FIELDS, SHERDS AND SCHOLARS

RECORDING AND INTERPRETING SURVEY CERAMICS

EDITED BY
ANNA MEENS, MARGARITA NAZOU, WINFRED VAN DE PUT

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NETHERLANDS INSTITUTE AT ATHENS IX

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Survey ceramics in the spotlight

Anna Meens, Margarita Nazou & Winfred van de Put

Introduction

Landscape archaeology has heavily relied on pedestrian survey as a field method for more than half a century. In most field projects, archaeological ceramics constitute the lion's share among the finds and the amount of collected sherds is overwhelming. The ceramics found on the surface may be unassuming, but it is worth putting them in the spotlight, because they provide key evidence for understanding human activity in a particular landscape through time.

This volume aims to be a book by and for people who work with these ceramics. Our starting point was a conference that took place in Athens on the 24th and 25th of February 2017 under the title "Fields, Sherds and Scholars: Recording and Interpreting Survey Ceramics". From the outset we targeted early career scholars specifically, offering a platform for ceramic specialists and those who work with ceramic survey datasets, yet we also invited senior scholars who were our teachers and/or inspired us. The conference and this book are geographically oriented towards Greece, Italy and Spain, three countries in which archaeological surface survey is widely practised. Chronologically, the contributions range from the Final Neolithic to the Medieval period. The papers delivered at the conference were reworked by the authors and reviewed in terms of content and language. The result is, we believe, a significant contribution to the field of survey pottery studies, which is not frequently theorised, and could also serve as a guide and provide inspiration to archaeologists designing their own survey projects and methodologies.

The structure of the book is as follows: Winther-Jacobsen discusses a well-known problem of surveys, the focus on dating rather than the use of the pottery, and suggests a way to resolve it. García Sánchez presents a method for ordering ceramic data through statistical methods. Cloke, Knodell, Fachard and Papangeli come back to the problems of diagnosticity and quantification, with more suggestions on the matter. The practical issues of work organisation in the storeroom, databases and maximisation of efficiency in pottery processing are dealt with by Nazou, Murphy, Abell, LaFayette Hogue and Wallrodt. Ippolito and Attema discuss the dating of coarse wares and the dating of non-diagnostic pottery based on technological aspects is raised by Krijnen, Waagen and Hilditch. De Haas and Tol focus on the issues of sampling, typologies and the way they shape our interpretations. The next three papers are devoted to urban surveys and the more complex datasets obtained by surveying towns and cities. Wiersma's contribution looks at the effect of collection conditions in the field in the investigation of a prehistoric city and Stissi examines matters of surveying classical towns, both small and large. Trainor and Stone also look at intensive surveys in large urban settings. The final two papers are devoted to extra-mural finds and their interpretation. Peeters, Bes and Poblome investigate the relationship of pottery with site function through statistical analysis. Finally, Meens raises the very under-studied issue of identifying graves in surveys.

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Aims and themes

Sherds that are collected in archaeological field surveys, as opposed to those found in excavations, present the archaeologist with a unique opportunity: it is possible to examine material from different find locations and thereby study a palimpsest of an entire ancient landscape. Simultaneously, it offers the opportunity to understand how this landscape developed through time, as most surveys encounter sherds from a multitude of periods. Survey ceramics thus enable addressing a different set of questions than those asked in excavations. That survey ceramics are a valuable source of information is emphasized in the various approaches to surface ceramics in this book. Three themes run as a red thread through the contributions in this volume: first of all transparency in ceramic collecting, processing and interpretation, secondly, improving diagnosticity, and thirdly, expanding the interpretive potential of survey ceramics.

Transparency in ceramic collecting, processing and interpretation

In survey archaeology, surface ceramics provide the basis for understanding human activity in a landscape, and sherds serve as convenient chronological markers for the archaeological sites discovered in field projects. However, how this pottery is collected and studied determines the possibilities for using the sherds as a source material. Not only the collection practices, but also the process and practicalities of ceramic analysis are rarely made explicit, even though the archaeological interpretations of human activity in the landscape strongly rely on them. Most contributions in this volume provide an insight in collection, processing and interpretation practices in a specific survey project, and we hope this transparency is inspiring and contributes to a better understanding of surface ceramics as a basis for historical interpretations.

How the collection strategy shapes the datasets is demonstrated by Stissi, who compares and contrasts data from two Greek surveys, the Halos Archaeological Survey Project and the Boeotia Survey. The differences between the datasets in terms of diagnosticity reveal different approaches in the collection strategy. Looking at the proportions of feature sherds and percentages of diagnostic sherds, he also raises the possibility that the amount of material available on the surface affects the selectivity (or inclusivity) of a sherd collection. Moreover, we should be aware that some of the patterns that occur in survey datasets may in fact be the result of the processing and classification of ceramics, rather than historical realities. This realisation underlines the importance of describing the process of collecting and processing ceramics.

De Haas and Tol describe the evolution of the collection strategy used in the Pontine Region Project in Italy and assess in what ways highly intensive sampling methods contribute to a better understanding of an archaeological site. Intensive approaches are costly in terms of time and storage space, so they try to find a good balance. They also stress the importance of describing the sampling methods, because this is essential for integrating and comparing survey data on a regional level.

Wiersma also discusses the effects of different sampling methods, in particular how these affect our understanding of prehistoric settlements. She compares total and selective samples taken in the course of the Ayios Vasileios Survey Project on the Peloponnese. It appears that total sampling is more effective for detecting Early (and -to some extent- Middle) Helladic and Early Mycenaean material on the surface, and that a better spatial resolution is obtained by using total collection, which eases the integration of the pottery data with the results of geophysical research. However, the area for total collection is reduced in order to keep the number of finds manageable.

The paper of Nazou, Murphy, Abell, LaFayette Hogue and Wallrodt is particularly devoted to pottery processing, which is organised by taking all practical issues into account: space, time and workforce. It emphasises the contribution of students and less skilled participants, whose role should not be underestimated; on the contrary, the study of survey pottery can provide great learning opportunities.

Trainor and Stone offer an insight into the processing of sherd material collected at the urban survey sites of Sikyon and Knossos. The methodology at Sikyon is based on index sherds which are recognized by specialists because they bear resemblance to dated sherds from other (excavated) contexts, in combination with a detailed fabric analysis. In Knossos, a pre-sorting of material according to broad chronological groups was the starting point, from which further refinements were added by specialists (for example specific fabrics) in a project database. Both pottery datasets reveal information about the functionality of specific areas in the city (in terms of pottery production and commerce), yet it is difficult to identify households and neighbourhoods.

García Sánchez discusses how we can move from the pottery data produced by specialists to archaeological interpretations. Usually, interpretations are based on maps and statistics, yet he proposes a method -called STADION- which incorporates both in a visual way. The transparent method, which is mainly geared towards detecting functional differences, enables comparison of survey results and allows integration with other archaeological data, for example the data obtained by remote sensing techniques.

Improving diagnosticity

Unfortunately, the preservation of ceramics collected in surveys is usually worse than excavated material, though the preservation of excavated pottery may also vary depending on the context. Post-depositional processes like ploughing, weathering and erosion can leave very fragmented and badly degraded sherds for the ceramologist to study, sometimes jokingly called 'dog food' because of its resemblance in colour (usually a shade of brown) and the lack of shape. The poor preservation thus presents the pottery specialist with a challenging material, where it is not straightforward to identify the fabric, shape and decoration, arguably three of the most important characteristics of a sherd. Generally, after one becomes familiar with the types and variations of broken pottery, quite a number of sherds can be positively identified (in terms of shape, decoration, fabric and/or chronology), yet the ceramologist is left with a remainder of less diagnostic material. The latter group of finds consume much study time and storage space, usually offering only a limited amount of information in return. For these reasons, such material is often left in the field or when it is studied these finds are left out of the final publication. Though in most landscapes selective collection is necessary because of the density of (ceramic) finds on the surface, selection criteria are rarely made explicit. Moreover, not including the less diagnostic material in the publication creates a skewed image of the pottery types present in the collected samples, and which sherds are considered diagnostic or undiagnostic varies between ceramologists, but also depends on the research questions. The present volume demonstrates that the study of less diagnostic material in fact contributes to a better understanding of human activity in the landscape, as it showcases different approaches to this pottery.

The ceramic methodology proposed by Winther-Jacobsen is geared towards identifying functional groups in the survey material. The use-typology is a hierarchical classification system based on various pottery characteristics, which provides a means for including plain body sherds as well. Recording the wall thickness (also undertaken by the pottery specialists working on Keros, see Krijnen, Waagen and Hilditch) allows the inclusion of these otherwise non-diagnostic sherds in the functional spectrum, adding to our understanding of activity differentiation at the site and regional level and aiding the identification of land use patterns.

The team working in the plain of Mazi, on the border between Attica and Boeotia, take the fabric of the non-diagnostic sherds into account, allowing them to establish the functional character and chronological range of the sherds (see Cloke, Knodell, Fachard and Papangeli). There appears to be a large degree of continuity in the use of specific regional fabrics, resulting in broad date ranges for much of this material. This honesty is characteristic of the team's approach to the finds processing. By assigning start and end dates to each sherd and subsequently visualising these categories on a map, nuances are added to the local settlement history and the differential 'visibility' (or diagnosticity) is partly remedied: some of the less 'visible' periods are most likely hidden among the plain and coarse wares.

A specific group of material which is often regarded as largely undiagnostic is impasto pottery found in Italy. Ippolito and Attema describe how they succeeded in dating this pottery, which amounts to an important part of the finds from the survey in the Raganello valley in Calabria. By considering a variety of survey sherd characteristics and a detailed comparison with excavated impasto shapes, Ippolito was able to add chronological nuance to the interpretation of 'impasto sites' and the landscape in which they occur.

In Krijnen, Waagen and Hilditch, pottery specialists working on material from the Keros Island Survey project describe how they pay special attention to recording the technological traits of the ceramic material, diagnostic and non-diagnostic alike. The combination of technological traits recorded in the diagnostics and belonging to various 'Period Groups' are then used as a chronological marker for the previously non-diagnostic material, hence providing further basis for tracing the extent and intensity of human activity on this Cycladic island.

Expanding the interpretive potential of survey ceramics

Survey ceramics are convenient chronological markers for the archaeological sites discovered in field projects. However, their potential is not limited to providing the building stones for the creation of a chronological framework. Rather than regarding the sherds as dating tools, several contributors to this book highlight how sherds can contribute to a better understanding of past peoples and settlements. For example, the survey datasets help us understand the nature and function(s) of archaeological sites and trace the networks in which the sites operate.

Of course it is important to know when a site was in use, but it is equally important to know what a site represents. All too often it is assumed that sites are settlements, but site function is worth a second thought. The contribution by Meens emphasizes that not all sites are settlements, and reminds us to consider the possibility of burials. Such sites may be identified based on the presence of grave infrastructure or bones, yet it is also possible to identify ceramic scatters as burial sites if we take a detailed look at the contents of the assemblage and compare it with pottery assemblages from excavated cemeteries. The surface sherds thus enable establishing site function, which in turn can help us understand the settlement pattern.

Site function is also a primary concern for Winther-Jacobsen, who advocates the use of a chronotypology (or use-typology) for identifying different (household) activities in pottery assemblages from survey sites.

Mapping the ceramic evidence from larger or urban settlements sometimes makes it possible to detect functional differences within settlements. García Sánchez's STADION permits the mapping of activity areas based on pottery statistics. Trainor and Stone have been able to identify certain activity zones within the cities of Sikyon and Knossos thanks to their detailed pottery study. Peeters, Bes and Poblome were curious to see if the survey samples from an extramural part of the city of Tanagra in Boeotia reveal information about the functions this area once had. By applying statistical analysis in a nuanced way they have been able to detect functional differences between the intra-mural and extra-mural areas. The increased presence of lamps and fine wares in the extra mural area suggests that this area functioned as a cemetery.

The surveyed ceramic material also makes it possible to place archaeological sites in perspective by revealing networks of site interaction. A detailed study of the survey sherds not only permits the identification of local pottery products but also of imports, transported either over small or large distances, which highlight the trade and cultural networks within which survey sites existed.

The KARS project (Nazou, Murphy, Abell, LaFayette Hogue and Wallrodt) surveyed areas on northern Kea that had been excavated and surveyed before; it was possible to design a more intensive collection strategy in order to obtain larger samples of pottery and to maximise efficiency in processing and studying pottery in order to answer detailed questions on local production and imports, highlighting the change from earlier (Final Neolithic) to later (EBA, MBA and LBA) prehistoric networks.

In Ippolito and Attema, the cultural traits inferred by the impasto pottery from the Raganello Archaeological Project and excavated parallels do not only point at trade relations between sites but also at cultural transmission. The people living in the inland of the Raganello basin partook in networks that reached far outside the valley, and Ippolito and Attema succeeded in unravelling the dynamics of these networks over time.

The typological pottery studies undertaken in the Pontine Region project, as described by De Haas and Tol, demonstrate that even the smallest settlements in this area, the farms, are included in the trade networks and received imported amphorae, and hence imported foodstuffs. This was already the case in the Republican period and increased during early Imperial times yet ceased to be the case by mid-Imperial period, when imports became limited to large rural estates. The distribution patterns and variability of amphora types also indicate that some (port) sites served as transport hubs. Meanwhile, the circulation patterns of local pottery products in the survey area could also be traced thanks to petrographic analyses and a study of misfired ceramics.

The contribution of this book to the study of survey pottery

The papers in this book have offered a look behind the scenes of several survey projects. New methods and interpretive pathways are explored by all authors, in order to get the most information out of our survey dataset. The focus on transparency (in ceramic collecting, processing and interpretation), improving diagnosticity, and expanding the interpretive potential of these data has demonstrated that many challenges, questions and solutions are shared across survey projects and specialists. In fact, many of the sampling and recording issues explicitly addressed in this book about survey sherds are just as evident for ceramics from excavations. The lack of stratigraphical control in survey archaeology brings these issues more to the foreground, but we firmly believe that the practical and theoretical approaches and methodologies for studying pottery presented in this book could also be adopted in the study of excavated pottery, especially when context is under-recorded or lacking (such as for example in old excavations).

The different approaches to survey ceramics which are explored by the contributors to this book emphasize the value of surface sherds as a source material. This dataset, however, is not neutral: it is shaped by the collection and recording practices. These strategic choices determine our research possibilities and comparability of project results. Transparency about these issues therefore, is very important, and we believe this book contributes to that aim. The compilation of papers in this book also demonstrates that even 'undiagnostic' sherds have a story to tell and that survey sherds are not only useful as dating tools, but also help us understand the nature of a site and how it relates to other sites around it.

When editing the contributions, we could not avoid using the necessary jargon and technical details of studying survey pottery; however, in order for beginners and students to be able to understand and use this book, we encouraged the authors to make special efforts to explain their terminologies as best as they could. We hope that this book offers inspiration to the next generation of scholars to engage with survey ceramics and helps them to discover the wealth of information hidden in this ceramic data.

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Pottery studies in survey in the eastern Mediterranean over the last 20 years – a personal account

Kristina Winther-Jacobsen

Abstract

The article discusses the possibility of raising the level of inference with methods already developed and used in landscape archaeology. Adopting a quantifiable method of collecting and spending more resources on the analysis of the pottery collected would allow the pottery specialists to bring the full range of their knowledge of the production and use of pottery in the ancient world to the interpretation of the landscape.

Keywords: Use-differentiation – Chronotypology – Sampling – Sorting – Recording.

Introduction

The boom in large scale landscape archaeology in the Mediterranean in the 1980s and 1990s came to a head at the end of the 1990s – early 2000s with a number of critical publications exploring the methodology of landscape archaeology such as the POPULUS series e.g. *Extracting Meaning from Ploughsoil Assemblages* and the much cited *Side-by-Side Survey*.[1] An element of fatigue characterizes these publications, landscape archaeology had become a highly complex multidisciplinary research method, and yet the level of inference appeared not to increase; the questions of chronology, site identification and interpretation still dominated the discussion. In 1998 Todd Whitelaw predicted that an increase in the level and reliability of inference would only come with substantially larger collections of material, which meant a greater investment of time in processing, identification, and analysis.[2] Other critique was concerned with the perceived increasing myopia seen as preventing the investigation of landscapes at a regional scale prompting some archaeologists to suggest a return to the less artefact-intensive extensive survey.[3] But the challenge is not just a question of more or less. William Cavanagh, Christopher Mee and Peter James concluded that there is no single right methodology for interpreting rural sites because conditions vary from region to region, and this may even be the case from period to period.[4] However, in 2006 William Caraher, Dimitri Nakassis and David

1 Francovich, Patterson & Barker 2000; Alcock & Cherry 2004.
2 Whitelaw 1998, 229.
3 Fentress 2000; van de Velde 2001.
4 Cavanagh, Mee & James 2005, 316-318.

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Pettegrew repeated the necessity of counting and recording pottery according to rational and consistent principles as an essential component of interpreting the whole.[5] The present article tries to expand on this argument, reiterating Whitelaw's 1998 call to invest more time in processing, identification, and analysis. It is basically a personal account as so little has been published which explains specifically the strategies of the pottery studies and their significance, something which hopefully the present volume will help to rectify. My personal experience comes from directing survey pottery studies in Cyprus and later designing survey strategies with a strong focus on the integration of the pottery studies in Crimea, Turkey and Greece.[6]

During the same period landscape archaeology discovered the geophysical science, and for a time this topic dominated all survey conferences as it seemed like landscape archaeologists could use geophysical survey to work around the archaeological problems. In the Mediterranean, ceramics are the age-old, archaeological key to the understanding of chronology and site identification; however ceramics in survey is a topic, which has been somewhat side-lined for some years. And it certainly has not become any simpler. The surface is a dynamic phenomenon created and recreated in a continuous cycle of depositional and post-depositional processes. In landscape archaeology we are trying to recreate human history in the form of diachronic patterns of human occupation based on dynamic phenomena, surface assemblages, on a regional scale in a series of two-dimensional representations, the distribution maps. The only aspect we can control is our methodology, and modern survey strategies are concerned with creating a strict methodology in order to consistently recreate the conditions of observation. Indeed, ceramics tools have been developed to increase control and reduce inconsistencies and thereby increase compatibility, legitimize our interpretations and increase the level of inference.

For most current surveys, artefacts are the basic units of observation, and based on those observations we hope to infer different patterns on the entire landscape and for that purpose we have developed different strategies: In the early surveys in the Greek world the finds were used first and foremost to identify the locations of "sites" and as a chronological tool to achieve periodization. Exchange, use differentiation, social hierarchy, and cultural identity were sometimes discussed, but apart from trade the discussion was never based on artefacts, rather on architectural remains.[7]

During recent years some of the research questions previously answerable only from surface finds are gradually shifting towards the realm of archaeometry such as delimiting sites. Remote sensing is much cheaper, and geophysical methods are becoming affordable enough to use over larger areas which means the surface finds have become much less important for delimiting spaces in for instance urban areas.[8] Ceramics will no doubt continue to play a major part in the dating of sites as well as in the delimiting of sites, but the shift is an opportunity to promote studies which focus more strongly on different research questions. Of course these studies do not only concern ceramicists. Landscape archaeology requires a truly interdisciplinary approach in order to increase the level of inference. The conditions we work under and the patterns we propose to study are much too complex to rely on one methodology or a single dataset.

Traditionally, the pottery specialists have not been much involved with the survey strategy or even the interpretation of the results. They should be. Integrating the knowledge of the ceramicists at every stage of the investigation is one easy way to increase the level of inference.

Use-differentiation

One way to increase the level of inference is to develop pottery study strategies to tackle use-differentiation, a question which ceramics are uniquely qualified to deal with, and with the artefact-based survey we already have developed the basic tools in terms of sampling and sorting.[9] Use differentiation is by no means a new idea, and the innovative work of Whitelaw on Kea based on archaeological sources introduced a simple use typology into the archaeological survey.[10] The pottery was sorted into three use categories, table, storage and processing, based on morphology, surface treatment and patterns of domestic association as the latter was argued in the doctoral thesis of Lisa Nevett.[11] Most if not all modern survey projects working in the Greek world apply some form of use typology most often directly inspired by Whitelaw's seminal work, but the potential of the methodology has not really been explored, although a few scholars have used it as a basis for more complex interpretations.[12] In 2004, Lin Foxhall suggested that more information on the functions of survey sites and the activities of their inhabitants could be gained from closer examination of the ceramic remains in context.[13] In this short article she made a very simple attempt at comparing proportions of different types of pottery from rural and urban sites and suggested this as a possible way forward.

5 Caraher, Nakassis & Pettergrew 2006, 34.
6 Given et al. 2013a; Guldager Bilde, Attema & Winther-Jacobsen 2012; Winther-Jacobsen & Bekker-Nielsen 2017; Frederiksen et al. 2017.
7 Winther-Jacobsen 2010a, 36, table 2.
8 E.g. Frederiksen et al. 2017
9 Winther-Jacobsen 2010a and b.
10 Whitelaw 1998; 2000.
11 Whitelaw 1998, 231; Nevett 1992 (a reworked version was published in 1999).
12 E.g. Foxhall 2004; Cavanagh, Mee & James 2005.
13 Foxhall 2004, 249.

However, from a methodological point of view, three conditions are absolutely essential if we hope to study activity or use differentiation from a ceramic perspective: First of all we need to be able to identify approximate use of the individual sherds based on observations of the physical properties. The relationship between physical properties and use are complex.[14] The physical properties of pottery related to fabric, morphology, surface treatment, manufacturing technique and firing vary greatly between periods and places, but they do provide the key for understanding the intended use of the pottery, and the more specialized the pottery is, the better. The more uniform the pottery is, the more difficult it is, and this needs to be developed for any area and period we wish to survey.

Secondly, in order to study activity differentiation from a ceramic perspective, we need to study the full range of material, which we need to be able to sort consistently and efficiently in easily recognisable types as well as in large groups based on negatively defined characteristics. One possible tool for this is the chronotypology.

The chrono-/use-typology

My first survey experience was the *Troodos Archaeological and Environmental Survey Project* (TAESP) directed by Michael Given and Bernard Knapp straight out of the *Sydney Cyprus Survey Project* (SCSP). When we sat down in 2000 during the pilot season to plan the sampling and recording strategies, we had the advantage of standing on the shoulders of at least one generation of intensive archaeological surveys as well as the first artefact-based surveys, although not much was published, and I inherited the concept of the chronotypology from SCSP. The chronotypology was originally developed for SCSP as part of the chronotype-system by Nathan Meyer and Tim Gregory.[15] The *chrono-* prefix is a product of the primary concern of the survey finds studies of the 1980ies and 1990ies. One of the main changes made to the typology for TAESP focussed on the aspect of use (Winther-Jacobsen 2013), and I prefer to refer to it as a use-typology, but the original name has caught on, and it is easier to refer to it as such. However, although the chronotypology was the basis for the chronotype-system, it is important to stress that it is not synonymous with the chronotype-system.[16] The chronotypology only refers to the multi-purpose taxonomy. The typology was designed as a multi-purpose taxonomy of hierarchic and divisive structure, which means that it is a method of cluster analysis which seeks to build a hierarchy of clusters from the top down so that observations start in one cluster, and splits are performed recursively as one moves down the hierarchy (Figure 1).

In terms of sorting large amounts of pottery consistently, the chronotypology is a great tool. It is easy to develop and adapt to local circumstances and concerns. Of course adapting the chronotypology should be a collective effort as it requires the input of the multiple pottery specialists.

In the chronotypology, the interpretative purpose of use is only the first level.[17] At this level the categories are defined pre-sorting (Table 1). The next level is chronological, and at this level the categories are defined simultaneously with the sorting according to the physical properties of the pottery. The primary level of the chronotypology can be broken into two elements: identity and meaning. The identity is the sum of all the diagnostic physical properties of the class, which cannot be summarized briefly. The definition of identities is the nitty-gritty part of classifying.[18] The meaning is the broad collective meaning attached to the type concept, anything we know about the use of a type, which cannot simply be determined by looking at its members.

A large amount of undecorated body sherds always makes up the majority of any surface assemblage. It is tempting to ignore this group, but there is a reason why it is there and unless we tackle this problem, it is difficult to see how pottery studies can significantly increase the level of inference. The group is defined negatively by the absence of certain physical properties of the surface treatment, fabric, morphology, manufacturing techniques, and style, but there is none the less a lot of variety within this group, and for TAESP we chose to divide it into two categories, Heavy and Light Utility, according to the thickness of the wall. An arbitrary division set at 8 mm was chosen because although there is correlation between thickness of wall, size of vessel, and use, there are no fixed, culturally meaningful dividing-points. It is a non-historical criterion selected to enable the consistent incorporation of useful data from the large amount of otherwise unidentifiable sherds, and I have found these categories to be very useful.[19] Utility wares include among others the main production, storage, and 'industry' vessels. They represent an important body of information when examining changes in the patterns of land use. Sorting the large amount of undecorated body sherds with no further physical distinctions into two groups based on the wall-thickness, allows us to check for fluctuations in the distribution pattern to be evaluated against the patterns in the distribution of the well-researched types of pottery.

14 Winther-Jacobsen 2010a, 61-67.

15 Meyer 2003.

16 Meyer & Gregory 2003.

17 Winther-Jacobsen 2010a, 67-70.

18 Winther-Jacobsen 2010a, 65-67.

19 Winther-Jacobsen 2010a and b.

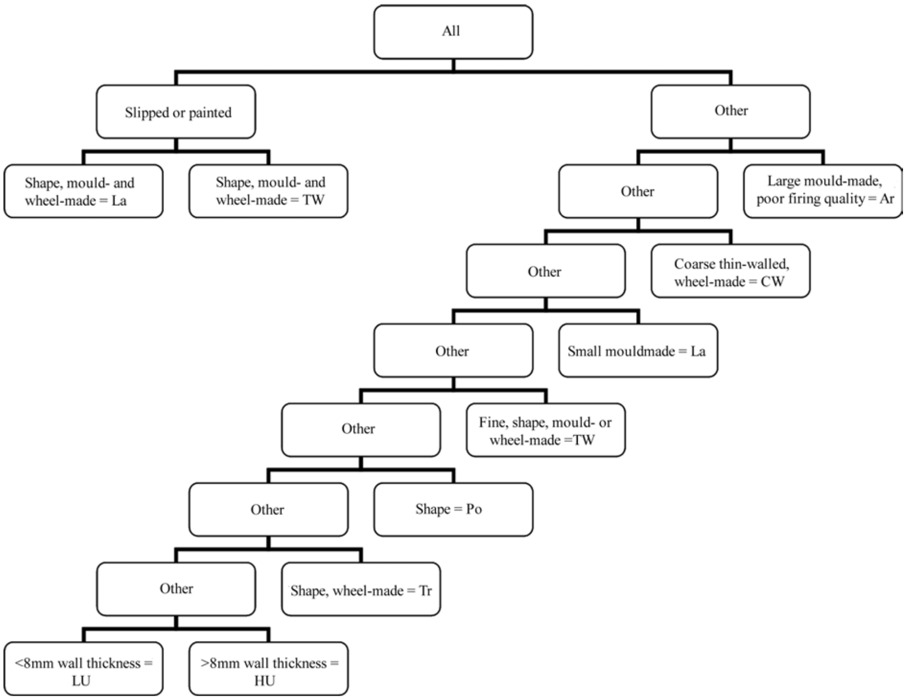

Figure 1: Sorting at use level in the TAESP chronotypology. Flow chart of the hierarchy of clusters from the top down so that observations start in one cluster and splits are performed recursively as one moves down the hierarchy (chart by author).

Code	Category	Meaning
Ar	Architectural	Domestic and public architecture
CW	Cooking Ware	Domestic and public cooking
HU	Heavy Utility	Domestic storage, *pithoi*, light industry, heavy industry (>8mm)
La	Lamps	Lamps
LU	Light Utility	Domestic dining, kitchen, light industry, burials, offerings (=<8mm)
PO	Personal Object	Adornment, personal interaction (*unguentaria*)
Sy	Symbolic	Domestic and public ritual, burial art, offerings, informational messaging (incl. miniatures and *kernoi*)
Tr	Transport	Transport *amphorae*
TW	Table Ware	Domestic dining, public and ritual dining, burials, offerings

Table 1: The functional level of the TAESP chronotypology (table by author).

Counting/sampling strategies

The third condition concerns the size and character of the sample: In order to study activity differentiation from a ceramic perspective, we need to be able to compare and differentiate our samples proportionally as well as in terms of size, which means we need quantifiable samples. This increases the size of the sample, and different projects have attempted different solutions to deal with this.

"Most of the artefacts if collected would be uninformative" is a statement true for early intensive surveys because 30 years ago pottery studies were different. There had been much less focus on non-table wares, and consequently there were very few *comparanda*. Consultants would typically be tableware specialists, and they could not be relied upon to go through everything, but would typically be invited to see selections of finds to confirm their chronological significance. However, the ambition to increase the level of inference beyond chronology led to the collection of so-called representative samples, which were assumed to reflect more closely what was actually present in the surface at any given time. But how can you truly know if your sample is representative?

The only way to create a genuinely representative sample is to collect everything and then select a representative sample according to your classification system. For TAESP, I inherited the representative sampling from SCSP, and in fact collecting everything and sorting at the end of the line was what some of the survey teams did during TAESP, especially at the beginning of the season and the less experienced field walkers. Also for TAESP we collected 31% of all the counted pottery, which is a high

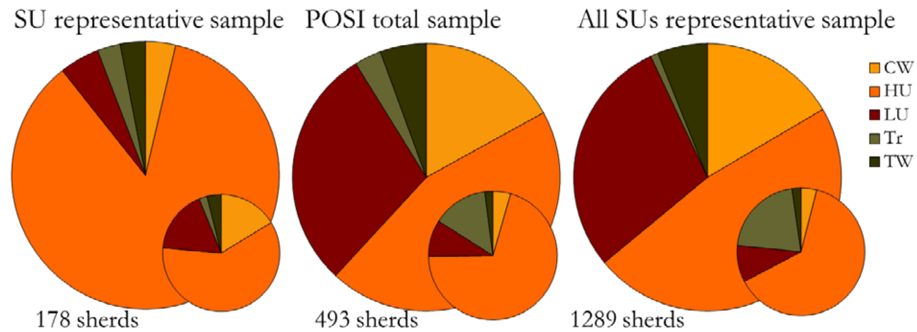

Figure 2: Comparison of the pottery indices from SU0622, TP104 and a compilation of all the pottery from the site. Comparison by raw counts (large pies) and weights (small pies), excl. tiles. For key to typology see Table 1 (figure by author).

percentage.[20] The problem is that there is no real way of testing if the sample is representative.

We may attempt to test our representative sample by re-surveying a certain percentage of the surface. I did this in 2004, resurveying 25% of the surface of a ploughed field, which had been surveyed the year before. First time around the field had been surveyed following normal procedures spacing field walkers five metres apart collecting a representative sample of the entire field.[21] The following year we laid out circles at regular intervals achieving a coverage of 25%, and within each circles my assistant and myself collected a representative sample. The resurveyed sample was not closely compatible with the sample from that individual Survey Unit, but comparing it to the aggregate sample of the whole site, the indices of the two samples were almost identical (Figure 2). Although somehow gratifying, it by no means proves that the sample was representative.

Consequently, I have given up on the representative sample based on types of pottery and chosen instead a total collection of a given percentage of the surface. Of course there is no easy answer as to how large a percentage we need to sample for the sample to be "representative" of the entire surface.[22] This depends entirely on the number of variables. In Crimea where finds were thinly scattered, we adopted an overall coverage strategy of 20% of the surface in blocks, but total samples were collected in smaller areas where multiple sherds had been collected in a discrete area by the block survey.[23] For the site survey at Papaz Tarlası in Turkey, where finds were thick on the ground, we adopted an overall coverage strategy of 10% of the surface in transects.[24] In between transects, sherds of special diagnostic significance were collected in a random sample. As has long been recognised, the random collection/grab sample is a valuable way to evaluate if you have missed certain types of pottery scarcely represented in the total sample.[25]

20 Given et al. 2013b, 25.
21 See n. 20.
22 Banning 2002, 124-130.
23 Attema et al. 2012b.
24 Winther-Jacobsen & Bekker-Nielsen 2017, 31-32.
25 Banning 2002, 113-114; Bintliff & Snodgrass 1985, 132.

Different parameters – alternative datasets

In order to distinguish truly behavioural phenomena of the ancient world in the distribution patterns we observe, we need to be able to evaluate the patterns consistently. We can do this by ensuring that our data collection strategy is complex enough for the ceramics to be sorted according to different parameters and by introducing different methods to create alternative datasets.

Because sherds get knocked about on the surface, weighing provides us with a way to calculate the average size of the sherds and thereby evaluate the relative age of the plough-zone population.[26] Weighing also provides another way of mapping the data, which allows us to turn the collected ceramics into two sub-datasets for comparison.[27] Figures 3-4 show the pottery indexes of two small rural sites on the plain of Koutraphas, and two mining settlements in the Lagoudhera Valley sorted according to the TAESP use-typology. There is a striking difference in the proportional distribution of heavy and light utility wares between the two types of sites which is consistent whether counted or weighed.[28]

Recording and calibrating visibility provides us with another way to evaluate if anomalies in the distribution pattern are in fact caused by changes in the visibility rather than behavioural phenomena. Many projects record visibility, and if we also calibrate the effect of visibility, we can multiply our sub-datasets from counting and weighing by two.[29] Changing the parameters of sorting allows us to evaluate the validity of the distribution patterns observed, are they likely to be the product of behavioural phenomena of the ancient world; or are they more likely to be the product of other factors such as collection strategies, post-depositional processes or visibility.

Sub-datasets are an important tool to evaluate the reliability of the patterns observed, but no matter how many different pottery based distribution maps

26 Dunnell & Simek 1995.
27 Millett 1979.
28 See also Winther-Jacobsen 2010a, 71-97.
29 Frederiksen et al. 2017, 311, figures 4-5.

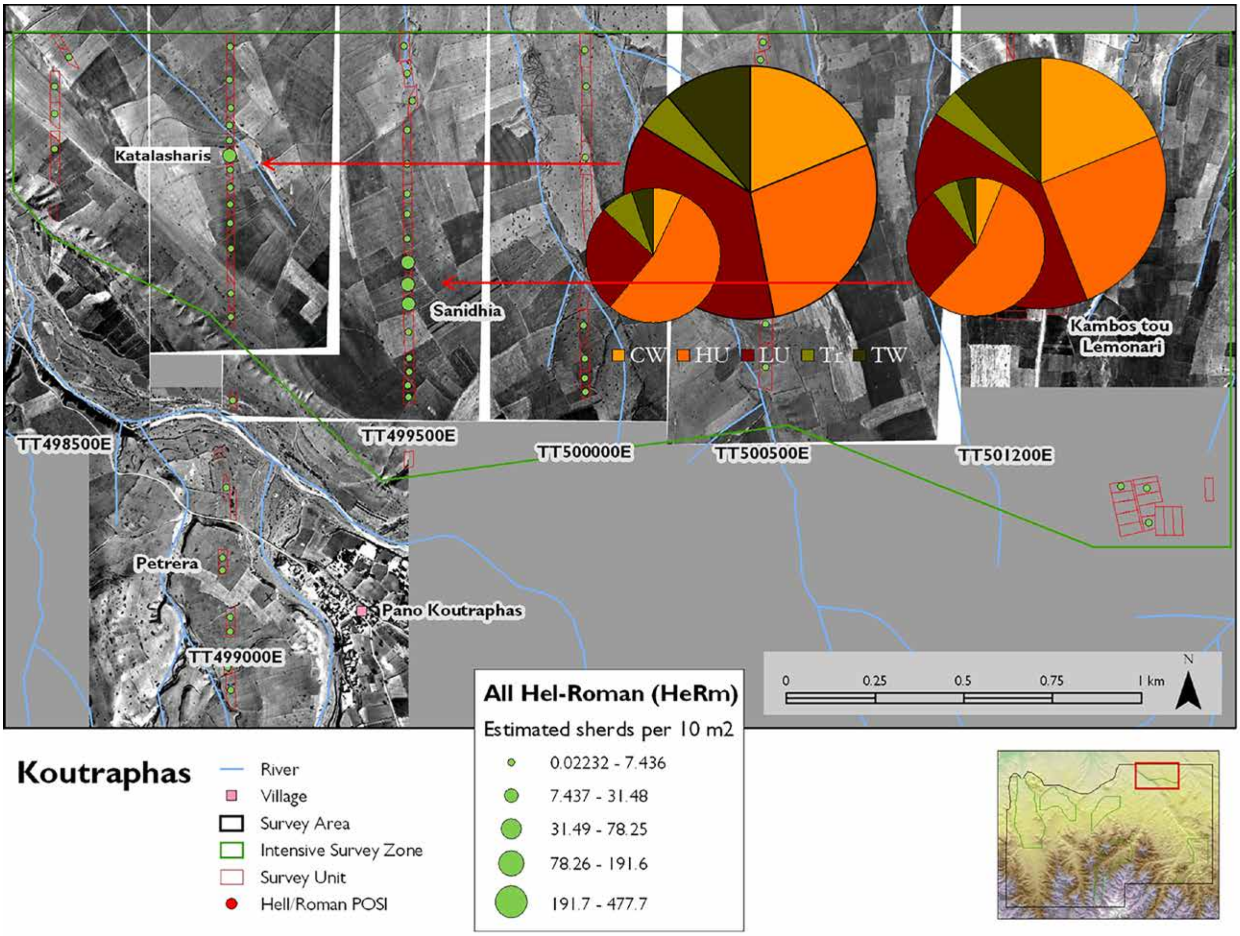

Figure 3: Agricultural settlements on the Koutraphas Plain, TAESP. Comparison of sites by raw counts (large pies) and weights (small pies), excl. tiles. For key to typology see Table 1 (figure by author).

we produce, pottery studies alone cannot answer the questions we wish to investigate. Therefore a multidisciplinary approach including geomorphology, remote sensing, geophysical survey and/or augering is essential. GIS allows us to quantify and map and thereby very quickly make out anomalies in the pottery dataset. Based on different survey methods it is possible to create alternative datasets to investigate the pottery anomalies and thereby recognise and confirm truly behavioural phenomena. Geomorphology, remote sensing, geophysical survey and augering provide us with alternative datasets to legitimize our interpretations and *vice versa*. At Papaz Tarlası in Turkey I was fortunate enough to survey a small site where geophysical survey had already revealed an easily identifiable structure, a Late Antique cruciform church with a peristyle with a fountain in it associated with two smaller structures.[30] Consequently, I had a chance to test the correlation between surface and sub-surface distribution of finds. In this case it was very strong both in terms of densities as well as indicating a clear spatial association of ceramics associated with food production. The distribution of *pithoi* and large basins is almost exclusively associated with the area of the two smaller structures – and down slope from it (Figure 5). At Papaz Tarlası total collections were sampled from 10 m^2 transects at 9 meter intervals, and several of these produced more than 10 kilos of ceramics. Even without the geophysical results, the large size/heavy weight of the sherds provided a strong indication that the plough-zone population was renewed with every agricultural episode, and thereby a close correlation between the surface and the sub-surface material, but this is far from always the case.

On the steppe of Northern Crimea, conditions for archaeological survey were often less than ideal due to

30 Winther-Jacobsen & Bekker-Nielsen 2017.

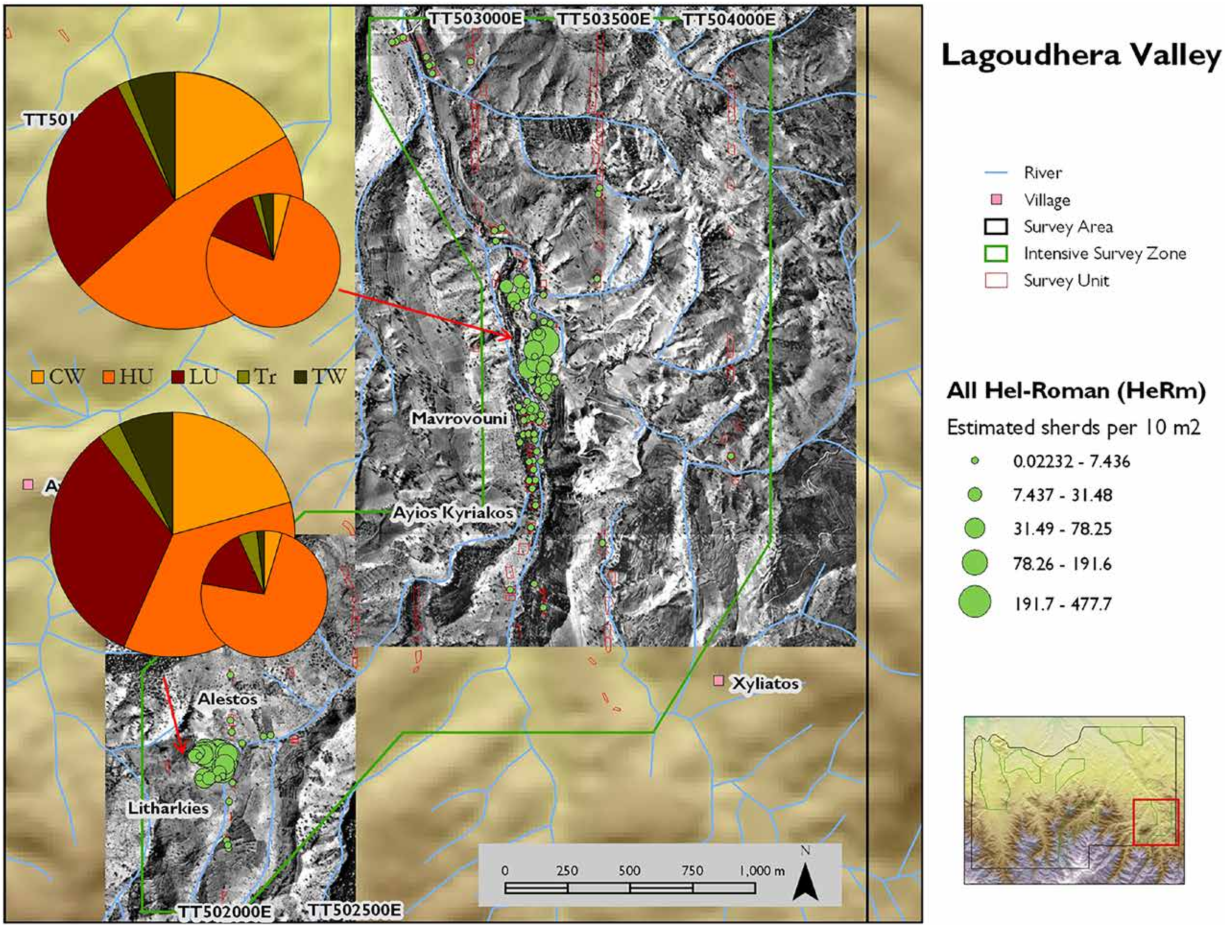

Figure 4: Mining settlements in the Lagoudhera Valley, TAESP. Comparison of sites by raw counts (large pies) and weights (small pies), excl. tiles. For key to typology see Table 1 (figure by author).

the sloping terrain and poor visibility.[31] We chose to be consistent in the spacing of the field walkers 10 metres apart and used GPS to navigate in an open landscape with few distinctive topographical features. Even under these circumstances we did collect pottery, if few and far between. The simultaneous geomagnetic survey confirmed that even very meagre finds were almost always associated with sub-surface structures.[32] For instance at site no. DSP08-H23-02, where the total collection on the surface consisted of two Hellenistic body sherds, geomagnetic survey identified the remains of an angular structure in the same area. This is something we would never have been able to suggest if we had only had the pottery dataset. Alternative datasets provide an important means to evaluate the reliability of the patterns observed thereby legitimizing our interpretations.

Recording/publication strategy

In terms of documentation survey material has always posed a special challenge, because drawings or even photos of body sherds and sherds with none of the original surface preserved do not provide much useful information in print. This means we have to find a different way of presenting the documentation. Catalogues including profiles of individual vessels and description of fabrics are necessary, but just as we need to be able to sort the pottery consistently into large, negatively defined groups; we also need to be able to present these groups for critical scrutiny. Some surveys have done this by publishing lists typically of the sherds collected at individual site level only.[33] Since then we have gone from including CDs to providing a complete online database.[34] These tools allow us to feel that we have documented the basis of our maps.

31 Winther-Jacobsen 2012, 23-26.

32 Winther-Jacobsen et al. 2012, 99, figure 4.277; Attema et al. 2012a, 246, no. DSP08-H23-02.

33 E.g. Gill, Mee & Taylor 1997; Cavanagh, Mee & James 2005.

34 E.g. Bintliff, Howard & Snodgrass 2007. For online databases see Given et al. 2007 (TAESP) and Knapp & Given 2003 (SCSP).

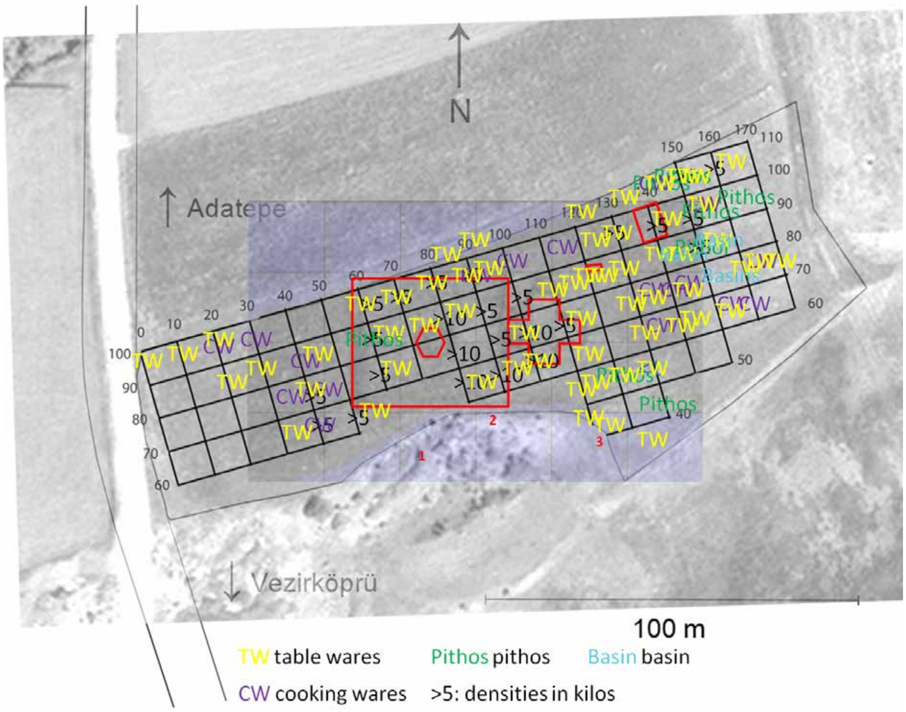

Figure 5: Papaz Tarlası, Turkey. The red lines indicate the cruciform martyrion church/complex and to the north-west two small rectangular structures. The distribution pattern is not quantified. It only indicates occurrence. The black numbers indicate the transects with the highest weight of finds, 5 kilos and above (map by author, based on Google).

Indeed lists and databases are useful, but only if one is very explicit about the typology according to which the pottery is sorted. Most ceramic categories are not as self-explanatory as we like to think, and unless the typology and sorting procedure are carefully explained, the lists are really only props, because they provide no real basis for critique – good or bad. Explaining our typology and sorting procedure explicitly, describing each chronotype and criteria for group assignment and referencing *comparanda* provide other scholars with the necessary tools to critically evaluate our results and interpretations. Potentially, it also allows us to use the data for comparative analysis, which is still the major challenge lying ahead of us. I believe we have already developed the tools to tackle this challenge and look very much forward to this next phase of landscape archaeology.

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Statistical distances on a map (STADION)

A method for exploring intra-site variability of pottery assemblages

Jesús García Sánchez

Abstract

This paper discusses ways to improve traditional approaches to survey results, which have mostly been based on a combination of cartography and statistics as the most appropriate methodological tools to analyse and display spatial information. I will highlight the importance of combining maps and multivariate statistics in order to understand spatial phenomena and gain insights into quantitative datasets recorded within the surveyed spatial geometries. A visual approach to studying pottery assemblages with Multivariate Visualization techniques will be presented, and a work-flow proposed for the examination of archaeological space, combining statistical distances and cartography with a new method called STADION: Statistical Distances on a Map.

Keywords: Survey Archaeology – Visualization – Multivariate Statistics – Statistical Distance.

Introduction

Some years ago, M. Llobera launched a thought-provoking paper discussing the role of visualization in archaeology, and establishing a claim for a new "Archaeological Science of Information" by summarizing different kinds of relevant data.[1] He points to two key references of quantitative data visualization, J.W. Tukey's early work on Exploratory Data Analysis,[2] and E. Tufte's work which boosted new visual developments with an extraordinary repertoire of what has been done in the historical emergence of data display.[3] These three publications are fundamental for our use of data visualization to both display and interpret archaeological survey data, and will guide the philosophy of the present contribution.

I will attempt to explore the role of statistics in the presentation and analysis of survey data, with special attention to spatial relationships. Space is, in the Cartesian western conception, largely reduced to cartography, i.e. trying to represent reality through maps or images. This conception is open to wide criticism about political ideologies biasing the study of cultural landscapes, from a quantitative perspective of depositional

1 Llobera 2010.
2 Tukey 1977.
3 Tufte 2001.

in A. Meens, M. Nazou & W. van de Put (eds), Fields, Sherds and Scholars. Recording and Interpreting Survey Ceramics, 21-30, Leiden: Sidestone Press. DOI: 10.59641/m11443py.

and post-depositional processes or from ideational or phenomenological perspectives.[4] Nevertheless, survey projects will probably never reject the powerful aid of a map in interpreting pottery scatters by displaying raw quantitative data, point-clouds or smoothed mathematical surfaces such as kernel densities.

Statistical representation also has a long tradition in archaeology; the paradigm of processualism (encompassing Tukey's work) and "New Archaeology" inaugurated the spread of a scientific approach in several fields of archaeology. This lively theoretical era of the archaeological discipline fostered the appearance of Computer Applications & Quantitative Methods in Archaeology (CAA), the first meetings of which were organized in 1973, and other publication series such as *Journal of Archaeological Science* and *Archeologia e Calcolatori*. In the paper noted above, Llobera criticized the current theoretical ladenness of data visualization, and looking at the origin of these journals, venues and the subjects addressed therein, we can clearly see how theoretical dynamics drove scientific visualization. B. Latour has also made some remarkable comments on what he calls 'inscriptions', two-way visualization to 'convince someone to take up a statement' or 'make more of facts'.[5]

Graphs and maps in survey archaeology

It is widely accepted that survey archaeology gained importance as a field of research thanks to the renewed interest of "New Archaeology" in the environmental processes that take place beyond the limits of the habitation centres. The popularization of GIS and a constantly increasing computation capacity fostered the era of Spatial (1970s-90s) and Landscape Archaeology (since the 1990s). Llobera highlights the historical importance of GIS in archaeological visualization from the very beginning of its introduction into archaeological practice.[6] This is deeply related to Kolácny's statement about the primal role of maps as vehicles for spatial information or 'broad communication systems'.[7]

As the above-mentioned work has stressed, there is an evident overlap between cartography and statistics, which produces the well-known topic of theme mapping (demography, social geography and so on). In survey archaeology we deal mostly with this kind of thematic cartography. Most early maps show proportional symbology as a way to communicate quantitative information. The production of thematic maps using proportional symbols has been widely discussed in the past, and the arguments given by different authors to support the practical and cognitive capacities of graduated circles are convincing.[8] Hence the technique is widespread, not only in archaeology but also in other fields.[9]

The advantages of graduated symbols are the easy conversion of quantitative data into symbol proportions, the efficient use of space, its visual effectiveness and, perhaps more importantly, the fact that the symbol does not unconsciously plot information about the area it represents (as a choropleth map does). That factor constitutes an important bias in survey data visualization, especially when dealing with regional surveys that use irregular survey units, such as the modern cadastre. In homogeneous areas, as in the case studies presented below, both graduated symbols and choropleths can be used to represent a single value, but the former is helpful when dealing with multivariate datasets because a circular symbol can be segmented to represent percentages (i.e. pie-charts) and the total quantitative data (proportional symbol).

STADION: the method

STADION is the acronym for Statistical Distances on a Map, inspired by the Classical Greek unit (a distance of 600 Greek feet, according to Herodotus). It is a method introducing statistical distance in the interpretation of pottery assemblages in survey archaeology. The method proposed below builds on this and aims to study local variation of pottery assemblages within a site context by using: 1. Multivariate statistics, chiefly dissimilarity and similarity coefficients, to analyse the variability in assemblage composition (normally employed in archaeology to build bi-dimensional plots such as dendrograms or clusters) and 2. GIS, in order to create a new spatial geometry to display the statistical information cartographically and thus give spatial meaning to the distance matrix produced by the statistical analysis.

The result is a network of lines representing the statistical distance (similarity or dissimilarity) with the orthogonal neighbouring assemblages.[10] The graph or plot can be created using any of the customary symbols contained in GIS software such as colour or thickness. The spatial nature of the graph allows it to be combined with any other kind of spatial datasets such as remote sensing, which has proven useful in understanding formation processes, functional change across areas and local geomorphology.

Below, I will explain the key elements which had to be taken into account for the creation of a STADION

4 Given 2004, 165.
5 Latour 1986, 4.
6 Llobera 2010, 195; Lock & Stančič 1995.
7 Koláčný 1969.

8 Brewer & Campbell 1998, 6; Brewer 2003; Nelson 1999, 11.
9 Flannery 1971; Meihoefer 1973; Brewer & Campbell 1998.
10 By orthogonal neighbour, I mean elements whose centroids (points or cells) are located at angles of 90 or 180 degrees to the specified one.

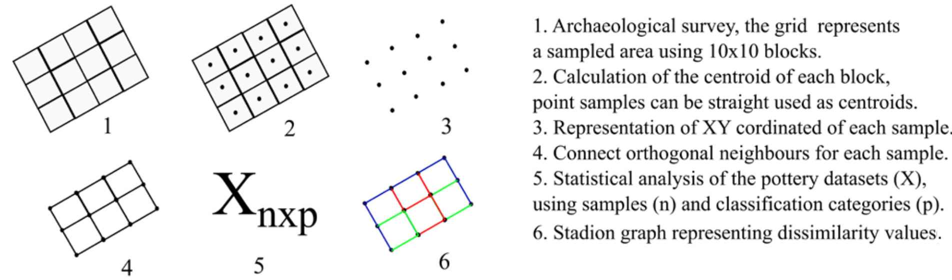

Figure 1: Schematic guidelines to construct a STADION graphic representation starting with an intra-site survey.

representation: archaeological samples, geometry calculations, classification and organization of data and Multivariate Statistical Analysis. These elements are similar in many intra-site surveys (sampling strategies, classification and interpretation). Thus the combined approach, using STADION, can be useful as part of the process of extracting meaning from surface assemblages.

Archaeological samples

Customary archaeological samples can be taken and recorded using any kind of spatial sampling design. Perhaps one the most commonly used in site survey is grid collection using evenly distributed blocks of a regular size: 10x10 or 20x20 metres (but the size is irrelevant for our purposes)[11]. Less traditional intra-site survey approaches use point-sampling, which can be applied to case studies where the original population (total amount of sherds present on the surface) is so large that total collection is not feasible. Other cases where the method can be applied is when the surface is covered by low vegetation and there is very poor visibility. In such cases, point-sampling serves as a window onto the surface record not immediately visible to the human eye, and it is less destructive and time-consuming than excavation.

Here, I use the term sample with regards to both the physical origin (XY location in space) and the archaeological assemblage involved in statistical analysis. In Mediterranean landscapes, survey assemblages will mainly comprise pottery. While the sherds may be recovered from any position within the sample, they will eventually be aggregated to the sample geometry, entailing a loss of spatial accuracy. As discussed above, the STADION method is a line geometry linking samples. Point samples can be recorded as discrete points in the space while blocks are areas adjacent to each other. In the latter case, we need to calculate the centroid of each block in order to create a line linking to adjacent blocks. A synthetic diagram of the STADION building process is presented in Figure 1.

Geometry calculation

Each sample has neighbours, which serve as nodes to create a new line geometry. This line geometry will eventually represent the variability of assemblage composition across the site focusing on micro-space changes, i.e. changes from sample to sample. In other methodologies, assemblages may be grouped using cluster- or k-means analysis resulting in bi-dimensional graphs. STADION adds the spatial context of such clustering techniques, potentially improving the understanding of other visual representations.

For the present study, only orthogonal neighbours were selected (see n. 10); these samples appear in the projection of 9, 90, 180 and 270 degrees from the original sample, following the orientation of the whole grid. Samples located on the edges of the grid will have three neighbour samples, and those located in the corners of the grid will have two. It is possible to include diagonal relationships as well, but omitting them enhances clarity, resulting in a neat visualization which can be modified for other purposes or case studies. The line geometry linking samples or sample centroids will have the length of the maximum scale of the original spatial sample. When using 10x10 m blocks, the lines will have a length of ten metres. We can automatically sort that information and calculate a line vector file (shapefile)[12] linking only neighbouring samples, and create an attribute containing the origin and the end of the line. From sample 1 to sample 2, the attribute will be labelled 1 to 2. To sum up, the basics for the construction of a line geometry which can subsequently express the values of a statistical distance is as follows:

1. Identifying orthogonal neighbours for each sample (minimum 2, maximum 4).
2. Extracting the XY coordinates (origin) of each sample (ID_origin) and the XY coordinates of neighbouring samples (ID_end).
3. Creating a new line geometry using XY origin and XY end coordinates.
4. Labelling each line with ID_origin and ID_end.
5. Creating a distance matrix within a statistical package.
6. Searching for the distance among ID_origin and ID_end.

11 For a more recent discussion on archaeological sampling and analysis of statistical datasets Stek & Waagen 2022.

12 The selection of orthogonal nearest neighbours has been done in QGIS.

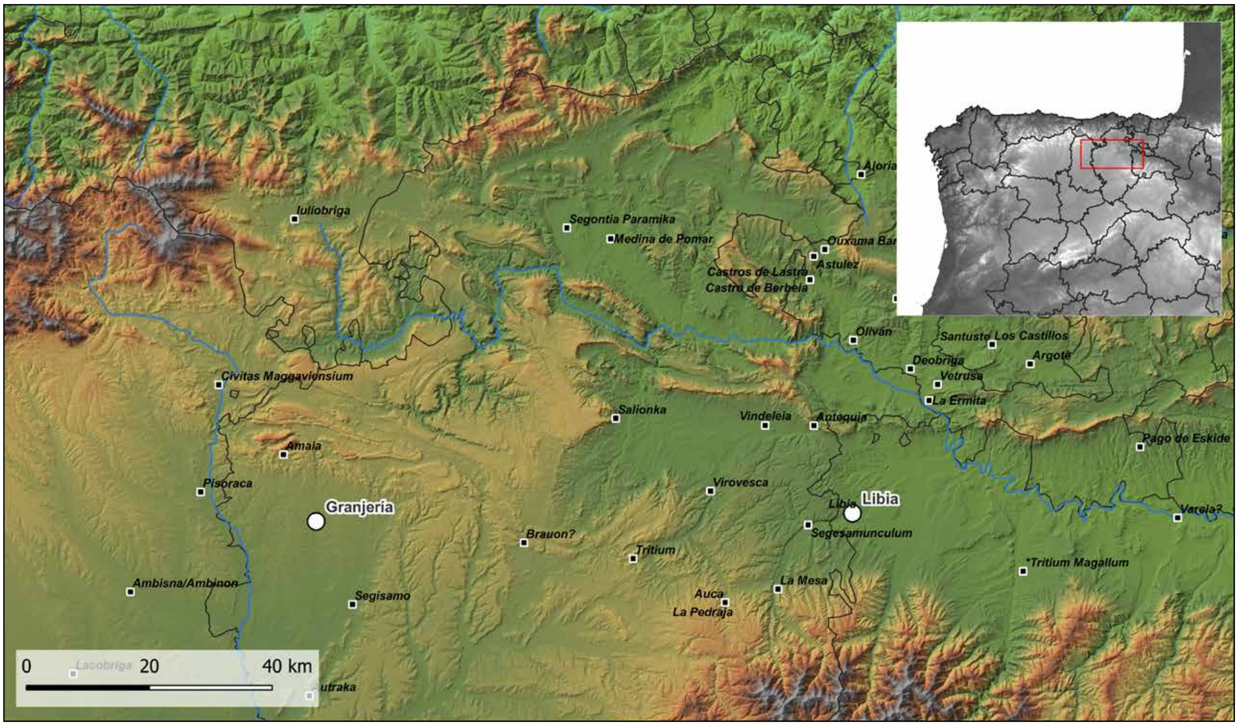

Figure 2: Location of sites mentioned in the text.

7. Linking the value to the line connecting the two samples.
8. Visualizing cartographically and modifying symbology to enhance interpretation.

This procedure helps summarize and visualize the variability of assemblage composition across the site's extension, plotting not only single elements but the entirety of the archaeological evidence retrieved during a survey. This leads us to the next discussion item, classification.

Classification and organization of survey data following K. Winther-Jacobsen

Classification of the archaeological data, e.g. pottery, is an essential step for any surface interpretation, since it provides basic information about chronology and function. Different surveys use different classification systems, in one way or the other expressing the two mentioned elements (chronology and function). But classification can only work with diagnostic sherds, which constitute a limited percentage of any assemblage. Low diagnosticity is indeed an acute problem in survey archaeology needing methodological development, as discussed in several papers in the present volume.[13]

Kristina Winther-Jacobsen[14] (henceforth KWJ) has reflected on the limited information that most survey sherds convey, proposing a functional typological model which could be useful for classifying survey pottery more effectively. Her classification comprises six basic types based on attributes with functional significance, such as coarseness and crafting technique which can be easily distinguishable in most cases: Table Ware, Cooking Ware, Light Utility Ware, Heavy Utility Ware, Amphorae Transport, and Building Materials. This classification was used at one of the sites presented below, the Late Roman villa at Granjería[15]. The survey assemblages from another site, Libia (Herramelluri, Spain)[16] (Figure 2) was classified according to completely different systems, elaborates categorizations aimed at enabling a characterization of its complex reality. I have "translated" the original pottery classification to the KWJ categories.

The Libia survey classification system has 33 pottery categories and comprises element notions as technology (e.g. handmade), decoration (moulded, painted, plain), production (Italic, Gallic or Hispanic sigillata), and

13 E.g. Krijnen, Waagen & Hilditch, chapter 7.

14 Winther-Jacobsen 2008.

15 Granjeria, Sandoval de la Reina is one site within a larger project addressing several Roman rural sites in the Dueron valley, see García Sánchez 2017b.

16 Data from Libia survey stems from the publication of Ariño Gil et al. 2019.

sometimes also chronology (early Hispanic and late Hispanic sigillata). Functional interpretation encompasses categories such as the most standardized and recognizable table- and kitchen wares; other categories are less easily assessed.

The KWJ classification was used to perform statistical analysis (dissimilarity and similarity coefficients), as explained below. It is possible to feed any kind of data from different classification systems into statistical software. However, the KWJ classification, which produces an easily understandable output where information about Table Ware, for instance, is not fragmented into different groups such as Black gloss, Italic terra sigillata, African red slipped, moulded Gallic sigillata and so on.

Multivariate Statistical Analysis: dissimilarity and similarity

The multivariate method was inspired by a 1970s paper by S. LeBlanc and P. Watson.[17] They proposed a classification of Halafian pottery using vessel forms and design elements to calculate similarity coefficients among seven archaeological sites, and mapped (diagrammatically) the statistical distances separating these sites.[18] Using current state-of-the-art GIS mapping, it is feasible to improve the representation output, so that it can function as a new kind of tool to interpret pottery scatters, taking into account the composition of the studied assemblages.

Despite there being 'no agreed upon best measure of similarity'[19], similarity measures are the most commonly used index by which to compare sites. It is especially popular in 'species composition'[20], a long-established tradition in biology and ecology that archaeologists began to tap into beginning with the 1980s.[21] There are several dissimilarity and similarity indexes which work with different kinds of data, for example quantitative, qualitative and absence-presence.[22] One of the main advantages of the STADION method is that it can visualize data using any kind of index, by representing a statistical value (attribute) with the newly generated line geometry. Thus, acknowledging that 'the choice of a similarity measure between groups is subjective and intuitive'[23], the researcher is free to choose any kind of index with the STADION method, because it is compatible with all measures of similarity.

For the case studies discussed below, I have chosen two different measures, Euclidean distance and Pearson distance. The former is a simple but intuitively appealing dissimilarity measure which can be calculated for different variables and plotted in a bi-dimensional graph.

17 LeBlanc & Watson 1973, 131.
18 Ibid., fig. 12.
19 Read 2009, 135.
20 Diserud & Odegaard 2007, 20.
21 Baxter 2001, 715.
22 Drennan 2009, chapter 22.
23 Read 2009, 136.

The dissimilarity value can be extracted from the resulting matrix and plotted using the STADION line geometry. The latter is a similarity coefficient related to the Pearson correlation, a very popular index of correlation among variables which gives information about the strength of a correlation and its direction. It can be a positive and a negative correlation, and the resulting value ranges from -1 to 1, 0 being a complete absence of correlation. Both these measures are suitable for data exploration, and are also easy to interpret by non-statisticians. Below, the case studies analysed with the STADION method are presented, while the elements of sample size and chronology and their relationship with the method will be discussed in the conclusion.

STADION case studies

Brief introduction to the intra-site case-studies

Granjería is a Roman villa, dated to the 3rd and 4th centuries AD, in the northern plateau of the Duero basin in Spain (Villadiego, Burgos). The site is located in the uppermost sector of a natural slope controlling the Odra river flow, at a safe distance to avoid flooding and thalweg movement, which seem to have occurred frequently in the past, judging by the many cropmarks and the pebble matrix in the lower parts of the slope. The site has been interpreted as an aristocratic residence similar to many others in the region, e.g. La Olmeda, Quintanilla de la Cueza (Palencia), Baños de Valdearados (Burgos) and Almenara-Puras (Valladolid).[24] The survey carried out in 2012 aimed at defining Granjería's extension, chronology and relationship with the surrounding landscape and other secondary settlements.

The second study case, a sector located around the Roman city of Libia (Herramelluri, La Rioja),[25] is instead located on the upper course of the Ebro river in Spain. Its existence began in the Late Iron Age; the Roman city was then built after the conquest of the northern peninsula (2nd century BC) and had an important military role, judging by traces of several army camps. It appears to have been inhabited into the Late Roman period. The survey project here involved artefactual survey (grid collections), geophysics (magnetic and GPR carried out by SOT Archaeological Prospection[26]) and remote sensing (oblique photography and satellite imagery), the main aim being to characterize different urban spaces and define the occupation of different parts of the city and the surrounding landscape, including a *mansio* (waystation) close to the Roman road (*De Italia in Hispania*), and

24 García Entero 2008; Chavarría 2005.
25 Ariño Gil & Novoa Jauregui, 2007; Ariño Gil et al. 2019,
26 Ariño Gil et al. 2019,

Figure 3: STADION graph of the Late Roman site of Granjería, Sandoval de la Reina (Spain). Background image: PNOA 2009-IGN.

explore the land division in Bañares. For this paper, only the so-called *mansio* sector has been selected to illustrate the results of the STADION method.

