Characterisation Studies of Early Anglo-Saxon Pottery from Stamford Road, West Deeping (SRD 719)

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Excavations at Stamford Road, West Deeping, Lincolnshire, by Albion Archaeology produced evidence for an early Anglo-Saxon settlement. A selection of the pottery, chosen to cover the visual range of fabrics present, was submitted to the author for thin section and chemical analysis.

Nine samples were examined (Table 1), using thin sections and Inductively-Coupled Plasma Spectroscopy (ICP-AES).

Table 1

TSNO	Action	Context	class	Cname	Part
V3021	TS;ICPS	2016	POTTERY	LIM	BS
V3022	TS;ICPS	2096	POTTERY	LIM+Q	BS
V3023	TS;ICPS	2140	POTTERY	ESANDY	BS
V3024	TS;ICPS	2138	POTTERY	LIM	B
V3025	TS;ICPS	2084	POTTERY	LIM	R
V3026	TS;ICPS	210	POTTERY	LIM	BS
V3027	TS;ICPS	2101	POTTERY	ESGS	R
V3028	TS;ICPS	2080	POTTERY	CHARN	BS
V3029	TS;ICPS	2109	POTTERY	LIM	BS

Thin Section Analysis

The nine sections can be grouped into five petrological groups on the basis of the inclusions present.

Oolitic Limestone (LIM)

Five samples contain oolitic limestone fragments as their most common inclusion type. All have slight differences in the range and character of inclusions and are described separately below:

V3021

- Oolitic limestone. Moderate subangular fragments of oolitic limestone, consisting both of loose ooliths and fragments of rock composed of non-ferroan calcite ooliths and some bioclasts in a matrix of sparry ferroan calcite. Fragments range from c.0.2mm to c.1.5mm across.

- Biotite Granite. Moderate angular fragments ranging from c.0.3mm to c.1.5mm consisting of biotite sheaves, quartz, perthite, and zoned feldspar. The inner zones of the feldspar are more heavily altered than the outer ones.

- Rounded Quartz. Sparse well-rounded grains, some with brown iron-stained veins, up to 1.0mm across.

- Clay/Iron compounds. Moderate almost opaque dark brown grains, mostly well-rounded with fuzzy boundaries with the parent clay.

The groundmass consists of optically anisotropic baked clay minerals and moderate dark brown clay/iron streaks up to 0.3mm long and specks up to 0.1mm across. Rare streaks of lighter-coloured brown clay are also present.

V3024

- Oolitic Limestone. Moderate angular fragments, more ferroan calcite than those in V3021 and with more finer-grained fragments. Also, containing more bivalve shell fragments, including punctate brachiopod shell up to 1.5mm long. One large grain, c.2.0mm long, with two feldspar crystals completely altered to kaolinite.

- Rounded Quartz. Moderate grains as in V3021.

- Clay/Iron Compounds. Sparse grains as in V3021.

The groundmass consists of optically anisotropic baked clay minerals and abundant angular quartz up to 0.1mm across.

V3025

- Oolitic limestone. Moderate subangular fragments of oolitic limestone, consisting mostly of loose ooliths, some with a ferroan calcite core. Fragments range from c.0.2mm to c.1.5mm across.

- Rounded Quartz. Moderate well-rounded grains, up to 1.0mm across.

- Clay/Iron compounds. Moderate almost opaque dark brown grains, mostly well-rounded with fuzzy boundaries with the parent clay.

The groundmass consists of optically anisotropic baked clay minerals and moderate dark brown clay/iron streaks up to 0.3mm long and specks up to 0.1mm across.

V3026

Very similar to V3024.

V3029

Very similar to V3025.

These oolitic limestone-tempered vessels can therefore be subdivided into three groups:

a) Fine-textured matrix with predominantly loose oolith temper (V3025 and V3029)

b) Fine-textured matrix with loose oolith and cemented oolith temper, plus biotite granite (V3021)

c) Fine sandy/coarse silty matrix with cemented ooliths and shell fragments (V3024 and V3026).

Sandstone, Oolitic Limestone and Quartz Sand (LIM+Q)

A single section (V3022) contained a mixed sand, composed of sandstone fragments, oolitic limestone fragments and quartz sand.

