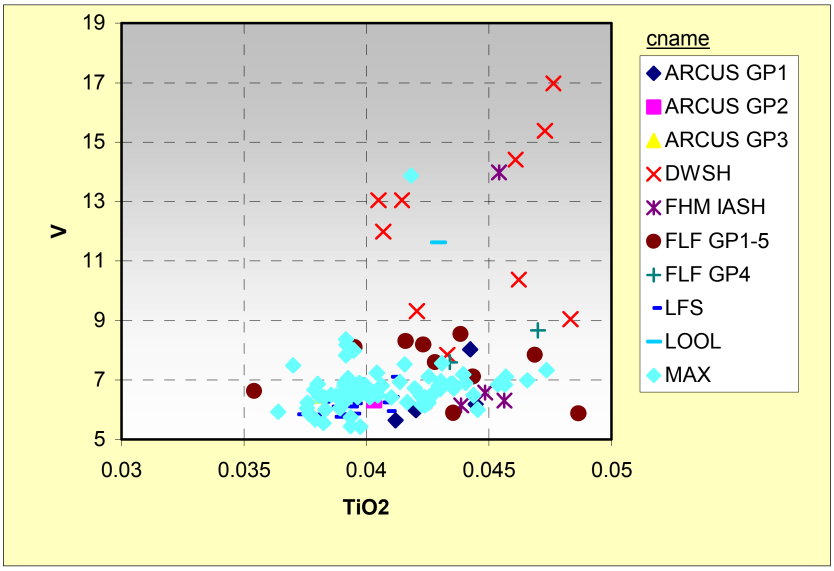

Figure 3

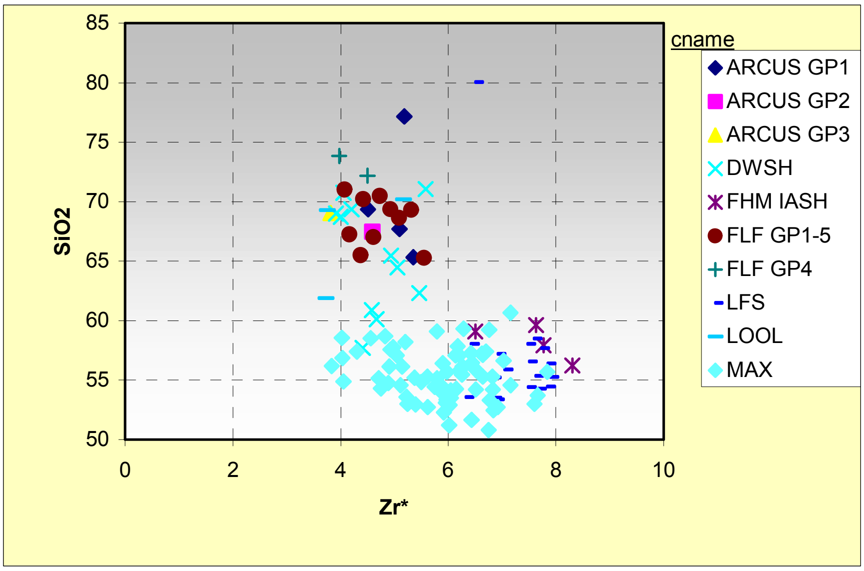

Figure 4

Discussion

There is a strong similarity between the shell-tempered samples from Stainton and those from Collingham. In thin section there are no distinguishing features (although the Collingham samples are all leached, making direct comparison difficult) and in the chemical analysis the only differences between the two groups are likely to be due to post-burial alteration.

This chemical similarity is also true for the possible limestone-tempered sample, Group 2, and the gravel-tempered sample, Group 3. This might suggest that the rounded iron-rich inclusions in the Group 3 sample are of Jurassic origin, such as the Northampton Sands or the Frodingham Ironstone. However, they are well-rounded and have clearly undergone considerable abrasion. Furthermore, such inclusions are not common in Lincolnshire pottery. Furthermore, a source in South Yorkshire is possible, since medieval pottery produced in Doncaster in the 12th century is characterised by very similar inclusions, probably derived partly from Permo-Triassic sands, such as the Sherwood Sandstone, and partly from Coal Measure sandstones transported down the Don valley.

