

4. CERAMIC PETROGRAPHY IN ARCHAEOLOGY

4.1 Introduction

This chapter provides a basic overview of ceramic petrography, its history (section 4.2), applications and use in archaeological science (section 4.3). A brief description of the recording criteria employed when using this method of analysis is also presented (section 4.4), followed by an overview of the use of ceramic petrography within the East Midlands (section 4.5). The sites outlined in this latter section form a comparative dataset for the three sites analysed as a part of this research (see Chapter 5).

4.2 Petrography: A Brief History

Petrography was first used by William Nicol in the second half of the 18th century to study fossilised wood in thin section (Peterson 2009: 3). Nicol examined these thin sections under a microscope to identify the species of wood. Henry Clifton Sorby was the pioneer of mineral and ceramic petrography, undertaking the study of rocks and minerals in thin section during the middle of the nineteenth century (Worley 2009: 2-4). His contribution to the techniques and methodology employed within petrography provide many of the basic foundations used by ceramic petrographers today. These included establishing the provenance of Roman and medieval tiles and bricks from East Anglia (Worley 2009: 6). Following on from Sorby, Anna Shepard and Wayne Felts were the first to employ petrographic analysis in the study of archaeological ceramics in the early 1940s. (Peterson 2009: 4). Their separate use of this technique on ceramics from New Mexico and Turkey respectively demonstrated the value that this scientific

technique had for archaeological analysis. Early prehistoric ceramic petrology was first utilised in the UK by David Peacock in the late 1960s. In 1968 he published a study on Iron Age ceramics within the west of England - *A Petrological Study of Certain Iron Age Pottery in Western England* (see Peacock 1968). Later in 1969 Peacock published research into the gabbroic tempered Neolithic pottery from south-west England, *Neolithic Pottery Production in Cornwall* (see Peacock 1969). This seminal study showed that the material used to produce the pottery under analysis came from a specific location, namely the Lizard Peninsula in Cornwall (Peacock 1969: 145-149).

Ceramic petrography has been used fairly frequently in the UK since Peacock's first demonstration of its value in the late 1960's. Though, the technique does appear to be more readily employed on assemblages from continental Europe, particularly in the Aegean and Mediterranean (Peterson 2009: 6). A good example of this is a publication by Whitbread (1995) entitled *Greek Transport Amphorae*. Exponents of ceramic petrography within the UK include, Williams (1979), Vince and Ixer (2009), Middleton and Freestone (1997), Whitbread (1995), Allen (1997), Reedy (2008), Day (1997) and Quinn (2009, forthcoming) to name but a few, demonstrating its established use as a research method. However, the use of petrography is not just restricted to ceramics with numerous other archaeological materials also forming the petrographical study, for example, metallurgical ceramics (Sahlen 2011) and stone axes (Clough & Cummins 1988).

4.3 Applications of Ceramic Petrography in Archaeology

Ceramic petrography, at a basic level, can inform the examiner of the components of a petrographic thin section taken from a ceramic vessel or sherd. The analysis and recording of ceramic thin sections, particularly focusing on the clay matrix (micromass) and any inclusions or impurities present (section 4.4) can provide information related to vessel production techniques and also help in the assessment of provenance through the identification of production sites and raw material sources (Reedy 2008). The mineral component can originate from sedimentary, igneous or metamorphic rock sources (Mackenzie & Guilford 1991). This requires an understanding of the trade/contacts of the period in question and knowledge of the geologies of potential production/source sites. This can be an interesting exercise where trade and exchange networks are extensive or complex, such as Whitbread's study into the provenance of Greek transport amphorae which identified regional production centres and characterised the amphorae fabrics from each (Whitbread 1995). The results from thin section analysis also allows for inter and intra-site comparisons of different vessel types to determine levels of variation and similarities in fabric types and inclusions (Reedy 2008: 111). The study of prehistoric ceramics, particularly from the earlier periods, requires a greater degree of focus on clay and raw material sources such as demonstrated by Peacock's study into Neolithic pottery production in Cornwall and gabbroic clays of the Lizard Peninsula (Peacock 1969) as opposed to the identification of production centres although this is still a research objective.

4.4 The Study of Ceramic Thin Sections

There are established methods for the identification of minerals and clay matrix contained within ceramic thin sections. These techniques are not restricted to ceramic petrography and most were originally designed for solid rock identification (Quinn 2009: v-vi). Ceramics are usually comprised of a clay matrix (micromass) with varying amounts of impurities or additives (inclusions) (Reedy 2008: 109). The study of these features allows the ceramic material to be characterised and recorded. The petrographic analysis is usually focused on the identification of these impurities and additives and whether they are naturally occurring within the clay or represent deliberate additions (Peterson 2009: 9), although tracing the clay material to a source is also an objective. The two settings used on a petrographic microscope are plane and cross-polarised light. This allows the thin section to be viewed in different formats and increases the number of diagnostic features which may be used to identify the clay micromass and the mineral inclusions within the clay (Whitbread 1995: Appendix 3).

The particular features observable are as follows (modified from Peterson 2009: 2):

- Nature and characteristics of the non-plastic inclusions
- Texture and optical properties of the clay matrix
- Shape, quantity and orientation of voids/vughs
- Relationship between body of ceramic material and surface/decoration

The identification of the individual components of the clay micromass is often impossible even in thin section. However, techniques have been developed to allow

the general characterisation of the micromass (Reedy 2008: 111) focusing specifically on its optical appearance (section 4.4.1) (Peterson 2009: 13).

4.4.1 Techniques of Identification

The techniques of identification of the minerals (non-plastic inclusions) within ceramic thin sections are summarised below and are taken from *A Colour Atlas of Rocks and Minerals in Thin Section* (Mackenzie & Adams 2005: 9-30), *Ceramic Petrography: The Interpretation of Archaeological Pottery and Related Artefacts in Thin Section* (Quinn 2013: 44-69) and *Guide to Thin Section Microscopy* (Raith *et al.* 2011: 30-91). These techniques can be used independently or in conjunction with one or more others to determine the identity of a mineral.