- Quartz. Abundant angular quartz grains up to 0.3mm across. A high proportion of these grains are overgrown and have one or more straight edges. In some cases, brown amorphous inclusions mark the original, rounded grain boundary.

- Sandstone. Sparse angular fragments up to 1.5mm across. The sandstone is composed mainly of overgrown quartz grains, with secondary silica cement in optical continuity of the original grains. This cement contains moderate amorphous brown inclusions.

- Oolitic Limestone. Sparse subangular fragments up to 1.5mm across. The limestone consists of rounded non-ferroan calcite micrite pellets c.0.3mm across, in a matrix of sparry ferroan calcite. The pellets show evidence of being ooliths which have been replaced by micrite as a result of biological action.

- Organics. Sparse linear voids surrounded by a darkened halo, up to 1.0mm long.

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

Lower Cretaceous Sandstone (ESGS)

A single section (V3024) contains a range of inclusions of lower Cretaceous origin.

- Quartz. Abundant rounded grains up to 1.0mm across.

- Opaques. Moderate rounded grains, and cracked rounded grains, up to 1.0mm across.

- Flint. Sparse angular, unstained fragments up to 1.5mm across.

- Limestone. Sparse fragments up to 1.0mm across, including ferroan calcite echinoid shell, non-ferroan calcite bivalve shell and non-ferroan calcite micrite.

- Organics. Sparse elongated voids surrounded by a dark halo, up to 1.0mm long.

- Sandstone. Sparse fragments consisting of quartz grains in an opaque matrix, up to 1.0mm across. Also rare fragments similar to Carboniferous Millstone Grit, consisting of coarse quartz grains up to 1.0mm across with kaolinitic cement.

- Glauconite. Sparse rounded grains up to 0.3mm across. Some unaltered, light green grains and others altered brown grains.

- Chert. Rare fragments of chalcedonic chert, probably of Lower Cretaceous origin.

The groundmass consists of light-coloured optically anisotropic baked clay minerals containing little quartz but abundant opaque inclusions.

Biotite Granite (CHARN)

A single section (V3028) contains mainly angular fragments of biotite granite.

- Acid Igneous rock. Moderate angular fragments ranging from 0.2mm to 3.0mm across. The rock consists of crystals of perthite, zoned feldspar, quartz and biotite (some zoned

- Mudstone. Moderate angular fragments of brown mudstone, with strong lamination composed of clay minerals, up to 1.5mm across. The mudstone is similar in colour and texture to the groundmass.

The groundmass consists of optically anisotropic baked clay with few visible inclusions. In the core of the vessel the groundmass is black and almost opaque.

Rounded Quartz Sand (ESANDY)

A single section (V3023) contains a rounded quartzose sand.

- Rounded quartz. Abundant grains up to 0.5mm across, includes some grains with high sphericity.

- Rounded chert. Sparse fragments up to 2.0mm across, probably of Carboniferous origin.

- Opaques. Moderate rounded opaque grains, up to 1.5mm across.

The groundmass consists of black, opaque baked clay minerals and abundant angular quartz grains c.0.05-0.1mm across.

Interpretation

The inclusions in these 9 sections can in many cases be identified and sourced. The oolitic limestone fragments are of varying lithologies of which one, well-sorted ooliths with sparse non-ferroan calcite cement, is probably the Ketton Freestone, a variety of Upper Lincolnshire Limestone which outcrops in the Stamford area. The remaining examples are clearly of Jurassic origin but cannot be identified from the evidence in these sections.

The ‘biotite granite’ noted in two sections is probably Mountsorrel granodiorite. In one sample, V3021, the associated inclusions suggest that the fabric contains a detrital sand or boulder clay, containing a mixture of pre-Cambrian, Triassic and Jurassic rocks, including Ketton Freestone. A boulder clay in the Stamford area deposited by ice travelling eastwards is the probable source of this fabric. The second sample, V3028, contains angular granodiorite inclusions in a clay which was probably a weathered mudstone. The texture and colour of this clay distinguishes it from those of Jurassic origin (it is similar to Triassic clays, such as the Mercian Mudstone) and it is possible that this fabric was actually produced close (or at least closer) to the Mountsorrel outcrop.

