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Is Less More?
An Assessment of an Experimental Purposive Sampling
Strategy using Roman Pottery from the A14C2H as a
Case Study

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Statement of Original Authorship**

I, Lanah Hewson, certify that this is my own work and that the use of material from other sources has been properly and fully acknowledged in the text.

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Abstract

Pottery is one of the most common artefact groups recovered from excavations, and the sheer quantity of this class of bulk find on large scale projects has significant time and cost implications for professional excavations. The pressures placed on professional units to efficiently process pottery and produce, most commonly, 'grey literature' reports for developers do not facilitate much additional study of wares and thus limits the way pottery consumption can be understood. For this reason, sampling is a vital tool for professional units that can alleviate the financial pressures and resource demands that these companies may face. However, there are many theoretical issues with sampling pottery assemblages owing to how many transformations an assemblage has already faced. This dissertation critically assesses an experimental, purposive, sampling strategy which involved sampling sherds from features of interest within the landscape block that would contribute to the broader understanding of site occupation, without needing to assess the entire archaeological assemblage. This included kilns producing products of the recently discovered Lower Ouse Valley (LOV) industry. The strategy was employed on c.205kg of Late Pre Roman Iron Age (LPRIA) and Roman pottery sherds from the West of Ouse landscape block on the A14C2H project, a major road development in Cambridgeshire and was largely successful, though illustrated some limitations which require further study to amend. Nevertheless, the project has demonstrated a method that has the potential to decrease the financial burden and demand of resources placed on professional units processing large quantities of pottery on infrastructure projects and thus change the ways pottery is processed by these units.

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1. Introduction

Pottery is one of the most common classes of artefacts recovered from archaeological sites and can make up a large percentage of bulk finds. For this reason, professional units are currently under a lot of pressure to process and analyse pottery as efficiently as possible, namely through spot-dating and quantification. The pressure to provide this service at the best value for money does hinder the degree to which ceramics are analysed, and prevents professional study from developing in the same way that academic study has in the past. The development of Roman pottery studies shall be discussed in depth in the next chapter, but can be summarised as pottery initially being used for culture studies, then for dating evidence, contextual and technological studies, and later to understand the economic factors and social identities of the Roman world (Shepard 1956:3; Booth, 1991:8; Evans, 2001:32; Cool, 2006:15). While the nature of academic studies has progressed, it has not been possible for professional studies to do so in the same way due to these high pressure demands to process large quantities of pottery. This is owing to the fact that professional units often work on large developer funded projects which usually produce 'grey literature' as their final outcomes, and these rarely facilitate more than a typological analysis. The limitations of professional pottery studies were a key consideration when raising this research question and have been reflected in the study itself. The way that pottery has been analysed within this project is in line with the demands of specialists working with the Museum of London Archaeology and Headland Infrastructure (MHI) and as a result includes the quantification of the assemblage and assessment at a hand specimen level. The methods will be outlined in detail in Chapter 3, but it is important to disclose that this project does not directly demonstrate how pottery studies in the professional sphere can develop in the same ways that academic studies can. Instead, this project will outline and critique an analytical technique that will assist in the relief of the time and financial restraints that limit professional studies. Through this, the project will theoretically allow for professional studies to develop in a similar way that academic study has, but the primary goal is the development and critique of a sampling strategy that will assist in this development, not provide it.

One way to combat these limitations within the professional field is to introduce a sampling technique that can reduce the quantity of pottery that needs to be analysed- thus combatting time and financial constraints- whilst still providing an accurate representation of the wares produced from a site. Thus, this project aims to demonstrate an experimental purposive sampling strategy used on the A14 Cambridge to Huntingdon (A14C2H) improvement scheme to determine its effectiveness, and how representative of the full dataset it can be. The sampling strategy has been critically evaluated and, as it has been deemed broadly successful, may have demonstrated an approach that can be

adopted by professional units working on large infrastructure projects in the future. The implementation of sampling is a clear solution to these limitations as it reduces the quantity of pottery that needs to be analysed, thus relieving both time constraints and the demand of financial resources. Simply put, the less pottery there is to analyse means that it takes less time to process, and costs less due to a reduction of time spent on each assemblage. Therefore, the implication of this dissertation is the demonstration of a sampling strategy that will allow greater efficiency whilst maintaining accuracy, and shall provide the necessary background for pottery specialists to begin considering robust and replicable sampling as part of projects with very large ceramic assemblages.

The assemblage discussed in this dissertation has been produced from excavations lead by the Museum of London Archaeology and Headland Infrastructure and comes from three TEAs (Targeted Excavation Areas) on the A14 (figure 1.1). These are TEAs 14, 15, and 16 which form one landscape block on the project and cover c.20 hectares spread across 1.5km of the terrace alongside the River Great Ouse (table 1.1). The landscape block (henceforth the West of Ouse or WoO landscape block) demonstrates a vast chronology of occupation and activity, ranging from the Bronze Age to the Medieval and Postmedieval periods, though most comes from the Late Iron Age (LIA) or Roman periods. Several key features were included within the landscape block including monuments, kiln structures, and settlement activity. Thus, the assemblage was diverse and allowed for the production of high quality data due to the large amounts of pottery recovered, meaning it was ideal for this kind of study.

The sample was formed of wares produced by features of importance (such as kilns and settlement areas outlined by the project's 'wish list') to understanding the landscape block and answering the research aims of the project. These wares were flagged and recorded separately by specialists Adam Sutton (Iron Age wares) and Eniko Hudak (Roman wares), while the unsampled wares were recorded by the author. The recording process is detailed in the methodology chapter. This method allowed for the sample and full dataset to be assessed separately, and thus for comparisons to be made in regard to the trends illustrated in both and whether the sample was an accurate representation of those demonstrated by the full dataset.

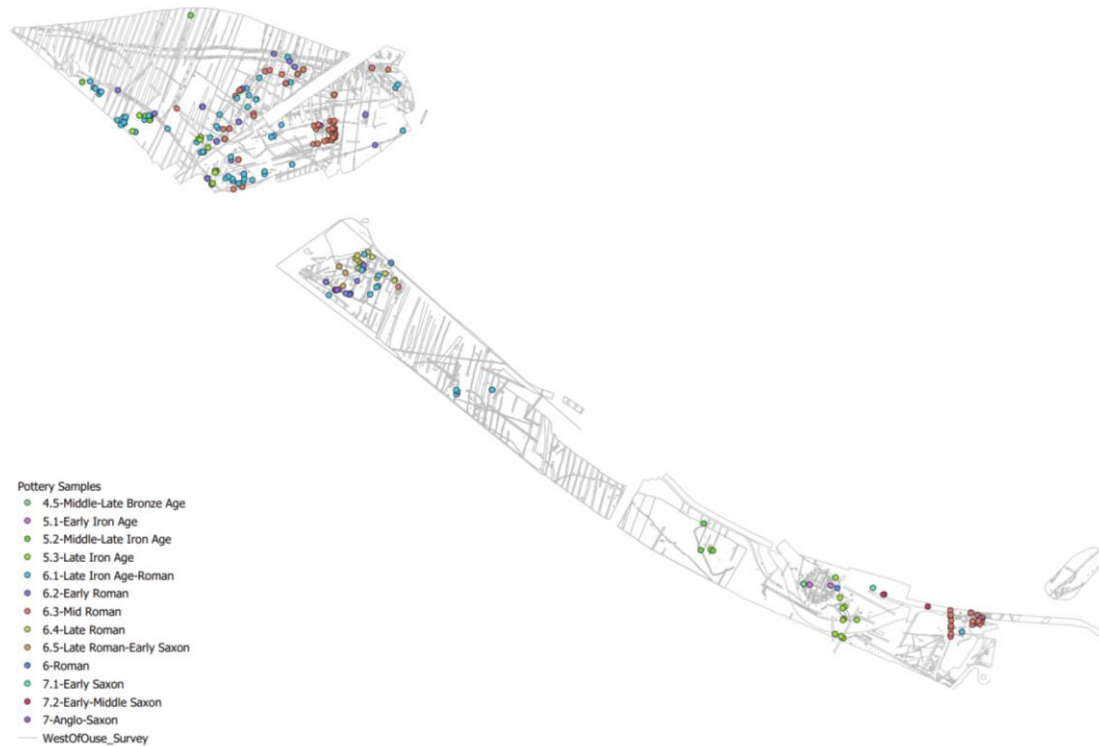


Figure 1.1: Map of pottery samples taken from TEA 14 (top left), TEA 15 (central), and TEA 16 (bottom right) which form the West of Ouse landscape block

TEA	Area (ha)	Dates of excavation	No. of contexts	Iron Age	Roman
14	9.5	Oct 2016 – Jan 2018	3,633	Settlement, agriculture, 1 cremation (LIA).	Settlement, agriculture, 2 kilns, trackway, 2 burials.
15	4.5	Oct 2016 – March 2018	807	Trackway.	Settlement (southern part of that in TEA 14), Industry, 1 kiln.
16	5.3	Nov 2016 – June 2018	1,774	Agriculture.	Settlement periphery, Industry, 6 kilns, 1 cremation, agriculture.

Table 1.1: Overview of the contents of TEAs 14, 15, and 16

However, there are limitations to this project. For example, the use of sampling strategies can be problematic in that they are not often discussed in the literature, meaning comparisons to past studies can be difficult. Additionally, there are often criticisms of using samples within pottery studies, owing to that fact that original artefact populations cannot be assessed when working with incomplete vessels. This means that the full dataset can be considered an unintentional sample, which in turn means that further sampling can be problematic when assessing accurate representations of a 'full' dataset (Tyers 1996:24). Therefore, this project has also briefly considered the value of the 'full' dataset as a worthwhile unit of analysis, given the nature of unintentional sampling.

This study lends itself to discussing theoretical disputes of this nature due to the method of sampling employed. When individual features are being targeted to answer specific research questions, it is due to their distinctive nature and the research opportunities that arise from them. So, if this is the case, is it fair to judge a sample from these features based on how representative it is of the entire population? What may be more beneficial is considering the features themselves as full populations and comparing the sampled data to these. Thus, the representativeness of the method can be accurately assessed while maintaining the individuality of these features. In this way, there is less opportunity for bias in the results from 'anomaly features', but the nature of these can be studied effectively. This form of *purposive* sampling is what has been conducted and critiqued in the study, and the sample has been compared to the full dataset on several levels (i.e. comparing the sample and full dataset of a feature, settlement, period, and entire datasets.)

In addition, as three people were involved in the analysis of the materials, interobserver error was an issue. This was especially influential over the results of the study owing to the experience discrepancy between myself (being new to the field of pottery analysis) and that of Sutton and Hudak (who both have c.10 years of pottery experience each). The varied experience each observer had influenced the way in which the assemblages were perceived and thus resulted in variations in our assessments (Whittaker et al., 1998:143). However, the quantities of pottery recovered (c.205kg) and the fact this material could be dated to multiple periods, demanded the contribution of multiple specialists. As is the case on most large infrastructure projects, subjectivity and interobserver variation was an inevitable challenge that was not unique to this project. Therefore, this limitation had to be considered during the course of the project, and recommendations to amend the issue have been discussed in the conclusion it will further benefit the ways in which bulk finds can be analysed in the professional sphere.

2. Academic Context

2.1. A Seat at the Potter's Wheel: Pottery Studies

2.1.1. *The History of Pottery Studies*

Pottery is one of the most common artefact classes recovered from archaeological sites and the study of which can be applied in numerous ways to improve our understanding of past civilizations. However, as an artefact class, pottery is viewed by archaeologists in a variety of ways, ranging from fascination to resentment, meaning the attention granted to this artefact group is not standard across professional nor academic units (Orton et al, 2013:3). Nevertheless, as pottery studies do hold huge potential for understanding the past, they have been utilised by archaeologists for decades. The way this has been done can be generally divided into three initial phases set out by Shepard in the 1950's (1956:3) which are as follows:

- 1) The study of whole vessels as culture-objects
- 2) The study of sherds as dating evidence for stratigraphic sequencing
- 3) The study of pottery technology as a way of relating to potters

While these phases have been assessed, critiqued, and re-assessed throughout the years, the trend has been broadly agreed upon by scholars. In recent years, Orton et al (2013:4-5) revisited these trends and applied dates to the study periods. The first (art historical) phase utilised complete forms to interpret past cultures and beliefs, particularly through the use of decoration, and was popular from the early 16th century. The second phase refers to the use of pottery sherds to date stratigraphic phases during excavations and can be considered one of the most common forms of pottery studies (Tyers, 1996: i). This method arose in the late 19th century and considered how vessel forms developed over time and how typologies could be used as dating evidence (Orton et al., 2013:4-5). Finally, in the mid-20th century, considerations shifted from *how* forms were changing to *why* they were changing, and how these likely coincided with developing technologies. The study of developments in pottery production technologies- namely the potter's wheel- assisted in allowing archaeologists to relate to past potters and the reason they manufactured wares the way they did (Sutton, 2020:218).

In more recent years, it is not just the ways in which pottery can be studied that has shifted, but also the motivation for doing so. In the later 20th century, a lot of pottery studies focussed on the economic implications produced by this field (Tyers, 1996:38). Significantly, Greene utilised the robust nature and sheer quantity of Roman pottery at most sites to draw conclusions of trade routes and vessel movements (1986:157). Discussions of the Roman economy made use of the nature of clay

matrices to indicate clay localities (Tyers, 1996:31) and type series' that could indicate storage vessels (Greene, 1986:162), either which would discern local or international movement of vessels. Inferences could also be drawn from vessel types and fabrics to comment on social status and economic hierarchies (Booth, 1991:8; Evans, 2001:32). This focus on social status and economy, Greene indicated, was the natural progression following the art-historical and typological phases of study previously outlined. However, in the late 20th and early 21st century, attention shifted away from economic implications and instead moved towards how the function of vessels and assemblages could indicate social identities (Cool, 2006:15). Anthropological and ethnographical teachings were applied to pottery studies in this period with the express purpose of interpreting the social functions of pottery and thus the social identities of the people that utilised these vessels (Tyers, 1996:42; Cool, 2006:15; Pitts, 2005:51). In this way, we can see the motivation of pottery studies shifting beyond Shepard's third phase of using technologies to relate to potters, and into using the vessels to relate to the economic and- later- social identities of the vessel owners. These developments illustrate how archaeologists can utilise a single artefact class to make suggestions of the past through considering technologies, theories, and contextual evidence.

However, it should be said that these phases are generalisations of past studies. To truly utilise past works on pottery, developments in both the field of study and pottery technologies need to be considered. In the current period of study, emphasis on what pottery is used for is largely dependent on the 'sphere' of study analysis is conducted within. The academic sphere of study, for example, has been able to develop from culture studies, through the typological phase, and finally to contextual understandings of the past (in this instance, Shepard's third phase has been extended to include the more recent works into economic and social understandings too). This is often achieved through the intelligent combination of form and fabric analysis, but enhanced through considerations of trade movements, pottery functions, and thus site functions and identities (Evans, 2001:27). In the meantime, the professional sphere has generally been limited to the typological phase of study as this is what is requested by developer funded projects, and time and financial pressures on professional units often prevents further discussion of economic and social connotations, despite the fact specialists may wish to (Marshall and Seeley, 2018). This is not to say that professionals do not produce works of this nature, key publications by Booth (1991), Evans (2001), and Cool (2015) all occurred outside the sphere of academia. Rather, in developer funded projects the final outcome is often 'grey literature' which does not facilitate anything more than typological analysis. Simply put, without the benefits of extended time, funding, and resources that some academic authors have, it is very difficult for professional units to fully utilise the wealth of information that ceramic bulk finds may provide. It is for this reason that a sampling strategy that allows for a focus on features of interest rather than an

entire artefact population could be beneficial to the ways in which professional units are able to utilise the wares produced. This is particularly the case on large infrastructure sites where huge quantities of ceramics are recovered, and the collaboration of multiple organisations may present opportunities for a development in studies. While less wares will be recorded through the implementation of a sampling strategy, resources will be ‘freed up’ and made more available, meaning more can be done with the wares themselves. The details of this strategy shall be outlined below.

2.1.2. Some Limitations in Pottery Studies

While the study of pottery has certainly developed within the academic sphere, certain limitations have prevented the professional sphere from developing in the same way. Professional units are often tasked with spot-dating and quantifying pottery assemblages in order to infer stratigraphic chronologies (Orton et al, 2013:21; Marshall and Seeley, 2018). However, this is often where the analysis of these wares ends. In the Standard for Pottery Studies in Archaeology document produced by Historic England, the Prehistoric Ceramics Research Group (PCRG), the Study Group for Roman Pottery (SGRP), and the Medieval Pottery Research Group (MPRG), the 4 main aims of pottery assessment are as follows:

1. *Establish the size and broad character of the assemblage.*
2. *Determine the level of analysis required.*
3. *Enable accurate estimation of the resources required for analysis.*
4. ***Provide sufficient information about the pottery (often chronological) to facilitate other project tasks such as stratigraphic dating.***

(Barclay et al, 2016:10,
emphasis added by author)

These aims, particularly number 4, illustrate the expectation of professional pottery assessments and how these are oftentimes limited to quantification for chronological understanding. This is frequently due to time constraints or limited finances which prevent the development of study beyond what is deemed absolutely necessary. These constraints mean that professional units can often get overwhelmed when larger quantities of ceramics are produced by sites- particularly larger infrastructure sites. One way to combat this is through the implementation of sampling strategies in these sites. The theory and practice of sampling will be discussed below in section 2.2.

An additional limitation within pottery studies comes from the fact that specialists, through the requirements of the job itself, work regionally and tend to cover a specific field. While this is not to say that specialists do not cover a general basis of knowledge, it does mean that there is no standard practice or resources (such as type series') for pottery specialists in England due to the unique demands of regional studies (Colley and Evans, 2018). For example, in his study of inter-site comparisons between pottery assemblages in Warwickshire, Booth highlights the difficulty of standardising what falls into the categories of fine and coarse wares in different regions and how this may hinder the expansion of his study (1991:5). Thus, it would be difficult for specialists to identify wares based on these categories when working non-locally. This is to be expected, a Roman pottery specialist in Yorkshire should by no means have the exact same knowledge base as an Iron Age specialist in East Sussex as this would be extremely limiting and prevent an understanding of unique local wares. Nevertheless, this does pose an issue for larger projects that will produce a high quantity of ceramic evidence and require more specialists to analyse it as a result.

The first limitation here is that by increasing the number of people working with the wares, the probability of interobserver error also increases. This is particularly problematic when the subjectivity of ceramic identification is considered. When differentiating fabric types, comparisons are often made and fabrics can be described as more or less powdery, orange, coarse, or any number of terms, to another fabric. Rice (2015:276), describes the subjectivity of colour perception which would also influence how fabrics are perceived and identified. For these reasons, assigning sherds to classifications can be complicated by the introduction of multiple specialists who may disagree on perceptions and descriptions. Furthermore, if one specialist is less familiar with local wares, they may hesitate to assign sherds to specific classifications and instead use 'bucket codes' which makes later study more complicated. This is an issue that is not unique to this project but must be considered carefully.

Furthermore, the fact that specialists are required to work in regions that they are unfamiliar with can lead to additional complications. As previously mentioned, not all those trained in Roman pottery will have the same foundation knowledge and it cannot be assumed that they will be aware of unique forms or fabrics specific to regions outside their own, much less the specific codes and type series that will apply to a single project (Colley and Evans, 2018). This may lead to further discrepancies in fabric and form identification, or at the very least, hesitation to assign sherds to classification. Moreover, these specialists will also require a training period where they must familiarise themselves with type-series associated with specific projects, the recording processes they must adhere to, and any programmes unique to the project. Not only does this take time away from the analysing and

recording processes themselves, but it also takes time for confidence to grow with all these new systems, codes, and processes.