Colour and Pleochroism

Colour and pleochroism can be characteristic of some minerals. The minerals colour in plane polarised light is known as its absorption colour and its variation depending on orientation is known as pleochroism (MacKenzie & Adams 2005: 14). Many minerals are nearly colourless in thin section, others, including some of the more common minerals, are coloured and can be recognised, and isotropic and anisotropic minerals giving different results (Raith *et al.* 2011: 57-59). Some minerals are also opaque and can only be identified through reflected light microscopy (MacKenzie & Adams 2005: 14).

Cleavage

Cleavage, the lines of fracture or formation on which a mineral breaks or cleaves, can be diagnostic of specific minerals. This is because some minerals break or weaken along certain identifiable lines whilst others do not fracture at all (MacKenzie & Adams 2005: 16). As a result, measuring the presence or absence of cleavage and, if present, the difference in angle of cleavage between the two examples of the same mineral may aid identification of the mineral (Harker 1964: 2).

Relief

Relief is beneficial when dealing with minerals of differing refractive index. Minerals will have a higher relief if their refractive index is greater than that of the surrounding material (Raith *et al.* 2011: 66). Minerals can have between one and three refractive indices depending on their symmetry (MacKenzie & Adams 2005: 18). In using relief to identify minerals, determining the relief of adjacent minerals and which has the higher relief and measuring this refractive index can help. This line between differing refractive minerals is called the *Becke Line* and allows the observer to determine which mineral appears higher in the refractive index (MacKenzie & Adams 2005: 20; Raith *et al.* 2011: 68).

Birefringence

Birefringence is the measurement of the colour given from minerals which have more than one refractive index. This is known as double refraction (Raith *et al.* 2011: 69-79). The light as it passes through the mineral splits and becomes out of phase and on exit

from the mineral interfere with one another and are known as interference colours. This interference can be measured on a birefringence chart. The birefringence is measured on a *Michel-Levy Chart* (MacKenzie & Adams 2005: 22).

Extinction Angles

Extinction angles are where the interference colour alters in intensity when the microscope stage is rotated due to the difference between vibration direction and the mineral cleavage (Raith *et al.* 2011: 81). To measure the extinction angle, the mineral is aligned so that a particular angle, either from a cleavage or crystal edge, is set at 90° and then rotated. The point where the interference colour goes black, or extinct, from the 90° is the angle of extinction (MacKenzie & Adams 2005: 26). This angle can be a useful diagnostic tool in determining the identity of a mineral as minerals can have specific angles of extinction and establishing this will enable the list of potential mineral candidates to be narrowed down.

Twinning and Zoning

Twining can be present where minerals occur in twin where two minerals of the same type are present but in different orientations whilst zoning is where a mineral can alter between its core and outer extent (MacKenzie & Adams 2005: 28-30). The twinned mineral will show differing interference colours and can be simply twinned, polysynthetically twinned or multiply twinned. Zoning is where the properties of the mineral change from core to exterior, such as differing birefringence, extinction angle

or absorption colour. These characteristics can be diagnostic when attempting to identify minerals.

4.5 Prehistoric Ceramic Petrography in Leicestershire and the East Midlands

There have been a number of petrographic studies of prehistoric pottery within Leicestershire and the surrounding counties. An obvious factor in the undertaking of these studies is the availability of subject material and consequently, given the dearth of earlier Neolithic pottery within Leicestershire (Chapter 3), no petrographic studies have been conducted on this type of ceramics. However, available material of this date has been subjected to petrographic analysis in Derbyshire, at Lismore Fields (section 4.5.1) and at Great Briggs, Nottinghamshire (section 4.5.2). Material dating to the middle Neolithic has also been assessed as part of the Great Briggs petrographic investigations (section 4.5.2). Further work has been done at Skendleby long barrow in Lincolnshire (section 4.5.3) and Briar Hill causewayed enclosure in Northamptonshire (section 4.5.4), both dating to the early and middle Neolithic. Hallam Fields in Birstall, Leicestershire (section 4.5.5) has had petrographic work done on the middle Neolithic Impressed Ware material recovered during excavations. Willington, Derbyshire (section 4.5.6), has had an extensive programme of petrographic work undertaken on the multi-phase ceramic assemblages although mainly concentrating on the middle and later Neolithic ceramics. Eye Kettleby (section 4.5.7), Cossington (section 4.5.8), Lockington (section 4.5.9) and Ashby Folville to Thurcaston (section 4.5.10), all in Leicestershire, contained earlier Bronze Age material. The location of those sites

presented below that form the comparative data for this research are illustrated in Figure 4.1.