The rounded quartzose sand present in section V3023, and in small quantities in some of the other sections, derives from Triassic sandstones but is the main constituent of terrace and alluvial sands over a wide area of the East Midlands, especially the Trent Valley. The opaque grains, given a Trent Valley source, could be ironstone of Jurassic age, and the lack of inclusions in them argues against their being recent iron pan, although this does occur widely in the valley.

The sandstone in section V3022 is probably of Middle or Upper Jurassic origin whilst the oolitic limestone which forms a minor element in the fabric is not the Ketton Freestone. A source on or to the east of the Jurassic scarp is likely.

Finally, the mixed inclusions in V3022 include a high proportion of material derived from lower Cretaceous deposits, but with some limestone fragments which are probably of Jurassic origin. This suggests an origin in a boulder clay somewhere to the east of the Jurassic ridge. Similar sands occur at Ely, for example whilst those at Bourne, which have a similar texture, have a lower proportion of Lower Cretaceous inclusions.

Chemical Analysis

Subsamples of each vessel were prepared for chemical analysis by mechanically removing the outer surfaces and crushing the remainder to a fine powder. This powder was then analysed at Royal Holloway College, London, using Inductively-Coupled Plasma Spectroscopy (ICP-AES). A range of elements were measured, the major elements as percent oxides (Appendix 1) and the minor and trace elements in parts per million (Appendix 2).

Silica was not measured, but forms upwards of one half of the sample, by weight. An estimate of silica content was obtained by subtracting the total measured major element values from 100%. There is a wide range of silica values ranging from 58% to 73% percent. To compare the samples without the dilution effect of variation in silica content affecting the results, the measured element values were normalised to Aluminium. Factor analysis was carried out on the normalised dataset.

Five factors were found, accounting in total for 93% of the variability in the dataset. A plot of F1 against F2 (Fig 1) shows that the five oolitic limestone-tempered samples have similar scores whilst the remainder are distinguished either by their F1 or F2 scores or both.

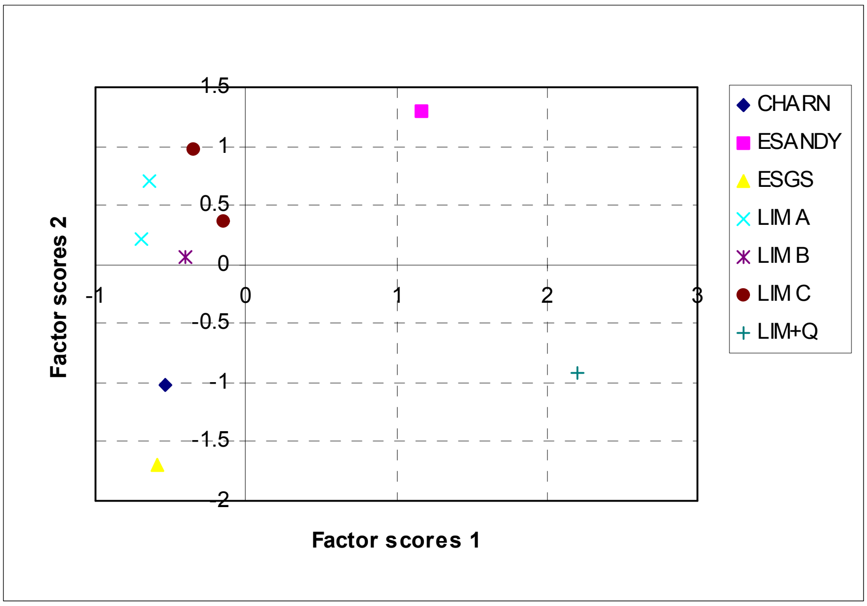

Figure 1

A plot of the F3 against F4 scores shows that the oolitic limestone-tempered samples with a silty matrix have higher F4 scores than the remainder (Fig 2) whilst the biotitegranite tempered sample has a higher F3 score than the remainder.

