

Thin Section analysis of Bronze Age Pottery from Washingborough, Lincolnshire (WPSE)

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Samples of eight Bronze Age vessels from Washingborough Pumping Station were submitted for thin section analysis by Carol Allen. Several of the vessels have a similar range of inclusion types and were probably made in the same area, probably nearby. Three of the vessels contain distinctly different inclusions and one of these was produced from raw materials which probably came from the Lincolnshire Wolds, although a more distant source is possible.

Description

The thin sections were each examined and a list of the inclusion types present in each section, together with a rough indication of their frequency (sparse/moderate/abundant) was recorded. On this basis of this detailed study, the sections were grouped into four fabrics, of which the first was subdivided into subfabrics.

Fabric 1 – Shelly Limestone tempered ware

Five sections contain a very similar range of inclusions, a number of which are derived from the same raw material, a shelly limestone interleaved with clays (Fabric 1a). One section, in addition, contains opaque inclusions (probably iron replacement of the limestone) and mudstone fragments (Fabric 1b) and in one section the shelly limestone inclusions are much coarser than in the other sections, organic matter is present (probably deliberately added) and the groundmass is not identical to the remainder (Fabric 1c).

Fabric 1a

The following inclusion types were noted:

- Shelly limestone. Moderate subangular fragments of a limestone consisting of large nacreous bivalve shells cemented with ferroan calcite and clay minerals up to 1.0mm across. Some of the shells have boreholes filled with ferroan calcite.
- Ferroan calcite. Moderate subangular fragments of ferroan calcite up to 0.5mm across.
- Marl pellets. Sparse subangular fragments of marl, consisting of baked clay with abundant ferroan calcite inclusions, up to 0.5mm across.
- Relict clay. Abundant subangular fragments with a similar composition to the main body, including the same range of inclusions, up to 2.0mm across.

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- Rounded quartz. Sparse rounded grains, some of which have a high sphericity, up to 0.3mm across.
- Fine-grained sandstone. Rare rounded grains, up to 0.3mm across, composed of subangular quartz grains up to 0.2mm across with a silica cement.
- Chert. Rare rounded grains, up to 0.3mm across, usually with a high sphericity.
- Phosphate. Abundant dark brown phosphate, usually filling laminae and voids left after the leaching of shell inclusions. In one section, however, the phosphate might be an original feature of the fabric (V3229). Also, in another section a single fish bone fragment (c.0.1mm diameter and c.0.3mm long) was present in one of the ferroan calcite pellets.

The groundmass consists of optically anisotropic baked clay minerals, sparse angular quartz, muscovite laths, dark brown to opaque grains and amorphous ferroan calcite, all up to 0.1mm across.

Fabric 1b

The following inclusion types were noted and were identical in character to those in Fabric 1a:

- Shelly limestone.
- Ferroan calcite.
- Marl pellets.
- Rounded quartz.

The groundmass was also identical to Fabric 1a.

In addition, the following inclusion types were present:

- Opaque grains. Moderate subangular fragments up to 1.0mm across, some with shell-shaped voids or bivalve shell inclusions.
- Mudstone. Moderate rounded fragments of laminated mudstone up to 1.0mm across, one of these contains progressively more quartz silt from one surface to the other.
- Quartz. In addition to the rounded, monocrystalline quartz grains, some strained, polycrystalline grains of metamorphic origin were present. These have a similar size range to the other quartz grains.

Fabric 1c

The following inclusion types were noted:

- Shelly limestone. Abundant fragments as in Fabrics 1a and 1b but much larger fragments, ranging up to 3.0mm long.

- Ferroan calcite. Moderate fragments as in Fabrics 1a and 1b, up to 0.5mm across.
- Quartz. Sparse rounded grains up to 0.3mm, as in Fabrics 1a and 1b.
- Organics. Moderate fragments, ranging up to 1.0mm across but mainly long, thin fragments of leaf or stem.

The groundmass consists of anisotropic baked clay minerals with moderate ferroan calcite inclusions up to 0.1mm across.

Fabric 2 – Flint tempered ware

The most distinctive feature of this fabric is the presence of large, angular flint fragments.