2.2. A Little Goes a Long Way: Sampling Strategies

2.2.1. Pottery as a Sample

Before discussing the theory behind sampling, there are a few broader concepts that must be considered first. For example, one common issue raised when discussing pottery sampling is that pottery assemblages are inherently samples to begin with. This is because we are often working with sherds rather than complete vessels, meaning there is not a known complete ‘population’ for this class. Instead, we are working with an unintentional sample that we call the ‘complete’ assemblage (Orton, 2000:40). Furthermore, the life course of artefacts means that this unintentional sample goes through several phases of sub-sampling before reaching this point. There are many processes that may account for this movement between assemblage phases, but the phases themselves are standard. While the vessel is in use it is part of the *life assemblage*, but once it is broken and stops being used, the vessel is considered part of the *death assemblage* (Tyers, 1996:24). Once vessels join the *death assemblage*, a non-random sample of these enter the *archaeological assemblage* through deposition and it is these that are later excavated (figure 2.1). However, as aforementioned, only a proportion of what is in these deposits is actually excavated, and so not only do archaeologists not have a complete population to begin with, but this population has also been subject to multiple levels of sampling before even reaching this point.

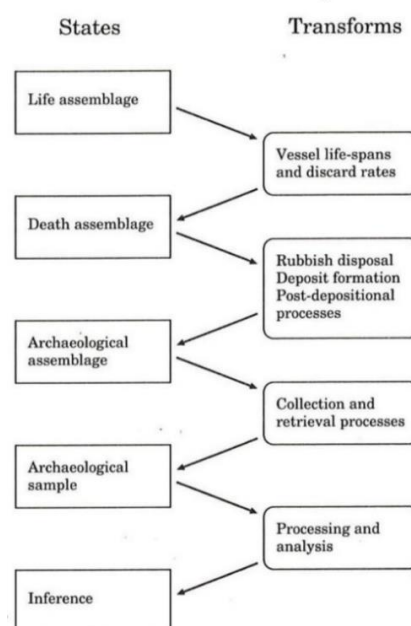


Figure 2.1: Transformations of the pottery assemblage (From Tyers, 1996:24)

However, while the life and death assemblages depicted by Tyers (1996:24) are very useful in illustrating unintentional sampling in archaeology, they are not unique to the study of pottery. The transformations between one phase of an artefact's life course to another can be applied to any other class of find such as metal objects or clothing accessories. A more specific issue to ceramic artefacts is that the fracturing of artefacts prevents a known *archaeological* sample and thus population size. The sheer quantity of pottery associated with most sites makes estimating the number of vessels in an area almost impossible which is why quantification processes are deemed so essential. While it is possible to acquire Estimated Vessel Equivalents (EVEs), Estimated Numbers of Vessels (ENVs), or the Minimum Numbers of Vessels (MNVs) through the quantification process, it is the *estimation* and uncertainty of population numbers that make some archaeologists sceptical of further sampling. It can be argued that sampling within samples (even unintentional ones) reduces the likelihood of accurately representing what the initial *life assemblage* of a site would have looked like. It is for this reason that specialists such as Rice (2015:269) suggest selecting as many sherds as possible of a range of vessel types in order to be as representative as possible. However, this is not always possible for professional units especially, and Rice does acknowledge that time and financial constraints can prevent this ideal large-scale sampling. Thus, to discuss the appropriateness, practicality, and perhaps standardisations of sampling methods in archaeology specifically, the theory of sampling practices must be considered.

2.2.2. *The Theory of Sampling*

Sampling as a concept has been used by many fields to assist in dealing with large quantities of data. Because of the many reasons and methods for collecting data there are equally as many methods for the sampling process itself. However, the need for consistent sampling approaches to be used in scientific fields led many to call for a more standardised approach, leading to the increased discussion of sampling theory within archaeological literature (Orton, 2000:14). Of these voices, Orton's is particularly prominent, and his assessment of past sampling techniques is of huge importance to the theoretical debate. The two main techniques Orton discusses and critiques that are relevant to this project are strategies within the *representative method: random* and *purposive* sampling. *Random* sampling assumes that every unit in a given population should have equal chance of selection, whereas in *purposive* sampling units are selected according to values which relate to variables being studied (Bowley, 1926 as cited in Neyman, 1934:559; Orton, 2000:14-15). Of these methods, the *purposive* method has been judged to be more appropriate for use on the A14 project as the purpose is to use key features to form a sample that represent the full populations. These features are selected owing to their value in answering the key research aims of specific TEA's, thus

demonstrating *purposive* sampling. Debates were had over which approach was more appropriate for archaeologists until Neyman's key contributions to the theoretical discussions in 1934. In his work, Neyman acknowledges that financial limitations and time constraints can prevent exhaustive research, a key limitation within the field that is still relevant. He argues that it is because of these limitations that the strategies of the *representative method* reached such popularity, likely owing to the fact that the method forms the basis for the minimum standard of analysis.

Neyman does present some limitations of the *purposive* method which will now be discussed. Firstly, he notes that samples are drawn due to specific research aims, and as a result data will not be as appropriate for future use as that resulting from *random* sampling should research aims differ from those influencing the sampling practice (Neyman, 1934:572). This is a very important limitation to consider, and the biases this method potentially produce can have an effect on wider research. However, at the time of publication Neyman only had two major case studies to consider and frequently acknowledges a lack of transparency within the methods of these. Since then, sampling practice has developed and the requirement for a representative sample, regardless of method, has been emphasised (Orton, 2000:20; Rice, 2015:267). Additionally, the issues with bias and reliance on hypotheses that Neyman mentions are theoretical, and it has not been possible to directly compare the two strategies within the *representative method* due to the stark differences in what is considered a population. The results of Neyman's work was the proposal of a *two-stage* sampling method which then inspired further theoretical discussion around *systematic* sampling. While Neyman's contributions to the discussion of statistics were great, his work was later criticised for being too general. As the *two-stage* method made no assumptions regarding the population being studied, it was not possible to make use of any existing knowledge of the site (Orton, 2000:15). Thus, these methods may not be the most appropriate for this particular study. As the dissertation project is purposely selecting features to answer specific research aims and has made it possible to directly compare these results to a full dataset, the *purposive* method is most appropriate and any biases will not only be identified, but actively considered and criticised.

As the prime requirement of any sample is to provide an accurate representation of the wider population (Orton, 2000:20; Neyman, 1934:560; Rice, 2015:267), this study will be able to contribute to the discussion of statistical theory by providing an opportunity to directly comment on the actual (rather than theoretical) representativeness of the methods used. The benefits provided to this study, both financial and time, have allowed a unique position that others discussing this topic have not been granted and so the results from this project will contribute to the broader discussion of statistics in a unique way.

2.2.3. *Big Data Projects: The Town and Country in Roman Britain Project*

The quantity of pottery produced by the A14 project is daunting and so sampling was an absolute necessity. It is beneficial to consider approaches used by similar 'Big Data' projects and the methodological issues they may have faced. Sampling as a concept is rarely discussed in report methodologies which makes comparisons challenging, though there are several large projects that do disclose their methods. One of particular relevance to this project is the 'Town and Country in Roman Britain' project. Interestingly, a *purposive* approach was taken for the 'Town and Country in Roman Britain' project with specific stratified contexts being selected as units of analysis (Perring and Pitts, 2013:14). One issue raised was the inevitable subjectivity of the sample selection process which is always a concern with the *purposive* method. However, the project selected features on the basis of size (and low levels of residual or reworked material) to ensure consistency in assemblage groups and minimise bias.

Additionally, in the methodological handbook discussing the Roman Essex assemblages, Doherty (2015:4) explains that stratified groups such as pit features were considered units for comparisons rather than individual sherd groups. This allowed for a clearer comparison of consumption across the broad spatial and geographic landscape of the project. Similarities between this sampling method and that proposed by this project are clear, as features are considered units or populations in and of themselves; thus, samples can only be considered as representative (or not) of the features rather than the broader landscape. However, this dissertation project is unique in the sense that the representativeness of these feature samples can be directly compared to the full populations, thus no assumptions of accuracy have to be made and instead representativeness can be verified. Additionally, it will be possible to determine how valuable the entire assemblage is in terms of units of analysis when compared to the sampled data. The nature of this dissertation allows for analysis and comparison that was not possible for the Town and Country in Roman Britain project, and thus contributes to the theoretical discussion of this sampling strategy in a unique way.

One key methodological issue that Doherty raises for this approach comes from the fact that the Town and Country in Roman Britain project draws data from a variety of institutions and databases. As a result, various typologies have been used and codes to describe wares are not standardised across databases (Doherty, 2015:8). As well as this, there are issues with the 'lumping' and 'splitting' of wares which, according to Orton and Hughes (2013:78), is a method of differentiating fabrics with the former assuming all are the same unless proven differently, and the latter assuming the opposite. Because of these differences in analysis and recording, there would naturally be a degree of interobserver variation within these data used for the project, meaning comparisons would be

difficult. Interobserver variation is not a unique issue to this study (nor something that can be resolved presently) and, as aforementioned, is something that must be considered whenever multiple specialists work on a single project.

2.2.4. Big Data Projects: Big Data on the Roman Table

Another project that should be discussed is the Big Data on the Roman Table research network (BDRT) which saw a group of c.50 international archaeologists and institutions work together to answer questions regarding the analysis of large datasets within the context of dining in the Roman world (Allison, 2018). There are many relevant aspects of this research network to the dissertation project, including the gathering of multiple specialists to work on large database collections and the methodological issues of this. Though, as these aspects have been previously discussed, this section will instead focus on the approaches used to analyse the data itself.

The BDRT network's primary aim was to explore dining cultures within the Roman world but had a secondary goal of challenging current approaches to large datasets through discussions of the quantitative analysis and visualisations of these (Allison, 2018). Colley and Evans (2018) discuss the importance of archaeologists producing, recording, and publishing data in a way that is *sustainable*, meaning that if data is recorded digitally, it must be accessible to researchers in formats that are interoperable to ensure preservation. This is an important issue when discussing digital data and one that this project must also consider due to the importance of the ORACLE database for the quantification of data. Due to the importance of standard information being accessible, the Museum of London Archaeology (MOLA) uses 'spot-dating' as a minimum standard of pottery analysis and, as a result, meant the BDRT network also used this practice to maintain sustainable digital records (Marshall and Seeley, 2018). During the 'spot-dating' stage, vessel form and fabric, condition, and quantification information (with a standard of weight, sherd count, and estimated vessel equivalents (EVEs)) are imputed into the ORACLE database. This allows ease of access to key information, as well as a standardisation for comparisons to other contexts. In this way, the research network demonstrates sustainable recording of digital records that must be reflected in this dissertation project.

2.3. The A14C2H Improvement Scheme

2.3.1. Background of the Project

The A14 Cambridge to Huntingdon improvement scheme is an ongoing infrastructure project that began with geophysical surveying in 2009. The scheme has since developed into one of the largest and most complex archaeological projects undertaken in the UK. The project spans c.350 hectares and is formed of 8 landscape blocks, each of which are comprised of a total of 27 individual Targeted Excavation Areas (TEAs) (Highways England, 2018). The West of Ouse landscape block includes TEAs 14, 15, and 16 which altogether cover 20 hectares spread across 1.5km of the terrace of the River Great Ouse.

2.3.2. The West of Ouse Landscape Block

The TEAs within this landscape block showcase a range of archaeological activity, spanning Bronze Age monuments and burials, to an extensive Roman settlement, and Anglo-Saxon and Medieval and Post-Medieval enclosure activities (MOLA Headland, forthcoming). However, for the purpose of this study, only the Late Iron Age and Roman periods of occupation shall be discussed (table 2.1). While broadly described as rural, the Roman occupational period shows diverse activity. TEA 14 shows an agricultural landscape, with evidence of boundaries and trackways, livestock enclosures, kilns, and a settlement that extends into TEA 15 (Sutton et al, 2019:85). TEA 15 continues to demonstrate these activities through the presence of a possible structure and pottery kiln surrounded by a series of ditches and pits containing later Roman materials (Sutton et al, 2019:89). However, TEA 16 shows a far more industrial landscape and hosts six kilns, which likely made use of the river, but also showed links between structures dated to the mid-Roman period and the agricultural landscape of TEA 14 to the west (Sutton et al, 2019:93).

TEA	No. of Sherds	Weight of Sherds (g)	Primary Material Date
TEA 14	12,665	132,933	LIA-Roman
TEA 15	1,838	24,507	LIA-Roman
TEA 16	5,525	61,118	IA-Roman

Table 2.1: Pottery quantification data gathered from Sutton et al, 2019.

This landscape block is ideal for this study as the assemblage sizes are large enough to provide an accurate assessment of activity within the occupation of the site, but not so large as to make analysis unrealistic within the timeframe presented by the MA. Furthermore, the majority of materials from all three TEA's are dated to either the Late Iron-Age or Roman periods, meaning the majority of the assemblages are relevant to this study. As a result, the TEAs reflect diversity within rural settlements and the activities associated with them throughout various phases of Roman (and other) occupation, allowing for a discussion of a range of wares and materials for study.

2.3.3. Roman Rural Settlements Studies

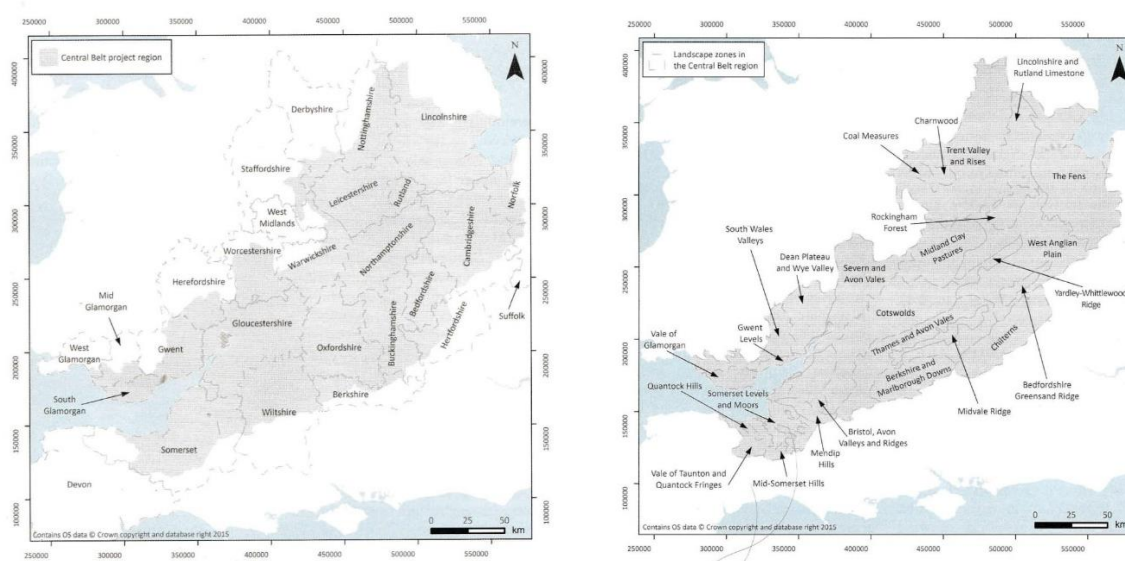
The importance of understanding the rural landscape of Roman Britain has been long discussed, particularly by Hingley in the late 80's. Hingley's work emphasised the necessity of incorporating the Roman rural settlements into studies that were dominated by that of military and villa site in order to effectively understand the socio-political intricacies of different communities in Roman-Britain (Hingley, 1989). He (and others) observed a distinction between what was considered 'native' and 'Roman' within the archaeological record in the 19th century and found that academics tended to focus on the elite and military Roman sites whilst neglecting 'native' ones (1989:2; Allen and Smith, 2016:17). He premised that this was due to the political context of the British empire's expansion and that the academics of the time could relate to the powers of the Roman empire. Regardless of whether this was the case, it was undeniable that sites with lesser socio-economic standing were historically neglected by archaeologists in favour of the wealthier villa and town sites. However, even the studies of these sites were limited to singular boundaries in many cases and in 1969 Webster stated that only 7 or 8 of the villas he excavated could answer the basic questions he wished to answer through excavation (Webster 1969 as cited by Hingley, 1989). Due to these limitations, it was necessary to expand excavations and by the 70's and 80's professional excavations became more large scale and began to incorporate techniques such as field surveying and arial photography to ensure broader study (Hingley, 1989:14:19).

However, despite the acknowledgement that it was necessary to broaden studies, there was still an emphasis on sites associated with wealth. This is demonstrated through the categories used to organise sites throughout the late 20th century which included:

- Villas and Villa Buildings
- Non-Villa or 'Native' Settlements
- Small Towns of the Province

While the vagueness of these definitions may reflect the neglect less wealthy sites faced, it should also be noted that there was and is not a standard consensus for classifying settlements and so this may simply be reflective of the difficulties of objectively identifying settlement types (Allen and Smith, 2016:17). Nevertheless, during this period, sites with an absence of buildings that showed a high surplus of wealth investment or implied an absence of materials and wealth were categorised as a non-villa settlement and largely neglected (Hingley, 1989:23). These were usually those settlements located in the rural countryside of the province, thus a large percentage of the population of Roman Britain was understudied in favour of the limited excavations of villas and towns. Hingley argued that this prevented academics from fully utilising the wealth of information the archaeology of this period presented and through using what he called the *historical method*, academics were pigeon-holing the province into a framework that had been constructed before more information had been made available. As a result, the unique nature of the province was not being realised and the only way to counter this was to apply further study to those areas that had previously been ignored: namely the rural settlements.

Hingley highlights the importance of studying Roman rural settlements as they are a key aspect of accurately reconstructing the social structure of communities in Roman Britain (19189:24). Fortunately, Hingley's work was continued by Taylor who focussed on the morphology of Roman rural settlements to draw distinctions between categories and further investigate the characteristics of specific sites (2007:19-21). This theme has been incorporated into modern big data studies such as the Roman Rural Settlement Project (RRS) which, in chapter two, cites the work by Hingley and continued by Taylor as a foundation on which the classifications for the project were formed (Allen and Smith, 2016:18). Beyond this, the RRS project specifically illustrates the importance of the Roman countryside by gathering data and grey literature on settlement sites from across Britain and using these to unlock knowledge on 'minor' sites and draw conclusions on settlement patterns. Of particular interest is the chapter discussing trends of the Central Belt and East which both encompass parts of Cambridgeshire where the A14 project is located (figures 2.2 and 2.3). Due to the wealth of information this monograph presents, this discussion will be limited to the Central Belt region in which most of Cambridgeshire resides.



Figures 2.2 and 2.3: The Central Belt region in relation to modern counties (From Smith, 2016:141) and landscape zones of the region (From Smith, 2016:142)

Within the Central Belt landscape zone, which makes up c.40% of all records for the entire project, there is a major concentration of these in Cambridgeshire and the surrounding areas (Smith, 2016:144). Most of these align with low-lying zones, similar to low-lying terrace of the Great Ouse this dissertation project is concerned with (Smith, 2016; LCA 2017). The Landscape zones used by the RRS project that overlap Cambridgeshire are The Fens and West Anglian Plain which both show a higher proportion of farmsteads to any other form of settlement and clear continuation of site occupation from the Iron Age through the conquest (figures 2.4 and 2.5; Smith, 2016). These are reflective of general trends within the Central Belt region and make clear the importance of understanding the countryside of the province, especially in light of the high proportion of rural settlements illustrated.

