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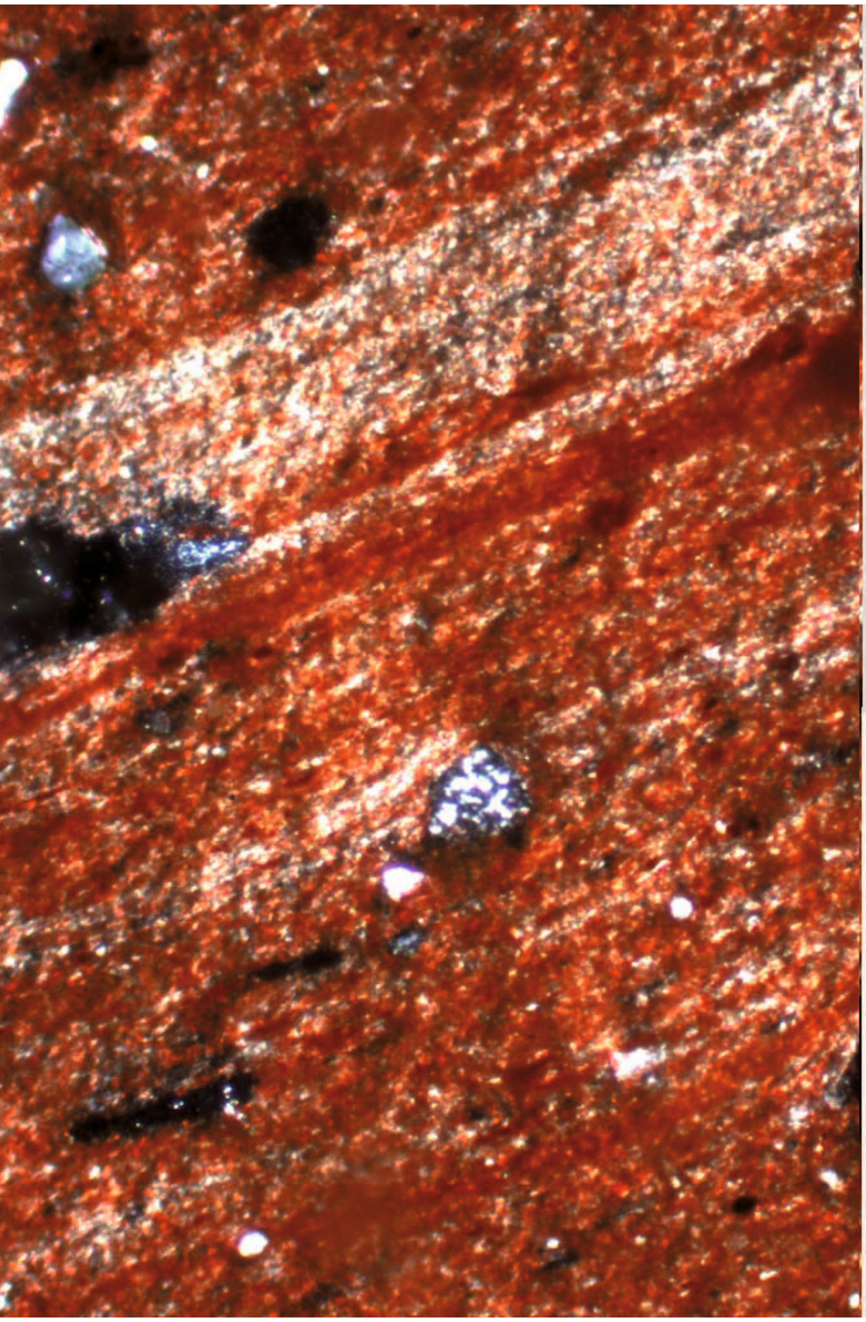
SILKSTONE POTHOUSE, SOUTH YORKSHIRE CHEMICAL AND PETROGRAPHIC ANALYSIS OF EIGHTEENTH-CENTURY GLAZED WARES

TECHNOLOGY REPORT

Harriet White



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Summary

The Silkstone pothouse is one of a number of known production centres that was involved in the manufacture of Slipwares, Mottled Ware and other glaze decorated pottery during the eighteenth century in England. This report presents the results of a scientific study of the pottery manufactured at the site. The methods used include petrographic and chemical analysis of the ceramic fabrics and chemical analysis of the glazes. Observations are made on raw material use and manufacturing technologies of the pottery and glazes, and the Silkstone products are characterised chemically and pertrographically.

Keywords

Post Medieval
Ceramic
Technology

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Introduction

During the eighteenth century Trailed and Combed Slipware, Mottled and other glazed wares were widely produced and used across England. The pottery workshop at Silkstone, located approximately five kilometres to the west of Barnsley, South Yorkshire, is one of a number of known production centres of these wares (Fig 1). Pottery from Silkstone has been examined macroscopically and a number of distinct fabrics have been identified and described based upon visual criteria such as fabric colour, and inclusion size, distribution and colour (Cumberpatch 2004, Dungworth and Cromwell 2006). Because visual characteristics of ceramic fabrics are influenced by firing temperature and atmosphere, the extent to which the different fabrics identified represent use of different raw materials is in question (Cumberpatch 2004). This report presents the results of a scientific study of the Silkstone pottery assemblage which was undertaken to characterise the Silkstone pottery assemblage on a more objective level than visual examination alone can provide, and to investigate more thoroughly raw material usage and production methods of the pottery in question.

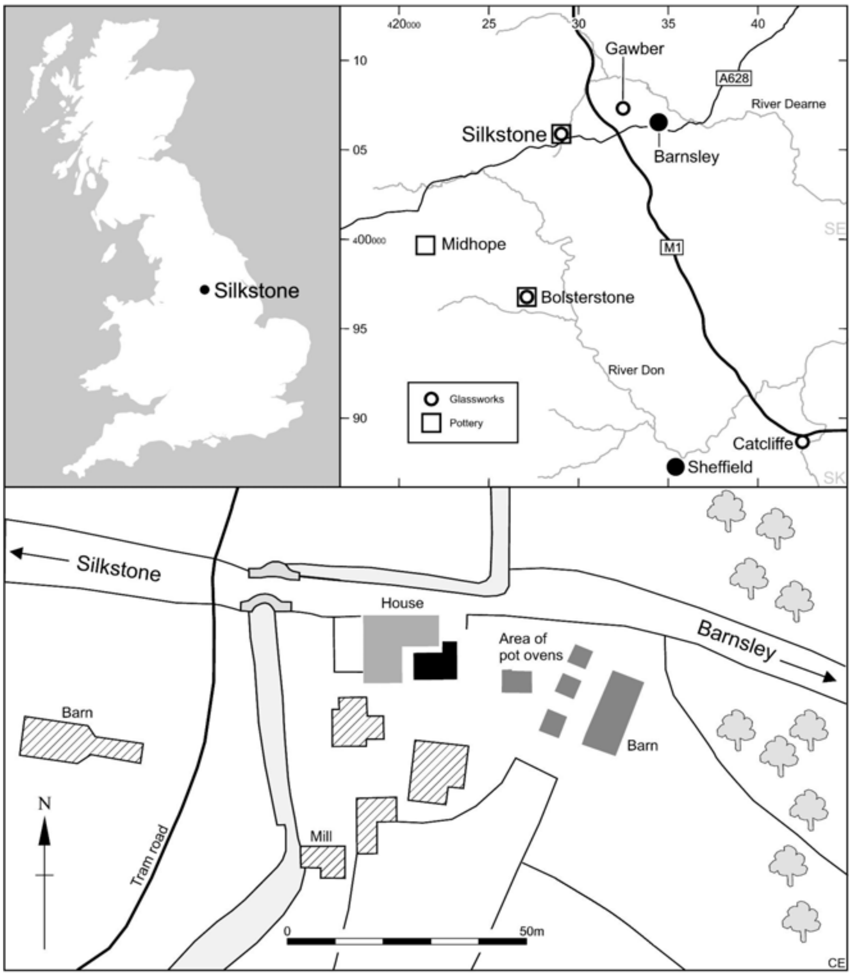

Figure 1: Location of Silkstone pothouse. The map is based in part on the 1850 Ordinance Survey map (drawn by Chris Evans)

Historical and Archaeological Background

A record of the industrial activities carried out at Silkstone during the seventeenth to nineteenth centuries survives in documentary and pictorial archives. Details of these have been published in Dungworth and Cromwell (2006, 160-162) and a brief summary of that work is presented here. The site was initially set up as a glasshouse by members of the Plimey family. The Plimeys are first documented at Silkstone in 1658 when John Plimey married Abigail Scott, the widow of William Scott, an affluent farmer and landowner. The first evidence for glass production at Silkstone comes one year later in 1659. (Dungworth and Cromwell 2006, 162). The will of John Scott, Abigail's son, shows that by 1707 glass production at Silkstone was in decline and a later inventory dating to 1746 makes no mention of the glasshouse (Dungworth and Cromwell 2006, 162).

Glass production was replaced by pottery production at Silkstone. Deeds dated to 1754, referring to potovens, a house and a cornmill owned by James Scott and occupied by John Bailey, Ralph Taylor, Joseph Goldthorpe and Michael Taylor, provide the first documentary evidence for the pottery at Silkstone. The estate was sold to Richard Fenton in 1775, and the deeds for this sale list the same tenants, excluding Michael Taylor. The potter John Taylor is recorded as a tenant from 1781 to 1812, and William Taylor, again a potter, from 1812 to 1821 (Dungworth and Cromwell 2006, 162).

Based upon the documentary evidence, the transition from glass production to pottery production at Silkstone appears to have occurred by the end of the 1740s (Dungworth and Cromwell 2006, 162). This is, however, contradicted by the archaeological evidence which suggests an earlier date for the establishment of a pottery there.

Archaeological excavations of a now derelict stone cottage at the Silkstone site were carried out in 2002 by English Heritage. A summary report of the excavations is provided by Cromwell and Dungworth (2002), and further details are published in Dungworth and Cromwell (2006). Excavated areas included one trench within the cottage itself and one outside to the south of the cottage. Six phases of activity were identified, with the first four relating to glass production, the fifth to pottery production and the sixth to the conversion of the cottage *c* 1900. Contexts relating to the pottery production include [0002], a thin clay floor layer containing pottery waste, below this [0007], a grey silt layer up to 0.2m thick, and under these [0009], a dump of pottery waste and kiln furniture in a red silty matrix, again up to 0.2m thick. Context [0009] butted the south and west walls of the cottage indicating it was dumped as a base for the clay floor, and the absence of soil within the deposit suggests that this occurred during the working life of the pottery. Context [0014], immediately below context [0009], was identified as a compact floor layer composed of black ash, coal dust, glass fragments and glass working waste and so represents the latest glass working phase (Phase Four). (Cromwell and Dungworth 2002; Dungworth and Cromwell 2006).

Clay tobacco pipe fragments recovered from these contexts provide evidence for their dating. Table 1 presents a summary of some of the results of a study of pipe forms and makers' stamps undertaken by Higgins (2003). The results indicate that pottery production began during the first half of the eighteenth century at Silkstone, half a century earlier than is suggested by the documentary records.

Table 1. Clay tobacco pipe dates for Phase Five and Phase Four contexts

Context	Date
[0002]	*c* 1700-1740
[0007]	*c* 1700-1750
[0009]	*c* 1700-1730
[0014]	*c* 1690-1720

The Pottery Assemblage

A full assessment of the pottery recovered from Silkstone has been carried out by Cumberpatch (2004), and a summary of this is published in Dungworth and Cromwell (2006). Cumberpatch discusses vessel form and decoration, and provides a description of the fabrics present, determined by examination with a x10 hand lens. Because of the very fragmentary nature of the assemblage, Cumberpatch was unable to establish the precise range of vessel forms manufactured at the pottery. He was nevertheless able to identify a number of distinct vessel types. The two most common are 'flatwares' and 'hollow wares'. The flatwares are divided into press moulded dish forms with a 'pie-crust' rim type or a knife-trimmed rim, and wheel-thrown plates. The thrown plates have a distinct profile and surface features which allows them to be distinguished from the press moulded dishes. The hollow wares include straight-sided, handled mugs, and possibly jugs. Other vessel forms were identified but are more poorly represented in the assemblage. They consist of bowls, cups, tygs and jars (Cumberpatch 2004; Dungworth and Cromwell 2006).

A number of decorative styles were identified which, in general, appear associated with specific vessel forms. For instance, Slipware decoration, comprising Trailed Slipware and Combed Slipware occurs predominantly on press-moulded dishes. A number of slip decorated hollow wares were also noted, but these form only a very small proportion of the assemblage. Mottled Ware decoration appears to be associated with the thrown plates and hollow wares. Mottled Ware is commonly referred to as Manganese Mottled Ware. This derives from a description of the production of the ware published by Dr Robert Plot in 1686, in which it is stated that 'the motley colour is produced by blending the lead with the manganese' (Philpott 1980-81, 52). However, analysis by X-ray spectroscopy of an example of Mottled Ware from excavations at Castle Street, Liverpool revealed that manganese was present in only trace amounts and the dark brown colour of the glaze in this case was more likely to be produced by iron oxide. Therefore this term should be used with caution (Philpott 1980-81, 54).

Other rarer decorative types were identified. These are Late Blackware, characterised by a very dark brown or black glaze, occurring in handled vessel, cup, tyg and unidentified vessel forms, Redware, distinguished by a thick glaze over a red slip and associated with jar forms, and Black Glazed ware identified in hollow ware and plate forms. This final type is visually similar to the Late Blackware, but was distinguished by its distinctive, white, underlying ceramic fabric. The rarity of these last two decorative types within the ceramic assemblage may indicate they were manufactured at a location other than Silkstone (Cumberpatch 2004).

In addition to the slip and glaze decorated domestic ware summarised above, a small but important part of the ceramic assemblage was composed of saggars (squat, cylindrical vessels which the glaze-decorated vessel were placed in for protection during firing) and kiln furniture. The kiln furniture consisted primarily of fired clay lumps, strips and plates, and these are likely to have been used for sealing gaps in the kiln structure or for propping up or separating the saggars (Cumberpatch 2004).

The ceramic fabrics were investigated by macroscopic analysis and a number of fabric types were identified (Cumberpatch 2004). These are listed with their distinguishing characteristics and associated vessel forms/decorative wares in Table 2. It can be seen from the summary table that Fabric 4 is by far the most common fabric, followed by Fabric 1. Furthermore, it appears there was a distinction between the use of Fabric 4 for wheel-thrown wares and Fabric 1 for press moulded wares, possibly reflecting technological choices made by the potters; different vessel forming techniques may require pastes with different working properties. Cumberpatch (2004) questioned how far the remainder of the fabrics represent distinct raw materials usage or clay-paste preparation methods, since clay processing, firing atmosphere and firing temperature can have a dramatic effect not only on the visual appearance of a ceramic fabric, but on the macroscopic appearance of inclusions contained within.