The Late Roman villa of Granjería, Burgos

The Late Roman villa of Granjería is located near the modern village of Sandoval de la Reina, in the municipality of Villadiego (Burgos, Spain). The site is important in the general context of the Late Roman settlement pattern in central Spain in the 4th and 5th centuries CE. At that time, several new large sites developed in the landscape of dry agriculture, some related to previous settlements, others *ex novo.* In 2012, a survey project was initiated to document two unexplored sites: La Tejera (Villavedón) and Granjería. A first recording strategy based on hand-held GPS survey revealed the existence of a large Roman-era building on top of a platform overlooking the Odra valley. The scattered disspersion and apparently homogeneous composition of ceramic assemblages were selected as a study case for a detailed intra-site survey, with larger pottery collections, and thereafter more specific statistical analysis and data visualizations.

The collection strategy for the pottery was total collection within a gridded area of 10x10 m blocks. Building materials were counted, weighed and eventually discarded where it had been collected in the field. Only relevant pieces of flooring, moulded elements and bath building materials were documented individually, and some were also drawn. All the pottery sherds were taken to the laboratory and sorted according to the classification scheme proposed by Winther-Jacobsen.

Aside from the functional classification, we employed a more detailed classification for specific kinds of pottery. Table Ware, which in our case study comprises only Late Hispanic Sigillata, was sorted using the typology of P. Peralta[27] and the more traditional Dragendorff classification. The utility wares were subdivided following the extensive repertoires studied by Aguarod[28] and Beltrán[29] in supra-regional (Tarraconensis) contexts, and Bermejo[30] for regional parallels.

In total, 96 units (10x10 m) were surveyed and sampled. All units yielded a strong presence of building materials as well as domestic material not represented in the figures

27 Paz 2008.
28 Aguarod 1991.
29 Beltrán 1990.
30 Bermejo 2013.

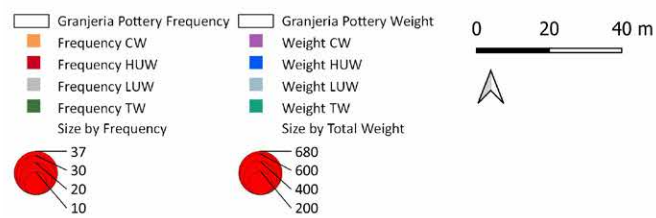

Figure 4: Spatial representation of frequency and weight of Table Ware (TW), Heavy Utility Ware (HUW), Light Utility Ware (LUW) and Cooking Ware (CW). Size of charts according to the sum of wares. Location: Granjería, Sandoval de la Reina (Spain). Background image: PNOA 2009-IGN.

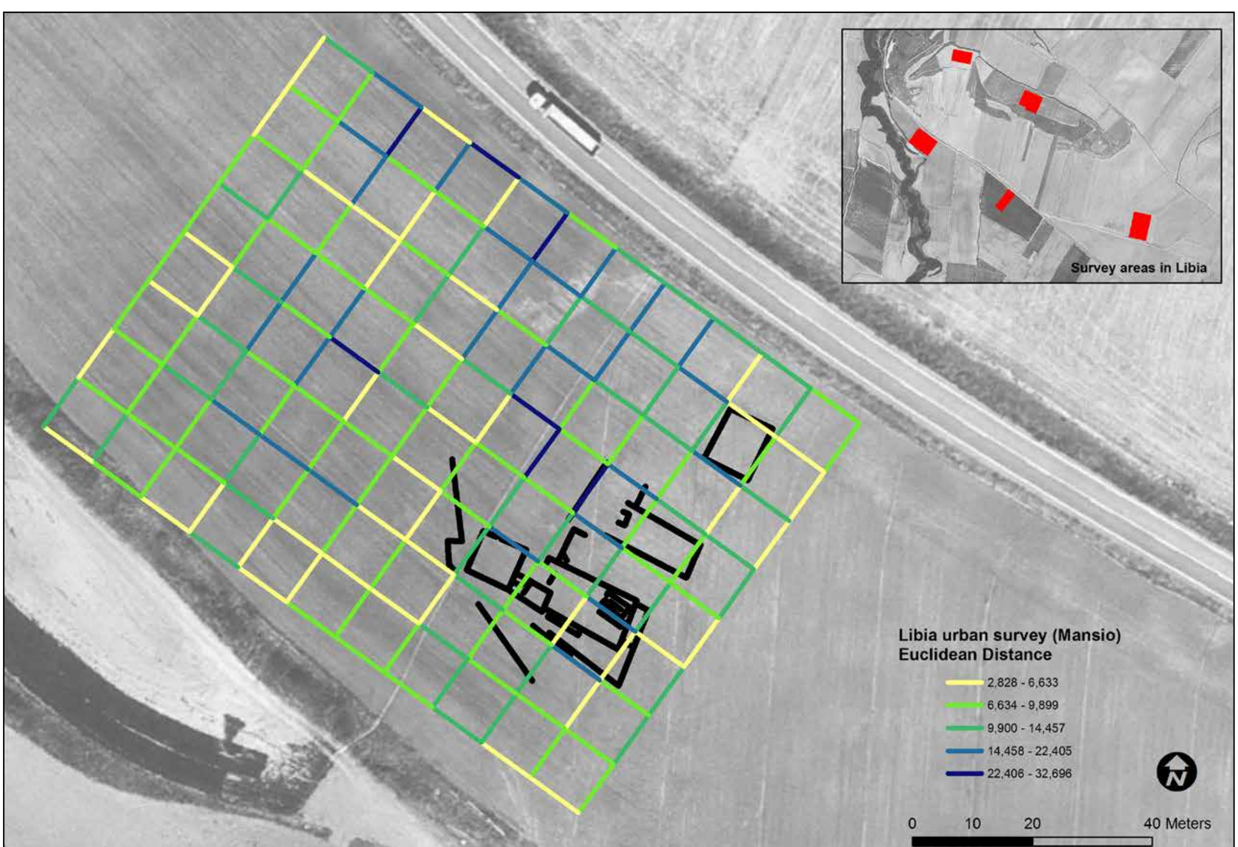

Figure 5: STADION graph of the *mansio* at Libia, Herramelluri (Spain), including the GPS results (by R. Sala). Background image: PNOA-IGN.

for clarity. The STADION graph, using Euclidean distance, reveals two areas with very dissimilar assemblages (see Figure 3 and Figure 4). At the southern edge of the grid, on the other hand, the variability is much reduced and it becomes evident that the more homogenous assemblages correspond to marginal areas of the built structures, or even off-site activity as demonstrated in other Rural sites in the same region, i.e. Tisosa site near the Roman city of *Segisamo*[31]. The areas with higher variability appear independent from each other, perhaps indicating intra-site functional differences which can be further explored by studying the variability of the specific types (Figure 4).

Figure 4 indicates the location of areas were the frequency of Table Ware (TW) is higher than in the peripheral areas of the site. Nevertheless, the representation of weight (in grams) also shows an important presence of Heavy Utility Wares, chiefly Dolium, that exceeds the total weight of smaller fragments of TW. This result is similar to what has been achieved at the Roman rural site of Tisosa[32], where most of the TW, storage and kitchen wares appear within the boundaries of the interpreted site. Meanwhile, the scatter of debris and building material is distributed randomly throughout the area. The north-western sector of the survey area shows a more striking relevance of both frequency and weight of HUW, perhaps related to the storage/ productive area of the site.

Libia, Herramelluri (La Rioja)

In 2016, an urban survey was carried out at different areas of the Roman city of Libia, located on a hilltop and its southern slopes in the municipality of Herramelluri (La Rioja, Spain). The urban area seems very well preserved, judging by aerial and satellite imagery, as is the immediate hinterland where numerous cropmarks can be spotted. In most cases, these stem from activities of the Roman army. The survey was carried out in five different areas of the Roman city and its vicinity. The STADION experiment uses datasets from the publication of a sector located immediately southeast of the city perimeter, as an example. Here, aerial photography and geoprospection (GPR, under the direction of SOT & Roger Sala, overlapping the entire grid) revealed an isolated building close to the Roman road (*De Italia in Hispania*). It was interpreted as a *mansio* based on Corsi's publication on architectonic parallels elsewhere in Italy.[33]

The area was surveyed using a grid of 10x10 m blocks, and all kinds of materials were picked up by the surveyors. Eventually, 88 units were surveyed, and 3911 sherds were collected and subsequently analysed by E. Ariño and R. de Soto. In this case, the interpretation of the STADION graph displaying Euclidean distances (Figure 5) is less evident. The variability between assemblages is higher in the northern sector, which is closer both to the modern road and to the Roman city centre. This pattern could be indicative of urban post-depositional activity, similar to that studied by Mlekuž at Trea (Picenum).[34] The surface scatters from the area immediately outside the wall could be associated with activities like garbage disposal or off-site dwelling as well as natural transformations (see also the contribution by Peeters, Bes and Poblome in this volume).

The area occupied by the *mansio*, on the other hand, is most likely indicated by local variations in assemblage dissimilarity. This is precisely what we are aiming at with this new visualization method – to detect functional differences by exploring all the data at once using GIS and statistical methods.

Discussion and conclusion

In this paper, a tool combining different methods such as modern GIS-based cartography and statistical distances with topological and geometrical basis has been presented. The main aim is to overcome the static situation of survey representation and mapping. The paper also presents a work-flow that can be applied to various case studies and adapted to multiple scenarios. The method itself suggests a way to display statistical information; the usage of the basic datasets depends on each scholar. For example, in the case of well-studied and rich datasets, the data can be filtered by chronology and thus enable different interpretations for each chronological phase. Difficulties may concern the composition of the datasets themselves: the assemblages are not homogeneous in terms of total amounts of pottery retrieved, thus the sample size will influence the statistical results unless further processes such as data normalization are applied before calculating statistical distances. One of these cases has been studied elsewhere, representing standardized values of the contribution of each functional category to the Principal Components.[35] Another disadvantage of this approach is the limited chronological information on coarse ware, although the method seems to be useful for studying functional variability. The main conclusion is thus that adapting the proposed STADION visualization method to traditional statistical analysis and intra-site case studies is a feasible method. It is easily adapted to the study of intra-site distribution of pottery, in survey projects which employ systematic strategies in the collection and analysis of their data. It is a tool combining the visualisation of space and statistical analysis of pottery and has significant potential in survey archaeology, combining geophysical and pottery information.

31 García Sánchez 2023.
32 García Sánchez and Cisneros Cunchillos 2014.
33 Corsi 2000, 246.
34 Vermeulen, Slapšak & Mlekuž 2013.
35 García Sánchez 2017, Figures 5 and 6.

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Diagnostic visibility and problems of quantification in survey assemblages

Examples from the Mazi Archaeological Project (Northwest Attica)

Christian F. Cloke, Alex R. Knodell, Sylvian Fachard & Kalliopi Papangeli

Abstract
The pottery collected by the Mazi Archaeological Project provides evidence for human activity in the Mazi Plain from the Neolithic to the present. Notably abundant are ceramic remains from the Classical, Late Roman, and Byzantine periods, representing a variety of settlement, fortification, and agricultural sites. Like many surveys in Greece, we have noted that periods with greater diagnostic 'visibility' tend also to have the most material associated with them. Remains commonly associated with other periods can be much more ambiguous, especially when it comes to coarse wares.

One way to deal with this discrepancy is by using a dating system whereby sherds are assigned a start and end date of manufacture rather than a single period. This allows us to filter the results of the survey based on the degree of certainty (or range of possibility) we desire. Database and GIS technologies allow us to query and display date ranges in a variety of ways, including a spectrum of definite and possible representations of periods across the landscape. This paper examines a range of possibilities for well- and poorly represented periods of ceramic distribution across the Mazi Plain, and considers how such an approach contributes to a more nuanced understanding of diachronic settlement patterns.

Keywords: Siteless Survey – Survey ceramics – Coarse Wares – Diagnosticity – Chronological Visibility – Quantification.

Introduction
The Mazi Archaeological Project (MAP) is a diachronic regional survey in northwest Attica, operating as a synergasia between the Ephorate of Antiquities of West Attica, Piraeus, and the Islands and the Swiss School of Archaeology in Greece.[1] The study area is the Mazi Plain,

1 The project is co-directed by Sylvian Fachard, Alex Knodell, and Kalliopi Papangeli. Christian Cloke has spearheaded the project's program of pottery analysis, as well as major elements of database design. For current scholarship and fieldwork see: Fachard 2013; Fachard, Knodell & Banou 2015; Knodell, Fachard & Papangeli 2016; Knodell, Fachard & Papangeli 2017; Papangeli, Fachard & Knodell 2018; Fachard, Murray, Knodell & Papangeli 2020.

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a fertile limestone valley in the Kithairon-Parnes range that forms the border between Attica and Boeotia. Its position on the main route between Athens, Eleusis, and Thebes makes it a natural crossroads, as well as a significant agricultural and economic surface.

This paper examines ways in which MAP has approached the quantification and analysis of collected pottery. Ceramic finds show signs of activity in the area from the Neolithic period to the present; to judge by sherds datable to a single period within this range (e.g. Geometric or Early Modern), settlement and land-use peaked in the Classical to Hellenistic, Late Roman, and Byzantine periods. While these intervals may well represent high levels of activity in the area, an implied lull in the preceding, intervening, and subsequent eras is harder to countenance based on negative evidence alone. Instead we suggest that this particular chronological distribution of finds is, in part, a byproduct of variable diagnostic 'visibility' (referring to the tendency for recorded assemblages to be dominated by sherds produced in periods when easy-to-spot and identify glazed and combed pot surfaces were common).

Because of our inability to identify all finds of all periods with surety – particularly when it comes to plain, coarse pottery – certain past periods (e.g. Early to Middle Roman) may appear disproportionately 'empty' in distribution maps. Periods without strong, specific signatures may become more apparent only when more broadly dated pottery is considered, and thus a significant loss of information is possible due to a failure to deal with less diagnostic material. Rather than advocating an approach that pushes ceramics experts to ascribe probable dates or degrees of certainty regarding chronologically ambiguous sherds, we believe that the material itself can be classified by varying degrees of specificity in a way that promotes model building and the development of informed inferences about periods of seemingly low-level activity.

The method presented here deals with the full range of pottery from the MAP survey. In this dating system sherds are given a start date and end date corresponding to the earliest and latest periods in which our pottery experts believe they could have been manufactured (for example, Classical to Middle Roman or Early to Middle Byzantine). This allows us to filter the results of the survey and modulate the degree of dating precision we require: in this way we can choose to view sherds certainly datable to a short interval in isolation, or plot them in views of the survey area alongside the many hundreds of other sherds that may or may not be contemporary. This paper describes our methodology and assesses evidence for settlement patterns in a range of past periods, both well-represented and more difficult to detect. We argue for embracing uncertainty and imprecision as important considerations for survey assemblages, and illustrate ways in which the quantification and mapping of ambiguous finds can contribute to more nuanced understandings of diachronic settlement patterns.

History of the problem

Variable ceramic visibility and diagnosticity, the notion that pottery of certain periods is more easily noticed and/or dated than that of other periods, has been recognized as a challenge by practitioners of survey archaeology in Greece since the Minnesota Messenia Expedition in the 1960s.[2] Awareness of this issue became especially acute, and discussion of it prevalent, during the 1980s and 1990s, following the work of such large, data-rich regional surveys as the Kea Survey, Nemea Valley Archaeological Project, the Boeotia Project and the Pylos Regional Archaeological Project.[3]

Pettegrew has highlighted the many ways in which differential visibility of ceramics belonging to particular periods may contribute to a picture of the countryside characterized by repeated cycles of 'boom and bust.'[4] In response to this line of critique, and amid a growing body of scholarship on aoristic analysis (i.e. that which attempts to model temporally uncertain or unspecific events and their material traces), Bevan, Conolly, and colleagues on the Antikythera Survey have advocated a novel approach utilizing probabilistic modeling to compensate for uncertainty in the dating of survey pottery and period-to-period variance in ceramic visibility.[5] This method is designed to predict the probability that certain sherds might date to a given period, based on the general and localized patterning of finds from the Antikythera Survey, and thereby suggests the most likely scenarios for temporal distribution of finds. Ultimately, this approach considers 'the degree to which the uncertainty associated with one period is linked to the uncertainty associated with another.'[6] While such aoristic or probabilistic approaches have shown great promise, the 'certainty' values they ascribe to experts' evaluations of the material insert an additional level of abstraction into the quantification process, and the resulting maps of finds (according to confidence or probability) can be difficult

2 McDonald & Rapp 1972.

3 For Kea, see Cherry, Davis & Mantzourani 1991, 330; for the Nemea Valley, see, e.g. Wright et al. 1990, 609, n. 60; Athanassopoulos 2016, 5; for the Boeotia Project, see Bintliff, Howard & Snodgrass 2007, 18-37; for the Pylos Regional Archaeological Project, see Davis et al. 1997, 419, 434; Alcock et al. 2005, 194-196. Rutter (1983, 137-139) also recognized this problem as the second wave of archaeological surveys was taking off in Greece. Sanders (1984), in re-considering the previously underestimated Medieval evidence from the Melos survey (see Renfrew & Wagstaff 1982), demonstrated that ceramic visibility could pose serious analytical problems for surveys, particularly when the expertise they applied to finds was not uniform for all past periods.

4 Pettegrew 2007, especially 744-745, 749-751; 2010, especially 218-221. See also Fentress et al. 2004; Caraher, Nakassis & Pettegrew 2006; Quercia et al. 2011, 50 ; Knodell et al. 2023, 294-295.

5 On aoristic or probabilistic modeling, see, e.g. Johnson 2004; Crema, Bevan & Lake 2010; Crema 2012; Verhagen et al. 2016.

6 Bevan et al. 2013, 327. For more on this project in general, see Bevan & Conolly 2013.

to interpret and evaluate for those without an intimate understanding of the statistical analyses involved.

In the present paper we advocate for an approach wherein every sherd is dated with *certainty*, but with varying degrees of *precision*. In such a way, pottery experts are asked to assess the material honestly and to express their candid impressions of finds, assigning them to a single period when warranted, while using broader date ranges when pieces have a lower level of diagnosticity. We suggest that the chief virtues of this approach are its malleability, the ease of replicating the method on other projects, and its overall capacity for visualizing precisely and imprecisely dated survey ceramics in a geospatial context.[7] Ultimately, we believe that the spatial representation of our approach using GIS is easily legible even for non-experts in survey archaeology, and allows for the visual analysis of maps to become a key component in interpreting the chronological patterning of finds.

Our approach

Our methods combine Mediterranean-style intensive pedestrian survey with more extensive, exploratory survey to map and document archaeological features throughout the survey area. For each survey unit, fieldwalkers proceed side-by-side across the landscape, spaced 10 m apart, observing and collecting artifacts within a two-meter wide swath: for each survey unit, then, a 20% sample was subject to quantification and collection. Within each transect, fieldwalkers counted all ceramic artifacts (pottery and tile) and collected all diagnostic and representative sherds for specialist analysis (i.e. sherds whose physical properties, such as shape, surface treatment, or fabric, provide some indication of their chronology or typology); typically, if there were multiple body sherds of the same fabric from a survey unit, a single representative piece would be retained for further study. Ceramics specialists were involved in fieldwalking and site visitation, becoming aware of the survey area and the conditions governing collection; this also meant that they were in regular communication with field teams.[8]

Database design and recording of pottery

In our database, all sherds collected by the survey are described in terms of their physical properties, including surface treatment, fabric, vessel shape, and function, as well as the part or parts preserved (such as rim, handle, base, etc.). Then each piece is assigned a start period and end period, which correspond to and trigger the entry into the record of absolute dates drawn from our chronological system. For example, a start date of Classical and end date of Early Hellenistic will give a sherd an absolute date range of 480 to 220 BC, or a range of 260 years.

In addition to diagnostic shapes and surface treatments, ceramic fabrics became a major focus in our documentation. As have other surveys, we used ceramic fabric as an important diagnostic factor in dating and determining the functional character of pieces that otherwise would have proved challenging to identify.[9] We noted striking similarities between ancient historical (i.e. Archaic to Late Roman) and Byzantine coarse fabrics, illustrative of recurrent cycles of local and/or regional raw material procurement and production of coarse wares. This correspondence demonstrates a challenge of working with such material, in that unstratified finds could not always be distinguished as either ancient or Medieval, and often had to be assigned very broad date ranges.

Each period in our database corresponds also to a slightly more general era – such as Late Helladic, Greek (Archaic to Hellenistic), or Byzantine – and a far broader epoch – such as Bronze Age, Ancient (historical), or Medieval (Figure 1). A series of fields in the pottery database table evaluate the start and end periods assigned to each piece to determine whether it belongs to a single chronological period (e.g. Archaic, Hellenistic, Late Roman), a pair of consecutive periods (e.g. Early to Middle Roman), a discrete era (e.g. Roman), or an epoch of longer duration (e.g. Ancient historical or Medieval). The database then determines the most precise information available for each piece or 'lot', based on a hierarchical ordering of these different categories of date range: if a specific single period cannot be determined, then a two period range is used; if this cannot be done, then the piece's era becomes its defining chronological description, and so on. We find this approach preferable to those that weight sherd counts based on the number of periods to which finds are assigned (for example, making a Classical to Hellenistic sherd worth ½ of a sherd in each period, an Archaic to Hellenistic sherd ⅓ of a sherd in each included period, and so on), which creates rather hypothetical counts abstracted from the actual number of finds encountered.[10]

7 The Kea Archaeological Research Survey (KARS) has employed a digital recording strategy similar to our own, which uses iPads in the field and an integrated Filemaker database, like ours designed with the input of John Wallrodt at the University of Cincinnati. See also Nazou et al., this volume.

8 On methods, see Fachard, Knodell & Banou 2015, 180-181. For the application of similar methods elsewhere see Knodell et al. 2017.

9 The Sphakia Survey, for example, found that 85% of their pottery was undecorated; 70% of that was coarse; 40% had no surface preserved (Moody et al. 2003, 79; Winther-Jacobsen 2010, 29). This survey also noted a particularly close correlation between the function of sherds/pots and the physical properties of the fired clay from which they were made, often tailored to how a vessel would be employed (e.g. for cooking, storage, etc.). For other recent approaches to fabric analysis by field survey projects, see Kiriatzi 2003.

10 For a general discussion of quantification in survey, see Fentress 2000. See also Cloke 2016, which grapples with this issue and considers the utility (or futility) of density counts comprising sherds counted as fractions thereof across multiple periods.

<table>
<tr><th>Period</th><th>Era</th><th>Epoch</th></tr>
<tr><td>Archaic
(700-480 BC)</td><td rowspan="7">Greek</td><td rowspan="10">Ancient Historical</td></tr>
<tr><td>Classical
(480-323 BC)</td></tr>
<tr><td>Early Classical
(480-400 BC)</td></tr>
<tr><td>Late Classical
(400-323 BC)</td></tr>
<tr><td>Hellenistic
(323-31 BC)</td></tr>
<tr><td>Early Hellenistic
(323-220 BC)</td></tr>
<tr><td>Late Hellenistic
(220-31 BC)</td></tr>
<tr><td>Early Roman
(31 BC-AD 140)</td><td rowspan="3">Roman</td></tr>
<tr><td>Middle Roman
(AD 140-400)</td></tr>
<tr><td>Late Roman
(AD 400-650)</td></tr>
</table>

Figure 1: Breakdown of the Archaic to Late Roman periods by era and epoch (figure by Christian Cloke).

Mapping the data

The most effective way of visualizing the data summarized above is through a series of stacked layers of dot-density diagrams showing the number of sherds dating to a particular period within the spatial boundaries of the survey units in which they were found (Figure 2). At the top of these stacks, we have plotted pottery that can be dated to a single period (e.g. Classical), below which is pottery datable to a range of two consecutive periods (e.g. Archaic to Classical or Classical to Hellenistic), followed by pottery of a discrete era (e.g. Greek, for pottery dated to some longer range between Archaic and Hellenistic), and, at the bottom, all pottery from the corresponding epoch (e.g. Ancient historical). An initial observation concerns the first category of dots, those representing the most closely dated pottery: these tend to show up where overall densities are higher, suggesting that the more pottery we have, the better are the chances of isolating particularly diagnostic sherds. When focusing instead on layers displaying finds with broader chronological designations, such as 'Greek,' 'Roman,' and 'Ancient,' we can observe that certain periods (e.g. ER – MR), which might appear vacant when judged solely by closely dated finds, are probably less bleak than imagined and show clear *potential* of activity if one considers finds assigned a range crossing multiple periods.

We turn now to six locations within the survey area, which illustrate different problems and possibilities for visual analysis of the dataset in this way: Eleutherai, Oinoe, the central Mazi Plain, the Kouloumbi Plain ("Area B" of our survey, directly to the south of the Mazi Plain), the Medieval settlement of Aghios Dimitrios (near the Kondita Tower at the north of the Mazi Plain), and the valley of Kato Kastanava, extending to the southwest of the Mazi Plain (Figure 3).

In the vicinity of the Eleutherai settlement, a loose scatter of closely dated sherds of the Classical and Hellenistic periods shows evidence of occupation in and around the fortress, and the extension of activity across much of the basin to the south (Figure 4). Inclusion of sherds determined to be of Classical *or* Hellenistic date, rather than assigned definitively to one period or the other, shows more spatially continuous activity, while inclusion of all 'Greek' sherds, that is those that were assigned to some multi-period range between the Archaic and Hellenistic periods, fills in the gaps further still (though without providing evidence for additional activity in any new areas).

Similarly, at Oinoe – a fortified site at the opposite end of the Mazi Plain – plotting of just closely dated Classical and Hellenistic sherds delineates the main part of the settlement clearly enough, but it is only with the introduction of more broadly dated sherds into the dataset that it is possible to see the spatial continuation of activity during these periods into the surrounding landscape (Figure 5). While numerous closely datable finds give an impression that Late Roman activity overshadowed that of the Classical to Hellenistic periods, comparison of broader categories – Ancient Greek vs. Ancient Roman finds – shows the opposite, suggesting that both eras were times of widespread activity around the site, albeit with different material signatures: one easily recognizable and datable, the other less so (Figure 6).

In the center of the Mazi Plain, between Eleutherai and Oinoe, two areas thought to have been the sites of Late Roman villas or small hamlets illustrate the difficulties

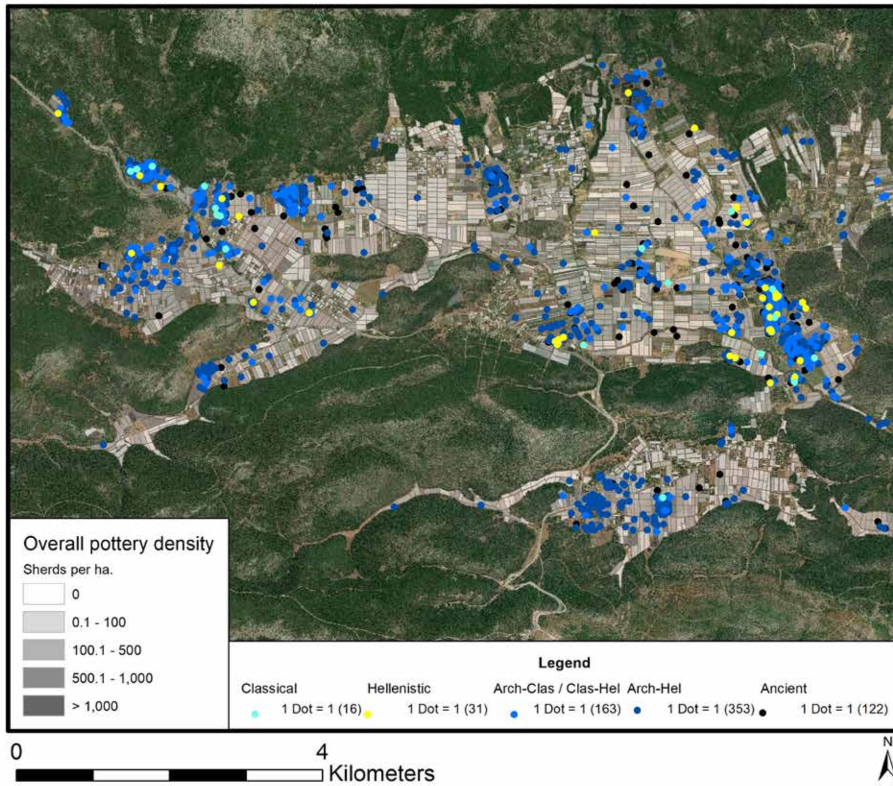


Figure 2: MAP survey area with all Greek historical (Archaic to Hellenistic) sherds represented via a dot density plot (map by Christian Cloke, background imagery is the World Imagery basemap, provided through ESRI's ArcGIS/ArcMap software. Sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community).

posed by differential visibility of pottery of different periods. In each case, our best ceramic evidence pointed to a major phase of activity in the Late Roman period, but the introduction of more broadly dated sherds makes it clear that these areas were, in fact, already significant in earlier centuries (Figure 7). The assigned dates of Classical and/or Hellenistic sherds from these locations typically comprised several consecutive periods; therefore such finds would not factor into maps of single-period finds. The recurrence of this general pattern in multiple locations suggests that the intrinsic diagnosticity of Late Roman pottery (with its distinctive combed amphora body sherds[11]) can be distorting, and only through the inclusion of less specifically diagnostic pieces do other periods become manifest, albeit with a greater degree of chronological ambiguity.

In the Kouloumbi Plain (south of the Mazi Plain), closely datable sherds of Classical or Hellenistic date were sparse. In this case, inclusion of all Greek finds helps to delineate the boundaries of possible farms or settlements, rather than showing a more extensive scatter of sherds throughout the entirety of the valley (Figure 8). In this way, simultaneous visualization of all available data does not simply expand the picture, but also provides better spatial definition. In the same valley, when we turn to later periods, closely datable sherds – quite numerous and concentrated in the western part of the plain – appear to indicate a single, modest settlement active at least during the Late Roman and Middle Byzantine periods (Figure 9). Inclusion of less precisely dated sherds from adjacent periods, however, reveals that this settlement was quite large in the Byzantine period; in the Late Roman period the settlement itself may not have been as substantial, but far more of the plain as a whole was inhabited or under intensive cultivation. Also visible in maps of multi-period finds is a clearly delineated locus of activity of Medieval date in the north-central part of the Kouloumbi Plain, which could not be recognized from viewing sherds dated to a single period only.

When looking at the entirety of the survey area using the sum total of the evidence we have quantified in this way, clear patterns emerge: the Classical to Hellenistic periods witnessed an especially full landscape, with some contraction into the Roman period. More striking, however, is the dramatic shift in the settlement pattern in the Medieval period. In the eastern part of the Mazi Plain, for example, Late Roman settlement was largely oriented around Oinoe and the southern reaches of the valley. By the Middle Byzantine period, however, there was a dramatic migration toward the north, with a pronounced concentration around the large Medieval settlement of Aghios Dimitrios, near the Kondita Tower (Figures 10 and 11). Likewise, in the more remote side-valley of Kato Kastanava, though Late Roman settlement

11 The diagnosticity of combed amphora sherds and its effect on survey pottery analysis in the case of Tanagra is discussed by Peeters et al. in this volume.

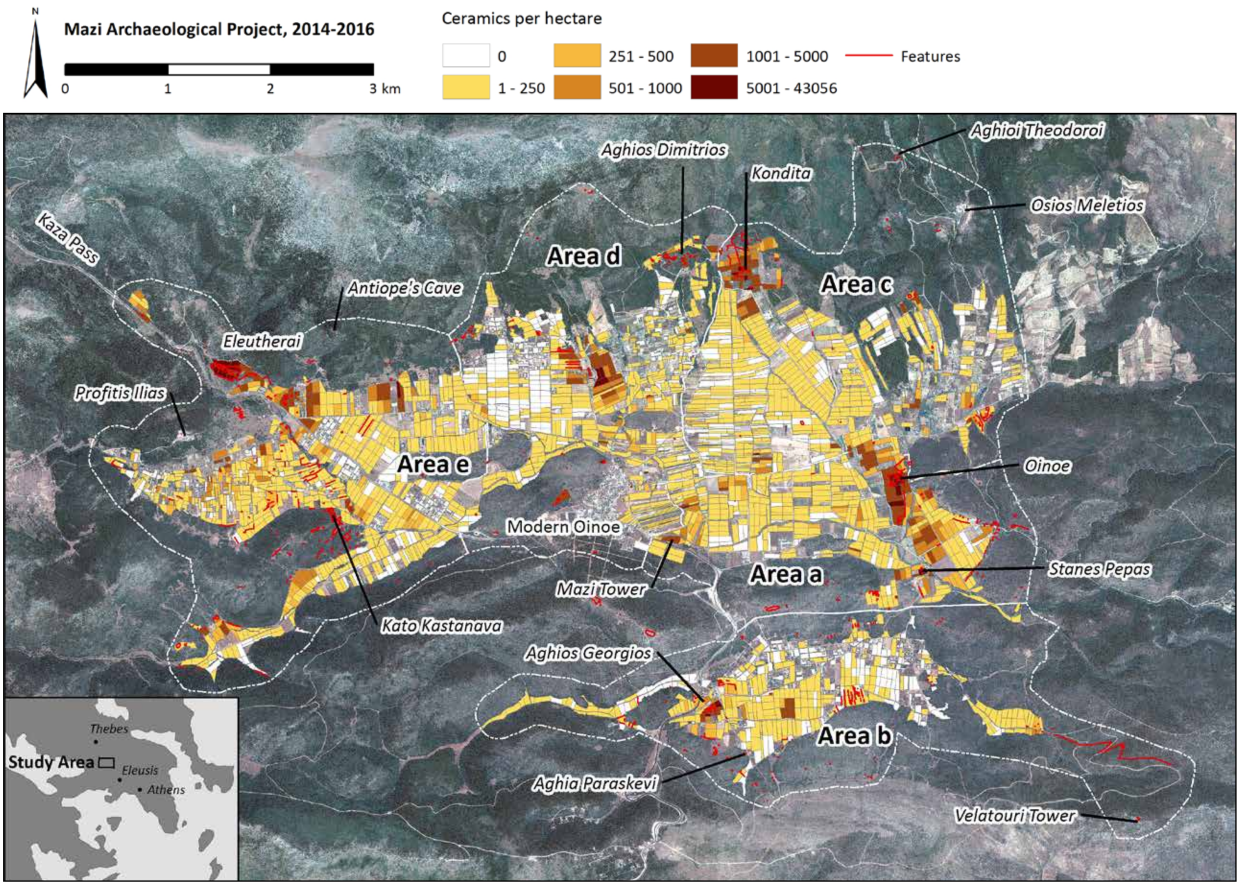


Figure 3: MAP survey area with toponyms and overall sherd densities per hectare (map by Alex Knodell, background imagery is the World Imagery basemap, provided through ESRI's ArcGIS/ArcMap software. Sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community).

occupied the middle part of the valley, Byzantine settlement retreated farther to the southwest, away from the Mazi Plain to a less exposed location where a church of Aghios Konstantinos was built (see Figures 10 and 11). These spatial patterns, elucidated by the employment of all categories of ceramic data in unison, speak to a concern for security by the communities in and surrounding the Mazi Plain at this time.

Discussion and conclusions

In closing we return to a consideration of patterning in the data we have produced and possible ways in which such patterns ought to be taken into account when 'reading' signs of diachronic change in the survey area, or can themselves be a focus for interpretation. A graph of the varying levels of specificity with which we were able to date the MAP pottery (Figure 12) demonstrates that very few sherds from the survey were datable with the sort of precision expected for ceramics from excavated sites: the merest fraction of all finds were given absolute dates ranges shorter than 50 or even 100 years. Many more sherds were datable only to a period of 500 or 1000 years, and the largest single subset not even to that. Because, however, survey ceramics are typically divided into chronological periods rather than given specific date ranges, it is somewhat more realistic to evaluate our material on these terms. Using periods of slightly different duration, on average around 220 years in length, we subdivided our pottery into a variety of period ranges, some quite close (such as Late Classical to Early Hellenistic), and others rather broad (such as Early to Middle Helladic or Late Roman to Byzantine). In all, over half of all our sherds were assigned date ranges spanning more than three consecutive periods, and over a third were assigned to a range of five or more periods (Figure 13).

The breakdown of our dataset into the commonest periods and period ranges assigned to our pottery (Figure 14) shows that, while rather general ranges (such as Classical to Roman, Classical to Byzantine, and Byzantine) were quite commonly utilized by specialists, so too were shorter intervals (such as Classical to Hellenistic and Middle to Late Byzantine), and certain single periods, (such as Late Roman). This iteration of the data shows that our pottery fell into many distinct date ranges of differing specificity. Rather than discounting fully half the dataset as too broad to be useful, we suggest it is both necessary and possible to view both more and less precise data together in a spatial context, as illustrated in the previous section.

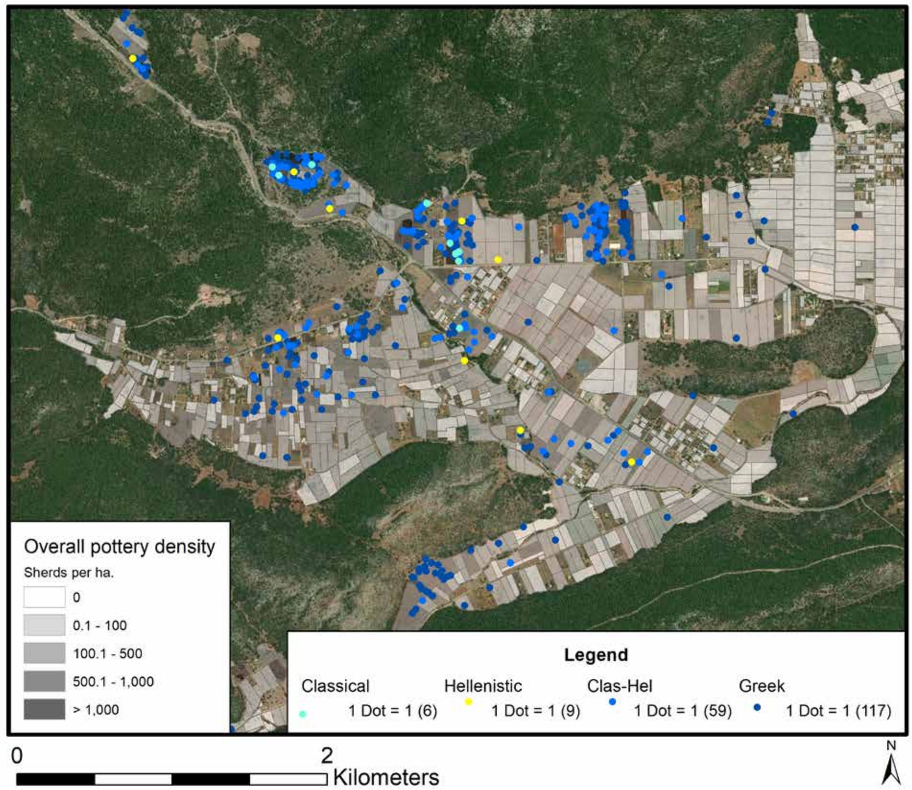


Figure 4: Classical and Hellenistic sherds, dated with varying levels of precision, in the vicinity of Eleutherai (map by Christian Cloke, background imagery is the World Imagery basemap, provided through ESRI's ArcGIS/ArcMap software. Sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community).

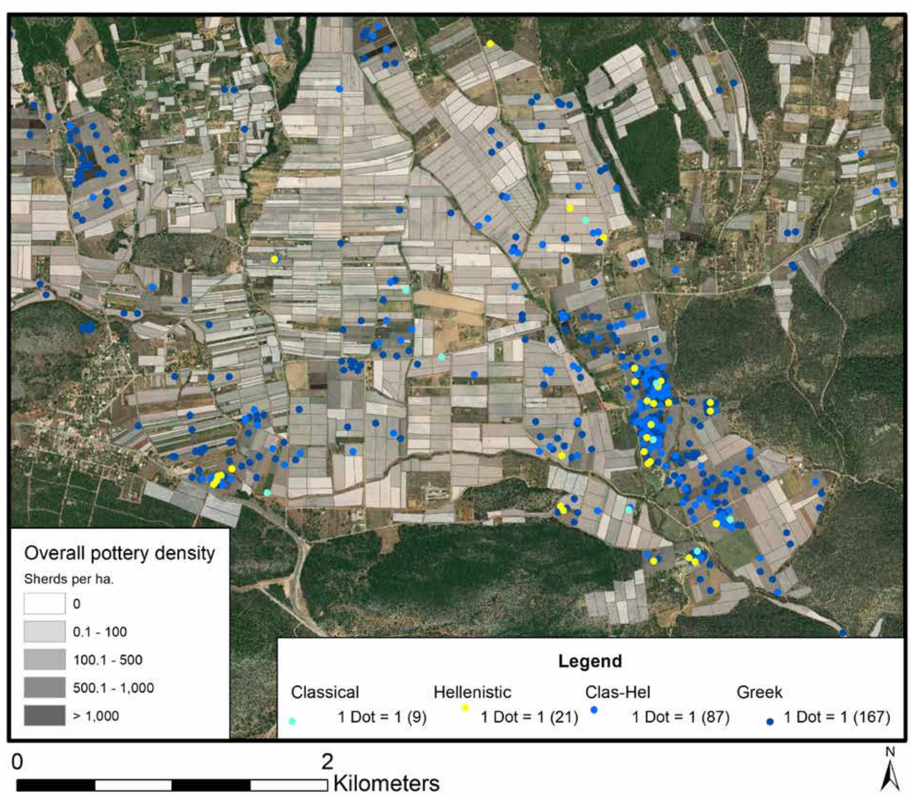


Figure 5: Classical and Hellenistic sherds in the vicinity of Oinoe (map by Christian Cloke, background imagery is the World Imagery basemap, provided through ESRI's ArcGIS/ArcMap software. Sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community).

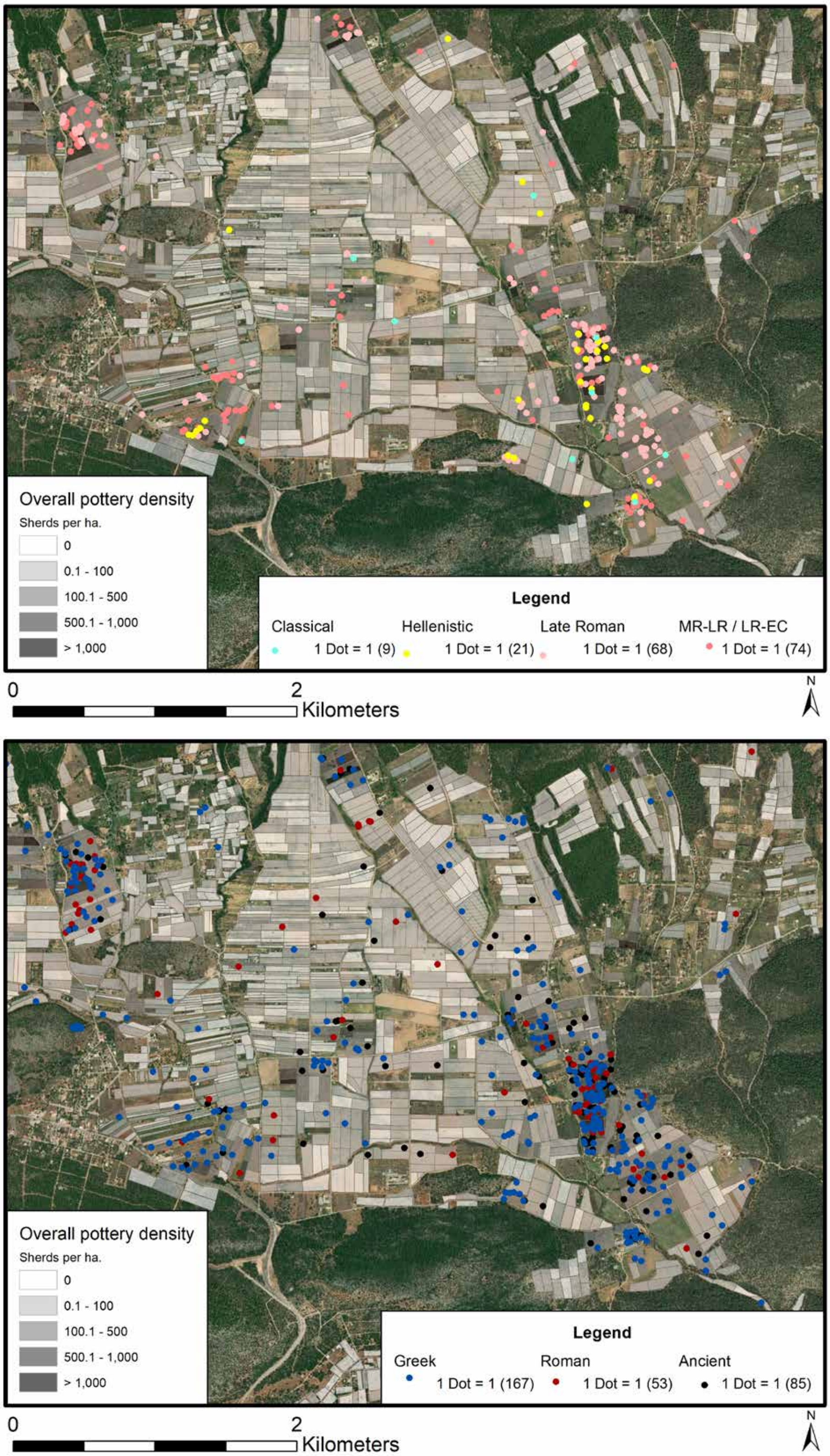


Figure 6: Maps of the vicinity of Oinoe, showing (above) closely dated finds of Classical/Hellenistic and Late Roman date, and (below) more broadly dated "Greek" and "Roman" sherds (map by Christian Cloke, background imagery is the World Imagery basemap, provided through ESRI's ArcGIS/ArcMap software. Sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community).

Figure 7: A pair of locations in the north central Mazi Plain where closely dated finds of Late Roman date were highly concentrated, though there was a wider distribution of less precisely datable Classical and/or Hellenistic sherds (map by Christian Cloke, background imagery is the World Imagery basemap, provided through ESRI's ArcGIS/ArcMap software. Sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community).

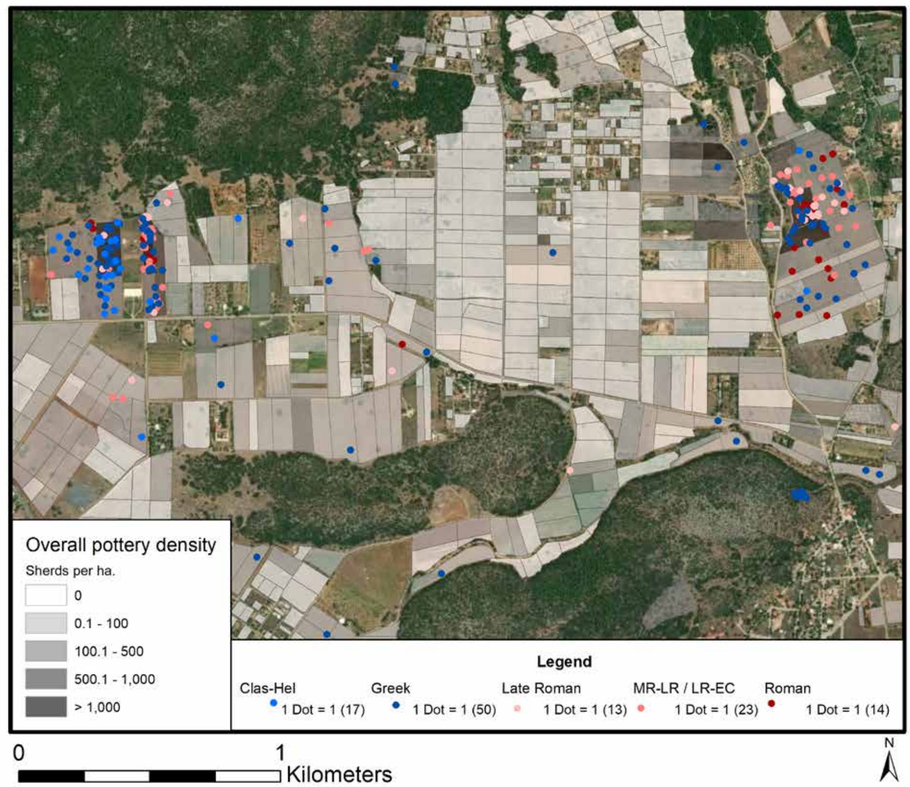
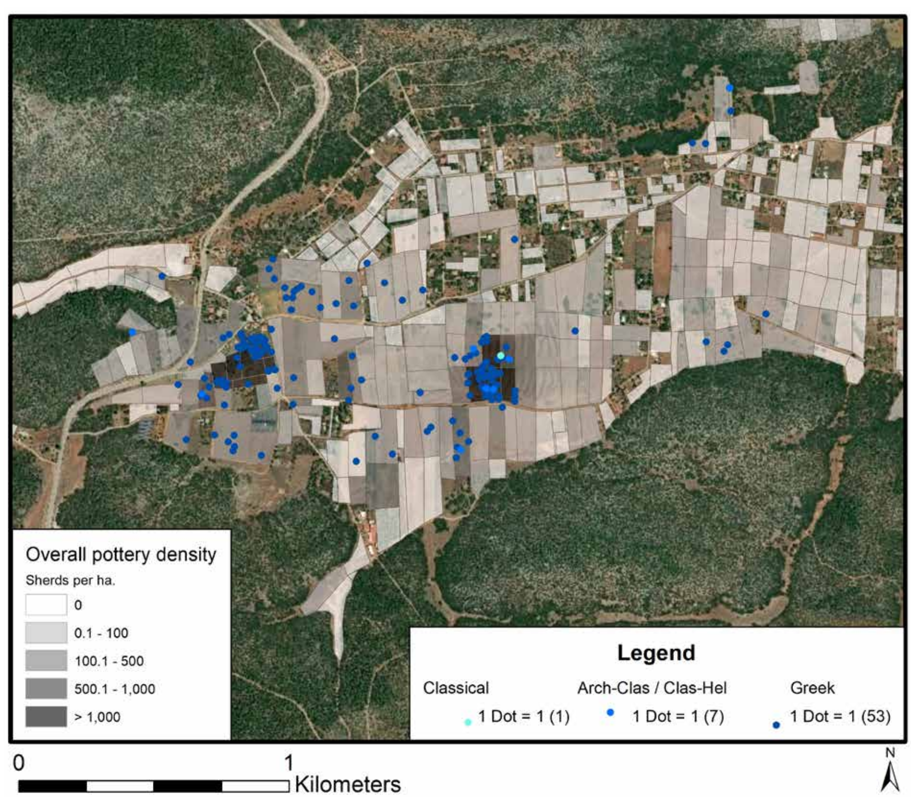


Figure 8: Plot of Greek historical (Archaic to Hellenistic) sherds in the Kouloumbi Plain, where more precisely datable sherds of these periods were scarce (map by Christian Cloke, background imagery is the World Imagery basemap, provided through ESRI's ArcGIS/ArcMap software. Sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community).



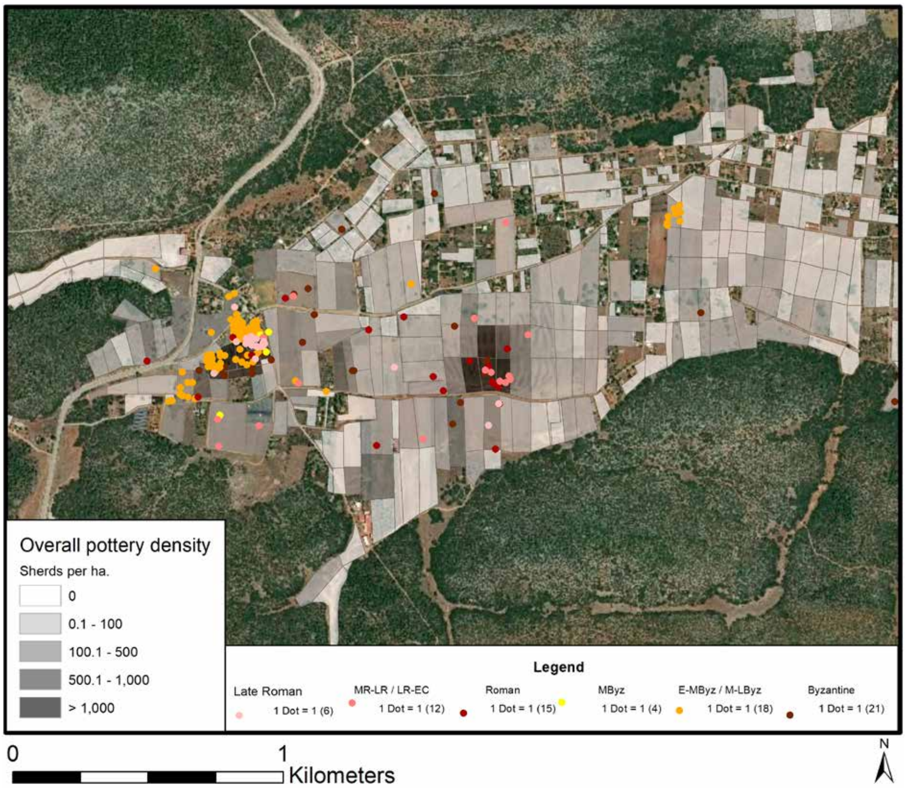


Figure 9: Map of the Kouloumbi Plain showing Late Roman and Byzantine sherds. Closely datable Late Roman sherds show two foci of activity, and less closely dated Roman sherds fill in the space between them. Middle Byzantine pottery was found only in the western part of the valley, though sherds dated to the Early to Middle and Middle to Late Byzantine periods were more widely distributed and turned up also in the central part of the valley (map by Christian Cloke, background imagery is the World Imagery basemap, provided through ESRI's ArcGIS/ArcMap software. Sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community).

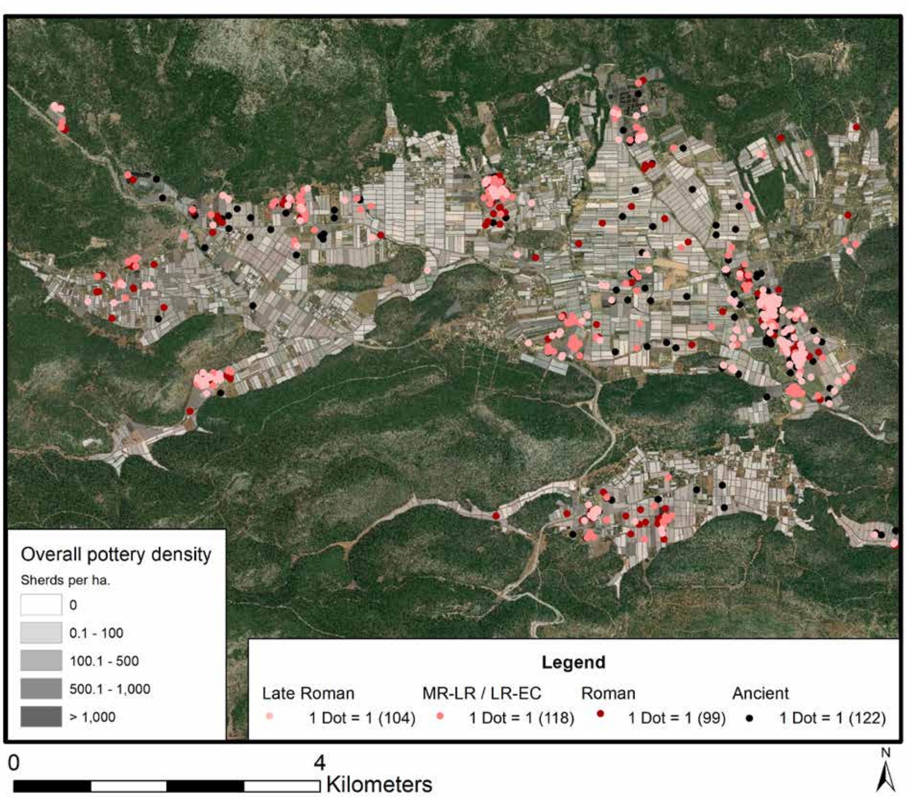


Figure 10: Plot of Roman sherds across the MAP survey area (map by Christian Cloke, background imagery is the World Imagery basemap, provided through ESRI's ArcGIS/ArcMap software. Sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community).

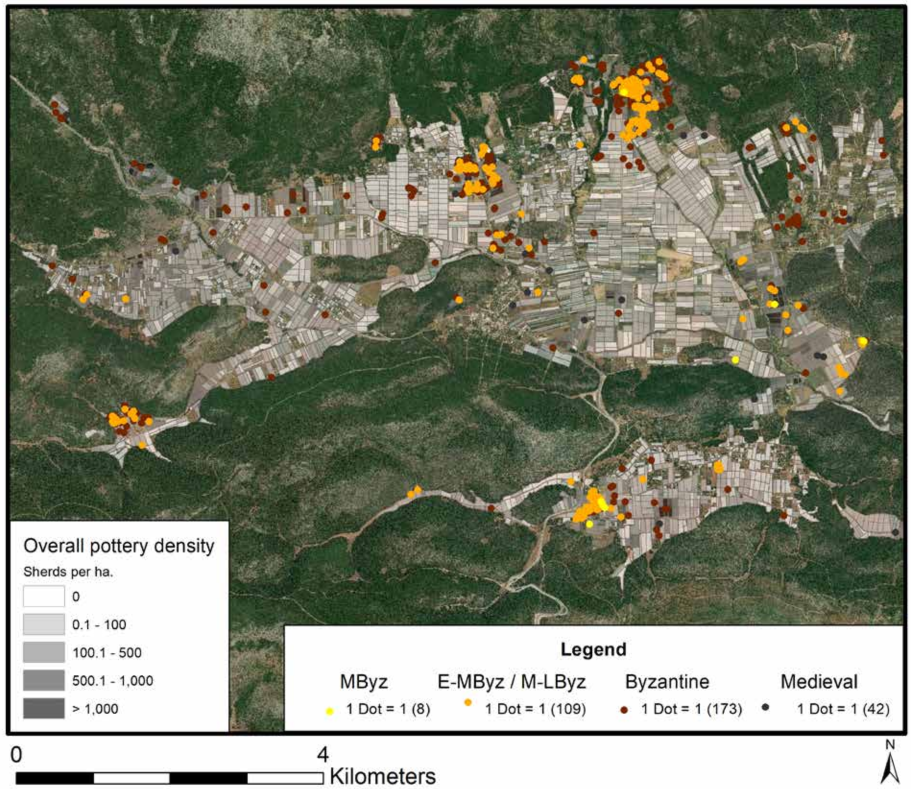


Figure 11: Plot of Byzantine sherds across the MAP survey area, showing in particular a contraction to the north toward the site of Aghios Dimitrios and to the southwest toward Aghios Konstantinos (map by Christian Cloke, background imagery is the World Imagery basemap, provided through ESRI's ArcGIS/ ArcMap software. Sources: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community).

In reflecting on this work we are reminded that there is no single 'cookie cutter' approach for survey methods or data analysis.[12] This is even truer due to the ongoing proliferation – and diversification – of database and analytical technologies in archaeology today. While GIS and relational digital databases are now standard elements of any archaeological survey project, there is remarkably little uniformity in how these are conceived and utilized. This calls for a great deal of methodological transparency in order for outside researchers to truly understand what is going on with any given project's data.[13]

To that end we close with some self-reflection: an obvious opportunity for critique of our approach concerns collection strategy. The decision to collect and save only diagnostic pottery is a practical one used by many projects. Yet there is no question that data is lost by not practicing total collection, and in fact diagnostic-only collection strategies almost certainly skew datasets toward periods that already have a high level of diagnostic visibility. Further testing of our method in the future would be facilitated by its application to a survey dataset generated by a project engaged in total artifact collection. Indeed we believe that the approach espoused here is well-suited to making the most of analyzing large collections of finds. A second matter of concern is the very large date ranges to which the majority of our collections were assigned. We note that analysis as of this writing has been thorough, but largely preliminary; we suspect that these dates will continue to be refined during subsequent re-examination of finds, both by our main ceramics analysts and by additional specialists. Such re-examination is only possible when sherds are collected and saved by surveys, and thus retention of finds is essential if we wish to continue to develop this and other approaches to deal with questions of chronological uncertainty.[14]

Ultimately, we suggest that a key contribution of the approach outlined here is its utilization of the full range of our dataset, both quantitatively and visually/spatially, without the introduction of further levels of numeric abstraction. This is especially important when considering the broad periods and chronological imprecision faced by all projects dealing with surface ceramics. By analyzing patterns within the dataset, we have been able to identify commonly assigned dates and date ranges, and to assess which periods and ranges of periods are disproportionately visible because their pottery can be dated quite precisely. This last recognition will permit us in the future to focus the visual display of our data in a spatial context to target poorly understood periods or points of inflection, as well as particular parts of our survey area whose history remains

12 Cherry 1983; Alcock & Cherry 2004 ; Knodell et al. 2023
13 Knodell & Leppard 2018.
14 On collection (or lack thereof) by survey projects, and the practical and intellectual consequences of varying methodologies, see e.g. Gregory 2004.

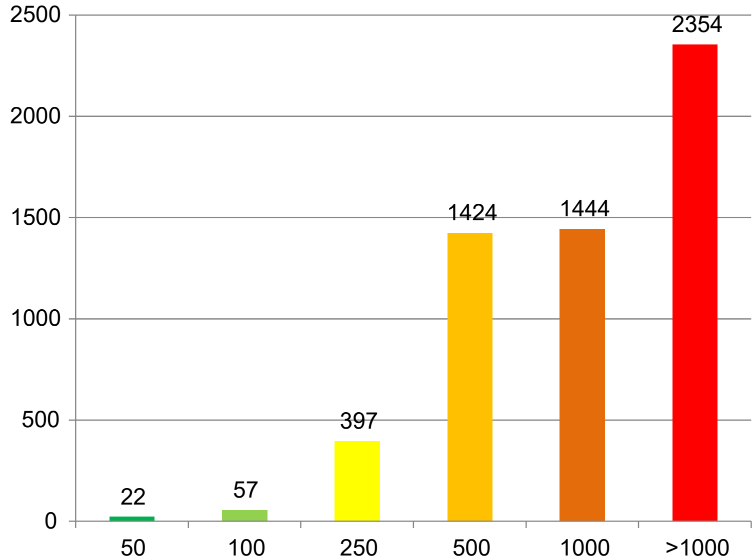


Figure 12: The number of sherds recorded by the survey, according to the length of the date ranges they were assigned (in years, listed along the x-axis) (figure by Christian Cloke).

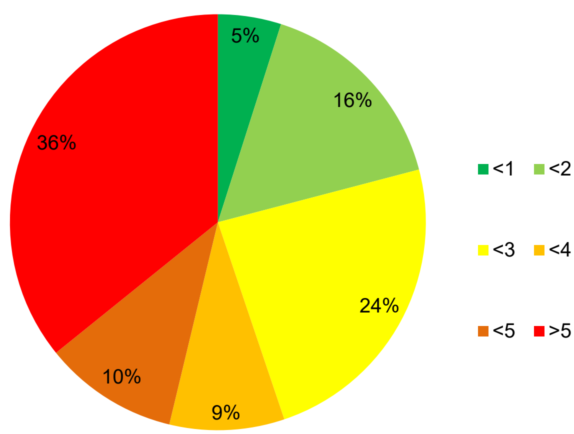


Figure 13: The number of consecutive periods to which sherds were dated (the average duration of the specific time periods the project utilized was ~220 years) (figure by Christian Cloke).

obscure. Future re-dating (or chronological fine-tuning) of pottery by fuller teams of experts armed with this information will not disrupt the structure of the data itself, but will improve its precision and promote better results and analysis through an iterative process.

Acknowledgments

The Mazi Archaeological Project is a *synergasia* between the Swiss School of Archaeology in Greece and the Ephorate of Antiquities of West Attica, Pireus, and Islands. We are grateful for further institutional and funding support from the Swiss National Science Foundation, Loeb Classical Library Foundation, Institute for Aegean Prehistory, University of Geneva, University of Nebraska-Lincoln, and Carleton College. Fotini Kondyli, Christine Hunziker, Maura Brennan, Aude-Line Pradervand, Katerina Ragkou, and Tobias Krapf contributed to ceramics analysis; John Papadopoulos and Margarita Nazou provided invaluable consultation and advice during visits to the project. We are also grateful to the survey team leaders who were instrumental in data collection and analysis: Sarah Craft, Thomas Kerboul, Evan Levine, Maeve McHugh, Sarah Murray, Timothy Pönitz, and Catherine Steidl. Alex Claman contributed to database editing as a Student Research Assistant at Carleton College. Eirini Svana, Polytimi Valta, and Evgenia Tsalkou have been invaluable team members and representatives of the Ephorate throughout the project. We thank all of these individuals for their particular contributions, and all other members of the 2014-2016 teams for all of their hard work as well.

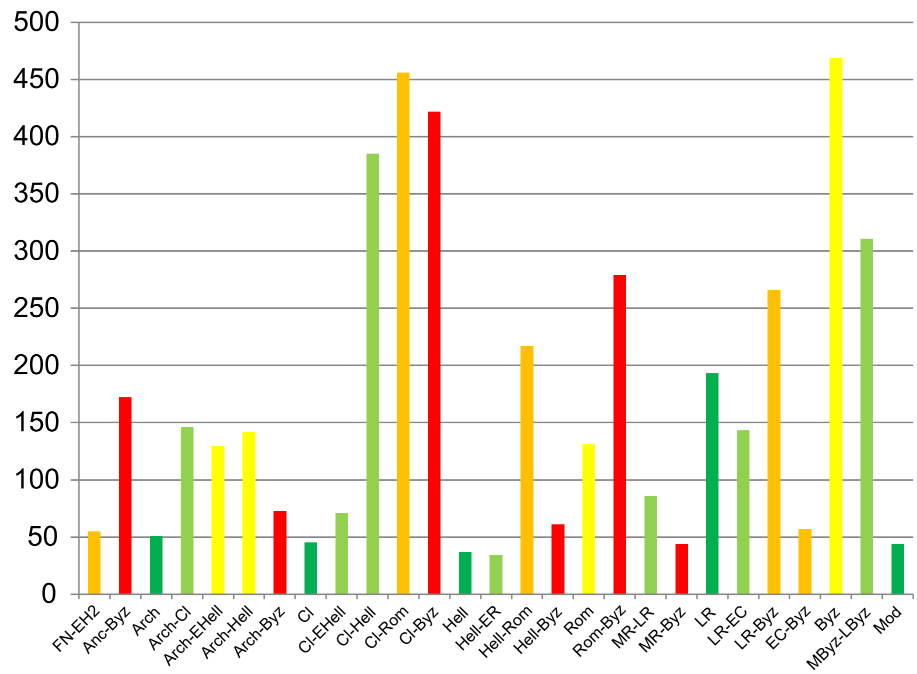


Figure 14: Number of sherds dated to common periods and ranges (with chronological precision denoted along a spectrum of green-yellow-orange-red) (figure by Christian Cloke).

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Down to the details

The pottery recording methodology from the Kea Archaeological Research Survey

Margarita Nazou, Joanne Murphy, Natalie Abell, Shannon LaFayette Hogue & John Wallrodt

Abstract

This paper discusses the recording strategy for the pottery recovered by the Kea Archaeological Research Survey (KARS). In the field we collected all pottery diagnostics (based on shape and decoration) and a sample of all fabrics not represented in the diagnostic collection. In three seasons of fieldwork we amassed a very large amount of pottery. In order to speed up the process of studying and cataloging the pottery we used digital recording devices and entered the raw pottery counts in the field on iPads in Filemaker Go. We used iPads linked to a laptop server to record the pottery details in the lab on inter-linked forms in a Filemaker database designed for detailed qualitative and quantitative analysis. We also maximized the skills and abilities of each project member from specialist to first year student assistant. This effective and speedy system produced a rich body of data that has enabled the identification of several new types of pottery and clarified distinctions among local and imported fabrics on the island.

