POTTERY SUPPLY OVER THREE MILLENNIA: PETROLOGICAL AND GEOCHEMICAL CERAMIC CHARACTERIZATION AT MELTON, EAST YORKSHIRE, UK

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Abstract: *One hundred and thirty-seven samples of pottery and fired clay, ranging in date from the Early Bronze Age to the Medieval Period, were examined in thin section and/or using Inductively-Coupled Plasma Spectroscopy. These techniques allowed the visually-identified fabrics, twenty of which were sampled, to be classed into several groups reflecting their source. For the Early Bronze Age through to the Late Pre-Roman Iron Age, these sources were mainly very local, with most of the pottery being matched with resources available within 15km of the site. Immediately after the conquest, however, local pottery supply ceased and pottery was obtained from south of the Humber. This, it is suggested, was related to the use of the ferry service set up in the first century as part of the great northern road, Ermine Street, which linked London to York.*

Keywords: *Bronze Age; Iron Age; Roman; Thin-section analysis; Inductively-Coupled Plasma Spectroscopy*

INTRODUCTION

The A64 runs east-west along the north side of the Humber estuary, linking Leeds to Kingston-upon-Hull. It sits in a narrow valley where the river cuts through an escarpment of Jurassic and Cretaceous rocks but these are obscured in much of the valley by deposits of Quaternary age. These include boulder clays and glacial lake sediments.

Excavations in advance of the widening of the A64 at Melton, East Yorkshire, revealed that the site had been occupied from the late Bronze Age until some time in the 2nd century AD, and then again in the 7th century and from the 12th to the 14th centuries. Prior to the occupation of the area, it had been used as a ritual landscape and burials of early Bronze Age and Middle Bronze Age date were found, both accompanied by pottery vessels, used in the first case as grave goods to accompany an inhumed burial and in the second to contain cremated bone.

Pottery was in common use for much of this period in East Yorkshire, although it is suspected that in the later 7th to 11th centuries it was scarce and that the area was almost aceramic in the mid-Saxon and Anglo-Scandinavian periods. Only a short distance to the west, however, pottery seems to have been scarce throughout the prehistoric period although it was in widespread use in the Roman period.

To judge by residues inside and outside these vessels, later Bronze Age and Iron Age pottery in Yorkshire was used mainly for cooking, with a smaller quantity of vessels probably used for storage. There was no tradition of decorated finewares such as existed in southern England (2004) with some examples being found immediately south of the Humber (May 1996).