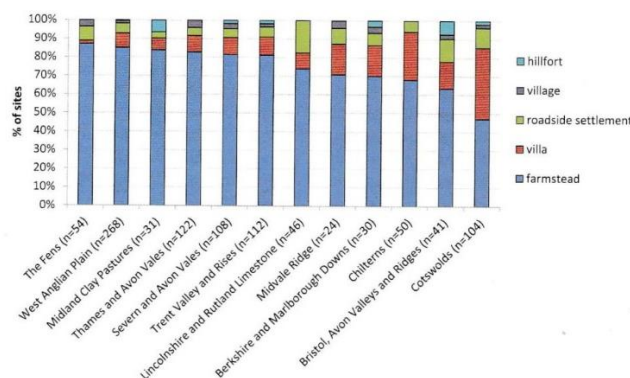


Figure 2.4: Relative frequency of main settlement types by landscape zone in the Central Belt (From Smith, 2016:147)

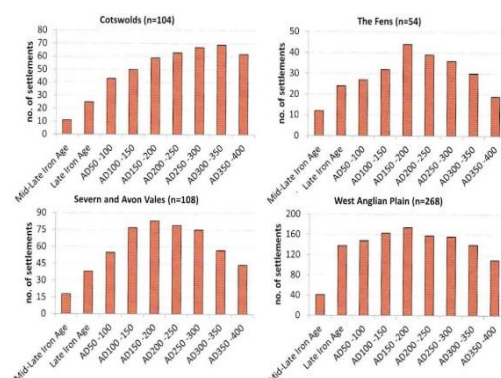


Figure 2.5: Variations in Settlement chronology by landscape zone in the Central Belt (From Smith, 2016:148)

Overall the Central Belt reinforces the ideas presented by Hingley in that a large proportion of 'Roman' communities were previously understudied due to their location within the rural areas of Britain and that these settlement types could be fundamental to understanding communities and how they may have changed during the transitional period. However, works like the RRS have presented the wealth of information these sites may offer, particularly through resources such as 'grey literature' that may otherwise not be accessible. The results of this project in particular can be compared to those of the A14 improvement scheme and specific sites- such as the settlements of the West of Ouse landscape block- may be discussed in the context of suggestions made by the RRS.

3. Methodology

3.1. Sampling the Assemblages

The assemblages used within this study came from the West of Ouse landscape block and incorporated pottery wares from TEAs 14, 15, and 16. These TEAs encompassed a long chronology of activity, including Bronze Age monuments, Iron Age activity, an extensive Roman settlement and agricultural activity, Saxon settlement activity, and Medieval and Post-Medieval activity. However, as the majority of pottery from these TEAs were dated to the Late Iron-Age and Roman periods, it was these wares that were selected and assessed for this study's sampling strategy critique. The relevant period codes used by MOLA for this study have been outlined in Table 3.1.

Period Code	Period Name	Dates
5.2	Middle-Late Iron Age	c. 350 BC – AD 70
5.3	Late Iron Age	c. 50 BC – AD 70
6.1	Late Iron Age – Early Roman	c. AD 43 – 70
6.2	Early Roman	c. AD 70 – 200
6.3	Mid-Roman	c. AD 150 – 300
6.4	Late Roman	c. AD 250 – 410
6.5	Late Roman – Early Saxon	c. AD 400 – 500

Table 3.1: TEA chronology information gathered from Sutton et al, 2019.

As previously discussed, *purposive* sampling was utilised within this project rather than a *random* sampling strategy which would commonly be used in a large-scale project to create an unbiased representation of an artefact population. However, due to the research aims of the West of Ouse landscape block, *purposive* sampling was used to generate representations of feature populations that were deemed essential to answering the research aims of the project rather than complete populations

The *purposive* sampling strategy was employed in two stages. Firstly, the aims of the landscape block's research design were considered to generate 'wish list' contexts which were essential to sample given their relevance to fulfilling these aims (Sutton, forthcoming; Hudak, forthcoming; MOLA Headland, forthcoming). Secondly, samples from these were retrieved using a 'bulk sample' method which considered the size of pottery groups (through a minimum weight threshold) and value associated with the context a group was produced from (through a minimum information value acceptance) (Sutton, forthcoming; Hudak, forthcoming; MOLA Headland,

forthcoming). Thus, to be accepted as part of the bulk sample, a pottery group must adhere to the following:

- Derive from a parent context which produced a minimum of 700g of pottery
- Derive from a feature which was, at the very least, assigned to both a Settlement and a Period during stratigraphic analysis.

However, this did result in some settlement periods being underrepresented, some of which were deemed important to the projects research aims and for the establishment of a chronological pattern. For these reasons, some settlement periods were included in the sample in their entirety (Sutton, forthcoming; Hudak, forthcoming). 136,374g, the equivalent of 65.5% of the Iron Age and Roman pottery was initially sampled through the criteria expressed above. Whilst exceeding the ideal 60% sample, this did include kiln pottery that had already been recorded. When this was excluded the sample size was reduced to 109,915g, or 52.8%, thus removing the problematic nature of the sample size which was now within the limits of the project resources (table 3.2).

Once 'wish list' contexts were sampled, the vessel assemblages associated with them were considered entire populations. In this sense, the samples from these contexts represented 100% of the populations of the features of interest rather than a percentage of the population of the TEA or landscape block. Rice (2015:267) argues that the purpose of sampling is to gain the most information possible from a sampled sherd and, through focussing on areas of interest, this strategy gathered the most valuable information for answering specific questions from a smaller sample size. In this way, it would be possible to achieve the primary goal of sampling in a method that required less material from excavations, thus reducing the demands placed on professional units.

	Sampled		Total Pottery		Weight.% sampled	Note
	Sherd Count	Weight (g)	Sherd Count	Weight (g)		
Settlement 0			1237	13766	0.00%	OMIT Settlement 0
Settlement 1	423	2879	423	2879	100.00%	
5.2-Middle-Late Iron Age	351	2186	351	2186	100.00%	100%. Small assemblage.
5.3-Late Iron Age	72	693	72	693	100.00%	100%. Small assemblage, possible chronological significance
5-Iron Age			0	0	0.00%	OMIT
Settlement 2	567	7720	567	7720	100.00%	
5.2-Middle-Late Iron Age	4	47	4	47	100.00%	100%. Small assemblage, possible chronological significance
5.3-Late Iron Age	563	7673	563	7673	100.00%	100%. Small assemblage.
Settlement 3	8446	97061	13246	144110	67.40%	
10-Modern			32	544	0.00%	OMIT
6.1-Late Iron Age-Roman	1313	7655	1313	7655	100.00%	100%. Small, significant assemblage.
6.2-Early Roman	2145	27044	4377	48212	56.10%	Accept autosample
6.3-Mid Roman	4649	57121	6879	80223	71.20%	Accept autosample
6.4-Late Roman	255	4819	499	6587	73.20%	Accept autosample
6.5-Late Roman-Early Saxon	84	422	85	428	98.60%	100% of Roman pot included
6-Roman			61	461	11.10%	OMIT
Settlement 4	1668	28226	2163	33368	84.70%	
6.1-Late Iron Age-Roman			21	130	26.20%	OMIT
6.2-Early Roman	289	3517	383	4415	79.70%	Accept autosample
6.3-Mid Roman	1199	21924	1438	24532	89.40%	Accept autosample
6.4-Late Roman	180	2785	196	2846	97.90%	Accept autosample
6-Roman			125	1445	1.20%	OMIT
Settlement 5	34	411	63	679	60.50%	OMIT Settlement 5
(blank)	33	77	2798	22571		
Grand Total	11171	136374	20497	225093	65.50%	

Table 3.2: Overview of sampled wares from each settlement

3.2. Pottery Assessment and Data Collection

Of the pottery recovered from TEAs 14, 15, and 16, c.99.44kg was not sampled, and was thus available for analysis and recording by myself while specialists A. Sutton and E. Hudak handled the remaining sampled wares. As three individuals with different academic backgrounds and levels of experience were analysing the wares separately, interobserver variation was a limitation that had to be considered and combatted throughout the analysis phase. This was achieved through consistent communication and a standardised approach to data recording.

Because of this, it was important to record the quantification of sherds in a standardised way. Not only did this combat subjectivity amongst three observers, but it would also allow data to remain sustainable and accessible to researchers in the future (Colley and Evans, 2018). To achieve this, MOLA's existing recording practice was implemented to ensure to the minimum standard of pottery analysis was met, and further investigation was undertaken when necessary (Marshall and Seeley, 2018). This required the assessment and recording of vessel form and fabric, condition, and quantification information (with a standard of weight, sherd count, and estimated vessel equivalents (EVEs)) to be imputed into the ORACLE database. The pottery recording form, shown below, was redesigned for the A14 improvement scheme in order to effectively cater for the needs of the project. This allowed data to be formatted in a way that was standard and facilitated later comparisons, thus resulting in the data becoming sustainable and appropriate for future use (Orton and Hughes, 2013:36).

Figure 3.1: Pottery by Vessel recording sheet from ORACLE

To do this, sherds were analysed as hand specimens, with the additional use of a microscope (10x magnification) when necessary, to identify fabrics and categories of sherds based on this information. Fabrics were determined through the use of a bespoke fabric series made for excavations on the A14C2H improvement scheme, with additional reference to the National Roman Fabric Reference Collection (Tomber and Dore 1998) when necessary.

Following the identification of fabric categories, sherds within these were assessed to see if it was possible to identify forms. Similarly to fabric analysis, this was done through a bespoke typology and form series for the A14C2H excavations, and reference was made to Thompson (1982), and Hill

and Braddock (2006). In addition to form and fabric, sherds were analysed for the following information:

- Sherd count
- Weight in grams
- Estimated Vessel Equivalent (EVE)
- Rim Diameter
- Decoration

Pottery quantification methods have been assessed in the past with mixed results, though generally it was agreed that weight was the most practical method, though not as accurate as EVE or sherd count (Orton and Hughes, 2013:22). Thus, it was important that a variety of quantification data be collected in this study as this allowed for a more accurate assessment of an assemblage. For example, sherd count and weight can provide assessments of the sheer quantity of pottery within an assemblage but in different ways that may be misleading individually. For instance, if faced with two assemblages where the first is comprised of a single amphora sherd weighing 100g, and the second is comprised of 20 greyware sherds weighing 15g, neither method would be able to produce an objective illustration of the makeup of the assemblage. Thus, when measuring quantifications through a single method, discrepancies in assemblage characteristics may not be clear and the accuracy of the study can be compromised. Furthermore, these methods of quantification are limited to providing information on project labour rather than site activities, meaning that sherd counts and weights can only illustrate how many sherds are excavated rather than the amount of pottery that was used by site inhabitants (Rice, 2015:260).

In addition, attempts to correlate sherd counts and weights to whole vessels have been problematic in the past (Orton, 1993:171) and so other methods to do so have been introduced to counter this. For this study, Estimated Vessel Equivalents (EVEs) have been used and were measured using a diameter chart (figure 3.2). This term is in reference to the idea that all sherds from the same vessel will be *equivalent* to a certain fraction of proportion of the complete vessel (Orton, 1993:173; Orton and Hughes, 2013:22). Thus, it was possible to measure rim sherds as vessel-equivalents (on a scale of 0-1). While this method was not applicable to all vessels, it did allow for a standardised approach to measuring size when rims were present which meant results could be directly compared. Moreover, as EVEs were calculated this way rather than on the basis of sherd quantities, the overrepresentation of finer walled vessels that would break into more sherds and underrepresentation of more robust vessels within the assemblage was prevented (Rice, 2015:261).

The data collected from these assemblages were recorded in the Oracle database which was utilised to generate data tables and visualisations. These allowed comparisons to be drawn between

the full and sampled datasets to identify if the sample was an accurate representation of the full. This made it possible to critique the sampling strategies and assess whether the proposed sampling approach successfully provided a more time- and cost- efficient method that could be employed by professional units.

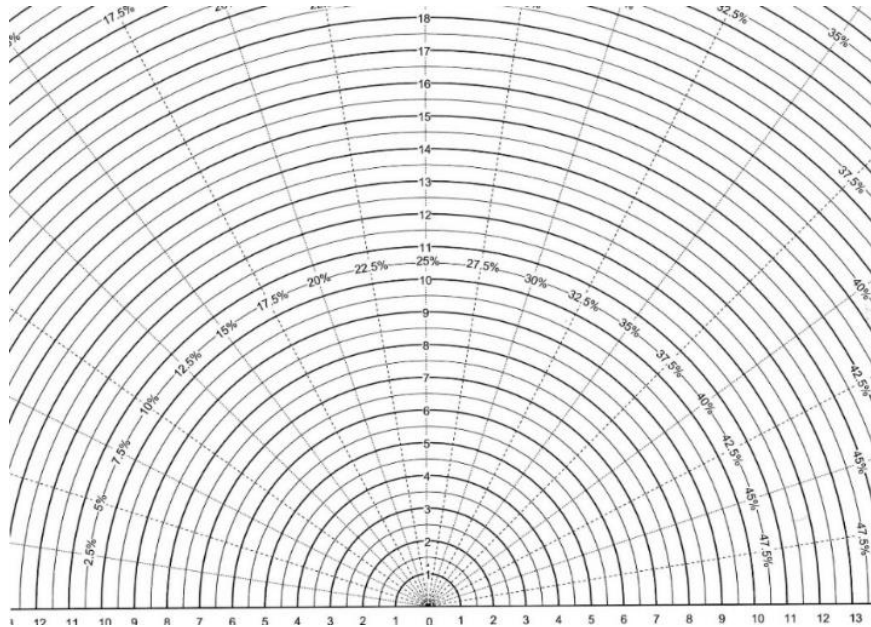


Figure 3.2: Chart used to measure rim diameters and calculate EVEs

3.3. Comparison of Sampled and Full Datasets

The sampled data was assessed and recorded in the method outlined above, but during this process it was deemed that pottery assemblages should be considered in terms of the settlement rather than the TEA which was what had been used previously. This allowed analysis to more accurately illustrate the ceramic culture of the occupation periods that spanned the landscape block. As settlements did extend beyond the boundaries of TEAs, it would be problematic to attempt to illustrate the nature of the broader settlement through isolated study of each TEA individually.

The West of Ouse landscape block hosted six settlements (0-5) and several ungrouped contexts, though only four of these settlements contained stratigraphic phases dateable to the Iron Age or Roman periods with those relevant for this project outlined below (table 3.3). For this reason, settlements 0 and 5 were omitted from the sampling process.

Period	Range	Settlement	TEA
5 - Iron Age	Early Iron Age	-	16
	Middle Iron Age	Settlement 1	14
	Middle – Late Iron Age	Settlement 2	15 and 16
6 - Roman	Late Iron Age – Early Roman	Settlement 3	14 and 15
	Early Roman	Settlement 3	14 and 15
	Mid-Roman	Settlement 3	14 and 15
	Late Roman	Settlement 3	15
	Late Iron Age – Early Roman	Settlement 4	16
	Middle – Late Roman	Settlement 4	16

Table 3.3: West of Ouse Settlement Chronologies and Location, data gathered from MOLA Headland, Forthcoming

In order to assess the effectiveness of the sample in terms of accurate representation, the initial reports of the sampled data (Sutton, forthcoming; Hudak, forthcoming) were used to determine five key inferences. These inferences then formed themed questions used to analyse the full dataset and determine whether the same conclusions could be drawn from the full and sampled datasets. The questions considered the representation of fabrics and industries, forms and fine wares, the chronology of the local industries, the spatial distribution of wares, and intrinsically interesting wares. As each question considered a unique aspect of pottery studies, multiple analytical techniques had to be employed. For example, direct comparisons were made between the quantities of wares found within each settlement, distributions were mapped, and statistical analysis was ran in the form of chi-squared goodness-of-fit-tests using methods outlined by Shennan (1997). The results of these analyses will be discussed in the next chapter, but all techniques used the data available on the MOLA SharePoint to ensure they used up-to-date data.

4. Results and Analysis

4.1. Analysis of Full Dataset

4.1.1. Preliminary Analysis

Before comparing the results of the sampled and non-sampled data sets, a preliminary comparison between that of the Roman wares was made in order to assess any major discrepancies or interobserver variation (Appendix 1). While the majority of results between the two were similar, there were some divergences.

Firstly, some discrepancies were simply errors made while imputing results into ORACLE. For example, 749g of glauconitic and sandy (quartz) fabric (GLSAM) fabric was recorded rather than sandy grog-tempered fabric (GRSAM) due to an error imputing fabric codes. Similarly, some sherds of Verulamium white wares were misidentified as Lower Nene Valley white wares (LNV WW) (Appendix 1). Additionally, as predicted, subjectivity seemed to be an issue within the early stages of this project. Interobserver variation was particularly prominent when discerning identifiers such as fabric type (coarse and fine wares) and 'bucket code' colours (such as buff, cream, and white wares) (Appendix 1). There were also discrepancies in the identification of specific fabrics. This included the differentiation between Horningsea oxidised wares (HOR OX) and Lower Ouse Valley oxidised wares (LOV OX) likely due to the similarities between the two, and the identification of Godmanchester white wares (GOD WH) owing to how recently the fabric was discovered and the resulting lack of publications covering its identification. The imputing errors were addressed through revisiting problem records, reassessing the materials within them, and maintaining communication with other specialists. The issues with subjectivity, however, could not be tackled as easily, and remained something that had to be considered as a factor that could potentially influence the composition of the datasets throughout later analytical processes.

4.1.2. Results of Amended Data

Having recognized these issues in the preliminary analysis, the data was reassessed and obvious issues such as the inclusion of GLSAM fabric were addressed. Any forms that raised concern, for example those that were assigned fabrics which did not often produce such forms, were acquired for additional assessment and in most cases were assigned new fabrics.

Discrepancies in subjective matters could not be addressed in the same way, as this would require the complete reassessment of both the full and sampled data alongside new criteria for 'problem' fabric types. Instead, subjectivity has been considered throughout the discussion of the results.

4.2. Comparison of Sampled Data to Full Dataset

4.2.1. Results

Following preliminary analysis, Sutton and Hudak produced a report on the sampled data which highlighted several key trends in the sampled data. Five of these have been used as comparison points for the full dataset in order to discern whether these trends are accurate illustrations of the full assemblage, or unique to the sampled data. Each question targeted a specific aspect of the way pottery and sampling theory has and is studied to allow for an in-depth analysis of the project's results. These shall be discussed below.

4.3. Fabrics and Industries: Is the prominence of a locally driven industry in Settlements 3 and 4 illustrated in both the full and sampled datasets?

To discuss this question, the fabric categories of Settlements 3 and 4 were assessed separately to determine whether the prominence of local fabrics and industries that was flagged in the sampled data was also illustrated in the full dataset. Local products included industries immediate to the area such as the Lower Ouse Valley (LOV) and Godmanchester (GOD) industries. While the Horningsea (HOR) industry is often considered local, it was considered a regional import for this study in order to keep focus on immediately local industries. Similarly, bucket code fabrics such as sandy wares which show no evidence to indicate being non-local, were not included as only definitely local wares were the focus. Data visualisations were used for a preliminary assessment of the illustrated trends, and statistical analysis in the form of a chi-squared goodness-of-fit test was used to investigate the significance of discrepancies in the datasets.

4.3.1. Settlement 3

Only a small quantity of continental imports were identified, Samian accounting for 2.4% of the full data and 3% of the sample, while Amphora accounted for 0.5% and 0.06% respectively. While regional imports were more common, they still only accounted for a small percentage of the overall assemblage in terms of weight. The most prominent of these were the Horningsea industry (7.56% and 11.63%) and Verulamium industry (6.33% and 7.88%) (see table 4.1). This illustrated the use and consumption of primarily local industries, and a preference for regional imports over continental imports.