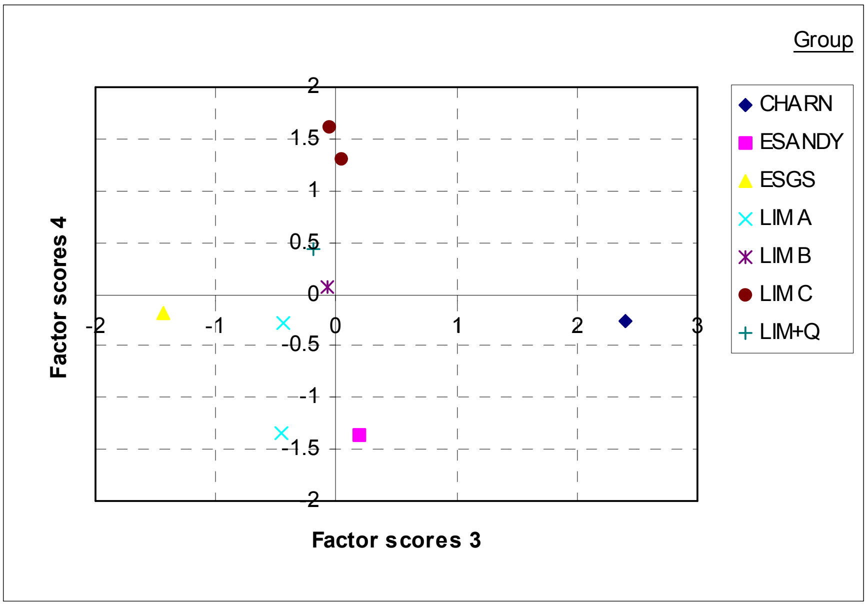

Figure 2

These results confirm the differences in composition observed in thin section and also suggest that the parent clay used for the oolitic limestone-tempered vessels can be distinguished from that used for the other vessels. The weightings assigned by factor analysis to the various element values suggests that the oolitic limestone tempered sherds have similar high calcium and strontium values, as is to be expected considering the nature of their inclusions, but also similarly low rare earth element values and Scandium, Chromium and Zinc values. The distinguishing features of the LIM C samples and high weightings for Magnesium, Sodium, Vanadium and Potassium, whilst the distinguishing features of the CHARN sample are high Phosphorus and Barium values.

Chemical analyses of other oolitic limestone-tempered Anglo-Saxon wares were then compared with the West Deeping samples Fig 3. The West Deeping samples have higher F1 scores than most of the comparanda, which come mainly from East Yorkshire and North Lincolnshire, but are comparable with a sample from Quarrington (most similar to the two LIM C and the LIM B samples) and with one sample from Sancton (most similar to the LIM A samples). In general, however, all these oolitic limestone tempered samples, except for the sample from West Deeping with mixed inclusions (LIM+Q), have similar compositions, which are probably due to the use of similar Jurassic clays tempered with Jurassic oolitic limestones.