Keywords: Kea Archaeological Research Survey (KARS) – Digital Recording – Skill Maximization – Macroscopic Ceramic Fabric Analysis (MACFA) – Neolithic/Bronze Age.

Introduction

The overarching goal of the Kea Archaeological Research Survey (KARS) is to test the long-term validity of pedestrian survey data by resurveying northwestern Kea using methodologies similar to those of the 1983 survey by Cherry, Davis, and Mantzourani (CDM) in order to see if we can still reach the same conclusions thirty years later (Figures 1 and 2).[1] Based on the preliminary results of the study campaigns we can already suggest that the project will significantly increase our knowledge of settlement patterns and human activities on northwestern Kea. This paper will present an overview of the collection and recording methodologies for the pottery at KARS, and explain how these methods have enabled us to refine our understanding of two previously known Final Neolithic (FN) sites: Kephala and Paouras (Figure 2).

1 For results from the earlier survey see Cherry et al. 1991a. For a more detailed discussion of the project's aims and methodology see Murphy et al. forthcoming and the project website: https://classics.uncg.edu/kea/.

in A. Meens, M. Nazou & W. van de Put (eds), Fields, Sherds and Scholars. Recording and Interpreting Survey Ceramics, 45-56, Leiden: Sidestone Press. DOI: 10.59641/m11443py.

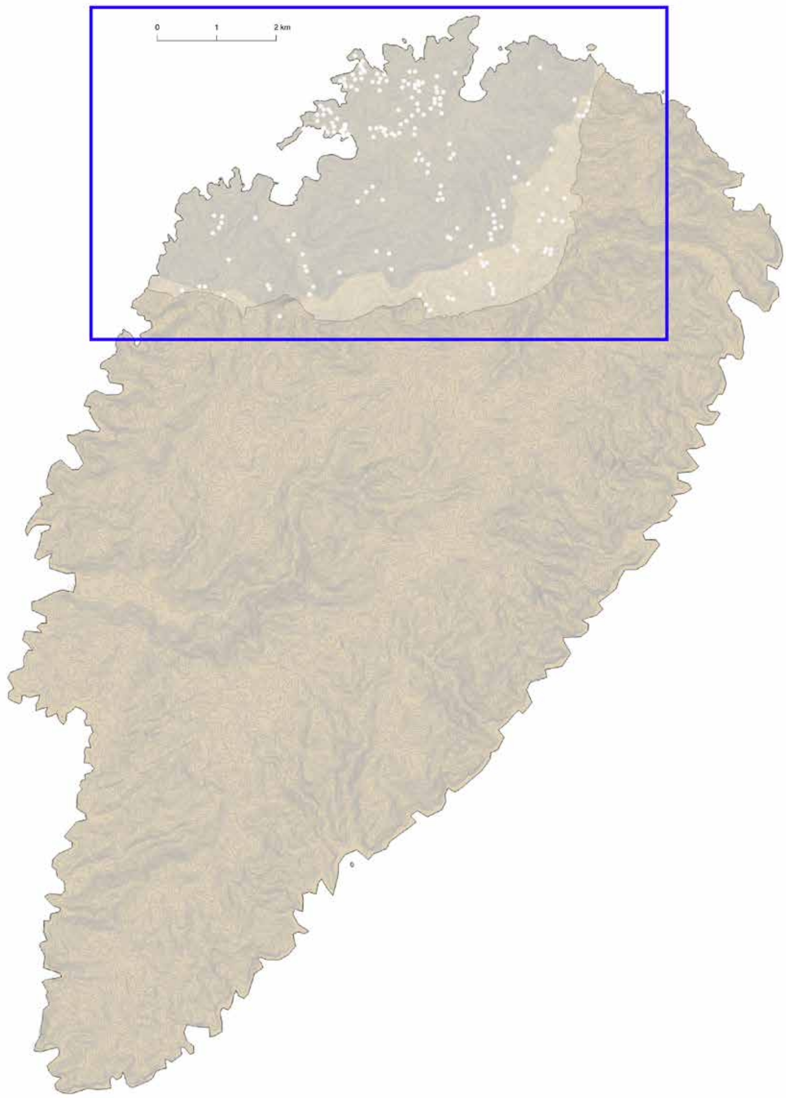


Figure 1: Map of Kea with general survey area indicated (map by John Walrodt).

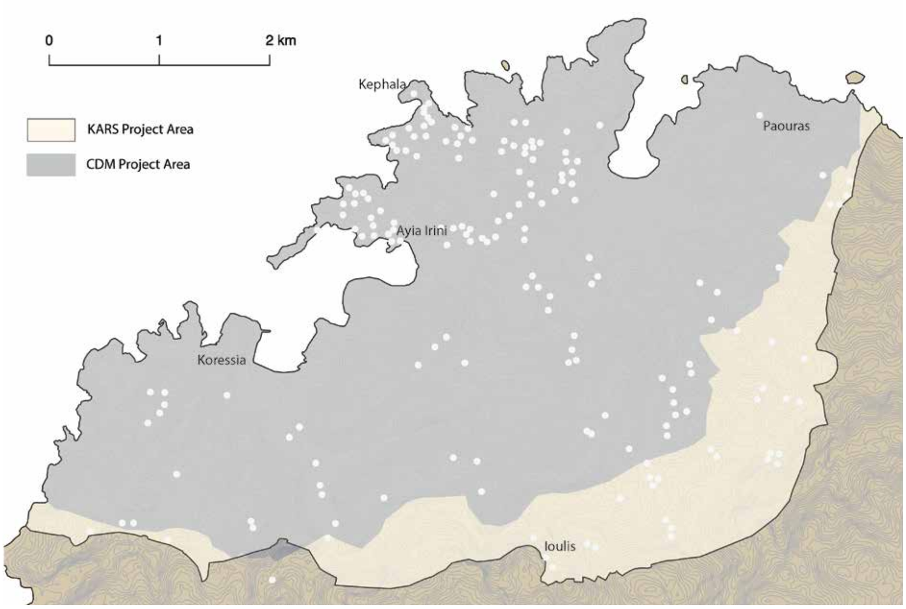
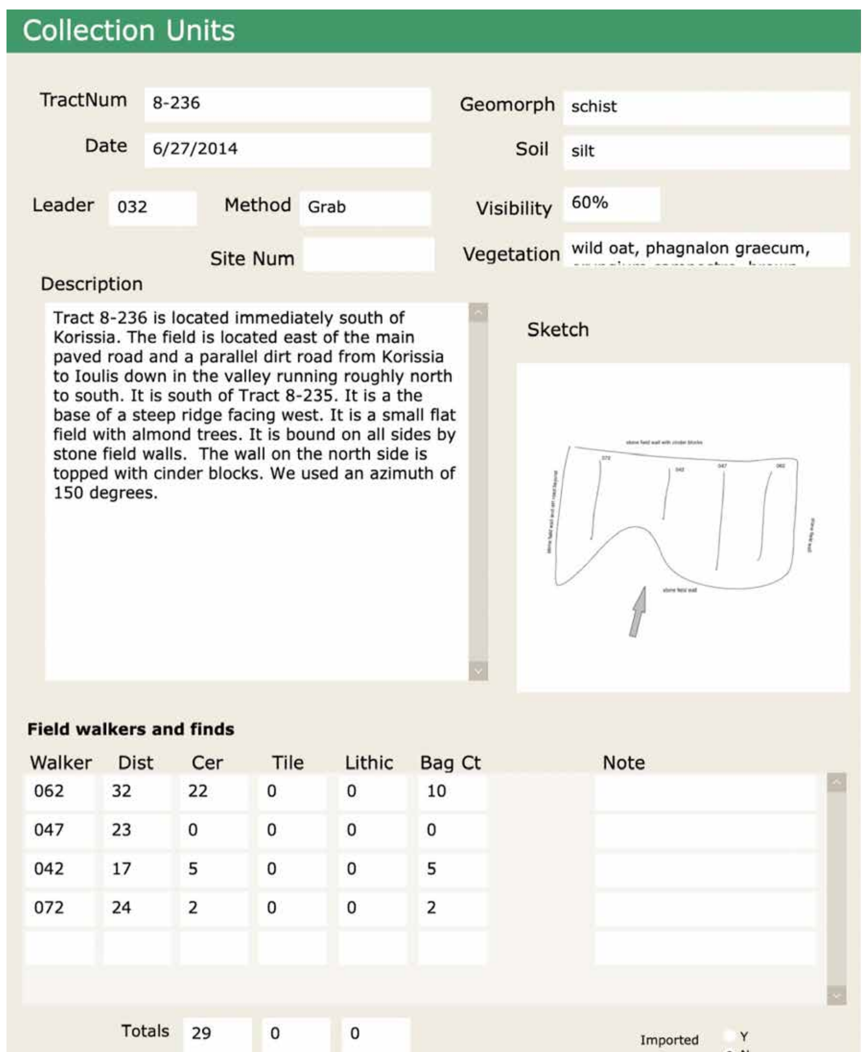


Figure 2: Map of northwestern Kea with areas surveyed by CDM and KARS (map by John Walrodt).

Figure 3: View of a tract that the team leader would have on the iPad (image by John Walrodt).



Collection Units

TractNum 8-236
Date 6/27/2014
Leader 032
Method Grab
Site Num
Geomorph schist
Soil silt
Visibility 60%
Vegetation wild oat, phagnalon graecum,

Description

Tract 8-236 is located immediately south of Korissia. The field is located east of the main paved road and a parallel dirt road from Korissia to Ioulis down in the valley running roughly north to south. It is south of Tract 8-235. It is a the base of a steep ridge facing west. It is a small flat field with almond trees. It is bound on all sides by stone field walls. The wall on the north side is topped with cinder blocks. We used an azimuth of 150 degrees.

Sketch

Field walkers and finds

Walker	Dist	Cer	Tile	Lithic	Bag Ct	Note
062	32	22	0	0	10	
047	23	0	0	0	0	
042	17	5	0	0	5	
072	24	2	0	0	2	
Totals		29	0	0		

Imported Y N

Figure 4: An example of a collection unit form on the iPad (database created by John Wallrodt, image by Shannon LaFayette Hogue).

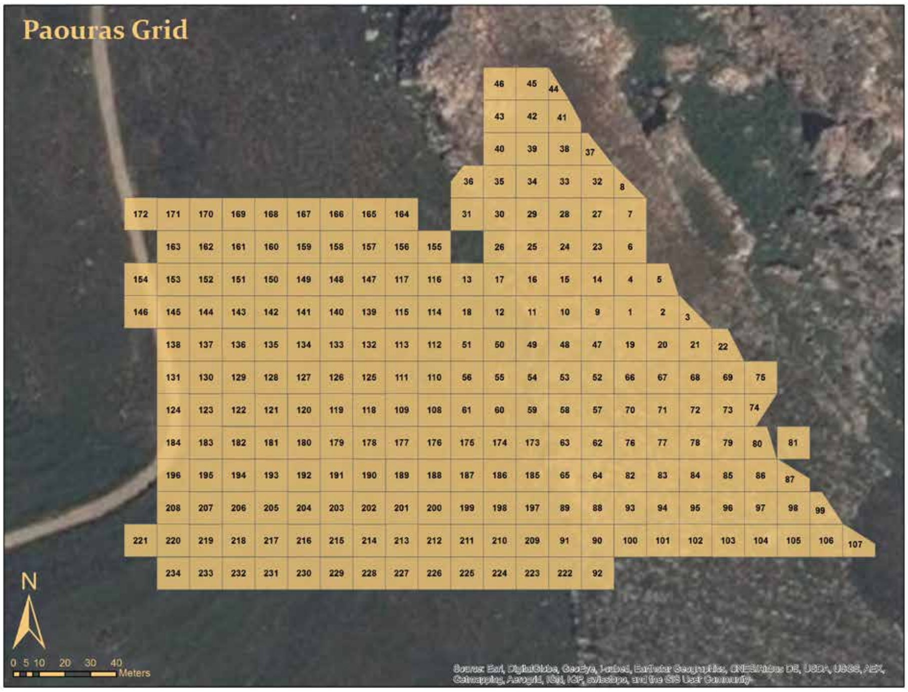


Figure 6: Paouras headland with overlaid KARS grid (map by Dora Lambert).

Collection methodology

We had two collection phases: Phase I and Phase II. Phase I was the initial exploration of an area. The standard interval between walkers in each tract was 15m. When teams were walking on collapsed terraces or extremely dense, spiky vegetation with low visibility, the interval was raised as far as 30m, which parallels the practice of the 1983 survey.[2] In Phase I, all diagnostic ceramics, all lithics, all slag, and a sample of each fabric not represented in the diagnostics were collected. In order not to flood the finds lab with artifacts and to have a more refined understanding of the location of the finds from Phase II collections, only one in five or ten diagnostics were brought back to the finds lab from tracts with extremely high densities. In all cases, walkers provided a count of the total number of sherds that they saw.

In the field, each team leader was equipped with an iPad with a set of apps for data collection. Loaded into iGIS were digitized, geo-referenced Greek military maps, satellite images, and Google maps of the survey area. These maps, in combination with the tablet's own GPS system, allowed the teams to record their "real" position in relation to the landscape. Polygons that represented the boundaries of the tract were drawn directly into iGIS on the tablet (Figure 3). Team leaders recorded all details about the tract, including the distances walked and the number of observed and collected artifacts, in FileMaker Go, which is the equivalent of the desktop software FileMaker Pro for iPads (Figure 4). Using TouchDraw, they drew a sketch of their tract, indicating any natural or cultural features, the line-up of the walkers, and any noted densities.

Areas with high artifact densities were targeted for Phase II collection. In Phase II, we laid out either a grid or a cross over the high density area. We extended the collection area until we reached an area without artifacts. In the grids, the walkers conducted a timed vacuum and grab sample in each square. Vacuum circles of 1.26m radius were located at the center of each grid square. The walker in the vacuum circle bagged all cultural material, while the walker in the grab area collected all diagnostics, a sample of fabrics, and counted as much cultural material as they could see. These procedures are consistent with our standard project sampling methods.

Grids were used primarily for large sites, while crosses were better suited to small sites. Two of our largest sites, Kephala and Paouras, were known to have high artifact densities from the 1983 survey, and they had also been investigated in the 1960s by Jack Caskey and his team through excavation (Kephala) and surface exploration (Paouras).[3] At both sites we laid out a grid consisting of 10x10m squares over the whole headland (Figures 5 and 6). We collected ceramics, obsidian, chert, possibly worked quartz, and slag from these sites.

2 Cherry et al. 1991b, 22-25.

3 Caskey 1971, 392; Coleman 1977; Whitelaw 1991.

Figure 5: Kephala headland with overlaid KARS grid (map by Dora Lambert).

Pottery processing

Even collecting only a sample of the ceramics, over the three seasons of fieldwork (2012-2014), we amassed thousands of sherds. We have attempted to streamline the processing and cataloging of this pottery in several ways, to take advantage of the different experiences or specialties and skills of people in the finds lab, from ceramic specialists to undergraduate field school students. To streamline the processing and cataloging of this pottery and to take advantage of the different experiences and skills of people in the finds lab, from ceramic specialists to undergraduate field school students, we break up the study into a sort of assembly line. Graduate students or advanced undergraduates lay out the pottery and make preliminary groupings of diagnostic and bulk sherds based on fabric, shape, ware, and part type. Next, specialists provide more specific information about date, ware, shape, fabric, forming methods, and decoration for sherds relevant to their periods of expertise. Students then complete additional data collection and processing: counting and weighing, providing Munsell descriptions, making measurements, recording preservation information, and labeling the sherds (Figure 7).

In the finds lab, ceramic data are entered using laptops and iPads that are connected by an in-house network to the FileMaker database. Some sherds are considered 'bulk' ceramics and are entered into the database as a group, with their quantity and general fabric, shape, and/or forming characteristics recorded. Sherds that are designated 'diagnostic' receive a unique number and their own database record. All diagnostic pottery is photographed and a selection is also drawn. On the table, color-coded post-it notes communicate the status of each sherd (Figure 8). Specialists either add data directly to the database, or write their assessments on standardized paper forms, which we aim to enter into the database within 24 hours. Disagreements between specialists about dating or other characteristics like ware or shape are recorded in a note field. Students enter information directly into the networked database. The digitization process allows for rapid review and error correction, which are also enabled by the database's audit trail. Changes to every field are recorded with a timestamp and the identity of the person entering the data. The aim of this system is to record speedily and effectively thousands of collected ceramics, and to maximize the information that our pottery experts provide in the sometimes limited timeframes of their study seasons (Figure 9).

Dating is one of the most important pieces of information provided by the specialists. For each sherd, we assign a date range that includes all possible periods of manufacture, with certain start and end dates recorded in the Start Period (SP) and End Period (EP) fields. More qualitative dating information is provided under 'Other Note' and 'Dating Note.' In practice, this means that our chronological data do not always break down into convenient periods. For example, at Paouras, a site occupied in the FN and later, there are diagnostic sherds that are recorded as FN as well as sherds that are clear diagnostics of Early Bronze Age (EBA) II, the Middle Bronze Age (MBA), or other periods, but there are also many sherds for which the date range can only be defined as FN-EBA (as in Figure 9) and even some that can only be given a broad range of FN to unknown end date. Broad dates occur in some cases because specialists have

Figure 7: The 'assembly line' in the finds lab. Lab. Depicted are: MN= Margarita Nazou, NA= Natalie Abell, SH= Shannon LaFayette Hogue, JBC= Jami R. Baxley Craig, AF= Amelia Fuller, EL= Emily Lewis (photos by Margarita Nazou).

different interpretations of the sherd, and in others because students collected pottery in the field that they considered potentially diagnostic, but which cannot be closely dated by specialists. Long-term stability in the characteristics of certain local ceramic fabrics also sometimes inhibits close dating. Explicit acknowledgement of ambiguity in dating contrasts with the kinds of data provided by many surveys, including the 1983 Keian one.

Other specialist data entered into the database, like ware, shape, and part names, are standardized as much as possible, to allow for more efficient querying and mapping. Common fabrics are given codes, either newly developed for the survey or, for prehistoric sherds, based on the coding system used by Abell at Ayia Irini.[4] This system encourages effective communication and learning among ceramic specialists and students and enables rapid, detailed recording of large quantities of pottery. The ceramics table in the database is linked to the collection unit table shown in Figure 4. The collection unit table holds the unique number field for each tract and cross or grid area (which allows us to link to the Collection Unit GIS layer) as well as the geography for the unit itself in the form of Well Known Text (WKT). This makes it possible to use the more user-friendly FileMaker interface for searches and summaries and then export our results to a tab-separated file that can be immediately mapped in GIS. Mapping this data through the linked GIS is clarifying our understanding of the Keian landscape from the FN through the early modern era.

Results of ceramic study

In the rest of the paper we will briefly present some of the results of the analysis of the pottery from two previously known FN sites, Kephala and Paouras.

4 Many local and imported prehistoric fabrics are known from previous macroscopic and petrographic studies: e.g. Davis & Williams 1981; Cherry et al. 1991c, 165; Wilson 1999; Hilditch 2004; Gorogianni, Abell & Hilditch 2020; Abell 2021.

Figure 8: Picture of pottery from Kephala on the table (photo by Margarita Nazou).

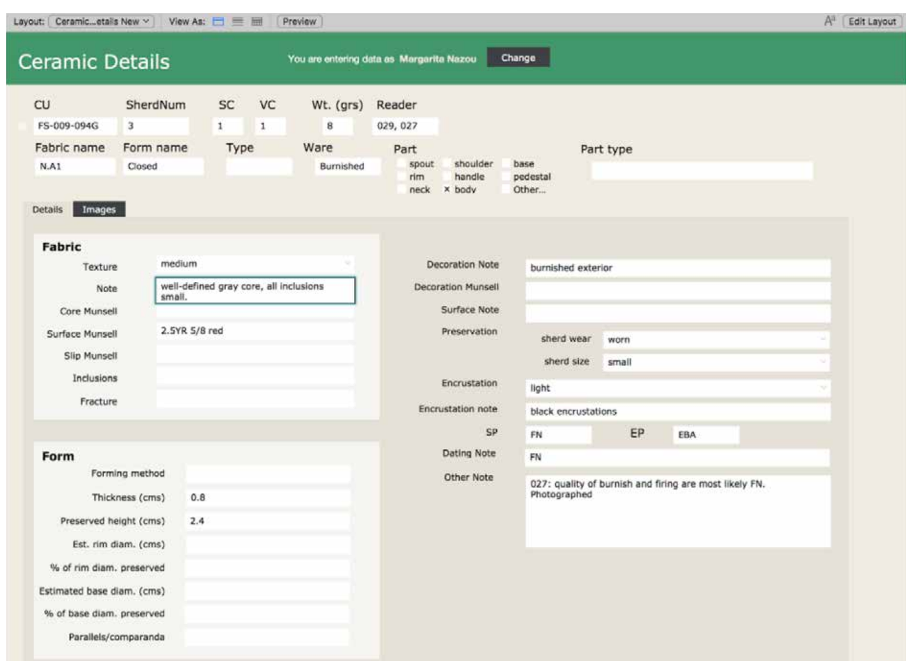


Figure 9: An example of a ceramic details form for a burnished body sherd from Paouras with the different kinds of information recorded by students and specialists (database created by John Wallrodt).

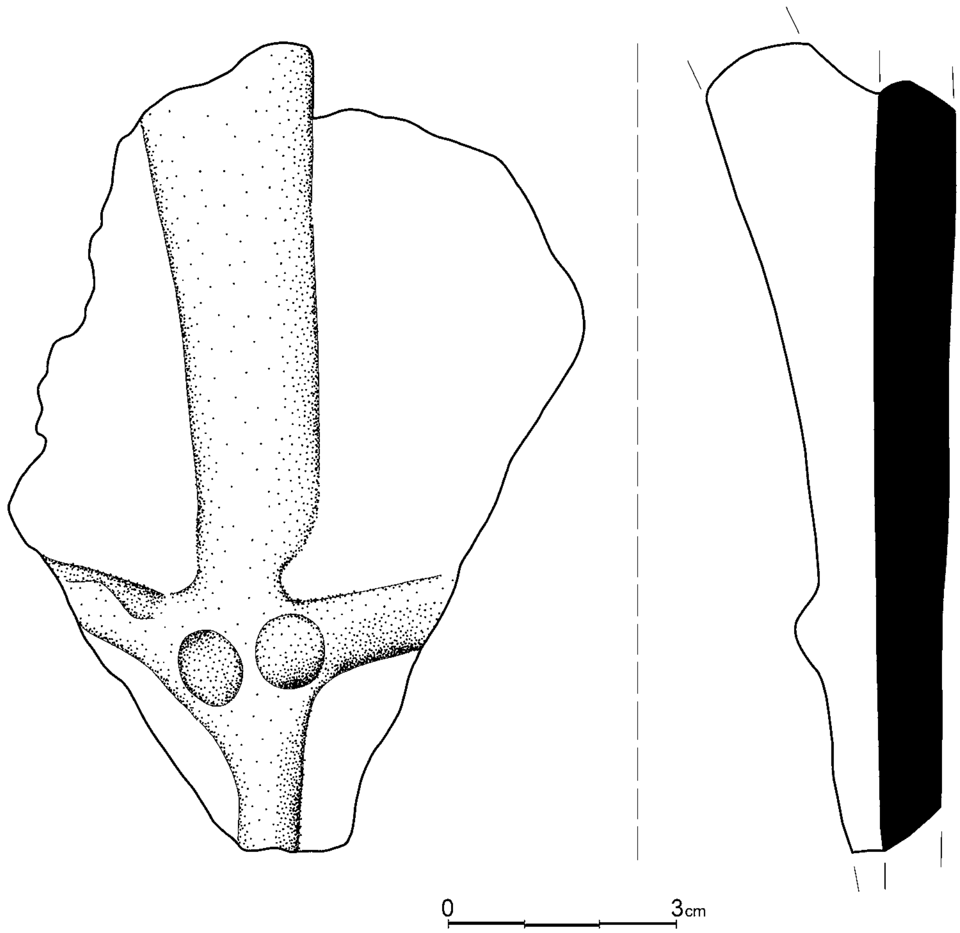


Figure 10: FN pithos sherd with relief decoration (FS-001-040G-13) (drawing by Lily Bonga).

Kephala was excavated in the 1960s and surveyed in the 1980s.[5] The preliminary recording of all the pottery recovered by KARS from Kephala is now complete. A total of 4627 sherds have been entered in the database. Owing to extensive breakage, however, those sherds probably represent at most 4335 vessels. In terms of chronology, a significant amount (38%) of the material has the FN as the start and end period. There is also a significant amount (60%) of pottery that has a start period in the FN and an unknown end period. These are body sherds in local fabrics which were used both in prehistoric and historical periods. Although most fabrics belong to groups known from later deposits at Ayia Irini, Abell has recognized a few fabrics that do not, at least one of which may be imported. Many of the larger sherds are rather porous compared to known local fabrics from Ayia Irini and preserve large oblong voids that seem to result from organic tempering practices; it is unclear how widespread this feature of the local Kephala assemblage is, because the poor preservation and very small size of most of the sherds make them difficult to characterize accurately. Nazou's study of the diagnostic pottery did not locate anything later than the FN material detailed in Coleman's (1977) publication of the excavation. Most of the shapes and surface treatments of the survey pottery, including pattern-burnished and red burnished ware, are comparable to the material from the excavation. The only fragment that seems to belong to a previously undocumented shape is a FN pithos sherd with relief decoration (FS-001-040G-13) (Figure 10), with parallels from the Kitsos Cave in Attica.[6]

The study of the pottery from Paouras is producing some very exciting results. A total of 5718 sherds from a maximum of 5668 vessels were collected. The majority of the pottery seems to be prehistoric, with 22% securely dated between FN and LBA. The assemblage includes some (12%) material of the historic periods (Archaic to Medieval) as well. Although previous investigations recognized that Paouras was a multi-period site, our study

5 Coleman 1977; Whitelaw 1991.

6 Karali 1981, 371, Pl. XLIV.

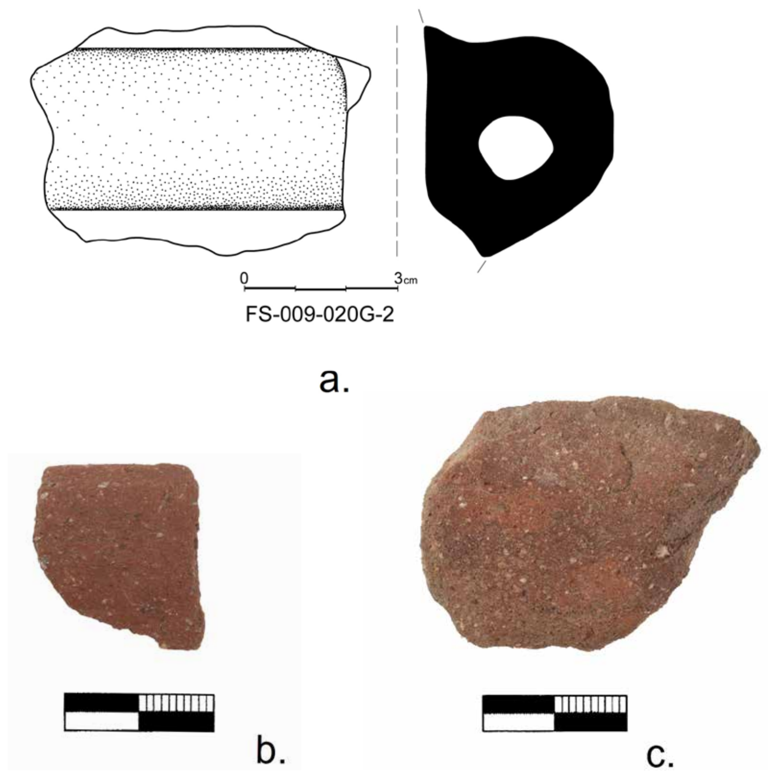


Figure 11: a (top), Tunnel lug (FS-009-020G-2), b (bottom left), T-rim bowl sherd (FS-009-147G-2), c (bottom right), Bowl sherd with a row of applied disks (FS-009-151G-1) (drawing by Lily Bonga, photos by Chronis Papanikolopoulos).

has demonstrated the existence of pottery from previously unknown periods there. Several sherds may be dated to the EB I period, which is not well documented on Kea, but it is known quite well from Attica.[7] The suspected EB I pottery comprises a tunnel lug, bowls with T-rims, and bowls with rows of applied disks below their rims (Figure 11).

The previous survey did not report any EB I pottery from Paouras, only a single possible FN or EB I sherd found near Koressia. However, in an unpublished report, David Wilson mentions one sherd from Caskey's exploration of Paouras that could possibly date to EB I.[8] Thus, the EB I pottery from Paouras collected by KARS significantly increases the evidence for occupation of northwestern Kea in this period. An excavation could establish whether Paouras was continuously occupied throughout the FN to EB I period and clarify the nature of the site: whether it was permanently occupied or a seasonal settlement. In addition, KARS recovered slag from the site, strengthening the evidence for metallurgy taking place at Paouras.[9]

No sherds belonging to the EB II period were identified among material from the previous survey at Paouras. However, David Wilson recognized EB II diagnostics amongst material collected by Caskey and Coleman at the site in the same unpublished report mentioned above. KARS also recovered several EB II sherds from Paouras (Figure 12). These include sherds with shape or decorative parallels at EB II Ayia Irini, including a sherd from a grooved pithos, pithos sherds with applied plastic bands, and a horned lug. One relatively well preserved vessel looks somewhat like a sauceboat, but is unusually coarse and otherwise atypical in its form (Figure 12b). EB II body sherds in distinctive wares also exist, including Talc Ware and Dark Brown Slipped and Burnished Ware. Some sherds could also be dated to EB II on the basis of their fabric or manufacturing technology, including several sherds in a probable Amorgian fabric, as well as a local burnished body sherd with marked smoothing striations on the interior, both of which are known from EBA deposits in Area B at Ayia Irini.[10]

7 For example at the sites of the Acropolis of Athens (Levi 1933, K. Dimitriou 2020), Palaia Kokkinia (Theocharis 1951), Loutsa (Efstratiou et al. 2009), Kiapha Thiti (Nazou 2014, 135-140), Thorikos (Nazou 2014, 221-223), Ayios Kosmas (Mylonas 1959), Moschato (Chrisoulaki et al. 2020), Asteria (Kaza-Papageorgiou 2020), Gerakas (Plassara 2020), Keratea (Andrikou 2020, 13), Merenda (Dimitriou 2020) and Tsepi (Pantelidou-Gofa 2005).

8 Caskey 1972, 358-9, no. P2. We are grateful to Wilson for sharing his report with us.

9 Georgakopoulou et al. 2016.

10 Abell 2021. This probable Amorgian fabric appears comparable to Vaughan's (2006, 100) so-called "Blue Schist" fabric, but petrographic analysis has demonstrated that the major inclusions are phyllite (Hilditch 2007, 239).

Figure 12: Sample of diagnostic Bronze Age pottery from Paouras: a (top left), Local pithos with incised applied bands, EBA (FS-009-048V-3), b (top right), Local sauceboat(?), EBA (FS-009-001G-1), c (bottom left), Local tripod leg, MBA-LBA (FS-009-054G-3), d (bottom center), Local arched handle with plug for push-through attachment partially preserved, EBA-MBA (FS-009-218V-1), e (bottom right), Straight rim from open vessel with coil seam visible in the break, in probable Cretan fabric, MBA-LBA (FS-009-050G-18) (photos by Chronis Papanikolopoulos).

No previous project had identified later Bronze Age pottery at Paouras either, but KARS recovered several sherds that are characteristic of the mid-MBA through LBA, comparable to pottery from Periods IV to VIII at Ayia Irini.[11] Some of these were identified on the basis of diagnostic parts like a carinated rim with handle from a carinated bowl, perforated crescent lug, or a tripod leg (Figure 12c, d), while others were recognized on the basis of fabric and forming technique, like a small rim sherd in a probable Cretan fabric, which shows evidence of manufacture by either coil-building or wheel-coiling (Figure 12e). Recent work at Ayia Irini has demonstrated that both this fabric and these manufacturing techniques are relatively well-documented there in MBA and LBA deposits.[12]

Conclusions

The basic processing of the data from Kephala and Paouras has been completed and already some new results have emerged in comparison with earlier projects focused on northwestern Kea. As we move forward, it is hoped that our fieldwalking and collection strategies, in conjunction with both our material and digital processing of the data collected, will enable us to refine our understanding of this much-studied region, and to address questions about the long-term validity of survey data. The study has not yet been completed, and much more will be revealed in time about the communities of Kephala, Paouras and their relationship to Ayia Irini. This of course links to the question of identifying colonisation episodes in the Neolithic and the EBA on northern Kea. But already we believe with this paper we have managed to show how a carefully designed database for pottery recording along with assigning roles to the members of the finds lab team according to their expertise and skills can lead to immediately usable detailed recordings in a survey project. Although the specialists have the final say in refining the chronologies and typologies of the pottery, a lot of tasks in the finds lab can be assigned to undergraduate and graduate students. This inclusive approach in the study of survey ceramics offers great possibilities for training and enables communication among the team along with scientific results.

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11 For the phasing of Ayia Irini, see Caskey 1979.

12 Abell 2021. Analysis of MBA-LBA pottery fabrics from the Northern Sector is also underway by Jill Hilditch. Similar Cretan fabrics are known from MBA Akrotiri, as well (Hilditch 2019).

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The potential of impasto pottery studies for understanding regional settlement dynamics, cultural transmission and connectivity in Bronze Age landscapes in Italy

Francesca Ippolito & Peter Attema

Abstract

The bulk of ceramic assemblages found on sites of protohistoric date in Italy is of a type of handmade pottery called impasto. Its study is labour-intensive as only limited reference assemblages exist and few studies on its production are available. Moreover, impasto shapes were often produced over long periods. The study of the pottery derived from surveys carried out in northeastern Calabria (Italy) by GIA's Raganello Archaeological Project (RAP) since the 1990s is a case in point. In these surveys, 113 pottery scatters dating between the Bronze- and Iron Ages were recorded. Of these scatters, 30 could be assigned to specific periods, having yielded potsherds that could be related to chrono-typological studies. The potsherds of the remaining 83 scatters had no obvious reference to such typological frameworks, and painstaking analysis of the materials was needed to increase the number of datable sherds. In this paper, we discuss the approach taken in our study of the pottery from the RAP surveys, which we based on the morphological characteristics of the material and on an extensive search for parallels from a range of published archaeological contexts. This approach resulted in new and important knowledge on the diachronic settlement development in the Raganello valley and in an assessment of its cultural connectivity across time and space, raising questions about how underlying mechanisms of cultural transmission were constituted.

Keywords: Bronze Age – Calabria – Survey – Impasto Pottery – Cultural Transmission.

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	Aegean Area	Calabria	Other Regions and Sites mentioned in the text
2150/2000-1700/1650 b.C.	Middle Helladic	Early Bronze Age (EBA)	Protoapennine Period (EBA+MBA1) -Dalmatia and Northeastern Italy -Sicily (Rodì Tindari Vallelunga) -Campania (Palma Campania)
1700-1650 b.C.		Middle Bronze Age1 (MBA1)	
1650-1550 b.C.	Late Helladic I-IIA		Protoapennine period (MBA1) -Puglia -Dalmatia -Campania
1550-1500 b.C.			
1500-1425 b.C.	Late Helladic IIB	Middle Bronze Age2 (MBA2)	Early Apennine (MBA2) North and Central Italy (Terramare) Dalmatia, Puglia
1425-1400 b.C.			Recent Apennine (MBA3) Tyrrhenian and Central Italy (Terramare) Campania, Puglia
1425-1300 b.C.	Late Helladic IIIA	Middle Bronze Age3 (MBA3)	
	Late Helladic IIIB		
1300-1200 b.C.		Recent Bronze Age1 (RBA1)	Early Subapennine (RBA1) Tyrrhenian and Adriatic Italian Coast (Terramare)
	Late Helladic IIIC		
1200-1150 b.C.		Recent Bronze Age 2 (RBA2)	Recent Subapennine (RBA2) Tyrrhenian and Adriatic Italian Coast (Terramare)
1150-1100 b.C.		Final Bronze Age 1 (FBA1)	
1100-925 b.C.	Late Helladic IIIC + Protogeometric Period		Protogeometric period (FBA) Central Italy (Etruria)
		Final Bronze Age 2 (FBA2)	
925-825 b.C.	PG+EG+MGI	Early Iron Age 1	Villanovan period (Etruria) Campania

Figure 1: Chronological table of Bronze Age (and Early Iron Age 1) phasing in the Aegean Area, in Calabria (Italy) and other regions and localities mentioned in the text (figure by F. Ippolito © 2017 under a CC BY 4.0 license).

Introduction

Over the last decade, doubtlessly stimulated by Horden and Purcell's *The Corrupting Sea, a study of Mediterranean History*,[1] connectivity has become an important concept in Mediterranean archeology. A plethora of studies, past and recent, has demonstrated that from an early point in history large parts of the Mediterranean were interconnected over often considerable distances, on the basis of the distribution of particular sets of artefacts, among which pottery plays an important role.[2] The case study presented by us concerns the Sibari area in southern Italy, where we have studied protohistoric pottery scatters from sites in the foothills surrounding the wide coastal plain and inland, in the uplands along the Raganello valley (Figure 1).[3]

While the foundation by Greeks of the colony of Sybaris in the 8th c. BC ranks as a prime example of early overseas contacts, such contacts were not new to the region[4]. Already before the historical Greek colonization, from the beginning of the Late Bronze Age onwards, the area had been caught up in long-distance overseas contacts with the Aegean

1 Horden & Purcell 2000.
2 See for instance Borgna 2009, 289-309; Van Wijngaarden 2002, 272.
3 Attema et al. 2010; Van Leusen & Attema 2001-2002; 2003.
4 Attema et al. 2023.

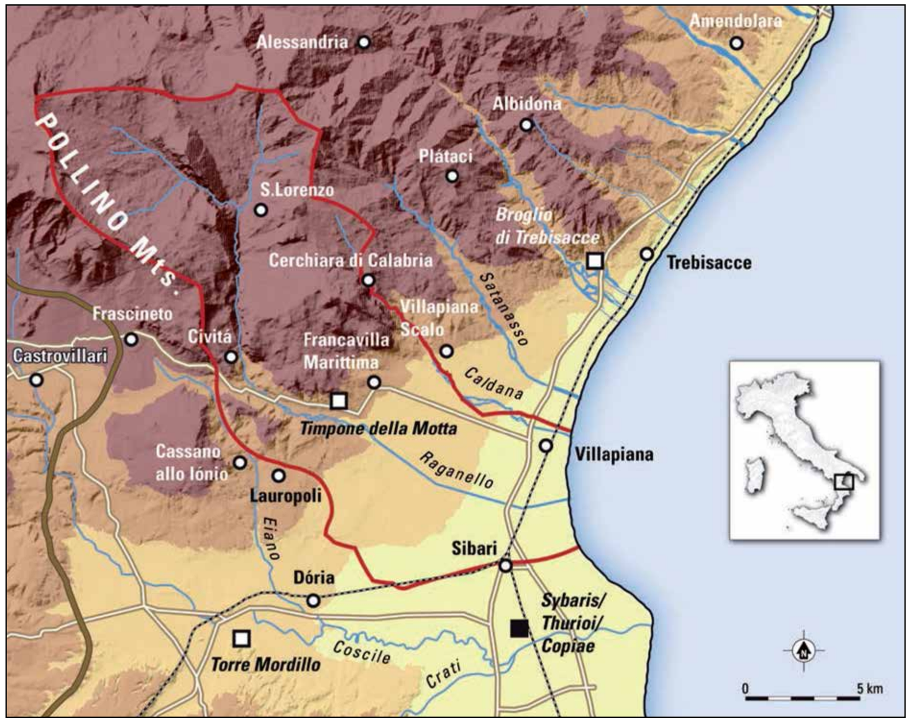

Figure 2: Map of study area of the Raganello Archaeological Project (red outline) (after Attema et al. 2010 © Amsterdam University Press).

world.[5] Complex patterns emerge in the way regions in the Mediterranean were interconnected on the basis of formal network analysis in archaeology and the availability of large datasets of diagnostic objects from sites scattered all over the Mediterranean.[6] However, the nature, significance and impact of these patterns and how they came about is not so easy to gauge and cannot be seen in isolation from even more complex patterns of intraregional and interregional interactions. For instance, while the presence of Aegean pottery on the Italic coasts is clear proof of long-distance connectivity, its influence on socio-economic and political developments in Bronze Age Italy can only be understood when viewed within an intricate longue-durée network of connectivity on the peninsula itself, Sicily and the Dalmatian coast, that had been developing already from the end of the Early Bronze Age.[7] Horden and Purcell show how small self-contained regions or micro-ecologies, as they call them, may belong to extensive networks, operating at various temporal and spatial scales. The data of the present paper, deriving from the PhD research of the first author, prove Horden and Purcell's point. Formal parallels for the impasto pottery repertoire, collected from pre- and protohistoric sites located in the foothills and uplands along the inland valley of the Raganello, were found at times in distant regions as far as northern Italy and Dalmatia and showed clear patterning in time and space (Figure 2).[8] Emma Blake already noted such shifts in connectivity in her *Social Networks and Regional Identity in Bronze Age Italy*, but based on metals and imported pottery only.[9] Below, we show that the incorporation of the chrono-typological study of impasto pottery in the reconstructions results in a broader image of Bronze Age connectivity and increases its significance for our understanding of regional societal change.

1.The potential of impasto pottery

1.1. Impasto as a dating tool

The primary objective of collecting pottery during surface surveys is the chronological characterization of archaeological sites. Finewares are most useful for this purpose, and our knowledge of finewares has greatly developed from the 1970s onwards. But finewares represent only a small portion of total surface collections, as site assemblages are mostly made up of coarse wares. Moreover, finewares do not occur in all periods. In the Italian Bronze Age, with the exception of Aegean or Aegean-type pottery, finewares are not common and the bulk of site assemblages is made up of impasto. In Italian

5 Vagnetti et al. 2009, 171-183; Bettelli et al. 2010, 109-118; Van Wijngaarden 2002, 248; Jacobsen 2007, 9-10; Jones et al. 2014, Sites 33-34; Ippolito 2016a, section 4.10.

6 Van Wijngaarden 2002, 273-275; Jung 2010.

7 Ippolito 2016b; 2013.

8 Ippolito 2016a, Introduction. The dissertation was written within the framework of the Raganello Archaeological Project (RAP) of the Groningen Institute of Archaeology (GIA) and comprised a detailed chrono-typological study of surface pottery of the impasto type.

9 Blake 2014.

prehistory and protohistory, impasto refers to a product made of clay with natural and added medium to coarse inclusions. Impasto vessels are as a rule handmade, with smoothed or polished surfaces, sometimes having incised or impressed decoration, and are fired at medium temperatures betwenn 700 and 800 degrees Celsius.

The production of impasto pottery occurred during a long period from prehistory into the Archaic period. Developments in shapes were gradual and only limited reference assemblages from stratigraphically investigated sites are available for comparison with the surface pottery. The fact that impasto found in surveys is often worn adds to the difficulty of working with this material. Therefore, in order to obtain reliable results, intensive study of the material was needed.

The pottery study carried out within the framework of the RAP was aimed at providing high-resolution chronological, functional and cultural information from the study of ceramics from 113 sites detected in the uplands of the Raganello valley. Of these scatters, 30 could be assigned to more specific periods having yielded potsherds that could be related to available chrono-typological studies. The potsherds of the remaining 83 scatters, however, had no obvious reference to such typological frameworks and required painstaking typological analysis to increase the number of dated potsherds. The first author classified the surface sherds as to their technology, considering thickness, colour, fabric, firing characteristics, level of preservation, sherd size, and possible decoration. Next, she dated the sherds typologically by identifying specific shapes or types of vessels.

In this way, 670 sherds were described; the shapes they come from were reconstructed, their fabric and surface treatment described, and finally they were dated based on parallels, where possible from excavated and stratified deposits elsewhere. The effort yielded relevant information about the chronological periods covered by our sites that before this study had been defined very generically as protohistoric.[10]

1.2. Reconstructing settlement dynamics using "impasto sites"

The survey work of the RAP builds on previous studies in the region carried out by the group of the late Renato Peroni of the Sapienza University of Rome, but is more intensive in nature and with more attention paid to upland settlement organization. Moreover, the specific pottery study we deal with in this paper incorporated finds from remote and at times almost inaccessible places discovered by the speleological association Sparviere, that were revisited by RAP researchers.[11] The intensive nature of the RAP surveys and the access to material already collected by the Sparviere group from the caves and hilltop sites along the Raganello provided a substantial body of datable impasto material.

It was possible to assign date ranges to 67 RAP sites based on the chronological evidence provided by the impasto pottery study. This caused a refinement in the chronological framework of settlement dynamics compared with earlier scholarship. The Peroni group had found little evidence for the Neolithic and the beginning of the Bronze Age in the Sibari area, while settlement development as described by Peroni[12] was not informative on the development of Middle Bronze Age sites in the upland Raganello basin. The RAP pottery study now offers for the first time information on the regional typo-chronological articulation of the Neolithic to the Eneolithic periods and more detailed insights into the Bronze Age phases preceding Middle Bronze Age 2 (Figure 3). With respect to the Raganello uplands, the RAP data show how the valley became more densely occupied during the Middle Bronze Age, but was gradually abandoned in the Late Bronze Age. We think this occurred because of the growth of settlements in the foothills overlooking the plain of Sybaris. The reasons why this change took place needs more study, but it was likely related to changes in subsistence patterns and political structure. The demographic change in itself is central to a process of nucleation first noted by Renato Peroni. According to this scholar, demographic pressure resulted in the centralized settlement pattern that arose in the Final Bronze Age and Early Iron Age in the foothills overlooking the vast plain of Sybaris, and which comprised large settlements like Broglio di Trebisacce, Timpone della Motta at Francavilla Marittima and Torre del Mordillo and their "satellites" (Figure 3).[13]

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10 There is no standard method to define a type, but in this study, the following factors were taken into account:
- specific characteristics of the assemblage (physical composition of the clay, and shapes)
- context of the assemblage and bias concerning provenance, preservation and sample reliability
- existing conventions applied to ceramic assemblages (facies/aspect, typologies)
- researcher skills

The successive step has consisted in establishing categories and distinguishing types through:
- grouping "traditional" types (dishes, jars, cups etc.)
- grouping vessels based on measurements (height/diameter of the various parts, and envelope assessments)
- grouping based on production techniques (handmade, wheel-turned and other)

The combination of this information led to group types based on similarity (parallels). Similarity was established starting from the whole assemblage, dividing it into smaller groups (applying a cluster analysis), taking into account similar characteristics of vessels and at the same time distinguishing differences among them (see Ippolito 2016a, 21-24).

11 Ippolito 2016a, section 2.1.

12 Peroni & Trucco 1994.

13 Peroni 1994, 874; Trucco & Vagnetti 2001.

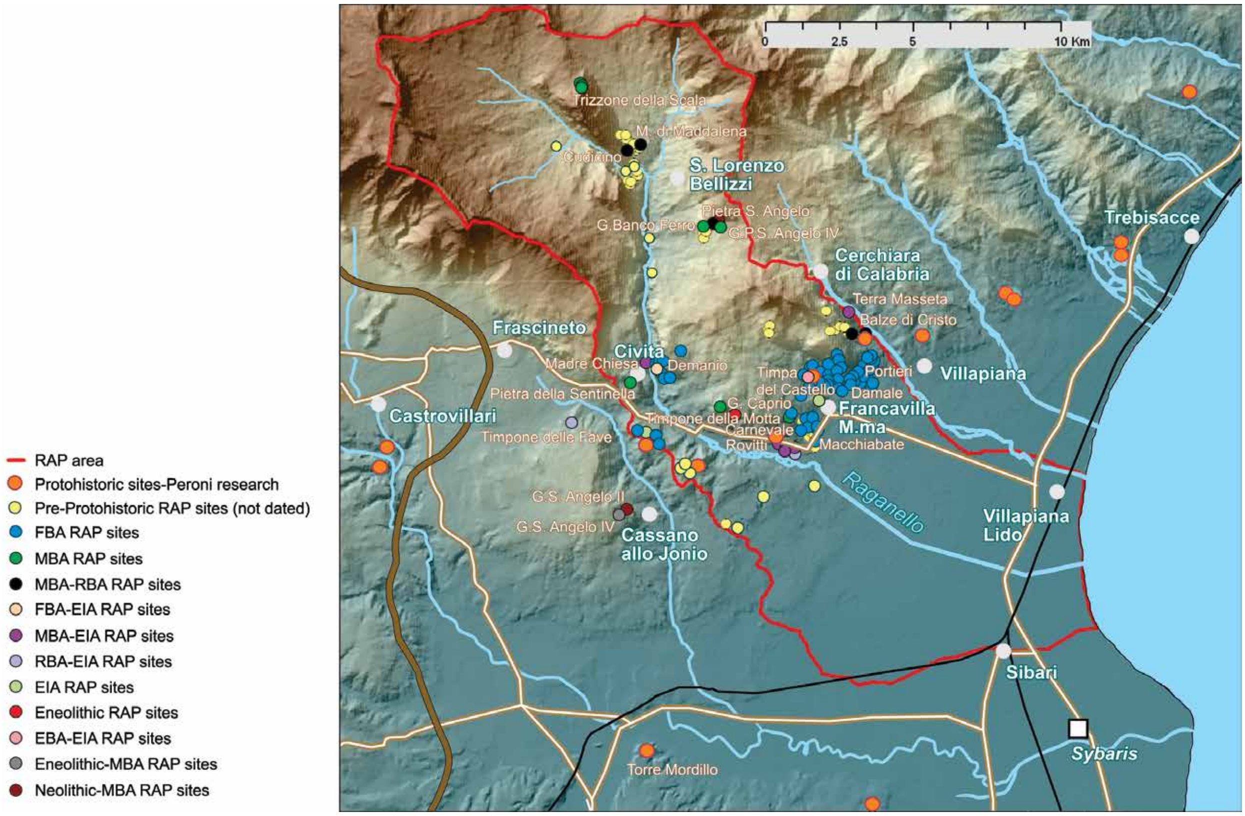

Figure 3: Distribution of sites within the study area from the Neolithic to the Early Iron Age. Note the clustering of sites in the Final Bronze Age in the foothills overlooking the vast plain of Sybaris (the blue dots) and the absence of these in the valley (after Ippolito 2016a, © 2016 under a CC BY 4.0 license).

2. Cultural transmission as a measure of connectivity

Apart from obtaining a more robust diachronic overview of Bronze Age human presence in the study area and new insights into settlement dynamics, the pottery study also yielded fresh information on resemblances in the impasto of our study area with that of other parts of the Italian peninsula and even the Adriatic coast opposite Italy (Figure 4a). Parallels for diagnostic pieces from RAP sites found in stratified deposits brought to light an intriguing network of site interaction, reconstructed from resemblances in pottery shapes and decorations over a wide geographical area. The series of phase-by-phase maps presented in Figures 4b-d and 5a-d shows distributions of sites that yielded parallels in pottery shapes for sherds from the RAP sites.

By presenting these maps, we do not claim that such resemblances were the result of direct formalized contacts. We believe that more complex mechanisms must be considered in order to explain the chronologically structured similarities in cultural traits over the large distances as seen on the maps. By structured similarity, we mean that the maps reveal geographical patterning in the formal resemblances in material culture between areas. This phenomenon was only revealed thanks to the broad time perspective of our pottery study, covering a period of over a millennium from the end of the Early Bronze Age into the Early Iron Age. In order to further clarify the relationship between spatial patterning and similarity in cultural traits, the next section discusses the methodology of working with parallels. This provides a basis for reflection on the mechanisms that may underlie such resemblances as dealt with in the theoretical literature on cultural transmission.

2.1. Notes on methodology: working with parallels

Morphological resemblances between diagnostic potsherds from RAP sites and sites outside the RAP survey area form the basis of our assumption that there is a roughly coeval cultural connection between the finds spots mapped in Figures 4 and 5. This departs from the idea that certain formal elements (shapes and decorations) within the impasto pottery repertoire can be seen as carriers of information transmitted from one place to the other by a slow process of imitation of successful functional and decorative traits (cultural transmission). The assumption of meaningful similarity should, however, be supported

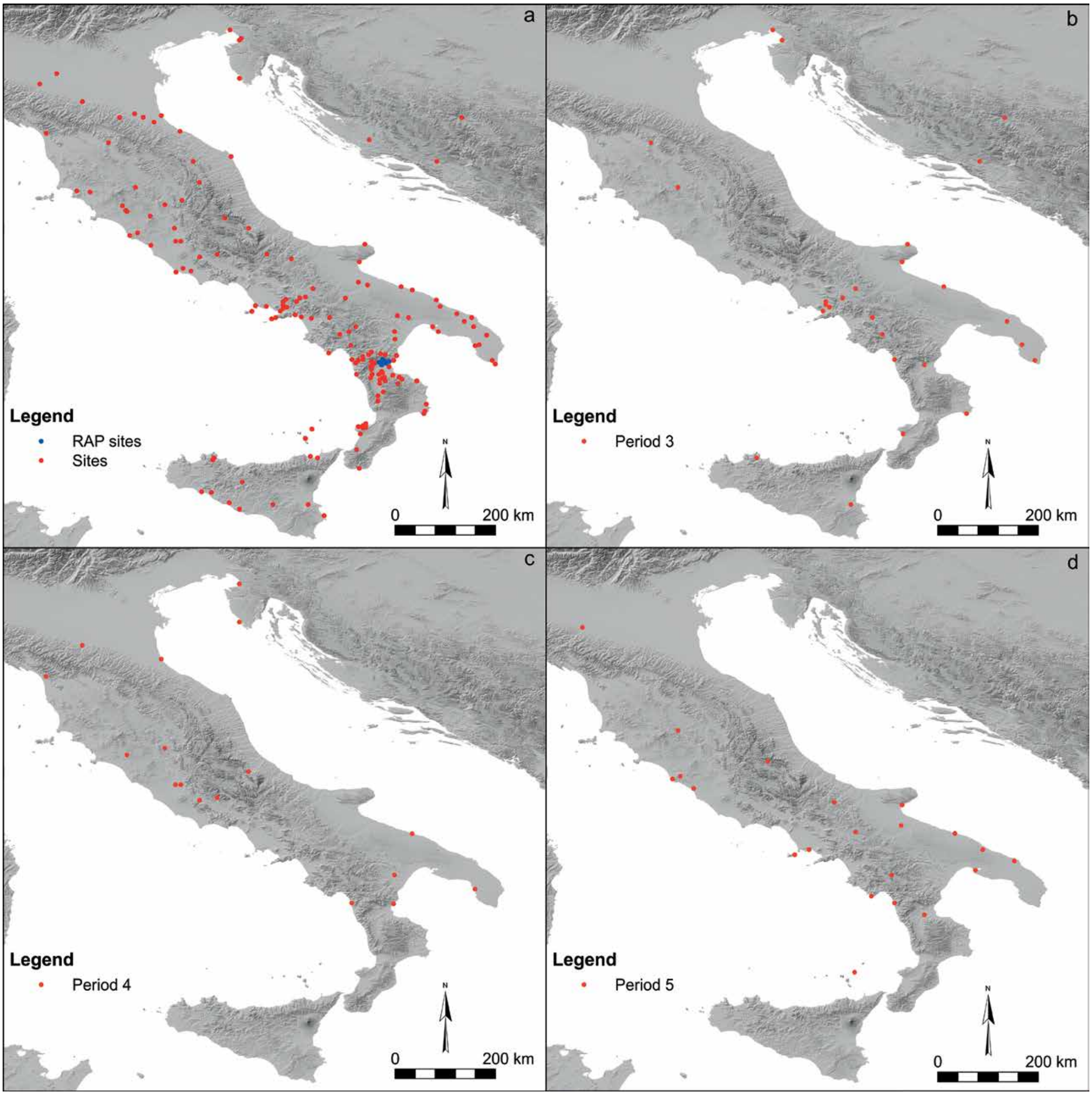

Figure 4: Distribution of sites where parallels for impasto pottery from the RAP area were found (from the end of the EBA to the beginning of the LBA). Note 4a: cluster of protohistoric sites in the study area of the RAP (blue dots) and sites where parallels were found (red dots). 4b: transitional period between the end of the EBA and the beginning of the MBA. 4c: MBA1-2. 4d: MBA3-LBA1 (after Ippolito 2016a, © 2016 under a CC BY 4.0 license).

by a number of additional contextual factors. Firstly, the parallels must come from archaeologically reliable contexts (well-delineated Italian Bronze Age sub-period, closed and/or stratified contexts). There is, however, no strict need to work with parallels from comparable functional contexts (funerary, ritual, domestic), since the same impasto shapes may occur in all three contexts within the periods studied: only very few shapes are exclusive to one of the three domains. Secondly, the morphological resemblance between fragments should not be limited to singular pieces, but have a quantitative basis that shows spatio-temporal patterning. Finally, we would not expect "true copies" but rather a certain extent of morphological variability due to individual technological and formal choices made by the potters – their agency.[14]

14 Needless to say, we also need to take into account effects of (post-) depositional processes.

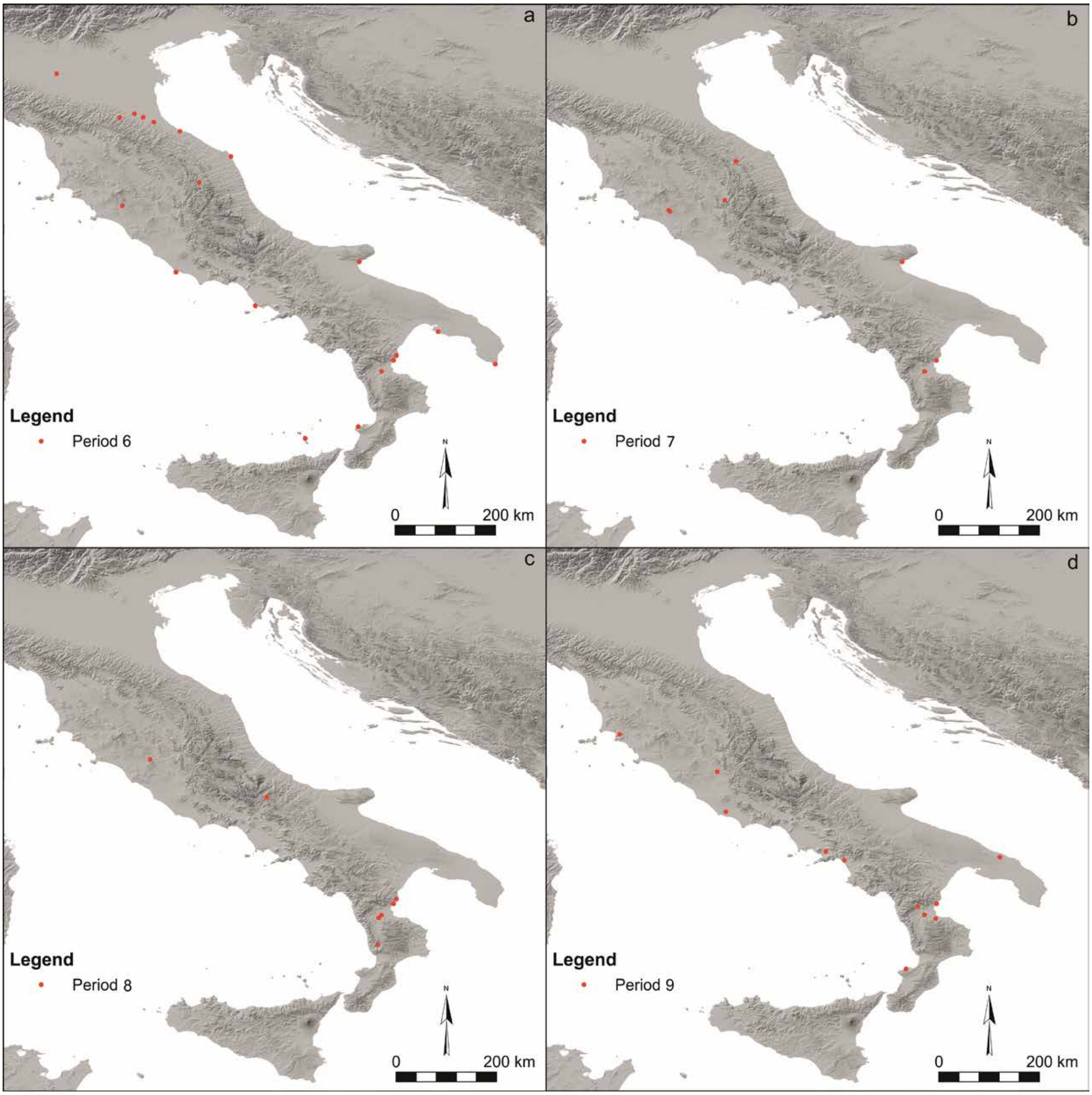

Figure 5: Distribution of sites where parallels for impasto pottery from the RAP area were found (from the second half of the LBA to the EIA). Note 5a: LBA1. 5b: LBA2. 5c: Period between LBA2 and the EIA. 5d: EIA (after Ippolito 2016a, © 2016 under a CC BY 4.0 license).

In our research, the above-mentioned four factors (morphology, context, patterning and limited variability within typologically classified shapes) had to be evaluated positively for each RAP pottery shape or particular feature to be equated with a specimen from another archaeological site. Only then were we confident that the resemblance was meaningful and involved cultural transmission. Following Mesoudi and O'Brien, we define cultural transmission as 'the process by which information (e.g., knowledge, skills, or beliefs) is passed from individual to individual via social learning'.[15] Different from diffusionism (departing from an area of origin whence an innovation spreads diffusely), the concept of cultural transmission allows for reciprocity, agency and the reconstruction of connectivity between areas (networks). The fact that we were able to discern spatio-temporal patterning in our data supports our hypothesis that it is possible to detect cultural transmission

15 Mesoudi & O'Brien 2008, 4.

through the intensive search for parallels for our impasto material and to define the morphological characteristics within this particular repertoire through which cultural transmission was mediated. Such knowledge can in turn be linked to possible patterns of consistent regional and interregional connectivity representing longstanding cultural contacts.[16] To test the hypotheses of the existence of such interaction between our study area and the regions depicted in the maps from the Early Bronze Age to the Early Iron Age, further study is needed, however, and the trends presented below should be taken as preliminary. We must also keep in mind that the maps reflect the status of research in these areas.

2.2. Peninsula-wide resemblances in the impasto repertoire

Parallels for the impasto sherds from RAP sites depicted on the overview map in Figure 4a were found among published materials from stratigraphic layers at sites outside the survey area and provide data about chronology and geographical occurrence over large parts of Italy and the Dalmatian coast. In the series of seven maps in Figures 4a-d and 5a-d, the overview map (Figure 4a) is broken down into the main periods into which the Italian Bronze Age is subdivided (Figure 1), in order to show the patterning in the formal resemblances of the impasto repertoire across time and space. On the basis of the distribution of sites showing formal resemblances in their impasto repertoire, we observe the following trends per period:[17]

1. In the transitional period between the end of the EBA and the beginning of the MBA (MBA1), parallels for the materials from the RAP area were mostly found in southern Italy, especially in Campania, then in Puglia and in Calabria itself (Figure 4b). To a lesser extent, parallels were found in Sicily (among which Rodì-Tindari-Vallelunga specimens), along the northeastern Italian coast and Dalmatia.
2. For the period of the MBA1-2, parallels were found in central Italy, Puglia and Calabria, in the area of the Terramare culture in northern Italy, and in Dalmatia. In contrast with the EBA-MBA1, no parallels were found in Campania until the MBA3, due to the devastating effects of the Avellino eruption dated shortly after 2000 BC. More analogies were found with central Italy, while cultural relationships with the Terramare culture in the Po valley (MBA-LBA) start in this period (Figure 4c). The Terramare culture appears as an exceptionally strong regional network in the analyses of Emma Blake, an observation corroborated by the RAP pottery.[18]
3. In the MBA3-LBA1, the number of sherds increases and we may speak of a peninsular connectivity. Now, nearby Broglio and Grotta Cardini in Calabria are the sites where most of the parallels are found, followed by sites in Campania and central Italy. There are several parallels also in Puglia and along the Tyrrhenian coast (Figure 4d). The larger number of sherds for this period and their distinct typological characteristics reflect an almost homogeneous spread of ceramic types during the MBA3, which would intensify during LBA1.[19]
4. Within the pattern of overall peninsular connectivity there is, in the RAP pottery record for LBA1, an exceptionally strong link to the Italian Adriatic coast. This is detected f.ex. at Roca Vecchia in Puglia, relatively nearby, where metal and amber evince contacts with the Terramare area as well.[20] Other LBA1 parallels were found in Calabria and along the Tyrrhenian coasts (Figure 5a).
5. During LBA2 (final Late Bronze Age), the cultural network changes completely with respect to the foregoing period and there is a sharp decrease of parallels for the RAP pottery – indeed, there is a general decrease in the number of contexts overall. This period of reduced connectivity corresponds to the period in which the Terramare and Mycenaean systems collapse. Parallels for the beginning of LBA2 were above all found at Broglio and Torre del Mordillo, but also in central Italy and Etruria (Figure 5b).
6. Between LBA2 and the EIA, the situation is similar and we might call this an inward-looking period. Parallels still come from Calabrian sites with only a few from central Italy (Figure 5c). Our dataset suggests that from the end of the LBA there is a decrease in material evidence. However, this may be due to methodological factors: while the presence of fine matt-painted pottery in the record of LBA2 onwards has drawn the attention of many scholars, the LBA2-EIA impasto pottery has often been neglected.[21]
7. During the EIA, we again witness a change, as a new connectivity pattern emerges, involving sites along the Tyrrhenian coast, from South Calabria towards Etruria, via Campania (Figure 5d).

16 One should bear in mind, however, that the meticulous study of the impasto material from the RAP sites was in the first instance meant to date the RAP sites and that a relatively small corpus of parallels was enough to meet this objective. We discovered the spatio-temporal patterning in the data only later on, when we mapped all the parallels in the time-slices presented in Figures 4 and 5.

17 EBA = Early Bronze Age, MBA = Middle Bronze Age, LBA1 = Beginning of the Late Bronze Age, LBA2 = final Late Bronze Age, EIA = Early Iron Age.

18 Blake 2014.

19 Pacciarelli 2001, 36; Peroni 1994, 848.

20 Jasink et al. 2011, 207.

21 But see Colelli 2012.

In sum, the patterning in resemblances in the impasto repertoire ranges from South Italy and Sicily in the EBA to central and northern Italy in the MBA and the Italian Adriatic coast in LBA1. In LBA2 and the transition to the EIA, a marked regionalization took place with a new pattern of resemblances with sites on the Tyrrhenian coast surfacing in the EIA. This summary overview illustrates how a small region or, in the words of Horden and Purcell, a micro-ecology, may be part of a wide-ranging network within which people, technological concepts and objects travelled from place to place. It also makes clear how such connectivity changed over time. However, the interpretation of the patterning that we have identified in terms of changing social and cultural dynamics is a more complicated matter. Below, we reflect briefly on the difficult question of how we may study the mechanisms that underlie this spatio-temporal patterning in resemblances in the impasto repertoire.