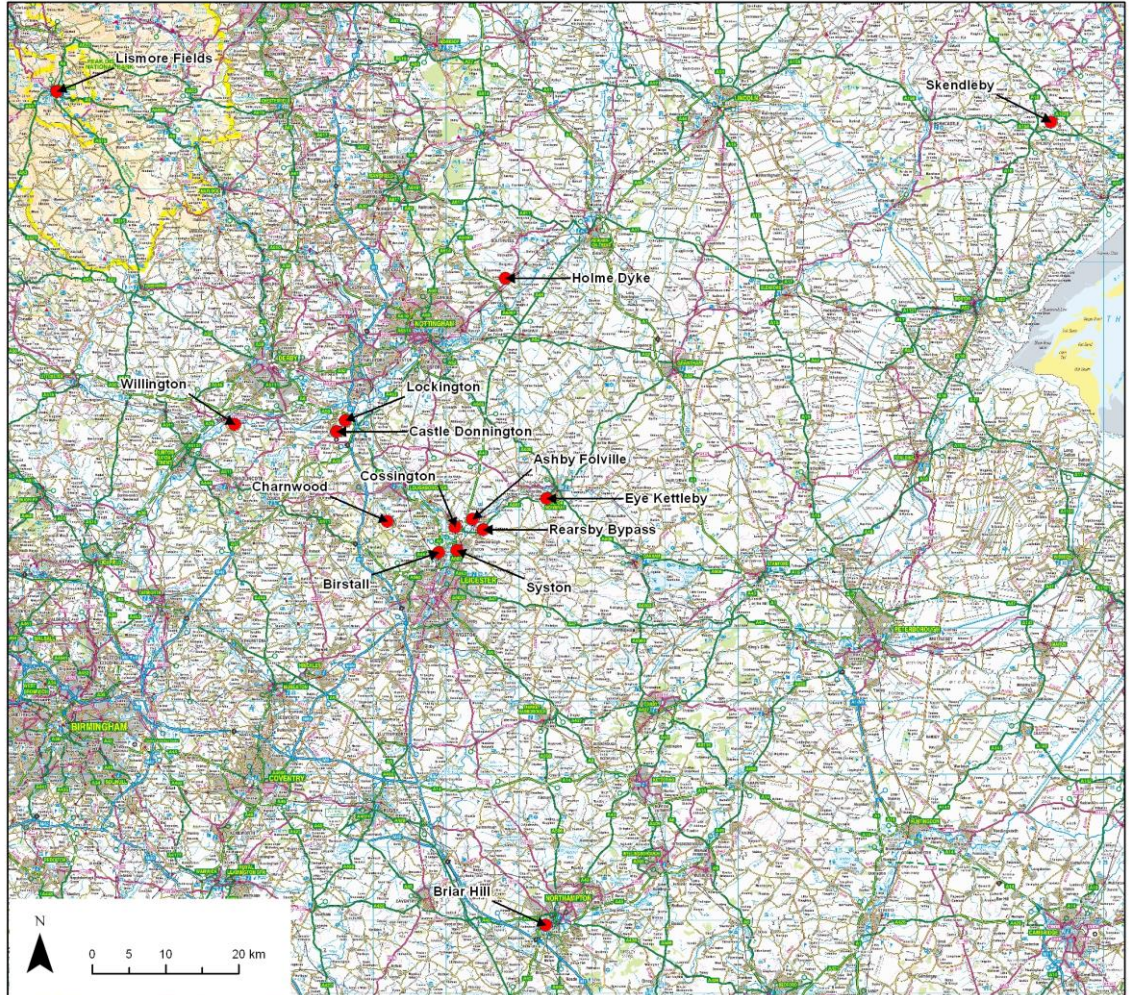


Figure 4.1 Leicestershire comparative sites location map (courtesy of D. McInnes, AECOM)

4.5.1 Lismore Fields, Buxton, Derbyshire

The site at Lismore Fields contained a number of early Neolithic structures along with a small assemblage of Carinated Bowls (Clay 2006: 71). The ceramic assemblage from the site totalled 152 sherds weighing 907 grams (Beswick *et al.* forthcoming). These were almost entirely from well stratified contexts. Twenty-three sherds were subject to petrographic analysis from this early Neolithic occupation site. The results indicated that the fabrics were quite uniform, with a fine fabric and some quartz sand inclusions present. The main diagnostic variation was the size and frequency of the voids within the thin sections (Beswick *et al.* forthcoming). It has been postulated that these could represent limestone that had leached into the sherds following deposition in the ground as the site at Lismore Fields is close to sources of Carboniferous Limestone (Williams unpublished archive report). It is possible that locally available clays were utilised for the ceramics, however, these would have had to undergo some preparation to remove the larger quartz fragments naturally occurring within the clays. Alternatively a particularly pure source of clay may have been utilised (Williams unpublished archive report). No photomicrographs were available for this site.

4.5.2 Great Briggs, Holme Dyke, Nottinghamshire

The site at Great Briggs was an earlier Neolithic ring ditch with some elements extending into the middle Neolithic period (Guilbert 2009: 100). Activity from the one pit containing charred hazelnut shells produced a mean date of 3710 to 3660 cal BC (68% probability) or 3770 to 3650 cal BC (95% probability) (Guilbert 2009: 83). This pit contained a large amount of Carinated Bowl (Figure 4.2) and the radiocarbon dates

from this pit suggests that it may date from the final stages of this ceramic tradition and the earliest Neolithic within the East Midlands (Guilbert 2009: 135). The ceramic assemblage comprised 340 sherds weighing 2178 grams including both Carinated Bowls and possible Impressed Wares. The Carinated Bowls weighed 1940 grams (Guilbert 2009: 101) and the Impressed Wares 178 grams (Guilbert 2009: 105). Fifteen samples were submitted for petrographic analysis.

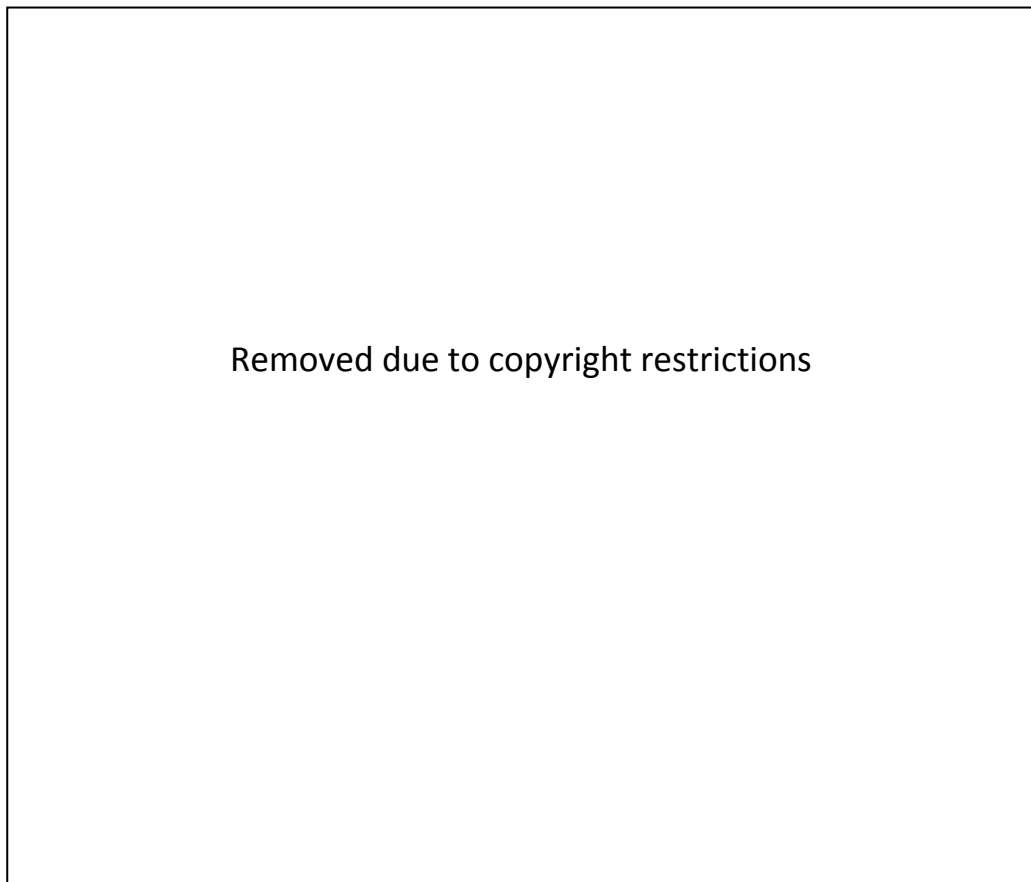


Figure 4.2 Carinated Bowl Pottery (Grimston Ware) from Great Briggs (Guilbert 2009: Fig 23)