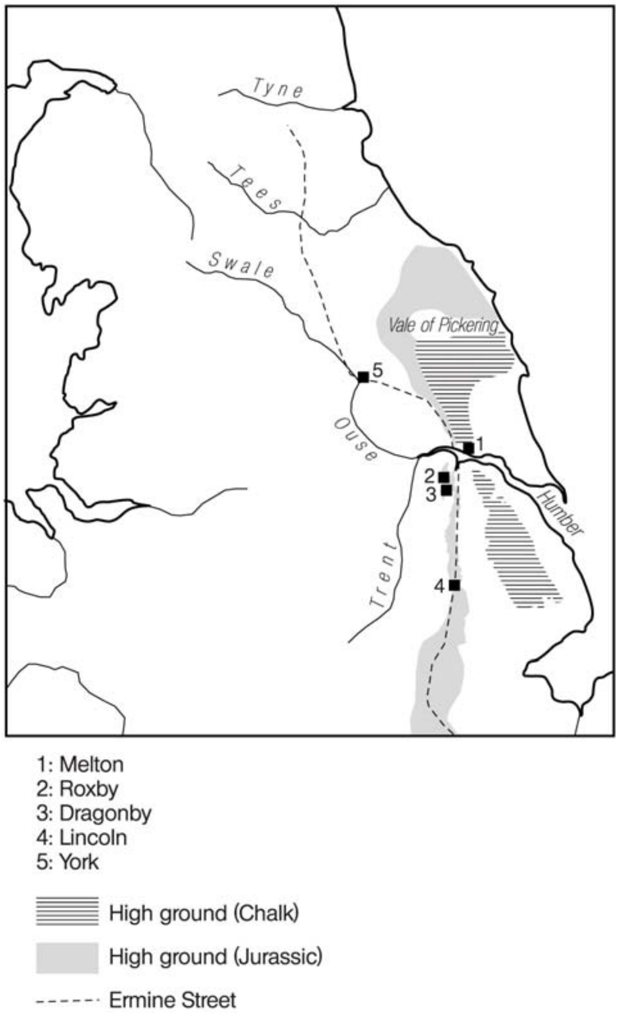

Fig. 1 Location of site and places mentioned in the text

Table 1 List of sampled sherds by fabric group

CNAME	NAME	PERIOD	PRINCIPAL CHARACTERISTICS	TS	ICPS
EBAERR	Early Bronze Age Erratic Tempered Ware	EBA	Angular igneous rocks, mainly basic	1	1
EBAGROG	Early Bronze Age Grog-tempered Ware	EBA	Angular clay pellets	1	1
ESAXLOC	Early Anglo-Saxon Ware	ESAX	Mixed coarse quartzose sand	13	13
FCLAY	Fired Clay	IA;ROM	Three fabrics i) no inclusions; ii) quartzose sand; iii) Poor mixture of (i) and (ii)	7	18
GREY	Greyware	ROM	Quartzose sand	4	4
IACALC	Iron Age Calcite-tempered Ware	IA; ROM	Sparry Calcite	8	8
IAERR	Iron Age Erratic-Tempered Ware	IA	Angular igneous rocks, mainly basic	19	17
IAFLINT	Iron Age Flint-tempered Ware	LBA; IA	Angular flint	2	2
IAGROG	Iron Age Grog-tempered Ware	IA	Angular clay pellets	10	10
IAGSQ	Iron Age “Greensand” Quartz-tempered ware	IA	Polished, rounded quartz sand	9	9
IALST	Iron Age Limestone-tempered Ware	IA	Fossiliferous limestone; re-crystallised fossiliferous limestone	9	9
IAOOL	Iron Age Oolitic-tempered Ware	IA	Oolitic limestone	6	6
IASH	Iron Age Shell-tempered ware	IA	Various suites of fossils – bivalve shell, punctate brachiopod shell; echinoid shell and spines	6	6
IASLAG	Iron Age Slag-tempered ware	IA	Angular fayalite slag	5	5
IASST	Iron Age Sandstone-tempered ware	IA	Sandstones of varying lithologies	4	4
LOOL	Limonite Oolith-tempered ware	ROM	Dark brown ooliths and limestone containing such ooliths	8	8
LSH	Lincoln Late Saxon Shell-tempered ware	LSAX (10th century)	Bivalve shell; Mudstone	2	2
MORT	Misc Mortaria	ROM	Quartz sand in a fine white groundmass	3	3
OX	Oxidized ware	ROM	Quartz sand	2	2
EYQC	East Yorkshire Quartz and Calcareous Ware	MED	Mixed sand composed of quartz; chalk; sandstones; limestones	9	9
Grand Total				**128**	**137**

In the Roman period, there was initially a dual culture of pottery use, with vessels used for a wide variety of functions on military and other official settlements (e.g. *Monaghan 1993*) whilst on rural settlements, such as Melton, the use of pottery continued in its pre-Roman Iron Age traditions. Thus, pottery was widely used on rural sites in East Yorkshire but was scarce or absent on rural sites in West and South Yorkshire.

Later in the Roman period, probably from the early 2nd century onwards, the assemblages found on rural sites mirror more closely those found on military and official sites and finewares such as Samian ware and colour-coated vessels and specialised Romanised vessels such as mortaria and amphora also occur, although not in such high frequencies as on sites such as the small riverside town of Brough (*Darling 2005*). Pottery use in the Anglo-Saxon period in Yorkshire also varies from region to region. In East Yorkshire pottery was in common use. A small quantity of this pottery was decorated but seems to have been made in the same fabrics and came from the same sources as the undecorated pottery, much of which has residues indicating its use in cooking (*Myres 1977* gives a general summary and *Timby 1993* presents the pottery from a large cremation cemetery at Sancton, 9 km to the northwest). This decorated pottery is found on domestic settlements but was clearly preferentially selected for use as cremation urns. Slightly later, in the later 6th and 7th centuries, inhumation with grave goods replaced cremation and the pottery found in those graves mainly consists of undecorated jars and bowls used in cooking.

In the mid Saxon period, the late 7th to mid 9th centuries, pottery use in Yorkshire seems to have declined, although at York, 31 miles to the northwest, a wide range of vessels, including imported pottery probably used to serve wine (*Mainman 1993*) whilst at Beverley, 11 miles to the northeast, pottery was hardly used (a single mid Saxon vessel, a spouted pitcher imported from East Anglia, was found in an extensive excavation of the mid Saxon monastery at Beverley Minster, *Watkins 1991*). In the late 9th century, the use of pottery in Yorkshire increased (e.g. *Mainman 1990*, *Watkins 1991*) and *Didsbury and Watkins (1992)*, although it was still hardly used in South Yorkshire, and from the mid 10th century onwards much of the pottery used in Yorkshire was obtained from outside the county, primarily from Lincoln (*Young & Vince 2005*). The Norman conquest was followed by a phase of rapid increase in the use of pottery and the foundation of a network of pottery production centres, many of which continued to operate throughout the remainder of the medieval period (*McCarthy & Brooks 1988 and Jennings 1992*).

Until recently, the only systematic use of petrography in the study of Yorkshire pottery was that carried out by Wardle for the earlier prehistoric period (*Wardle 1991*) and the British Museum for the Iron Age (*Freestone & Middleton 1991; 2004*). However, in recent years petrological work has been carried out regularly as part of the analysis and publication process for the prehistoric period (although much of this work has yet to reach publication) whilst a major project has been carried out on the Anglo-Saxon pottery, including both thin section and chemical analysis (*Vince et al. forthcoming*). Characterisation studies of a variety of medieval wares have been carried out including studies of the Beverley and Humberware industries. Much of this work is at present in grey literature with only a summary of the results available in published reports (those reports produced by the author are archived online at http://www.avac.uklinux.net/potcat/).