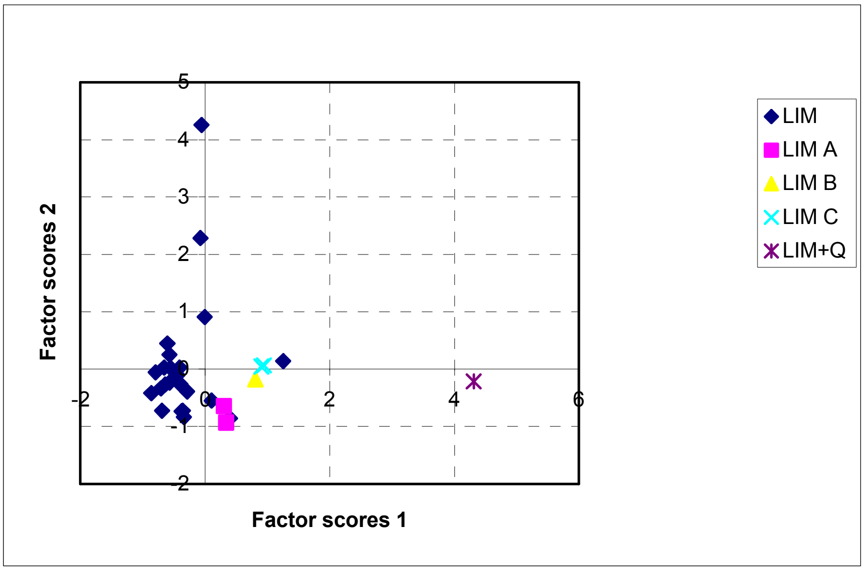

Figure 3

The ESGS sample data was then compared with that from ten other early to mid Anglo-Saxon vessels from Lincolnshire and Yorkshire which contain a high proportion of lower Cretaceous-derived inclusions. Factor analysis found seven significant factors, accounting for 95% of the variability in the dataset. A plot of F1 against F2 scores (Fig 4) indicates that the West Deeping vessel is similar to the majority of samples, with samples from Brough (Nottinghamshire), York and Dunholme forming outliers. A plot of F3 against F4 (Fig 5) again shows the West Deeping sample as having a similar composition to the majority, with samples from Barnetby and Flixborough forming outliers.

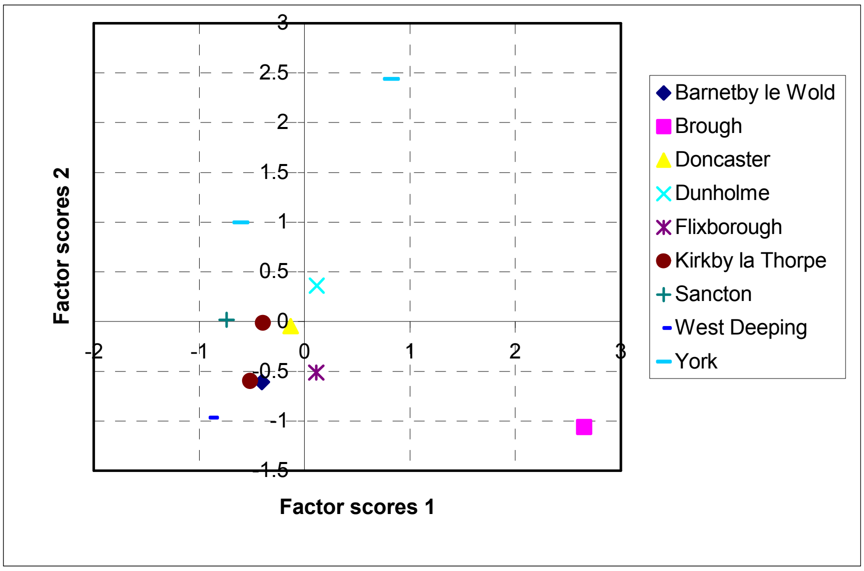

Figure 4

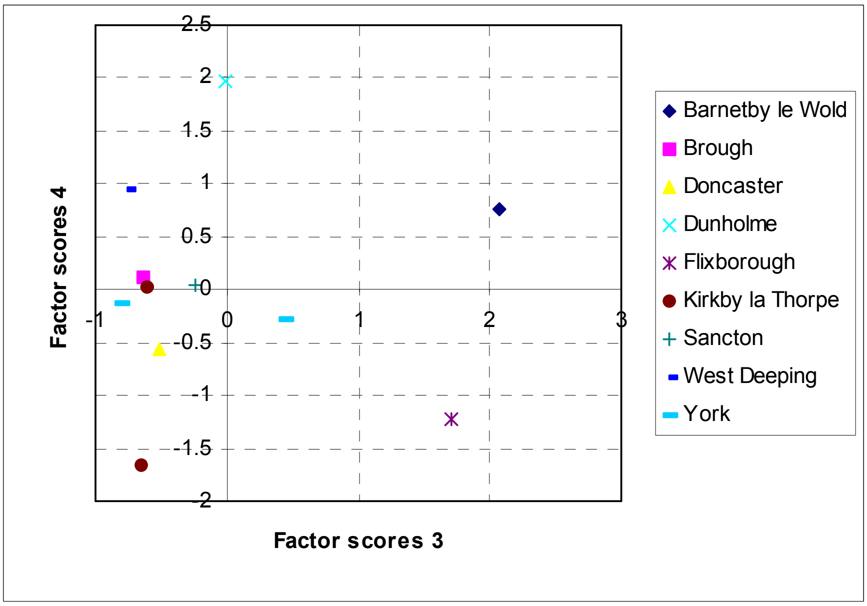

Figure 5

The ESGS dataset was then compared with analyses of medieval wares from Ely (EFH = Fore Hill, ELYPL = Potter's Lane and ELY = miscellaneous consumer sites), Bourne and Baston (BOUA = Bourne/Baston ware). Factor analysis of this dataset shows that the early Anglo-Saxon samples are similar to these medieval wares, with some exceptions and that the West Deeping sample is similar in composition to those from Forehill, Ely. Thus, the chemical data does not help to decide whether the West Deeping sample was made from

Lower Cretaceous deposits close to the outcrop or those redeposited as a result of glacial action further south and certainly leaves an Ely origin as a possibility.