The petrographic analysis concluded that some of the vessels studied may have contained non-local granitic materials . This included at least five and possibly up to ten of the Carinated Bowl samples and one Impressed Ware sample (Guilbert 2009:

112). This material could be associated with the Pre-Cambrian rocks of the Charnwood Forest area of Leicestershire, some 30 km to the south from Great Briggs. It is speculated that it would be unlikely that the raw materials would have been transported this far and it is more feasible for the finished vessels to have been moved (Guilbert 2009: 112). A cautionary note is added as the Charnwood Forest area also contained the probable source of the Group XX axes and that it could be these, or fragments of such, that are travelling and incorporated within vessels for ritual or symbolic reasons or that rocks from significant places, such as the source of axe heads, were being used as temper (Woodward 2002: 110; Guilbert 2009: 112). Another speculation focuses on the visits to procure the raw materials for producing axes; it is possible that ceramic vessels were broken and new ones made to replace them incorporating any nearby material including the waste products of the axe preparation. It is interesting to note that the petrographical examination of the stone axes recovered identified one Group XX axe from the Charnwood area and two Group VI axes from Cumbria. A flint flake of Lincolnshire Wolds flint was also found (Guilbert 2009: 114). These items are obviously non-local and demonstrate that item exchange, transport and trade occurred. No photomicrographs were available for this site.

4.5.3 Skendleby long barrow, Lincolnshire

This is the site of a pair of long barrows, one of which was excavated in 1936 and the second between 1975 and 1976. This review concentrates on the second long barrow and its results (Evans & Simpson 1991). The site is located at the southern end of the Lincolnshire Wolds on a southerly facing slope overlooking a small river (Evans &

Simpson 1991: 1). The excavation found that pre-barrow activity included a facade of posts and set parallel to the west were two large half-tree trunks containing a mortuary area dating from between 3500 and 3000 BC. It was on this mortuary area that the barrow was located following the burning of the tree trunks around 3000 BC (Evans & Simpson 1991: 44). The excavation found at least 70 sherds of pottery from the pre-barrow phase of activity and all were of Plain Bowl typology (Evans & Simpson 1991: 3-7). Within the mound and ditches, six phases were identified. In the earliest, layer six, Plain Bowl sherds were recovered. Layer four contained a large amount of Impressed Wares and some Beaker towards the uppermost limits of this phase. It is suggested that this is a result of secondary reuse of the barrow due to the extensive amount of pottery and the fairly good condition (Evans & Simpson 1991: 18-20). A total of 60 sherds were submitted for petrographic analysis. The results indicate that most, if not all, of the assessed thin sections could have been produced locally or obtained locally in the Lincolnshire Wolds (Woods 1991: 38-39). Thirty-four of the samples contained black opaque's which could be found locally as could the red and yellow opaque material. Most of the fabrics also contained flint, grog or shell with grog being the most common in 46 of the samples. It is likely that the flint was added deliberately. Certainly the flint appears to have been burnt prior to crushing and inclusion within the clay matrix (Woods 1991: 39). No possible source has been postulated for the flint inclusions or whether the shell is fossil shell or from a differing source. Small amounts of granite, quartzite and sandstone were found but are considered in the report to be of relatively minor importance and are not discussed further. No colour photomicrographs were available for this site.

4.5.4 Briar Hill, Northamptonshire

The site of Briar Hill causewayed enclosure is located to the south-west of Northampton (Bamford 1985). The site was discovered by aerial photography in 1972 and excavated between 1974 and 1978. Although the excavations revealed that the site had at least 14 phases, extending from the earlier Neolithic through to the Saxon, medieval and post-medieval periods, it is primarily phases one to nine which we are of interest here representing the main Neolithic and earlier Bronze Age activity. Radiocarbon date ranges for the initial phase of the monument are 4170 to 3355/4250 to 3355 cal BC (95% probability) or 3745 to 3415/3760 to 3415 cal BC (68% probability) (Healy *et al.* 2011: 299). The Neolithic assemblage recovered from the excavations totalled 1523 sherds. The assessment concluded that a minimum 117 earlier Neolithic vessels and 33 later Neolithic or early Bronze Age vessels were present (Bamford 1985: 101). Pottery typology included Carinated Bowl, Plain and Decorated Bowls, Impressed Wares of the Mortlake and Fengate sub-styles, Grooved Wares and Beakers giving the site an impressive range of both longevity and variation (Bamford 1995: 103-1-4). The petrographic assessment is not included within the main report but on microfiche with only a brief synopsis of the results. The assessment was based on sherds from each of the main ten fabrics identified within the site assemblage. The conclusion of the petrographic assessment was that the majority of the fabric components, and therefore, the vessels themselves, could have been obtained and produced locally in the Northampton area. The one exception is fabric D3, which contained glauconite and crushed flint and whose vessels were almost exclusively from a single bowl of the Mildenhall variant of the earlier Neolithic (Bamford 1985: 105). The report states that

the closest known source for the glauconite is 20 miles (32 km) distance (Bamford 1985: 109). The probable intentionally added inclusions are the organics, the larger polycrystalline quartz and flint and obviously the grog (Bamford 1985: 109). No colour photomicrographs were available for this site.

4.5.5 Hallam Fields, Birstall, Leicestershire

The site, located just to the north of Birstall village on the outskirts of Leicester, is primarily of Iron Age date and consisted of a number of enclosure ditches, pits, post holes and round houses (Speed 2009). During the excavation, two pits were located containing what were initially identified as Collared Urns (Figure 4.3). No radiocarbon dates were obtained from these features although the lithics assessment did conclude that the material was consistent with a Neolithic-Bronze Age date with components of both periods being present (Cooper 2009: 91). However, a reassessment of the vessels has indicated that they may actually be from the Fengate sub-style of the Impressed Wares (section 2.4.2).