In much of east Yorkshire, the local geology does not allow pottery and other ceramics to be easily characterised, since the majority of the available raw materials consist of Quaternary sands and gravels, derived from a mixture of local outcrops with a variable component of glacial erratics, which include material of Northern English, South-west and south-east Scottish and Scandinavian origin (**Fig 1**). However, in the area around the Melton excavations the geology is more variable and there are geographically limited outcrops of distinctive rocks, such as fossiliferous clays, sandstones and limestones, oolitic limestones and fine-textured sands of Jurassic origin whilst Quaternary sands and gravels to the west of Melton have a high component derived from Carboniferous sandstones with lesser contributions from Jurassic sandstones and erratics of south-west Scottish and Northwest English granites and basic igneous rocks derived from Tertiary sills and dykes which outcrop in northeast England (1992; Geological Survey one-inch sheet 79 - Goole).

The geology of Lincolnshire, to the south of the Humber, is of similar age to that East Yorkshire but because of diachronic differences in the character of the rocks (for example, the much higher incidence of oolitic limonite in Lower Jurassic rocks in northwest Lincolnshire compared with East Yorkshire, where the contemporary strata consist of fossiliferous and re-crystallised fossiliferous limestones) it is usually possible to distinguish fabrics produced from Jurassic raw materials north and south of the Humber. Similarly, the Lower Cretaceous strata of north-east Lincolnshire include well-developed sandstones some of which have iron-rich cement, whereas the equivalent strata in East Yorkshire are extremely thin, often obscured by later deposits and consist mainly of red-stained chalk with a minor quartz sand component.

In order to establish where the pottery used at Melton had been made and whether there were changes in supply during the long period of occupation represented in the excavations, a large number of samples were taken for thin section and chemical analysis (**Table 1**). Sampling was carried out using a stratified system. All the pottery was examined at x20 magnification and on that base a series of fabric groups were created. For all the major groups, six samples were taken for thin section and chemical analyses, trying where possible to make sure that the samples came from different parts of the site and came from vessels which could be reconstructed and illustrated.

METHODOLOGY

One hundred and twenty-eight thin sections were prepared by Steve Caldwell, University of Manchester, and stained using Dickson's method (*Dickson 1965*). This staining distinguishes ferroan (blue) and non-ferroan (pink) calcite and distinguishes dolomite (unstained) from calcite (blue or pink, depending on iron content). Each section was examined at x40 magnification, with x100 and, rarely, x400 magnification used to study the groundmass and specific inclusions. On the basis of the presence/absence and character of the major inclusions and the texture of the groundmass, each section was then assigned to a petrological subfabric (or, rarely, was re-assigned to a different fabric group from that determined using the binocular microscope).

The chemical composition of these 128 samples and a further nine samples, mostly of fired clay, was established using Inductively-Coupled Plasma Spectroscopy (ICP-AES).