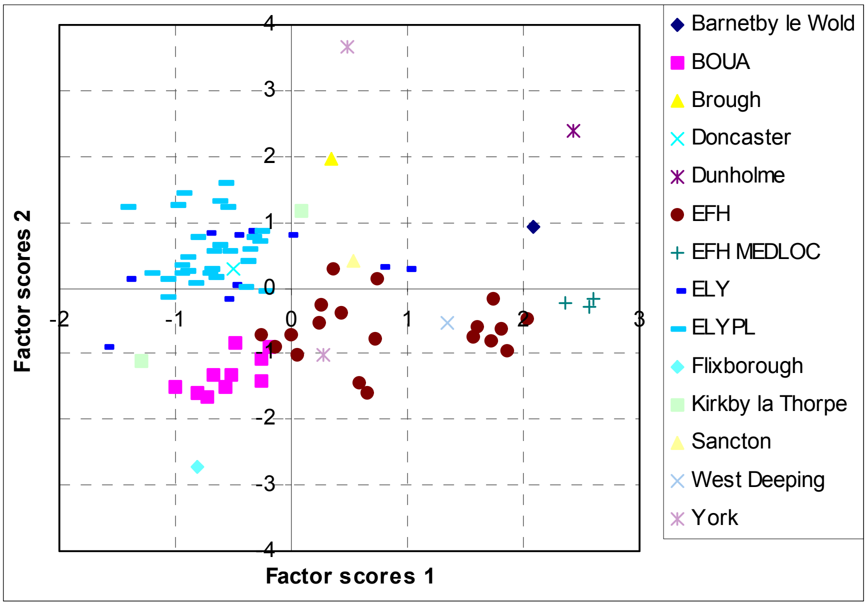

Figure 6

The data from the rounded quartz sand tempered sample was compared with a small number of samples, of Iron Age and Early Anglo-Saxon date, with similar inclusions. Factor analysis of this data found four factors, accounting for 95% of the variability in the dataset. A plot of F1 against F2 scores indicates that the West Deeping sample is distinguishable from the remainder by its rare earth element values and its iron content.

Finally, the data from the biotite granite-tempered sample was compared with that from a range of Midlands and Yorkshire sites. Factor analysis found five factors, accounting for 62% of the variability in the dataset. A plot of F1 against F2 scores (Fig 7) shows that the West Deeping sample is similar to others from the East Midlands (e.g. a set of analyses from Brough, Notts) and distinguishable from those from sites in Yorkshire. This is confirmation that the acid igneous rock is probably Mountsorrel Granodiorite but does not answer the question of whether the rock is present through glacial action or whether the sample is an import from the northeast Leicestershire area.