2.3. Cultural transmission and connectivity

In the absence of direct evidence for the movement of people or goods, it is not easy to explain the resemblances in the impasto repertoire as recorded by us on the scale of peninsular Italy and beyond. In this paper we can only hint at theoretical approaches that may help furnishing eventual answers.[22] In our study of the RAP pottery, we considered both functional and cultural aspects of impasto production. The functional aspects concerned the use of the vessels as inferred by their shapes, arguably corresponding to storage, food preparation and consumption of drink and food.[23] The cultural aspects we observed rather regarded the characteristics of shapes and decorations. The cultural traits of vessels (rather than the functional ones) constitute, generally speaking, the most appropriate means by which to detect cultural changes and contacts in a chrono-typological study like ours.[24] A good example is the coeval production at Torre del Mordillo of the same shape in impasto and in Grey Ware in the LBA: the function is presumably the same, but a cultural association is seen in the Grey Ware, which points to Aegean influence.[25] By considering the extent to which these cultural traits were shared (or not) by people in different localities, we think it possible to obtain a sense of the range and scale of cultural transmission *sensu* Mesoudi & O'Brien who, we reiterate, define cultural transmission as 'the process by which information (e.g., knowledge, skills, or beliefs) is passed from individual to individual via social learning'.[26] Within a long time perspective, and using a large geographical scale, such transmission may become visible as a pattern of connectivity between localities as shown in the maps in Figures 4 and 5. One could point to diffusionism (as traditionally conceived) as a vehicle for the observed spread of similar morphological and decorative traits in local impasto pottery production over the large geographical spaces we identified, but the spatio-temporal patterning in our data suggests that this is not a satisfactory explanation. Also, while diffusion mainly regards change *per se* – notably the appearance/disappearance of cultural traits – the theoretical framework of cultural transmission investigates underlying mechanisms.[27] Cultural transmission between localities implies, in the specific case of the impasto repertoire, that similarities in cultural traits of certain shapes within this otherwise technologically undifferentiated pottery production are so strong that social connections of some sort must be assumed. We emphasize once again that such similarities do not imply straight one-to-one formal relationships, as we can assume variability to have occurred in the transmission process as a result of experimentation, copying and production choices. At the same time, when we are convinced of resemblances of culturally defined aspects of functional categories of vessels from different localities – in the guise of certain types of handles, rims or decorative attributes – we cannot but assume a slow but persistent form of cultural connectivity to have existed. This implies that social learning overcame distances of hundreds of kilometers. As our maps suggest, the links between our study area and "the outside world" seems to a great extent determined by the waxing and waning of strong regional cultural networks, such as the successive Palma Campania, Terramare and Villanovan cultures. This is then, briefly and in simplified form, what the spatio-temporal patterning in our impasto data suggests.

22 O'Brien 2005; 2010, Stark et al. 2008, 1-16; Eerkens & Lipo 2007.

23 We assume that the bulk of the pottery studied was produced for daily usage as only few contexts and fragments hint at a possible ritual use. This means that we assume that when shapes are abandoned and new ones are adopted this may be indicative of a new behavioral pattern in the ways that storage, preparation and consumption took place, which may or may not carry specific cultural characteristics.

24 The ability to transmit and receive cultural traits involves behavioral transmission, which is based on interaction and social learning. Important in the context of this study is, however, the understanding that people may independently evolve similar behavior. Eerkens & Lipo have noted that 'pottery emerges at different times and places to solve similar needs (i.e., food processing, storage) given similar kinds of resources (e.g., clay, water, heat sources). Populations have repeatedly found baked clay to be a highly efficient solution for the creation of watertight and fire-resistant vessels. Even forms of decoration can be highly convergent [...]. Many other kinds of cultural convergences are likely to exist, so we cannot take all measures of similarity to indicate the presence of CT [Cultural Transmission] between entities' (2007, 243-244).

25 Trucco & Vagnetti 2001, 253-255.

26 See n. 14.

27 Eerkens & Lipo 2007, 241-242; Lyman & O'Brien 2007, 697-699.

3. Settlement dynamics and Aegean ceramic imports

We will now turn to our final point: the abandonment of the inland valley of the Raganello basin and the contemporary settlement concentration in the foothills. This is a dynamic that in material culture terms is associated with Aegean-type ceramics, both locally produced and imported. From our pottery study, it appears that most inland sites were founded in the Middle Bronze Age and abandoned during the Late Bronze Age. MBA sites on hilltops in the lower valley and the foothill zone overlooking the plain, however, continued to exist.[28] It thus appears that the upland area was not favoured for settlement purposes in the LBA, although exploitation continued. This is the type of development that we have described as a weak form of centralization taking place in the foothill zone of the Sibari area: in this period, the settlements of Torre del Mordillo, Timpone della Motta and Broglio started to acquire proto-urban characteristics in the form of the concentration of certain socio-economic factors (e.g. craft specialisation) and demographic growth.[29] Our pottery study corroborates the idea that connectivity with the outside world now became mediated through these centres: this is evident from the pottery characterized by Aegean material cultural traits appearing in the study area during this period.[30] The pottery is comprised of imported Late Helladic fineware, local imitations of it in larger numbers, Grey Ware and corded pithoi. The first two categories are foremost found on the larger LBA sites in the coastal area,[31] the corded pithoi, however, are more widespread over the foothills, as RAP surveys have shown.[32] The fact that we do not have evidence so far of these categories in the hinterland would corroborate Blake's conclusion that the regional social network based on Aegean-type objects was above all a coastal affair: the production was readily adopted within the developing proto-urban constellations, but did not spread inland.[33]

Of the Aegean-type pottery, Grey Ware is a good indicator of LBA cultural transmission between the Aegean world and coastal settlements of the Sibari area.[34] So far, ceramics bearing Aegean cultural traits occur only in the largest LBA sites, and at these sites, fragments of corded pithoi of Aegean inspiration are also regularly found.[35] Although we do not know whether these pithoi were made by local or foreign potters, we note that they were in use together with impasto pottery of a very different fabric and production. This coexistence indicates that cultural exchanges were the result of deliberate choices made by local potters and consumers based on current functional and cultural considerations. While the adoption of Aegean technology and concepts may rank as a prime example of cultural transmission and is recognized as such by archaeologists, this is less straightforward for the impasto repertoire of the earlier periods we discussed. It is, however, not far-fetched to imagine that the same mechanism of social learning was at work in the earlier periods as well, albeit that its detection is more complicated in view of the lack of more obviously specific cultural traits.[36]

Conclusion

In this paper, we have highlighted the potential of morphological analysis of impasto pottery sherds deriving from surface collections for dating purposes, attained by comparing them with well-dated stratified deposits elsewhere. We discussed how we found parallels for the pottery collected at survey sites in the Raganello valley over large parts of peninsular Italy, Sicily and the Dalmatian coast. While realizing that the detection of parallels to some extent reflects the state of research elsewhere, the resulting distribution showed patterning in space and time revealing changing connectivity between our study area and the areas where the parallels were found. This led to a further potential of the formal analysis of survey pottery, establishing cultural links with other areas. On the basis of our typo-chronological study, we detected cultural connections suggested in material culture from the Middle Bronze Age to the Late Bronze Age ranging from the Tyrrhenian to the Dalmatian coasts and from the northern Terramare to the Sicilian Rodì-Tindari-Vallelunga culture. This brought about reflections on how such connections may have been constituted. Rather than to diffusionism, we looked at cultural transmission as an explanatory model in which social learning plays an important role. While cultural transmission through social learning is hard to detect in the productions of impasto pottery, our study shows that there is scope for this, even when using surface collections of handmade pottery. What mechanism of knowledge transfer we must imagine over

28 Attema & Ippolito 2017.

29 Peroni 1994, 852-859.

30 Vagnetti et al. 2009, 171-183; Bettelli et al. 2010, 109-118; Van Wijngaarden 2002, 248; Jacobsen 2007, 9-10; Jones et al. 2014, Sites 33-34; Ippolito 2016a, section 4.10.

31 Already Van Wijngaarden observed that Late Helladic IIIA2 and Late Helladic IIIB pottery was concentrated at relatively few large centers in the central Mediterranean (2002, 266-267).

32 De Neef 2016.

33 We have to be cautious here as intensive survey has so far been limited in much of the Sibari area inland.

34 Already at the beginning of the LBA, local shapes began to be made in Grey Ware, both handmade and wheel-turned, and co-existed with handmade impasto pottery, creating a cultural koiné for this pottery category.

35 Levi & Schiappelli 2004, 96-104; Attema & Ippolito, forthcoming.

36 For in-depth studies of long-term changes in the impasto repertoire of northern Calabria and external influences, see Peroni & Trucco 1994.

such great distances is an issue that needs to be looked into from anthropological and ethnographical perspectives.

We further highlighted how, having dated the impasto pottery from our survey sites, we detected a particular demographic change in the study area during the Final Bronze Age that led to a centralized settlement pattern where connectivity with the outside world became mediated through its main settlements. Material culture at these central sites and their satellites bears clear cultural traits related to Aegean influence, but they were reworked to suit the new proto-urban-type society. Blake's observation that in South Italy no strong regional networks developed was based on the presence of Aegean goods, or exotica, along the coasts. In reality, this coastal network pattern is complementary to other networks represented by other archaeological materials like the impasto pottery that was the object of study presented in this paper. Indeed, when taking a broader view of material culture, a more complex pattern emerges, suggesting the existence of long-lasting and wide-ranging protohistoric exchange networks. In order to understand what happened in the period that preceded the historic Greek colonization, we need to probe much deeper into this complex pattern of long-term Bronze- and Early Iron Age cultural transmission and connectivity aiming to create a firmer context for such specific and highly visible networks as the Aegean connection, the Euboean connection and finally Greek colonial presence. In this regard, the theoretical framework of cultural transmission seems suitable. We may also ask ourselves how we can improve the use of impasto pottery as an analytical tool. The answer is surely to increase connectivity between researchers working with impasto pottery, and finding ways to share chrono-typological data. A way to move forward could be the creation of a shared database of impasto finds including detailed drawings from as many surveys and excavations as possible. However, such an initiative can only be successful if the meticulous recording and publishing of impasto pottery becomes standard practice. There is potential for this, as we hope to have shown, and we are convinced that it would help to assemble the difficult puzzle of regional identities and connectivity during the Mediterranean Bronze Age and later.

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Survey, ceramics and statistics

The potential for technological traits as chronological markers

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Abstract

In contrast to excavated datasets, the lack of stratigraphic context for ceramic survey material often means that a considerable part of the collected sample is essentially non-diagnostic and can offer little beyond a presence/absence for determining the spatial extent of human activity. Whilst detailed regional comparison between excavated ceramic sequences and survey assemblages of feature sherds presents the best opportunity to identify specific periods of activity across the landscape, this paper explores the potential to characterise broader chronological periods into which less diagnostic sherd material might be reliably placed. We discuss the results of a preliminary statistical analysis on ceramic material from the Keros Island Survey to establish the degree to which values of specific technological variables are spread throughout the assemblage, since parameters such as wall thickness, fabric coarseness, firing characteristics and level of preservation may be considered indicative or 'diagnostic' for broad chronological periods. Increasing the diagnostic potential of material collected during a pedestrian field survey can offer a more nuanced and also robust interpretation of the nature of human activity in a particular region and how it changed through time. In the case of the Keros Island Survey, this approach has contributed to the interpretation of diachronic land use strategies that extend from the establishment of the Early Bronze Age maritime sanctuary at Dhaskalio-Kavos up until the recent abandonment of the island in the 1950s.

Keywords: Chronological Modelling – Statistical Analysis – Ceramic Technological Characteristics – Survey Assemblage – Keros.

Introduction

This paper focuses on the interpretation of ceramic survey assemblages using a methodology developed to extract as much information as possible from non-diagnostic sherds. Whilst detailed regional comparison between excavated ceramic sequences and survey assemblages of feature sherds presents the best opportunity to identify specific periods of activity across the landscape, this paper explores the potential to characterise broader chronological periods into which less diagnostic sherd material might be reliably placed, thereby providing a more robust means of interpreting long-term human activity from survey data.

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We discuss the results of a preliminary statistical analysis of ceramic material from the Keros Island Survey (hereafter KIS) to establish the degree to which values of specific technological variables are spread throughout the assemblage. This approach uses wall thickness, fabric coarseness, firing characteristics and level of preservation, often considered, in combination with one another, to be indicative or 'diagnostic' of broad chronological periods identified on pedestrian surface surveys. Chronological modelling is common in archaeology, particularly in archaeological field survey where finely datable material is often lacking. The main principle of such studies is usually to aggregate artefacts that date to periods with variable chronological resolution in order to explore the diagnostic potential by combining their information. A key requirement for this process is the attribution of probabilities for each individual artefact for every interval within its chronological range, e.g. an artefact dating from 450-350 BC will be given a probability for the interval 450-440 BC, another probability for 440-430 BC, and so on. A well-known approach for assigning probabilities is applying the weighted mean, the *media ponderata*, where a uniform probability distribution is assumed for every artefact,[1] but variants assuming a normal distribution for probabilities are also known.[2] Another approach is the assignment of probabilities based upon material specialists' experience.[3] All these approaches use the modelling of uncertainty to be able to create what may be called *fuzzy* or probabilistic dates that can subsequently be used for aoristic modelling, in which various temporal scenarios can be explored.[4] For the vast majority of applications, this has been done a posteriori, establishing probabilities after-the-fact, and for the few that have been done a priori, the method remains somewhat subjective and opaque, in the sense that it depends on the judgement of a specific individual or individuals and cannot easily be replicated.[5] Therefore, we aim to provide a robust, quantified, replicable and transparent methodology to substitute (at least part of) the subjective attribution of probabilities in ceramic chronology interpretations.

Context

The island of Keros is situated in the southern Cyclades in the middle of the Aegean Sea (Figure 1). The site first rose to prominence during the 1960s due to large-scale looting activities in search of prestige objects, including the iconic marble figurines of the Early Cycladic period.[6] Several episodes of systematic investigation since this time, including both survey and excavation, have sought to understand the nature of the Special Deposit[7] at Kavos and the settlement on the islet of Dhaskalio on the west coast of the main island of Keros.[8] Despite these investigations, many important questions remained for contextualising the oldest maritime sanctuary in the Aegean.[9] For example: was there other significant Early Bronze Age occupation of the island? What was the extent and nature of any wider habitation on Keros, and how might that have changed through time? Might other specialised sites, such as a workshop for finishing marble objects, or a site related to the breakage of the choice materials deposited in the sanctuary, exist somewhere else on the island? What were the internal dynamics of Keros and how did these change across the short and long term occupation of the island?

The KIS was designed to address these important questions.[10] Over four three-week seasons in 2012-13, the survey covered approximately 1223 ha (81% of the surface of the island), with only dangerous and inaccessible areas excluded. The ceramic methodology, and expected dataset, was considered from the outset of the survey and was devised in line with the field methodology and with previous approaches to ceramic finds on Aegean surveys in mind.[11]

Ceramic methodology

In total, 8,701 ceramic finds were collected during the KIS, using one of the four methods: i) extensive tract walking; ii) intensive collection of diagnostic 'grabs' within a 10 × 10 m square; iii) intensive total 'vacuum' collection within a 5m^2 circle at the centre of the collection square; and iv) a few chance finds. A single sherd digital recording system was deliberately chosen to provide flexibility for the successive steps of sherd characterization.

Post-survey study of the ceramic material provided four levels of hierarchical information: index sherds (level 1), diagnostic feature sherds (level 2), feature sherds (level 3) and non-diagnostics (level 4).[12] Index sherds are defined as the most detailed and reliable evidence for specific chronological periods within survey material. The term was first used within the Sphakia Survey[13] but has been modified in the KIS to include shape, surface treatment and/or ceramic fabric. Index sherds were defined by each of the four ceramic specialist teams within their chronological ranges: Neolithic to Late Bronze Age

1 E.g. Fentress et al. 2004; Di Giuseppe 2012; Tol 2012; see Pelgrom et al. 2015 for advanced application.
2 E.g. Carter & Prieto 2011, 104-111.
3 E.g. Bevan et al. 2013.
4 E.g. Crema, Bevan & Lake 2010; Bevan et al. 2013.
5 E.g. Bevan et al. 2013, 315.
6 Zapheiropoulou, Doumas & Renfrew 2007, 13-38.

7 A concentrated area of dense archaeological finds relating to, marble figurines, marble vessels and pottery.
8 Renfrew et al. 2007; Renfrew et al. 2013, 2015.
9 Renfrew, Boyd & Bronk Ramsay 2012.
10 Renfrew et al. in press.
11 Haggis & Mook 1993; Moody et al. 2003; Kiriatzi 2003.
12 For the full methodology of the KIS ceramic study, see Hilditch forthcoming.
13 Moody et al. 2003, 51.

Figure 1: The island of Keros in the Cyclades, Greece (map by the Keros Project).

(Period Group A), Early Iron Age to Middle Roman (Period Group B), Late Roman to Middle Byzantine (Period Group C) and Late Byzantine to recent (Period Group D).[14] In this way, a chronological sequence of index categories has been constructed, from the earliest prehistoric periods until the modern period (Figure 2).

Diagnostic feature sherds, or level 2 sherds, are defined as having been identified within a broader chronological range than a single index period, i.e. belonging to two consecutive index periods, either within a specialist Period Group (e.g. Early Cycladic to Late Cycladic, Index Periods 2-3) or across the specialist boundaries (Middle to Late Roman, Index Periods 10-11 that cross Period Groups B-C). To give an example, mat impressed bases are typical of the Final Neolithic to Early Cycladic III period but without an identifiable shape or decorative motif on the rest of the vessel, these sherds often cannot be attributed to a more specific chronological period within the broad prehistoric Period Group A.

Feature sherds, those showing an identifiable vessel part but where chronological attribution was not possible, form level 3 within our study, while the remaining sherds are classified as level 4, featureless and non-decorated, also currently without chronological attribution (Figure 3).

Technology as diagnostic indicator

Of the 8,701 sherds that were recovered during the KIS, 2,868 sherds (just under 33%) could be attributed as level 1 or 2 sherds of variable resolution, meaning that 67% of the collected ceramics could not initially be used in the survey interpretations. This represents a substantial quantity of collected survey material that effectively added little to nothing towards the short- or long-term interpretation of human use and occupation of Keros. Ceramic technological characteristics, as opposed to typological or stylistic attributes, are present on all sherds regardless of the condition of the sherd or the vessel part. As a result, even sherds traditionally considered non-diagnostic (featureless, undecorated body sherds) can be assigned technological characteristics.

On the KIS, technological characteristics for sherds from all 4 levels collected were recorded into the database. This leaves us with a sample of 7,907 sherds or 91%, a considerably larger sample than the previously mentioned level 1 and 2 sherds.[15]

Technological characteristics were recorded using four variables, namely wall thickness, fabric coarseness, firing temperature and degree of weathering. Each sherd

14 The following specialists worked on four specific chronological ranges: Period Group A was studied by Jill Hilditch and Ayla Krijnen; Period Group B was first studied by Christina Mitsopoulou and subsequently by Vladimir Stissi and Anna Meens; Period Group C was studied by Charikleia Diamanti and Marina Vogli; and lastly, Period Group D was studied by Christanthi Sakellakou and Stavroula Tseva.

15 Due to time constrains, vacuum sherds from one of the intensive collection areas (polygon 2) were not assigned with technological attributes yet.

LEVEL 1			LEVEL 2
Index Period IP	Chronological terminology	Date range	Period Group PG
1	Final Neolithic-Early Cycladic I	4500-2850 BC	A
2	Early Cycladic II-III	2850-2100 BC	
3	Middle Cycladic-Late Cycladic	2100-1100 BC	
4	Early Iron Age	1100-800 BC	B
5	Late Geometric - Early Archaic	800-600 BC	
6	Late Archaic - Classical	600-350 BC	
7	Late Classical-Early Hellenistic	350-250 BC	
8	Middle Hellenistic	250-100 BC	
9	Late Hellenistic - Early Roman	100 BC - 100 AD	
10	Middle Roman	100-300 AD	
11	Late Roman/Early Byzantine	300-700 AD	C
12	Middle Byzantine	700-1100 AD	
13	Late Byzantine	1200-1400 AD	D
14	Post Byzantine	1400-1780 AD	
15	Early modern - Modern	1780-1950 AD	

Figure 2: Chronological chart indicating absolute and relative chronology of various Index Periods (level 1) and Period Groups (level 2) (chart by Jill Hilditch).

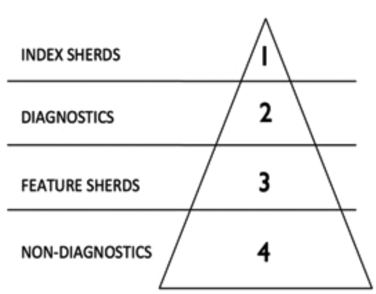

Figure 3: Hierarchical data levels within the ceramic assemblage, with respect to relative proportions of the sherd material (figure by Jill Hilditch).

that contained part of a vessel's wall was classified as thin, medium or thick. The coarseness of the pottery was noted on a scale from fine to very coarse. The degree of firing was qualitatively assessed on a scale of low, medium or high. This was done by tapping on the sherd, where a higher pitch indicates generally a greater degree of clay sintering and vitrification caused by increased firing times and temperatures. A final variable, degree of weathering, was recorded, despite the fact that weathering is an index for geomorphological or post-depositional formation processes rather than any original decision or technological choice by the potter. However, given the very thin layer of subsoil over the island resulting in a considerable exposure of almost all material after original deposition, we were interested to test the degree to which weathering could actually be correlated to the duration of this exposure.

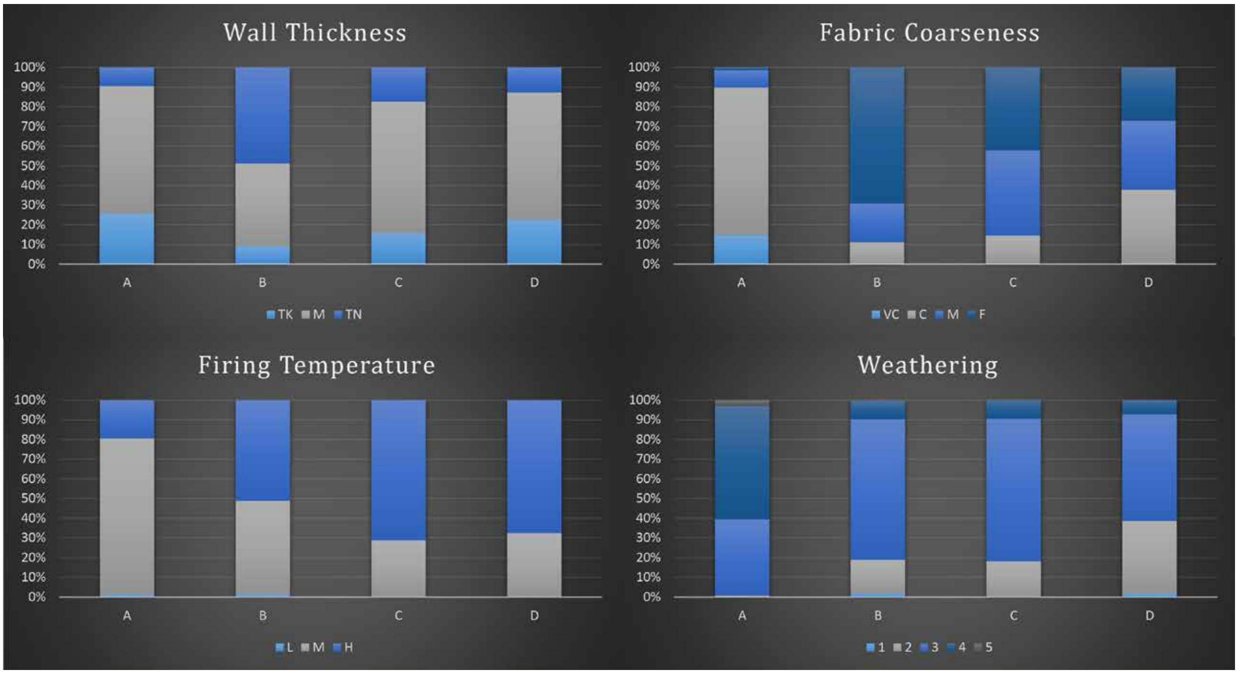

Figure 4: Proportional distribution of variables used for chi-square (figure by the authors).

A statistical approach

The main question then is whether the datable body of ceramic evidence shows distinct technological patterning for the different broad chronological periods, to a degree that they could be regarded as characteristic and thus predictive for those periods. As such, the level 1 and 2 sherds could provide a means to broadly date non-diagnostic material, so that eventually we would be able to promote level 3 and 4 sherds into diagnostic level 2 sherds. Conceptually, the statistical workflow followed a relatively straightforward scheme: first, we established whether there was any reason to assume chronological differences in the technological characteristics of the ceramic material; second, we constructed groups (or clusters) and identified those that show strong patterning over the periods; third, we produced probabilities based on frequencies of those clusters per period; fourth, we predicted periodization for level 3 and 4 sherds; and lastly, we tested this model.

General chronological patterning

The proportional distribution of the technological parameter categories over the periods using the already dated level 1 and 2 sherds were assessed using a chi-square test of homogeneity. The mechanism of this test, in which two or more batches of such distributions can be compared, then offers a means to decide between differences as a result of errors or chance.[16] Comparing the four Period Groups (hereafter PG) for every technological parameter, as well as comparing between individual periods, a great deal of statistically significant patterning was found.[17] These highlighted a very general, and not very surprising, progressive trend from relatively low fired, coarse, thick walled and badly preserved material dominating in PG A, to high fired, fine fabrics, thin walled and better preserved material dominating in PG D. They also emphasized the unique patterning of PG B due to the collection of many fine wares from that period, and the regression towards coarser fabrics in PG C and D (Figure 4).

Part of this exploratory phase of the analyses included extensive bias checking. The batches of material from different intensive collection areas were tested with a chi-square to see if the material showed overall very different behaviour in terms of its technological characteristics as a result of different local taphonomical circumstances. As such, we have not identified any biases of this sort across the island. Important in general, as well as specifically for statistical tests, are sample size effects. On one end of the scale, it is important to check whether your sample is large enough for the statistics of choice, and on the other end of the scale, whether it is not so large that it renders all statistical testing significant by default. The well-known 'sample-size effect', for example sample variability (number of categories) being a function of the sample size, based on the notion that increasing a sample size will up to a certain point increase

16 For an explanation, see Drennan 2009, 181-193.

17 For statistical details on these tests, and those presented below, see Waagen, Krijnen & Hilditch, forthcoming.

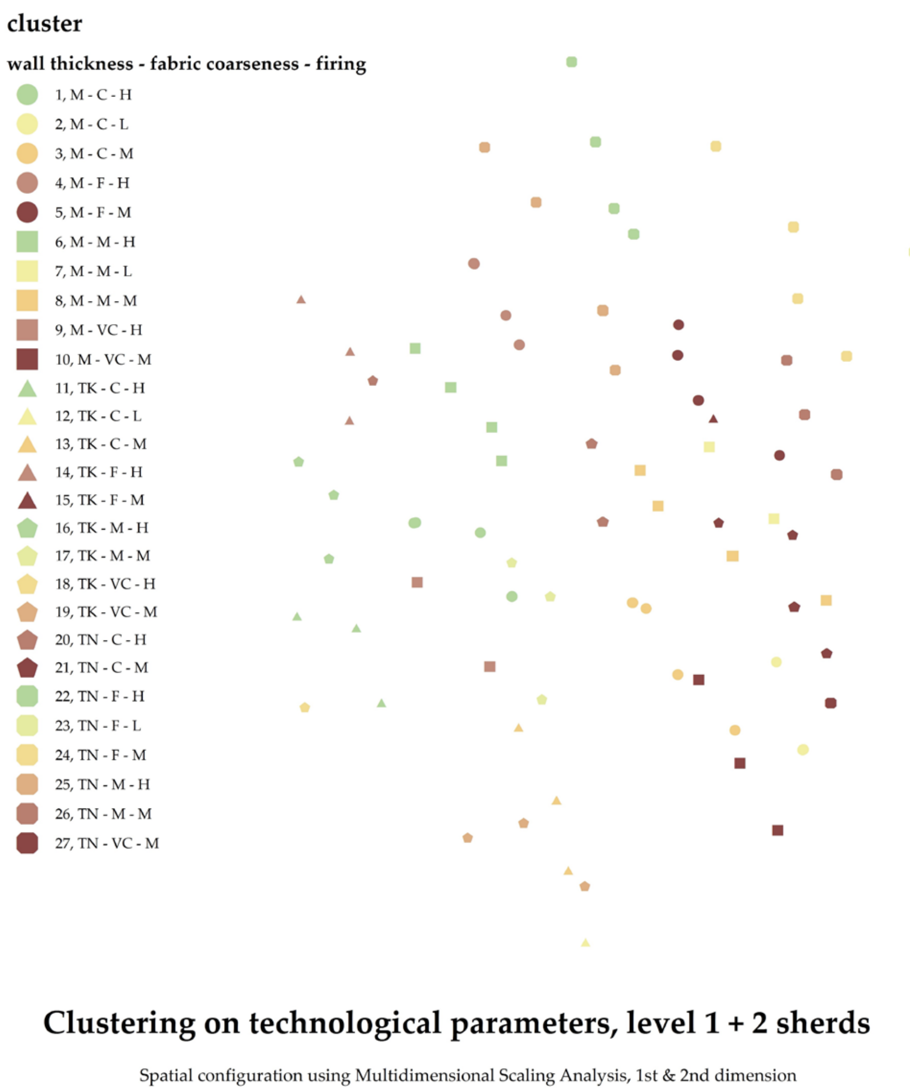

Figure 5: Results of multivariate exploratory analyses of level 1 and 2 sherds (figure by the authors).

variability, can safely be excluded here.[18] Our categories per parameter are few and our sample size is considerable, consisting of at least 100 sherds for every period. As for the other end of the scale, undertaking a statistical test on such a large sample could render all statistical tests significant, for which we checked by carrying out various sensitivity tests by creating hypothetical datasets and checking what the chi-square picked up, or not, as significant effects.

Grouping sherds

As opposed to looking at the parameters as individual phenomena, the next phase comprised the exploration of the actual datable sherds as objects in which those parameters come together. After all, we want to understand to what degree the combinations of those parameters create groups, or clusters, that show a distinct chronological patterning. In order to create those clusters, we assessed whether, and if so which, parameters create a natural grouping for individual periods as well as regardless of periods; it would of course be interesting if we would, for example, identify a group consisting of very coarse, thick walled and medium fired sherds that would uniquely, or almost exclusively, occur in PGA.

We employed extensive multivariate exploratory analyses in order to be able to identify the parameters in the dataset that create the strongest differences between objects in the dataset (Figure 5).

In other words, we identified the parameters that are more influential in creating groups or trends than others. Statistical cluster analysis was very useful for this purpose.[19]

18 Orton 2000, 172; in the context of field survey methodology, see Van Leusen 2002, 4.9; Waagen 2014.

19 For accessible explanations of multivariate statistics in archaeology see, e.g. Shennan 1997; Baxter 2003; Drennan 2009.

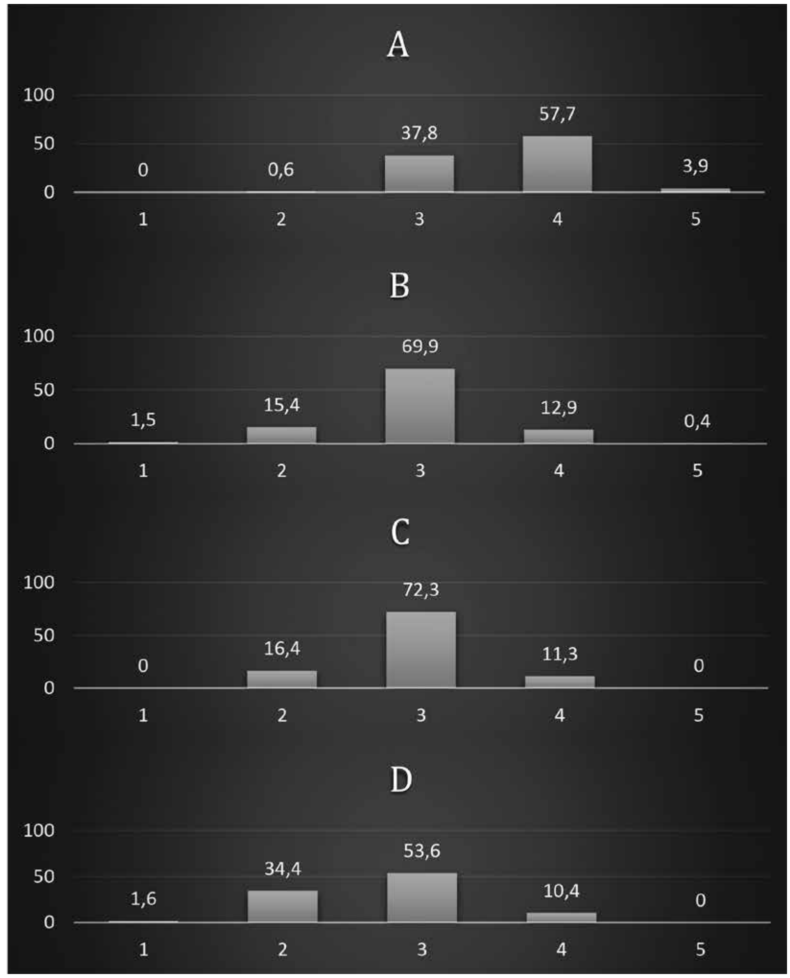

Figure 6: Proportional distribution of weathering parameter per Period Group (figure by the authors).

Our analyses showed most clearly that wall thickness in combination with firing temperature or fabric coarseness are the strongest parameters for the creation of clusters; weathering is the variable that is the least important; and, in creating some simple graphs, we can clearly see that where weathering shows a fairly consistent overall chronological progression, it appears that itis rather normally distributed over the various clusters of sherds (Figure 6).

As a result of this distribution, given that in almost all possible combinations of individual parameters all weathering categories do occur, this parameter is of limited potential for placing individual sherds within a specific PG. After having established which parameters create the strongest chronological patterning through the multivariate analyses, we decided that we would look at every possible combination of those, which led to an end result of 27 clusters (three firing categories x three wall thickness categories x four fabric coarseness categories = 36, minus the combinations that did not exist).

Probabilities and predictions

As for the probabilities and predictions, we returned again to constructing PG profiles based upon the 27 clusters. In order to demonstrate this, it is important to emphasize that we are now looking at the distributions of these groups over periods; in other words, with every cluster, we are looking at whether the group of material is equally present in all periods or only in one period, or any other variant in between (Figure 7). Such proportional differences can then tentatively be considered as probabilities and extrapolated for making predictions. So, if a group would for 90% be dated to PGA, for 10% to PGB and does not occur in PG C and D, we would postulate that any level 3 or 4 sherds with those characteristics would have a 90% probability to date to PGA, a 10% probability to date to PGB and 0% probability to date to PGC and D.

Cross validation tests showed that some confidence in our model is warranted.[20] This procedure splits the data into two sections, one section of 70% on which you

20 For a brief treatment of cross validation techniques in archaeology, see Baxter 2003, 109-110.

cluster #	1	2	3	4	5	6
Wall Thickness	M	M	M	M	M	M
Fabric Coarseness	C	C	C	F	F	M
Firing Temperature	H	L	M	H	M	H
PG A	66	5	197	0	2	6
PG B	6	0	5	35	15	19
PG C	14	0	11	42	16	70
PG D	17	0	11	18	4	14
sum sherds	103	5	224	95	37	109
%A	64,1	100	87,9	0	5,4	5,5
%B	5,8	0	2,2	36,8	40,5	17,4
%C	13,6	0	4,9	44,2	43,2	64,2
%D	16,5	0	4,9	18,9	10,8	12,8

Figure 7: Cluster outcomes and their relative occurrence per Period Groups (figure by the authors).

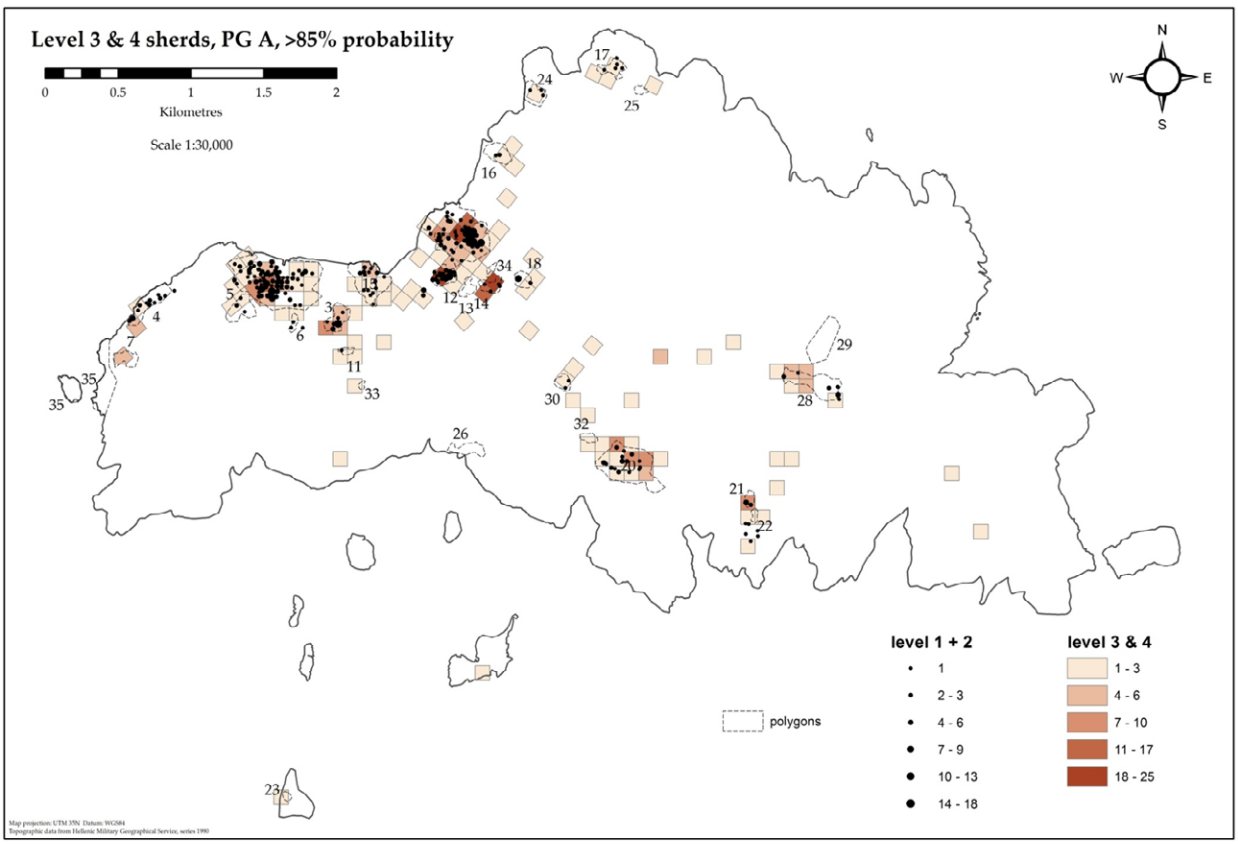

Figure 8: Preliminary map with level 1 and 2 sherds (indicated as black dots) and level 3 and 4 sherds with a >85% probability dating to the Period Group A (map by J. Wright and Jitte Waagen).

will build the described model and one section of 30% that is randomly left out from modelling. Repeating this procedure several times tests the robustness of our predictions, which can be expressed in error estimates, e.g. the percentage of sherds which are wrongly classified as PG A (false positives) and sherds from PG A that are dated to another PG (false negatives). Using these error estimates, cross validation can also be applied to post-hoc test the model for overfitting, that is, the inclusion of variables that make the model so specific that it actually loses predictive power. It must be emphasized that applying this technique does not literally prove the correctness of the predictions but does give a sense of the strength of the model that we created as the outcome of all statistical testing and would be, if we accept that our testing group is an exact reflection of the material that we want to date, evidence towards the reliability of those dates.

Results

Here we report on the results of this procedure using an early version of the KIS ceramic dataset in order to demonstrate proof of concept. The full analysis using the final KIS dataset will be reported on separately.[21] The preliminary implications for the interpretation of the KIS dataset reported here will be refined in these future publications.

Some of the 27 clusters are so small that including them in any predictive model would need very careful consideration. However, at this point, we used all clusters for the cross validation as a proof-of-concept and combined the probabilities and error estimates from the cross validation in our model.[22] The probabilities and errors are strongly interconnected: if we set the criterion for a sherd's inclusion in PG A strictly, say >85% probability, this will exclude material that has a probability to belong to PG A of 75%. The effect will be that the error for inclusion, the false positives, will be low but the error for exclusion will be high, with sherds that are quite likely to belong to PG A being left out of the prediction. If we were however to set the criterion less strictly, such as 'PG A more probable than other PGs' we would considerably increase the false positives and decrease false negatives. This might in most cases be less useful for studying PG A, but would increase the reliability of the remaining material as evidence for post-PG A phases.

The clearest outcome of the model is the difference between clusters dated with a large degree of confidence to the Bronze Age, and those which very likely date to any of the later periods. Cross validation shows that this model works quite well for this dataset; the average error estimate for false positives (so incorrectly dated to PG A) is 7.7% and for the false negatives (so incorrectly dated to any other period group than A) is 29.7%. This means that our confidence in maps in which level 3 and 4 sherds are added as a layer of evidence for representing human activity in the Bronze Age is rather well-founded.[23]

This motivated the production of a preliminary map (Figure 8), in which we can observe the densities of level 3 and 4 sherds dated to the Bronze Age and their spatial relation to the level 1 and 2 sherds (indicated as black dots, a total of 1078 sherds). In total 383 sherds, indicated as squares in various shades, can be added as additional evidence for Bronze Age activity. The first obvious observation is that this map shows a clear correlation between the known concentrations of prehistoric sherds with recently promoted sherds, that is those sherds assigned to this period based on the results of the statistical study. Zooming in, we can see that Polygon 14, which already includes a PG D site, now reveals a larger prehistoric component as well (Figure 9). An additional 40 sherds can in the present model be assigned to the Bronze Age thereby significantly changing our interpretation of this polygon. Elsewhere, areas with no previously known Bronze Age activity can be observed westward of Polygons 28 and 29 (Figure 10). This complements the overall ceramic distribution map for the island by adding additional chronological information beyond the polygons (and so beyond the areas of more intensive collection) and, as such, complements evidence for off-site activity on the island.

Conclusion

Regarding the applicability of the method for other datasets, two points need to be stressed. First, the clusters are locally determined which means that they are not directly applicable to survey data from other areas. More specifically, it is not the clusters themselves but the methodological steps followed that could be adapted in other future projects. Secondly, despite the fact that assigning technological information to sherds is a rather quick and easy undertaking, this method is potentially only possible to apply on a limited dataset: it requires a comprehensive single sherd recording system, which may not be feasible in surveys with much more intensive recovery strategies than ours. However, the potential to promote essentially non-diagnostic sherds into survey interpretations does enhance the value of smaller datasets and hence improves the feasibility of working with a limited collection strategy.

The clearest result at this stage is our increased knowledge of the relative intensity and spatial extent of human activity in the Bronze Age. Refinement of the methodology, in addition to tests with new datasets, such as the data of the Southeast Naxos survey[24], will hopefully allow us to identify more clearly historical patterns of habitation as well. Nevertheless, the present results have already improved the diagnostic potential of the previously non-diagnostic material, simply because the quantitative base for alternative explanations is considerably reduced.

This research is the first of its kind to test technological parameters such as wall thickness, fabric coarseness and degree of firing statistically as chronological markers. We hope to have shown that there is indeed great potential to use such variables to date sherds that initially were labelled 'undiagnostic'. This system is not based upon

21 Hilditch & Krijnen, forthcoming.

22 Other approaches can be found in e.g. Bevan et al. 2013.

23 It must be noted that, as a result of ongoing study in the spring of 2017, new data has become available mainly increasing the level 1 and 2 sherds for PGs B-D. The new material increases sample sizes, counteracts any possible biases towards PG A and affects error margins. It must thus be emphasized that the errors presented here are of a temporary nature and will be adjusted in the final model. Preliminary outcomes of the new data however, do not point towards a radically different picture.

24 Renfrew et al. in press.

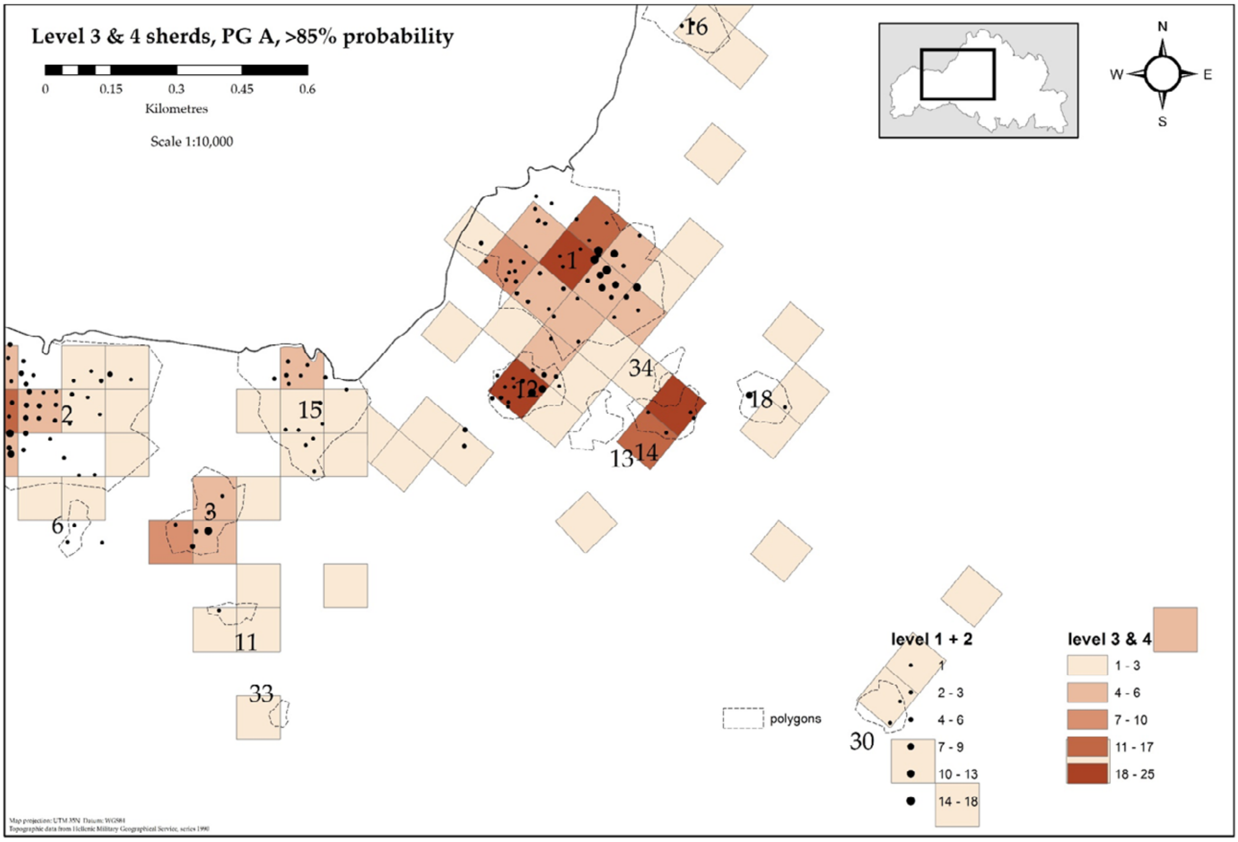

Figure 9: Close-up of map in the area of Polygon 14 (map by J. Wright and Jitte Waagen).

gut instinct but archaeologically sound observations deriving from diagnostic ceramic material. As such, the model has provided us with a richer understanding of multi-period sites that were previously overshadowed by one period of activity and contributed to our knowledge on ancient pathways, connectivity and land use between contemporary areas of activity across the island of Keros.

Acknowledgements

We would like to thank the workshop organisers for inviting us to participate in such an enjoyable and valuable event. This study owes much to the generous support of Michael Boyd (University of Cambridge) and Joshua Wright (University of Aberdeen), our KIS colleagues, as well as the project directors, Colin Renfrew (University of Cambridge), Marisa Marthari (formerly Director of the then Cycladic Ephorate of Prehistoric and Classical Antiquities) and Aikaterina Dellaporta (formerly Director of the then 2nd Byzantine Ephorate). Our ceramic specialist colleagues were instrumental for data collection and interpretation on the KIS: Charikleia Diamanti, Chrisanthi Sakellakou, Stavroula Tseva and Marina Vogli (of the then 2nd Byzantine Ephorate); Christina Mitsopoulou (University of Volos); and Vladimir Stissi and Anna Meens (Universiteit van Amsterdam). Lastly, our thanks to Hallvard Indgjerd for his valuable assistance in the *apotheke*.

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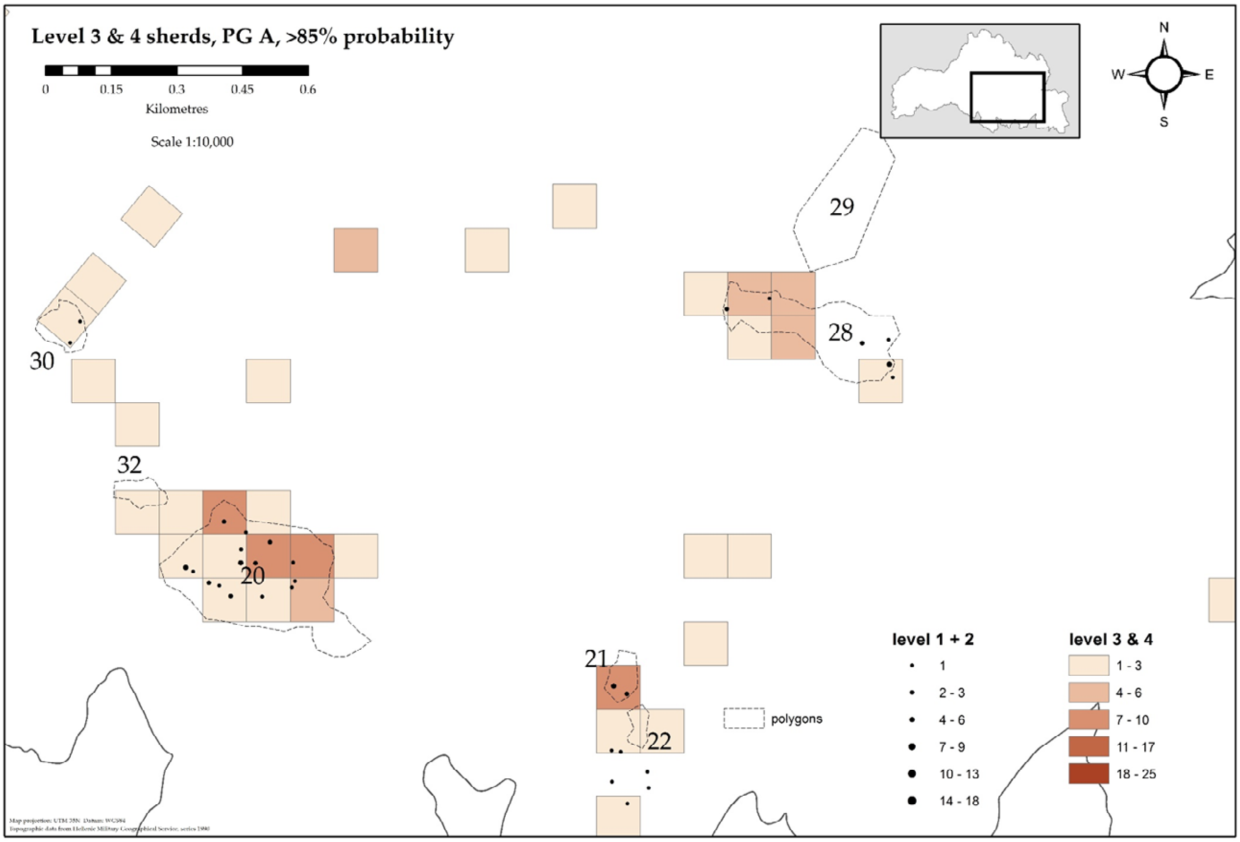

Figure 10: Close-up of map in the area of Polygon 28 and 29 (map by J. Wright and Jitte Waagen).

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The analytical potential of intensive field survey data

Developments in the collection, analysis and interpretation of surface ceramics within the Pontine Region Project

Tymon de Haas & Gijs Tol

Abstract
This paper provides a succinct overview of developments in field survey practices and artefact collection strategies within the Pontine Region Project (PRP), a long-running landscape archaeological project in central Italy. Drawing on various examples from the PRP database, we specifically aim to evaluate the increasing research intensity and artefact sampling approaches adopted in the project and their analytical contribution: first, to refine the chronological and spatial resolution of rural data and to move beyond simplistic rural site classifications; second, to systematically analyse and interpret off-site distributions; and third, to reconstruct regional systems of production and exchange. Countering critiques of the purportedly myopic character of Mediterranean survey practices, we argue that the intensive investigation of small research areas not only complements more extensive survey approaches, but is crucial to counter biases and refine generalizing trends in such datasets.

Keywords: Pontine Region Project – Intensive Survey – Ceramic Studies – Off-Site Distributions – Trade and Exchange.

1. Introduction
The Pontine Region Project (PRP), a major and long-running landscape archaeological field project, has since the mid-1980s gathered a wealth of information to reconstruct long-term developments in settlement and land use in the Pontine Region, central Italy. The historiography of the project reflects broader developments in Mediterranean archaeology: the PRP arose as part of a wave of regional survey projects strongly rooted in processual archaeology, while in its theoretical frameworks the *Annales* School and, later on, post-colonial theory were important sources of inspiration.[1] Although less explicitly, such frameworks are still at the core of more recent research undertaken within the PRP.[2] From the outset the project adopted intensive field-walking procedures and systematic artefact collection strategies to investigate both sites and off-site contexts.

1 Attema 1993; Attema et al. 1998; Attema et al. 2010a.
2 Attema et al. 2011; De Haas 2011; Tol 2012.

in A. Meens, M. Nazou & W. van de Put (eds), Fields, Sherds and Scholars. Recording and Interpreting Survey Ceramics, 81-96, Leiden: Sidestone Press. DOI: 10.59641/m11443py.

With the advent of user-friendly databases and, later, mobile GIS applications, field- and data processing procedures became more standardised and efficient. This contributed to an intensification of field-walking and collection strategies.

In some respects, the PRP is an exceptional project. Where many other major regional projects were conceived as a single effort to collect a uniform dataset representative of either a physiographic region (e.g., a river valley, coastal plain) or a cultural unit (e.g., the hinterland of a city), the PRP dataset was gradually built up during several phases, in most cases lasting four or five years (a typical funding cycle). In each phase, a selection of physiographical or cultural units was targeted with a specific set of questions in mind. While intensive off-site approaches were used from the start, methods developed over time and adapted to these changing research questions. Recording information that helps to identify and correct for biases in the data became an increasingly important aspect of these methods.[3]

The PRP dataset therefore consists of an accumulation of individual survey datasets, each with specific characteristics in terms of site and off-site data, ceramic classifications and site classifications and interpretations. This obviously poses considerable challenges for synthetic analysis – not only technically (e.g., integrating the data into a single database that enables us to query at the regional scale), but also methodologically and conceptually: meaningful integration can only be achieved if we integrate like with like. This requires considerable investment in data evaluation and source criticism to ensure that pottery classifications and chronologies as well as site definition and classification criteria are compatible and/or calibrated between surveys. If we query the data but have not addressed such issues, our queries will not deliver meaningful results.

The development of increasingly intensive field methodologies in the PRP is part of a wider trend in Mediterranean survey archaeology which has received substantial criticism from scholars working in other parts of the world. Richard Blanton, for example, has argued that the 'myopic' micro-regional focus common in Mediterranean surveys contributes little to our understanding of broader long-term societal developments, which require a much larger spatial scale of analysis.[4] Along similar lines, Elizabeth Fentress has questioned whether the recording, collection and analysis of large numbers of artefacts is giving us any useful information in comparison to quicker, less intensive survey methods.[5]

3 Van Leusen 2002.

4 Blanton 2001.

5 Fentress 2000.

Despite the challenges posed by the disparities in our dataset, and countering theses critiques, we believe that the extensive body of ceramic data of the PRP, representing the accumulation of over 30 years of expertise on regional ceramic traditions, has great potential. In this paper we aim to illustrate this potential. To do so, we first introduce the PRP in more detail, and provide an overview of methodological developments with regard to field procedures, ceramic sampling and processing. Using several examples drawn from the PRP database, we then illustrate how ceramic data, initially mainly used to date sites, are now improving our understanding of the complexity of survey data and their interpretation in terms of past behavioural patterns, and how they allow us to evaluate methodological developments, especially the increasing intensity of artefact sampling. The examples deal with issues relating to site chronology and typology, the meaning of off-site distributions and the reconstruction of systems of production and exchange. In the final part of the paper, we reflect on these examples in light of the abovementioned critiques on Mediterranean survey practices, and look at the current and future potential of our regional dataset to study larger-scale socio-economic processes.

2. The Pontine Region Project: a brief history

The Pontine Region is situated in central Italy, some 50 kilometres south of Rome (Figure 1). It consists of a coastal plain bounded to the west by the Tyrrhenian Sea, and to the north and east by the Alban Hills and Lepine Mountains. The plain itself can be divided into a higher system of marine terraces and, further inland, a lower area generally known as the Pontine marshes. Historically, the Pontine region forms a particularly interesting area for the study of processes of early centralization and urbanization, which occurred from the Late Bronze Age and Early Iron Age onwards.[6] In the Archaic period, the area housed various Latin communities that cultivated the land around urban settlements, but the region was radically transformed during Rome's early expansion, by the establishment of colonies and large infrastructural and reclamation projects.

Centralization, urbanization, colonization and their impact on rural settlement and land use have been at the core of the PRP's research agenda from its inception in the mid-1980s. However, over the last 30 years, the project has changed its geographic and thematic focus several times; as already alluded to, in parallel, it also adopted increasingly sophisticated field methods.

The first PRP field surveys were undertaken between 1985 and 1988 by Peter Attema, as part of his dissertation.[7] Alongside field surveys at and around the Archaic urban

6 Alessandri 2016.

7 Attema 1993.

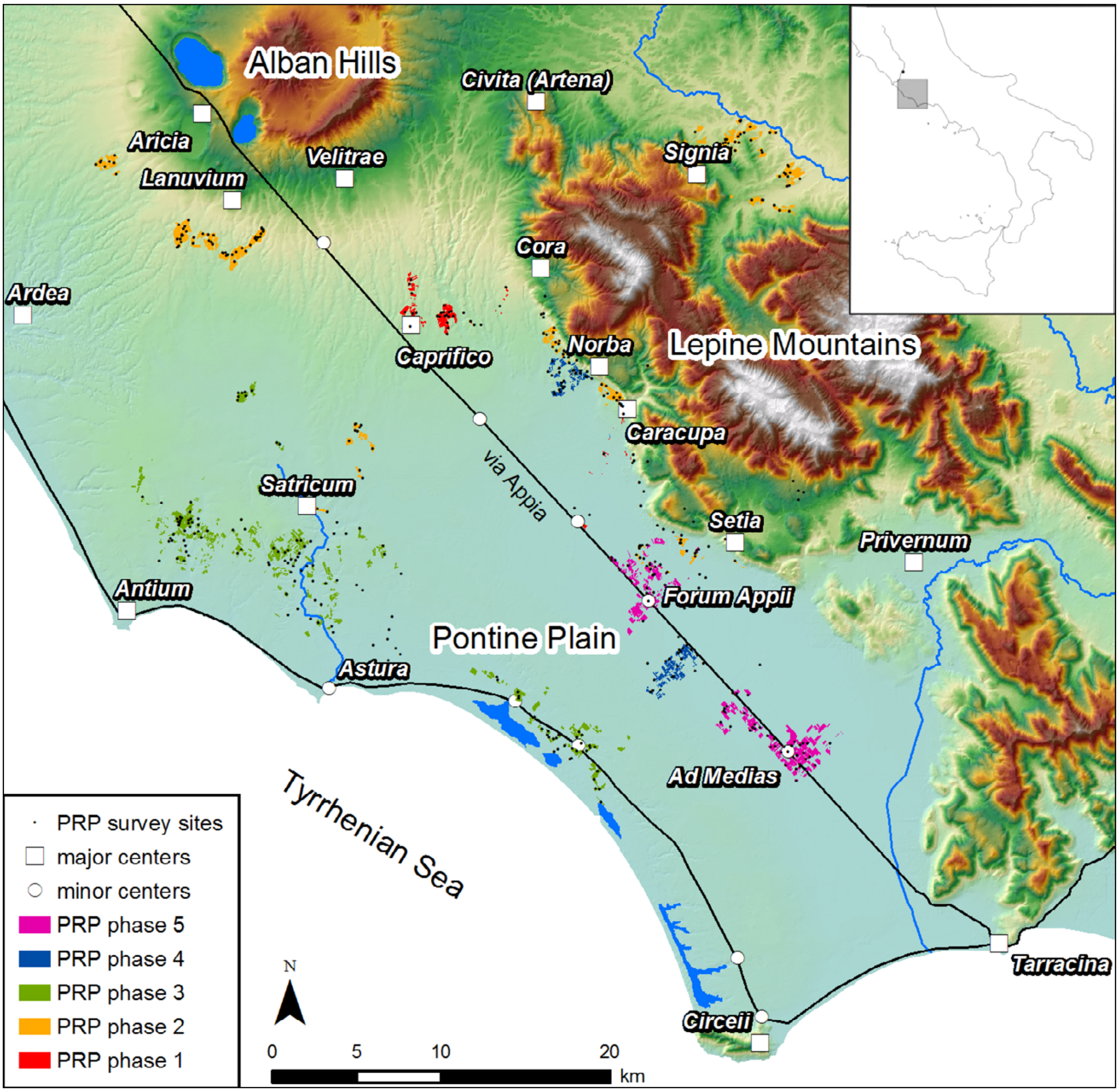


Figure 1: The Pontine Region with main sites and areas studied by the PRP (DEM courtesy Regione Lazio; further data generated by the authors).

centers of Caracupa and Caprifico, he investigated three transects through the Pontine plain between the Via Appia and the Roman colonies of Cora, Norba and Setia. An intensive off-site sampling approach was used, systematically collecting 20-40% of the artefacts on the surface per agricultural field.[8] Knowledge of ceramic typo-chronologies was limited at the time, so artefacts were classified according to ceramic fabrics, and sites were only ascribed to broad periods. No strict site classification system was used. While these transect surveys provided a first insight in the development of rural occupation in the territories of these colonies, the scale of investigations was limited, covering modest areas of between 10 and 31 hectares.

In the second phase of the PRP (early 1990s), the impact of colonization was the central theme of a comparative study of the territories of the colonies Setia and Signia and the non-colonial centre Lanuvium, while research was also conducted in the colonial territories of

8 As in many other projects, we presume that walkers pick up artefacts from a 2 m wide swath. With a distance of 5 or 10 m between walkers, this results in a coverage of 40 or 20% respectively.

Satricum and Norba. Field methodologies were similarly intensive, but the scale of surveys increased (covering areas between 0.8 and 4.2 km^2) and systematic on-site sampling took place in so-called string squares (a series of 4 × 4 m grid units). Still primarily based on ceramic fabrics, sites were dated to phases of c. 150-200 years, but site classification schemes were not developed. At the end of this phase, during the Sezze survey, the resolution of off-site sampling increased by no longer collecting such samples per field, but per individual walker transect.[9]

In a third phase, between 1998 and 2005, surveys focused on the coastal part of the plain. Extensive areas were covered around lake Fogliano, in the lower Astura Valley and between Antium and Satricum.[10] In this phase, a gridded off-site approach, systematically sampling 100 × 100 m and later 50 × 50 m grid units became the standard. At the same time, site-based sampling continued, as additional diagnostic samples were regularly collected in order to provide a more robust basis to establish site chronologies. As our knowledge of the regional ceramic repertoire grew, more refined pottery classifications were developed that used not only fabrics but also aspects of ware and function. Also, we now regularly used established ceramic typo-chronologies, including for the identification of coarse wares, amphorae, black gloss, terra sigillata, and African cooking and red slip wares, to date sites with more precision and to use ceramics as criteria in formal site classifications, along with site size, location and architectural features.[11]

In the fourth phase of the PRP (2006-2010), its methodological toolkit was diversified to address a range of historical and methodological issues. De Haas continued gridded off-site surveys (still using 50 × 50 m units) to study land use strategies and the impact of Roman colonization around ancient Norba and in the inner Pontine plain, and confronted the data with those gathered with a similar gridded off-site approach in the coastal zone in the previous phase.[12] Tol continued work around Antium, primarily with a methodological aim: he conducted an extensive program of site revisits and detailed on-site surveys to increase our understanding of the function and chronology of individual sites.[13] Ceramic classification procedures were very similar to those developed during the previous phase, but new methods for site dating and classification were used. For example, we increasingly used the "weighted average" to assign chronologies to sites, and the compositional characteristics of artefact assemblages to interpret sites in terms of functions.[14] Concurrently, Van Leusen and Feiken developed new approaches to deal with the specific difficulties in exploring the hidden pre- and protohistoric landscapes of the Lepine mountains and the interior Pontine plain.[15]

During the fifth and most recent phase of the PRP, field surveys focused on the inner Pontine plain. As part of the Minor Centres Project, two Roman roadside settlements (Forum Appii and Ad Medias) and their hinterlands were investigated to better understand the role of such non-urban centres in regional economies and settlement systems. The project adopted both intensive on-site surveys (using 25 × 25 m grids) and site-oriented surveys in their rural surroundings (covering individual fields, gridding sites with 10 × 10 m grids). At both Forum Appii and Ad Medias and in rural contexts, we applied intensive sampling procedures to date sites accurately and to provide insight into intra-site functional zoning. In this phase we also combined our field surveys with geophysical prospections and geo-archaeological work.[16]

This overview of the PRP shows important changes in our approaches to sampling, artefact classification and site dating and classification (Table 1[17] and Table 2[18]).

In our sampling approaches, sites and off-site contexts alternated as the main sampling units. In the first phase, sampling was done using an off-site approach: walkers systematically collected all artefacts from their individual transects, which were subsequently put together per agricultural field. From the 1990s onwards, such intensive off-site approaches were abandoned in favour of site-oriented sampling: agricultural fields were surveyed without collecting finds, after which sites were sampled through total collections from string squares (of 4 × 4 m). From the late 1990s onwards, off-site sampling was re-introduced as the main collection strategy. These off-site

9 Attema & Van Leusen 2004.

10 Attema et al. 2002; 2005; 2008; 2010b; Van Loon et al. 2014. The first of these surveys took place as part of the interregional comparative research project Regional Pathways to Complexity (Attema et al. 1998; 2010a).

11 Attema et al. 2005; De Haas 2011.

12 De Haas 2011; 2012.

13 Tol 2012.

14 De Haas 2011; Tol 2012; cf. Witcher 2012.

15 Van Leusen at al. 2010; Feiken 2014.

16 Tol et al. 2014; Tol & De Haas 2016. The final publication of these surveys is currently in preparation (Tol et al. forthcoming).

17 Note on the Corba/Norba/Sezze transects area coverage: 27 ha within the Cora transect, 30.7 ha during the Norba transect survey and additional fields, and 10 ha in the Sezze transect.