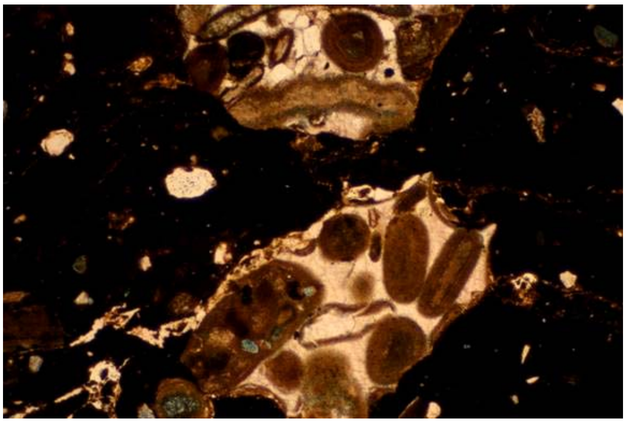

Fig. 2 Photomicrograph of Prehistoric Pottery Fabric

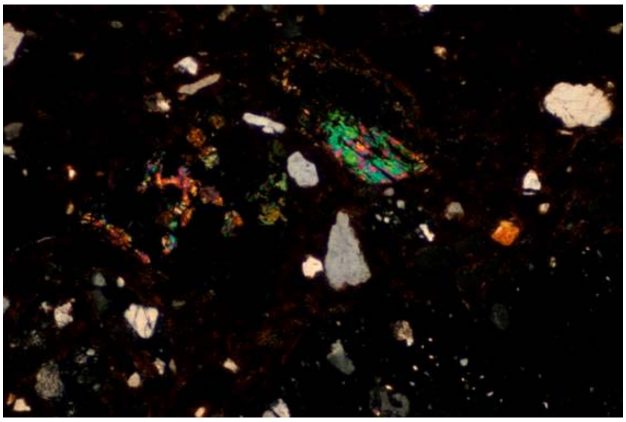

Fig. 3 Photomicrograph of Prehistoric Pottery Fabric

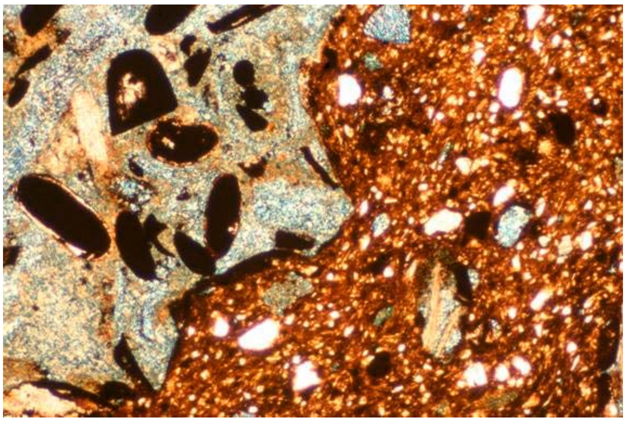

Fig. 4 Photomicrograph of Prehistoric Pottery Fabric

Because of the vesicular, inhomogeneous nature of many of the fabric, offcuts of about 10-15 mm square were removed and all broken edges and surfaces removed, to a depth of between 0.5 and 1.0 mm. The remaining sample weighed between 1.0 and 3 gm.

These analyses were carried out at Royal Holloway College, London, under the supervision of Dr J N Walsh. Nine major elements were measured, as percent oxides, and the frequency of silica was estimated by subtracting the total of these nine measurements from 100%. Nineteen minor and trace elements were measured, although the method used did not fully digest zirconium, which is therefore underestimated.

The ICPS data were normalised to aluminium before being analysed using the factor analysis routine from WinSTAT (2002). None of the elements where the overall frequency is likely to have been seriously affected by post-burial alteration, leaching or concretion, were included. These consist of calcium and phosphorus and the respectively associated elements of strontium and barium. Other elements did show significant correlations with calcium and phosphorus in specific instances, for example the limonite oolith-rich fabric (LOOL) shows a correlation of phosphorus with iron. The results of the factor analysis of the reduced dataset complement those derived from the thin section analysis.

The raw ICPS data and its statistical study using factor analysis are archived online (*Vince 2007; Vince 2006b; Vince 2006a; Vince 2008*).

RESULTS

The thin sections were able to recognise a series of wares of "local" origin (**Figs. 2-4**), since these contained a scatter of fine subangular quartz sand derived from Upper Jurassic deposits which outcrop immediately to the west of the site and which were carried eastwards in Quaternary deposits. To the south of the Humber, this sand outcrops in the Vale of Ancholme and in valleys along the western scarp of the Lincolnshire Wolds. In the first instance the clays are mostly obscured by peats, alluvium and boulder clays and in the second occur alongside inclusions of lower Cretaceous origin. Thus, thin sections on their own can be used to identify local wares, which can then be subdivided according to the nature of the deliberately added tempering material, such as erratic rocks or fayalite slag (**Table 1**, IAERR and IASLAG), or angular clay pellets.

The identity of these pellets is worthy of some discussion: they fit Whitbread's criteria for being grog and it is indeed possible that they might be fragments of earlier vessels (*Whitbread 1986*). However, the firing pattern suggests that they are rarely if ever fired at a higher temperature or for a longer period of time than the groundmass and it may be that they were added as air-dried clay.

Table 2 Normalised ICPS data for local fabrics, major elements

TSNO	N		SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	P_2O_5	MnO
EBAGROG	1	Mean	67.31	18.07	0.37	0.11	0.13	0.01	0.13	0.04	0.01	0.00
ESAXLOC	13	Mean	71.77	16.62	0.35	0.06	0.07	0.02	0.13	0.04	0.02	0.00
ESAXLOC	13	SD	3.74	0.95	0.11	0.02	0.02	0.01	0.04	0.00	0.01	0.00
IAFLINT	2	Mean	75.08	17.38	0.13	0.02	0.14	0.01	0.03	0.04	0.06	0.00
IAFLINT	2	SD	1.61	1.47	0.01	0.00	0.01	0.00	0.00	0.00	0.03	0.00
IAGROG	10	Mean	65.00	19.73	0.36	0.06	0.11	0.01	0.13	0.05	0.05	0.00
IAGROG	10	SD	2.51	1.56	0.08	0.02	0.03	0.01	0.04	0.01	0.02	0.00

