AN ANALYSIS OF SHAPE AND DECORATION IN MYCENAEAN POTTERY FROM LATE BRONZE AGE CYPRUS

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A thesis submitted for the degree of
Master of Arts
At the University of Otago

2018
ABSTRACT

Mycenaean ceramics have been found in sites across the Eastern Mediterranean, however an impressive amount of this pottery has been found on the island of Cyprus, which once lay in the midst of important Mycenaean trading routes. Due to the large number of Cypriot excavations by different international and local schools, Mycenaean pottery from Cyprus can now be found in numerous locations around the world. It is therefore a struggle to perform any kind of systematic analysis or sourcing study, although many pots have been recorded and analysed by museums and are available to view photographically. This thesis uses an approach that draws on that photographic record. It uses both shape and decoration to expand the pool of resources that can be used to further divide and analyse groups of pottery. Sixty-seven pots were divided into groups of the same motif choice, which were then further subdivided by running each group’s shape data through a hierarchical clustering analysis. The analysis showed that pots in each motif group clustered into distinct shapes. Further analysis revealed that some shape groups shared a close relationship with pots from other motif groups. Two distinct group combinations were identified from the dataset, and these were interpreted as representing the output of at least two individuals or workshops.
ACKNOWLEDGEMENTS

First and foremost, I would like to thank my supervisors, Richard Walter and Dimitri Anson, of the Department of Anthropology and Archaeology at the University of Otago, for their unwavering support and guidance throughout the course of my thesis.

I’d like to extend a special thank you to Mr. Tim Jowett, from the Department of Mathematics and Statistics at the University of Otago, for his considerable help and advice regarding the statistical analyses undertaken in this thesis.

This thesis would not have been of the same quality without the support of my editorial team – thanks to Lori, Helen, Jamie, Alana, and Lucy for reading through my work and providing valuable feedback, and to Jessie for her early suggestions regarding my statistics.

Thanks to my coffee girls, Jamie, Lucy and Sam, and to my support team, Claire, Simon, Craig and Katie. Without all of you I would have spent more time struggling and less time in caffeine-fuelled creativity.

Last but not least, I would like to thank my family for their unconditional support emotionally and financially. Thank you for your unwavering belief in my ability to complete this thesis, and for the encouragement you gave throughout the course of this work.
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CHAPTER ONE

1.1 INTRODUCTION

Mycenaean ceramics can be found in almost every corner of the Aegean, sometimes even further abroad. What is typically referred to as "Mycenaean-ware" begins to appear in the early sixteenth century BCE, but does not become prominent until the fifteenth century BCE, when dependence on Minoan styles ceases entirely (Karageorghis, 1982, p. 77). The Mycenaean era, also referred to as the Late Helladic era, encompasses the Late Bronze Age in the Aegean, ca. 1600 – ca. 1050 BCE. Mycenaean Greece did not become a prominent power until ca. 1400 BCE, when Crete was struck by natural disaster; until this point, the Aegean was primarily under Minoan rule (Karageorghis, 1982, p. 78). However, either during or following this period of upheaval Mycenaean Greece replaced Crete as the leading authority; gaining significant political, military, and cultural power. Following their domination of the Aegean, Mycenaean Greece replaced Minoan Crete in widespread foreign trade (Karageorghis, 1968, p. 40). Their influence can be seen through commercial items, most significantly pottery, from as early as the sixteenth century until the end of the Mycenaean era (Wijngaarden, 2002).

Figure 1.1 Map of the Eastern Mediterranean
The island of Cyprus holds a strategic position in the Eastern Mediterranean, and from the Bronze Age onwards found itself in the midst of important trade routes between the Aegean and the Near East (Karageorghis, 1982, p. 11). Mycenaean trade routes crossing the Aegean into Turkey, included the island of Cyprus; this is the most probable reason that so many Mycenaean ceramics have been identified in archaeological excavations on Cyprus. It therefore stands to reason that the archaeological evidence of trade and warfare on Cyprus presents a reflection of the events of neighbouring lands, especially Mycenaean Greece. As well as acting as the gateway for trade between the two cultural areas, Cyprus was an active participant, most prominently with the successful production and export of copper (Knapp, 2013, p. 348).

1.2 THE PROBLEM

It is generally agreed that early Mycenaean pottery found on Cyprus was most likely imported, while a certain amount of later material was made locally. It is the extensive collection of material between these two limits, encompassing the fourteenth and thirteenth centuries BCE, which sparked a lasting debate over the origin of the pottery. Were copies of Mycenaean-style pottery being made locally, or were the ceramics being imported from elsewhere? Despite initial arguments that the pottery was too abundant and widespread to have been imported, compositional analysis and indications of selective representation suggest that most of the pottery was being manufactured and imported from the Peloponnese (Catling & Millett, 1965, pp. 212, 221; Karageorghis, 1968, p. 61; Wijngaarden, 2008, p. 129).

Though contentious, this topic has been widely addressed. A central issue in this debate, however, is the availability of material to be analysed. Due to the number of uncoordinated Cypriot excavations by different international and local schools, Mycenaean pottery from Cyprus can now be found in numerous locations around the world. It is therefore a struggle to perform any kind of systematic analysis or sourcing study – however many pots have been recorded and analysed by museums and collections and are available to view photographically. In many cases this has provided the necessary information for attribution studies, which
can potentially aid sourcing projects by dividing the pool of ceramics into smaller groups. It is this area that the research of this thesis hopes to expand upon; by developing an approach to expand the pool of resources that can be used to further divide and analyse these groups of pottery, thus contributing to the debate around import versus local imitations of Mycenaean pottery, as well as the ongoing investigations into the origin of these pots across the mainland of Greece.

1.2.1 PROVENANCE

In this expanding field of academic work, applying attribution studies to prehistoric material has become both a source of contention and of optimism. The immediate purpose of studying attributions is to identify the original creator of the material. This thesis argues that the process of attribution studies is tantamount to provenance studies undertaken through geochemical analyses. Using a geochemical approach, it is possible to broadly identify the earliest known geographical locations of an object. However, using analyses of decoration and shape it is also possible, to a certain extent, to identify the individual hand, or to identify works produced within the same workshop. This thesis considers both approaches to be within the realm of provenance studies. The study of style and attribution will be briefly introduced below, while the discussion of provenance will continue in Chapter Three.

The earliest example of attribution studies was the study of human ears in Renaissance paintings, undertaken by Giovanni Morelli in the late 19th century (Morelli, 1892-3). The first attribution study of prehistoric art was most likely carried out by Sir John Beazley almost a century later, through the analysis of red-figure vases (Morris, 1993, p. 42). In the case of Mycenaean pottery, it is very difficult, perhaps impossible, to identify a single painter or potter. This may be in part due to the extensive but fragmented nature of Mycenaean pottery but also due to the type of decoration found on Mycenaean vessels, which is often highly stylised. Morris (1993, p. 44) notes that attribution studies in this area have thus far shown a preference for pictorial elements, such as depictions of humans and animals, which she attributes to the relative familiarity of such designs. The issue
with such a focus on pictorial pottery is that it severely limits the sample size, especially for complete vessels. Much more common on Mycenaean vessels are motifs, or highly stylised plant or animal life. Nevertheless, attribution studies of prehistoric pottery have been used to expand upon geochemical sourcing studies, providing a method which allows the researcher to narrow a large, homogenous group of pottery to its smallest denomination. The purpose of this thesis is to carry out a provenance study using both shape and decorative elements, expanding our ability to identify clusters and patterns of variation within larger groups of Mycenaean pottery. Before further discussing this, I must first review the chronological and typological standing of this research, due to considerable variation in the current literature.

1.3 Chronology and Discussion for Naming of Time Periods

Figure 1.2 shows the chronology of Cyprus and Greece during the Late Bronze Age. These chronologies are based on pottery sherds that have been dated both comparatively and using scientific analyses, such as radiocarbon dating (Karageorghis, 1982, p. 9). As the figure indicates, the Cypriot and Helladic time periods are largely dissimilar, with the exception of Late Cypriot IIB and Late Helladic IIIA:2. This change can most likely be attributed to the shift in power in Greece, and the consequent expansion of Mycenaean influence between the two regions.

There has been some discussion on what terminology is appropriate to use when referring to Mycenaean pottery from the period between c.1500-1200 BCE (Daniel, 1943; Furumark, 1941; Lacy, 1967). The term ‘Helladic’ refers to three Greek periods: Early Helladic (c.3000-1900 BCE), Middle Helladic (c.1900-1580 BCE), and Late Helladic (c.1580-1050 BCE). Many choose to refer to this final period as ‘Mycenaean.’ Categorising artefacts as ‘Helladic’ can imply exclusivity to Greece, however the authority and culture of Mycenaean Greece was both wide and influential, and a significant portion of Mycenaean pottery was actually produced beyond the borders of Greece (Furumark, 1941, p. 9; Lacy, 1967, p. 144).
For the purpose of this thesis I will be using the term 'Mycenaean' instead of 'Late Helladic,' (although period distinctions will remain the same, i.e. LHIIIA simply becomes Myc. IIIA), as I am dealing only with ceramics from the Mycenaean era. Unless Cyprus is the sole point of discussion, I will use 'Mycenaean' to refer to the same period of history on Cyprus, otherwise 'Late Cypriote' or 'LC' will be used. When discussing a specific period within the Mycenaean era (1500-1200 BCE) the abbreviation 'Myc.' will be used, for example, Myc. IIIA:2. In referring to the Bronze Age more generally, I will be using the modern divisions of the 'Protohistoric Bronze Age' and the 'Prehistoric Bronze Age', as indicated by Knapp (2013). Often pottery typologies are used to create chronologies such as these, although this use of typology is not without risk. The following section will outline where this thesis fits within the wider framework of typology.
Figure 1.2 Chronology of different time periods, including the Protohistoric Bronze Age (KNAPP, 2013, P. 27), Late Cypriote, and Late Helladic timelines (Karageorghis, 1982, p. 9; Mountjoy, 1993, p. 4)
1.4 TYPOLOGICAL APPROACH OF THE THESIS

As one of the functions of this thesis is to lay the foundations for a new typology, it is important that I briefly discuss typologies and the current typological work that has been applied to Mycenaean pottery.

A typology is created to organise datasets into an assumed order of development, and to build upon information available from other resources (Bahn, 2002, p. 84; Furumark, 1941, p. 5). These datasets, or types, are classified and divided according to specific criteria which remain constant across the typology. The classification of ancient pottery is usually based upon aspects of shape, decoration, and material. This approach holds potential for the unintentional inclusion of trends, for example, isolated areas of change, or the revival of older styles, placing them incorrectly in the chronological sequence (Furumark, 1941, p. 6). Typologies are therefore generally used alongside more weighted evidence, such as stratigraphy, absolute dating, sourcing studies and comparative analysis (Bahn, 2002, p. 84; Clark, 1947, pp. 134-137; Furumark, 1941, p. 5).

The most complete and comprehensive study of the shape and decoration of Mycenaean pottery was published by Arne Furumark in 1941, with 336 identified types, and well over 400 ceramic examples. Furumark claimed that Mycenaean pottery could, to a certain extent, avoid the previously mentioned shortcomings, because each specimen has several criteria and can easily fit into multiple categories, which can be compared against one another to reduce the risk of including flawed information (Furumark, 1941, p. 5). Furumark presents two typological series, the first based on shape, the second based on style, including motifs and pictorial images (Furumark, 1941, pp. 6, 16). His classification of three-handled Mycenaean pots is of particular interest to this thesis and are the focal point of this investigation. These three-handled pots fit broadly within a conical-piriform shape-spectrum from the Myc. IIA:2 period, however Furumark notes that some of the shapes can be identified as early as Myc. IIB (Furumark, 1941, p. 22).

Furumark's work is extensive and focuses on the chronological ordering of the different styles and shapes of Mycenaean pottery. This thesis will be using many
of the same elements of shape and style, although the methodology will vary. The typology created by this research will take into account chronological information where possible but will focus more on using shape and style in order to identify the smallest analytical unit.

1.5 MYCENAEN HISTORY AND AN INTRODUCTION TO POTS

1.5.1 MINOAN CULTURAL DOMINATION

Historians and archaeologists have used architecture, art, and absolute dating to create a chronology that can be separated into distinct time periods. These studies illustrate a shift in the artistic style of Mycenaean pottery during the Late Bronze Age. Lacy (1967, p. 166) suggests that the Mycenaean era can be organised into two phases: the first incorporates Myc. I and Myc. II and is a time of Minoan “cultural domination,” the second ranges from Myc. III A to Myc. IIIC and can be considered a time of “independent development.” Concordantly, earlier pictorial and non-pictorial designs show a strong Minoan influence, while Mycenaean pottery after the fall of Knossos begins to show new ceramic styles and motifs that are either derived from or are completely separate to Minoan pottery (Mountjoy, 1993, p. 31). Many of the motifs, especially those with Minoan origins, are considered to degrade in quality over time. Following the end of the palatial period (LH IIIB:1), there is less variation seen in the style and motifs found on Mycenaean pottery in the Aegean and Cyprus (Wijngaarden, 2008, p. 129).

1.5.2 END OF LBA ON MYCENAEAN AND CYPRUS

The Late Bronze Age in the Aegean is characterised by Mycenaean trade and expansion by warfare. This suggested period of increased warfare is corroborated by the number of architectural elements such as defensive walls and palaces, being constructed in major cities at this time. It is generally agreed that it was during Myc. IIIB that Greece was heavily involved in warfare with Troy, which historical texts suggest ended around 1200 BCE with the destruction of the Trojan city. The end of Myc. IIIB is marked with a trail of destruction and
the end of the palatial period. Although it is unclear whether this was due to natural causes, the lack of recovery and rebuilding in some major centres has led to the suspicion of warfare (Bennet, 2013; Karageorghis, 1982, p. 254). Damaged remains and the expansion of fortifications suggest conflict, although it is difficult to ascertain whether this came from within the settlement or from external sources (Bennet, 2013, p. 253).

Similarly, the end of Late Cypriote IIC/beginning of LC IIIA saw a wave of destruction throughout Cyprus (Karageorghis, 1982; Steel, 2014, p. 586). Many sites were abandoned, such as Kalavasos Ayios Dhimitrios, Maroni Vournes, and Morphou Toumba tou Skourou, while other sites, such as Kition, Enkomi, and Kourion, continue to show evidence of occupation throughout LC IIIA (Karageorghis, 1982, p. 112). The rest of Late Cypriote IIIA is marked by a series of cultural changes, which some argue are the result of Mycenaean refugees settling on Cyprus (Steel, 2014, p. 586).

1.6 RESEARCH AIMS AND QUESTIONS

Despite the interest in carrying out provenance studies on Mycenaean ceramics, research thus far has focused on applying this to pictorial pottery. The aim of this thesis is to expand our ability to identify groupings and patterns of variation through the use of provenance studies, thereby reducing the amount of pottery that one must have access to in order to perform any kind of sourcing study on Mycenaean ceramics.

This research will create a more accurate and inclusive methodology that focuses on the shape and proportion of pots, and possible correlations between shape and non-pictorial decoration. The purpose of this research is to provide the framework for a new typology, which will allow researchers the opportunity to incorporate a wider variety of information in their study.

In this thesis I will examine the shape and decoration of Myc. IIIA:2 three-handled piriform pots. My primary interest is to determine whether there is any correlation between shape and decoration, and, if so, what this might mean. In doing this I will address the following questions:
1. Are three-handled pots a homogenous category, or can we identify groups on the basis of shape?

2. If so, do these groups correlate in any way with decoration?

3. How do the results of this research correlate with Furumark's shape and style sub-groups?

4. How can we interpret these groupings? Do correlations between shape and decoration indicate the hand of an individual or the output of a workshop?

The scope of this investigation is focussed on piriform shaped vessels with three handles, this due to their relative abundance and the number of complete vessels. Many of the pots in this thesis have been previously assigned to a specific period of time, usually around Myc. III. A significant portion of Cypriote Mycenaean-ware is suggested to belong to Myc. IIIA:2 and Myc. IIIB:1.

This investigation utilises a computer programme known as the ‘Potometer,’ which provides the user with the proportional and dimensional data of the pot, requiring only a photograph. This allows the user a broader scope of resources than are usually available for this type of analysis. The purpose is to separate the pots into groups that have similar features of shape and size. An additional step in this process is to compare correlations between shape and motif patterns; these results will then be used to suggest the presence of multiple workshop origins.

Although attribution studies have been used for prehistoric Mycenaean pottery, prior studies have focussed on pictorial pottery as previously mentioned, some examples including Benson (1961), Immerwahr (1956), and Stubbings (1951). The decorated pottery used for this thesis features non-pictorial motifs, and the study will focus on shape, motif, and other decorative elements. This work will approach the issue from an archaeological point of view, using a more rigorous typological approach.
1.7 CHAPTERS IN THIS WORK

This chapter has introduced several concepts, as well as briefly introducing the history of Late Bronze Age Cyprus and Mycenaean Greece, Mycenaean pottery on Cyprus, and the purpose of this thesis.

Chapter Two will focus on Cyprus, outlining its history, the major archaeological work that has taken place on the island, as well as historical overviews of the Cypriot sites from which the pottery for this dataset originated.

Chapter Three will follow on from the historical background by providing an overview of applicable work that has been undertaken in the field of provenance of Mycenaean pottery. This will include perspectives from Archaeology, Art History and Classical Archaeology, placing this thesis and its contributions within the context of these studies.

Chapter Four will explain the methodology of the experimental portion of the thesis, including data collection, programmes used in the analysis, an overview of the statistical analyses undertaken, and any problems that were encountered and resolved during this process.

In Chapter Five the results of the statistical and observational analysis will be given. Chapter Six will discuss these results by answering the questions from section 1.6, providing relevant interpretations and bringing this work to a conclusion.
2.1 INTRODUCTION

The purpose of this chapter is to give contextual background information concerning the prehistory of Cyprus. To this end, the chapter has been divided into three sections. The first (section 2.2), a general history of Cyprus, will provide temporal and geographical context for the island, especially concerning the impact and absorption of influences from the surrounding Mediterranean. The second (section 2.3) will discuss the background of archaeology in Cyprus, including influential figures, groups, and excavations, as well as major historical events and laws which influenced the archaeology of Cyprus. The aim of this section is to provide some context for the confusing mosaic of information available to researchers today, and to highlight the incomplete nature of archaeology on the island following the Turkish invasion of 1974. The third section (2.4) will provide specific information for a selection of sites considered to be important or dominant during the Late Bronze Age.