By contrast, there are differences between the Stainton Gp 1 and 2 and the Collingham samples, on the one hand, and those produced in North-West Lincolnshire (LOOL and DWSH) on the other and these differences are both in petrology (the lack of oolitic ironstone grains and echinoid shell and spine fragments) and in the chemical composition. Loughlin has suggested that Dales shelly ware was produced using weathered Rhaetic mudstone (now re-named the Penarth Group). However, the oolitic ironstone grains probably indicate a Lower Lias source. In either case, a source in the area to the west of the Jurassic ridge (such as it is in north-west Lincolnshire) and to the east of the Trent is consistent with the petrological and distribution evidence. Furthermore, a late Iron Age/Early Roman precursor of the Dales-shelly ware fabric (LOOL) occurs in this area and is chemically and petrologically similar.

Furthermore, there are differences between the Stainton and Collingham samples and those produced using Jurassic shelly limestone, probably the Great Oolite formation which outcrops on the dip slope of the Jurassic ridge. Two Anglo-Saxon fabrics made in this area contain considerably less silica, both in the form of quartzose sand and angular silt/fine sand (cf Fig 4). Surprisingly, this group includes three samples of Iron Age shell-tempered pottery from Ferrybridge. In thin-section, these contain bivalve shell fragments, sometimes set in a ferroan calcite matrix. Unlike the Dales-type shelly ware and LOOL, they do not include echinoid shell or spines but, unlike the Anglo-Saxon wares, the range of shell types present is wider. Shelly limestones of Jurassic age occur in a limited area of East Yorkshire, to the south and immediately west of the Wolds, from Market Weighton southwards, and this is a potential source for the Ferrybridge vessels, although a Lincolnshire source is still more likely.

The possible sources for the Stainton and Collingham shelly wares are: (a) exposures of the Penarth Group within the Trent Valley or (b) Lower Jurassic clays, also within the Trent Valley. At present, the only potential distinguishing features are that the Stainton vessels include pellets of laminated clay, whereas the Penarth Group mudstones are specifically stated to be unlaminated (Macquaker 1999). Furthermore, the shell beds found in the Penarth Group are usually of smaller bivalves than those represented in these samples and include ornamented shells, such as *Clamys.* Lower Lias clays, however, often contain beds of ‘oysters’, such as *Gryphaea*. It might be possible to distinguish these clays if test briquettes were collected, fired and sampled for thin sectioning and chemical analysis.

Appendix 1

TSNO	Al2O3	Fe2O3	MgO	CaO	Na2O	K2O	TiO2	P2O5	MnO
V2863	16.65	7.68	1.89	0.82	0.32	2.32	0.74	0.18	0.048
V2864	13.11	4.68	1.05	0.91	0.26	2.11	0.54	0.17	0.034
V2865	13.34	6.48	0.67	9.17	0.16	1.36	0.59	0.4	0.113
V2866	15.71	7.98	3.14	3.94	0.48	2.39	0.66	0.25	0.107
V2867	16.12	8.75	2.07	1.29	0.28	2.87	0.65	0.33	0.146
V2868	16.52	9.18	1.12	0.72	0.2	2.21	0.63	0.27	0.083

Appendix 2

TSNO	Ba	Cr	Cu	Li	Ni	Sc	Sr	V	Y	Zr*	La	Ce	Nd	Sm	Eu	Dy	Yb	Pb	Zn	Co
V2863	897	115	33	44	31	15	48	103	18	75	34	59	35	5	1	3	2	39	85	10
V2864	868	79	26	62	39	11	51	74	23	68	31	57	33	6	1	4	2	43	162	13
V2865	473	92	23	40	51	12	135	107	23	68	40	72	42	7	1	4	3	24	88	19
V2866	620	122	30	80	80	16	91	94	23	84	33	69	35	7	1	4	3	23	220	24
V2867	590	104	24	50	55	15	70	102	27	74	40	74	43	8	1	5	3	32	123	21
V2868	475	102	31	43	60	16	49	107	24	63	39	71	41	7	1	5	3	40	128	18

Bibliography

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