	Settlement 3		Settlement 4	
	% By Weight (Full Dataset)	% By Weight (Sample)	% By Weight (Full Dataset)	% By Weight (Sample)
Continental Imports				
SAM	2.39%	2.92%	0.54%	0.53%
AMPH	0.53%	0.06%	N/A	N/A
Regional Imports				
HOR	7.80%	11.63%	12.26%	14.22%
LNV	3.07%	2.06%	3.81%	4.00%
VER WH	6.33%	7.88%	0.33%	0.38%
DOR BB 1	0.02%	0.04%	1.19%	1.39%
Main Local Industries				
LOV	18.76%	29.43%	51.35%	60.37%
GOD WH	1.14%	0.25%	0.21%	N/A

Table 4.1: Percentage of Continental and Regional Imports Assemblages from Settlements 3 and 4 by Weight (g)

In the full dataset, 41% could be attributed to identifiable industries and 18.76% of those were identified as LOV wares (figure 4.1). This was the most prominent of any industry within Settlement 3 and was also illustrated in the sample (accounting for 30%) (figure 4.2). While the percentage values of the full and sampled datasets were not perfect, the general trends of the industry distributions were very similar, and both indicated a predominantly locally driven assemblage.

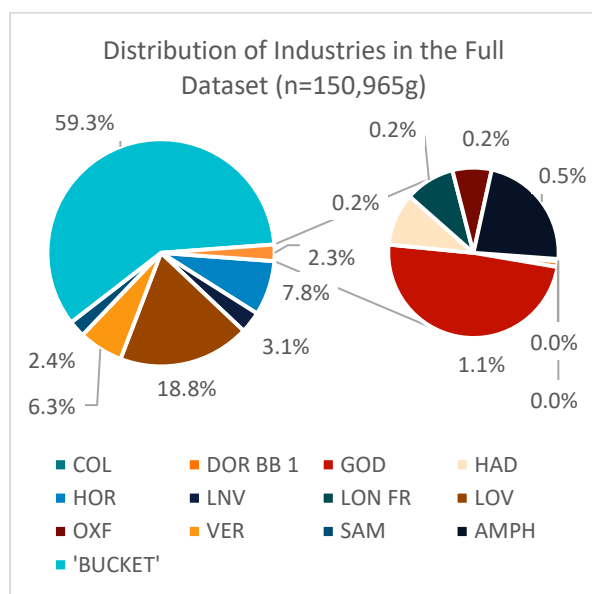


Figure 4.1: Chart illustrating the prominent fabric categories of the full dataset from Settlement 3

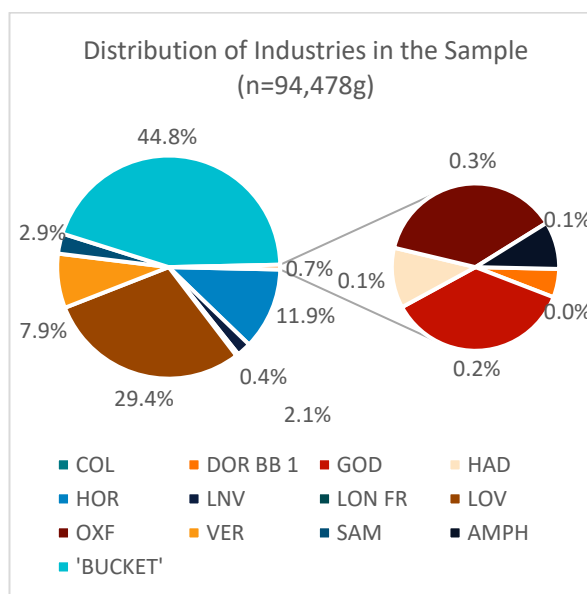


Figure 4.2: Chart illustrating the prominent fabric categories of the sampled data from Settlement 3

A goodness-of-fit chi-squared test (χ^2 test) was run to compare the observed sample distribution to a pre-specified theoretical population (the full dataset) in order to determine if there was any statistical significance to the distributions. Two tests were run, one measuring sherd counts and the other using weights, which could be compared to reduce bias in the results (Appendix 2). Both tests indicated statistically significant differences between the distribution of the sampled wares and those of the full data set (sherd counts: χ^2 (9, n=9,262) = 80.0, $p > 16.9$; sherd weights: χ^2 (9, n=94,478) = 755.5, $p > 16.9$). As the visualisations demonstrated very similar trends, it was unlikely that the discrepancies were as severe as the test results suggest and may have been the result of discrepancies in smaller fabric categories (Appendix 2). Though, the higher proportion of LOV fabrics identified in the sample were also a likely contributor.

Whilst not an industry, the datasets also demonstrated a high quantity of fine sandy greywares (FSGW) in the full dataset. This is a significant observation that may highlight the influence of interobserver variation on the results and the discrepancy in the percentages of LOV fabrics in the full

and sampled datasets. As FSGW is a bucket code (a term used to group fabrics with similar characteristics where an industry was not identifiable), it likely encompasses a number of fabrics and there is a high possibility that many LOV wares would have fallen into this code owing to how recently the industry had been discovered at the time of analysis. Thus, it is a distinct possibility that rather than risk misidentification, some LOV wares were categorised as FSGW and as a result, the prominence of this fabric code does not equate to a lack of LOV wares. LOV products were shown to dominate the entire assemblage, having accounted for c.19% of the full dataset and c.30% of the sampled data. The > 10% discrepancy here was of interest and may be accounted for by the inclusion of all kiln pottery in the sampled data which could have resulted in a sampling bias. Interobserver variation may also account for some of this discrepancy, but this shall be considered in the discussion section.

4.3.2. Settlement 4

Similar to Settlement 3, continental imports were not overly present in this assemblage with Samian accounting for 0.54% of the full data and 0.53% of the sampled, while Amphora were not identified at all (figures 4.3 and 4.4.). Regional imports were more present, though still only a fraction of the overall assemblage in terms of weight, with Horningsea being the only significant industry (12.26% and 14.22%) (table 4.1). As in the previous settlement, the percentage values of the sample were not a perfectly accurate match to those illustrated of the full dataset, but this was likely due to the aforementioned interobserver error. Additionally, these discrepancies did not affect the ways in which general trends were inferred from the dataset.

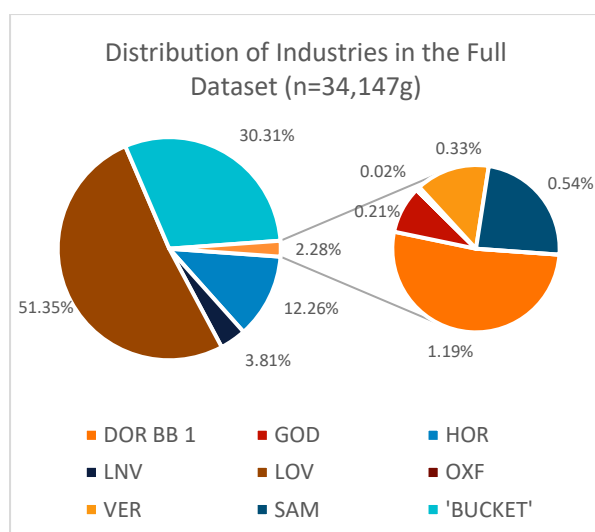


Figure 4.3: Chart illustrating the prominent fabric categories of the full dataset from Settlement 4

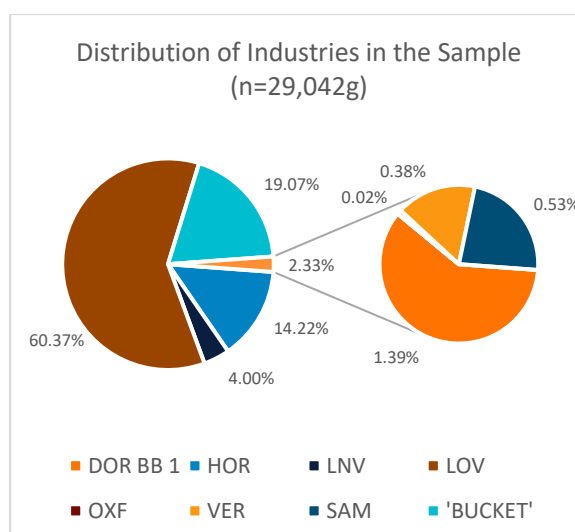


Figure 4.4: Chart illustrating the prominent fabric categories of the full dataset from Settlement 4

As with Settlement 3, two goodness-of-fit χ^2 tests were run to determine any statistically significant distributions of the datasets. Both tests indicated statistically significant differences between the distribution of the sampled wares and those of the full data set (sherd counts: χ^2 (7, $n=1,907$) = 54.2, $p > 14.067$; sherd weights: χ^2 (7, $n=29,042$) = 916.9, $p > 14.067$) (Appendix 5). This was in contrast to what the visualisations suggested and confirmed that issues were caused by smaller categories or minor differences in major categories (such as the misidentification LOV wares as FSGW for instance). Following this, the industries associated with the reduced wares were assessed. Both the full dataset and the sample illustrated the prominence of the Lower Ouse Valley industry which dominated the entire assemblage, making up over half of the full dataset with 51.35% and 60.37% of the sampled data. This discrepancy was also noted in the previous settlement and may be accounted for by interobserver variation. Additionally, there may have been an issue of sample bias as the majority of kiln features were included in the sample, meaning high quantities of LOV products would have continued into the sample whilst other fabric quantities would have reduced.

4.3.3. Discussion

The data visualisations depicting the prominent industries in Settlements 3 and 4 illustrated a clear preference for local products over regional or continental imports. Of the wide array of fabrics associated with both settlements, only a fraction were continental imports, and a small number were regional imports (table 4.1). The most prominent of these were the Horningsea industry which is relatively local to Cambridge, thus emphasising the prominence of industries local to the area. By fabric class, REDU wares were by far the majority by weight in the full and sampled datasets of Settlements 3 (41% and 42%) and 4 (52% and 52%) and within this classification, the Lower Ouse Valley industry dominated amongst all datasets. In this way, the prevalence of a locally driven industry has been demonstrated.

While Settlement 3 did show a higher percentage of FSGW than any other reduced ware in the sampled data, there remains a strong possibility that the degree of this prominence may have been accounted for by interobserver variation. The Lower Ouse Valley industry was a recent discovery at the time of writing and so classification could be difficult. Meanwhile FSGW was a 'bucket' code, and thus tended to be formed of sherds that could not be assigned to any one industry. Thus, it may have been that some LOV sherds were misidentified as FSGW due to hesitation in assigning wares to such a new industry and there was a likelihood that the discrepancy between the sampled and full datasets on this occasion may have been enhanced by the difference in experience and confidence between the observers of these assemblages. Regardless, these results only considered reduced wares, and when the oxidised fabrics of the Lower Ouse Valley industries were considered, there was

no doubt that LOV was the most prominent industry in both settlements discussed. This industry formed 18.76% and 29.43% of Settlement 3's full and sampled datasets, and 51.35% and 60.37% of Settlement 4's respectively. While there is a c.10% discrepancy between the full and sampled datasets from both Settlements, this may be due to interobserver variation which is supported by the higher percentage of FSGW in the full datasets than the sample, overall suggesting bucket codes have been preferred when analysing. Additionally, a sampling bias may have influenced these data as all kiln pottery was included in the sample, meaning the wares produced on site would be more prominent in the sample. Nevertheless, when considered alongside the minute quantities of continental and regional imports, it seemed that the sampled data had accurately illustrated the prominence of a locally driven industry.

Overall, despite the results of the statistical significance tests, both datasets do demonstrate a predominantly locally driven industry and the same conclusions can be drawn from both the sampled and full data. Additionally, due to the variability in fabric weights and fragmentation rates, it is not realistic to assume that any sample would necessarily fit into the narrow margins of the statistical analysis model. As the visualisations and large fabric categories were accurately representative, the discrepancies of the smaller fabrics can be attributed to small samples and varying preservation rates.

4.4. Forms and Vessel Classes: Do fine ware vessel forms and classes remain limited with the exception of the increase in S3, period 6.3?

For this assessment, both local and imported fine wares were considered such as Samian, Colour Coated vessels, and the fine reduced ware LON FR. This is a similar criterion to that used by Booth in his discussion of ceramics as indicators of site status (1991:5). Amphora and mortarium were not considered despite often representing imported wares (Booth, 1991) due to only accounting for 0.05% and 0.77% of the entire assemblage by weight. Because of this low quantity, it was believed that these wares would influence the analysis results in a way that was not truly representative of what the assemblage suggests. In addition, Lower Nene Valley colour-coated wares (LNV CC) have been considered as fine wares for this assessment. While it is true that LNV CC wares were no longer recognised as fine wares post AD300 (Booth, 1991), the high proportions of Beakers when compared to other wares in Settlement 3 and especially Settlement 4 are more indicative of fine wares than utilitarian wares (figure 4.2).

	Settlement 3, LNV CC				Settlement 4, LNV CC			
	Full Dataset		Sample		Full Dataset		Sample	
	EVE	count	EVE	count	EVE	count	EVE	count
Forms								
-	0	84	0	38	0	36	0	19
Beaker	1.29	13	0.87	8	0.6	15	0.27	4
Bowl	1.13	9	1.13	7	0.65	4	0.65	4
Flagon	0.81	3			1.8	6		
Jar	2.26	15	2.03	12	0.49	3	0.16	1
Lid	0.4	1	0.4	1				
Open Form	0.05	3	0	2				
Platter/Dish	0.96	10	0.68	6	0.88	5	0.2	2

Table 4.2: LNV CC forms from Settlements 3 and 4

4.4.1. Settlements 1 and 2

Neither Settlement 1 nor 2 were sampled and so cannot be used for this comparison, however the data from these has been considered to provide context to any significant changes in fine ware consumption in the later settlements. Iron age fabrics formed all of Settlement 1 and the majority of Settlement 2 (99% by weight) and no fine ware fabrics or forms were identified in either dataset. Within the limited Roman wares in Settlement 2 some white wares of possibly Gallo-Belgic origin were identified, though are not generally considered fine wares. Regarding forms, both settlements showed majority undiagnostic sherds, but those that could be identified were utilitarian wares (figure 4.5). Settlement 1 demonstrated a preference for jars and bowls while Settlement 2 demonstrated an increase in serving vessels, indicating a possible shift in food culture between the settlement periods (Hill, 2002:154).

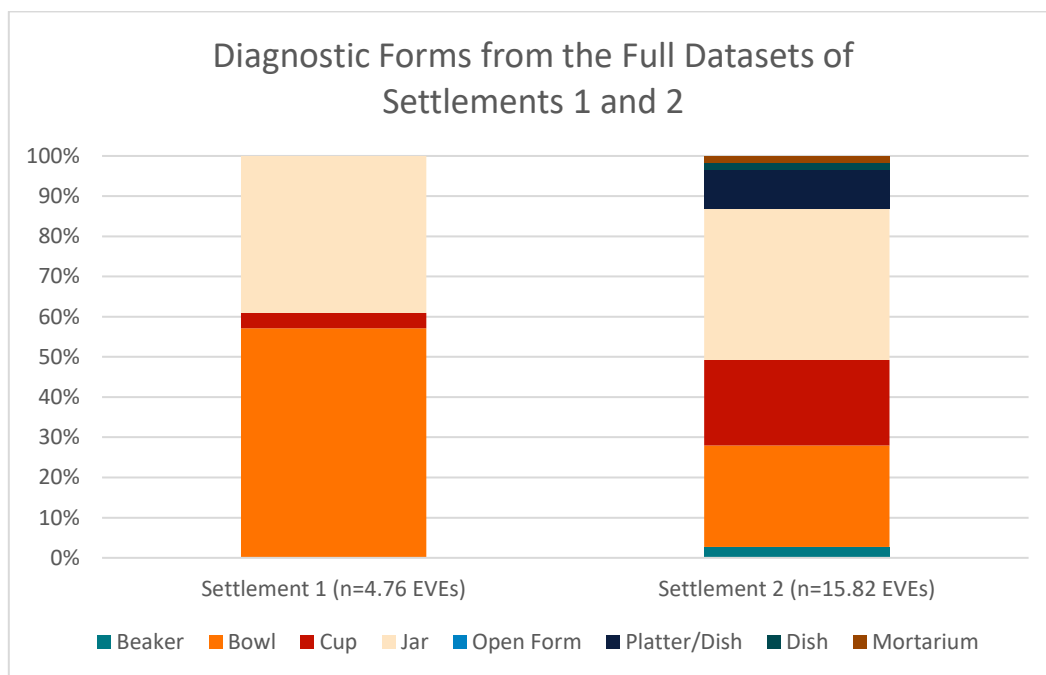


Figure 4.5: Chart illustrating forms from Settlements 1 and 2 by EVE

4.4.2. Settlements 3 and 4

A drastic increase in the identification of fine wares was noted in Settlement 3, particularly the introduction of colour coated wares (2.82% and 3.30% of the full and sampled data respectively), which were the most prominent fine ware within this settlement (table 4.3). However, this was still relatively limited as fine wares only account for 5.44% and 6.58% of the total assemblage for Settlement 3 (table 4.3). Fine wares were also identified in Settlement 4 but remained in small quantities. Colour-coated wares were the most prominent (table 4.4), though this could be attributed to no longer being recognised as fine wares in c.AD300 (Booth, 1991:1), as the settlement produced far less beakers and more bowls than Settlement 3. However, flagons did dramatically increase (figure 4.6). Fine reduced wares were not identified and Samian products appeared to have drastically reduced.

	Full Dataset				Sampled Data			
	Count (SUM and %)		Weight (g and %)		Count (SUM and %)		Weight (g and %)	
Fabrics								
CC	437	2.86%	4263	2.82%	278	3.00%	3115	3.30%
FNRD	40	0.26%	335	0.22%	40	0.43%	335	0.35%
SAM	223	1.46%	3608	2.39%	132	1.43%	2762	2.92%
Total	700	4.59%	8206	5.44%	450	4.86%	6212	6.58%

Table 4.3: Fine ware fabrics from Settlement 3

	Full Dataset				Sampled Data			
	Count (SUM and %)		Weight (g and %)		Count (SUM and %)		Weight (g and %)	
Fabrics								
CC	100	4.11%	1032	3.02%	68	3.57%	904	3.11%
SAM	25	1.03%	184	0.54%	17	0.89%	155	0.53%
Total	125	5.13%	1216	3.56%	85	4.46%	1059	3.65%

Table 4.4: Fine ware fabrics from Settlement 4

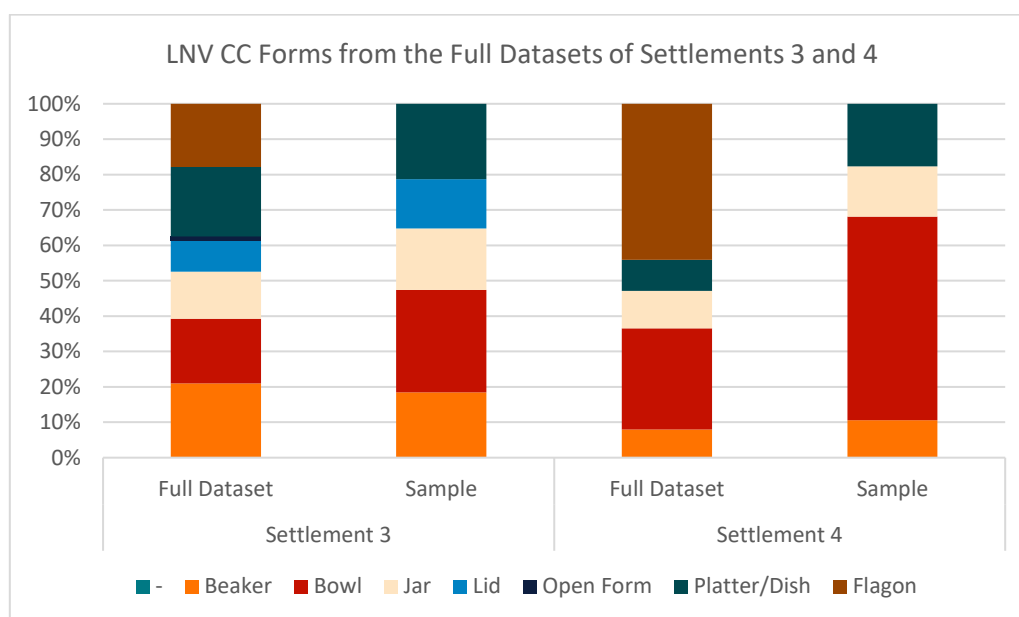


Figure 4.6: Chart illustrating LNV CC forms from Settlements 3 and 4 by EVE

The full assemblage (both coarse and fine wares considered together) forms differed from the previous settlements drastically, including the introduction of new forms such as flagons, lids, amphora, and specialist forms. Of the diagnostic forms, those that dominated were jars (64% of the full dataset and 68% of the sample for Settlement 3; 19.43% and 29.51% for Settlement 4). In order to interpret the form profile of the Settlements, a similar method was used to that of Evans (2001:26) to differentiate urban from rural assemblages. Evans found that higher proportions of jars than tableware forms were often seen in rural sites while the reverse was true for urban and rural sites. These observations supported a correlation between site type and pottery consumption which was used to discuss the limited fine wares associated with these settlements. The proportions of jars to tableware forms (bowls, dishes, and platters) from both Settlement 3 and Settlement 4 indicated similarities to utilitarian-driven rural assemblages which overall lack in fine wares (figure 4.7). This was true for both the full and sampled datasets, meaning that the organisation of wares could be interpreted in the same way when using this model.