18 Note on the 17,641 objects collected in the Corba/Norba/Sezze transects: 6000 objects collected from the Cora transect, 11,114 from the Norba transect and 527 from the Sezze transect. The 358 diagnostics are distributed as follows: 73 from the Cora transect, 187 from the Norba transect (including 28 fragments in a grab sample collected on a rural site in the Norba transect in 1989; see Attema 1993: 332-333) and 98 from the Sezze transect. The numbers of collected artefacts and diagnostics mentioned for the Contrada Casali on-site survey have been calculated on the basis of the data presented in Attema 1991. The 25,010 objects collected in the Sezze survey is the figure given in Attema & Van Leusen 2004: table 1 includes the 8876 artefacts collected during the on-site survey at Tratturo Caniò.

Phase	Survey	Area covered (ha)	Survey units	Off-site sampling	On-site sampling	Data Publication
1	Cora/Norba/Sezze Transects (1987/1988)	67.7	Fields	Systematic	-	Attema 1993
	Caracupa on-site survey (1985-1988)	2.2	Grids	-	Total collection in grids (20 x 3m)	Attema 1993
	Contrada Casali on-site survey (1988)	0.4	String squares	-	Total collection in string squares (4 x 4m)	Attema 1991 and 1993
	Cisterna survey (1990)	198.5	Fields	Systematic	-	Attema 1993
2	Satricum area (1991/92/96)	>75	Fields	Systematic	-	Drost 1996
	Sezze (1994)	83.5	Walker Transects	Systematic	Diagnostic?	Attema & van Leusen 2004, Attema et al. 2014
	Selva Forcella (1997)	>1.7	Fields	-	Systematic collection from grids	-
	Tratturo Canió on-site survey (1994)	0.1	Grids	-	Total collection from grids (4 x 4 m)	Attema 2001
	Lanuvium (1995)	407	Fields	Diagnostic	Total collection in string squares (4 x 4m)	Attema & van Leusen 2004; Attema & van Oortmerssen 2000
	Norba (1995)	80	Fields	Grab	Total collection in string squares (4 x 4m)	-
	Segni (1997)	332	Fields	Grab?	Total collection in string squares (4 x 4m)	Attema & van Leusen 2004
	Ninfa (1998/1999)	85	Fields	-	Total collection in string squares (4 x 4m)	-
3	Fogliano (1998/99)	274	Grids (100 x 100 m)	Systematic	Diagnostic	Attema et al. 2002; Attema et al. 2005
	Platform site survey	7	Fields	-	Diagnostic	De Haas et al. 2012
	Astura valley (2003)	155	Grids (50 x 50 m)	Systematic	Diagnostic	Attema et al. 2008; De Haas 2011
	Nettuno (2004/2005)	675	Grids (50 x 50 m)	Systematic	Diagnostic	Attema et al. 2010b; De Haas 2011
4	Hidden Landscapes Project upland surveys (2005-2009)	?	Grids, points	Systematic and unsystematic	Diagnostic	Van Leusen et al. 2010
	Pontinia (2007/2008)	180	Grids (50 x 50 m)	Systematic	Diagnostic	De Haas 2011
	Norba (2008)	135	Grids (50 x 50 m)	Systematic	Diagnostic	De Haas 2011
	Nettuno on-site surveys (2006-2008)	-	Grids (4x4 m)	-	Total collection from grids	Tol 2012
	Nettuno revisits (2006-2008)	-	Sites	-	Diagnostic	Tol 2012
5	Forum Appii and Ad Medias on-site surveys (2012-2015)	98.8	Grids (25x25 m)	-	Systematic collection from grids, Diagnostic	Tol et al. 2014; Tol et al. forthcoming
	Minor Centres Project rural surveys (2012-2015)	735	Fields	Diagnostic	Systematic collection from grids (10 x 10 m), Diagnostic	Tol & de Haas 2016; Tol et al. forthcoming

Table 1: PRP phases and individual surveys.

Phase	Survey	Basis of Artefact Classification	Typological studies	N artefacts collected	N diagnostics
1	Cora/Norba/Sezze Transects	Fabric classes (V)	-	17,641	358
	Caracupa on-site survey	Fabric classes (V)	-	66,875	670
	Contrada Casali on-site survey	Fabric classes (V)	-	5430	203
	Cisterna survey	Fabric classes (V)	-	31,039	778
2	Satricum area	Fabric classes (V)	-	7398	-
	Sezze	Fabric classes (V/TS)	(recent restudy)	25,010	326
	Selva Forcella	Fabric classes (V)	-	>1206	?
	Tratturo Caniò on-site survey	Fabric classes (V)	(recent restudy)	8876	243
	Lanuvium	Fabric classes (V/TS)	-	20,809	?
	Norba	Fabric classes (V)	-	?	35
	Segni	Fabric classes (V/TS)	-	10,132	?
	Ninfa	Fabric classes (V)	-	?	?
3	Fogliano	Fabric classes (V)	X	12,201	733
	Platform site survey	-	X	-	534
	Astura valley	Ware/function classes	X	4565	172
	Nettuno	Ware/function classes	X	39,379	1659
4	Hidden Landscapes Project upland surveys	Ware/function classes	X	18,096	604
	Pontinia	Ware/function classes	X	6733	692
	Norba	Ware/function classes	X	11,531	393
	Nettuno on-site surveys	Ware/function classes	X	48,115	930
	Nettuno revisits	-	X	-	1688
5	Forum Appii and Ad Medias on-site surveys	Ware/function/fabric classes (V/TS)	X	99,661	9816
	Minor Centres Project rural surveys	Ware/function/fabric classes (V/TS)	X		
TOTAL				>434,697	>19,834

Table 2: PRP surveys and ceramic analysis characteristics. V = based on visual classification; TS = based on thin-section classification.

PRP phase	area surveyed	artefacts collected	diagnostics collected	diagnostics typologically dated	artefacts/ha	diagnostics/ha
1	268.8	120985	2009	0	450	7.5
2	1064.3	73431	604	0	69	0.6
3	1111	56145	3098	670	51	2.8
4	315	84475	4307	2447	268	13.8
5	833.8	99661	9816	>4132	120	11.8
PRP total/ average	*3592.9*	*434697*	*19869*	*>7249*	*121*	*5.5*

Table 3: Summary statistics of the different phases of field surveys within the PRP.

approaches had a higher resolution: fields were now subdivided into standardised artificial units, from which artefacts were systematically collected. Such gridded off-site approaches were combined with systematic on-site sampling.

Our approaches to artefact studies evolved alongside our sampling strategies (Table 2). Before the PRP surveys had started, an extensive program of petrographic studies had already been developed to study ceramics from Satricum, a central settlement in the region occupied between the Early Iron Age and the Roman Republican period.[19] As the different fabrics discerned for Satricum appeared to change through time, they were used to classify and date survey ceramics during the first two phases of the PRP, when typological studies of diagnostic fragments were very limited and did not contribute to site dating. During the third phase, as noted, new ceramic classification systems were developed that combined functional, ware and fabric characteristics. These multi-criteria classifications were refined during subsequent phases and are still being used. They co-developed with our knowledge of regional and supra-regional ceramic typologies, and typological studies accordingly became increasingly important in establishing and refining site chronologies: we moved from dating to generic phases (Archaic, Republican, Imperial) on the basis of fabrics alone towards an approach combining fabric, ware and typo-chronological information that permitted dating within chronological intervals of 150 years. Currently, we primarily rely on typo-chronological evidence to date sites to even shorter time intervals using both regional typo-chronologies of coarse wares and more general ones for amphorae and table wares. An important prerequisite for this is to have sufficiently large numbers of diagnostic artefacts, and this is why the size of our diagnostic samples has increased (Table 3; see also section 3.5).[20]

3. The potential of the PRP ceramic data: selected examples

The PRP has thus collected increasing quantities of ceramics at an increasing spatial resolution and with increasing knowledge of typo-chronologies and functional aspects. But in what ways have these methodological developments enhanced our understanding of past settlement and land use? In this section we discuss several examples that demonstrate the enhanced analytical potential of the intensified methodology.

3.1. Beyond schematic site interpretation: the role of ceramic assemblages

One significant development is in the way we have interpreted and dated sites, in which ceramics have come to play a crucial role. Unlike many other projects that use historically informed or, in Rob Witcher's terms, 'objective' classification systems, the PRP has applied more flexible, bottom-up approaches to site classification and interpretation.[21] Especially in the first phases of the project, site interpretations did not follow strict typologies and were only implicitly based on criteria such as scatter size and artefact assemblages. Later on, we applied more formal, bottom-up approaches that used the variability (especially in site size) within a survey dataset to classify sites. One of the adjustments made was to design different classification schemes for pre-and protohistoric sites and Roman sites.[22] More recently, we adapted our classification strategies further, to address different research questions. On the one hand, we use traditional, generalising classifications (e.g., farms-villas-villages) to address demographic and socio-economic issues.[23] On the other hand, as such classifications are less helpful to understand the variability and complexity of rural landscapes, we also developed approaches that focus more on quantitative aspects of ceramic assemblages in order to look at site functions and consumption patterns.

The latter approach is in our view only possible with the relatively large site-based samples as collected from phase three onwards. We here present two examples that show how this approach helps us to better understand the diversity in rural settlement.

On the single site level, the first example concerns site 15106, a small scatter of ceramics and building materials we identified during gridded off-site surveys in the coastal area in 2004.[24] Our initial analysis, based on a systematic sample collected from 50 × 50 m units at a coverage of 20%, showed this site to have an assemblage of tiles, kitchen and storage wares as well as table wares and transport amphorae. The relative frequencies of these functional categories were quite similar to those at many

19 Attema et al. 2003.

20 'Diagnostics' refers to all feature sherds (rims, handles, bases and decorated fragments) that have the potential to be assigned a date range by means of typo-chronological referencing. As seen in table 3, in practice only a minority of these diagnostics is attributed such a reference.'Diagnostics typologically dated' is based on references given in the primary publications of each survey (see tables 1 and 2). All published diagnostics are currently being re-examined by the second author in order to assign them to typo-chronologies. For the PRP phase 2 Sezze survey, the outcomes of the re-study are published in Attema et al. 2014. For phase 5, typological studies are ongoing.

21 For a problematization of the dichotomous, historically informed categories farm and villa, see Rathbone 2008. For a discussion of current site classification approaches and the terms 'objective' versus 'subjective' classification, see Witcher 2012.

22 Attema et al. 2005; Van Leusen et al. 2005.

23 Attema & De Haas 2005; 2011.

24 Attema et al. 2010b: 247.

other small rural sites in the region and were taken to reflect a simple rural settlement (farm). The diagnostics that could be dated typologically at this site suggested a date between the 4th century BC and the 2nd century AD (Figure 2a/c/e).[25]

In 2008, the second author again surveyed this site but in a more intensive way, using grids of 4 × 4 m and collecting *all* artefacts on the surface – with quite different outcomes.[26] First, the proportions of particular functional groups in the assemblage were different: the total collection of the re-survey contained a far larger proportion of tile (especially small lumps that are not collected during less intensive surveys), while the relative amounts of amphora and table wares were much lower (these were apparently preferentially picked up during the initial survey). Despite these differences, that mainly result from different sampling intensities, the functional categories present and their relative proportions would in both cases arguably still be compatible with that expected on a farm site. However, a more important difference that results from the increased resolution of the data, is the much better understanding of the structure and functions of the site. While the initial survey suggested that it consisted of one continuous scatter, the re-survey rather showed two smaller concentrations that represent separate buildings or activity zones: the southern contained building debris as well as various kinds of household wares, while the northern contained much more black gloss pottery, including misfired fragments, as well as a kiln spacer (see Figure 2b). Thus, the larger dataset shows that this rural site, perhaps indeed a farm, had an associated ceramic production workshop. A third difference concerned the chronological profiles.[27] While both give the same date range (between the 4th c. BC and the 2nd c. AD), the one based on the more intensive explorations (Figure 2f) highlights the phase during which the ceramic workshop was active (late 4th to mid-2nd c. BC). Also, it shows a phase of re-use of the site in late Antiquity that left limited traces not picked up in the initial sample.

We should admit that extremely labour-intensive re-surveys as carried out on site 15106 cannot regularly be included into survey strategies and have indeed only been conducted on very few sites in our region. However, the gridded surveys of PRP phase 5 used an intermediate intensity (10 × 10 m grids, 40% sampling), and provide further confirmation that increasing spatial resolution allows for much more refined interpretations of even seemingly small and simple scatters.[28]

More intensive and systematic sampling can not only increase our understanding of single sites; it also allows us to compare more general differences between rural sites in different parts of the region. On the basis of the chronological and compositional characteristics of their assemblages, De Haas showed that rural sites, in terms of longevity of occupation, assemblage composition and especially consumption of fine wares and amphorae, showed significant differences between landscape zones.[29] For example, on rural sites in the immediate hinterland of Antium, in Imperial times one of the main port and market cities of the region, relatively large amounts of fine wares and amphorae were consumed. In the more remote parts of Antium's hinterland fine wares become less abundant while in other parts of the region, further away from the coastal ports (in the inner plain, around ancient Norba and Setia) the consumption of fine wares decreases further (cf. Table 4). The distribution of amphorae follows a similar trend in Antium's immediate hinterland, which seems again to reflect higher levels of consumption of imports closer to the port city. By contrast, high shares are also clear in the surroundings of Setia and in the inner Pontine plain (see also below), but here we may point at an explanation primarily in terms of production rather than consumption. Amphora fragments here are mainly of local fabric and more likely attest to local specialisation in viticulture.

3.2. Off-site distributions and differential land use patterns

Besides providing a deeper understanding of sites, the systematic intensive off-site surveys conducted during phases 3-5 have also increased our understanding of the ceramic landscape in its entirety. As we have seen, intensive sampling of off-site distributions had been carried out from the start of the PRP, but the analytical potential of these data was at the time not fully explored: they were merely considered a general indicator for the agricultural exploitation of the region, particularly in the Roman period. Only more recently have more formal, quantitative methods been used to assess the meaning, chronology and variability in off-site distributions. Thus, the first author[30] used a series of models developed by Peter Hayes[31] to interpret off-site distributions as mapped in the gridded surveys of phases 3 and 4 in terms of manuring patterns: while accounting for the possibility that such spreads include local, ephemeral structures

25 The chronologies in Figures 2e-f were generated using the *media ponderata* approach. This method assumes that there is an equal chance that a ceramic type was deposited during each year in its date range. When reconstructing trends, each identified type then contributes proportionally to each phase covered by its entire date range. See also Di Giuseppe 2012 and Fentress & Perkins 1988.

26 Tol 2012, 231-237.

27 These profiles are based on the feature sherds collected as part of the systematic 20% and 100% coverage surveys of the two visits.

28 Tol et al. forthcoming.

29 De Haas 2011, 157-166.

30 De Haas 2011, 157-166; 2012.

31 Hayes 1991.

(sheds, outbuildings), he argued that differences in the overall density and extent of off-site carpets reflect different agricultural regimes. In the surroundings of a series of villas in the coastal area near Antium, dense and extensive off-site carpets reflect intensive cultivation on large estates, probably producing for the nearby urban and more distant markets. In contrast, a series of small farms in the lower plain showed only limited off-site scatters and were probably involved in smaller scale mixed farming with some manuring of vegetable gardens or small plots. In a more diversified landscape on the edge of the mountains, off-site patterns partly arose because of erosion processes, but also reflected manuring of vineyards and/or olive orchards on larger elite estates.

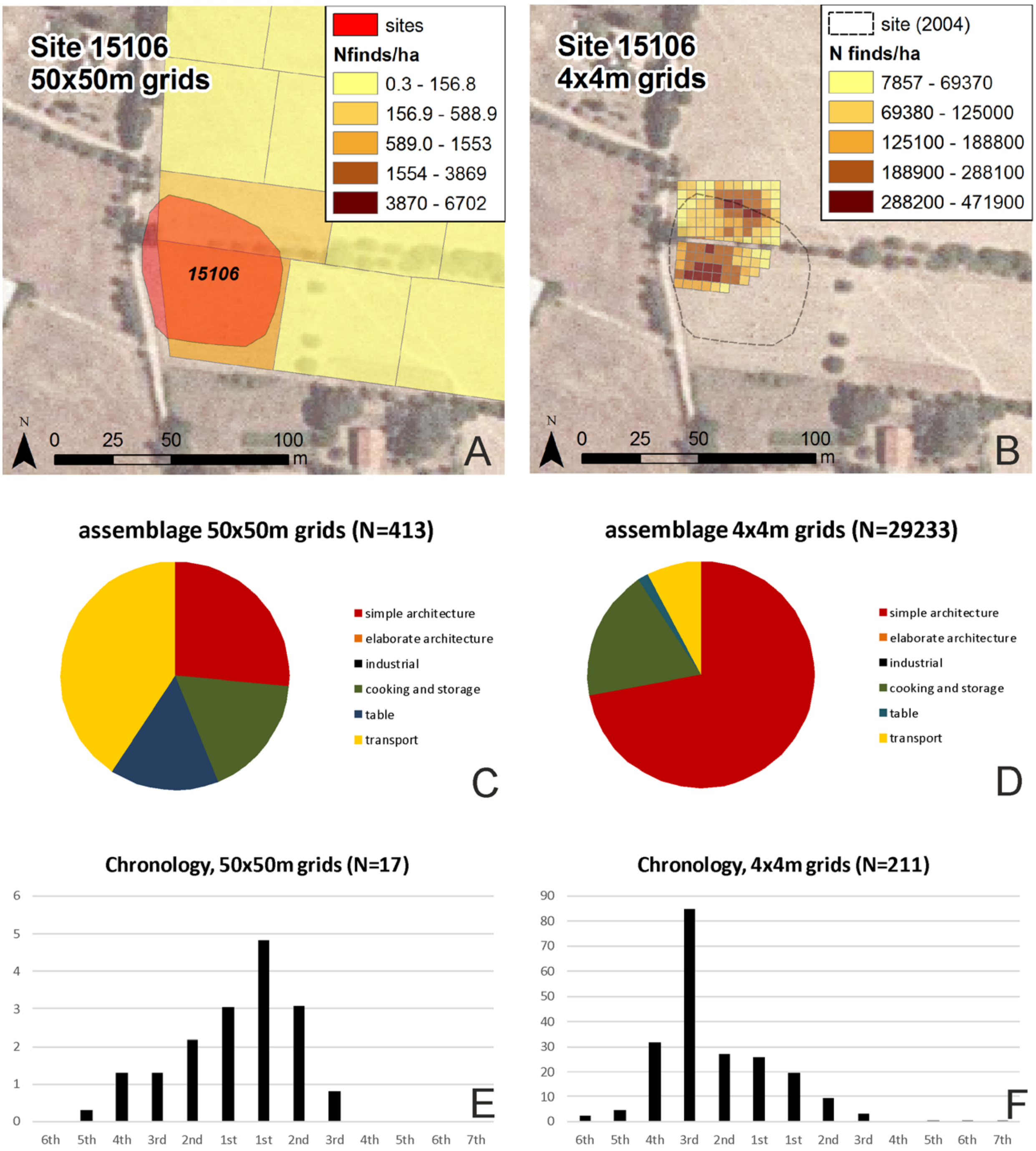


Figure 2: plan (top), assemblage composition (middle) and chronology (bottom) of site 15106 based on the 50 × 50m grid survey (left) and 4 × 4 m grid survey (right)) (aerial photos courtesy IGM; further data generated by the authors).

	N sites	average N pottery sherds	average % of table wares	average % of transport wares
Antium – town proximate	12	437	26.9	39.1
Antium – town remote	9	127	23.8	14
Inner plain	10	267	19.8	32.6
Norba	10	192	18.1	22.2
Setia	22	440	2.8	37

Table 4: Pottery assemblage characteristics of rural sites (with a ceramic sample of N>50) in different parts of the Pontine region (data after De Haas 2011 and Attema et al. 2014).

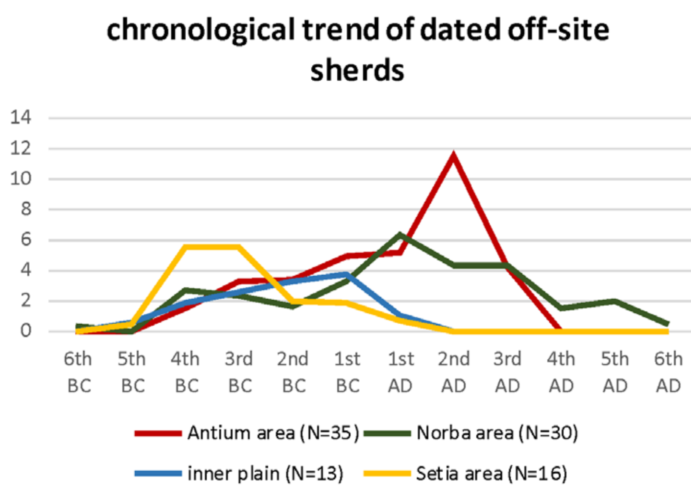


Figure 3: Chronological trend of dated sherds from off-site contexts (data generated by the authors).

If we consider the chronological trend of the (few) typo-chronologically dated ceramics from off-site contexts as an indicator for the chronology of manuring activities, this interpretation seems to be confirmed (Figure 3): off-site distributions have relatively large proportions of Republican ceramics in the interior parts of the region (around Setia and Norba), areas that were exploited intensively from elite estates from an early moment on. In the inner plain, most off-site materials date to the 3rd to 1st centuries BC, which roughly corresponds to the peak in rural settlement in this area. In the Norba and Antium area, where Imperial period elite estates are clearly attested archaeologically, most of the dated off-site ceramics also date to the 1st to 3rd centuries AD.

3.3. The distribution of imported pottery as a reflection of trade patterns and routes

A third issue our large ceramic dataset allows us to address concerns systems of trade and exchange. Whereas imported ceramics are more often used to reconstruct such systems,[32] survey data have only rarely been used to reconstruct intra-regional supply chains or to evaluate diachronic changes and spatial patterns in the access to imported goods. We believe that the typological studies made for the more recent phases of the PRP provide a good starting point to explore such patterns.

As a brief example, Figure 4a-f presents a series of distribution maps of Roman amphorae, the bulk of which reflect the trade and consumption of imported foodstuffs (e.g., wine, oil, fish sauce).[33] The maps clearly illustrate the changing patterns of access to such goods over time and space. In the Republican period, imported amphorae occur in relatively large quantities in the interior parts of the region, especially on the many small farm sites in the interior plain. Apparently, the occupants of these sites were relatively prosperous, as they had regular access to imported wine. In the early Imperial period, the quantities of imported vessels are even larger, showing a widespread distribution of amphorae from Italy, Spain and Africa on both larger elite estates (villas) and smaller farm sites. The ports of Antium and Tarracina were probably the main hubs in the distribution of these vessels. As we have shown elsewhere, the site of Forum Appii had both large quantities and variability in amphora types in comparison to surrounding sites. The site, situated on a crossroads and a navigable canal in the interior plain, with its river

32 E.g., Mattingly 1988; Panella & Tchernia 2002.

33 As this analysis only draws on data from PRP phases 3 to 5, unfortunately the northwestern part of the region is excluded here. The maps display for the mid-Republican period: Graeco-Italic amphorae; for the late Republican: Dressel 1 and Neo-Punic amphorae; for the early Imperial: Dressel 2-4 (Italian and Catalan), Haltern 70 and Tripolitana 1 amphorae; for the mid-Imperial: Gauloise 4, Tripolitana 2, Leptiminus 1, and Africana 1 and 2a amphorae; for the late Imperial: Africana 2c, d and 3a/b amphorae.

port (marked by an anchor in Figure 4) probably served to further distribute goods that came in via Tarracina.[34]

We now also see divergent distribution patterns for amphorae from different regions (Figure 4f): while wine amphorae from Gaul occur mainly in the western part of the region, Leptiminus 1 amphorae occur almost exclusively in the interior parts of the region. These differential patterns may suggest that amphorae from the western Mediterranean were imported mainly through the port of Antium, whereas some North African products came into the region by other routes, probably through the port of Tarracina. This pattern seems to be confirmed by the distribution of another western Mediterranean import, Dressel 2-4 wine amphorae from Catalunya, that are also mainly found in the direct hinterland of Antium. Also, Terra Sigillata found in the region mainly includes Pisan products in the hinterland of Antium, while imports from the Tiber Valley and Campania occur more in interior parts of the region, and seem to have arrived there via different routes.[35]

In the Mid-Imperial period, the quantities of imported amphorae are smaller and the distribution of amphorae is limited to fewer sites, predominantly larger elite estates. Apparently, imported foodstuffs became a much less common phenomenon on simple farm sites, which in turn could reflect a decrease in wealth of peasant farmers.

3.4. Local production and exchange

Besides identifying external trade contacts as reflected by the distribution of imported goods, we now also use our ceramic data to identify patterns of local production and exchange. Through our highly intensive collection strategies we have, in the most recent phase of the PRP, been able to identify several pottery production sites in the Pontine plain.[36] By combining intensive pick-up of misfired ceramics from such contexts with petrographic analyses, we can now fingerprint these local productions. In addition, we have also conducted thin section analysis on ceramics from small rural "consumption" sites in an attempt to establish the distributional range of these local productions.[37] While these analyses concern a limited number of samples, this pilot study shows that during the Late Republican period, local products regularly travelled distances of 8 km, whereas the Early Imperial period possibly sees an extension of regional trade networks with tiles and amphorae from production sites on the coast being found on sites in the interior plain as far as 25 km from their place of production.[38] Finally, we also combine typological and petrographic approaches to study the mechanisms of production and exchange of common types of cooking wares that are generally considered to be of local production.[39]

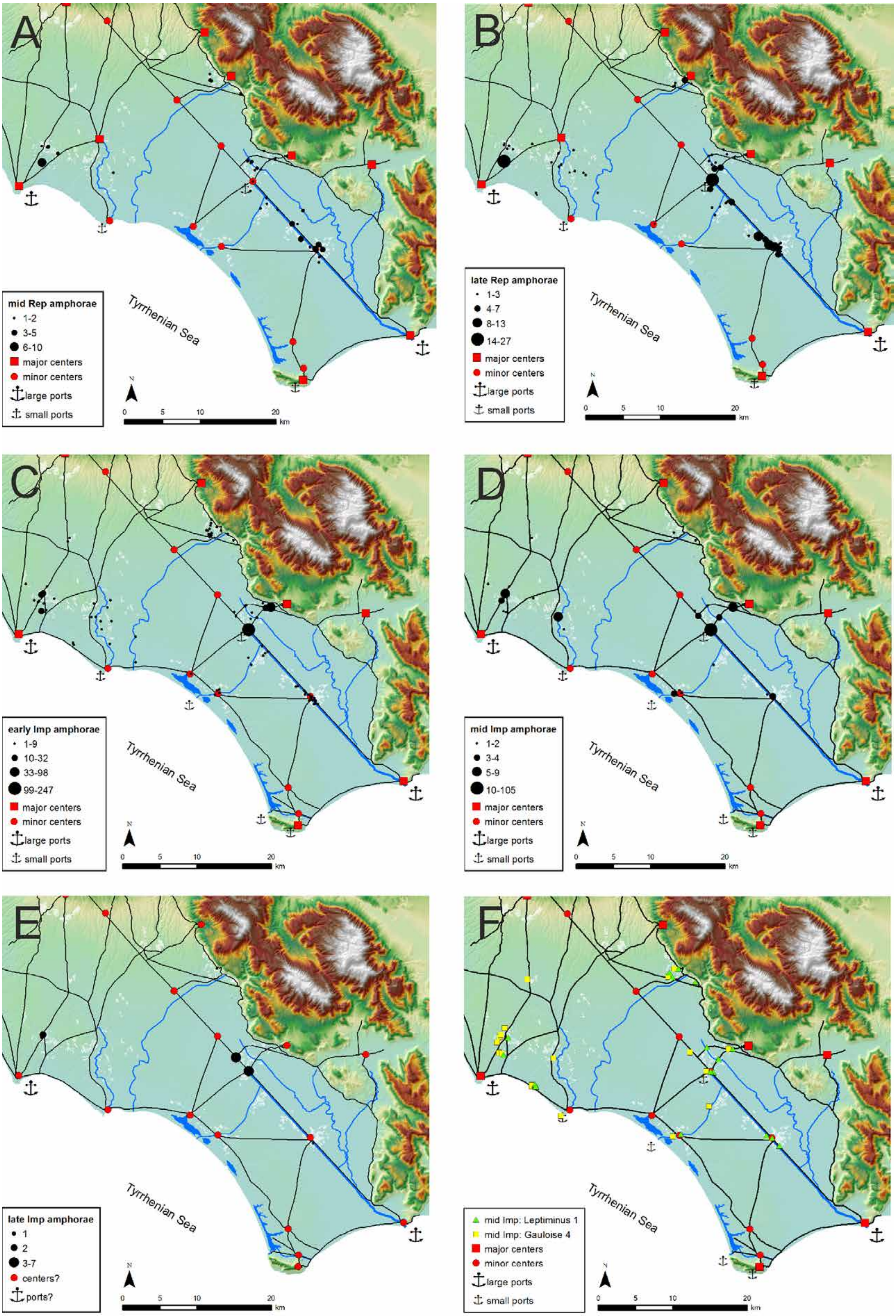
3.5. Too many sherds?

These examples clearly show that intensive sampling approaches in combination with more detailed typological and technological studies allow us to understand rural landscapes and economies in much more detail than before. At the same time, we should acknowledge that highly intensive approaches are extremely labour-intensive and also require considerable storage space. In order to establish a balance between sampling intensity and analytical potential we recently evaluated whether the intensive sampling strategies we used in the most recent phase of the PRP were actually worth the effort – did they indeed yield different and/or more reliable information?

During the recent surveys, we applied a two-step sampling procedure on sites: first, a systematic sample of 25-40% of all surface ceramics was collected; and second, a diagnostic sample was taken from the entire surface.[40] To check whether this second stage of sampling really added much to the information already acquired in the first stage, we compared the chronological profiles of both types of samples. As an example, we show the comparison for one small rural site (14003) and for part of the larger nucleated settlement of Forum Appii (Figure 5).[41] The outcomes show that on the small rural site both samples result in exactly the same chronological profile, and our two-tier sampling approach is redundant. However, at Forum Appii, which has a more complex and dense plough soil assemblage, the standard samples comprise comparatively few diagnostics, as these are obscured by the high quantities of building materials on the surface. In addition, this larger site also had a much more extensive chronology. Here, the additional diagnostic sample adds significantly to our insight in the chronology of the settlement.

We also conducted a desktop re-sampling experiment to see whether surveying only half of a site's surface with our systematic collections of 25-40% of materials would show the same composition of the assemblage (Figure 6). We divided all grid units into two subsets of alternating units (as if it were the white and black grids of a chequerboard) and compared the composition of the assemblages of both. Again, we present rural site 14003 and part of the site of Forum Appii as examples, displaying the two subsets as Units A and B. In the case

34 Tol et al. 2014.
35 Tol 2017.
36 De Haas 2011; Tol 2012; Tol & Borgers 2016.
37 Borgers et al. 2018a.
38 Borgers et al. 2018a; cf. De Haas et al. 2008.
39 Borgers et al. 2018b.
40 During the former procedure, walkers are spaced at either 5 or 8 m, picking up all artefacts from a 2 m wide swath. In the latter procedure, surveyors are walking shoulder to shoulder to collect all feature sherds from the surface.
41 These comparisons were carried out by Evelien Witmer (2015).


A
mid Rep amphorae
1-2
3-5
6-10
major centers
minor centers
large ports
small ports
Tyrrhenian Sea
0 5 10 20 km
B
late Rep amphorae
1-3
4-7
8-13
14-27
major centers
minor centers
large ports
small ports
Tyrrhenian Sea
0 5 10 20 km
C
early Imp amphorae
1-9
10-32
33-98
99-247
major centers
minor centers
large ports
small ports
Tyrrhenian Sea
0 5 10 20 km
D
mid Imp amphorae
1-2
3-4
5-9
10-105
major centers
minor centers
large ports
small ports
Tyrrhenian Sea
0 5 10 20 km
E
late Imp amphorae
1
2
3-7
centers?
ports?
Tyrrhenian Sea
0 5 10 20 km
F
mid Imp: Leptiminus 1
mid Imp: Gauloise 4
major centers
minor centers
large ports
small ports
Tyrrhenian Sea
0 5 10 20 km

(Opposite page) Figure 4: The distribution of the most common typologically identified amphorae in the Pontine Region. A: Mid-Republican period (350-200 BC); B: Late Republican period (200-50 BC); C: Early Imperial Period (50 BC-AD 100); D: Mid-Imperial Period (AD 100-250); E: Late Imperial Period (AD 250-400). F: Early Imperial, (African) Leptiminus 1 vs (French) Gauloise 4 amphorae (DEM courtesy Regione Lazio; further data generated by the authors).

of site 14003, the proportion of different functional groups in the assemblage shows only minor variations that would certainly not affect our interpretation of the site: it therefore seems that we would have gained the same information by surveying either subset A or B. In the case of the more complex site of Forum Appii, the differences between the two assemblages is also limited, but here we also find more "rare" functional indicators (such as luxury architectural remains or evidence related to craft production) that would perhaps be missed if we had surveyed only part of the area or collected smaller samples. As these types of evidence were of particular importance for our research questions, the choice of an intensive sampling scheme seems warranted, but there is obviously a cost-benefit trade-off here. Both examples suggest that especially in the case of smaller and less complex rural sites, we might well decrease the intensity of sampling in the future.

4. Concluding remarks: intensive survey, myopia and the bigger picture

In this paper, we have summarised some 30 years of survey and ceramic studies within the Pontine Region Project, and reflected on the analytical potential of this dataset for the study of rural landscapes. We here return to the two main critiques of intensive survey practices discussed in the introduction: first, the critique on collection strategies as voiced by Fentress; and second, Blanton's critique regarding the relevance of small-scale surveys in light of "the bigger picture" of societal development in the long-term and at larger spatial scales.

In light of our evaluation of sampling strategies, we should indeed be critical of our own approaches. In the most recent phase of the PRP, we may have collected more artefacts than necessary to reliably date and characterise rural sites. However, it is clear that the intensive sampling approaches and the more integrated types of ceramic studies we have developed allow us to extend the interpretive value of our survey data: by now, we can use surface ceramics not only to date sites much more accurately, but also to interpret them in terms of functions, understand past land use patterns and study trade patterns and regional systems of production and consumption. However, these intensive approaches only pay off with a high level of expertise on (regional) ceramic traditions – in our case, expertise that has accumulated over more than 30 years.

Regarding the second line of critique: although the PRP has focused on small study areas, it is precisely because of the sustained effort that we now dispose of a dataset that is representative for rural settlement in an area of some 1300 km^2.[42] Properly integrated with urban data (which in in the context of the Pontine region and many other parts of the Mediterranean can simply not be obtained with similar methods), the dataset with its extensive body of ceramic data allows us to improve on traditional large-scale datasets in two ways. First, by studying chronology and functions of rural sites in detail, we can start to critically re-assess and calibrate more extensive datasets and traditional site classifications.[43] Second, this type of data provides a basis for various quantitative analyses beyond the reconstruction of settlement trends, and therefore open up new research questions, especially with regard to issues of economic performance and processes of market integration.[44]

Thus, although the PRP can be considered a typical 'myopic' Mediterranean project, we certainly have not lost sight of the bigger picture of long-term, large scale societal developments. We, and many with us, acknowledge the need to integrate Mediterranean regional datasets (both from surveys and excavation); although methodologically challenging, these challenges are not unlike those we successfully faced in some of the comparative analyses of individual PRP surveys presented here. Much effort clearly remains to be done to analyse and integrate intensive survey datasets in order to arrive at the level of macro-regional analyses known from other regions of the world.[45] However, we are convinced that the intensive investigation of rural landscapes is not only a crucial element in regional analyses, but will also contribute to a much richer macro-level reconstruction of Mediterranean landscapes and societies.[46]

Acknowledgements

We would like to thank the organisers of the conference Fields, Sherds and Scholars for the invitation to contribute to the workshop and the resulting publication, and the anonymous reviewer for his helpful remarks.

42 This area is not unlike that of many datasets from other parts of the world (cf. Drennan et al. 2015).

43 One area where such work could have considerable impact is that of ancient demography: a better understanding of site functions and the longevity of occupation may lead to revised population reconstructions.

44 Witcher 2006; Jongman 2014; De Haas & Tol 2017: De Haas 2017.

45 Lawrence et al. 2016; Kintigh et al. 2014.

46 Cf. Alcock & Cherry 2004; Witcher 2008.

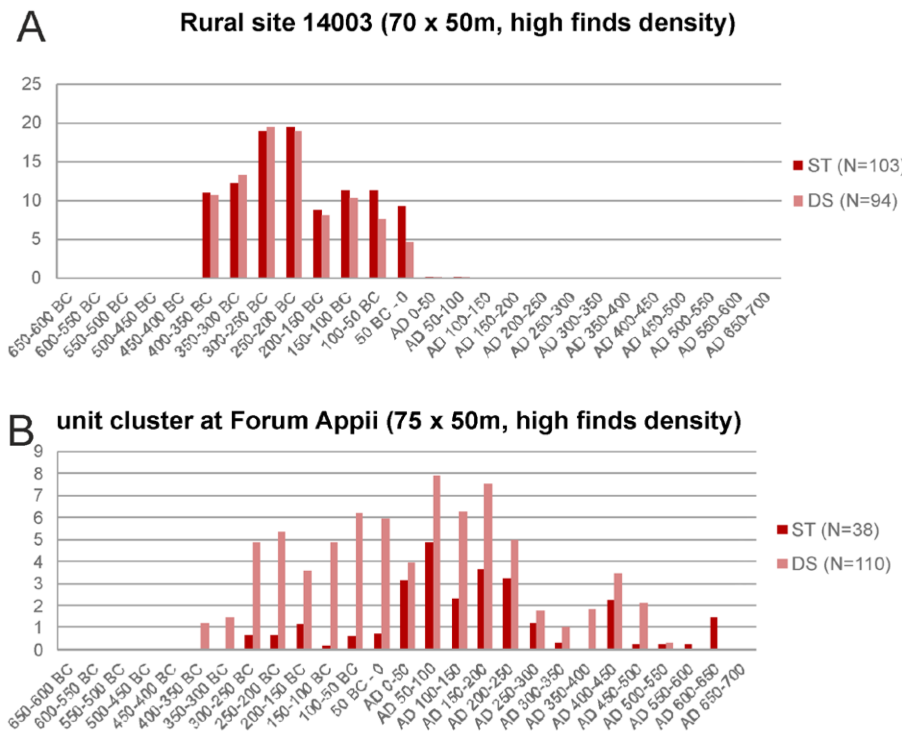


Figure 5: Comparison of date ranges of rural site 14003 and a cluster of units within Forum Appii on the basis of Standard Samples and Diagnostic Samples (data generated by the authors).

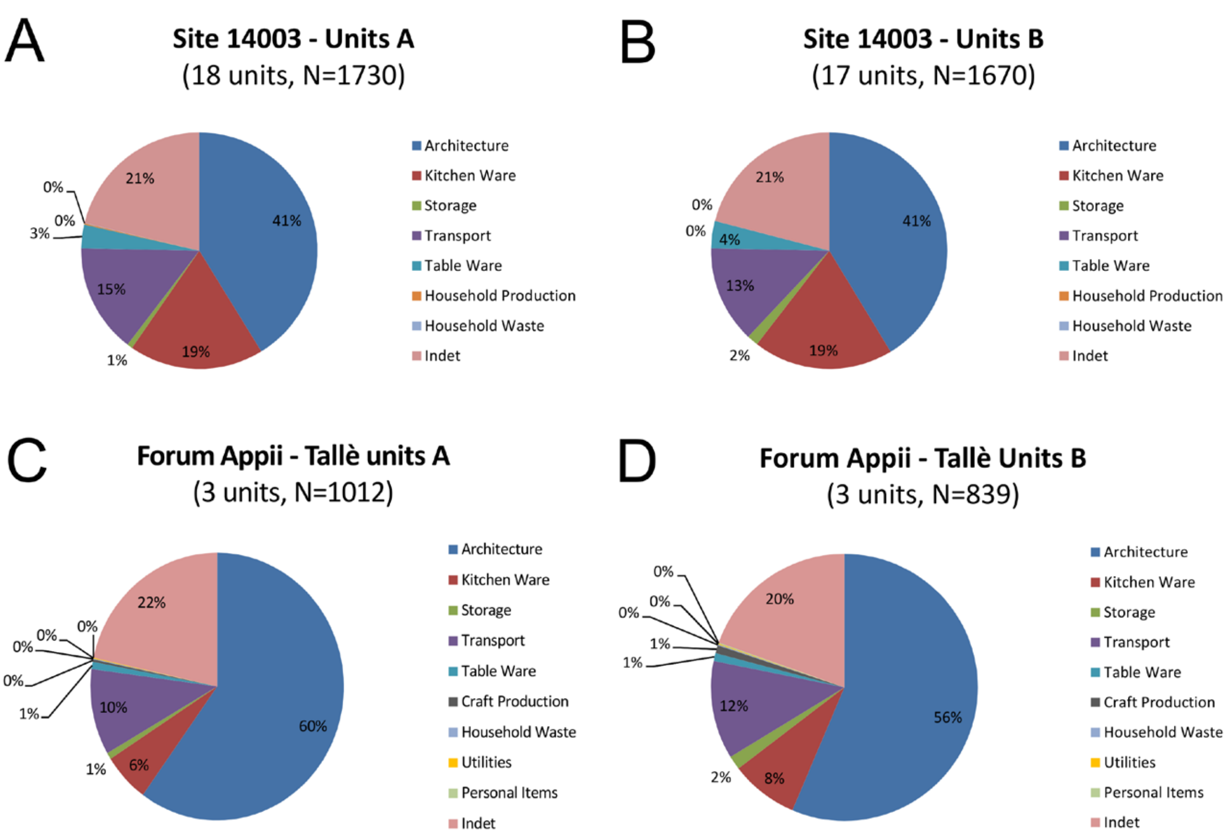


Figure 6: Comparison of assemblages of rural site 14003 (A/B) and a cluster of six units within Forum Appii (C/D) on the basis of standard samples from two subsets of units (after Witmer 2015).

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The Ayios Vasileios Survey Project

Diagnostic samples versus total samples and their biases

Corien W. Wiersma

Abstract

The Ayios Vasileios Survey Project focuses on a prehistoric palatial settlement in the Peloponnese. The main aims of the project include a reconstruction of the extent and spatial development of the site through time, including functional areas.[1] One of the aims of the pedestrian survey, a component of the overall project, is to develop a suitable survey methodology for a prehistoric settlement. The first survey campaign explored 10x10 m and 20x20 m units in which a total collection sample was typically taken in a quarter of the unit, and a diagnostic sample in the remainder. This article presents the preliminary results of this campaign. First, the biases involved in the collection of the samples are discussed, as bright sunlight, disturbances of the archaeological remains and poor ground visibility negatively affect the collections. An example is provided of the application of a weighting formula to correct for poor visibility, which, however, seems to be of limited value in this context. Secondly, the content and usefulness of the two different samples are compared and discussed. Analysis shows that compared to the diagnostic sample, total collections 1) contain three times more feature material, 2) represent earlier periods better (in this case EH, possibly MH and early Mycenaean), and 3) render spatial patterns that match geophysical data obtained from Ayios Vasileios better.

Keywords: Survey – Sampling – Biases – Greece – Prehistory.

Introduction

Sampling in surface surveys is a debated procedure in archaeological projects in Greece and the wider Mediterranean.[2] The focus of these discussions is generally on sampling procedures (where what is collected) and regional surveys or sites of historic date are often used as case studies. Historic sites, and especially urban ones, are characterized in Greece by a dense carpet of material.[3] Since it is not always possible to collect everything, a selective collection strategy is usually necessary, but raises problems, including the underrepresentation of prehistoric pottery and cooking wares and the statistically insignificant size of the samples.[4]

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1 For an extensive discussion of the questions, aims and methods of the project, see Voutsaki et al. 2019.

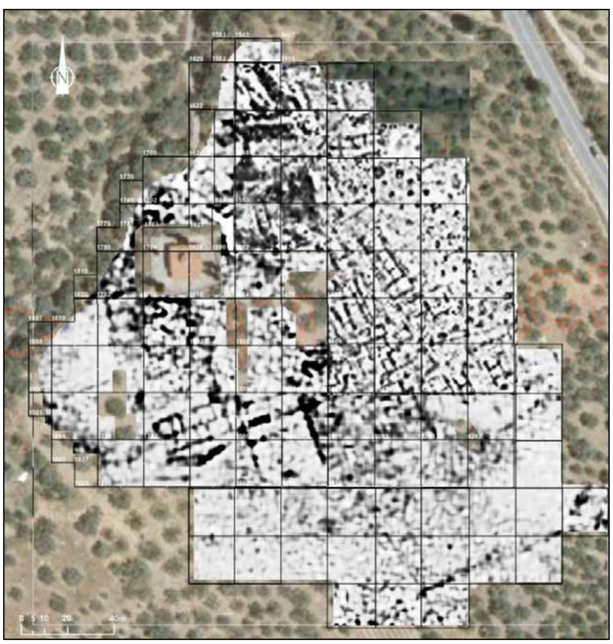
2 Corsi, Slapšak & Vermeulen 2013; Vermeulen et al. 2012; Johnson & Millett 2012.

3 Bintliff & Snodgrass 1988.

4 Whitelaw 2012.

in A. Meens, M. Nazou & W. van de Put (eds), Fields, Sherds and Scholars. Recording and Interpreting Survey Ceramics, 97-108, Leiden: Sidestone Press. DOI: 10.59641/m11443py.

Figure 1: Location of Ayios Vasileios and aerial photo showing terrain of the 2015 survey.



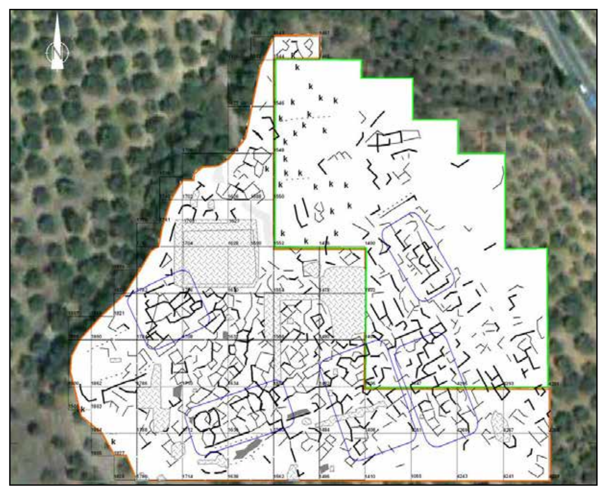


Figure 2: Results of electrical resistance survey (left) and interpretation (right) (from Polymenakos 2012, image source Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community).

It is unclear to what extent and in what ways the methodologies employed in regional and urban surveys are also applicable in the survey of prehistoric (urban) settlements. One of the objectives of the Ayios Vasileios Survey Project is to explore this question.

The aim of this paper is to present the preliminary results of the survey methodology used during the Ayios Vasileios pilot survey. First, the site of Ayios Vasileios, the pedestrian survey project and the survey methodology are introduced, followed by a discussion of the biases involved in the collection of the samples. The survey data have been modified in relation to the observed visibility, to assess the usefulness of "multiplying" the number of finds. Finally, the two different sample collections, total samples and diagnostic samples, are compared.

Every region, area and site is unique and therefore no universal "recipe" exists for pedestrian surveys.[5] The conclusions and suggestions put forward in this paper are therefore not necessarily applicable to other prehistoric (urban) settlements in the Mediterranean. However, the discussion and conclusions provide useful information on the limitations of using a weighting factor to modify survey data and the use of different types of samples at a prehistoric site, which may carry wider relevance.

5 Cherry 1983.

The Ayios Vasileios Survey Project

Ayios Vasileios is located in Laconia, Greece, approximately 10 km south of Sparta, on a low hill range of ca 200 m high, and has a commanding view over the plain (Figure 1). The hill is steep on the northern side, but slopes gently to the west and south. The hill range, and presumably the site as well, are cut by the modern Sparta-Gytheio road. Steep terraces are constructed on the southwestern side of the road, while on the northeastern side, shrubs cover the hillside. Both sides are undergoing severe erosion. The hill range and surrounding area is largely under cultivation, mainly of olive trees planted from the 1960s onwards.

The excavations showed that during the Late Helladic (LH) IIIA2 period, large terraces were constructed to support monumental buildings on the site, which may have caused surfacing of remains from earlier periods. The site was intensely inhabited especially during the LH IIIA period and was destroyed in (probably) the LH IIIA/B transition. Some sparse activity took place in the LH IIIB and LH IIIC period, after which the site seems deserted. Post-Bronze Age activities (Classical/ Hellenistic and Byzantine to Early Modern) have also disturbed the LH layers. Notably, large pits dug during the Byzantine period have caused the surfacing of Bronze Age material. Today, the archaeological remains are under serious threat of looting and agricultural activities. Especially ploughing and the planting of new olive trees causes surfacing of archaeological materials, as also reported by local farmers.

Previous extensive surveys have shown that Ayios Vasileios was an important large Mycenaean settlement, estimated to at least 20 ha.[6] Fragments of Linear B tablets, indicating the presence of an archive, were recovered on the surface of the site in 2008.[7] These were the first Linear B fragments ever found in Laconia and as archives are usually associated with Mycenaean palaces, excavations were prompted beginning in 2009. These exposed a late Middle Helladic (MH) to early LH cemetery,[8] remains of large LH buildings and a large court, and yielded many precious, unique and important finds, including more Linear B tablets and a hoard of bronze swords.[9] These finds indicate that Ayios Vasileios was an important Mycenaean palace. Geophysical research was carried out,[10] which, in combination with test trenches, showed the existence of an extensive Mycenaean settlement around the main palatial buildings (Figure 2).

The Ayios Vasileios Survey Project[11] consists of three components: a pedestrian,[12] a geophysical[13] and an ethnographic[14] survey. The project has a duration of 5 years, during which three pedestrian survey campaigns will be carried out, as well as additional geophysical research, coring to ground-truth the geophysical and survey data, and final study and publication of the data. The main aims of the survey project are 1) to reconstruct the extent and spatial development of the site of Ayios Vasileios through time, including functional areas, and 2) to develop a synthetic strategy for the non-invasive investigation of urban prehistoric settlements by means of geophysical prospection, pedestrian survey and the history of modern land use. This paper focuses on the methodology of the pedestrian survey, including the collection of sherds in the fields.

Methodology

A survey methodology was developed and tested during a three-week pilot survey in 2015. A gridded survey took place in units of 10x10 m, but areas of lower find densities were sampled in 20x20 m units. The rationale behind the size of the grid unit was to explore whether a 100 m^2 unit can inform us about intra-site differences, such as functional areas, rather than a larger grid unit (i.e. 400 m^2).[15]

Since we were offered the unique opportunity to map the spatial development of a relatively undisturbed and potentially significant Mycenaean palatial settlement, we decided to sample every single grid unit by means of a total collection and a diagnostic sample. Within each 10x10 m grid square, the team leader indicated an area of 25 m^2 where the visibility was best. In this area, all artefacts larger than 1 cm were collected. In the remainder of the square, only potentially diagnostic ceramics[16] were collected as well as objects such as worked obsidian and figurines. The walkers, usually five, arranged themselves shoulder-to-shoulder and slowly walked the area while collecting finds. When total collections were made, walkers would walk the area twice, the second time from a different direction and in a different order to limit the effects of sunlight and inter-observer error and to double-check that everything

6 Waterhouse 1956; Waterhouse & Hope Simpson 1960; Banou 1996.
7 Aravantinos & Vasilogamvrou 2010.
8 Moutafi & Voutsaki 2016.
9 Vasilogamvrou 2010.
10 Tsokas et al. 2010; Polymenakos 2011; 2012; 2013; 2014.

11 The Ayios Vasileios Survey Project is directed by Prof. Sofia Voutsaki and Mrs Adamantia Vasilogamvrou. The project is carried out under the auspices of the Archaiologiki Eteria of Athens.
12 The pedestrian survey is directed by Dr Corien Wiersma.
13 Dr Wieke de Neef, in collaboration with Eastern Atlas, is responsible for the current geophysical prospection.
14 Prof. Sofia Voutsaki is responsible for the ethnographic survey, which focuses on recent land management in the survey area.
15 For example, the survey at the Mycenaean palace of Nestor in Messenia was carried out in 20x20 m units, and did not provide any conclusive evidence for intra-site spatial differences.
16 I.e. feature sherds (rim, spout, handle, base etc.) and decorated sherds.

	Diagnostic Sample	Total Sample
Sunny	(34) 5,2	(34) 4,6
Cloudless	(9) 3,1	(9) 7,6
Cloudy	(85) 9,2	(85) 8,9
Rainy	(9) 10,2	(9) 15,3

Table 1: Weather in relation to average number of feature sherds.

	Diagnostic Sample	Total Sample
Bright	(7) 3,6	(7) 4,3
Light	(96) 8,8	(96) 8,8
Patchy / shady	(31) 5,8	(31) 6,3
Dark	(2) 15,5	(2) 16,5

Table 2: Lighting in relation to average number of feature sherds.

	Diagnostic Sample	Total Sample
Extremely hot	(0) NA	(0) NA
Hot	(0) NA	(0) NA
Warm	(36) 8,6	(35) 7,6
Moderate	(87) 7,6	(88) 8,4
Cold	(13) 7,2	(13) 8,1

Table 3: Temperature in relation to average number of feature sherds.

was collected. The finds from the total collection and the diagnostic sample were bagged separately. In areas of low find densities, only diagnostic samples were taken. Because some urban survey projects obtained positive results from total sampling as an addition to other forms of sampling,[17] we used both to explore whether total sampling would also benefit data collection on prehistoric settlements, i.e. provide more and better data on prehistoric habitations, especially phases that are difficult to attest in surveys,[18] and in general more data to explore intra-site differences.

Biases

Before we can proceed to compare the two different find collection methods in detail, we need to establish the effects of various variables and processes.[19] To this end, details on the field- and survey conditions were registered during the fieldwork. In the following, the effect of weather conditions and surface conditions on the two find collection methods are evaluated.

Weather conditions during the survey

During the Ayios Vasileios Survey Project, details were listed on the weather circumstances, light and temperature. Table 1 presents the data on the relationship between the weather and the collections of finds. Sunny and largely cloudless weather are related to fewer feature finds, while cloudy and rainy weather are related to a higher number of detected feature sherds. Details were also listed on the natural light. Table 2 shows that bright light hinders the collection of finds (the above-mentioned sunny and cloudless skies are of course related). Sunny skies and bright light thus lead to smaller collections, presumably because brightness and reflection hinder good vision. Cloudy skies and less intense or direct sunlight result in larger collections, as vision is not hindered, while fresh rain is likely to wash off dust from the sherds, making them easier to identify on the surface.[20] Finally, temperature was recorded.[21] Table 3 does not show much difference between collections taken at different temperatures. Having said that, (extremely) hot weather was not experienced during the survey. It therefore remains possible that (extremely) high temperatures affect the size of the sample.

Surface conditions during the survey

Notes were also taken on the surface conditions, including disturbances,[22] land use,[23] soil type[24] and visibility. Table 4 shows that disturbances cause a drop in the number of feature sherds collected, probably because part of the surface are obscured (especially in the case of dirt tracks where sherds may be pressed into the ground and/

17 On Phlius: Alcock 1991, 443-44 where the total collection (Field Middle) yielded good results for prehistoric sherds; on Sikyon: Lolos, Gourley & Stewart 2007, 283 where 'the sheer volume and range of material recovered – particularly in the case of total collection squares – has proved to be of immense value for the detailed interpretation of the diverse ceramic body.' On Koroneia: Bintliff et al. 2010, 7 where total collections yielded more evidence of cooking wares and prehistoric finds.

18 See Rutter 1983, who ascribes low survey visibility to the Final Neolithic, Early Helladic I and III, Late Helladic I and II and the Submycenaean periods.

19 Shennan 1985, 115.

20 The term 'Dark' is only used twice, by the same team leader, while the neighbouring team leader chose at that same time the qualification 'Light'. This divergence shows that it is better to consult the survey team as a whole to reach a qualification on the natural light. This also applies to the temperature: it is best to ask the whole team how they experience the temperature, rather than only the team leader.

21 We have chosen not to record the temperature as simply a thermometer indication but rather to ask people how they experience the temperature, as this may vary depending on, for example, (sea) wind.

22 I.e. plowing, bulldozing, construction, dirt track, dump/waste, erosion, terracing etc.

23 I.e. olive cultivation, fallow, grass, weeds etc.

24 I.e. shallow-ploughed, deep-ploughed or unploughed.

or shattered in tiny pieces). Land use (olive cultivation) and soil type (shallow-ploughed, with some patches that may have been unploughed) were generally the same everywhere. Therefore, these aspects were not further analyzed, but such an analysis may give useful insights when applied to (regional) surveys with more variation. Table 5 shows that poor visibility[25] negatively affects the number of feature sherds collected.

One would expect that total collections a) are less affected by weather and surface conditions, since everything is picked up and b) result in larger amounts of feature sherds. Although the total collections indeed result in three times more feature sherds (discussed below), they appear similarly affected by weather and surface conditions as the diagnostic samples: the numbers of feature sherds increase when the weather is cloudy or rainy (Table 1) and decrease when the light is bright (Table 2), in case of disturbances (Table 4), or when the visibility is poor (Table 5). In sum, weather and surface circumstances affect both types of collection methods.

It is generally agreed that it is useful to be aware of biases affecting our data, and to have some understanding of the extent of this, but what kind of actions need to be taken next? During fieldwork, measures can be taken to downplay biases or to understand and modify them accordingly.[26] Data can also be modified post-collection to counter biases. The best known and most utilized measure is the application of weighting factors,[27] usually to correct for poor visibility. The question we should also ask ourselves is what we expect from such a modification of the data in the context of a prehistoric survey, i.e. will modifications significantly improve possibilities to answer our research questions? In the following, I will outline the use of a weighting factor to correct for poor visibility at the site of Ayios Vasileios, and show that it has limited effects, as 'multiplication is not diversification'[28].

Case study: multiplying raw counts

At the Ayios Vasileios survey we are especially interested in 1) the habitation history of the site, 2) the boundaries of the settlement through time and 3) intra-site spatial patterns, indicating for example functional areas and/or

	Diagnostic Sample	Total Sample
Undisturbed	(115) 8,8	(115) 9,1
Disturbed	(23) 2,8	(23) 3,3

Table 4: Disturbances in relation to average number of feature sherds.

Visibility	Diagnostic Sample	Total Sample
Very poor	(24) 2,1	(14) 3,0
Poor	(36) 6,1	(29) 4,6
Moderate	(35) 8,7	(33) 9,2
Good	(37) 12,1	(46) 8,5
Very good	(5) 10,8	(14) 17,5

Table 5: Visibility in relation to average number of feature sherds.

specialization in the use of space. Because geophysical research and the digging of trenches have been carried out at the center of the site, we know where Bronze Age architectural remains are located below the surface. Therefore, the case study provides us with the opportunity to explore whether multiplying raw counts leads to a better match between surface- and subsurface remains. This case study is limited to two groups of material: all potentially diagnostic sherds, and prehistoric ceramics.

The total numbers of diagnostics and prehistoric finds from each visibility category are multiplied by a weight, based on Schon (Table 6).[29] Figure 3 illustrates the effects of the use of weighting factors on the diagnostic sample taken at Ayios Vasileios:[30] the potentially diagnostic material has a slightly larger concentration towards the south, and so does the prehistoric material. It is also up to this point that the geophysical data indicate subsurface structures. However, no higher densities are seen in areas in the north and northwest, where find densities seem low due to the poor visibility, but should have been higher as prehistoric remains are located beneath the surface. This example shows that the application of a weighting factor to correct for poor visibility on our prehistoric site survey data has very limited effect. After all, only the densities are modified,

25 Visibility was separately assessed for the surface from which the total collection and the diagnostic sample were collected. Visibility was categorized into one of the following five groups: 1 very poor; 2 poor; 3 moderate; 4 good; 5 very good.

26 E.g. seeding experiments, as done by Schon 2002 and Banning et al. 2011, and spending more time on collections under some circumstances, as for example suggested by Bintliff et al. 1999, 158.

27 I.e. Kamermans 1995; Terrenato & Ammerman 1996, Bintliff et al. 1999; Martens et al. 2012: 86; Bintliff, forthcoming: Thespiai, where counts were modified by a visibility correction whereby counts would be doubled when soil visibility was set at 50%.

28 Van de Velde 2001, 27.

29 The formula provided in Chart 5.5 in Schon 2002 appears incorrect. I have therefore placed the three points provided in the chart into Excel and calculated a new formula closely fitting a straight line through the three points provided. The formula is $y = 0{,}7204x + 15{,}294$, whereby $R^2 = 0{,}9994$. Other weighting factors have also been formulated, whereby the most straightforward way is to use a multiplier in direct relation to the visibility percentage, i.e. see note 27.

30 The density categories in all the figures are automatically calculated in ArcMap (Natural Breaks).

Visibility category	Visibility %	Average visibility %	Recovery % (based on Schon 2002)	Multiplying weight
Very poor	0-20	10	17	5.9
Poor	21-40	30	38	2.6
Moderate	41-60	50	52	1.9
Good	61-80	70	67	1.5
Very good	81-100	90	80	1.3

Table 6: Visibility in relation to the weighting factor.

rather than the spatial distribution, as zero finds cannot be multiplied. This can also be exemplified by referring to material which is difficult to identify in surveys (see n. 18): we have found very little EH and LH I-II material during the survey. Their numbers can be boosted by a certain weight, but this will not change the spread over the site, which will remain static. Possible (new) concentrations of material after weighting should therefore also be scrutinized.

Let me end this section on biases on a positive note: above, I have established the effects of various variables and processes on the total collections and grab-samples taken at Ayios Vasileios. Although both sample types were affected by weather and surface condition, the general spread and density of the material matches the data rendered by the geophysical research well.

Grab-samples versus total collections

This section will explore to what extent the content of the total collection sample (TC) and the diagnostic sample (DS) are similar or different and what their use and potential is at a prehistoric site and with respect to the posed research questions. First, however, a few words are needed on the effort involved in the two types of collection. A TC requires more collection- and processing time as well as more storage space than a DS per square meter. Depending on the size of the TC, and the manner in which the remainder of the unit is investigated, a TC may be a quicker way to sample.[31] In our survey, a DS of 75 m^2 and a TC of 25 m^2, collected by a team of 3-5 people, took on average ca 8.3 and 8.2 minutes respectively.

When comparing the average number of feature materials found in the TC and DS, it is immediately clear that three times more came from the TC: ca 0,24 per m^2, versus 0,08 per m^2 in the DS.[32] This may be due to the fact that everything was collected and that there was overall better visibility in the area where the TC was taken. The two types of samples render the same impression regarding site habitation periods: both show a large proportion of prehistoric material, a very small proportion of Classical/Hellenistic material, and a slightly larger proportion of Byzantine material (Figure 4). Zooming in on the prehistoric periods, some differences between the two types of samples become apparent (Figure 5). The earlier prehistoric periods (Early Helladic I-II, Middle Helladic III-Late Helladic I and Late Helladic II) are slightly better represented in the TC, whereas the later prehistoric periods are better represented in the DS. Non-ceramic finds are also better represented in the TC. In summary, the diagnostic content of the two samples appears largely the same, but the TC adds some significant information to the DS, as it provides slightly more data on deeply buried remains and rare objects. However, this result is mathematically expected: the larger the sample, the more varied it will be.[33]

We will now proceed from the content of the samples to the spatial patterns they render at Ayios Vasileios. With respect to reconstructing site extent, the TC seems more reliable: in the TC, the spread and density of fine Mycenaean unpainted ceramics (Figure 6), which we may assume date to the main period of habitation in the LH IIIA period,[34] coincide better with the LH settlement remains as indicated by the geophysical data. Some small concentrations of Mycenaean material surrounding the settlement coincide with geophysical anomalies and may indicate extramural activities. However, these concentrations are observed in both the TC and the DS. The finds themselves does not shed any light on the nature of these activities and can be interpreted in various ways, i.e. habitation, burial, refuse, erosion. Beside the intramural/extramural activities, not other intra-site spatial patterns have thus far been identified.[35] Combining survey and geophysical data may reveal more intra-site spatial patterns, but these will need further ground-truthing by means of coring or excavation to ascertain the assumed relationship between the two and the nature of the activities.

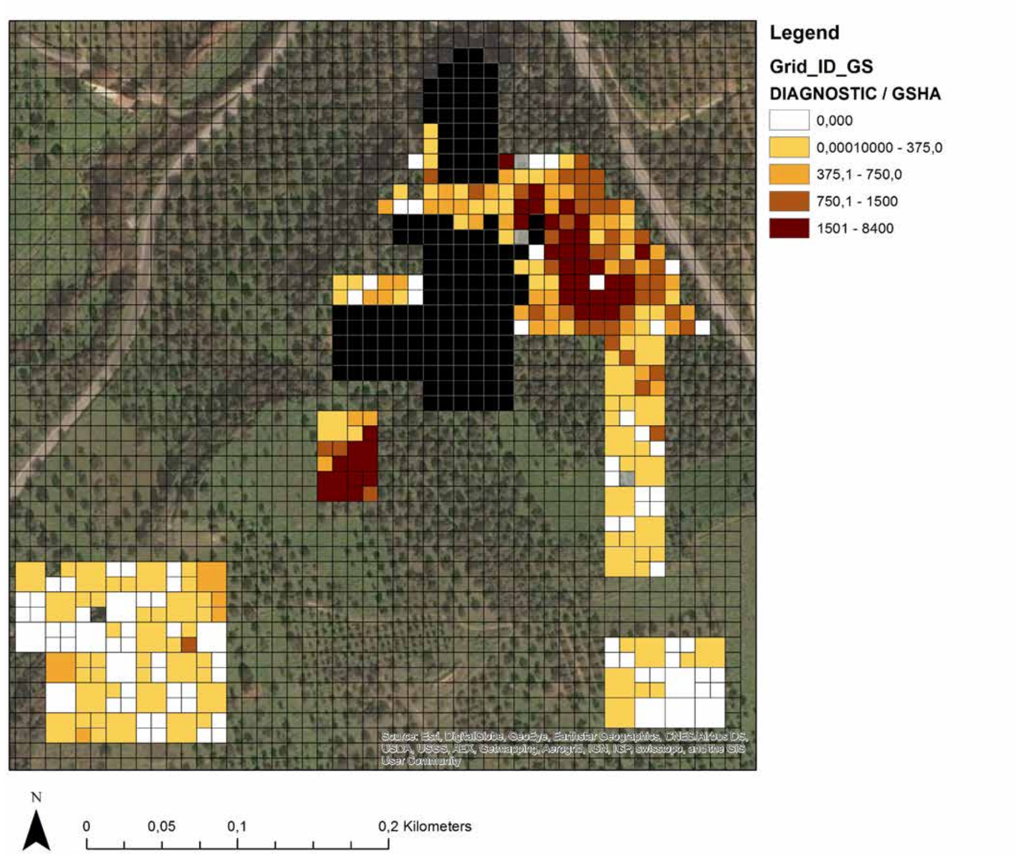
31 See also Van de Velde 2001: 39, who shows that point-sampling at the Riu Mannu is no less time-effective than line-walking. However, see also Whitelaw 2012, who switched from point-sampling to line-walking at Knossos to be able to cover more ground.

32 At the ancient coastal town of Pyla-Koutsopetria on Cyprus, various sampling experiments were carried out (Caraher et al. 2014, chapter 3), which also show a significantly higher proportion of finds in total collection samples.

