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VALUE AND TERRITORIES

Pithoi, Storerooms, Redistribution across the Eastern Mediterranean, Aegean and Italy during the Bronze Age

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“Quando ti metterai in viaggio per Itaca
devi augurarti che la strada sia lunga,
fertile in avventure e in esperienze.

I Lestrigoni e i Ciclopi
o la furia di Nettuno non temere,
non sarà questo il genere di incontri
se il pensiero resta alto e un sentimento
fermo guida il tuo spirito e il tuo corpo.
In Ciclopi e Lestrigoni, no certo,
né nell'irato Nettuno incapperai
se non li porti dentro
se l'anima non te li mette contro.

Devi augurarti che la strada sia lunga.
Che i mattini d'estate siano tanti
quando nei porti - finalmente e con che gioia -
toccherai terra tu per la prima volta:
negli empori fenici indugia e acquista
madreperle coralli ebano e ambre
tutta merce fina, anche profumi
penetranti d'ogni sorta;
più profumi inebrianti che puoi,
va in molte città egizie
impara una quantità di cose dai dotti

Sempre devi avere in mente Itaca -
raggiungerla sia il pensiero costante.
Soprattutto, non affrettare il viaggio;
fa che duri a lungo, per anni, e che da vecchio
metta piede sull'isola, tu, ricco
dei tesori accumulati per strada
senza aspettarti ricchezze da Itaca.
Itaca ti ha dato il bel viaggio,
senza di lei mai ti saresti messo
in viaggio: che cos'altro ti aspetti?

E se la trovi povera, non per questo Itaca ti avrà
deluso.

Fatto ormai savio, con tutta la tua esperienza
addosso già tu avrai capito ciò che Itaca vuole
significare.”

Itaca, Κωνσταντίνος Καβάφης

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Index of Abbreviations

CM	Cypro-Minoan
EM	Early Minoan
FBA	Final Bronze Age
LBA	Late Bronze Age
LC	Late Cypriot
LH	Late Helladic
LM	Late Minoan
MBA	Middle Bronze Age
MM	Middle Minoan
PM	Palace of Minos
RBA	Recent Bronze Age

Abstract

The present research has the main objective of studying storage modes regarding pithoi in the Late Bronze Age Mediterranean, aiming at better understanding the socio-economic organisation of the three contexts under examination - Pyla-Kokkinokremos, Kommos, and Broglio di Trebisacce.

Despite the fact that this research embraces the whole Mediterranean, the research question arises from the Italian perspective. Indeed, the Italian pithos production started - after the contact with the Aegeans - during the 13th century BC (Italian Recent Bronze Age).

The Late Bronze Age was indeed characterised by the existence of intense Mediterranean networks linking Anatolia, the Levant, Egypt, Cyprus, the Aegeans and, at a lower extent, also the Western Mediterranean.

The work is developed in nine Chapters, which includes typological, technological and functional analyses in order to obtain a proper comprehension of the pithos.

Samenvatting

Dit onderzoek heeft als belangrijkste doel het gebruik van pithoi bij voorraadopslag in de Late Bronstijd in het Mediterrane gebied te bestuderen, teneinde de socio-economische organisatie van de drie bestudeerde contexten (*Pyla-Kokkinokremos*, Kommos en Broglio di Trebisacce) beter te begrijpen.

Ondanks het feit dat het onderzoek het hele Mediterrane gebied omvat, is het Italiaanse perspectief doorslaggevend geweest voor de onderzoeksvraag. De Italiaanse pithos-productie startte na het contact met het Egeïsche Gebied tijdens de 13de e. v.Chr. (Italiaanse Recente Bronstijd).

De Late Bronstijd werd inderdaad gekarakteriseerd door het bestaan van intense Mediterrane netwerken, die Anatolië, de Levant, Egypte, Cyprus, het Egeïsche Gebied en, in mindere mate, ook het westelijke Mediterrane gebied met elkaar verbonden.

Deze studie is onderverdeeld in negen hoofdstukken, die typologische, technologische en functionele analyses omvatten welke noodzakelijk zijn om tot een correct begrip van de pithos-productie en het gebruik van de pithoi te komen.

Introduction

The present research has the main objective of studying storage modes in the Late Bronze Age Mediterranean, aiming at better understanding the socio-economic organisation of the three contexts under examination - *Pyla-Kokkinokremos*, *Kommos*, and *Broglia di Trebisacce*. The study is based on the analysis of pithoi and pithos fragments retrieved in those sites in different excavation campaigns ranging from the seventies up until our days. The main geographical focus is thus on Cyprus, Crete and Southern Italy, where the three sites are respectively located.

Despite this research embraces the whole Mediterranean, the research question arises from the Italian perspective. Indeed, the Italian pithos production started - after the contact with the Aegeans - during the 13th century BC (Italian Recent Bronze Age). This also applies to Italo-Mycenaean pottery and Gray ware, which share with pithos the selection of specific raw materials, the use of the wheel and the increasingly complex firing technology. These vases are totally different from the local pottery tradition and raise thus questions related to their manufacturing.

Previous studies (Vagnetti 1989; Bettelli 2002; Schiappelli 2003) suggested the hypothesis that the first Italian production phase was more influenced by Cretan models, while, during the subsequent Final Bronze Age, Italian pithoi could rather be related with Cypriot prototypes.

The Late Bronze Age was indeed characterised by the existence of intense Mediterranean networks linking Anatolia, the Levant, Egypt, Cyprus, the Aegeans and, at a lower extent, also the Western Mediterranean. The latter was more and more integrated in such routes with the passing of time, reaching the maximum level in Late Helladic IIIB. Within this network, contacts bringing fragments of Aegean origin in the Italian territory date most likely back to the Late Helladic I (Italian Middle Bronze Age): materials dating to this period were indeed retrieved in Aeolian Islands, north of Sicily and Vivara (Procida Island). The Recent Bronze Age (Late Helladic III B) was the period of maximum apex of this network, which involved then not only products, but also people and know-how circulation. It is thus hypothesized that Italian production was influenced by the circulation of potters also bringing new advanced technologies.

Pithoi production continued also during the Italian Final Bronze Age, after the collapse of the Mycenaean Palaces at the end of Late Helladic III B. This opens questions related to the rooting of the technological tradition in Italy and the reasons behind his continuation, as well as to the involvement of new regions in the contacts network described above (mainly Cyprus).

The first three chapters has an introductory function and serve to build the historical and geographical frame as well as to provide context regarding previous researches on the topic which will be deepened afterwards.

Chapter 1 is an historical and chronological frame of the Late Bronze Age in the Mediterranean, in particular in Cyprus, Crete and Southern Italy. Chapter 2 offers a theoretical overview on the storage studies. It also presents a focus on the history of studies of this specific topic in the three main Mediterranean regions under analysis. Chapter 3 presents the three sites of this research: the history of the excavations is followed in each case by the description of the site areas excavated and functional to our analyses (either because of the direct presence of pithos fragments or useful to understand the site asset and functioning).

The following pithos analysis is organised on different levels: typological, use-related and technological.

The typological analysis (Chapter 4) concerns the elaboration of a formal typology which embraces all the published pithoi retrieved in Cyprus, Crete and Southern Italy, to which this research adds unpublished materials from Pyla during the excavation seasons 2014-2016. The elaboration of such typology confirms the hypothesis of an Aegean derivation for the Italian production and thus the Southern Italy involvement in these international maritime routes.

After the elaboration of the formal typology, some morphological characters have been analysed from the functional point of view (Chapter 5). The objective was a deeper understanding of the real function of analysed vases. Pithos are by default characterised as storage vases, but the identification of morpho-functional features provides hints on their real use, the storage practices, and their transport modalities. To have a more complete understanding of the use of the pithoi, also chemical analysis of organic residues has been made on five fragments from Pyla and five from Broglio.

The following step is the analysis of pithos in the context where they were found (Chapter 6). Every site shows a different frequency distribution of Types and Varieties deriving from the Typology. The distributional analysis aimed at identifying the presence of storage areas in the

site, and thus isolating which pithos Type or Variety were more frequently used in this way. Quantitative research was coupled with density distribution analysis to triangulate the data. Finally, qualitative insights derive from the observation of other artefacts (e.g. pottery classes and lithic or metal tools) retrieved in the same contexts. Hypotheses on storage scale and mode for each site derive from all these investigation levels.

Finally, the study presents the technological aspects related to pithos production and the use of the wheel. Pithos production is indeed very demanding, given their dimension, and has thus interesting socio-economic implications. Chapter 7 provides an in-depth bibliographical analysis of the past technological studies about the introduction and spread of the wheel technology in the Mediterranean. Chapter 8 presents the technological analysis made within this research on both archaeological materials retrieved in Pyla, Kommos and Broglio, experimental replica, and ethno-archaeological comparisons.

Besides visual observation of archaeological and experimental material, X-ray analyses were performed. Moreover, following the approach used by Sara Levi in Broglio (1999), the technological analysis was completed by archaeometric investigations on Pyla material. Fragments were in this case selected to identify their origin and define more in depth the mode of production of Pyla pithoi.

The work is thus developed in 9 Chapters, the last one being the conclusions which aim at tracing a red thread among all the historical and archaeological evidences arising from the different type of analyses presented.

1. LATE BRONZE AGE IN THE MEDITERRANEAN

1.1. Introduction: chronological framework

The purpose of the following chapter is to provide a Mediterranean chronological and historical framework within which to develop the technological, typological and functional study – with the relative socio-economic implications – of the pithoi.

The Late Bronze Age (henceforth LBA) represents an important break in history as the Mediterranean becomes a connecting sea since in the midst of the second millennium BC (Sherrat and Sherrat 1991; Broodbank 2013; Knapp 2013).

As stated by Susan Sherrat (2003, p. 53), some mechanisms operating during the LBA “led to the opening up and encouragement of direct exchange at hitherto unprecedented social levels and over unprecedented distances, to increasingly wide and ungovernable flows of hitherto more restricted materials and goods (whatever in the form of bronze weapons, black market nuclear material, or simply “information”) and to increasing incentives to invent new types of goods and stimulate new types of market”.

The LBA is, therefore, a period of great interaction among all the countries around the Mediterranean Sea which were characterised by strong differences in their internal political organization. Indeed, the Mediterranean Basin became “a single zone of maritime innovation, mobility and connectivity” (Knapp 2013, p. 249).

The current research focuses, in particular, on the Italian Recent Bronze Age (henceforth RBA) and the Italian Final Bronze Age (henceforth FBA) which correspond to the Late Helladic IIIB-C in Aegean chronology (Tab. 1.1).

In the first phase (RBA), contacts between Aegean/East Mediterranean and southern Italy peaked, while they became more sporadic in the subsequent period (FBA), following the collapse of the Aegean palaces. Indeed, the unprecedented political and social upheaval taking place between the end of the 13th century BC and the beginning of 12th century BC lead to a phase of profound instability and to the collapse of both the Aegean palaces and most of the states and empires that had characterized the age of the Mediterranean Bronze up to that time.

The ongoing debate about the collapse of the state system in the Aegean and eastern Mediterranean can be related, among other factors (i.e. climate change, droughts and an earthquake storm) to the action of the *Sea People*, as called by historical sources (Liverani 1994; Bettelli 2002, 133-7; Voskos and Knapp 2008; Jung 2009b). Between the end of the 13th

century BC and the beginning of the 12th century BC, the palace societies in Greece, the Hittite empire as well as most of the Syro-Palestinian states suffered that crisis or were abandoned/destroyed. Egypt as well underwent an internal crisis and was exposed to external pressure. For example, the Egyptian pharaoh Ramesses III (20th Dynasty) displayed (in a propaganda-driven way) his victorious campaigns against his external enemies – the Sea Peoples –, at his mortuary temple at Medinet Habu.

The first attestations of these groups date back to the mid 14th century BC but their presence becomes preponderant in the eastern Mediterranean history one century later, at the end of 13th century BC. The term Sea Peoples refers to a horde of men who sailed in the eastern Mediterranean, destroying and looting several cities and countries. The Egyptian sources¹ reports several ethnic groups such as *Pelset* (Philistines?), *Shekelesh* (Sicilian?), *Shardana* (Sardinian?), *Tjekker*, *Lukka*, *Danuna*, *Eqweš* and *Washesh*. Several questions concerning the Sea Peoples are still open, most notably their identity, the identification of their place of origin as well as their actual role in the collapse of the LBA societies.

The following table reports the complete chronological classification used in the Mediterranean region under analyses – Cyprus, Crete, and Italy – (Tab 1.1). Moreover, it shows the occupational phases of each site analysed (Pyla-Kokkinokremos, Kommos and Broglio di Trebisacce) and the presence of Aegean-derivative pithoi in Broglio. Tab. 1.2 presents more details on the Italian *facies* during each chronological period considered.

¹The main sources regarding Sea Peoples are the images depicted on the Egyptian reliefs at Abu Simbel, Abydos, Thebes and Medinet Habu. Most of the efforts concerning their geographical location have therefore been based on the analysis of the armaments that characterized them and in particular on the type of swords and dagger.

Absolute Date BC	Italy	Aegean chronology	Cyprus	Kommos	Pyla	Broglio
1700/1675-1635/1600	Middle Bronze Age 1	Late Helladic I	MCIII-LCI			
1635/1600-1420/10		Late Helladic II	LCI			
	Middle Bronze Age 2	Late Helladic IIIA	LCIIA			
LCIIB						
1420/10-1330/1315	Middle Bronze Age 3	Late Helladic IIIB Early				
1330-1315-1200/1190	Recent Bronze Age 1	Late Helladic IIIB - Developed and final	LC IIC			Pithoi
1200/1190-1170/1160		Late Helladic IIIC Early 1				Pithoi
	Recent Bronze Age 2	Late Helladic IIIC Early 2	LCIIIA		?	Pithoi
Late Helladic IIIC Developed					Pithoi	
Late Helladic IIIC Advanced/Late					Pithoi	
1170/1160 - 1150/1140	Final Bronze Age 1	Final Helladic IIIC/ Sub-Mycenaean	LCIIB			Pithoi
1150/1140-1100						Pithoi
1100-1070/1040	Final Bronze Age 2					Pithoi

Tab. 1.1 Comparative Chronology Table among Aegean, Cyprus and Italy

Aegean Chronology	Southern Italy facies	Italian Chronology
LH (LM) I	Protoappenninico	MBA 1
LH (LM) II	Protoappenninico	MBA 2
LH (LM) IIIA	Appenninico	MBA 3
LH (LM) IIIB	Subappenninico	RBA1
LH (LM) IIIC early/developed	Subappenninico	RBA 2
LH (LM) IIIC advanced/late	Protovillanoviano	FBA 1
Submycenaean-Final LHIIIC	Protovillanoviano	FBA 2
Protogeometric	Protovillanoviano	FBA 3

Tab. 1.2 Italian Facies during the LBA

1.2. Mediterranean Interconnection during the LBA

Archaeological evidence testifies the abovementioned international connections and the existence of long-distance sea routes crossing the whole Mediterranean from east to west.

The discovery and the excavation of three relicts dated to the LBA – Uluburun, Cape Gelidonya, and Point Iria – provide us, for the first time, a clear indication of the value of the traded products and their origin.

Uluburun, in particular, which sunk at the end of the LHIIIA2 off the coast of Kaş in Turkey stands out for the intrinsic value of its cargo. The underwater excavation of the relict permits to ascertain a stunning cargo of mixed origins, including Egyptian, Syro-Palestinian, Mesopotamian, Cypriot, Aegean and also Italian materials.

The efforts of excavators and numerous researchers (Bachhuber 2006, Pulak 2008) have therefore focused for a long time on the identification of the nationality of the ship and its route. The excavators (Pulak 2008) proposed that the ship was following a circular route and that it had as a *home port* – and therefore also as the point of final arrival/return – a site located on the Levantine coast. This reconstruction is supported by the presence of a large number of materials coming from the Levant.

As far as the route is concerned, the most reliable hypothesis is that, after leaving the port roughly along the Costa del Carmelo, the ship had continued north along the Syrian coast, then turning west to Anatolia, until when, arriving at Cape Kaş, it sunk².

The discovery of the Cape Gelidonya relict (Bass 2010) and the presence of other oxhide ingots along the southwestern Anatolia coast provide a further confirmation of the actual existence of a route that moves from east to west.

As stated above, the Uluburun cargo, which is preserved practically intact, was composed by a mix of products of different origin. In the cargo, a lot of valuables were present – including 10 tons of copper and 1 of tin – together with organic products, raw materials, semi-finished and finished objects. Of particular relevance is the presence of a sword belonging to the Italian typological family of Thapsos-Pertosa, dated in Sicilian contexts to MBA3-RBA.

²The idea of a circular east-west-east route, thus direct towards the Aegean, is also justified on the basis of the scarcity of Aegean materials in the cargo in comparison to the Levantine ones. However, maintaining the idea that the Uluburun ship was sailing towards the Aegean, quite recently it was questioned the hypothesis that it used to see in a port of the Greek mainland the destination of the ship in favor, instead, of a Cretan port, thus reducing the extent of the circular route (Bachhuber 2006).

Two additional relicts are dated to a century later (end of LHIII B): the first one sunk close Cape Gelidonya (from which it derives its name) along the southern Turkish coasts. The second one sunk close to Point Iria in the Gulf of Argolis.

These two wrecks represent what appears to be a less sumptuous and imposing load than the one of Uluburun, especially Point Iria, perhaps engaged in a mid-short route within the Aegean. Uluburun, Cape Gelidonya, and Point Iria, have therefore allowed to directly verify not only what types of goods travelled around the Mediterranean (including perishable materials normally invisible in the archaeological record), but also the way they were stored inside the ships.

A further and indispensable research support for this period – confirming once again the mobility of the LBA – is provided by the exceptional contemporary literary testimony, such as the so-called Letters of Tell el Amarna, the annals of the Hittite Kings and the tablets of the archive of Ugarit in which it is clearly visible the extraordinary network of contacts that united the whole Mediterranean.

The so-called letters of el-Amarna represent the correspondence between the Pharaoh and the "Little Kings" (king vassals of the Levantine coast subjected to the Egyptian authority) or the "Great Kings" of the near Eastern Kingdoms. Despite their strong propaganda value, these letters allow to read clearly the complexity of the practices of relationships and exchanges that took place between the parties involved. In fact, the exchange saw the interweaving of three different levels, the first concerning the exchange of formal messages between a sovereign and the other, the second on the exchange of wives aimed at making alliances between the various parties involved, and the third on the exchange of goods, which represented the ceremonial form of a real trade that actually took place between the parties involved (Liverani 1999).

Several authors, first of all Pulak and Bass, underline the strongly elitist type of trade represented by Uluburun, defining it as a form of high-level exchange mainly concerning palatine realities.

The relations between palatine realities diplomatically labelled as exchanges of gifts often hide much more commercial needs and purposes, as for example it seems to show the correspondence between the king of Alashya and the Pharaoh interested in Cypriot copper.

This elitist interpretation of the trade represented by Uluburun is certainly supported by the idea, now quite rooted among the Late Bronze scholars, that only a palatine-type reality could bear the costs and risks (first of all piracy and the frequent possibility of a shipwreck) of a company capable of moving high-level goods over long distances.

Transactions of a purely commercial nature would have taken place at a lower level, probably on shorter routes. Archaeological evidence of this type of trade would be the wrecks of Cape Gelidonya and Point Iria. The latter, in particular, would represent a purely ceramic minor trade (in fact, it excludes metals considered to be the real driving force of trade) within the Argolis. Elitist trade also implies that every asset loaded on board already had its own precise destination (*pre-negotiated directed trade*) differently from the one at the lowest level, definable under the label of *opportunistic trade* or *tramping*, conducted by less tied traders to the buildings where goods loaded on the ship, usually without a destination, are traded from time to time.

1.3. The Western Mediterranean

It is precisely within this dense network of exchanges and interconnections between the different Mediterranean realities that the production of the Italian pithoi of the LBA must be considered.

The reasons behind the increased involvement of the western Mediterranean within trading routes are not yet fully understood. Exploitation of metal supplies has always been postulated, especially for the Sardinian case during the eastern Mediterranean crisis of the end of the 13th century BC.

Several hypotheses have been advanced, mostly framed within a system of interaction between the centre and the periphery (Wallerstein 1974), in which the centre exploits peripheral resources (Borgna Càssola Guida 2004; Borgna Càssola Guida 2005).

One of the main indicators of the involvement of southern Italy in Mediterranean traffics is undoubtedly the presence of Mycenaean imports in several Italian sites.

As already established over decades of studies (Jung 2006, Jones *et al.* 2014) the ancient finding in southern Italy (dated to the LHI-II) were retrieved in MBA1-2 levels. They are mostly concentrated in the Aeolian Islands and in the island of Vivara, as well as from Apulia and Calabria and Sicily. In the subsequent phase of the LHIIIA (coeval with Uluburun), Mycenaean pottery was retrieved in the regions of Apulia (with a high concentration at Scoglio del Tonno) Basilicata and Calabria. Other attestations come – as in the previous phase – from the Aeolian Island and from some necropolis in eastern Sicily.

However, with the subsequent LHIIIB (RBA), the intensity of the contacts increased, favouring the development of a phase of great interaction, also visible in the wider phenomenon of “metalwork” *koine*. To this phase can be dated several true Mycenaean, Late Minoan and Cypriot imports. Moreover, and most importantly, this period marks the beginning of the local

production of new ceramic classes of Aegean derivation: the Italo-Mycenean ware, the Gray ware and levigated-clay pithoi.

The introduction of these classes is of key importance because they testify the circulation not only of materials but also of know-how (new technologies) and people (artisans).

Although on a smaller scale, contacts also continued in the FBA, after the collapse of Palaces. During this period, however, significant changes in the maritime routes are visible, in particular the increased involvement of Cyprus in the Mediterranean network. Connections with Cyprus were already testified in Sicily and Sardinia by the presence of Cypriot pottery in Cannatello and Antigori during the LHIIIB.

1.4. Cyprus

The LBA (1650-1050 BC) represents a clear break even for Cyprus. It is precisely during the transition between MC and LCI that Cyprus emerges from the isolation that suffered until the middle Bronze Age and it became part of the Mediterranean exchange network (Knapp 2008, Knapp 2013). The main engine of this change is the beginning of the exploitation of copper from the Troodos mountain area.

The strong instability that affects the Aegean and the eastern Mediterranean between the 13th and 12th centuries BC (in Cypriot terms LCIIIC and early of LCIIIA) affects also Cyprus, albeit less dramatically than the surrounding regions. Certainly, with the end of the LCIIIC, there is a drastic decline in the number of sites as some of the large coastal settlements are abandoned, including Toumba Tou Skourou, Kalavassos-*Ayios Dhimitrios* and Maroni-*Vournes*. However, destruction levels which seem to have been identified in other sites, such as Enkomi (Enkomi IIB Level), have been followed by reconstruction (Enkomi IIIA phase, LCIIIA) and continued occupation, even in the later phases. Finally, Hala Sultan Tekke and Alassa continued to be in use, respectively, until the 11th century BC and the mid 12th century without any signs of destruction (Knapp 2008; Georgiou 2011).

Upheavals in the Aegean resulted into a growing role of Cyprus within trade routes both to the east and the west (Sherrat 2003, p.50). According to several authors, Cyprus also played a major role in the economic changes taking place between the end of the Bronze Age and the beginning of the Iron Age. In particular, the role played by Cypriot middle-men has been emphasized, considering it as more independent, free from the economic needs of Palaces and centralized organization, and therefore more adhering to personal interests and market rules (Sherrat 2003; Borgna and Càssola Guida 2004).

2. STORAGE AS ARCHAEOLOGICAL INDICATOR OF SOCIAL ORGANIZATION AND ADMINISTRATION SYSTEMS

2.1. Introduction

The study on the accumulation of primary goods, in particular agricultural products, has always attracted the attention of archaeologists. Through the analysis of goods accumulation modalities, it is possible to understand the production modes of the first complex societies and – even more – to try to understand precisely the reasons for the appearance of these complex forms of organization (Renfrew 1972; Christakis 2008, Privitera 2010; Benati 2016, Manzanilla and Rothman 2016).

Storage concerns the control upon goods (*surplus*) that people produce for a delayed use in terms of their direct consumption, redistribution or transformation into other products (Rothman and Fiandra 2016, p. 39). It is a necessity shared by all sedentary and also many nomadic societies, but each type of society develops specific control mechanism.

Storage systems are not indeed just a practical economic means but represent a complex twine of social, political and ideological factors (Rothman 2016, pp. 19-34).

Christakis underlines that the importance of storage in the understanding of ancient communities lies in its being an intermediate stage in a complex process of production, distribution and consumption of goods (Christakis 2008). Storage becomes therefore a powerful archaeological indicator of social organization and administration systems (Manzanilla and Rothman 2016, p. 13).

One of the major theoretical contributions to the study of the organization of the first complex societies is owed to Karl Polanyi (1886-1964) who, based on Weber's studies, refused to analyse ancient societies through paradigms valid for modern capitalist societies. Polanyi described three different forms of integration (see *infra*) on the basis of the analysis of economic processes in ancient society: reciprocity, redistribution and market.

In particular, the definition of redistribution as pooling of staples inside a central place and their subsequent movement outside to the broad community become a key concept in the reconstruction of the economies of many ancient societies.

However, in more recent years the Polanyian economic model has been subject to a strict criticism that has led to the elaboration of different theoretical models based essentially on the concept of mobilization (of wealth finance) rather than redistribution (Earle 1977).

The idea – now widely shared – that large central organizations did not have a global control over the economy of their territories, but that they were interested in precisely specific sectors, paved the way for studies focusing on what could be defined as the private sector of the economy (Galaty *et al.* 2011).

The involvement of a private sector does not concern only the internal management of goods but also their circulation abroad the states and consequently the existence of a private entrepreneurial and mercantile sector (Parkinson and Pullen 2014).

2.2. Theoretical models in the study of storage

Several theoretical paradigms, borrowed mainly from economic anthropology, have been used in order to interpret and understand the archaeological evidence. In particular, considering here only the old continent, great attention was paid to the development and the organization of the recent prehistoric societies of the III and II millennium BC in the Near East and Mediterranean basin³.

The fundamental starting point of these reconstructions is undoubtedly the enormous work Polanyi made in the first decades of the 20th century. As previously mentioned, Polanyi's thinking was profoundly influenced by the studies conducted in the economic and anthropological field by Max Weber as well as by Bronislaw Malinowski and Marcell Mauss.

Weber was in fact the first to reject paradigms taken from contemporary societies to describe ancient economy: ancient societies were indeed strictly dependent on the agricultural production and characterized by a political nature. However, Weber did not deny at all the existence inside of them of a certain dynamism and of some kind of mercantile aspects (Weber 1992). Moreover, he underlined the importance of social ties and how these influenced the economic aspects. In other words, he claimed that social relationship prevailed on the economic ones in ancient societies.

The research of Marcell Mauss – exposed in the famous sage “*Essai sur le don. Forme et raison de l'échange dans les sociétés archaïques*” published in 1923 – opened new perspectives in the understanding of the ancient economy. Thanks to Mauss work it was possible to verify that in many pre-monetary societies social relations were reinforced also

³ Several studies are now available also about the Andean Region and the Mesoamerica for Inca, Maya and Aztec societies (Manzanilla and Rothman 2016 with references).

through practices of gifts exchange. The exchange of gifts did not represent a payment, but rather allowed the establishment of possibly lasting bonds, through the establishment of a formal obligation to return the gift received.

The best example in this regard was provided by the anthropologist Malinowski: in his "*Argonauts of the Western Pacific*" of 1922, he describes the development of an important exchange circuit, the *Kula*, between some communities of Melanesia.

The economic theory elaborated by Polanyi starts from the recognition of two different meanings of economy, often confused and considered indiscriminately: the substantive and the formal meaning. The *substantive meaning* of economy derives from the fact that man depends on nature for his survival, thus generating a continuous exchange between the subject and his (natural and social) environment. The *formal meaning* concerns instead the logical sphere, or the type of logical relationship that links the means and the ends. This meaning implies therefore the existence of rules on the basis of which the means are allocated to different uses (Polanyi 1957, pp. 243-250). Having defined the two different meanings, Polanyi's basic assumption is that only the substantive meaning is able to provide the concepts that the social sciences need to analyse the types of economics that have actually existed in the past (Polanyi 1978, p 298). Archaeology, as a social science, must therefore start from the substantive meaning of the economy and analyse it as an integrated part of the socio-cultural contexts.

For these reasons Polanyi introduced the definition of three abovementioned "forms of integration" (Polanyi 1978, page 298) useful in describing economic processes:

- Reciprocity includes symmetrical exchanges between symmetrical social units;
- Redistribution indicates appropriative movements towards a centre and then from the centre outwards;
- Market exchange indicates bilateral movements taking place in a market system (which acts as a price regulator). Market exchange is therefore the method for obtaining goods that are not immediately available, but from the substantive point of view this differs from forms of coercive appropriation such as military spoils, raids and taxes, precisely because of the bilateral nature of the movement of goods and/or money, which therefore guarantees, in general terms, a peaceful form of relationship aimed at repeating itself on a regular basis (Polanyi 1957)⁴.

⁴ During his life, Polanyi provided several articulations of this theoretical proposal; the one exemplified here represents the essential form.

Each of these three levels corresponds to forms of long-distance trade: the exchange of gifts links business partners in a bond of reciprocity; in the administered trade, managed by a central entity, the appropriative movements take place between separate redistributive systems through commercial channels that are also centralized. Finally, in the market system it is the exchange itself that relates the different parts and the market becomes the prices regulator.

Each of these three systems is not exclusive but refers to the management and transfer mode prevalent in each society. In fact, according to Polanyi (1957, pp.250-256), exchange of gifts and administered commerce were dominant among ancient societies, at least until the mature classical age.

Reciprocity was the prevalent mode of exchange in egalitarian societies while redistribution was common in chiefdom. Redistribution can be seen as a solution to the problematic transition from egalitarian groups to state (Nakassis *et al.* 2011, p. 178). Redistribution was indeed first traditionally interpreted as a cultural (and necessary) adaptation to agricultural specialization in areas with ecological niches (Service 1975, p. 75). Surplus in staple and wealth goods was centrally distributed in order “to finance the institutional apparatus of power (e.g. warriors, managers and craftsmen of wealth items and weapons) with the goal to expand political reach” (Earle 2011, p. 238).

Polanyi also elaborated the definition of staple and wealth finance which have become basic concepts in the archaeological economic field. The first term refers to all primary goods (i.e. cereals, cattle or textile fibres) as well as coercive payments (corves and taxes) while the second one concerns the supply and production of valuable products (i.e. metals, ointments) intended for both internal and external circulation.

The last decades have been characterized by a deep reevaluation of the real role played by the redistribution of staple finance in protohistoric societies.

Timothy Earle (1977) – during his research on the Hawaiian chiefdoms – established a clear watershed in the history of research. The idea of a totally redistributive nature of the economy of the archaic societies was replaced by the concept of mobilization. Earle connected mobilization to prestige goods – the wealth finance – and refused to consider redistribution as simple pooling of staples. In this sense, redistribution would have served to finance the activities of the chief (i.e. feasting) and to support his followers.

The researches of Earle in Hawaii were focusing on “how social economies were transformed by the political economies of the chiefdoms and archaic states” and on the role of redistribution “as a means to mobilize and direct surplus to finance emergent institutions of power and management” (Earle 2002; Earle 2011, p. 238).

A core concept in Earle's thought is that of bottlenecks as restrictions in the flow of resources. The creation of bottlenecks in resources flow opens the possibility to mobilized surplus and to convert the resources in other source of power. Earle assumes that the management and the distribution (flow) of primary production are fundamental in the construction of politic power of the would-be leaders (Earle 2015).

Starting from the 1970s, some instances of the World System Theory, formulated by Immanuel Wallerstein (Wallerstein 1974) in reference to the modern capitalist economy, were incorporated into the study of ancient societies. This definition starts from the recognition that the commercial ties extend over far wider distances than the boundaries of each political unit, thus linking each of these in a larger conglomeration.

Within each of these World-Systems (more than one system can exist at the same time) it is possible to identify a centre, centralizer of resources and governed by an elite of power, and a periphery, from which the wealth of the centre is appropriated.

Although Wallerstein's theory has been widely used for the reconstruction of economic processes of ancient economies, it must be noted, as many have done, that the adaptation of the concept of centre and periphery to the ancient world could be too artificial.

2.3. Redistribution in archaeological studies of the Aegean Late Bronze Age societies

For the Aegean area, the study of agricultural products storage is closely connected to the main archaeological discoveries in Crete. In particular, it started with the investigation of the site of Knossos by Arthur Evans at the beginning of 20th century and the discovery in the western wing of the Palace of a complex completely dedicated to storage (Evans 1935, p. 648).

Additional important evidence came from the sites of Phaistos, Haghia Triada, and Mallia, just to mention the main ones, which made it possible to understand the importance and variety of storage practices in Crete during the Bronze Age.

A further step forward was the decryption of the Linear B, made in 1953, which allowed to understand more in detail the organization of the Aegean palatial societies of the last phases of the Bronze Age.

In the same years new explorations took place also in the Greek Mainland that led to the recognition of storage areas as well as to the discovery of numerous pithoi also in important sites as Mycenae and especially Pylos.

Such archaeological and philological evidence was immediately connected to the Asiatic mode of Production defined by Karl Marx regarding the resource management system of palaces and temples in the great societies of the Ancient Near East. In this system the big central organizations would have centralized and controlled the movement of subsistence products and goods, entirely managing the economy of their territories.

Following the anthropological economic theory of Polanyi, the concept of redistribution became central in the definition of the palatial societies, both for the Minoan Palaces and for the Mycenaean ones. The historical-archaeological and economic reconstructions of the Palatial societies of the Aegean are essentially based on structural evidence pertinent to the phase of the First and Second Minoan Palaces and from the one dated to the more recent phases of the Bronze Age. For this last phase a prominent role was played by the Linear B clay tablets which allowed a full integration of the philological data within the historical reconstruction.

The economic model postulated on the basis of archaeological and epigraphic sources⁵ saw the Palaces as centres of accumulation of primary goods (staple finance) produced in their territory. Goods were then moved outside – redistributed – thus ensuring both the maintenance of the entire bureaucratic organization involved in the management of the Palace itself but also of all those workers not directly involved in primary agricultural activities (i.e. skilled craftsmen)⁶.

As previously mentioned, a confirmation of this theory was provided by the decryption of the Linear B and by the seminal contribution of Moses Finley on the Mycenaean administration system. In his writings, the scholar points out how the analysis of the tablets allows to assume the Palaces involvement in the agricultural management and pastoralism, in the production of specialized goods and in the storage of several goods, in quantities that clearly exceed the needs of Palace itself. However, Finley recognizes the difficulty of understanding whether the redistributive system of the Palaces covered all or only some economic aspects of the Mycenaean society, thus leaving the possibility for the existence of other forms of economic management (Finley 1957, pp. 134-135).

Colin Renfrew in the early seventies put further the idea of a centralized-redistributive economy and clearly explained how the growth of the Palaces should be seen as the development of primary redistribution centres controlled by a well-defined social hierarchy (Renfrew 1972, p.29).

⁵ This model was considered universally valid and therefore generically applied to all phases despite it was sometimes created through the overlapping of archaeological sources (storehouses and pithoi) and philological sources (Linear B clay tablets) belonging to different times (Privitera 2010, pp. 13-14).

⁶ In support of these reconstructions, comparisons were suggested with the Mesopotamian societies of the III millennium, in particular with the III Dynasty of Ur and its rich epigraphic documentation.

More in detail, the Palaces would have been involved in the management and control of agricultural resources (in particular cereals, oil and vine, the so-called Mediterranean triad), subsequently redistributing them to rural communities specialized in the cultivation of only one of these products.

This sharp diversification of production systems postulated by Renfrew has been subject to several criticisms. Firstly, the concept itself of Mediterranean triad was challenged, which does not consider other products, such as legumes, whose real weight in the diet of ancient communities is now undisputed. Moreover, some scholar underlined the lack of evidence of a full specialization and diversification of subsistence systems already in the period of the First Palaces during the MM (Halstead, 1981, 1988 and 1992). According to Halstead, in fact, the accumulation of resources within the first Palaces must be read more as social storage, or as a preventive system in case of drought and famine period.

Following Earle, in the Bronze Age Aegean societies, the most probable bottlenecks were the land ownership by the elite, the tax system imposed for trade, for example to give access to safe harbours, and finally the Palaces control of high craft production (Earle 2011).

Palaces would then have been involved in the production, management and exchange of goods that can be inserted into the wealth finance (i.e. metals, perfumed ointments). This also seems to be confirmed by the tablets in Linear B where records of valuable goods given to (specialized) workers prevail to primary (staple) goods.

Mycenaean palaces would thus not have been able (or interested) in controlling the primary economy and would have rather focused on the specialised valuable production control. An alternative hypothesis related a possible monopolistic centralised administration uniquely with specialised sectors (i.e. cereals, oil, wine and wool). Some believe that the consequences of this selective control of primary goods did contributed to the palaces system crisis (Healstad 1992). The palace would indeed not have been able to react positively to socio-economic stresses, adopting large-scale welfare measures.

However, this does not necessarily imply that redistributive activities from the central authorities did not take place for example towards specialized attached/semi attached artisan and workers.

Moreover, it seems useful to underline how staple and wealth finance can often be considered together: staples could be converted into prestigious goods (i.e. wool or oil) and used by the central authority as means of redistribution and exchange both within the community and outside in the international exchange system (Earle 2011, p. 241).

2.4. Redistribution in archaeological studies of Late Bronze

Age Cyprus

The bipolar model of staple and wealth finance was used also in Cypriot studies, especially during the LCII phase, in order to explain the socio-economic organization and the interaction among all the sites that flourished on the island during this period.

Late Bronze Cyprus was characterized by the presence of several large coastal centres included in the Mediterranean trade routes and directly responsible for the circulation of the copper produced in the mine district of the Troodos massif.

The presence of many imported goods, coming from both the Levante and the Aegean, in the levels of the LCII-III, confirms the participation of these coastal sites into the Mediterranean exchange routes.

Regarding the internal socio-political organization, the evidence currently available seems to indicate, for the LC, the absence of a single central authority which control was extended over the entire island. It seems rather that Cyprus was divided into different regional systems organized around some large coastal centres, such as Enkomi, Toumba Tou Skourou, Hala Sultan Tekke, Kalavassos-Ayios *Dhimitrios*, Maroni-Vournes, Kition, Palaepaphos and Alassa or Kourion) and devoted to the production and exchange of copper (Merrillees 1992; Keswani 1993).

This model presupposes the existence of a functional division between sites within the same organizational system. There is no agreement among scholars about the quantity and identification of these hierarchical levels. However, it is possible to identify a first site-level composed by the large coastal centres, a second level represented by the centres responsible for agricultural production and for controlling the internal copper circulation, which still maintain some administrative functions, and finally a third level composed both by mining and agricultural villages (Knapp 2008; Knapp 2013). This three-tiers system is questioned by Knapp who recognized four levels.

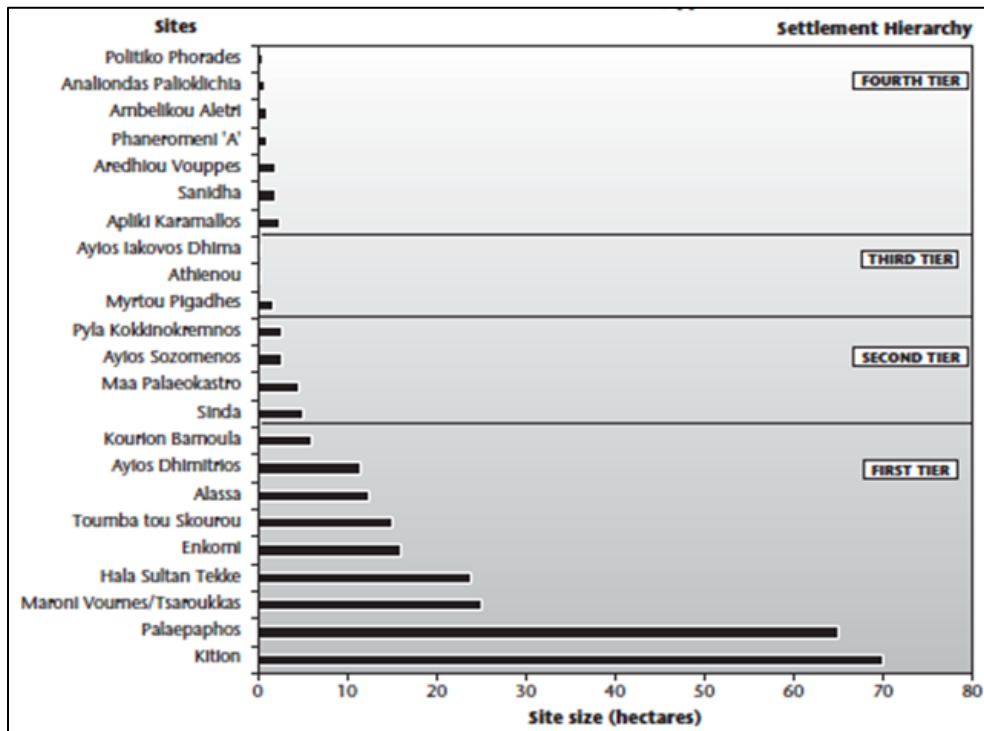


Fig. 2. 1 Settlement organization (Knapp 2008).

In Knapp's view the secondary and tertiary tier sites which served respectively administrative and ceremonial functions were located at strategic communication points.

The nature and organization of these centres is still largely unknown, Priscilla Keswani (1996) recognizes however the existence of at least two types of internal organization: according to her model the large coastal centres can be divided into two large groups. The group of the heterarchical sites – such as Enkomi, Kition and Hala Sultan Tekke –, is characterized by the absence or scarcity of administrative and monumental storage buildings suggesting the existence of different groups that control the power and the artisan production.

On the other hand, there are sites such as Kalavassos-Ayios Dhimitrios, Maroni-Vournes and Alassa in which the existence of monumental administrative and storage buildings reveals the presence of a specific group elite holding the power.

However, it should be noted that, even if the presence of monumental storage areas is currently limited to few sites (i.e. Kalavassos-Ayios Dhimitrios, Maroni-Vournes and Alassa), the presence of pithoi is much more widespread. Pithos fragments – belonging to big specimens (in the present classification are Type 24.3, 24.4 and 25.3, see Chapter 4) and generally connected to centralized storage – have been also found in centres where buildings clearly designed for storage are absent as well as in several small inland sites devoted to agricultural production.

Each regional system also functions for the internal circulation/redistribution of products. It is possible to imagine the circulation from the inland to the coastal of copper (ore or metallic copper as well as agricultural produce) and on the opposite way the circulation of staple and imported goods (wealth finance) from the primary sites to the interior⁷.

2.5. Redistribution in archaeological studies of Late Bronze Age Southern Italy

The debate around the concepts of centralization and redistribution and their replacement with the mobilization pertains also to the Italian LBA.

In particular, the Italian issue concerns the types of control over goods operated by the local elite during the LBA and if this can be read within the framework of a redistributive system. Within this argument a key role is played by pithoi – aside with the other Aegean-derivative ware locally produced – and their diffusion in the southern Italy communities.

During the FBA, in particular, the process of social transformation that led to the overcoming of the social organization based on tribes with territorial connotation, characteristic of the MBA societies, is fully completed⁸.

Several archaeological data seem to confirm, during the FBA, an intensification and specialization of land activities and with the production, for examples, of oil and wine. Moreover, since this period the local elites stabilized a tendency towards the accumulation of (agrarian) produced resources, visible – *inter alia* – in the increase in the capacity of the storage vessels of this period in comparison to the previous ones and especially in the presence of storehouses aimed at hosting pithoi⁹. The existence of storehouses for foodstuffs – both free standing independent structures or rooms within more complex buildings – are documented in several settlements in southern Italy. Aside Broglio di Trebisacce (§3.2.4), storehouses were identified, for example, in Roca Vecchia, Otranto e Santa Maria di Ripalta (Apulia), and Toppo Daguzzo (Basilicata). The data available from Broglio and Roca Vecchia permits to ascertain that the total capacity of these structures exceed that of normal single-family needs.

⁷ Within this general model Keswani (1993) identified differences related to the nature of the primary centre – heterarchical or hierarchal – and to its distance from the copper ores.

⁸The communities from the RBA are organized on a type of patron-client relationships between the elites and lower social segments.

⁹Despite the production of pithoi started during the Italian RBA, structures devoted to the storage of pithoi are attested only since the FBA.

The available evidence brings to the hypothesis of the establishment of some kind of redistributive practices controlled by socially relevant groups within the community (Schiappelli 2006). Moreover, as Peroni and Schiappelli (Schiappelli 2003; Schiappelli 2006) pointed out, redistribution was probably not only related to the substances stored inside the magazines but also to other material goods (i.e. Aegean and local Aegean pottery) as well as to immaterial goods such military protection, community membership.

However, some scholars (Borgna and Càssola Guida 2004, Borgna and Càssola Guida 2005) reject the possibility of the existence of redistribution in the Italian communities because it implies the presence of a hierarchical settlement system and a complex political organization based on land control¹⁰. According to these scholars, Italian pithoi were thus not directed to internal redistribution but oriented to the exchange networks with the Aegeans. In particular, “the mobilization of land resources towards major sub-coastal settlements such as Broglio might be framed within a pattern of social storage for the supplying of Aegean partners (Borgna and Càssola Guida 2005, p. 501).

In this framework therefore, the Aegean people would have met southern Italy communities to obtain supplies of agricultural products and specialised ones (e.g. wine and oil), especially in the early post-palatial period.

Finally, it is important to consider the available data about land control systems and ownership of means of production do not allow to build a complete picture of Italian LBA. It is however important to stress the existence of a relation between ownership and agricultural intensification. The adoption of crops involving high investments in labour force, such as oil trees and grapevines, happened after the beginning of the collective land ownership crisis, in favour of the private control of elite individuals or families (Pacciarelli 2009).

2.6. Archaeological visibility of storage in protohistoric societies

Several studies have focused on the identification of all those elements that could be linked to the presence of storage (Begg 1975; Christakis 2008, Darcque 2005; Paulette 2015; Benati 2016, Manazilla and Rothman 2016).

In short, we can summarize the following elements as more significant:

1. Architectural evidence;

¹⁰At present though, data about settlement systems and political organisations remain poor. Only few territorial districts have been identified (such as the Sybarite), but scholars do not agree on the value of this evidence.

2. Installations, implements and technical devices;
3. Presence of containers;
4. Ecofacts and organic remains residual in vases
5. Bureaucratic tools.

Thanks to the analysis of the architectural elements, it is possible to identify entire buildings, or specific areas within these, used for storage. In general, areas destined in whole or in part to the storage have a modular layout formed of modular rooms arranged in a row where access could take place directly, for example from a corridor, or indirectly through openings in the floor of the upper storey.

The modularity pattern of storage areas could respond to control needs, as it is easier to control and manage small spaces separated from each other, as well as to the possibility of separating different substances that may even have different storage requirements.

Inside these rooms it is also possible to find fixed devices such benches or niches used for housing both ceramic and perishable containers.