The following inclusion types were noted in thin section:

- Flint. Moderate angular fragments up to 1.0mm across. These show no staining but some have a thin (i.e. 0.05mm or less) dark coating indicating that they are not recently broken.
- Relict clay. Abundant angular fragments up to 1.5mm across. Some of these differ in firing conditions to the groundmass (the carbon, which causes the blackening of the main body is absent), and they contain sparse muscovite laths absent from the body. They may therefore be fragments of grog, deliberately crushed pottery fragments. One contains a fragment of flint.
- Quartz. Sparse rounded grains, as in Fabric 1. Also, sparse rounded fragments with a low sphericity up to 0.4mm across.
- Chert. Sparse fragments as in Fabric 1.
- Glauconite. Rare rounded altered glauconite grains up to 0.2mm across.
- Concretion. A single soil concentration feature was present, 1.5mm across. This consists of a spherical or oolitic concentration of dark clay/iron composed of staining of the surrounding clay. Such nodules are formed *in situ* in the parent clay.

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

Fabric 3 – Bioclastic Limestone tempered ware

This fabric is characterised by large rounded fragments of a distinctive bioclastic limestone.

The following inclusion types were noted:

- Bioclastic Limestone. Moderate rounded fragments of a limestone composed of fragments of bivalve shell, echinoid shell, echinoid spines and punctate brachiopod shell cemented with ferroan calcite and marl. Small rhombs of dolomite occur in the groundmass of one of the limestone fragments.

- Quartz. Abundant rounded quartz grains up to 1.0mm across. Most are unstrained and monocrystalline but others are strained and polycrystalline and of metamorphic origin.
- Fine-grained sandstone. Sparse rounded fragments as in Fabric 1.
- Chert. Sparse rounded fragments as in Fabric 1.
- Plagioclase Feldspar. Sparse rounded fragments, up to 0.5mm across.
- Organics. Moderate fragments, up to 1.0mm long and surrounded by a blackened halo.

The groundmass is composed of optically anisotropic baked clay with few inclusions visible in thin section.

Fabric 4 – a leached calcareous ware

This sample, unlike the remaining sections, has been heavily leached and most of the calcareous inclusions are represented by voids.

The following inclusion types have been noted:

- Voids. Abundant voids, probably shell, up to 1.0mm long.
- Relict clay. Moderate rounded fragments up to 1.0mm across.
- Opaques. Moderate rounded opaque grains up to 0.4mm across.
- Quartz. Moderate rounded grains, up to 0.3mm across, as in Fabric 1.
- Phosphate. Abundant post-depositional dark brown phosphate. One fragment might either be an original phosphate pellet or altered glauconite.

The groundmass consists of optically anisotropic baked clay, sparse angular quartz and possibly voids from leached-out calcite.

Interpretation

Fabric 1

The shelly limestone, ferroan calcite and marl fragments present in Fabrics 1a to c are similar to those seen in shell-tempered pottery of Anglo-Saxon and medieval date from Lincoln and Potterhanworth. Visual study of rock samples supplied by John Aram suggests that they are probably derived from shelly facies of the Great Oolite (1980, 49) rather than the Cornbrash (Kent 1980, 49-50), although the latter rock does outcrop in Potterhanworth parish. However, this shelly Great Oolite facies outcrops in a narrow band running north/south from central Lincolnshire to the Humber (although in the north it is mainly obscured by Quaternary deposits). One might also expect it to be present in glacial till which outcrops in patches on

the dip slope of the Jurassic ridge, perhaps extending well to the south (Kent 1980, 120, the Wragby Till).

The rounded quartz, fine-grained sandstone and chert inclusions are components of the quartzose sand which is ubiquitous in central Lincolnshire, being ultimately derived from Triassic deposits and then redeposited in river terraces and, from there, carried as windblown cover sands which can outcrop on top of the Jurassic ridge (Kent 1980, 120). They are therefore of little use in determining the source of the pots.

The organic inclusions in Fabric 1c do not appear to be natural components of the clay, although organic mudstones do occur in the local Jurassic strata, and are probably either deliberately added organic matter, such as chaff or dung, or indicate the use of a recent clay, such as might be formed where streams and rivers cut through Jurassic clays.

The difference in groundmass, and the presence of the organic matter, suggest that Fabric 1c was made at a different location from Fabrics 1a and 1b. Fabrics 1a and 1b were probably made from a weathered outcrop of shelly marl contaminated with windblown or riverine sand and the similarity to medieval Potterhanworth ware suggests a similar setting; on the dip slope of the Jurassic ridge, probably in central Lincolnshire.

