Petrological Analysis of Anglo-Saxon Pottery from the Silk Willoughby to Sleaford Pipeline

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Samples of five Anglo-Saxon vessels from a small cemetery found during archaeological work undertaken by Field Archaeology Specialists Ltd on the line of the Silk Willoughby to Sleaford pipeline were submitted for petrological analysis following a visual assessment of the pottery (Vince 2002). The aims of this analysis were twofold:

- To test the identification of rock and mineral inclusions in the pottery fabrics determined in 2002 as a result of x20 binocular microscope study
- To see whether these inclusions can be used to establish the place of manufacture of the vessels.

Methodology

The thin-sections were produced at the Department of Earth Sciences, University of Manchester, by Mr Steve Caldwell. Each section was stained, using Dickson's method (a mixture of Alizarin Red S and potassium ferricyanide, Dickson 1965). This method stains carbonates containing ferrous iron a pale to deep blue, depending on iron content, and distinguishes calcite (which is stained red with considerable reduction in relief) from dolomite, which is unaffected. The sections were assigned the identifying codes V1692 to V1696 (Table 1)

Table 1

TSNO	Sitecode	Context	cname	Inclusions visible by eye (from Vince 2002)
V1692	ssp252:00 int10 field 14	1058	SST	Tempered with abundant quartzose sand. There are moderate rounded fragments of a sandstone, composed of illsorted subangular quartz grains up to 0.3mm with sparse light-coloured cement. Most of the quartz sand is composed of grains of similar character to those in the sandstone but a few larger, rounded grains with a matt surface, up to 1.0mm across. Sparse fragments of biotite up to 1.0mm across were also noted.
V1693	ssp252:00 int10 field 14	1039	LIM	The fabric is tempered with moderate angular fragments of oolitic limestone up to 4.0mm across and sparse subangular quartz grains.
V1694	ssp252:00 int10 field 14	1052	SSTCL	Tempered with abundant quartzose sand, including sandstone fragments of two lithologies: a fine-grained rock with well-sorted, overgrown quartz grains c.0.2mm

TSNO	Sitecode	Context	cname	Inclusions visible by eye (from Vince 2002)
				across and a fine-grained rock with well-sorted quartz grains and a brown, haematite-rich cement.
V1695	ssp252:00 int10 field 14	1074	CHARN	Tempered with abundant quartzose sand and moderate fragments of biotite-rich acid igneous rock up to 2.0mm across. There are possible fragments of a coarse-grained sandstone composed of overgrown quartz grains, up to 2.0mm across.
V1696	ssp252:00 int10 field 14	1428	ESAXLOC	The fabric of this vessel is not readily visible as a result of concretions on the surfaces and broken edges of the sherd. However, a number of rounded limestone fragments, up to 5.0mm across, are present. It is not clear under x20 magnification what type of limestone these fragments come from. Also present are subangular quartz grains and medium-grained sandstone fragments.

Petrological Description

V1692

The following inclusion types were noted in thin section:

- Abundant rounded quartz grains up to 0.5mm across
- Moderate rounded sandstone fragments up to 1.0mm across. The clasts consist of rounded quartz and chert grains up to 0.5mm across. The cement is tentatively identified as sparry gypsum.
- Sparse rounded chert grains up to 0.5mm across
- Sparse rounded opaque grains up to 0.3mm across
- Rare ovoid quartz grains with high roundness and sphericity up to 0.5mm across. One is cracked.

The groundmass consists of opaque clay minerals, probably the result of finely-divided carbon, with sparse angular quartz grains up to 0.1mm across.

It seems very likely that the quartz and chert grains are mainly derived from the sandstone. Presumably the sandstone is of Permo-Triassic age and the well-rounded grains are of similar age, but clearly not derived from the same sandstone. These characteristics suggest that the ultimate source of the inclusions in this sample lies to the west of the Trent. However, there is very little evidence for the use

of pottery in that area, apart from on sites in the Trent valley itself. Trent valley sands, at least in the stretch of the valley from Newark to Torksey, contain similar quartz sands with chert as a notable minor inclusion but they also contain fragments of sandstone of varying textures, usually finer than the present pieces and not with gypsum cement (for example the recently excavated site at Glebe Farm, Brough, where rounded quartz sand temper is the most frequent pottery temper). The characteristics of the clay groundmass are not distinctive. An origin in the Trent valley further to the south is likely.