Other special devices that may be present are silos and granary. Both rooms and cellars inside the buildings and silos or granaries could be coated with specific substances in order to improve the isolation and thus prevent the deterioration of the goods stored because of the action of microorganisms and animals.

The presence of containers, generally in ceramic, is obviously one of the main indicators of storage practices. The number and the size of containers is certainly a useful element in identifying both the modality and the scale of storage. The original presence of containers could also be underlined by the presence of stone or wooden bases used for the placement of pithoi and jars.

Finally, it is important to consider the tools related to the administrative control over the goods stored: clay sealing affixed on vases or doors, seals, weighing tool and written records (Ramhstorf 2012; Benati 2016).

The visibility of storage practices is also significantly conditioned by the scale of storage itself. In general, centralized storage in specifically dedicated buildings is certainly more clearly identifiable than forms of domestic storage, created in spaces within the domestic units¹¹. Multifunctional spaces dedicated to storage as well as other type of activities like food processing provided sometimes ambiguous evidence on the reading of the type of surplus managements.

¹¹A very interesting study on domestic short, middle and long-term storage is the one conducted by L.P Thalmann in the site of Tell Arqa on the EBA IV levels (Thalmann 2007).

However, a great visibility does not necessarily imply a greater understanding of the management system behind the storage evidence.

Despite a careful lecture of the archaeological evidence, the comprehension of the type of surplus management is very difficult and most of the time the reconstruction is only speculative. For this reason, the use of ethnographic analogies is very common. The comparison with ethnographic reality allows to link more directly the material evidence to the type of surplus management and social organization.

Among all these sources, the present study concerns in particular the examination of pithoi as indicator of storage practices. Only after the analysis of the pottery containers, where and when possible, additional sources will be used to reach a full comprehension of the storage practices.

3. CONTEXTS ANALYSED AND OTHER SITES

3.1. Introduction

The materials analysed in the present research come from three sites which are cardinal for the study of the Late Bronze Age. Proceeding from east to west, the sites are Pyla-Kokkinokremos (hereafter Pyla), located along the south-eastern coast of Cyprus, Kommos, on the southern coast of Crete and Broglio di Trebisacce (hereafter Broglio), on the Ionian coast in southern Italy.

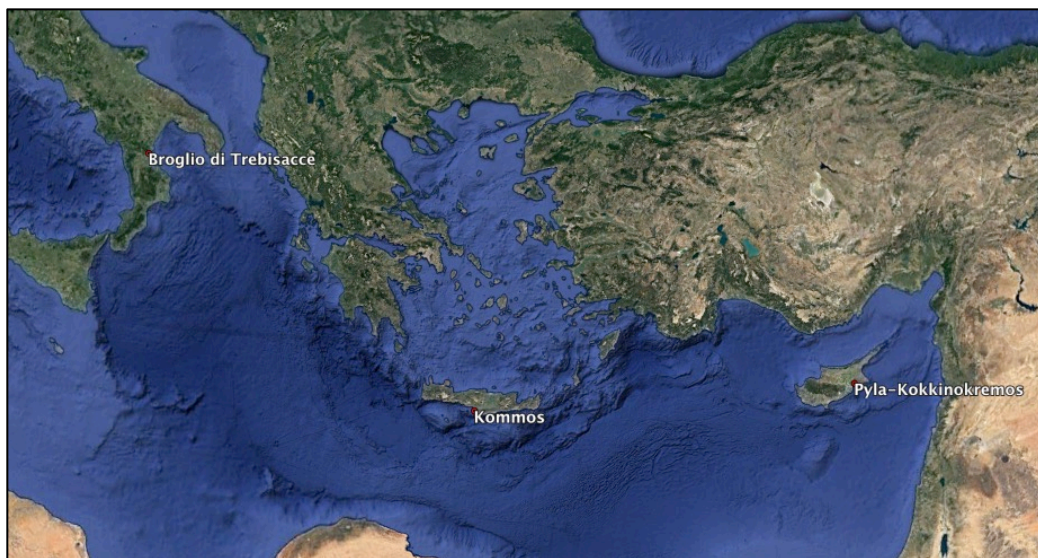


Fig. 3. 1 General map of the sites under analysis.

They represent, in different ways, key points in the investigation of the maritime interconnections in the Mediterranean area. The material culture at Pyla and Kommos sites is, indeed, characterized by the presence of numerous imported items coming from several Mediterranean regions.

The level of inter-connectivity reached during the LBA was so high that similar practices and way of life were spread in whole Mediterranean.

Pyla and Kommos were certainly included, albeit with different functions and prerogatives, within this globalized Mediterranean micro-cosmos.

Kommos was one of the main trade ports in the Mediterranean with a huge building devoted to the storage of ships. Pyla, despite its very short life span, was characterized by a cosmopolitan cultural material and a high number of valuables.

Among the allochthonous materials found in the two last sites, it is noteworthy the presence of Nuragic type pottery produced in Sardinia. In particular, Pyla is the easternmost place where genuine Nuragic pottery was found in the whole Mediterranean basin.

The presence of Nuragic vessels in contexts dating to the LHIIIB (13th century BC) confirms the involvement of the western Mediterranean, not only Sardinia, within this network of long-distance exchanges.

The real reasons of the indigenous communities of southern Italy involvement in the international maritime traffic are not yet fully understood. However, an increased number of archaeological evidence confirms how these contacts were bidirectional, involving the circulation in both directions of materials, people and know-how.

Although Aegean-type pottery was already known in sites such as Vivara and on the Aeolian Islands already from levels of the Italian MBA (LHI-LHII) and in a large number from levels of LHIII contexts, the excavation in Broglio added some important evidence. In particular, thanks to the study of the material retrieved there, it was possible to understand how the contact with the Aegeans led not only to the presence in Italy of Aegean ceramics but also to much wider socio-economic phenomena.

Among these we must certainly mention the technological innovations in the ceramic field with the production of three new Aegean-derivative classes: Italo-Mycenaean, Grey ware and precisely the pithoi. Broglio and, more generally, the area of the Taras Gulf, are key areas to understand the international maritime network during the LBA: they offer elements related both to the presence of imported Aegean items and also to the study of new socio-economic phenomena.

The three sites under analysis have very different characteristics, and the ways in which they have been excavated and published are different as well.

The comparative analysis between the sites is obviously conditioned by these differences, making it impossible to follow a single methodology within this study.

In the analyses the published materials were also considered. They come from all the main sites in each region (Cyprus, Crete and Italy) where pithoi were found. They have provided an extensive documentation to develop the pithos formal typology¹².

¹² In many cases, however, due to the absence of graphic or photographic documentation or its poor quality, many materials have not been included in the typology classification. In the latter case, the materials were anyway recorded in the Pithos Catalogue.

3.2. Analysis of archaeological contexts

3.2.1. Pyla-Kokkinokremos: an introduction

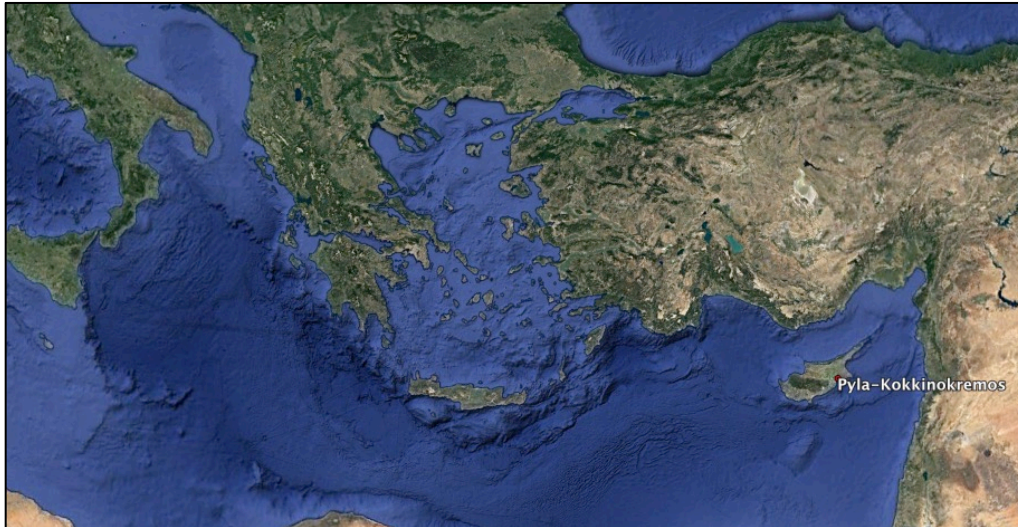


Fig. 3. 2 Cyprus and Pyla-Kokkinokremos.

The site of Pyla-Kokkinokremos is situated in the village of Pyla, near the modern city of Larnaka. The site lies within the Dhekelia Sovereign Base Area³.

The LBA settlement is located at the top of the hill *Kokkinokremos* (red cliff) at an altitude of ca. 83 m above the sea level. The summit of the hill takes the form of an irregular 6 ha. plateau at a distance of 800 m from the coastal line (Bretschneider *et al.* 2015, pp. 1-3). It was surrounded by low and marshy land that could serve as a land-locked harbour (Karageorghis and Dema 1984, p. 5). From the top of the plateau it is possible to dominate the entire Larnaka's bay and to control the routes between the inland Mesaoria plain and the coast¹³. The plateau is naturally fortified with abrupt sides and does not present natural spring water sources.

Larnaka's bay was densely populated during the Late Bronze Age as testified by archaeological remains of contemporary and/or directly preceding sites located in *Verghi*, *Stavros*, *Steno* and *Koukoufouthkia* (Knapp 2008, Karageorghis 2014, pp. 156-158). Other important LBA sites clustered in this south-eastern part of Cyprus are the harbour town of Hala Sultan Tekke, the important coastal centre of Kition (the modern Larnaka) and Enkomi (24 Km south-west).

¹³ It should be noted that the name Pyla Πύλα means gate in Greek.

3.2.2. Excavation at Pyla-Kokkinokremos

3.2.2.1. The First Excavation campaigns (1952 and 1981-1982)

The first excavation of the site was made by Porfirio Dikaios in 1952 after the discovery of some golden jewellery by looters. During that period, Dikaios, was working on the investigation of the near Late Bronze Age site of Enkomi (Dikaios 1971).

Before starting the excavation Dikaios conducted a surface survey on the plateau in order to understand the extension of the site. The excavations concerned two areas: Sector I, which exactly location is unknown, but is probably close to the north-eastern edge of *Kokkinokremos*, and Sector 2, close to the eastern edge of the plateau.

Sector 1 was located by Dikaois in the area interested by the golden jewellery finding by looters in order “to secure undiscovered treasures” (Dikaios 1971, p. 896). The excavation brought to light a complex composed of a court bounded by rooms on its west and south west sides. He identified a rectangular pith with ash in the central position of the east side of the court. The excavation remained incomplete but Dikaios suggests a parallel for this type of architectural remains with those found at the sanctuaries of Myrtou-Pigadhes and Ayia Irini. Dikaios conjectured therefore the performance in this area of some kind of ritual activities.

Sector 2 was placed at the east edge of the plateau, in an area already recognized as particularly rich in findings. The excavation uncovered several architectural remains (belonging to Complex A and part of Complex B) and floor levels in a very good conservation state (Dikaios 1971, p. 900).

Vassos Karageorghis and Martha Demas made a second investigation in 1981 and 1982. The excavation report was published in 1984; it also included some material from both the Dikaios' excavation and the surface discoveries made by the Department of Antiquities in 1953. The two scholars continued the excavations of Sector II initiated by Dikaios thirty years before and discovered a series of architectural complexes (named A, B, C, D and E) connected with the system of the site fortification.

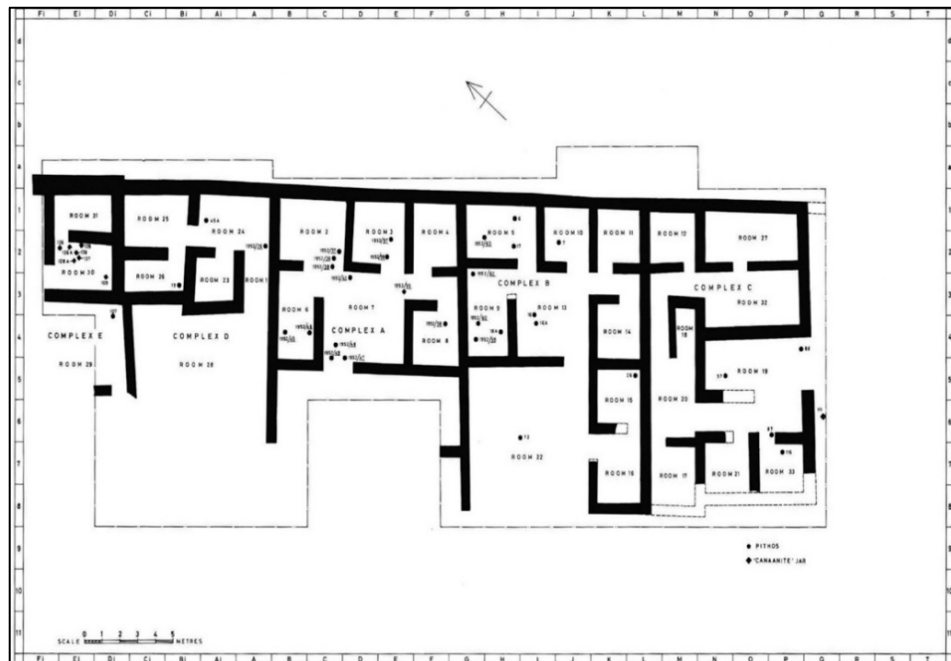


Fig. 3. 3 Plan of the 1981-1982 excavations in Sector 2 (Karageorghis and Demas 1984, fig. 4).

3.2.2.2. The 2010-2011 and 2012 excavation campaigns

After thirty years, Vassos Karageorghis and Athanasia Kanta made a new investigation in the site of Pyla-Kokkinokremos. The project was fully published in 2014. The area under investigation was located immediately to the south of Sector 2. The excavation brought to light at least four complexes, with 46 different rooms/spaces, very similar in the general arrangement to the first five complexes excavated during the eighties. For this reason, the new ones were numbered consecutively to the previous ones (i.e. Complexes F, G, H, I) (Karageorghis and Kanta 2014).

In 2012, Athanasia Kanta continued alone the investigation of the *Kokkinokremos* plateau. The area investigated was at the opposite edge of the plateau, in the western lobe. She discovered a series of five rooms and one of the entrances to the settlement. The excavated area is published in a preliminary report inserted in the publication of the two-years excavation 2010-2011 (Kanta 2014, pp. 103-112).

It is noteworthy the discovery of two clay tablets with incised marks inside Room 3 (Kanta 2014c p. 110).

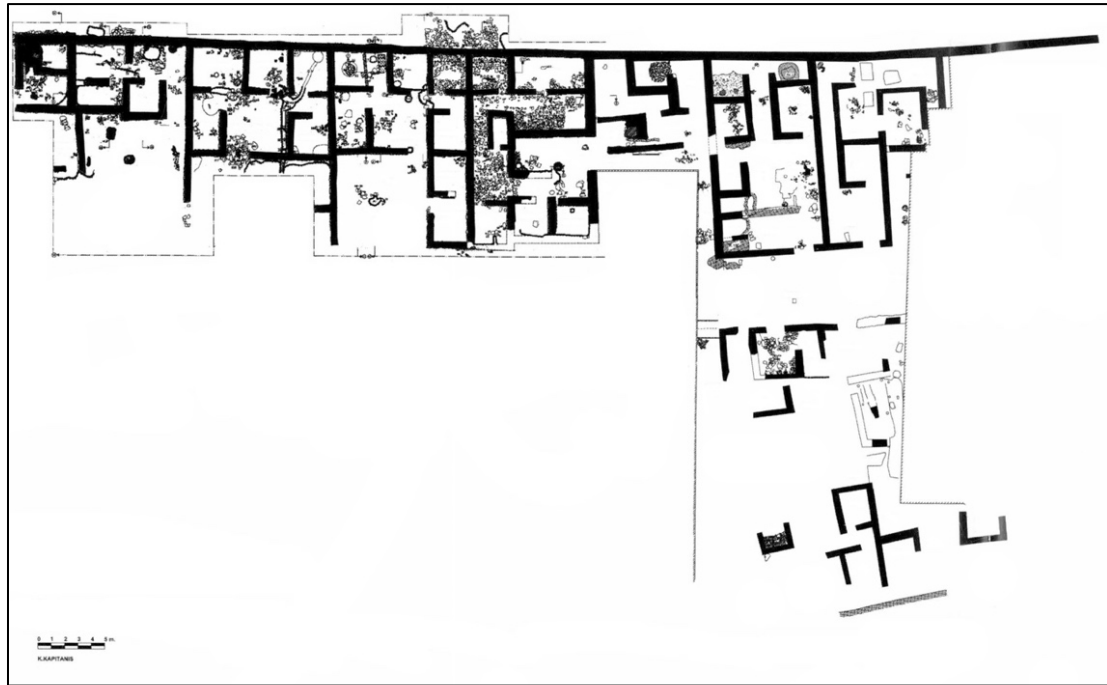


Fig. 3. 4 General Plain of Excavation in Sector 2, with all the complexes excavated during the eighties and the new ones uncovered during the 2010-2011 season (Karageorghis and Kanta 2014).

3.2.2.3. Current Excavation: the 2014-2018 Project

The current excavation (2014-2018) is part of a five-year research program led by an international joint mission of the Universities of Louvain (UCLouvain, Prof. Jan Driessen), Leuven/Ghent (Prof. Joachim Bretschneider) and the Mediterranean Archaeological Society of Crete (Dir. Athanasia Kanta).

The current excavation interested both the northern (Sector 3.3, Trenches 3.2, 3.3 and 3.6) and the south-eastern edge of the plateau of *Kokkinokremos* (Sector 5), in order to understand if the plateau was completely provided with a fortification wall. The excavation of the western lobe area (Sector 4.1), started in 2012 by Kanta (Kanta 2014 pp. 103-112), continued in parallel.

The new trenches and sectors (Fig. 3.5) revealed a larger portion of the settlement. Architectural remains were identified for the first time also in the central part of the hill.

The description of these sectors and trenches will be provided together with a brief focus on the most interesting spaces.

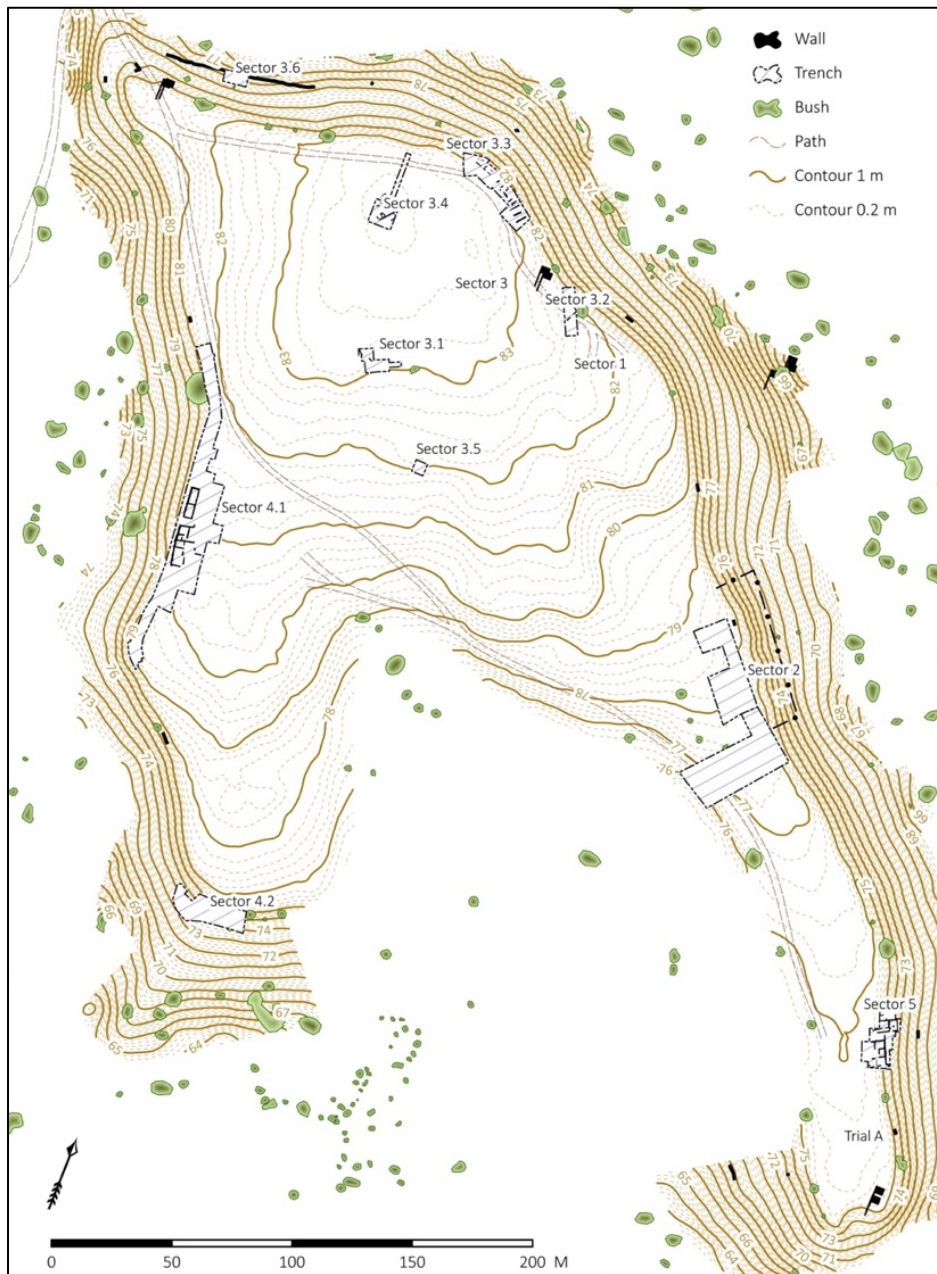


Fig. 3. 5 General Map of the Pyla-Kokkinokremos excavations (2014-2018).
Plan: N. Kress (Bretschneider et al. 2017).

Trench 3 – the Central and Northern Parts of the Hill

UCLouvain is exploring the central and the northern parts of the plateau. Some random test trenches have been opened in the central part of the plateau (Trenches 3.1, 3.4-3.5) in parallel with the systematic investigation along the northern edge (Trenches 3.2-3.3 and 3.6) (Jusseret 2017).

Trench 3.1

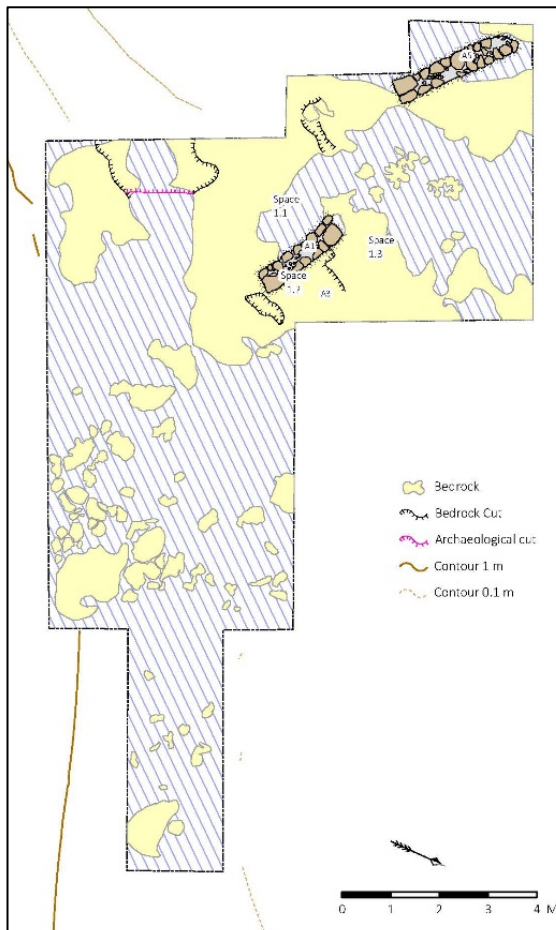


Fig. 3. 6 Sector 3, Trench 3.1: 2016 plan (N. Kress) (Bretschneider et al. 2017).

The excavation in Trench 3.1 revealed some architectural remains which defined at least three spaces (3.1.1-3.1.3). Space 3.1.1 revealed the most interesting and well-preserved floor assemblage (Jusseret 2015, pp 6-7). Several high-quality vases were found directly on the floor. Among them there were a Late Minoan IIIB mug (inv. no. PK14 166) decorated with whorl shells and a local Mycenaean IIIC Early 1 bell shaped deep bowl FS 285 (inv. no. PK14 175 (Jusseret 2015, pp 6-7; Caloi 2015, pp 32-33, fig. 27). The presence of a hole in the mug and the deep bowl base suggest their use as *rhyton*. The materials retrieved from this space can be related to some kind of domestic activities but the presence of two *rhyta* seems to indicate the performance of ritual actions as well¹⁴.

Trench 3.2

Trench 3.2 is located 80 m northeast of Trench 3.1, close to the eastern edge of the plateau. During the excavation several walls were identified, delimiting a square space of 6 by 6 m called Space 3.2.2 and aligned with the edge of the plateau itself. The area was damaged by the digging of the trench used to cable the firing range's flag pole.

¹⁴ Rhyta are generally rare in Kokkinokremos: until now an ostrich egg rhyton from Sector 2, Complex H (Kanta 2014a, p. 65), a fragmentary Mycenaean conical rhyton from Trench 3.3, Space 3.4 and finally an alabaster rhyton from Sector 4.1, Space 12 (Kanta 2017 in press) are known.



Fig. 3. 7 Sector 3, Trench 3.2: 2016 plan (N. Kress) (Bretschneider et al. 2017).

During the 2014 excavation season in Space 3.2.1 a floor level with pebbles and eroded sherds together with a potential hearth that could be dated to Late Bronze Age (Jusseret 2015, pp. 7-8) were identified. The presence of this floor towards the northwest is still unclear. In Space 3.2.2 a stamped earth floor was recognized on which a few sherds lied, in particular a base of closed vessel and a fragmentary wall bracket. More excavation is needed in order to get a better understanding of this area.

Trench 3.3

Trench 3.3 is located along the north-eastern edge of the plateau, 90 m north of Trench 3.1. From the beginning of the excavation until 2016, several walls delimiting at least 12 different spaces were exposed.

This area of the hill is deeply damaged, and the architectural remains are often badly preserved in comparison to those of Sectors 4 and 5 (see *infra*). During the excavation well-preserved rock-cut pits, cut bedrock ledges and foundation trenches were discovered. All these elements are helpful in locating the position of missing walls. As Kanta pointed out (Kanta 2014b, p. 118), the presence of rock-cut pits (usually interpreted as cisterns) could suggest the existence of a casemate room system similar to the one recognized in the well-preserved Sectors 2 and 4.1. Following this interpretation, the excavator underlined that it is possible that erosion destroyed most of the casemate walls in this sector of the hill (wall C16 C56 and C 44 to the north of Space are the only surviving parts) (Jusseret 2017).

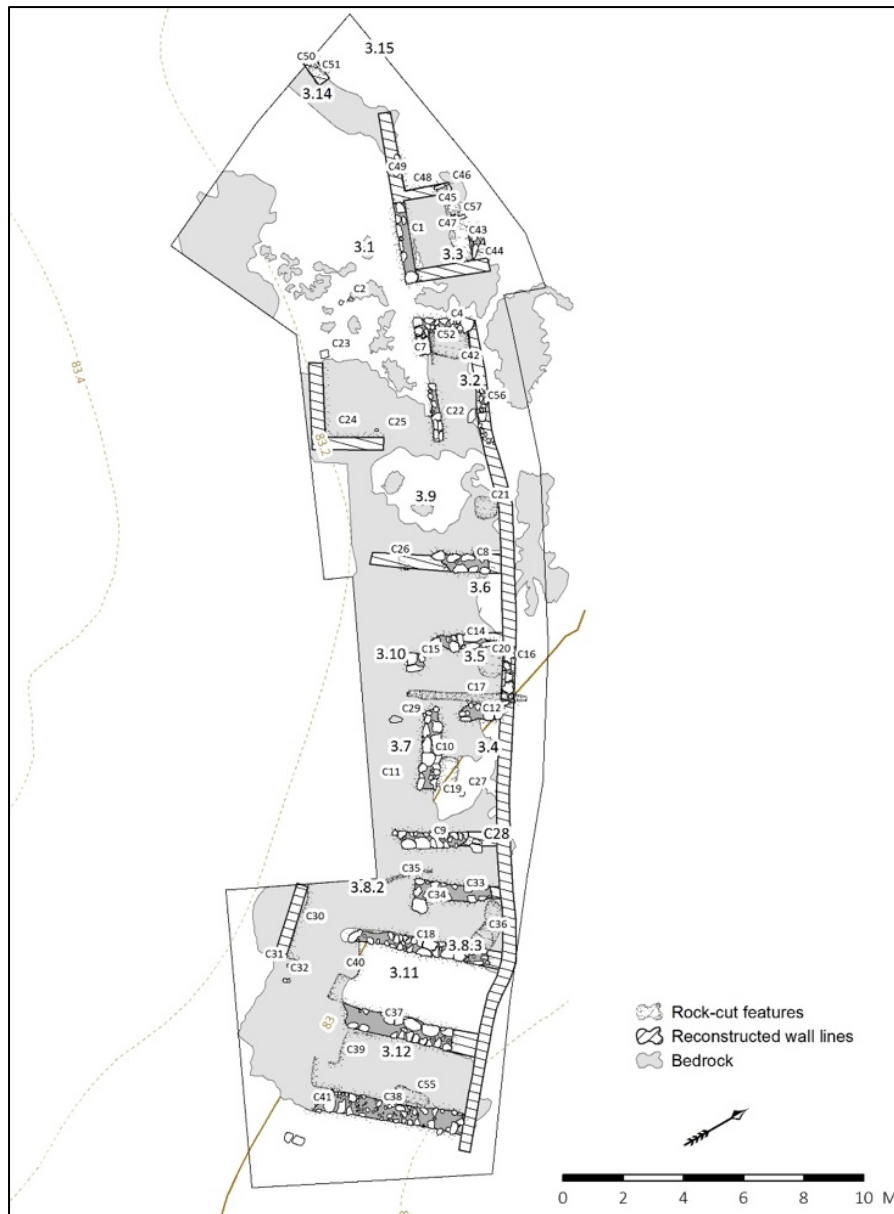


Fig. 3. 8 Sector 3, Trench 3.3: plan up to 2016 Kress (Bretschneider et al. 2017).

After four years of excavation, it is possible to ascertain evidence of metal production and textile industries. Evidence of metal production seems concentrated in Spaces 3.3.4, 3.3.7 and particularly in 3.3.8.1 and 3.3.8.2 where the workshop was probably located.

Tools related to textile production were found for the first time in 2014 in Space 3.3.1. Until then there was no evidence of the weaving activity in the entire settlement of Pyla. The excavators found an additional cluster of seven terracotta loom weights inside a Space 3.3.6, lying on top of a sediment which was interpreted as a collapsed roof material. Another loom weight was found in the northern part of the same space (Jusseret and Claeys 2017).

Space 3.3.1 displayed a very interesting assemblage; most of the findings come from the central and the eastern part of the space. Among the pottery found in this space there were

some fragments belonging to a Minoan painted pithos (14/03/5007 + 14/03/5009). As mentioned above, two loom weights and many stone tools as well as a duck shaped stone weight were also found inside the space. The area is interpreted as an open courtyard related to different activities connected with the textile industry and food processing.



Fig. 3. 9 Space 3.3.1: floor deposit. Ph.: S. Jusseret. (Bretschneider et al. 2017).

Little evidence comes from Space 3.3.2. The space is located to the northeast of Space 3.3.1 but it is not clear now if a doorway existed between those two spaces. Space 3.3.2 is currently interpreted as a casemate room. During the excavation a possible occupation/floor level was identified, and aside some sherds belonging to a Cannanite-type jar, a spindle whorl and lead clamps were found (Jusseret personal communication).

Like Space 3.3.2, Space 3.3.3 is located on the northern slope and is unfortunately very badly preserved, with bedrock outcrops at shallow depth. No architectural remains and only few sherds were found there.

Space 3.3.4 was probably a casemate like room. It was bounded to the west by Space 3.3.5, to the east by Space 3.3.8, to the south by Space 3.3.7, and to the north by the plateau's north slope. An opening was probably located between Space 3.3.4 and 3.3.7 (Jusseret 2017).

The excavation deposit brought to light a rock-cut shaft dug into the bedrock (dimensions 0.99 m x 0.68 m x 1.80 m) inside the space. The shaft was found filled with large stones, with a White Shaved Ware spindle bottle, two tuyères and the nozzle of a stone pot-bellows in the clayey sediment beneath the stones.

Space 3.3.7 is only partly excavated but it was possible to identify a doorway leading to Spaces 3.3.8.1-2 to the east. The floor level consists of a gravel layer used to level the bedrock irregularities. On the floor there were some metal related objects like *tuyère*, a fragmentary stone trough, and several lithic tools.

Space 3.3.8 was initially identified as a single architectural unit. However, in the course of the 2016 campaign a small partition wall was identified, and the space was therefore divided into three compartments. Spaces 3.3.8.1 and 3.3.8.3 are oriented northeast-southwest, while Space 3.3.8.2 was located to the south of the two previous ones and directly connected to both of them.

The importance of these spaces lies in the presence of several objects¹⁵ related to metal-working activities, scattered on the surface of an ashy level.

Space 3.3.8.3 was empty apart from a copper (or bronze) needle and an irregular pit filled with a gravelly sediment. The excavation of this sediment brought to light an intact Egyptian alabaster flask with black painted decoration in a form of a lotus flowers garland. The flask was filled with objects including a cylinder seal of Cypriot manufacture, three beads made of semi-precious stones and another fragment of a semi-precious stone, a bronze knife, a bronze tool with anthropomorphic handle, an unidentified bronze object, three bronze rings, a chunk of blue glass, a spindle whorl decorated with circular motifs, and a possible cylindrical ivory container (Jusseret 2017).

Space 3.3.9 was in a bad state of preservation and its original dimensions are difficult to evaluate. The space was empty apart from few findings made in a rock-cut pit (C21). The excavators related this pit with the presence of a casemate wall system like room as in other areas of the plateau (Kanta 2014b, p. 118).

Space 3.3.11, which excavation is still unfinished, is located southeast of the rooms just described. The preliminary analysis of the material found there permits to identify some vases and one almost complete pithos.

Space 3.3.12 is another casemate room like space located southeast of Space 3.3.11. As for the previous room the excavation is unfinished, but it presents a rich pottery assemblage. Many sherds were found on the flat sloping bedrock surface. The excavation led to the identification of a 0,40 m deep pit (C55) in the centre of the room containing pithos sherds lying vertically against its western limit.

¹⁵They include slags a possible crucible and/or furnace fragments, *tuyère* fragments and bronze scraps.

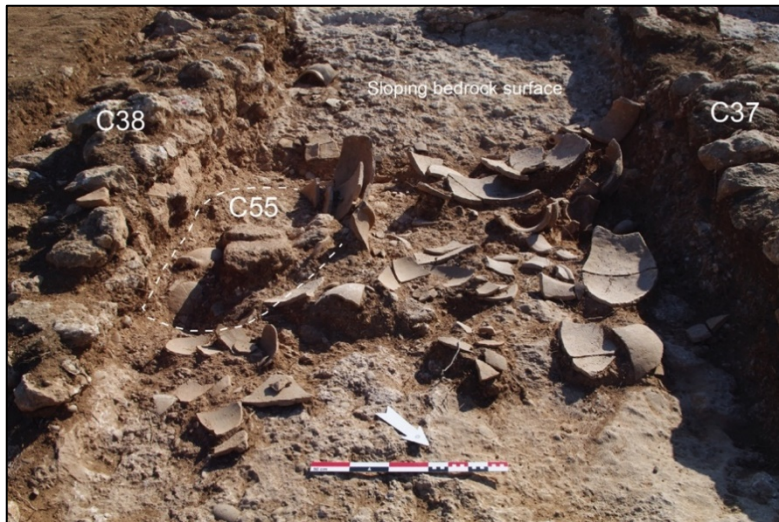


Fig. 3. 10 Space 3.3.12: floor deposit, with pit C55. Photo: S. Jusseret. (Bretschneider et al. 2017).

Trench 3.4

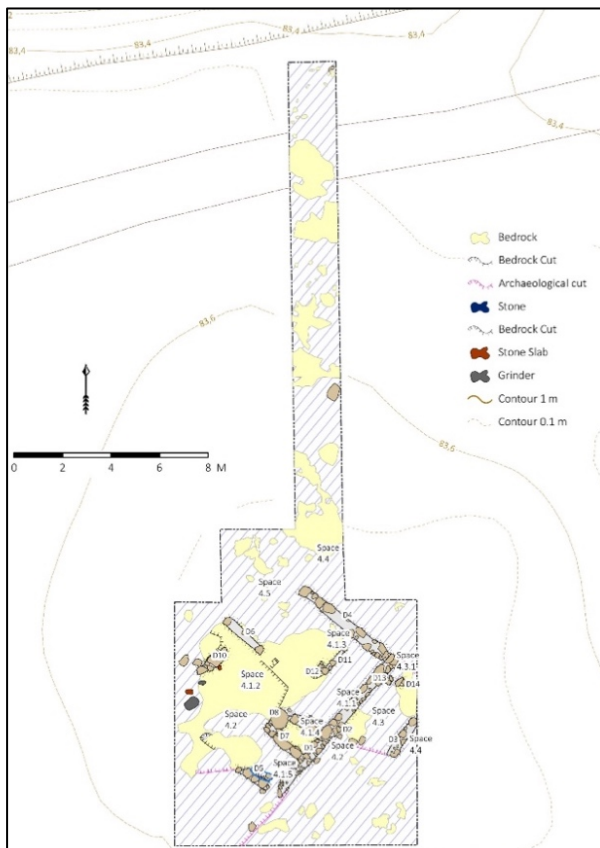


Fig. 3. 11 Plan of Trench 3.4 (N. Kress) (Bretschneider et al. 2017).

Trench 3.4 is located at the highest part of the plateau (83.7 m a.s.l.). The remains consist of series of walls delimitating five different spaces, at least in one case with further internal division. Most of the architectural remains are gathered in the eastern part of the sector, while on the western side walls are generally badly preserved (Claeys 2017).

In order to understand the relationship between this trench and the Trench 3.3, in 2016 the excavators added a narrow extension to the north. Unfortunately, no architectural remains were found there.

The first space under examination is Space 3.4.1. The excavators suggest that these spaces were internally divided into five compartments. None of these are very clear and part of these

may have been connected to Space 3.4.2 forming an inner courtyard. The small space 3.4.1 may have been a corridor (Claeys 2017).

The most interesting assemblage comes from Spaces 3.4.2/3.4.1.2 with the presence of a considerable number of Canaanite-type jars and cooking pots. Moreover, some stone tools were retrieved and, among them, two grinding stones.

Space 3.4.1.5, located to the southwest of Space 3.4.1.4, has a low bench (D52). Space 3.4.1.5 may have been open towards courtyard 3.4.2/3.4.1.2. During the excavation patches of whitish-grey sediment were recognized that may be connected to the existence of a light roof structure.

The excavator (Claeys 2017) suggests a parallel with other architectural complexes in Sector 2, in particular with Room 30 in Complex G, (Kanta 2014a, p. 35) and Room 45 in Complex I (Kanta 2014a, p.86).

Inside Space 3.4.3 the excavators found a fragmentary Pastoral Style amphoroid krater depicting bulls and hybrid animals, and a burnt bowl in Monochrome Ware with wishbone handle. Space 3.4.4 produced several fragmentary vessels including an alabaster vase. The excavation of the last space, named 3.4.5, is unfinished (Claeys 2017).

Trench 3.5

Trench 3.5 was located ca. 50 m to the southeast of Trench 3.1 and ca. 80 m to the southwest of Trench 3.2. No archaeological features came to light apart from a few sherds, two (possible) stone tools and a bronze coin (Jusseret and Claeys 2017).

Trench 3.6

In Spring 2016 a small trial trench was opened on the northern slope of the hill; its position was chosen on the basis of the wall line remains. The exploration in this area had, indeed, the attempt to clarify the presence of the wall line identified during the 2014-2015 topographical surveys. The data available until now do not permit any kind of chronological conclusions (Jusseret and Claeys 2017).

Sector 4.1– The Western Lobe of the Hill

Sector 4 has been investigated by the Mediterranean Archaeology Society since 2014. The excavation is mainly focused on two different areas, namely Sectors 4.1 and 4.2. The current excavation follows the exploration conducted in 2012 during which five rooms and a gate area

(Rooms 1-6) were exposed. Until the 2016 excavation season 30 spaces were explored to the north side of the gate and 11 to the south.

During the 2016 campaign Sector 4.2 was opened discovering six spaces (Kanta 2017).

Sector 4.1 is generally well-preserved. Only its easternmost part is deeply interested by ploughing. In general, the best-preserved spaces are the semi-subterranean ones, often discovered with the contents still *in situ* (Kanta 2017). The walls of these spaces were constructed on rock-cut ledges following the *hyposkafon* technique (Kanta 2014, p. 113-114) used elsewhere in the site.

This is undoubtedly the part of site investigated over the largest portion. The excavators related some of the spaces uncovered here to industrial and workshop installations. Following this interpretation and according to the traces related to industrial activities in Sector 3.3, it is possible to assume some kind of specialisation and differentiations in the areas of the *Kokkinokremos* settlement (see *infra*, Kanta 2017).

Area north of the gate



Fig. 3. 12 Sector 4.1, Area north of the gate (north to right). Aerial photo: N. Kress. (Bretschneider et al. 2017).

Space 4.7 space was excavated in 2014 as an extension of the previous excavation carried out in 2012. Its west side is a casemate wall and in its south-west corner there is a cut-rock pit/shaft with a diameter of about 2 m and 2.90 m deep (Kanta 2015, pp 14-15).

The room was found full of smashed vases and apart from few fragments belong to tableware vessels and one bathtub it contained only storage vases of different size and shape. Most of

them are nearly complete and mendable. A Pastoral style Krater was found inside the pit interpreted as a cistern¹⁶.



Fig. 3. 13 Space 7 from N with the vase deposit and, to the west, the water channel longing the casemate wall (Ph. A. Kanta).

Rooms 4.8 A and B lie to the east side of 4.7. The area was excavated between 2014 and 2015 but is unfortunately preserved worse than Room 4.7. Bedrock directly outcrops under a thin layer of topsoil.

The rooms named 4.18-4.19 are rather well-preserved thanks to their subterranean nature. This area has a long and narrow shape. On its east side there is a clay vat just in front of the door leading in Space 4. 25.

A large, flat, rectangular but broken stone seal belongs to the material found there. A parallel can be traced with specimens from Enkomi (Kanta 2017). The excavator underlines that the seal is unfinished which suggests it was either taken as a trinket or made in situ. It shows an incised *oxhide* ingot and a human figure.

¹⁶The shaft was interpreted as a cistern used to collect the rain water from the roof. The real function of this pit is still problematic, and the question needs more investigation.

Area south of the gate



Fig. 3. 14 Sector 4.1, Rooms south of the Gate. Photo: N. Kress. (Bretschneidere et al. 2017).

Room 4.9 is a rectangular casemate room provided with a doorway on its east side. It was found full of smashed vases which had fallen on their side (Kanta 2015, p 16).

East to Room 4.9 there is a large space, Room 4.10. The limits of the space are not clear because no walls remains are identified. For this reason, most of the pottery coming from the area of Space 4.10 joins with vases found in the nearby rooms 4.11, 4.12 and 4.13. The excavator interprets the area as an open space because of the presence of several post holes and a rectangular shallow pit (Kanta 2015, p 17).



Fig. 3. 15 Room 9 (from south) with vases in situ. (Kanta 2015, p. 16).



Fig. 3. 16 Rooms 9, 10, 11 general view from SE corner (ph.: A. Kanta).

Room 4.11 is located east to 4.9 and was unfortunately found largely empty.

Room 4.12, south to room 4.9, is another casemate room provided with a rock cut channel on the southwestern casemate wall. A small circular pit was found close to the north wall. The

space was found full of pottery, some pithos fragments, a decorated Pastoral Krater and an alabaster *rhyton* (Kanta 2017)

South room 4.12, there is a larger semi-subterranean space (Room 4.14) divided by a partition wall into two spaces called 14A and 14B. In both spaces a great number of vases were retrieved *in situ*.



Fig. 3. 17 Sector 4.1, Rooms 14A and 14B, from west and from south. (Ph.: A. Kanta). (Bretschneider et al. 2017).

Rooms 4.13, east to room 4.12, was full of smashed vases. Most of them were found in a line on the south edge of the room suggesting the limit between this room and room 4.15.



Fig. 3. 18 Space 13 with pithoi in situ, from East. (Ph.: A. Kanta).

The excavators were able to identify a series of small post holes cut in the rock suggesting the presence of a roof made of light material. Apart from pottery, in the room they found a large quern, a bronze hoe and a bronze mallet, and several stone tools. Also a lead scale weight

and a miniature Astarte pendant possibly of silver were found in the same place. (Kanta 2015, p. 18).

Rooms 4.15 and 4.16 are very badly preserved and a little quantity of material was found. Among the sherds coming from these spaces, it was possible to identify joins with pithoi from room 4.13.

The area south of space 4.14, named room 4.22, is badly preserved in comparison with the former one but is still possible to follow the casemate wall line. In the northwest corner of 4.22 there is a rock-cut shaft. The excavators found a very large querns and a stone tripod mortar (probably of a Syro-Palestinian origin), and a rectangular stone seal of the same type as the one from room 4.18-19 inside this space. The motif on the seal consists of a double headed eagle with a vase on one side and an animal on the other.

South of room 4.22, room 4.21 was identified, not very well preserved and with bedrock outcrops just below a thin layer of topsoil. The exploration is not concluded and needs more excavation.

Between Sector 4.1 and Sector 4.2 (see *infra*) two casemates like spaces were excavated in an area called Sector 4.1.1 (New Casemate Wall Area, NCW). Two spaces (Rooms 1 and 2) were identified along with the continuation of the casemate external wall. Room 1 was fully excavated and present a rich pottery assemblage while room 2 was only partly excavated in its western half. During the excavation a surface survey was carried out in the area nearby, which let identify substantial walls and what seems to be a large bastion.



Fig. 3. 19 Sector 4.1.1 (NCW area). Aerial Photo: N. Kress.

Sector 4.2 – The South-Western Lobe of the Hill

During the excavation season 2016 an area further south of the southern limit of Sector 4.1 was investigated. In this area the plateau curves toward east, the archaeological remains found are generally well preserved and all the spaces present a rich archaeological assemblage.

Until the 2016 excavation campaign, several spaces were explored, but most of them were only partially excavated and thus more work is necessary to clarify the nature of this part of the settlement. I analysed just a small part of the material coming from this part of the settlement since in most of the spaces the excavation continued in spring 2017.



Fig. 3. 20 General Plan of Sector 4.2. Aerial Photo N. Kress (Breschneider *et al.* 2017).