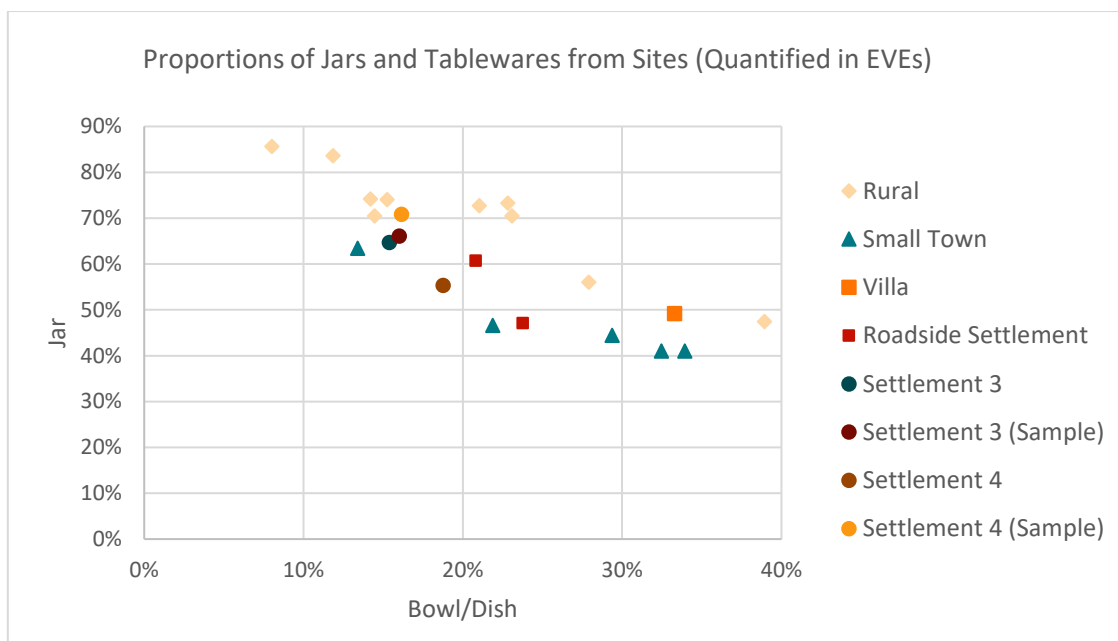


Figure 4.7: Graph illustrating the proportions of jars and tableware's in Settlements 3 and 4 when compared to data gathered from various sites from across the Central Belt region of Britain (namely Northamptonshire, Cambridgeshire, and Oxfordshire)

4.4.3. Discussion

A clear increase in the identification of fabrics considered fine wares was noted in both the full and sampled datasets of Settlement 3. This likely signifies the change in ceramic culture that occurred during the transitional period between the LIA and Roman periods in Settlement 2 which then continued into Settlements 3 and 4.

Significant changes in form were documented in both the full and sampled datasets. Settlement 1 demonstrated a limited range of utilitarian forms, while Settlement 2 showed the introduction of five new forms within the local repertoire and an increase in cups serving vessels (figure 4.5). While these wares were not considered fine wares, they may represent changes in ceramic dining culture, potentially the result of developing technologies and a desire to acquire non-local wares during this transitional period (Hill, 2002:155). Nevertheless, the lack of fine ware fabrics in (figure 4.8) identified in Settlements 1 and 2 would be accounted for by the lack of Roman contexts within these Settlements, and as a result, a lack of Roman fine ware fabrics.

The drastic increase in Settlement 3 identified in both the full and sampled datasets was indicative of the changing ceramic culture, and the continuation of the identification of these fine wares in the datasets of Settlement 4 supported this. While a decrease in fine ware fabrics in Settlement 4 was indicated by figure 4.8, this was possibly a signifier of the limited range of periods

associated with Settlement 4 (periods 6.2 and 6.3) when compared to Settlement 3 (periods 5.3, 6.1, 6.2, 6.3, and 6.4) rather than a decrease in the use of fine wares. This is also supported by the higher proportions of beakers compared to jars in Settlement 4 than in Settlement 3. Whilst fine ware consumption did decrease in prominence in the later centuries, the trends of this graph would not represent this as periods 6.2 and 6.3 encompass the early and mid-Roman periods, so the likeness to this trend should be considered coincidental. As the complexity of these trends could be identified in both the full and sampled datasets of Settlements 2, 3 and 4, the sample thus accurately illustrated the trends of the full dataset.

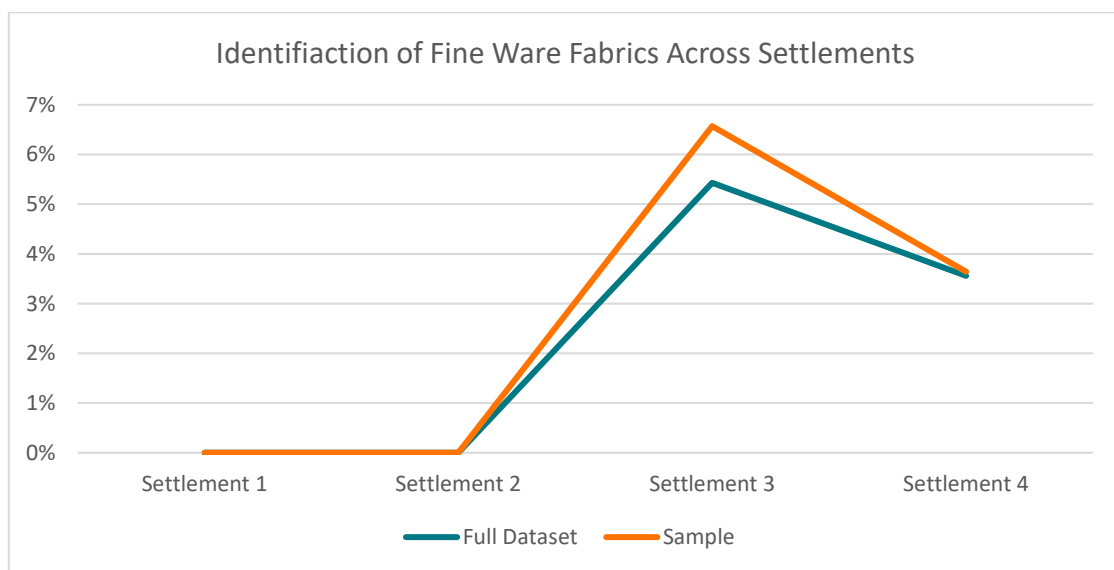


Figure 4.8: Graph illustrating the percentage of fine wares identified within the complete Settlement assemblages

4.5. Chronology and Local Industries: Is the decline of the local industry (particularly the LOV industry) by the end of period 6.3 demonstrated and the discrepancy in what replaces it in Settlements 3 and 4 shown?

The consumption of different industries was assessed through plotting assemblage makeup for settlements 3 and 4 across periods 6.1, 6.2, 6.3, and 6.4. This allowed a visualisation of consumption throughout the chronology of the landscape block and was done for both the full and sampled databases. The five most prominent fabrics from each settlement were included in the data visualisation and for clarity all others were included in an 'Other' category (figure 4.9).

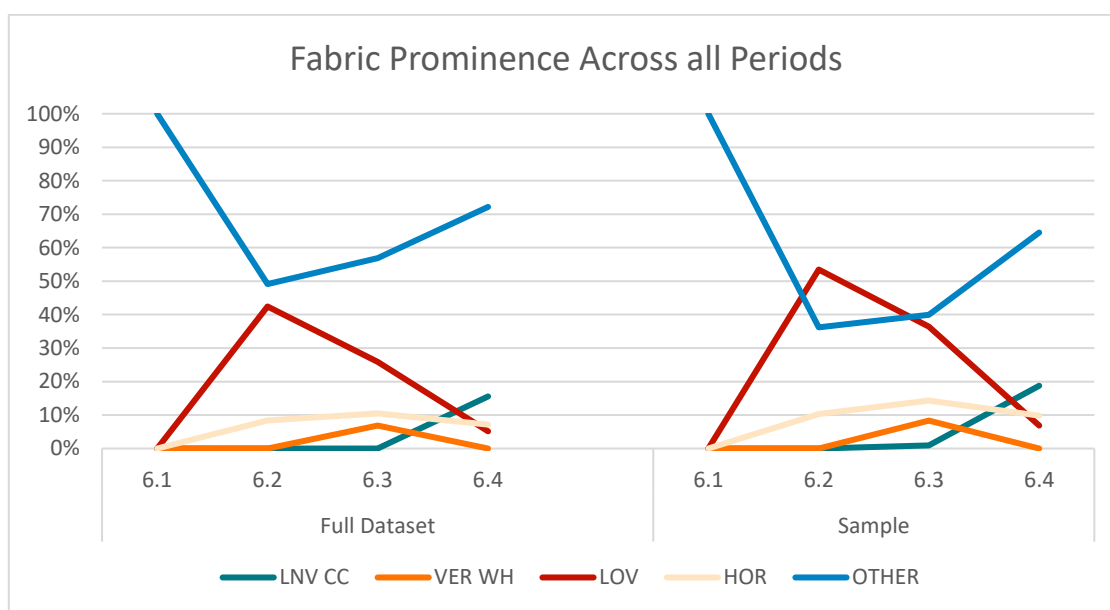


Figure 4.9: Chart illustrating the growth and decline in prominence of different fabrics across the full and sampled datasets

4.5.1. Periods 6.1 and 6.2

Only Settlement 3 had an occupation period that included Period 6.1, and this was the only settlement assessed. No fabrics of interest were identified as the assemblage consisted of entirely Iron Age wares and no regional or continental imports were identified in either the full or sampled data.

Both Settlements 3 and 4 had occupation periods that extended into Period 6.2, though Settlement 4 was omitted due to a minute assemblage size (933g). Local industries remained prominent in this period with LOV products being the most abundant named industry (42% of the full assemblage and 53% of the sample). Thus, the prominence of the local industry was demonstrated in both datasets (figure 4.9).

4.5.2. Period 6.3

In Settlement 3, the decline of the prominence of the LOV industry is illustrated, reducing to 15% of the full assemblage and 24% of the sample. The degree of reduction of more extreme in the case of the sample which could be due to no cases of LOV OX being identified, or an increase in sample size which may have resulted in a wider array of fabrics being identified.

The reverse is true for Settlement 4, where the prominence of LOV products dramatically increases to 56% of the full assemblage (previously being 0.54) and 60% of the sample (previously 16%). While regional imports can also be seen in this period for Settlement 4 (Horningsea products contributing to 13% and 14% of the assemblages), this is to a lesser extent than in Period 6.2. However, the sample sizes for Settlement 4 have radically increased so the distribution pattern may have been influenced by a larger sample, resulting in an increased array of wares, and a shift in distribution patterning.

Regardless, a general decrease of the local industries can be seen between periods 6.2 and 6.3 with no dramatic increase in any other industry, suggesting the changes to the LOV production were unique to this industry (figure 4.9). As this trend was recognised in both the full and sampled datasets it can be said that the sample has accurately illustrated the decline of the LOV industry in this period.

4.5.3. Period 6.4

Only Settlement 3 demonstrated an occupation period during Period 6.4. The LOV industry is far less prominent only accounting for 5% of the full assemblage and 7% of the sample (figure 4.9). The Lower Nene Valley colour-coat industry greatly increased in prominence (16% and 19%), though this was likely a result of change in fine ware status previously discussed. Furthermore, bucket code fabrics have increased in prominence, particularly ROB SH (35% and 38%), indicating that a local industry persisted, just not in the form of LOV.

4.5.4. Discussion

Overall, the decline of the LOV industry by the end of Period 6.3 has been demonstrated in Settlement 3, though not in Settlement 4. Settlement 3 illustrated this with the industry's prominence peaking in Period 6.2 and steadily decreasing beyond this point. Settlement 4 was only assessed during Period 6.3 due to the assemblage associated with Period 6.2 being too small for accurate analysis and the occupation period not spanning into Period 6.1 or 6.4. The prominence of the LOV industry in Settlement 4 may be a response to the decline in Settlement 3 and indicate a change in the industry's

production. However, as Settlement 4 was not occupied in Period 6.4, the decline of the industry as a whole by the end of Period 6.3 has been illustrated.

Other prominent fabrics included those of the Horningsea industry which followed similar trend, though peaking in Period 6.3 (9% and 14% of Settlement 3 and 13% and 14% of Settlement 4) and declining by Period 6.4 (7% and 10% in Settlement 3). This may indicate a general trend across the entire assemblage rather than a decline of local products. This is also supported by the fact that assemblage sizes do appear to decrease following period 6.3. While an increase in the LNV industry can be seen by period 6.4 this does not necessarily illustrate the replacement of the local industry with regional imports as other import fabrics (such as HOR and VER WH) also demonstrated a decline. Furthermore, while the decline of the named local industries is clear the local industry may have persisted through the bucket code fabrics that maintain prominence throughout all periods assessed.

Whilst the sample was not an absolute illustration of the trends of the full dataset in some cases (particularly Settlement 3 in period 6.2) the general prominence and later decline of the local industries was still translated. As a result, the same conclusions can be made from the full and sampled datasets.

4.6. Spatial Distribution: Do the results of the sampling strategy change the way in which we interpret the spatial distribution of fabrics?

To assess the spatial distribution of wares amongst settlements, feature types that produced pottery were identified and the quantities of materials they produced were compared to other feature types. This allowed for an assessment of distribution within settlements which could then be compared and contrasted to others that shared the same occupation period. Several settlements were omitted from this assessment, for example as both Settlements 1 and 2 were fully sampled there were no differences in spatial distribution to be assessed. In addition, while Settlement 4 did produce wares from occupation period 6.2, these were not of significant quantity (<950g) and thus was omitted from the period assessment. Visualisations of key features from each settlement and how much the wares they produced contributed to the overall assemblages were overlaid onto maps of the excavation areas to assess distribution. This assessment was only able to identify where materials were recovered from and thus deposited, though the context of these wares does allow for interpretations of settlement activity.

4.6.1. Period 6.2

Settlement 3 was the only settlement that produced wares in any significant quantity during this occupation period. Both the full and sampled datasets illustrate that the majority of wares were recovered from ditches (63.1% of the full and 56.5% of the sample) and kilns (16.3% and 29.4%) (figure 4.10). There was a c.7% discrepancy between the full and sampled data for both feature types and general discrepancies throughout, though this was likely due to the effects of minor differences amongst smaller fabric categories.

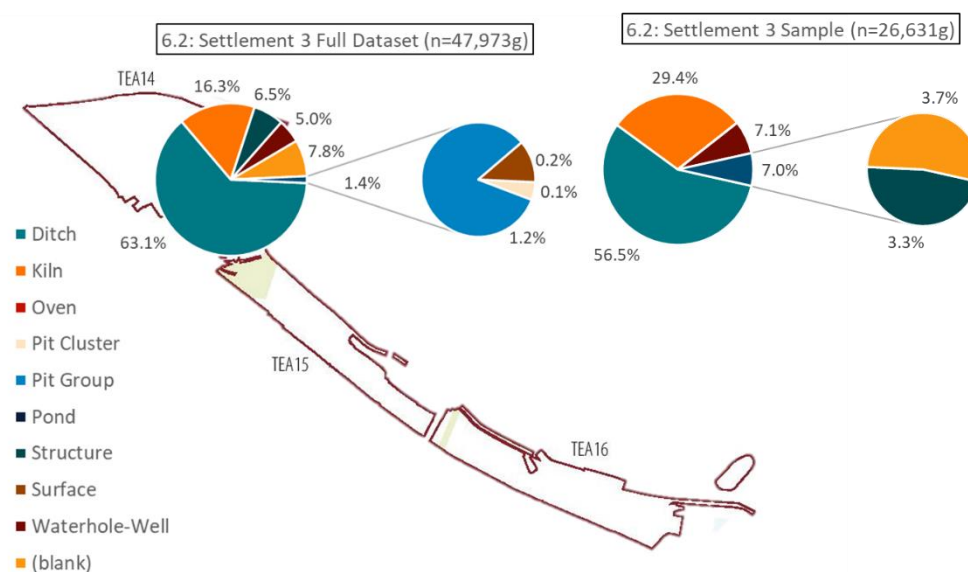


Figure 4.10: Map illustrating the distribution of fabrics across feature types in Period 6.2

4.6.2. Period 6.3

Both Settlement 3 and Settlement 4 had occupation periods that included period 6.3. Kiln features no longer produced the majority of fabrics in Settlement 3 (accounting for only 0.1% of both datasets), though, materials were increasingly recovered from pit groups, waterhole-wells, and contexts without features (figure 4.11). Settlement 4 showed that most wares came from kiln (63.6% and 69.3%) and ditch (19.2% and 13.4%) features. While there were discrepancies in percentage values this did not affect the ways in which spatial distribution was interpreted overall.

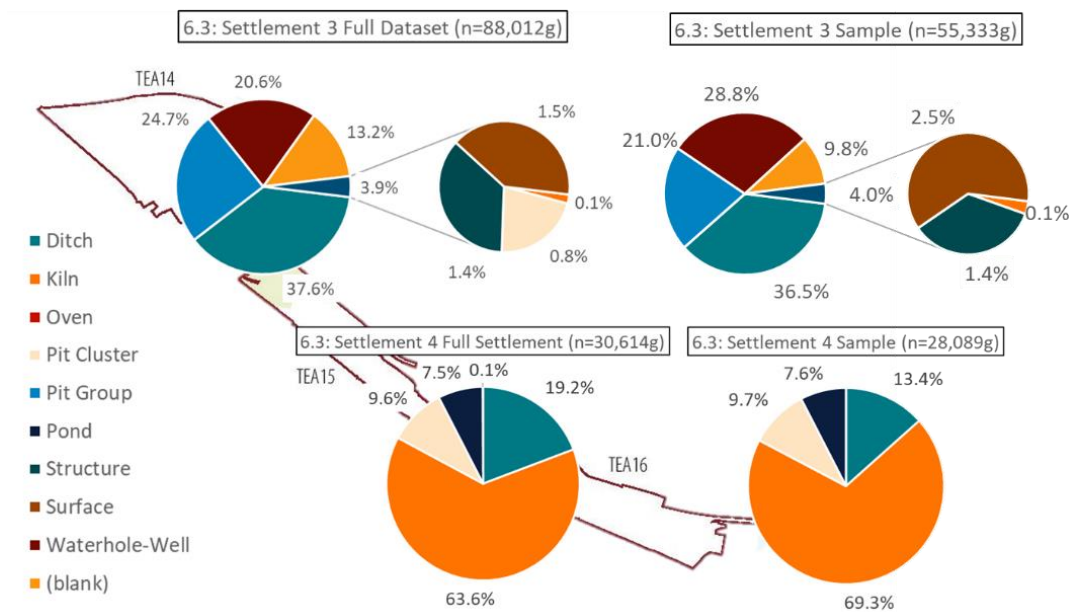


Figure 4.11: Map illustrating the distribution of fabrics across feature types in Period 6.3

4.6.3. Period 6.4

Only Settlement 3 had an occupation period that included Period 6.4. Ditches were the only named feature type to produce significant quantities of pottery and accounted for 57.3% of the full dataset and 56.7% of the sample (figure 4.12). This supports the interpretation that wares were no longer being manufactured during this period of the Settlement's occupation.