2.2 GENERAL ISLAND HISTORY

Over the last twenty to thirty years the focus of Cypriot archaeology has shifted from a study of the island as a reflection of greater civilisations, to an understanding of the agency Cyprus played in its own history, and the political and economic influence they held, within the Mediterranean trade network (Knapp, 2013, p. 1). It is important to understand the history of Cyprus in order to understand why such a large number of Mycenaean ceramics survived there in such large quantities. The location of Cyprus and the nature of its archaeological remains, have provided a relatively clear picture of events and trends that were occurring both on and away from the island at the same time.

The earliest occupation of Cyprus is well debated and has, in recent years, been subject to a significant overview. Until archaeological discoveries during the late 1980-1990’s, the earliest evidence of a human presence on Cyprus was assumed
to have been during the Neolithic (Karageorghis, 1968, p. 34; Simmons, 2012, p. 86). However, radiocarbon evidence from coastal sites such as Akrotiri Aetokremnos, and the Nissi Beach sites Akamas Apros and Alimman, indicate that the earliest human presence on Cyprus can be traced back at least as far as 11,000 – 9,000 BCE (Knapp, 2010, pp. 80-81). This section of brief general history will therefore begin during the Epipalaeolithic, until the Late Bronze Age, which is contemporary with the Mycenaean period which produced the conical piriform pot shape that will be looked at in this thesis.

2.2.1 EPIPALAEOLITHIC

The term ‘Epipalaeolithic’ is used variously to describe transition periods between the Palaeolithic and Mesolithic, but in this case can be regarded as synonymous with Mesolithic, a term commonly used in Europe to refer to the start of the Holocene epoch. Excavations at the Epipaeolithic site Akrotiri Aetokremnos have revealed a large number of extinct pygmy hippopotami and spurred debates over the potential involvement of humans in their extinction, for which there is debatably little evidence (see Simmons (1991) and Binford (2000) for opposing arguments). Radiocarbon results from Aetokremnos were based on shell, bone, and charcoal, with a high degree of correlation, and place human presence during the 11th millennium, although the calibrated dates for the shell range between +33 years and +400 years (A. Simmons, 1991, p. 864-865).

Although this evidence does suggest an early human presence, it does not indicate permanent settlement (Knapp, 2013, p. 48). The first evidence of permanent occupation is found some two thousand years later, during the Neolithic period.

2.2.2 NEOLITHIC

The Neolithic period on Cyprus spans approximately five thousand years (9900-4500/4000 BCE), and can be divided into three distinct periods - early aceramic Neolithic, late aceramic Neolithic, and ceramic Neolithic - separated by difference in settlement types, burials, material remains and, at present, a gap in the archaeological record (Simmons, 2012, p. 86; Steel, 2004, p. 63). Early aceramic
sites were typically coastal, with only one known farming community (Ayia Varvara Asprokremnos). Late aceramic sites were characterised by settlements surrounded by defensive structures, although there is no clear evidence as to the threat they were defending themselves against (Steel, 2004, p. 49). There also appear to be changes in burial practices, from little or no homogeneity across sites and implications of second burial (see Kissonerga - Mylouthkia), to burials across the island that focus on the individual, with gendered distribution of grave goods (Steel, 2004, p. 37).

Radiocarbon evidence suggests that the late aceramic Neolithic saw continuous occupation between 7200/6800 – 5200/5000 Cal BCE (Knapp, 2013, p. 154). The transition between the late aceramic Neolithic and the ceramic Neolithic is as contested as it is unknown, due to a significant lack of archaeological evidence. At the end of the late aceramic Neolithic settlements have clearly been abandoned, with populations either dispersing or disappearing from the island; whether this was due to economic, environmental, or health related reasons is still a widely discussed topic today (Steel, 2004, p. 63).

Radiocarbon dates for the ceramic Neolithic place maximum occupation between 5200/5000 – 4100/4000 Cal BCE (Knapp, 2013, p. 192). Debates concerning the origin of this period mainly focus on two differing hypotheses. The first hypothesis is that the ceramic Neolithic was a local development. Towards the end of the late aceramic Neolithic there was a reversion from a sedentary way of life to a more ephemeral, possibly village-based manner of living (Knapp, 2013, p. 154). This hypothesis is supported by the fact that the economic package of sheep, pig, and deer, has not changed. There is no evidence that new breeds of livestock were introduced, which would be expected with a migrating population (Steel, 2004, p. 65). The second hypothesis is that the ceramic Neolithic represents a migrating population: that the absence of evidence in the archaeological record represents the collapse of late aceramic Neolithic society and the subsequent depopulation of Cyprus. After an uncertain amount of time the island was repopulated by a new group of people with knowledge of the plastic properties of clay – how to form, decorate, and make ceramics (Knapp, 2013, p. 154). This argument is tenuously supported by the presence of defensive
structures, which suggest that the new occupants of the island felt unease with their surroundings (Steel, 2004, p. 64).

As well as ceramics, the ceramic Neolithic saw an increase in sedentary inland farming communities, as well as new forms of architecture, settlement organisation, the organisation of domestic space, and changes in funerary practices (Steel, 2004, p. 64). Towards the end of the ceramic Neolithic sites across the island were abandoned once more, although this does not appear to have been an immediate island-wide phenomenon, and it is unlikely to represent island-wide depopulation.

2.2.3 CHALCOLITHIC

The Early-Middle Chalcolithic periods lasted between ca. 4000/3900 – 2700 Cal BCE (Knapp, 2013, p. 195). Markers of the Chalcolithic period include an increase in population, reorganisation of settlement patterns, and the use of copper (Harper & Fox, 2008, p. 6). It was during this period that the presence of pottery in sites became a homogenous island-wide phenomenon with regional variations (Steel, 2004, p. 81). Although settlements in the Chalcolithic remained rural and self-sufficient, it was during this period that outside influences began to be seen once more (Knapp, 2013, p. 245).

Although the reasons remain unknown, from the end of the early aceramic Neolithic until the Chalcolithic was a period of limited contact with surrounding peoples and cultures (Knapp, 2013, p. 245). Evidence from the Late Chalcolithic site Kissonerga Mosphilia indicates that this period of supposed isolation started to disappear, although evidence is mostly seen in materials, designs, traits and features that appear to be inspired by connections to Anatolia or East Aegean (Knapp, 2013, p. 245).
2.2.4 BRONZE AGE

2.2.4.1 PREHISTORIC BRONZE AGE

The Prehistoric Bronze Age has previously been referred to as two separate periods – the Early and Middle Bronze Age – however those who refer to the Middle Bronze Age admit that it is hard to define from the Early period (Karageorghis, 1982, p. 52). It is generally regarded as a transitional period between the Prehistoric and Protohistoric Bronze Age periods, defined by the appearance of a specific type of pottery known as White Painted II (Karageorghis, 1982, p. 52). This thesis will follow the modern example of grouping both EBA and MBA into the so-called Prehistoric Bronze Age, or ‘PreBA.’

The beginning of the PreBA is generally accepted as beginning around 2500 BCE. Some variation occurs depending on whether or not the researcher considers the beginning of the Philia Culture to be a part of the PreBA, or considered it part of the Chalcolithic period, however, this continues to be perhaps the most well accepted and corroborated date (Karageorghis, 1982, p. 10). Karageorghis (1968, p. 38) notes that the 2500 BC date coincides with the disaster that brought about the end of Early Bronze Age II in Anatolia. He suggests this is potentially significant, as the pottery of the Cypriot Philia culture is closely related to Anatolian pottery of the same time. Karageorghis suggests that new settlers may have migrated to Cyprus after the disaster in Anatolia, settling around Morphou Bay before gradually moving inland, a view shared by archaeologists as early as Einar Gjerstad in 1926 (Karageorghis, 1982, p. 40).

PreBA Cyprus can be distinguished from its Chalcolithic predecessor by changes in settlement patterns and architecture techniques, indicating innovative uses of the island’s natural mineral resources) (Steel, 2004, pp. 119, 121). The island’s material culture also underwent a dramatic overhaul, revealing innovations such as plough technology (and the reintroduction of cattle), sub-rectangular and often multi-cellular architecture, Red Polished (Philia) pottery, and pot burials (Steel, 2004, p. 121). The material record also reveals a variety of new mould-cast copper tools, weapons, and ornaments, and an increase in spindle whorls and loomweights, indicating that new types of textiles were now being produced.
The PreBA economy, like that of the Neolithic and Chalcolithic before, relied on an agro-pastural way of life (Knapp, 2013, p. 263).

Karageorghis (1968, p. 39) suggests that one of the main patterns seen in the Middle Bronze Age was a sudden increase in commercial and cultural contact with neighbouring countries; the intensification of copper production allowed Cyprus to participate in trade with neighbouring countries, and to later become an integral part of the Aegean trade network during the ProBA (Karageorghis, 1968, p. 39).

Towards the end of the PreBA conditions appear to become less peaceful. Several of the settlements excavated from this time period included forts, many of which are reasonably far inland (Karageorghis, 1982, p. 52). Karageorghis (1982, p. 53) suggests that the location of the forts may be indicative of an increasing internal stress beginning during the PreBA, when control of the island was divided between the west (in control of copper mines) and the east (in control of arable land).

2.2.4.2 PROTOHISTORIC BRONZE AGE

The Protohistoric Bronze Age (ProBA), often referred to as the Late Bronze Age, or on Cyprus as the Late Cypriot period, is commonly dated to 1700/1650 BC – 1050 BC (see Chapter One, Figure 1.2). Using pottery seriation, the Late Cypriot period can be divided further into several sub-periods (LCIA-B, LCIIA-C, LCIIIA-B) which correlate briefly with the Mycenaean period in the Aegean, c. 1400 – 1200 BC (or LCIIA-C and LHIIIA1-B2). The correlation of these distinct time periods is likely the result of the expansion of trade across the Mediterranean, and the participation Cyprus plays in this network, as both a nexus and a participant.

The ProBA on Cyprus can be distinguished from its predecessor by a sudden increase in population, and the expansion of settlements into previously unoccupied areas (Steel, 2004, p. 149). These new settlements were larger and more numerous than those of the PreBA, and there was also a shift in location towards the coast (Steel, 2004, p. 156).
Knapp suggests that during this time a four-tiered settlement hierarchy emerged: (1) primary coastal centres (main urban sites); (2) secondary inland centres with storage and administrative functions; (3) tertiary inland centres; and (4) specialised economic sites, for agricultural and/or pottery production or copper procurement (Knapp, 2013, p. 355). In this proposed hierarchy, the smaller, specialised production centres focussed on the procurement of copper (Apliki and Politiko-Phorades), specialised production of pottery (Sanidha-Moutti tou Ayiou Serkou), and small farmsteads or agricultural centres (Analiondas, Aredhiou-Vouppes, possibly Ayia Irini) (Steel, 2004, pp. 157-158).

The secondary and tertiary centres functioned as local redistribution centres, controlling the movement of goods from specialised sites to the primary coastal centres (Steel, 2004, p. 157). These major urban sites (including Enkomi, Morphou-Toumba tou Skourou, Hala Sultan Tekke, and Kourion-Bamboula) were centres of specialised economic and ceremonial activities, as well as the dominant economic and political force within the surrounding landscape (Steel, 2004, p. 157).

Another distinction from PreBA and ProBA was the establishment of fortified sites placed along the route from the copper-rich region of the Troodos massif to the coastal centre of Enkomi, suggesting their purpose was to protect the movement of copper to the island’s new economic centres (Steel, 2004, p. 152). Many of these fortifications can be dated to LCIA, the beginning of the ProBA on Cyprus (Crewe, 2004, p. 130). Despite the tension that these fortifications suggest, the ceramics in Cyprus developed in a homogenous manner across the island, suggesting that settlements were relatively unified and participating in friendly trade (Karageorghis, 1982, p. 63). In fact, the material culture of people living in urban centres such as Enkomi, Kition, Kalavasos Ayios Dhimitrios, Koukla Palaipaphos, Maroni Vournes and Alassa Paleotaverna, were all very similar, and there is wide ranging evidence of group identity, such as cylinder seals, depictions of oxhide ingots on various media, and gendered representation in figurines (Knapp, 2013, p. 473).
From as early as c.1400 BC, during the LCIIA, there is a significant increase in Mycenaean pottery on the island; tombs at sites such as Enkomi, Pyla, Hala Sultan Tekké, Maroni, and Kourion have produced large quantities of Mycenaean pottery, including large vessels decorated in the pictorial style (Karageorghis, 1982, p. 78). The large quantities of Mycenaean pottery are one of the clearest indicators for Cypriot participation in long-distance trade (Steel, 2004, p. 170). Archaeological evidence for contact between Cyprus and the Aegean earlier than ProBA suggests trade was sporadic, with only a few items being exchanged between Crete and Cyprus (Steel, 2004, p. 170). Despite this new booming trade Mycenaean imports are rarely found in the remote areas of Cyprus and are instead found mainly in the large coastal towns, especially at Enkomi and the Bay of Larnaka. Within these coastal towns pottery was generally widely available, although ceramics decorated in the pictorial style continued to be controlled by the urban elite (Steel, 2004, p. 171). The importance of Cyprus in this trade network can be seen in the Mycenaean vases which copy distinct Cypriot forms, as well as the introduction of forms specific to Cyprus and the Near East. These examples indicate Cyprus had become a market to be catered to directly, and the presence of large quantities of Mycenaean vases and Cypriot pottery found together in Ugarit and as far east as Amman, suggest they were being exported together from Cyprus (Karageorghis, 1982, p. 79).

Towards the end of LCII (which lasted c. 1450 – 1200 BC) the peaceful conditions which encouraged such a healthy trade relationship began to deteriorate (Karageorghis, 1982, p. 82). There is evidence of extensive destruction of monumental structures in major coastal centres (e.g. at Enkomi, Kition, and Maroni Vournes), while some towns are abandoned altogether (e.g. Ayios Dhimitrios, Paleotaverna, Hala Sultan Tekke Vyzakia, and Athienou) (Karageorghis, 1982, p. 84; Knapp, 2013, p. 474). Following this destruction many towns were completely rebuilt, and mudbrick walls were replaced by cyclopean walls signalling the beginning of Late Cypriot IIIA (Karageorghis, 1982, p. 84).

There is cultural continuity in Cypriot material culture despite the destruction and partial abandonment, and there is no major disruption following this period.
until the 11th century BC, heralding the end of Protohistoric Cyprus (Knapp, 2013, p. 474). Disruptions observed on Cyprus during LCII – LCIII reflect the collapsing political climate in the eastern Mediterranean, which followed the various disasters that struck Mycenaean Greece from c. 1250 – 1150 BC (Bennet, 2013, p. 252). It is likely that some refugees from this period came to Cyprus, and have often been referred to as the “sea peoples” (Karageorghis, 1982, p. 82). Although it has been thought by some scholars that these refugees represent a ‘Mycenaean colonisation’ of Cyprus, Knapp (2013, p. 474) argues that from a postcolonial perspective it is no longer possible to accept this hypothesis. He goes on to suggest that refugees coming to Cyprus would have “undergone intensive social transformations” and become integrated into Cypriot society (Knapp, 2013, p. 474). It is no longer feasible to argue that Cypriot society passively adopted the ‘superior’ Mycenaean culture or a displaced power structure (Knapp, 2013, p. 474).

Between 1075-1050 BC there is evidence of a violent destruction or disaster; the cyclopean walls and rectangular bastions at Kition were found destroyed, tumbled across adjacent streets, and violent destruction can also be seen in Enkomi signalling the end of the Bronze Age (Karageorghis, 1982, p. 89).

### 2.2.5 POTTERY ON PROBA CYPRUS

The ceramics I am concerned with are complete three handled jars with a piriform shape, ranging from 10-20cm in height. These pots are typically Mycenaean in origin and are found in Late Cypriot sites from around 1400 BC. Some were clear indicators of wealth, such as ceremonial vases, as well as pictorial Mycenaean kraters, which were particularly common in wealthy graves (Steel, 2004, p. 174).

The earliest pottery on Cyprus dates to the ceramic neolithic period, from about 5000 BC (Knapp, 2013, p. 192). Between the ceramic neolithic and the ProBA, ceramics on Cyprus progress through a series of innovations, although these tend to co-exist with rather than replace older styles, and additionally may vary in usage across the island. For example, the first type of ceramic vessel on Cyprus, aptly referred to as ‘Red-On-White ware’, is characterised by red patterns on
white backgrounds (Karageorghis, 1982, p. 27). Over time this developed to include geometric, abstract or floral motifs, while also existing alongside the new ‘Red Lustrous ware’ (Karageorghis, 1982, p. 32). Other ceramic types of the same period include ‘Glossy Burnished ware’ and ‘Red Monochrome Painted’ (Karageorghis, 1982, p. 35). During the PreBA ceramic types expanded to include ‘Black Polished ware’, typically decorated with deep incisions filled with lime. Towards the end of this period ‘White Painted’ pottery becomes more common, with decoration varying between linear in the east, and geometric in the west (Karageorghis, 1982, p. 57). The peaceful conditions of ProBA Cyprus encouraged innovations such as ‘White Slip ware’ (a thick white slip over a hard core, decorated in orange, brown, or bichrome) and ‘Base Ring ware’ (with thin dark walls and a shiny surface) (Karageorghis, 1982, p. 76).

During Late Cypriot IIC, due to expanding Mycenaean presence and relations with the island, Cyprus became fully immersed in trade relations with the Aegean and surrounding countries. A result of this is a significant amount of LH IIIA2 pottery being identified on the island, some popular shapes including the stirrup jar, piriform jar, amphoroid krater, alabastron, and flask (Mountjoy, 1993, p. 171). These were imported to sites along the southern and eastern coasts of Cyprus, such as Enkomi and Hala Sultan Tekke, before being gradually distributed further inland (Mountjoy, 1993, p. 171). By c. 1300 BC genuine Mycenaean pottery became scarce on Cyprus, and the ‘pastoral style’ (previously referred to as the ‘rude style’), which was an attempt to copy the Mycenaean originals, became widespread in its place (Karageorghis, 1982, p. 85).