Table 3 Normalised ICPS data for local fabrics, minor and trace elements

TSNO	N	cname	Ba	Cr	Cu	Li	Ni	Sc	Sr	V	Y	Zr*
EBAGROG	1	Mean	29.16	8.02	1.83	4.59	3.38	1.00	4.43	7.47	1.38	5.70
ESAXLOC	13	Mean	44.09	7.58	1.85	3.00	3.32	0.93	4.73	9.04	1.40	5.51
ESAXLOC	13	SD	11.15	1.09	0.19	0.68	1.07	0.04	1.09	1.11	0.28	0.93
IAFLINT	2	Mean	21.36	6.59	2.19	2.31	1.01	0.75	7.39	5.59	0.70	5.92
IAFLINT	2	SD	2.25	0.03	0.71	0.20	0.04	0.02	1.32	0.23	0.14	0.15
IAGROG	10	Mean	28.52	6.93	1.79	3.00	2.99	0.95	6.24	8.92	1.33	5.56
IAGROG	10	SD	7.49	1.38	0.28	0.54	1.10	0.10	1.29	1.46	0.48	0.90
TSNO	**N**	**cname**	**La**	**Ce**	**Nd**	**Sm**	**Eu**	**Dy**	**Yb**	**Zn**	**Co**	**Pb**
EBAGROG	1	Mean	2.32	4.32	2.41	0.34	0.08	0.24	0.15	4.32	1.11	0.93
ESAXLOC	13	Mean	2.32	4.25	2.37	0.42	0.08	0.20	0.15	6.62	1.04	1.13
ESAXLOC	13	SD	0.37	0.85	0.39	0.11	0.02	0.06	0.02	2.17	0.27	0.19
IAFLINT	2	Mean	1.29	2.16	1.27	0.12	0.03	0.06	0.09	3.51	0.52	1.05
IAFLINT	2	SD	0.01	0.06	0.01	0.03	0.00	0.00	0.01	0.03	0.04	0.13
IAGROG	10	Mean	2.18	3.78	2.26	0.38	0.07	0.22	0.14	5.99	0.93	1.00
IAGROG	10	SD	0.45	0.91	0.47	0.13	0.02	0.05	0.03	1.44	0.28	0.22

Contrasts in the presence of organic matter in the “grog” inclusions and firing conditions have been used to show that the inclusions are not simply residual pellets of parent clay but in many cases it is by no means certain what the status of the inclusions is.

A distinctive fabric contains deliberately calcined (i.e. fired-cracked) flint (IAFLINT). This occurs in a “local” groundmass and is characteristic of the later Bronze Age/early Iron Age.

These “local” fabrics include that used in the 7th century AD although the character of the sand inclusions distinguished this fabric from any used in the prehistoric period (ESAXLOC).

A further group of fabrics was identified as originating in areas of Jurassic deposits to the west of Melton. These include examples containing inclusions of oolitic limestone (IAOOL), fossiliferous limestone and recrystallised fossiliferous limestone (IALST) as well as

Table 4 Normalised ICPS data for East Yorkshire Jurassic fabrics, major elements

cname	N	mode	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	P_2O_5	MnO
EYQC	10	Mean	67.67	13.29	0.36	0.10	0.69	0.02	0.18	0.04	0.07	0.00
EYQC	10	SD	2.98	1.49	0.02	0.01	0.32	0.00	0.01	0.00	0.06	0.00
IALST	9	Mean	61.60	12.70	0.38	0.09	1.35	0.02	0.13	0.04	0.07	0.01
IALST	9	SD	5.08	2.41	0.08	0.02	0.54	0.01	0.02	0.00	0.04	0.01
IAOOL	6	Mean	57.95	13.91	0.37	0.09	1.35	0.01	0.13	0.05	0.07	0.00
IAOOL	6	SD	1.45	1.53	0.05	0.01	0.35	0.00	0.01	0.00	0.04	0.00
IASH	6	Mean	59.85	13.43	0.48	0.08	1.28	0.02	0.14	0.04	0.06	0.01
IASH	6	SD	4.00	2.56	0.13	0.03	0.63	0.00	0.01	0.00	0.05	0.00

Table 5 Normalised ICPS data for East Yorkshire Jurassic fabrics, minor and trace elements

cname	N	mode	Ba	Cr	Cu	Li	Ni	Sc	Sr	V	Y	Zr*
EYQC	10	Mean	30.80	6.71	2.14	4.45	3.03	0.87	17.84	7.24	1.43	4.44
EYQC	10	SD	4.57	0.88	1.37	0.64	0.40	0.04	8.20	0.50	0.13	0.52
IALST	9	Mean	36.73	7.25	1.88	4.81	3.09	0.93	19.33	7.80	1.51	4.16
IALST	9	SD	10.88	0.48	0.62	0.81	0.22	0.07	5.69	1.88	0.28	0.80
IAOOL	6	Mean	27.02	7.43	1.52	4.58	3.08	1.00	29.22	9.81	1.63	6.07
IAOOL	6	SD	8.85	1.39	0.33	0.74	0.54	0.03	7.57	1.09	0.34	1.59
IASH	6	Mean	29.93	7.67	1.94	4.07	3.17	0.91	18.45	7.14	1.66	4.69
IASH	6	SD	5.99	1.03	0.43	0.73	0.51	0.03	5.83	0.62	0.37	1.40
cname	**N**	**mode**	**La**	**Ce**	**Nd**	**Sm**	**Eu**	**Dy**	**Yb**	**Zn**	**Co**	**Pb**
EYQC	10	Mean	2.50	4.30	2.60	0.42	0.07	0.27	0.16	5.22	0.95	1.03
EYQC	10	SD	0.17	0.26	0.17	0.03	0.01	0.02	0.02	0.94	0.11	0.14
IALST	9	Mean	2.49	4.83	2.56	0.45	0.09	0.24	0.17	7.57	1.04	0.90
IALST	9	SD	0.36	0.59	0.38	0.11	0.02	0.05	0.02	5.30	0.13	0.19
IAOOL	6	Mean	2.68	5.15	2.86	0.47	0.10	0.30	0.19	6.05	1.14	1.06
IAOOL	6	SD	0.33	0.65	0.37	0.09	0.01	0.07	0.03	1.40	0.14	0.11
IASH	6	Mean	2.65	4.44	2.84	0.49	0.08	0.30	0.17	4.90	0.97	1.11
IASH	6	SD	0.16	0.39	0.39	0.06	0.01	0.06	0.03	0.78	0.13	0.26