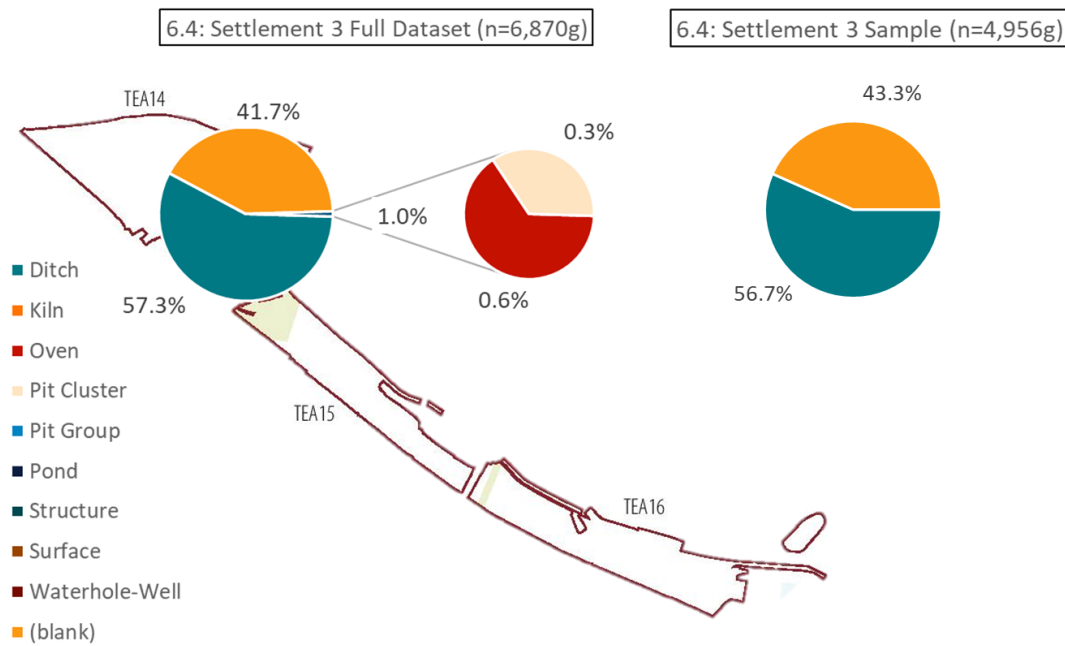


Figure 4.12: Map illustrating the distribution of fabrics across feature types in Period 6.4

4.6.4. Discussion

The results of the sampling strategy had minimal effect on the interpretations of spatial distribution gained from the full dataset. However, this may be due to the fact that key features were selected for the sample, and so those with a greater influence over how the sites were interpreted were more likely to be sampled and thus accurately depicted in the visualisations. For this reason, a recommendation for future study would be to assess each feature individually to determine the spatial distribution of wares more accurately rather than assessing all features of any one type as a collective. Unfortunately, due to the limitations of this dissertation this kind of assessment was not possible within the time frame.

4.7. Sampling Representativeness: Has the sampling strategy missed any forms or fabrics of intrinsic interest to the project that would result in a limitation of our understanding of the landscape block?

Here, a ware was considered of intrinsic interest if any component of the ware altered our understanding of pottery consumption or production within the wider area or could contribute to a wider corpus of wares. For example, whilst multiple base sherds with deliberate post-firing holes were identified in the non-sampled wares, they were not considered of intrinsic value as similar wares were included in the sample and did contribute to our understanding of pottery consumption beyond the fact that the repurposing of wares was visible.

The representativeness of the sample has been discussed through previous assessment and the results generally suggest it has been accurate enough that the same conclusions can be drawn from the full dataset and the sample. However, the sample has not always accurately illustrated the intricacies of the data, such as small fabric categories or minor discrepancies within larger ones. As intrinsically interesting forms are inherently rarer than others, the issues in representation of minor categories must be considered. This was best illustrated through a chi-squared test ran on materials from Settlement 4 discussed in section 4.3. The tests assessed the distribution of fabrics based on sherd weight, with one assessing those with a sum of weight <1,500g and the other assessing those >1,500g. It was found that the sampled smaller fabric categories (<1,500g) were distributed significantly differently to that of the full dataset (χ^2 (4, n=186) = 47.3, $p > 9.5$) (Appendix 6) whereas the larger categories were far more accurately illustrated (χ^2 (2, n=1721) = 0.8, $p < 5.991$) (Appendix 7). This trend was also seen in Settlement 3 where both tests indicated significantly different distributions, but the larger categories to a far less extent (Appendices 3 and 4). Thus, by not including the sherds discussed below, the sample has demonstrated limitations in the identification and illustration of minor categories and rarer forms.

4.7.1. Mortarium

Two sherds of a bead-and-flange type mortarium were recovered from a ditch in Settlement 3 (located in TEA 14) and the context indicated they were associated with Period 6.2 (figure 4.13). The fabric was a fine sandy oxidised ware, though the industry was not identified. One mortarium sherd was stamped [...TINV], interpreted as possibly being Matinus (figure 4.14). It is highly likely that this was the stamp of a new potter discovered in the area, thus meaning the sherds were of high informational value to the project and more generally. As a result, the consequences of this sampling strategy failing to include such wares could be major limitations to the understanding of the production and distribution of mortaria in the area.

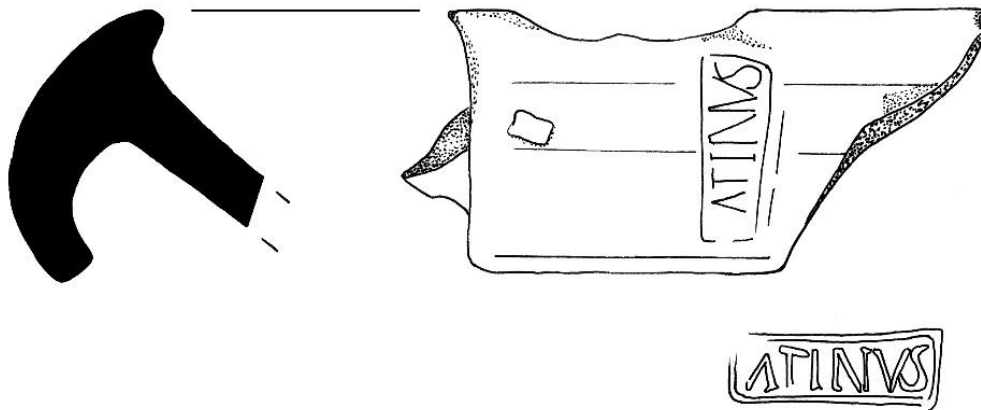


Figure 4.13: Stamped sherd of a mortarium from Settlement 3, Illustration by author

4.7.2. Triple Vase

Another sherd of intrinsic value came from the fill of a ditch in Settlement 3 (located in TEA 15) associated with Period 6.2. The sherd was a fragment of a hollow, circular tube, made in a sandy oxidised fabric. The form also had a flat base and two pre-firing holes in the top which did not penetrate the base (figure 4.15). Preservation was good, though significant lamination had occurred on the top. It was thought to be part of a triple vase.

As well as being of intrinsic interest on an individual level owing to the unique nature of the form, this sherd would be of interest to the project. One of the research aims associated with the early-Roman period (Period 6.2) was to undergo a detailed analysis of pottery, kiln furniture, and other associated tools to allow for an understanding of the Lower Ouse Valley industry's organisation. As the fabric of this form has been identified as FSOX (fine sandy oxidised ware) there is a possibility that it could be a product of the LOV industry. Whilst only a possibility, this would alter our understanding of the industry and its products, and thus the way it was organised. Thus, further fabric assessment of this sherd must be done in order to understand the implications it has on the organisation of the LOV industry.



Figure 4.14: Sherd of possible triple vase from Settlement 3

4.7.3. Amphora

Finally, the rim of a possibly Gauloise 4 type amphora was identified from a ditch feature in Settlement 3 (TEA 14). The sherd had a thick rounded rim and the remnants of two flat handles with grooves in the centre positioned either side of the neck, though only one of these handle bases remained intact and the other was only evidenced by a joining scar (figures 4.16 and 4.17). While the form of this amphora seemed to match the Gauloise 4 type, the fabric required further research to identify due to the blackened nature of the vessel walls, making the fabric difficult to identify with any certainty. Nevertheless, the vessel importantly acted as an indicator of continental trade and so would influence the way in which the site was interpreted regarding these.

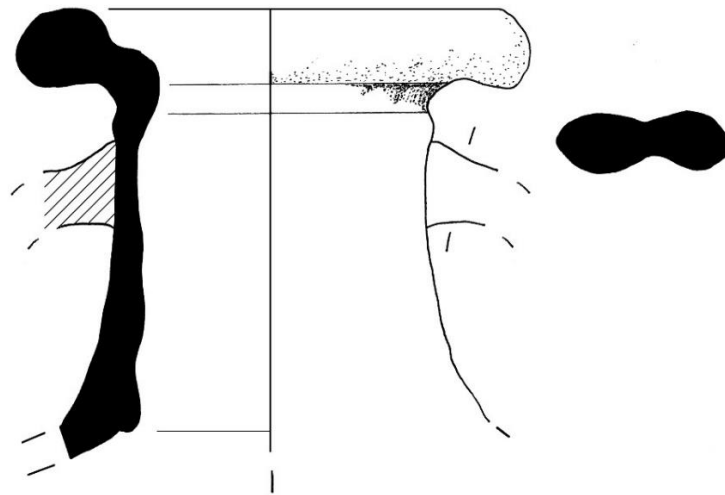


Figure 4.15: Rim sherd of possible Gauloise 4 type amphora from Settlement 3, illustration by author

These three forms were of intrinsic interest to the projects aims and the unique nature of the vessels contributed to the ways in which the pottery industry of the landscape block and wider area would have been understood. Thus, by not including these wares, the sample would have limited our understanding of pottery within the area. Particularly, had the sample consistently failed to include mortarium sherds displaying the stamp of a new potter (as this sherd demonstrates is a possibility) our understanding of the production of these wares would continue to be less than what available evidence allows and thus the sample would greatly hinder projects such as a regional or national corpus of stamps.

However, they did not directly limit the understanding of organisation, continuation of occupations, or other Roman period specific research aims of the project. In addition, whilst these vessels were certainly unique, they were also the only intrinsically interesting vessels missed by the sampling strategy. Generally, the sample was successful in identifying all key vessels which allowed for similar conclusions about the landscape block to be drawn by the full and sampled datasets. As a result, while the significance of these wares must be acknowledged, it cannot be said that through missing them the sample has been limited to such an extent that the broader trends of the landscape block cannot be understood in the same way as the full dataset allows.

4.8. Conclusion

Overall, the sampling strategy employed was effective in representing the overall trends of the full dataset but was not an entirely accurate representation. This was particularly well illustrated in section 4.3 where the distribution of local industries was illustrated despite a c.10% discrepancy in quantities of LOV wares identified between the full and sampled datasets (figures 4.1 and 4.2, and 4.3 and 4.4). The main issues seemed to occur with smaller fabric categories such as fine wares which were more susceptible to statistical variation, possibly as the full dataset demonstrated such small quantities that minor discrepancies between the two datasets appeared more prominent and thus resulted in statistically significant variations. In addition, some key discrepancies in the data were caused by variations of bucket codes. For example, high quantities of FSGW were identified in the full dataset of Settlement 3 but not the sample, and though not discussed due to irrelevancy to the question, section 4.5 also demonstrated more coarse variations of bucket code fabrics in the full datasets of Periods 6.1 and 6.2 (i.e., CSOX, SAC, CSGW) than the sample which demonstrated fine variations (i.e., FSOX, SAF, FSGW). For this reason, it was likely that the sample was influenced by interobserver variation throughout analysis, as these differentiations are often due to subjectivity and the personal opinion of the observer.

In other respects, the strategy's effectiveness can be queried due to the fact that several sherds of intrinsic interest were missed by the sample. While not analysing these did not hinder the ways in which the landscape blocks were interpreted too severely, the consequences to not including them in the study would be limiting the ways in which the production and distribution of LOV forms, mortarium, and amphorae may be understood across the broader landscape.

5. Discussion

5.1. The Reflectiveness of the Sample

The results of these analyses demonstrated that the sample was broadly representative of the full dataset and was more accurate in its representation of larger categories within the datasets. Sections 4.3, 4.5, and 4.6 each demonstrated that the sample accurately reflected the major components of assemblages, often within a 5% margin. Thus, the sample allowed for the same conclusions to be drawn regarding the organisation, distribution and eventual decline of the local pottery industry, and the limited quantities of fine wares and continental imports as the full dataset did.

Having said this, the intricacies of assemblages were not as accurately represented. While the same broad trends could be seen in the sample, there were often discrepancies in the smaller fabric categories which effected how the distribution of these wares was interpreted. This was particularly well illustrated in section 4.3 where, despite great accuracy in its reflection of a locally driven industry, statistical analysis deemed the sample as illustrating a significantly different distribution of data to the full dataset. This was due to discrepancies in smaller fabric cases such as OXID, BB, and FNRD wares in Settlement 3, and CC, AMPH, FNRD, SAM in Settlement 4. As the quantifiable contribution of these wares to the full dataset was so small, the discrepancies were not immediately apparent in the data visualisations produced and were only flagged by statistical analysis. However, whilst the discrepancies in the distributions of these wares was statistically significant, they did not have any major impact on the ways in which the data as a whole was interpreted. Though, the discrepancies of these smaller fabric categories could have an influence over how investigations specific to these categories are answered, for example, identifying the primary sources of fine wares within the assemblage. This wasn't a major issue in the analysis of this assemblage, as in section 4.4.2 it is clearly illustrated that the majority of fine wares come from the Lower Nene Valley industry, followed by Samian products, and finally London fine wares, the proportions of which were visible in both the full and sampled datasets (tables 4.3 and 4.4). Though, the proportions of vessel forms in this same section did differ between the sample and full dataset (figure 4.6), meaning that there is potential for this issue to throw off the data and skew how it is interpreted. In this way, the sample would not accurately illustrate trends seen in the full dataset regarding the exchange of pottery and the representation of the more minor fabrics and forms and affect the way that the area is understood. Thus, it has been illustrated that this limitation of the strategy, whilst not being a major issue in this particular study, has the potential to cause major issues if not addressed.

Nevertheless, the real significance of these discrepancies must be questioned- if data discrepancies in the sample did not impact the way in which data was interpreted enough to affect our understanding of the 'life assemblage', can they be considered significant enough reason to call the sample ineffective? In addition, as the data missed by the sample (in this example) has not improved our understanding of the life assemblage, can the full dataset be considered a more valuable unit of measurement than the sample, which has allowed for the same understanding?

5.2. Interobserver Variation

While this question may be difficult to answer in a concrete manner, it is important to discuss the limitations of the sample and how these might be addressed before the validity of the sampling strategy is determined. Firstly, as aforementioned, the sample demonstrated a number of discrepancies in smaller fabric cases. However, these fabrics were predominantly bucket codes and often included variations of very similar fabrics (such as fine sandy oxidised wares, FSOX, or coarse sandy oxidised wares, CSOX). Whilst it is possible that a slight differentiation in the local industry (between fine and coarse products) or a sampling bias (owing to the sample being weighted towards kiln groups) was being observed, it is more likely that interobserver variation was influencing the results of the study. This is due to the fact that differentiating between fine and coarse variations of a fabric is subjective and relies largely on an individual's past experience with materials and personal opinions (Whittaker et al., 1998:143). This is a very similar concept to that discussed by Rice regarding the colour of sherds (2015:276). Thus, in a situation like this where multiple specialists with a range of experiences and expertise were working on the same materials, it is likely that subjectivity and this interobserver variation will affect how the assemblage is interpreted. This form of interobserver variation is what Daniels identifies as bias in his 1972 study (as cited by Whittaker et al., 1998:135) and is countered by 'quality control', namely the reproduction of results and agreement of these by different observers. While it was not within the parameters of this study to reproduce the initial fabric assessments, quality control was attempted through constant communication and cross-comparison. Nevertheless, due to the nature of having three observers with a vast range of experiences, bias was not something that could be avoided during this study. This was only emphasised by the fact that I myself am new to the field of pottery study, whilst Sutton and Hudak each have 10 years of experience. Though, it can be argued that no matter how many years of experience two specialists may have, they are very likely to view assemblages and individual sherds differently, as is the nature of such a subjective subject. Thus, as different specialists were working with the sampled and non-sampled wares, it is more probable that interobserver variation has resulted in what appears to be

discrepancies in quantities of these kinds of fabrics. Particularly, the issues of subjectivity could also account for divergences in the quantities of LOV industry wares being identified. As the fabric is a recent discovery it can be difficult to confidently identify, and the degrees of confidence would vary between specialists. Thus, some discrepancies between the sample and full dataset cannot be exclusively attributed to the method employed, rather they are likely the result of the nature of these studies where multiple specialists collaborate on one assemblage. Indeed, it is possible that subjectivity and interobserver variation are more at fault for the results of the statistical significance tests ran throughout the assessment of the sampling strategy, though it is not possible to judge this conclusively.

5.3. The Nature of the Sample

It is also important to consider the nature of the sample when discussing its representativeness and validity. As the sample was drawn from features of importance to answering the research aims of the project, the sample was naturally more accurate in its reflection of the distribution of these features. This was demonstrated through section 4.6 which illustrated that most wares discussed were included in the sample and so were naturally well reflected. However, this also presented some potential issues in representation. For example, in section 4.3 a c.10% discrepancy was identified between the LOV wares of the full and sampled datasets discussed. While this may have been the result of interobserver variation as discussed above, another contributing factor may have been that all kiln features were included in the sample. Due to the importance of the LOV industry to the research aim, it was important to include any production sites of these wares. However, this would result in a sample bias meaning that an increased proportion of LOV wares would be included in the sample when compared to any other ware, possibly resulting in this 10% discrepancy. While this sample bias was evident in section 4.6 and 4.3 to a lesser extent, it did not have any major influence over the interpretation of the dataset as a whole whilst being an important aspect of the strategy for the aims of the research.

Furthermore, it should be noted that similar selective factors would also affect the interpretation of 'non-sampled' assemblages, and that this issue is not unique to this study. This is due to fieldworkers being selective in their decisions to excavate features on most sites rather than randomly or totally excavating a site. Thus, the selectivity of the purposive method can often already be a factor in excavations and needs to be considered when specialists report on any assemblage. As a result, both specialists and fieldworkers must be explicit in their decisions that could affect the composition of an artefact assemblage, especially when sampling methods are being employed.

5.4. *Wares of Intrinsic Interest*

Several wares of intrinsic interest were not included in the sample, all three of which had great potential to alter the ways in which the pottery industry of the area was interpreted. For example, evidence of a new potter through the presence of a mortarium stamp would be greatly beneficial to any corpus of stamps in Britain and the exclusion of which could hinder future study. Although it could not be confirmed that this stamp belonged to a new potter due to the time limitations of this study, it is a high possibility according to the specialists conferred with. As a result, the production, consumption, and distribution of mortaria in this landscape block and the broader area may be better understood with further study, though this would not be possible had the pottery of this landscape block been assessed solely on the basis of the sample.