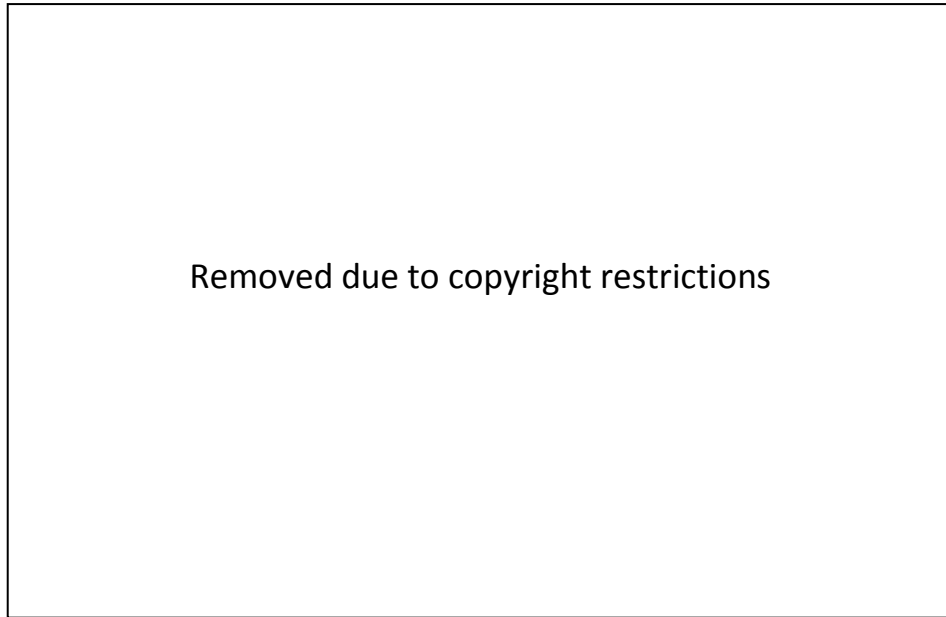


Figure 4.3 Plan of the pits containing Fengate Ware at Hallam Fields (Speed 2009: fig 10)

Four of the sherds from these pits and one sherd from the residual Impressed Wares in an Iron Age context were sent for petrographic analysis and two for Inductively-Coupled Plasma Spectroscopy as part of a wider sample from Hallam Fields (ICP-AES) (Vince 2009: 80). The petrographic analysis found that the samples were generally of local appearance with a range of rock and mineral inclusions which could have been easily obtained within north-east Leicestershire (Vince 2009: 90). However, these could also be obtained from a much wider area and it is noted that petrography alone cannot be relied upon for determining provenance in this instance. This is particularly evident as the ICP-AES results indicated that two samples may have a non-local point of origin (Vince 2009: 90). These had both been identified as containing a calcitic/shelly fabric possibly from Lincolnshire or East Yorkshire although Jurassic Clays from

Lincolnshire and the Trent Valley were also a possible source (Figure 4.4) (Vince 2009: 90).

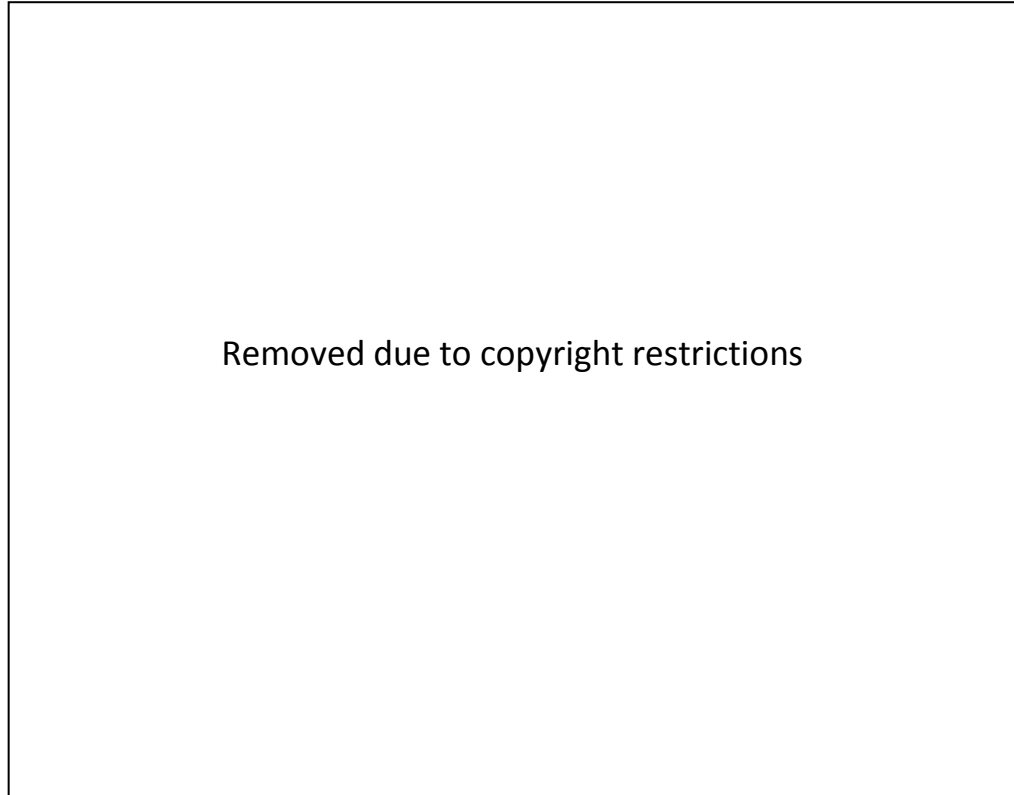


Figure 4.4 Thin section V4943, from context 691 displaying shell fragments (red arrows) and voids (black arrow) (Vince 2009: Fig 21)

The petrographic analysis of these two samples found that there were voids indicating bivalve shell and other voids left by organics (Figure 4.4). The micromass was optically active and contained amorphous opaque black burned clay minerals, abundant angular quartz and sparse muscovite laths (Vince 2009: 85).