fabrics produces from fossiliferous marls (IASH). In the case of the prehistoric fabrics it could be demonstrated in many cases that the clay had been obtained close to the outcrop of the inclusions since these show little sign of weathering and there is no mixture of types from different outcrops. Furthermore, the texture and other characteristics of the groundmass (e.g. the presence of silt-sized quartz, muscovite and clay/iron inclusions) usually show a correlation with the inclusion type.

A fabric used in the 12th to 14th centuries AD contained similar Jurassic inclusions to those found in the prehistoric fabrics, but always in the form of a rounded sand which included material derived from different strata (EYQC). These vessels appear to have been produced using Jurassic clays and tempered with sand deposited in a stream or river draining the Chalk and cutting through underlying Upper and Middle Jurassic strata. fabrics produces from fossiliferous marls (IASH). In the case of the prehistoric fabrics it could be demonstrated in many cases that the clay had been obtained close to the outcrop of the inclusions since these show little sign of weathering and there is no mixture of types from different outcrops. Furthermore, the texture and other characteristics of the groundmass (e.g. the presence of silt-sized quartz, muscovite and clay/iron inclusions) usually show a correlation with the inclusion type.

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Table 6 Normalised ICPS data for Roman wheel-thrown oxidized and greywares from Melton and Roxby, major elements

Sitecode	N	cname	SiO_2	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO_2	P_2O_5	MnO
Melton	5	Mean	68.16	18.28	0.41	0.06	0.05	0.02	0.15	0.04	0.02	0.00
Melton	5	SD	3.67	2.46	0.07	0.01	0.02	0.00	0.01	0.00	0.02	0.00
Roxby	5	Mean	65.28	20.79	0.36	0.07	0.03	0.02	0.14	0.05	0.01	0.00
Roxby	5	SD	3.03	2.04	0.03	0.00	0.01	0.01	0.01	0.00	0.01	0.00

Table 7 Normalised ICPS data for Roman wheel-thrown oxidized and greywares from Melton and Roxby, minor and trace elements

Sitecode	N	cname	Ba	Cr	Cu	Li	Ni	Sc	Sr	V	Y	Zr*
Melton	5	Mean	23.56	4.66	1.56	4.01	2.35	0.86	5.62	8.17	1.17	2.88
Melton	5	SD	3.36	0.33	0.11	1.74	1.14	0.03	0.71	2.40	0.41	0.27
Roxby	5	Mean	20.50	5.61	1.11	4.27	1.96	0.93	4.39	8.30	0.86	5.60
Roxby	5	SD	1.53	0.45	0.08	1.19	0.17	0.04	0.80	0.74	0.09	0.27
Sitecode	**N**	**cname**	**La**	**Ce**	**Nd**	**Sm**	**Eu**	**Dy**	**Yb**	**Zn**	**Co**	**Pb**
Melton	5	Mean	2.14	4.14	2.15	0.35	0.06	0.15	0.13	4.53	0.76	1.14
Melton	5	SD	0.15	0.82	0.19	0.11	0.03	0.07	0.02	1.33	0.23	0.10
Roxby	5	Mean	1.97	3.75	1.08	0.33	0.07	0.13	0.12	4.97	0.80	1.51
Roxby	5	SD	0.17	0.33	0.23	0.07	0.01	0.02	0.01	1.23	0.06	0.43

produced using Jurassic clays and tempered with sand deposited in a stream or river draining the Chalk and cutting through underlying Upper and Middle Jurassic strata.

Pottery from sources to the south of the Humber have been identified and include handmade vessels, some containing fragments of a fossiliferous limestone containing abundant limonite ooliths, which also occur loose in the groundmass (LOOL). They also include fine sandy wares which also have a high clay/iron inclusion content (GREY; OX). The latter types date exclusively to the later 1st and early to mid 2nd centuries whilst the former and mainly handmade vessels of later Iron Age to early Roman character. Analysis of the stratigraphic context of the vessels suggests that at Melon all post-date the Roman conquest, although usually they are by far the most common type present in an assemblage, and often the only fabric present.

Sherds of the two LSH vessels were thin-sectioned and matched samples from production sites in Lincoln (*Young and Vince 2005*, LSH).

In the case of the “local” wares, it was possible to see a family resemblance between many of the groups, and to show that “grog”-tempered vessels of early and mid Bronze Age date were made from similar resources to those used in the mid/late Iron Age (**Table 2** and **3**, EBAGROG and IAGROG). However, the late Bronze Age/early Iron Age flint-tempered ware samples (IAFLINT) have a distinct chemical composition which implies a separate, although still local, source. Similarly, the 7th century AD fabric (ESAXLOC) is chemically distinct.