Sector 5 – The Southeast Lobe of the Hill

The southeast lobe of the hill is under excavation by the joint Leuven/Ghent team. Between 2014 and 2016 12 different spaces were uncovered (Jans *et al.* 2017).

Generally, the architectures of Sector 5 are well preserved, and floor levels were identified during the excavation. The general layout is similar to the arrangement of the other sectors, but here the architectural remains are built on three distinct terraces (Jans *et al.* 2017).

One of the main aims of Sector 5 excavation was to verify whether the casemate walls found on the other edge enclosed also the southeast lobe of the *Kokkinokremos* hill. Until now, however, the north-south wall discovered in this sector was built by non-adjoining walls constructed on different terraces. Furthermore, the excavators suggest that the protruding walls of Spaces 5.1, 5.4, 5.9 and 5.10, as well as a wall southeast of Space 5.11, may form some kind of bastion connected with the fortification system. However, the presence of a big pithos, still *in situ*, further downhill to the east suggests the existence of another line of architectural remains. This area still needs to be deeply investigated (Jans *et al.* 2017).

Despite what seems to be an arrangement over three different levels, the general outline of the rooms relates to the one found in the other sectors of the plateau. The excavator brought to light corridor-shaped spaces and a plastered floor and recognised the use of the building *hyposkafon* technique.

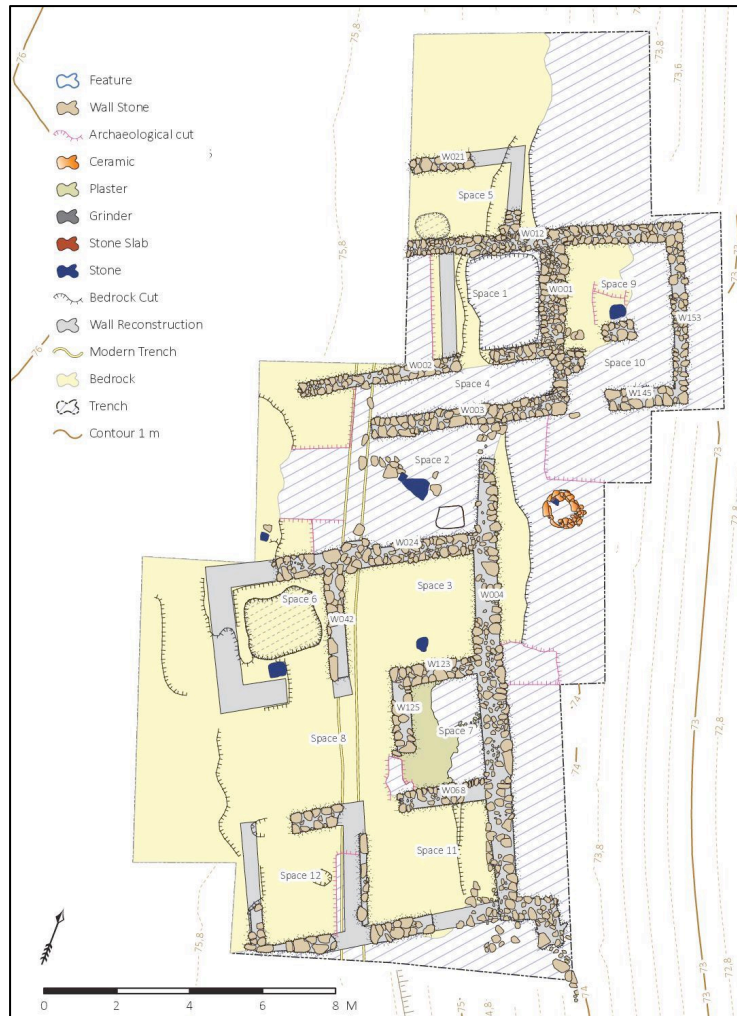


Fig. 3. 21 Architectural plan at the end of the 2016 campaign (N. Kress). (Bretschneider et al. 2017).

Space 5.1 is fully excavated. The western limit is missing while the northern wall was built directly on the bedrock. The floor was made of beaten earth and is deeper than the bases of the east and south walls. This floor level is also deeper than the floor level found in Spaces 5.4 and 5.5 close to it.

The gap between the floor levels of Spaces 5.1 and 5.4 was overcome by an opening in the south wall and creating a stepped ramp directly cut in the bedrock (Jans et al. 2017). A large amount of pottery was found on the floor.

Space 5.3 was excavated during the 2014 season and contained a hoard composed by 28 metal objects (Bretschneider *et al.* 2015).

Space 5.3 is fully excavated, and a rich and interesting assemblage was retrieved. Among the pottery material there were an almost complete local, wheel-made spindle bottle decorated with Mycenaean-inspired motifs (Museum Inventory no. PK14 170: Caloi 2015: fig. 28) and an incomplete hollow Base Ring II female figurine (Museum Inventory no. PK15 421).

Also two fragmentary alabaster vases and one bronze pin and a bronze spiral (Jans *et al.* 2017) were found in the room.

Space 5.6 is very different from the other spaces because of the presence of a very large and deep shaft structure (3.50 m deep for ca. 1.80 m north-south by 2.10 m east-west). The big pit was cut inside the room and filled with homogeneous soil with the exception of a 40 cm wide structure against its western side, which had a fill of harder, yellow-greyish clay. At the bottom of the shaft a thick layer of ash was found with a large number of charcoals. It contained a complete big jug and an oval terracotta recipient turned upside down. The recipient was found filled by burnt organic material. On top of this there was an oval stone structure with several sherds lying on it.

At the moment, the function of this shaft is still unclear. The analyses of the organic remains will perhaps help in the comprehension.



Fig. 3. 22 The shaft within Space 5.6. (Ph: J. Bretschneider). (Bretschneider *et al.* 2017).



Fig. 3. 23 Oval recipient filled with burnt organic (Ph: J. Bretschneider). (Bretschneider *et al.* 2017).

Space 5.8 was interpreted as an internal courtyard thanks to the presence of a small channel within the door opening that leads to Space 5.7. The excavators suggest the possibility that the channel was used to transport rainwater collected in Space 5.8 to Space 5.7 where it was actually used. Space 5.7 is a rather smaller space (2.75 m north-south by 1.80 m east-west)

with a plastered floor (thick up 1 cm) running up to the walls. The Space 5.7 is interpreted as a basin.

Inside space 5.8 a great amount of material was found: at the centre of its southern half there was a circular, flat stone with a smooth upper side interpreted as a possible pot stand. Among the materials noteworthy is the presence a nearly complete two handled stone jar and the Krater in Pictorial Style with birds (inv. no. PK15 422, Caloi 2017)

Spaces 5.9 and 5.10 are the easternmost part of Sector 5 excavated until the 2016. The two spaces are divided just by a short wall (interpreted also as possible work platform) (Jans *et al.* 2017).

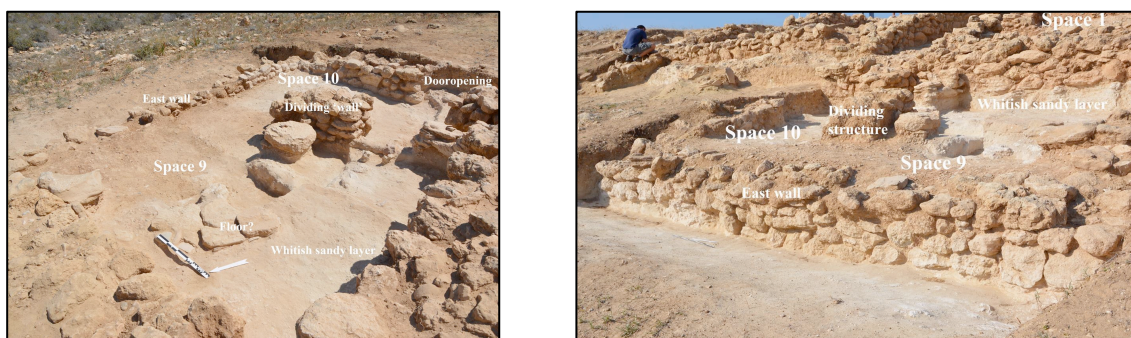


Fig. 3. 24 Sector 5: Spaces 5.9 and 5.10. (Ph: J. Bretschneider). (Bretschneider *et al.* 2017).

Space 5.11 is deeply disturbed by the modern cable trench. However, it was possible to recognize two different floor levels. In the eastern part the floor is 70 cm deeper than in the rest of space.

Moreover, the space is provided with a rock-cut pit where a complete pithos was found (P 1848).

Other vessels were retrieved in the western part of the room, including Canaanite-type jar, four lithic tools, probably pestles and a bronze pin (Jans *et al.* 2017).

Space 5.12 is west of Space 5.11. Its north wall is the prolongation of the dividing wall between Space 5.7 and 5.11 while on its western wall there was a door opening through Space 5.8. In front of the entrance a shallow oval depression was identified, which function is still unclear, probably directly cut out of the bedrock.

Sherds belonging to one pithos were found lying on the floor of the space (P 1850). The most interesting vase from this space is a painted Minoan amphoroid krater mended in antiquity using six lead straps.

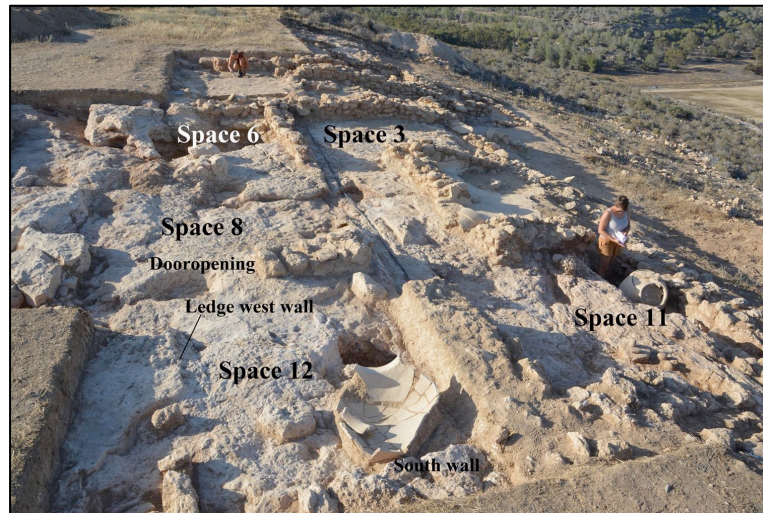


Fig. 3. 25 Space 5.12 and 5.11, view to the north-east. (Ph: J. Bretschneider). (Bretschneider et al. 2017).

3.2.2.4. Some open questions

Some problems remain still unsolved despite the long history of excavation at Pyla. In particular, the most problematic topic concerns the chronological aspects. The foundation of the site is dated between the end of the 13th century BC and the beginning of the 12th century BC, that in the Cypriot chronology this corresponds at the transition between LC IIC and LC IIIA¹⁷.

Together with the site of *Maa-Palaeokastro*, located in the western part of the island, *Pyla-Kokkinokremos* was founded in a period of turbulence, the so-called ‘crisis years’ that upset the whole Eastern Mediterranean¹⁸. In this period, we witness the breakdown and the collapse of the great powers and state cities that prospered throughout the LBA in the whole eastern Mediterranean.

Despite this general scenario the crisis in Cyprus was less dramatic than in the other Mediterranean regions. However, signs of a political and territorial restructuring are certainly evident on the entire island (§1.4).

¹⁷After his short excavation, in 1952, Dikaouis proposed a chronological parallel between Pyla and level IIIA at Enkomi. However, in the eighties, Karageorghis questioned this equation, underlying the total absence in Pyla of Mycenaean pottery LHIIIC1b, which is very common in Enkomi. He, therefore, dated the site at the end of the previous period the LC IIC, comparable with the Period I at Maa (Floor II). For the same reason Karageorghis dated the abandonment of Pyla prior the appearance of LHIIIC1b pottery (before the Level IIIA at Enkomi) (Karageorghis and Demas 1984, pp. 67-68).

¹⁸In the same period the site of *Idalion-Ambeleroi* was occupied. It was a fortified settlement but unlike Pyla and Maa after the LC IIIA *Ambeleroi* remained in use and became the administrative centre of the Iron Age kingdom of Idalion.

The centres that seem to get more advantage during this phase of contraction and territorial restructuring are certainly Kition and Palaepaphos whose history is closely linked to that of Pyla and Maa.

Pyla and Maa have always been associated and compared, because of their almost simultaneous foundation¹⁹ and their short life-span. Both sites were indeed inhabited for a short period, and they were abandoned few generations after their foundation, roughly in the initial phase of the 12th century.

As pointed out before, the dates of foundation and abandonment of Pyla remain open questions to which the new excavations attempt to give clarity. Chronological elements useful in the identification of its period of life and abandonment are obviously the numerous imported ceramics, and in particular the painted wares coming from mainland Greece and from Crete. During the 2016 excavation campaign, in Sector 4.2, located in the southwestern edge of the plateau, inside Room 6 a deep bowl was retrieved that can help us in fixing the abandonment date during the early stage of LH IIIC.

Despite the interest of many scholars some aspects still need to be clarified, in particular regarding the function of the site and as well as its "ethnic component".

The presence at Pyla of ceramics and valuables from different regions of the Mediterranean (i.e. Egypt, Levante, Anatolia, Crete, Mainland and Sardinia) attracted the attention of many archaeologists since the beginning. The multi-ethnic nature of the site and the presence of a fortification system have often been called into question in the interpretation of the nature of the site as well as of the reasons for its foundation and then its sudden abandonment.

Dikaios suggested that the construction of Pyla and Maa was made by "settlers who used Myc. IIIC1b pottery, the origin of which was the Argolid" (Dikaios 1971, p. 911). In his opinion, they were Achaeans and Anatolians in contraposition to those who destroyed the fortification of Enkomi (Level IIB) composed mainly by Myceneans who fled from the destruction of their homeland.

Karageorghis and Demas (1984, p. 69-75), after their excavation at the sites in the eighties, considered Pyla and Maa as the earliest establishments of Aegean people who had escaped from their homeland. They suggested that the "builder" of the fortifications at Maa, Enkomi and Pyla were Aegeans and Anatolians, who settled in Cyprus during the LC IIC period, while those who destroyed the fortifications were Achaeans "who brought with them the Myc. IIIC1b pottery" (Karageorghis and Demas 1984, p. 69).

¹⁹It seems that Maa was founded slightly earlier than Pyla.

However, an increasing number of scholars (Knapp 2008, p. 142; Knapp 2016; Keswani 1996, p. 234, Georgiou 2011, 2012) proposes a different lecture of both sites, considering the strong Cypriot nature of their material culture. The sites are considered at the dependency or as an outpost of other centres: Kition in the case of Pyla and Palaepaphos for Maa (Caraher *et al.* 2005; Sherratt 1998; Steel 2004;). They are therefore interpreted as local strongholds: Pyla served as support settlement for a port near Dhekelia, established in order to protect and ensure the movements of traded goods from the coast to the inner settlements. Pyla, indeed, lies in a crossroads linking the Mesaoria plain to the coast and not so far from the Trouli copper-mines (less than 10 km south-east).

Maria Iacovou (2007) put forward this idea and interpreted Pyla as a Kition supporting settlement during the political confrontation between Kition itself and Enkomi in LCIIIC and LCIIIA. Moreover, Iacovou (2012) suggests that both Kition and Palaepaphos were engaged in the expansions and consolidation of their political territories, after the collapse of other centres like Kalavassos and Maroni, and that the new founded sites were used as a land control of those territories.

Artemis Georgiou more recently (2011 and 2012) evaluated in detail similarities and differences between Pyla and Maa. She considered many aspects, such as the chronology and life-span of the sites, their position as well as the general buildings layout and some aspects of the material culture (pottery and metal). She concluded that the newly established settlements of Pyla and Maa served “as special-function satellite sites attached to urban centres, possibly those of Kition and Palaepaphos, which aimed to ensure their safeguarded trading operations, while expanding, consolidating and protecting their domains” (Georgiou 2012a, p. 125).

Karageorghis questioned all these interpretations in his publication of *Pyla-Kokkinokremos* 2010-2011 excavation seasons, despite a partial review of his previous hypothesis (Karageorghis 2014, pp. 155-162). He disputes, in particular, the association between Pyla and the port located in the Dhekelia area. Moreover, he wonders why Kition, the dominant centre in the area, needed a second port in the Dhekelia area. The city of Kition was indeed provided with a major harbor and it seems unreasonable to admit the necessity of a second easternmost port.

After his more recent excavation, Karageorghis reconsidered in particular the length of the settlement's life. While he previously considered the length to span from 25–30 years from the 1230–1200 BC (Karageorghis and Demas 1984, p. 74), he now considers it to be "about 50 years or less", between the end of the 13th and the beginning of the 12th century BC (Karageorghis 2014, p. 162).

Karageorghis now interprets Pyla as a defensive settlement built in emergency time: the site was founded to accommodate large population from the neighboring settlements (i.e. Pyla-Verghi or Pyla-Steno) with a sizable portion of foreigners (from Aegean and especially from Crete) who brought with them their belongings. The site is no more interpreted as a purely Aegean foundation (enclave or colony)²⁰, even if Karageorghis still considers the presence of allochthonous goods not necessarily connected to overseas trade (Karageorghis 2014, p. 158, point 2). He indeed places much emphasis upon the presence of Aegean immigrants despite some other scholars (Sherratt 1992) sustain the archeological invisibility of these migrants and they take into account a more marked economic-base explanation for the socio and cultural changes registered during this period.

Another issue concerns the presence of some kind of authority behind the foundation and the construction of both sites. We have already mentioned the idea that Pyla and Maa could be considered sites at the dependency of other major centres.

Both sites seem indeed to betray the presence of a general planning in the construction of the settlement that does not grow on itself in a chaotic manner and that implies a sponsorship and investments in time and wealth that only other rich and prosperous centres could have supported (Georgiou 2011 and 2012). The construction of the Cyclopean walls at Maa or the casemate wall system at Pyla is particularly relevant for this interpretation.

Karageorghis recognized that the building operation was well-organized at Pyla, but it had all the characteristics of a refugee camp with modest houses and no public buildings” (Karageorghis 2014, p. 159).

The presence of some kind of central authority, whose nature is still elusive, responsible for the functional organisation of the settlement and maybe also connected with metal production and domestic industries is corroborated also by the current excavations (Bretschneider *et al.* 2017).

Regarding the origin of the people who lived in Pyla, in their last publication (Bretschneider *et al.*) the excavators wonder whether the people of Pyla were or not part of the Sea People and if “the site was some kind of multi-ethnic pirate-like establishment of a newly formed group of which the various members originated in different parts of the Aegean or the Central and Eastern Mediterranean, including Cyprus”. And again “should we see the valuable objects either as loot obtained from nearby settlements (Enkomi) or regions (Egypt, Ugarit) and/or as

²⁰In his first interpretation Karageorghis suggested that “we had to assume some degree of cooperation between Myceneans and Cypriots in the establishment of both Maa and Pyla-Kokkinokremos because “Myceneans were not present in any great numbers” (Karageorghis and Demas 1988, p. 266).

heirlooms that were repaired if necessary because they retained memories of past times and places?” (Bretschneider *et al.* 2017).

Regarding the last stages of Pyla, the new campaigns continue to stress that the site was suddenly abandoned. In all the sectors under excavation it is possible to find rich floor deposits (Bretschneider *et al.* 2015). The finding of several hoards of valuables should be mentioned in this respect. Four different hoards were uncovered until now: the “Founder’s Hoard” and the “Goldsmith’s Hoard” (Karageorghis and Demas 1984: 60-65), the hoard from Space 5.2 in Sector 5 (Bretschneider *et al.* 2015, pp. 26-27) and finally the Egyptian alabaster vase full of metal objects and semi-precious stone beads (Jusseret 2017). The excavators interpret the presence of this great quantity of valuables as a clear intention of the inhabitants to come back at the end of the troubles.

Weapons, however, are generally scanty apart from some arrowheads, armour fragments, spear points and many bronze and lead sling-shot bullets.

3.2.3. Kommos: an introduction

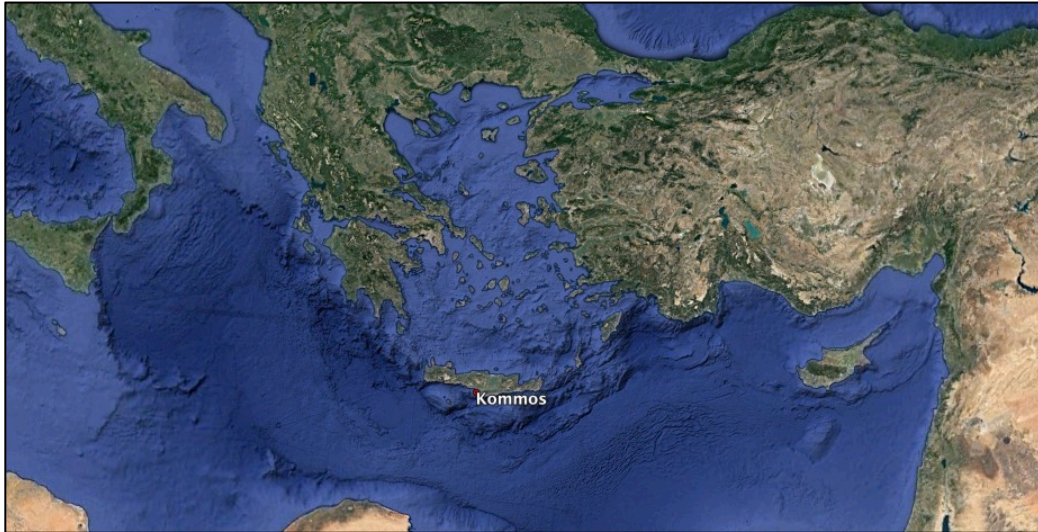


Fig. 3. 26 Crete and Kommos.

Kommos is located along the south coast of Crete, facing the Libyan Sea at the edge of the great Mesara plain²¹. It is located not far from the modern city of Pitsidia and a few km norths of Matala, the Roman port of *Metallon*. In front of the site there are two uninhabited islands called “*Paximadhia*” because of their similarity to the typical dried bread.

Kommos was a large Middle-Late Minoan site; however, the real extension of the site is unknown because its eastern and northern limits are still covered by sands (Shaw 1996, p. 1-14). It was one of the main ports of the Late Bronze Age Mediterranean and probably the most important of Crete, at least in the final stages of the LBA. The extraordinary repertoire of imported ceramics found in the LBA levels testifies that Kommos was fully involved in the trade network that linked the Mediterranean basin. Especially in LM contexts archaeologists found vases produced in Egypt, Palestine, Syria, Anatolia, Cyprus, Greece Mainland and Sardinia. The first occupation of the area dates back to the Late Neolithic-Early Minoan period on the slopes of the southernmost hill called *Tou Spanou ta Kephalia* (“glabrous heads” referring to the absence of vegetation on the entire hilly in modern times) (Shaw and Shaw 2010, p. 543).

²¹The Mesara Plain is a large alluvial plain that stretches for about 50 Km in width. It is surrounded by the White Mountains (*Lefka Ocri*), the Asteroussia Mountains and Mount Ida on its NW side and by the Libyan Sea on the W side. The plain was densely populated since the Neolithic, while during the LBA other important Minoan centres flourished, among which the main ones are Phaistos and Haghia Triada from which Kommos seems to depend politically (up to the LMI) from Phaistos while in the final stages of the Late Bronze from the second).

However, the occupation during the Neolithic period is attested only by few sherds while that of the Early Minoan period is more remarkable, with a wider distribution and a larger quantity of pottery than in the previous phase.

Kommos was founded at the beginning of the MMI as many other sites in the Mesara Plain in coincidence with Phaistos, the main site of all MM in the area.

The structures occupied the whole area of the hill, the Hilltop, the Central Hillside and the Southern Area (see *infra*).

Kommos, as well as Phaistos, was partially destroyed at the end of MMIII (First Palatial Period) and rebuilt later. During the Second Palatial Period many new buildings and roads were constructed (Shaw J.W. 1995, pp. 128).

Since this period Kommos become probably a seaport both for Phaistos and other inland sites in the Plain and starts to be interested by the presence of exotic pottery.

As recently pointed out by Rutter (Rutter 2017), during the LMIIIB, Kommos was subject to a gradual dismiss of spaces and to a retrenchment. It seems, indeed, that Building N (see *infra*) went out of use before the final floor of Building P.

The rate of this contraction is still to be estimated.

After the general abandonment of the site at the end of LMIIIB, some evidence points to a certain presence during the LM/IIIIC. In Room 7 of Building N a LIIIIC early import from Mainland was retrieved. This vase marks the construction of a zig-zag wall inside the Room after its abandonment.

Like the other sites located in the Mesara Plain, Kommos had an agricultural character, given the great fertility of the plain, but is also deeply linked to the sea thanks to its position (Shaw and Shaw 2010, p.545).

The Mesara Plain during the MM and the LM, was indeed rich in fields and orchards. Part of the agricultural economy was represented by the cultivation of the olive tree: from the archaeological perspective, the exploitation of olives is testified by the discovery of olive pits (present both in MM and LM contexts) often in connection with stone structures linked to the production of oil. For example, the stone presses with spouts and central depression, found in the *House of the Press* on the Hilltop and in Room 21 of the Central Hillside, are particularly interesting for the LM phases (Shaw J. W 1996, pp. 380-383).

In addition to olive groves there were also vineyards for the production of wine. Wine and oil were probably the two most cultivated products and then exported from the Mesara in the eastern Mediterranean, according to the reconstruction Joseph Shaw (Shaw J. W. 1996, p.381) proposed on the basis of archaeobotanical analyses (Shay-Shay 1995).

Remains of acorns, almonds, carobs, figs, legumes (beans) and cereals (*Triticum/Hordeum*) were also found (Shaw J.W. 1996, pp. 380).

Activities of food-processing are testified by the findings of implements like querns, mortar and basin produced with local sandy or fossiliferous limestone and conglomerate in some houses (Blitzer 1995).

Regarding the consumption of meat, the most common mammal bones retrieved belong to sheep and goats. They were found in about 90% of contexts of the site corresponding to a minimum number of more than 185 individuals²². In addition to meat, they certainly provided milk as well as leather and wool for fabrics.

Pigs were also very common; their presence is estimated in around 45% of the contexts corresponding to a minimum number of 108 individuals. Beef consumption seems to grow progressively over time²³, reaching higher levels in the late LM phases. Cattle are identified in 18% of the Deposits for a total of some 55 individuals. There are no contexts with cattle bones that may be connected with ritual functions. Other mammals attested are wild deer and hares, one dog and one equid.

However, structures clearly in charge of hosting animals within the settlement were not found. They were probably located in the surrounding hills.

Also fishing tools (Blitzer 1995) and the remains of meals based on fish and molluscs were retrieved in the site. These point to the exploitation of the sea also for the consumption of fish products.

According to the study conducted by Shaw, in the Minoan period the installation of port sites occurred in peninsulas with open port on all sides to ensure different points of docking the boats²⁴. This type of ports differs from the ones built in the classical Greek period, where "closed" ports were favoured (i.e. built on protruding promontories) to allow ships protection from the action of the waves. A second type of Minoan port was built on open shoreline stretches, sometimes partially protected by the presence of an islet in proximity to the coast. Kommos belongs to this second type, as well as Amnisos, given the presence of the prospect island of *Papadoplaka* at a few hundred meters (Shaw M.C and Shaw J.W 2010, p. 549. Shaw J.W, 1990).

According to what has emerged in recent studies it seems that during the Bronze Age the sea level was considerably lower, about 4 m lower than the current one (Amato 2011).

²²52%EMII-MMII; 49 MMIII-LMI, 56% LMI-II, 53% LMIII (Shaw J. W 1996, p. 381).

²³3% MM, 8% MMIII-LMI, 16% LMI-II, 64% LMIII (Shaw J. W 1996, p. 381).

²⁴The site Haghia Irene on Kea and Knidos and probably Akrotiri on Santorini belong to the first type (Shaw and Luton 2000; Shaw and Shaw 2010, p. 549).

For a complete description of the structures (Buildings T and P) used to store the ships see *infra*.

3.2.3.1. The Early Excavation at Kommos

Antonio Taramelli first drew attention to the site was at the end XIX century B.C., trying to investigate the human presence in prehistory in the area southwest of the Geropotamos river. His connection between the Northern cliffs of Cape Nisos (S and W of Kommos) with the site of the shipwreck where part of the Menelaos's contingent befallen (Odyssey III.293-99) is particularly interesting.

However, Kommos was first identified as an important Minoan site by Arthur Evans in 1924 while investigating the shore zone south of the Asterousia Mountains and the Matala area (Shaw J.W. 1996, pp. 8–9).

3.2.3.2. The University of Toronto Excavation

Some decades later the Minoan site was excavated for fifteen seasons, from 1976 to 1985 and again from 1991 to 1995, by the University of Toronto, under the guidance of Joseph W. Shaw and Marie C. Shaw²⁵.

Kommos has not received great attention by scholars and archaeologists between the discovery of the site by Evans and the beginning of the excavation by the University of Toronto, both before and after the Second War World. This lack of interest was related both to technical reasons, such as the difficulty to excavate a partially inaccessible site, and to the presence of a minefield after the War (Shaw J.W. 1996, pp. 10).

The results of the Canadian excavation campaigns are fully published both in preliminary excavation reports in *Hesperia* – the Journal of the American School of Classical Studies at Athens – as well as in more comprehensive monographies fully dedicated to the analysis of both its structures and artefacts.

The excavation of the site interested three main sectors distinguished from N to S: the top of the hill (Hilltop), the central slope (Central Hillside) and the southern area (Southern Area), where a Greek sanctuary was built in historical times.

Before analysing in details the structures found in all the sectors of the site, it is necessary to specify the terms used by the authors for the description of Minoan housing complexes. In the

²⁵I would like to express my thanks to Maria and Joseph Shaw and Jeremy Rutter which did gave me the opportunity to study the pithoi from Kommos and work with them at Pitsidia Apotheke in July 2017-1018.

characterization of architectural elements, the excavators define *Space* and *Rooms* as the minimum construction units. Rooms and Spaces can then join together in various ways to compose more complex agglomerations called *Houses*, within which there is usually at least one large outdoor multi-purpose area, the *Court*. Each room can also be characterized by additional structures, such as fireplaces, stone presses, objects related to metallurgical production or ritual elements that determine their specific function. Other distinguishable spaces inside the Minoan Houses are *Staircase* and connecting *Corridors*.

Some of the private houses found at Kommos belong to the Minoan Type 3 House proposed by McEnroe (1982)²⁶, in particular the North House and the House of the Snake Tube, while the House X belongs to Type 2, which grouped houses formed by many rooms with different dimensions and a pillar portico.

During the excavation *Roads* and public spaces were also identified. One of the main roads of the settlements, called *Rampa del Mare*, runs north-south. It finishes, on the south, at the entrance of Building T. Another north-south road runs on the east side of House X and finishes at the T's north-east corner. Road 017 runs east-west and separates the residential sector of the settlement (on the north side) from the Civic Centre in the Southern area.

In the description of areas and structures more attention will be devoted to the LMIII levels, which represent the main focus of this research. According to the chronological division used by Rutter (2006; 2011 and 2017) the period under analysis in this research belongs to the Monopalatial (LMII-LMIIA2 Early) and the Postpalatial Era (LMIIIA2-LMIIIB).

In the first two areas the remains can only be dated to the pre- and protohistoric periods, between the Late Neolithic and the Bronze Age, approximately 3500-1200 BC. In the Southern Area, instead, the prehistoric remains have been covered, after a hiatus of more than a century, from the construction of an extra-urban sanctuary around 1000 BC, the so-called Temple A, and of an important Greek sanctuary later on, Temple B of the Archaic period²⁷.

During the Late Neolithic/Early Minoan period the town appears to be concentrated in the Central Hillside area, as in part of the MMIA period.

During the MMIB the settlement expanded to the north and to the south. It should be noted, however, that in the Southern Area the evidence of the MM occupation is scanty, due to the large levelling of the LMI, necessary for the construction of the monumental buildings of the

²⁶Type 3 gathers house of small dimension provided with spaces such closet, vestibule, stairway and doorless spaces as in Type 2 Houses, but they are, in general the smallest and simply type of Minoan houses (McEnroe 1982, p 10).

²⁷For a more precise description of the Greek temple complex, refer to Kommos IV (Rutter 2006).

so-called Civic Centre. The new LMIII buildings obliterated almost entirely the previous phases (Shaw J.W. 1996, p.2).

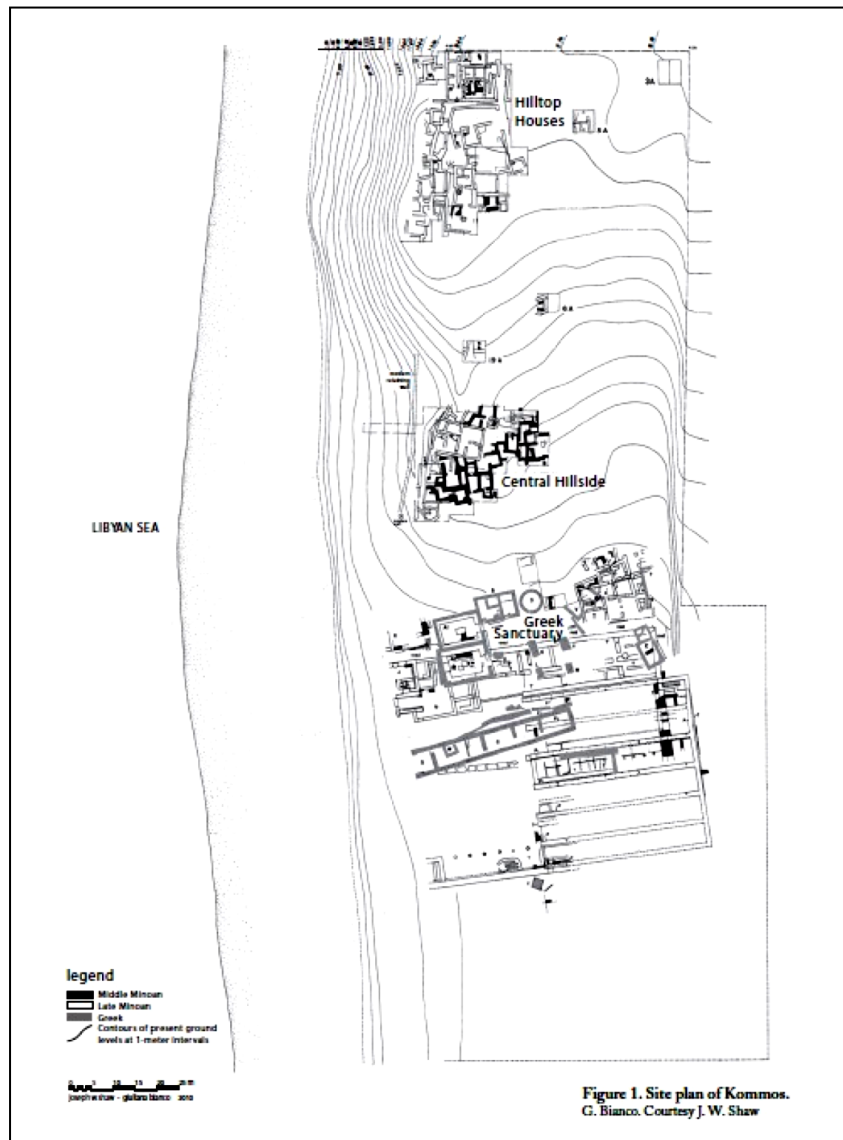


Fig. 3. 27 Kommos General Plan. (Watrous 1992).

The settlement expanded during the MM, reaching the size of 1.5 ha. After the first destruction caused by earthquakes in the MMIII/LMI, it was rebuilt and enlarged reaching the dimension of 3.5 ha. The prosperity of the site continued even in the later phases of the LM, until the end of the LMIIIB, when the site was abandoned. LMIIIC/LHIIIC evidence are scattered, and the first substantial post Minoan occupation dates roughly at the end of the 11 century BC. when a small sanctuary (Temple A) is built on the Minoan ruins.

The MMIII/early LMI period marks one phase of major structural changes, in which the dwellings of the previous phases are abandoned, and new ones are built, often using pre-

existing walls as a foundation. This happens for example in the *House of the Press* or in the *North House* in the Hilltop sector.

In Central Hillside MM houses were abandoned, and new completely independent structures are built at a higher level than the previous ones, after the levelling of the collapsed structures.

It should be noted that the westernmost portion of Kommos has been eroded by the combined action of waves and winds, causing the loss of all structures in that area of the slope.

Within the long site lifespan, LM is the most represented moment, also for the reasons previously reported, with a series of residential buildings both on the top (Hilltop) and on the central flank of the hill (Central Hillside). In the Southern area there are monumental structures, all datable within the LM, such as Building T and the subsequent N and P, which are located south of the main E-W street of the site that leads from the interior of the site to the sea. On its north side there is a well finished house called House X.

The main episode of construction activity was during early stages of the LMIIIA2 when in the Southern Area at the Civic Centre the construction of two monumental buildings starts. The buildings named N and P are related to the commercial activities of the port.

This is a very important period, beyond Kommos: Knossos was destroyed, and after its collapse there was the development of more autonomous power centres in different regions of Crete (for example, in Chania in the west of the island, to Haghia Triada in the western part of the Mesara, and perhaps to Týlissos in the north central Crete).

The end of a central hegemonic power, together with the manifestation of decentralized autonomous thrusts, will lead to an overall reorganization of the island and the formation of regionalisms, the echo of which also arrives to the ceramic production (D'Agata 2005).

Following Maria Shaw (Shaw M.C 1996, pp. 371-373), it is necessary to point out that all known constructional episodes of the LMIIIA in the Mesara Plain are not related to residential or housing constructions. In Kommos, such as in Haghia Triada²⁸, large monumental buildings are built in this phase, while no residential structures are installed *ex novo* either on the Hilltop or on the Hillside. There, existing houses are continuously modified with the displacements of hearths, the construction of new walls and the abandonment of entire spaces through the walls of the entrances.

²⁸The reconstruction of the LMIIIA2 to Haghia Triada involves the sector traditionally linked to the exercise of power. The *Megaron* ABCD and the FG *Stoà* in the *Villa Minoica* were built. In both sites the new buildings have a monumental aspect, characterizing themselves as totally innovative structures in the architectural panorama of the Mesara, so much that some scholars define them as a hybrid between the Minoan tradition and the Mycenaean continental. (D'Agata 2005, p. 111; Privitera 2014).

Hilltop

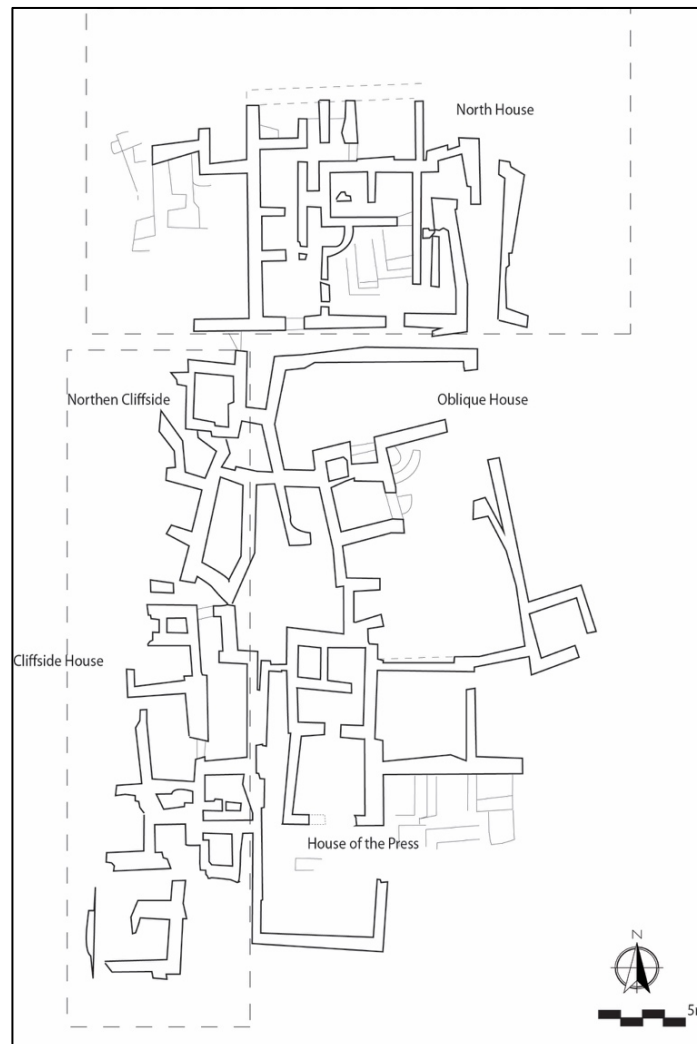


Fig. 3.28 Hilltop Houses (Author elaboration after Watrous 1992)

The Hilltop area corresponds to the top of the hill. The excavated area is about 840 m sq., and many houses were identified there. The units are not always easily distinguishable from one another, due both to the propensity to lean one against the other and to the tendency in the last housing phases of the LM to concentrate the settlements in the western portion of the site, facing the sea. New spaces were built outside the houses, such as for example 04, 06, 09 012 and existing spaces were divided, building courtyards and streets through walls (Space O19) (Shaw M. C 1996, p. 16). The high density of structures did not allow easy access to the most ancient levels, making very scanty the knowledge of the MM period in this area.

Proceeding from N to S the following structures are encountered:

North House:

It is one of the largest (218 m sq.) and better constructed houses of all Kommos. It was a two-storey house, given the discovery of staircases and collapsed materials pertaining to the second floor. Like the other Houses, it has been subject to internal remodelling and, in the very last phase of life, to a division that leads to the creation of three distinct and independent units. The most interesting evidence are the traces of metallurgical activity dating to LMIIIB.

The North House is separated from the remaining Hilltop Houses by a paved W-E road, the O2 Road.

Oblique House:

As easily understood, this building owes its name to its orientation, which runs from NW to SE. It is slightly smaller than the North House (111 m sq.), with a large courtyard located at the N and bounded by a wall overlooking the O2 Road, which develops in the W-E direction and separates it from the North House. It is ascertained that much of the House was built in the LMI. From LMIIIA1 onwards, as in the previous case, this House was divided into smaller independent units. Subsequently, and in particular during the LMIIIA2, some additional modifications were made, prior to the complete abandonment.

The east side of the house is flanked by a road, the Road O18, which unfolds in the N-S direction, and which ends in the south with Room O19, obtained at the expense of the road, by raising a wall in the last stages of life of the site.

Cliffside

Northern Cliffside: northernmost part. In the area some non-interconnected rooms were identified, whose life phase pertains entirely to the LMIII (the spaces considered are O1 and O3-O9). Much of this area has been removed from erosion and until now no previous walls have been found below those of these rooms.

Cliffside House: it is a complex of seven rooms (45 m sq.), which materials confirm the purely domestic character. Built in the LMIIIA1/2, it incorporates part of the structures of the LMI and at least one wall of the MM. Its abandonment in the LMIIIB is consistent with the rest of the site. Area East of Cliffside House: the area O11 / 21 and the lane 7/4 are oriented N-S, starting substantially from the Road O2 and ending at the entrance of Space 2 of the House of the Press. The area under examination begins with the O4 and O6 spaces of the Northern Cliffside:

O4 remains in use until the beginning of LMIIIB while O6 is abandoned during the LMIIIB at the same time as the rest of the site. The pottery found in the area consists mainly of debris from the road, even if some complete vases are present. The best represented period is the LMIIIA2-B, but there are also fragments of previous periods, dating back to the early stages of the LM. The material, certainly in secondary deposition, probably comes mainly from the House of the Press (see *infra*) and/or from Oblique House. Probably, the 7/4 road was abandoned relatively early in the LMIIIB, but while in use it allowed access to many structures on the western side of the Hilltop.

House of the Press:

It occupies the central part of the Hilltop and owes its name to the presence of a stone press with spout used for the production of oil and / or wine inside Room 5. Its dimensions are approximately 91 m sq., making it comparable to another important house in Kommos, the Central Hillside House of the Snake Tube.

It was built in the LMI and remained in use up to the LMIIIB; one of the main changes seems to have affected Space 2, which was first a space inside the house, then reconverted to an external courtyard, perhaps partially covered.

Central Hillside

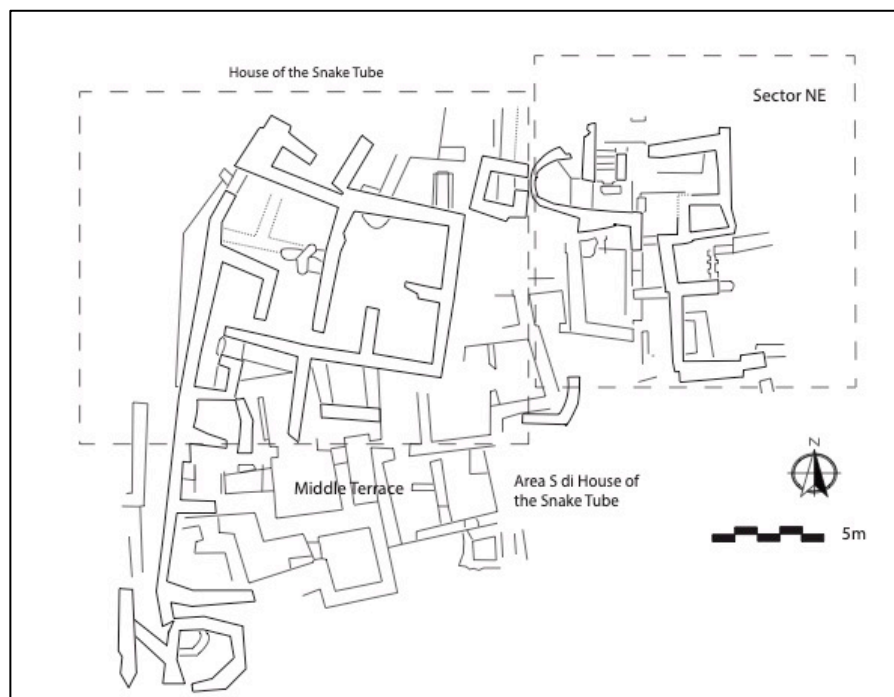


Fig. 3.29 Central Hillside (Author elaboration after Watrous 1992)

The central part of the hill (611 m sq.), unlike the Hilltop area, does not have a high number of Late Bronze structures leaning against each other (Shaw M.C 1996, p. 139). Only a few residential areas are recognizable, the most important is the so-called House of the Snake Tube. This situation allowed to study the structures dating back to the MM, differently than in other sectors. It was therefore possible to separate two housing phases quite clearly: one phase dated to MM and the second one to LM. This second phase begins with the construction of new buildings over the older ones, also making a series of changes to the surrounding environment. This situation remains unchanged until the LMIIIB, moment of site abandonment.

House of the Snake Tube

It is a rather small house (91 m sq.), if compared for example with the North House in Hilltop. The house owes its name to the presence inside it, more precisely in Room 4, of a Snake Tube²⁹ associated with the shrine belonging to the phase of the LMIII. The House has been interpreted as a publicly accessible shrine for the entire Kommian community, and therefore somehow different from the pure domestic houses of the site.