33 Kintigh 1984; Rhode 1988. Moreover, it should be added that the number of finds involved in these rarer categories are very small.

34 Fine Mycenaean material can date to the entire Late Bronze Age, but since LH IIIA was the main period of habitation, it seems likely that most of this material dates to LH IIIA.

35 Perhaps a study of the proportion and spread of (prehistoric) fabrics might render some spatial patterns.



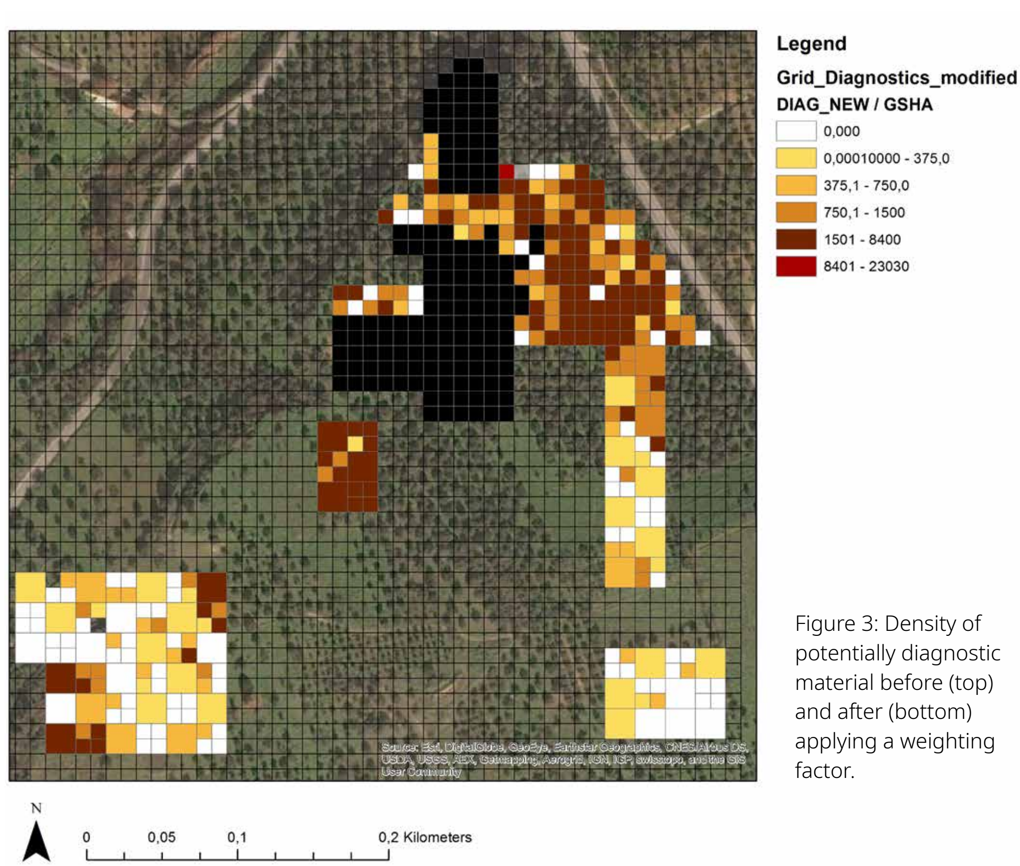


Figure 3: Density of potentially diagnostic material before (top) and after (bottom) applying a weighting factor.

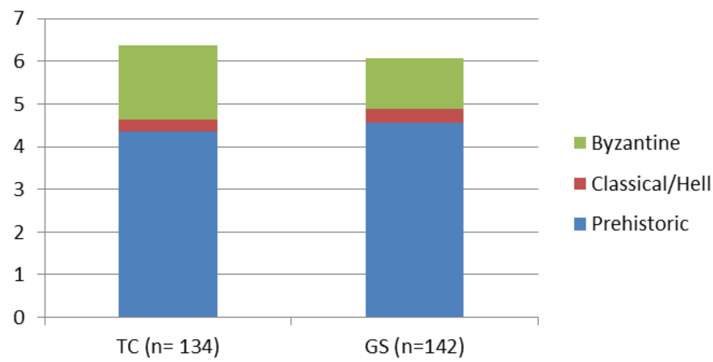


Figure 4: Preliminary average numbers of datable finds per unit in a high-density area. Total collection (TC) compared to grab-samples (GS).

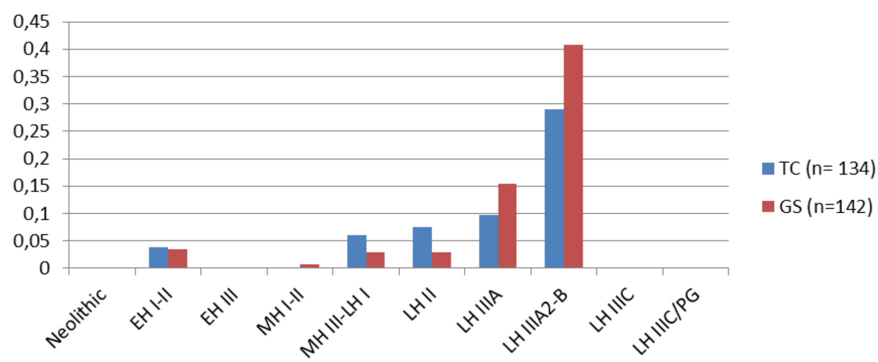


Figure 5: Preliminary average numbers of datable finds per unit in a high-density area.

Although the TC appears to render slightly more reliable distribution/density maps, interpreting these maps remains problematic, due to the effects of site formation processes. For example, the small area in the southwest in Figure 6 shows higher densities, but these seem caused by the planting of new olive trees. In addition, the earlier phases remain elusive, as it is likely that the core of the earlier settlements is buried below the LH settlement and that its associated material is barely emerging on the surface.[36]

Based on these preliminary results, we have decided to continue with the TC at Ayios Vasileios in addition to the DS, but on a smaller scale, only 5%.[37] We will continue to explore what the benefits are of TC as opposed to DS, and whether these effects are different for the various periods represented at the site (prehistoric, Classical-Hellenistic and Byzantine to Early Modern).

Conclusions

What can we learn from the pilot survey at prehistoric Ayios Vasileios and the sampling methods used? A brief visit combined with a targeted collection of finds may be enough to gain a general understanding of the size and habitation periods of a site. Diagnostic sample survey adds more detail, as do (limited) total collections. When site extent is of interest, more spatially controlled mapping and counting of finds is needed, and the total collections at Ayios Vasileios appear to render a density map that corresponds better to the geophysical data. However, most if not all prehistoric sites are so affected by post-depositional factors that an interpretation of density maps needs to be checked against other data, such as geophysical data, soil analyses and test trenches. These issues are also exemplified in the Laconia Rural Sites Project.[38] For reconstructing site extent and intra-site spatial patterns, total collections appear more reliable than diagnostic samples, although they are also affected by weather and surface conditions.

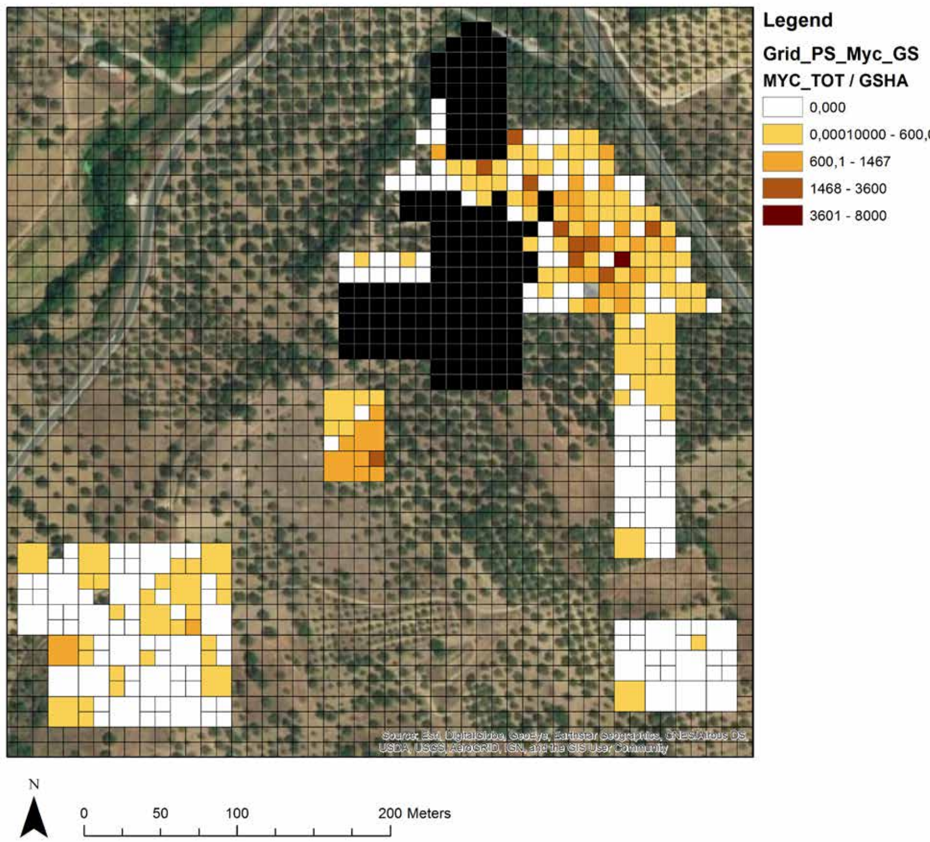
In conclusion, we should continue to seriously consider, and perhaps reconsider, how we sample remains at different types of sites. Compared to the diagnostic sample, we expected the total collections at Ayios Vasileios to render even more detailed information on prehistoric material than it has done so far. Are the observations at Ayios Vasileios site-specific, specific to the prehistoric period, or more widely applicable? Whether total collections should be preferred over diagnostic samples remains to be further tested, analyzed and discussed, not only at Ayios Vasileios but also at other prehistoric sites.[39] Based on the data offered in this paper, however, it seems reasonable to limit sampling on a prehistoric site to 5% total collections within 10x10 m grid units.

36 Thus far, some Middle Helladic layers have been found below LH remains during the excavations.

37 A 5% total collection was advised by E. Kiriatzi, based on positive result in the Kythera survey (pers. comm.)

38 Cavanagh, Mee & James 2005, i.e. prehistoric sites LP7, LP8, LP10 and LP20 which suffered from erosion.

39 See for example the following, which, however, especially consider historic sites or larger areas: n. 17; Van de Velde 2001; Whitelaw 2012; Caraher et al. 2014, Chapter 3.



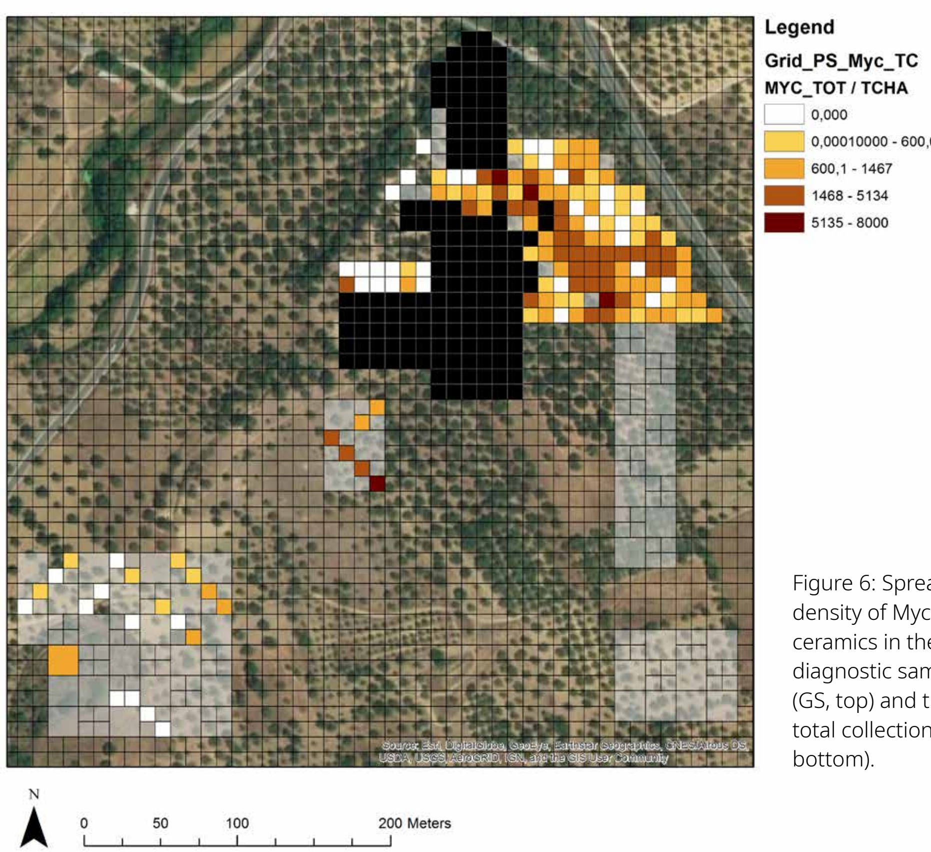


Figure 6: Spread and density of Mycenaean ceramics in the diagnostic samples (GS, top) and the total collections (TC, bottom).

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Diagnosing the undiagnostic

Using sherd databases as a source of interpretation

Vladimir Stissi

Abstract

In this paper, I offer a plea for the use of full sherd databases, rather than a small selection of catalogued items, as a starting point for interpretation of survey finds. While most sherds are not as precisely dateable or otherwise diagnostic as most items in traditional catalogues, in my experience a very large majority of survey finds is usually dateable in period categories, and most can be assigned a shape or function. By looking at examples from projects in Thessaly and Boeotia I am involved with, I hope to show that these 'medium diagnostic' sherds provide a solid starting point for interpretations of assemblages, even if conditions in the field or selective processing have stuck us with less than ideal collections. These examples also showcase possible approaches to find collection and processing.

Of course, the fact that much is possible does not mean that results are always straightforward or that there are no pitfalls. In the second part of the paper I illustrate some problems and possible ways to tackle them, and also reflect on some methodological issues, particularly implications of the limitations of our classification systems – which of course simplify results and produce biases. Finally, I will present some unsolved riddles. None of these difficulties, however, are problematic enough to invalidate or even seriously hamper the use of all kept material as the main source of our interpretations of survey finds. Most of the apparently undiagnostic mass is quite diagnostic and useable if given proper attention!

Keywords: Archaeological Survey – Ceramics – Diagnosticity – Chronology – Function.

Introduction

The finds publications of most Greek and Italian archaeological field surveys are oddly traditional: they usually present a relatively small number of (relatively) highly diagnostic finds – dozens or hundreds out of thousands or ten thousands. This may give a good introduction to local and regional ceramic production, and offers some anchor points for dating, but can at best only partly be related to the chronological and functional analyses of single sites and regions which are often the core of survey publications. The bulk of the finds simply remains out of sight, and conclusions that appear to be based on them, or some of them, are uncontrollable.

In apparently less traditional publications, finds are regularly presented in tables with so many categories and numbers that they are barely readable, and hardly useable as a starting point for interpretations. Furthermore, one sometimes wonders how classification of survey finds can be so precise, and what happened to the large

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proportion of finds which cannot be classified so precisely. In fact, there are clear cases where 'complete' overviews of finds can only be overviews of diagnostic finds – whatever selection these may represent.[1] In the end, the resulting interpretations are often not that different from those coming out of more traditional approaches starting from smaller numbers of catalogued items, and the control problem remains.

Of course, these various approaches leading to selective presentations of finds are at least partly a result of the sad but inevitable fact that in most surveys much of the encountered material is considered to be more or less undiagnostic or uninteresting, and that there often are so many of such finds that it is very tempting to leave them aside and 'forget' them in the interpretative process. It is also only natural to concentrate on finds that are easier to classify and understand – thus remaining in a circle which makes it difficult to extend our expertise into categories of finds we cannot grasp yet.

Shouldn't we be able to do better? I think the now available expertise in processing even worn and highly fragmented sherd collections indicates we could. In my experience, in several Greek surveys the numbers of kept material that can be labelled as what I would call 'medium diagnostic' are very high -- thousands of sherds and more than two thirds of collections can often be dated within a few centuries and a large majority of these can be given a rough shape, fabric and/or functional grouping. As will be shown below, for some areas and periods, over 80% of diagnostic in this wider sense is not unusual, even when relatively little material is left behind in the field.[2] Fortunately, elsewhere in this volume, many good examples of innovative approaches effectively using such masses of finds can be found.

In this paper, I do not want to look at specific methods and results of single projects so much, although I will start from the finds I have studied over the last decades in Thessaly and particularly Boeotia.[3] Instead, I will try to stay close to the material itself, looking at ways it can be approached, starting from basic classifications as used by many projects, but focusing on the possibilities and also limitations of these medium diagnostic sherds mentioned above – items which can be grouped in basic categories, without being very diagnostic. By looking at some partial results and small sections of data I hope to offer some case studies which show how even humble sherds can be quite informative when studied in bulk, but I also want to highlight some problematic aspects of our datasets, indicating limitations and potential pitfalls. In addition, I want to present some riddles: sometimes our data also show inexplicable patterns, at least for now. Finally, my series of small case studies and the accompanying illustrations are also meant to explore possible ways of meaningfully presenting and discussing large collections of normally mostly overlooked finds. In short, this is an article about method, in which specific results and interpretations are only illustrating the main point: survey publications should give more attention to the mass of finds which are not interesting as catalogue entries.

Numbers, densities, diagnostics

A first issue to address regards the numbers of finds which can be labelled as diagnostic in a useful way, and the insights quantitative approaches can offer – or cannot offer, because survey material obviously has its limitations as well. As there is no systematic research in this field I am aware of, it is difficult to judge what proportions of finds which can be dated or classified by specific shapes or fabrics or uses may be considered regular for Greece. Of course this also depends on ways of classification and definitions of what is specific enough to be considered diagnostic, for which there is nothing approaching a standard or even a common practice. I do have the impression however, from both existing publications and discussion with many survey archaeologists, that the interpretative potential of full survey assemblages (rather than small selections of highly diagnostic items) is underestimated.

I will therefore start by looking at two extreme cases I am involved with: on the one hand a relatively small assemblage, subject to heavy selection before study, from an area where finds are generally badly dateable and also otherwise rather undiagnostic and on the other hand a set of assemblages of much better preserved and more diagnostic material, which was mostly less 'filtered' before study, and where the sheer bulk of material may seem overwhelming. These collections come from two entirely different survey projects in Thessaly and Boeotia respectively. However, seen together the rather different problems of diagnosticity in relation to quantity they illustrate combine well in offering generally valid insights and possible approaches to various kinds of 'difficult assemblages'.

1 See e.g. the find lists in Mee & Forbes 1997; Bergemann 2010; Carter & Prieto 2011.

2 I am not aware of any intensive surveys in Greece or Italy which have collected and published all material on surface in the researched areas and squares, or even all material they picked up. More and more projects are now depositing their datasets in digital repositories, however. These are likely to include more complete documentation, but unfortunately some I have tried to access are not very user-friendly, and many remain only partially filled-in. I have for now abandoned my plans of collecting case material this way.

3 I here want to thank the project directors of the Boeotia surveys, John Bintliff and Anthony Snodgrass, and the Halos Survey, Reinder Reinders, for inviting me to participate and study finds, and the Ephorates of Boeotia and Magnesia and their staff for their cooperation in making this work possible, and the support during the stays there.

In its early phases (1990-2002), the Halos survey, covering parts of the territory of the small polis of Halos in southern Thessaly, has mostly collected very small and highly diagnostic groups of selected material, from rural sites only. These can now be compared with larger samples collected or sometimes only counted during targeted revisits and tests in 2011-2015. These include offsite areas, but coverage remains patchy.[4] By contrast, the Boeotia Survey and its follow-ups have targeted more substantial and more continuous parts of the territories of several poleis, including the main settlements, and have generally collected quite intensively in their long history starting in 1978, especially in the urban sites I will focus on in this paper.[5] Most, but not all, of the surveyed Boeotian cities, but also some villages and larger isolated structures, have produced collections of thousands or even tens of thousands of sherds.

One aspect both projects have in common is that collection strategies and intensity have varied considerably over time, but generally moved towards fuller coverage and more detailed collecting and recording. While on the one hand this can hamper comparisons between sites and collections, on the other hand it also allows a better understanding of the effects of different approaches in picking up and keeping finds. It is moreover a typical situation of many projects, which in the course of time tend to adapt their strategies to earlier experiences.

During the 1990-2002 surveys around Halos, offsite finds were usually not picked up, and only small numbers of very diagnostic finds were brought in from the sites encountered. During processing, further selection took place, removing duplicates and finds which were somehow considered to be of little diagnostic value. All judgment was impressionistic, and not based on systematic criteria. As a result, the number of kept sherds is very low, and the representativity of the kept assemblages is unclear. In many sites (48 out of ca. 230) no finds at all were collected or kept; in the majority of remaining sites (119) less than 20. As a result of the selection process, in most sites, almost all preserved sherds are dateable, and many are also diagnostic regarding shape and surface finish. However, diagnostic sherds are not necessarily unproblematic. In some cases (like some Early Iron Age sherds found in a ruinous Medieval or Ottoman building on top of the Halos Akropolis) these are clearly not representative of the surface assemblage. The picture is not always so straightforward, however. Especially in small multi-period sites, which seem to be quite frequent in the area, many bags contain finds belonging to three or four chronological phases, each represented by one or two sherds. Obviously, some of these may well be background noise (although offsite density is very low in much of the area), but even if they are not, these tiny quantities are not much to base a site history on.

Unfortunately, a series of intensive resurvey campaigns in 2011-2015 have shown that bringing in more finds does not necessarily solve such problems. The combination of low artefact densities on mostly small sites, rather badly preserved material and multiperiod sites often still leads to very low numbers of sherds for each period. It must be said, however, that, rather to our own surprise, the chronological patterns visible in the old small selections of material were mostly confirmed by the somewhat larger new collections. This, at least, appears to confirm that our multiperiod sites are not built up out of background noise.

Meanwhile, even in some of the larger sites where we now picked up hundreds of sherds instead of handsful or dozens, diagnosticity remains a major problem. Particularly on unplowed, overgrown hilltop sites, but also in some plowed fields, most of the surface material is highly fragmented and heavily eroded, leaving very few sherds which can be classified by shape or surface finish (see Figures 1-2 for examples). Perhaps further study focused on fabric and bringing in finds from excavations and well-dated single period survey sites could help here, but for the moment on many sites we remain stuck with small numbers of even roughly dateable sherds, which do not bring us much further than the original selective collections.

However, in some cases the revisits did offer new insights. Particularly sites on plowed land do show that looking at larger numbers of finds can really take us forward. The enigmatic site 1990/35, a small elevation close to the large Early Iron Age cemetery at Voulokaliva, is perhaps the best example. Even though a large number of finds had been kept after the first survey in 1990 and several revisits, allowing us to differentiate between Bronze Age settlement material and Early Iron Age finds with an apparent, but less certain, funerary profile, the spread of finds of different periods over the site was not very clear, mainly because the collection units were large. As a result, particularly the possible connection between the site and the nearby cemetery area remained problematic.[6] This was addressed in 2011 by a short intensive collection in 14 × 14 m squares, aligned with the olive trees in one

4 For an introduction to the Halos Surveys and further references, see Stissi et al. 2015.

5 There is no overall summary of the work in the various phases of the Boeotia surveys. A very short introduction can be found online: http://www.boeotiaproject.org/site/project-history/ (visited 26/8/2018; online but not accessible 26/5/2020); some important summaries can be found in Bintliff & Snodgrass 1985; Bintliff et al. 2004; Bintliff, Howard & Snodgrass 2007 and Bintliff et al. 2017 (the last two also offer many references to earlier publications); see also Stissi 2011; 2012; 2017 for some targeted studies on Boeotian finds.

6 Stissi in Reinders 2004, 91-93, 99-102; Stissi et al. 2015, 79-81.

Figure 1: Halos Survey: some of the sherds from site 1992/1, just after they were collected during the 2012 revisit (photo by the Halos field team).

of the fields (Figure 3). Since it was known beforehand that find density would be high, we already had a good collection for qualitative analysis and we did not want to spend much time on this, we chose to do the processing in the field with a primarily chronological focus, taking in only exceptional finds. Of course, this was only possible because our knowledge of the existing collections made it relatively easy to identify and date the artefacts. In less than two working days, more than 5.000 sherds were collected and processed, of which 78% turned out to be dateable (Figure 4). One of the clear results was that a small core with Mycenaean and early Early Iron Age finds, possibly a small settlement, could be distinguished within a general spread of later Early Iron Age finds that seem to be related to the cemetery area, which indeed seems to have expanded and to have been used much more intensively in this period.[7] While this outcome was not a complete surprise – the Mycenaean core was already visible in the earlier finds, and there already was a little bit of Protogeometric – only the detailed mapping of all the finds allowed a better understanding of what we saw.

While the Halos survey has a strong focus on rural sites, the surveys in Boeotia have always been more focused on polis centers and their surroundings, even though smaller towns and more peripheral areas were often covered as well. Ground conditions and preservation of finds were generally much better than in Thessaly, but not always.

7 See Stissi 2011, 65-67; Stissi et al. 2015, 80-81.

Figure 2: Halos Survey: some of the sherds from site 2000/48 (Kato Xenias), just after they were collected during the 2012 revisit (photo by the Halos field team).

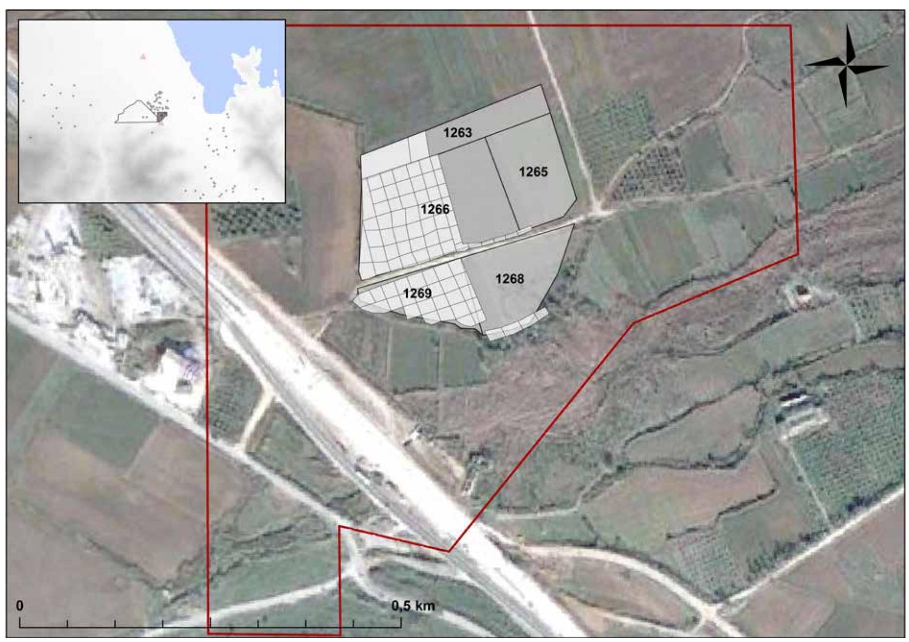


Figure 3: Halos Survey: map of site 1990/35 showing field numbers, the areas examined in 1990-1996 (light and dark grey) and the 2011 revisit transects (light gray) (map by Jitte Waagen).

Indeed, the first cities to have been surveyed in the project, Haliartos and Thespiai, offered contrasting conditions, resulting in two very different finds assemblages: Haliartos was mostly unplowed and overgrown, leaving little material on surface, much of it very worn, while the area of Thespiai is almost entirely intensively cultivated and regularly plowed, resulting in a thick carpet of finds, partly very worn, but also partly quite fresh.

In both cities, the collection and processing focus was strongly on diagnostic finds, that is feature sherds (rims, handles, bases, decorated sherds), but interestingly the rather desperate situation at Haliartos led to a very small collection (ca. 660 sherds) including a surprising 90% of dateable items, while at Thespiai a much more impressive number of finds was retained- 14.500, of which 81% were dateable and 44% diagnostic by shape – still fairly high percentages.

While on the one hand the conditions at Haliartos have clearly led to a very strict selection, leaving almost all of the less diagnostic material in the field, the Thespiai results

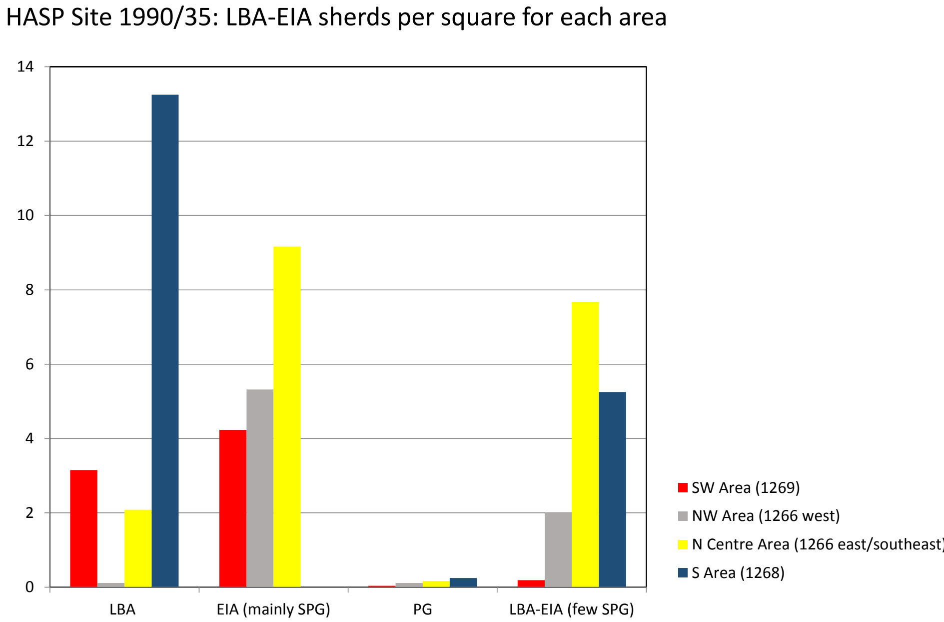


Figure 4: Halos Survey: the Late Bronze Age to Early Iron Age finds recorded during the 2011 revisit of site 1990/35, subdivided by area and period (figure by Vladimir Stissi).

seem to show that rough dating by fabric partly works, but also that not all feature sherds are dateable. Interestingly, transects walked in the direct surroundings of Haliartos, which were mostly plowed, brought in a larger find collection of much lower diagnosticity (over 1.500 sherds, 58% dateable), while the eight smaller sites around the city which were surveyed separately occupy a middle ground, closer to the Thespiai figures (ca. 2.200 sherds, 73% dateable); these are again from cultivated land, mostly. I have not looked at material from the direct surroundings of Thespiai, but the nearby large village of Askra, which was mainly surveyed through rather small samples, on its own yielded 2.282 sherds (88% dateable), again indicating that high densities of finds can go well with high proportions of dateable (and otherwise diagnostic) material.

During the later years of the Boeotia surveys, field walking was more intensive and relatively more material was collected and kept. The peak was reached at the town of Koroneia, a fairly large site (ca. 40 ha), where more than 60.000 sherds have been collected and kept, even though substantial parts of the site were not surveyed. Even leaving aside the partial coverage, the number of kept sherds per hectare is ten times that reached in Thespiai. These finds have not been fully processed yet, but preliminary study clearly indicates that both the quantity of diagnostic material and its quality are relatively high, so very detailed analysis should be possible. With these numbers, however, processing and presentation of the results may become issues to consider.

This was less of a problem when working on the now upcoming Boeotia volume, on the small city of Hyettos and a part of its hinterland. In the city itself about 14.000 sherds were picked up, a number similar to that at Thespiai, on a site which is less than a third its size (104 ha vs. ca. 30 ha). Just as at Thespiai most of the area is cultivated (or was till recently) and the percentage of diagnostic material (82% dateable, while 46% of the Early Iron Age to Hellenistic finds which I studied has a shape attribution) is very similar. It is, however, quite a bit higher than that of the part of the rural territory near the town which was surveyed, and the sites in that territory which were separately surveyed. In the territory, about 56% of the slightly more than 10.000 finds were dated, and of the almost 10.900 sherds from seventeen sites ca. 52% were dateable, while the proportions of Early Iron Age-Hellenistic items with a recognizable shapes were 39% and 40% respectively.

These similar general figures, however, hide a rather complex reality. The rural transects also covered the sites, including some with much higher percentages of dateable material. Almost all of these clear, dense sites belong to the Roman period or later, a time span which produces almost two thirds (64%) of the dated site finds. The same period, however, covers less than half (48%) of the dated transect finds, and most of these finds appear to come from these very sites or their surroundings. In other words, the actual percentage of dateable offsite material is lower than it seems, and the percentage of Early Iron Age-Hellenistic material in it (about two thirds of the dated material) is higher than it looks at first sight. Taking this into account it can hardly be a coincidence that all but one of the areas designated as 'Classical' (or rather Archaic-Hellenistic) sites have a rather wide date range very similar to that of the rural 'background noise', and also show very high percentages of small non-diagnostic sherds, suggesting that actual site-related material there may be rather meagre, or even non-existing. The shape and functional ranges, which are nearly identical in offsite and 'site' areas, seem to confirm this. Determining sites mainly or exclusively from find densities may be problematic, it seems – but dating alone already offers an interesting possibility to control things.

It may be remarked that these 'thin' multiperiod collections from the surroundings of Hyettos look somewhat similar to those of the Halos multiperiod sites mentioned above. There are two crucial differences, however: first, in most of the Halos area, there is no 'background' noise in between sites, while this seems to be a very significant factor around Hyettos. It is possible, nevertheless, that at least some of the smaller Halos multiperiod sites in reality represent some form of on site noise, not resulting from primary use of materials on the spot. Intentional or accidental (in mudbrick, perhaps) reuse of older items might be one (partial) explanation. Second, the date and shape ranges in the Hyettos 'sites' are remarkably uniform (and similar to the background noise) whereas they show considerable variation in the Halos area.

Returning to Boeotia, it is interesting to note that the relatively high percentage of Early Iron Age-Hellenistic material in the offsite collections is a recurring phenomenon. It has been noted around Thespiai,[8] and it also seems to characterize the Tanagra offsite (about 15.500 sherds, still under study), where in the various transects between 15-40% of all finds are Archaic to Hellenistic (Early Iron Age finds are generally absent in most areas), while the numbers of Roman and later material are usually much smaller. The provisional data suggest that the proportion of diagnostic material is comparable to that around Hyettos, so about half (for dates) or somewhat less (for shapes). A difference, however, is that Classical-Hellenistic sites usually seem to stand out more clearly. On the other hand, I have argued elsewhere that a thin spread of Early Iron Age and Archaic finds which can be found in one specific area near Tanagra only, may represent a combination of site and site haloes with traces of burial plots.[9] Here again, it seems detailed study of apparently ephemeral phenomena can offer very specific results, if the right focus can be found.

More generally, I hope the case studies offered show that both dating and shape attribution of complete preserved assemblages, whether small or large, and highly diagnostic or less so, generally provide a solid basis for interpretation. Proportions of usable finds are usually substantial, and by closely looking at specific features of assemblages in comparison with other assemblages, and taking account of contextual factors, even superficially similar situations can be differentiated. Focused approaches can reach a level of detail that may seem surprising to some.

Shapes, diagnosticity, classification vs. reality

The high potential of our assemblage-based data does not mean that results are always easy to achieve and straightforward. While making nice tables showing chronological developments and shape ranges and using these to trace historical developments in habitation and use of space seems relatively simple, we should be aware that such tables hide complex issues of diagnosticity and classification. Our chronologies are at least partly constructs, based on simplifications, and on a partial knowledge of assemblages, and we have to remain aware of the bias we build in our data when producing tables and filtering out categories of finds to support our interpretations. I would like to illustrate this by Figure 5, which shows the relative numbers of the ten most frequently present shapes through time, in Early Iron Age to Hellenistic Thespiai.

First of all, we should be aware that such tables represent only a fraction of the material, in this case a little more than 10% (1.385 out of ca. 14.500) of the total finds, and about 30% of the ca. 4600 finds with an Early Iron Age-Hellenistic date. Most survey finds, even dateable ones, are wall fragments which can at best be assigned to open or closed shapes. Even many feature sherds, particularly handles but also bases, cannot be associated with specific shapes. Generally, simple household pottery is more strongly affected by this than finer material, but it is also clear that some shapes, like unguentaria or beehives, are much easier to recognize than others, through shape details, ware and/or fabric and finish. While this obviously affects our understanding of functional aspects of pottery, there are also chronological implications.

In the earliest period shown in Figure 5, more than half of the items with a recognizable shape are cups, which completely disappear from the assemblage later on, while the jugs, dishes and unguentaria present in the final periods of the table are hardly present before. Most of these developments appear to represent 'real' chronological evolution of shape preferences, but it is clear typochronology plays a significant role too: the more than 20% jugs in the Hellenistic-Roman group are simply there because many sherds of a rather recognizable type of small jug cannot be dated more precisely than this; on the other hand, unguentaria tend to end up in the Hellenistic group, even though very few might be a little earlier,[10] and some are likely to be later. Part of this

8 Bintliff, Howard & Snodgrass 2007, 25, 149-151, 164-166.

9 Stissi 2011, 68-71.

10 For an overview of the history of the shape, see Anderson-Stojanović 1987.

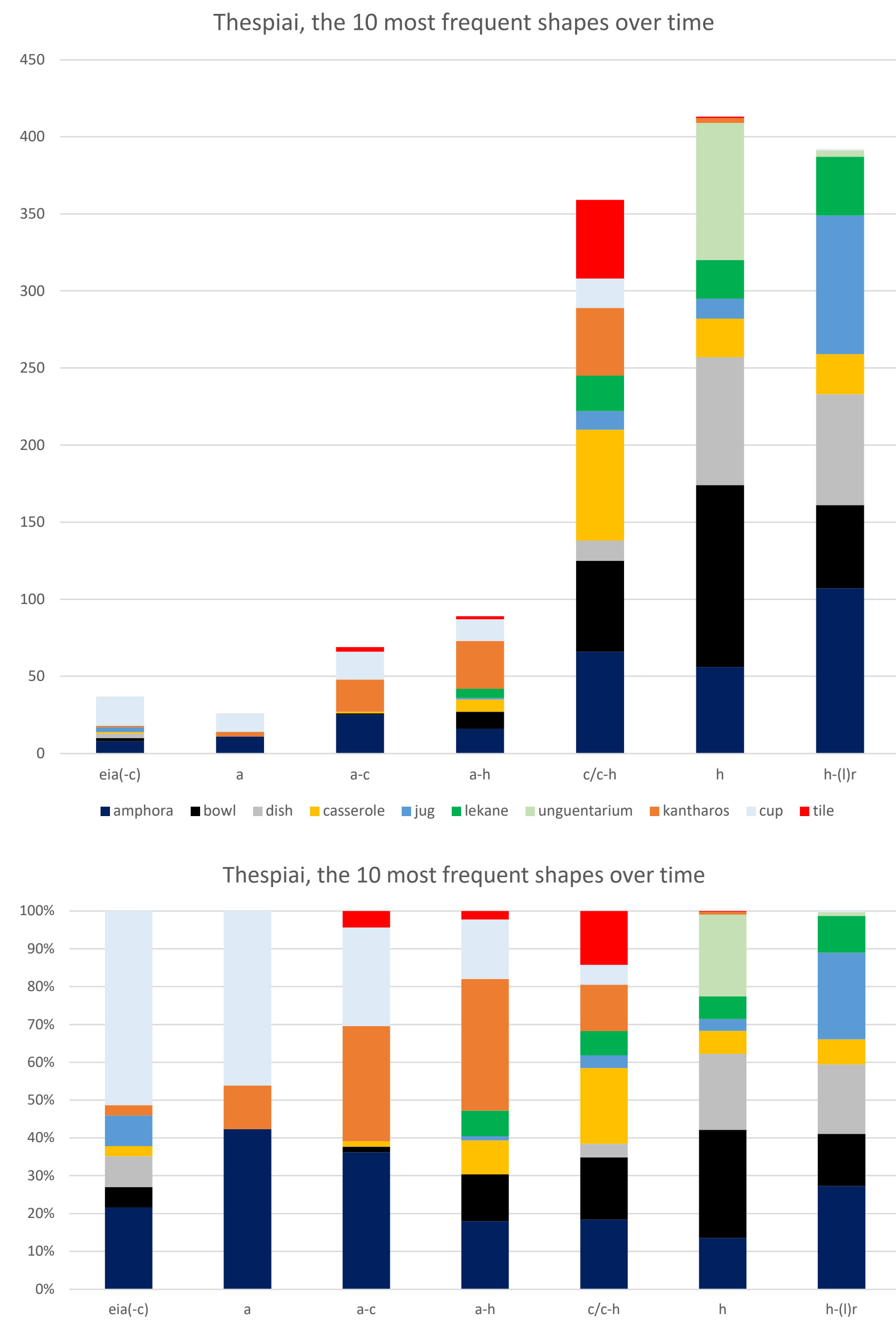


Figure 5: Boeotia Survey, Thespiai city: The ten most frequently recorded shapes over time (figure by Vladimir Stissi).

simplification could be avoided by using more precise dating categories, but these are available for some of the material only, and do not always overlap neatly, thus impeding a concise overall picture.

It should also be noted that showing proportions or absolute numbers gives a very different impression: the relatively many early cups are few in absolute numbers, while the jugs just mentioned alone form 125 of the 1.385 finds taken into account in Figure 5. This means they are much more visible in the field, but would also be over-represented in any functional analysis which does not take chronology into account. We can be sure that similar situations are hidden in single period analyses, since not every shape lasts as long as our chronological categories. Similarly, shapes that remain in use for long periods, like transport amphorae, or that appear to do so because a single term is used for pots that are quite different in reality (like cups and bowls, or more generic terms like ‘container’ or ‘jar’) would also show more prominently in the overall picture than they may be when focusing on shorter periods, as continuous presence in low numbers may results in fairly high totals.

Besides issues of chronological definition, as just mentioned there is also a second problem affecting the interpretation: even though some of the popular shapes, like cups and kantharoi and (part of the) bowls appear represent a similar functional category through time, and (transport) amphorai are always present, none of the single bars in Figure 5 offers a convincing functional assemblage, and parts of the use range of pottery appear and disappear in the bars. Of course, this is at least partly a result of the focus on the ten most frequent shapes – but surely not completely: these ten shapes alone cover the large majority of recognized shapes (76%, 1.385 out of 1.811). In fact, other shapes are barely represented the material: the eleventh, the plate, is represented by only 48 items which are all Hellenistic or later, and the total of 426 items not in the shape top ten covers about 22 different shapes, of which half are represented by less than ten items. Clearly, a very large part of the assemblages which must have been there, including shapes and types which should be easy to date, remain mostly or completely invisible in our collection. While on the one hand we have to assume that our dated assemblage does somehow give a reasonable overall picture of chronological developments, on the other hand we can also be sure that our tables are more blurry than they look, and hide quite some problems on a detailed level.

This does not mean we should despair. In fact, we have some indications that at least substantial parts of our picture may be quite reliable on a general level. Looking more closely at the functionality of assemblages, and taking into account finds which cannot be linked to a specific shape but can be assigned to a range of use (like drinking or cooking vessels), it seems possible to discern a 'typical domestic assemblage' for the Classical-Hellenistic Greek world, which can be seen in both survey and excavation assemblages from both urban and rural sites. As I have illustrated earlier[11], these assemblages show a combination of a large proportion of vessels related to drinking with a wide range of processing, cooking and storage vessels and some loomweights and lamps. Perhaps not a surprising combination, but the relative proportions of the components can be quite strikingly similar throughout the Classical-Hellenistic period, in different places (see Figure 6[12]). Even in the hinterland of Halos, where almost all single 'farm' sites are too small to offer reliable figures, combining them gives a near perfect match (Figure 6a-b).

Interestingly, ongoing PhD research by Anna Meens on survey material from Boeotia suggests that within this generally similar basic pattern, some differentiation between small rural sites ('farms'), a village (Askra) and urban sites like Thespiai can be noted. Perhaps unsurprisingly, the urban assemblage looks slightly more 'luxurious', with somewhat more fine wares and drinking vessels, while the small rural sites have a stronger focus on basic utilitarian pottery and simpler fabrics. The composition of the assemblage from Askra falls somewhere in between. It seems clear that the means of the purchasers, practical considerations, but perhaps also status play a role. Further study of the other Boeotian cities may allow further differentiation – a first look suggests Hyettos has a relatively 'poor' assemblage and Koroneia a richer one. Furthermore, both survey and excavation material from the Halos area suggest a much lower presence of black gloss fine wares, even though the functional range of material, as expressed by shape groups, appears to be similar. At the Magoula Plataniotiki excavations, the proportions of decorated and of black gloss wares also seem to decrease through time, along with the general quality of the pottery (measured by fineness, hardness, regularity of shape and smoothness of finish). Again, this may suggest that the investment people were willing or able to devote to pottery was a relevant factor, even though perhaps not the only one.

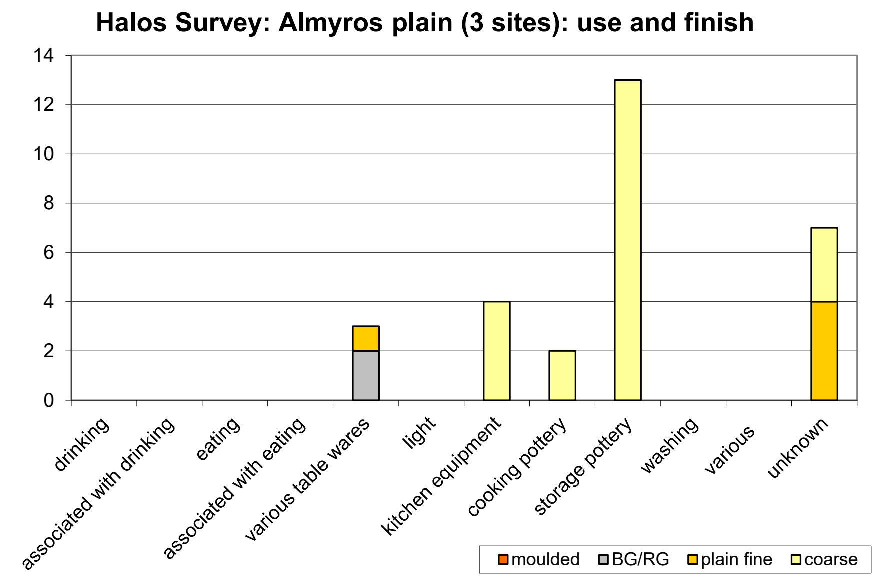
This brings us back to Figure 5. It may be noted that typical fine ware shapes, including cups, dishes and unguentaria, are very well represented in the 'top 10' of shapes. While this certainly is a result of their diagnosticity, as mentioned, and, related to that, the effects of selection in the field and during processing, we should perhaps take into account durability, as an effect of production quality, as well. Hard, high-fired and coated fine wares are likely to have better chances of survival in a recognizable form, and thus become somewhat overrepresented, perhaps not so much on the ground, but certainly in collections of kept finds. We could even speculate that low investment in quality may be a factor (certainly not the only one) in the relatively low diagnosticity of pottery at both Hyettos and Halos. Perhaps a comparison of the most commonly found shapes and their frequencies between a series of survey and excavation contexts, which has not been done yet, may also be revealing in this way. I hope to have showed that, despite some difficulties and potential pitfalls, survey material allows such comparisons.

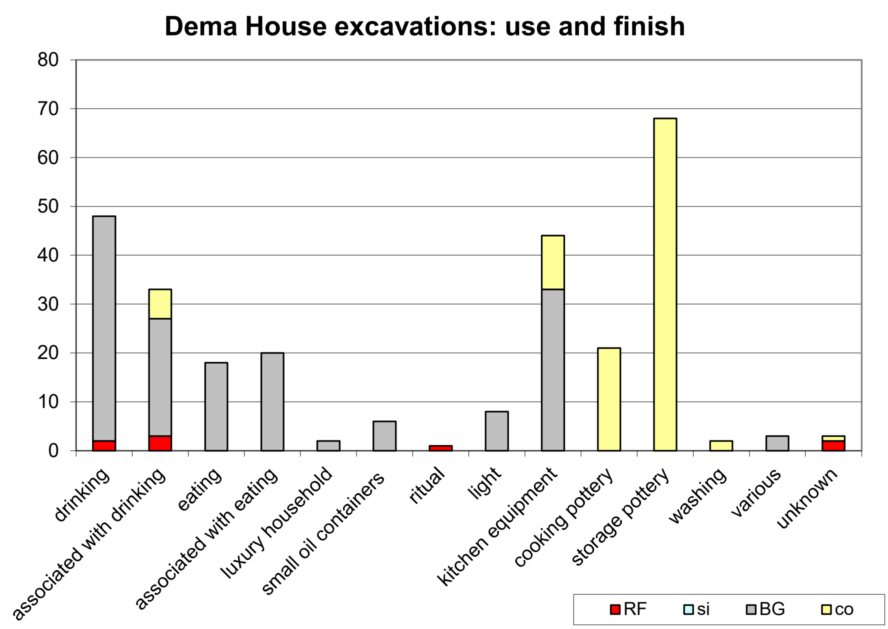
Some 'funny' phenomena

Selection does not only affect the range of wares and functions in our find collections. One obvious, but generally overlooked, result of selection of pottery during survey and find processing is that normally find collections contain relatively few wall fragments, and

11 Stissi 2002, 220-229; Stissi 2012, 396-399.

12 Tables 6a-c are based on the author's research; 6d on Jones, Sackett & Graham 1962; 6e on Jones, Graham & Sackett 1973; 6f on Mee & Forbes 1997, Appendix 4, 282-343.





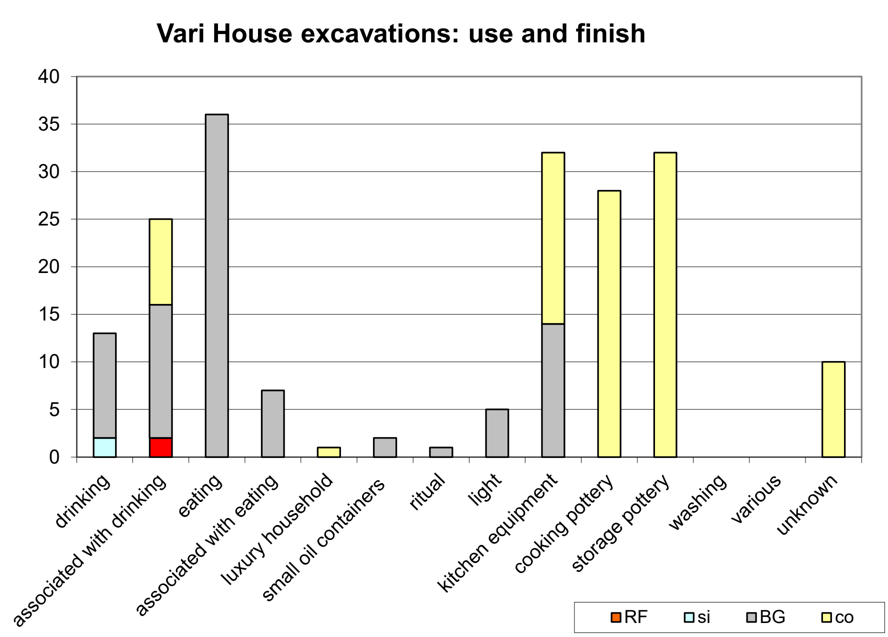
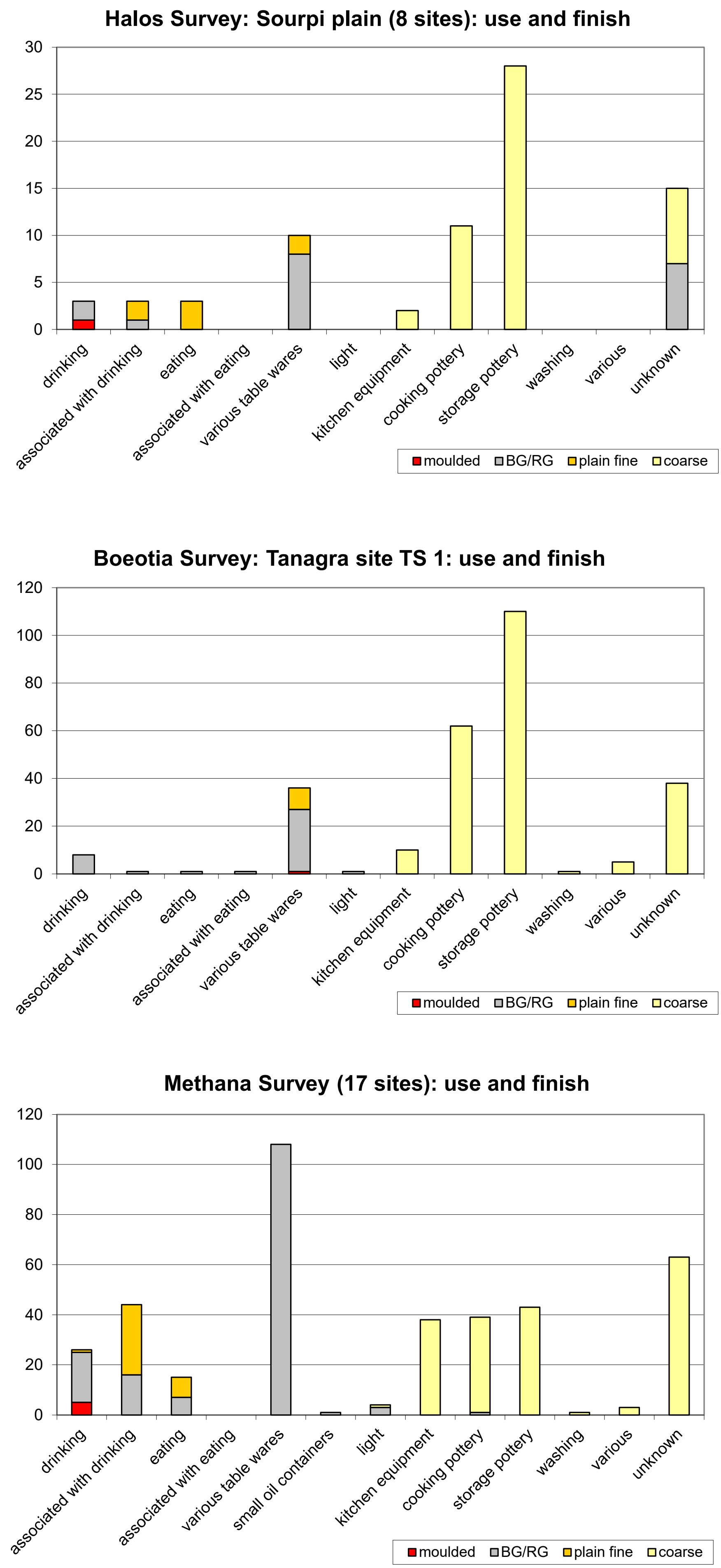


Figure 6: Domestic assemblages from various excavations and surveys in Greece (Classical-Hellenistic period) (figure by Vladimir Stissi).



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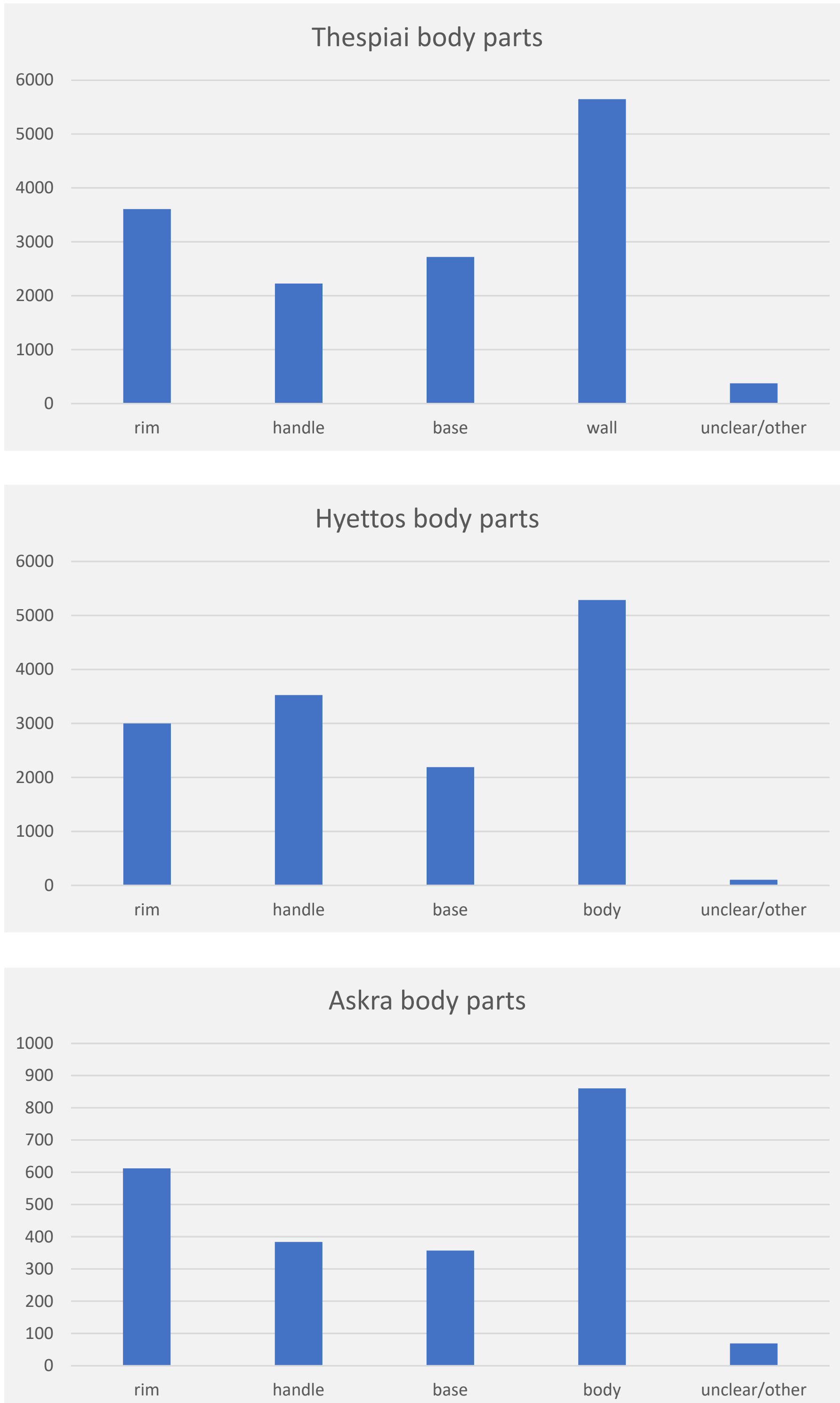
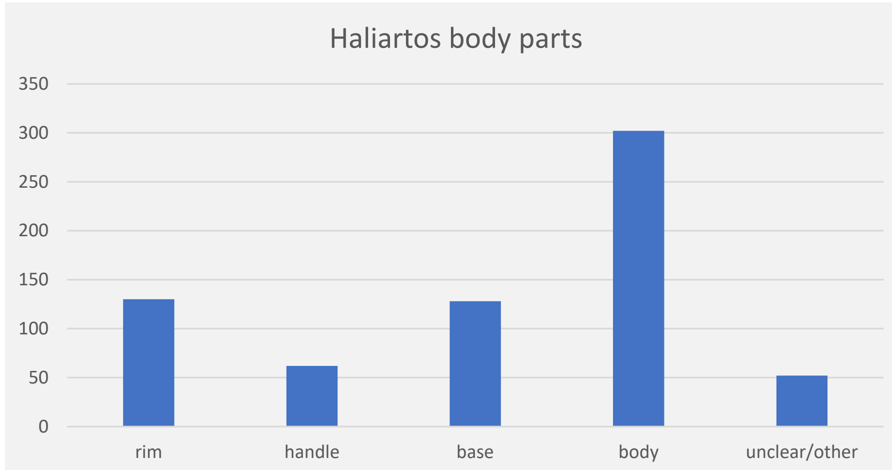
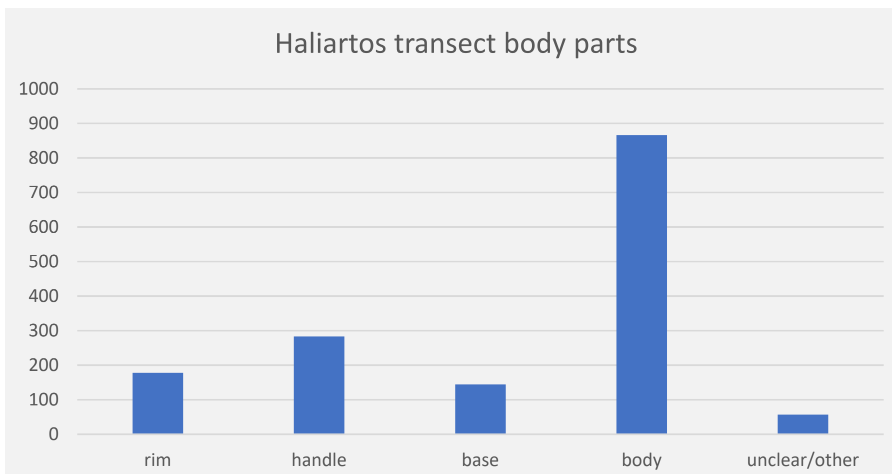


Figure 7: Boeotia Survey: the relative numbers of rims, handles, bases and bodysherds in different cities and their surroundings (figure by Vladimir Stissi).





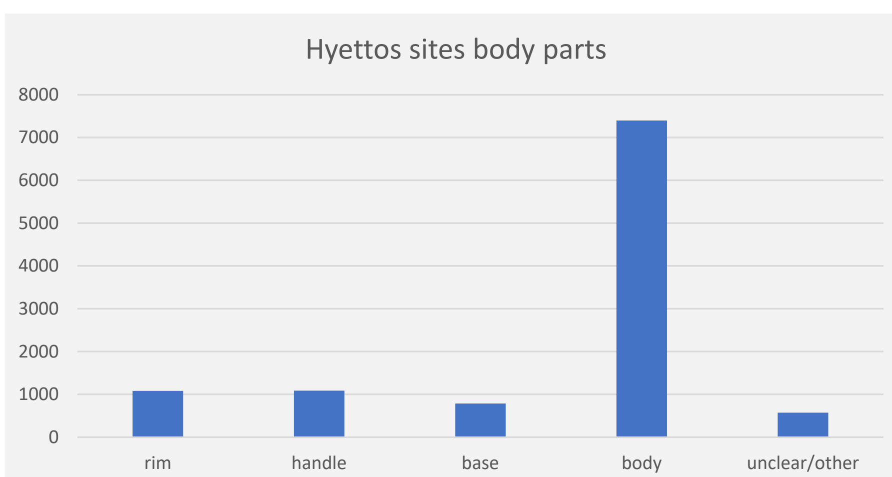


Figure 7: continued.

rather too many rims, handles and bases. At the cities of Thespiai and Hyettos, the proportion of walls to features seems to be about 5:9; the figure for Askra is more or less the same; the very small collection at Haliartos, however, has an almost 50/50 division (Figure 7a-d). This may be related to the relatively large numbers of decorated items, and perhaps the presence of easily recognizable prehistoric sherds, in a small and probably relatively selective collection which seems strongly focused on highly diagnostic finds, and, as said, generally has very little undiagnostic material.

However, things are not completely straightforward: as we have seen, the transects around Haliartos, where the proportion of wall fragments is even higher (they form 57% of the assemblage, Figure 7e), have relatively many undated finds (ca. 42%, compared to the ca. 10% of the city). The situation here may be compared to that of the sites around Hyettos, which yielded more than twice as many wall fragments as features, at about 52% dated (Figure. 7f). This material is poorly preserved and has very few decorated sherds. Here, it seems that not high quality but lack of anything better to pick up has led to the resulting pattern. It would be interesting to explore if we could indeed systematically distinguish between 'normal', 'high quality and selective' and 'poor and desperate' find collections by looking at proportions of features and percentages of diagnostics, perhaps in combination with sample size.

While the general patterns regarding proportions of feature vs. non-feature sherds do not seem surprising, nor very relevant for interpretation, a closer look also shows a far more puzzling phenomenon: the relative numbers of handles, rims and bases not only show considerable fluctuations between collections, but also within collections through time. In Askra and Thespiai, rims are the most frequent feature, in Hyettos city and the Haliartos transects handles, while in the Hyettos sites the numbers of rims and handles is more or less the same, and in Haliartos city the numbers of rims and bases (Figure 7). In Thespiai, each of six periods shows a different pattern (Figure 8). While the latter is surely at least partly a reflection of classification bias (e.g. we simply do not seem to be able to recognize specifically Hellenistic handles), the differences between sites are not easy to explain. Differences in the chronological composition of the material might play a role, but at first sight there are no obvious patterns. Possibly, besides chronology variations in shape, preferences or functional context of the material play a role, in addition to unintentional differences in pick-up strategy and perhaps issues of preservation. Correlation analysis might offer some interesting outcomes here.

Conclusions

I hope my examples and cases have shown that 'widening our nets' by using not only highly diagnostic selections but full datasets from intensive collections is worthwhile. Squeezing out as much as possible from the large numbers of 'medium diagnostic' finds that even apparently 'difficult' collections produce can offer useful insights – not only directly in the form of archaeological interpretations and conclusions, but also indirectly by revealing patterns in our collection, processing and classification strategies, which in turn affect our interpretations. In other words, if we study and understand our full assemblages more comprehensively, this then allows more specific interpretations of parts of it.

Comparing and contextualizing survey results from different areas, and from different sites or areas within a single region (like Boeotia) seem to offer one way to gain insights in the ways archaeological formation processes (from deposition to modern land use), survey strategies and interpretations could interact. More specifically, a comparative approach could help us understand how apparently similar finds collections can be a product of different archaeological realities. It could also help us to handle the qualitative and quantitative diversity of our collections. As the Halos and Boeotia cases show, numbers and state of preservation of finds can vary considerably depending on the situation at deposition and past and present circumstances in the field, with consequences for diagnosticity. Particularly if pottery is thinly spread or badly visible under unfavorable conditions, numbers of even 'medium diagnostic' finds can be low, while in ancient urban areas densities are often staggering.