### 2.3 History of Archaeology on Cyprus

The history of archaeological research on Cyprus varies significantly in quality over time. The earliest “archaeology” on the island was antiquarianism, rather than systematic excavation. Once the Phoenician history of Cyprus was realised, European antiquarians descended on the island to perform glorified treasure hunts – of particular interest were tombs and ancient sanctuaries, which contained prized items such as coins, terracotta figures, and inscriptions, which could be sold to museums (Steel, 2004, p. 7).
One of the first antiquarian excavations was undertaken by Luigi Palma di Cesnola. During 1865 –1877 Cesnola was appointed American consul in Larnaka, one of the six districts of modern day Cyprus (Swiny, 1991, p. F2). During this time Cesnola began funding a series of digs for valuable artefacts, however his excavations were lacking in terms of accurate records, and his methods essentially involved the plundering of tombs (Swiny, 1991, p. F2). This type of investigation often focussed on identifying and removing items that seemed valuable, such as jewellery or highly decorated ceramics, leaving ‘less important’ finds unreported. Cesnola’s discoveries did, however, highlight the fact that Cyprus had its own extensive history to share (Steel, 2004, p. 7). However, his work was undermined by his own fabrication of archaeological discoveries, notably the so called ‘Treasure of Curium’ (Curium being the latin name for Kourion). In an effort to outdo his contemporary, Heinrich Schliemann, Cesnola produced false accounts of his excavation at Kourion, wherein he described discovering a series of underground chambers filled with treasure (Steel, 2004, p. 7). The inconsistencies in his reporting, and the heterogeneous nature of the deposit caused doubts over the authenticity of the nature of the find; it was later discovered that the ‘treasure’ consisted largely of an amalgamation of jewellery from numerous tombs in the Kourion burial grounds below the acropolis (Swiny, 1991, p. F4).

The first systematic excavation on Cyprus was undertaken in 1867 by Sir Robert Hamilton Langdon, American consul from 1871 – 1872 (Steel, 2004, p. 7). Langdon was the first to record the extent and depth of the excavation, topographical plans of the site, and contextual information of archaeological finds. In 1878 Cyprus came under British control and unauthorised excavations were officially banned (Knapp, 2013, p. 20). Legally excavated artefacts, however, continued to be taken from the island on a tremendous scale (Knapp, 2013, p. 21). Despite the progress seen in excavations like those of Langdon, the excavations undertaken by the British Museum in the 1890s left much to be desired. Aside from disregard of new excavation techniques, the excavations in question resembled earlier antiquarian treasure-hunts, with little regard for context and items of ‘lesser quality’, such as undecorated pottery (Steel, 2004, p. 8).
Some of the most famous excavations on Cyprus were those undertaken by the Swedish Cyprus Expedition (SCE). Established in 1923, and led by Einar Gjerstad, the SCE excavated across 25 sites between 1927-1931 (Steel, 2004, p. 10). These sites spanned a period of time from the aceramic Neolithic to the Roman period. The excavations undertaken by the SCE were both systematic and organised, and provided a platform from which data could be organised into a chronological sequence based on pottery seriation (Steel, 2004, p. 10). The detailed publication of the excavations allowed Gjerstad to develop a culture history interpretation of the islands archaeological remains for the Neolithic, Bronze Age, Iron Age, Hellenistic and Roman periods (Steel, 2004, p. 10).

The Antiquities Law was introduced in 1905, which restricted the removal of artefacts from the island. In 1935 a new Antiquities Law was introduced from the recently established Department of Antiquities, which restricted the removal of excavated finds from Cyprus by half (Knapp, 2013, p. 22). In 1960, after a period of protest and violence between the Greek Cypriots, Turkish Cypriots, and the British administration across the island, Cyprus eventually succeeded in becoming independent from the United Kingdom (Pagedas & Nordenman, 2014, p. 65). In 1963 Vassos Karageorghis became the second Cypriot director of the Department of Antiquities and amended the Antiquities Law to disallow the removal of artefacts from archaeological sites on Cyprus – all artefacts excavated from Cyprus were to remain on the island with no payment required towards the foreign party (Knapp, 2013, p. 31).

In 1974 archaeological excavations came to a halt due to the Turkish invasion of Cyprus, during which the Northern part of Cyprus was occupied (Pagedas & Nordenman, 2014, p. 66). Excavations in Northern Cyprus (or, the Turkish Republic of Northern Cyprus, recognised only by Turkey) remain discontinued to this day, however excavations have continued in Southern Cyprus (Knapp, 2013, p. 24). This will presumably lead to a geographical bias in archaeological information, and therefore bias regarding island-wide investigations, especially as archaeological methods, theory, and practice continue to adapt and expand how archaeology is performed in Southern Cyprus.
Although it does not directly affect the outcome of this thesis it is important to understand the context from which the ceramic vessels were excavated. Due to the nature of prior excavations and recording priorities, it is impossible to identify the sites in which every single pot was originally located. Many of the pots, especially those from the British Museum catalogue, have been sourced from Enkomi and Hala Sultan Tekke, however a large portion of vessels from the Cyprus Museum and Cyprus Private Collections have been recorded with ‘provenance unknown’, and in some cases this information is completely omitted.

This section will outline five Protohistoric sites considered to be ‘first tier’ settlements, including (from largest to smallest) Kition, Maroni, Hala Sultan Tekke, Enkomi, and Kourion (Knapp, 2013, p. 355) (See section 2.2.4.2 for more information on Knapp’s ProBA four tier settlement hierarchy). Almost all of these sites produced large amounts of Mycenaean pottery (Karageorghis, 1982, p. 78).

Of the 130 vases being analysed for this thesis, forty-five are from Enkomi, four from Kourion, three from Hala Sultan Tekke, and two from Maroni. Several of the vases being analysed were found at other sites in small quantities; one vase was found in Salamis, a settlement established during the late ProBA (Karageorghis, 1982, p. 143); two were found at Klavdia-Tremithos, a secondary centre which is presumed to have been part of the political and economic orbit of either Hala Sultan Tekke or Kition; one from Aegina, one of the Saronic Islands of Greece, two from Amorgos, the easternmost island of the Greek Cyclades island group, and four from Apollakia, a site on the island of Rhodes. Additionally, two pots were recorded as having been recovered from a tomb in the modern region of Dhekelia, and one from Kition. The remaining pots have been recorded as “Provenance Unknown.”
For each of the five sites being discussed here, the following section will provide information regarding six categories: (1) site name, including any known variations, (2) location/geography, (3) period of occupation, (4) type of site/site information, and (5) excavation history.

Figure 2.1 Map of Cyprus showing sites where pottery was found
**Kition**

*Kition Kathari, Kition Pampoula*

| Location | Kition is located on the southeastern coast of Cyprus and lies within the limits of the modern city of Larnaka (Georgiou, 2012a, p. 1). Geological studies indicate that the coastline would be closer to the city than it appears today (Georgiou, 2012a, p. 1). |
| Occupation dates | First established in the 13th century BC, occupied into the Roman period (Campbell, 2007a). Several sites make up Kition, including Kition Kathari and Kition Pampoula (Department of Antiquities, n.d. (a)). The site of Kathari was occupied since the 13th century BC, while Pampoula was occupied from the 9th century BC (Georgiou, 2012a, p. 1). |
| Site type | Kition is a settlement site. Some tombs in the area can be dated to PreBA and early LC I-II (1600-1300 BC), while the earliest architectural evidence coincides with LCIIC (1300-1200 BC) (Georgiou, 2012a, p. 1). The town was enclosed by a natural acropolis, a natural harbour, and surrounded by a mudbrick wall. Within the walls were public buildings, copper-smelting workshops, and two temples of Near Eastern design (Campbell, 2007a). |
| Excavated by | Kition has been excavated since the early 20th century. In 1913 Sir John Myres excavated at Bamboula Hill, followed by the Swedish Cyprus Expedition in 1929, and the Cypriot Department of Antiquities in 1959-76 (Georgiou, 2012a, p. 1). From 1976 onwards, excavations in Kition have been under the jurisdiction of the French Expedition of the University of Lyon (Department of Antiquities, n.d. (a)). |
### Maroni

*Kapsaloudhia, Vournes, Tsaroukkas*

| **Location** | Maroni River Valley, less than 3km southwest of the modern village of Maroni, and just over 6km east of Kalavasos *Ayios Dhimitrios* (Crewe, 2004, p. 98). Slightly further inland, but near the south coast of Cyprus. |
| **Occupation Dates** | Established or became prominent from the beginning of LCI. Structures from LCIA to LCIIC are known at *Vournes*, and LCI onwards has been identified at Maroni *Kapsaloudhia* at the north of the site (Crewe, 2004, p. 98). |
| **Site Type** | Town and cemetery. Underwater survey and discovery of many large stone anchors revealed the important maritime role the community played (Crewe, 2004, p. 98). Many looted tombs have been identified, and construction at both Maroni sites resulted in the disturbance of earlier tombs (Kiely, n.d. (a), p. 1). Tsaroukkas covers at least 20 hectares, and *Vournes* is located 500m NW of *Tsaroukkas* (Kiely, n.d. (a), p. 2). The function of these areas remain unclear, however the presence of the several large, presumably administrative centres, suggest that *Vournes* may have been a major economic and administrative centre in Maroni (Kiely, n.d. (a), p. 2). |
| **Excavated by** | Maroni was initially excavated by Luigi Palma de Cesnola, then by German archaeologist Max Ohnefalsch-Richter on behalf of Charles Newton of the British Museum in 1881 and 1885, followed by the British Museum in 1897 (Kiely, n.d. (b), p. 1). |
**Hala Sultan Tekké**

*Vyzakia, Dromolaxia Vyzakia*

Site is located beside the Mosque (Tekké) of Umm Haram (also known as Hala Sultan) (Georgiou, 2012b).

<table>
<thead>
<tr>
<th>Location</th>
<th>Hala Sultan Tekké is situated on the southeastern coast of Cyprus, only 3km from Kition beside the Larnaka Salt Lake, which was most likely once an internal harbour that has since silted over (Crewe, 2004, p. 102).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Occupation</td>
<td>The site was established towards the end of PreBA (MCIII-LCI) (Georgiou, 2012b). Early phases are poorly preserved, the majority of excavated remains belong to the LCIIIA period in the 12th century BCE (Crewe, 2004, p. 102). The settlement was abandoned when the harbour silted up in the 12th or early 11th century BCE.</td>
</tr>
<tr>
<td>Dates</td>
<td>This town site was established on a grid system with wide stone-paved roads and structures clustered on either side, some lined with ashlar blocks (Crewe, 2004, p. 102; Georgiou, 2012b). The site has also provided evidence of industrial activities such as metalworking and fabric dyeing. Hala Sultan Tekké has produced the single largest concentration of ‘Canaanite Jars’ on Cyprus, containers used for maritime transport of liquids across the Mediterranean (Georgiou, 2012b).</td>
</tr>
<tr>
<td>Site Type</td>
<td>Excavated by Hala Sultan Tekké was excavated 1897-8 by the British Museum Expedition, revealing sixty tombs (Georgiou, 2012b). From 1971-2008 the site was excavated by a Swedish team led by Paul Åström, which was then picked up by the Swedish Cyprus Expedition (Georgiou, 2012b).</td>
</tr>
<tr>
<td><strong>Enkomi</strong></td>
<td></td>
</tr>
<tr>
<td>-------------------------</td>
<td></td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td>Enkomi is located on the eastern coast of Cyprus in a sheltered bay (Georgiou, 2012c, p. 1). It lies just north of the Pedieos River on the eastern alluvial plain of the Mesaoria (Crewe, 2004, p. 137).</td>
</tr>
<tr>
<td><strong>Occupation Dates</strong></td>
<td>The earliest evidence of occupation at this site dates to MC III – LC I (ca. 1750 – 1450 BC) (Campbell, 2007b). The city was destroyed by natural disasters c. 1050 BC and its inhabitants moved closer to the coast to found the city of Salamis (Karageorghis, 1982, p. 143). There is evidence that these two cities coexisted briefly, until the harbour at Enkomi silted up, and the city was abandoned permanently (Karageorghis, 1982, p. 144).</td>
</tr>
<tr>
<td><strong>Site Type</strong></td>
<td>Coastal city. The earliest architectural remains of Enkomi include a large fortified enclosure in the northernmost part of the city (Georgiou, 2012c, p. 1). This was later replaced in LC IIC by a ‘cyclopean’ type wall which enclosed the city (Campbell, 2007b). The city was organised according to a grid system, parallel streets oriented east-west, with a central main street oriented north-south (Georgiou, 2012c, p. 1). The town was divided into quarters that supported public, private, religious, and metallurgical activities (Georgiou, 2012c, p. 1).</td>
</tr>
<tr>
<td><strong>Excavated by</strong></td>
<td>Enkomi was excavated by five groups. The first systematic excavation took place in 1896 by the British ‘Cyprus Exploration Fund’, followed by the Cyprus Museum in 1913 (Crewe, 2004, p. 138). In 1930 the Swedish Cyprus Expedition excavated 22 tombs, and in 1934 the French Mission took over excavations (Crewe, 2004, p. 139). From 1948-58 Enkomi was excavated by both the French Expedition and the Cyprus Mission in a joint venture, under the direction of Porphyrios Dikaios (Georgiou, 2012c, p. 1). Following the Turkish occupation of Northern Cyprus, Enkomi has become inaccessible and excavations were discontinued.</td>
</tr>
</tbody>
</table>
### Kourion Bamboula

*Episkopi Bamboula*, Curium (Latin name)

| Location | Kourion Bamboula is located on a low hill 400m west of the Kouris, east of Episkopi and the classical city site of Kourion (Karageorghis, 1968, p. 149). The Kourion area hosts several famous sites, such as the sanctuary of Apollo Hylates. |
| Occupation | The earliest occupation of the Kourion area dates back to the Neolithic, including the site of Sotira Teppes (Penn Museum, n.d. (a)). The ProBA site of Kourion/Episkopi Bamboula was established during the Middle Cypriot/Late Cypriot I periods and was abandoned c. 1050 BC (Department of Antiquities, n.d. (b)). Following this the acropolis became the centre of Kourion and was occupied until Arab raids in 649 AD destroyed the acropolis, wherein the centre of occupation was relocated to Episkopi, 2km northeast of the acropolis (Campbell, 2007c). |
| Dates | Kourion Bamboula was considered to be the primary ProBA settlement in the area, although it may still be considered small or less influential than other contemporary ProBA coastal settlements (Kiely, n.d. (c), p. 4). The settlement itself is surrounded on the outskirts by tombs. The most substantial remains are from the 13th to the 12th century BCE, and excavations have revealed multi-room houses, workshops, and a street (Penn Museum, n.d. (b)). |
| Site Type | The Kourion area has been excavated extensively. The site of Kourion Bamboula itself was excavated in 1937-39 and 1948 by John Franklin Daniel. Following his death, Saul S. Weinberg and J. L. Benson returned briefly in 1951 and 1954 (Penn Museum, n.d. (b)). The major schools/authorities who excavated the major Kourion area include the British Museum, the Cypriot Department of Antiquities, several private parties, the University of Pennsylvania Museum, and the Kent State University Survey (Kiely, n.d. (c), p. 1). |
CHAPTER THREE: PREVIOUS APPROACHES

3.1 INTRODUCTION

As outlined in Chapter One, the purpose of this thesis is to identify any correlations between individually organised shape and decoration groups that may indicate the hand of an individual or workshop. Chapter Three will selectively summarise current and past research concerning the provenance of Mycenaean pottery, as well as providing an overview of specific aspects of Arne Furumark’s work on the classification of form and decoration.

Before continuing it is important that I clarify the use of ‘provenance’ in the context of this thesis. Provenance is something that is studied in many disciplines, and which often appears under different names – I will present two aspects of this here. The Oxford Online Living Dictionary defines provenance as ‘the place of origin or earliest known history of something.’ While archaeology typically focuses on the first half of this definition, art history and classical archaeology often focus more broadly on the second half. In an archaeological context, provenance studies are concerned with identifying natural groupings of objects that reflect their origins, and, where possible, provide enough information to determine the source materials (Orton & Hughes, 2013, p. 153). This is typically approached with methods such as geochemical analyses, which enable us to discover and study the composition of a ceramic vessel. In this case the objective is to literally identify the origin of the object through a comparison to material with a known location – in classical archaeology this is in reference to a pool of ceramics that are considered to be compositionally representative of the pottery at a particular site. However, less scientific approaches can contribute to provenance studies in other fields, particularly the study of style and form. With these approaches, the focus is often on identifying ‘the individual,’ or organising objects into groups that were likely to have been created by the same people, either as individuals or a workshop. Provenance studies in all their forms can provide a greater understanding of the social aspect of pottery, such as the movement of pottery and therefore trade relations and the movement of
materials between groups of people, or perhaps the social significance of different decorative styles.

The following chapter will summarise appropriate examples of the research areas mentioned above, though it must be made clear that while the methodologies discussed can be applied to provenance studies, they are not necessarily considered provenance studies in and of themselves. This will be followed by a discussion of the previous typological work undertaken by Furumark, and the modern reviewing of this typology by Mountjoy. This will provide a foundation for the methodology that is described in Chapter Four.

### 3.2 PROVENANCE STUDIES

#### 3.2.1 GEOCHEMICAL ANALYSIS

The most direct way to identify the origins of a pot or a group of pots is through an analysis of fabric, or, more specifically, to study its chemical composition. This type of information can be used to separate pots into groups that likely reflect their provenance. If several pots have a very similar composition, it may be that these pots originated from the same workshop or individual. When the chemical composition of such groups is compared to that of potential source material, similarities that arise may be used to imply that the pottery could have come from that specific source location. In the following paragraphs I will summarise a series of related research endeavours that approached this issue, particularly with regards to Mycenaean pottery found on Cyprus.

In the 1950-60s a series of compositional studies were undertaken to discern whether composition and provenance of Mycenaean pottery could be related to one another. The results of this research were then used as a base for answering the question of whether pottery on Cyprus was being made on site by migrant Greek potters, being reproduced by local Cypriot potters, or being traded to the island by Greek merchants. As has been previously discussed, there is a general agreement that the earliest Mycenaean pottery found on Cyprus was likely imported, while much of the later material was made in Cyprus in imitation – however the pottery which falls into the gap between these has often been a point
of contention (Catling & Millett, 1965, p. 212). The investigation that dealt with this was undertaken and published in various parts by E. E. Richards, A. E. Blin-Stoyle, A. Millett, and H. W. Catling. The statistical and chemical details of the study are outlined in the 1963 article ‘Correlations between Composition and Provenance of Mycenaean and Minoan Pottery’ (Catling, Richards, & Blin-Stoyle, 1963), for which the archaeological results are summarised succinctly in Catling’s ‘Minoan and Mycenaean Pottery: Composition and Provenance’ of the same year (Catling, 1963).

In the original study, 500 samples were collected. Two different site types were targeted for this collection – first, material from known manufacturing centres in both the Minoan and Mycenaean regions, and secondly from sites beyond the Aegean borders - Tell Atchana in northern Syria, Tell el Amarna in Egypt, and Enkomi, Hala Sultan Tekke, and Arpera Chiflik in southern Cyprus. The authors note that previous work has shown no qualitative differences between compositions of pottery from different provenances, and therefore a focus on quantitative difference was established (Catling et al., 1963, p. 96). A total of 13 distinct composition groups were identified, labelled A to M, as well as eight outliers or ‘rogues’ that did not match with any group, and occurred on their own – no site accounted for more than one of these outliers (Catling, 1963, p. 3). Groups A and B were the largest, with Group A accounting for more than twice the sample size of Group B at 246 samples. The Group A composition type accounted for 98% of the samples taken from sites in the Peloponnesian, and is thus considered representative of Peloponnesian manufacture (Catling, 1963, p. 3).