The walls of the house cover those of the MMIII, but the complex is marked by a strong continuity of use starting from the LMI-II up to the LMIIIB.

The pottery and tools³⁰ found there are related to food preparation and consumption. Over the life course of the house, some rooms are added to the initial building. As in all the other structures examined in Kommos, the phase of LMIIIA2-B involves numerous structural changes.

Watrous (1992), in his study of the ceramics of the LM phases, identifies some ceramic deposits coming from an area outside the House of the Snake Tube, towards the NE limit of the sector, in rooms 30, 32 and 33, in which the presence of remains of crucibles and lumps of bronze testifies metallurgical activities.

The entire S-shaped area of the structure up to the terracing wall of Room 53 (outside the House) is a single slope that seems to have been exposed for centuries, given the presence of Minoan, historical and modern mixed materials. Only at the SW end it has been possible to

²⁹The definition of Snake Tube indicates sacred objects typical of the Minoan period, about half a meter high and that present at the sides of the decorations plastic waves that recall the shape of a snake. The upper end is open and able to support a *skouteli* in which the actual votive offer was deposited. Snake Tubes can be more or less elaborated and variously painted.

³⁰The stone mortar was found in Room 3a, while in 3b there was a deposit of organic remains, additional confirmation of the preparation / consumption of food inside the rooms. Room 6 is also interesting, with a pithos belonging to the initial phases of the LM that in the final moments of life of the House was used to contain kitchen ceramics (Watrous 1992, p.30).

find uncontaminated LMIIIB levels, including Room 53. Among the various materials found there, we mention many melting pots and moulds that also indicate the development of metallurgical activity in this area.

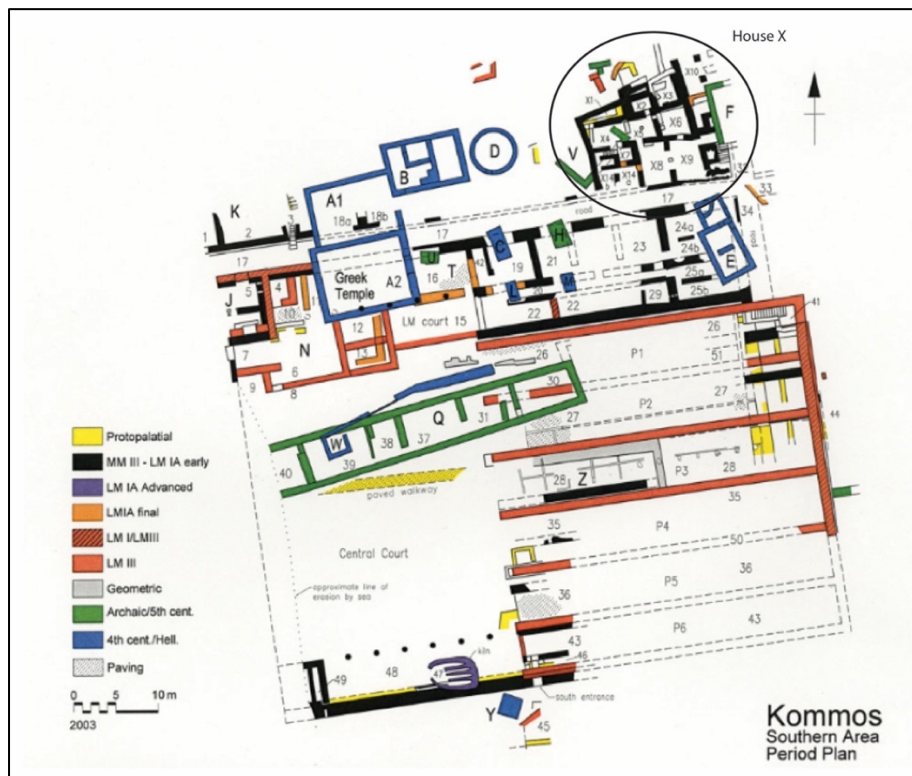


Fig. 3. 30 General Plan of the Southern Area (Rutter 2006).

House X

House X is a private residential structure (205 m sq. m). It is the largest and best appointed of all the Minoan Houses in the site (Shaw M.C. 2012, p. 1). House X is the most well-preserved private house found in the site with walls stand up to 2m high and with a rich prehistoric deposit (Rutter 2017, p. 3). Maria Shaw underlines that, despite the plan of the house is not atypical with respect to many other houses, inside it some no-domestic activities may have taken place (Shaw M.C. 2012, p. 2).

The House is now fully published in two volumes, one devoted to the structures and the stratigraphy (Shaw M. C. 2012) and the other on the pottery (Rutter 2017).

House X was built during the LMI advanced (*Neopalatial Era*) and remains in use until the LMIIIA2 early, with ongoing remodeling as already seen in other areas of the site (the end of *Monopalatial Era*).

The structure can be interpreted as a "Minoan Mansion"(Shaw and Shaw 2012), composed of several rooms on two-story in which there were figurative frescoes³¹ with floral motifs. The decoration differs from the motifs that decorated the walls of most houses, such as, for example, those of the Building T, composed of fantastic representations of stones, typical of Minoan architecture (Shaw M.C. 2009).

The excavation exposed entirely more than 15 rooms with a rich archaeological assemblage, but the E side of the house has been seriously damaged by the construction of the Greek Temple and the leaching materials from the side of the hill.

The internal arrangement of the space was probably divided into three sectors, west central and east. The first was interpreted as the formal or official one. Room 7 of the house was a domestic shrine. The central part of the house had probably utilitarian functions while the east section was devoted to the communication with the outdoor.

House X was built at the crossing point between the two majors slab-paved roads: Road 17 (E-W) and Road 32/34 (N-S). It is separated from Building T by Road 17 but its proximity with the monumental civic building was interpreted as a proof of the elite status of the house and its owners.

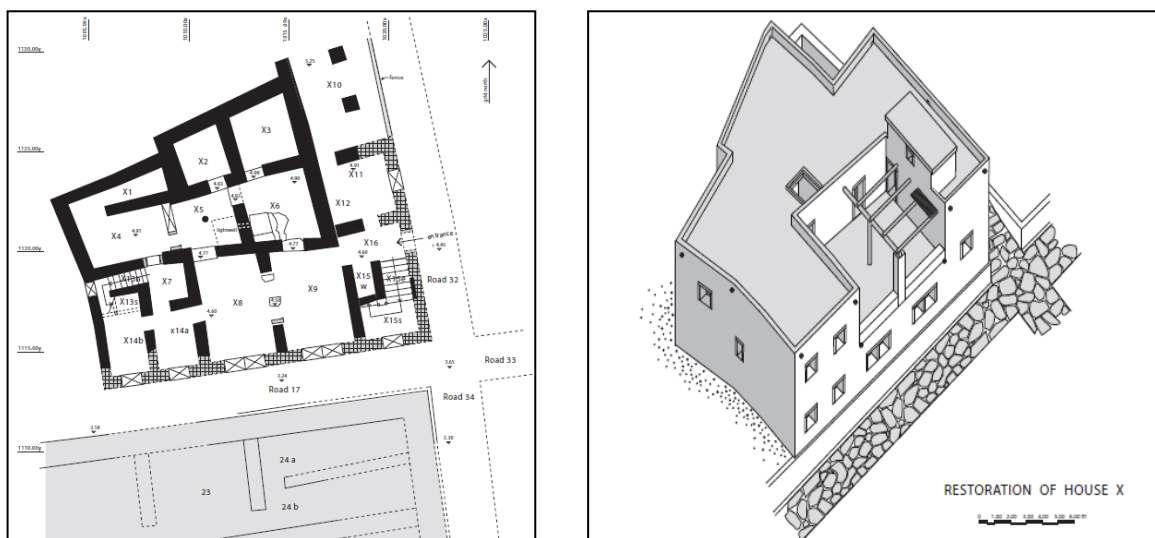


Fig. 3.31 General Plan of House X (on the left). Reconstruction of House X (on the right).

³¹According to the excavators, the presence of frescoes and the position of the house, behind a paved road, near Building T, would be signs of the high status of its inhabitants.

The Civic Centre

The complex of the Civic Centre (Shaw J.W 2006a, pp 1-116) is located in the Southern Area of the site and consists of several buildings mainly related with the trade activities of the port. The buildings lay south of the paved east-west road (Road 17) that separates the Civic Centre from the other two residential areas described above.

The remains of the first construction phase are very scanty (i.e. paved passage) because of the later large constructive operations. The second construction phase, dated to the MMIIB, begins with the excavation for the construction of the E-W road that cuts the side of the hill and extends for about 60 meters. South of this, there is a huge rectangular platform for the construction of the AA Building³², of which during the excavation phases only the walls E and S were recognized, since the W one was knocked down by the sea, while the N one has been obliterated by successive constructions (yellow structures in Fig. 3.28). Not much is known of the characteristics of this structure, but it is assumed the presence of a central courtyard with *stoà* along the southern side and perhaps also along the north one³³ (Shaw M.C, Shaw J.W 2010, pp. 547-548). This feature makes it possible to assume that the building was a palatial-like structure, or, as proposed by the authors, a place with a public function.

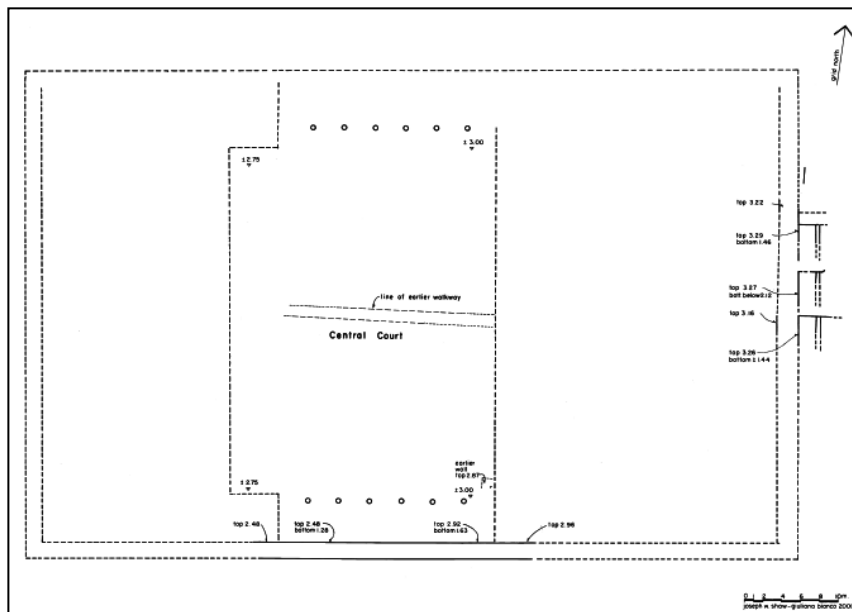


Fig. 3. 32 General Plan Building AA (Shaw 2006).

³²AA Building was only discovered with the 1991-92 excavation campaign, refuting the previous hypothesis that recognized in Building T the oldest building of the Civic Centre. For a complete description of the Protopalatial complex see Shaw 2006.

³³The foundations of some of the columns still in situ have been found, four for the southern *Stoà* and at least two for the northern one (Shaw 2006).

During the MMIII or slightly later in LMI, the AA Building is replaced by a new one, Building T, with ashlar masonry. Like the previous one, this develops around a rectangular central courtyard (26.68 mx 39.10 m) with *stoà* on the N and S sides formed by 6 columns each. The presence of these spaces refers to the palatine architecture, where they are generally used for collective events that involve the community. At the sides of the court, the building consists of two parts, the eastern one formed by long corridors for storage, and the westernmost wing, unfortunately destroyed by the sea, which was originally on two-story and probably linked to administrative functions connected to the port.

The excavator supposed that after the LMI and before the LMIIIA2 the western portion of Building T was destroyed by the sea.

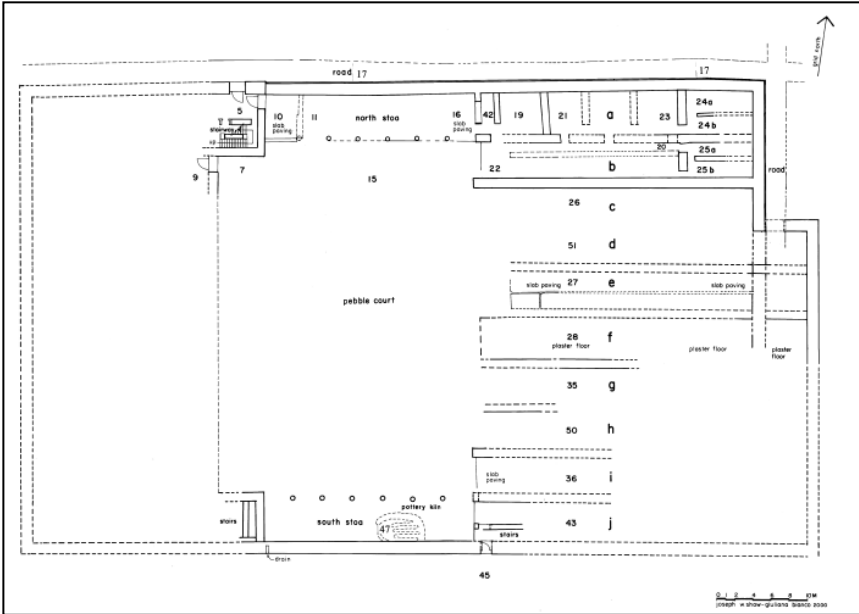


Fig. 3. 33 General Plan of Building T in LMIA (Shaw 2006)

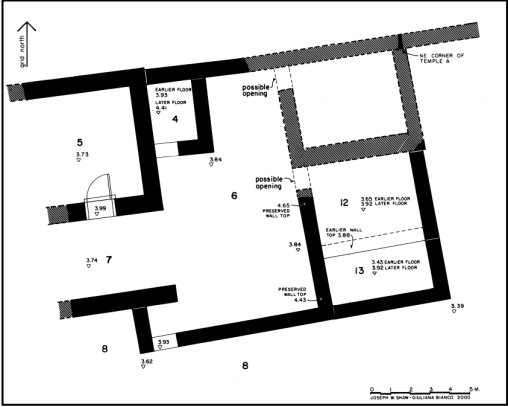


Fig. 3. 28 General Plan of Building N (Shaw 2006).

The life span of this building is very short; during the LMIIIA1 it was completely destroyed and in the subsequent LMIIIA2 it was replaced by two new buildings, the N and P. In the constructions of the new buildings the collapsed materials of the T were used.

Building N was built exploiting the N-W wing of T raising the floor level of 1 m. In Building P, in the area of S-E, which was not exposed to the force of the waves, the earlier floor level is maintained. Building N is smaller than its predecessor (13.78 m N-S and 19.40 m in the E-W). It is provided of a courtyard and some rooms around it. There is no evidence that suggests the presence of a second floor. In the NW corner of its court, a room with a southward opening is currently visible. Court 6 opens to the west in Space 7, probably covered, if not with a real roof, at least with a light structure. On the other side of the Court, there are at least two other rooms, Rooms 12 and 13 and perhaps even a third one not yet excavated. Over the time this wing of the building underwent several changes regarding the division of interior spaces. Building N, though on a small scale, may have retained some of the administrative functions of the previous Building T.

The building was abandoned before the end of LMIIIB and before Building P (Rutter 2017, p. 278).

The most interesting part of the Southern Area is undoubtedly Building P. It consists of six long galleries opening on the west side. The first two Galleries (P1 and P2) were built more or less in the same period of Building N at the beginning of LMIIIA2 while the others (P3-P6) were added during the LMIIIB. All the Galleries are internally indistinct spaces about 38.50 m long, with a width ranging from 4.50 m to 5.80 m (the southern tunnel called P6 is the smallest). The height is estimated to be at least 4 m. Gallery 3 is the only one completely excavated. It was provided with an earthen floor and scattered fragments of cooking pot and short necked amphoras. In its southern corner there was a hearth and, on the southern wall, two clay ovens.

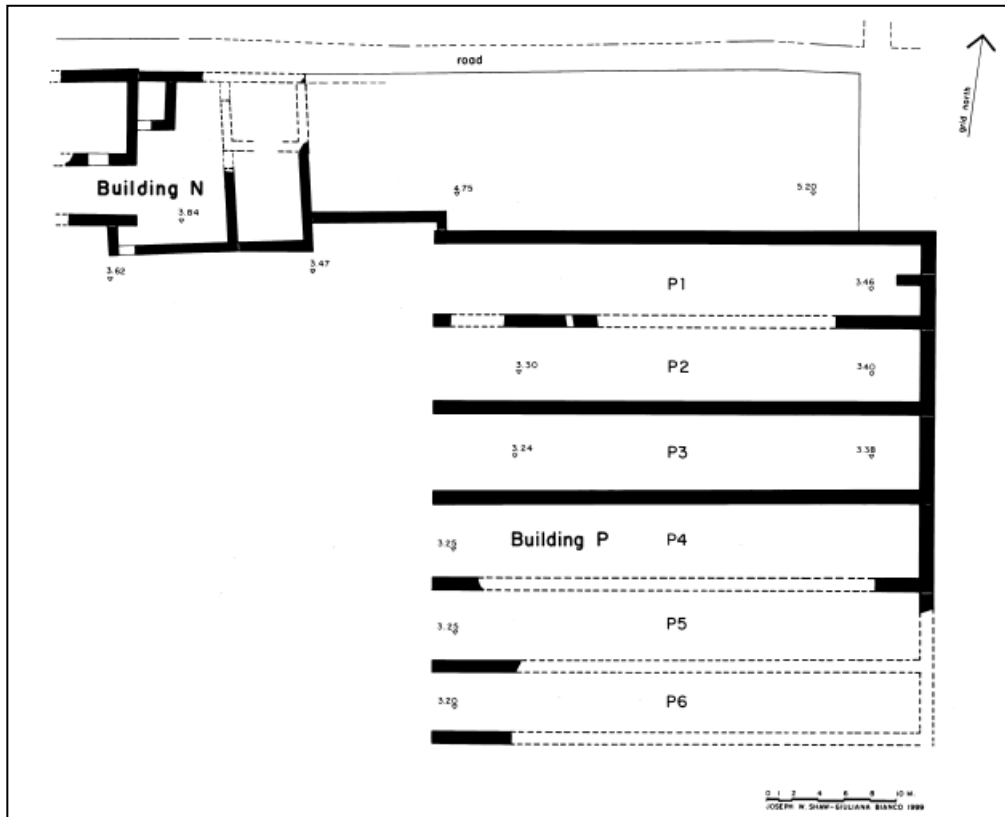


Fig. 3. 35 General Plan: Buildings N and P (Rutter 2006).

According to those who studied them, these large tunnels completely opened towards W, on the side facing the sea, and were used for ships shelter during the no sailing periods.

According to the most recent reconstruction, which sees the lowest sea level at about 4 m, the galleries would then be separated from the sea by a steep gradient.

The most immediate comparison for these galleries comes from the classical Greek world (Blackman 1968, 1982), but Shaw quotes (Shaw M.C, Shaw J.W 2010, p.548) what reported by Whitley (2007). According to Whitley in *Poros Katsamba*, port of Knossos, there was a coeval structure very similar to this, interpreted as well as a housing area for boats. Except for this news reported by Whitley, the Kommos Galleries represent a unique within the Bronze Age panorama.

The evidence in favour of this interpretation is based essentially on the observation that tunnels of such dimensions completely open on the side facing the sea could not simply serve for the storage of foodstuffs, as well as on the presence of recurrent traces of hematite inside Galleries 2 and 3. The hematite, according to the Toronto team, would have served to cover the hulls,

so as to prevent the attack of marine organisms, as was still the case in Roman times (Shaw M.C, Shaw J.W. 2010, pp.548)³⁴.

Some trenches have been excavated outside the excavation areas previously described. Two of these, called 3A and 5A, are located at E of the Hilltop. The 6A trench is located much more to E than the other two, half way between the sectors of Hilltop and Hillside, along the hill.

Except in 3A, wall structures have been found everywhere. Trenches 3A and 6A allowed to recover a good quantity of MM pottery, respectively MMI-II in the first one and MMIII for the second one, here associated with masonry structures (Betancourt 1990, Context 15).

On the other hand, trench 5A intercepted later building structures, relevant to the Late Bronze but also more recent, with the findings of tiles from historical periods (Shaw M.C 1996, p.128). The walls traced in this trench should belong to at least two different structures: in the northernmost space much worn fragments of LMIIIB fragments and also a fragment of LMIIIC bowl were found (post-abandonment); the Southern space is smaller than the previous one and the western wall inside it is built at least partly above the southern wall of the North space, just described, thus reporting its dating to a later phase. The ceramic belonging to the LMIIIA-B, coming from this latter southern area, is largely composed of kitchen and storage vases.

³⁴Interesting insights could come from an in-depth study of the uses of hematite. Hematite and, more generally, iron oxides have different properties, some already known from prehistory; in addition to be a dye, thanks to its chemical characteristics it is an excellent waterproofing agent. Among the mechanical properties, on the other hand, there is the abrasive one, which can be used in dry-docking operations (Salomon 2009).

3.2.4. Broglio di Trebisacce: an introduction

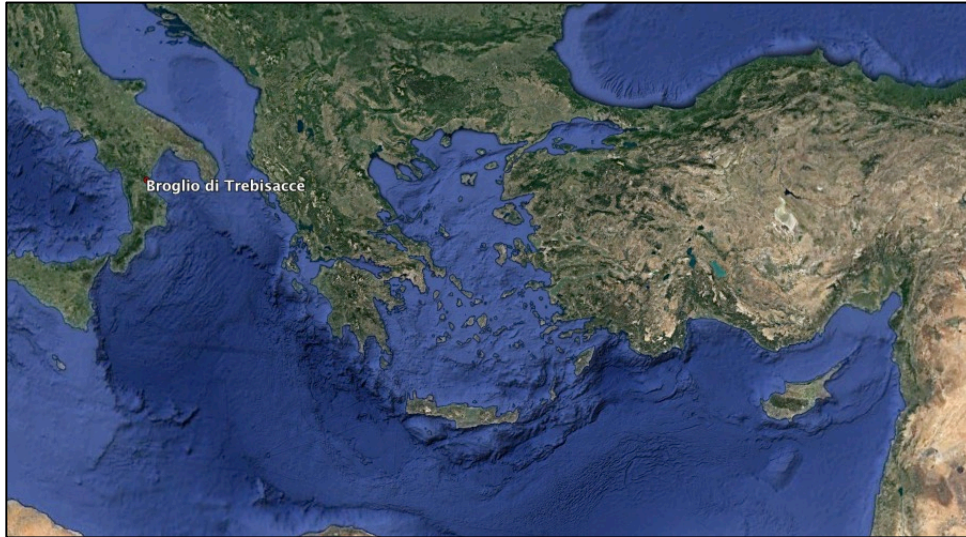


Fig. 3. 36 Italy and Broglio di Trebisacce.

The site of Broglio di Trebisacce is located in the modern village of Trebisacce (CS), which belongs to the Calabria region, in southern Italy.

Broglio lies in the northern part of the Sybaris Plain, where a series of plateaus stands between the Ionic coastal line and the Pollino Massif.

The area of Broglio is a complex of 10 ha of plateaus. It is surrounded north and east by the Marzuca channel valley and south by the Saraceno torrent. A small pass allows the access to the mountain paths located west. The site is now 1.5 km distant from the coast.

The so-called acropolis (about 1,5 ha area) stands on the top of a hill (181 m a.s.l.). Looking towards the sea, the observer can identify the small hill of the *Castello* (113 m a.s.l.), which overlooks the confluence between the Marzuca channel and the Saraceno torrent.

Despite these natural defenses the site was also provided with a fortification system since the MBA.

The Sybaris plain, which opens to the south of Broglio, was once characterized by marshy land and therefore unsuitable for agriculture in ancient times. The Sybarites probably reclaimed it only in the Archaic period. On the contrary, the Broglio area soils were favorable to a type of dry agriculture, particularly suitable for cereal and legume crops (Vallino 1994).

3.2.4.1. The excavation at Broglio

Broglio di Trebisacce was discovered in 1978 by professor Renato Peroni and young professor Andrea Cardarelli. The excavations began the following year and were led by the University of Rome La Sapienza, under the direction of Renato Peroni with the collaboration of Giovanna Bergonzi and Andrea Cardarelli himself.

From 1981 to 1985 Peroni was assisted by Dr. Flavia Trucco in the excavation management, while from 1990 to 2009 the direction was shared by Peroni and Professor Alessandro Vanzetti. The excavation and the research project are currently directed by Vanzetti.

The history of the research in Broglio is therefore marked by two main excavation cycles. The first one lasts from the end of the 70s up to mid-80s and the second one started in 1990 and is still ongoing. These research cycles are characterized by the use of different excavation methods and this aspect is of great relevance for everyone who wants to study the settlement and the artifacts retrieved there. In the initial explorations, in particular in sectors B and D, excavators proceeded by removing very large and thick units corresponding to entire phases and including several levels of activity (Moffa 2002, page 13).

Starting from 1983, the collection of materials in the D East and D West sectors was instead regularized within a 2 x 2 m grid.

In the more recent research cycles, an alternative reference grid of one meter by one meter was established (with the exception of topsoil levels where it is 2 x 2) and the excavation proceeded with a strict stratigraphically methodology. The location of material or artifacts is therefore more precise in the more recently excavated areas than in the previous ones and this could represent a problem when comparisons between areas is needed.

We will proceed below with the description of all the sectors of the acropolis investigated over the years. The detailed analysis of these sectors or of particular structures will be provided only if they are in direct relation with pithoi or fragments thereof. Therefore, we will focus in particular on the levels of the RBA and FBA.

However, it seemed useful to provide a full description, albeit brief, of all the areas excavated both to allow deeper understanding of the settlement and also to better locate the distribution of all the pithoi fragments.

Some of the (unpublished) data and the pictures used in this chapter are courtesy of the excavation team and Professor Alessandro Vanzetti.

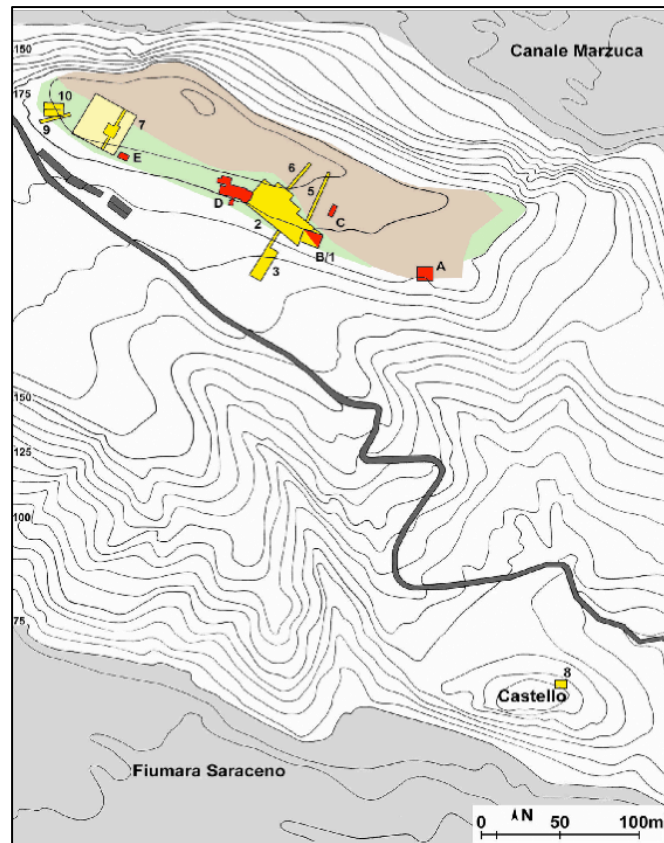


Fig. 3. 37 General Plan of the Acropolis with all the excavated sectors.

Sectors A, B/1 and C

In 1979 three excavation sectors were opened: sectors A, B and C. Sector A, located on the southern-eastern edge of the plateau, and Sector C, lying in its eastern-central area, are deeply eroded and archaeologically less relevant in comparison to other sectors of the Acropolis. In Sectors A and C materials were only found in topsoil levels which were lying directly on the geological substratum.

On the contrary, Sector B/1, located on the southcentral part of the plateau, allowed the discovery of the most complete stratigraphy of Broglio, which covers all the occupational phases from the Middle Bronze Age to the early Iron Age. (Bergonzi, Cardarelli 1982).

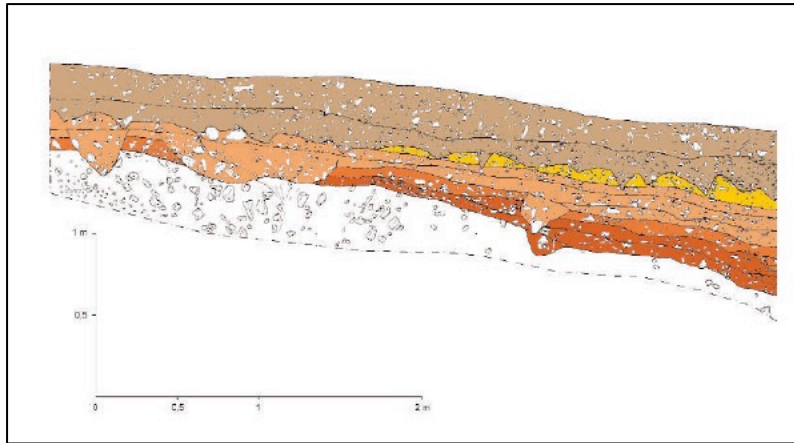


Fig. 3. 38 Sector B/1: Profile during the excavation in 1990 (in brown and yellow the FIA levels; in pink the FBA levels and in red the level of RBA and MBA).

Sector D

The excavation in Sector D started in 1980 with the opening of a narrow and long trench of 2m x 10m. The trench was excavated to explore a point where the current course of the edge of the plateau did not seem to deviate much from the one hypothesized for ancient times. On its northern limits a floor level, belonging to what was later identified as a hut, was discovered (Peroni 1982).

During the following excavation campaign, in 1981, Sector D was expanded in order to uncover an area of 10m x 10m around the original trench (Peroni 1984).

In 1982, the sector was expanded again reaching the dimension of 14m in length in the East-West, and 8m in width in the North-South. During this excavation campaign the floor levels of the hut was entirely exposed.

One of the main archeological deposit identified in Sector D is the so-called Central Hut; the name of this area derives from its location between sector D east and D west. After the early 80s excavation the hut was excavated again in 2013-2014. The aim of this two years excavation project was to gain a better understanding of the structure shape as well as of its internal stratigraphy. The central hut dates to RBA, and is, indeed, a very important context characterized by the presence of greater quantity of Aegean-derived pottery in comparison to other sectors of the settlement.

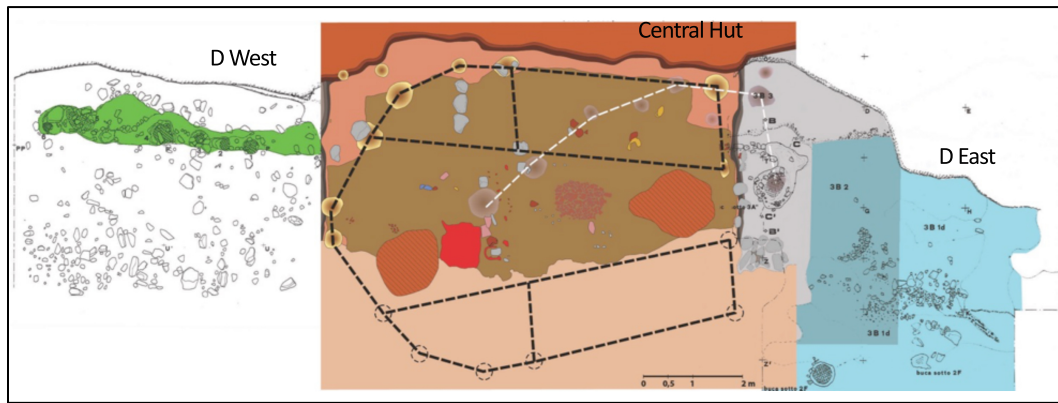


Fig. 3. 39 Central Hut: General plan (Vanzetti unpublished).

The hut is preserved only in its upstream half part. Despite this, it has been possible to identify its original form: it is a horseshoe-shaped house with an apsidal on one of the short sides. The entrance with a stone threshold was located in its eastern side opposite to the apse. The dimensions of the hut are of 8 m x 7 m. To the right of the threshold there was a complete cup bearing a swastika incised on its body wall.

The walls were made by wattle-and-daub with main pole every 3m and small pole between them. The roof was supported by two pots located inside the hut.

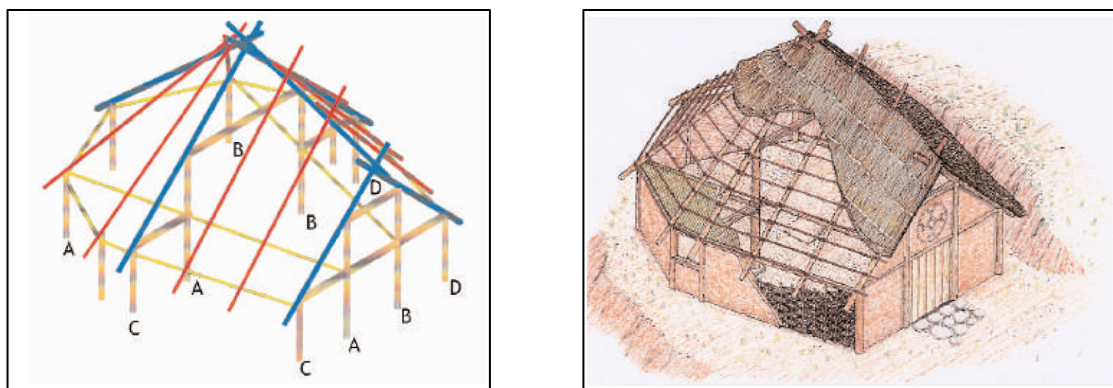


Fig. 3. 40 Reconstruction of the Central Hut (Peroni et al. 2008).

The earth floor of the hut was slightly sunken in comparison with the floor outside. Inside the hut two hearths with potsherd pavement were retrieved dating respectively to RBA1 and RBA2. In the back of the hut some vases were stored: in addition to the local impasto some Italo-Mycenaean vases (amphorae) as well as Grey ware tableware (mainly jugs and cups) were retrieved. The study of the sherds and the fabric carried out by M.A. Castagna (2002) ascertains the presence of four complete drinking set. These drinking sets, mixing typical local

features with Aegean ones, testify the strong nature of the relationships with the Aegean during the RBA.

D North: Pithos Storehouse 1

This structure is located not far upstream of a structure that overlaps the ruins of the Central hut, above layer S / 1. From the excavation of the structure it was possible to identify how this was founded during the early FBA.

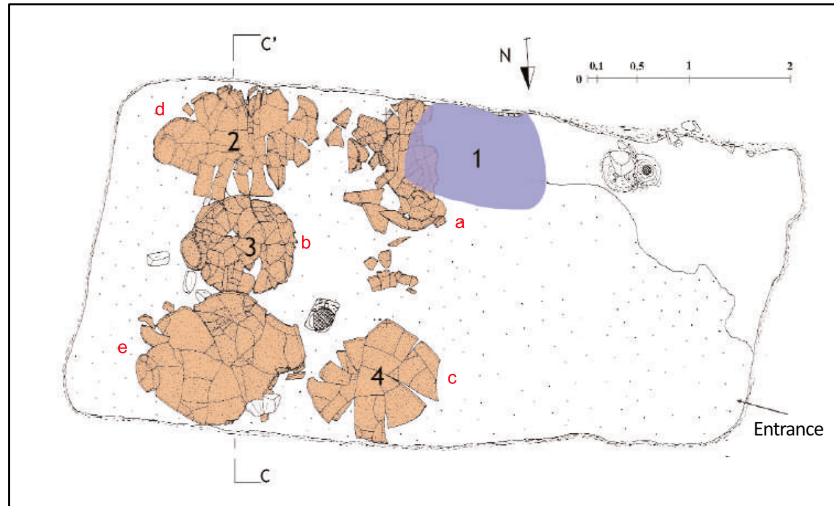


Fig. 3. 41 Storehouse 1: General Plan with pithoi in loco. In lilac the FBA 3 pit (Peroni et al. 2008).

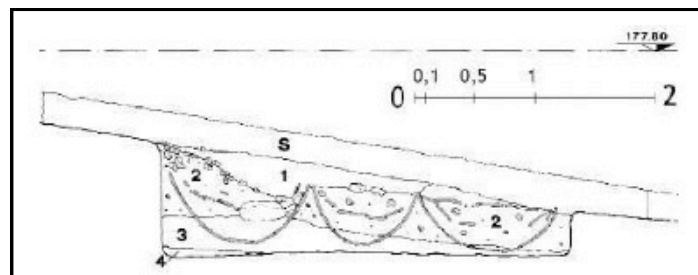


Fig. 3. 29 Storehouse 1: Profile (Peroni et al. 2008).

It has a rectangular plan of 6.6 x 3.5 m oriented east-west. The floor is sunken with respect to the external floor level. The access to the structure was provided with a lower ramp of about 40 cm in the downstream side and of 1m in the upstream one. The entrance was on the short western side. The elevation consisted of a dry-stone wall, which later collapsed into the structure along the entire upstream wall (Trucco 1994, p. 100).

On the opposite side of the entrance, five pithoi decorated with grooves were found (complete, but in fragments).

The pithoi, found in place, collapsed on their long side, were originally arranged in a horseshoe shape. The excavators underline the absence of overlap between them: this could mean that the abandonment and collapse of the structure occurred after their overturning. They did not rest on the floor level of the structure but rather on a blackish and greasy layer (Layer 3). The same layer was also found inside them, and it is presumably connected to the substance stored inside the pithoi. The installation of the pithoi within the storehouse is coeval with the foundation of the structure itself and date to initial phase of the FBA.

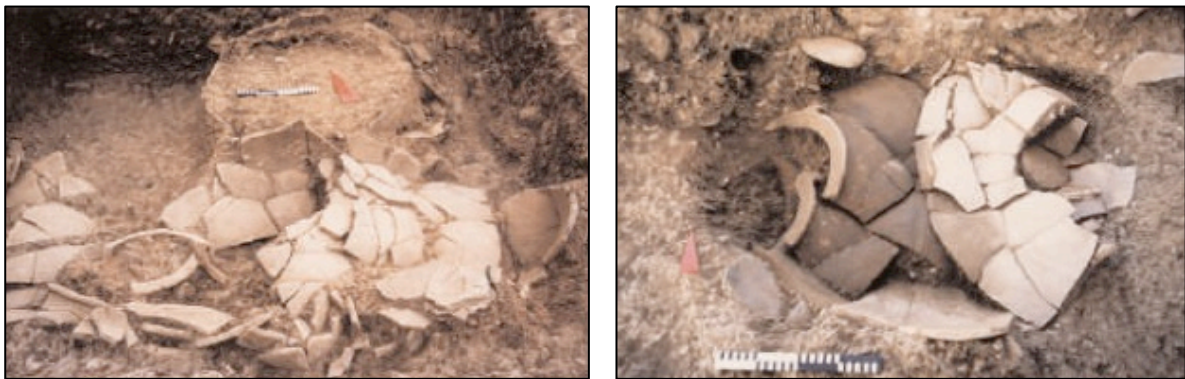


Fig. 3. 43 Storehouse 1: Pithoi during the excavation (Peroni et al. 2008).

This phase was followed, after a short transition and in a more recent phase of the FBA, by a second use phase. The final abandonment of the structure is dated to FBA3. During this period a rectangular pit (1.40 x 0,90 m) was excavated over the structure. The excavation of the pit reached the floor level of the earlier storehouse and cut the pithos located along the north wall (Pithos A). At the bottom of the pit a whole cup was placed, protected by the placement of some stones around it. The pit was later intentionally filled with household furnishings (hob fragments, andirons and grinders) and pottery together with ashes and above them stones and pieces of hut plaster. Finally, in the layer above the pit, bones belonging to six whole deer were found. A ritual meaning has been attributed to the pit: it was probably an expiatory rite connected to the fire of a nearby structure. The excavator proposed a comparison with the rite of the *fulgur conditum* used by Roman and Etruscans (Schiappelli 2006, Trucco 1994, p. 68; Peroni 1994 p. 861).

Sector E

The sector was opened in 1983, about 70 meters west of sector D (Peroni, Trucco 1994). The archaeological deposit dates entirely to the MBA, in particular in its non-developed phase. However, fragments belonging to a more advanced period of the MBA have also been found.

No fragments dating to the RBA and FBA were found, with the exception of a single fragment of gray ware which exact date cannot be determined more precisely (Trucco 1994, p. 80).

Sector 2

The excavation of this sector was planned in order to connect sectors D and B. It is the largest sector of the settlement measuring about 850 m sq. The original dimensions of the Sector opened in 1990 were 30 x 20 m, to which during the following year a northward extension of 13 x 4 m was added (Peroni and Vanzetti 1998, p.10).

In this sector, as well as in the other area of the site, the combined action of plowing and erosion has considerably compromised the consistency of the archaeological deposit, which is visible only within hollows, depressions and cuts in the substrate.

The evidence found in the sector date mainly to FBA. It must be underlined that the FBA was a period of intense construction activity which involved the installation or restoration of the acropolis terraces and the consequent obliteration of the stratigraphy belonging to previous periods (MBA and RBA).

According to the excavators (Peroni and Vanzetti 1998, p.14) in Sector 2 the several important archaeological deposits brought to light.

One of the most important discovery in whole settlement come indeed from Sector 2. It is a well related to a forge for iron production and some structures dating from FBA and EIA that can be placed between the northern limit of Sector 2 and the expansion towards the north. The forge was found inside a rectangular house, on its eastern side. The presence of the forge in FBA levels testifies the early introduction of the iron technology in some Italian contexts (especially in Calabria and Sicily) thanks to the contact with the eastern Mediterranean, in particular Cyprus during the last stage of the LBA.

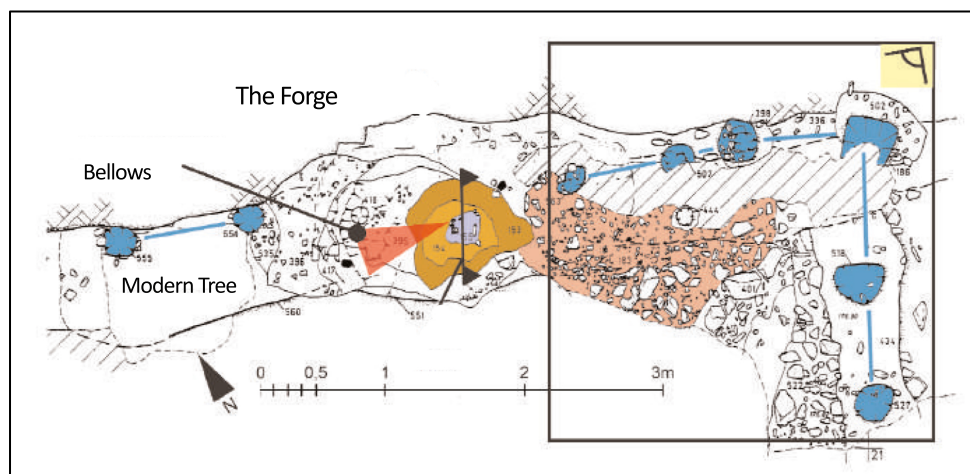


Fig. 3. 30 The forge. In light blue the posthole of the rectangular structure (Peroni et al. 2008).

Pithos Storehouse 2 has been identified in the SW corner of the sector near the D east sector. In this case, the structure is deeply damaged by plowing and erosion. The best-preserved portion of the structure is located in its NW portion, while its eastern side has almost completely disappeared. For the same reason the foundation levels were better preserved while the more recent ones appear of difficult interpretation. Numerous fragments of pithoi have been found since the first phase of the cleaning and the excavation inside this structure. In particular, there was at least one pithos partially reconstructed and decorated with grooves (Inv. BT810). Unlike the previous ones, however, the use of this structure as a storehouse seems to be of shorter duration and the pithoi fragments were then reused as a base for the hearth and as building material for the walls.

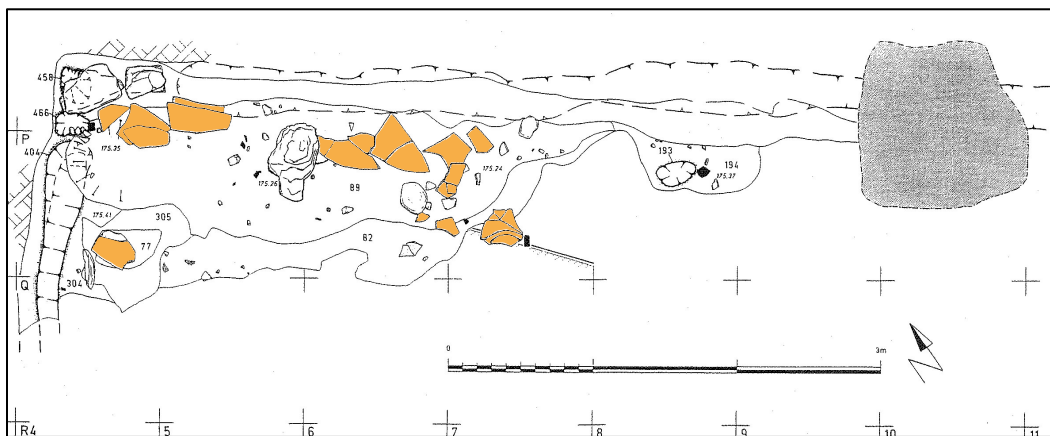


Fig. 3.45 Pithos Storehouse 2 general plan (Author elaboration after Peroni and Vanzetti 1998)

The foundation of this structure dates to a non-advanced phase of the FBA, more or less simultaneously with the first and second phases of use of the Pithos Storehouse 1. The Storehouse had a sunken floor as the other one, even if less deep. The structure had a rectangular plan with NW-SE orientation and dimensions of 4 x 9m. At least five accumulation levels had been identified within the structure limits, corresponding to three macro-phases related to structural activities and use. The second and third phases are separated by a collapse level caused by the action of fire (Peroni, Vanzetti 1998, pp. 34-37).

First Phase – the foundation: the cut made to build the structure probably compromised all the ancient archaeological levels. For this reason, materials typologically classified in the RBA were found in the foundation bumps (Peroni, Vanzetti 1998, p.37).

The greatest depth is reached in the NW angle and is equal to 60 cm while proceeding towards E this is reduced to 0. Above the foundation level (US 257) two floors of small thickness had been identified (US 255 = first floor level and US 80 = second floor level).

The walls of the structure were probably lined up with main pots located at the distance of 1.5 m from each other and smaller poles which housing was inside a gable placed along each side of the structure.