V1693

The following inclusions were noted in thin section:

- Moderate rounded fragments of bioclastic limestone up to 1.5mm across. The clasts are mainly replaced by non-ferroan micrite but include some nacreous bivalve shell fragments (with very little staining). The cement consists of sparry ferroan calcite.
- Sparse rounded quartz grains up to 0.5mm across, some cracked.
- Sparse rounded chert grains up to 0.3mm across
- Sparse organic inclusions up to 0.5mm long.
- Sparse subangular opaque grains up to 1.0mm long.
- Sparse rounded mudstone fragments, some laminated, up to 1.0mm long.
- Sparse subangular quartz grains up to 0.3mm across.
- Sparse angular quartz grains up to 0.2mm across.

The groundmass consists of anisotropic baked clay minerals and sparse angular quartz grains up to 0.1mm across

The limestone fragments are almost certainly from the Lincolnshire Limestone. However, they are detrital grains and may therefore have travelled some distance from the outcrop of the limestone. Furthermore, they include no ooliths or micrite pellets, both of which are common in many exposures of the Lincolnshire Limestone. The mudstone may be ‘relict clay’ and probably indicates the use of a Jurassic clay. However, the quantity of angular and subangular quartz grains between 0.1mm and 0.3mm across is not paralleled in those clays nor in other vessels made from Jurassic clay. Thin section analysis shows that this vessel is not identical to those classed as LIM in the East Midlands Anglo-Saxon pottery survey, which do contain ooliths and micrite pellets, with or without any calcite cement.

V1694

The following inclusions were noted in thin section:

- Moderate subangular fragments of sandstone up to 1.5mm across. The rock contains illsorted rounded grains of quartz, some overgrown in optical continuity with the original grain. There are, however, brown inclusions along the original grain boundaries and in the outer quartz coating. Similar grains occur loose in the fabric.
- Moderate rounded quartz grains up to 0.3mm across
- Sparse angular fragments of igneous rock up to 1.5mm across. These include angular plagioclase feldspar and a rock composed of sheaves of muscovite, biotite and quartz.
- Sparse rounded clay pellets up to 0.3mm across
- Sparse rounded opaque grains up to 0.3mm across
- Sparse organic inclusions up to 0.5mm across. These do not seem to be chaff/dung as is often found in Anglo-Saxon pots but have irregular outlines and are surrounded by carbon-rich haloes.
- Sparse angular quartz grains between 0.1mm and 0.3mm across.
- Sparse rounded chert up to 0.3mm across
- Sparse polycrystalline quartz grains with a high sphericity and roundness, often broken up to 0.5mm across.

The groundmass consists of inclusionless anisotropic baked clay minerals.

Most of the inclusions in this sample are typical of sands in the Trent valley. The broken quartzite grains are ultimately derived from the Triassic Sherwood Sandstone but are common in detrital sediments and the sandstone fragments are probably also of Permo-Triassic age. The clay pellets may be relict clay from the working of the parent clay, whose lack of inclusions suggests a Jurassic origin.

The coarse angular fragments of igneous rock are difficult to interpret. The nearest source of such rocks is the Charnwood inler in northeast Leicestershire, but these pieces are not typical of the Mountsorrel granodiorite and it is possible that they are glacial erratics of Scottish or Scandinavian origin. However, their fresh condition contrasts with that of the other inclusions, which form a fine sand. It may be, therefore, that the source of the potting clay was not undisturbed Jurassic clay but a glacial till.

V1695

The following inclusions were noted in thin section:

- Abundant rounded quartz grains up to 0.5mm across
- Moderate angular fragments of acid igneous rock up to 2.0mm across. These include composite fragments containing feldspar, quartz and magnetite and feldspar, quartz and biotite (with a green-blue tinge).
- Sparse rounded inclusionless clay pellets up to 0.5mm across
- Sparse rounded chert fragments up to 0.5mm across.
- Sparse well-rounded quartz grains with a high sphericity up to 0.5mm across

The groundmass consists of anisotropic clay minerals, sparse angular quartz up to 0.1mm across and sparse muscovite up to 0.1mm long.