The results of the samples taken from Cyprus are, of course, the most relevant for this study. The Cypriot samples were chosen to represent two groups – those that looked identical to Mycenaean pottery, and those that looked like copies; ten of each from Enkomi, ten of each again from Arpera Chiflik, and from Hala Sultan Tekke 20 samples that appeared identical to Mycenaean pottery. Significantly, all samples chosen because of their similarity to Mycenaean pottery were of the Group A composition (Catling, 1963, p. 5). The other ten samples from Enkomi and Arpera Chiflik each represented their own distinct composition group (Catling, 1963, p. 5). It can therefore be summarised that a significant amount of
pottery found in these three sites originated in the Peloponnese, and that at two of the three sites were pottery workshops creating imitation pottery (Catling, 1963, p. 5).

In 1965 further study was conducted based on these results, focusing exclusively on pictorial pottery found on Cyprus, none of which had been used in the previous study. Twenty-five samples were taken, all from vases or fragments in Oxford and the British Museum – these represent seven sites in Cyprus; eleven from Enkomi, eight from Maroni, two from Arpera Chaflik, and one each from Episkopi, Klavdhia, Psilatos, and Galinoporni (Catling & Millett, 1965, pp. 214-215). Out of the twenty-five samples, the compositions of twenty-two were consistent with the characteristics of Group A; two samples were ambiguous, while another was defined a ‘rogue’ (Catling & Millett, 1965, p. 219). It can therefore be strongly argued that those pots that fit into Group A were made in the Peloponnese rather than on Cyprus, and it would be a reasonable argument that pots belonging to the same group or attributed to the same artist came from the same source (Catling & Millett, 1965, p. 219). It is important to note that the presence of ‘rogue’ pots in the research presented in this section indicate that there is more than one source for this pottery; the samples taken from sites in the Peloponnese are of groups of pottery considered to be representative of that particular site, rather than comparative source material, and it is therefore likely that the established ‘groups’ may be further divisible. The material in question dates to the fourteenth century BCE and part of the thirteenth, which reflects a clear image of Peloponnesian trade and export to Cyprus between Myc. IIIA2 into the IIIB phase (Catling & Millett, 1965, p. 219). The authors suggest that inspiration for the type of subject matter on the pottery (typically chariot scenes) was most likely the fresco-paintings or sculptures in palatial centres to which the workshops were attached – these type of centres did not exist in Cyprus during the 14-13th centuries BCE (Catling & Millett, 1965, p. 221).

A 1975 article by Anson expanded upon these studies through an analysis of ‘Rude Style’ (RS) pottery (Anson, 1980a, p. 109). The RS pottery was a local imitation of Mycenaean pottery that developed during the Late Cypriot IIC phase (c. 1300-1200 BCE – equivalent to the LHIIIB period) as a reaction to declining
imports of genuine Mycenaean pottery (Wijngaarden, 2002, p. 159). All of the sherds analysed in this study were compared to the composition groups established in the 1965 study by Catling and Millet, which are discussed above. The results of this comparison show that none of the RS pottery samples shared enough characteristics with the Peloponnesian groups to be positively identified as a Mycenaean import (Anson, 1980a, p. 118). Twenty-nine samples from Enkomi were analysed and found to form a coherent group that matched local clay and pottery compositions, suggesting that they were made locally (Anson, 1980a, p. 117). Many of the remaining RS samples closely resembled the Enkomi group, and it is very likely that they were made in Enkomi before being distributed, while another set of samples were close to the Enkomi pattern, but not similar enough to be confidently placed within that group (Anson, 1980a, p. 118). Most of the pictorial pottery samples analysed in this study were found to match with Peloponnese Group A, although three samples showed a degree of similarity to the Enkomi RS group (Anson, 1980a, p. 118).

Although fabric analysis, or the study of composition, is not a technique employed in this thesis, the research summarised here presents some important ideas regarding grouping, manufacture, and provenance, that are applied and adapted to suit the aims of this thesis. The research above shows that it is possible to divide pottery into groups based on provenance and composition patterns, and also loosely based on decoration and shape. Using composition patterns Mycenaean-style pottery on Cyprus can be confidently organised into imported Greek pottery from a number of locations on the Greek mainland, and local Cypriot imitations, which can be further divided by known local pottery workshops. The approach taken in this thesis draws on elements of this, dividing pottery by shape and decoration, which will hopefully provide a base from which others can further investigate aspects such as physical provenance.

3.2.2 STYLE AND ATTRIBUTION STUDIES

In the fields of art history, classical archaeology, and in the circumstance where one does not have physical access to ceramics for the purpose of chemical analyses, particular attention is paid to the style of the vessel, especially the art
and motifs used as decoration. This section will discuss how attribution studies are used in the pursuit of what Redman (1977, p. 44) refers to as the ‘analytical individual.’

Attribution studies is as the title assumes – the study of attributions, usually a specific artistic feature or detail that can be compared across many different works. This concept was first introduced in the late 19th century by Giovanni Morelli in his work ‘Italian Painters: Critical Studies of their Works’ (Morelli, 1892-3). Morelli argued that minor details of a painting, such as the shape of earlobes, fingers, toes, and nails, were minor enough to be established early and then forgotten, remaining constant throughout an artists’ career (Locatelli, 2015, p. 4). These types of details, which could be considered small or insignificant, and which are repetitively used, are unlikely to be shared or copied by other artists (Morris, 1993, p. 42). Therefore, the study and comparison of a specific feature, or collection of features, could reveal an individual hand across different works.

In 1977 James Hill conducted an experiment to contribute to the argument that motor habits result in an individual style that is not transmissible by teaching or copying (Hill, 1977). The experiment involved several artists copying geometric vase paintings onto pots of their own (Hill, 1977, p. 65). The pots were then broken into sherds, and those of a large enough size were analysed according a number of variables relating to the design elements: line width, angles, spacing, and the shape of certain elements (Hill, 1977, p. 69). These sherds were divided into clusters, each corresponding to a specific artist – of the 92 analysed sherds, 89 were assigned to the correct potter (Hill, 1977, p. 81). This result implies that even in prehistoric art, it is theoretically possible for the individual to be distinguishable below the level of design element (Morris, 1993, p. 44).

As previously stated in section 1.2.2, the application of this method to prehistoric art is somewhat limited; though it is possible to attribute a collection of works to a prehistoric individual, it is extremely difficult to prove conclusively the accuracy of these claims (Morris, 1993, p. 46). In 1977 Charles Redman published a paper on the stylistic variation of pottery decoration, with particular insight into what he called the ‘analytical individual’ (Redman, 1977). Redman indicates
that the search for the individual in classical archaeology and art history focusses on individual pieces of art as important in themselves, as they are more focused on understanding developments and changes in art styles (Redman, 1977, p. 41). Redman’s approach explores the identification of individuals as a stepping stone towards a clearer understanding of prehistoric craft specialisation and distribution networks (Redman, 1977, p. 41). He suggests that instead of trying to find the ‘individual’, it would be more plausible to assign groups based on the relative intensity of interaction between group members, as reflected in the style of objects they have produced (Redman, 1977, p. 44). These groups can be divided into those who have little contact, and those with intense contact – i.e., the largest versus the smallest interaction group. Redman refers to the smallest interaction group as an ‘analytical individual’; the number of people in this analytical unit is not of significant importance (Redman, 1977, p. 44). By claiming that a group of pottery can be attributed to an analytical individual, there is an acknowledgement that the pottery samples in question are similar enough that a single person may have made them, but also that they could have been produced in a workshop by more than one individual (Morris, 1993, p. 47).

The research summarised above emphasises that while it is possible to assign decorated pottery to an individual craftsperson, attempting to prove such claims can become complicated and difficult. This is particularly true regarding prehistoric art, even more so in a medium such as decorated pottery, where many pots may be produced quickly in a factory-like manner. It is because of this that using terminology such as the ‘analytical individual’ is recommended. Although it has difficulties, using decoration to attribute works to an analytical individual based on similarities or differences in style can become more firmly argued if it is supported by studies based on other criteria – for example, shape. The methodology of this thesis draws upon these ideas, using aspects of decoration and shape to inform the groups that will be seen in the end result.

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3.2.3 FORM: SHAPE AND SLICING METHOD

While the previous examples focused largely on decoration and geochemical analyses, the research discussed here will examine the use of shape, as well as a
combination of decoration, form, and fabric analysis. Using shape for pottery classification is not a new approach, however the following examples are provided in an effort to show different ways in which this can be undertaken.

A particularly relevant example is that of Shennan and Wilcocks’ 1977 article ‘Shape and Style Variation in Central German Bell Beakers: A Computer Assisted Study’ (Shennan & Wilcock, 1975). In this study Shennan and Wilcock apply two different methods for understanding variation in the shape of the Bell Beakers: the mosaic and sliced methods. As is described later in Chapter Four, this thesis also employs the sliced method, although the programme requirements vary considerably. The programme used to employ these methods was referred to as the ‘PLUTARCH System’, and requires a digitised profile of the left-hand section of a pot drawing, over which the programme then inserts a vertical centre line, and scales the pot to a standard height (Shennan & Wilcock, 1975, p. 19). This particular programme also allows for the input of an interior profile for the purpose of calculating the volume of the vessel (Shennan & Wilcock, 1975, p. 19).

The sliced method records the radii from the centre line to the leftmost point of the vessel profile, from the very base to the rim, and at equal intervals in between (Shennan & Wilcock, 1975, p. 19). These radii are expressed as a percentage of the height of the pot, and are therefore standardised and independent of the size of the pot (Shennan & Wilcock, 1975, p. 19). The authors explain that while the sliced method identifies large differences in the pot profiles, finer differences are often overwhelmed and remain undetected (Shennan & Wilcock, 1975, p. 21). An issue that arose when applying this method to the German Bell Beakers concerns the measurements of the base. While the pots being studied in this thesis have flat bases, many of the German Bell Beakers have ring or concave bases, where the centre of the pot is raised higher than the lowest point (the feet). Because of this, the mosaic method was also provided as an example, which allows the researcher to record the entire outer profile from the base to the rim – this method will not be approached in any detail here, but a full explanation is provided by the authors (Shennan & Wilcock, 1975, pp. 19-21).
Shennan and Wilcock (1975, p. 18) also stress the importance of investigating decoration and shape separately, before exploring correlations in variation. This approach has been adopted by many, including the three-tiered example presented by Dimitri Anson in his 1980 article ‘The Rude Style Late Cypriot IIC-III Pottery: An Analytical Typology.’ Anson analyses the decoration, shape, and fabric of the pots in question to examine the origins and development of Rude Style Cypriot pottery (Anson, 1980b). Anson's approach involves identifying groupings within each category which can be then combined, divided further, and provide support for final conclusions. Using decoration Anson identified seven groups of pictorial kraters, each with a number of compositional and stylistic criteria. For example, the Group B bull decoration is distinguished by eight different criteria, including a thick dorsal line (i), and the presence of leaves at the end of a branch under the bulls head and mouth (viii) (Anson, 1980b, pp. 2-4).

The analysis of shape in this study began with four sets of measurements based on profile drawings of each pot (Anson, 1980b, p. 7). The four points of data for each pot include the largest diameter of each pot, the height of each diameter (or point of intersection with the vertical axis), the distance between the rim and the root of the handle, and the diameter of each base (Anson, 1980b, pp. 7-8). This data was standardised by dividing the height of each krater by each of the dimensions listed above, and was then run through a multivariate cluster analysis (Anson, 1980b, p. 8). The results of this analysis were labelled according to their initial decorative groups, from this three distinct groups could be identified – (A + B), (C + D), and (E + G) (Anson, 1980b, p. 9). Further analysis revealed that these groups could be defined by a high centre of gravity and high handles (A + B), wider bases with a lower centre of gravity (C + D), and an elongated shape with very low handles (E + G) (Anson, 1980b, p. 9). An analysis of the chemical composition of these pots confirmed that Groups B and C differ, which was also reflected in their shape and decoration (Anson, 1980b, p. 14). Groups A and B, however, revealed distinct differences in composition, despite being clustered together on the grounds of decoration and shape, implying that these two groups did not share origins (Anson, 1980b, pp. 16-15).
This section is perhaps the most relevant to the work undertaken in this thesis, and the methodology here will draw on many aspects of this research, especially with regards to the work undertaken by Dimitri Anson. While the slicing technique will be used for data collection, the height of both the handle base and the maximum diameter will be considered. Similar to the method described above, both shape and decoration groups will be compared to one another in order to provide clusters that may represent an analytical individual. One advantage to Anson’s research is the access to ceramic material that was used to further analyse the decoration/shape groups, which allowed him to see that even though two decorative groups were put into the same cluster initially, in reality they did not share origins. Groupings identified in this thesis will not have the same benefit, however there has been an emphasis placed on considering this work a step towards further research, rather than an end goal in and of itself.

3.3 FURUMARK

In 1941, Swedish archaeologist Arne Furumark published a series of books encompassing the body of research he had pioneered concerning Mycenaean pottery. The three volumes addressed analysis and classification, chronology, and plates of pots and artefacts referred in the previous two volumes. His work was groundbreaking, though, naturally for a work of this size, it had its limitations. Within his first volume, ‘Analysis and Classification’, Furumark presented a typology of pots, organised first by shape, and then chronology. At the time of its publication, Furumark’s work was unparalleled in the field of Mycenaean pottery and remained a vital tool for the identification and classification of Mycenaean pottery, until his work was updated and revised by P. A. Mountjoy in 1986.

This thesis does not specifically aim to use the classification system designed by Furumark, however it is important to have a solid understanding of his approach and the improvements made by Mountjoy. To this day ‘Mycenaean Pottery’ and its later revisions remain the largest and most complete body of work dedicated to Mycenaean pottery, and Furumark’s typology of shapes has been applied to Mycenaean pottery in museums and collections across the world. Rather than directly using Furumark’s typology, or critiquing it, this thesis hopes to build
upon it, taking a closer look at visually similar pots in order to assess whether further divisions can take place. In his first volume Furumark himself takes the time to explain that he was limited by the sheer amount of research he had to pioneer in order to create his work, and that the types he created should be considered very general (Furumark, 1941, p. XVIII). In the following paragraphs I will briefly discuss Furumark and Mountjoy’s work and their approach to classifying shapes, with specific reference to the type of pot that I am looking at.

Furumark begins the identification process by introducing the readers to a series of general shape classes, such as the ‘conical-piriform shapes’ or ‘globular shapes’ (Furumark, 1941, pp. 18, 29). These sections discuss the origin and development of the shape types within each class over time. Furumark also provides small sections of drawn pots that represent different pottery types – these are organised and separated chronologically. This gives the reader a fair idea of where their specific pot fits and can be followed up by an investigation of the ‘Catalogue of Vessel Types’ towards the rear of the volume (pp. 583-643). This catalogue is a complete list of all Furumark types (FS 1 through FS 336) and includes descriptions of characteristics, as well as a list of example pots.

Furumark explains that the general shape is considered first as the most important typological criterion due to the ‘remarkable uniformity’ of Mycenaean pottery shapes (Furumark, 1941, p. 16). He also notes, however, that there are different levels of within-group variation, and therefore accessories such as handles, spouts, necks, and lips, are vital to the placement of certain types (Furumark, 1941, p. 17). Accessories are discussed in detail at the end of the shape chapter (specifically pp. 80-100), where Furumark discusses their change over time. Furumark also includes a series of figures which illustrate the differences between various features that are mentioned throughout this work, for example, the difference between torus and splaying bases – this is invaluable for those unfamiliar with pottery types and the associated descriptive language.

The type of pot being investigated in this thesis is referred to in Furumark’s work as ‘piriform’ or ‘conical-piriform.’ A number of forms have been included in this shape class – pithoid, amphoroid, hole-mouthed and false-necked jars, deep and
amphoroid kraters, and several forms of jug (Furumark, 1941, p. 18). These types can be identified in the Catalogue of Vessel Types under ‘Form 7: Pithoid Jar,’ although there are a number of subsections which must first be navigated through before your pot may be identified, including chronological placement, size, and a number of general shape groups (Furumark, 1941, pp. 587-592).

The rest of Furumark’s volume dedicates itself to decoration, including sections on the following: the development and use of different decorative elements (pp. 110-235); a systematic explanation of motifs and their respective designations and chronological affiliations (pp. 236-429); a section on the composition of pictorial decorations within different styles (Levanto-Mycenaean and Koine, Hellado-Mycenaean, etc) (pp. 430-470); lastly, a section dedicated to explaining the composition of Mycenaean decoration styles from Myc. I (1550-1500 BCE) through IIIC:2 (1125-1100 BCE) (pp. 471-582). It is important to note that the dates listed here are those that Furumark used at the time of publication, noted in vol. 2 ‘The Chronology of Mycenaean Pottery’ p.115. The dates/periods used in this thesis differ slightly, especially towards the end of the Mycenaean period – see chapter 1.3.

3.3.1 MOUNTJOY: REVISION OF FURUMARK

Furumark’s system was updated by P.A. Mountjoy in 1986, with her work ‘Mycenaean Decorated Pottery: A Guide to Identification,’ which was published as part of Paul Åström’s series, titled ‘Studies in Mediterranean Archaeology.’ In her revision of Furumark’s shape, motif, and chronological classification, Mountjoy revises the organisation of information, allowing for a more intuitive arrangement. Where Furumark divided shape, decoration, and accessories, Mountjoy’s work provides a culmination of all aspects of classification, using time periods as the main division. Each section introduces the pottery shapes that are common, commenting briefly on those that have been introduced or discontinued, as well as outlining the types of motifs that can be expected in that period. In order to assist those wishing to identify sherd material, a brief outline of potential misidentifications is provided after each shape has been discussed. The end of Mountjoy’s volume includes an appendix on the development of each
shape type over time, with a brief explanation of various features described throughout the work (Fig. 270, p. 201), and a collection of Furumark’s original drawings of the shapes, arranged in numerical order (pp. 206-218).

The typologies presented by both Furumark and Mountjoy are traditional in the sense that they aim to identify change through time for the purpose of building up a chronology, however it is possible for typologies to be drawn up with different outcomes in mind (Adams & Adams, 1991, pp. 205-206, 344). The approach taken in this thesis is to draw up a shape typology that looks further into the meaning and validity of Furumark’s decoration types. This will be achieved by undertaking a more complex, numerical classification of three-handled pots found on Cyprus which fit the shape groups listed below in table 3.1, largely from the LHIIIA – IIIB periods. This category of pots was chosen due to their place among the most common Mycenaean decorated pottery.