During the excavation two depressed zones were identified, placed at a similar distance from the N side of the structure. These are pits with a deeper central part surrounded by a wider but less deep external area. The two depressions do not seem to be in phase: the one more to W is cut into US 257 and filled by both floor levels (US 255 and 80) while the second, more to the E, is cut into US 98 that stratigraphically linked to US 255 (first floor level). A third depression has been identified more to W and as the previous one cuts the first-floor level and was filled by the second. One of the most intriguing hypotheses about the pits regards their relation with pithoi. They could indeed be used to house pithoi. (Vanzetti 1998, p.40, footnote 150). The threshold of the structure was not found but it was surely not located along the sides N and W. Second phase: the floor level of this second phase follows directly the previous one. However, important structural interventions occur, a threshold was inserted in the NW corner and near the latter a hearth was built. The hearth was also provided with two fixed elements used either as a fender or to facilitate the draft. The first element added since the founding of the hearth is a vertically fixed cutting stone in the west side of the hearth. The second element added at a later time to delimit the area of the hearth is a large fragment of pithos base. This fragment joins perfectly with another one found in the topsoil level not so far from here (P7 square). The lowest floor level belongs to this phase (US 82), it is preserved discontinuously and generally for a very thin thickness. These characteristics seem to be related to the presence of the threshold and therefore to foot traffic.

The fourth floor level (US 89) found inside the structure (that is the highest of this phase) has a very different character. In fact, it is characterized by a greater thickness and greater friability. This is a level of accumulation in which numerous fragments of pithoi have been found lying on the N side of the structure or leaned down obliquely to the banks. The study of the fragments and of the fabric carried out have led the excavators to suggest that they could belong to a single pithos. Chemical analyzes carried out on the sediments of US 89 allowed to verify the presence of high concentrations of phosphates: this abnormal concentration could be related to function of the structure in this period and attributed to the presence of animals. The presence of phosphates seems to seal the end of the use of the structure as a storehouse between phase 1 and 2 or within the latter (Vanzetti 1998, p.42).

Above this level of accumulation, it was possible to identify the traces of fire that destroyed the structure itself.

Third phase: above the collapsed structure, traces of a reconstruction of the structure have been identified, which accurately traces the perimeter of the previous one. This third structural phase is preserved only in a small part and even the materials associated with it are very few. The life-span of the structure could thus be summarized as follow, as suggested by Peroni (Peroni 1998, p.56): the structure seems to change its use from storehouse to a probable stable for animals in more recent phase. After that there was the final destruction caused by a fire.

In addition to the forge and the pithos storehouse in Sector 2 several pole holes and foundation channels dating from MBA to FBA pertaining to unidentifiable structures were also identified. In the central part of the sector these structures were covered by a paving of smoothed and rounded stones. Given the high degree of homogeneity of the stones and the level of wear (probably associated with foot traffic), the structure has been interpreted as a path inside the town. It dates to an advanced phase of the FBA.

Finally, two deep sub-circular dumps (about 80 cm depth) filled with dump materials that can be dated to the MBA (Pit 45 and Pit 10) were also retrieved.

Sector 3

A defensive system has been identified along the southern slope of the Aacropolis. The remains date to the FBA, which have evidently erased all traces of the fortifications dating between MBA and RBA. The fortifications system was provided with a 14 m wide and 4 m depth ditch, covered with stones placed on different steps. In the centre there was a small channel for water drainage.

The excavation of the moat led to the identification of different levels dating between FBA and FIA. Upstream of the moat there was a dry wall made with large blocks (Schiappelli 2003).

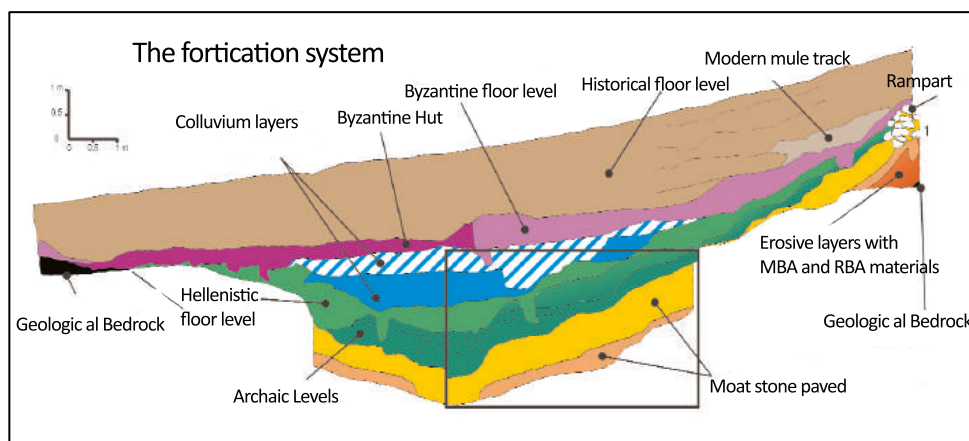


Fig. 3. 31 Sector 3: complete profile (Author elaboration after Peroni et al. 2008).

Sector 7 and 7N

Sector 7 lies immediately east of the saddle. The area is still completely unpublished (Schiappelli 2003) but the excavation brought to light at least two structures, one of which dates to the RBA-FBA and the second one, located in the northern portion (Sector 7N), to the FBA.

In the northern part of the sector a structure dating to the FBA was identified. Many pithos fragments bearing grooved decoration (perhaps belonging to 2 or 3 specimens) were identified from the beginning of the excavation in the top layers. The continuation of the excavation has however ascertained the progressive reduction of the fragments of pithoi and therefore it is not possible at the moment to establish more precisely their exact position or if they were part of another storehouse as the ones in Sector D or 2.

Downhill another structure was found partially built in stone with an apsidal *pars postica*. During the excavation the floor level was found located just below a level containing deer and ox horns, a bear canine and a horse plinth. The materials found in the basal levels of the structure date back to the RBA, and among these there were many Italo-Mycenean fragments. After the collapse of the structure during the advanced FBA, the area was probably transformed into a place dedicated to worship. The change in its use seems documented by the presence of painted protogeometric Oinotrian pottery, bronze needles and awls and especially by the presence of three horses made in fine clay and painted in protogeometric style. One specimen shows small holes for hanging the mane and chariot wheels, two of which have also been found.

Sector 10

The first fortification system, located on the northern side, dates to the MBA. It consists of a moat of 7m width and at least 4 m depth. In addition to the moat, barriers of perishable material (wood and hulled) and a wooden formwork whose height has been estimated at around 3 m have also been recognized. Even further downstream and near the moat there was another barrier in perishable material reinforced by a dry-stone wall.

During the construction of a trench for hydraulic arrangements, it was possible to make some observations and some tests along the access road to the Broglio hill. The stratigraphic series, outside the housing area, proved interesting: there were many levels rich in sherds, bones and coals (Barbieri *et al.*, 1984).

During the FBA the town probably occupied also the lower plateau (Peroni 1994, p.831) that according to the hypothesis of the excavators not only hosted houses but also cultivated areas, fences for livestock or productive installations. Therefore, the summit plateau displays the

features of an Acropolis both topographically and functionally. It was indeed inhabited by a minority and elite portion of the population separated from the rest of the community also through a fortification system.

Finally, it is necessary to underline how the accumulation of the deposit at Broglio has always been very poor, even in ancient times: this is therefore not just due to erosion or plowing.

The study of substrates and pedogenetic analyses suggests that the acropolis was articulated in a much more complex way than it appears today.

In the northern area substrates were identified quite deeply. They were not altered by pedogenetic activity, thus leading to the hypothesis of the presence in that area of a slight morphological eminence then truncated (Vanzetti 1998, p. 46).

This circumstance forces us to consider more in detail the morphology of the inhabited area in an attempt to understand if this developed on artificial terraces or if any natural morphological anomaly influenced its development.

Obviously, it is also necessary to consider the heavy structural intervention of the FBA, which partly obliterated the previous phases stratigraphy.

3.2.4.2. Classical Sources and the history of Broglio di Trebisacce

Our understanding of the MBA and LBA southern Italy is enriched by information coming classical sources that describes Italy and the indigenous communities who lived there before the Greek colonization.

The classical sources, indeed, identify the ancient inhabitants of Broglio (and the Sybaris Plain area) with the Oenotrian. In particular, following an older tradition, Dionysius of Halicarnassus describes the landing of Oenotrus and his gents on the Italian coasts and the subsequent establishment of small settlements upon the hills³⁵.

Broglio is located exactly in the region described by Dionysius. Calculating an average of thirty years per generation, the period when Oenotrus lived and reached the Italian coasts should be around 1700 BC. This period corresponds in archaeological terms to the transition between the Ancient Bronze Age and the Middle Bronze Age.

³⁵“The Arcadians, first among the Hellenes, crossed the Adriatic and settled in Italy, led by Oenotrus, son of Lycaon, born 17 generations before the Trojan war [...] Oenotrus [...], bringing with him the majority of the expedition, arrived at the sea which bathes the western regions of Italy. And who has many suitable lands both for grazing and agricultural crops, but for the most part deserted, and not very populous even those that were inhabited, he freed some parts from the barbarians, and founded small villages on the heights close to each other, according to the form of a traditional settlement among the ancients. The occupied region, which was vast, was called Enotria, and all the peoples upon whom he reigne were called Enotri.” Dionysius of Halicarnassus, Roman Antiquities, I, 11, 2-4, 12, 1.

The research conducted since the early '80 in southern Italy and especially in the Sybaris Plain, underlined how this period was characterized by a general demographic reorganization with the creation of a dense network of settlements.

From the MBA until the FIA the general settlements organization was based on the existence of long-life settlements with an average dimension around 10 ha established on naturally fortified hills and/or with a fortification system (Vanzetti 2011, p. 79). Most of these centres were located on the coast while the inland was occupied by less steady settlements. During the RBA and FBA this general pattern grew in complexity thanks to the contact with the people coming from the Aegean area. The original organization of the indigenous community, ruled by aristocratic elites based on family ties, evolved to more complex forms: family ties then played a less important role in favor of a more marked influence of economic factors (Peroni 1994; Vanzetti 2011, pp. 79-80; Vanzetti 2013).

Moreover, the classical sources completely overlap the Oinotrian region with the *Italia* and the area that in historical time would have been interested will be interested by the Greek colonization. In this reconstruction the figure of King Italo plays a relevant role: following the description made by Aristoteles, he indeed imposed for the first time new laws and established communal feasting for the member of the community (*sissizie*)³⁶ (Vanzetti 2011, pp. 79-80). In archaeological terms Italo would have lived around 1350 BC (MBA-RBA early), the period in which the relation between local community and Aegean reached its maximum intensity.

Broglio was therefore founded and existed in this period of great change in the western Mediterranean, in which, despite what claimed by some minimalist position (Blake 2008), the contact with the Aegean played a preeminent role in the formation and consolidation of a new power elite in the indigenous communities.

In RBA layers, many fragments of true Aegean or Aegean-derivative pottery as grey-ware, Italo-Mycenaean and pithoi (Jones *et al.* 2014) were indeed found. The Aegean pottery – both locally made or imported – mostly consists of tableware (grey-ware and Italo-Mycenaean, Aegean Imports) and storage vases (pithoi, Italo-Mycenaean, Aegean imports).

The relation between local communities and the Aegean is testified not only by the presence of imported pottery of locally made Aegean style pottery but also by social changes. The indigenous elite progressively assimilated an Aegean style of life, visible in the introduction in the local drinking set of some allochthonous shapes and a new way of managing the staple resources inside storage rooms.

³⁶For a description of the figure of King Italo and its implication in the historical reconstruction of the ancient Italian communities, please see Vanzetti 2011 with references.

During the FBA, the eastern Mediterranean underwent a great crisis, but southern Italy communities did not cease to exist. On the contrary, this period represents a period of strong vitality and economic prosperity. For example, all the storehouses devoted to the storage of foodstuff within pithoi retrieved so far in southern Italy date to this period (§ 6.5.6).

The village continued to exist until the foundation of Sybaris around 720-710 BC. The foundation of the Greek colony marks indeed the abandonment of some of the indigenous settlements and a re-organization of the territory of the entire plain (Vanzetti 2013).

4. MEDITERRANEAN PITHOS TYPOLOGY

4.1. Introduction

Despite the importance of pithoi in LBA contexts, a typological classification embracing the whole Mediterranean basin is still missing nowadays. This lack is even more stunning considering the issue from the Italian point of view: the pithoi production in southern Italy began, as noted, after the contacts with the Aegean and the elaboration of a general typology overcoming regional classifications could be a useful tool to understand this relation. The main purpose of this formal typology is indeed to explore and verify more in detail the derivation of Italian pithoi from Aegean models.

As pointed out by several authors (Vagnetti 1998a; Guglielmino 1999; Schiappelli 2003; Jones *et al.* 2014,) the first Italian production seems to depend more closely on Late Minoan models (LMIIIB-C) while Italian FBA production rather relates to Cypriot influences.

In this chapter we develop a formal typology that involves the material from all the areas of interest: Italy, Crete and Cyprus.

4.2. Nomenclature problems

The terminological question could seem of scarce interest but becomes fundamental when we have to deal with a classification. Indeed, as Peroni (Peroni 1998) pointed out, it is impossible to separate the classification from the terminology which becomes a conceptual and a cognitive tool.

Defining what a pithos is and isolating the most useful attributes in the identification of classes and types could seem simple tasks. However, many problems arise when we look at them more carefully.

In each of these areas, vases, generically defined and definable as pithoi, have quite different morphological and dimensional characteristics.

Considering the terminology used in Italy and following the definition provided by Peroni (1994, p. 128), a pithos (*dolium* in his classification) is a container used to store liquid and solid foodstuffs, distinguished from the *olla* by the dimensions. They are also characterized by the presence of handles and often by a plastic decoration of cordons and bands.

In the Cretan contexts, the term pithoi refers to all those large vessels with a height over 50 cm made of coarse fabric and decorated with trickle-painted patterns and/or plastic band or

ropes (Christakis 2005, p. 2). Specimens with similar shape but smaller size are instead called *pitharakia* (small pithoi).

In Cyprus all the vases taller than 50 cm and characterized by a semi-coarse fabric are currently classified as pithoi, as in the Cretan context.

According to the Aegean classification, in this research we will consider pithoi all the vases bigger than 50 cm. All the specimens considered will be classified in formal Types on the base of morphological and stylistic features. Technological aspects such the type of clay and the forming methods³⁷ are not considered for the classification. These two last parameters will rather be considered apart and evaluated in the reconstruction of the mode of production.

4.3. Pithos Typology in the Mediterranean: state of the art

4.3.1. The Cypriot Late Bronze Age Pithoi

Pithoi are very common in all of the excavated sites belonging to LCII-III and in some sites (i.e. Kalavassos-Ayios Dhimitrios, Maroni-Vournes) also monumental specialized storage building devoted to their recovering were retrieved.

Pithoi belong to a Late Cypriot class of *Plain White Ware*; this class is characterized by light-coloured medium-coarse fabric. The definition of the *Plain White Ware* was made by Åström (1972) and the most distinctive characteristic is the presence of black grit temper with other big elements like grog, chaff and mica. Sometimes a further distinction is made, and pithoi are classified into a distinct *Pithos Ware*. It differs from the general *Plain White Ware* class just in terms of higher thickness and coarser paste (Åström 1972).

Following the classification made by Priscilla Keswani (Keswani 1989) for the material from Kalavassos-Ayios Dhimitrios, Cypriot pithoi are basically divided in short-necked and long-necked specimens. Scholar grouped the pithoi in three main Groups named I, II and III which are further subdivided into various categories of styles and sizes. This general classification takes into account formal attributes and size of the vessels (Shuster Keswani 2009; Pilides 2000). Group I gathers pithoi with short neck while both Group II and III include long-necked pithoi.

³⁷In the Aegean, pithoi are generally classified as coarse or semi coarse ware in comparison to wares produced with extremely fine clays. In Italy fine clay (figuline ware) pithoi are produced aside more coarse specimens (that resemble more closely the typical Italian impasto).

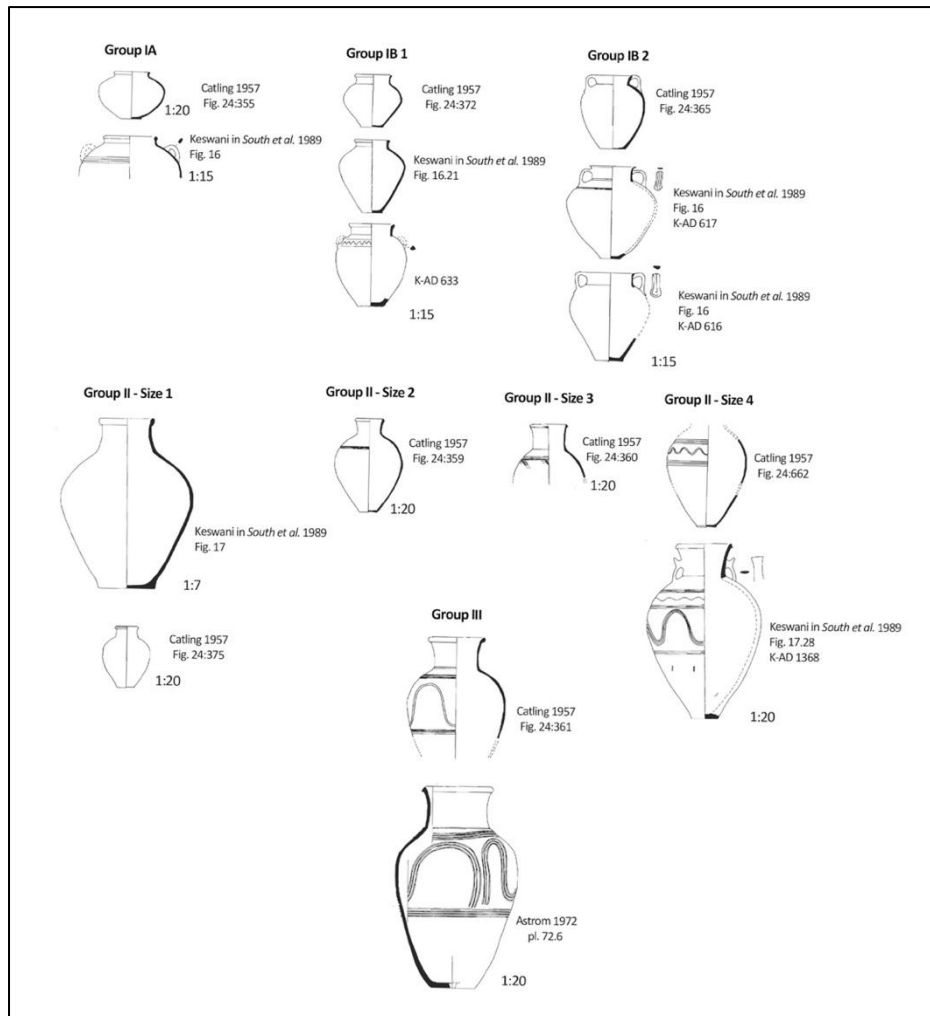


Fig. 4 1 Traditional Classification of Late Bronze Age Pithoi (After Pilides 2000)

Group I includes small/medium-sized vases with short neck and wide mouth in comparison with their size. Group IA is distinguished from IB by the presence of a very short neck (average 6.9 cm versus 8.5 in Group IB, Shuster Keswani 2009), wide diameter and thick walls. Rims are usually rounded or square-shaped. Both Groups IA and IB display a very high degree of internal variations in body profile, presence/absence and type of handles. The decoration, when present, is engraved on the shoulder and consists in general of two singles horizontal lines with a wavy line between them.

The difference between Group IB1 and IB2 depends on the presence – in the latter – of ribbed vertical handles mounted on the rim or just below it. The shape could be ovoid or piriform and generally the specimens belonging to this group are less than 1m tall.

Group II and III are long-necked pithoi. Vases in Group II have a long neck and constricted mouth with respect to the body size. In Group I there is a great internal variation in terms of body shape, neck height, presence/absence of handles and decorations. Group II is further

sub-divided in four size categories (size 1, 2, 3, and 4) based on rim diameter, neck height and vase height.

The decoration consists of a horizontal relief band (usually with four ribs) on the shoulder or in a pattern on the shoulder and on the belly with two horizontal relief bands and one wavy band between them.

Finally, giant pithoi (up to 2 m tall) with very thick walls (3/3.5-6 cm) are classified inside Group III. Their shape and the decoration's type are similar to the Group II size 3 and 4 pithoi, but they are generally handleless. Reliefs are usually made directly on the vessels surface and are composed by four ribs.

This general scheme made for the material of Kalavassos-Ayios *Dhimitrios* is normally used to classify all the pithoi and pithoi sherds found in all the Late Bronze contexts. The material classified by Keswani could be dated to 13th century B.C, since the site of Kalavassos was abandoned at the end of the century (end of LCII). In the first instance it seems that pithoi retrieved in LCII-III contexts shared broad typological similarities³⁸.

In her study, Priscilla Keswani also considers some functional aspects and relates each of these groups to a different kind of storage. Group I pithoi, due to their dimensions and their global shapes, are generally related to short-term storage. Their wide mouth makes the access to contents easier; they are also manageable in a simple way thanks to the presence of handles. Scholar (Shuster Keswani 2009) underlines their presence both in domestic and monumental storage buildings. Pithoi belonging to Group II and III are related, on the contrary, to a long-term storage. Keswani intended Group II pithoi like vases used to store products over long periods. They were used both in domestic and monumental storage buildings. Group III pithoi seem mainly related to centralized monumental (*ashlar*) buildings.

Some questions are still open, among which that of a clear definition of the type of production modes. Keswani (Shuster Keswani 2009) indeed also discussed the possible existence of three different modes: centralized production (few production centres, each serving a large area), localized mode (potters active in many different villages and towns) and itinerant artisans (§ 8.6) .

In addition to the work conducted by Keswani, Despina Pilides (Pilides 2000) catalogued in accordance with the Keswani typology all the pithos fragments retrieved in the "major" LC sites. The publication is provided with a catalogue and drawings and represents a useful tool for

³⁸A recent and still in progress comparative study among the pithoi from southwestern Cyprus is carried on by Priscilla Keswani and Eleni Nodarou. Vessels are analysed in their stylistic aspects and in fabric recipes. Preliminary results were presented at ARIEL Workshop in September 2015. This recent paper is the only scientific work which explores the regional variations in shapes and technological attributes of Cypriot pithoi so far. Only for macroscopic analysis see Shuster Keswani 2009.

everyone who wants to study Cypriot pithoi. Pilides considered in the publication also Cypriot pithos retrieved abroad and furnished a first petrographic study carried on 34 fragments.

4.3.1.1. Cypriot pithoi with impressions

Pithos fragments bearing impressions appear in LCIIIC-LCIIIA contexts. Until now more or less one hundred fragments with relief impression have been discovered (*Appendix A, Volume II*). After the work conducted by Smith (Smith 2007), it is now possible to ascertain how some of these fragments, grouped by similar impressions, may belong to the same pithos but it is still difficult to estimate their precise number. At present, they come from nine sites located both on the coast and small inland villages.



Fig. 4 2 Diffusion of Impressed pithoi in Cyprus: in green the inland sites and in red the coastal ones.

A large number of these fragments come from *Alassa-Palaeotaverna* (more than fifty fragments) and by *Maa-Palaeokastro* (25 fragments). In both contexts, they come from monumental *ashlar* buildings related to centralized storage. Most of the findings from *Maa-Palaeokastro* come from monumental *ashlar* Building III and, in this case, it was also possible to recognize two different rollers, one depicting a chariot hunting and one with goats and trees. (Smith 2007).

Differently from *Maa-Palaeokastro*, at *Alassa-Palaeotaverna* it is possible to observe more variability in the scenes depicted: there are griffins, griffin and lion fights, bull baiting or fighting and bull running with a chariot.

The impression, made with a wooden roll, is realized either directly on the vase surface or on a clay band applied on the vase. In latter case, the band is often of lighter colour and applied before firing. The decoration is in the area of the maximum expansion of the vase, in easily visible spots. Sometimes the impression is made vertically on the handles or on top of the rim in the case of small pithoi or basins.

In one case Smith was able to identify the use of the same roller in one specimen from Alassa-*Paleotaverna* and Episkopi both located on the Kouris river (Smith 2007).

Pithoi with sealing impressions were retrieved also in small inland sites generally interpreted as agricultural villages (i.e. Analiondas). This led some scholars to suppose not only the existence of an elite storage system but also that this implied a managed transport of staple between production and consumption centres (Smith 2007; Knapp 2008, p. 164).

The real meaning of this kind of marking is still an open question. Smith underlines that they were purposeful and held a precise meaning. The position on vases makes them bureaucratic tools to mark the ownership and/or the quality of the contents³⁹.

4.3.2. The Cretan Late Bronze Age Pithoi

Pithoi were very common in Crete during the entire Bronze Age period. Despite their widespread dissemination and their importance in understanding the economic organization of the Palaces and local communities, they have not always received much attention from the archaeologists.

The first contributions regarding this class are connected with the excavation of some of the major centres of the island. Evans elaborated a chronological classification for the specimens coming from Knossos (PM I-IV), Warren on pithoi from Myrtos Phounou Koriphi (Warren 1972) and finally Levi and Carinci (1988) for Phaistos. To these first typological contribution we must add the petrographic study by Petr Day about Neopalatial pithoi (Day 1988; 1991).

The pithoi classification currently in use in Crete was developed by Kostis Christakis and published in 2005 in a monography completely dedicated to storage vases. The study is characterized by a complete examination of Minoan pithoi dating to the Bronze Age, from EM to LMIIIC⁴⁰, (dataset 4235 specimens from almost the entire island, the west being less represented) in which besides the typological and decorative aspects also the functional ones are considered.

An entire chapter of the book is dedicated to the typological classification. Typology is organized on several levels, the first one is the shape identified considering the ratios of height

³⁹Residual analyses on the organic remains on pithoi are rare. The exceptions are the analyses carried out by Keswani on some pithos fragments from the Building X of Kalavassos-*Ayios Dhimitrios*. The content of vases was olive oil. A stone press was found close to this storage building. The residual analysis of organic remains on it confirms the presence of olive oil (Keswani 1992).

⁴⁰Most of the evidence referring to pithoi and storage practices comes from the Protopalatial and in particular Neopalatial periods. Within the palaces, several areas destined to storage within pithoi were identified. Archaeologically less visible, perhaps also due to a contraction of the effective range of storage practices, are the LMII-III A-B periods. New and recent data, with numerous attestations, date to the Final LMIIIB and LMIIIC, come from the area of Mirabello Gulf.

to the maximum diameter as well as the presence and height of a collar. Regarding the shape, Christakis considers six macros “types” on the basis of the general shape: ovoid, globular, piriform, barrel, conical, and tub pithoi. On the contrary other attributes such as fabric surface treatment and decoration are not taken into account, in the definition of the types because the “ware-based system of classification cannot be applied meaningfully to a ceramic corpus so varied in time, space, and context” (Christakis 2005, p. 5). Neither elements called by Christakis “smaller details”, such as shape of rim, handles and base, are considered.

Christakis also emphasizes how the shape can be used in the definition of some properties and functions of the vessel such as stability, capacity, accessibility to the content, and graspability. The second level of classification is represented by the “form”: 122 forms⁴¹ were identified and described with a selection of pithoi recurring in time and space for each of them but without a detailed catalogue. Moreover, the drawings do not always represent real specimens but are sometimes an ideal prototype with a combination of the morphological and decorative features of the pithoi that belong to that type.

As for the shape, Christakis also works on the decoration. He divides four mains “decorative elements”: appliqués (rope and raised band, knob and button, medallion-plain or finger-impressed and finally pictorial-bulls, bull's heads, zoomorphic figures, rosettes, double axes, papyrus flowers, leaves, and "architectural structures"), incisions (zig-zag, herringbone, and X-lines), impressions (concentric circle imprint, seal impression, reed stems or marine shells) and painted decorations (abstract geometric patterns, used as main decoration or a secondary motif used as a filler).

More recently, Helle Vankilde organized the material (872 elements) from at the Agia Aikaterini Square on top of the Kastelli Hill (Vankilde 2016). The material spans from EM to modern Greece with a major concentration of fragments between LMIIIA2 and LMIIIC (Vankilde 2016, p. 341). Thanks to her classification, it was possible to isolate attributes such as fabrics composition, rim shape and decoration arrangements representative for each period. In Kastelli the specimens dated to LMII-III A/LMIIIB-C are ovoid low-bellied and characterized by gravel tempered fabric. They generally have a rounded rim (small or big). With regard to the decoration, the LMIII pithoi present clay band with finger impression of rope motif (Vankilde 2016).

⁴¹Ovoid: 50 forms; Globular: three forms; Piriform: 52 forms, Conical: 16 forms; Tub 1 form.

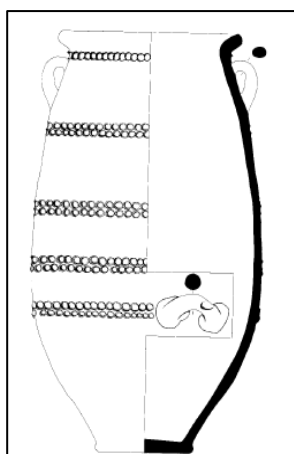


Fig. 4 3 Complete Pithos from Kastelli, Khania LMIIIC (Vankilde 2016).

4.3.3. The Italian Late Bronze Age Pithoi

The Italian LBA pithoi typology is strongly connected to the discovery and history of these vases as a pottery class profoundly different from the traditional local *impasto*. Traditionally, in the Italian prehistoric contexts, it is more common the use of the term *dolio* (*dolii* at the plural, with reference to the Latin name of *dolium*) to indicate these vases. Despite the tradition, in this research, the term pithos is preferred, both to underline the Aegean derivation of this ware and to use the same term for all the examined areas.

The first discovery of fragments of what would later be recognized as a local class of containers of Aegean derivation/inspiration dates back to beginning of the excavation in the site of Broglio. Giovanna Bergonzi and Andrea Cardarelli defined the class as “large containers of fine and well-baked clay, with the addition of inclusions and with plain or grooved bands” (personal translation, Bergonzi and Cardarelli 1982, p. 63).

Italian LBA pithoi are very different from all the large vessels (usually called *olla*) and pithoi⁴² used in Italy until this period both in terms of typological features and technological aspects. From the early 1990s, fragments of large containers with similar characteristics to those from Broglio were also recognized in other regions of southern Italy, especially in Apulia. Thanks to the increasing number of discoveries, the typological derivation of Italian pithoi from Aegean models is now ascertained and they became a tool to understand more in depth the contacts between local communities and the east Mediterranean.

⁴²Large containers – pithoi – are documented in southern Italy even before the RBA. In particular, we refer to the production from Sicily and from the Aeolian Islands belonging to the Capo Graziano facies. However, these large vases are very different from those produced from the RBA: they are, indeed, handmade burnished vases, produced without the wheel and they do not present plastic bands or grooved decoration as the ones under examination here.

The increased number of specimens made clear that the definition of the new ware was not simple because of the great variation of many formal and technological aspects. Several scholars dealing with this task tried to emphasize one or another aspect.

Starting from the first definition already proposed by Bergonzi and Cardarelli in the aftermath of their discovery, the main elements involved in defining this class are the use of fine (or semi-fine) clay, the use of the wheel at least during the finishing operation and the presence of cordons, clay bands or grooves as decorative motifs. However, the presence of many examples produced with clay recipes more similar to the traditional *impasto* makes it more difficult to elaborate a precise definition of the class.

Some technological issues related to the production of pithoi were already known and used at a different degree in the definition of the class. However, it is only at the end of the 90s – with the contribution of Sara Tiziana Levi – that all the technological aspects were deeply investigated (Levi 1999). Levi was able to isolate archaeometric classes through a series of petrographic analyses and for the first time she clearly addressed the technological study of the forming methods, underlining how it involved the use of the wheel, not only in finishing operation (Levi 1999). From this moment the technological aspects became fundamental in the identification and the definition of the class⁴³.

The increased number of specimens made it necessary also to elaborate a detailed formal typology of all the fragments retrieved. It is again thanks to the Broglio team that, in occasion of the 1983-1985 excavation campaign publication (Peroni and Trucco 1994), Paola Tenaglia tackles for the first time the chrono-typology of these large containers. This typology of Broglio's specimens has then been updated by Daniela Tabò on the occasion of the publication of the campaigns held in Broglio between 1990 and 1994 (Peroni and Vanzetti 1998).

To date, the most important contribution (unfortunately mostly unpublished) about these vases is definitely the research of Andrea Schiappelli. During his PhD at La Sapienza-University of Rome, Schiappelli elaborated an exhaustive chrono-typology of all the pithos fragments found in Italy (updated in the early 2000s). The study included also a detailed gazetteer of all the sites with pithos fragments and a chapter about the use of pithoi in southern Italy.

The elaboration of a seriation allowed a more detailed identification of all the attributes and characteristics of the pithoi produced during both the Italian RBA (13th century BC) and FBA (12th -10th century BC).

It is important to underline that until now most Italian pithoi date to the FBA, and differently from this last phase, no complete specimen could be dated surely at the RBA. The known RBA

⁴³Already Guglielmino (1999) at Camaiore (congress in 1998) proposed the sophisticated production technology as a determining factor hand defining the class.

specimens are barrel-shaped and decorated with wide plain bands. Sometimes these bands could show an incised pattern such as zig-zag or chevrons. Other types of decorations are also identified: circles, crisscross and herringbone decoration. Schiappelli isolated the latter as a quite common feature also after the end of RBA.

During the FBA, pithoi became larger than in the previous phase and they were globular. The decoration consisted of horizontal grooves or band with two, three or four ribs. Other specimens show ropes with impressed decoration (Schiappelli 2013, p. 234).

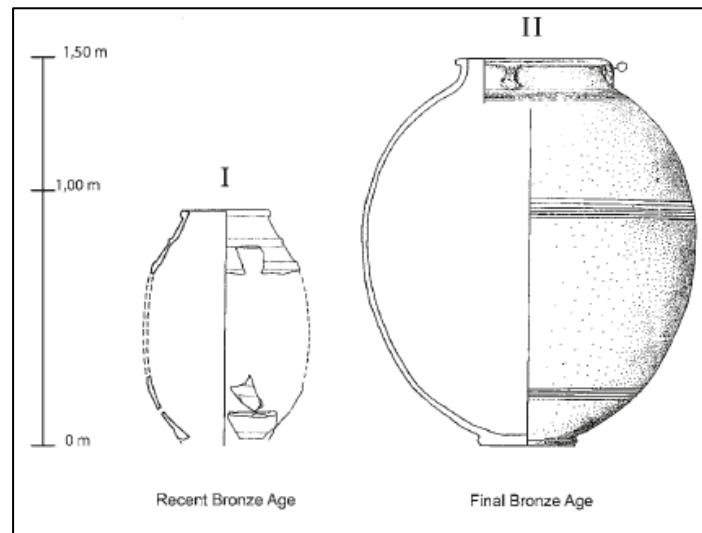


Fig. 4.4 Pithoi from Broglio di Trebisacce, Italian Late Bronze Age. (After Schiappelli 2013).

4.4. Typological classification

The archaeological typological classification is based on principles and methods derived from Natural Science⁴⁴. Classifying means indeed grouping similar items together: each group gathers objects which share some affinities (Rice 1987, p. 274). All these affinities are something significant in the nature of the members of the group and for these reasons define them as different from the other items. The group is called *Type* in archaeology and represents the main collecting unit among a population. However, the type is not the only level in the classification system. In fact, it is possible to organize the materials both on a smaller scale or on a greater level of detail. In the first case it is possible to group the types into larger sets (i.e. categories, classes, shapes and functional families) that share a smaller number of attributes but also to establish a distinction within each type, through the presence of varieties. The

⁴⁴Renato Peroni (1998) in his definition of Protohistory underlines that this discipline is a “cerniera e interfaccia di osmosi tra scienze naturali, in cui è centrale la classificazione, e scienze sociali, in cui è essenziale il momento dialettico” (hinge and osmosis interface between natural sciences - in which the classification is central - and social sciences - in which the dialectical moment is essential. Personal translation).

variety is defined by elements that partially differ from the general model to which the type refers by secondary attributes. However, these are not statistically relevant and therefore they do not represent a change to the norm – the type – but rather a variation within it. In the case in which only one element deviates from the type, this is called variant.

Regarding pottery classification, the attributes generally considered in the type's creation are the global shape of the vessel, the dimension, the specific shape of the rim, handles and bases or the fabric. Each scholar can choose the attributes that best represent the material under analysis and the most useful in reaching his goals. The important thing is that all the parameters chosen in the classification are made explicit for anyone who is faced with it⁴⁵.

In the case of the typological classification that follows, extended on a Mediterranean scale, entire vases or partially complete specimens (in which it is possible to check simultaneously all the attributes) will be considered in the first instance. Small fragments will be associated later, when possible. Some other fragments were only attributed to the typological family or to the most probable type(s). Moreover, only general elements that could allow framing the material coming from different regions and order them will be considered, because the aim of this classification is to understand whether Italian materials depend on or not from allochthonous Aegean models. The final classification will be provided in a general scheme in which all the pithoi were grouped, and it will be used as a starting point for a more detailed regional classification.

In the elaboration of this formal typology, great attention is reserved to all the significant elements, also from a functional point of view.

4.4.1. Analyses Methods

All the pithoi that were studied, published and unpublished, have been catalogued within a database in Excel format (Pithos Catalogue in Volume II). This database made it possible to order the materials by region, site and single context. A catalogue number (i.e. P 001) has been assigned to all the materials considered and used as single reference.

As far as concern the unpublished materials from Pyla each pithos is numbered by a Catalogue number followed by the Excavation number (e.g. 15/03/5041/OB006), and, when present, by

⁴⁵The choice of an adequate scale of analysis is fundamental: according to the aims of each research, different classification strategies must be applied. A classification which has as its purpose the elaboration of an intra-site or regional ceramic chrono-typology is preferably based on the variability of specific attributes. In this case the materials are ordered in a large number of types that allow to verify in detail morpho-stylistic changes incurred over time. The elaboration of a very detailed taxonomy permits to verify and understand more precisely chronological changes. In a different way, if its purpose is not chronological, a classification can also be based on the variability of more general attributes.

the inventory number of the Larnaka Museum (e.g. PK 2014 162). The excavation number is composed by the excavation year (e.g. 14, 15 or 16), the Sector (e.g. 03, 04 or 05), the *zembil*⁴⁶ number/s and the progressive object number (OB 000). In the case of Sector 5 the excavators refer to the *locus* number instead of *zembils*. Each *locus* identifies a precise area within the room and the associated material (soil, artefacts, and ecofacts). In Sector 4 neither *zembils* nor *loci* are used but there is a reference to the Space excavated and the progressive object numbers (e.g. 14/04/R4.9/OB002).

Sector	Excavation Number
SECTOR 3	15/03/ <i>Zembil</i> number/Object number
SECTOR 4.1 and 4.2	15/04/Space number/Object number
SECTOR 5	15/03/ <i>Locus</i> number/Object number

4.4.2. Criteria used and hierarchical organization of attributes

The materials under study were ordered following a hierarchal classification. Pithoi could be classified from a functional point of view, as storage and transport vessels such as other type of vessels like jars. This is the highest level of classification (and therefore of definition) of the materials under analyses. The current study concerns in particular a specific category (second level of classification) of storage and transport vessels: pithoi. Jars and amphoras will not be considered.

All the specimens categorized as pithoi are then classified in typological families, the third hierarchal level. Typological families group vases on the basis of the profile articulation (no-articulated profile or articulated profile) and the presence or not of a neck. Five typological families are identified among the material analysed so far. Each of these families is further divided into types (26 types in total) with regard to the body shape and to the presence, position and number of handles.

Within the types, varieties were sometimes defined on the basis of the decoration. Varieties are defined from the simplest form of decoration or the complete absence of decoration till the more complex ones (i.e. plain specimens, painted decoration, engraved or impressed decoration and plastic decoration). Finally, a further division is based on the dimension.

⁴⁶ Zembils is a Turkish word indicating the rubber basket used in archaeological excavation. The excavation method based on zembils was developed on Crete and each represents an excavation unit of a homogeneous archaeological context. It is defined by its spatial coordinates and the related sediments, artifacts and ecofacts. At the end of the day the zembils are interrupted also in the case of partly excavated contexts. The following excavation day the classification starts with new zembil number (Fiasse 2009, p. 179).

1. **FUNCTIONAL CLASS**
2. **CATEGORY**
3. **TYPOLOGICAL FAMILY**
4. **TYPE**
5. **VARIETY**
 - 5.1. **Sub-variety:** dimensional differentiation (a - small dimension; b - big dimension)

When the preservation state of the specimen does not allow a classification into a type or a variety, the elements are only *attributed or ascribed* to the type.

Sometimes it was necessary to classify the materials as *Variant* of specific types or varieties due to their difference from the norm used in the definition of types and varieties.

Pithoi, and in general coarse ware, are sometimes not completely included in the site's publication because they do not provide chronological hints as the tableware or painted vases do. In some cases, indeed, pithoi are just mentioned without any kind of graphic reference and therefore they were not inserted in the typology.

4.5. The pithos Mediterranean typology

The material will be presented according to the hierarchal scheme described in the previous paragraph. The scheme presents first the complete specimens, used in the definition of types and varieties, and then the fragmentary ones attributed or associated to types and varieties.

I TYPOLOGICAL FAMILY: Pithoi with no-articulate profile, without neck and wide mouthed.

TYPE 1: Pithoi with truncated-cylindrical shape. Everted rim, sometimes with lip with a rectangular profile. Without handles. Flat base. (Pl. 1)

Average rim diameter: 37.5 cm

Average base diameter: 34 cm

001	P 1334	KV P 15
002	P 1335	KV P 17
003	P 1336	KV P 18
004	P 1337	KV P 56

TYPE 2: Pithoi with truncated-cylindrical shape or truncated-cone globular shape. Everted rim, sometimes with lip with a rectangular profile. Two vertical handles just below the rim. Flat base. (Pl. 2).

Average rim diameter: 37.60 cm

Average base diameter: 27 cm

005	P 1345	HA ND
006	P 1338	KV P 16
007	P 1340	KV P 5
008	P 1341	KV P 14
009	P 1343	KV P 19
010	P 1915	SI N.I.
011	P 1342	KV P 25

Associated to Type 2: Pithos with truncated-cone shape. (Pl.3)

012	P 1344	KV P 17 (Building N)
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TYPE 3: Pithoi with truncated-cone shape. Everted rim with lip with rectangular profile. Two horizontal handles just below the rim. Plastic cordon with finger impression. (Pl. 3)

Average rim diameter: 54 cm

013	P 1423	KO X8:3/20
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Attributed to the I Typological family: (Pl. 3)

014	P 1344	KV P 20
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II TYPOLOGICAL FAMILY: Pithoi with articulated and restricted profile, without neck and wide mouthed.

TYPE 4: Pithoi with biconical shape with triangular tongue handles just below the rim. Flattened rim with lip with rectangular profile. Incised decoration on the handles and in the upper part of the body. Flat base very restricted in comparison to the maximum diameter. (Pl. 4)

Average rim diameter: 35 cm

Average base diameter: 14 cm

015	P 1401	PK16/04.1/R42/OB001
016	P 1798	KI Inv. 963A

Unicum 1: Pithos with biconical shape. Slightly everted rim with rectangular lip profile. Ribbed bands recurring several times of the body. Distinct base, very restricted in comparison to the maxim diameter. (Pl. 4).

017	P 1768	PK16/04.1/R11/OB001
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TYPE 5: Barrel-shaped pithos. No complete specimens were retrieved so far. Flattened rim with lip with rectangular profile. Sometimes the rim is cut obliquely inward. Cordon with

triangular section on the shoulder. Decoration composed by a plastic band repeated more times on the vessel's body⁴⁷ (Pl. 5).

Average rim diameter 37.5 cm.

018	P 0799	872, 874, 3379
019	P 0800	1080
020	P 0795	2788
021	P 0798	6303
022	P 0793	1010
023	P 0796	444
024	P 0797	617
025	P 1673	PN 133
026	P 1588	MG 381

TYPE 6: Pithos with ovoid shape. Everted rim. Plain cordon on the shoulder. Flat base restricted in comparison to the maximum diameter. Plain. (Pl. 6).

Average rim diameter: 28 cm

Average base diameter: 14 cm

027	P 0042	AP 425
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TYPE 7: Pithoi with ovoid or ovoid-globular profile. Flattened ring-rim with a lip with triangular profile. Small handles (generally 4) with grooved decoration and circular section from the rim to the shoulder. Distinct short base restricted in comparison to the maximum expansion. The decoration consists of grooves made directly on the body of the vase (generally consisting of 4 grooves repeated 3 times). (Pls. 7-12)

Average rim diameter: 46.8 cm

Average base diameter: 37 cm

7_a: small dimension

028	P 0936	BT Pithos C
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7_b: large dimension

029	P 0938	BT Pithos E
030	P 0937	BT Pithos D

⁴⁷In addition to the Italian material classified, among the Broglio materials analysed by Andrea Schiappelli, some rim fragments with square profile - but provided with a large plain handle attached directly on the rim (not ribbed as in FBA ones) - are dated to the RBA. For the shape of the rim they could be compared with the specimens classified in Type 5. However, the chronological association is based only on the shape of the lip because they come from mixed context and therefore their attribution to RBA remains uncertain.

For these reasons, they are not included in present classification. Hopefully further excavation in RBA contexts will enrich our knowledge about the beginning of the pithos production in Italy.

031	P 1894	RV 1
032	P 1895	RV 2
033	P 1829	TR1
034	P 0935	BT Pithos B
035	P 0801	BT Inv. V 79
036	P 1953	TM 1*
037	P 1144	GM 2
038	P 0986	CO 42532
039	P 0794	BT Inv. 242
040	P 0938	BT Pithos E

TYPE 8: Pithoi with ovoid or ovoid-elongated profile. Everted rim, with lip with a rounded or rectangular profile, in some cases flattened at the top. Cordon, plain or decorated with finger impression on the shoulder just below the rim. Two or three vertical handles on the shoulder, and other two handles close to the base. Flat, moulded and generally restricted base provided with two vertical handles. Presence or absence of clay bands on the body and possible presence of a cordons with a triangular section close to the bottom. (Pls. 13-17)

Variety 8.1: Plain pithos (uncertain for the fragmentary nature of the specimens).

Rim diameter: 44 cm

041	P 1916	SI N. I.
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Variety 8.2_a: Pithoi with decoration composed of bands of clay applied several times on the body (at least 3). The bands may be plain or decorated with herringbone patterns, vertical or oblique notches or impressed circles.

Average rim diameter: 34 cm

Average base diameter: 31 cm

042	P 1327	KV P 18
043	P 1320	KV P 22
044	P 1172	KP K 55
045	P 1917	SI N.I.
046	P 1918	SI N.I.
047	P 1919	SI N.I.
048	P 1920	SI N.I.
049	P 1138	GO Inv. A 154

Variety 8.2_b: large dimension

Average rim diameter: 48 cm

Average base diameter: 23 cm

050	P 1346	HA
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051	P 1323	KV P 29
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Variety 8.3: Pithoi with composite decoration of horizontal bands of clay applied several times on the body and serpentine clay bands. Bands decorated with vertical or oblique notches or impressed circles. Composite decoration of horizontal bands with incised patterns repeated several times in the body of the vase and wavy bands or small oblique bands with incised motifs.