Low numbers and low diagnosticity are relative phenomena however, and rarely turn out to be so low that survey assemblages are useless for interpretation. While both too small and too large datasets do offer difficulties, one interesting consistent pattern in all my datasets (also from other projects I am involved in, on Zakynthos and Keros, actually) seems to be that, contrary to what may be expected, intensity of collection and selection (in the field or afterwards) do not appear to affect the relative numbers of dateable material very much: in all Boeotian cities, but also in Halos site 35 (a total collection!), the percentage seems to be between 70 and 90%, with the lowest figure for Thespiai, where the number of picked up sherds per hectare was perhaps below average, but still quite high, and the highest for Haliartos, where indeed kept finds are very few; outside the cities, where find densities are mostly much lower, and preservation is not always very good, even offsite the percentages of dated material remain well over 50. The proportions of items

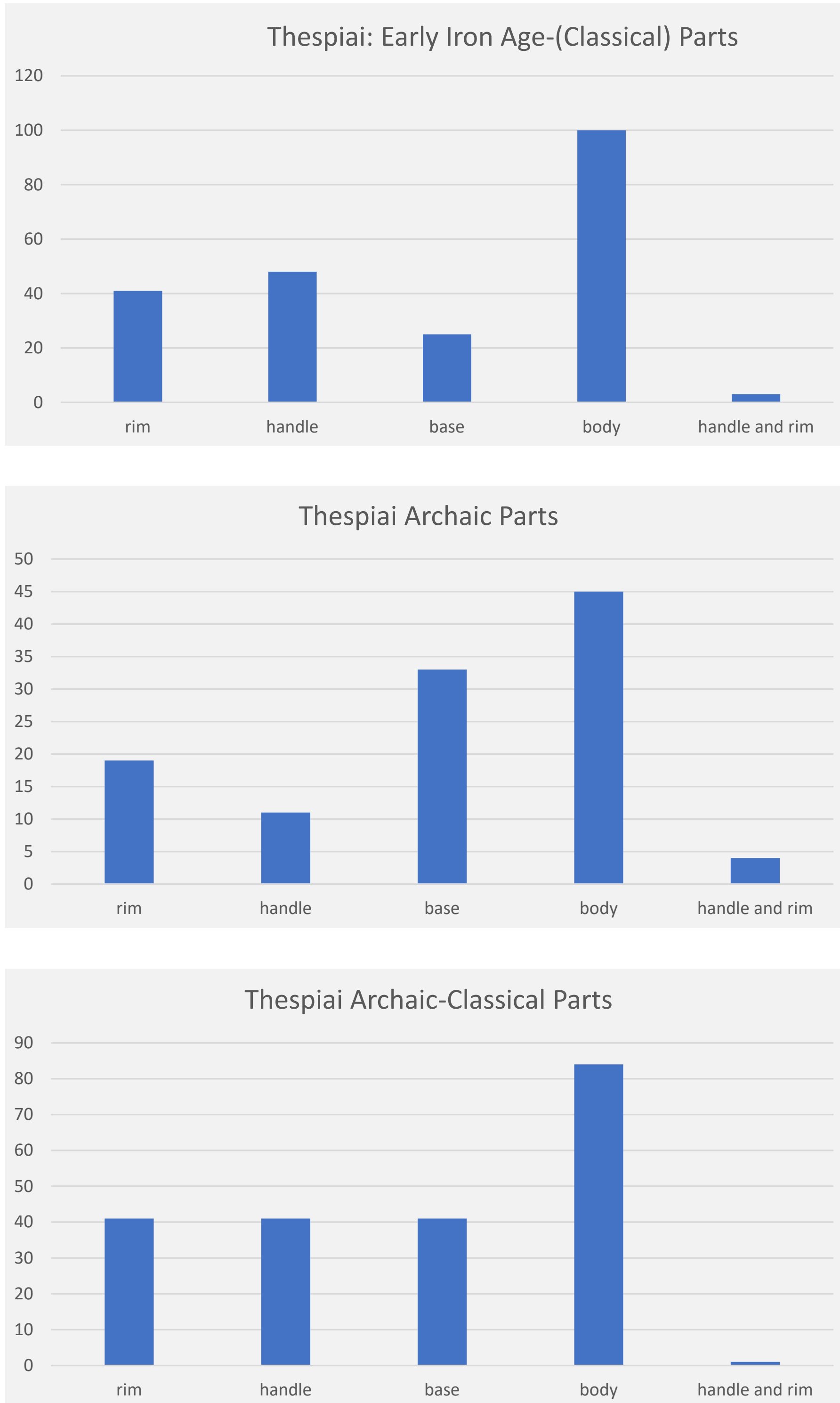


Figure 8: Boeotia Survey: the relative numbers of rims, handles, bases and bodysherds from the city of Thespiai in different periods (figure by Vladimir Stissi).

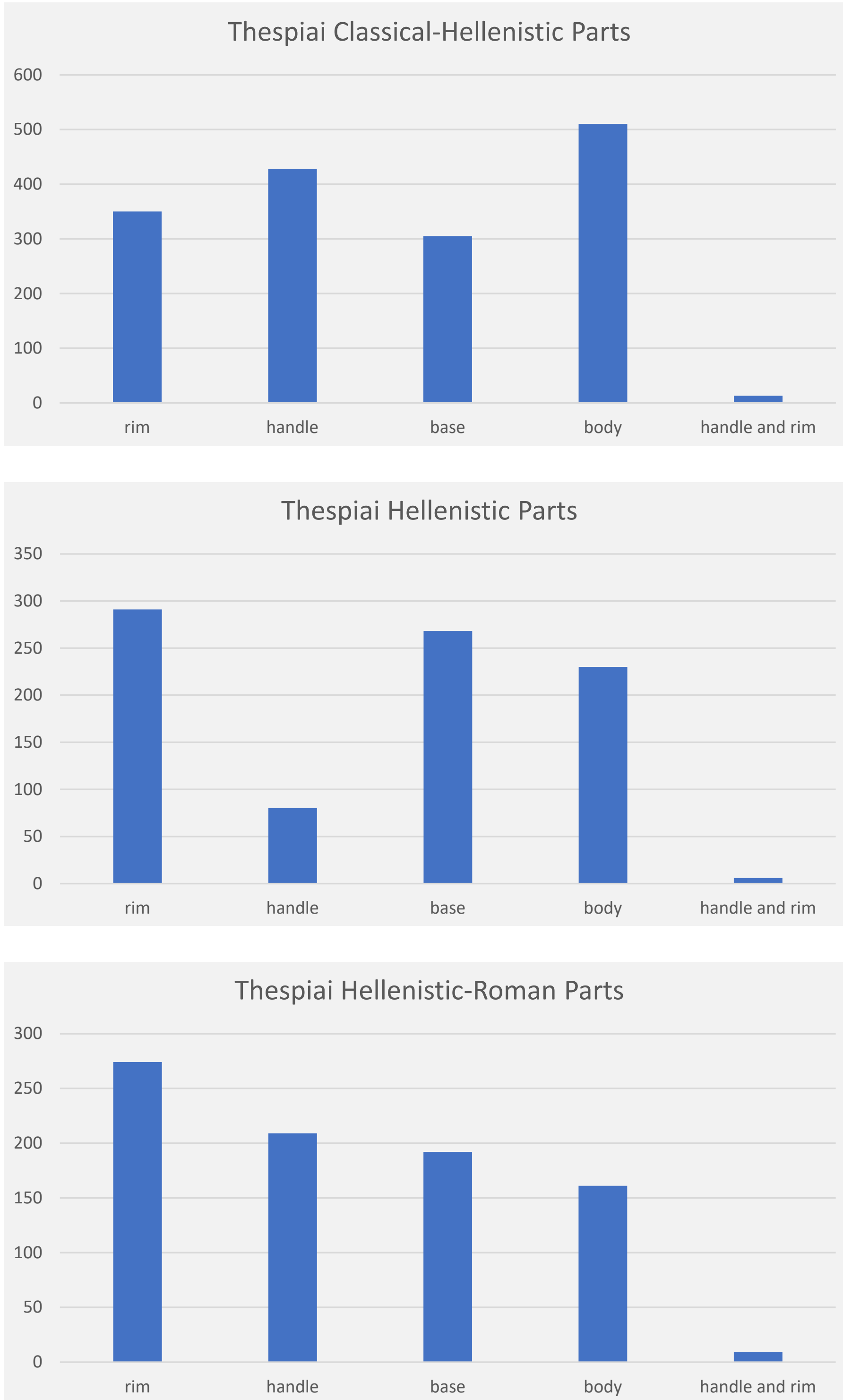


Figure 8: continued.

diagnostic by shape are lower, but still substantial and fairly consistent at 30-40%, usually mostly overlapping with dated material. Such figures seem a good starting point for research, even on collections which do not reach tens of thousands of sherds.

Nevertheless, I hope that my case studies have also shown that statistics using our classification attributes like dates and (frequency of) pottery shapes or features (body parts) are not just mathematical and 'objective'. Many figures are clearly at least partly results of our strategies of collecting, processing and classification – in other words, fitting our finds in categories does not only inevitably produce artificial borders, as most of us are probably aware of already, but also really affects our interpretations in a less obvious and more hidden way. Part of this seems the result of classification issues, but as the Thespiai example I offered indicates our data also clearly show that large proportions of assemblages – both plain and fine wares and both generic and specific shapes and wares – simply remain out of sight.

On the positive side, comparisons between collections and projects also show that potential pitfalls can be noted and included in our interpretations in a positive way and that many phenomena and patterns are consistently visible over large areas. We can apparently spot typical domestic assemblages, for example, even in difficult minimal collections around Halos. Moreover, also when our assemblages are clearly incomplete, they do usually make some functional sense, and many chronological developments seen in survey assemblages, like changes in popularity of shapes, fit what we know from excavations and typochronological studies. Whatever noise we see or miss, it does not seem strong enough to invalidate the inclusion of large numbers of medium diagnostic finds in our studies of survey assemblages, or more generally to discourage precise study of our often despised surface sherds. In studying survey assemblages spending more time on more sherds, by going to the database rather than to just the catalogue, pays off.

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Tales of two cities

Urban surveys of the Hellenistic and Roman cities of Sikyon and Knossos

Conor P. Trainor & Peter J. Stone

Abstract

In recent decades, archaeological survey has become a significant tool for studying sites and their surrounding landscapes. This popularity has led to the development of a broad range of survey techniques and methodologies, and critically, to the intensification of collection strategies. The latter, coupled with an increasing understanding of regional ceramic chronologies in Greece has resulted in a substantial increase in the resolution of survey data, meaning that it is possible to present a functionally delineated and chronologically nuanced picture of a survey area that would not have been possible even a decade ago.

The cities of Sikyon and Knossos have been the subjects of recent hyper-intensive systematic urban surveys, each aimed at presenting an overview of the long-term habitation and usage of an urban core and its immediate surrounding area. With a particular emphasis on Hellenistic and Roman ceramics (4th century BCE-7th century CE), this paper will compare and contrast the methodologies, collection strategies, processing strategies and some findings from the Knossos Urban Landscape Project and the Sikyon Survey Project.

Keywords: Sikyon – Knossos – Urban Survey – Ceramics – Sampling – Classification.

Introduction

Two recent volumes exploring urban survey, *Urban Survey in Italy and the Mediterranean* and *Archaeological Survey and the City* provide a very welcome and useful discussion of the key problems, challenges and benefits of urban survey, which differ considerably from those of non-urban and regional surveys.[1] The aim of this paper is to present and discuss urban surveys from two Hellenistic to Roman urban cities, Sikyon and Knossos from a ceramics perspective. The Sikyon Survey Project (SSP) and the Knossos Urban Landscape Project (KULP) both covered similarly sized urban areas, employed similar collection strategies, have a few broadly relevant historical sources, and therefore the large volume of data collected on both is comparable (Figure 1). With this in mind, we would like to compare some aspects of both projects and to assess some common strengths and challenges relating to surface ceramics from these Hellenistic and Roman urban areas.

1 Vermeulen et al. 2012; Johnson & Millett 2013.

in A. Meens, M. Nazou & W. van de Put (eds), Fields, Sherds and Scholars. Recording and Interpreting Survey Ceramics, 127-136, Leiden: Sidestone Press. DOI: 10.59641/m11443py.

Figure 1: Map of Greece showing the locations of Sikyon and Knossos (map by Conor Trainor).

Two of the main scholarly issues long associated with urban survey are data resolution and collection strategy:[2] what should be picked up, what should be left *in situ*, what should be recorded in the field and what should be studied in more detail (as well as how it should be studied). In designing collection strategies, archaeologists generally seek to strike a balance between higher data resolution with slower collection/recording and higher storage costs on the one end of the spectrum; or lower data resolution with faster collection and recording and lower (or possibly no) storage costs at the other end. Both SSP and KULP were designed to get as high a data resolution as possible, and both collection strategies struck a balance between thoroughness of sampling against the collection of large amounts of data that would not add sufficiently to our overall picture of each urban area.

The Sikyon Survey Project

Sikyon is located on the northern coast of the Peloponnese approximately 20 km to the west of Corinth. In the Archaic and Classical period, Sikyon was located on the coastal plain, probably under the modern town of Kiato with an acropolis located on a plateau to the south partially occupied by the village of *Archaia Sikyona*. In 303 BCE Demetrius Poliorketes relocated the city to this defensible 250 ha plateau. Unlike Corinth to the east, there had been comparatively little excavation at Sikyon aside from a handful of rescue excavations and clearing of monumental architecture in and around the agora.

From 2004 to 2008 the Sikyon Survey Project (hereafter SSP), under direction of Yannis Lolos of the University of Thessaly, conducted an intensive survey across 114 ha of the plateau of ancient Sikyon. This project followed in the footsteps of Lolos' extensive survey of the Sikyonia, which elucidated a diachronic picture of regional settlement patterns.[3] In contrast, SSP was intended to give a detailed look at the arrangement and use of different areas within a city and changes in layout, function, and size over time.[4] As such, it focused on the plateau, already identified as the site of the Archaic and Classical acropolis of Sikyon and the city itself after Demetrius Poliorketes moved it in 303 BCE.

2 E.g. Bintliff & Snodgrass 1988; Terrenato 2004; Whitelaw 2012a.

3 Lolos 2011.

4 Lolos & Gourley 2012.

The Sikyon Survey Project – Collection strategy

In the hopes of achieving the desired level of resolution, an intensive collection strategy was devised. The survey area was divided into three plateaus (Upper, North and South), onto which a system of tracts was imposed. These tracts were then divided into grid squares of 20 × 20 m and walkers in teams of five were spaced only four meters apart to ensure that representative materials would not be missed in fields with good visibility (Figure 2). In each square walkers counted all surface sherds and collected all diagnostic sherds that were potentially indicative of vessel shape (e.g. rims, bases, and handles) or sherds with slip or other decoration. Every fifth square was designated a total collection square, from which all visible pottery was collected. In areas of extremely high density only a cross sample, or total collection of all artefacts along two intersecting lines from the corners of a square to its center, of the 'total collection' square was collected.[5] The total sherd count from SSP was 739,313; densities across the site varied from few or no sherds per square to 6000+ sherds per square with an average of 260 (2839 squares/739313) sherds per square.

Sikyon Survey Project ceramic processing strategy (Classical through Early Modern)

When we started examining the pottery at the beginning of the survey's third season (2006) no proper ceramic analysis had been conducted yet. On the one hand, a big backlog of unexamined sherds had piled up, meaning that we were well behind the collection survey itself. On the other, it was clear what we would be facing in terms of quantities and preservation of material so that we could plan around it, rather than designing a theoretically ideal system before the beginning of the survey only to have it prove ill-suited with the practical reality at hand.[6] We knew that there was a lot of pottery and that it would continue to pile up, so we designed our analysis accordingly. In order to work quickly through the material our specialists on Classical and Hellenistic (Peter Stone) and Roman and later pottery (Elissavet Tzavella and Matthew Maher) went through all collections and identified and quantified shapes from their period that could be recognized on the basis of published examples from excavations. Each of them put at least one example of each shape they recognized in a labeled slot in a tray of 'index sherds' that would serve as a reference and ensure consistency; examples for illustration and cataloguing were selected out of these trays. All sherds from the total collection squares were then grouped into common fabrics (Conor Trainor) by piling like with like to isolate commonly occurring fabrics and detailed descriptions of outliers. Like Tzavella and Stone, Trainor kept an index tray of fabrics, from which he selected examples for petrographic analysis to determine their geological composition and check the consistency of groupings.[7]

Results

When we started, we saw great quantities of relatively well preserved pottery from squares collected on the south plateau in 2004-2005 and as such had hopes of elucidating discrete functional zones (e.g. domestic, cultic, industrial and/or commercial) across much of the plateau in different periods. The high concentration of wasters and diagnostics of late Hellenistic and Roman date in these early collection squares on the south plateau suggested large-scale production of transport *amphorae*, *lekana*i, jugs, and cooking vessels and more occasional production of plates, bowls, and *unguentaria* from the 2nd century BCE to the 3rd century CE.[8] After this date ceramic production ceased at Sikyon or moved elsewhere and left no new traces evident in survey collections.[9] However, during the course of our analysis over the next several seasons we encountered few other areas with a sufficient density of recognizable pottery to argue for a specific function in the absence of other evidence like surface architecture or geophysical results.[10] Many squares produced at least some pottery that could be characterized as probably originating from a "domestic" context (e.g. *lekanai*, *chytrai*, plate fragments), which accords well with the likelihood that most of the city was covered in housing. But a handful of identifiable sherds of this sort in any particular tract or square, often with a potential date range of more than a century, cannot be considered conclusive proof of a "domestic" function, much less elucidate the character of individual households.

Fortunately, the large sample of pottery collected still permitted us to reach some general conclusions about household activities in the Hellenistic and Roman periods. Geophysical results suggested that, as at most sites, much of the surface area of Sikyon was occupied by housing and having a very large total sample of pottery at our disposal, it was possible for us to identify much of the typical household equipment used over broad horizons and get a sense of typical habits and preferences. The 3,736 diagnostic sherds of Hellenistic date allowed us to identify several shapes that occurred with great regularity across the site, such as kraters with overhanging rims (940 examples), *chytrai* with flanged and thickened rims (280 examples), and mold made

5 Lolos, Gourley & Stewart 2007, 278-279.

6 For a general discussion of this issue see Adams 1988.

7 Trainor 2015, 10-13.

8 Trainor 2015, 95-98.

9 Tzavella, Trainor & Maher 2014, 92.

10 Lolos & Gourley 2012 – for a picture of the city which draws in these other classes of evidence.

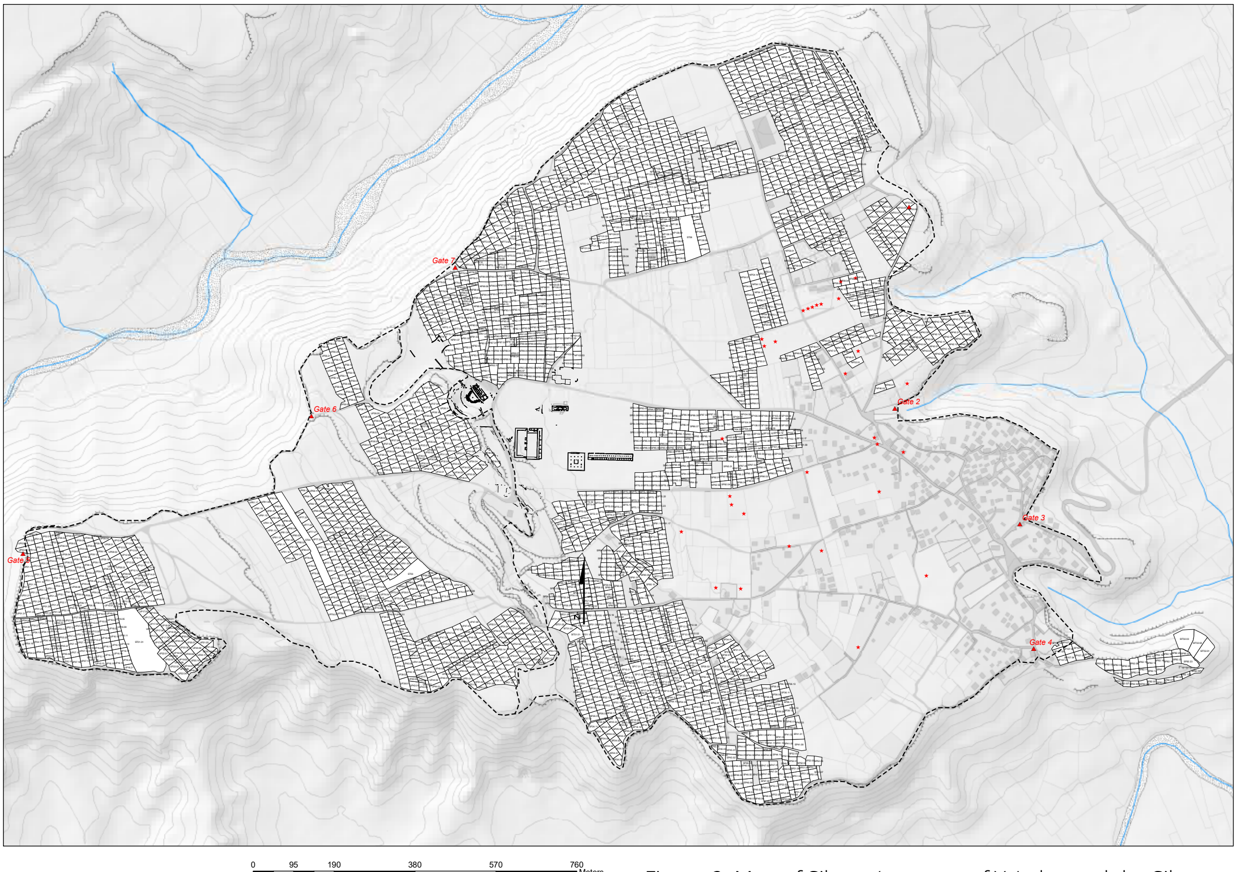

Figure 2: Map of Sikyon (courtesy of Y. Lolos and the Sikyon Survey Project).

bowls (144 examples).[11] However, comparisons between the survey assemblage and the material recovered from two rescue excavations at the site suggest that some fine ware shapes from excavated contexts were surprisingly rare in the survey material (e.g. bowls with incurved rim; thin walled ware cups).[12] This is in all likelihood a well-known issue of preservation and visibility on the surface and recognizability in the apotheke rather than ancient reality.[13] Thus, while we can say with some confidence that shapes that occurred frequently in the survey were regular components of household assemblages, we cannot be sure that they were the *only* regular components of those assemblages.

Knossos Urban Landscape Project

The Knossos valley is approximately 10 km^2 and is bounded by low hills to the west (*Monastiraki Kephala*-Greek acropolis/Roman aqueduct), south (*Gypsadhes*) and east (*Ailias*), with the modern Venezelion Hospital complex to the north. Ancient settlement in the valley extended considerably beyond the bounds of the Minoan palace complex. The valley in its entirety is currently being studied as part of the Knossos Urban Landscape Project, but we want to discuss the urban area of Hellenistic-Roman Knossos.

Knossos Urban Landscape Project – Collection Strategy

The project is directed by Todd Whitelaw, Maria Bredaki and Antonis Vassilakis and has been designed to 'survey intensively and systematically the Knossos valley, documenting the material record of occupation from initial Neolithic colonisation down to the early 20th century.'[14] KULP explored an 840 ha area centered on the Knossos valley, with collection seasons for the project in 2005-2008 and annual study seasons ongoing.

The collection strategy for KULP was systematic and intensive and consisted of over 21,000 20 m x 20 m collection units around the Knossos valley (Figure 3).[15] In total 450,000 sherds were collected, providing an

11 For discussion see Stone 2021; Tzavella 2021 and Grigoropoulos 2021.

12 See James 2021; Likoudi 2021; and Stone 2021.

13 For an exploration and discussion of this problem see Whitelaw 2012a, 88-92.

14 Whitley et al. 2006, 107-108.

15 Morgan, Pitt & Whitelaw 2009, 94.

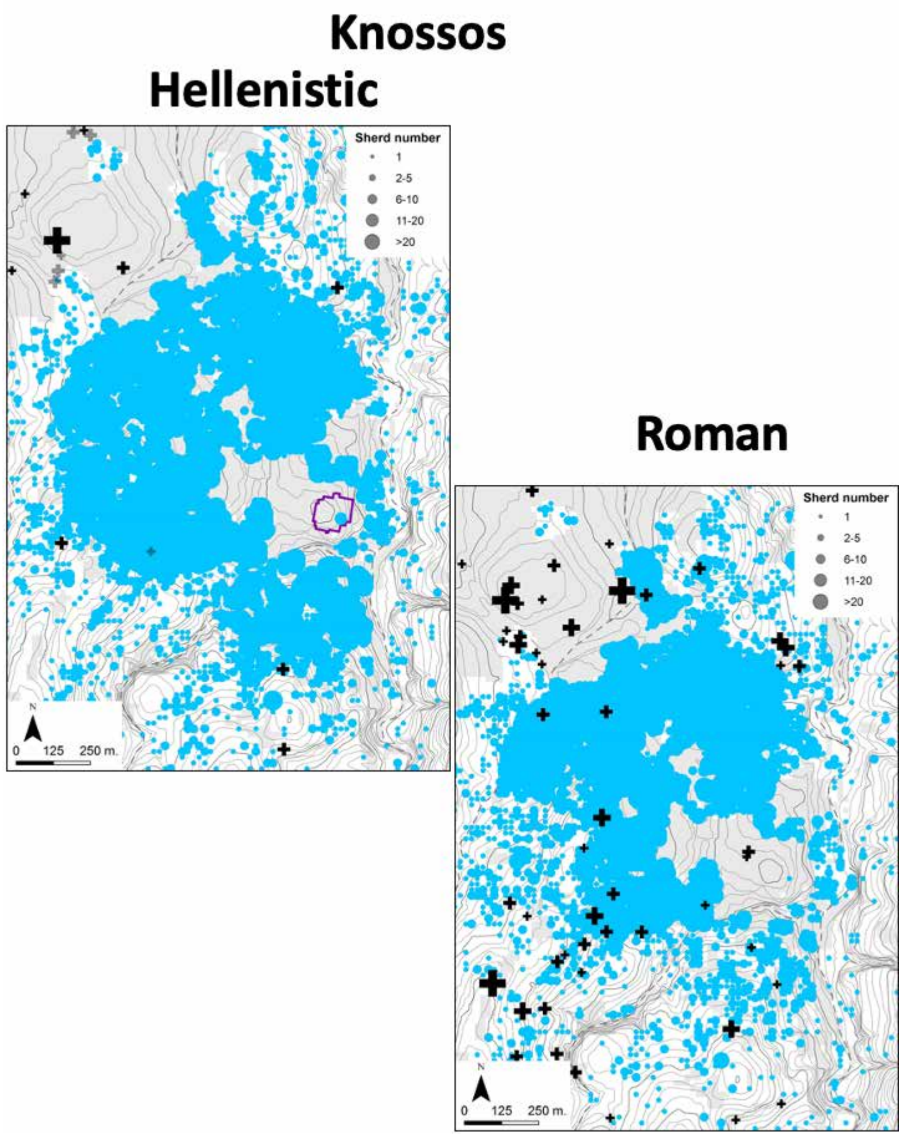

Figure 3: Map of Knossos (courtesy of T. Whitelaw and the Knossos Urban Landscape Project).

average density of 21.4 sherds per square. Within each square, a 10 m^2 area was laid out and vacuum collection was conducted in order to provide a fully representative sample of material from each unit. Throughout the rest of each square, grab-sampling was conducted, with feature sherds and 'exceptional artefacts' collected. For areas with low find densities beyond the urban core another collection strategy was devised in order to increase speed, while also ensuring that material was spotted. This entailed two walkers investigating each square in two 20-metre transects (usually along the west side and down the centre). A one-metre wide area was investigated intensively along each transect, thus, resulting in a 40 m^2 area in each unit being searched. The thinking behind this two-tiered approach was that each square would yield a fully representative sample of finds, while moderating potential storage problems that would have been associated with a total collection survey.[16]

Knossos Urban Landscape Project – Ceramics processing strategy (Classical-Late Roman)

Once collected, Whitelaw ensured that all sherds were washed, recorded, and sorted into broad chronological categories: Prehistoric (Neolithic, Minoan and Mycenaean); Hellenic (Early Iron Age, Archaic, Classical and Hellenistic); Hellenistic-Roman (Hellenistic-Roman transitional); Roman; Post-Roman; and Modern, which were then bagged separately. This approach made it possible to establish approximate counts and volumes of material that could be broadly assigned to chronological

16 Whitelaw et al. 2019, 5-7.

periods, while separating out collected ceramics which were not likely to yield much, if any, chronological or functional information. With these broad categories established, period specialists were then brought in to look at the material again with the aim of refining chronologies and interpreting functions. Each of the ceramicists (Borja Legarra Herrero, Andrew Shapland, Jo Cutler, Antonis Kotsonas, and Conor Trainor) would work through all of the material to which Whitelaw had assigned broad period dates and to add their observations into a central KULP Microsoft Access database. Ceramics were categorised by findspot; collection method; bag number; fabric name; shape; vessel size; ware; part; date; typology; surface treatment and decoration.

Results

Despite being an on-going project, it is possible to make some observations on the Hellenistic-Roman city of Knossos. A combination of Whitelaw's broad period analysis and finer grained period-specific study has established that the urban area of Knossos likely reached its greatest extent during Late Classical-Hellenistic times, ca. 130 ha, reducing to ca. 70 ha during the earlier Roman period, then contracting further and moving northward by Late Roman times.[17] The centre of Roman Knossos appears to have been in the area of the Villa Dionysus, below the Hellenic (Early Iron Age-Hellenistic) acropolis and the line of the Roman aqueduct that traversed its spine.

As pertains to Hellenistic and Roman ceramics specifically, the survey has provided us with an overview of the typical domestic ceramic repertoires across time. Before the survey, the location and extent of the Hellenistic city had been estimated based largely on remains from rescue excavations.[18] The findings of the Knossos Urban Landscape Project, however, have enabled us to present the extent of the Hellenistic urban area. Common ceramic finds from the survey project included jugs, *lekythoi*, echinus bowls and shallow bowls, flanged cooking pots and a variety of *lekanai*. Cretan cup forms (high-necked, cylindrical, everted rim) have also been identified amongst the survey assemblage, but their numbers are relatively low, surely approaching the true proportion of cups within these unbiased ceramic assemblages. Imported ceramics indicate exchange connections with Attica in the earliest phase, and with the Eastern Aegean, Asia Minor and the Dodecanese after ca. 250 BCE.

The survey results indicate a notable increase in transport/storage vessel production, especially *amphorae* during Early Roman times (Figure 4). We do get the full ceramic repertoire often represented at sites in this region (for instance cooking wares, local fine wares, plain wares, transport and storage wares, tiles and imported fine wares), but the spike in the production of *amphorae* as well as *amphora* stands and beehive extension rings is noteworthy. Two clusters of *amphorae* appear to be located along roads connecting Knossos to the coast in the north, and connecting Knossos to the agricultural hinterlands to the south. As the *amphorae* found in the cluster to the north are mostly imported, it is possible that warehouses or shops with imported goods were located at the north end of the city. On the other end of the spectrum, given that the *amphorae* at the south are mostly local, this area may have held establishments that processed and packaged agricultural goods from the city's hinterland for export. In addition to imported amphorae (from Kos, Rhodes, Knidos, Italy [Dressel 1 and 2-4]), examples of Eastern Sigillata A, Italian sigillata, Eastern Sigillata B and Çandarlı ware, suggesting that Knossos was a widely connected Roman city.

Putting it together

At this stage it is worth noting some key factors shared by both projects that were of foundational importance for ensuring high data resolution: 1) The location of the sites was more or less known prior to the survey; 2) We had access to solid regional ceramic typologies for the analysis of the survey finds; 3) These ancient urban areas had generally not been built over since antiquity.

Functional delineation and the identification of typical assemblages

The results from both sites discussed above point towards some activities or trends that we can reasonably expect to identify on an intensively surveyed urban site.

Pottery production and commercial activities involving pottery seem to leave a fairly clear footprint in the survey collection record. Concentrations of kiln-wasters as were discovered on the south Plateau of Sikyon obviously point to areas of ceramic production, while large concentrations of transport *amphorae* near roads entering and leaving urban Knossos suggest commercial areas for the import, export, and possibly retailing of *amphora*-borne goods. Because of the nature of such activities – great concentrations of goods – and the nature of the specific ceramic products involved – large, thick walled vessels – it should be little surprise that they are evident in the survey record, which often consists in large part of thick walled coarse ware sherds.

Achieving such spatial precision for the domestic sphere was more difficult. But the large total quantity of pottery at both Sikyon and Knossos survey made it possible to identify some shapes and forms used commonly across the site and as such give us a rough picture of typical household activities, tastes, and trade connections in periods of high visibility; Hellenistic and early Roman in the case of Sikyon and Hellenistic and Roman at Knossos. However, excavation

17 Whitelaw et al. 2019 and Trainor 2019.

18 For an earlier discussion of the topography of Hellenistic Knossos see Callaghan et al. 1981, 105-106.

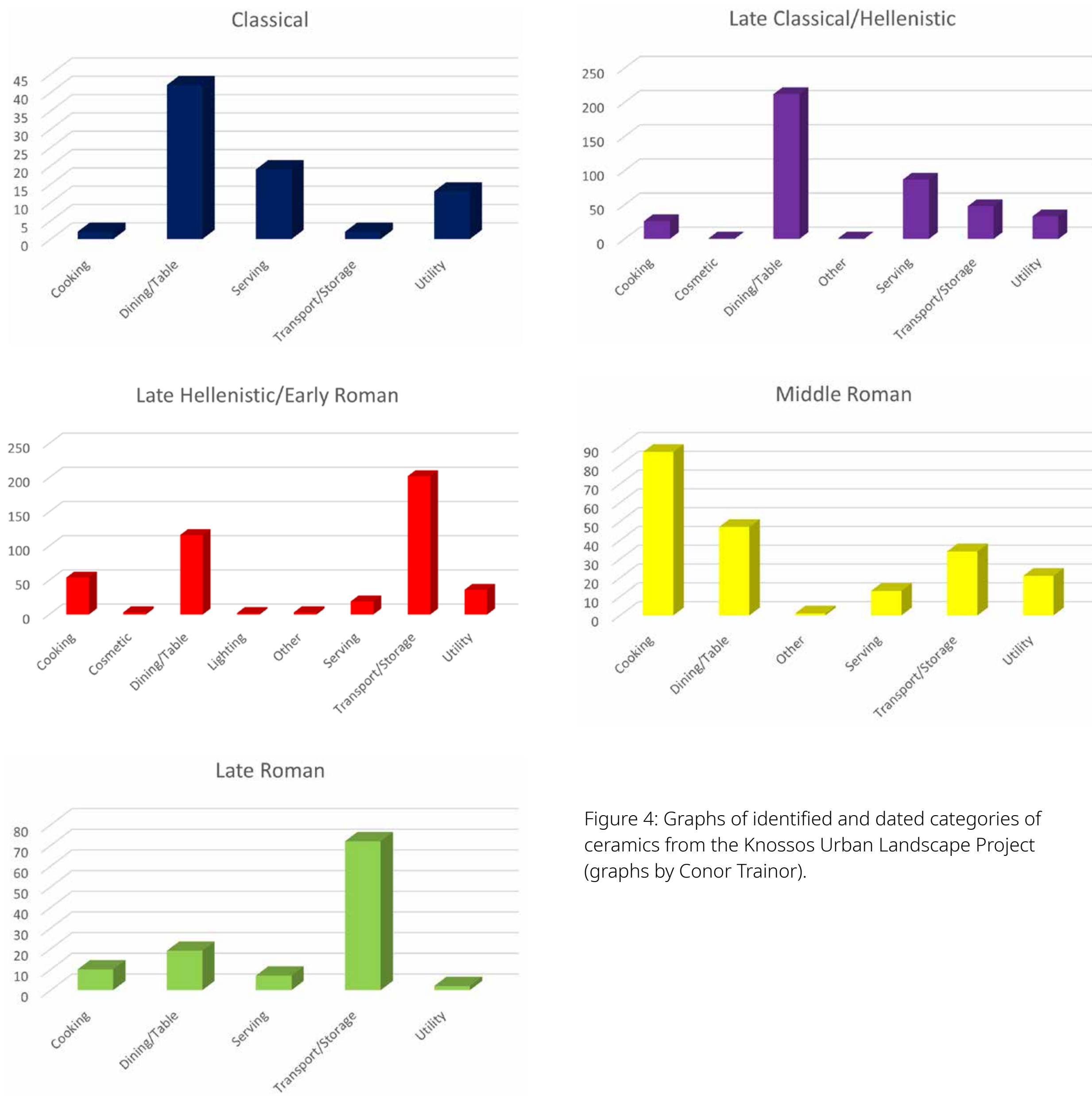

Figure 4: Graphs of identified and dated categories of ceramics from the Knossos Urban Landscape Project (graphs by Conor Trainor).

at both sites suggests that some quite common but delicate shapes such as echinus bowls and thin-wall ware cups are underrepresented in survey. Thus, while the accumulated range across the site is good for illustrating many 'typical' trends, it is obviously not well suited to picking up variations from household to household.

Considering the sheer volume of ceramics collected during both surveys, one surprising aspect (which *may* change as reading the KULP material progresses) is the relatively hazy picture that the ceramics present of neighbourhoods. Some categories of ceramics found in both projects, such as lamps, figurines, kiln-wasters and *amphorae* formed the basis for the identification of ritual and commercial areas, while the presence of cooking, serving and utility vessels suggests that large tracts of the urban area were probably dedicated to domestic activities. Proving these hypotheses would likely require geophysical results or excavation. Furthermore, ceramics were, on the whole, not especially helpful for establishing the urban layout (as opposed to establishing urban extent). Indeed, the picture from the ceramics tends to be quite consistent across much of the urban space of both Sikyon and Knossos, and therefore not especially helpful for detailed functional interpretations of domestic space. Instead, at both Knossos and Sikyon, specifics of urban layout in many areas were clarified through surface traces of architecture, on-going geophysical prospection,[19] and analysis of non-ceramic finds, such as millstones, glass, tesserae and marble veneers.[20]

19 For an example at Sikyon, see Lolos & Gourley 2012.
20 For an example at Knossos, see Whitelaw 2012b.

Conclusions

Laying out this combination of positive results and remaining questions can aid in project design. We could envision, for instance, a project in three complementary parts:

1. A systematic, but less collection-intensive survey than described above to gauge the approximate extent of an urban area, likely fluctuations of that extent over time, and document the remains of monuments or surface structures.
2. Upon detection of notable concentrations of wasters or discarded coarse wares, a more intensive systematic collection in the manner of 'site collections' would illuminate the range of products and trade goods in industrial or commercial areas (which when excavated often produce overwhelming quantities of bulky ceramic finds).
3. To illuminate the lifestyle of the inhabitants of the site, a complementary limited program of geophysical prospection and excavation focused on areas of housing identified through survey. Such excavation would serve as an important functional and chronological calibration for the surface finds, while the surface survey would provide spatial context for the excavated finds.

A project designed along these lines would enable archaeologists to capture both the diachronic and spatial data that systematic surface survey can provide, while also providing fixed points of chronology for fine-tuning the dating of a historical period site and providing some concrete insights into lifestyle. So while the fine tuning of the dating was not problematic at Sikyon and Knossos owing to the presence of regional ceramics chronologies, survey in areas with less well established ceramic chronologies could significantly increase their data resolution through this combined approach.

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A case in point(s)

The Late Hellenistic to Late Roman pottery from extra-mural Tanagra and the formation of the surface record: methodology, chronology and function

Dean Peeters, Philip Bes & Jeroen Poblome

Abstract

This paper strives to go beyond the common, traditional points on an archaeological map by illustrating the potential, as well as biases and limitations, of using large numbers of ceramic-based data to obtain a more nuanced understanding of the complex traces of past human action in an urban and peri-urban setting. An extra-mural area to the north of the ancient city of Tanagra (Boeotia, Central Greece), which was studied through intensive field survey by the Ancient Cities of Boeotia Project between 2000 and 2006, is used as a case-study. Geophysical research shows that this area appears to have been almost void of structures during the last phase of major occupation in the Late Roman period. The body of Late Hellenistic to Late Roman ceramics collected on the surface, however, reflects some activities here. By evaluating these ceramics from a spatial and quantitative comparative perspective, unique snapshots of the intensity, chronology and nature of the activities can potentially be created. But the formation of the surface record, biases during field collection and macroscopic study of the ceramics, and the small size of analytical samples for some periods influence and limit our interpretations. In all, Tanagra may serve as a case in point regarding typical issues in survey archaeology and pottery studies.

Keywords: Tanagra – Late Hellenistic-Late Roman Pottery – Urban/Peri-Urban Survey – Spatial and Statistical Analysis – Post-Depositional Processes.

Introduction

In archaeology, maps are traditional tools used for the presentation and evaluation of material culture in space.[1] They are, for instance, commonly used to give an impression of the quantity and range over which certain classes of ceramics were distributed or they present the distribution of sites identified in the landscape. Distribution maps are not as self-explanatory and objective as they seem, however, as they can be designed as powerful tools to convince a reader of one's argument or hypothesis in an "any fool can see that" manner.[2] To go beyond the mapping of spatial patterning on the basis of complex datasets and explain them requires

1 Hodder & Orton 1976; Orton & Hughes 2013, 238-241.
2 Orton 1980, 113.

in A. Meens, M. Nazou & W. van de Put (eds), Fields, Sherds and Scholars. Recording and Interpreting Survey Ceramics, 137-152, Leiden: Sidestone Press. DOI: 10.59641/m11443py.

a critical stance towards the data themselves and the way in which the selected methodology influences the outcome. This is especially needed in survey archaeology, as fieldwork methodologies differ, often by necessity, from project to project and develop from year to year, because of differences in the landscape, the properties of the archaeological record, the research questions that are addressed and/or certain practicalities, such as restricted storage facilities or permits limiting the collection of artefacts. Survey projects are heavily reliant upon ceramics for the reconstruction of past human action and processes, as this material survives relatively well and was used by past societies for a very broad range of activities. The study of pottery can clarify a (broad or more precise) chronology, provenances and (primary) functions of ancient pots, providing parameters to serve the reconstruction of both the chronology and nature of ancient human activities. Taking a critical stance towards applied methods and data, this paper aims to "let the sherds speak for themselves" as much as possible. These sherds will, on the one hand, be used to evaluate a range of ceramic-based research approaches and, on the other hand, illustrate the potential that survey pottery carries towards the spatial, chronological and functional reconstruction of ancient activities in urban and peri-urban settings. In this light, the study of the pottery from Tanagra in eastern Boeotia exemplifies typical methodological issues, as well as possibilities, in survey archaeology.

Research setting and questions

Tanagra is an ancient city situated on the Asopos river, strategically dominating a fertile area in eastern Boeotia, some 50 km to the north of Athens. The first systematic studies of the site were carried out by Duane Roller in the 1970s and 1980s, who mapped the architectural remains that were visible on the surface and identified several public buildings and spaces, such as a gymnasium, a theatre and several temples. On the basis of these explorations, a Hippodamian street-grid was proposed inside the circuit of city walls that is still partially recognisable on the surface and which is argued to have been originally laid out in the (Late) Classical-Hellenistic period.[3]

From 2000 onwards, the site was gridded and intensively surveyed by the Ancient Cities of Boeotia Project under the direction of John Bintliff. It was quickly noted that huge amounts of Roman, and especially Late Roman pottery, were present on the surface. While 'the city appears to be little noted after the Severan period' in the historical sources,[4] the over 4,000 sherds (of a total of 25,616 collected on the site)[5] that can be dated specifically to 401-700 CE suggest a relatively high intensity of activity also, and perhaps especially, in that span of time. Geophysical research, carried out by Božidar Slapšak and his team, provides unique insights and additions to the urban topography: the Classical-Hellenistic street-grid, proposed by Roller, continues to the north and east beyond the fortification wall that is traceable on the surface. Furthermore, a fortification wall built with a technique similar to standard Classical masonry was identified to the north of the city. Subsequent partial cleaning of the inner line of fortifications showed the (re)use of tiles and *spolia* in the construction, hinting at Late Antique construction or renovations.[6] Furthermore, several kilns were identified east of this architectural barrier, hinting at (ceramic?) production activity. In 2016, the outer line of the Classical fortification could be traced more substantially in the east during a magnetometric study by a team from Eastern Atlas (headed by Cornelius Meyer).[7] The Classical wall direction proposed on the basis of the geophysical measurements lines up quite neatly with the distribution of ceramics that were counted in the survey transects running into Tanagra's hinterland, showing a drop-off in density beyond the wall in the north, east and south transects (Figure 1a).[8] These findings seem to suggest a contraction of the fortified area from close to 60 hectares in Late Classical times to almost 30 hectares by the (Late) Roman period. Although this contraction is seen also elsewhere in Boeotia and in many other parts of Greece, a walled area of almost 30 hectares still seems quite substantial.[9]

This paper focuses on an area between the circuit of city walls suggested for Classical and (Late) Roman times respectively (Figure 1b). While the geophysics show a continuation of the Late Classical-Hellenistic street-grid

3 Cf. Roller 1989, cf. fig. 6.4 and 6.5 for an overview of his work.

4 Roller 1989, 140.

5 This total constitutes an estimate of '1% or less' of the total body of ceramics encountered on the surface (Bintliff et al. 2001, 94).

6 Bintliff 2006, 38; Slapšak 2012, 58. The incorporation of *spolia* (column drums) in the city wall was also identified by James Frazer as early as 1895 in a part of the wall on the acropolis near the Early Christian church, which was excavated a few years before by Kontsas, who linked this fortification to the period of 'Barbarian invasions' in Greece (Frazer 1965, 1.77-79; Kontsas 1893).

7 Bintliff 2016, 9.

8 The high densities of sherds just outside the city wall in the west might be explained differently, since the Classical-Hellenistic street-grid did not turn up on the geophysics in this area. A zone of mixed activity, possibly including cemeteries, industrial activities, extra-mural dumping, or even habitation in higher or lower intensities, might be expected. The ceramics from this area that was covered by 'off-site transects', however, do not allow for a specific functional reconstruction.

9 The contraction of the walled area in the Boeotian city of Thespiae is argued to have been more dramatic: from roughly 72 hectares in Early-Mid Hellenistic times, to 34 hectares in Late Hellenistic-Early Roman Imperial times and only 12 hectares by the Late Roman period. Yet based on the high densities of Late Roman sherds outside this walled area, an extra-mural area is believed to accompany this *kastro* and, as such, a size of ca. 30 hectares is postulated for Late Roman Thespiae (Bintliff et al. 2017, 389). See e.g. Alcock 1993, 96-99; Bintliff 2008, 24 on the general pattern of contraction in city size in later Hellenistic-Early Roman Imperial times.

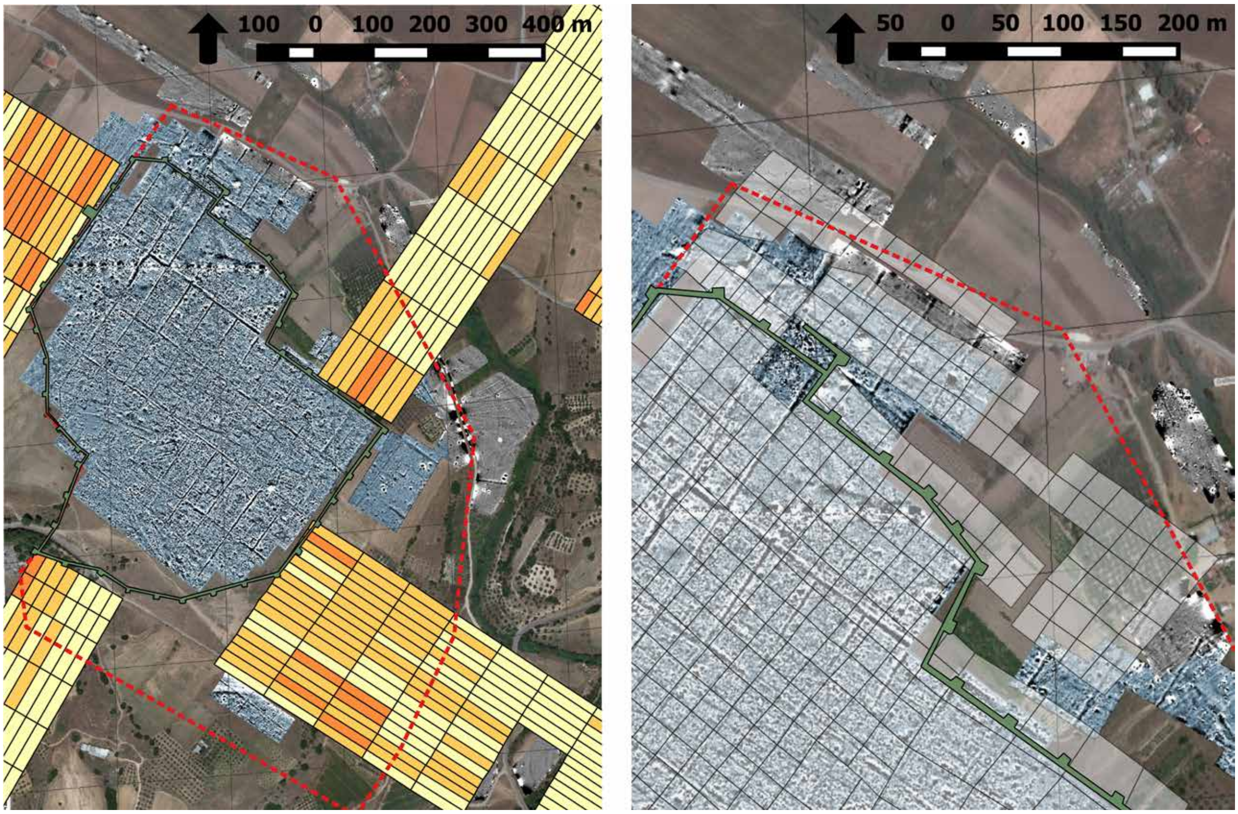

Figure 1a (left image): Counts of sherds (in ha-scale) from the inner transects running into Tanagra's hinterland plotted on top of the combined magnetometrical results of the studies by Slapšak et al. and Meyer et al., published in Bintliff 2016. The (Late) Roman walls and proposed circuit of Classical city walls are respectively visualised as a green and dashed red line) (after Bintliff 2016, 10). Figure 1b (right image): Close up of the extra-mural area and survey units on which this paper focuses (map data ©2017 Google).

beyond the (Late) Roman fortification, the area appears to be void of structures (at least) by the Late Roman period, which is the last phase of large-scale occupation. A substantial quantity of 2,083 Late Hellenistic to Late Roman ceramics (of a total of 3,879 extra-mural sherds), however, was collected on the surface. Especially in the context of the geophysical results and the argued contraction of walled area, this collection of ceramics potentially provides important insights into the chronology and nature of activities in this area. We aim to better understand the chronology, intensity and range of functions of this urban or peri-urban area by comparing the ceramics found *within* and *outside* the (Late) Roman city wall in terms of chronology, function and spatial distribution.[10]

10 It should be emphasised that the inner line of city walls will serve as a point of reference throughout this paper. It is, however, not clear whether a fortification wall existed on the very same spot prior to the Late Roman period. Selective architectural studies hint at Late Roman wall segments or renovations, but it cannot be excluded that this fortification (also in its northern tract) incorporated parts of an earlier city wall.

A methodology in brief of Late Hellenistic-Late Roman pottery studies in Boeotia

The Late Hellenistic-Late Roman pottery studies of the Boeotia Project are based on three fundamental building blocks: fabric, shape and surface finish. Each individual sherd is macroscopically analysed in the same way, assuming that the combination of shape, fabric and surface finish (and only fabric in cases where no shape or surface finish can be determined) provides information on provenance, function and chronology. The project's (Late) Hellenistic-Late Roman reference collection, created for Tanagra by Jeroen Poblome and Philip Bes, serves as an ample basis for identification purposes, especially for studying imports, for most sites covered by the Boeotia Project. This reference collection not only comprises types with a known shape and fabric, but also fabric groups that are usually difficult to associate with a specific provenance and/or chronology. Several of these fabrics can, however, be related to individual Boeotian locations of production on the basis of the layering of several classes of evidence. This includes the presence of

Late Hellenistic (LHELL)	c. 150 – 1 BCE
Early Roman Imperial (ER)	c. 1 – 200 CE
Mid-Roman (MR)	c. 201 – 400 CE
Late Roman (LR)	c. 401 – 700 CE

Table 1: Chronological framework for Late Hellenistic-Late Roman ceramics in the Boeotia Project.

production-related ceramics, the recurrence of specific fabrics at certain sites, and morphological and stylistic properties that are shared between sherds in such fabrics and wasters. Recently, several of these Boeotian fabric groups were analysed by means of portable X-Ray Fluorescence analysis (pXRF). Thereby, a certain chemical homogeneity of sherds ascribed to individual macroscopically defined fabrics was confirmed, and the potential of such relatively quick and affordable archaeometric methods to distinguish several Boeotian fabrics on a rough level on the basis of their chemical profiles was also illustrated.[11] The chronological ascription of vessels produced in and around Boeotia centres on the morphology, fabric, and surface finish of individual fragments that can be cross-referenced with vessels excavated elsewhere. More and more pottery from generally small-scale rescue excavations in Boeotia is currently being published. Yet especially without excavations of the actual workshops in which ceramics in the defined Boeotian fabrics (Tanagran, Askran, Thespian, Koroneian, etc.) were produced and/or extensively published “closed” stratigraphies related to consumption contexts in Boeotia, chronological assignation is still quite dependent upon external frames of reference, such as those published for Athens, Corinth, Knossos, and other sites on the Greek mainland and beyond.[12] The chronological system applied to the ceramics collected by the Boeotia Project is mostly built around general changes in ceramic production and distribution in such deposits elsewhere (Table 1). The fact that these sites are located at some distance creates potential methodological and interpretative difficulties, partly resulting from morphological, stylistic and chronological diversity in the production, circulation, and consumption of ceramics on a very local scale. In this light, it should be stressed that the majority of the 15,861 Late Hellenistic-Late Roman sherds collected on the surface of urban and peri-urban Tanagra cannot be dated within one of these individual ceramologically defined periods,[13] often leading to a Late Hellenistic-Late Roman or Early Roman Imperial-Late Roman assignation, for example. On a broad level, however, the chronological framework has proven functional.[14]

Space, sherd chronology and intensity of deposition

In this section, the chronologies that were ascribed to individual sherds are used to spatially explore the intensity of deposition over time on a grid-to-grid basis, specifically for the surveyed extra-mural zone between the (Late) Roman and Classical lines of defence (Figure 1b). During the first year of the Tanagra survey, 50x50m areas were used as units of collection, but from 2001 onwards, 25x25m grids were applied to increase control over spatial resolution (Figure 2).[15] To compare these two methodologies in a distribution map and gain a better insight regarding the densities of sherds in individual grids, the counts of sherds that were collected in individual grids were extrapolated to a hectare scale.[16] Visibility measures noted during the survey are not corrected for here, so as not to extrapolate the data further than what is needed for initial comparison; on a general level, it can be said that the area within the (Late) Roman fortification looks similar on the surface, as the area is not ploughed and vegetation is kept relatively low by grazing. A part of the grids outside the (Late) Roman city wall was ploughed, however, and will be given special attention later. The counts of sherds with a certain chronology were classified on the basis of Jenks’ method of natural breaks, emphasising the contrast between individual classes on the same map.[17] It should therefore be stressed that the extrapolated ranges and corresponding colours in Figures 2-3 differ from map to map. This is not ideal for comparability, but necessary in view of the substantial differences in sample size between individual grids or zones for certain periods.

11 See Peeters 2023, 140-166 for the methodology and results of these pXRF analyses. A sample of 225 sherds that were collected on the surfaces of Thespiae, Askra, Hyettos, and Tanagra, and which are mostly LHELL-LR in date, was measured.

12 It should be emphasised that a broad range of ceramic publications yields points of reference. Noteworthy examples of publications often used for cross-referencing are Robinson 1959, Hayes 2008 (Athens), Slane & Sanders 2005 (Corinth), and Hayes 1983 (Knossos). Chamilaki 2010 and Gerousi 2014 are recent publications concerning Tanagra’s port Delion.

13 30% of the sherds that can be dated from the LHELL to LR period fall within the confines of one of these individual periods.

14 The LHELL-LR pottery from Tanagra was initially studied between 2001 and 2008 by Jeroen Poblome and Philip Bes. The city assemblage and most of the ceramics from the rural surveys were subsequently re-studied by Dean Peeters and Philip Bes from 2012 till 2016 in order to update the study using the latest developments in ceramology.

15 Cf. Bintliff et al. 2002, 34 for a description of the fieldwork methodology.

16 The counts of sherds from the large and small grids were multiplied respectively by 4 and 16.

17 Jenks 1967.

Such a procedure enables the depiction of nuanced spatial differences for individual periods.

While it might be more common to evaluate urban development chronologically, we start here with the last phase of major occupation for reasons that will soon become clear. When reviewing the spatial distribution of pottery that can be dated specifically within the Late Roman period (hereafter LR), a concentration of surface ceramics *within* the inner line of fortifications seems apparent: the grids with the highest ranges of sherd density are all, except for one, located within the walled area (Figure 2a). Although the density in the extra-mural area seems relatively low when compared to the intra-mural grids, we are still talking about relatively substantial numbers of sherds, as the number of LR ceramics in the extra-mural grids ranges between 2 and 20. When compared to the LR pottery, we see a substantial decrease in numbers for the Mid Roman period (hereafter MR): only 185 sherds could be dated specifically to this phase for the whole site. The large amount of LR sherds is likely to be influenced by the large(r) diagnosticity of combed and ridged amphorae, as such surface treatments became increasingly common especially during the LR period (standing out in terms of their characteristic surface finish and fabric).[18] In contrast, the 3rd and 4th centuries are often characterised as "a comparatively more difficult period" from a ceramic studies point of view. Although the image for the MR period is based on a relatively small sample of both sherds and grids, the patterning reveals that the two highest classes of sherd density are, also in this period, only present *within* the inner line of defence (Figure 2b). The sample for the Early Roman Imperial period (hereafter ER) is again small, with 164 sherds. The deposition of ER ceramics, however, seems to be a bit more diffused with the highest densities occurring both *in*- and *outside* the (Late) Roman fortifications (Figure 2c). Turning to the Late Hellenistic period (hereafter LHELL), we face another substantial decrease in sample size as only 82 sherds could be identified for the whole site. The image based on this sample is, however, similar to the ER pattern as it also provides a diffuse pattern of distribution (Figure 2d).[19]

The spatial distribution of sherds that can be dated within the confines of individual periods seems to show some patterning regarding differences in density. The distribution maps for LHELL-MR times, however, appear incomplete, as they are based on small samples. Undoubtedly, more LHELL, ER, MR and also LR sherds were collected, although at this point they cannot be ascribed more precise dates within the individual periods. It is, for instance, widely acknowledged and apparent in the data (as illustrated below) that some classes of pottery, such as plain wares and cooking pots, are harder to date on the basis of typological parallels than for example tablewares, at least for some periods. Although recent publications, like the Late Roman Coarse Wares series,[20] increasingly provide information on these less diagnostic classes by illustrating that they also developed typo-chronologically and not always in the same way from area to area, traditional foci in ceramic research influence ceramic-generated data in many ways. It therefore seems worthwhile to increase our sample size by including more broadly dated ceramics in our analysis and explore a broader range of activities that might be indicated by broken pots.[21] In this paper, we choose to sum up the sherd-counts of two subsequent periods at a time (LHELL and ER, ER and MR, MR and LR) and complement the single-period quantities with sherds that can be given a date extending from one period into the other (e.g. 1-400 CE; ER-MR).

After combining the LR and MR counts and adding the sherds datable from the MR into the LR period, the image of intra-mural focus is not significantly altered (Figure 3a). The LR pattern is in fact almost replicated, due to the presence of 4,217 sherds that can be dated specifically from the 5th to the 7th century. The increase of the sample size with 1,770 MR-LR sherds is, however, still substantial and a concentrated deposition *within* the inner circuit of city walls therefore seems confirmed. Almost doubling the sample size by the inclusion of 337 sherds that can be dated to the ER-MR period, the MR pattern of relative focus inside the walls seems to "smear out" a bit towards the pattern shown for the ER period, as the highest ranges of sherd densities are plotted both *in*- and *outside* the inner line of defence (Figure 3b). By including 426 sherds of LHELL-ER chronology, the numbers of sherds for this span of time increases by 75%, generating a pattern of distribution of highest sherd densities *outside* the wall (Figure 3c). The

18 E.g. Pettegrew 2007 on the 'over-representation' of LR dots on the map in the Eastern Korinthia Archaeological Survey, argued to be heavily influenced by the high diagnosticity of combed and ridged amphora body sherds, both in the field and the ceramics lab. Methodological exercises exploring these biases and potential over-/under-representations of sherds at Tanagra are to some extent discussed in Peeters 2023 and will be further evaluated in the Tanagra volume of the Boeotia Project that is in preparation.

19 This decrease in sample size when approaching older phases is also encountered for the Boeotian city of Thespiae: LR – 1,349 sherds, MR – 133 sherds, ER – 90 sherds and LHELL – 32 sherds (Bes & Poblome 2017, table 12.2). Proportionally speaking, however, the number of LR sherds is substantially higher for Tanagra.

20 E.g. Gurt i Esparraguerra et al. 2005 and subsequent LRCW volumes.

21 Methodological examinations from Boeotia and other surveys in the Mediterranean regarding the inclusion and chronological distribution of more broadly datable ceramics touch upon this point and are becoming increasingly widespread (e.g. Willet 2012, Poblome et al. 2013, Bes & Poblome 2017, Peeters 2023).

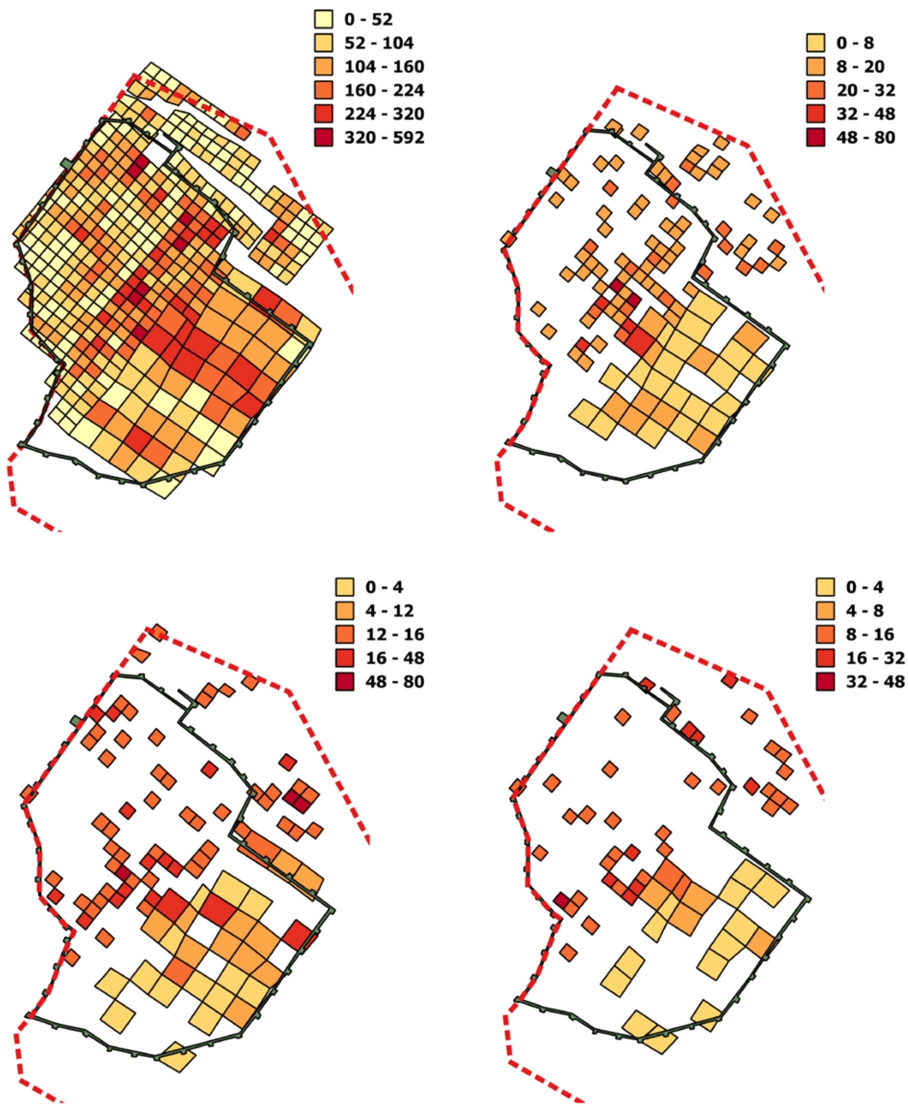

Figure 2: Spatial distribution of sherds of specific chronologies, a (top left): LR, 401-700 CE, n=4,217; b (top right): MR, 201-400 CE, n=185; c (bottom left): ER, 1-200 CE, n=164; d (bottom right): LHELL, 150-1 BCE, n=82.

walled area, however, still exhibits relatively substantial sherd densities.

Although we face some difficulties in terms of the number of both sherds and grids represented for certain periods, the patterns reflected by the individual spans of time seem to hold quite well after the inclusion of sherds that can be dated to a broader chronological period. At least theoretically, the inclusion of more sherds into our analysis adds to the degree of representativeness of the patterning. The relative resemblance between the maps on the basis of individual and partial overlapping time slices seems encouraging and is potentially meaningful in terms of the intensity of deposition over time, specifically in the extra-mural area in which comparatively fewer LR sherds were collected on the surface.

The generated spatial and chronological patterning from an archaeological and (post-)depositional point of view

The ascribed ceramic chronologies and substantial differences in sample size among individual periods do not allow for the identification of an exact chronology of the change in pottery densities (that are higher inside the inner defensive wall in later times). Yet the patterning seems to suggest a change after or at the end of the ER-MR period. Several hypotheses and observations might be discussed in the light of these patterns, including a certain bias caused by the formation of the archaeological record.

Instinctively, the most obvious explanation for the (MR-)LR concentration of deposition *within* the inner line of fortification seems to be the LR chronology of (at least part) of this *enceinte*. But it might also reflect other typical Late Antique processes and/or changes in urban

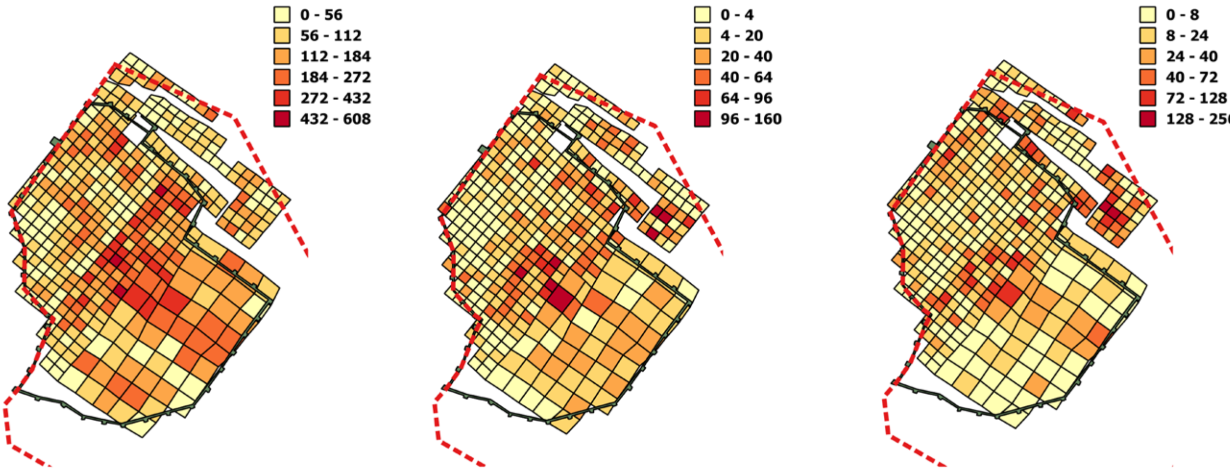

Figure 3: Spatial distributions of sherds of specific chronologies, a (left): MR-LR, 201-700 CE, n=6,172; b (centre): ER-MR, 1-400 CE, n=686; c (right): LHELL-ER, 150 BCE-200 CE, n=672.