3.3.1.1 THE PIRIFORM SHAPE: A BRIEF INTRODUCTION

The piriform pot is the focus of this study. It can be sorted into different shape groups based on height, handle orientation and placement, and motif choice. In many instances both Mountjoy and Furumark appear to consider ‘piriform’ an inclusive term, encompassing the shape types ‘conical’ and ‘conical-piriform.’ With each variation the horizontal centre of gravity shifts closer to the rim (conical lowest, piriform highest) (Mountjoy, 1986, p. 202). I will briefly cover piriform shapes in LHIIB through LHIIIB2, as described in the revised work by Mountjoy. Of the 130 pots included in this study, seventy-seven were placed chronologically, sixty-nine of which were listed as ‘LHIIIA2,’ ‘LHIIIA,’ or ‘LHIIIA-B.’ Fifty-four pots were given a Furumark Shape (FS) number, as shown in table 3.1 below. The following paragraphs will describe the piriform types within each period, and any corresponding motif preference – this will include descriptions of pots with both vertical and horizontal handles, although the actual data analysis for this thesis will exclusively focus on pots that have three horizontal handles. This decision was made based on the nature of the data being collected for analysis.
**TABLE 3.1 RECORDED FURUMARK SHAPE NUMBERS WITHIN THIS THESIS**

<table>
<thead>
<tr>
<th>FS</th>
<th>28</th>
<th>44</th>
<th>45</th>
<th>45/46</th>
<th>46</th>
<th>47</th>
<th>Pots without FS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pot count</td>
<td>1</td>
<td>2</td>
<td>32</td>
<td>4</td>
<td>2</td>
<td>15</td>
<td>74</td>
</tr>
</tbody>
</table>

**LHIIIB (FS 22, 28, 30) (Mountjoy, 1986, p. 39-40)**

Although the piriform shape has been identified in earlier phases, in LHIIIB this shape type expands in variety and can be divided into three size classes, large (FS 22; 36-48cm), medium (FS 30; c.20cm), and small (FS 28; 10-15cm). Popular piriform motifs for this period include scale pattern, palm, and ivy (Mountjoy, 1986, p. 39).

**LHIIIA1 (FS 19, 22, 23, 31, 44) (Mountjoy, 1986, p. 53-56)**

The piriform shape in this period can divided by size and shape variations, including neck size, and differences between conical, conical-piriform, and piriform. These can be visually distinguished by the horizontal centre of gravity shifting closer to the rim with each variation (conical lowest, piriform highest) (Mountjoy, 1986, p. 202). The two types relevant to or noted in this thesis are those grouped into small to medium (FS 31; 11-26cm), and small (FS 44; 15-18cm). The FS 31 shape is a conical shape with vertical handles, while FS 44 is conical-piriform and has round horizontal handles. The decorative zones differ in width between sizes, the large pots featuring a decorative zone that stretches below the handles and greatest diameter, while the smaller pots have narrower decorative zones that tend to run across or just below the handles (Mountjoy, 1986, p. 56). A monochrome paint typically covers the base and a considerable portion of the lower body (Mountjoy, 1986, p. 56).

**LHIIIA2 (FS 34, 35, 39, 45) (Mountjoy, 1986, p. 70-72)**

During the LHIIIA2 period pots become more piriform in shape. The divisions of large (FS 34, 35; 30-50cm), medium (FS 39; 25-30cm), and small (FS 45; c.15cm) remain, though the lip becomes more sloping, and the bases are now only torus or splaying (Mountjoy 1986, p. 202; for informative drawing of base shapes refer to Mountjoy 1986, p.201, Fig. 270: Definitions of Features). FS 45 is a continuation of LHIIIA1 shape FS 44. The decoration of this period is quite
different to its predecessor, and by the end of LHIIIA2 zonal decoration predominated. Shape types FS 39 and 45 have narrow decorative zones, while the rest of the body may be decorated with bands, either of equal width, or in variations of broad and narrow bands (Mountjoy, 1986, p. 71). The base of these shapes is always monochrome, and popular zonal motifs include the U-pattern, wavy lines, and repeating V and N patterns (Mountjoy, 1986, p. 71). Common LHIIIA1 motifs, such as net, stipple, scale, and spiral, appear less in LHIIIA2, with the exception of the running spiral, and in fact scale and net motifs are generally only found on Piriform jars by this period (Mountjoy, 1986, p. 68).

Although LHIIB has been covered here, it should be noted that Mycenaean pottery was only brought to Cyprus in very small amounts before the end of the fifteenth century (Catling & Millett, 1965, p. 213). Mountjoy continues to outline the shifting levels of popularity of the piriform shape in Mycenaean pottery throughout LHIIB1-2, these shape types are no longer found by the end of LHIIB2 (Mountjoy 1986, p. 96-98, 123-124). It is also worth noting that pottery types attributed to LHIIB2 are much less likely to be found on Cyprus - Mycenaean pottery as a whole became scarce around 1300 BCE, coinciding with the end of LHIIIA2 (see section 2.2.5) (Karageorghis, 1982, p. 85).

3.4 SUMMARY

The literature reviewed in this chapter was chosen from a much broader field of research in order to lay the foundation for the methodology of this thesis. The works regarding provenance will help the reader understand the technical choices made in this thesis, as well as placing this work within a wider context. The section summarising Furumark’s typology also provides a vital foundation component, as many aspects of Furumark’s work will be revisited in the following chapters. In the next chapter I will outline the methodology, drawing on many of the approaches to provenance outlined above, and drawing on Furumark for classification.
CHAPTER 4:
METHODS

4.1 INTRODUCTION

The primary purpose of this thesis is to determine whether there is any correlation between shape and decoration in Mycenaean three-handled jars, and to produce an appropriate interpretation of these results. In Chapter One I outlined my research questions; (1) Are three-handled pots a homogenous category, or can we identify groups on the basis of shape? (2) If so, do these groups correlate in any way with decoration? (3) How do the results of this research correlate with Furumark’s shape and style sub-groups? (4) How can we interpret these groupings? Do correlations between shape and decoration indicate the hand of an individual or the output of a workshop?

This chapter will address the methods used to answer these questions. For the collection of the shape data of the pottery used in this thesis, a programme called the ‘Potometer’ was used. This programme, written and created by Geoff Wyvill, was designed to analyse photographs and provide accurate measurements of objects with circular symmetry (Wyvill & Anson, 2004). The following sections will outline the type of information collected both for use in the potometer and further analysis, organisation of data into subjective groups, and the statistical treatment of the data.

4.2 DATA COLLECTION

4.2.1 INITIAL COLLECTION

The majority of samples used in this thesis were collected from the series of catalogues published by the Corpus Vasorum Antiquorum, through both physical and online versions. All collected samples conformed to a conical-piriform or piriform shape with three horizontal handles (as seen in Figure 4.1). A total of 130 pot samples were collected for analysis, most of which were collected by Dimitri Anson through investigation of the physical ‘Corpus Vasorum Antiquorum’ publications. These were later re-confirmed by myself via the online
database, where additional pots were collected as appropriate samples. The remaining pots were identified by Dimitri Anson within the ‘Enkomi Excavations 1948-1958’, published by Porphyrios Dikaios (1969) (refer to Appendix: Catalogue of Pots for full list of plate numbers and references).

For each sample the following data was collected where available: current museum collection (at the time of publication), provenance of the pot (if recorded), total height of the pot, the designated Furumark shape and motif numbers (if recorded), as well as any additional measurements. The photograph provided with the catalogue entry for each pot was either photocopied or retrieved from the online publications. All data were recorded on an Excel spreadsheet.

4.2.2 SHAPE DATA

Each pot image was run through a programme referred to as the ‘Potometer,’ which uses the field of photogrammetry to identify the measurements of a symmetrical object from a photograph (Wyvill & Anson, 2004). The Potometer was used to generate the base data for the next step of analysis.

The purpose of the Potometer is to correct the perspective from which the photograph of the pot was taken. Based on the perspective and the angle of the camera, circles in 3D space may become ellipses (Wyvill & Anson, 2004, p. 2). Because of this, features become difficult to measure and may lead to inaccurate observations; the Potometer was created to provide a solution to this problem. The Potometer model consists of an axis and a set of circles, which can be arranged over an imported image of a pot; with the axis placed down the centre of a pot the circles can be adjusted to match the curvature, with the top and bottom circles representing the rim and the base of the pot (Wyvill & Anson, 2004, p. 3). The programme also allows the user to adjust the angle of the pot towards the viewer, and the distance of the base of the pot away from the viewer; this changes the aspect ratio of the programme’s ellipses (Wyvill & Anson, 2004, pp. 4-6).
The vertical axis down the centre of the pot, from the rim to the base, presents itself as ‘0-100’ and can be considered as representing 100% of the height. By adjusting the circles to match the curve of features on the pot, the user is also matching the height and angle that the photo was originally taken in. The Potometer thus provides a set of measurements that are not affected by the angle of perspective – specifically the height and the radius of the pot at a given point. These are provided not as metric values (as you are not able to input any specific data), but as percentages of the total height of the pot. An example of the measurements obtained from the Potometer can be seen in Figure 4.1.

The Potometer was used to record a series of measurements following the sliced method (Shennan & Wilcock, 1975, p. 99). The premise is to divide the profile of the pot into equally spaced horizontal ‘slices,’ and then to measure the radius of each (Orton & Hughes, 2013, p. 194). The final spreadsheet of raw data contained the following field headings; Code (a number assigned to each pot for reference purposes), Picture Reference, Museum Collection, Origin, Height, Furumark Motif number, Furumark Shape number. This information was followed by a set of measurements that were obtained using the Potometer. The measurements at each of these points are, as stated above, the distance of the radius recorded as a percentage of the height (100%); base (Ht0%), rim (Ht100%), handle root, handle base, maximum radius, and incremental measurements every 10%, from 10-90.

Before undergoing analysis, the data first had to be cleared of unreliable variables. Two variables in particular were removed: height at 80%, and handle root height. Both measurements tended to occur at such a point that the body of the pot, where the Potometer circle would be placed, was obscured by handles; this resulted in unreliable measurements for many pots, and it was decided to exclude these variables from further analysis.
Example: the Potometer records two measurements, the height of a specific point, and the radius of the pot at that point. All measurements are based on the height, which is set at 0-100%, and therefore all measurements can be considered a percentage of the actual height of the pot.

In this example the Potometer provides the following numbers: 49/58. The number 49 represents the radius (r) of the pot, while 58 represents the vertical position (ht) at that point. If we say the pot has a total height of 17 cm, then 49% and 58% must each be considered a percentage of 17 cm. Therefore at 58% of the total height from the base (58% of 17cm = 9.86cm) the radius of the pot would 8.33cm (49% of 17 cm).

Figure 4.1 Understanding the Potometer, with example described below.
4.2.3 DECORATIVE DATA

4.2.3.1 MOTIF GROUPS

Before the data was run through any statistical analyses, we organised the pottery into groups based on their central motif decoration. These groups were created for the purpose of studying the association between shape and decoration. The easiest method to achieve this was to begin with groups which we could clearly define (motif design) and analyse shape variation within those groups. Eleven primary motif groups were identified within the dataset, often with several sub-group designs within that. For example, the ‘scale’ pattern identified on sixteen pots could be further divided into four different sub-groups, each with a slightly different design, such as single-outline scales, as well as single-outline scales with a centre dot, etc. All motif groups and sub-groups present within this dataset are shown in Figure 4.2. Each sub-group is synonymous with a Furumark Motif, of which thirty-nine are represented. These groups were designated with a motif group number for ease of separation and cross-referencing between groups.

4.2.3.2 BODY DECORATION

Other than central motif decoration, several other decorative elements were considered for analysis. The dataset was organised into its motif groups and considered against a set of categories, including the width of the central motif zone, the presence of bands below the belly area, the presence of rings or dots around the base of the neck, and the presence and organisation of bands below the central motif area on the belly of the vessel. The purpose of this was to provide an additional element which may add to or further divide sub-groups of shape-motif data.

4.3 ANALYTICAL TREATMENT OF DATA

4.3.1 INTRODUCTION OF STATISTICAL CONCEPTS, APPROACHES, METHODS

The shape data was approached with two different clustering methods, using both the software environment ‘R’ and the statistics programme ‘SPSS’ (ver. 25).
Figure 4.2 Showing all motifs present in dataset, alongside corresponding Furumark motif designations.

<table>
<thead>
<tr>
<th>Motif Type</th>
<th>Motif Examples</th>
<th>Furumark Designations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Foliage Band Motifs: (1) Lines</td>
<td><img src="image" alt="Lines" /></td>
<td>64:1, 64:2, 64:3, 64:4, 64:5, 64:6, 64:7, 64:8, 64:9</td>
</tr>
<tr>
<td>(2) Arrows</td>
<td><img src="image" alt="Arrows" /></td>
<td>64:28, 64:29</td>
</tr>
<tr>
<td>Netting</td>
<td><img src="image" alt="Netting" /></td>
<td>57:2</td>
</tr>
<tr>
<td>Scale Pattern</td>
<td><img src="image" alt="Scale Pattern" /></td>
<td>70:1, 70:2, 70:3, 70:4, 70:5, 70:6, 70:7, 70:8, 70:9</td>
</tr>
<tr>
<td>U, V, N Patterns</td>
<td><img src="image" alt="U, V, N Patterns" /></td>
<td>45:1, 53:8, 59, 60:1</td>
</tr>
<tr>
<td>Stem and Tongue</td>
<td><img src="image" alt="Stem and Tongue" /></td>
<td>19:20, 19:23, 19:38</td>
</tr>
<tr>
<td>Unidentified</td>
<td><img src="image" alt="Unidentified" /></td>
<td></td>
</tr>
</tbody>
</table>
Both a K-Means clustering analysis and a Hierarchical Clustering analysis were employed at various points in this analysis; although each were employed for slightly different purposes, the majority of the analysis moved forward only with Hierarchical Clustering Analysis (HCA). Both methods have been employed in archaeological research, such as Mainfort's (2005) study of Late Period ceramic variation in the Central Mississippi Valley using K-Means clustering, or the (2012) study by Reale et al. using HCA to find correlations between corrosion and burial soil on ancient coins.

The first stage, which was performed in R, allowed us to see how many clusters were statistically relevant based only on the differences between shape variables. The second stage took place using the HCA in the statistics programme SPSS (ver. 25). This method allowed us to make subjective decisions regarding where to draw the line for pottery groups. This was particularly crucial for data concerning motif and decoration and its relation to shape. It was necessary to be able to visually and subjectively identify clusters, allowing us to clarify the data further by understanding more minute variations within shape and decorative elements.

Identifying the optimal number of clusters within a dataset is a complex mathematical issue, and many methods have been developed to solve this, each with their own set of criteria. Both K-Means and HCA are clustering methods - SPSS also offers ‘Two-Step Cluster’ as a third method which essentially combines both approaches. A dataset may be run through any cluster method; however, results can vary depending on the measure or type of clustering method. For example, a K-Means analysis in SPSS requires the user to input a predetermined number of clusters (k), but all other features are pre-set. By contrast the Hierarchical Analysis requires the user to make a number of decisions regarding linkage methods such as ‘Between-groups linkage,’ ‘Within-groups linkage,’ ‘Ward's method,’ and ‘Nearest neighbour,’ as well as an appropriate distance measure. The variables in this dataset can be considered ‘interval data,’ for which measures such as Squared Euclidian Distance are common; this measure magnifies the importance of large distances, while reducing the importance of small distances. The following sections will outline the purpose of each method in more detail and provide an overview of the statistics involved.
4.3.2 K-MEANS CLUSTERING

On a basic level the purpose of K-Means clustering is to minimise the total within-cluster variation. To improve the efficiency of this type of clustering process, all variables were standardised further using a logit transformation, which served to normalise the distribution of the variables. The standard K-Means algorithm is the Hartigan-Wong algorithm (Hartigan & Wong, 1979) which uses Euclidean distances between items and the corresponding centroid to define the total within-cluster variation. The total within-cluster variation can be summarised as follows:

$$\text{tot.withinss} = \sum_{k=1}^{k} W(C_k) = \sum_{k=1}^{k} \sum_{x \in C_k} (x_i - \mu_k)^2$$

The ‘total within-cluster sum of square,’ seen above as ‘tot. withinss,’ measures how compact the cluster is, for which a smaller result is favourable. In this equation $x_i$ is a data point belonging to the cluster $C_k$, and $\mu_k$ is the mean value of the points assigned to the cluster $C_k$. Each observation $(x_i)$ is assigned to the cluster most appropriate in order to minimise the sum of squares (SS) distance between the observation and its assigned cluster centre $(\mu_k)$.

As mentioned above, trying to identify the optimal number of clusters is a complex issue; to address this issue a function called NbClust was run in the software environment ‘R’ (Charrad, Ghazzali, Boiteau, Niknafs, & Charrad, 2014; R Core Team, 2015). This was followed by running the eclust function from the factoextra package for R to obtain the cluster membership for each pot (Kassambara & Mundt, 2016). A silhouette procedure was then applied to the data in order to evaluate the validity of the clusters produced in R.

4.3.2.1 OPTIMAL NUMBER OF CLUSTERS

The function NbClust provides 30 different indices which are obtained by varying all combinations of number of clusters, distance measures, and clustering methods. The results indicate both the number of clusters that have been identified (on the x-axis), and the number of methods that agree on each number of clusters (on the y-axis).
The distance measure used was Euclidean by default, which is also the most commonly used measure for K-Means clustering, as that method is implicitly based on pairwise Euclidean distances between data points. This measure can be expressed as:

\[ d(x, y) = \left( \sum_{j=1}^{d} (x_j - y_j)^2 \right)^{\frac{1}{2}} \]

In this situation \( x \) and \( y \) are the vectors, and the data is a \( d \)-dimensional vector arising from measuring \( d \) characteristics on each of \( n \) objects or individuals. It can be summarised as the usual square distance between two vectors.

After identifying the optimal number of clusters, the cluster solution or membership was obtained by running the \textit{eclust} function from the \textit{factoextra} package for R (Kassambara & Mundt, 2016). The optimal cluster number was then applied to a k-means cluster analysis in SPSS (ver. 24), which produced a very similar cluster solution. This cluster solution was then used to perform a Silhouette procedure in order to assess the validity of the clusters.

### 4.3.2.2 SILHOUETTES – CLUSTER VALIDITY

In statistics a Silhouette procedure refers to a method developed for the purpose of interpreting and validating data clusters. They are most useful when the clusters are based on a distance metric, such as Euclidean or Manhattan distance (Rousseeuw, 1987, p. 55). The Silhouette procedure is based on the proximities of an object to all other objects in each available cluster, for which the value can be written \( s(i) \).