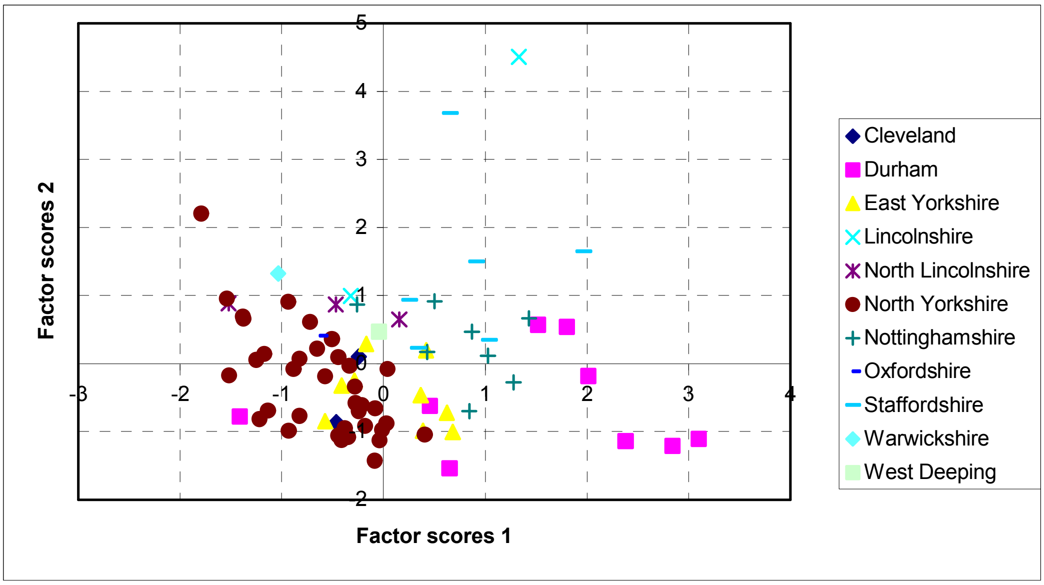

Figure 7

Conclusions

The thin section and chemical analyses confirm the visual impression that the West Deeping samples come from vessels made from differing raw materials. However, in all cases it would be possible to find these raw materials in southwest Lincolnshire. Therefore, the analyses could be interpreted as indicating that about half of the samples come from local products and the remainder were obtained from neighbouring areas, up to 30 miles away or they could be interpreted as showing that all the pottery was obtained within a few miles of the site, but making use of a variety of geological deposits, including boulder clays containing mainly material of non-local origin.

There is clearly considerable potential in the early Anglo-Saxon pottery of West Deeping for further studies since in no case was more than two samples with the same petrology analysed and ideally a study based on chemical composition would include at least six samples of each group. In addition, a series of analyses of other early Anglo-Saxon pottery from southwest Lincolnshire is required to determine how typical the West Deeping material is of the area.

Appendix 1

TSNO	Al2O3	Fe2O3	MgO	CaO	Na2O	K2O	TiO2	P2O5	MnO
V3021	17.65	6.22	0.94	11.66	0.49	1.44	0.68	1.06	0.095
V3022	13.6	4.59	0.73	4.58	0.19	1.22	0.67	0.75	0.13
V3023	14.46	13.78	0.81	1.76	0.31	1.31	0.62	0.23	0.134

TSNO	Al2O3	Fe2O3	MgO	CaO	Na2O	K2O	TiO2	P2O5	MnO
V3024	14.05	5.19	0.91	8.81	0.34	1.33	0.58	0.98	0.079
V3025	18.41	6.15	1.1	14.24	0.2	1.07	0.69	0.42	0.039
V3026	15.96	7.44	1.04	4.14	0.31	1.42	0.61	1.36	0.072
V3027	17.05	6.6	0.78	2.18	0.16	1.69	0.51	0.67	0.041
V3028	17.78	6.49	1.52	1.96	0.7	2.74	0.74	0.85	0.09
V3029	19.52	8.38	1.29	8.78	0.14	0.93	0.71	0.76	0.096

Appendix 2

TSNO	Ba	Cr	Cu	Li	Ni	Sc	Sr	V	Y	Zr*	La	Ce	Nd	Sm	Eu	Dy	Yb	Pb	Zn	Co
V3021	512	111	27	72	64	18	218	125	39	87	50	110	53	12	2	7	4	40	107	11
V3022	502	86	34	24	46	13	114	98	40	107	90	203	94	25	4	10	4	42	111	22
V3023	475	101	29	68	60	17	86	121	72	84	78	170	84	18	3	11	6	35	152	22
V3024	549	95	29	51	46	15	158	97	30	81	43	80	46	10	2	6	3	29	113	10
V3025	430	118	31	95	62	19	213	141	38	78	51	86	54	12	2	6	4	31	110	8
V3026	619	113	28	63	58	18	161	122	37	91	49	110	52	11	2	7	4	40	154	16
V3027	293	89	25	38	39	13	167	116	17	94	59	112	59	9	1	4	3	48	71	15
V3028	542	90	24	90	62	15	157	160	23	90	43	99	45	8	1	4	3	41	92	17
V3029	562	128	32	83	78	20	170	152	37	99	50	111	53	11	2	6	4	25	161	15