Silkstone Pottery and Pottery Production in Eighteenth-Century England

Silkstone was one of a number of potteries manufacturing the wares identified. Others in the South Yorkshire region include Sheffield Manor, which produced Mottled Ware (Lawrence 1974; Barker 1987), the Midhope group of potteries centred around the villages of Midhopstones and Upper Midhope which produced Combed and Marbled Slipwares and black-glazed earthenwares (Lawrence 1974; Ashurst 1987; Cumberpatch 2004) and Bolstersone, which manufactured Slipwares, Mottled Wares and Late Blackwares and Brown Glazed coarsewares (Ashurst 1987; Cumberpatch 2004). The ceramic fabrics of pottery from the Midhope and Bolsterstone workshops are reported to resemble the Silkstone Fabric 1 (see above) and are described as having a fine sandy texture and an orange to pale red colour with some white streaking in the case of the Midhope material, and a fine sandy texture and a buff to pale orange colour with streaking in the case of Bolsterstone (Cumberpatch 2004).

The manufacture of these pottery styles was not just limited to the South Yorkshire region but was widespread across the country. Other known production centres include North Staffordshire (Gaimster 1997; Dawson 1997), the Water Lane Pottery (Temple Back), Bristol (Price 2005) and Buckley, Flintshire (Philpott 1980-81).

The question of how readily these similarly decorated wares from different production centres can be distinguished on visual criteria alone has been addressed by David Dawson and David Barker who carried out a thorough visual comparison of Bristol and Staffordshire slipwares on consecutive days. They concluded there were subtle differences between the two groups of wares examined that might be used to reach conclusions about source, nevertheless, found that as time passed, the details became less clear (Barker pers com). Therefore, while slip- and glaze- decorated wares were produced at a number of locations across England and are commonly found in domestic pottery assemblages of the late seventeenth and eighteenth centuries, problems occur in identifying source of these types of pottery recovered from consumption sites based on appearance alone.

Table 2. Summary of fabrics identified by Cumberpatch (2004)

Fabric	Distinguishing Characteristic	Associated form/decoration	ENV (%)*
1	Colour: very pale buff, orange buff, mid-orange grey, occasional thin white streaks Texture: Sandy Inclusions: red non-crystalline, rare white	Most common is press moulded dishes with trailed and combed slip decoration. Less common is thrown plates with mottled glaze, hollow wares are rare.	27.0
2	Colour: dark red, very thin white streaks Texture: smooth, hard, dense, vitrified appearance Inclusions: as Fabric 1	Press moulded dishes with trailed and combed slip decoration.	0.4
3	Colour: buff, pale orange, dark red stripes Texture: fine, sandy Inclusions: rare large white	Most common is press moulded dishes with trailed and combed slip decoration. Other forms in this fabric are rare	3.0
4	Colour: creamy-buff, white Texture: fine, homogenous Inclusions: white non-crystalline, fine black	Predominantly mottled ware plates and hollow wares	50.9
4 Type	Dark red to mid-red version of Fabric 4	Predominantly mottled ware plates and hollow wares	
5	Colour: red Texture: fine Inclusions: white inclusions	Late Blackware	5.1
6	Colour: dark red Texture: fine, even Inclusions: absent	Mottled hollow wares	3.2
7	Colour: pinkish-buff Texture: soft, fine, sandy	Redware	0.8
8	Colour: white, buff Inclusions: platey fragments of non-crystalline rock and rounded, red non-crystalline grains	Black Glazed ware	0.7
Other	Colour: red Inclusions: white non-crystalline, dark red, non-crystalline	Brown Glazed Coarseware	0.7

* ENV = Equivalent Number of Vessels

Research Aims

This research has a number of aims. These are:

1. To characterise the local products from Silkstone in a more objective manner than provided by visual criteria alone. The ceramic fabrics are defined using a combination of petrographic and chemical analysis.
2. To establish details of production technologies of the ceramic fabrics and glazes that cannot be gleaned from macroscopic analysis. The relationship between raw material use and pottery type is explored.
3. To provide a dataset of petrographic and chemical characteristics that can be used to distinguish Silkstone products from visually similar wares manufactured at other production centres (Staffordshire, Bristol). If in future, a similar methodology is applied to pottery from these production centres and pottery excavated at consumption sites it may be possible to investigate patterns of trade in these wares during the seventeenth and eighteenth centuries.

Methodology

Sampling Methodology

The majority of pottery sampled for analysis originated from Context [0009], five samples from Context [0007], and one sample from Context [0001], the modern levelling deposit. It included all pottery styles represented in the assemblage in addition to examples of pottery wasters and kiln furniture (see Appendix 1 for catalogue of sherds). At this point in time no sampling of local clays have been undertaken to help characterise local products, however, the kiln furniture and pottery wasters are used as references materials.

Petrographic Analysis of the Ceramic Fabrics

Thin sections of the 41 ceramic samples were prepared according to the standard method of mounting a section onto a glass slide and polishing down to a thickness of 0.3 mm. They were examined using a Leica polarizing light microscope. The petrographic analysis was supplemented with investigation using a scanning electron microscope with attached energy-dispersive X-ray analytical facilities (SEM-EDS) in order to aid in the identification of minerals that were too small for distinguishing properties to be present and to investigate opaque amorphous concentration features.

The ceramic fabrics were characterised using Whitbread's (1989; 1995, 379-388) thin section descriptive system, developed out of techniques of sedimentary petrology and soil micromorphology. Rather than being concerned solely with the characteristics of the aplastic inclusions in relation to issues of provenance, this method of ceramic analysis treats the ceramic fabric as a whole. The ceramic fabric is defined as the arrangement, size, shape, frequency and composition of components of the ceramic material (Whitbread 1989, 127), and so places emphasis on the 'plastic' component of the ceramic fabric as well as the aplastic mineral content.

The importance of this approach lies in its underlying principle, summed up succinctly by Day *et al* (1999,1028) who state that ceramic fabrics not only reflect the geological reality of a specific area but also human habit/choice in the selection and preparation of raw materials, the forming and firing techniques. Therefore, by considering the appearance of a ceramic fabric as a whole it is possible to explore its origin and significance with respect to the technological processes involved in its production in addition to examining questions of provenance.

The principle criteria for fabric grouping following Whitbread's system are:

1. The colour and optical activity of the micromass
2. Void type and orientation
3. The mineral and rock types comprising the non-plastic inclusions
4. The quantity, shape, size and grain-size distribution of the non-plastic inclusions
5. The textural (tcfs) and amorphous (acfs) concentration/depletion features.

Tables 1 to 5, Appendix 2 explain the terms and measurements employed in the thin section descriptions.

ICP-AES Analysis of the Ceramic Fabrics

Chemical analysis was carried out on the ceramic fabrics using inductively coupled plasma-atomic emission spectrometry (ICP-AES) because of its ability to detect elements that might be present in concentrations below the detection limit of other analytical systems and its capability to determine large numbers of major, minor and trace elements simultaneously. The instrument used was a Perkin Elmer Optima 3300RL ICP-AES with Winlab 32 software and AS91 Autosampler located at Royal Holloway, University of London. The following major, minor (in terms of oxides) and trace elements were analysed for: Al_2O_3, Fe_2O_3, MgO, CaO, Na_2O, K_2O, TiO_2, P_2O_5, MnO, and Ba, Co, Cr, Cu, Li, Ni, Sc, Sr, V, Y, Zn, Zr, La, Ce, Nd, Sm, Eu, Dy, Yb and Pb. The pottery samples were prepared using the hydrofluoric/perchloric acid dissolution method (Thompson and Walsh 1989, 122-124) with 0.1 ± 0.0005 mg dried, powdered sample, and all samples were analysed in a single batch. The system was calibrated using the internal rock standards: KC10, KC11, KC12, KC14 and RH21, and a blank solution. After each ten samples analysed the standard RH21 was run to calibrate for instrumental drift. The precision and accuracy of the system were tested by comparing replicate samples of the soil standards IAEA SL-1 and NIST 2711 analysed as 'unknowns' at various points within the run. Soil standards are employed as reference materials in the chemical analysis of archaeological ceramics since fired ceramic reference materials with certified values for element concentrations do not currently exist (Tsolakidou *et al.* 2002).

Precision and Accuracy of the ICP-AES results

The precision and accuracy of the analytical system needs to be assessed when analyzing samples of unknown composition (in this case archaeological ceramics) in order to appraise the quality of the analytical results. Precision measures the reliability of the analytical procedure by looking at the degree of agreement between repeated results, and is characterised by the standard deviation of a set of replicate analyses of the same standard material. It is often expressed as the coefficient of (%) variation using the equation:

$$(Sdev / \bar{X})x100$$

(Jones 1986, 23)

Accuracy signifies the extent to which an average or final analytical result differs from the true value and is estimated from the correspondence between the ICP-AES results of the standards and their certified values (where provided) using the equation:

$$((\bar{X} / CertValue)x100) - 100$$

(Jones 1986, 23)

The values for the precision and accuracy for the major and minor element oxides and trace elements are presented in Appendix 3. The major and minor elements for both standards show very good within-batch precision, with the majority of elements having <5% error. The only exception to this is for the element TiO_2 which has an error of 5.25%. The accuracy of the major and minor elements for both standards is also very good with most elements having an error range of <±10%. Exceptions to this are TiO_2 (SL-1 with an error of ±10.09% and 2711 with an error of 10.54%) and P_2O_5 (2711 with an error of 11.30%).

The trace elements for both standards also demonstrate very good precision ranging from 1.6% (Cu in SL-1) to 10.83 (Sm in 2711). Conversely, the error for the accuracy of the trace elements has a far greater range, spanning from ±0.15% (Ba in 2711) to ±33.27% (Nd in 2711). Those elements that varied more than 15% were not included in the subsequent statistical treatment. They are: Y, Ce, Nd, and Dy. The exception to this is Sm. Where the range in error for SL-1 is ±15.59%, it shows good accuracy for 2711 (±8.09%). It was therefore included. Further elements excluded from the statistical analysis include P_2O_5 (concentrations of P_2O_5 in archaeological ceramics may be affected by leaching, enrichment or alteration processes (Bishop *et al.* 1982; Lemoine and Picon 1982 and Buxeda *et al.* 2001)), Zr (problems in the complete digestion of Zr in the hydrofluoric/perchloric acid dissolution method are common (Thompson and Walsh 1989)), and Pb (the archaeological ceramics analysed were decorated with lead glazes (see below) and the variable concentrations of Pb noted can be attributed to contamination of the ceramics from the glazes). The following element oxides and trace elements that were considered the most precise and accurate, and suitable were selected for further statistical treatment: Al_2O_3, Fe_2O_3, MgO, CaO, Na_2O, K_2O, TiO_2, MnO, and Ba, Co, Cr, Cu, Li, Ni, Sc, Sr, V, Zn, La, Sm, Eu, Yb and Dy. Appendix 4 presents the chemical data for all samples

Statistical Analysis of the Ceramic Compositional Data

The ceramic compositional data obtained using ICP-AES was explored using multivariate statistical analysis to determine whether or not there are distinct groups present in the data set that have significance with respect to raw material selection, technological processes or provenance. Multivariate statistical analysis identifies and quantifies (dis)similarities between individual samples and groups of samples. According to Glascock *et al* (2004, 98) the pottery groups formed by statistical analysis can be thought of as "centres of mass" in the compositional hyperspace defined by their measured element concentrations. The individual groups are characterised by the location of their centroid and the unique correlations between their measured elements to one another.

Hierarchical agglomerative cluster analysis (HCA) is commonly applied to the study of ceramic compositional data in archaeology. It was utilized to explore the data produced in this study. HCA was carried out on log transformed data, using squared Euclidean distance as the measure of (dis)similarity, and the Wards clustering algorithm. The statistical analyses were carried out using the software packages S-Plus Professional 6.2 for Windows and SPSS 12.0.1 for Windows.

SEM-EDS Analysis of the Glazes

Twenty-three samples were selected to provide information about glaze composition. Samples were mounted in epoxy resin to display a cross-section of the fabric, slip and glaze. These were then ground and polished to a 1-micron finish and carbon coated before being examined by SEM-EDS. All analyses of chemical compositions were carried out using an Oxford Instruments germanium detector. Each sample was analysed using at least three separate areas. The analyses of the glazes avoid both potentially weathered outer surfaces and the glaze-ceramic interface. In order to aid comparisons between different samples all results have been normalised to 100 wt%.

Results

Petrographic Analysis

The petrographic study begins with a brief overview of the geology of the area surrounding Silkstone. Summaries of the petrographic fabric groups are presented, detailed fabric descriptions are given in Appendix 5 and photomicrographs of each fabric type are given in Appendix 6.

Geology of the Area Surrounding Silkstone

Silkstone lies within the Yorkshire coal measures (Pugh 1957). The site of the pottery workshop itself is located to the east of the village by the Silkstone Beck, at the boundary between the middle and lower coal measures. The middle coal measures occur to the north of Silkstone (the uppermost seam being the Silkstone seam), to the west (the upper most seam is the Joan Seam) and to the south (the uppermost seam is the Flockton Thin). To the west and south west of Silkstone is the Whinmoor Seam, which is the uppermost seam of the lower coal measures. The measures between the coal seams comprise shales, sandstones, siltsone and ironstones. Penistone flags underlie the Whinmoor Seam and include thin flaggy sandstone, shale and fireclay seams, and these overlie further coal seams (Hard Bed Band, Ganister Coal, Clay Coal, Coking Coal and Pot Clay Coal). These seams are separated by bands of sandstone, shales, mudstones, ganister, fire and pot clays (Bailey 1942; Mitchell *et al.* 1947). The lower coal measures overlie the Millstone Grit series, which is a group of mudstones and shales with beds of sandstone and grit (Edwards and Trotter 1954). The geology surrounding the Silkstone area therefore provides locally available raw material resources for the manufacture of pottery, including pot clay, and coal for the firing of kilns.

Petrographic Groupings of the Ceramic Fabrics

The fabric groups and fabrics identified can be separated into those used for wheel thrown wares and those used for press moulded forms. They are:

Wheel thrown forms

Fine Quartz and Chert Fabric Group (Fig. 1, Appendix 6)

This group contains examples of Mottle Ware (two plates) and Black Glazed ware (three hollow ware forms), and two examples of kiln furniture. It relates to Cumberpatch's Fabrics 4 and 8 (Cumberpatch 2004), and includes the samples: SK 00/19, 00/22, 00/43, 00/44, 00/45, 00/47, 00/58, 0059. It is characterised by its vughy microstructure. The voids occupy 10 to 15% of the total field and include predominant mesovughs and few mesovesicules. The groundmass is dark grey (xp x40) and is optically inactive to optically slightly active. Inclusions are few, moderately to poorly sorted and show a unimodal grain-size frequency distribution. They comprise predominant fine silt to fine sand-sized grains of monocrystalline quartz, few fine to coarse sand-sized grains of chert (predominantly megaquartz), rare to few fine- to coarse sand-sized shale. The shale is optically very active and dark yellow brown (xp x40). Very rare to few fine to medium sand-sized (up to granule-size in Sample SK 00/58) grains of sandstone are also present, and silt-sized grains of zircon and plagioclase are absent to very rare. The coarser fraction of the monocrystalline quartz inclusions appears to be the terminal grade of the sandstone fragments.