To determine this value, we must consider the following equation elements. For each object \((i)\), \( a(i) \) is the average distance between \( i \) and all other objects within cluster \( a \). Next, we define the average dissimilarity of \( i \) to \( c \), which is any cluster different from \( a \), and can be written as \( d(i, c) \) (Rousseeuw, 1987, p. 55). After computing \( d(i, c) \) we then establish the lowest average distance of object \( i \) to all points in clusters \( c \neq a \) which is represented by \( b(i) = \frac{\text{minimum}}{c \neq a} d(i, c) \).
We can then define the silhouette value using the equation:

\[
s(i) = \begin{cases} 
1 - \frac{a(i)}{b(i)}, & \text{if } a(i) < b(i) \\
0, & \text{if } a(i) = b(i) \\
\frac{b(i)}{a(i)} - 1, & \text{if } a(i) > b(i)
\end{cases}
\]

which can also be written as:

\[
s(i) = \frac{b(i) - a(i)}{\max\{a(i), b(i)\}}
\]

These equations imply the following:

\[-1 \leq s(i) \leq 1\]

When \(s(i)\) is closest to 1, there is smaller degree of variation within-cluster \(a(i)\) than between-cluster \(b(i)\), which would imply that \(i\) is well clustered (Rousseeuw, 1987, p. 56). If the \(s(i)\) value is closer to zero it implies that \(a(i)\) and \(b(i)\) are roughly equal, and it is therefore unclear which group the object \(i\) should be clustered to. If the \(s(i)\) value is closer to -1 it implies that the \(a(i)\) (within cluster distance) is greater than \(b(i)\) (between cluster distance), which implies that it would have been more appropriate or natural to assign \(i\) to the opposing cluster, and that the object may have been misclassified (Rousseeuw, 1987, p. 56).

### 4.4 HIERARCHICAL CLUSTERING

While the K-Means method creates centroid-based clusters, hierarchical clustering is based on connectivity between objects, in particular the idea that objects will be more closely related to nearby objects than objects that are further away. Hierarchical clustering can be split into divisive and agglomerative approaches (James, 2013, p. 390). The divisive approach is a top-down clustering method where all observations are assigned to a single cluster and then partitioned into the two least similar clusters. This is repeated continuously until there is a single cluster for each of the observations. With the agglomerative, or bottom-up method, each observation begins as its own cluster (James, 2013, p.
394). The agglomerative hierarchical process has been employed in this thesis and will be described in detail below.

The hierarchical clustering process begins by establishing a dissimilarity matrix. This thesis used Squared Euclidean distance as the dissimilarity measure, which magnifies the importance of large distances, while reducing the importance of small distances. This was deemed appropriate for the specific circumstances of this thesis, as the purpose of the clustering analysis is to organise the pot samples into groups of maximum difference. The equation for Squared Euclidean distance can be seen here:

\[ d^2(x, y) = \sum_{j=1}^{d} (x_j - y_j)^2 \]

An example of a dissimilarity matrix using Squared Euclidean distance has been included in Table 4.1. The clustering process begins by identifying the pair of clusters that are the most similar (or, more accurately, have the lowest dissimilarity) (Greenacre & Primicerio, 2013, p. 90). In this example A and D share the lowest dissimilarity, which is equal to 0.04. The first step of the dendrogram is therefore joining A and D at the level of 0.04, (as seen in Figure 4.3).

The dendrogram is built by repeating this step until all the samples have been paired, however we must now calculate the dissimilarity between the pair (A,D) and the other samples, for which we have chosen average linkage (Greenacre &

<table>
<thead>
<tr>
<th>Sample</th>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>.000</td>
<td>.98</td>
<td>.855</td>
<td>.040</td>
<td>.234</td>
</tr>
<tr>
<td>B</td>
<td>.98</td>
<td>.000</td>
<td>.702</td>
<td>.090</td>
<td>.151</td>
</tr>
<tr>
<td>C</td>
<td>.855</td>
<td>.702</td>
<td>.000</td>
<td>.619</td>
<td>.240</td>
</tr>
<tr>
<td>D</td>
<td>.040</td>
<td>.090</td>
<td>.619</td>
<td>.000</td>
<td>.119</td>
</tr>
<tr>
<td>E</td>
<td>.234</td>
<td>.151</td>
<td>.240</td>
<td>.119</td>
<td>.000</td>
</tr>
</tbody>
</table>

FIGURE 4.3 SHOWING FIRST STEP OF HIERARCHICAL CLUSTERING OF DATA FROM TABLE 1.1
Primicerio, 2013, p. 90). In an average linkage hierarchical analysis, the distance between two clusters is defined by the average distance from each point in one cluster to every point in the other cluster (Figure 4.4).

\[ L(r, s) = \frac{1}{n_r n_s} \sum_{i=1}^{n_r} \sum_{j=1}^{n_s} D(x_{ri}, x_{sj}) \]

Using the average method, at each step the dissimilarities are recalculated to be the average of all pairwise dissimilarities between the clusters (Greenacre & Primicerio, 2013, p. 94). Rather than simply averaging the two values available at each step, however, the average linkage method takes into account all samples within the cluster; when joining two clusters, if one cluster contains two samples, and the other three, then the average will be based on six dissimilarities (Greenacre & Primicerio, 2013, p. 94). The linkage is repeated at each step, resulting in a new dissimilarity matrix (Table 4.2). The process can now be repeated as before, find the smallest dissimilarity in the matrix (now 0.094, between AD and B) and join the two clusters at that level. Figure 4.5 shows all pairs from the dissimilarity matrix as they would be after all data has been appropriately transformed.

<table>
<thead>
<tr>
<th>Sample</th>
<th>AD</th>
<th>B</th>
<th>C</th>
<th>E</th>
</tr>
</thead>
<tbody>
<tr>
<td>AD</td>
<td>.000</td>
<td>.094</td>
<td>.737</td>
<td>.177</td>
</tr>
<tr>
<td>B</td>
<td>.094</td>
<td>.000</td>
<td>.702</td>
<td>.151</td>
</tr>
<tr>
<td>C</td>
<td>.737</td>
<td>.702</td>
<td>.000</td>
<td>.240</td>
</tr>
<tr>
<td>E</td>
<td>.177</td>
<td>.151</td>
<td>.240</td>
<td>.000</td>
</tr>
</tbody>
</table>

Figure 4.5 Dendrogram showing all pots from example matrix in Table 4.1
4.4.1.1 DENDROGRAMS

It is important to briefly discuss how a dendrogram produced by the hierarchical analysis should be read or interpreted. Each ‘leaf’ of the dendrogram represents a single observation. As we move up the tree these leaves may join to form ‘branches,’ which represent observations that are similar to one another (James, 2013, p. 391). These branches then may fuse with other branches, until all branches are connected. Consequently, all pots that join earlier in the tree must be very similar to one another, while observations that join later on in the tree must represent pots or clusters that are different or less similar (James, 2013, p. 392).

It is also important to note we cannot conclude anything by reading the tree horizontally – that is, across the leaves, rather than up the branches (James, 2013, p. 392). It would be possible for two pots to appear to be closely connected by their placement beside other pots, however if they do not join the other pot or cluster until further up the tree, they are in reality quite different observations. Additionally, the positions of two joined branches could be swapped without affecting the results of the dendrogram (James, 2013, p. 392). Therefore, conclusions should only be drawn based on the location on the vertical axis (up the tree) where branches of observations first connect. The height at which the dendrogram is cut plays the same role as selecting a group number (k) for k-means clustering (see example in Figure 4.6); it determines the number of clusters obtained from the dendrogram (James, 2013, p. 393).

![Figure 4.6 Dendrogram of example data from Table 4.1 showing an example cut, creating two groups of pots](image-url)
4.4.1.2 DISCRIMINANT ANALYSIS

Discriminant Analysis in SPSS (ver. 25) is also commonly referred to as Linear Discriminant Analysis. There are a variety of applications, however for this thesis the main purpose of the Discriminant Analysis was to identify which variables were strongly related to distinction between groups, and discard those which contributed few differences. It was also used to produce a scatterplot of the po clusters. Discriminant Analysis operates through a series of ‘discriminant functions’ which maximise the difference between the values of the dependent variable, which in this case is cluster membership.

The discriminant method used in this research is referred to as ‘stepwise,’ and involves the removal of independent variables that are not significant to the division of clusters. This method begins with none of the variables; at each step the variable with the largest ‘F to Enter’ value that exceeds the entry criteria (set at a default 3.84) is added.

4.5 SUMMARY

This chapter has outlined the collection and treatment of data and has provided a general overview of the statistical analyses undertaken with this dataset, as much as is appropriate to help the reader understand the processes at work. The following chapter will present the results of these analyses, focusing primarily on body decoration and the results of the HCA.
CHAPTER FIVE: RESULTS

5.1 INTRODUCTION

As outlined in Chapter One, the aim of this thesis is to expand our ability to identify patterns of variation, using a methodology that focusses on intricacies in shape and decoration, as described in Chapter Four. This chapter will outline the results of the aforementioned analysis; as outlined in Chapter Four, this analysis underwent two different processes, K-Means and HCA. The K-means analysis involved the least investigation, focusing on shape data with a brief look at the placement of motifs and height. One of the primary outputs of the HCA was the introduction of dendrograms, which allow the user to make subjective decisions regarding groups based on small differences between pots. The pottery was initially organised according to motif groups; three motif groups were identified as representative of almost 72% of all pots in the dataset and the remaining analysis therefore focused primarily on motifs within these three groups. It was also hoped that within-group differences would be more easily distinguished by focusing on a specific set of pots. The three motif groups were run separately through HCA, which clustered the pots according to differences in shape. These new motif-shape groups were then analysed for any observable differences in motif pattern and other design choices. Combining all three motif groups facilitated investigation into whether the motif-shape groups continued to cluster together when more individuals were introduced.

5.2 STATISTICS

K-MEANS CLUSTERING

The clustering method used for most of the data analysis that is covered in this chapter is HCA, although initially the data was also analysed using a K-Means approach. Both of these methods have been outlined in Chapter Four, where it is also briefly explained why K-Means was not continued as a central method for analysis. This section provides an overview of the results of the K-Means clustering analysis and establishes the reasons this analysis was not used moving forwards.
The K-means method was primarily run as an objective approach, without separating the data into motif groups. The intention with this method was to see if the dataset would organise itself into statistically relevant groups. The initial stage in this part of the analysis was run in the statistics programme R (see section 4.3.2). The NbClust function identified a number of ‘optimal cluster’ options, ranging from zero to twenty, and also recorded the frequency of their occurrence which can be seen in Figure 5.1 below. The optimal number of clusters was seen to be two; using the function `eclust` from the `factoextra` package for R (Kassambara & Mundt 2016), cluster membership was obtained for all pots in the dataset. The optimal cluster number was then applied in a K-Means cluster analysis in SPSS (ver.24) which produced a cluster solution that was almost identical (this was used for further analysis with motif associations, which is addressed below).

![Figure 5.1 Bar graph showing the results of the NbClust function in R](image)

When the shape groups were overlaid with motif group memberships, there were no clear associations between the two. The cluster membership was used to run a Silhouette procedure in SPSS, which allowed the evaluation of the validity of the clusters produced through R (Rousseeuw, 1987, p. 53). As explained by Rousseeuw (1987), if the clusters are well separated the silhouette width will be closer to 1.00 while no separation between clusters would be 0.00, and a negative
value would imply that the pot has been sorted incorrectly. These values can be identified on the x-axis of the plot shown in Figure 5.2. The average silhouette width value therefore reflects the validity of the clusters. In this case, as indicated in Figure 5.2, the average silhouette cluster width for two clusters was 0.3, which is considered a weak structure. This either suggests that the differences between the two groups were very subtle, or perhaps that despite the indication that two clusters were the best fit, two clusters were not the number that would reflect the highest degree of separation.

The K-means method was used to see if, on a large scale, the data would separate into groups based on shape alone. As can be seen above this was not reflected in the results. Additional issues included a difficulty in identifying which pots were most closely related to one another in shape, and our ability to identify groups which reflected that association. The analysis therefore continued into HCA, which created a visual element that was more appropriate to the type of dataset being worked with.
5.3 STATISTICS
HIERARCHICAL CLUSTERING

The ability of the HCA to create dendrograms was of central importance in this analysis. These dendrograms allowed for the subjective selection of groups based on proximity between pots. The analysis was based around analysing groups of specific motif designs, as well as combining and restructuring these groups based on variables such as height. The dendrograms were invaluable tools through which we could begin to analyse the relationships between pots, and to understand the relationship between shape and decoration.

5.3.1 MOTIF GROUPS

The pottery used in this study featured eleven different motif styles, including variations on vertical lines, spirals, net, scales, waves, alternating u- or v-shapes, arrows, stems, repeating N pattern and vertically aligned dots in repeating rows. The data was initially divided into these eleven groups, as seen in Table 5.1. Each group was subsequently divided further according to various design intricacies to create sub-groups that were as homogenous as possible. These sub-groups were comparable to design designations identified by Furumark (please refer to Figure 4.2 in Chapter Four for examples of all motifs identified in this dataset). The nature of this research is to combine the study of both shape and motif, we therefore restricted further investigations to the most common and numerous motif groups, which were each analysed separately using HCA in SPSS (ver.25). This included nineteen spiral pots (FM 49:22, 46:45, and 49:28), twenty-two line pots (FM 64:21), and twenty-six netting pots (FM 57:2). The next largest group was the scale motif, specifically the eight pots of FM 70:1. Multiple motifs were incorporated in the Spiral Motif group following an initial HCA of the complete dataset which revealed that all three motifs clustered closely and coherently with one another. The entire sample which we proceeded with, as identified above, accounts for 52% of the total assemblage.

To differentiate between the larger category of motifs (e.g. all five different line motif styles) and the motifs specifically studied in this thesis (e.g. only pots with ‘vertical straight line’ decoration that conform to FM 64:21) I will refer to the
larger pool of motifs as a ‘Category,’ and refer to the specific motifs being analysed as a ‘Motif group’ (e.g. Line Category versus Line Motif group). When referring to clusters within each Motif group that have been identified on the basis of shape, I will refer to them either by their abbreviated name (e.g. LG1) or collectively as a ‘motif-shape’ group.

Table 5.1 Motifs present in data and number of pots featuring each design

<table>
<thead>
<tr>
<th>Spirals</th>
<th>Lines</th>
<th>Netting</th>
<th>Scales</th>
<th>Waves</th>
<th>'U'</th>
<th>'V'</th>
<th>'N'</th>
<th>Stem</th>
<th>Arrow</th>
<th>Dots</th>
</tr>
</thead>
<tbody>
<tr>
<td>28</td>
<td>39</td>
<td>26</td>
<td>16</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>1</td>
</tr>
</tbody>
</table>

Figure 5.3 Figure showing motifs used in this analysis, including corresponding Furumark motif numbers. For Figure containing all motifs listed in Table 5.1, please refer to Figure 4.2

5.3.2 SPIRAL MOTIF GROUP

The pots in the Spiral Motif group consisted of three design variations; Design A (FM 49:22) featured a repeating curve-stemmed spiral, Design B (FM 46:45) shows a running spiral design, decorated by small triangular filler designs, while Design C (FM 49:28) showed a series of spirals connected at the stem (refer to Figure 5.3 for all designs). Design A was the most commonly identified, consisting of 50% of the Spiral Category. Design B was the next largest, making up 14%. With the exception of the singular pot belonging to FM 46:32 (dated by Furumark to Myc. I-IIA), all motif designs in the spiral category were dated between Myc. IIIA2 early (e) and late (l). Design A is considered to be Myc. IIIA2e, while design B is considered Myc. IIIA2l.
Through the HCA the nineteen pots separated into two groups with one outlier. Group one (SG1) shown in Figure 5.4a, consisted only of design A, while group two (SG2) consisted of all three designs. Designs A and B did not cluster separately within SG2, but both SG2 and SG1 consistently formed coherent and separate clusters, even when combined with the other two Motif groups.

![Figure 5.4](image_url)

Figure 5.4 Figure showing Dendrogram (a) and Scatterplot (b) for vessels within the Spiral motif group (FM 49:22, 46:45, 49:28), with two groups and one outlier identified in each plot. Both plots were created in SPSS ver. 25

The data was then run through a discriminant analysis using the stepwise method, creating a scatterplot of the results. The scatterplot in Figure 5.4b shows a well-defined separation between the groups. The stepwise results provide an indication of which variables account for the highest degree of separation between groups, although it does not necessarily account for all variation. In this case the variables identified were 10%, 50%, and 90%. Although pot height was not one of the suggested variables, it has been included in Table 5.2 below and is considered an important variable for analysis between both sub-groups and motif-groups. Figure 5.5 displays graphed representations of the average pot shape within each group, as well as the outliers.
Table 5.2 Table showing averaged values of each Spiral sub-group for variables 10%, 50%, and 90%.

<table>
<thead>
<tr>
<th>Variables (cm)</th>
<th>SG1 (Average)</th>
<th>SG1 (max/min)</th>
<th>SG2 (Average)</th>
<th>SG2 (max/min)</th>
<th>SG3 (outlier)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>12.2</td>
<td>15.0</td>
<td>10.6</td>
<td>11.8</td>
<td>14.2</td>
</tr>
<tr>
<td>90%</td>
<td>25.2</td>
<td>26.6</td>
<td>23.5</td>
<td>21.3</td>
<td>22.1</td>
</tr>
<tr>
<td>50%</td>
<td>38.5</td>
<td>40.3</td>
<td>37</td>
<td>35.3</td>
<td>38.2</td>
</tr>
<tr>
<td>10%</td>
<td>13</td>
<td>13.6</td>
<td>11.9</td>
<td>11.8</td>
<td>12.5</td>
</tr>
</tbody>
</table>

The differences identified in Table 5.2 are significant enough to create an observable division. On average, pots in SG1 tend to be wider than SG2 vessels; at 90% SG1 is wider by a measure of 3.9, at 50% it is wider by 3.2, and at 10% by 1.2. The outlier vessel is similar in shape to SG1 vessels; the belly however extends from a lower point on the pot, and likewise tapers towards the neck at a lower height. The differences overall can be summarised as SG2 being both slightly shorter and narrower than SG1, while the outlier vessel stands alone with a lower centre of gravity.