4.5.6 Willington, Derbyshire

Willington, located on the floodplain of the River Trent, has seen numerous excavations since 1998 which has uncovered evidence from the early Neolithic through to the Bronze Age (Beamish 2009). The area seems to have been a focus for earlier prehistoric activity with a possible cursus at Potlock and a henge at Twyford nearby and further extensive prehistoric remains close to the north-east of this site (Wheeler 1979). The nature of the archaeological remains found at Willington consisted of several burnt mounds and associated troughs, a ring ditch and burial, pits and post-holes, some of which were structural, hearths and ovens and numerous palaeochannels. A total of 2057 sherds were recovered from the excavations dating from the Neolithic and Bronze Age and weighed a combined 9381 grams (Marsden *et al.* 2009: 81). The ceramics present comprised of Mildenhall sub-style Bowls, Ebbsfleet, Mortlake and Fengate styles of Impressed Wares, Beaker and other early Bronze Age styles although Impressed Wares made up 92% of the assemblage by weight (Figure 4.5) (Marsden *et al.* 2009: 81). Radiocarbon dates associated with the Impressed Wares can be seen in Table 2.1 in Chapter 2.



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Figure 4.5 Early Neolithic Bowl (1-3) and Mildenhall Ware (4-7) from Willington (Marsden *et al.* 2009: Fig 45)

Thirteen sherds were submitted for petrographic analysis consisting of ten sherds of Impressed Ware, one middle Neolithic sample, one Beaker sample and one Biconical Urn sample (Johnson & Whitbread 2009: 87). The resulting assessment found that three of the samples contained igneous material including gabbroic rock and altered igneous material (Sample P3, Figure 4.6), possibly a granodiorite with the speculated source being the Mountsorrel complex in Charnwood Forest (Johnson & Whitbread 2009: 87). Two other samples were interesting due to the absence of sedimentary rocks including quartz and sandstone, possibly indicating a non-local point of origin (Sample P12, Figure 4.7 & Sample P7, Figure 4.8).

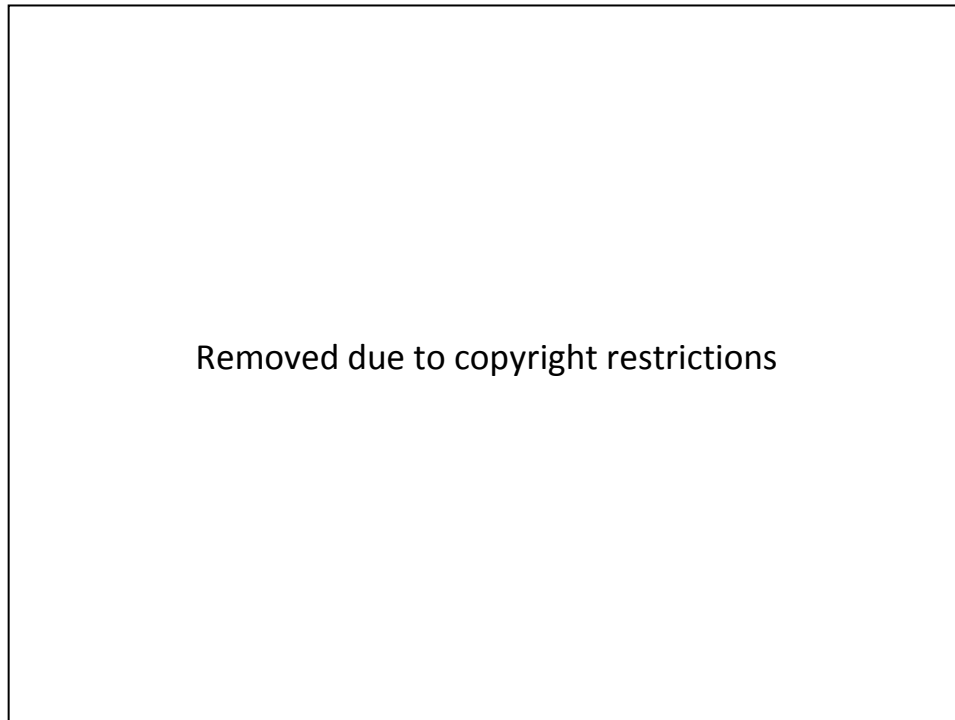


Figure 4.6 Sample P3 (Impressed Ware) showing altered igneous rock (red arrow) (http://ads.ahds.ac.uk/catalogue/resources.html?willington_eh_2008).



Figure 4.7 Sample P12 (Impressed Ware) showing granitic rock, amphibole and biotite but a lack of sedimentary rocks (http://ads.ahds.ac.uk/catalogue/resources.html?willington_eh_2008)



Figure 4.8 Sample P7 (Impressed Ware) showing granitic rock fragment in very fine matrix, with a notable lack of sedimentary rocks.
(http://ads.ahds.ac.uk/catalogue/resources.html?willington_eh_2008)

4.5.7 Eye Kettleby, Leicestershire

Eye Kettleby, located to the south-west of Melton Mowbray, was excavated between 1996 and 1997 (Finn 2011). The site mainly consists of a Bronze Age monument complex in use through the early and middle Bronze Age. Isolated elements of earlier activity are spread through the site and include Mesolithic flint material, early and late Neolithic pit deposits, recovery of Neolithic flint and stone axes in later contexts and palaeoenvironmental evidence gathered from the former carr (Cooper 2011: 110-113). The recovered ceramic assemblage was extensive, totalling 3448 sherds weighing 56,973 grams. However, a large proportion of this came from the cremation cemetery which included 28 cremations contained within urns. The Neolithic and early Bronze Age portion of the assemblage is much more modest, totalling 104 sherds weighing

744 grams (Woodward & Marsden 2011: 121). The report states that the petrographic analysis has been incorporated into the fabric results but no information is provided from the petrographic report which is deposited with the site archive. Three samples from the early Bronze Age fabrics contained igneous granitic rock inclusions and a possible source at Mountsorrel has been suggested (Woodward & Marsden 2011: 122). The other samples are considered likely to have a local origin with the inclusions composed of grog, sand, sandstone and fossil shell, all being available within the area.