The coarse, poorly sorted inclusions and presence of terminal grades from the sandstone fragments indicate the clay was poorly refined and probably used in its natural state, or with only the larger rock fragments noted in the kiln furniture examples removed from the clay used for the manufacture of vessels. It can be strongly linked to Silkstone by its use for kiln furniture (Samples SK 00/58 and 59) and by its occurrence in a vessel waster (SK 00/22). This observation is also supported by the sandstone and shale inclusions being compatible with the local coal measure geology (see above).

Well Sorted Quartz Fabric Group (Fig. 2, Appendix 6)
This fabric group contains three examples of Mottled Ware (one plate, two hollow ware forms) and three examples of Red Ware (hollow ware forms) and corresponds to Cumberpatch's Fabric 4 Type and Fabric 7. It includes samples: SK 00/23, 00/27, 00/30, 00/39, 00/40, 00/41. It is characterised by its dark red-brown to black (xp x40), optically inactive groundmass. Voids are very few, occupying 5 to 10% of the total field. Frequent meso- and macrovughs and few mesovesicules are present. The inclusions are common, very well sorted and show a unimodal grain-size frequency distribution. They comprise predominant medium silt to fine sand-sized monocrystalline quartz, rare rounded coarse silt-sized chert and biotite. The biotite grains are up to fine sand-sized. Muscovite mica and zircon are very rare, and coarse silt to very fine sand-sized sandstone and granule-sized, optically inactive, dark red mudstone are absent to rare. Yellow (pp), pleochroic epidote is absent to very rare. Tcfs occupy <2% of the total field. They are dark red (xp x40), have neutral optical density and clear boundaries, are rounded to sub-rounded with moderate apparent sphericity and constituents are absent. Their average size is *c.* 0.5mm.

Cumberpatch (2004, 4) identified Fabric 4 Type as a dark red to mid-red version of Fabric 4, with the colour thought to be produced by variations in firing conditions, and Fabric 7 as a fine textured, pinkish buff sandy fabric which is generally distinguished by its association with a matt or dull shiny red glaze (Red Ware). Because of the small quantity of Red Ware recovered from the site questions were raised about whether it was manufactured at Silkstone or at another location. The Well Sorted Quartz Group includes examples of both Fabric 4 type and Fabric 7, demonstrating they are indeed one fabric, and that Fabric 4 Type is petrographically distinct from Fabric 4 (Fine Quartz and Chert Group, see above). Though having some non-plastic inclusions in common (monocrystalline quartz, sandstone and chert), most obvious features that separate this group from the Fine Quartz and Chert Group are the presence of biotite grains, mudstone and epidote, and by the absence of optically very active shale. This indicates that vessels belonging to the Well Sorted Quartz Group were manufactured from a different clay source than that exploited for the Fine Quartz and Chert Group. The presence of vessel wasters in this group (SK 00/27 and 30), and non-plastic inclusions compatible with the local geology (sandstone and mudstone, see above) reveals it to be a Silkstone fabric. This confirms Red Ware type pottery was also manufactured at the site.

Quartz and Feldspar Fabric Group (Fig. 3, Appendix 6)
This group exclusively comprises samples of the Brown Glazed Coarseware jars (Cumberpatch 2004) and includes samples: 00/49, 00/51, 00/52, 00/53. It is easily distinguished by its optically inactive brown (xp x40) to optically very active red (xp x40), micaceous groundmass and vughy microstructure. The voids occupy approximately 15% of the field and consist of frequent meso- and macrovughs and rare megavughs and mesochannels. Inclusions are few, moderately sorted and show a unimodal grain-size frequency distribution. They consist of dominant sub-rounded to angular and coarse silt to medium sand-sized monocrystalline quartz, common muscovite mica (laths up to 0.15mm in length) and biotite mica (up to coarse silt-sized). Few rounded to sub-rounded coarse silt to fine sand-sized chert, and very few rounded to sub-rounded fine to medium sand-sized grains of monocrystalline quartz are also present. Feldspars are also few. They comprise coarse silt to very fine sand-sized plagioclase with polysynthetic twinning, zoned felspars with sodium-rich cores and potassium-rich rims in the same size range, and sub-rounded, medium sand-sized grains of perthite. Sub-angular, coarse silt-sized, slightly pleochroic epidote is very rare. Tcfs occupy approximately 10% of the total field. They are dark red (xp x40), with high optical density, with clear to diffuse boundaries and are rounded to elongate. The maximum size present is 2.5mm and the mode size is approximately 0.75mm.

The Quartz and Feldspar Group has distinct characteristics that separate it from the fabrics discussed above. These include the micaceous micromass, the presence of plagioclase, zoned feldspars and perthite inclusions, and absence of sandstone and shale fragments. This suggests the clay derives from a different geological setting, and so it is thought the pottery was made at a location other than Silkstone. At present there is a paucity of petrographic (or chemical) analyses of comparative material from other sites manufacturing these wares thus there is little information available against which to test the provenance of the sherds.

Quartz Silt Fabric (Fig. 4, Appendix 6)
This fabric is represented by one sample of Red Ware (jar form) only: SK 00/36. It is identified by its optically very active, orange-brown (xp x40), micaceous groundmass and rare silt to very fine sand-sized inclusions. The inclusions comprise frequent muscovite mica and sub-rounded to sub-angular monocrystalline quartz, common biotite mica and very rare rounded chert. Tcfs occupy <1% of the field. Only one example is noted and is 0.5mm in size. It is dark red (xp x40) and optically slightly active, has neutral optical density, clear to diffuse boundaries, and is rounded to distorted.

The very fine character of this fabric suggests the use of a naturally fine or refined (levigated) clay. There is nothing remarkable about the fabric to make provenance determination clear, and the absence of further samples particularly in examples of vessel wasters or kiln furniture mean that at this stage it cannot be confirmed as a Silkstone product. The fabric is distinct from the Well Sorted Quartz Group characterised by common inclusions which contains the remainder of the Red Ware examples sampled for this study. If at a later date further examples of this fabric were recovered that could be physically linked to the site (for example pottery wasters) it would demonstrate that Red Ware was manufactured at Silkstone by potters exploiting different clay sources or using unique paste-making recipes.

The three remaining fabrics identified for wheel thrown forms are represented by one sample of Late Blackware hollow wares each. They are:

Quartz and Shale Fabric (Fig. 5, Appendix 6)
This fabric corresponds to sample SK 00/31 and Fabric 6 (Cumberpatch 2004). It is characterised by dark red-brown (xp x40), optically inactive groundmass and vughy microstructure. The voids occupy approximately 15% of the total field and are strongly aligned with the vessel margins. Inclusions are few, moderately sorted and include dominant sub-angular to sub-rounded, coarse silt to fine sand-sized monocrystalline quartz, common sub-rounded and elongate, optically very active, fine sand to granule-sized, optically very active, grey shale, and rare rounded and very coarse sand-sized siltstone.

Quartz and Siltstone Fabric A (Fig. 6, Appendix 6)
The quartz and Siltstone Fabric is represented by sample SK 00/33. Like the Quartz and Shale Fabric, it has a dark red-brown optically inactive groundmass and vughy microstructure with the preferred orientation of voids (predominant mesovughs, few macrovughs and very few megachannels) strongly aligned to the vessel margins. It can be differentiated, however, by the range of inclusions present. They are few, moderately sorted and show a unimodal grain-sized frequency distribution, and include dominant rounded to sub-angular and silt to fine sand-sized monocrystalline quartz, frequent muscovite and biotite silt, and few rounded to sub-rounded and fine sand-to medium sand-sized grains of siltstone with well sorted and medium silt-sized sub-grains. Well sorted tcfs occupy approximately 5% of the total field. They are dark red-brown (xp x40), rounded with sharp to clear boundaries and have a high to neutral optical density. Their mode size is approximately 0.4mm.

Quartz and Siltstone Fabric B (Fig. 7, Appendix 6)
The final fabric is represented by sample SK 00/32 corresponds to Fabric 5 (Cumberpatch 2004). It is distinguished by its vughy microstructure with frequent microvesicules, common mesovesicules and few microvughs which occupy about 20% of the field. The groundmass is dark red (xp x40) and optically inactive. Inclusions are well sorted and have a unimodal grain-size frequency distribution. They comprise predominant medium silt to medium sand-sized monocrystalline quartz, rare rounded to sub-rounded fine to medium sand-sized siltstone, very rare sub-rounded fine sand-sized polycrystalline quartz with equigranular, stretched sub-grains, and silt-sized biotite mica. Tcfs are absent.

It is interesting to note that although the Late Blackwares make up only a small proportion of the ceramic assemblage from Silkstone (3.3 % of ENV or 5 % of weight, *cf* Table 7, Dungworth and Cromwell 2006, 184)), they occur in a range of different fabrics. The mineralogical features are consistent with the local geology which supports Cumberpatch's notion that Late Blackwares were manufactured at Silkstone (Cumberpatch 2004, 7). It is unclear whether the use of different clays for the manufacture of this ware type reflect changes in raw material availability over time or if it represents the use of different raw materials depending on individual potters' choice.

Press moulded forms
Fine-Grained Quartz Group (Fig. 8, Appendix 6)
This small group contains exclusively examples of press moulded Combed Slipped Ware dishes and relates and Cumberpatch's Fabric 2 (Cumberpatch 2004). It includes samples: SK 00/12, 00/13, 00/14, 00/15. This fabric group is easily distinguished petrographically by its dark red and grey (xp x40), optically very active, banded groundmass. Voids occupy about 10% of the total field and are strongly aligned to the vessel margins. Inclusions are very few, sub-rounded to sub-angular, well sorted with a unimodal grain-size frequency distribution. They comprise predominant coarse silt to very fine sand-sized monocrystalline quartz, rare silt-sized red mica and absent to very rare medium sand-sized grains of sandstone containing

moderately sorted medium silt- to very fine sand-sized sub-grains. Textural concentration features (tcfs) are present and are dark red (xp x40), rounded to elongate with clear to diffuse boundaries. Their average size is approximately 0.75mm but can be present up to 1.5mm.

The dark red and grey banding observed in the groundmass may indicate this fabric was produced by mixing two clays together, while the very fine and well sorted nature of inclusions suggest these clays derive from well sorted deposits or that they were highly refined by the potters. By itself, there is nothing to link this fabric group to Silkstone; vessels in this fabric form only a very minor proportion of the assemblage (Table 2), no wasters in this fabric have yet been identified, and given its very fine character there is nothing remarkable about it that makes provenance determination straight forward. Nevertheless, it can be firmly identified as a Silkstone product by the identification of this paste as a component in the Mixed Clay Fabric Groups which are linked with confidence to the site (see below).

Mixed Clay Group A (Fig. 9, Appendix 6)
This Fabric groups contains examples of press moulded Slipped and Combed Slipped Ware dishes and corresponds to Cumberpatch's Fabrics 1 and 3. It includes samples: SK00/01, 00/04, 00/05, 00/06, 00/07, 00/08, 00/09, 00/16, 00/17, 00/18. The fabric is characterised by is vughy microstructure and the preferred orientation of the voids is strongly developed, parallel to the vessel margins. The groundmass is heterogeneous, showing banding of pink-grey and dark orange-red to red-brown and dark red to black (xp x40). The banding, aligned to the vessel margins, is most pronounced in Samples SK 00/16 and 17 and these samples relate to Cumberpatch's Fabric 3. Inclusions are few, moderately sorted and show a unimodal grain-size frequency distribution. They include predominant fine silt- to fine sand-sized monocrystalline quartz, rare to very few coarse- to very coarse sand-sized chert, rare very coarse sand-sized sandstone and fine sand- to coarse sand-sized shale. The shale is pale yellow and optically very active. Silt-sized zircon is very rare. Dark red (xp x40) tcfs with sharp to clear boundaries and ranging in size from 0.25mm to 1.25mm are also present.

The banded texture of the micromass demonstrates the potters prepared the clay paste of this fabric using a mixture of two paste preparations. The banding is strongly aligned to the vessel margins and this is consistent with the clay paste being rolled flat in preparation for it being pressed into the mould. Where mixing is less thorough (samples SK 00/16 and 17) it can be seen that the clays used are those identified in the Fine-Grained Quartz Group and the Fine Quartz and Chert Group, with the coarser inclusions (quartz, sandstone, shale and chert) deriving from the 'Fine Quartz and Chert' clay. This petrographic grouping brings together fabrics that were separated by macroscopic features such as colour and presence or absence of red or white streaks (Cumberpatch 2004, see above), but the petrographic observations demonstrate these features are determined by the thoroughness of clay mixing and so the two groups should be considered as one. Pottery belonging to this group was manufactured at Silkstone as shown by vessel wasters occurring in the fabric (Samples SK 00/08 and 00/09). The presence of the 'Fine Grained Quartz' paste visible as a component in this mixture also confirms that the pottery belonging to the Fine Grained Quartz Group was manufactured at Silkstone (see above).

Kiln Furniture
Mixed Clay Group B (Fig. 10, Appendix 6)
This fabric group contains exclusively examples of kiln furniture and includes samples: SK 00/54, 00/55, 00/56, 00/57, 00/60. The fabric is easily distinguished by its heterogeneous

groundmass which has a 'marbled' texture demonstrating mixing between a red and pale firing clay. At its most extreme (samples SK 00/57 and 60) inclusions are only present in the pale clay component. It has a vughy microstructure with voids occupying 10% of the total field. Meso- and macrovughs are frequent, macrochannels are rare and megavughs are very rare. Inclusions are poorly sorted and show a unimodal grain-size frequency distribution. They include dominant fine silt- to fine sand-sized monocrystalline quartz, few coarse to very coarse sand-sized chert, rare very coarse sand-sized sandstone and fine sand to granule-sized shale. The shale is optically very active and pale yellow (xp x40). Rare white (muscovite) mica and very rare silt-sized zircon is also present.

The components of this fabric (inclusions of quartz, sandstone, chert and shale) and a texture indicating the mixing of red and pale firing clays reveal it was produced using the same paste recipe as identified in the Mixed Clay Group A. It is however differentiated from Group A by the presence of a 'marbled' rather than banded texture and by the presence of coarser (up to granule size) inclusions. The marbled texture shows the clay components were poorly mixed, and the prepared paste was used in this state without further processing. The 'lose' mixing may be expected as all samples in this group relate to examples of kiln furniture, including wedges of clay (samples SK00/57 and 60) thought to be used for sealing gaps in the kiln (Cumberpatch 2004). This contrasts with the finer and more thoroughly mixed and rolled version used for the manufacture of press moulded vessels described above.