Average rim diameter: 41 cm

Average base diameter: 35.5 cm

052	P 1921	SI N.I.
053	P 1922	SI N.I.
054	P 1164	KP MK 3
055	P 1170	KP K 53

Variety 8.4: Pithoi with composite decoration of horizontal bands of clay applied several times on the body and drops of paints on the rim and the body. Bands decorated with herringbone patterns, vertical or oblique notches.

Average rim diameter: 45 cm

056	P 1526	MO P 3881
057	P 1518	MO P 462
058	P 1519	MO P 512

TYPE 9: Pithoi with ovoid or ovoid-elongated profile (hypothesis based on incomplete material). Rim flattened at the top or channelled with lip rectangular profile. Four vertical handles below the rim. Cordon, plain or with impressed circles under the rim. Composite decoration of horizontal bands of clay applied several times (at least 2). Bands decorated with oblique notches. (Pl. 18):

Average rim diameter: 47 cm

059	P 1924b	SI N.I.
060	P 1192	KK Pithos 77-P 1393

Attributed to type: (Not in plate)

061		PK Minoan import
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TYPE 10: Pithos with ovoid profile. Everted rim with lip with rounded profile cut obliquely inwards. Two bigger horizontal handles interspersed with two smaller vertical handles just

below the rim. Plain cord below the rim. Decoration composed of a plain band in the middle of the vase. (Pl. 19):

Rim diameter: 34 cm

062	P 1329	KV INV. P9
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TYPE 11: Pithoi with ovoid or ovoid-globular profile. Flared funnel-shaped rim or with lip with rectangular section flattened at the top (this rim has been arbitrarily ascribed by the excavators). Two vertical handles just below the rim. Two horizontal handles between the base and the maximum expansion.

Flat base or distinct and moulded base very restricted to maximum expansion. Composite decoration of horizontal bands of clay applied several times on the body. The bands are decorated with impressed circles or pseudo-twisted rope pattern. (Pl. 20):

Average rim diameter: 50.5 cm

Average base diameter: 29.5 cm

063	P 1190	KK Pithos 3
064	P 1189	KK Pithos 2
065	P 1191	KK Pithos 77-P1397

TYPE 12: Pithos with ovoid profile. Everted moulded rim with lip rectangular profile. Two horizontal handles just below the rim. Cordon with impressed circles under the rim. Composite decoration of horizontal bands of clay applied several times on the body. The bands are decorated with herringbone pattern. (Pl. 21):

Average rim diameter: 36 cm

066	P 1321	KV P 9
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III TYPOLOGICAL FAMILY: Pithoi with articulated and restricted profile with short neck.

TYPE 13: Pithoi with globular-squat profile. Everted rim with lip with rounded profile. Without handles and plain. (Pl. 22):

Average rim diameter: 36.5 cm

Base diameter: 23 cm

067	P 1617	MP P 207
068	P 0006	AP 389

TYPE 14: Pithos with globular-squat profile. Flattened and everted rim rounded or rectangular profile. Two vertical handles on the shoulder. Decoration with horizontal grooves (generally with four ridges). (Pl. 23):

Average rim diameter 39.5 cm

Base diameter: 28 cm

069	P 1621	MP P 456
070	P 1152	AD 1
071	P 1151	AD 2

IV TYPOLOGICAL FAMILY: Pithoi with articulate profile and distinct short neck:

TYPE 15: Pithoi with ovoid or ovoid-globular profile, rounded shoulder and walls tapered towards the base, narrow compared to maximum expansion. Distinct cylindrical or concave neck. Everted rim with a flattened rectangular lip profile sometimes obliquely cut inwards, or with a triangular lip profile or with rounded lip profile. Without handles. Flat base. (Pls. 24-28):

Variety 15.1: Plain pithoi

Average rim diameter: 40 cm

Average base diameter: 25 cm

702	P 1616	MP P 446
073	P 1615	MP P 206
074	P 1452	MP 140
705	P 1137	GL 001
076	P 1473	MA Inv. 99
077	P 1892	PK trail A/4
078	P 1413	KI Inv. 1025
079	P 1400	KI Inv. 546
080	P 1837	PK16/04.2/R5/OB001
081	P 1732	PK16/03/5009/OB004

Variant to the type 15.1

082	P 1817	PK 14/04.1/R8/OB001
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Variety 15.2: Pithoi with incised decoration on the shoulder, generally composed by two horizontal lines and a wavy line between them.

Average rim diameter: 31 cm

Average base diameter: 26.5 cm

083	P 1161	AD 14
084	P 1160	AD 13
085	P 1815	PK 16/04.1/R7/OB008
086	P 1804	PK 16/04.1/R7/OB006

Variety 15.3: Pithoi with horizontal groove decoration on the shoulder.

Average rim diameter: 42 cm

Base diameter: 23 cm

087	P 1654	MP P 354
088	P 1509	MM Inv. 8125

Variety 15.4: Pithos with applied arc-shaped cords with finger impressions

Rim diameter: 32 cm

089	P 1293	KV Inv. P 141
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Variety 15.5: Pithos with decoration composed of two horizontal grooves (generally composed of 3 or 4 ridges) and in the middle a wavy line.

Average rim diameter: 96 cm

Average base diameter: 40 cm

090	P 1404	KI Inv. 1125
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TYPE 16: Pithos with ovoid profile, rounded shoulder and walls tapered towards the base, narrow compared to maximum expansion. Everted rim with lip with a triangular profile. Truncated-cone neck. Decoration composed of horizontal grooves and a wave line. Two large horizontal handles on the shoulder. Flat base. (Pl.29):

Average rim diameter: 63 cm

Average base diameter: 43 cm

091	P 1402	KI Inv. 1124
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TYPE 17: Pithoi with ovoid or ovoid-globular or rounded shoulder and walls tapered towards the base, narrow compared to maximum expansion. Everted rim with lip with a triangular, rounded or rectangular section. Distinct neck and generally cylindrical or flared or with concave walls. Sometimes a cordon, plain or with finger impression, between the neck and the shoulder. Two vertical handles on the shoulder, generally with an oval section. Flat base. (Pls. 30-39):

Variety 17.1: Plain

Average rim diameter: 36 cm

Average base diameter: 24.2 cm

092	P 1835	PK 16 609
093	P 1697	PK Inv. 126
094	P 0113	AT N 3
095	P 1688	PK Inv. 6

096	P 1703	PK 157
097	P 1694	PK Inv. 87
098	P 1852	PK 14 480
099	P 1698	PK Inv. 107
100	P 1853	PK 14 427
101	P 1686	PK Inv. 26
102	P 1813	PK 14/04.1/R7/OB016
103	P 1790	PK 15/04.1/R18/OB002
104	P 1789	PK 14/04.1/R18/OB001
105	P 1850	PK 15/05/076/OB001
106	P 1767	PK 14/04.1/R10/OB001
107	P 1434	KO inv. 1594
108	P 1675	PH 1
109	P 0008	AP 391
110	P 1185	KP K 42

Variety 17.2: Pithos with drop paint on the rim and on the body.

Rim diameter: 42 cm

111	P 1517	MO P 138
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Variety 17.3: Pithos with incised decoration on the shoulder, generally composed of two horizontal lines and a wavy line between them. Three cases with a single wavy line and one with two wavy lines.

Average rim diameter: 37 cm

Average base diameter: 24 cm

112	P 1426	KO C 9013
113	P 1462	MA Inv. 530
114	P 1155	AD 633
115	P 1153	AD 497
116	P 1692	PK Inv. 88
117	P 1777	PK 14/04.1/R13/OB005
118	P 0007	AP 390
119	P 1614	MP P 447
120	P 1154	AD 22
121	P 1463	MA 469
122	P 1408	KI Inv.3008
123	P 1407	KI Inv. 3681
124	P 1510	MM inv. 8.121

Variety 17.4: Pithoi with composite decoration of horizontal cordons of clay applied several times on the body disposed in pair or rarely in group of three. Cordons decorated with finger impression.

Average rim diameter: 35 cm

Average base diameter: 16 cm

125	P 1294	KV P 142
126	P 1295	KV P 143

127	P 1535	MO IIB. 840
128	P 1515	MO P 121

Variety 17.5: Pithoi with composite decoration of horizontal cordons of clay applied over the whole body's vessels. Cordons decorated with finger impression. Very large ring-rim.

Average rim diameter: 42 cm

Average base diameter: 25 cm

129	P 1431	KO C67d/3
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Variety 17.6: Pithoi with composite decoration of horizontal bands of clay applied probably several times on the body. Plain bands or bands decorated with herringbone pattern.

Average rim diameter: 37.5 cm

Average base diameter: 25 cm

130	P 1186	KP K 9
131	P 1322	KV P 10

Variant 1 to the Variety 17.1: Pithos with two vertical raised handles on the shoulder. Single plain band placed in the lower half of the vase. Without cordon on the shoulder.

132	P 1923	SI N.I.
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Variant 2 to the Variety 17.1: Pithos with two vertical small handles on the shoulder. Single plain band placed in the half of the vase. Restricted neck.

133	P 1924	SI N.I.
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TYPE 18⁴⁸: Pithoi with piriform, ovoid or ovoid-globular profile, rounded shoulder and walls tapered towards the base, narrow compared to maximum expansion. Everted rim, in some cases cut obliquely inside. Distinct and generally truncated-cone neck. Two vertical ribbed handles laying from the rim (or mid-neck) to the shoulder. Flat base. (Pls. 40-45)

Variety 18.1: Plain pithoi (three pithoi classified here are less than 50 cm tall, but they were anyway included in this typology because of their correspondence with this shape)

Average rim diameter: 37 cm

Average base diameter: 23 cm

134	P 0016	AP 399
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⁴⁸In some typological classification the vases belonging to this type were labeled as Amphoroid Kraters due to the presence of big vertical handles from the rim to the shoulder.

135	P 0114	AT n. 4
136	P 0015	AP 398
137	P 1409	KI Inv. 580
138	P 1411	KI Inv. 4634
139	P 1690	PK Inv. 16
140	P 1156	AD 616
141	P 1622	MP 205
142	P 1696	PK Inv. 45a
143	P 1157	AD 24
144	P 1704	PK 147
145	P 1474	MA inv. 241
146	P 0017	AP 400
147	P 1809	PK14/04.1/R7/OB012
148	P 1754	PK16/03/6020/OB004
149	P 1803	PK14/04.1/R7/OB005
150	P 1794	PK 15/04/R14B/OB001
151	P 1881	PK 16/05/0075/OB007

Variety 18.2: Pithoi with incised decoration on the shoulder, generally composed by two horizontal lines and a wavy line between them.

Average rim diameter: 35.5 cm

Base diameter: 25 cm

152	P 1788	PK 14/04/14B/OB 002
153	P 1158	AD 25

Variety 18.3: Pithoi with horizontal groove decoration on the shoulder.

Average rim diameter: 34 cm

Average base diameter: 16.5 cm

154	P 1410	KI Inv. 4633
155	P 1159	AD 617
156	P 1464	MA Inv. 356

Variant to 18.1: Pithos with biconical profile.

157	P 1825	PK 14 162
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TYPE 19: Pithoi with ovoid or ovoid-elongated profile, rounded shoulder and walls tapered towards the base, narrow compared to the maximum expansion. Moulding base. Distinct neck with slightly concave walls. Extruded rim with a generally circular and triangular lip (sometimes pendulous). Vertical handles (generally two) on the shoulder and two vertical handles (oval section) set just above the base. Flat base. (Pls. 46-48):

Variety 19.1: Pithoi with composite decoration of horizontal bands of clay and cordons applied several times on the body. Bands decorated with incised herringbone pattern and cordons decorated with incised with oblique notches

Average rim diameter: 44 cm

158	P 1312	KV P 5
159	P 1314	KV P 3
160	P 1282	KV P 22

Variety 19.2: Pithoi with composite decoration of horizontal bands of clay applied several times on the body and serpentine clay cordons/bands. Horizontal bands decorated with herringbone pattern. Serpentine bands decorated with oblique/vertical notches.

Average rim diameter: 69 cm

Average base diameter: 38 cm

161	P 1281	KV P21
162	P 1280	KV P20
163	P 1284	KV P 26

Associated to Variety 19.2: Pithos with horizontal band with impressed rosette

164	P 1418	KO Inv. 1328
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TYPE 20: Pithoi with ovoid or ovoid-globular or ovoid-piriform profile, rounded shoulder and tapered walls the base, narrow or very narrow compared to maximum expansion. Distinct and generally cylindrical or with slightly concave walls neck. Everted rim sometimes flattened or cut obliquely inwards. Two horizontal handles on the shoulder. Flat or moulded base. (Pls. 49-50):

Variety 20.1: Plain pithos

Average rim diameter: 35 cm

Average base diameter: 26 cm

165	P 1687	PK Inv.17
166	P 1419	KO Inv. 932
167	P 1550	MC tomb 27
168	P1171	KP K 54
169	P 1925	SI N.I.
170	P 1693	PK Inv. 57

Variety 20.2: Pithoi with drops of paint on the rim and on the body.

Average rim diameter: 42 cm

Average base diameter: 26 cm

171	P 1545	MC tomb 19
172	P 1516	MO P 137

Variety 20.3: Pithoi with composite decoration of (two) horizontal cordons with oblique notches of clay applied one in the middle of the body.

Rim diameter: 30 cm

Base diameter: 24 cm

173	P 1163	KP K 26
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Variety 20.4: Pithos with decoration composed of a band of clay decorated with incised motif and drops of paint.

Rim diameter: 48 cm

Base diameter: 28 cm

174	P 1547	MC Tomb 24
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TYPE 21: Pithoi with ovoid or ovoid-elongated profile, rounded shoulder and walls tapered towards the base, narrow compared to maximum expansion with moulding. The neck is distinct and generally cylindrical. Everted rim flattened at the top. Two horizontal handles interspersed with small vertical little handles on the shoulder with a circular section. Sometimes, vertical handles just above the base. Flat base. (Pl. 51)

Variety 21.1: Plain pithos

Average rim diameter: 31 cm

Average base diameter: 30 cm

175	P 1420	KO Inv. 924
176	P 1421	KO X5:5/42
177	P 1428	KO X8:4/16

Variety 21.2: Pithos with drops of paints.

Rim diameter: 36 cm

Base diameter: 23 cm

178	P 1414	KO Inv. 775
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Variety 21.3: Pithos with plain clay band applied several times on the body

P 179	P 1675B	PH 2
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TYPE 22: Pithoi with ovoid or ovoid-elongated profile, rounded shoulder and walls tapered towards a flat moulded base, narrow compared to the maximum expansion. The distinct neck has slightly concave walls. Everted rim sometimes flattened or with pendulous lip. Four vertical handles with oval or circular section on the shoulder. Flat or moulded base. (Pls. 52-53):

Variety 22.1: Pain pithoi

Average rim diameter: 28 cm

Average base diameter: 23 cm

180	P 1538	MC Tomb 23
181	P 1543	MC Tomb 15
182	P 1551	MC Tomb 28

Variety 22.2: Pithos with decoration with cordons with finger impression applied several times on the body.

Rim diameter: 40 cm

Base diameter: 27 cm

183	P 1539	MC Tomb 5
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Variety 22.3: Pithos with horizontal bands with incised decoration.

Rim diameter: 27 cm

Base diameter: 18 cm

184	P 1536	MC Tomb 3
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Unicum 2:⁴⁹ Pithos with vertical handles imposed on the rim and hand-painted decoration.

Rim diameter: 24 cm

Base diameter: 18 cm

185	P 1422	KO Room X4:2/10
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TYPE 23: Pithoi with ovoid or ovoid-elongated profile, rounded shoulder and walls tapered towards the base, narrow compared to the maximum expansion. Possible presence of channels close to the base. Distinct neck with slightly concave walls, cordons plain or with notches on the shoulder. Everted rim with lip with triangular profile sometimes pendulous. Four vertical handles on the shoulder and sometimes four vertical handles (oval section) slightly above the base. Flat or moulded base. (Pls. 54-57):

Variety 23.1: Pithoi with decoration with cordons applied several times on the body of the vase and generally arranged in pairs. One specimen has a clay band with incised herringbone pattern.

⁴⁹This Komman specimens is classified as *Unicum* due to the exceptionality of its decoration, totally different from the ones retrieved so far in Crete.

Average rim diameter: 39 cm

Average base diameter: 29 cm

186	P 1548	MC Tomb 25
187	P 1549	MO P 1634
188	P 1520	MO P 773
189	P 1332	KV P 21

Variety 23.2: Pithos with composite decoration of horizontal bands of clay applied several times on the body. Bands decorated with herringbone pattern.

Rim diameter: 50 cm

Base diameter: 32 cm

190	P 1541	MC Tomb 8
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Variety 23.3: Pithos with composite decoration of horizontal bands of clay applied several times on the body and serpentine clay bands, sometimes arranged in pairs. Bands decorated with oblique/vertical notches.

Rim diameter average: 50 cm

Base diameter average: 38cm

191	P 1540	MC Tomb 6
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Variety 23.4: Pithos with composite decoration of cordons, generally disposed horizontally in pairs repeated several times on the body and drops of paints on the rim and the body. Bands decorated with herringbone patterns, or crisscross incision.

Average rim diameter: 46 cm

Average base diameter: 34.5 cm

192	P 1546	MC Tomb 21
193	P 1544	MC Tom 17
194	P 1537	MC Tomb 16
195	P 1533	MO P 7022

Attributed to Variety 23.1 or 23.4

196	P 1527	MO IIB 832, P 3882,
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V TYPOLOGICAL FAMILY: Pithoi with articulated profile with long distinct neck.

TYPE 24: Pithoi with ovoid profile, rounded shoulder and walls tapered towards the base, narrow compared to maximum expansion. Long, distinct and generally cylindrical or with

concave walls neck. Everted rim with a lip with a triangular (or rounded) profile. Without handles. Flat base. (Pls. 58-74):

Variety 24.1a: Plain pithos.

Average rim diameter: 28 cm

Average base diameter: 27 cm

197	P 1618	MP 437
198	P 1149	AD 8
199	P 1865	PK 15/05/107-108/OB001
200	P 1730	PK 14/03/5006/OB006
201	P 1729	PK 16/03/5114/OB005
202	P 1700	PK 159
203	P 1699	PK 148
204	P 1752	PK 15/03/5041/OB006
205	P 0018	AP 401
206	P 0020	AP 403
207	P 0045	AP 428
208	P 1513	MM 9.99
209	P 1776	PK 14/04.1/R13/OB004

Variety 24.1b: Large dimension

Average rim diameter: 49 cm

Average base diameter: 25 .5 cm

210	P 1824	PK 14 660
211	P 1461	MA Inv. 563
212	P 1685	PK inv. 7
213	P 0031	AP 414

Variety 24.2_a: Pithoi with incised decoration on the shoulder

Average rim diameter: 34 cm

Average base diameter: 23 cm

214	P 1706	PK Inv. 30
215	P 1927	TB jar 01
216	P 0027	AP 410
217	P 1432	KO inv. 846

Variety 24.2_b: Large dimension

Average rim diameter: 45 cm

Average base diameter: 38 cm

218	P 1454	MA Inv. 463
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Variety 24.3_a: Pithoi with horizontal groove decoration on the shoulder (generally four ridges) made directly on the surface of the vase on shoulder.

Average rim diameter: 32 cm

Average base diameter: 19.5 cm

219	P 0026	AP 409
220	P 1623	MP 441
221	P 1691	PK 16A
222	P 1705	PK 18A
223	P 1689	PK Inv. 18
224	P 1677	PI Pithos 3
225	P 1728	PK 16/03/5102/OB003
226	P 2015	UG 2
227	P 1679	PI Pithos 2
228	P 2014	UG1
229	P 1695	PK Inv 19

Variety 24.3_b: Large dimension Average rim diameter: 46.5 cm

Average base diameter: 25 cm

230	P 0111	AT 1
231	P 1475	MA 462
232	P 2018	UB KW 255
233	P 2017	UG 4
234	P 1779	PK 14/04.1/R13/OB002

Variety 24.4_a: Pithoi with composite decoration of two horizontal grooves (generally composed of 4 ridges) and a wave line between them.

Average rim diameter: 43.5 cm

Average base diameter: 27 cm

235	P 0112	AT 2
236	P 1652	MP P 360
237	P 1653	MP P 223
238	P 1453	MA 460

Variety 24.4_b: Large dimension

Average rim diameter: 59 cm

Average base diameter: 33 cm

239	P 0001	AI 1
240	P 1620	MP 443

Variety 24.5: Pithos decoration with plastic band with incised arrows.

Rim diameter: 36 cm

Base diameter: 30 cm

241	P 1587	MB 2
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TYPE 25: Pithoi with ovoid or globular profile. Rounded shoulder and walls tapered towards the base, narrow compared to maximum expansion. Long, distinct and generally cylindrical or with walls concave neck. Everted rim with lip with a triangular or rounded profile. Two vertical handles at the middle of the neck to the shoulder. Handles usually provided with an apical plastic termination. Flat base. (Pls 75-81)

Variety 25.1_a: Plain pithos

Average rim diameter: 24.5 cm

Average base diameter: 21 cm

242	P 1467	MA Inv. 586
243	P 0019	AP 402
244	P 1701	PK Inv. 29

Variant to 25.1_a

245	P 1848	PK 16/05/203/V001
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Variety 25.1_b: Large dimension

Average rim diameter: 40 cm

Average base diameter: 17 cm

246	P 1928	TB Jar 2
247	P 1406	KI Inv. 1112
248	P 1405	KI Inv. 922A

Variety 25.2: Pithos with horizontal grooved decoration on the shoulder (generally four ridges) made directly on the surface of the vase on shoulder. Handles without apical plastic termination.

Rim diameter: 44 cm

Base diameter: 26 cm

249	P 1459	MA 494
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Variety 25.3_a: Pithoi with composite decoration of two horizontal grooves (generally composed of four ridges) and a wave line between them.

Average rim diameter: 47 cm

Average base diameter: 24 cm

250	P 2016	UG 3
251	P 1462	MA Inv. 611
252	P 1455	MA Inv. 210
253	P 1457	MA Inv. 589

Variety 25.3_b: Large dimension

254	P 2009	TS P 939
255	P 1150	AD 1368
256	P 1458	MA Inv. 75/2

Variant to 25.3: Pithos with globular profile.

257	P 1435	KP TA 415
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TYPE 26: Pithos with ovoid profile. Rounded shoulder and walls tapered towards the base, narrow compared to maximum expansion. Long, distinct neck with concave walls. Everted rim with lip with rounded profile. Two horizontal handles on the shoulder. Flat base. (not in Plate)

258	P 1085	PK 14/04.1/R7/OB017
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4.6. Frequency Type and Varieties distribution

According to the typological classification proposed above it is possible to underline some preferential distributions of Types and Varieties in the Mediterranean regions under examination.

A large quantity of materials analysed comes from Cyprus and Crete; the Italian complete pithoi are less in comparison to the others. For that reason, the comparison among the archaeological data risks to remain partial.

The graph below (Fig. 4.5) shows the total number of Types and Varieties identified (67 in total) in the typological classification and their distribution in the Cyprus, Crete and Italy. Types and Varieties usually gather specimens coming from only one area, except in two cases (see *infra*) in which they collect material coming from both from Crete and Cyprus (the categories Cyprus-Crete in the graph). The graph also presents the Kythera import retrieved in Kommos and the probable Palestinian pithos found in Pyla.

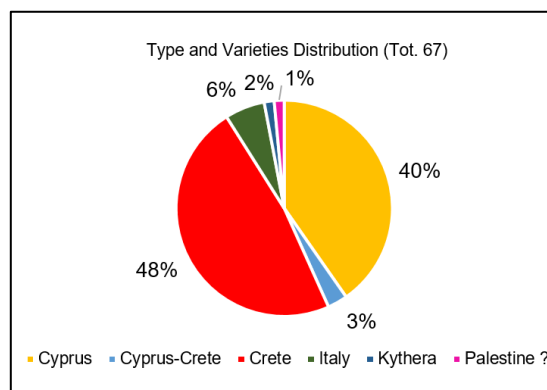


Fig. 4. 5 Type and Varieties distribution in the Mediterranean

The classification is based on the six levels presented above. Starting from the third level of the classification, five typological families were identified on the basis of the profile articulation (no-articulated profile or articulated profile) and the presence or not of a distinct neck.

Typological family	Description
I Typological family	Pithoi with non-articulated profile, without neck and wide mouthed.
II Typological family	Pithoi with articulated and restricted profile, without neck and wide mouthed.
III Typological family	Pithoi with articulated and restricted profile with short neck.
IV Typological family	Pithoi with articulated profile and distinct short neck
V Typological family	Pithoi with articulated profile with long distinct neck

Tab. 4. 1 The Typological families identified and their description.

Considering the 67 Types and Varieties identified in total (Fig. 4.6), it is possible to note that the fourth one – which includes *pithoi with articulated profile and distinct short neck* – gathers the greatest number of types and varieties. This means that pithoi with articulated profile and short distinct neck are the most common storage vases found in the LBA Mediterranean. This family, however, is completely absent in the LBA Italy.

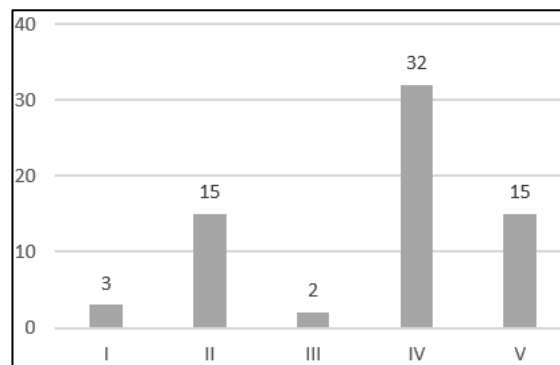


Fig. 4. 6 Number of types/variants for each typological family, on the X-axis there are the Typological families and on the Y-axis the number of Types and Varieties for each family.

Taking into consideration the geographical distribution of these typological families and their relative types/varieties it is possible to identify some specific correlation (Fig. 4.7).

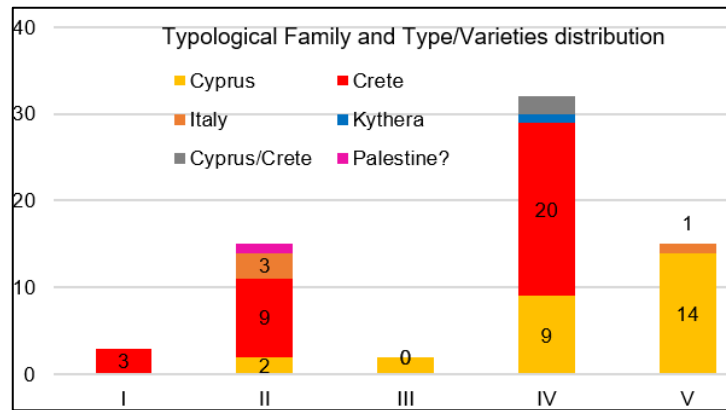


Fig. 4. 7 Type Variant distribution in the Mediterranean and their quantity for each Typological family. On the X axis the typological families and on Y axis the number of type and varieties. The numbers represent the quantity of type/varieties for each family.

The first typological family, for example, recurs only in Crete. It gathers pithoi with non-articulated profile and truncated-cone shape. They are all small-sized wide mouthed vases (Type 1, 2 and 3).

The second typological family – *with pithoi with articulated and restricted profile, without neck and wide mouthed* is more widespread in Crete (9 Types/Varieties) than in the other regions (3 Types/Varieties). The two no-necked types from Cyprus, classified in the second typological family, are, until today, very uncommon in the general panorama of Cyprus: this family gathers in total only three vases (Type 4 and Type 6). The preferential trend of short-necked or long-necked pithoi seems confirmed. In this family is classified also the only probable Palestinian imports retrieved in Pyla (*Unicum 1*, § 8.5.1.7).

The Italian pattern situation is more complicated because of the low availability of complete specimens. However, with the exception of the RBA pithos from Monte Belvedere (Variety 24.5), all the Italian pithoi (both RBA and FBA) belong to this second typological family.

The third typological family - *pithoi with articulated and restricted profile with short neck* - is spread only in Cyprus. It gathers short-necked pithoi with a squat shape.

As mentioned above the fourth typological family gathers the greater number of types and varieties. Most of them (20 types/varieties) come from Crete where vase with short necks – either small/medium or big-sized – provided with handles are the most common types of pithoi. This family is present also in Cyprus with nine attestations. The Kythera pithos retrieved in Kommos belongs to this family as well.

The fifth typological family – with specimens with long and restricted neck – is attested only in Cyprus (14 types/varieties), with the exception of the aforementioned RBA pithos from Monte Belvedere.

To sum up, pithoi without or with short neck, and thus wide mouthed (Typological families I, II and IV), are more common at Crete than in the other regions under analysis. In Cyprus the pattern is totally different: there is high spread of vases with a distinct neck either short or long. The Italian specimens all fall into the second typological family (with the exception of the Italian pithos from Monte Belvedere – Variety 24.5).

It seems important to underline again how all the types and varieties (67 in total) usually gather specimens from the same Mediterranean region. This means that the vases produced in each region display different formal features associated in a very characteristic way. Only in varieties 17.1 and 20.1 there are pithoi from two different Mediterranean regions (Fig. 4.7). These two varieties are in any case characterized in great majority by pithoi from a single region. In the case of 17.1 the variety is “Cypriot” with the inclusion of only few Cretan vases. Variety 20.1, *with plain short-necked pithoi with two horizontal handles*, is less copious than the previous one and collects two Cypriot and four Cretan pithoi. The presence of horizontal handles set on the shoulder, however, is more common in Crete than in Cyprus where pithoi usually present two vertical handles.

4.6.1. Chronological Types' Distribution

Regarding the Types and Varieties chronological distribution, the situation is more complicated. This is a direct consequence of the formal typology just elaborated. Considering a wide geographical area in the creation of the types, greater attention was put to general formal attributes rather than to other elements (e.g. variation in the shape of rims or in the decoration layout) generally useful in the elaboration of chronological grids or in the identification of regional micro variations.

Moreover, we have to consider that some types seem to be long-lasting and diffused during the 14th, 13th and 12th century BC. Pithoi are indeed less sensitive to chronological variation than tableware and – thanks to their resistance – they could be used for many years, passing from generation to generation.

However, some types and varieties mainly gather vases coming from a single site or context with a short life span, such as for example Pyla and Kavousu Vronda. These types allow more precise chronological references, even if the regional picture remains partial for their very local character. For those types which occurrence is only represented by one vase, generalisation is difficult both in terms of geographical and chronological distribution.

For what concerns Cyprus, the identification of chronological differences is challenging and would require a more detailed typology. Some types are present indeed, without any

discontinuity, in LCIIC-III A sites. None of them can be, at the present, undoubtedly ascribed to LCIIC or LCIII A.

Considering LMIII A-B Crete, pithoi belonging to the fourth typological family are very common. Generally speaking, indeed, ovoid specimens with short and distinct neck, provided with vertical or horizontal handles (or both), plain or with painted decoration, seem to be more common or exclusive in LMIII A-B contexts (i.e Types, 21.1, 20.2, 21.1, 21.2 and 22.1) rather than in LMIIIC. They come from Kommos and from Mochlos (settlement and cemetery). From Mochlos also ovoid specimens characterized by horizontal band or cordon – sometimes in association with serpentine bands – were found (Variety 22.2, 22.3, 23.2, 23.3). Most of the vases from Mochlos – Settlement and Cemetery – display also drops of paints on the body (Variety 20.4, 23.4). From the second typological family, Variety 8.4 gathers two pithoi diffused only in LMIII A-B Mochlos.

Varieties 8.3, Variants 17.1 and 21.3 are exclusive of LMIIIB contexts (in particular at Sissi).

Some other types are, on the contrary, quite common in LMIIIC sites such as for example, Types 1 and Types 2 from the First Typological family. Until now, indeed, only one specimen from LMIIIB Sissi belongs to Types 2. They all come from Kavousi Vronda with the only exception of Variety 20.3 from Karphi.

From the Second Typological Family Variety 8.2_b, Type 10 and 12 are exclusive of LMIIIC. Type 10 and 12, however, gather one specimen each and therefore cannot be considered representative. The two pithoi are medium-sized ovoid, without neck and provided with handles on the shoulder. Decoration in Type 10 consists, of a horizontal plain band while in Type 12 there are series of horizontal bands with incised motifs.

Finally, from the fourth typological family, Varieties 15.4 and 19.1, and 20.3 gather only LMIIIC materials. They are small and big-sized vessels with ovoid shape and short neck, provided with at least two handles on the shoulder and sometimes also close to the base. The figurative pattern could be simple – characterized by horizontal plastic band plain or decorated – or more complex with a combination of horizontal and serpentine plastic band with incised decoration. The latter decoration recurs, in general, of medium and big-size specimens. Variety 15.4 is the exception with plastic arcs on the shoulder.

However, some Cretan types are long-lasting and specimens without or with short neck decorated with applied horizontal and serpentine bands are common both in LMIII A-B and C contexts.

4.6.2. The Italian pithoi: typological characteristic and the issue of their Aegean derivation

The issue of the Aegean derivation of the Italian pithoi was the subject of several studies (Vagnetti 1999, Guglielmino 1999; Bettelli 2002, Schiappelli 2003; Schiappelli 2013). They took into account technological and typological elements, but also took a functional perspective, analysing the storage facilities during the FBA.

Reconstructing the Mediterranean trade routes and establishing certain relations between Italian and Aegean materials remains however complicated. Vagnetti (1999) had seen in the Late Minoan (IIIB) the prototype of the first Italian production. With the next phase, however, the decoration with impressed grooves seems to relate Italian material more closely to Cypriot models. Moreover, Vagnetti underlines that the Cypriot influence could be linked not only to the type of decoration but also to storage practices. It is during this period that spaces (uniquely) devoted to host pithoi appeared in Italy.

In order to better understand the derivation issue, Bettelli (2002) and Schiappelli (2003; 2013) tried to work with pithos decorations. The table below briefly summarizes the decoration displayed on pithos's band and their location in the Mediterranean basin.

Italy	RBA	FBA	FBA	FBA	FBA	FBA	FBA	FBA	FBA
Greece		Corinh; Tiryms; Asine;	Corinth; Tiryms; Asine; Kastas	Corinth;	Corin; Tiryms;	Kastanas	Corinth; Asine	Corinth; Asine	
Crete	Phaistos; Sissi; Kharpi; Kavousi Vronda			Kavosoii Vronda; Kharpi*		Mochlos Cemetery	Kavousi Vronda; Gouves; Khalasmenos; Monastiraki; Katalimata	Mochlos; Mochlos Cemetery; Monastiraki Katalimata**	
Cyprus				Enkomi; Toumba Tou Skourou			Myrtou Pigades; Atheniou; Enkomi; Toumba Tou Skourou; Sanida		X
Anatolia	Troy		Troy	Troy	Troy				

Tab. 4. 2 Decorative patterns of clay bands (Bettelli 2002, Schiappelli 2013 and author elaboration).

*Impressed circles in Crete are usually disposed on horizontal rows. **Plastic cordons in Crete are generally decorated with finger impressions

Marco Bettelli, in his evaluation of the Aegean-derived/inspired pottery (2002, p. 106-113), analysed more carefully the chronology of all these types of decoration in the Aegean contexts. The first decorative motive, the plain band, could be compared with some specimens from Crete dating to the LMIIIB. The presence of some vases in LMIIIC contexts at Kavousi Vronda and Kharpi testifies the continued use on the island of this motive also in the later period. Further east, plain band are also common in the level VI late/VIIa at Troy corresponding to LH IIIA-B in Aegean chronology. In the same level pithoi could, however, bear also bands decorated with incised circles and triangles.

The same comparison with LMIIIB-C Crete can be made with bands with zig-zag or herringbone decoration.

The simple zig-zag decoration was also found in LHIIIC middle levels of Corinth and it was attributed to LHIIIC level at Asine without further specification. The decorative pattern with impressed dots was retrieved in LHIIIC developed at Tiryns while in Corinth they come from LHIIIC late levels (i.e. the terrace wall).

For the decoration with impressed grooved bands, as stated above, the best parallels come from LCII-III Cyprus, where this kind of decoration characterizes many medium and large size vases. A further comparison with Cyprus can be made with two fragments retrieved in Frattesina di Fratta Polesine. These fragments, unique until now in Italy, display an impressed figurative motif upon a clay band. Paola Càssola Guida interpreted the scene as a parade theory of (Cypriot) warriors. They were found on the surface layer and for that reason their attribution to LBA is still uncertain. However, if we accept their temporal collocation, the only possible comparison in LBA Mediterranean for this kind of decoration is in Cyprus and in particular in LCIIIA context (Bettelli 2002, p. 110-112).

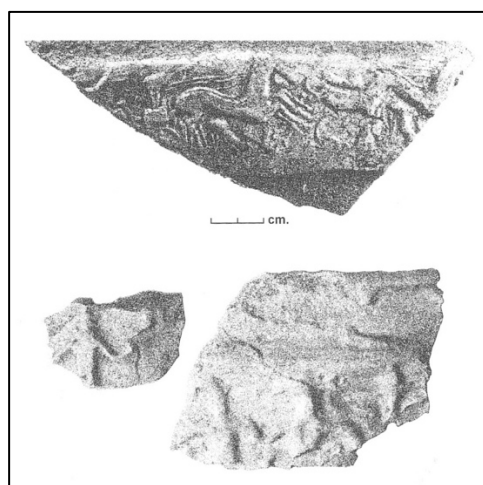


Fig. 4. 8 Pithos with figurative relief decoration from Frattesina.

Summing up all these evidences, RBA vases are characterised by plain bands, while the latter disappear in late RBA and early FBA, in favour of zig-zag and impressed circles bands. These last ones seem to be long-lasting and they remained in use until the advanced FBA. However, during the FBA the most common decorations are grooved bands.

The approach based exclusively on decorative elements⁵⁰ (Tab. 4. 1) without any kind of reference to the shape is not sufficient to solve in detail the problem of the Aegean derivation of Italian. However, given the actual state of research, it remains an important starting point for further investigation, especially if considered in parallel to technological and productive aspects.

As also showed by the present typology, indeed, the most significant feature for the RBA Italian materials is the presence of plain bands on the body. Plain bands are known, among the material analysed, only on LM IIIB-C Cretan specimens while they are totally absent in the Cypriot ones⁵¹. The low number of known RBA pithoi makes it difficult to evaluate other common elements between Cretan and Italian pithoi. At present, common features can be recognized in the generic barrel-like shape (no whole vases are noted in Italy) and in the presence of a flattened and everted rim with lip with a rectangular profile. In this scenario, plain bands remain therefore the main element that could actually support the hypothesis of a Cretan inspiration for the RBA materials; the other features described are considered too elusive to be taken as a proof in this direction.

It is important to stress that transfer did not only regard decorative features, but also the technological aspects. The aforementioned plain bands have indeed to be seen not only as simple decorative features but also as a technological expedient. A technological transfer has a more important weight than the simple adoption of a decorative style. Moreover, the technological aspect is extremely important in relation to the presence and circulation of specialized potters and not only of material goods (§ Chapter 8).

Differently from the RBA, the Italian FBA pithoi present grooved decoration similar to the one characteristic of the Cypriot ones. However, the shape is very different from the Cypriot pithoi, especially for the absence of a distinct (long) neck.

The change in style just described, together with the formal (and technological § 8.5.3) evolution of Italian pithoi, happening at the end of RBA and beginning of FBA, was part of a moment of great changes in the whole Mediterranean. This is the period of the collapse of

⁵⁰Most of the decorative motifs analysed have a long-life span and it is possible to find them associated in more complex patterns.

⁵¹Decoration with plastic bands is rare in Cypriot. The only vases known until now come from Toumba Tou Skourou, Myrtou Phigahes and Enkomi. In all the cases the bands are not plain but decorated with incised motifs.

Aegean palaces. After this – in the last part of LBA – Cyprus became, indeed, prominent in the Mediterranean maritime exchange. The presence of imported Cypriot pithoi (as well as few fragments belongs to the typical Base Ring II bowl and juglets and White Slip Milk bowls and the introduction of the iron technology as in Broglio di Trebisacce) in few Italian contexts (see *infra*) confirms the increased involvement of Cyprus in the maritime trade and a change in the trade routes.

Summing up, thanks to this typology – despite the production of Italian pithoi displays only few selective formal allochthonous elements – it is possible to confirm the derivation of the Italian pithoi from Aegean models. Their presence is therefore a clear indicator of the southern Italy participation in the Mediterranean networks during the LBA. Such contacts gave rise to new ceramic productions, intrinsically different from the local *impasto*. According to Vagnetti in the first phase of the production, the RBA, it is possible to recognize a major influence of Crete and the central Mediterranean while during the FBA the Cretan impact seems to decrease in favour of Cyprus (Vagnetti 1999; Bettelli 2002; Schiappelli 2003).

The Aegean-Cypriot influence probably also concerned the movements of Aegean potters (§ 8.5.3.7) especially in the first production phase (RBA). However, aside this Aegean-Cypriot influence, the development of this class of vases was also strongly related to the local dynamics and the socio-political development of interested communities. As stated in § 8.5.3, pithoi are indeed the only Aegean derived pottery class which remained in production for the whole FBA and also in the EIA, differently from the Italo-Mycenaeans and Grey ware, because of the pithoi major correspondence to local socio-economic needs.

4.6.2.1. Future research paths

Finally, the possibility that the other Aegean areas involved in exchange networks with southern Italy were somehow “responsible” for the beginning of the production of pithoi in Italy remains to be explored. In particular, the presence of Rhodian imports in the level corresponding to LHIIIA-C at Scoglio del Tonno (Apulia, Taranto) gives us a hint and suggests a further and future direction of investigation that includes the Dodecanese and paraps the western costal Anatolia.

As stated above, in Troy late VI/VIIa (LH IIIA-B), pithoi present plain clay bands on the body. This is the most spread feature, but there are also some vases which show band with incised/impressed decoration on the shoulder zone (Tab. 4. 2). Regarding the shape they are

generally handleless ovoid or piriform, but as the Italian ones they are without neck and with a restricted mouth in comparison to the maximum diameter⁵².



Fig. 4. 9 Pithoi from Troy VI Late/VIIa (Kibaroglu and Thumm-Doğrayan 2013)

4.6.3. Circulation of Minoan and Cypriot pithoi in the Mediterranean

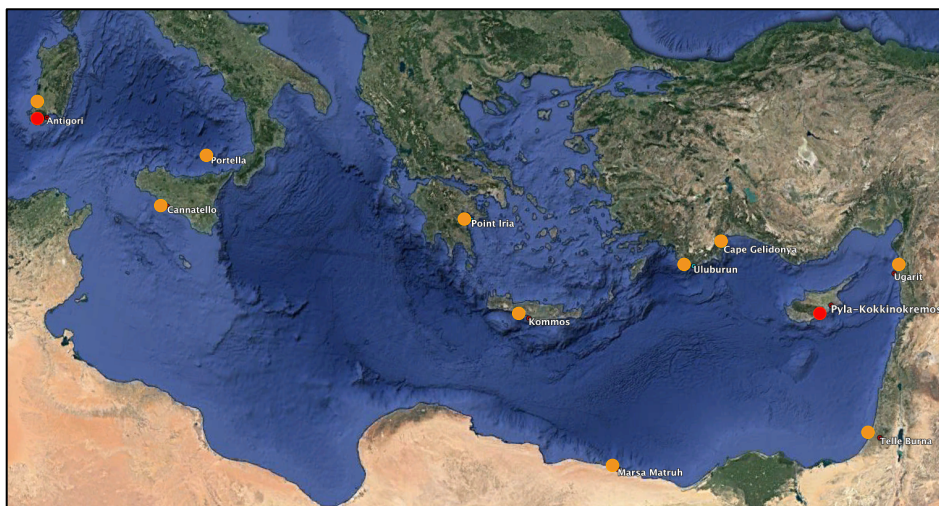


Fig. 4. 10 Distribution of Minoan (spot in red) and Cypriot pithoi (spot in yellow) in the Mediterranean basin.

Considering the circulation abroad of the types and the varieties identified, it is possible to observe how the Cypriot pithoi are more widespread in the Mediterranean basin than the Cretan ones.

⁵²All these features seem shared in a broad area. Pithoi used for burials in the Beşiktepe cemetery (dated to the transition from LHIIIA2 to IIIB/Transition VI late/VIIa) next to Troy (8 km distance) are similar to the Late VI/VIIa pithoi of Troy.

Typological Family	Type/ Varietis	Origin	Distribution
II	9	Crete *	SI, KK, PK*
IV	15.3	Cyprus*	MP, MM*
IV	17.3	Cyprus*	KO*, MA, AD, PK, MP, KI, MM*
V	24.1_a	Cyprus*	MP, AD, PK, AP, MM*
V	24.2_a	Cyprus*	PK, TB*. AP KO*,
V	24.3_a	Cyprus*	AP, PK, PI*, UG*
V	24.3_b	Cyprus*	AT, MA, UB*, UG*, PK
V	25.1_a	Cyprus*	MA, PK, AP, TB*
V	25.3	Cyprus*	MA, UG*, TS, AD, KP

Tab. 4. 3 Presence of Cretan and Cypriot pithoi in the Mediterranean according to the typological classification proposed above. The sites are presented with abbreviation of the catalogue while the * put aside identified it as an import.

The table above (Tab. 4. 3) summarized all the sites which presents imported pithoi.

Despite the great diffusion of Late Minoan pottery in the Mediterranean, and the circulation of truly Minoan transport vessels, such as the *Transport Stirrup jars* (FS 164), Minoan pithoi are not common. Until today Minoan imported pithoi are known only in few sites, despite being very easily recognizable – also when they are in small fragments – thanks to the complex and very specific decorative pattern. Hitherto, Minoan pithoi were found at Pyla and Nuraghe Antigori in Sardinia⁵³. The specimen from Sardinia is too small to allow a precise typological classification. However, the body fragment displays a typical Minoan decoration with bands with oblique notches and finger impressions. The chemical analyses available for the Minoan import from Pyla locate its origin in the north central Crete (Jones et Day 1987, p. 263), while the fragments from Antigori were produced in central Crete (Jones *et al.* 2014).

The absence of Minoan pithoi is noteworthy especially in some contexts (i.e. the Uluburun, Cape Gelidonya and Point Iria shipwrecks as well as in the site of Marsa Matruh) characterized by the presence of a huge amount of Minoan imported pottery. In the same contexts however, some of the Cypriot imported pithoi were retrieved. Despite the scanty number of Minoan pithoi could depend in part on study reasons leading to an underestimated picture, the greater circulation of the Cypriot ones seems a matter of fact.

Cypriot pithoi are present outside Cyprus in some of the main ports/centres of the LBA involved in the Mediterranean exchange routes. Among these, there are Kommos, Marsa Matruh and Ugarit. The importance of Cypriot pithoi in maritime trade is further confirmed by their use as

⁵³However, it is possible that in some cases they were not fully published (or recognized as pithoi) and that in the future we will be able to enrich our dataset.

containers in the Uluburun ship⁵⁴. Moreover, the recent excavation of Tell Burna (Palestine) – an inland site – points to the possibility that further research could enrich the picture (ASOR Annual Meeting, San Antonio, November 2016)⁵⁵.