4.5.8 Cossington barrows, Leicestershire

The barrows at Cossington have been excavated over a number of years with two undertaken in 1976 and the third in 1999 (Thomas 2008). Evidence of pre-barrow activity has been recorded, mainly consisting of palaeoenvironmental data, the barrow phases, a later Iron Age settlement and finally Anglo-Saxon re-use of the barrows (Thomas 2008: 127-129). The main Bronze Age ceramic assemblage was recovered from the 1976 excavations of barrows 1 and 2 although the ceramic report is contained within the present volume (2008). A total of 277 sherds of Bronze Age date weighing 8872 grams were recovered representing at least 19 vessels (Allen 2008: 27). These included two food vessels (Figure 4.9) and two Collared Urns (Figure 4.10).

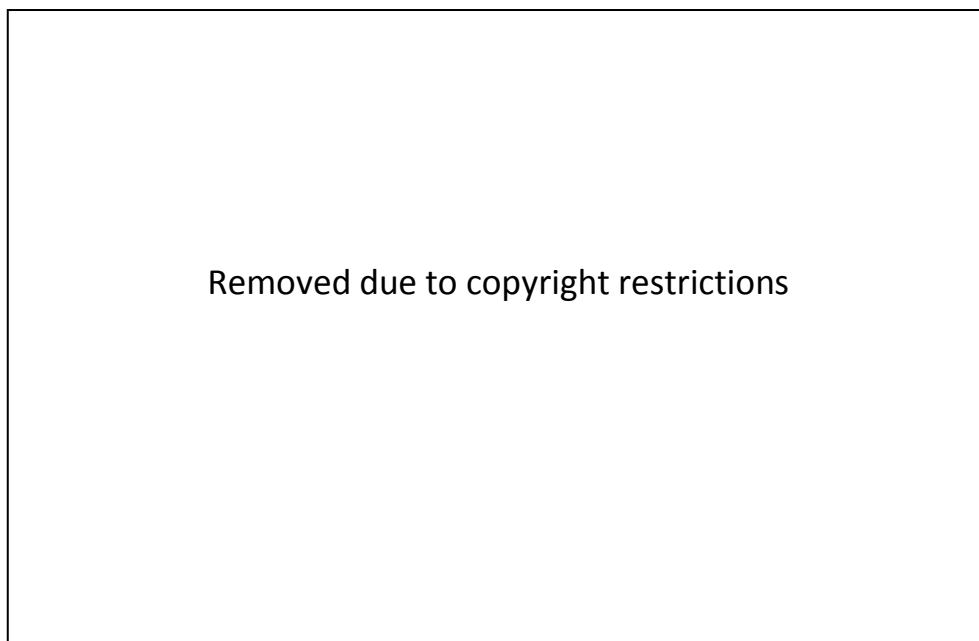


Figure 4.9 Two Food Vessels recovered from Cossington (Allen 2008: Fig 32)

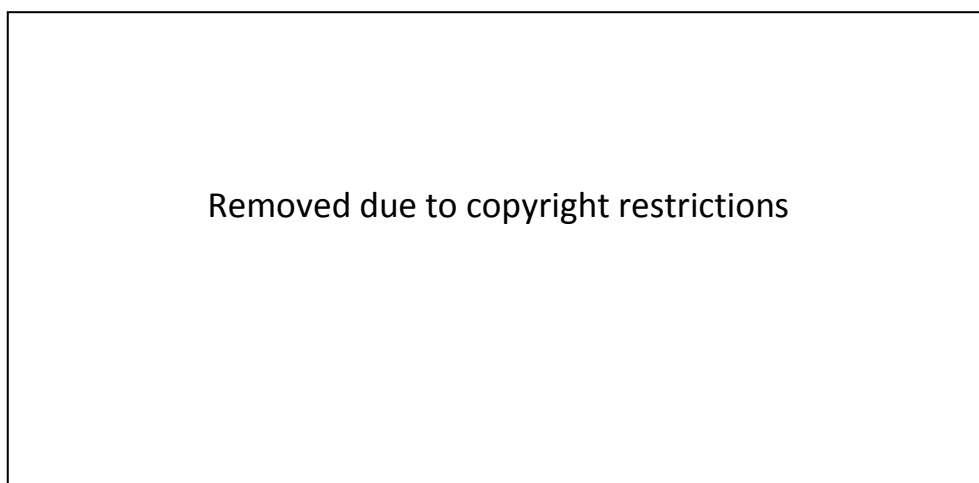


Figure 4.10 Two Collared Urns from Cossington (Not to scale) (Allen 2008: Fig 33).

Three fabric types were recognised within the Bronze Age ceramic assemblage and a representative sample of these were subjected to petrographic analysis. The granitic material in Fabric 1, samples V4085 (Figure 4.11) and V4087 (Figure 4.12), was determined to have come from granodiorite sands, possibly from a stream which had

passed through the Mountsorrel outcrop (Allen 2008: 28). Both samples also contained acid igneous rock, possibly non-local (Vince 2007: 1-3). The roundedness of the granitic material suggests it is located within the clay source as opposed to intentionally added. Sample V4086 (Figure 4.13) has a fine matrix with relatively few inclusions and those noted may be of Triassic origin, whilst the clay may be of Jurassic origin. It is speculated that an origin in the Trent Valley is possible but that a local boulder clay source is more likely (Vince 2007: 5).



Figure 4.11 Sample V4085 containing igneous rock (basic and acid), quartz (red arrow) and clay pellets (Vince 2007: Fig 1)

<http://www.avac.uklinux.net/potcat/pdfs/avac2007019.pdf>



Figure 4.12 Sample V4087 with possible acid igneous rock (black arrow) (Vince 2007: Fig 3) <http://www.avac.uklinux.net/potcat/pdfs/avac2007019.pdf>.