Chemical Groupings of the Ceramic Fabrics
The petrographic analysis revealed a variety of clays and clay mixtures were utilised by the potters at Silkstone, while one fabric type was identified as non-local. The chemical analysis was undertaken to further investigate the Silkstone productions. The aim was to identify chemical groups and compare them with petrographic groups. If the two datasets were found to correspond then the fabric groups could be characterised on a more detailed level and relationships between the various fabrics and fabric groups could be investigated.

Stucture of the Dataset
Hierarchical Cluster Analysis of the samples produced a dendrogram showing six groups (Fig. 2). Table 3 presents the mean element concentrations and % standard deviations for each group. With the exception of Group 5, all groups show a low degree of internal variation, with the majority of major, minor and trace elements showing < 15% standard deviation. Group 5 shows a high degree of internal variation with ten elements showing >15% standard deviation. The variation observed in this group is explained below when the petrographic correlates are taken into consideration.

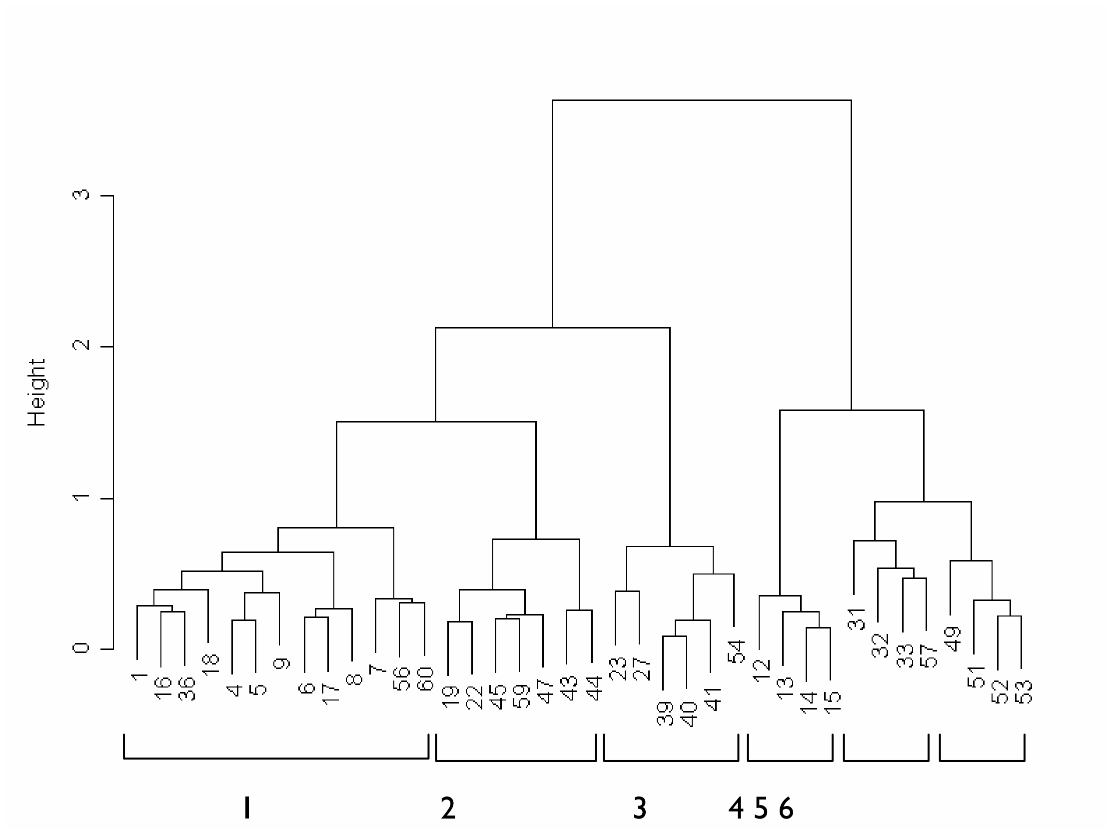

Figure 2: A dendrogram resulting from the cluster analysis performed on compositional data from the Silkstone pottery.

Table 3: Mean element concentrations and % standard deviations for each group identified by HCA. Element oxides are expressed as wt%, trace elements are expressed as ppm.

	Group 1 (n=13)		**Group 2 (n=7)**		**Group 3 (n=6)**		**Group 4 (n=4)**		**Group 5 (n=4)**		**Group 6 (n=4)**	
	$\bar{X}$	% sd	$\bar{X}$	% sd	$\bar{X}$	% sd	$\bar{X}$	% sd	$\bar{X}$	% sd	$\bar{X}$	% sd
Al_2O_3	**21.3**	6.8	**21.1**	5.4	**16.4**	7.9	**25.9**	6.6	**20.5**	22.4	**17.8**	4.2
Fe_2O_3	**3.4**	9.6	**2.0**	12.5	**2.9**	10.1	**6.4**	3.6	**5.4**	10.1	**7.3**	12.9
MgO	**1.0**	11.6	**0.7**	7.6	**0.7**	14.5	**1.9**	9.7	**1.1**	26.1	**1.1**	1.6
CaO	**0.1**	24.4	**0.1**	19.6	**0.1**	26.4	**0.2**	10.9	**0.1**	28.5	**0.1**	8.4
Na_2O	**0.2**	9.1	**0.2**	9.4	**0.4**	17.8	**0.4**	6.0	**0.6**	9.9	**0.5**	10.6
K_2O	**2.7**	12.9	**2.4**	6.4	**2.0**	11.3	**4.3**	7.2	**3.1**	6.5	**2.6**	7.6
TiO_2	**1.0**	7.5	**1.0**	6.5	**0.9**	4.5	**1.0**	5.1	**1.0**	32.2	**0.9**	6.5
MnO	**0.01**	37.6	**0.03**	46.8	**0.02**	20.2	**0.04**	7.9	**0.03**	10.4	**0.1**	14.6
Ba	**449.9**	10.6	**418.5**	6.5	**338.2**	10.6	**667.3**	7.8	**510.2**	15.7	**451.6**	5.8
Co	**13.1**	9.3	**10.3**	4.8	**9.4**	8.5	**20.1**	13.2	**14.2**	10.8	**16.8**	10.0
Cr	**88.2**	13.1	**77.2**	17.7	**65.7**	19.9	**121.9**	15.2	**96.3**	17.1	**97.2**	15.4
Cu	**26.7**	13.3	**20.6**	5.5	**14.7**	24.3	**42.9**	9.0	**31.3**	37.8	**32.1**	15.9
Li	**134.8**	25.8	**171.0**	6.3	**57.5**	10.5	**114.3**	3.7	**107.8**	30.5	**67.8**	8.0
Ni	**32.0**	13.1	**23.7**	10.8	**18.5**	15.8	**59.5**	14.6	**37.4**	7.0	**43.0**	6.8
Sc	**18.3**	8.4	**17.6**	3.2	**13.8**	5.7	**25.1**	7.3	**18.7**	24.1	**17.1**	4.3
Sr	**79.1**	7.4	**64.0**	7.6	**63.0**	12.4	**141.5**	5.2	**112.0**	12.4	**93.5**	34.0
V	**121.2**	6.2	**111.3**	8.2	**85.3**	7.5	**165.8**	8.1	**129.7**	21.8	**122.2**	8.5
Zn	**51.8**	11.4	**33.0**	13.1	**39.4**	14.7	**115.6**	7.2	**70.5**	9.5	**81.3**	5.3
La	**45.2**	6.7	**39.6**	6.4	**39.3**	7.6	**56.0**	4.9	**49.8**	18.9	**44.7**	2.5
Sm	**5.9**	13.0	**5.5**	10.9	**5.1**	7.7	**9.3**	10.0	**7.1**	14.1	**6.1**	13.2
Eu	**1.2**	8.9	**1.0**	5.1	**1.0**	3.7	**1.7**	7.7	**1.4**	11.8	**1.0**	18.3
Dy	**3.5**	12.2	**2.8**	4.1	**2.8**	3.8	**5.0**	10.6	**4.0**	14.9	**3.2**	13.1
Yb	**2.2**	12.1	**1.8**	5.2	**1.7**	8.9	**2.7**	12.6	**2.5**	22.4	**1.9**	14.9

Some general statements can be made regarding characteristic compositions of the Silkstone assemblage. In all groups calcium oxide concentrations are low. Alumina concentrations are variable, ranging from low (Group 3) to high (Group 4), and Groups 1 to 3 have low iron oxide concentrations while Groups 4 to 6 are high in iron oxide. Specific trace elements that show substantial differences between groups are barium, lithium, strontium, vanadium and zinc (Table 3).

Chemical and Petrographic Correlates

The following sub-sections present the chemical characteristics of each group identified by cluster analysis explore the relationships to their petrographic and stylistic correlates. For consistency of discussion, the groups treated in order of the petrographic categories (see above and Appendix 8).

Group 2

This group is low in most major, minor and trace elements. Nevertheless, lithium and vanadium concentrations are high. It comprises exclusively the Fine Quartz and Chert Fabric Group.

Group 3

This group is characterised by low concentrations of alumina, barium, lithium and vanadium in comparison to the other chemical groups. It comprises samples belonging to the Well Sorted Quartz Group and one example belonging to the Mixed Cay Fabric B group (sample 00/54). The Well Sorted Quartz fabric groups together examples of Cumberpatch's (2004) Fabric 4 Type and Fabric 7. The results of the chemical analysis support the petrographic findings that Fabric 4 and 7 should be regarded as a single Fabric and that Fabric 4 Type is distinct from Fabric 4 (Fine Quartz and Chert Group/Chemical Group 2).

Given the petrographic features of sample 00/54 reveal it to belong to the Mixed Clay Fabric B, it might be expected to be a member of Chemical Group 1 (below). Nevertheless, it has a composition equivalent to the remainder of the samples in Group 3, having in common low concentrations of alumina, barium, lithium and vanadium. Possible explanations for this include natural variations in the raw material resources or the effect on overall composition of paste by the mixing of different clays (Buxeda *et al* 2003; Hein *et al* 2004).

Group 6

In comparison to the other groups described Group 6 is low in alumina and lithium, high in iron and manganese oxides and nickel, and relatively high in copper and zinc. It comprises exclusively samples belonging to the Quartz and Feldspar Fabric Group which was identified as manufactured at a location other than Silkstone.

Group 5

This group is defined by its high concentrations of iron and sodium oxides, barium and strontium. It was noted above that it has a high degree of internal variation with ten elements showing greater than 15% standard deviation. This is explained if the petrographic correlates are taken into account. Group 5 comprises the Quartz and Shale Fabric, the Quartz and Siltstone Fabrics A and B, a single example of the Mixed Clay Group B (00/57). The first three fabrics each represent examples of Late Blackware. Though the petrographic differences noted demonstrate the three examples of Late Blackware were manufactured using different clays, their chemical similarity indicates the clays derived from the same geological setting and so share a same broad chemistry. The inclusion of kiln furniture sample (0/57) in this chemical group is unexpected given petrographic features show it was manufactured using a mixture of the 'Fine-Grained Quartz' and 'Fine Quartz and Chert' clays (see above) and so might be expected to belong to Chemical Group 1. However, as noted with sample 00/54, Chemical Group 3 (above), this may be accounted for by natural variations in the raw materials or by the process of clay mixing altering element ratios.

Group 4

Chemical Group 4 contains exclusively examples of the Fine Grained Quartz Fabric Group. It is iron rich and low in calcium, and in comparison to the other chemical groups extracted by cluster analysis it has high concentrations of most major, minor and trace elements, in particular, alumina, iron oxide, potassium oxide and barium, lithium, strontium, vanadium and zinc. The high element concentrations may be explained if the petrographic characteristics of the pottery are considered. The samples in this group are distinguished by the presence of very few, fine inclusions, especially quartz, in contrast to the other samples. Therefore the paste is rich in the elements held in the clay minerals.

Group 1

Group 1 is the largest chemical groups and contains all samples belonging to the Mixed Clay Group A, two samples belonging to the Mixed Clay Group B, and the single example of the Quartz Silt Fabric. The petrographic analysis suggested that the clay paste recipe of the Mixed Clay Fabric Class was prepared using a combination of the clays used for the Fine Grained Quartz Fabric Group (Chemical Group 4) and the Fine Quartz and Chert Fabric (Chemical Group 2). This is supported by the chemical evidence. The element concentrations of Chemical Group 1 fall in between those of Groups 2 and 4, showing the contributions of both clays to the final composition of the mixed paste (Fig 3, Table 3). The inclusion of samples from the Mixed Clay Group B with Mixed Clay Group A in this chemical group strengthens the argument (above) that the same clays were used for the production of both pastes. The inclusion of the Quartz Silt Fabric sample (00/36) in this chemical group was unexpected as it is petrographically distinct from the remainder of the samples with a homogenous groundmass and rare silt to fine sand-sized inclusion of quartz, chert and mica. Moreover, unlike the other vessels in the group which are Slipped or Combed Slipwares it belongs to the Red Ware category. One possible explanation is that the potters used a highly refined and thoroughly mixed version of the clay combination for the manufacture of the Red Ware type, which would account for its petrographic dissimilarities.

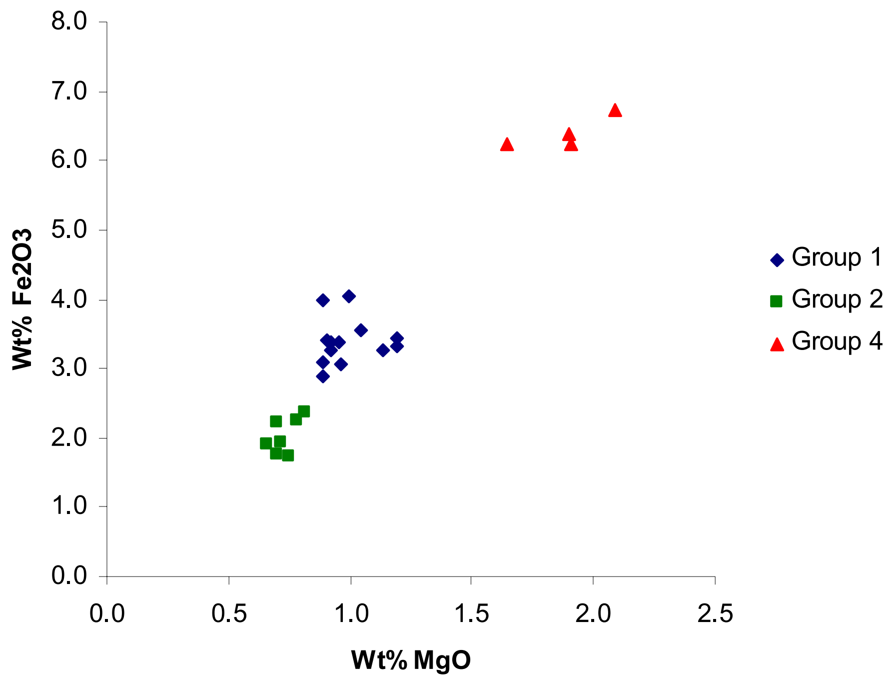

Figure 3: Biplot of magnesium oxide and iron oxide concentrations in chemical groups 1, 2 and 4. The magnesium and iron oxide concentrations fall in between those detected for groups 2 and 4.