Figure 4: View to the northwest of the ploughed extra-mural area in front (orange) and the (Late) Roman wall line covered in vegetation in the background on the left. The unploughed extra-mural area starts with the line of trees on the horizon on the right (photo by Dean Peeters).

topography. Besides the erection of large Early Christian churches (one of them seemingly covers parts of the [former?] "Upper Agora"), the geophysical examinations at the site also seem to illustrate for instance that streets were blocked and *insulae* left unoccupied in the middle during this last phase of major occupation. Among other things, such open areas might have provided space for urban gardens or industrial activities. But it can also be imagined that such locations functioned as spaces for dumping and piling up urban refuse within (rather than outside) the walls, reducing the effort otherwise required for the removal of waste.[22] In a scenario that includes the presence of gardens, we might also need to consider the possibility of "urban manuring".[23]

Identifying urban and peri-urban dumping on the basis of surface pottery is, however, arduous and post-depositional formation processes have usually been at

22 E.g. Johnson 2012, 126-160, specifically p. 134, for such changing strategies or attitudes to waste disposal in Rome, where former public buildings on the Palatine and former privileged domestic structures were in use as rubbish dumps by the Late Antique period.

23 See Tsivikis 2021, 47-48 for relevant evidence in this respect, since a boundary inscription from Messene is argued to show that there systematic cultivation took place in a part of the ancient city that saw a very dense layout of buildings till the 4th century CE.

work as well. Tanagra's walled area has, for instance, been a protected archaeological site since the 1950s, predating the introduction of mechanised agriculture and deeper ploughing in Boeotia.[24] This status protects the area within the (Late) Roman fortification walls from large-scale soil movements. The absence of such processes potentially limits the extent to which older ceramic periods lower down the tip of the stratigraphic iceberg can come to the surface. Theoretically, the observed presence of higher densities of LHELL-ER (-MR) ceramics in Tanagra's extra-mural grids might thus (at least partly) have been influenced by this differentiation in land use, as this area was (and still is) not part of an archaeological zone. In the light of this, it is encouraging that especially the easternmost extra-mural grids seem to show a relatively high density of pre-LR material: this area is heavily ploughed as it is part of a farm to its north, situated on the exact spot of the Classical line of city walls hypothesised on the basis of the geophysical evidence (Figure 4).

In sum, the generated patterning in the distribution of ceramics of various chronologies in urban and peri-urban Tanagra might thus be evaluated in the light of identified changes in urban topography, including a (Late) Roman re-walling and a less densely built cityscape. At the same time, however, the patterning is probably at least in part the result of the formation of the archaeological record, as well as of our relative ability to date sherds to specific periods.

The nature of activities in the extra-mural area: Late Hellenistic to Late Roman ceramics

In addition to mapping the density of sherds of specific chronologies and changes therein, the range of vessels represented in individual zones can provide evidence on the range of activities in certain areas over time. In this section, the ceramics will be further explored from such a functional perspective. In order to accrue an adequate sample for analysis, it was necessary to create larger groups by broadening our spatial and chronological framework and group the sherds by rough find-spot (within or outside the wall) and broad chronology (LHELL-ER, ER-MR, MR-LR) for comparison (Figure 5). We already noted the higher visibility of certain ceramic periods, as well as differences in the diagnosticity of certain classes of pottery compared to others. For the recognition of ceramics with similar chronologies in the pottery lab, however, we can at least assume that we are dealing with similar biases for the material collected in- and outside the walls.

Drawing on the identified range of vessel types broken down by chronology and find-spot, several patterns emerge from the analysis. A first observation is that LHELL-ER ceramics are, just like the ER-MR sherds, mainly constituted by tablewares (Figure 5a-d). Further exploration of the dataset for the LHELL-ER period reveals that, on average, almost 20% more tablewares, 8% fewer amphorae, 6% fewer cooking pots and 6% fewer jars/jugs were identified in the area outside the walls (Figure 5a-b). Although it should be stressed that the sample of ER-MR sherds in the extra-mural area is small (only 75 sherds), the ER-MR distribution pattern seems to be similar to the LHELL-ER pattern: comparing the ER-MR pots from both zones reveals that 14% more tablewares, 7% fewer amphorae, 5% fewer cooking pots and 4% fewer jars/jugs were identified in the extra-mural area (Figure 5c-d). The pie-charts for these periods do not compare directly, although the differences between intra- and extra-mural for these date ranges are quite similar. The general predominance of LHELL-MR tablewares across the site likely illustrates our ability to identify and date tablewares comparatively easily, while other types of pottery are more difficult to date. For the MR-LR period we have a better understanding of the pottery types represented in the collected assemblage, as the total sample, as well as the number of represented functional categories, is much larger (Figure 5e-f). As noted, sherds of MR-LR amphorae are more diagnostic in terms of surface finish, which seems to be reflected in higher visibility in the field (compared to plain body sherds), more secure/precise dating in the ceramics lab, and thus greater abundance in our maps compared to previous periods.[25] When grouping the collected bodies of ceramics into intra- and extra-mural, the figures also seem more balanced than for preceding periods: the largest deviations are represented by the percentage of jars/jugs and amphorae, while the differences in tablewares and cooking pots are minimal. It should, however, be noted that these two bodies of sherds (MR-LR intra-mural versus MR-LR extra-mural) are still statistically heterogeneous according to the conventional 5% range of error in the χ^2 test.[26]

24 Friedl 1962, 21.

25 The number of amphorae might indeed be higher in the MR-LR period than before, but their greater diagnosticity also affects the figures (perhaps particularly of pre-LR data), as it eases their identification (sherds are commonly ridged, grooved or combed), while older amphorae usually lack such surface treatments. Plain sherds are less likely to be selected in the field (as they are deemed less diagnostic); those that are collected are subsequently less easy to date (as they present fewer morphological/stylistic clues). In our case, amphorae (compared to other classes of ceramics) might not be so much overrepresented for the MR-LR period as underrepresented for earlier periods.

26 A χ^2 -value of 38.04 was calculated. The critical value for homogeneity/heterogeneity is 14.1 with 7 degrees of freedom and a conventional 5% range of error (e.g. Fletcher & Lock 2005, 202).

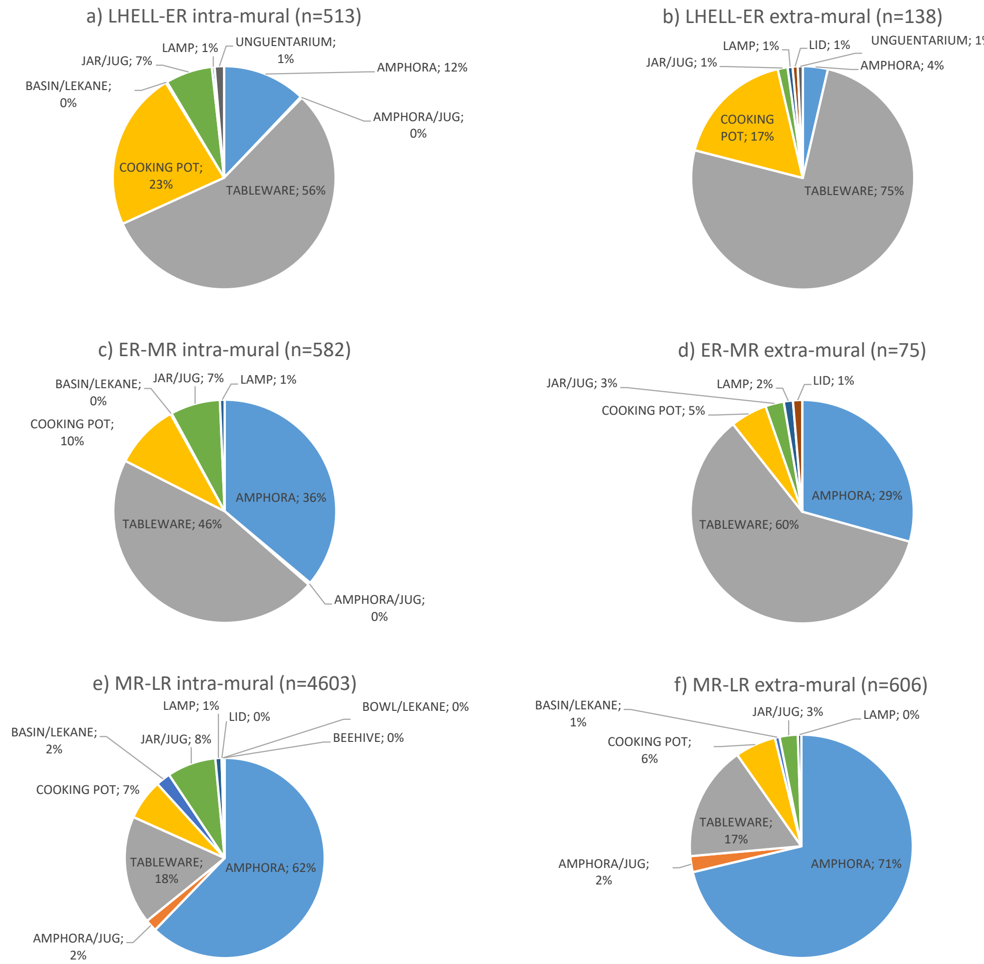

Figure 5: The collected bodies of LHELL-ER (a-b), ER-MR (c-d) and MR-LR (e-f) sherds, grouped by find-spot (intra-/extra-mural) and vessel type.

These initial comparisons were by necessity carried out on a broad spatial scale and structured around broad, partially overlapping time slices in order to enlarge the extra-mural sample size of LHELL-MR sherds and subsequently enable diachronic evaluations. Although some clear biases towards recognisability can be observed from a diachronic perspective, this comparative analysis also highlights some interesting differences/similarities between intra- and extra-mural Tanagra that are potentially meaningful in terms of the reconstruction of activities across the site.

Correspondence analysis of the Late Roman ceramics

Before further discussing and interpreting the LHELL-LR ceramics from the intra- and extra-mural areas from a functional perspective, it appears worthwhile to single out the LR ceramics for a more detailed statistical exploration. The LR period provides a larger sample for evaluation (n=4,217) and an interesting case study for the application of correspondence analysis (hereafter CA).[27] CA can be defined as an exploratory, multivariate statistical technique that simultaneously represents both the rows and columns of a pivot-table in the same plot, thereby enabling the evaluation of interrelationships between variables (in this case vessel type and find-spot).[28] The method has been proven to be an invaluable tool in material studies, especially for the analysis of large datasets and the highlighting of nuanced differences and interrelations between occurrences of artefact types. The application of CA has, for instance,

By conventional criteria, this difference is considered 'extremely statistically significant' with a two-tailed P-value of less than 0.0001. The categories 'lid' and 'bowl/lekane' were eliminated from the analysis, because the expected values for these classes would be smaller than 1 for one of the defined zones and 'under no circumstances any of the expected frequencies should be less than 1' for the χ^2-test to be valid (Fletcher & Lock 2005, 131). See Shennan 1988, 65-74; Drennan 2009, 182-188 for a detailed description of this statistical technique; see Peeters 2015, 64-65 for an earlier example of its application on a sample of grids from Tanagra.

27 E.g. Greenacre 1993; Baxter 1994, 100-114 for more background and the technical workings of this technique.

28 Baxter 1994, 100.

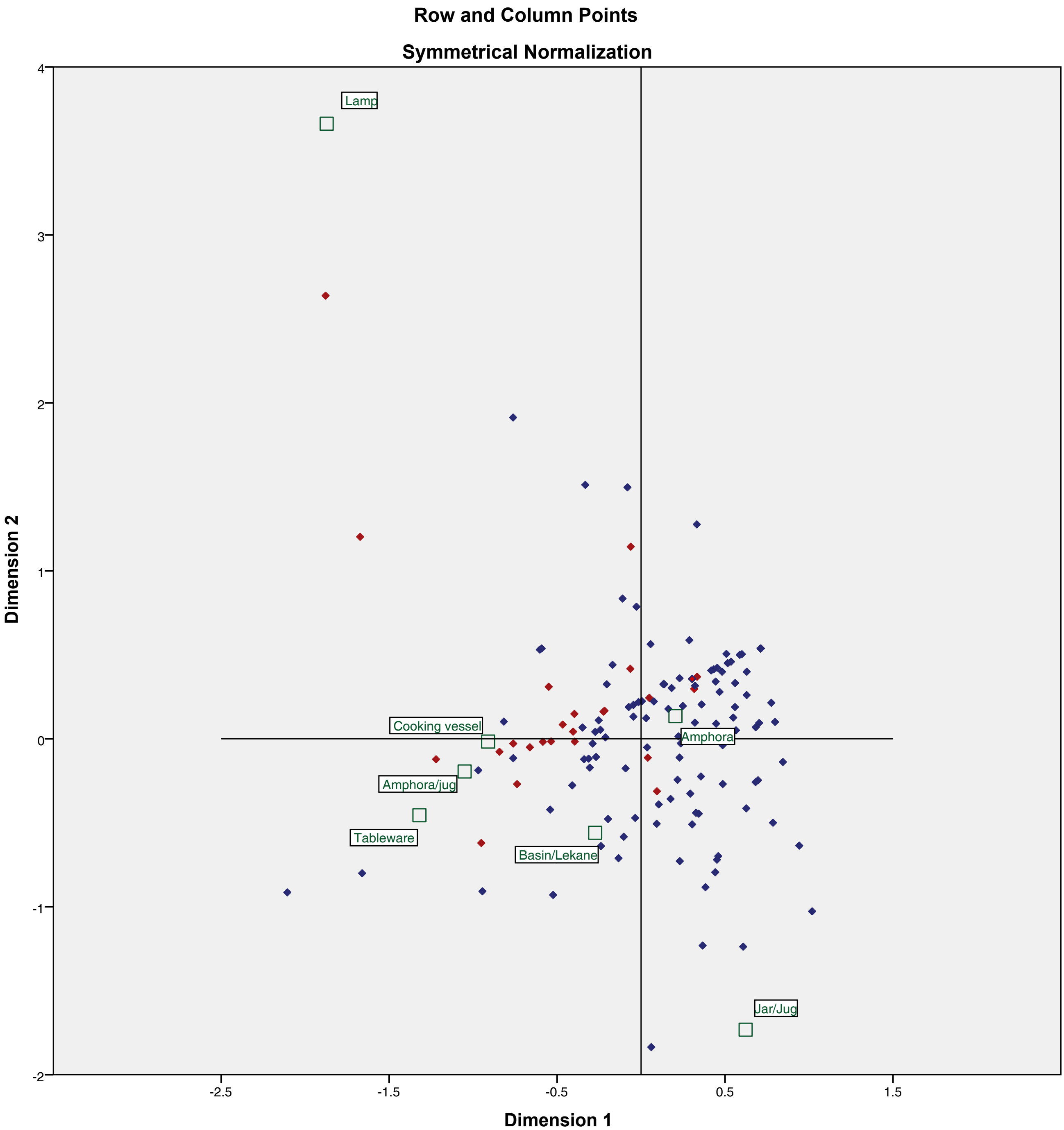

Figure 6: Correspondence analysis of rows (vessel types – green open squares) and columns (grids – extra-mural: red diamonds, intra-mural: blue diamonds). 46.5% of the total inertia is explained by the first (26.4%) and the second (20.2%) dimensions.

contributed to discussions on the role(s) of material culture in social practice and the creation and maintenance of local and regional identities.[29] As shown by Martin Pitts for the site of Elms Farm/Heybridge (England), CA also proves to be a solid technique by which to highlight differences in the deposition and consumption of bodies of material culture on an intra-site level.[30]

Acknowledging this potential, our LR sample can be evaluated on a smaller spatial scale, as the sample is substantially larger than for other periods. Grids were grouped on the basis of the largest survey units (50x50m areas) for comparison. The categories 'lids', 'beehives' and

29 Noteworthy are the contributions by Martin Pitts focused on the mapping and evaluation of meaningful similarities, differences and interrelations in 'suites' of material culture from several sites in Roman Britain (e.g. Pitts 2005, 2010).

30 Pitts 2006.

'bowl/lekane' were omitted from the analysis, since CA is sensitive to 'rare species': vessel types that occur in small numbers in a small number of grids and/or vessel types that prove to be hard to date specifically to the Late Roman period (under discussion here) on the basis of surface evidence and stylistic cross-referencing. The inclusion of such categories in the analysis would create a plot in which CA discriminates grids by centring on categories that are only rarely datable within such a specific timeframe. As a result, more nuanced differences in the contribution of other vessel types to individual grid collections, which provide a more appropriate and representative basis for analyses (as sample sizes are larger), become invisible. Although the category 'lamps' is also represented by a small number of fragments (and as such will exemplify how CA reacts to the inclusion of categories with small sample sizes), they were accounted for in the analysis as potentially meaningful indications for burial practices in Roman Greece. Excavated funerary deposits from Isthmia, for instance, hint at practices in which lamps were left by mourners outside graves, whilst such ceramics also 'appear very frequently *in* Roman graves' in Corinth's Northern Cemetery.[31] A total of 46.5% of the inertia was accounted for by the first two dimensions depicted in the plot,[32] which is not an uncommon figure for CA.[33]

Figure 6 reveals nuanced distribution patterns of pottery types in the intra- and extra-mural grids. Although (groups of) outliers are certainly present, the majority of extra-mural grids is plotted between -0.8 and 0.4 on the *x*- and -0.5 and 0.4 on the *y*-axis. As a group, the extra-mural grids seemingly show less variance compared to the intra-mural grids. The general presence of these grids relatively close to the axes indicate somewhat average profiles within the whole sample. Although the initial comparison between intra-/extra-mural for the MR-LR periods (Figure 5e-f) did not show clear associations with tablewares and cooking vessels, the CA reveals some strong associations on a grid-to-grid level with cooking vessels in the extra-mural area. The categories 'lamps' and also 'jars/jugs' are clear contributors to the inertia of the plot on the *y*-axis, which is undoubtedly heavily influenced by the observation that they are relatively "rare species". Yet the relative position of several extra-mural grids towards the vessel type 'lamp' is potentially of interest. Grid 147, which is the red square closest to this vessel type and therefore showing a relatively high association, indeed shows relatively many lamps: 20% of the LR vessels in this grid were identified as lamps. Sample size, however, remains an issue as only ten LR sherds were identified in this grid and interpretive caution is clearly needed. Exemplary are the observations made during the Knossos Urban Landscape Project, that percentages of fine, cooking- and coarse wares only appear to stabilise as collections reach about 40 sherds.[34] This rule of thumb might differ from period to period, region to region and site to site, but the application of this figure to the grouped 50x50m Tanagra units reveals that the collections from only 25% of the grids are constituted by 40 or more LR sherds,[35] again illustrating that we have to be alert to the effects of sample size on the outcomes. The strength and potential of CA to highlight nuanced differences and evaluate larger bodies of ceramics towards archaeological explanation, however, comes clearly to the fore on the basis of the different descriptive and exploratory statistical methods illustrated in Figures 5 and 6.

Running our head against a (Late) Roman fortification wall?

Attempting to go beyond the points on a map proves a fruitful yet challenging exercise, heavily influenced by issues regarding sample size and the ability to date sherds to individual periods using ceramic parallels. For example, the reconstruction of LHELL-ER(-MR) activity in the area studied at Tanagra is more dependent upon the recognition of tablewares, while amphorae were predominantly identified for the MR-LR periods. This difference clearly shows that for the reconstruction of ancient activities, we are not working with "viable" assemblages that can be taken at face value as being a realistic reflection of the range of vessels in use in the past.

Although vessel types like cooking- and plain wares are better represented by fragments with ascribed LHELL-ER, ER-MR and MR-LR chronologies, such ceramics are usually datable only to even broader periods, such as ER-LR or LHELL-LR. The observation that the respective 516 and 1,781 cooking ware fragments, which are ascribed to these chronologies in our dataset, outnumber the 142 LHELL-ER, 62 ER-MR and 366 MR-LR fragments of cooking vessels that are accounted for in the figures is illustrative. Hence, the application of further statistical distribution methods – also to account for these large bodies of sherds that are more broadly datable – seems needed in order to gain better insights into ancient activities or at least achieve

31 Slane 2017, 203f (emphasis added); Rife 2012, 197.

32 Inertia is a measure of variance of the individual rows (e.g. vessel types) and columns (e.g. grids) against the average profile for the whole assemblage and is related to the earlier noted χ^2-value.

33 Murtagh 2005, 39. See e.g. Pitts 2010, 151 for the application of measures of inertia ranging between 11 and 50 on the first two dimensions.

34 Whitelaw 2012, 80.

35 The breakdown of the percentage of 50x50m grids corresponding to the number of LR sherds per grid: 0 to 9 LR sherds = 11% of the grids, 10-19 LR sherds = 29% of the grids, 20-29 LR sherds = 18% of the grids, 30-39 LR sherds = 17% of the grids, 40-49 LR sherds = 8% of the grids, 50-59 LR sherds = 5% of the grids, 60-69 LR sherds = 8% of the grids, 70-79 LR sherds = 3% of the grids, 80-89 LR sherds = 0% of the grids, and 90-99 LR sherds = <1% of the grids.

"assemblages" that are less influenced by biases in the field and recognition in the ceramics lab.

It should be clear that the provided figures are to a large extent influenced by a whole range of biases, not least our relative ability to identify and date pots to specific time periods. Yet a comparison between the pottery retrieved within and outside the (Late) Roman fortification wall might still provide meaningful patterns, when assuming similar biases in the identification of vessel types from the whole site in the *same* periods. As shown in Figure 5a-d, overall, 14-19% more LHELL-MR tablewares and fewer amphorae, cooking pots and jars/jugs of such chronologies were retrieved and identified in the extra-mural area. As already noted, it is not clear whether a fortification wall existed in this northern zone prior to the LR period: indications hint at LR wall segments or renovations, but this fortification might also in its northern segment have incorporated parts of an earlier city wall. If this is not the case, the outer Classical line of defence might still have been in use, or a city without a wall might have existed. Although the samples of ceramics from the extra-mural area are relatively small for certain periods, the noted differences in the range of LHELL-MR pots in the intra- and extra-mural areas are of interest and do not exclude the presence of an architectural barrier spatially influencing human activity also in these spans of time. The larger body of LHELL-MR tablewares in the extra-mural area, for example, may suggest the presence of graves, as these ceramic types are not uncommon in such contexts, and as graves are often found in extra-mural areas close to urban cores, as at Thespiae.[36] The same might be true for the LR period, which was explored through CA: the relatively strong association between individual (extra-mural) grids and lamps might hint at burial contexts, as these pottery types commonly occur in graves (at least in the Corinthia).[37] Although the sample sizes per grid are (even for the LR period) indeed not uncommonly on the small side, the observed occurrence of such 'rare species' in relatively small samples might still provide meaningful indications towards functional reconstructions.

The generated ceramic patterns potentially reflect differences in ancient activity across the site and/or hint at certain chronological patterning. It should, however, be emphasised that evidence for the existence of a fortification wall in certain periods should come from architecture itself, while the presence of graves is most properly documented through excavations. Especially surface identification of graves faces complications: in Roman Greece, grave offerings for the journey to the underworld appear to become rarer and ceramics were increasingly replaced by glass vessels.[38] Yet even for the Roman period some relatively typical shapes seem to be mostly associated with graves (at least in some contexts). S*tamnoi*/urns with large diameters retrieved in a 2nd-3rd century 'family tomb' near the Boeotian city of Chaeroneia,[39] and *lekythoi* argued to 'have been manufactured expressly for use in burial at both Corinth and Argos', are, for instance, also excavated in (MR) LR graves at Tanagra's port Delion.[40] Such shapes are, however, not always easily identified on the basis of fragmented sherds, and they also occur in graves alongside shapes used in 'everyday life'.[41] The observation that other vessels that are often seen as grave markers, such as Hellenistic fusiform *unguentaria*, are spread in low densities across Tanagra's surveyed area illustrates that the identification of graves on the basis of the surface record is a difficult matter (at least for the periods and site focused on here).[42]

Further quantitative comparison of ceramic data from excavations (specifically "standard ranges" of types commonly found in certain contexts) with the ceramics collected from the surface of Tanagra is tempting. Yet it should be stressed that a certain gap exists between what we expect and what we see on the surface. Even excavated assemblages, for instance from houses, do not always confirm what one might expect on the basis of other houses.[43] Earlier methodological exercises, on the basis of the LR pottery from a sample of grids from Tanagra, revealed that the material from the "Upper Agora", above all, seems to fit "standard excavated household assemblages" best (as far as they can be approached).[44] The possibility of LR houses on the (former) agora cannot be entirely dismissed in the light of changes in urban topography documented elsewhere in this period.[45] But it should be clear that associating excavation data to the survey data adds many unknowns and assumptions to the equation, making direct comparisons hazardous.

Despite these issues regarding period-specific biases in the field and ceramics lab and difficulties in identifying graves or other functional contexts on the surface, the exploration of large amounts of ceramic

36 Bintliff et al. 2017, 63.

37 E.g. Rife 2012, 197; Slane 2017, 203f.

38 E.g. Slane 2017, 6-7, 229.

39 Kountouri & Petrochilos 2017, 489-490. See Slane 2017, 200-201, plates 49-50 for similar vessels in Corinth's Northern Cemetery.

40 Chamilaki 2010. See Rife 2012, 194-195 for these *lekythoi*.

41 E.g. Slane 2017, 6-7, 229.

42 See Stissi 2017, 295 and Bintliff et al. 2017, fig. 3.67 for similar observations for urban Thespiae. E.g. Rotroff 2006, 137-149, esp. 140 for the dating of these vessels, including extensive discussion on their provenance, contents and functional application.

43 E.g. Allison 1992, 53 and 2009, 27.

44 Peeters 2015, 66-67. See Gebhard et al. 1998 for such 'standard household assemblages' that are mostly based on the data from Carthage.

45 E.g. Potter 1995, 99.

data is a fruitful exercise which not only illustrates the complexity of datasets and the archaeological record, but also contributes to a better understanding of ancient and modern Tanagra. For instance, although the Late Antique historical sources are relatively silent, the large number of LR ceramics on the surface of Tanagra hint at a substantial phase of occupation. It can moreover be stated with some confidence that extra-mural deposition was substantially less intensive in the (MR-)LR period. This observation complements the geophysical and architectural studies on the site by on the one hand being not incompatible with a scenario of LR re-walling and, on the other, by raising the possibility that the open spaces in Tanagra's Late Antique cityscape were (perhaps increasingly) used for refuse disposal. The identification of exact processes on the basis of surface sherds appears, however, to be a different matter, since urban and peri-urban areas are by definition contexts of massive variance in activity and, especially for the surface record, show an accumulation of past processes and activities over time. In terms of the formation of the archaeological record, especially the apparent correlation between the identification of smaller/larger numbers of pre-LR ceramics and the absence/presence of deep ploughing appear to be of interest, illustrating that modern land-use and other post-depositional processes should be considered when exploring survey pottery data. The pre-LR ceramic patterning appears more biased in this respect, thereby limiting possibilities of detailed reconstructions. But indications for an "urban core" within the (Late) Roman fortifications are strong, as the distribution of (Roman) building-ceramics (like hypocaustum tiles and water pipes), which were used to distinguish urban from peri-urban at Leptiminus,[46] is heavily skewed towards the area within the inner circuit of the city walls. In light of this, the apparent functional differences in the LHELL-ER (-MR) collections from the surveyed areas in- and outside Tanagra's inner defensive circuit might be of interest, but require further examination. Pottery research, however, increasingly stands less on its own in survey archaeology and a more interdisciplinary approach (including geophysics, geomorphological studies and certainly also excavations) complements ceramic-generated snapshots towards a better understanding of ancient processes and activities. Although the archaeological record and the formation of our datasets are complex matters, forcing us to step away from simplicity and single cause-and-effect reasoning, this certainly should not close the door to meaningful comparative ceramological examinations, even on a small spatial scale.

46 Stone et al. 2011, 189-190.

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Buried landscapes and landscapes of the buried

Considering rural burial in survey

Anna Meens

Abstract

This article treats a distinct kind of site discovered in archaeological survey: cemetery sites. It discusses issues of recognizability and visibility of these sites and stresses the importance of cemeteries for understanding settlement systems, in particular small farm sites. The article presents evidence from various Greek landscapes studied in archaeological (survey) projects, with special attention to the Classical and Hellenistic periods when the isolated farmhouse was very common. Furthermore, cemetery sites from the Boeotia Survey project, together with written sources, shed new light on the countryside organization of the polis of Thespiae and specifically the Valley of the Muses, where burial sites are few.

Keywords: Archaeological Survey; Countryside; Cemeteries; Farmsteads; Land Leases.

Introduction

Archaeological survey enables us not only to study landscapes of the living, but also landscapes of the dead. Most survey projects focus on the settled landscape, asking questions about the diachronic developments in habitation patterns, but next to settlement sites, most projects encounter burial sites as well in their fieldwalking, and these are commonly not systematically studied. Such burial sites, especially rural burial sites, have the potential to elucidate countryside organization, in turn clarifying the role of the settlements in it. I argue that in order to understand the reasons behind habitation patterns – countryside organization – we need to study not only settlement sites, but also non-habitation sites, like burial grounds.

Recognizing rural burials in archaeological survey

Anthony Snodgrass brought rural burial to the attention of survey archaeologists with his 1998 article 'Rural burial in the world of cities'. He stresses that rural burial can only occur in a landscape in which there is also an urban component: the city. For this reason, he focusses on the 'world of cities' of the Classical and Hellenistic periods in Greece. He highlights the connection between the rural burial sites, land and farmsteads. He argues that the burials prove ownership of land, since people could only be buried on land they owned. This is also clear in his definition of rural burial: 'Burial in a site sufficiently distant from any nucleated settlement to be inexplicable in terms of the location of

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such settlements, in a location chosen on grounds of the ownership of rural land'.[1]

Furthermore, he argues for an intimate relationship between countryside burials and farmsteads. The burials do not necessarily prove residence on these farmsteads, but nevertheless make it likely. In his words: 'I think it much more likely that so close an association in death implies the closest possible association in life, that of permanent residence on the land'.[2]

With regard to finding these burial locations, Snodgrass distinguishes two categories of sites. The first is that of exposed graves. Agricultural activity, taphonomic processes, modern landscaping and building works bring to light ancient burials that were previously undisturbed. A second category of burial sites discovered in survey is manifested by surface scatters. Since most archaeological sites discovered in survey consist of a surface scatter, it is important to distinguish funerary sites from those that served other purposes. According to Snodgrass, artefact scatters of cemeteries can be distinguished on the basis of six characteristics.[3] The first is that it is small. Secondly, the scatter is concentrated and not surrounded by a halo of material around the site nucleus, as is the case with habitation sites.[4] The third and fourth criteria relate to the preservation of the material. The material from funerary sites is often less abraded than material from other sites, typically shows recent breaks and include pieces that join (the latter being rare in the typical survey assemblage). The last two characteristics concern the specific artefactual content of the scatter. Snodgrass notes that the pottery is often of unusually high quality, consisting of fine wares, either black gloss pottery or decorated wares. A final characteristic are the shapes found in the scatter, containing typical funerary shapes such as the lekythos, skyphos, aryballos or kantharos, depending on the date and region.

Review of burial sites in survey projects

Which survey projects in the Greek world have recorded burial sites and to which of Snodgrass' categories do they belong: exposed graves or surface scatters? How were they identified? I have reviewed 12 survey projects,[5] noting the number of burial sites for each survey,[6] as well as the criteria used for identification. Table 1 summarizes the results.

It is clear that burial sites are encountered in most (intensive) archaeological surveys, although more in some than in others. There appear to be four main reasons for identifying a site as a burial site (see Table 1[7]). The first and most commonly mentioned reason is the presence of grave infrastructure, rock cut graves, chamber tombs, tumuli and cist graves. Secondly, the finds are often mentioned: decorated pottery and specific funerary shapes, as well as their good preservation and quality. An additional group of telling finds include fragments of sarcophagi or stelai. A third commonly cited reason is the presence of human bones. A fourth criterion is the small size of the scatter. It is also clear that by far the most burial sites encountered in survey correspond to Snodgrass' first category, that of exposed graves, found for example in road cuts or gully scarps (Figure 1). Few projects have identified burials based on the presence of a surface scatter only.

In practice, the criteria are very similar to those mentioned by Snodgrass. However, they are nowhere made explicit (except for the Metaponto survey[8]). Moreover, a single site rarely yields all criteria. It seems that the presence of grave infrastructure is usually the main reason for identifying a site as a cemetery site (arguably correlating with the category of exposed graves used by Snodgrass). An addition to Snodgrass' criteria is the discovery of human bones. Unfortunately, artefactual finds often seem to be sparse at exposed graves, which is problematic since the dating of the site is often dependent on it.

1 Snodgrass 1998, 37.
2 Snodgrass 1998, 41.
3 Snodgrass 1998, 38.
4 Bintliff & Snodgrass 1988.
5 Keos: Cherry, Davis & Mantzourani 1991. Southern Argolid: Jameson, Runnels & Van Andel 1994. Laconia: Cavanagh et al. 1996 & 2002; Cavanagh, Mee & James, 2005. Berbati-Limnes: Wells & Runnels, 1996. Asea Valley: Forsén & Forsén 2003. Messenia: McDonald & Rapp 1972. Pylos (PRAP): http://classics.uc.edu/prap. Atene: Lohmann 1993. Methana: Mee & Forbes 2007. Melos: Renfrew & Wagstaff 1982. Metaponto: Carter & Prieto 2011; https://metaponto.la.utexas.edu/survey/bradano-to-basento/ (with online database).

6 Fredrik Fahlander did a similar review, published in the Asea Valley Survey volume (Fahlander 2003, 354). However, this list is problematic for its lack of chronological assignations, and I have doubts about the recognizability of single graves in survey (note that he does not mention a number of burial sites but of individual graves). Ian Morris also compiled a list of intensive survey projects including burial sites focusing on the Geometric and Archaic periods (1987, 159). Because my focus is on the Classical and Hellenistic periods, this list is not particularly relevant here.
7 Periodizations used in Table 1: PREH: Prehistoric; BA: Bronze Age; EIA: Early Iron Age; A: Archaic; C: Classical; HL: Hellenistic; R: Roman; MED: Medieval; EBYZ: Early Byzantine; EMOD: Early Modern; MOD: Modern. The 'possible burial sites' are labeled with a question mark. For Laconia: LRSP stands for Laconia Rural Sites Project (Cavanagh, Mee & James, 2005). On the Messenian Post-Mycenaean Sites: these sites are dated more specifically, but grouped here for convenience (see the register of sites in McDonald & Rapp 1972: 264-321).
8 Prieto & Carter 2011, 593. Criteria mentioned are: small surface area (4-100 m^2), concentrated and isolated scatter, ceramic vessel shapes and decoration consistent with grave goods or grave markers, findings of human bone, and presence of cremation ashes. In addition, the presence of tomb materials (stone slabs, rooftiles) is also noted.

Survey	Amount of sites with burials	Chronology (cf. footnote 7)	Reasons for identification
Keos	3	A-HL: 1 Site 17 A-R: 2 Site 24, 62	Rock cut graves or cover slabs High quality ceramic finds
Southern Argolid	16 (+5 possible)	BA: 2 (+1?) E16, G2, F26 EIA-A: 1 (+1?) B17, B77 C: 3 A16, A25, C41 C-HL: 2? B86, F55 R: 3 B19, C45, C11 MED?: 1? F53 MED-MOD: 1 B5 Multi-period: 6 A8, A21, A33, E9, E19, G34	Rock cut graves, visible cists, sarcophagi and steles Based on the ceramic assemblage Human bones Grave exposed in a bulldozer trench or scarp
Laconia	3	Laconia survey: 1 A120 HL LRSP: 2 LP5, LP1 A-HL; HL-R	Inscribed funerary stele Specific shapes: unguentarium, miniature, pithos Size of site Geophysical analysis: pits Tile grave exposed in gully wall
Berbati-Limnes	23	BA: 7 FS16, 18, 20, 419, 514, 515, 526 EIA-A: 3 FS7, 18, 402 C: 1 FS423 R: 8 FS403, 505, 507, 509, 513, 520, 521, SM13 EBYZ-MOD: 4 FS511, 519, 13, SM9	Chamber tombs, cists, cover slabs, rock cuttings Human bones Tiles and (well-preserved) fine wares Small scatters of material
Asea valley	9	C-R: S44 R: S42 HL-MED?: S22-23 LR-MED: Feature 4 MED-EMOD: S3-5-10, S18 HL/R: S40, Feature 7 Unclear date: Feature 8	Visible cists, rectangular slabs and rock cuttings Narrow concentrations of tiles, stones and bones: plunderings? Human bones A cremation burial: Dark patch with burnt bone under slab
Messenia	112	92: Prehistoric 20: Post-Mycenaean (cf. footnote 7).	Cists, sarcophagi, cover slabs, rock cut tombs, steles, tumuli and tholoi Human bones Bronze hydriai, statuettes, tripods, pins Many excavated burial sites visited
Pylos	25 (+13 possible)	Various periods (PREH-MOD), though many sites remain undated because of the scarcity of (datable) pottery.	Findings of human bones Rock cut graves, chamber tombs and tumuli Cist graves and cover slabs Tile concentrations Grave exposed in a bulldozer trench
Atene	15 (+5 possible)	PREH: 1? TH62 A-HL: 2 GA7, PH34 C: 8 (+3?) CH8, CH14, TH29, TH36, TH37, AN15, AN20, ME21, PH70, TH58, ME11 C-HL: 2 CH3, PH3 C-HL-R: 1 LE16 Unclear date: 2 (+1?) ME 19, ME20, CH38	In situ Grabterrassen and tumuli Fragments of funerary steles, sarcophagi and ostothecs Graves exposed in robber pits Black gloss and tiles
Methana	1 (+4 possible)	EIA: 1? MS11 C-R: 3? MS7, MS8, MS9 5th-6th CE: 1 MS22	Small site size Specific pottery shapes: miniature skyphoi Inscribed steles found nearby
Melos	1?	A: 1? Site 59	Specific shapes: skyphoi, relief pithos and decorated pottery Large size of the sherds and good preservation Small site size
Metaponto	197	The majority is dated between 625-25 BCE.	Small site size (4-100m2) Concentrated and isolated ceramic scatter Decorated pottery with funerary shapes Human bone Ashy residue of cremation Tomb materials (e.g. slabs) A distinctive kind of tile for the construction of tile graves

Table 1: Summary of 12 surveys in the Greek world with regards to burial data (table by author).

Figure 1: A cist grave in a scarp (Site A01, Ayios Konstantinos), The Pylos Regional Archaeological Project (courtesy of the Dept. of Classics, University of Cincinnati).

Another issue relating to chronology is the differential visibility of graves from different periods. In part, this is due to the kind of monuments erected for the remembrance of the dead. One can imagine that a tumulus is potentially more visible in the modern landscape than an entirely subsurface feature such as a tile grave. We also need to take into account that the number of people receiving a permanent grave marker will have varied through time.[9]

Two surveys should be mentioned here that have contributed significantly to our understanding of the phenomenon of rural burial: Hans Lohmann's Atene survey in Attica and the Metaponto survey in Italy by Joseph Carter

9 Oliver 2000; Bergemann 1997 (especially chapter 6); Nielsen et al. 1989.

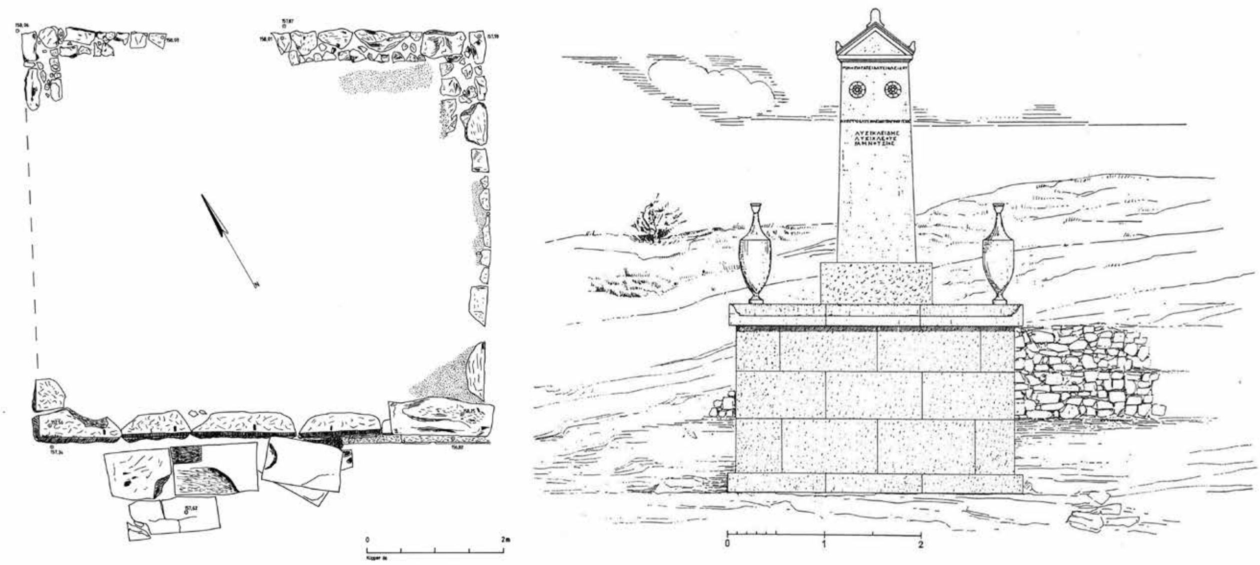

Figure 2: (left) Grave terrace PH3 (Lohmann 1993, 190); (right) Reconstruction of a grave site at Rhamnous (Petrakos 1991, 5; Petrakos 1999, 372, drawing by Manolia Skouloudi). Courtesies of Lohmann and the Archaeological Society at Athens.

and colleagues. The Atene survey stands out because of the clear spatial and chronological association between farms and burials.[10] In the exceptionally well-preserved study area, many farmsteads were found that were accompanied by burial places in the form of grave terraces. An example is illustrated in Figure 2. These terraces were still visible as stone foundations, where fragments of grave markers were found. In most cases, the pottery evidence was meagre. The few shapes that were distinguished are, however, consistent with a funerary function. Lohmann uses the presence of these burials to argue that the farm sites were owner-occupied.[11]

The second survey which has particularly enhanced our understanding of rural burial is the Metaponto survey in southern Italy.[12] What makes this survey so special is that apart from surveying rural cemeteries, four have also been excavated.[13] Thanks to this, the internal organization of the cemeteries could be studied, and the presence of burial groups or clusters was noted. Because the skeletal material was collected and well-studied here, it was furthermore possible to verify what had long been assumed: that the burial clusters indeed represent family groups.[14] In one of the small countryside cemeteries, Pizzica, it was even possible to establish the presence of two women who came from the city of Metaponto, while the men's origin was in the rural area.[15] This could mean that the two urban women had married men from the countryside and were buried with their new families there, suggesting a pattern of patrilocal residence.[16]

To conclude the review of surveys, we can say that generally, the criteria for identifying a site as a burial site are implicit, but in practice identical to those mentioned by Snodgrass, with the addition of the presence of bones. Furthermore, it is evident that most burial sites discovered in survey are exposed graves, Snodgrass' first category. They are visible due to disturbance by modern landscape alterations, and can be classified as chance finds. Clearly it is much more difficult to recognize a burial site by its artefactual footprint alone: the surface scatter.

Burials and land: written sources

What is the connection between burial sites and the status of the land? And why do Anthony Snodgrass and Hans Lohmann (amongst others) attach so much value to it?

Snodgrass states that people could only be buried in land they owned, so rural burial may be used to prove ownership of land. He supports this argument by referring to the Roman *Digest*.[17] In this compendium of Roman laws, it is explicitly stated that a burial can only occur in a plot of land that is the property of the people in charge of the

10 Lohmann 1993.
11 Lohmann 1992, 49-51; 1993, 185.
12 Carter & Prieto 2011.
13 Pantanello (Carter 1998), Sant'Angelo Vecchio (Silvestrelli & Edlund-Berry 2016), Saldone (Carter 1998), Pizzica (Carter & Prieto 2011).
14 Carter 1998, 143-162; Henneberg & Henneberg 1998, 163-165. Based on a combination of genetic, epigenetic and polyfactorial characteristics, combined with dating evidence and location of the skeleton in a burial plot.

15 Based on dental data, see Henneberg & Henneberg 2011, 1113-1114.
16 I would add that the burial plots reveal family ties between the individuals implying that we cannot discern any non-related household members, like slaves (contra Garland 1982, 132).
17 Snodgrass 1998, 37-38.

burial (thus not necessarily the deceased themselves). But interesting though this is, the applicability of a 6th century CE source[18] for Greece in the Classical and Hellenistic period is unclear.

Fortunately, there are two other written sources that can shed some light on the matter.

The first is by the 4th century BCE Greek statesman and orator Demosthenes.[19] In his *Orations* 55, he describes a boundary dispute between the son of Teisias and Kallikles. The latter filed a lawsuit because his land flooded, for which he accused his neighbor, the son of Teisias, as he had built a wall on his property diverting a stream onto Kallikles' land. In Demosthenes' speech, burials are cited as proof of private ownership of the land in which they occur. About non-private land, he says 'who would think of burying his own ancestors there? No one, I think, would do this [either].'[20] An additional remark shows that tombs were found on most private pieces of land: '[Do they not appear to you to testify expressly that it is a place full of trees,] and that it contains some tombs and other things which are to be found in most private pieces of land?'[21]

Based on these remarks, we can conclude that many private plots contained burials, and that it was apparently common to be buried on your own land. At the same time, burial on non-private land, like tenancy plots, will have been rare.[22] Presumably this was because such plots were held for limited amounts of time, beyond which tenants would not have access to the graves of their relatives anymore and not be able to tend them and perform the necessary rituals.[23]

Another kind of written evidence in which rural burial is mentioned are lease inscriptions. They record lease contracts of various plots of land, register the conditions and term of the tenancy agreement, the name of the tenant and the guarantor, the sum of the yearly payment and the consequences of not paying.[24] Two such contracts mention explicitly that it is forbidden to bury someone on the leased plot. The first is a 3rd century BCE inscription from the Greek town of Amos in the Rhodian Peraia, Asia Minor,[25] prohibiting the tenant from burying on the leased piece of land, penalty 100 drachmae and the removal of the burial. A second prohibition is found in a 4th century BCE lease inscription from the Greek colony of Herakleia Lucania in Southern Italy.[26]

These sources thus confirm Snodgrass' conviction that graves are indicative of the private status of the land in which they occur. Demosthenes attests to the frequency of burial on private land and writes that people would not think of burying their relatives on a leased plot, and the lease inscriptions show that burial was not allowed on leased land in these cases.

Excavated Boeotian burials

We will now turn to Boeotian archaeological evidence for rural graves. To be able to identify burials in survey, we need to know what burials of the Classical and Hellenistic periods look like. A large number have been excavated in Boeotia but to my knowledge, these are all urban necropoleis.[27] However, they present local or regional characteristics – for example shapes and kinds of pottery popular in Boeotia – enabling us to identify burial sites also in rural survey.

For the Classical period, the preferred vessels in Boeotian graves were clearly the palmette cup and kantharos. The former is found almost exclusively in funerary contexts.[28] It is a local product that seems to have been acquired specifically for deposition in graves. The kantharos occurs also in domestic contexts, but the high-stemmed, over-sized ones are typical for graves. While the palmette cup and kantharos serve as convenient markers for 5th and 4th century BCE graves, from the 3rd century BCE onwards the picture is less clear. The introduction of unguentaria, bowls and lamps in graves, as well as an increase in the presence of plain wares do not improve their visibility. Furthermore, there seems to be more regional variation within Boeotia with regard to preferred funerary shapes.[29] However, a narrow functional concentration containing unguentaria, bowls and lamps should be a signal for Hellenistic graves.

The recently investigated cemeteries of the city of Thespiae can now be added to the list of excavated

18 Roberts 2007, 394-395.

19 Also discussed by Osborne (1985), Roy (1988) and Langdon (1991).

20 Dem. 55.14, trans. A.T. Murray 1939. Loeb.

21 Dem. 55.15, trans. A.T. Murray 1939. Loeb.

22 Non-private land includes land of the poleis (public land) and land owned and leased by sanctuaries (sacred land). Such plots could be leased to individual tenants. Private land could also be leased, but since such agreements were not registered by an official authority we know much less about private tenancy (see Osborne 1988).

23 Kurtz & Boardman 1971, 147-148.

24 Lease inscriptions from the Greek world are neatly composed in Pernin 2014.

25 IG XVI, 645; Fraser & Bean 1954 (text 8, line 8-10); Pernin 2014 (text 255); Osborne 1987, 43.

26 This inscription (SEG 14, 683) is not entirely unequivocal and not all agree on this reading (like Pernin 2014, 465, see note 10). But Fraser & Bean (1954, 17) and Prieto & Carter (2011, 592, footnote 6) interpret it as a prohibition of burial on the leased plot.

27 E.g. the cemetery of Rhitsona (Ure 1927), Livadia (Andreiomenou 2001), Thebes (Charami 2012), Tanagra (Andreiomenou 2007), Akraiphnion (Andreiomenou 1994 & 2001) and Haliartos (Faraklas 1967a & b; Aravantinos 1994 & 1995).

28 Heymans 2013, 237-238. Only four non-cemetery find locations are mentioned.

29 Lamps, for example, are very frequent in the Hellenistic graves from Akraiphnion, whereas they occur only in very small numbers in the contemporaneous graves of Thebes (Charami 2012, 210).

cemeteries.[30] Over 60 graves were excavated (Archaic to Roman in date), including cist graves, tile graves, shaft graves, pyres and pot burials. Pottery included kantharoi and palmette cups, but also lekythoi, unguentaria, skyphoi and miniatures, as well as amphorae and beehives used as burial containers for children.[31]

Another welcome addition to the excavated cemetery record in Boeotia is a burial ground close to Thebes, discovered in 2014.[32] It is especially interesting because it is not a city cemetery. The excavators presume that it belonged to a secondary center in the polis, probably a village.[33] The burial ground was partly excavated, due to road work, and six graves were encountered, all Classical (four pyres and two tile-roofed graves). The excavators note that the pyre graves were more richly furnished than the tile graves, containing not only the usual black gloss Boeotian kantharoi, palmette cups and black figure vessels, but also red figure lekythoi (one per grave), suggesting contact with Athens or local availability of high-quality lekythoi.[34]

Neither excavation has yet been published in full, so they can only offer us impressions of Thespian and rural burial culture. In the near future, however, it should become possible to compare the surveyed parts of the Thespian city cemetery with the excavated parts. The presumed village-cemetery shows that graves in such settings could match city cemeteries in terms of relative wealth – and even surpass them.

Thespian burials in the Boeotia Project

With the excavated Boeotian graves in mind, we can start to assess the data from the Bradford-Cambridge Boeotia Project, directed by John Bintliff and Anthony Snodgrass.[35] Burial sites have been found in the survey area, either in the form of exposed graves or manifested as surface scatters. The remainder of this paper will be devoted to the burial sites discovered in the polis of Thespiae, what these tell us about the Thespian hinterland and how we can combine the survey evidence with inscriptions.

To start with an example of a surface scatter, on the left in Figure 3, the material from site PP11 is displayed. This is a small, concentrated scatter covering 200 m². The sample from this site contains 134 finds, all of which Classical-Hellenistic, with a few intrusions of modern material. Clearly, this is not a common domestic assemblage. The preservation of the material, as well as the proportion of black gloss pottery, the presence of black figure wares, palmette cups and kantharoi are reminiscent of graves excavated in Boeotia. The presence of tiles at the site indicates that the cemetery may have contained tile graves. That the site was not surrounded by a halo is a further indication that it was not a domestic site.

At the other end of the burial spectrum is site PP30, depicted on the right in Figure 3. This was a disturbed tile grave discovered in the field, so it belongs to the category of exposed graves. It was so small that no measurements were taken. A tile fragment, the base of a black gloss bowl and a weight of some sort is all that was found here. Possibly the grave had been looted, but it is also possible that it never contained much goods. If the latter is indeed the case, we have been fortunate to find it at all – if there had been no indication of disturbances, it would surely have been missed.

Quite a few burial sites have been encountered in the Boeotia Survey (Figure 4). Six burial sites have been discovered within a 1 km radius from the city of Thespiae: THS11, THS15, LSE4 immediately south of the city and THS1, THS3, THW CEM (south)west of it (these would have been city cemeteries). Site THW2 to the west probably also belongs to the city cemetery as it is located alongside one of the major roads leading out of the city. Three other burial sites have been found north of Thespiae, TE3, PP11 and PP30. A contemporary farmstead has been found close to PP30, making it likely that this was the burial ground belonging to that farm, rather than to the city. The cemetery at site TE3 is close to what was probably also a farmstead, although the identification is not entirely certain. The most clearly identified rural cemetery is PP11. It is surrounded by farmstead sites, and it is difficult to say to which of the farmsteads the cemetery might have belonged, but the potential farmstead PP17 is a good candidate considering its proximity. In another part of the survey area, site VM28, located at the western end of the Valley of the Muses, appears to be a burial site too, possibly belonging to farmstead site VM29. Lastly there is the cemetery at site VM5, northeast of the village of Askra and probably belonging to it.

The sites display all criteria for burial sites mentioned by Snodgrass. The sites are characterized by their small size, the absence of a site halo and the good preservation of the material. The pottery assemblage contains a large share of black gloss and decorated pottery is present as well. It also features typical funerary shapes, like kantharoi and palmette cups.

The diagrams in Figure 5 illustrate the assemblage composition for six cemetery sites for which the collected sample is large enough. At the top, three sites are illustrated which were part of the city cemetery (THS11, LSE4 and THS15). Below, the rural assemblage of PP11 is displayed. Unfortunately, the assemblages of PP30, TE3 and VM28 are too small to be similarly displayed, so for reference I have

30 This was a rescue excavation for the widening of a road between 2011 and 2014 (Charami 2014).

31 Oikonomou 2014.

32 Kourkouti 2014.

33 Kourkouti 2014, 35. If it belonged to a village, the cemetery would not be 'rural' in Snodgrass' definition.

34 Kourkouti 2014, 35.

35 Bintliff 1996; Bintliff, Howard & Snodgrass 2007; Bintliff et al. 2017.

Figure 3: Ceramics from Site PP11 on the left and Site PP30 on the right (photos by the author).

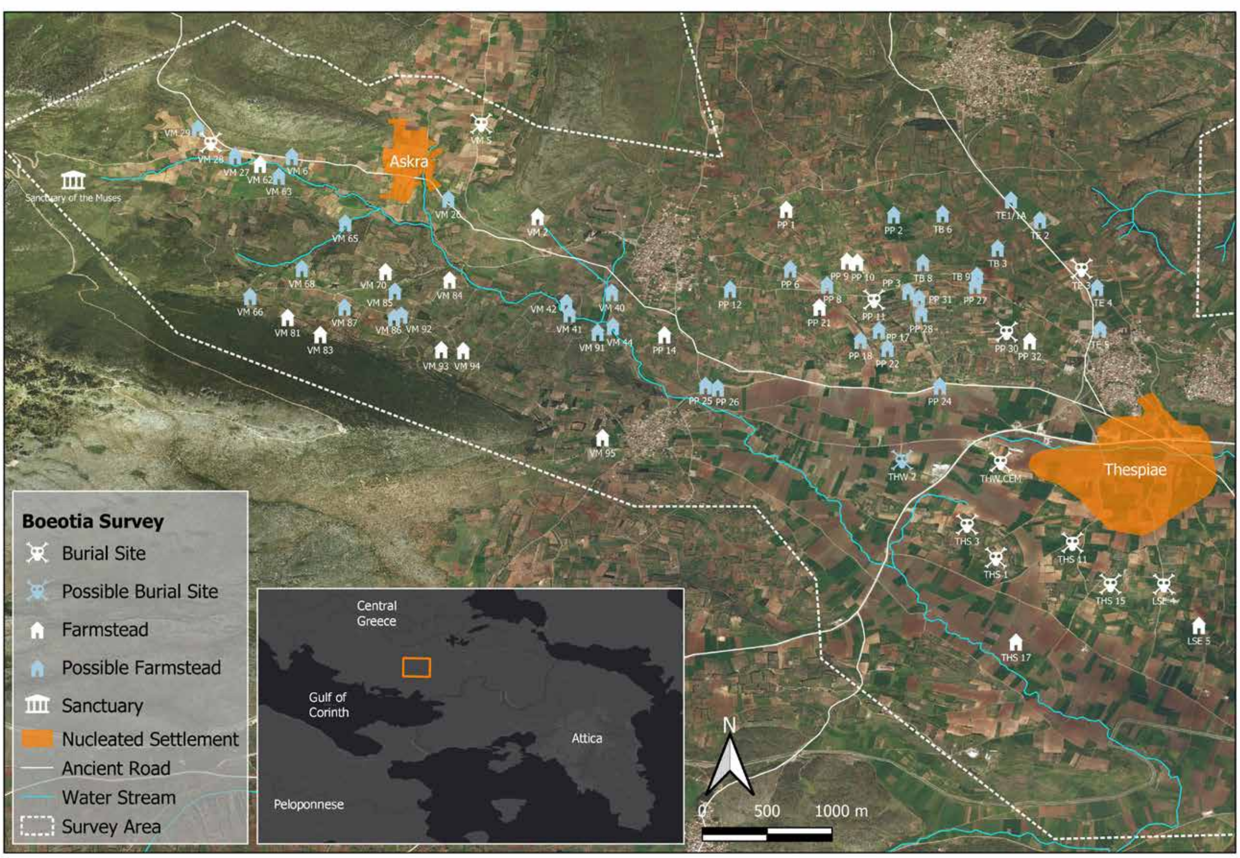

Figure 4: Survey in the polis of Thespiae. The Valley of the Muses is south of Askra (maps by the author, basemaps Bing Satellite and ESRI Gray).

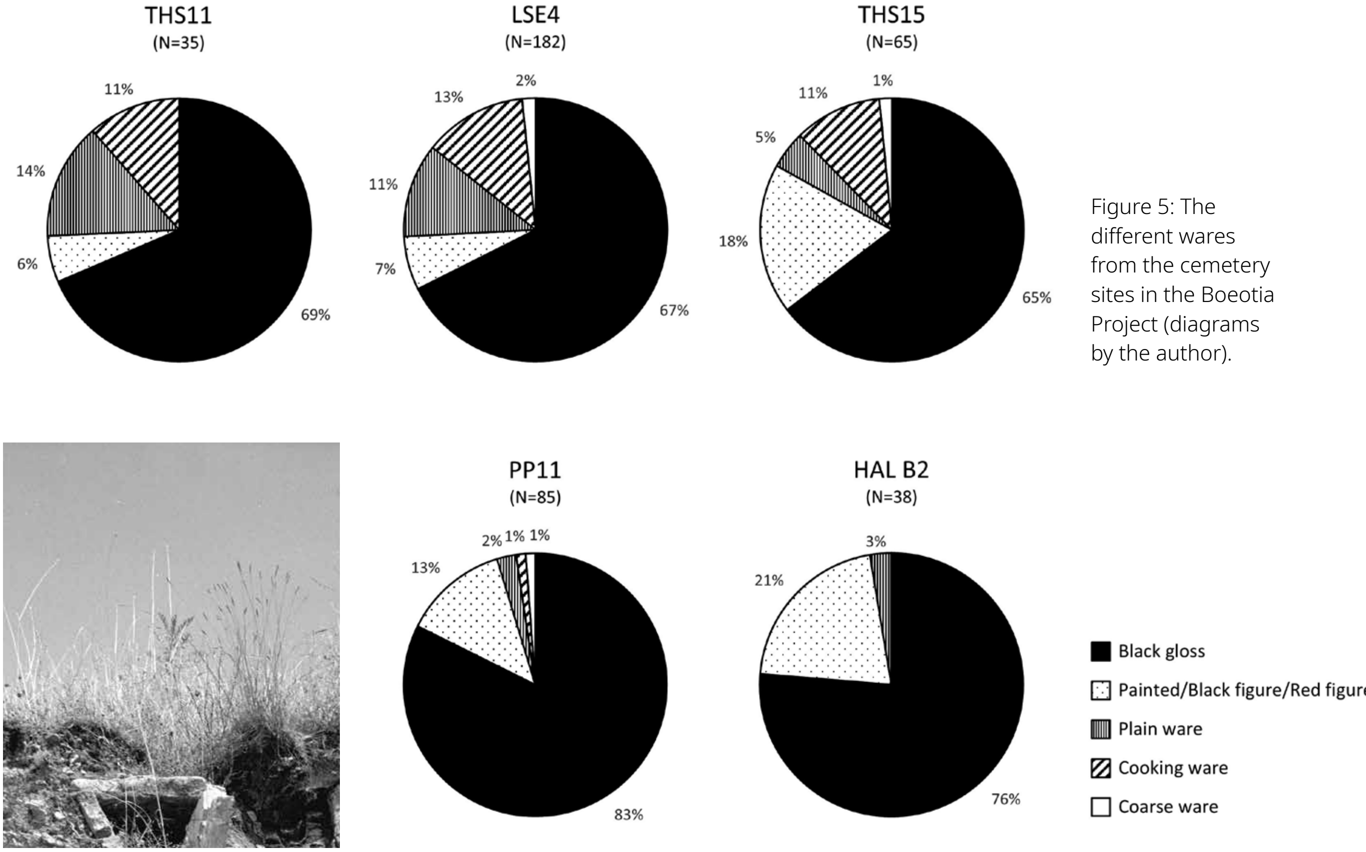

Figure 5: The different wares from the cemetery sites in the Boeotia Project (diagrams by the author).

added another rural cemetery from the neighboring polis of Haliartos (site HAL B2). The assemblage from cemetery VM5, belonging to Askra, is displayed too, and can be classified as semi-urban.

The majority of the assemblages from all these cemetery sites consists of fine wares: black gloss and painted pottery. Plain and cooking wares occur more commonly in the city cemeteries and are virtually absent at the rural cemeteries and the semi-urban burial ground. Apart from that, there is no clear difference in the cemetery pottery assemblages.

Turning to the map, we can assess what the rural burials tell us about the organization of the lived countryside of Thespiae. The presence of a city cemetery was already expected; north of the town the farms and burials show that land was apparently private property, where the owners were buried. A striking contrast appears with the Valley of the Muses area close to Askra. Here, the evidence for farmsteads is in fact stronger, but only two burial sites have been located in the survey. One of them, site VM5, is in all likelihood the cemetery of Askra. The other, site VM28, might belong to nearby farmstead VM29. However, for the remaining 25 farmstead sites, no graves have so far been attested.

Arguments ex silentio being problematic, we should consider the possibility of invisible graves, either so poorly furnished that we do not detect them, or still under the ground, undisturbed. We should however also not exclude the possibility that there were never any rural burials associated with those farms in the valley of the Muses. That the household members were not buried there indicates that the land might not have been their private property: bearing in mind the inscriptions we saw earlier, these may have been tenancies.

An additional source of information that points in the same direction are the 3rd century BCE lease inscriptions from Thespiae.[36] There are eight of them, three of which refer to land of the Muses.[37] The Muses were worshipped in the Panhellenic sanctuary which adjoins the valley (see Figure 4). Their sacred land was leased out in plots for terms between five and 40 years. It is peculiar that it is only in the leases of land belonging to the Muses that the presence of buildings is mentioned, and in no other Thespian lease inscription. Buildings are in fact mentioned in each of the leases regarding the land of the Muses. Perhaps these were the only settled tenancy plots in Thespiae?

Judging by the prices, it seems that at least 130 hectares belonged to the Muses and were leased.[38] It does not seem an unreasonable suggestion that we are seeing these tenancy farms in the survey of the Valley of the Muses.

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36 Pernin 2014, 101-142.

37 Pernin 2014, texts 24, 25 and 27.

38 This calculation is based on a remark in one of the Thespian lease contracts (text 27 in Pernin 2014, line 25-26), that one plethron (c. 900 m^2) costs two drachmae to rent per year. Although reasoning from this premise has its problems, it does give an indication of the order of magnitude of the landholding of the Muses. The total rental figure for land belonging to the Muses is 2891 drachmae, but this should be regarded as a minimum value.

Conclusion

Anthony Snodgrass pointed out the value of studying burial sites in archaeological survey already in 1998. Two decades later, however, burial sites and especially the relation between burial sites and settlements seem still not to have received the attention they deserve. Although not all landscapes preserve burial sites in the form of built grave terraces, such as in the exceptional case of Lohmann's Atene survey, it is worth considering the reasons why burial sites are exposed or remain hidden from view.

The review of survey projects presented here has made it clear that most burial sites found in surveys belong to Snodgrass' category of exposed graves. The problem with such sites is that they are chance finds, and we should not expect meaningful patterning from them. The examples from the Boeotia Survey show that besides exposed graves, surface scatters can also be identified as burial sites. This means that by paying more attention to the finds and pottery assemblages and their characteristics, there is a potential to detect more burial sites.

It is important, however, to compare survey assemblages with those from known (excavated) local cemeteries, because typical cemetery pottery (shapes, decoration) varies across time and space. Unfortunately, local burial records all too often consist solely of city necropoleis, and more (published) rural cemeteries would be a welcome addition to our current state of knowledge.

Written documents have given us two important bits of information concerning the relation between graves and the status of the land in which they occur. These are that that graves are indicative of the private status of the land and that most private pieces of land contained burials, but also that burial on leased land was not allowed and not desired.

This information is crucial for linking the cemetery landscape with the settled landscape, for example in the territory of the city of Thespiae. Here, 12 burial grounds have come to light through survey – some disturbed graves, but mostly scatters of cemetery material. Some of these are undoubtedly parts of an extensive city cemetery, while others belong to the rural landscape. Since burials occur in the area north of Thespiae, we may conclude that this included privately owned land, presumably owner-occupied farmsteads. In contrast, in the Valley of the Muses, which is full of farm remains, only one single rural burial ground was found, apart from the cemetery of Askra. It is thus possible that many of the farmsteads here were tenant farms. The evidence from land leases points in the same direction.

Studying the cemetery landscape by combining survey evidence with evidence from excavations and written sources thus allows us to explore settlement in the Thespian landscape and analyze the landscape in terms of landholding patterns, contributing to our understanding of the ancient farmstead and the countryside.

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FIELDS, SHERDS AND SCHOLARS

This book is a significant contribution to the field of survey pottery studies, which is not frequently theorised, and could also serve as a guide and provide inspiration to archaeologists designing their own survey projects and methodologies.

Landscape archaeology has heavily relied on pedestrian survey as a field method for more than half a century. In most field projects, archaeological ceramics constitute the lion's share among the finds and the amount of collected sherds is overwhelming. Survey ceramics provide the basis for understanding human activity in a landscape, and sherds serve as convenient chronological markers for the archaeological sites discovered in field projects. However, how this pottery is collected and studied determines the possibilities for using the sherds as a source material. Not only the collection practices, but also the process and practicalities of ceramic analysis are rarely made explicit, even though the archaeological interpretations of human activity in the landscape strongly rely on it.

Most contributions in this volume provide an insight in collection, processing and interpretation practices in a specific survey project, and we hope this transparency is inspiring and contributes to a better understanding of surface ceramics as a basis for historical interpretations. Three themes run as a red thread through the contributions in this book: first of all transparency in ceramic collecting, processing and interpretation, secondly, improving diagnosticity, and thirdly, expanding the interpretive potential of survey ceramics.

The chapters are geographically oriented towards Greece, Italy and Spain, three countries in which archaeological surface survey is widely practised. Chronologically, the contributions range from the Final Neolithic to the Medieval period.

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