Although by no means identical with V1694, there are points of similarity. In particular, the rounded quartzose sand appears to be typical of the Trent valley whilst the clay matrix could be of Jurassic age. In both cases the presence of acid igneous rock must be explained. Again, the fragments are not typical of the Mountsorrel granodiorite. The frequency of fragments, together with their angularity, discounts a detrital origin and this leaves only three possibilities: a) that the pots were produced to the south of Charnwood Forest, where Charnian rocks are widespread in fluvio-glacial deposits, b) that boulder clay containing erratics was used or c) that crushed rock was deliberately added. Against option (a) is the fact that vessels which clearly originate in the Leicestershire area do not contain the quartz sand with its high Triassic component (Williams and Vince 1997). Against option (b) is the fact that no such boulder clays have been observed or reported in this part of Lincolnshire whilst the third option still begs the question of where the rock fragments actually came from.

V1696

The following inclusions were noted in thin section:

- Moderate well-rounded spherical quartz grains up to 0.3mm across. Some of these grains are cracked.
- Moderate rounded mudstone fragments up to 1.0mm across. Some of these grains show lamination.
- Moderate rounded and subangular micrite fragments up to 1.0mm across. Some of these appear to be heat altered. Brown staining around the edges of these grains and their texture suggest that these fragments may be concretionary nodules, naturally present in the clay, rather than detrital limestone fragments.
- Sparse rounded chert fragments up to 0.3mm across.

- Sparse sandstone fragments up to 1.0mm across. The rounded quartz is overgrown, and there are two types of cement present. One is a dark coloured clay and the other opaque.

The groundmass consists of isotropic baked clay minerals and contains abundant vesicles and sparse angular quartz up to 0.2mm across.

The character of the groundmass, together with the micrite fragments suggest that the parent clay for this fabric may be Lower Lias or Rhaetic, which outcrop in the Trent valley. The quartzose temper is typical of Trent valley sands.

Conclusions

Despite the fact that four of the five vessels were visually assigned to widely-recognised Anglo-Saxon pottery fabrics the thin section analysis suggests that most could in fact have been made from materials available locally.

Despite this, they are clearly made from very different raw materials. The sandstone inclusions in V1692 are consist with the use of a sand derived from the weathering of this sandstone and would certainly have a wider range of inclusion types present if the sand was a Trent valley terrace sand. V1693, by contrast, was probably made from a calcareous gravel derived from the Lincolnshire Limestone but the quartzose inclusions indicate a contribution from fluvio-glacial sands in the Trent valley. V1694 and V1695 both contain similar fluvio-glacial sand but with the addition of varying quantities of angular acid igneous rock fragments. These are sparse in V1694 but the second most common inclusion type in V1695. Finally, V1696 may have been produced from a calcareous clay such as the Lower Lias. This fabric too was tempered with Trent valley quartzose sand.

Thus, we have five samples and at least four separate fabrics. This could be interpreted in several ways: it might indicate that production took place in numerous localities and that pottery was exchanged between these groups; or it might indicate that pottery was not a well-organized craft and that when pots were required the potter had to hunt for suitable raw materials rather than returning to traditional clay pits or sand exposures. In one case the potter also added chaff (V1693) whilst in another the identify of the organic inclusions is uncertain. Finally, the interpretation of the two fabrics which contain igneous rock fragments is uncertain. Similar instances of acid igneous rock associated with locally-available rounded quartz sand have been noted at Brough and at Dunholme (Vince 2003). One possibility for the source of the two samples which contain igneous rock fragments is boulder clay. Only small pockets of till occur in the area of the site but the Heath Till which outcrops in the Trent Valley to the north of Lincoln is apparently composed of Triassic material. Study of this outcrop would at least be able to discount it as a potential source if acid igneous rocks do not occur within it (1980). Boulder clays outcrop extensively to the east of the Lincoln Edge, but their constituents include Jurassic and Cretaceous rocks which are absent from the samples under discussion. Igneous rocks are common in the Basement Till which outcrops to the east of the Lincolnshire Wolds but these are

mainly basic rocks, derived from the dolerite sills of northeast England and biotite granite, from the Cheviots, although present, is rare.

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