Similarly, the presence of a potential triple vase sherd influenced the discussion of the types of forms produced by these sites, especially if the sherd is part of the LOV industry which is a strong possibility. Again, it was not possible to confirm the fabric of this sherd due to time limitations, though an initial assessment of the sherd as a hand specimen showed the fabric shared similarities with the characteristics of the LOV OX fabric. Additionally, this ware was intrinsically interesting owing to the uniqueness of the form. Triple vases come in two main varieties, those with vessels standing upon individual bases and those with vessels standing upon a common base (Kaye, 1914:175), the ware in question belonging to the latter group. Regardless, both variations are uncommon and this find is particularly interesting amongst the otherwise utilitarian wares of the assemblages. Some other specialist wares were identified such as cheese presses, though as these were present in both the full and sampled wares a single triple vase sherd was a more intrinsically interesting piece. Therefore, even if this ware is not part of the LOV industry, it would still alter the ways in which pottery consumption within the landscape block was interpreted through the nature of the vessel, and should the fabric be identified as LOV the organisation of this particular industry would be better understood as a whole.

And finally, while the presence of a Gaulish amphora would not necessarily impact the interpretation that the pottery industry of this site was predominantly locally driven, it would contribute to the broader understanding of continental imports in the landscape block. Generally speaking, imports have been limited throughout the occupational periods assessed and so the introduction of any additional wares that would support the presence of imports would be considered important. However, the sample did pick up some amphora and other imports, and so the singular sherd that was missed did not improve the overall understanding of the assemblages beyond the fact

that continental trade did occur. Thus, while of intrinsic interest, the actual information value of these wares must be considered when discussing the degree to which the sample has failed in this area.

Furthermore, when considering the importance of these wares to the interpretation of the landscape block it must be remembered that owing to the time limitations faced, some of these interpretations are hypothetical. Thus, it is not definitively possible to say how harmful the exclusion of these wares from the sample has been. Additionally, the theoretical issues of sampling must also be considered as it is not possible to say that other wares of this nature have not been missed by the excavation processes. Because of this, it must also be queried how fair it is to critique the sample on this basis. These theoretical issues shall be discussed further in the next section. Nevertheless, we know these intrinsically interesting wares are important and were missed, so in this way the sample hasn't been accurate in its reflection of the full dataset and further consideration must go into how to prevent this.

5.5. Theoretical Issues

By comparing the results of the sample to those of the full dataset the accuracy of the sample in regard to representation has been assessed. There have been attempts to definitively say “yes, this method has been accurate representation of broader trends” or “no, this method has failed and not represented the full dataset in a concise and accurate way”. However, as demonstrated through various tests, that is not a simple question to answer owing to what is considered accurate representation and when it is considered important to do so. One of the primary issues with arguing representativeness was that the sample very rarely demonstrated absolutely accurate reflections of the full data when results were visualised, despite accurately translating the trends of the assemblage. For example, in Section 4.3.1, the predominance of a locally driven industry was clearly illustrated by the sample, and accurate in its findings of which industries dominated the assemblage, though the percentage values of these did not align and in several areas the proportions of (smaller) fabric categories to one another were not represented accurately. So, what does this say about the effectiveness of the sample- has it worked? Again, it is not so clear cut that a simple yes or no answer would suffice. While it is true to the proportions of the smaller fabric categories were not accurately reflected when compared to one another, they were accurately reflected in the sense that they were minute portions of the wider assemblage. Furthermore, we must question how important the accuracy of these categories was. In the greater picture, does it matter that Amphora formed 0.5% of the full assemblage and only 0.1% of the sample when both would be reported at >1% and thus provide the same implications to anyone reading the site report?

This raises the further issue of how harshly it is possible to critique representativeness when, as archaeologists, we cannot be sure of what the sample is meant to be representing in the first place. This study has compared the sampled data to that of the full dataset, but when the full dataset is not a complete population and a sample in of itself (Orton, 2000:40), how can we be sure it is an accurate unit of measurement to compare a further sample to? This is an inherent issue with pottery studies. Owing to the natural processes that transform a life assemblage to a death assemblage and eventually an archaeological assemblage, very few vessels will reach the final stage complete and not all vessels will be identified during excavational processes (Tyers, 1996:24). Thus, the full dataset is not synonymous with a complete population and so the accuracy of the sample to the full dataset does not equate accuracy of reflection of the original life assemblage. This is not to say that it does not matter how the sample presents the data as, as previously discussed, the prime requirement of any sample is to provide an accurate representation of the wider population (Orton, 2000:20; Neyman, 1934:560; Rice, 2015:267). However, as it is impossible to determine whether the full dataset is representative of the wider population, the degree to which the sample must be an *accurate* representation of the full dataset is not absolute. Thus, while it is important the sample is accurate, or at least to a certain extent, it is not necessary to fixate on minor discrepancies when the general trends are indeed reflected as to do so is to suggest the full dataset is a pure representation of a life assemblage we have no way of knowing.

6. Conclusion

6.1. Conclusions of the study

The experimental sampling strategy proposed has been effective in the respect of accurately illustrating the general trends of the full dataset of wares produced by the West of Ouse Landscape block on the A14 Cambridge to Huntingdon Improvement Scheme. Through analysing the results of the sampled dataset several key trends were identified. The results of the full dataset were then assessed to determine whether these same trends were present. This was done primarily through the comparison of data visualisations and statistical significance tests which illustrated similar results across both datasets. The initial predominance and eventual decline of a locally driven industry, a limited quantity of fine wares, and spatial distribution of fabric classes were all illustrated through both datasets, meaning that the strategy was accurate in this regard.

While the sample was not absolutely accurate, especially in regard to fabric categories occurring in smaller quantities, these did not influence the results of the data analysis significantly and did not change the way in which the landscape block was interpreted. This was despite the effects of interobserver variation which undoubtedly impacted the study's results, perhaps more so than the strategy itself, though further study is required to confirm this. However, it should be noted that these discrepancies do have the potential to create greater issues in the interpretation of assemblages, specifically in regard to these smaller ware categories. While this wasn't particularly illustrated as a major concern in this study, some minor issues were raised in the discussion of fine ware forms that could translate to the misrepresentation of wares. Therefore, this limitation must be considered should further study commence. Nevertheless, as these discrepancies were not major in their impact of how the assemblages were interpreted, as well as theoretical issues surrounding the degree to which a sample must perfectly represent the full archaeological assemblage, the strategy cannot be considered a failure in these criteria. Furthermore, the accidental exclusion of wares of intrinsic interest from the sample would indeed limit the interpretation of the landscape block, though further investigation is again needed to determine to what extent. Recommendations for the prevention of this have been included below in order to ensure the strategy is as effective as possible.

As the major limitations of this approach require further study to combat, it is not possible at this time to recommend the strategy be employed by professional units. Having said this, the strategy has demonstrated success in the illustration of broad trends and allowed the sampled dataset to be as accurate to the full as possible, meaning the same conclusions regarding site occupation and the local pottery industry could be inferred by both. Therefore, the assessment of this strategy has

provided the foundations for a successful sampling technique to developed through further study which would certainly reduce the time and resources spent working on these wares.

6.2. Recommendations for Future Work

In the current phase of study, this sampling technique remains solely appropriate for large-scale projects such as infrastructure improvement. This is owing to bias of representativeness to larger ware categories, meaning that should the sample size decrease there is a possibility the accuracy of the sample as a whole would decrease. Though, this was disclaimed prior to the techniques assessment of accuracy and so one could argue the sample has been successful within its design criteria. It would be appropriate for further study to include comparisons of this technique with different sample sizes to determine whether accuracy decreases as sample size does, though this was not within the parameters of this study.

In addition, interobserver variation was clearly a factor in the discrepancies of representation of certain of wares between the full and sampled datasets. This was to such an extent in certain tests (see section 4.3 in particular) that in order to fully assess how accurately the sample illustrates the patterns of the full dataset, it is recommended that the study be repeated by one specialist. While multiple specialists may work on the same project should the sampling strategy be used in the professional sector, the discrepancy of experience between myself, and Sutton and Hudak is not something that would likely be an issue in most circumstances. Therefore, it is necessary to assess the factor of interobserver variation and its influence over the results of this study, before it can be recommended for use in the professional sphere.

One of the major pitfalls of this method was the accidental exclusion of intrinsically interesting sherds from the sample. As the sherds discussed here came from contexts producing minimal assemblage, it is likely they were not included in the sample due to not meeting the minimum sampling criteria (these have been outlined in the methodology chapter) rather than being deemed unimportant during an initial assessment. One way to counter this exclusion would be for sherds of high informational value to be flagged during the initial assessment of the assemblage before the sample is conducted. Through doing so it would be possible to ensure these wares were accounted for and included in the sample without necessarily retaining the entire context they were identified in. In this way, the important wares can still contribute to our understanding of the assemblage and excavated area without the sample having to include entire contexts that would not benefit this understanding.

Finally, the general success of this study means the implications for future use should be discussed. As the sample only includes c.60% of the total wares from an excavation it should take 60% of the time and resources to process whilst still illustrating the key trends of a site, making for a more efficient assessment of materials. However, due to the nature of studying the wares and strategy over the course of one academic year, it has not been possible to appropriately discuss the time taken to assess the sample and full dataset comparatively. Therefore, should this study be repeated, this would be an important additional factor to monitor and compare. Though, it is also important to consider the additional time and financial costs unique to working with a sample. For example, this requires the initial assessment of wares, deciding which features would be included in a sample, the processing of these wares, and further archiving implications of separating these from a full assemblage. Should the time and financial cost of these factors be too great, it would undermine that saved by the sampling process. As a result, these are important factors that need to be considered in the future study of this strategy, Nevertheless, by observing the results of this study it would appear that the sample has been successful and to some extent more efficient.

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Appendices

Appendix 1

Preliminary Comparison of results between non-sampled wares and sampled Roman wares with major discrepancies and matches highlighted

Row Labels	Not Sampled Sum of SHERD_WEIGHT	Sum of SHERD_WEIGHT2	Sampled Sum of SHERD_WEIGHT	Sum of SHERD_WEIGHT2
-	10268	10.33%	15715	14.78%
CAC-B		0.00%	87	0.08%
CAGRM-B		0.00%	908	0.85%
FEC-B		0.00%	25	0.02%
FLC-B		0.00%	196	0.18%
FLGRM-B		0.00%	25	0.02%
FLSAC-B		0.00%	27	0.03%
FLSAM-B		0.00%	50	0.05%
GLSAM-B	749	0.75%		0.00%
GRC-B	405	0.41%	146	0.14%
GRF-B	648	0.65%		0.00%
GRM		0.00%	18	0.02%
GRM-B	1119	1.13%	3188	3.00%
GRSAC-B		0.00%	215	0.20%
GRSAM-B		0.00%	508	0.48%
GRSHC-B		0.00%	51	0.05%
GRSHM-B		0.00%	777	0.73%
MISAF-B	34	0.03%		0.00%
ORC-B		0.00%	5	0.00%
ORSAC-B		0.00%	10	0.01%
ORSAM-B		0.00%	107	0.10%
SAC-B	192	0.19%		0.00%
SAF-B	3355	3.37%	6332	5.96%
SAM-B	815	0.82%	718	0.68%
SASHM-B		0.00%	300	0.28%
SHC-B	42	0.04%	1418	1.33%
SHF-B	1411	1.42%		0.00%
SHM-B	1498	1.51%	604	0.57%
Amph	741	0.75%	60	0.06%
AMPH-B	741	0.75%		0.00%
BAET-B		0.00%	60	0.06%
Bb	632	0.64%	1022	0.96%
BB2-B		0.00%	66	0.06%
DOR BB 1-B		0.00%	441	0.41%
HOR BB-B	352	0.35%	494	0.46%
IMITBB-B	280	0.28%	21	0.02%
Cc	1635	1.64%	3974	3.74%
BLKSL-B	16	0.02%		0.00%
CC-B	7	0.01%	53	0.05%
COL CC-B	17	0.02%		0.00%
FMBLK-B	21	0.02%		0.00%
FSBLK-B	10	0.01%	31	0.03%
FSMBLK-B		0.00%	229	0.22%
HAD RS-B		0.00%	31	0.03%
LVN CC-B	1441	1.45%	2214	2.08%
OXF RS-B	6	0.01%	240	0.23%
OXF WS-B	18	0.02%		0.00%

WS-B	99	0.10%	1176	1.11%
Fnrd		0.00%	335	0.32%
LON FR-B		0.00%	335	0.32%
Misc	11567	11.63%	18032	16.96%
CALC-B	40	0.04%	30	0.03%
GROG-B	623	0.63%	3889	3.66%
ROB SH-B	10231	10.29%	14113	13.28%
SAND-B	673	0.68%		0.00%
Oxid	20342	20.46%	9391	8.83%
CSMOX-B	3	0.00%	50	0.05%
CSOX-B	534	0.54%	1366	1.28%
FSMOX-B	4	0.00%	116	0.11%
FSOX-B	8118	8.16%	480	0.45%
HAD OX-B	350	0.35%	45	0.04%
HOR OX-B	749	0.75%	4719	4.44%
LOV OX-B	10584	10.64%	2515	2.37%
MORT		0.00%	100	0.09%
Redu	43799	44.05%	39639	37.29%
CSBLK-B	1755	1.76%	3085	2.90%
CSGW-B	253	0.25%	3170	2.98%
CSMGW-B		0.00%	427	0.40%
CSMRDU-B	77	0.08%	903	0.85%
CSRDU-B	357	0.36%	2297	2.16%
FSGW-B	21916	22.04%	1175	1.11%
FSMGW-B	64	0.06%	133	0.13%
FSMRDU-B	165	0.17%	130	0.12%
FSRDU-B	5375	5.41%	96	0.09%
GREYSLIP-B	50	0.05%		0.00%
HOR GW-B	1978	1.99%	2986	2.81%
HOR RE-B	56	0.06%	4570	4.30%
LVN GW-B	238	0.24%	480	0.45%
LOV BW-B	3711	3.73%	10356	9.74%
LOV GW-B	7804	7.85%	9831	9.25%
Sam	1182	1.19%	2806	2.64%
ARG SA-B	25	0.03%		0.00%
LEZ SA1-B	40	0.04%	4	0.00%
LEZ SA2-B	516	0.52%	2400	2.26%
LGF SA-B	353	0.35%	111	0.10%
LMV SA-B	229	0.23%	291	0.27%
RHZ SA-B	1	0.00%		0.00%
SAM-B	18	0.02%		0.00%
Ww	9274	9.33%	15333	14.42%
BUFF-B	220	0.22%	925	0.87%
CREAM-B	232	0.23%		0.00%
FSBUFF-B		0.00%	3	0.00%
GOD WH-B	1698	1.71%	236	0.22%
LVN SC-B	79	0.08%	114	0.11%
LVN WH-B	1610	1.62%	204	0.19%
NOG WH-B	25	0.03%		0.00%
OXF WH-B	26	0.03%	4	0.00%
VER WH-B	2499	2.51%	7527	7.08%
WW-B	2885	2.90%	6320	5.95%
(blank)		0.00%		0.00%
(blank)		0.00%		0.00%
Grand Total	99440	100.00%	106307	100.00%

Appendix 2: 4.3.1 Settlement 3 Initial χ^2 tests

Full Data: i.e. the theoretical model		
Fabric	No. of Sherds	% by sherd
-	1441	9.4%
AMPH	23	0.2%
BB	153	1.0%
CC	437	2.9%
FNRD	40	0.3%
MISC	1959	12.8%
OXID	1947	12.8%
REDU	7457	48.9%
WW	1585	10.4%
SAM	223	1.5%
15265		100.0%

Sample	Observed	%	Expected	(O-E)	(O-E) ²	(O-E) ² /E
-	1024	9.4%	874.3	149.7	22403.2	25.6
AMPH	8	0.2%	14.0	-6.0	35.5	2.5
BB	141	1.0%	92.8	48.2	2320.1	25.0
CC	278	2.9%	265.1	12.9	165.2	0.6
FNRD	40	0.3%	24.3	15.7	247.4	10.2
MISC	1127	12.8%	1188.6	-61.6	3796.8	3.2
OXID	1061	12.8%	1181.3	-120.3	14481.1	12.3
REDU	4481	48.9%	4524.5	-43.5	1893.6	0.4
WW	970	10.4%	961.7	8.3	69.0	0.1
SAM	132	1.5%	135.3	-3.3	10.9	0.1
9262						80.0

DF (10-1)	9
Test level of significance	0.05
χ^2_{calc}	80.0
χ^2_{alpha}	16.9

Full Data: i.e. the theoretical model		
Fabric	Sum of Weight(g)	% by weight
-	9636	6.38%
AMPH	801	0.53%
BB	485	0.32%
CC	4263	2.82%
FNRD	335	0.22%
MISC	24826	16.44%
OXID	20792	13.77%
REDU	63670	42.18%
WW	22549	14.94%
SAM	3608	2.39%
150965		100%

Sample	Observed	%	Expected	(O-E)	(O-E) ²	(O-E) ² /E
-	5793	6.38%	6030	-237.5	56392.3	9.351232
AMPH	60	0.53%	501	-441.3	194734.7	388.4691
BB	275	0.32%	304	-28.5	813.7	2.680965
CC	3115	2.82%	2668	447.1	199897.3	74.92679
FNRD	335	0.22%	210	125.3	15712.1	74.94365
MISC	15538	16.44%	15537	1.2	1.5	9.49E-05
OXID	13005	13.77%	13012	-7.2	51.8	0.003983
REDU	38609	42.18%	39846	-1237.4	1531199.5	38.42753
WW	14986	14.94%	14112	874.2	764265.8	54.15801
SAM	2762	2.39%	2258	504.0	254031.7	112.5037
94478						755.4651

DF (10-1)	9
Test level of significance	0.05
χ^2_{calc}	755.5
χ^2_{alpha}	16.9

Appendix 3: 4.3.1 Settlement 3 Second χ^2 test (only including fabric categories with sum of weight <10,000 grams)

Full Data: i.e. the theoretical model		
Fabric	No. of Sherds	% by sherd
-	1441	62.2%
AMPH	23	1.0%
BB	153	6.6%
CC	437	18.9%
FNRD	40	1.7%
SAM	223	9.6%
	2317	100.0%

Sample	Observed	%	Expected	(O-E)	(O-E) ²	(O-E) ² /E
-	1024	62.2%	1009.4	14.6	213.6	0.2
AMPH	8	1.0%	16.1	-8.1	65.8	4.1
BB	141	6.6%	107.2	33.8	1144.3	10.7
CC	278	18.9%	306.1	-28.1	790.0	2.6
FNRD	40	1.7%	28.0	12.0	143.5	5.1
SAM	132	9.6%	156.2	-24.2	585.9	3.8
	1623					26.4

DF (6-1)	5
Test level of significance	0.05
χ^2_{calc}	26.4
χ^2_{alpha}	11.07

Full Data: i.e. the theoretical model		
Fabric	Sum of Weight(g)	% by Weight
-	9636	50.38%
BB	485	2.54%
CC	4263	22.29%
SAM	3608	18.86%
AMPH	801	4.19%
FNRD	335	1.75%
	19128	100%

Sample	Observed	%	Expected	(O-E)	(O-E) ²	(O-E) ² /E
-	5793	50.38%	47595	41801.6	1747375944	36713.72
BB	275	2.54%	2396	-2120.5	4496676.78	1877.106
CC	3115	22.29%	21056	17941.0	321880505	15286.86
SAM	2762	18.86%	17821	15058.8	226768027	12724.89
AMPH	60	4.19%	3956	-3896.3	15181468	3837.25
FNRD	335	1.75%	1655	-1319.6	1741474.03	1052.473
	94478					71492.3