Comparison of the chemical groups and petrographic groups show in general good correspondence between the two datasets. That the two analytical techniques support each other implies the groups of pottery are "real", representing different traditions of raw material usage. By combining the complimentary datasets the groups of pottery are described in detail.

Glaze Compositions

The glazes were analysed to investigate if differences in composition and use of colourants exist between the different groups of Silkstone and non-local productions, and between the decorative types represented in each group. All of the glazes were found to be high lead glazes (average lead oxide content is approximately 42 wt%) with significant concentrations of silica and alumina, and minor amounts of potassium and magnesium oxides (Appendix 7). Calcium oxide is generally low (less than 0.5 wt%), however, three examples (SK 15, 23 and 30) contain notable concentrations (between 1.6 and 2.8 wt%). Given the low calcium oxide content of the ceramic bodies (between 0.03 and 0.2 wt%) (Table1, Appendix 3), its presence in the glaze cannot be attributed to diffusion from the underlying ceramic. In these instances the calcium oxide should be considered as an added component to the raw glaze mixtures.

Glaze colourants

The glazes are either yellow (appearing yellow over a pale fabric or red/brown over a red to dark red/grey fabric) or brown. The metal oxides responsible for colouring the glazes are highlighted in Appendix 7. The yellow overglaze of the Trailed and Combed Slipwares belonging to the Fine Grained Quartz and Mixed Clay A Fabrics is coloured by the presence of iron oxide (between 1 and 3 wt%). The brown glazes on the Mottled Ware and Black Glazed Ware examples belonging to the Fine Quartz and Chert Fabric Group are coloured by the presence of manganese oxide (approximately 3 to 7 wt%) which is the primary colourant, and lesser amounts of iron oxide (between 1 and 2 wt%). The Well Sorted Quartz Fabric contains examples of Mottled Ware and Red Ware. Like the Mottled Ware examples noted above, the brown glazes on the Mottled Ware in this fabric group are produced using a combination of manganese oxide and iron oxide. However, the manganese oxide concentrations are lower (approximately 1 to 2.5 wt%) and not enough to produce brown on its own, while the iron oxide concentrations are higher (3 to 4 wt%). The use of iron and manganese together to obtain brown in glass is well known. During melting manganese acts as an oxidizing agent changing FeO into Fe_2O_3, while the higher oxides of manganese are reduced to MnO (Weyl 1959,116, Biek and Bayley 1979,15). The yellow glaze of the Red Ware examples in this same fabric group and the Quartz Silt Fabric group is coloured by additions of iron oxide on its own, and iron oxide is the colourant for the Brown Glazed Coarsewares. In these examples the glaze has a brown hue. This is caused in part by the increased concentrations (approximately 4.5 wt%) but also by the dark red colour of the underlying ceramic fabric. The brown glazes of the Late Blackware examples belonging to the Quartz and Shale and Quartz and Siltstone Fabrics are coloured in a similar manner to the Brown Glazed Coarsewares with approximately 4 wt% iron oxide. However, the brown glaze of the Late Blackware example belonging to the Well Sorted Quartz Fabric is coloured by the addition of similar amounts of manganese and iron oxides (approximately 4 wt% each) and so reflects the use of a different glaze recipe.

Summary and Conclusions

The chemical and petrographic analysis of glazed pottery from Silkstone allows the characteristics of the pottery fabrics and details of production methods to be described. The findings support some of the more general ones presented by Cumberpatch (2004), but additional information is provided. Appendix 8 presents a summary of the results. This research has shown that the potters manufacturing the different types of slip and glaze decorated wares at Silkstone made use of a number of clays and clay mixtures, and these appear to be related to specific manufacturing methods. In addition differences were noted in the methods of producing brown glazes between the groups of pottery.

Two main fabric groups were identified for the manufacture of wheel thrown forms. These are the Fine Quartz and Chert Group and the Well Sorted Quartz Group. Macroscopically, the two fabrics appear very similar however their unique petrographic features and chemistries show two different clay sources were exploited for their manufacture. Both of these pottery groups were manufactured at Silkstone. This is evidenced by examples of pottery wasters and kiln furniture being present in the fabrics. Each group contains examples of Mottled Ware. Differences were noted in the use of colourants to produce their brown glaze decoration. The glazes belonging to the Fine Quartz and Chert Group were coloured using significant amounts of manganese oxide and so is consistent with the method described by Dr Robert Plot in 1687 (see above). In contrast, the glazes belonging to the Well Sorted Quartz Fabric were coloured by high iron oxide and lower manganese oxide concentrations. This shows that the same decorative result could be achieved through more than one method. Historical records reveal the pothouse changed hands a number of times throughout its operation (see above). The use of different clays and glazing methods identified in the production of the Mottled Wares may therefore indicate these are chronological distinctions and so are the products of individual potters coming to Silkstone who manufactured pottery according to their own ways of doing things.

Different fabrics were identified for the Combed and Trail decorated press moulded Slipwares. The Mixed Clay A fabric is common while the Fine Grained Quartz Fabric more rare. Petrographic features (the presence of pale and red clay striations in the fabric groundmass) show the Mixed Clay Fabric Group A paste was prepared by blending two different clays. In poorly mixed examples it is clear to see that the clays utilized for the mixture were those identified for the manufacture of the Fine Grained Quartz and the Fine Quartz and Chert Fabric Groups. This same clay mixture was used in the manufacture of saggars and kiln furniture at Silkstone (Mixed Clay Fabric Group B). The two groups were distinguished petrographically by their textures. As noted above, Group A is characterised by banding of the two different clays which is parallel to the vessel margins, while Group B is characterised by its 'marbled' texture. The differences in texture relate to the vessel forming methods employed. The marbling indicates in the case of the kiln furniture that after mixing the saggars and strips were pinched into shape. The clay striations visible in the press moulded dishes indicate that after mixing the clay paste was rolled flat before being pressed into the moulds.

Examples of Brown Glazed Coarseware recovered from Silkstone were included in the analysis. These utilitarian wares are common on consumption sites throughout the South Yorkshire region and though no systematic study has been undertaken to date they are known to occur in a range of fabrics (Cumberpatch pers. com. 2007). The petrographic analysis shows that they are distinct from other fabrics identified as Silkstone products. They are differentiated by the presence of a range of feldspars inclusions (plagioclase, perthite and zoned feldspars) and micaceous micromass. The contrast between this and confirmed Silkstone fabrics suggests that this group of pottery was manufactured elsewhere. Given the paucity of petrographic or chemical analyses of comparative material from other post-medieval production sites there is currently little information available against which to test the provenance of these sherds.

In addition to resolving the relationships between the different fabrics identified by Cumberpatch (2004) and identifying patterns in raw material use at Silkstone, the petrographic and chemical analyses mean that the pottery from Silkstone is described in a more objective manner. Similarly decorated wares were manufactured at other pottery production sites in the South Yorkshire region and across England. The similarity in the pottery not only applies to the decoration used but also to the macroscopic appearance of the underlying ceramic fabrics. Difficulties have been noted in distinguishing pottery from the different production centres on visual characteristics alone (see above). Chemical and petrographic information from products manufactured at known production sites provide a more objective dataset against which pottery recovered from consumption sites can be compared in order to investigate source. If in future this same methodology is applied to pottery from other known pothouses producing the wares investigated, it would be possible to explore the scale of trade and movement of these pottery types in post-medieval England.

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Appendix 1: Catalogue of sherds

Sample	Context	Type	Form	Sherd
SK 00/01	0009	Trailed Slipware	Dish	Rim
SK 00/04	0009	Trailed Slipware	Dish	Rim
SK 00/05	0009	Combed Slipware	Dish	Rim
SK 00/06	0009	Combed Slipware	Dish	Rim
SK 00/07	0009	Trailed Slipware	Dish	Rim
SK 00/08	0009	Combed Slipware	Dish	Rim
SK 00/09	0009	Trailed Slipware	Dish	Body
SK 00/12	0009	Combed Slipware	Dish	Body
SK 00/13	0009	Trailed Slipware	Dish	Body
SK 00/14	0009	Combed Slipware	Dish	Body
SK 00/15	0009	Combed Slipware	Dish	Body
SK 00/16	0009	Combed Slipware	Dish	Rim
SK 00/17	0009	Combed Slipware	Dish	Rim
SK 00/18	0009	Trailed Slipware	Dish	Body
SK 00/19	0009	Mottled Ware	Plat	Rim
SK 00/22	0009	Mottled Ware	Plate	Base
SK 00/23	0009	Mottled Ware	Hollow ware	Base
SK 00/27	0009	Mottled Ware	Hollow ware	Base
SK 00/30	0009	Mottled Ware	Hollow ware	Base
SK 00/31	0009	Late Blackware	Hollow ware	Body
SK 00/32	0009	Late Blackware	Hollow ware	Body
SK 00/33	0009	Late Blackware	Hollow ware	Body
SK 00/36	0009	Red ware	Hollow ware	Rim
SK 00/39	0009	Red ware	Hollow ware	Base
SK 00/40	0009	Red ware	Hollow ware	Body
SK 00/41	0009	Red ware	Hollow ware	Body
SK 00/43	0009	Black Glazed Ware	Hollow ware	Body
SK 00/44	0009	Black Glazed Ware	Hollow ware	Body
SK 00/45	0009	Black Glazed Ware	Hollow ware	Body
SK 00/47	0009	Black Glazed Ware	Hollow ware	Body
SK 00/49	0009	Brown Glazed Coarseware	Jar	Rim
SK 00/51	0009	Brown Glazed Coarseware	Jar	Base
SK 00/52	0009	Brown Glazed Coarseware	Jar	Base
SK 00/53	0009	Brown Glazed Coarseware	Jar	Base
SK 00/54	0009	Saggar		?base
SK 00/55	0001	Saggar		Body
SK 00/56	0007	Saggar		Body
SK 00/57	0007	Saggar		Body
SK 00/58	0007	Saggar		Body
SK 00/59	0007	Strip		
SK 00/60	0007	Strip		

Appendix 2: Tables explaining terms and measurements employed in the petrographic thin section descriptions (from Whitbread 1995, 379-382)

Table 1: Frequency Labels

Predominant	> 70%
Dominant	50 – 70%
Frequent	30 – 50%
Common	15 – 30%
Few	5 – 15%
Very Few	2 – 5%
Rare	0.5 – 2%
Very Rare	<0.5

Table 2: Inclusion Boundaries

Sharp	Knife-edge
Clear	<0.06mm
Diffuse	>0.06mm
Merging	Part of the boundary is missing

Table 3: Void Descriptions

Planar Voids	Linear in thin section, but planar in 3-D, sub-angular changes in direction may be noted
Channels	May be linear in thin-section, but cylindrical in 3-D
Vughs	Relatively large, irregular voids
Vesivles	Regular in shape, smooth surfaces
Mega	> 2mm
Macro	0.5-2mm
Meso	0.05-0.5mm
Micro	<0.05mm

Table 4. Degree of optical activity

Optically Active	Domains display interference colours and extinction
Optically Inactive	No change in optical properties when stage is rotated

Table 5: Porphyric related distribution modifiers

Closed-spaced	Grains have point of contact
Single-spaced	The distance between grains is equal to their mean diameters
Double-spaced	The distance between grains is equal to double their mean diameters
Open-spaced	The distance between grains in more than double their mean diameters

Appendix 3: The values for precision and accuracy for the major and minor element oxides and trace elements in the soil standards SL-1 and 2711

Table 1. Precision and accuracy for the major and minor element oxides and trace elements for SL-1

		Certified Value of SL-1	Mean Analysed Value (n=5)	Standard Deviation	Precision	Accuracy
Wt%	Al_2O_3		20.82	0.79	3.78	
	Fe_2O_3	9.64	10.31	0.35	3.36	6.93
	MgO		1.08	0.04	3.55	
	CaO		0.46	0.01	1.76	
	Na_2O	0.23	0.22	0.01	2.87	-4.70
	K_2O	1.74	1.60	0.07	4.21	-7.92
	TiO_2	0.86	0.77	0.04	4.73	-10.09
	P_2O_5		0.26	0.00	0.98	
	MnO	0.45	0.48	0.01	2.66	6.18
ppm	Ba	639	679.40	34.53	5.08	6.32
	Co	19.8	17.92	0.37	2.07	-9.49
	Cr	104	108.84	8.22	7.55	4.65
	Cu	30	30.80	0.50	1.64	2.67
	Li		58.20	2.39	4.10	
	Ni	44.9	47.88	1.37	2.87	6.64
	Sc	17.3	17.12	0.67	3.93	-1.04
	Sr	80	77.50	2.63	3.40	-3.13
	V	170	174.86	5.78	3.31	2.86
	Y		38.00	1.70	4.47	
	Zn	223	203.28	17.93	8.82	-8.84
	Zr		126.28	6.68	5.29	
	La	52.6	49.60	2.35	4.75	-5.70
	Ce	117	96.34	5.65	5.86	-17.66
	Nd	43.8	54.61	2.53	4.63	24.68
	Sm	9.25	7.79	0.40	5.15	-15.79
	Eu	1.6	1.50	0.13	8.59	-6.21
	Dy	7.46	8.50	0.38	4.42	13.89
	Yb	3.42	3.86	0.18	4.78	12.92
	Pb	37.7	32.48	2.90	8.93	-13.85

Table 2. Precision and accuracy for the major and minor element oxides and trace elements for 2711

		Certified Value of 2711	**Mean Analysed Value (n=5)**	**Standard Deviation**	**Precision**	**Accuracy**
Wt%	Al_2O_3	12.34	12.58	0.29	2.31	1.97
	Fe_2O_3	4.13	4.27	0.19	4.44	3.48
	MgO	1.83	1.75	0.07	3.78	-4.33
	CaO	4.03	3.94	0.12	3.08	-2.17
	Na_2O	1.54	1.54	0.04	2.47	0.27
	K_2O	2.95	3.00	0.07	2.44	1.68
	TiO_2	0.52	0.47	0.02	5.25	-10.54
	P_2O_5	0.20	0.18	0.00	2.66	-11.30
	MnO	0.08	0.08	0.00	4.20	2.85
ppm	Ba	726.00	727.06	21.33	2.93	0.15
	Co	10.00	9.20	0.40	4.35	-8.00
	Cr	47.00	41.50	3.32	8.00	-11.70
	Cu	114.00	100.54	3.95	3.93	-11.81
	Li		26.80	1.30	4.87	
	Ni	20.60	18.78	1.36	7.22	-8.83
	Sc	9.00	9.18	0.24	2.60	2.00
	Sr	245.30	241.54	5.71	2.36	-1.53
	V	81.60	76.84	4.03	5.24	-5.83
	Y	25.00	29.90	1.56	5.22	19.60
	Zn	350.40	301.32	12.23	4.06	-14.01
	Zr		79.76	6.54	8.20	
	La	40.00	39.28	2.47	6.28	-1.80
	Ce	69.00	72.08	3.88	5.38	4.46
	Nd	31.00	41.31	2.49	6.03	33.27
	Sm	5.90	5.42	0.59	10.83	-8.09
	Eu	1.10	1.00	0.09	8.55	-9.22
	Dy	5.60	4.67	0.23	4.92	-16.61
	Yb	2.70	2.68	0.18	6.55	-0.74
	Pb	1162.00	1017.30	53.14	5.22	-12.45