The ICPS data also confirm that the lower Jurassic Iron Age fabrics (IALST; IASH; IAOOL) are made from clays with slightly differing compositions, consistent with the suggestion that each visually-recognisable fabric is distinct (**Table 4** and **5**).

Similarly, the samples of medieval coarseware (EYQC) are slightly different in composition.

The Lincolnshire wares could be distinguished from the East Yorkshire wares using their chemical composition and this supports the suggested origin of the limonitic oolitic fabric (LOOL) as being a north Lincolnshire product. The samples of sandy wares of Roman date (OX; GREY) were close in composition to those from a production site at Roxby although there are several other known production sites in the same area which were not sampled and which might also have been the source of the Melton wares (**Table 6** and **7**).

DISCUSSION

There is no doubt that the results from the analyses of the Melton samples are remarkable and compare extremely favourably with analyses of pottery used and presumably produced to the west of Melton, in the Vale of York, and to the east of Melton, in the Holderness claylands. In both of those cases, the sampled pottery was produced from clays of Quaternary origin in which the inclusions are derived from a wide range of sources, redeposited in boulder clays, glacial sands and gravels and post-glacial lacustrine deposits. Because of the unusual geological configuration, however, the Melton site allows much more precision to be obtained and within limits the results obtained from the study of this material can be applied to neighbouring areas. The first conclusion is that much of the pottery used was produced "locally", which in the case of Melton must mean within 1-5 km of the site. A study of the geology of the excavation itself, and of fired clay used on the site in the Iron Age and Romano-British periods, indicates that clay could not have been obtained from the fill of ditches or pits, all of which were cutting into Quaternary gravels, but that within a few hundred metres of the site such clays would have been obtainable in the sides of streams which drained the Wolds scarp and emptied into the Humber, as well as presumably along the terrace edge between the Quaternary gravels and recent alluvium. Such distances were within easy walking distance and it is quite possible that this pottery was made on site with clays collected elsewhere and brought to the site in an unfired state.

The wares made from lower Jurassic deposits, however, indicate the presence on site of pottery which must have been made by specialised potters. Even these sites were probably only located between 7 and 15 km from the site. There is no evidence for any chronological progression in fabrics, apart from the flint-tempered fabric which is characteristic of the later Bronze Age to early Iron Age, and it therefore seems that these various potteries co-existed. They may simply indicate the presence of a few specialised potters within several distinct communities all living within a few kilometres of each other.

There is little evidence for medium scale importation of pottery. There are some vessels which contain calcite inclusions (IACALC) which in thin section can be seen to have been formed as veins within a chalk country rock. The incidence of faulting on the chalk appears to have been much higher on the northern side of the Yorkshire Wolds than in the Melton area, and in some cases the thin sections indicate the use of a glauconitic clay which cannot have been obtained locally and is present in the Vale of Pickering (the Speeton Clay). However, not only are these vessels rare but there is some doubt as to whether they are of Iron Age date, since the same fabric was used in the later Roman period in the Melton area, and isolated features of that date were excavated on the Melton site whereas previous work on the Iron Age pottery fabrics of East Yorkshire has found that most finds of Iron Age calcite-tempered ware were found very close to the Vale of Pickering (*Rigby 2004*).

There are certainly no obvious exotic fabrics present in the Iron Age period, which is perhaps surprising, given the location of the site near the mouth of one of the major estuaries of Eastern England.

A major change, however, took place in the period soon after the Roman conquest. No sherds of limonite oolitic tempered ware were present in definite pre-Conquest assemblages and there are a series of assemblages, from the fills of pits and ditches, which contain predominantly that ware with only a scatter of definite pre-conquest sherds, if any. This suggests that before the wholesale adoption of wheel-thrown, kiln-fired pottery, in the late 1st to early 2nd century, there was already a complete change in pottery supply. This probably reflects the existence of the ferry crossing between Winteringham and Brough-on-Humber. This must have been established at the same time as Ermine Street, which by c.75AD ran from London to York, using this ferry crossing and is presumably an unintended economic consequence of the existence of this ferry. This North Lincolnshire connection continued into the early to mid 2nd century, with the use of oxidized and grey wares of Roxby type on the site and outlasted the Melton settlement, since shell-tempered pottery, Dales shelly ware, produced somewhere in northwest Lincolnshire, was the most common ware used in the mid to late 3rd century at the neighbouring site of Elloughton. However, that pottery was associated with new types of grey ware which were probably made north of the Humber, in the Holme-upon-Spalding Moor area, and, later, with calcite-tempered ware from the Vale of Pickering. Whether this indicates that the ferry service had become unreliable by the 4th century or the superior marketing of the Vale of Pickering products is not known.

CONCLUSIONS

The thin section and ICPS analyses provided complementary evidence which between them allowed most of the sampled pottery to be assigned to a broad source. There is little evidence for large-scale production and distribution of pottery before the 1st century AD although there is clear evidence that some pottery, perhaps all of it, was produced by specialists in other communities rather than by individual households at Melton.