Fabric 2

The flint in Fabric 2 is fresh but not flint debitage. The inclusions, therefore, probably come from a deposit of clay with flints or decalcified flint gravel was used to temper the parent clay (since no chalk or other calcareous inclusions are present). The remaining inclusions and the groundmass characteristics suggest a clay-with-flints origin. The low-sphericity quartz grains are probably of lower Cretaceous origin and occur sparsely in the Red Chalk of East Yorkshire and the northern part of the Lincolnshire Wolds, but are more common in Lower Cretaceous sands which outcrop on the western side of the Lincolnshire Wolds, from Barnetby-le-Wold southwards to the fens (Kent 1980, 90). Most Lincolnshire ceramics produced on the southwest side of the Wolds have a higher quartz sand content than this sample, and are micaceous (Kent 1980, 90 and 120, the Belmont Till) or have a completely quartz-free groundmass derived from Upper Jurassic clays, either in situ or redeposited in till, Kent 1980, 120 the Wragby Till). Therefore, an east Yorkshire or northern Wolds origin is perhaps more likely but in either case, the source must be either at least 20 miles to the east, across the central clay vale, or 50 miles to the north, and involves a crossing of the Humber. Flint is present in Quaternary gravels in northwest Lincolnshire, but only as part of a mixed gravel and not as the sole component. It should be noted that even without the flint inclusions, the fabric is distinguishable in texture from the remaining types.

Fabric 3

The inclusions in Fabric 3 are probably deliberately added to a clean clay. In Lincolnshire, such clays are all of Jurassic age, and include outcrops of Lower Jurassic clay, in the Trent

Valley, Middle Jurassic (interleaved with sands and limestones) in the Middle Jurassic and, extensively, in the Upper Jurassic on the dip slope of the ridge and in the central clay vale, where they are masked by Quaternary deposits. The bioclastic limestone includes a mixed fauna which can occur in either the Lower Jurassic (some outcrops of Lias limestone, for example), or in the Middle Jurassic (e.g. the Cornbrash, which is noted by Kent (1980, 49) as being usually richly fossiliferous with abundant brachiopods and bivalves). At present, no precise source can be assigned to this fabric, but similar characteristics have been noted in shell-tempered wares from northeast Lincolnshire and the southern fringes of the Yorkshire Wolds although, clearly, a source utilising detrital Cornbrash would be much closer to the Washingborough site.

Fabric 4

It is most likely that this sample is actually a leached example of Fabric 1. However, it does not include muscovite laths in the groundmass.

Conclusions

The samples probably come from three or four different sources: Fabric 1a, 1b and possibly Fabric 4 are probably from the same area, and contain fragments of a shelly limestone which outcrops on the dip slope of the Jurassic ridge (in other words, very local to Washingborough). Fabric 1c is tempered with a similar limestone but whereas the limestone inclusions in the first group appear to be present naturally in the parent clay, those in Fabric 1c appear to be added. Fabric 3 contains rounded fragments of a bioclastic limestone, possibly from a lower Jurassic outcrop in the northwest of Lincolnshire, but quite possibly from another source. It is, however, very different from the other shelly fabrics. Finally, Fabric 2 was produced close to the Chalk either in Lincolnshire or further afield.

The possible grog noted in Fabric 2 is interesting, since several of the fabrics have similar inclusions of relict clay, which has been interpreted here as being due to the use of fairly dry clay and to a lack of mixing. In Fabrics 1b and 1c this mudstone is clearly not grog, since the original bedding of the rock survives but the difference in firing and mica content makes it fairly certain that the fragments in Fabric 2 are grog.

It would be possible to establish the source of all three fabric groups with more certainty using chemical analysis (ICPS). Data from samples, of Roman and later date, of shell-tempered wares produced in the Wolds, central Lincolnshire, northeast Lincolnshire and East Yorkshire exist producing a very good basis for comparison.

Table 1

TSNO	Fabric	Action	Context	REFNO	class	Subfabric (visual)	Form	Description
V3229	1a	TS	003	14319	POTTERY	FOSSILIFEROUS LST;S RQ		
V3230	1a	TS	003	5339	POTTERY	GROG;ANG VOIDS	JAR	GLOB BODY;BURNISHED

V3231	1a	TS	003	5010	POTTERY	FOSSILIFEROUS LST			INT AND EXT
V3232	2	TS	003	5208	POTTERY	GROG; FLINT			
V3233	3	TS	011	5959	POTTERY	MIXED LST GRAVEL (LOWER JURASSIC?)			
V3234	4	TS	104	281	POTTERY	RQ	JAR	THIN WALLED;BURNISHED INT AND EXT	
V3235	1c	TS	105	255	POTTERY	FOSSILIFEROUS LST/SHELL			
V3254	1b	TS	424	8896	POTTERY	FOSSIL SHELL;FOSSILIFEROUS LST;MUDSTONE;GROUNDMASS AND MUDSTONES MICACEOUS			

Bibliography

Kent, Peter (1980) *Eastern England from the Tees to the Wash*. 2nd Edition. British Regional Geology London, HMSO