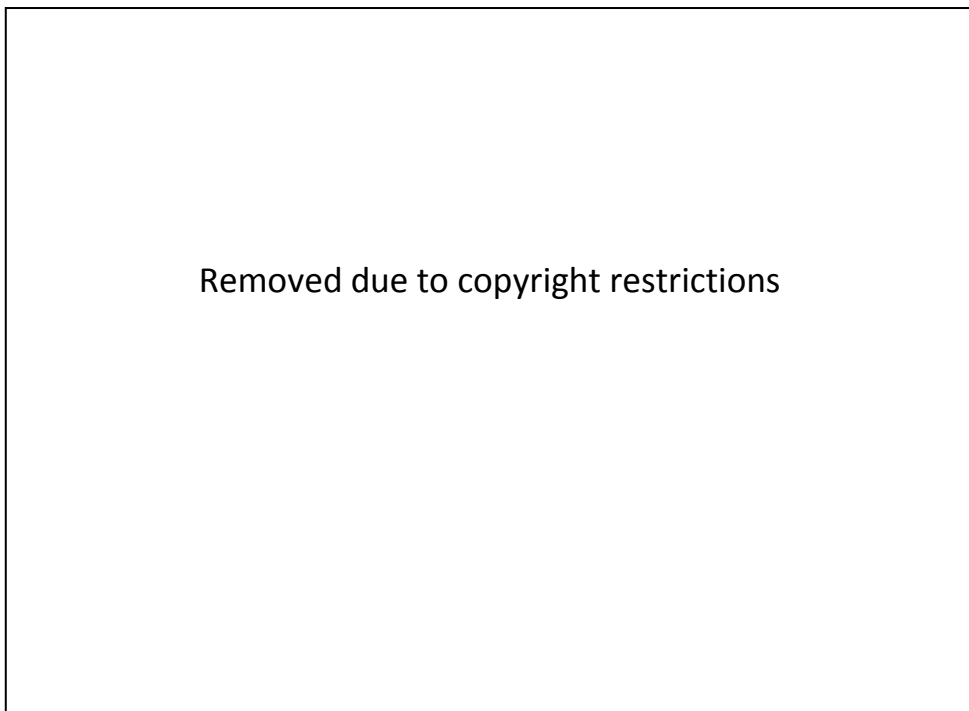


Figure 4.13 Sample V4086 with clay of possible Jurassic origin (Vince 2007: Fig 2) <http://www.avac.uklinux.net/potcat/pdfs/avac2007019.pdf>.

4.5.9 Lockington Barrows, Leicestershire

The Lockington barrow cemetery was excavated in 1994 (Hughes 2000) although earlier parts were excavated in 1954 (Posnansky 1956). The later excavations at the site revealed only limited Neolithic evidence from a solitary pit although portions of the flint assemblage were diagnostically Neolithic (Hughes 2000: 96). The Bronze Age evidence is fairly complex and may represent at least two separate episodes of activity with the earlier enclosure and ritual deposition of the hoard including the dagger from Amorica, on the Breton peninsula, and a later phase of barrow construction (Hughes 2000: 100-101). The Site VI barrow assemblage numbered 276 sherds weighing 2005 grams whilst the assemblage from Site V, a short distance to the west of the barrow area, contained 42 sherds weighing 333 grams. The barrow assemblage was exclusively Bronze Age in date while the VI group ranged from Neolithic to Iron Age (Woodward 2000: 48-56). In total, 13 fabrics from Site V and nine fabrics from Site VI were identified macroscopically. Eighteen samples representing 13 fabrics were sent for petrographic analysis. These include the later Bronze Age and Iron Age fabrics found in Site VI. The resulting petrographic groupings do not indicate a non-local point of origin for the Neolithic and early Bronze Age vessels. Some of the later Bronze Age and Iron Age fabrics containing igneous material may have a non-local source, possibly one of the Charnwood Forest outcrops, the nearest of which are six miles to the south of Lockington (Williams 2000: 61). However, these periods are not within the temporal scope of this study and are not considered further. The Neolithic sample does have quartz which is likely to have been deliberately added whilst the Bronze Age grog fabrics have such a common range of inclusions that a point of origin cannot be stated

with any degree of confidence (Williams 2000: 60-61). The potential for some of the vessels within the hoard feature to be heirloom vessels have been raised (Woodward 2000: 58-59). It would be interesting to undertake further provenance studies on these vessels including ICP-AES. No photomicrographs were available for this site.

4.5.10 Ashby Folville to Thurcaston, Leicestershire

The site of earlier prehistoric activity was located during archaeological works on the Ashby Folville to Thurcaston pipeline (Moore 2007). The sites were excavated between 2004 and 2005. The Neolithic site was discovered within the Radcliffe-on-the-Wreake parish and consisted of two pits containing a number of ceramic sherds and lithics (Moore 2007: 3). Sherds from different pits conjoined, indicating a contemporary date. In addition to these features, a number of other remains were present within this area containing later material and equally a large number of undated features (Moore 2007: 3). Radiocarbon dates for these two features are given in Chapter 3. The recovered ceramic assemblage totalled 865 sherds, including 531 from soil samples weighing 2004 grams. These possibly represented 20 vessels. The assemblage has been identified as belonging to the Fengate style of Impressed Wares (Figure 4.14) (McSloy 2007: 3-4).

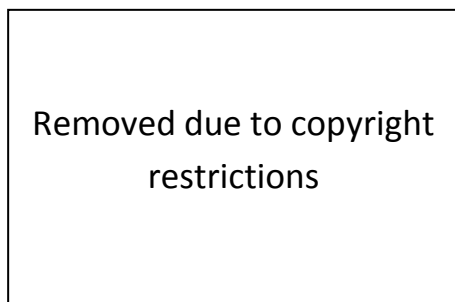


Figure 4.14

Fengate vessel from Site 10 on the Ashby Folville Pipeline (Moore 2007: Fig 6)

A selection of six samples representing four fabric types identified macroscopically were sent for petrographic and chemical analysis. The petrographic assessment concluded that on matrix and mineral inclusion proportions, two main fabrics were present (Vince 2007: 140-141). One fabric was dominated by flint debitage or calcined flint crushed and added to the clay and the second was a sandy fabric with differing amounts of quartz and vesicular voids. The components of both fabric types, although of differing sources as indicated by the ICP-AES, could both be obtained locally from the Triassic clays (Vince 2007: 141-142). No photomicrographs were available for the site.

4.6 Summary

This chapter has looked at the prior petrographic studies located within the East Midlands region which are intended to be used as comparative material for the primary sites, Rearsby Bypass, Syston and Castle Donington. The review has indicated use of both local and non-local material within the region and that these are not restricted geographically or chronologically.