Appendix 4: Compositional data of all Silkstone pottery samples analysed by ICP-AES

Table 1: Major and minor elements (wt%)

Sample	Al_2O_3	Fe_2O_3	MgO	CaO	Na_2O	K_2O	TiO2	MnO
SK 00/01	23.25	3.38	0.95	0.13	0.21	2.68	1.17	0.02
SK 00/04	20.27	3.37	0.93	0.10	0.21	2.38	0.94	0.02
SK 00/05	21.43	2.90	0.89	0.10	0.17	2.29	1.03	0.02
SK 00/06	19.28	3.10	0.89	0.15	0.22	2.42	0.92	0.02
SK 00/07	20.79	4.03	0.99	0.15	0.26	2.71	0.95	0.05
SK 00/08	20.52	3.27	0.92	0.19	0.24	2.50	0.98	0.02
SK 00/09	20.53	3.99	0.89	0.11	0.22	2.37	0.94	0.02
SK 00/12	23.79	6.23	1.65	0.28	0.49	3.91	0.94	0.05
SK 00/13	27.86	6.73	2.09	0.25	0.45	4.66	1.05	0.04
SK 00/14	26.38	6.38	1.90	0.22	0.43	4.42	1.00	0.04
SK 00/15	25.50	6.24	1.91	0.22	0.42	4.28	0.96	0.04
SK 00/16	22.08	3.45	1.20	0.12	0.22	3.11	1.00	0.02
SK 00/17	19.10	3.40	0.90	0.15	0.24	2.42	0.94	0.02
SK 00/18	21.28	3.56	1.05	0.20	0.22	2.67	0.96	0.02
SK 00/19	20.52	2.25	0.79	0.11	0.18	2.45	0.96	0.02
SK 00/22	21.40	2.37	0.82	0.12	0.19	2.52	1.04	0.02
SK 00/23	14.61	2.53	0.57	0.08	0.32	1.78	0.83	0.02
SK 00/27	15.12	2.53	0.54	0.05	0.25	1.67	0.84	0.02
SK 00/30	16.27	2.60	0.68	0.03	0.38	2.02	0.87	0.01
SK 00/31	22.16	5.65	1.06	0.11	0.68	3.43	0.99	0.02
SK 00/32	19.37	6.90	1.01	0.16	0.72	2.78	0.94	0.03
SK 00/33	20.07	4.04	1.16	0.11	0.58	2.85	1.05	0.03
SK 00/36	23.51	3.32	1.19	0.10	0.23	3.37	1.07	0.02
SK 00/39	17.61	3.06	0.75	0.09	0.40	2.23	0.89	0.02
SK 00/40	17.29	3.08	0.79	0.10	0.40	2.20	0.87	0.02
SK 00/41	16.02	2.77	0.71	0.10	0.36	2.04	0.83	0.02
SK 00/43	20.92	1.76	0.70	0.08	0.16	2.29	1.07	0.04
SK 00/44	19.96	1.91	0.66	0.08	0.16	2.24	1.00	0.05
SK 00/45	22.94	1.74	0.75	0.08	0.19	2.66	1.17	0.02
SK 00/49	18.83	8.61	1.14	0.10	0.54	2.87	0.93	0.06
SK 00/51	17.40	6.67	1.10	0.11	0.43	2.47	0.91	0.05
SK 00/52	17.13	6.57	1.12	0.12	0.44	2.43	0.83	0.07
SK 00/53	18.02	7.19	1.14	0.12	0.48	2.63	0.81	0.06
SK 00/54	17.50	3.18	0.67	0.06	0.41	2.04	0.93	0.01
SK 00/55	17.52	3.38	0.74	0.11	0.39	1.97	0.95	0.03
SK 00/56	21.93	3.26	1.14	0.15	0.23	3.11	1.03	0.04
SK 00/57	20.54	4.95	1.27	0.19	0.35	3.20	0.91	0.05
SK 00/58	20.24	1.75	0.67	0.06	0.18	2.30	1.03	0.01
SK 00/59	22.29	2.24	0.70	0.08	0.18	2.52	1.07	0.02
SK 00/60	23.26	3.07	0.96	0.14	0.23	2.99	1.10	0.03

Table 2: Trace elements (ppm)

Sample	Ba	Co	Cr	Cu	Li	Ni	Sc	Sr	Zn	La	Sm	Eu	Dy
SK 00/01	466	14	83	28	118	34	19	83	48	50	6.4	1.4	3.9
SK 00/04	403	12	102	29	141	32	17	76	47	45	6.3	1.2	3.3
SK 00/05	404	12	110	25	150	32	18	74	44	47	6.0	1.3	2.8
SK 00/06	399	12	98	26	82	27	16	72	49	40	4.4	1.1	3.1
SK 00/07	454	14	82	30	157	35	19	81	58	43	5.2	1.1	3.3
SK 00/08	447	12	97	21	100	26	17	80	49	44	4.9	1.2	3.5
SK 00/09	403	12	81	24	143	31	17	75	46	44	5.7	1.1	3.7
SK 00/12	602	16	126	38	119	47	23	136	105	54	8.2	1.6	4.4
SK 00/13	727	23	143	46	109	66	28	152	125	60	10.5	1.7	5.0
SK 00/14	681	21	98	42	116	63	24	140	116	57	9.5	1.9	5.7
SK 00/15	660	21	121	46	113	62	25	138	116	54	9.0	1.7	4.9
SK 00/16	493	15	82	30	126	35	20	85	62	48	6.7	1.4	4.4
SK 00/17	401	12	75	25	85	28	16	74	51	42	6.0	1.2	3.2
SK 00/18	433	14	76	34	153	33	19	85	56	45	6.8	1.3	4.0
SK 00/19	416	11	97	22	166	27	17	69	39	42	5.6	1.0	2.8
SK 00/22	432	11	69	22	185	27	18	70	39	42	6.0	1.1	2.7
SK 00/23	306	9	72	12	56	16	13	56	34	36	5.0	1.0	2.6
SK 00/27	285	9	61	9	51	14	13	51	32	37	4.4	1.1	2.9
SK 00/30	315	10	58	13	46	19	14	21	41	41	6.0	1.1	3.1
SK 00/31	578	11	83	26	72	24	20	151	54	56	8.2	1.6	4.5
SK 00/32	467	14	93	31	80	33	17	104	72	45	5.2	1.2	3.5
SK 00/33	470	15	104	30	161	43	19	90	65	50	7.3	1.4	4.2
SK 00/36	534	13	88	23	121	31	21	70	53	50	5.8	1.1	3.6
SK 00/39	374	10	58	16	62	21	14	71	45	42	5.5	1.1	2.7
SK 00/40	372	10	57	17	63	21	15	70	45	43	5.2	1.1	2.9
SK 00/41	341	10	57	17	63	20	13	65	43	41	5.1	1.0	2.8
SK 00/43	405	10	97	19	178	22	17	61	31	38	5.5	1.1	2.8
SK 00/44	387	10	69	20	157	20	17	59	30	36	4.7	1.1	2.8
SK 00/45	456	10	66	20	181	22	19	62	29	41	6.1	1.1	2.6
SK 00/49	419	18	95	36	68	39	18	46	87	46	5.3	0.7	2.6
SK 00/51	453	15	77	37	62	43	17	107	78	44	6.7	1.1	3.6
SK 00/52	451	18	107	29	66	45	17	106	79	44	5.5	1.1	3.4
SK 00/53	483	16	110	26	75	45	17	115	81	45	6.8	1.0	3.3
SK 00/54	351	9	90	18	50	18	15	66	37	38	5.3	1.0	2.8
SK 00/55	351	12	85	24	217	29	15	67	44	39	4.4	0.9	2.6
SK 00/56	506	15	99	28	206	42	19	89	61	46	6.8	1.3	3.8
SK 00/57	526	17	106	39	118	50	19	102	91	48	7.8	1.3	3.8
SK 00/58	395	10	91	23	182	22	17	60	29	38	4.4	1.2	2.9
SK 00/59	446	10	72	22	160	24	18	69	32	41	5.8	1.0	2.9
SK 00/60	505	14	74	24	170	31	20	85	49	44	5.4	1.1	3.2

Appendix 5: Thin Section Descriptions

Fine Quartz and Chert Fabric Group
Sample: SK 00/19, 22, 43, 44, 45, 47, 58, 59

I: Microstructure:
(a) Vughy microstructure: predominant mesovughs, common macrovughs, few mesovesicules, very rare megavughs (b) inclusions show single to double-spaced porphyric related distribution (c) voids show weakly preferred orientation.

II: Groundmass
(a) Heterogeneous: though containing the same range of constituents, the rock fragments present in sample SK 00/58 are coarser
(b) Micromass: optically inactive to optically slightly active, Colour: pp (x40) = grey-brown , xp (x40) = dark grey

(c) Inclusions
$c:f:v_{10\mu}$ = 15:75:10 to 15:70:15

Composition: Inclusions are moderately to poorly sorted. Due to the unimodal grain-size frequency distribution the coarse and fine inclusions are treated together

Predominant: *Monocrystalline quartz* – sub-rounded to angular and fine silt to fine sand-sized. May show undulose extinction and contain vacuoles.

Few: *Chert* – predominantly meqaquartz, rounded to sub-rounded and fine to coarse sand-sized. Few grains contain rounded very fine sand-sized quartz grains.

Rare to few: *Shale* – sub-rounded and elongate, fine to medium sand-sized, optically very active, dark yellow-brown (pp x40), dark yellow to grey brown (xp x40), *Mica* – white, mean length of lathes *c* 0.1mm, maximum length 0.4mm

Very rare to few: *Sandstone* – rounded to sub-angular and fine to medium sand-sized. Grains present in sample 00/58 are up to granule sized. Sub-grains are well sorted, rounded and on the coarse silt/very fine sand-sized boundary.

Very rare: *Zircon* – rounded and medium to coarse silt-sized

Absent to very rare: *Plagioclase* – sub-angular, coarse silt-sized

III: Textural concentration features
Tcf = 5% of total field

Dark brown (pp x40), red (xp x40), high to neutral optical density, clear boundaries, rounded to sub-rounded with moderate apparent sphericity. Constituents: *c* 2% well sorted, silt-sized monocrystalline quartz. The average size is *c* 0.5mm.

IV: Amorphous concentration features
Acf = 2 to 5% (of total field)

Rounded to sub-angular, black (pp x40, xp x40) pure nodules. Mean size *c* 0.1mm, maximum size is 0.375mm

Well Sorted Quartz Fabric Group
Sample: SK 00/23, 27, 30, 39, 40, 41

I: Microstructure:
(a) Vughy microstructure: frequent meso- and macrovughs, few mesovesiclues, (b) single to double-spaced porphyric related distribution, (c) voids show weakly preferred orientation.

II: Groundmass
(a) homogenous
(b) Micromass: optically inactive, Colour: pp (x40) = pale brown to brown, xp (x40) = dark red-brown to black

(c) Inclusions
$c:f:v_{10\mu}$ = 20:75:5 to 20:70:10

Composition: Due to the very well sorted unimodal grain-size frequency distribution coarse and fine inclusions are treated together.

Predominant: *Monocrystalline quartz* – sub-rounded to sub-angular and medium silt to fine sand-sized. Grains commonly contain vacuoles and rarely show undulose extinction.

Rare: *Chert* – predominantly microquartz, grains are rounded and coarse silt-sized, *Mica* – biotite: lathes up to 0.22mm

Very rare: *Mica* – white: lathes up to 0.1mm, *Zircon* – up to coarse silt-sized

Absent to rare: *Sandstone* – medium sand-sized, sub-grains are rounded, well sorted and on the coarse silt to very fine sand-sized boundary. Sub-grains of chert (microquartz) are absent to few, *Claystone* – sub-angular and granule sized. Optically inactive and dark brown (pp x40), dark red (xp x40).

Absent to very rare: *Epidote* – coarse silt-sized, yellow in pp, slightly pleochroic

III: Textural concentration features
Tcf = <2% of total field

Dark brown (pp x40), dark red (xp x40), neutral optical density, clear boundaries, rounded to sub-rounded with moderate apparent sphericity. Constituents: absent. Average size is *c* 0.5mm.

IV: Amorphous concentration features
Acf = <2% (of total field)

Black (pp x40), sub-rounded, pure nodules. Average size is *c* 0.05mm, maximum size is 0.2mm

Quartz and Feldspar Fabric Group
Sample: SK 00/49, 51, 52, 53

I: Microstructure:
(a) Vughy microstructure: frequent mesovughs and macrovughs, rare megavughs and mesochanels, (b) single- to double-spaced porphyric related distribution, (c) voids and micas show weakly preferred orientation.

II: Groundmass
(a) homogeneous
(b) Micromass: optically inactive to optically very active, Colour: pp (x40) = yellow-brown to orange-brown to dark brown, xp (x40) = brown to red to dark red.

(c) Inclusions
$c{:}f{:}v_{10\mu}$ = 15:70:15

Composition: Inclusions are moderately sorted. Due to the unimodal nature of the grain-size frequency distribution the coarse and fine fraction are treated together.

Dominant: *Monocrystalline quartz* – sub-rounded to angular and coarse silt to medium sand-sized, commonly contains vacuoles and shows undulose extinction.

Common: *Mica* – white mica, lathes up to 0.15mm, red (biotite) mica, up to coarse silt-sized.

Few: *Chert* **-** microquartz, rounded to sub-rounded, coarse silt to fine sand-sized.

Very Few: *Polycrystalline quartz* – rounded to sub-rounded and fine to medium sand-sized, equigrannular, straight sub-grain boundaries, sub-grains commonly show undulose extinction.

Rare: *Plagioclase* – (a) sub-rounded to sub-angular and coarse silt to very fine sand-sized, polysynthetic twinning, (b) sub-rounded to sub-angular, coarse silt to fine sand-sized, zoned, twinning absent, *Microperthite* – sub-rounded, medium sand-sized.

Very rare: *Epidote* – sub-angular, coarse silt-sized.

III: Textural concentration features
Tcf = 5% (of total field)

Dark red brown (pp x40), dark red (xp x40), high optical density, clear to diffuse boundaries, rounded to elongate with medium apparent sphericity. Constituents: *c* 2%; predominantly well sorted silt-sized grains of monocrystalline quartz and rare silt-sized zoned plagioclase. Maximum size is 2.5mm, mode is *c* 0.75mm.

IV: Amorphous concentration features
Acf = <2% (of total field)

Black (pp x40), black (xp x40) pure nodules. Well sorted, average size is *c* 0.1mm.