DF (6-1)	5
Test level of significance	0.05
χ^2_{calc}	71492.3
χ^2_{alpha}	11.07

Appendix 4: 4.3.1 Settlement 3 Second χ^2 test (only including fabric categories with sum of weight >10,000 grams)

Full Data: i.e. the theoretical model		
Fabric	No. of Sherds	% by sherd
MISC	1959	15.1%
OXID	1947	15.0%
REDU	7457	57.6%
WW	1585	12.2%
	12948	100.0%

Sample	Observed	%	Expected	(O-E)	(O-E) ²	(O-E) ² /E
MISC	1127	15.1%	1155.8	-28.8	827.2	0.7
OXID	1061	15.0%	1148.7	-87.7	7688.1	6.7
REDU	4481	57.6%	4399.4	81.6	6651.1	1.5
WW	970	12.2%	935.1	34.9	1217.3	1.3
	7639					10.2

DF (4-1)	3
Test level of significance	0.05
χ^2_{calc}	10.2
χ^2_{alpha}	7.815

Full Data: i.e. the theoretical model		
Fabric	Sum of Weight (g)	% by Weight
MISC	24826	18.83%
OXID	20792	15.77%
REDU	63670	48.29%
WW	22549	17.10%
	131837	100%

Sample	Observed	%	Expected	(O-E)	(O-E) ²	(O-E) ² /E
MISC	15538	18.83%	17791	-2253.0	5075966.7	285.3111
OXID	13005	15.77%	14900	-1895.1	3591464.2	241.036
REDU	38609	48.29%	45628	-7018.7	49261636.0	1079.644
WW	14986	17.10%	16159	-1173.2	1376468.9	85.18159
	94478					1691.173

DF (4-1)	3
Test level of significance	0.05
χ^2_{calc}	1691.2
χ^2_{alpha}	7.815

Appendix 5: 4.3.2 Settlement 4 Initial χ^2 tests

Full Data: i.e. the theoretical model		
Fabric	No. of Sherds	% by sherd
-	42	1.7%
BB	64	2.6%
CC	100	4.1%
MISC	127	5.2%
OXID	550	22.6%
REDU	1442	59.2%
WW	86	3.5%
SAM	25	1.0%
	2436	100.0%

Full Data: i.e. the theoretical model		
Fabric	Sum of Weight(g)	% by Weight
-	881	2.58%
BB	1118	3.27%
CC	1032	3.02%
MISC	3857	11.30%
OXID	8153	23.88%
REDU	17843	52.25%
WW	1079	3.16%
SAM	184	0.54%
	34147	100.00%

Sample	Observed	%	Expected	(O-E)	(O-E) ²	(O-E) ² /E
-	1	1.7%	32.9	-31.9	1016.3	30.9
BB	64	2.6%	50.1	13.9	193.2	3.9
CC	68	4.1%	78.3	-10.3	105.8	1.4
MISC	106	5.2%	99.4	6.6	43.3	0.4
OXID	461	22.6%	430.6	30.4	926.4	2.2
REDU	1154	59.2%	1128.9	25.1	632.2	0.6
WW	36	3.5%	67.3	-31.3	981.2	14.6
SAM	17	1.0%	19.6	-2.6	6.6	0.3
	1907					54.2

Sample	Observed	%	Expected	(O-E)	(O-E) ²	(O-E) ² /E
-	25	2.58%	749	-724.3	524595.9	700.124
BB	1118	3.27%	951	167.1	27936.4	29.38016
CC	904	3.02%	878	26.3	690.9	0.787141
MISC	3407	11.30%	3280	126.6	16033.7	4.887756
OXID	7618	23.88%	6934	683.9	467690.6	67.44772
REDU	15221	52.25%	15175	45.5	2074.0	0.136666
WW	594	3.16%	918	-323.7	104774.4	114.1721
SAM	155	0.54%	156	-1.5	2.2	0.014222
	29042					916.9497

DF (10-1)	7
Test level of significance	0.05
X^2_{calc}	54.2
X^2_{alpha}	14.067

DF (10-1)	7
Test level of significance	0.05
X^2_{calc}	916.9
X^2_{alpha}	14.067

Appendix 6: 4.3.2 Settlement 4 Second χ^2 test (only including fabric categories with sum of weight <1,500 grams)

Full Data: i.e. the theoretical model		
Fabric	No. of Sherds	% by sherd
-	42	13.2%
BB	64	20.2%
CC	100	31.5%
WW	86	27.1%
SAM	25	7.9%
	317	100.0%

Full Data: i.e. the theoretical model		
Fabric	Sum of Weight(g)	% by Weight
-	881	20.52%
BB	1118	26.04%
CC	1032	24.03%
WW	1079	25.13%
SAM	184	4.29%
	4294	100.00%

Sample	Observed	%	Expected	(O-E)	(O-E) ²	(O-E) ² /E
-	1	13.2%	24.6	-23.6	559.0	22.7
BB	64	20.2%	37.6	26.4	699.5	18.6
CC	68	31.5%	58.7	9.3	87.0	1.5
WW	36	27.1%	50.5	-14.5	209.1	4.1
SAM	17	7.9%	14.7	2.3	5.4	0.4
	186					47.3

Sample	Observed	%	Expected	(O-E)	(O-E) ²	(O-E) ² /E
-	25	20.52%	574	-548.7	301022.7	524.7448
BB	1118	26.04%	728	390.0	152118.9	208.9615
CC	904	24.03%	672	232.0	53834.4	80.11334
WW	594	25.13%	703	-108.6	11789.9	16.78083
SAM	155	4.29%	120	35.2	1238.3	10.33585
	2796					916.9497

DF (5-1)	4
Test level of significance	0.05
χ^2_{calc}	47.3
χ^2_{alpha}	9.488

DF (5-1)	4
Test level of significance	0.05
χ^2_{calc}	916.9
χ^2_{alpha}	9.488

Appendix 7: 4.3.2 Settlement 4 Second χ^2 test (only including fabric categories with sum of weight >1,500 grams)

Full Data: i.e. the theoretical model		
Fabric	No. of Sherds	% by sherd
MISC	127	6.0%
OXID	550	26.0%
REDU	1442	68.1%
	2119	100.0%

Sample	Observed	%	Expected	(O-E)	(O-E) ²	(O-E) ² /E
MISC	106	6.0%	103.1	2.9	8.1	0.1
OXID	461	26.0%	446.7	14.3	204.6	0.5
REDU	1154	68.1%	1171.2	-17.2	294.4	0.3
	1721					0.8

DF (3-1)	2
Test level of significance	0.05
X^2_{calc}	0.8
X^2_{alpha}	5.991

Full Data: i.e. the theoretical model		
Fabric	Sum of Weight(g)	% by Weight
MISC	3857	12.92%
OXID	8153	27.31%
REDU	17843	59.77%
	29853	100.00%

Sample	Observed	%	Expected	(O-E)	(O-E) ²	(O-E) ² /E
MISC	3407	12.92%	3391	16.0	256.8	0.075716
OXID	7618	27.31%	7168	450.1	202580.4	28.26212
REDU	15221	59.77%	15687	-466.1	217261.1	13.84966
	26246					42.1875

DF (3-1)	2
Test level of significance	0.05
X^2_{calc}	42.2
X^2_{alpha}	5.991

Appendix 8: 4.4.2 Settlement 3 fine ware fabric χ^2 tests

Full Data: i.e. the theoretical model		
Fabric	No. of Sherds	% by sherd
CC	437	62.43%
FNRD	40	5.71%
SAM	223	31.86%
	700	100%

Sample	Observed	%	Expected	(O-E)	(O-E) ²	(O-E) ² /E
CC	278	62.43%	280.9286	-2.92857	8.576531	0.030529
FNRD	40	5.71%	25.71429	14.28571	204.0816	7.936508
SAM	132	31.86%	143.3571	-11.3571	128.9847	0.899744
	450					8.866781

DF (3-1)	2
Test level of significance	0.05
X^2_{calc}	8.87
X^2_{alpha}	5.991

Full Data: i.e. the theoretical model		
Fabric	Sum of Weight(g)	% by Weight
CC	4263	51.95%
FNRD	335	4.08%
SAM	3608	43.97%
	8206	100%

Sample	Observed	%	Expected	(O-E)	(O-E) ²	(O-E) ² /E
CC	3115	51.95%	3227.121	-112.121	12571.15	3.895468
FNRD	335	4.08%	253.5974	81.40263	6626.389	26.12956
SAM	2762	43.97%	2731.282	30.7185	943.6262	0.345488
	6212					30.37052

DF (3-1)	2
Test level of significance	0.05
X^2_{calc}	30.37
X^2_{alpha}	5.991

Appendix 9: 4.4.2 Settlement 3 form χ^2 tests

Full Data: i.e. the theoretical model		
Form	No. of Sherds	% by sherd
Beaker	64	5%
Bowl	107	8%
Cup	38	3%
Flagon	45	3%
Jar	907	64%
Lid	29	2%
Open Form	22	2%
Platter/Dish	158	11%
Dish	12	1%
Mortarium	18	1%
Specialist	6	0%
Amphora	3	0%
	1409	100%

Sample	Observed	%	Expected	(O-E)	(O-E) ²	(O-E) ² /E
Beaker	27	5%	32.93116	-5.93116	35.17862	1.068247
Bowl	58	8%	55.05678	2.943222	8.662557	0.157339
Cup	16	3%	19.55287	-3.55287	12.62292	0.645579
Flagon	20	3%	23.15472	-3.15472	9.952256	0.429815
Jar	493	64%	466.6962	26.30376	691.8879	1.482523
Lid	11	2%	14.92193	-3.92193	15.38154	1.030801
Open Form	10	2%	11.32009	-1.32009	1.742625	0.153941
Platter/Dish	76	11%	81.29879	-5.29879	28.07721	0.345358
Dish	5	1%	6.174592	-1.17459	1.379666	0.223442
Mortarium	8	1%	9.261888	-1.26189	1.592361	0.171926
Specialist	1	0%	3.087296	-2.0873	4.356804	1.411204
Amph	0	0%	1.543648	-1.54365	2.382849	1.543648
	725					8.663824

DF (12-1)	11
Test level of significance	0.05
χ^2_{calc}	8.66
χ^2_{alpha}	19.675

Appendix 10: 4.4.2 Settlement 3 fine ware forms χ^2 tests -All fine ware fabrics

Full Data: i.e. the theoretical model		
Form	No. of Sherds	% by sherds
-	171	41%
Beaker	16	4%
Bowl	54	13%
Cup	34	8%
Flagon	3	1%
Jar	30	7%
Lid	1	0%
Open Form	13	3%
Platter/Dish	81	20%
Dish	11	3%
Mortarium	1	0%
	415	100%

Sample	Observed	%	Expected	(O-E)	(O-E) ²	(O-E) ² /E
-	52	41%	72.5205	-20.5205	421.0902	5.80650
Beaker	8	4%	6.7855	1.2145	1.4749	0.21736
Bowl	33	13%	0.6506	32.3494	1046.4835	1608.48
Cup	14	8%	14.4193	-0.4193	0.1758	0.01219
Flagon	0	1%	1.2723	-1.2723	1.6187	1.27229
Jar	14	7%	12.7229	1.2771	1.6310	0.12819
Lid	1	0%	0.4241	0.5759	0.3317	0.78205
Open Form	5	3%	5.5133	-0.5133	0.2634	0.04778
Platter/Dish	44	20%	34.3518	9.6482	93.0876	2.70983
Dish	5	3%	4.6651	0.3349	0.1122	0.02405
Mortarium	0	0%	0.4241	-0.4241	0.1799	0.42410
	176					1619.91

DF (11-1)	10
Test level of significance	0.05
χ^2_{calc}	1619.91
χ^2_{alpha}	18.307

Appendix 11: 4.4.2 Settlement 3 fine ware forms χ^2 tests -Colour coated wares

Full Data: i.e. the theoretical model		
Form	No. of Sherds	% by sherds
-	84	60.87%
Beaker	13	9.42%
Bowl	9	6.52%
Jar	15	10.87%
Lid	1	0.72%
Open Form	3	2.17%
Platter/Dish	10	7.25%
Flagon	3	2.17%
Mort	0	0.00%
	138	100%

Sample	Observed	%	Expected	(O-E)	(O-E) ²	(O-E) ² /E
-	38	60.87%	45.04348	-7.04348	49.61059	1.101393
Beaker	8	9.42%	6.971014	1.028986	1.058811	0.151888
Bowl	7	6.52%	4.826087	2.173913	4.725898	0.97924
Jar	12	10.87%	8.043478	3.956522	15.65406	1.946181
Lid	1	0.72%	0.536232	0.463768	0.215081	0.401097
Open Form	2	2.17%	1.608696	0.391304	0.153119	0.095182
Platter/Dish	6	7.25%	5.362319	0.637681	0.406637	0.075832
Flagon	0	2.17%	1.608696	-1.6087	2.587902	1.608696
	74					6.359509

DF (8-1)	7
Test level of significance	0.05
χ^2_{calc}	6.36
χ^2_{alpha}	14.067

Appendix 12: 4.4.2 Settlement 3 fine ware forms χ^2 tests -FNRD wares

Full Data: i.e. the theoretical model		
Form	No. of Sherds	% by sherds
-	1	50.00%
Bowl	1	50.00%
	2	100%

Sample	Observed	%	Expected	(O-E)	(O-E) ²	(O-E) ² /E
-	1	50%	1	0	0	0
Bowl	1	50%	1	0	0	0
	2					0

DF (2-1)	1
Test level of significance	0.05
χ^2_{calc}	0.00
χ^2_{alpha}	3.841

Appendix 13: 4.4.2 Settlement 3 fine ware forms χ^2 tests -Samian wares

Full Data: i.e. the theoretical model		
Form	No. of Sherds	% by sherds
-	86	31.50%
Beaker	2	0.73%
Bowl	44	16.12%
Cup	34	12.45%
Jar	15	5.49%
Open Form	10	3.66%
Platter/Dish	70	25.64%
Dish	11	4.03%
Mort	1	0.37%
	273	100%

Sample	Observed	%	Expected	(O-E)	(O-E) ²	(O-E) ² /E
-	13	31.50%	31.50183	-18.5018	342.3178	10.8666
Beaker	0	0.73%	0.732601	-0.7326	0.536704	0.732601
Bowl	25	16.12%	16.11722	8.882784	78.90385	4.895625
Jar	2	5.49%	5.494505	-3.49451	12.21157	2.222505
Open Form	3	3.66%	3.663004	-0.663	0.439574	0.120004
Platter/Dish	38	25.64%	25.64103	12.35897	152.7442	5.957026
Dish	5	4.03%	4.029304	0.970696	0.942251	0.233849
Mort	0	0.37%	0.3663	-0.3663	0.134176	0.3663
	100					25.39451

DF (9-1)	8
Test level of significance	0.05
χ^2_{calc}	25.39
χ^2_{alpha}	15.507

Appendix 14: 4.4.3 Settlement 4 fine ware fabric χ^2 tests

Full Data: i.e. the theoretical model		
Fabric	No. of Sherds	% by sherd
CC	100	80.00%
SAM	25	20.00%
	125	100%

Sample	Observed	%	Expected	(O-E)	(O-E) ²	(O-E) ² /E
CC	68	80.00%	68	0	0	0
SAM	17	20.00%	17	0	0	0
	85					0

DF (2-1)	1
Test level of significance	0.05
χ^2_{calc}	0.00
χ^2_{alpha}	3.841

Full Data: i.e. the theoretical model		
Fabric	Sum of Weight(g)	% by Weight
CC	1032	84.87%
SAM	184	15.13%
	1216	100%

Sample	Observed	%	Expected	(O-E)	(O-E) ²	(O-E) ² /E
CC	905	84.87%	899.6053	5.394737	29.10319	0.032351
SAM	155	15.13%	160.3947	-5.39474	29.10319	0.181447
	1060					0.213798

DF (2-1)	1
Test level of significance	0.05
χ^2_{calc}	0.21
χ^2_{alpha}	3.841

Appendix 15: 4.4.3 Settlement 4 fine ware forms χ^2 tests -All fine ware fabrics

Full Data: i.e. the theoretical model		
Form	No. of Sherds	% by sherds
-	62	28%
Beaker	16	7%
Bowl	51	23%
Cup	42	19%
Flagon	6	3%
Jar	3	1%
Open Form	25	11%
Platter/Dish	71	32%
Dish	23	10%
Mortarium	1	0%
	222	100%

Sample	Observed	%	Expected	(O-E)	(O-E) ²	(O-E) ² /E
-	22	28%	12.8468	9.1532	83.7802	6.52146
Beaker	4	7%	3.3153	0.6847	0.4688	0.14140
Bowl	9	23%	10.5676	-1.5676	2.4573	0.23253
Cup	4	19%	8.7027	-4.7027	22.1154	2.54121
Flagon	0	3%	1.2432	-1.2432	1.5457	1.24324
Jar	1	1%	0.6216	0.3784	0.1432	0.23032
Open Form	2	11%	5.1802	-3.1802	10.1135	1.95235
Platter/Dish	3	32%	14.7117	-11.712	137.1642	9.32347
Dish	0	10%	4.7658	-4.7658	22.7125	4.76577
Mortarium	1	0%	0.2072	0.7928	0.6285	3.03329
	46					22.1860

DF (10-1)	9
Test level of significance	0.05
χ^2_{calc}	22.19
χ^2_{alpha}	16.919

Appendix 16: 4.4.3 Settlement 4 fine ware forms χ^2 tests -Colour coated wares

Full Data: i.e. the theoretical model		
Form	No. of Sherds	% by sherds
-	37	52.11%
Beaker	15	21.13%
Bowl	5	7.04%
Flagon	6	8.45%
Jar	3	4.23%
Platter/Dish	5	7.04%
	71	100%

Sample	Observed	%	Expected	(O-E)	(O-E) ²	(O-E) ² /E
-	19	52.11%	18.76056	0.239437	0.05733	0.003056
Beaker	4	21.13%	7.605634	-3.60563	13.0006	1.709338
Bowl	4	7.04%	2.535211	1.464789	2.145606	0.846322
Flagon	6	8.45%	3.042254	2.957746	8.748264	2.875587
Jar	1	4.23%	1.521127	-0.52113	0.271573	0.178534
Platter/Dish	2	7.04%	2.535211	-0.53521	0.286451	0.112989
	36					5.725826

DF (5-1)	4
Test level of significance	0.05
χ^2_{calc}	5.73
χ^2_{alpha}	9.488

Appendix 17: 4.4.3 Settlement 4 fine ware forms χ^2 tests -Samian wares

Full Data: i.e. the theoretical model		
Form	No. of Sherds	% by sherds
-	25	10.92%
Beaker	1	0.44%
Bowl	46	20.09%
Cup	42	18.34%
Open Form	25	10.92%
Platter/Dish	66	28.82%
Dish	23	10.04%
Mort	1	0.44%
	229	100%

Sample	Observed	%	Expected	(O-E)	(O-E) ²	(O-E) ² /E
-	3	10.92%	1.746725	1.253275	1.570698	0.899225
Beaker	0	0.44%	0.069869	-0.06987	0.004882	0.069869
Bowl	5	20.09%	3.213974	1.786026	3.18989	0.992506
Cup	4	18.34%	2.934498	1.065502	1.135295	0.386879
Open Form	2	10.92%	1.746725	0.253275	0.064148	0.036725
Platter/Dish	1	28.82%	4.611354	-3.61135	13.04188	2.82821
Dish	0	10.04%	1.606987	-1.60699	2.582407	1.606987
Mort	1	0.44%	0.069869	0.930131	0.865144	12.38237
	16					19.20277

DF (8-1)	7
Test level of significance	0.05
X^2_{calc}	19.20
X^2_{alpha}	14.067