A major change took place in the late 1st century, with the complete collapse of the pre-Roman supply system and its replacement by pottery produced to the south of the Humber which was probably transported by ferry from Winteringham to Brough. The inhabitants of Melton at this time presumably obtained their pottery from the new market located at Brough, or from traders who passed through Brough and carried the wares to the customers. This new system lasted from the later 1st to the later 3rd centuries but did not survive into the 4th century. By the mid 3rd century, however, (and probably by the later 2nd century) the Melton settlement had been almost completely abandoned and occupation had started on the neighbouring ribbon settlement.

Occupation took place again in the 7th century, when pottery was made from similar local materials to those used in the Iron Age. With the exception of a handful of 20th-century sherds produced in Lincoln, the site was then abandoned again (or at least did not use pottery) until the late 12th century and the coarseware used on that settlement was produced from raw materials obtainable locally but not comparable to any used in the Iron Age.

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REFERENCES

DARLING, M. (2005): Brough-on-Humber fine wares production. *J Roman Pottery Studies*, 12, 83-96.

DICKSON, J. A. D. (1965): A modified staining technique for carbonates in thin section. *Nature*, 205, 587.

DIDSBURY, P. & WATKINS, G. (1992): The Pottery. in D. H. Evans and D. G. Tomlinson, eds., *Excavations at 33-35 Eastgate, Beverley, 1983-86*, Sheffield Excavation Reps 3 J R Collis Publ, Sheffield, 81-120.

FREESTONE, I. C. & MIDDLETON, A. P. (1991): Report on the petrology of pottery from Iron Age cemeteries at Rudston and Burton Fleming. in I. M. Stead, ed., *Iron Age cemeteries in East Yorkshire: Excavations at Burton Fleming, Rudstone, Garton-on-the-Wolds, and Kirkburn*, English Heritage Archaeol Rep 22 English Heritage in association with the British Museum, London, 162-164.

GAUNT, G. D., FLETCHER, T. P., & WOOD, C. J. (1992): *Geology of the Country around Kingston-upon-Hull and Brigg*.

JENNINGS, S. (1992): *Medieval Pottery in the Yorkshire Museum*. York, The Yorkshire Museum.

MAINMAN, A.J. (1990): *Anglo-Scandinavian Pottery from 16-22 Coppergate*. The Archaeology of York 16/5 London, Council British Archaeol.

MAINMAN, A.J. (1993): *The pottery from 46-54 Fishergate*. The Archaeology of York 16/6 London, Council British Archaeol.

MAY, J. (1996): *Dragonby*. Oxbow Monograph 61 Oxford, Oxbow.

MCCARTHY, M.R. & BROOKS, C.M. (1988): *Medieval Pottery in Britain AD900-1600*.

MONAGHAN, J. (1993): *Roman Pottery from the Fortress: 9 Blake Street*. The Archaeology of York 16/7 London, Council British Archaeol.

MYRES, J.N.L. (1977): *A Corpus of Anglo-Saxon Pottery of the Pagan Period, 2 Vols*. Cambridge, Cambridge University Press.

RIGBY, V. (2004): *Pots in Pits*, East Riding Archaeological Society.

TIMBY, J. (1993): " Sancton 1 Anglo-Saxon cemetery. Excavations carried out between 1976 and 1980." *Archaeol J*, 150, 243–365.

VINCE, A. (2006a): *Characterisation Studies of Medieval Coarseware from Melton, East Yorkshire (OSA04 EX03)*. AVAC Reports 2006/153 Lincoln.

VINCE, A. (2006b): *Characterisation Studies of two Anglo-Scandinavian Pottery Vessels from Melton, East Yorkshire (OSA04 EX03)*. AVAC Reports 2006/152 Lincoln.

Vince, A. (2007): *Characterisation Studies of Prehistoric and Early Roman Pottery from Melton, East Yorkshire (OSA04 EX03)*. AVAC Reports 2007/105 Lincoln.

Vince, A. (2008): *Characterisation Studies of Humberware from Melton, East Yorkshire (OSA04 EX03)*. AVAC Reports 2008/37 Lincoln.

VINCE, A., IXER, R., & YOUNG, J. (forthcoming): Pottery and Society in Northern Britain, c.450AD to c.1100AD: The Northumbrian Kingdom Anglo-Saxon Pottery Survey. *Medieval Archaeology*.

WARDLE, P. (1991): *Earlier Prehistoric Pottery Production and Ceramic Petrology in Britain*. BAR British Series 225 Oxford, BAR.

WATKINS, G. (1991): The Pottery. in P. T. D. Armstrong and D. H. Evans, eds., *Excavations at Lurk Lane Beverley, 1979-82*, Sheffield Excavation Rep 1 J R Collis Publ , Sheffield, 61-103.

WinSTAT(r) (2002), Fitch, Robert K. R. Fitch Software, 2001.

WHITBREAD, I. K. (1986): The characterisation of argillaceous inclusions in ceramic thin sections. *Archaeometry*, 28 No.1 (1), 79-88.

YOUNG, J. & VINCE, A. (2005): *A Corpus of Anglo-Saxon and Medieval Pottery from Lincoln*. Lincoln Archaeological Reports Oxford, Oxbow.