Some of the Cypriot pithoi abroad were subject to chemical analysis. Petrographical investigation conducted on some Kommian specimens located the origin of P 1426 in the Enkomi region while the P 1432 (LMIII A2) was related to the Kalavastos or Maroni area (Limassol district⁵⁶) (Tomlinson et al. 2010; Jones *et al.* 2014). In addition to the specimens in the present typology, other Cypriot fragments were found at Kommos (C 4143 and C5770). In these last cases petrographical analyses associated their origin to the Kition area⁵⁷ (Tomlinson *et al.* 2010). Two Cypriot pithoi were also found in Antigori and the analyses show that they were produced in the area of central and south-central Cyprus (Jones *et al.* 2014). Two specimens from Portella-Salina (they could be the same vase since their chemical composition is very similar) were analysed as well as seven from Cannatello⁵⁸ (Jones *et al.* 2014). The ultrabasic volcanic rocks and fossiliferous clay suggest an association with the Troodos ophiolite in south-central Cyprus in accordance with the Antigori's fragments. Regarding the Burna specimens petrographic and chemical analyses showed that P 1827 was probably produced in the east costal area of Cyprus while the second P 1828 relates, once again, in the south-central coast.

Until today, therefore, the great majority of Cypriot imported pithoi analysed seems to have their origin in the area of the Limassol district where the sites of Kalavastos and Maroni flourished during the 13th century BC. The pithoi analysed from Antigori, Cannatello, Salina, Kommos and Burna are indeed compatible with this area. To these it is possible to associate at least three specimens from Point Iria and probably one from Uluburun (Jones *et al.* 2014). The harbour town of Kommos represents an exception, where a more variegated situation emerged. The presence of pithoi associated with different Cypriot regions confirms its importance – as port of trade – and its entanglement in the LBA Mediterranean networks.

⁵⁴For the other two relicts, it is impossible to ascertain if they were part of cargo or they were used as containers.

⁵⁵In the site a Cypriot White Slip bowl and a Base Ring juglet were also found.

⁵⁶Pithoi coming from the central and south-central Cyprus are characterized by sand-sized fraction dominated by material derived from basic igneous rocks, primarily pyroxene, amphibole and some rounded basalt.

⁵⁷In that area, in addition to the Kition site, two additional ones flourished: Hala Sultan Tekke and of course Pyla.

⁵⁸In the ongoing excavation project in Cannatello thanks to the review of all the material coming from the older excavation, new analyses were made on some Cypriot pithoi. The results of the analysis made by Valentina Cannavò confirm that all the Cypriot pithoi retrieved in the village (and analysed so far) come from south-central Cyprus (Levi and Vanzetti personal communication).

I would like to conclude considering that exactly the general low circulation of pithoi – if compared with other pottery classes – make their presence in an allochthonous context particularly significant and probably indicative of its role in the international trade routes.

4.6.4. The Road to the Western lands

An additional aspect to be considered concerns the presence of Cypriot pithoi along what represents a southern route which linked the eastern Mediterranean and the Aegean with the West. It was particularly active since the LHIIIB phases and involved in great instance, as in the previous phases, the Cypriot component.

This route reached Sardinia passing by the southern coast of Sicily. In both the islands Mycenaean, Minoan and Cypriot imports were indeed found.

A further validation of the importance of this route, and of the main involvement of Cyprus in the network, is provided by the presence along the path of Nuragic pottery. Indeed, Nuragic pottery was identified in Cannatello (Sicily) – both imported from Sardinia and locally made (Levi and Vanzetti personal communication) – in Kommos (only in LMIIIB contexts) and finally at Pyla-Kokkinokremos (Fagnoli *et al.* 2010). The Nuragic pottery retrieved in the Mediterranean belongs, in general, to closed shapes, jars sometimes provided with the so-called *anse a gomito a rovescio* typical of the Sardinia RBA. In Kommos also some open shapes were found, mostly bowls (*conche* in the Sardinian terminology) (Watrous 1992; Rutter 2006).

Considering the diffusion of pithoi, the overlap between Cypriot pithoi and Nuragic pottery in Cannatello, Kommos and Antigori is very interesting⁵⁹. They, indeed, provide a clear indication of specific trade paths and their change over the time.

⁵⁹In the last site a Minoan pithos was also found as happened in Pyla.

5. THE USE OF PITHOI

5.1. Introduction

In the study of pithoi, the functional aspect is already prominent in the definition of the class itself. Pithoi are in fact vases generally used to store arid, solid and liquid foodstuffs or other commodities. However, the generic storage function includes, for example, different modes of storage: short, medium and long-term storage. Beside the static storage, pithoi could also be used as transport vessels over short, medium and long distance.

For these reasons, this chapter will provide with a more detailed functional analysis in order to isolate all those elements that could allow a deeper understanding of the real function performed by pithoi and therefore also have a better understanding of the context from which they come from.

The function performed by a vessel can be investigated in several ways. Direct evidence comes from the analysis of the technological, morphological and stylistic features of the vessels. Additional information can be found indirectly through the analysis of the archaeological context in which they were found, the comparison with written and figurative sources and finally with the ethnographic analogy.

Two levels of investigation will be addressed in this research. The first level concerns the analysis of the use of the vessel (primary use, secondary use and re-use). For this first level a series of stylistic, technological and morphological parameters have been selected that can be useful in identifying the hypothetical function of the vase. Moreover, in order to understand the real use performed by pithoi, analyses of the organic residues were performed on some of the pithos fragments retrieved in Pyla-Kokkinokremos and Broglio di Trebisacce.

The second level of investigation will be presented in the following Chapter 6 and concerns the analysis of the archaeological context where pithoi were found in the three sites under analysis.

5.2. Intended functions of pithoi

Pithoi could be used to conserve and transport a very broad range of substances and stuff. In some classification it is still common to distinguish *a priori* between pithoi (large vases) and small-medium size storage jars (or small pithoi): this distinction goes beyond the dimensional and typological aspects pointing to a functional difference between, respectively, static intra-site conservation and transport (Pedrazzi 2003, pp. 452-453). However, despite the dimensions do affect the possibility and the way in which a vase could be moved, this

distinction seems rather schematic. Several factors aside the dimensions need to be considered in the differentiation between vases used for static storage and transport (see *infra*).

5.2.1. Storage function

A variety of storage methods could be identified both in domestic settings and in supra-domestic or centralized institutions (i.e. palaces and temples).

In general, it is possible to assume that different storage methods are related to the type of substances stored and to the necessity of long, middle or short-term storage (and use) of specific products (Rice 1987, pp. 208-210; Pedrazzi 2007, p. 232; Thalmann 2007, p. 226).

Pithoi of different shapes and dimensions were, indeed, used in short, medium, or long-term storage of several products both in domestic contexts and centralized storehouses. Storage length depends on the type of substance pithoi had to contain and on its conservation needs. Moreover, each substance had to be stored in the best way until its consumption. For this reason, researchers identified different methods of sealing the vases that may include the presence of textile, wooden, stone or clay lids, perhaps secured to the rim and to the handles of the vase by means of cords. It was also necessary to coat the inner walls of pithoi and jars with pitch, tars or beeswax in order to protect the contents and guarantee a longer conservation (Margomenou and Roumpou 2011).

5.2.2. Transport function

Pithoi were also used to transport and trade substances and stuff over short or long distances. Short-distance transport occurred, generally, inside the same settlement in order to move water or other (frequently-used) substances. Long-distance transport is related, on the contrary, to the regional or international movement of stuff. One example of regional circulation is the one active in the Sybaris Plain during the LBA. The petrographical analyses carried out by Levi (1999) permits indeed to ascertain that some specimens retrieved at Broglio⁶⁰ were produced in the southern part of the plain about 20 Km far from the site.

Moreover, thanks to the underwater excavation of the Uluburun relict, sunk at the end of LHIIIA2 near Cape Kaş in Turkey, we have evidence of the international trade activity over (maritime) long-distances. The ships provided a clear snapshot of the way in which pithoi and

⁶⁰Analyses conducted on some specimens retrieved in Broglio show that up to 30% of pithoi in the RBA and 20% in FBA were produced in the southern Plain of Sybaris (Schiappelli 2003; Jones *et al.* 2014, p. 457).

jars were used on the ships. The excavation also gives a more detailed comprehension about substances transported and traded during the LBA in the Mediterranean. Apart from metals – the main part of the cargo – several organic products were transported. The most widespread organic product onboard was the terebinth resin (*Pistacia atlantica*), totalling roughly one ton. Besides the terebinth, there were also orpiment and hundreds of murex opercula, dispersed among the *oxhide* ingots⁶¹. Other organic products have also been found: spices, including coriander (*Coriandrum sativum*), black cumin (*Nigella sativa*), safflower (*Carthamus tinctorius* L.), sumak (*Cyperus coggygria*) and remnants of food products such as olive stones, figs and pomegranates seeds, almonds, toasted barley, wheat and fruit, part of which was probably also intended for the sustenance of the crew members (Pulak 2008).

The most interesting information for the present research is that on the Uluburun ship pithoi were also used as multitask containers, loading a wide set of pots, objects and paraphernalia, stored in a safe place (see *infra*). Organic substances were instead mainly transported inside the 150 Canaanite Jars retrieved on board.

5.2.3. Burials use (or reuse)

The main secondary use of pithoi concerns their use as urns for the deposition of human bodies (*enchytrismòs*). In general, pithoi were used for inhumations of sub-adult individuals. However, there are also testimonies of tombs of adults deposited within pithoi as attested in the LMIIIA-B cemetery of Limenaria⁶² (Mochlos) (Soles and Davaras 2011).

The use of pithoi as burial containers is well attested also in the Aeolian Island during the FBA (e.g. Piazza Monfalcone at Lipari, Bernabò Brea and Cavalier 1960) and in the north-eastern Sicily in the area of Milazzo and Messina since the MBA (Schiappelli 2003, Martinelli 2010, Veca 2015).

5.2.4. Secondary use and re-use of the vessels

A vessel can also be used to perform a different – additional – function with respect to the one for which it was designed and constructed. Secondary functions can usually be inferred on the basis of the finding context.

Due to the wall thickness and to the general resistance to mechanical shocks, pithoi and pithos fragments were frequently re-used as building material.

⁶¹According to what was stated by Pulak (2008), these were probably contained in containers of perishable material which, dissolving over time, led to the dispersion on the rocky bottom of the opercula.

⁶² In this a pithos side had been sawn to allow the body deposition inside it. .

An interesting form of reuse of pithoi has been attested in Crete where they were used as chimneys, as attested in the LMIC site of Kavousi Vronda in Building C (Soles *et al.* 2008)⁶³.

In the Central Hut at Broglio a big pithos fragment was used in connection with the hearts – as firewalls – located in the centre of the hut (Vanzetti personal communication). Finally, the upper part of pithoi was often also reused as well-curb (Guglielmino 1999, pp. 480-481).

Pithos sherds can also be used as potsherd pavements in the preparation of hearths or insert with other building materials in the walls as attested in Broglio di Trebisacce in Sector 7 (Schiappelli 2003).

Moreover, in some cases large base fragments of pithoi were cut and re-used as lid or pot stand for other vases.

Vases were frequently mended with the use of metal (lead) clamps⁶⁴. In the case of pithoi which economic value was higher than other types of vases – due to their demanding production – repairs were common. Several pithos fragments with repaired holes were indeed retrieved in Broglio di Trebisacce. In Pyla there were not direct findings, but anyway, Trench 3.1, Space 2.1 hosted several lead clumps which point to the existence of the repair practice.

5.3. Parameters used in the identification of pithos functions

The function of a vessel can be determined by considering several direct (*technological, morphological and stylistic features of the vessel; painted or incised signs on the vessels surface and analysis of the organic residues*) and indirect (*written sources; archaeobotanical data and comparison with ethnographic contexts*) aspects (Rice 1987; Christakis 2005; Pedrazzi 2007).

5.3.1. Technological, morphological and stylistic features

Thanks to the improvement of the technological studies of pottery, is it possible to identify and relate technological features to the fulfilment of specific tasks. In this respect it is necessary to think that the technological choices made by a potter during the production of a vessel can be not casual but designed specifically to make the vessel suitable for a specific task, set aside stylistical or equi-functional aspects. The type of clay and the presence of temper influence mechanical and chemical proprieties of the vase. In relation to their function, pithoi needed to

⁶³Actually, the practice of using pithoi as chimney is also frequent today in some rural village of Crete.

⁶⁴The presence of these holes could make the vase less adapt to hold liquid that could spill outside but still useful for example in storing arid stuff. It was also possible that holes were closed with resins or wax.

be resistant to mechanical shock and were thus generally produced with calcareous clay fired at high temperatures. A set of not-clayey elements were added to clay to diminish plasticity during processing, shrinkage during drying and cooking.

The visual analysis of the shape of a vase and the identification of meaningful morphological elements is certainly the first step in the investigation of its function. The presence of certain elements assures some specific morpho-functional properties (Juhl 1995; Recchia 1997; Christakis 2005, pp. 46-50; Pedrazzi 2007, pp.233-246).

1. *Stability*: it is strictly connected with the way in which a pithos can be stored. Some elements are related to necessity of increasing stability and therefore when present could point to (long-term) static storage in a specific environment. The morphological elements associated with a high standard of stability are essentially (Christakis 2005, pp. 46-50; Pedrazzi 2007, pp.233-246):

- Flat base (not restricted)
- Centre of gravity towards the middle of the vessel and a balanced relationship between height and maximum diameter.

Pithoi with a restricted base in comparison with the maximum diameter were probably at least partially sunk or were suitable for frequent movements. In fact, a restricted base could make the movement of the vase easier, especially when it is very big, since it allows to revolve it. The complete incorporation of pithoi, up to the rim, in the floor level, is related to the maintenance of the right thermic and micro-environmental conditions for the conservation of the products. On the contrary, an unrestricted base gives more stability to the vase that can be stored free-standing. Also the presence of a spout or a hole in the lower part of pithoi (generally used to spill the liquid content outside) as well as that of handles, provides clues, in favour of their free-standing position.

2. *Graspability*: the possibility of handling and transporting a vase provides clear indications about its intended use. Elements to consider in the portability of a vessel are:

- General size and weight of the vessel (empty and full)
- Presence, number and position of handles
- Presence and size of the neck. Furthermore, the presence of a (long and restricted) neck prevents the leakage of liquid outside.

3. *Accessibility to the content*: the accessibility and manipulation of the contents is conditioned by many morphological and dimensional factors (Pedrazzi 2007, p. 235):

- Mouth diameter

- Presence, size and shape of the neck
- General size of the vase
- Presence of handles

The different degree of accessibility is proportional to the frequency with which a product must be available and also affects how the product should be introduced in or extracted from pithoi (directly, by spilling or through the use of ladles). Therefore, the presence of handles is an indication of the need to grasp the vessel to overturn it for example to pour its contents.

The mouth shape – more or less restricted – of a vase also determines what kind of substances can be stored according to their preservation needs.

The shape of the rim influences and facilitates the pouring operation as well as the sealing of the vase. The presence of the neck (and therefore of a restricted mouth in respect to the maximum diameter) can be linked to the necessity to avoid the risk of liquid spill or to the need to seal the vase in order to protect the content.

4. *Capacity*: corresponds to the quantity (and in part also the type) of the substance that the vase can contain, to the length of consumption and use of that substance and to the number of consumers (Christakis 2005, p. 47; Pedrazzi 2007, pp. 236-241; Thalmann 2007; Thalmann and Sowada 2013). The evaluation of the capacity of storage vessels is very important from several points of view. It provides indeed economic information: in first instance it permits to ascertain the degree of dimensional standardization of the vases (types and varieties) and to determine a relation between specific measures of capacity and formal types.

Moreover, it provides information about their intended use: big vases with high capacity, are, for example, generally used to hold a large amount of stuff and they are less subject to transport than smaller and handier vases.

Functional elements may also be charged with stylistical features, in a complex mix of characters, making the case a little bit more complicated. Pithoi are often characterized by a complex decorative pattern composed by ropes and bands. Usually, some of these ropes and bands are localized in the joint point between rim/neck and the shoulder or in the other main morphological (and manufacture) joint points on the vessel body. Bands and cordons have therefore a static function and reinforce the vessel in its weak points.

These decorative patterns led some scholar (Guglielmino 1999; Schiappelli 2003) to suggest that they were replicas of real cords used to safe the vase or to seal it with a lid. In this respect it also possible that clay ropes and bands may have functioned as the anchor point for the real cords.



Fig. 5. 1 Pithos with rope decoration from Mallia (Crete) (Langhor 2017, p. 255).

5.3.2. Painted or incised signs on the vessels surface

Some containers were engraved, painted or imprinted (before or after cooking) with signs that provide information about their contents or their capacity. Doumas and Costantinides, for example, (Doumas and Costantinides 1990, pp. 41-43) pointed out that the complex association of painted signs visible on the wall of big Theran pithoi indicated the capacity of the pithos itself. The capacity of the pithos was therefore indicated by the number of times the sign appears on it. Moreover, it is likely that the basic shape of each sign could be related to the type/quality of the substance stored (Fig. 5.2).

Some Cretan pithoi such as, for examples, the ones in the West Magazine Complex of Knossos, bear on their wall the wine ideogram providing thus the description of their main content (Palmer 1994, pp- 27-43; Christakis 2005, p. 60).

In southern Italy up until today only one pithos bearing a sign have been found: a FBA specimen from Roca Vecchia with an incised X on the rim (Guglielmino 1999, fig. 8). The unicity of this discovery makes its comprehension difficult. Guglielmino suggested, in comparison with the Aegean evidence, the possibility that the X was related to the capacity of vase (Guglielmino 1999, p. 484).

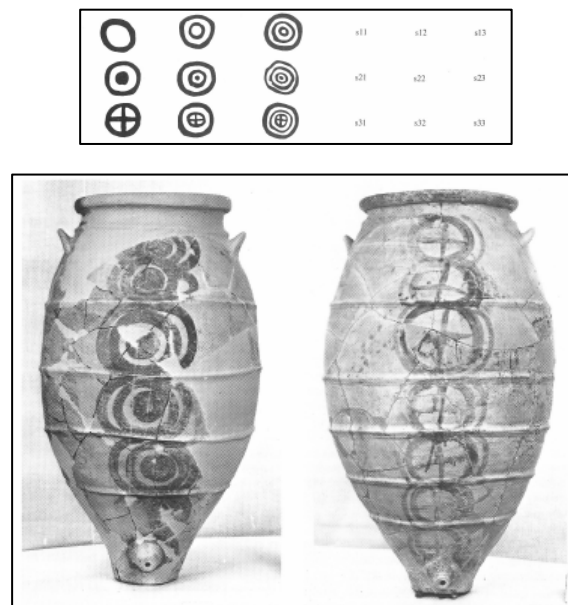


Fig. 5. 2 Matrix with signs identified by Dumas and two Theran pithoi with painted signs. (Dumas and Costantinides 1990, pp. 41-43).

5.3.3. Analysis of the organic residues

The crucial issue of pithoi contents is tricky for the problems concerning the conservation of organic substances in the archaeological deposit.

Despite the presence of labels, signs or “speaking” morphological features, which can give hints about the function performed by a vessel or the type of substance contained, a definitive identification of the vase’s use is possible only through the chemical analysis of the organic residues. In addition to organic residues trapped inside the pot’s walls, in luckier – but rare –, cases, the environmental conditions have favoured the direct conservation of seeds, fruits and kernels inside the vessels. Their presence provides of course a clear indication, at least, of the last function performed by the vessel and of its contents.

Regarding the contents, in theory the spectrum of substances that can be stored inside pithoi is potentially infinite. Both in domestic and centralized magazines several kinds of foodstuff like grains, flours or legumes can be conserved for a short or medium period of time inside pithoi and jars⁶⁵. Pithoi can be used to store for a medium-long period of time also various types of vegetable oils (olive, sesame, castor and almonds) or animal fats as well as wine and beer. Archaeological findings and analyses of the organic residues have allowed to verify the

⁶⁵The long-term conservation of these substances takes place frequently also in underground silos or plastered containers under airtight conditions. Silos and granaries allowed better protection against humidity and the action of micro-organisms.

conservation inside clay containers also of animal and fish food products as well as of fruits or honey (Guglielmino 1999; Schiappelli 2003; Christakis 2005, pp. 50-52; Pedrazzi 2007, pp. 247-250).

Pithoi were also used to collect rainy water and to conserve scented oils and ointments used for medical or hygienic purpose as well as in funerary and ritual performances.

Finally, pithoi were used as containers to store tableware or stone and metal tools inside the domestic units or in artisanal areas (Watrous 1992; Bartheleim 2008).

In archaeology, the organic remains trapped in the vessel's walls or fouling can be identified through the following techniques:

- IR/ FT-IR (infrared spectrometry): Fourier transform infrared spectrometry
- GC/MS: gas chromatography/mass spectrometry
- HPLC: high pressure liquid chromatography

FT/IR is often used to preliminarily verify the presence of organic residues in archaeological materials, before a more in-depth gas chromatography analysis. In the present research, the analysis of Broglio fragments (§ 5.3.1.3.) has been performed through a gas chromatography first and then through HCPL to increase precision in the identification of the organic substances. However, despite these analyses are essential for the study of archaeological artefacts, results are often ambiguous or difficult to interpret in archaeological terms (Mc Govern 2004; Evershed 2008). As a first element it must be emphasized that a vase can be used in the course of its life in different ways or contain different substances (both as a case of multi-functional intended use or of eventual use vs. intended use). This overlap of substances can generate a palimpsest, making it difficult to read the spectrogram. Furthermore, many substances are similar and the identification of each of them can be problematic.

Working on archaeological artefact that have been underground for long time, also post-depositional phenomena linked to the permanence of the vases in the archaeological deposit can influence the degradation of the substances and therefore compromise their identification.


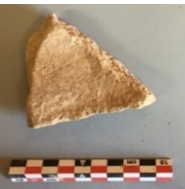


5.3.3.1. Pyla-Kokkinokremos: analysis of the organic residues

The five samples analysed (Tab. 5. 1) were selected from the thousands of pithoi retrieved at Pyla so far. Despite base fragments should be preferred, in the case of storage vases, for the higher residuals' concentration, all the fragments selected are body walls. It was not possible to select base fragments due to conservation reasons, according to suggestions received from the Museum of Larnaka District, responsible for Pyla site.

The analyses were performed by Maria Roumpou at the Fitch Laboratory in Athens.

The extraction of lipids fraction from the samples were done using combined gas chromatography – mass spectrometry (GC/MS) with a Hewlett Packard 6890 series II gas chromatograph connected to a 5972 mass selective detector.

The samples selected come from each of the main sectors under excavation and belong to vases of different shape and dimension. The aim is indeed to try to identify both the existence of potential differences in the substance stored in the areas of the settlement and to underline a specific relation between the type of vase and its content. We are aware in this sense of the necessity to increase the number of samples in order to have a better understanding of the storage management in Pyla but this first sampling give us precious information.

Photo		Sample
	Body wall	PK 16 Vase 2 Sector 4.2 Room 2, level 2 PYKO01 P 1830
	Body wall	16/03/5108/OB 005 Trench 3.3 Space 3.12 PYKO02 P 1729
	Body wall	16/03/5102/OB 003 Trench 3.3 Space 3.12 PYKO03 P 1728
	Body wall	16/05/00203/OB001 Sector 5, Space 11 PYKO05 P 1848

Tab. 5. 1 Samples for residual analyses from Pyla-Kokkinokremos.

The analyses permit to ascertain that four of the five pithoi analysed present a similar compound. PYKO01 (P 1830) presents instead a different chemical pattern. All the fragments present contamination from post-excavation but this did not compromise the organic residues conservation of the contents.

GC/MS underline the presence of both cholesterol and β -sitosterol in almost all the samples analysed. All these components were related to the presence inside the pithoi of substances

both plant and/or animal origin. The results obtained, however, do not allow to understand more precisely the original contents of the vases and a sure association between formal type and contents. At present, it is possible that a mixture of lipids and resins was used as a sealant, or that vegetal resins were added to the material present inside the pithoi analysed, as a preservative. In three samples (PYKO02, PYKO03 and PYKO04) compounds characteristic of plant lipids (*n*-alkanes and *n*-alcohols) were present. In these last cases it is possible that those substances indicate on the contrary the storage of plant derived products in the vessels.

5.3.3.2. Broglio di Trebisacce: analysis of the organic residues



The five samples analysed (Tab. 5. 2) were selected from the numerous pithos fragments datable to RBA and FBA retrieved in the most significant contexts of the site of Broglio di Trebisacce.

Pithos D (Peroni and Trucco 1994) was already analysed at the beginning of '90 by Professor Renato Peroni (Peroni 1994, pp. 855-859). It was sampled again because of the importance of the context where it was found (Pithos Storeroom 1) and to check the results obtained with a new chemical approach.

The analysis of organic residues was performed through gas chromatography/mass spectrometry (CG/MS) and high-performance liquid chromatography/high resolution mass spectrometry (HPLC) by Professor Erika Ribechini and Dr. Jeannette Jacqueline Lucejko at the Department of Chemistry and Industrial Chemistry of the University of Pisa (Lucejko *et al.* 2018).

In accordance with the indications provided by the analysis laboratory, fragments pertinent to the bottom of the vessel were preferably chosen, because impregnations were proportionally greater there.

The analysis was carried out by pulverizing a very small quantity of sample taken both from the external surface and from the internal surface of each fragment. The analysis of the fragments outer walls residues provided information concerning the contamination of the soil lying on the samples under analysis and verified the veracity of the residuals found inside the vessel.

Photo		Sample	Chrono
	Body wall	BT 98 Inv. 6745, Sector 2 US 2363 P 0448	RBA
	Base	BT 00 Inv 8824, Sector 7 US 7073 P 0555	FBA
	Base	BT 00 Inv.8548, Sector 2 US 2363 P 0541	FBA (Probably imported from the southern Sybaris Plain)
	Base	BT Inv. 810 (Pithos P), Sector 2, Pithos storehouse 2 P 0183	FBA
	Body wall	Pithos D, Sector D north Pithos Storehouse 1 P 0935	FBA

Tab. 5. 2 Samples for residual analyses from Broglio di Trebisacce.

In all the examined cases, except in P 0448, the contamination of the environment can be considered secondary if not totally negligible compared to the organic residue actually contained in the vessels. In P 0448, on the other hand, no traces of organic substances were found except those coming from the external environment.

CG/MS was used as a preliminary test in order to verify the presence of the fatty acids and to characterize their profiles. HPLC/ESI-Q-ToF was then used to further investigate the lipid fraction of only those samples that showed evidence of ricinoleic acid in the fatty acid profile.

The analyses with HPLC/ESI-Q-ToF were indeed performed as part of a more general project carried out by Professor Erika Ribechini and her team focused on the comprehension of acyl-glyceride composition as well as on to identification of ergot fungi (*Claviceps*) traces⁶⁶.

⁶⁶Also sherds from Domusde Janas IV, in the necropolis of Molia (Sardinia) and stone vessels from Entella (Sicily) were analysed in addition to the Broglio samples (Lucejko *at al.* 2018).

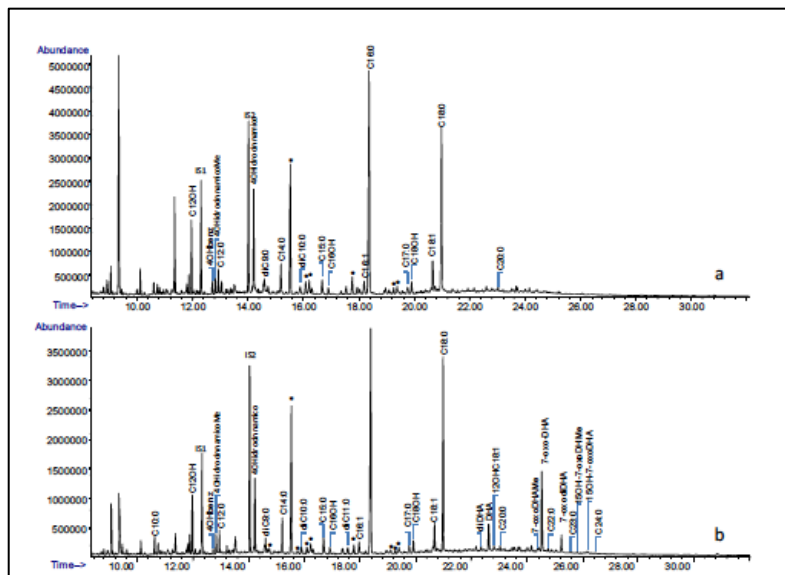


Fig. 5. 3 Chromatogram P 183 a) External sample and b) internal sample.

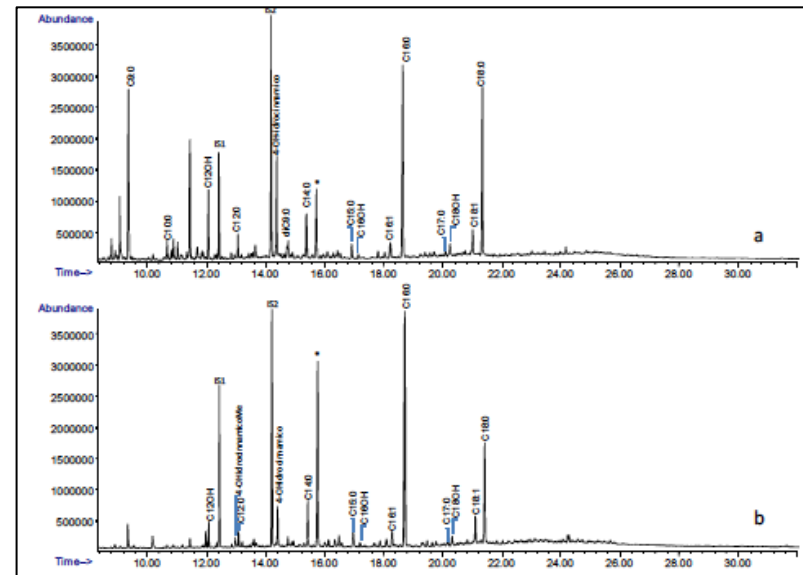


Fig. 5. 4 Chromatogram P 448. a) External sample and b) internal sample.

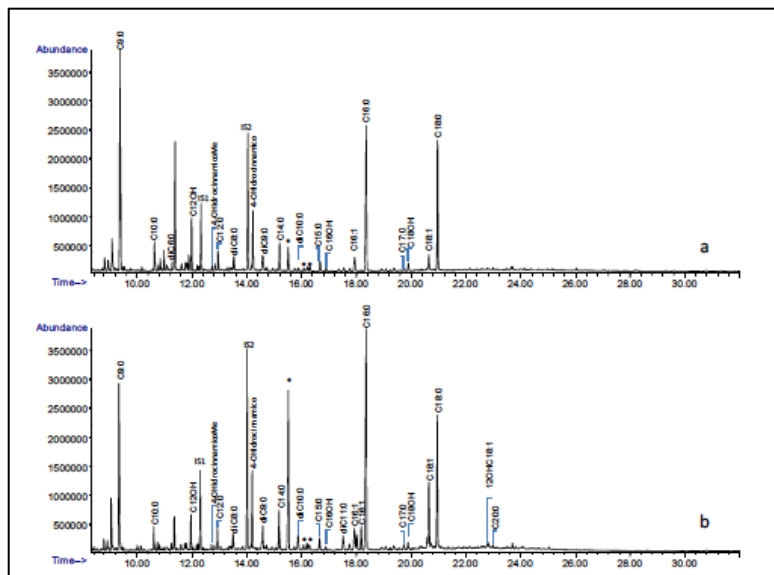


Fig. 5. 5 Chromatogram P 541. a) External sample and b) internal sample.

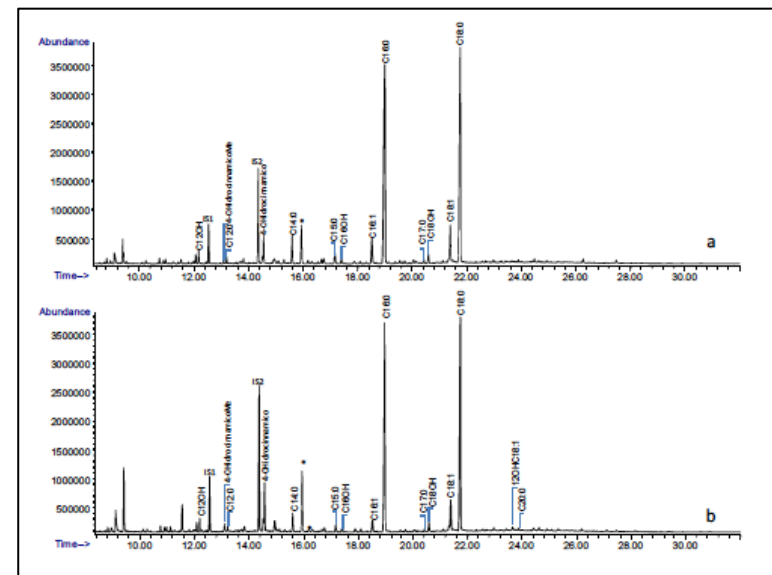


Fig. 5. 6 Chromatogram P 555. a) External sample and b) internal sample.

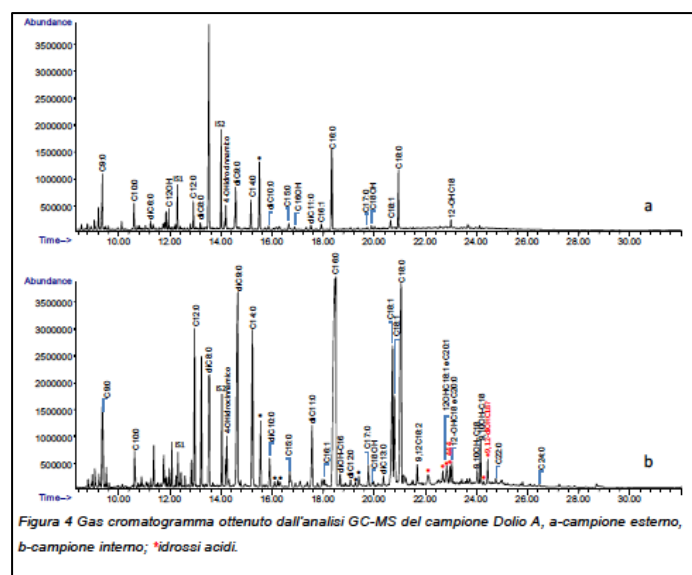


Fig. 5. 7 Chromatogram P 935 External sample and b) internal sample.

Ergot is a quite common *Gramineae* fungi⁶⁷. The action of ergot on cereals produces lipids characterized by a complex mixture of more than 70 compounds. Among them, ricinoleic acid (12-hydroxy-9-octadecenoic acid) is the most abundant acyl substituent. The results of these analyses relate the presence of ricinoleic acid with the presence of cereals inside the vessels. Traces of ricinoleic acid were found in all the Broglio fragments analysed except for P 448 in which no organic residues were found at all.

In addition to fatty acids, in P 0183 also tricyclic diterpenoid acids with an abietane skeleton were identified. The presence of these elements is related to pine pitch.

Taking into account all these data we can assume that some of the pithoi recovered in Broglio were used, in large instance, to store cereals. The presence of pine pitch could be related to the necessity of coating vases used to store liquid stuff, with the exception of oil since resins are not used in its conservation process. In the specific case of pithos P 0183, we can exclude water in favour of other type of products, because of its presence inside a Storehouse 2 rather than in a domestic context.

Moreover, the complex chemical pattern found in this last sample confirms that one vase could be used to store several products along his life.

⁶⁷ The action of ergot on cereals produces sclerotia, which contains poisonous or psychoactive alkaloids of the ergotine group. The long-term poisoning by ergot – ergotism – produces symptoms, that can be divided into convulsive and gangrenous. Among the convulsive symptoms there are effects over the central nervous system which produce – among other symptoms – hallucinations in poisoned people. The convulsive symptoms from ergot poisoning are the causes of accusations of bewitchment in Salem during the 17th century BC.

As stated above, pithos D was already sampled in the earlier 90's by Professor Peroni. The published chromatogram (Peroni 1994, p. 256) presents in a more concise form the same peaks identified also in Fig. 5.7; however new methodologies of analysis allowed to interpret the data differently.

The organic compound in the early 90 – the same of the one visible now in the new chromatogram – was connected to the presence of some kinds of decomposed vegetal oils (olive or hazelnut). The decomposition process, however made impossible at that time a more precise identification of the substances and the laboratory left the decision to the archaeologist⁶⁸. Archaeological consideration led Peroni to consider olive oil as the most probable content. The new analyses instead, in light of the innovative chemical approach, read in the chromatogram the presence of ricinoleic acids, pointing therefore to the presence of cereals as explained before.

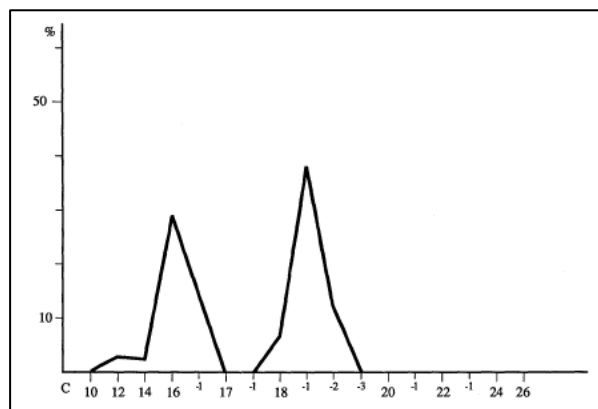


Fig. 5. 8 Chromatogram of Pithos D in the first analysis.

The positive results obtained and the need to deepen the issue of oil or cereals presence in the vases underline – as for Pyla – the necessity to increase the number of samples to analyse especially with specimens datable at RBA.

⁶⁸The following is the text of a letter sent by Prof. Rottländer of the Tübingen University Analysis Laboratory to Peroni (1994, p. 855): "Ich möchte Ihnen mitteilen, dass wir, leider mit etwas Verspätung die Dolio-Scherbe untersucht haben. Sie enthielt genügend Fett, um einen Extrakt zu erhalten. Anbei linden Sie die graphische Darstellung der Fettzusammensetzung. Auf der Abszisse bedeuten die Zahlen die Zahl der Kohlenstoffatome in den Fettsäuren; -1 oder -2 gibt die Zahl der Doppelbindungen an. Wir haben drei Gaschromatogramme erstellt. Die Graphik gibt die Mittelwerte wieder.) Die Probe auf Cholesterin (Dünnschichtchromatographie) fiel negativ aus; also handelt es sich bei dem Extrakt um ein ehemaliges Pflanzenfett. Das Fett ist nicht zu stark zersetzt, dennoch gestattet die bisher abgelaufene Zersetzung es nicht, eindeutig zwischen Haselnussöl und Olivenöl zu unterscheiden. Evtl. gibt der archäologische Befund die Entscheidung.

5.3.4. Textual sources

Additional information about the vases' function can be inferred by the analysis of indirect evidence listed at the beginning of the chapter, not directly related to the intrinsic vase's features.

Textual sources play a key role. They include all the written sources related to the management of goods and staples. When present, they usually give information about the movements of goods stored inside and outside the storage (centralized) rooms, their quantity (sometimes signalled by the number and types of pithoi/jars used) and the system of their redistribution, for example to specialized workers (Milano 1990).

5.3.5. Botanical remains

Paleobotanical data can be analysed both at intra and extra site levels. The analyses of botanical macro samples found inside the site permit to understand which agricultural or wild products were stored – and sometimes also produced – inside the settlement as well. The analysis of extra site data, especially pollen, gives hints about the natural environments and about the agricultural production of the contexts where vases were found. All these data linked to the study of the vessels and to a broad analysis of the archaeological context may suggest the most probable products used and consumed by an ancient society.

5.3.6. Comparison with ethnographic data

Further indications are provided by the comparison with living communities. The observation of living communities permits to verify for example the correlation between the use of specific vases or storage system to the type of substances stored. In the case of storage practices, ethno-archaeological analogy is frequently used also in the comprehension of the link between storage systems and the socio-economic organization of the community (Manzanilla and Rothman 2016).

In pre-industrial Crete, for example, pithoi and jars were very common and used not only to store oil and wine but also a very wide range of organic products. Pithoi used to store specific substances also had a different name and present different morpho-functional attributes. In addition to organic substances pithoi were also used as a container for clothes, tools and house stuff.

5.4. Evaluation of the vessel's capacity

The evaluation of the vessel's capacity is not as easy as it seems. The most relevant problem concerns the scanty number of complete vessels, which does not allow to build statistically significant evaluations.

It is important to consider that the volume is a cubic function: small variations in diameters or height result in wide differences in the total capacity of the vase (Thalmann 2007). This means that simple approximation in the scale of archaeological drawings between one vase and another, or even vase asymmetry, may lead to deeply different estimations of capacity.

The volumes were calculated using AutoCAD. Only entire vases were considered, for a total amount of 94 specimens analysed so far. For this reason, the Types and Varieties isolated in the present Typology are not equally represented (Appendix B in Volume II).

The starting point was the original drawing of the vase. The three-dimensional solid was built through AutoCAD from the (left) profile of the vase. The profile was revolved around the central axis. Once the three-dimensional solid was obtained, its capacity was finally estimated using the software function "MassProp".

In case of very asymmetric pithoi, a second three dimensional solid was built using the right profile. The estimated capacity resulted therefore from the average between the volumes of the two 3D solids obtained.

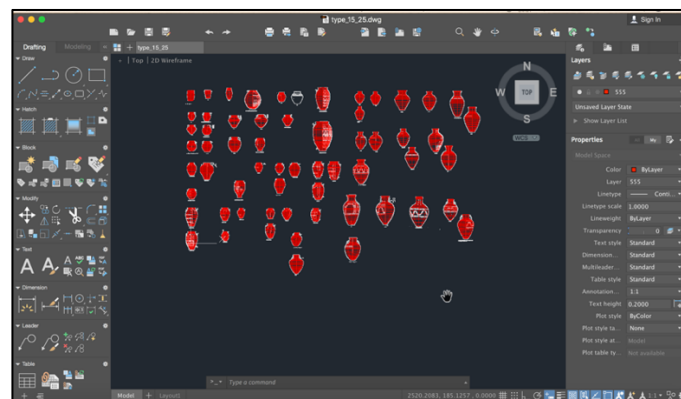


Fig. 5. 9 3D solid elaborations in AutoCAD.

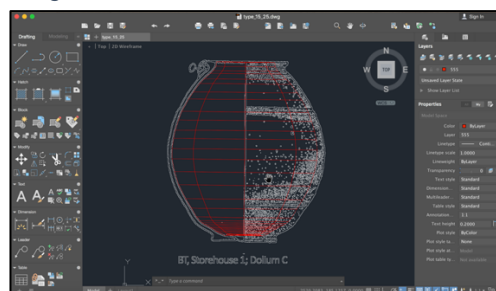


Fig. 5. 10 Example of 3D reconstruction of Pithos C from Broglio.

The values listed in the Appendix B correspond to the total volume of the vase, from the base to the rim, also in the case of long necked specimens. The evaluation of the capacity included therefore also the neck, although the vessels were often not filled up to the rim. This approach has been used to avoid establishing a line of maximum capacity which may result subjective and different among different vases.

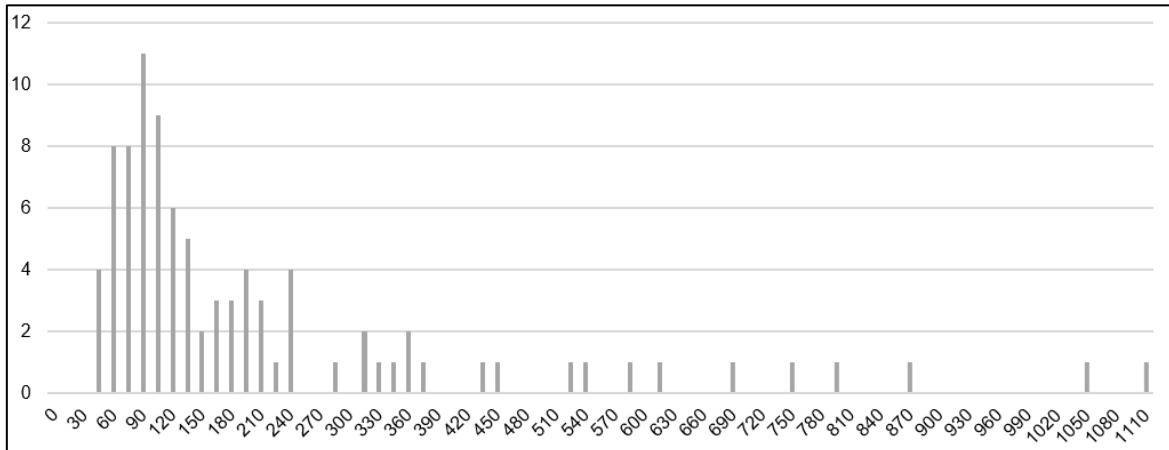


Fig. 5. 11 Volume Frequency Distribution. The X axis reports the capacity range isolated (the values are in liters), while the Y-axis reports the quantity of specimens belonging to each range.

A frequency distribution of the estimated volumes was calculated. The main goal of this frequency distribution was to verify the presence of recurring dimensional groups among all the vases analysed and if there were standardized productions or not.

Unfortunately, the low number of complete specimens used in the calculation of the volume does not allow the evaluation of the intra-type dimensional variability. As expected, at present it is not possible to understand if the pithoi analysed were standardized from the volumetric point of view.

However, the frequency distribution let us build the following groups:

1. 30-150 l: *small-medium*;
2. 165-225 l: *medium*;
3. 240-390 l: *big*;
4. >435 l: *very big*.

The richest cluster is that containing vases with a volume ranging from 30 to 150 l. It is a broad group which gathers specimens very different both in shape and dimension, including pots five times bigger than the smallest ones. Enlarging the number of specimens considered could probably lead to the enhancement of some other differences and the identification of more meaningful sub-clusters. According to the present typology, all the vases in this first group are,

in general, characterized by a wide mouth and provided with handles. This first group also includes some Cypriot specimens with long and restricted neck with or without handles.

The second group comprises vases with a volume ranging from 180 and 240 litres. From a typological perspective, the second group gathers specimens generally without neck or short-necked and provided with handles as in the first one. The third group gathers vases with a volume between 285 and 390 litres and, finally, the remaining biggest specimens are not clustered but widely spread along the distribution. The vases that fall into this last category are indeed the very big ones, i.e. the biggest vases in each Mediterranean region under analysis. This widespread distribution also depends, as stated above, by the low number of available complete specimens. Regarding the typology, pithoi of the third and fourth groups are very similar. In Cyprus they all belong to long-necked vases except one (Type 15.3) while in Crete and Italy they are without neck and very wide-mouthed.

Considering separately the vases from Cyprus and Crete it is possible to underline a partial difference.

In Cyprus the main cluster groups specimens with an average volume between 60 and 120 litres and there is a lower but significant presence of vases with a capacity over 150 litres.