Quartz Silt Fabric
Sample: SK 00/36

I: Microstructure:
(a) Vughy microstructure: dominant mesovughs, frequent macrovughs, few microvughs, very rare macrovughs, (b) open-spaced porphyric related distribution, (c) voids show weakly preferred orientation.

II: Groundmass
(a) homogeneous.
(b) Micromass: optically very active, Colour: pp (x40) = yellow-brown, xp (x40) = orange-brown.

(c) Inclusions
$c:f:v_{10\mu}$ = 2:88:10

Composition: Due to the well sorted unimodal grain-size frequency distribution all inclusions are treated together.

Frequent: silt-sized *Muscovite* mica, *Monocrystalline quartz* – sub-rounded to sub-angular and silt to very fine sand-sized.

Common: *Biotite* mica silt.

Very rare: *Chert* – rounded, coarse silt-sized microquartz.

III: Textural concentration features
Tcf = <2% (of total field)

Brown (pp x40), dark red (xp x40), neutral optical density, clear to diffuse boundaries, rounded to distorted with moderate to low apparent sphericity. Constituents: <2%; well sorted quartz silt. This tcf is slightly optically active. Only one example is recoded and this is 0.5mm in size.

IV: Amorphous concentration features
Acf = 2% (of total field)

Dark red to black (pp and xp x40), moderately impregnated to pure, rounded nodules. Mode is 0.1mm, maximum size is 0.5mm.

Quartz and Shale Fabric
Sample: SK 00/31

I: Microstructure:
(a) Vughy microstructure: dominant mesovughs, frequent macrovughs, few microvughs, (b) single to double-spaced porphyric related distribution, (c) voids show strongly preferred orientation and are aligned with the vessel margin.

II: Groundmass
(a) homogeneous

(b) Micromass: optically inactive, Colour: pp (x40) = dark brown, xp (x40) = dark red-brown.

(c) Inclusions
$c{:}f{:}v_{10\mu}$ = 10:75:15

Composition: Due to the unimodal grain-size frequency distribution all inclusions are treated together

Dominant: *Monocrystalline quartz* – sub-angular to sub-rounded and coarse silt to fine sand-sized

Common: *Shale* – rounded to sub-rounded and elongate, and fine sand to granule size. Grey brown (pp x40), grey (xp x40), optically very active.

Rare: *Siltstone* – rounded and very coarse sand-sized. Sub-grains are very well sorted, rounded grains of quartz. Lathes of white mica are very rare.

III: Textural concentration features
Tcf = absent

IV: Amorphous concentration features
Acf = <2% (of total field)

Black (pp x40, xp x40) rounded, pure nodules. Average size is 0.25mm, maximum size is 0.3mm

Quartz and Siltstone Fabric A
Sample: SK 00/33

I: Microstructure:
(a) Vughy microstructure: predominant mesovughs, few macrovughs, very few megachannels, (b) inclusions have a double to open-spaced porphyric related distribution, (c) preferred orientation of voids is strongly developed.

II: Groundmass
(a) homogeneous
(b) Micromass: optically slightly activite, Colour: pp (x40) = dark brown, xp (x40) = dark red-brown.

(c) Inclusions
$c{:}f{:}v_{10\mu}$ = 15:80:5

Composition: inclusions are moderately sorted and show a unimodal grain-size frequency distribution.

Dominant *Monocrystalline quartz* – rounded to sub-angular and silt to fine sand-sized. Grains commonly contain vacuoles and show undulose extinction.

Frequent: *Muscovite* – coarse silt-sized, *Biotite* – coarse silt-sized, slightly pleochroic.

Few: *Siltstone* – rounded to sub-rounded and fine sand to medium sand-sized. Sub-grains are well sorted and medium silt-sized.

III: Textural concentration features
Tcf = 5% (of total field)

Black-brown (pp x40) dark red-brown (xp x40), rounded, with sharp to clear boundaries and high to neutral optical density. Constituents: *c* 10% predominant monocrytalline quartz silt, few biotite quartz silt. Mode is *c* 0.4mm, maximum size is 0.55mm.

IV: Amorphous concentration features
Acf = absent

Quartz and Siltstone Fabric B
Sample: SK 00/32

I: Microstructure:
(a) Vughy microstructure, frequent microvesicules, common mesovesicules, few mesovughs, (b) single-spaced porphyric related distribution, (c) preferred orientation is weakly developed.

II: Groundmass
(a) homogeneous
(b) Micromass: optically inactive, Colour: pp (x40) = very dark brown, xp (x40) = dark red

(c) Inclusions
$c{:}f{:}v_{10\mu}$ = 10:70:20

Composition: well sorted unimodal grain-size frequency distribution

Predominant: *Monocrystalline quartz* – rounded to sub-rounded and medium silt to medium sand-size.

Rare: *Siltstone* – rounded to sub-rounded and fine to medium sand-sized.

Very rare: *Polycrystalline quartz* – sub-rounded and very fine sand-sized. Equigranular, strectched sub-grains with undulise extinction, *Biotite* mica – silt-sized

III: Textural concentration features
Tcf = absent

IV: Amorphous concentration features
Acf = <2 (of total field)

Black (pp x40, xp x40) well sorted, sub-rounded pure nodules. Mode is *c* 0.05mm, maximum size is 0.15mm

Fine-Grained Quartz Fabric
Sample: SK 00/12, 13, 14, 15

I: Microstructure:
(a) Vughy microstructure: dominant mesovughs, frequent microvughs, rare macovughs , (b) open-spaced porphyric related distribution, (c) preferred orientation of voids is strongly developed parallel to the vessel margins.

II: Groundmass
(a) Heterogeneous. The micromass shows banding of dark red and grey clay. Banding is predominantly parallel to the vessel margins though one sample (00/14) shows distortion around tcfs (see below).
(b) Micromass: optically very active, Colour: pp (x40) = black to brown and brown-grey, xp (x40) = dark red to red and grey

(c) Inclusions
$c{:}f{:}v_{10\mu}$ = 5:85:10

Composition:
All inclusions are treated together due to well sorted unimodal grain-size frequency distribution

Predominant: *Monocrystalline quartz* – sub-angular to sub-rounded, coarse silt to very fine sand-sized, rarely showing undulose extinction.

Rare: silt-sized red mica

Absent to very rare: *Sandstone* – sub-rounded, medium sand-sized. Sub-grains are moderately sorted medium silt to very fine sand-sized.

III: Textural concentration features
Tcf = 10% (of total field)
1. Dark red (xp x40), black (pp x40), high optical density, clear to diffuse boundaries, rounded to elongate. Constituents: absent. Average size *c* 0.75mm in diameter but can be present up to 1.5mm in diameter

IV: Amorphous concentration features
Acf = absent

Mixed Clay Fabric Group A
Sample: SK 00/01, 04, 05, 06, 07, 08, 09, 16, 17, 18

I: Microstructure:
(a) Vughy microstructure: dominant mesovughs, common macrovughs, few microvughs (b) open to double-spaced porphyric related distribution (c) preferred orientation of voids is strongly developed

II: Groundmass
(a) inhomogenous: banding is present in micromass. The banding is most strongly pronounced in samples SK 00/16 and 17.

(b) Micromass: optically slightly active to optically active, Colour: pp (x40) = pale grey-brown and brown to dark grey brown to brown, xp (x40) = pink-grey and dark orange-red to red-brown and dark red to black

(c) Inclusions
$c:f:v_{10\mu}$ = 15:80:5 to 15:75:10

Composition: Due to the well sorted, unimodal grain-size frequency distribution all inclusions are treated together.

Predominant: *Monocrystalline quartz* – sub-rounded to angular and fine silt to fine sand-sized. May contain vacuoles and show undulose extinction.

Rare to very few: *Chert* – rounded to sub-rounded, coarse to very coarse sand-sized. Predominantly megaquartz and can contain very fine sand-sized, rounded quartz inclusions.

Rare: *Sandstone* - rounded, very coarse sand-sized, sub-grains are well sorted, sub-rounded and coarse silt to very fine sand-sized, sub-grains may be supported in a sillaceous cement, *Shale* – sub-rounded and elongate, fine sand to coarse sand-size, optically very active, pale yellow (xp x40), pale yellow (pp x40), *Mica* – silt-sized white mica.

Very rare: *Zircon* – rounded and up to very fine sand-sized,

III: Textural concentration features
Tcf = <2% (of total field)

1. Dark red-black (xp x40), black (pp x40), high optical density, sharp to clear boundaries, rounded to elongate. Constituents: absent. Size ranges from 0.25mm to 1.25mm

IV: Amorphous concentration features
Acf = absent

Mixed Clay Fabric Group B
Sample: SK 00/54, 55, 56, 57, 60

I: Microstructure:
(a) Vughy microstructure: frequent meso- and macrovughs, rare macrochannels, very rare megavughs (b) fine-grained inclusions (up to 0.125mm) have a closed to single spaced porphyric related distribution, coarse inclusions (above 0.125mm) have a double to open-spaced porphyric related distribution, (c) voids show absent to weak preferred orientation

II: Groundmass
(a) Heterogeneous: the micromass has a 'marbled' texture showing mixing between dark red and pale clay. At its most extreme (00/57, 60) inclusions are only present in the pale clay.
(b) Micromass: optically inactive, Colour: pp (x40) = dark brown-black and grey brown, xp (x40) = dark red and grey

(c) Inclusions
$c:f:v_{10\mu}$ = 10:80:10 to 20:70:10

Composition

Because of the bimodal grain-size frequency distribution the coarse and fine inclusions (either side of *c* 0.125mm) are treated separately.

Coarse Inclusions
Predominant: *Chert* – rounded to sub-rounded, coarse to very coarse sand-sized. Predominantly megaquartz and can contain very fine sand-sized, rounded quartz inclusions.

Absent to rare: *Sandstone* – rounded, very coarse sand-sized, sub-grains are well sorted, sub-rounded and coarse silt to very fine sand-sized, *Shale* – sub-rounded and elongate, fine sand-sized to granules, optically very active, pale yellow (xp x40), pale yellow (pp x40).

Fine Inclusions
Predominant: *Monocrystalline Quartz* - sub-rounded to sub-angular and fine silt to fine sand-sized. Commonly contains vacuoles and shows undulose extinction. The coarser grains appear to be terminal grades of the sandstone inclusions.

Rare: *Mica* - white (muscovite) mica, lathes up to 0.15 mm in length

Very rare: *Zircon* - rounded and up to coarse silt-sized,

III: Textural concentration features
Tcf = absent

IV: Amorphous concentration features
Acf = *c* 1% (of total field)

Predominantly black (pp x40, xp x40) rounded nodules, up to 0.05mm

Appendix 6: Photomicrographs of examples of each fabric type. All images are taken in xp and width of field is 0.9mm.

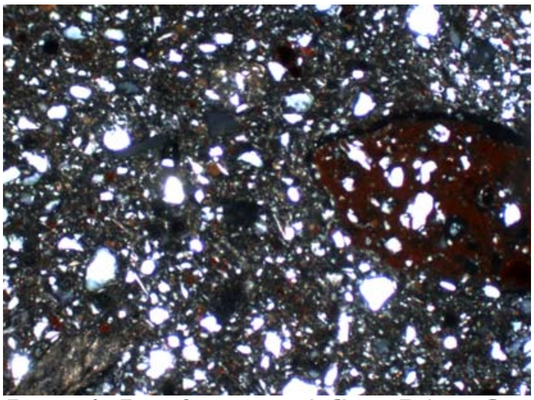

Figure 1: Fine Quartz and Chert Fabric Group. The white inclusions are quartz grains, a fragment of shale is visible in the bottom left corner and a red tcf is visible to the right.

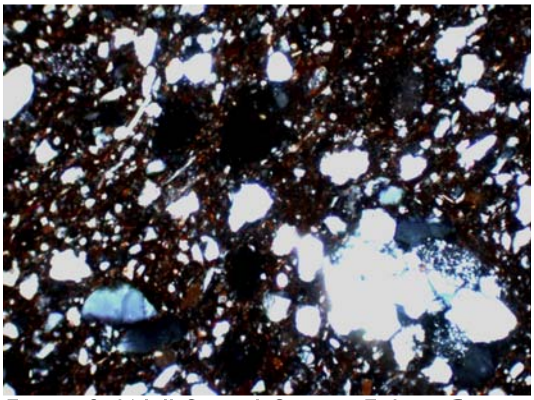

Figure 2: Well Sorted Quartz Fabric Group. The white inclusions are quartz. A sandstone grain with quartz and chert sub-grains is visible in the bottom right corner.

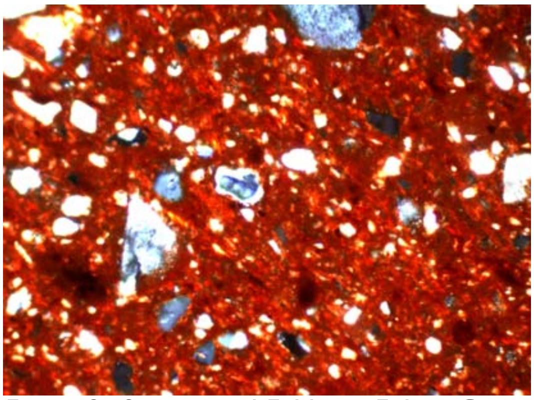

Figure 3: Quartz and Feldspar Fabric Group. A zoned feldspar inclusion with a sodium-rich core and potassium-rich rim is visible in the centre of the image.

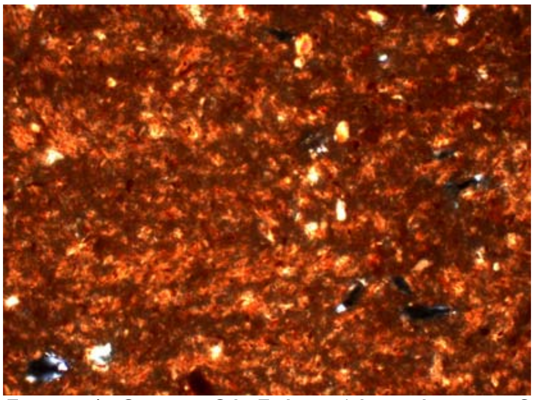

Figure 4: Quartz Silt Fabric. Note the very fine texture with rare quartz silt inclusions.