5.3.3 LINE MOTIF GROUP

As stated above, the group analysed here consists of 22 of the 39 specimens decorated with variations of a line style motif (refer to Figure 4.2 and 5.3), and accounts for all pots matching Furumark Motif designation 64:21. This specific design, as shown in Figure 5.3, consists of straight vertical lines which attach to both the top and bottom border. Furumark places this design into a broad spectrum of Foliate Band motifs (Furumark, 1941, p. 396), branching out from an earlier metallic type which was has been dated to Myc. IIA. All line designs shown in Figure 5.3 were dated by Furumark to Myc. IIIA2.
The HCA dendrogram in Figure 5.6a shows a strong separation between two sets of data, however closer analysis of the pot shapes in this motif group suggested that further separation could be appropriate. The data was therefore separated at the points indicated in Figure 5.6a, creating three groups and two outlier pots. Figure 5.6b shows a scatterplot of these groups, indicating a reasonable degree of separation.

Figure 5.6 shows a scatterplot of these groups, indicating a reasonable degree of separation.

Figure 5.7 below shows a series of graphed representations of the average pot shape within each group, which can be used to highlight differences between the established groups. Using the Discriminant Analysis ‘Stepwise method’ the variables 50%, 70%, and 100% were established as important and marked accordingly on each pot in Figure 5.7. Table 5.3 provides an indication of the average, maximum and minimum values of these variables.

The three groups identified below can be roughly divided by height and width. LG3 vessels are the shortest on average, however are also the widest across the belly, and have a wider rim. LG2 vessels by comparison are both taller and their bodies narrower; the midground is held by LG1, which also has the widest variation between vessels, and a difference of 7cm in height. Comparatively, LG2 vessels vary by only 2-3-points. LG3 shows very low variation at 50% and 70% height, however the measurements at 100% (measured at the rim) show a large
variation. Further investigation revealed that this was due to a single outlier, identified as number 17 on the dendrogram in LG3, noted in Figure 5.6a, whose rim width was similar to that of LG1 vessels.

Table 5.3 Table showing averaged values of each line sub-group for variables 50%, 70%, and 100%.

<table>
<thead>
<tr>
<th>Variables</th>
<th>LG1 (Average)</th>
<th>LG1 (max/min)</th>
<th>LG2 (Average)</th>
<th>LG2 (max/min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height (cm)</td>
<td>15</td>
<td>18.1</td>
<td>11.1</td>
<td>17.5</td>
</tr>
<tr>
<td>100%</td>
<td>27.8</td>
<td>30.1</td>
<td>25.9</td>
<td>25.7</td>
</tr>
<tr>
<td>70%</td>
<td>43.4</td>
<td>45.3</td>
<td>40.5</td>
<td>40</td>
</tr>
<tr>
<td>50%</td>
<td>38.5</td>
<td>40.3</td>
<td>36</td>
<td>36.1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variables</th>
<th>LG3 (Average)</th>
<th>LG3 (max/min)</th>
<th>LG4 (Outlier)</th>
<th>LG5 (Outlier)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height (cm)</td>
<td>12.3</td>
<td>13.5</td>
<td>9.8</td>
<td>11</td>
</tr>
<tr>
<td>100%</td>
<td>30.9</td>
<td>33.7</td>
<td>27.1</td>
<td>28.1</td>
</tr>
<tr>
<td>70%</td>
<td>45.5</td>
<td>46.7</td>
<td>44.7</td>
<td>48.2</td>
</tr>
<tr>
<td>50%</td>
<td>42.4</td>
<td>42.5</td>
<td>42.2</td>
<td>46.9</td>
</tr>
</tbody>
</table>

Figure 5.7 Figure showing the average shape of pot groups, with red points indicating the location of 50%, 70%, and 100% of the height. The height in all examples is standardised.

It should also be noted that the sample size between motif-shape groups varies dramatically; LG1 represents 13 vessels, while LG2 and LG3 represent three and
four vessels respectively. The ranges displayed for each group, however rough, nevertheless support the trends in height and width. The outlier pots are both short; LG4 shows an exceptionally wide belly, while the belly of LG5 is of a similar width, but considerably squatter. Additionally, the width of LG5 between 0-20% is significantly narrower than LG1-3 and LG4.

5.3.4 NETTING MOTIF GROUP

All 26 pots identified with a net design fit into the Furumark motif designation 57:2; the design itself is of multiple diagonal lines crossing over one another in opposing directions and without further embellishment. This motif has been dated by Furumark to Myc. IIIA1 – C1. The pots in this group were not as easily separable as the Spiral Motif and Line Motif groups, potentially explained by a lack of diverse outlier shapes. The analysis moved forward with four groups, as identified in Figure 5.8a. NG1 represents ten specimens, NG2 twelve specimens, leaving groups NG3-4 with two specimens each, which can be considered the outliers of the group.

Figures 5.8b shows the degree of data variation and group separation. Both plots suggest that there are few significant differences, especially between groups one and two. This can be further corroborated by the ‘average pot shape’ displayed in Figure 5.9, and the average values displayed in Table 5.4. The primary difference
in shape between NG1 and NG2 appears to be the width of the pot, particularly at the belly which peaks in width between 60%-70%. NG4 vessels can be separated by a lower centre of gravity which has resulted in a larger, lower set belly area. The two vessels in NG4 are distinguishable by their narrow, tall nature. Though not excessively slimmer than the other average-pots across the maximum diameter, the belly of NG3 vessels tapers down to a more elongated ‘ankle’ zone. Perhaps the most significant aspect of the Netting motif groups is the degree of similarity, rather than the differences, which are few.

Table 5.4 Table showing averaged values of each netting sub-group for variables 40%, 90% and pot height.

<table>
<thead>
<tr>
<th>Variables</th>
<th>NG1 (Average)</th>
<th>NG1 (max/min)</th>
<th>NG2 (Average)</th>
<th>NG2 (max/min)</th>
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</thead>
<tbody>
<tr>
<td>Height (cm)</td>
<td>14.2</td>
<td>17.9</td>
<td>10.9</td>
<td>17.4</td>
</tr>
<tr>
<td>90%</td>
<td>24.5</td>
<td>26.4</td>
<td>23.1</td>
<td>22.4</td>
</tr>
<tr>
<td>40%</td>
<td>32.5</td>
<td>36</td>
<td>29.2</td>
<td>30</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Variables</th>
<th>NG3 (Average)</th>
<th>NG3 (max/min)</th>
<th>NG4 (Average)</th>
<th>NG4 (max/min)</th>
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</thead>
<tbody>
<tr>
<td>Height (cm)</td>
<td>15.1</td>
<td>16</td>
<td>14.2</td>
<td>19.9</td>
</tr>
<tr>
<td>90%</td>
<td>26.6</td>
<td>27.2</td>
<td>25.9</td>
<td>20.1</td>
</tr>
<tr>
<td>40%</td>
<td>27</td>
<td>27.6</td>
<td>26.3</td>
<td>35.3</td>
</tr>
</tbody>
</table>

Figure 5.9 Figure showing the average shape of pot groups with red points indicating the location of 40%, and 90% of the height. The height in all examples is standardised
As well as shape and basic motif type, consideration was given to other decorative aspects. As described in section 4.2.3 the vessels in each motif group were analysed within the following categories (also indicated in Figure 5.10): the extent of the ‘Central Motif Zone’ (CMZ), the arrangement of bands in ‘Zone One’ below the CMZ, the presence and type of extra bands found in ‘Zone Two’ on the main body of the vessel, and the presence of bands or dots around the base of the neck. As mentioned in section 5.3.1, the results presented here may describe results of both motif ‘Categories’ and specific ‘Motif groups.’ For example, the ‘Spiral Category’ refers to all pots in this dataset which have been identified as having a spiral design, while the ‘Spiral Motif group’ refers only to those pots which have been analysed earlier in the chapter, specifically those of FM 49:22, 46:45, and 49:28.

The decoration at the base of the neck is usually also immediately above the CMZ, and is either a series of thin bands, a ring of dots, both (although this only occurs in one case), or neither. Within the Line Category, 95% of all vessels were identified with a series of bands around the base of the neck – within the Line Motif group specifically, twenty-one of the twenty-two vessels showed bands around the neck base, one of which also had a ring of dots.

Only one vessel could not be classified. The Netting Motif vessels showed fairly similar results, with twenty-two instances of bands around the neck base, two cases where no decoration was found in that area, and two where the photo quality or angle prevented the identification of decoration in that area. Within the Spiral Category, twelve of the twenty-eight vessels had a ring of dots around the neck base, and three vessels were decorated with bands. Of the remaining thirteen vessels, seven had no decoration in this area, and six were not able to be confidently classified. The vessels within the Spiral Motif group notably accounted for all twelve instances of a ring of dots around the neck base, one
example of band decoration, three vessels with no decoration in that area, and three where no assessment could be confidently made.

The extent of the CMZ can be divided into three groups – handle-width, extending slightly-below handles, and extending onto the belly. For both the Line Motif and Netting Motif groups, handle-width decoration is the most common, with only a few cases each of decoration extending below the handles or onto the belly. By contrast the Spiral Category almost entirely consists of decoration that extends down onto the belly, with only two occasions where the decoration was restricted to being handle-width, neither of which were included in the Spiral Motif group.

The two most common arrangements of bands in Zone One include two thick bands, and between these a series thin bands, which may range in number from one to five. The second most common is an arrangement of equally sized bands
ranging in number from two to five. Some less common arrangements include a thick band flanked by thin bands; in some cases, a thick band with several thin lines below was identified, as well as several other unique arrangements of thick bands and thin lines. The most popular Zone One arrangement in the Line Category was that of two thick outer bands and thin inner bands, found on almost 60% of vessels in the Line Motif group; the most common number of inner bands here were two and three. The same arrangement was most popular on vessels in the Netting Motif group, accounting for 66% of vessels. Contrastingly the Spiral Category showed a clear preference for arrangements of equally sized bands, which were identified on twenty-three of twenty-eight vessels, and notably accounted for all but one vessel in the Spiral Motif group.

Band arrangements in Zone Two were significantly less common and were found on less than a quarter of the vessels. The most common choice of bands in this zone were arrangements of thin lines, ranging between two and four in number. Other arrangements include thick outer and thin inner bands, thin outer bands and a thick inner band, or a singular thick band. Of the remaining vessels in the dataset, 75% had no zone two decoration, while 5% of the photos were too low in quality to confidently assess the presence of Zone Two decorations. The Line category accounts for almost half of the vessels with bands in this zone, and only half again were included in the Line Motif group. Of those vessels the decoration is almost exclusively arrangements of thin lines. Only one Spiral vessel was recorded with decoration here, and it was not included in the Spiral Motif group. Only four of twenty-five vessels in the Netting Motif group had Zone Two decoration.

Although there are notable differences in extra body decoration between the Netting Motif and Line Motif groups and the Spiral Motif group, there appeared to be few intra-group differences in this type of decoration. The data was examined to identify any correlation between motif-shape groups and decoration choices. For example, within the Spiral Motif group, would the presence or absence of a ring of dots at the base of the neck correlate with different motif-shape groups, or perhaps body bands in 'Zone Two' would only occur in LG1, as opposed to LG2. The analysis revealed that the presence or absence of certain
decoration choices did not appear to correlate between motif-shape groups, and the sample was too small in many cases to comfortably identify correlations between design choices. For example, within the Netting Motif group there were several cases where Zone One ‘equally sized bands’ were used; if the Spiral Motif group is held as a standard for this then we might expect that each time this decoration showed up it would follow the convention of either a shorter height, or a CMZ large enough to extend onto the belly. However, only two out of the five Netting Motif pots with this decoration were also associated with belly-width decoration, and additionally only two out of five were below fifteen centimetres in height. There appeared to be little to no correlation between extra-body decorations and height; although the Spiral category and Motif group, which can be considered the ‘shortest’ group, was almost exclusively decorated with equally sized bands.

5.5 COMBINING THE GROUPS AND ANALYSING HEIGHT

To test the strength of the motif-shape groups, all three of the motif groups were run together in an HCA to identify whether or not the pots would remain in their separate clusters, and which (if any) other sub-groups they may cluster together with. The results showed that only pots which had clustered closely together in their original analysis remained close in the combined tree. This mostly occurred with pots that had clustered together at a distance of less than ‘5,’ (distance in this context referring to the ‘rescaled distance’ marked on the left-hand side of the dendrogram) but in cases of isolated pairs, up to a distance of ‘15’. The results, therefore, reflect small groups of two to three pots from motif-shape groups remaining clustered together. With a few exceptions, motif-shape groups did not tend to cluster with another from their particular motif, though they did appear to cluster with one another. NG1 and LG1 clustered together often, as did NG2 and LG2; NG1 and LG1 were also closely related to SG1. The Spiral motif-shape groups remained in their separate clusters with only two SG1 exceptions – these groups and outliers are indicated below in Figure 5.12.
The pots which clustered closely (in this case, those clustering at a distance of ‘1’ on the dendrogram in Figure 5.12) revealed an interesting situation where two pots, very similar in shape, were also often very similar in decoration. Eleven pairs were singled out from Figure 5.12 allowing the following observations:

1) Pots were extremely similar in both body decoration and in motif style.
2) Pots had the same motif style and slightly different decoration.
3) Pots had the same motif style, but the decoration choice was entirely different.
4) Pots had different motifs, but the decoration choices remained similar.
5) Pots had different motifs, and the decoration choices were not similar.

Most of the pairs which shared the same motif were of Spiral Motif and Line Motif groups, however the most interesting results were pairs that joined pots from different motif groups. The three cases of mixed-motif pairs were as follows, NG1 and LG1, NG2 and LG2, and SG1 and NG1. In the case of NG1 and LG1, the body decoration was very similar.

The observation that both spiral shape groups grouped together coherently and were also shorter on average than the other groups, led to an analysis of height across the three groups. Figure 5.13 shows a combined graph of all heights across the three groups, as well as individual graphs which highlight the ‘maximum height’ for each group. The combined height distribution graph seemed to organise itself into two distinct ‘peaks,’ which were then used to manually split the data into two separate data sets; short pots constituted pots less than or equal
to 14 cm, while tall pots were greater than or equal to 15 cm. This separation has been highlighted on the combined-group dendrogram shown in Figure 5.12, indicating that the separation of height has some correlation to shape.

![Height Distribution](image)

**Figure 5.13** Height distribution of pots in three main motif groups; the graph on the left is a combined plot, while the three graphs on the left are individual plots.

5.5.1 SMALL POTS VS. TALL POTS

The two height-based data sets were run through separate HCA in SPSS so that they could be analysed independently; the results are shown in Figures 5.14 and 5.15 below. Figure 5.14 represents the majority of Spiral Motif pots, as well as 23% of Netting and 41% of Line motif pots. Due to the Spiral vessels clustering together, it is natural that the Netting Motif and Line Motif vessels also cluster together in Figure 5.14. If the dendrogram clusters are separated at a distance of ‘10’ then all SG1 pots cluster together with a few pots from NG1 and LG1, while SG2 forms a coherent cluster of its own. A separate cluster can be seen comprising of the outlying SG3 vessel, as well as pots from NG1, LG3, and LG5. The two-vessel clusters on the right-hand side of the dendrogram are made up of LG1 vessels in one, and LG3-4 vessels in the other.
The dendrogram in Figure 5.15 shows that the Line and Netting pots did not separate cleanly into their original motif-shape groups. While LG1 and NG1 vessels still appear to cluster together, they also cluster here with the singular spiral vessel, and four NG2 vessels. The fourth cluster significantly clusters into only LG2 and NG2 vessels. As with the larger dendrogram in Figure 5.12, pots that clustered tightly together in their own motif-shape groups remained in these groups across Figures 5.14 and 5.15. In fact, the order of pots in their clusters remained largely unchanged from those in Figure 5.12, which perhaps is unsurprising considering how clearly the pots were organised by height.
Figure 5.15 Dendrogram showing "small" pots from three main motif groups. Pots from each motif group are indicated in orange, yellow, and blue as appropriate. The ‘x’s mark where clusters would be separated at a distance of ‘10’

Figure 5.14 Dendrogram showing "tall" pots from three main motif groups. The grouping of pots by motif is indicated in orange, yellow, and blue. The ‘x’s indicate where the clusters would be separated at a distance of ‘10’
As well as combining all the pots across the three motif groups for analysis, an HCA was also performed using the ‘average pots’ which were displayed for each motif group in sections 5.3.2-4. The results of this HCA, shown below in Figure 5.16, show which motif-shape groups are most closely related to one another. When combined, the three motif groups can be broadly divided into three new groups (indicated on Figure 5.16 at a distance of ‘15’), which can be further divided into seven sub-groups, three of which are grouped branches of two or three motif-shape groups. These new sub-groups have been labelled on the diagram at a distance of ‘6’. The groups which appear most closely related reflect results presented earlier in section 5.5, specifically the close relationship between NG2 and LG2, as well as NG1, LG1, and SG1. Additionally, SG2 is connected to NG2 and LG2, though at a greater distance, and two outliers SG3 and LG5 are introduced as being quite similar to one another. Also shown in Figure 5.16 are the average-pots representing the motif-shape groups in 1a and 1b, as well as 2a.

Figure 5.16: Dendrogram showing HCA of average pot data, also showing average-pots representing the motif-shape groups in the sub-groups indicated.
5.6 SUMMARY

There are several central results that have been outlined in this chapter. The first and most obvious result is the separation and cohesive organisation of the Spiral Motif shape groups, reinforced by both height and body decoration. Another result worth noting is the connection between LG1 and NG1 pots, which can be seen clustering together often, and share similar results in body decoration and height. Also, worth noting for discussion is the high degree of similarity between pots that cluster together at a low distance. These results will be picked up in Chapter Six and discussed in relation to the questions outlined in Chapter One.
6.1 INTRODUCTION

In Chapter One I introduced the purpose, aims, and questions that drive the research behind this thesis. The purpose of this thesis was to investigate the potential of adopting a fine-grained typology of shape to study the origins and the production of Mycenaean pottery found in Cyprus. This has been exemplified through the results in Chapter Five, and its effectiveness investigated through this chapter by addressing the aims and answering the main questions. The aim, or primary interest of the thesis, was to determine whether there was any correlation between shape and decoration, and, if so, how this might be interpreted. In order to address the aim, I will answer the following questions: (1) Are three-handled pots a homogenous category, or can we identify groups on the basis of shape? (2) If so, do these groups correlate in any way with decoration? (3) How do the results of this research correlate with Furumark’s shape and style sub-groups? (4) How can we interpret these groupings? Do correlations between shape and decoration indicate the hand of an individual or the output of a workshop?

6.2 QUESTIONS ONE AND TWO: IDENTIFYING GROUPS ON THE BASIS OF SHAPE

This section will discuss results that relate to the first two questions; (1) Are three-handled pots a homogenous category, or can we identify groups on the basis of shape, and (2) if so, do these groups correlate in any way with decoration?