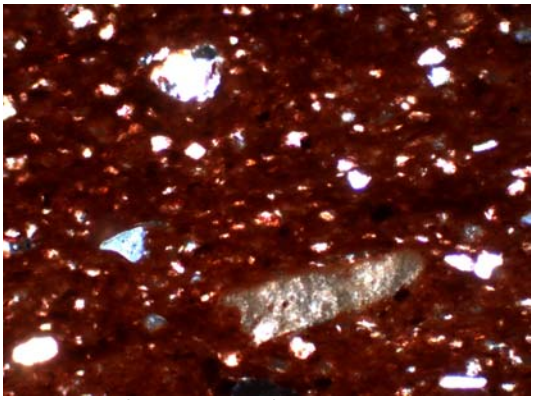

Figure 5: Quartz and Shale Fabric. The white inclusions are quartz and a fragment of shale is present in the bottom centre of the image

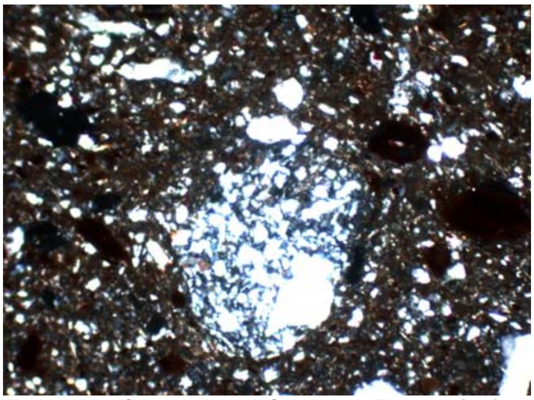

Figure 6: Quartz and Siltstone Fabric A. A coarse siltstone inclusion is visible in the centre of the image and dark red, rounded tcfs are present to the right centre.

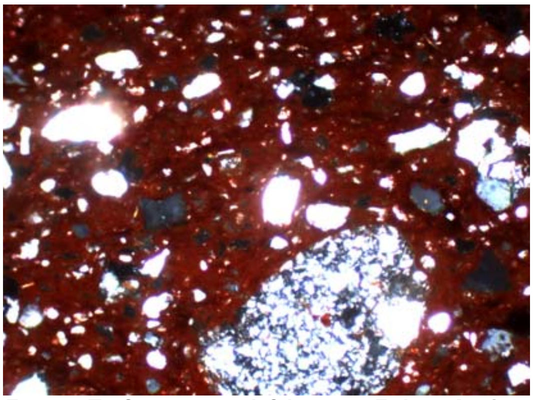

Figure 7: Quartz and Siltstone Fabric B. A coarse siltstone inclusion is visible in the centre of the image. This fabric is differentiated from the Quartz and Siltstone Fabric A by the absence of tcfs

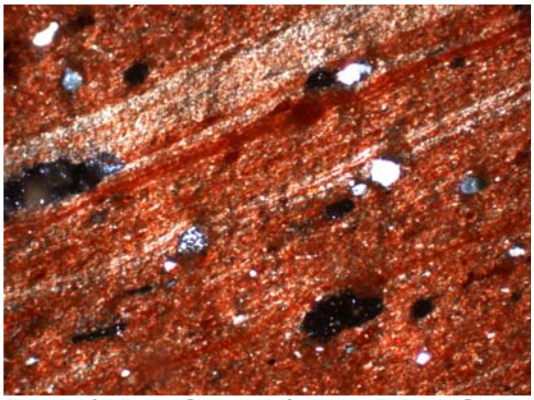

Figure 8: Fine Grained Quartz Fabric Group: Note the very fine texture and banded micromass

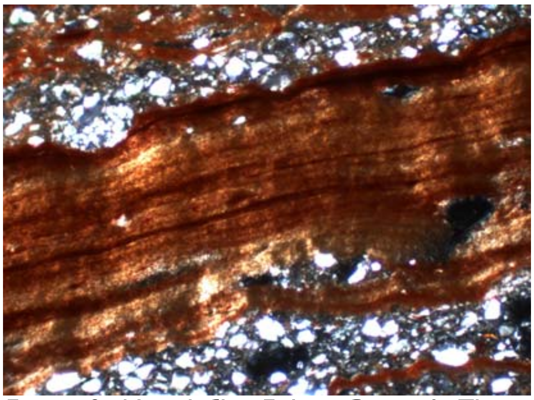

Figure 9: Mixed Clay Fabric Group A. This sample shows clear evidence of the incomplete mixing of two clays with its banded micromass. Inclusions are absent in the red clay component.

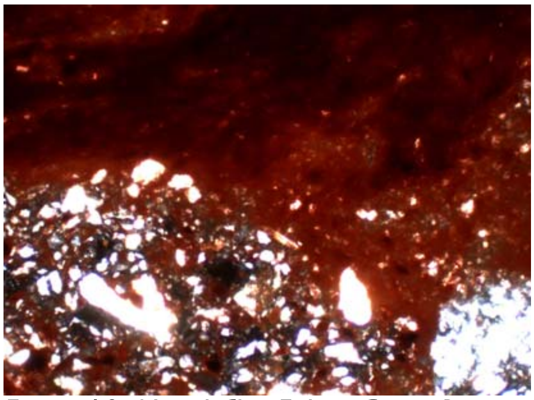

Figure 10: Mixed Clay Fabric Group B. Note the incomplete mixing to two different clays. Inclusions are absent in the red clay component.

Appendix 7: Composition of the glazes. Element oxides responsible for the glaze colours are highlighted in bold

Fabric Group	Decorative Type	Glaze Colour	Sample	Na_2O	MgO	Al_2O_3	SiO_2	K_2O	CaO	TiO_2	MnO	Fe_2O_3	PbO
Fine Quartz and Chert Fabric	MW	Brown	SK19	<0.5	0.8	10.9	42.6	1.2	<0.1	0.7	**4.3**	**1.6**	37.7
	MW	Brown	SK22	<0.5	0.9	15.4	49.8	1.9	0.2	0.9	**7.2**	**1.9**	21.7
	BGW	Brown	SK45	<0.5	0.9	12.4	46.8	1.5	0.3	0.6	**3.1**	**1.8**	32.1
	BGW	Brown	SK47	<0.5	0.6	11.2	42.0	1.0	0.1	0.6	**5.3**	**1.2**	38.0
Well Sorted Quartz Fabric	MW	Brown	SK23	<0.5	0.6	9.5	46.6	1.1	2.8	0.6	**1.3**	**4.3**	32.8
	MW	Brown	SK30	<0.5	0.6	8.6	39.6	0.8	1.6	0.6	**2.6**	**3.1**	42.4
	RW	Yellow	SK40	<0.5	0.5	9.2	36.0	0.8	<0.1	0.7	<0.1	**2.5**	50.6
	RW	Yellow	SK41	<0.5	0.6	9.5	37.3	0.8	<0.1	0.7	<0.1	**2.5**	48.9
Quartz and Feldspar Fabric	BGC	Brown	SK51	<0.5	0.8	8.5	33.6	0.7	0.1	0.6	<0.1	**4.6**	51.7
	BGC	Brown	SK52	<0.5	0.8	7.9	31.6	0.5	0.2	0.5	<0.1	**4.5**	54.6
Quartz Silt Fabric	RW	Yellow	SK36	<0.5	0.4	8.5	32.0	0.6	<0.1	0.5	<0.1	**1.4**	56.9
Quartz and Shale Fabric	LBW	Brown	SK31	0.6	0.9	14.4	43.1	2.1	0.3	0.6	<0.1	**4.7**	33.4
Quartz and Siltstone Fabric A	LBW	Brown	SK33	<0.5	0.7	10.7	40.9	1.3	<0.1	0.7	<0.1	**3.7**	41.9
Quartz and Siltstone Fabric B	LBW	Brown	SK32	<0.5	0.8	11.3	41.9	1.3	0.3	0.8	**4.2**	**4.7**	34.3
Fine Grained Quartz Fabric	T/C SW	Yellow	SK12	<0.5	0.5	8.9	36.5	0.7	<0.1	0.6	<0.1	**1.1**	51.9
	T/C SW	Yellow	SK15	<0.5	0.5	10.1	42.3	1.0	2.2	0.6	<0.1	**1.1**	41.7
Mixed Clay Fabric A	T/C SW	Yellow	SK01	<0.5	0.6	9.2	40.1	0.9	<0.1	0.6	<0.1	**1.9**	46.8
	T/C SW	Yellow	SK04	<0.5	0.7	10.0	38.0	1.2	<0.1	0.6	<0.1	**3.1**	46.5
	T/C SW	Yellow	SK16	<0.5	0.6	10.8	50.6	1.6	<0.1	0.7	<0.1	**2.0**	33.7
	T/C SW	Yellow	SK18	<0.5	0.6	9.6	39.4	0.8	0.2	0.7	<0.1	**1.1**	47.8

T/C SW = Trailed/Combed Slipware, MW = Mottled Ware, BGW = Black Glazed Ware, RW = Red Ware
BGC = Brown Glazed Coarseware, LBW = LBW

Appendix 8: Summary of results.

Sample	Fabric Group*	Petrographic Group	Chemical Group	Stylistic Category	Glaze Colour	Glaze Colourant
SK 00/19	Fabric 4	Fine Quartz and Chert Fabric Group	Group 2	Mottled Ware	Brown	MnO
SK 00/22	Fabric 4	Fine Quartz and Chert Fabric Group	Group 2	Mottled Ware	Brown	MnO
SK 00/43	Fabric 8	Fine Quartz and Chert Fabric Group	Group 2	Black Glazed Ware	Brown	
SK 00/44	Fabric 8	Fine Quartz and Chert Fabric Group	Group 2	Black Glazed Ware	Brown	
SK 00/45	Fabric 8	Fine Quartz and Chert Fabric Group	Group 2	Black Glazed Ware	Brown	MnO
SK 00/47	Fabric 8	Fine Quartz and Chert Fabric Group	Group 2	Black Glazed Ware	Brown	MnO
SK 00/58	—	Fine Quartz and Chert Fabric Group	Outlier	Sagger	Unglazed	
SK 00/59	—	Fine Quartz and Chert Fabric Group	Group 2	Strip	Unglazed	
SK 00/23	Fabric 4 Type	Well Sorted Quartz Fabric Group	Group 3	Mottled Ware	Brown	Fe_2O_3 and MnO
SK 00/27	Fabric 4 Type	Well Sorted Quartz Fabric Group	Group 3	Mottled Ware	Brown	
SK 00/30	Fabric 4 Type	Well Sorted Quartz Fabric Group	Outlier	Mottled Ware	Brown	Fe_2O_3 and MnO
SK 00/39	Fabric 7	Well Sorted Quartz Fabric Group	Group 3	Red Ware	Yellow	
SK 00/40	Fabric 7	Well Sorted Quartz Fabric Group	Group 3	Red Ware	Yellow	Fe_2O_3
SK 00/41	Fabric 7	Well Sorted Quartz Fabric Group	Group 3	Red Ware	Yellow	Fe_2O_3
SK 00/49	—	Quartz and Feldspar Fabric Group	Group 6	Brown Glazed Coarseware	Brown	
SK 00/51	—	Quartz and Feldspar Fabric Group	Group 6	Brown Glazed Coarseware	Brown	MnO
SK 00/52	—	Quartz and Feldspar Fabric Group	Group 6	Brown Glazed Coarseware	Brown	MnO
SK 00/53	—	Quartz and Feldspar Fabric Group	Group 6	Brown Glazed Coarseware	Brown	
SK 00/36	Fabric 7	Quartz Silt Fabric	Group 2	Red Ware	Yellow	Fe_2O_3
SK 00/31	Fabric 6	Quartz and Shale Fabric	Group 5	Late Blackware	Brown	Fe_2O_3
SK 00/33	—	Quartz and Siltstone Fabric A	Group 5	Late Blackware	Brown	Fe_2O_3
SK 00/32	Fabric 5	Quartz and Siltstone Fabric B	Group 5	Late Blackware	Brown	Fe_2O_3 and MnO
SK 00/12	Fabric 2	Fine-Grained Quartz Group	Group 4	Combed Slipware	Yellow	Fe_2O_3
SK 00/13	Fabric 2	Fine-Grained Quartz Group	Group 4	Trailed Slipware	Yellow	

* Fabric group as assigned by Cumberpatch (2004)

Sample	Fabric Group*	Petrographic Group	Chemical Group	Stylistic Category	Glaze Colour	Glaze Colourant
SK 00/49	—	Quartz and Feldspar Fabric Group	Group 6	Brown Glazed Coarseware	Brown	
SK 00/51	—	Quartz and Feldspar Fabric Group	Group 6	Brown Glazed Coarseware	Brown	MnO
SK 00/52	—	Quartz and Feldspar Fabric Group	Group 6	Brown Glazed Coarseware	Brown	MnO
SK 00/53	—	Quartz and Feldspar Fabric Group	Group 6	Brown Glazed Coarseware	Brown	
SK 00/36	Fabric 7	Quartz Silt Fabric	Group 2	Red Ware	Yellow	Fe_2O_3
SK 00/31	Fabric 6	Quartz and Shale Fabric	Group 5	Late Blackware	Brown	Fe_2O_3
SK 00/33	—	Quartz and Siltstone Fabric A	Group 5	Late Blackware	Brown	Fe_2O_3
SK 00/32	Fabric 5	Quartz and Siltstone Fabric B	Group 5	Late Blackware	Brown	Fe_2O_3 and MnO
SK 00/12	Fabric 2	Fine-Grained Quartz Group	Group 4	Combed Slipware	Yellow	Fe_2O_3
SK 00/13	Fabric 2	Fine-Grained Quartz Group	Group 4	Trailed Slipware	Yellow	
SK 00/14	Fabric 2	Fine-Grained Quartz Group	Group 4	Combed Slipware	Yellow	
SK 00/15	Fabric 2	Fine-Grained Quartz Group	Group 4	Combed Slipware	Yellow	Fe_2O_3
SK 00/01	Fabric 1	Mixed Clay Fabric Group A	Group 1	Trailed Slipware	Yellow	Fe_2O_3
SK 00/04	Fabric 1	Mixed Clay Fabric Group A	Group 1	Trailed Slipware	Yellow	Fe_2O_3
SK 00/05	Fabric 1	Mixed Clay Fabric Group A	Group 1	Combed Slipware	Yellow	
SK 00/06	Fabric 1	Mixed Clay Fabric Group A	Group 1	Combed Slipware	Yellow	
SK 00/07	Fabric 1	Mixed Clay Fabric Group A	Group 1	Trailed Slipware	Yellow	
SK 00/08	Fabric 1	Mixed Clay Fabric Group A	Group 1	Combed Slipware	Yellow	
SK 00/09	Fabric 1	Mixed Clay Fabric Group A	Group 1	Trailed Slipware	Yellow	
SK 00/16	Fabric 3	Mixed Clay Fabric Group A	Group 1	Combed Slipware	Yellow	Fe_2O_3
SK 00/17	Fabric 3	Mixed Clay Fabric Group A	Group 1	Combed Slipware	Yellow	
SK 00/18	Fabric 1	Mixed Clay Fabric Group A	Group 1	Trailed Slipware	Yellow	Fe_2O_3
SK 00/54	—	Mixed Clay Fabric Group B	Group 3	Saggar	Unglazed	
SK 00/55	—	Mixed Clay Fabric Group B	Outlier	Saggar	Unglazed	
SK 00/56	—	Mixed Clay Fabric Group B	Group 1	Saggar	Unglazed	
SK 00/57	—	Mixed Clay Fabric Group B	Group 5	Saggar	Unglazed	
SK 00/60	—	Mixed Clay Fabric Group B	Outlier	Strip	Unglazed	

* Fabric group as assigned by Cumberpatch (2004)