The results in Chapter Five show that it was possible to identify groups on the basis of shape, however most decorative factors did not correlate or reinforce intra-motif groupings. Pots in the Spiral Motif and Line Motif groups can be divided into distinct shape groups, although the Netting Motif group appears to be less divisible. Certainly, the most coherent groups can be observed among the Spiral Motifs, which were reinforced by different motifs, an aspect investigated only in this motif group.
The Spiral Motif group consisted of pots with one of three different spiral motif designs, indicated in Chapter Five, section 5.3.1. The choice to use multiple spiral motifs rather than a single spiral motif followed an initial analysis of all spiral pots in the data set, which indicated that pots with these three motifs clustered together strongly. These motifs have been referred to in this text as Designs A, B, and C. Through an analysis of shape, the Spiral Motif pots clustered into three groups, one of which was an outlier pot; all three motif-shape groups were similar in proportions, although on average SG1 pots were wider than SG2 pots, particularly at the neck, lower belly, and ankle. SG3 (the outlier) was similar in shape to SG1 with a slightly wider ankle. The division of motifs between these groups is of particular interest; pots in SG1 consisted only of Design A, the most numerous motif, however Design A was also found in SG2, alongside Designs B and C. The outlier pot was also of Design A. These trends reinforce the shape groups, potentially indicating the popularity of designs across different workshops or individuals or may represent a change chronologically.

The body decoration elements on Spiral Motif pots did not provide any intra-group separation, however they did serve to reinforce the separation of Spiral Motif pots from the Line Motif and Netting Motif groups. Although there were a few variations, the most common arrangement of decorative elements on Spiral Motif pots were as follows; a ring of dots around the base of the neck, the CMZ extending onto the belly of the vessel, followed by a series of uniform bands (refer to Figure 5.10 for different areas of decoration, and Figure 5.11 for the different types of decoration found in each area). While not exclusive to the Spiral Motif group, these elements occurred here with higher frequency than the Line Motif and Netting Motif groups.

Height was an element that was effective in reinforcing both intra-group and inter-group variation. As with body decoration, height was most effective in separating the Spiral Motif pots from the Line Motif and Netting Motif groups; the Spiral Motif pots made up a significant portion of the ‘short’ vessels. Netting Motif and Line Motif pots were both much taller on average.
6.2.2 LINE GROUPS

On the basis of shape, five groups were identified among Line Motif pots, two of which were outliers. The results in section 5.3.3 showed a strong separation between LG1-2, and LG3-5, which was reflected in the ‘average shapes’ shown in Figure 5.7. The greatest areas of difference between these two group sets are height, and the proportions of the upper half of the pot. LG1-2 tend to be taller and narrower with a higher-set belly; LG3-5 pots tend to be wider and shorter.

The body decoration observed on Line Motif pots did little to reinforce intramotif-group variation but was useful in highlighting some decorative trends. The Line Motif group showed the widest variety of decorative choices, but one constant was a fine line group found at the base of the neck above the CMZ, which appeared on almost all of the vessels in this group. Similarly, almost all pots in this group had a handle-width CMZ. The choice of bands in Zone One didn’t vary between sub-groups, and several different types were used, including uniform series of bands and broad bands flanked by narrower ones. The most common choices in this zone were variations of thick bands flanking fine line group, which most often contained three lines. Potentially due to the handle-width CMZ, the Line Motif group had the highest proportion of decoration on the lower body (Zone Two). This included a fine line group, which was observed on vessels in LG1, LG2 and LG3, and a pair of thin lines flanking a single, very thick band, which was only observed in LG1.

6.2.3 NETTING GROUPS

While the identification of shape groups within the Spiral Motif and Line Motif groups were relatively obvious conclusions, the Netting Motif pots were not so easily separated. The height graphs in Figure 5.12 (Chapter Five section 5.4), and the two plots in Figure 5.8 (section 5.3.4) reveal few dramatic differences between the identified groups. Although identifying and separating these pots into four groups was possible, many of the pots cluster at quite a large distance – for example, in the Spiral Motif and Line Motif dendrograms, we can clearly see that most differences occur between the distance of 0-5, while the Netting Motif
groups tend to cluster between the distance of 5-15. As was explained in Chapter Four section 4.3.3.1, a greater distance is equivalent to a greater measure of dissimilarity, implying that these pots are potentially not very similar after all.

Regardless, the HCA results for the Netting Motif group allowed the identification of four groups. The dendrogram in Figure 5.8(A) suggested that NG1 and NG2 should be quite different to NG3 and NG4. NG1 and NG2 separated from one another on the basis of height, the width of the neck, and the lower extent of the belly. NG1 pots tended to be both shorter and wider than NG2 pots. NG3 and NG4 are each separated by proportional width; NG3 pots are wider at the neck than the other three groups, but narrower at the lower belly area. NG4 pots are taller, narrower at the neck, and wider at the lower belly area. These differences are exemplified by the ‘average pot’ graphs in Figure 5.9.

Within the context of body decoration, the Netting Motif group served as a decorative middle ground of sorts between the Spiral Motif and Line Motif groups. Pots in the Netting Motif group typically had a group of fine lines around the base of the neck, while the CMZ width was either handle-width or slightly larger, of which three examples fully extended down to the belly. Zone Two decoration was also very sparse with only four occurrences, a number so small that no correlations could be considered applicable to intra-group variation.

6.2.4 RELATION OF SHAPE-MOTIF GROUPS TO ONE ANOTHER

The brief analysis in section 5.5.2 indicated that these shape groups could be closely related outside of their Motif groups. An additional HCA was run using data from the average pot shapes identified for each motif-shape group. Considering that this data was built on averages across inconsistent group sizes, these results should not be used as anything other than an indication of a potential relationship between groups. The results were, however, supported by various findings of the height analysis in section 5.4. The results of this HCA suggested that there were at least three sets of closely related groups. First, NG2, LG2, and (less closely) SG2. Second, NG1, LG1, and SG1. Third, SG3 and LG5 (both outlier pots). The analysis in section 5.4 reflects two of these observations, specifically the relation of NG2 and LG2, and the relation of NG1, LG1, and SG1.
These results support the results of the ‘average pots’ and reaffirm the relation between these groups on the basis of both shape and height.

6.3 QUESTION THREE: FURUMARK AND MOUNTJOY

In this section we approach the third question: How do the results of this research correlate with Furumark’s shape and style sub-groups? This discussion will also take into consideration the limitations of each approach.

One of the primary aspects of Furumark’s work is its heavy focus on chronology, followed by shape and decoration. Motifs are organised by type, and within each type motifs are arranged by chronology. In Mountjoy’s revision of Furumark’s work she provides an overview of shapes common to each time period, as well as motifs and the forms with which they are most commonly associated. Additionally, Mountjoy specifically indicates how each Furumark shape interacts with different decorative elements. The piriform pot is classified as a ‘pithoid’ form, within which shapes are organised by height, and then by physical characteristics, e.g. ‘tall conical type’ or ‘low and broad type’ (Furumark, 1941, pp. 587-592). Using the examples and descriptions provided by Mountjoy (1986, p. 202) we can place most, if not all, of the pots in this collection in conical-piriform, or piriform categories. The Spiral Motif pots appear to be closer to the conical-piriform shape, while the Netting Motif and Line Motif vessels appear to be more commonly piriform in shape. Among the piriform shapes, only three types matched the physical characteristics of pots used in this study. These four potential shapes were placed chronologically in LHIIIA1 (FS44), LHIIIA2 (FS45) and LHIIIB1 (FS48).

My work intrinsically connects motif and shape by changing the primary order with which one looks at these pots; rather than analysing them separately and combining the two groups later, this research began by singling out specific motif types and using them as the basis for all further analysis. This allowed us to clearly see whether or not shape data would reveal coherent groups within each motif. By combining these groups, both in the form of averaged pot shapes and in a combined-group plot, we were able to see how these motif-shape groups interacted with one another. Another important difference between Furumark’s
work and this research was the desired outcome. For Furumark, this was a chronology of shape and decoration, for this research, it was provenance. In this thesis the hope was that the subdividing of pots into groups of similar dimensions might be indicative of and reflect their earliest origins, either an individual, a team, or a workshop, and that differences could reflect different origins in terms of creator, location, or chronology. As suggested in Chapter Five section 5.5.2, the results of the HCA indicate a series of primary shape-motif groups that could be considered equivalent to the shape types created by Furumark.

The approach utilised in this thesis is similar to the one undertaken by Furumark; both use shape to create as narrow a group as possible, and both combine this with an understanding of different decorative elements. Furumark’s approach was limited by the type of access he had to the pots he was trying to study. Despite his access to many Mycenaean vessels, for a comprehensive study of as many relevant examples as possible, Furumark was limited to photographs, drawings and descriptions produced by others. While this thesis uses a similar approach, it has the advantage of being able to produce accurate shape measurements using photographs and height alone, greatly reducing the amount of legwork required to cover a wide range or large number of vessels.

6.4 QUESTION FOUR: SHAPE, PURPOSE AND DISTRIBUTION

This section discusses results relevant to question four: How can we interpret these groupings? Do correlations between shape and motif reflect the hand of an individual or the output of a workshop? This will include a discussion of whether distribution (east versus west of sites in Figure 6.1) correlates with shape-motif groups.

To interpret the results of this research I will reiterate how this work ties itself into the topic of provenance studies. As was explained in Chapter Three section 3.1, the definition of provenance can be broken into two interpretations: one, the earliest known origin or location of something, and two, the earliest known history of something. This thesis argues that our effort to identify the correlations
between shape and decoration, reducing a large group to the smallest denomination, reflects the search for the earliest known history of these pots.

In Chapter Three I introduced the idea of provenance extending to the time or moment of creation, as well as the geographical location. The purpose of identifying pottery groups was to narrow the groups of pottery to the smallest denomination, in an attempt to see whether or not it would be possible to interpret this as reflecting the hand of an individual or the output of a workshop.

Of particular relevance are the results of the average-HCA in section 5.5.2, and the results in section 5.5 which present the similarity of pots connecting at a very low level within each motif-shape group. The average-HCA in section 5.5.2 shows the results of combining the average pots for all motif-shape groups. From this analysis, the pots in all three motif groups could be separated into three new shape categories (1-3). Within these categories a further seven shape types were identified based on their level of dissimilarity on the dendrogram, in particular the groupings in 1a, 1b, and 2a are worthy of note. These groups might be viewed as the equivalent of the groupings made by Furumark, however by starting the analysis at a point where motif and shape are intrinsically connected, this work has been able to identify further divisions within these shape categories.

If the results in section 5.5.2 present the closest relationships between groups, the results at the beginning of section 5.5 investigate an even closer relationship between individual pots. The similarities observed in the shape of closely related pots are also reflected in body decoration choices; often two pots closely related in shape share very similar or identical body decoration. For example, three pairs of pots on the Line Motif group dendrogram (Figure 5.6a) are connected at a distance of ‘1’. In two of these pots, the body decoration choices are identical, and the style in which the lines have been painted is similar in consistency and thickness. The Netting Motif group has only one pair which connect at a distance of ‘1.’ Both use identical forms of body decoration, the netting pattern is identical in consistency and brush stroke width, and extra decoration is included under the handles of both. The results in section 5.5 also present several cases of paired pots that have clustered together from different motif groups. These pairings
reinforce the observations from the average-pot HCA, as well as the more general observations regarding the relationship between NG1, LG1, and SG1, and between NG2 and LG2, which were observed in the combined-group dendrogram in Figure 5.12.

The results being discussed here are both important investigations of similarity at different levels, and are vital for addressing the questions listed above - How can we interpret these groupings, and do correlations between shape and motif reflect the hand of an individual or the output of a workshop? The similarities between individual pots provides a glimpse at a closer relationship between shape and motif, and therefore between potter and painter. The paired-pots are likely to have been created by the same individual, especially considering the similarities in heights. These pots, presumably created by a single individual, are then decorated either by the same person, or by another individual. When decorative elements are consistent between the two vessels, this can be interpreted as the work of a single individual painting both pots. Variation in decoration may suggest either a change in a painter's preference or style, or it may indicate that the two pots were painted by different individuals.

In cases where the two paired-pots have been decorated with different motifs (such the NG1 and LG1 example mentioned in Chapter Five) but where the body decoration is similar or identical, it is still possible that these vessels are being painted by the same individual. This may also, however, suggest a team or workshop environment where the output has been standardised, and which produces multiple different motif designs. If the two pots have different motifs and different body decoration (as with the SG1 and NG1 pairing) it suggests two different individuals; it may represent evidence that a workshop is producing many motif and shape styles at once, or potentially that the painter, or the preferred style of motif and body decoration, have changed over time.

When considered alongside the results of the average-pot HCA, it seems natural to interpret that pots in NG2 and LG2 are being created in a single workshop or by a single individual, and likewise NG1 and LG1 are probably being created in the same environment. The Spiral Motif group presents a further complication,
as the results until this point have shown that the two Spiral Motif groups cluster very tightly and consistently. The results of the average-pot HCA, however, suggest a reasonably close relationship between SG1 and NG1, LG1, and between SG2 and NG2, LG2 (though still at a greater distance than the pairs they cluster to). This could be interpreted in several ways: One, an individual potter is responsible for all three styles, but has changed the shape of pot that they prefer to make over time, or to reflect a change in demand.

In support of the change over time hypothesis, it is significant that there are chronological variations between the three spiral motifs that were analysed. As has been previously mentioned (sections 5.3.2, 6.2.1, see also Figure 5.3), vessels in the Spiral Motif group are made up of Designs A, B, and C. Designs A and C are both what Furumark refers to as ‘reverse curve-stemmed spirals,’ which he considers to be Myc. IIIA2 ε (Furumark, 1941, p. 357); Design B is referred to as a ‘running spiral,’ and has been assigned by Furumark to Myc. IIIA2 / (Furumark, 1941, p. 363). Within the spiral motif-shape groups the designs separated into SG1 (Design A) and SG2 (Designs A, B, and C). We could, therefore, interpret the two groups as being produced by the same workshop or individual, with SG1 being produced at an earlier time, and SG2 being produced at a later time, reflected by the introduction of Design B. The connections between SG1, NG1 and LG1, could then all reflect earlier production, while SG2, NG2, and LG2, could represent later production. According to Furumark, both the netting motif and the line motifs analysed here are common designs across the Myc. IIIA2 period (Furumark, 1941, pp. 383, 397).

The second interpretation of the relationships seen in the average-pot HCA, is that the Spiral Motif pots are being made by different potters to the Netting Motif and Line Motif pots, but within the same workshop environment. Three, the pots in the Spiral Motif group may represent an attempt to copy the style of Mycenaean vessels, most likely in a local workshop on Cyprus. A potential point of support for this argument was mentioned briefly in Chapter Two section 2.4, which lists a number of pots that were found off the coast of Cyprus; in the Line Motif and Netting Motif groups it is not uncommon to see these off-island sites (never more than one). In support of local production, therefore, all Spiral Motif
pots with a recorded excavation origin were from Enkomi, with the exception of a singular pot from Hala Sultan Tekke (see Figure 6.1).

The question of whether or not distribution correlated with shape-motif groups was difficult to answer due to scarcity of information. The excavated origin of the pots was not always noted in the resources from which these pots were collected - in fact only 46% of the pots analysed in this thesis had a location related to them, which does not include those simply stating ‘Cyprus.’ The distribution of these pots across Cyprus appears to be spread along the eastern coast of the island, with a particular concentration around the North Eastern peninsula (see Figure 6.1); these sites were also mentioned in Chapter Two Section 2.4, including Enkomi, Hala Sultan Tekke, and Dhekelia. There did not appear to be any correlation between the motif-shape groups and the location in which the pots were found.

![Map of Cyprus](image)

*Figure 6.1 Map showing locations of Cypriot sites where pots were excavated*

### 6.5 CONCLUSION AND FUTURE RESEARCH DIRECTIONS

During this thesis research I have aimed to achieve two primary goals: to address the gap in the literature concerning non-pictorial Mycenaean pottery, and to introduce a methodology connecting decoration and shape. These goals contribute towards the study of the origins and production of Mycenaean pottery found on Cyprus. In order to ascertain the effectiveness of such a methodology, this thesis set out to answer a series of questions concerning whether or not shape groups were possible to identify, their relationship to decoration, how they
related to Furumark's original shape and motif groups, and how these groups could be interpreted. This chapter has summarised and discussed the results from Chapter Five in order to provide answers to these questions.

The discussion in this chapter established that it was indeed possible to identify groups on the basis of shape, and that these shape groups related to one another across different motifs. From this I interpreted the presence of at least two individuals or workshops. The division between the two primary groups of data identified in section 5.5.2 was interpreted as representing either change over time, the output of a local individual or workshop copying the Mycenaean form, or both.

In a comparison to Furumark's work, I concluded that both the methods and output were similar, however my method differed in that it intrinsically connected decoration and shape, and therefore my output was much more specific than that of Furumark's. Furumark's work allows one to assign a pot to any shape group according to a basic description, although this leaves much room for human error. My method introduced a greater level of detail; however, it does not allow one to simply slot a pot into the closest shape category.

The research of this thesis was limited by a number of factors: sample size, number of motifs analysed, and the type of sample assemblage used. Although the dataset I began this thesis with had 130 pots, the actual analysis used only sixty-seven pots. This number could be increased through the introduction of either more vessels within each motif group, or the introduction of other motifs. The introduction of more than one design within each motif category, as with the Spiral Motif group, may yield similar correlations with shape, indicating motif preference either between artists, workshops, or changing preference over time, either of an individual or of a society.

There are many directions this research could be taken in the future. For example, an interesting step forward would be to undertake a large-scale study of spiral motif pots with stratified contexts. It has already been established several times during this thesis that the Spiral Motif pots presented both the clearest division between groups, and the most coherent within-group clustering. A large scale,
more inclusive analysis of pots with this type of motif design, may reveal a
correlation between shape and decoration, and chronological stratification,
which may in turn support the argument for changing decorative output of a
workshop over time. This type of interpretation may allow the researcher to
further understand the social aspect of style preference over a period of time.

It could also be beneficial to introduce an entirely new shape that is decorated
with motifs that have already been analysed. If these new motif-shape groups
reveal similar divisions between motif designs and other decorative elements, it
may be indicative of the same individual potter, painter, or the output of the same
workshop.

A step this thesis was unable to take was to connect the results of this analysis
with the many geochemical studies that have been conducted on Mycenaean
pottery. The most desired outcome of this thesis is to provide a methodology
which may be used as a stepping stone towards combining motif-shape groups
and geochemical research. It is my hope that by combining these two aspects of
provenance studies, we may significantly increase our ability to interpret these
results as the output of an individual or workshop.
REFERENCE LIST


Wijngaarden, G. J. V. (2002). Use and Appreciation of Mycenaean Pottery in the Levant, Cyprus and Italy (1600-1200 BC). Amsterdam: Amsterdam University Press.


## Collection: Corpus Vasorum Antiquorum

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