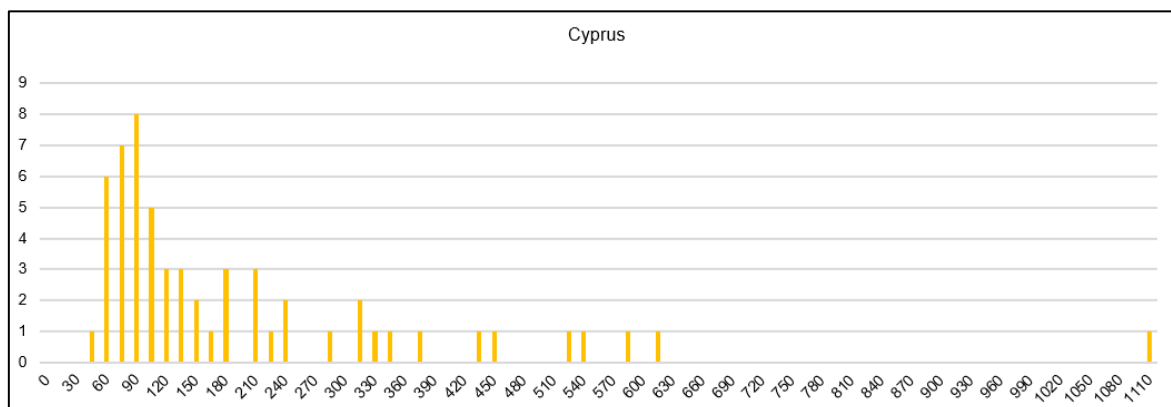


Fig. 5. 12 Volume Frequency Distribution for Cypriot pithoi. The X axis lists the isolated capacity range (the values are in liters), while the Y-axis reports the quantity of specimens belonging to each range.

In Crete less samples have been analysed making it more difficult to define formalised groups. However, it is possible to note the presence of small-sized vases with an average capacity between 45 and 60 litres and a significant presence of pithoi with a volume between 105 and 120 litres. The available data for the biggest pithoi are not sufficient to establish a valid statistic evaluation.

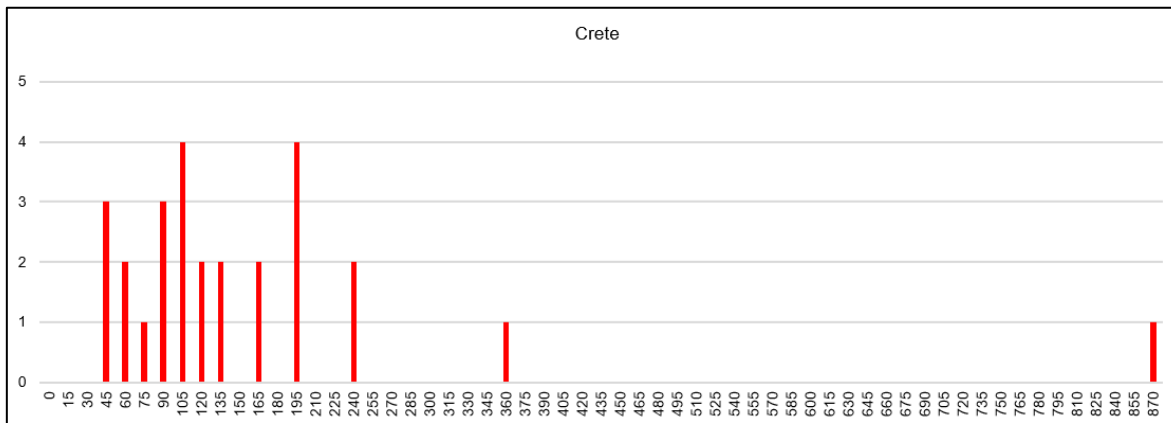


Fig. 5. 13 Volume Frequency Distribution for Cretan pithoi. The X axis lists the isolated capacity range (the values are in liters), while the Y-axis reports the quantity of specimens belonging to each range.

As far as it concerns the Italian pithoi, most of the available complete specimens come from Broglio (Storehouse 1) and they all belong to the fourth dimensional group, except for Pithos C which belongs to the third one. Despite they all belong to the same type (Type 7 in the present Typology), the low number of specimens does not allow – also in this case – the evaluation of the internal standardization of the type itself.

5.5. Comparative pithoi functional study in Cyprus, Crete and Southern Italy

Thanks to the elaboration of the pithoi formal typology, it was possible to isolate regional features recurring in the materials. Some of these features are also relevant from a functional point of view. The following table (Tab. 5. 3) lists all the technological, morphological and stylistic features identified in the pithoi under study.

Features - Properties	Function Associated	Area/Type ⁶⁹
Calcareous clay	Resistance to mechanical shock	Italy
Ring-Rim	Easier sealing?	Italy (Type 7) Crete
Long restricted neck	Sealing and Mobility	Cyprus (Types 24 and 25)
Big handles on the shoulder and in the lower part of the vessel	Graspability Mobility	Crete Cyprus (Types 17, 18 and 25)
Small handles (on the rim, on the shoulder)	Sealing and to a lesser extent mobility.	Italy (Type 7) Crete
Handles in the lower part of the vessel	Mobility, their presence seems to exclude the possibility to be embodied in the floor	Crete
Plastic bands or cordons in the body	Reinforce the joint Secure and seal the vase with real cords	Crete Italy (Type 5 and partially 7) Cyprus (Types 24 and 25)
Capacity	Storage (supra-familiar or not) Transport	
Flat restricted base	Mobility, possibility to be embodied in the floor	Italy (Type 7) Cyprus Crete
Spout or hole in lower part of the vessel	Pouring the liquid content Cleaning operation? Hopper ⁷⁰ ?	Italy Crete

Tab. 5. 3 Technological, morphological and stylistic feature relevant from a functional point of view.

Starting from Cyprus, the LCII-III A Cypriot pithoi are always characterized by a piriform shape and by the presence of a distinct neck, sometimes restricted and tall. Handles, if present, are generally only vertical and located on the shoulder or from the rim-neck to the shoulder. Until now, no specimen presents handles close to the base. The decoration, when present, is always located in the upper or central part of the vase. Cypriot pithoi usually present flat and very restricted bases in comparison to the maximum diameter. Only few specimens, usually of small-medium dimensions, show a distinct or a base-ring base (i.e. at Kition Types 18.1 and 18.3). The restricted base, especially in the pithoi of big dimension, probably served to facilitate the movement of the vase through a pivotal rotation on the base.

⁶⁹Recurring characters are associated to each of the area under analysis. When a character is found in single types or variant, then this reference is added here.

⁷⁰If the hypothesis of cereals presence in at least part of the pithoi was confirmed, then the hole found in one of the bases could relate that vase to the function of a hopper.

The base is anyway flat, providing stability features which in the majority of the cases allowed pithoi free standing. Pithoi were indeed stored both free standing inside storehouses as well as sunk in the floor. The practice of putting pithoi, both of small-medium and big dimension, in the floor is well attested in Cyprus, for example in the sites of Toumba Tou Skourou (Vermule and Wolski 1991), Hala Sultan Tekke and in several cases in Pyla (§ 6.3.2.3).

Considering Crete, the LMIII Cretan pithoi are characterized by wide mouths and by the absence of a distinct and long neck. When present, the neck is usually very short. Wide-mouthed vases made the access to the contents easier both directly or with the aid of ladles. Handles are always present both in the upper part of the vase, on the shoulder, and very often also in the lower part of the vase. The presence of handles in the lower part of the vessels distinguishes indeed Cretan pithoi from all the other analysed ones. Vertical handles with very small dimensions on the shoulder were probably used to assure the lids with the aid of cords. The association between large horizontal handles with small vertical ones arranged alternately (Variety 21.1 in the present typology) suggests both the possibility of handling and sealing the vessels. Finally, the presence of lower body handles also hints that they were not sunk in the floor but free standing. The presence of the decoration over the whole body in several registers of the vase could speak in favour of this last hypothesis. The presence of bands and cordons is indeed the most characteristic feature of Cretan pithoi. The plain or decorated horizontal bands are generally placed at the conjunction point between the different forming sections that composed the body in order to reinforce it. In Crete the base is in general less restricted in comparison to the maximum diameter and some specimens display a moulded base, sometimes with the presence of deep channels.

Technological information about the Italian pithoi, deriving from specific laboratory analysis, allows to consider also techno-functional elements. The technological studies conducted by Sara Tiziana Levi (Levi 1999) made indeed available several data about the technological features. The analyses show that pithoi were produced with specific technological characteristics that made them suitable for the storage function. They were produced with an accurate selection of raw materials. In Broglio they were manufactured with the prevalent use of calcareous clay (CaO > than 7/8%) to which specific temper materials were added (i.e. siltstone or fossil-bearing siltstone). Pithoi were finally fired at high temperatures, around 900 ° C in oxidizing atmosphere. The calcareous clay, when fired at temperature around 900 °C, becomes particularly resistant to mechanical shocks but not to thermal ones. This feature is well aligned with the intended function of these vessels, used to store goods and hypothetically also for their transport while completely unsuitable for cooking food on the fire. As already pointed out, considering the formal attributes the RBA Italian pithoi were probably medium-sized and barrel-shaped, characterized by wide mouths and by the absence of a

distinct and long neck. At present few RBA pithoi are known, and no complete specimens were retrieved; the evaluation risks therefore to remain partial. RBA pithoi are generally handleless. However, as recorded in Chapter 4, some rim fragments with square profile – but provided with a large plain handle attached directly on the rim – were retrieved in Broglio (Schiappelli 2003). For the shape of the rim they could be compared with the specimens classified in Type 5 and therefore classified tentatively to RBA. The most characteristic feature of the RBA Italian pithoi is the presence of plain horizontal clay bands recurring several times on the vessel's body. The bands are generally placed at the conjunction point between the different forming sections as for the Cretan ones. The bases were probably flat.

The FBA Italian specimens are very different from and bigger than their RBA predecessor. They have an ovoid shape with a wide mouth and they are characterized by the absence of a distinct neck. Handles are in general vertical and placed directly on the rim. They are very small and probably used to assure lids and close the vases. They do not seem useful in grasping the vases but the possibility that they were used to revolve the vases themselves around their bases cannot be ruled out. In general, a grooved decoration is present on the body, placed probably in main conjunction point to reinforce the vase. FBA pithoi have always a short distinct base, very restricted in comparison with the maximum expansion. It is possible that the vases were partially sunken in the floor despite the presence of a grooved decoration close to the base. This is in accordance with the presence at Broglio of shallow pits inside the storehouses, likely used to host the pithoi.

Appendix C in Volume II provide a complete list of the all types and varieties identified in the typology with references to the degree of transportability, stability and contents accessibility.

5.5.1. Static Storage versus Transport function

Trying to sum up all the elements, it is possible to identify formal elements more related to static needs and others connected to the transport ones. The use of pithoi as containers on the ships required different features with respect to those that had to be used for “land transport”.

For a complete analysis, evaluations based on morpho-functional and technological features have to be coupled with a general analysis of the findings' context.

Use	Morphological features
Static Storage	<ul style="list-style-type: none"> - High rate of stability - Flat base (preferable not very restricted)
Transport	<ul style="list-style-type: none"> - Not overwhelming dimension - Handles - High neck - Easier sealing
Maritime Ship Container	<ul style="list-style-type: none"> - Piriform shape - High neck - Without handles - Easier sealing

Tab. 5. 4 Morphological features related to static storage, transport and maritime transport.

5.5.1.1. Static Storage

According to the analysis presented above the main parameters related to static uses are its stability granted by a flat base (if they were not stored sunk in the floor).

Static storage relates both to domestic context and to specialised storehouses. Obviously, static storage within houses or storehouses can imply movements from a space to another, as well as longer distance movement for the transport of foodstuff.

For this reason, pithoi often present handles, as in specimens from Crete or Italian FBA. Larger specimens as well can require handles, both to make their movement easier, and to allow their handling in cleaning operations. Finally, as stated before, handles can be used to anchor the lids, especially small handles on the shoulder. This type of vertical handles is only found in Crete (most examples) and Italian specimens (Type 7, FBA), very wide mouthed without neck or with short distinct neck.

The dimension (and therefore the capacity) affects the possibility to move the vase.

Probably, big vases (i.e. Type 19, 24.3 and 25) with a high capacity were mainly (but not uniquely) thought for long-term storage inside magazines. Moreover, it is reasonable to connect them to supra-domestic storage and perhaps to a centralized system. This means that the substances stored – maybe belonging to the wealth finance system – were not intended for a daily use. Long-term storage could regard substances which consumption is less frequent but also substances that can be conserved for a longer time without the risk of bio-degradation. On the opposite side, small vases – with a low capacity – are preferentially connected with domestic needs and related to a non-centralised storage system. They were intended for domestic and “private” storage within each single household of family unit.

However, this distinction may be too simple: small pithoi could indeed be used also in centralized storage buildings in association with the bigger ones and, moreover, in the

evaluation of the storage modalities other elements need to be considered such as, for example, the type of substances stored.

In the case of small pithoi, their dimension – implying easier transport – makes these vases suitable in the performance of several daily activities inside a settlement. Small vases are connected to short-term storage and linked to the necessity of high accessibility to the contents.

However, vases of different shapes and different dimensions could be used to store of different products. This means that small pithoi could be used not only to store substances with a high rate of consumption but also substances (e.g. flour) that need to be consumed in a short time. Once the vase was opened and the airtight conditions lost, all the product contained inside needed to be consumed shortly. Especially in domestic contexts, it could have been desirable to split the product in vases of lower capacity in accordance with the time of consumption. This, once again, depends on several factors such as the type of substance, the frequency of its demand and the number of consumers.

5.5.1.2. Transport

According to the functional classification proposed above elements related to transport are the presence of handles, a not overwhelming dimension and possibly the presence of a distinct neck.

Among analysed pithoi, Cretan ones are those which present more frequently handles, both in the higher and lower part of the body. Their production seems therefore to respond to transport needs, even if they were largely used for storage inside storehouses.

Our research made it clear that maritime transport required specific technological expedients, the presence of certain morphological elements and the absence of others. Available archaeological testimonies show a sharp preference of Cypriot pithoi over Cretan ones.

It should be reminded indeed that pithoi definitely of Cypriot origin have been found inside the cargoes of Uluburun, Point Iria and Cape Gelidonya. At least in the case of Uluburun, we are sure that these were used as containers to store other goods and probably they were not commodities to sell (Pulak 2008). The circulation of Cypriot pithoi is testified also by their presence in several Mediterranean contexts (§ 4.6.3). In this case we cannot be sure if their presence in these contexts was originally connected to their use as containers on the ships or if they were acquired specifically.

This seem to raise some contradictions as Cypriot pithoi have more restricted bases, making them less stable in their placement in the ships. In general, they have less handles than Cretan ones, and these are placed only in the upper part of the body, which again would imply static

storage rather than transport functions. The reasons that led to their presence on the ships have thus to be further analysed.

The possibility to use Cypriot pithoi as more suitable containers on ships could in first instance be related to the presence of the long and distinct neck that prevents the leakage of liquid outside also implying an easier sealing. Despite the possible lower stability, the piriform shape of Cypriot pithoi with their restricted base could help in their housing in the restricted spaces typical of ships.

However, the reason behind the major circulation of Cypriot pithoi and their use as containers should be elsewhere. As already proposed by Lolos (1995; Vagnetti 2001, p. 81), the circulation of Cypriot pithoi and their use as containers on ships could depend on their excellent quality in comparison with pithoi of Creto-Mycenaean origin. In the context of the present research it was not possible to perform the same technological analyses on Cretan and Cypriot pithoi as the one made on the Italian ones (Levi 1999). However, some speculative suggestions can be made. Considering these technological aspects, while awaiting more specific analyses, it is possible to speculate that even the Cypriot pithoi were produced in a way that improved their resistance to mechanical shocks.

As a counterevidence it is possible to note the absence of Cretan or Mycenaean pithoi in the same cargoes where however tableware and stirrup-jars of these origins were found. Therefore, according with this evaluation, the presence of handles as in Cretan pithoi and the possibility to grasp them for moving were related to short or medium distance transport rather to long-term maritime one.

The chemical and petrographical analyses on several Broglio specimens (Levi 1999; Schiappelli 2003) made available a large amount of data which allow some considerations about the circulation of pithoi in the Sybaris Plain. During the RBA imported pithoi in Broglio reached 30% of the total ones while during the subsequent FBA this percentage decrease to 20%. Most of those imports came from the southern area of the Plain.

These data permit to ascertain that pithoi circulated at least in the area of the Sybaris plain. Considering typology in this evaluation it seems important to underline how they usually display bands with herringbone patterns and they were slightly smaller than the locally produced pithoi⁷¹ (Levi 1999, p. 229).

This confirms how the circulation of pithoi is strictly connected to the dimensional aspect. The typology of the Cypriot pithoi retrieved abroad or on the shipwrecks confirms this trend. They are all medium-sized specimens and never belong to the “giant” version (Pilides 2000). In this

⁷¹It is important to recall that imported pithoi have not been so far retrieved in Broglio storehouses (1 and 2) where grooved decoration pithoi (Type 7) are instead concentrated.

sense, one might safely say that vases used as transport containers should respond to several needs: stability and capacity sufficient to transport a suitable quantity of goods, but also possibility to be handled and moved (hence not too big dimensions).

A last consideration aside transport ones concerns the role of the vase in the circulation of the products. This is not a specific topic regarding pithoi – they indeed did circulate less than other closed shapes – but rather a question related to all the transport vases (i.e. Canaanite Jars, Stirrup Jars or Alabastra). There is thus a strict correlation between a container and its content; van Wijngaarden (2002, p. 278) underlines that a specific type of vase could increase the value of the content, for example through the characterization of its origin. The role of a product packaging would then be not just functional (protection of the content and facility to transport and store) but would also provide a quality guarantee and increase the marketability of the content.

As specified in this chapter, pithoi can have more or less static storage functions in settlements or centralised contexts such as the Palaces, but also serve as containers for long-distance maritime transport (this could be considered static storage on mobile carriers). In the case of pithoi, however, more than for other transport vases, to understand if they were used as a simple container is not always so straightforward.

In the case of regional circulation of pithoi in the Sybaris Plain, for example, it is impossible to ascertain if pithoi circulated as main products (and therefore empty) or as containers of other products.

6. SPATIAL ANALYSES AND DISTRIBUTION FREQUENCIES

6.1. Introduction

After the pithos typological classification and the investigation of their use, vessels were analysed in the context where they were found.

In each of the sites under study, a quantitative and spatial analysis of the pithoi was carried out. This analysis has been associated, where possible, with the examination of the facilities related to storage (i.e. silos, cellars), the objects for food production (i.e. querns, tanks), and the tools for the bureaucratic management of goods (Ramhstorf 2012; Benati 2016). The aim was to verify the existence or not of specific relations between pithoi and other classes of artefacts/ecofacst/facilities that could be indicative of specific storage methods and practices.

Organic residues analyses were performed for some samples from *Pyla-Kokkinokremos* and *Broglio di Trebisacce* (§ 5.3.3.1 and 5.3.3.2).

6.2. Archaeological context analysis

The distribution analysis of the structures and the finds (artefacts and ecofacts), allows to study the organization of the space inside inhabited areas. Any kind of distribution analysis starts from the assumption that the position of the finds in the archaeological deposit is not casual but rather represents the consequence of precise activities and processes. Through the analysis of the association of materials it is possible to reconstruct the activities that took place and then establish the function of specific areas or environments (Binford 1978).

The reliability of the results depends, however, on whether the finds analysed are found, with a certain degree of approximation, in the same place where they were produced or used. Many times, these are indeed found in a different place, both because they have been voluntarily moved from their original position (i.e. discarded and throw in a dump) or because of the action of natural agents. With this respect we have to consider that the archaeological evidence is the results of the action of many factors over a long-time span (Schiffer 1976, 1985).

Moreover, the floor deposits are the results of several factors that modified their original composition. Schiffer identified and discussed “eight major processes or families of processes [that] are responsible for the composition of house-floor assemblages” (Schiffer 1985, p. 24):

- *Primary refuse*: artefacts discarded from their original location. This is supposed to be rare.
- *Abandonment refuse*: remains that are left for totally non-care cleaning of the place one intends to leave.
- *De facto refuse*: still usable objects left once the structure was abandoned. Several factors influence its composition. Among them there are the conditions of abandonment, available transport means and distance to the next occupation site. In the analysis of the De facto refuse other factors need to be considered in order to evaluate the history and the modality of the abandonment of the site. The most important are: the transport of goods at the time of abandonment (Curate behaviour), the transfer of used objects from a user – probably the original users – to another (Lateral cycling), the dispersion of material during the natural collapse of the structures (Draw down), the stripping of objects by third parties and finally the looting by clandestine excavation.
- *Ritual deposit*: ritual reason in the abandonment of houses or settlements.
- *Post-abandonment uses*: activities carried out from third parties (e.g. squatters or travellers) with respect to the original inhabitants.
- *Secondary refuse*: use of the abandoned structures as trash disposal by the remaining people.

The materials retrieved in a space on the floor do not therefore necessarily represent exactly the original assemblage of the space (i.e. the *Pompeii Premise*): this is to be considered to avoid the risk of the elaboration of simple inferences between objects and function.

All these considerations are taken into account when in the present research spatial analyses are used in order to underline the presence of spaces devoted to storage and to understand the rate of storage itself.

In this case, however, we can assume that a higher number/concentration of pithoi in a single space or in one sector with respect to another most likely indicates that those spaces were involved in storage practices (Achino *et al.* 2016).

As stated above, before starting any distribution analysis, it is necessary to understand what human and environmental variables have influenced the formation of the archaeological deposits (*De facto refuse*) and to clearly assess the state of conservation of the deposit for each single area of study (Schiffer 1987)⁷².

⁷²In the formation of an archaeological context play a key role also behavioral and abnormal depositional factors (i.e. collapse or instant abandonment of structures). All of them need to be

The evaluation of the impact of post-depositional phenomena on the conservation of the archaeological deposit is in fact fundamental for the correct analysis of the spatial organization. In a protohistoric settlement a complete conservation of the archaeological deposit is very difficult. Several factors may compromise its integrity but the most common are the agricultural and building activities (both in ancient and modern times).

The impact of agricultural activities on the archaeological evidence is clearly visible in the sites of Pyla-Kokkinokremos (Bretschneider *et al.* 2017) and Broglio di Trebisacce (Peroni and Vanzetti 1998, p. 68) where the archaeological evidence is deeply compromised in several areas of the settlement.

Finally, other elements to be considered in the analyses are the geological study of the soils and a more general evaluation of the natural environment and the climate. In fact, not all types of soil allow the conservation of, for example, faunas, botanical macro remains or pollens that are increasingly indispensable for a correct reconstruction of an archaeological context.

Given the different characteristics of the sites in question, as well as the different excavation methods, the spatial analysis will take place in different ways in the contexts under examination (Pyla-Kokkinokremos, Kommos and Broglio di Trebisacce). In particular, for Pyla and Kommos we will proceed from the distribution of the artefacts using as spatial grids spaces and buildings.

For Broglio, where the extent of the preserved structures does not allow to proceed as in the other contexts under study, only the best-preserved structures or the ones where the presence of pithoi appears macroscopically evident will be considered (Pithos Storehouse 1 and 2).

The spatial analyses of the pithoi retrieved in each site was followed by the analysis of the pithoi *density*. The density was calculated, measuring (sq m.) every single area occupied by the presence of pithoi (or imported storage vases in the case of Kommos). The density data of each single room affected by the presence of storage vases and belonging to the same house, were added in order to obtain a value of total density for each structure/complex.

The density evaluation allowed a more detailed understanding of the presence of pithoi providing useful elements for the comparison among the three sites.

considered in the analysis of the spatial organization of artefacts inside a settlement (Cazzella 1989, p. 158)

6.3. Pyla-Kokkinokremos Frequency Distribution Analysis

The aim of the following distribution is trying to identify some functional differentiation among the excavated areas of the settlement⁷³. Thus, the study will present first the analyses of the sectors investigated during the current project, followed by a comparison with the data from the old excavation seasons conducted on the plateau (Karageorghis and Demas 1984; Karageorghis and Kanta 2014).

The description follows the division by Sectors. Each pithos is numbered by a Catalogue number (i.e. P 1800).

6.3.1. 2014-2016 excavation seasons

Pithoi are very widespread in the Pyla-Kokkinokremos plateau: pithos fragments were indeed found inside every excavated area. Most of the pithoi are well preserved and generally mendable.

The massive presence of pithoi is even more significant if we consider the excavation of new extensions⁷⁴ (i.e. extension 5 in Sector 5 of Extension 6 in Trench 3.4) and the presence of pithos fragments in the topsoil's layers of each Sector.

The overwhelming quantity of pithoi retrieved during the excavation season 2014-2016 confirms the picture which emerged during the eighties investigations (Karageorghis and Demas 1984) and in 2010-2012 (Karageorghis and Kanta 2014) when a large number of pithoi were brought to light (see *infra*). However, despite the huge quantity of pithoi present in Pyla, the current excavation confirmed the absence of monumental (*ashlar*) buildings devoted to storage as the ones known in the sites of Kalavassos-Ayios Dhimitrios, Maroni-Vournes or Alassa. Although some areas of the plateau still need to be investigated more and some of them are not in a good state of preservation – especially in the central part –, the absence of *ashlar* buildings seems a matter of fact. In Pyla, also fragments with impressed figurative decoration are, until now, totally absent (§ 4.3.1.1).

⁷³Despite pithoi alone are not enough for the full comprehension of the storage practices or for the understanding of the wide range of activities that had been carried out in a complex settlement as Pyla is, the analyses of the storage modalities and of the zones where they took place could offer precious hints in the understanding of the socio-organization of the settlement.

⁷⁴During the excavation seasons 2015 and 2017 some trial extensions were opened in order to verify the presence and the consistence of the archaeological evidence in other areas of the plateau or to verify the extension of the evidence retrieved.

Despite these absences could be interpreted in a chronological perspective, since some of the most important monumental storage complexes were built in the LCIIIC while Pyla was founded at the end of that period⁷⁵, the lack of this kind of evidence also has to be interpreted in connection to the nature of the site itself and probably linked to the geo-political situation in the island and in the Mediterranean basin during the last 13th century BC.

However, the huge quantity of pithoi retrieved in the site, their specific distribution and the presence in the same spaces of stone weights, seals, and clay tablets point to the existence of some kind of centralized authority that may have controlled the management of the stored goods.

The present study permits to identify some diagnostic pithoi or pithos fragments among the total bulk of the pottery retrieved inside specific spaces. All the diagnostic pithoi recognised so far will be included in the analysis, while those for which allocation is uncertain will simply be presented.

The spatial distribution takes into consideration only the aforementioned mendable pithoi and pithos fragments which provenience is clearly identifiable. Those with uncertain allocation, identified in the topsoil levels and scattered on the surface were carefully analysed with the first aim to make joins with the pithoi retrieved inside the spaces. They were recorded in the database and photographed because of their importance in the understanding of the global diffusion of pithoi over the whole plateau. Moreover, some of them, despite the uncertain allocation, are very interesting from a technological point of view and useful in the elaboration of the formal typology. In the following distribution maps their presence will be just underlined with a grey spot (Pls. 121-124 in the Volume II).

A further analysis concerns the typology and the capacity evaluation presented in § 5.4. Pithoi were divided into small/medium-sized vases (30-225 litres) versus the big-sized ones (> 240 litres). The table below synthetized the Types and Varieties identified in Pyla with their dimensional classification. In this case also pithoi retrieved in the topsoil levels – and dispersed over the whole area of each sector – were considered.

Size-Categories	Types/Varieties
Small/Medium	4, <i>Unicum</i> 1, 6, 13, 14, 15.1, 15.2, 15.3, 17.1, 17.3, 18.1, 18.3, 20.1, 23.3_a, 24.1_a, 24.2_a, 24.3_a, 26
Big	16, 24.3_b, 24.1_b, 24.4_a, 24.4_b, 25.1_b, 25.2, 25.3

Tab. 6.1 Types and Varieties identified in Pyla with their dimensional classification

⁷⁵Monumental buildings full of pithoi have been found in the roughly contemporaneous site of Maa and in Alassa which is in use until the LCIIIA.

The analyses of pithoi in contexts will be presented following the Sector/Trench number.

Trench 3.2

Inside the area, that needs more excavation, some pithos sherds were retrieved. The fragments come, in particular, from Space 3.2.1 but the identification of the types to which they belong is difficult due to the bad state of conservation and their fragmented nature. However, the presence of pithoi also in this sector of the plateau is confirmed.

Trench 3.3 (Pl. 121)

As previously noted, Trench 3.3 is deeply damaged, and the architectural remains are badly preserved in comparison to the other sectors. In this trench pithoi are sometimes not mendable, and a large part of the archaeological materials come from top layers. However, the excavation permits to uncover several spaces devoted to productive activities and a valuable alabaster Egyptian flask.

In Trench 3.3 14 pithoi were retrieved within the 12 spaces uncovered during the excavation season 2014-2016.

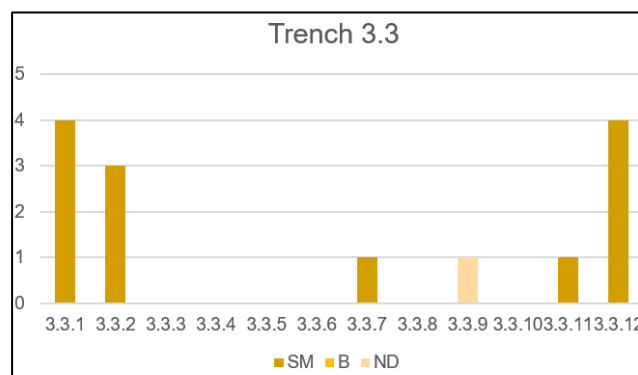


Fig. 6. 1 Quantity of pithoi for each Space of Trench 3.3 (the X axis reports all the spaces considered while the Y axis represents the number of pithoi retrieved). Pithoi are classified according the dimension in Small-Medium (SM), Big (B). ND means not determined.

First of all, considering the present spatial analysis, it is important to bear in mind that some spaces, such as 3.3.7 and 3.3.11, are not fully excavated. Other spaces (i.e. 3.3.14 and 3.3.15) were excavated during spring 2017 but the analyses of the material retrieved there was impossible due to logistic reasons. It is therefore possible that new data will enrich or modify the picture emerged in the present study.

In at least two spaces of Trench 3.3 (3.3.1 and 3.3.12) four pithoi associated with each other were retrieved.

Space 3.3.1 was interpreted as an open court where several activities were carried out including textile production and food processing (Jusseret 2015). The court provided a rich pottery assemblage comprising the four pithoi, none of which is complete. The study carried

out permits to ascertain that two of them belong to Variety 18.1 (P 1738 and P 1739), one to 15.1 (P 1732) and the last, P 1730, to 24.1_a.

Most of the finds come from the central and the eastern part of the space: among the pottery found in this space there were some fragments belonging to a Minoan painted amphoroid krater. Inside the space two loom weights and many stone tools were also found.

In Space 3.3.2 at least three pithoi were identified. They are all fragmentary but one (P 1744) could be attributed to Variety 24.1_a, another (P 1745) to Variety 15.1 and finally a complete handle retrieved there belongs to 18.1 (P 1743).

At least one clearly identifiable pithos was retrieved also in spaces 3.3.7 (P 1752), 3.3.9 (P 1753) and 3.3.11 (P 1740) respectively. All of them are associable to long-necked specimens of Type 24.

Among the fragments scattered over the Trench area and coming from top layers (in grey in pl. 121) several other pithos sherds were recognized there.

The most interesting space is for sure Space 3.3.12 – a casemate-like structure – which seems in part devoted to storage. Pithoi indeed represent the majority of the pottery found inside the space, in addition to two local jugs and the upper part of a wall bracket. All the pithoi retrieved there belong to Type 24 (two to 24.1 and two to 24.3) – namely long-necked medium-sized specimens. Some sherds of these pithoi were found lying vertically against the edge of a 0.40 m deep pit (C55) excavated in the centre of the room. This could suggest the possibility that at least one of the four pithoi of the space was housed inside a pit as elsewhere in settlement (see *infra*).

The preference for long-necked specimens in the portion of Pyla *Kokkinokremos* just observed is not fully confirmed by all the fragments retrieved in the area of Trench 3.3. The analysis of topsoil materials permits to recognize other 45 specimens in addition to the ones presented above (Fig. 6.2).

The typological classification permits to ascertain their belonging in large instance to type 24 (22%) to varieties 24.1 and 24.3 – in accordance with the pictures emerged above. However, among the 27 non-determinable fragments (60% of the total), 10 specimens could reasonably be classified as short-necked vases (IV typological family) while only two are long-necked pithoi (V typological family). The last 14 are totally unclassifiable.

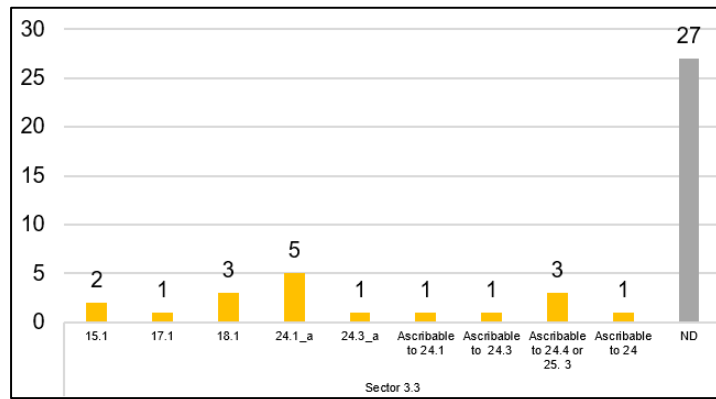


Fig. 6. 2 Type's Distribution of pithoi in Trench 3.3 (the X-axis reports the pithos types and varieties and the Y axis the quantity).

If all these associations were true the percentage of short-necked specimens, that now represent only the 14% of the vases present in the sector, would slightly increase. In conclusion, the most common types of Cypriot pithoi (Types 15, 17, 18 and 24-25) were all present in Trench 3.3 without any kind of ascertained sharp preference.

Until now, a space specifically devoted to storage could be identified only in 3.3.12.

However, the most remarkable feature of this Trench is the evidence of craft activities. In Trench 3.3 several proofs of textile production were indeed found. Apart the two loom weights discovered in Space 3.3.1 in 2014, in 2015-2016 excavation eight additional specimens were uncovered inside Space 3.3.6 as well as two spider whorls in Space 3.3.2. The weaving activities do not seem the only craft production that had been carried out in this portion of the settlement. Spaces 3.3.8.1-2 were connected to metal working activities as well as the two adjacent spaces 3.3.7 and 3.3.4.

The relation between productive areas and pithoi has to be investigated more in details. At present it is possible to suppose that some of those pithoi may have been used as containers in support of these activities. They could have been used, for example, to store water, used in the metal production, or as a container for tools and instruments. As a further suggestion, it is important to remember that in the Sanctuary of Athienou, in *Stratum II* a group of 11 pithoi⁷⁶ originally stood on a slab in the eastern platform. The excavator suggested the possibility that these may had contained oil used in the metal working activities (roasting copper ore)

⁷⁶Only two pithoi of this group were published, and they are recorded as P 0111 and P 0112 in the database. They were in association with two other short-necked specimens (P 0113 and P 0114) named krater in the Athienou publication.

performed in that area of the site (Dothan and Ben-Tor 1983, p. 113). On the platform, traces of fire were identified, and few olive stones were mixed with ash⁷⁷.

Trench 3.4 (Pl. 122)

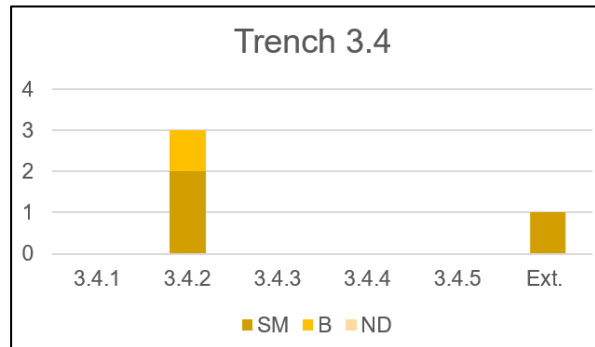


Fig. 6.3 Quantity of pithoi for each Space of Trench 3.4 (the X axis reports all the spaces considered while the Y axis presents the number of pithoi retrieved). Pithoi are classified according the dimension in Small-Medium (SM), Big (B). ND means not determined.

At present, four pithoi were identified in this Trench (Fig. 6.3). All the pithoi from Trench 3.4 – except one – come from Space 3.4.2. Two of them belong to variety 18.1 (P 1754 and P 1759) while one with impressed grooved decoration to 24.4_a (P 1758). The vases were found close to each other and in connection the remains of a wall. Another base was identified but the rest of the vase is missing, probably spread out by the ploughing activities.

According to the excavator, the space, interpreted as an internal courtyard, provided the most interesting archaeological assemblage of the Trench. The space is characterized by the presence of Canaanite-type jars, local kraters, jugs, spindle bottles, cooking pots and an almost complete deep bowl decorated with red bands.

Some of the largest pottery fragments were associated with stones that the excavator interpreted as possible pot stands (Claeys 2017). In addition, a lot of lithic tools and two grinding stones were found there.

As in the case of other spaces interpreted as courtyards, the material assemblage points to the use of the space in the performance of domestic and maybe more specialized activities (Claeys 2017).

⁷⁷Sophocles Hadjisavvas interpreted instead the context as a place where olives were crushed, and pithoi served to contain the olive oil produced (Hadjisavvas 1992, 27; Pilides 2000, p. 22). The same opinion is Priscilla Keswani (Keswani 2009).

Finally, body fragments of another pithos were identified in the Extension 6. They seem to belong to a small/medium-sized vase, but it is impossible to classify it into any types or varieties.

Sector 4.1 and New Casemate wall (Pl. 123)

Until now the sector of the plateau with the largest number of pithoi is Sector 4.1 (Fig. 6.4). Several spaces are, indeed, characterized by the presence of many pithos, such as Room 4.7, 4.9, 4.13, and 4.14.

The description of the rooms will be presented according to the internal division of the sector in area north and south of the Gate. The Gate area correspond to the one excavated during the excavation season 2012 made by Kanta and it is not part of the present research. That excavation uncovered Rooms 1-6 and it is particularly interesting because of the presence, inside Room 5, of two clay tablets with CM signs. The rooms were only preliminarily analysed but several pithoi were found there. It is at present impossible to know the exact quantity and the typology of pithoi stored in these rooms.

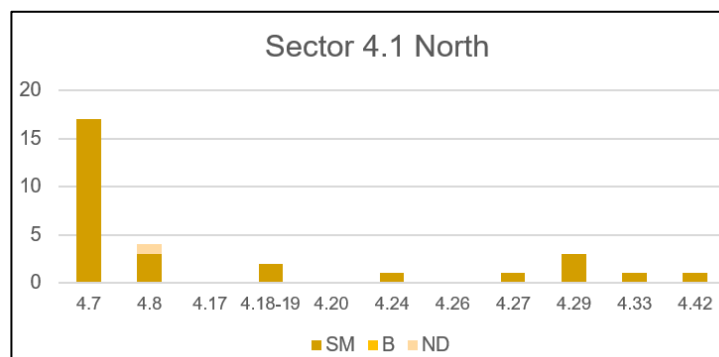


Fig. 6. 4 Quantity of pithoi for each room in Sector 4.1North (the X axis reports all the spaces considered while the Y axis represents the number of pithoi retrieved). Pithoi are classified according the dimension in Small-Medium (SM), Big (B). ND means not determined.

Room 4.7 is particularly noticeable, since 17 pithoi of different types were found there⁷⁸. All the vases belong to medium-sized vessel types both with short or long neck. The retrieved short-necked pithoi belong to Varieties 15.1 (P 1806), 15.2 (P 1800, P 1804 and P 1815), 17.1 (P 1813) and 18.1 (P 1799, P 1801, P 1803 and P 1809). The long-necked pithoi are instead classified as Variety 24.1_a, (P 1802, P 1805, P 1808, P 1810 and P 1812). One was generically attributed to Type 24 (P 1807).

Pithos P 1814 is particularly remarkable, as it represents the only specimens of Type 26.

⁷⁸P 1811 is a ND base and may belong to the same vase of P 1806. However, joints were not found, and they were catalogue as to different vases.

Together with these pithoi, Room 4.7 has revealed few vessels: a clay bathtub, a wall bracket and a local bowl.

Close to Room 4.7, also Room 4.8 was found full of vases. During the excavation the Room was further sub-divided into two spaces: 4.8 and 4.8A. All the pithoi come from the SW corner of Room 4.8. Two of them belong to Type 24 (P 1818 and P 1819) while the last, P 1817, is the variant of Type 15.1.

Differently from Room 4.7, inside Rooms 4.8-4.8A many body fragments probably belonging to small vases were also retrieved.

Until now the study conducted by Ilaria Caloi led to the identification of two local jugs, a local krater, a Base Ring II bowl and a painted (Mycenaean IIIB) shallow bowl (Caloi personal communication).

Close to them, toward the north, Room 4.18-4.19 are rather well-preserved and two short-necked pithoi (P 1789 and P 1790) belonging to Variety 17.1 were identified among the material retrieved there.

East of Room 4.8 there were Rooms 4.17 and 4.20. They were found very damaged by cultivation and no materials were retrieved there.

In Room 4.24 some pithos fragments were retrieved. They belong to a small/medium sized specimen with incised decoration which could belong to Variety 15.2 or 17.3.

In Room 4.27, on the contrary, some body fragments – with grooved decoration were found – belonging to a medium-sized pithos of Variety 24.3 or 24.4.

Further north, several rooms were cleared and partially excavated during the 2016 season. The excavation of some of them ended during spring 2017 but it was not possible to insert all of them in the present study for logistics reasons.

However, three rooms were studied as a trial in order to check if also the northernmost edge of the Sector 4.1 was characterized by the massive presence of pithoi (Room 4.29, 4.33 and 4.42).

The first room analysed is Room 4.29: among the scanty materials retrieved there three incomplete pithoi were identified. One (P 1795) belongs to Variety 15.1 while the others have been attributed to Variety 24.1 (P 1794 and P 1796). This room also hosted a clay bathtub, a local krater imitating a bronze model and a pyramidal loom weight (Kanta 2017).

The second space analysed is Room 4.33, where one short-necked pithos was found, belonging to Variety 17.1 (P 1797). The space contained also a fragmentary Canaanite-type, a chisel, a loom weight, a decorated spindle whorl and bronze earring (Kanta 2017).

Due to typological specificities, in addition to all these materials one pithos from Room 4.42, (P 1798) was also examined. The analysis of the room is only at a preliminary stage, but it seems that no other pithoi were present. The pithos belongs to Type 4 and is very uncommon in the Pyla repertoire both in terms of fabric and shape.

Passing to the analysis of the area south of the Gate, several rooms were excavated there.

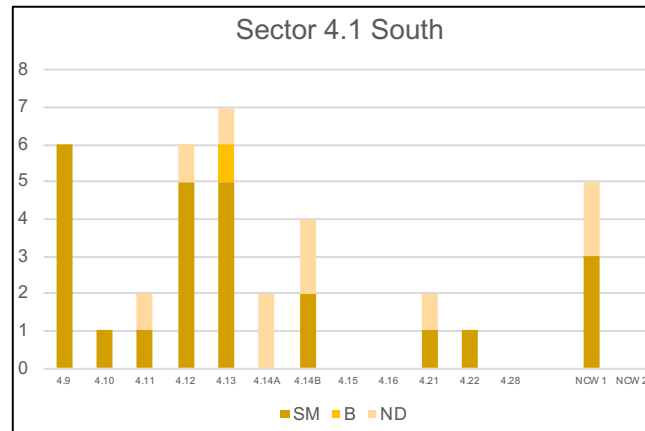


Fig. 6. 5 Quantity of pithoi for each room in Sector 4.1 South (on the X axis there are all the spaces considered while the Y axis represents the number of pithoi retrieved). Pithoi are classified according the dimension in Small-Medium (SM), Big (B). ND means not determined.

Room 4.9 is a rectangular casemate-like room. It was found full of smashed vases which had fallen on their side (Kanta 2015, p. 16). Six pithoi were identified, they belong to different types: starting from short-necked pithoi, one belongs to Variety 15.1 (P 1822), two belong to Variety 17.1 (P 1820 and P 1823), one (P 1821) to Variety 17.3 and one is a Variant to 18.1 (P 1825, PK 14 162). Finally, the last one is the biggest and the only long-necked pithos retrieved in the room (P 1824); it belongs to type 24.1_b

Beside pithoi, the assemblage of Room 4.9 is very rich and comprises a painted local krater, a fragmentary painted footed bowl, an imported Canaanite-type jar with a CM sign on the handle, a Plain White local jug, a White Slip II Milkbowl and a local plain *pyxis* (Caloi personal communication).

East to room 4.9 there is a large space interpreted as a large open space: Room 4.10. Since no walls remains were identified, most of the pottery coming from Space 4.10 joins with vases found in the nearby spaces 4.11, 4.12 and 4.13. Among the scanty fragments from 4.10, it was possible to identify only one small pithos (P 1767) catalogued as Variety 17.1 and bearing an incised mark on the handle. Inside the space a Mycenaean three-handled piriform jar was also found (PK 14 169).

Room 4.11 is located east to Space 4.9. The space was found largely empty but at least two pithoi were recognized. The first (P 1768) is, at present, an *unicum* in the Pyla plateau and no vase were found as a comparison (*Unicum 1*). The archeometric analysis carried out in the

present research permits to ascertain that this pithos is likely an import from Palestine. Its fabric is indeed very different from the Cypriot pithoi with the prevalent presence of quartz (between the 50-70%) as temper.

The second pithos (P 1769) belongs to the V typological family but the low number of sherds retrieved doesn't allow a more precise attribution, even if some sherds present grooved decoration. In the space archaeologists also recognized a Minoan amphoroid krater (PK 14 163), a White Shaved trefoiled spindle bottle and two Canaanite-type jars. One of the Canaanite-type jar bears a CM incised sign on the body.

Space 4.12, south of Space 4.9, is another casemate room and was found full of pottery: five pithoi were identified beside other vases. An entire short-necked pithos belonging to Variety 18.1 (P 1775, PK 15 392) was found inside a roughly circular pit close to the north wall.

Among the sherds retrieved in the room, it was possible to recognize three other short-necked pithoi: the first one (P 1770) belongs to Variety 17.1, the second one to 17.3 (P 1771) and the last one (P 1774) to 15.1. In addition, another pithos base was identified. Also a decorated Pastoral krater and an alabaster *rhyton* came from this space (Kanta 2017).

Room 4.13 was found full of smashed vases. Most of them were lying on the south edge of the room. The analysis permitted to identify seven pithoi; none of them is complete and some of them have joins with sherds from Space 4.10. Two of the pithoi retrieved in this Room belong respectively to Variety 24.3_a (P 1778) and 24.3_b (P 1779). Two additional specimens belong to long-necked pithoi and can be classified in Type 24 or 25 (P 1780 and 1782). Among the short-necked pithoi, one (P 1776) could be categorized inside Type 15 and one (P 1777) in Variety 17.3. Finally, another base of pithos was identified that could not be allocated to any Type (P 1781). In addition to pithoi, fragments belonging to small vases were recovered: at the moment a White Shaved trefoiled spindle bottle and fragments belonging to the Mycenaean three-handled piriform jar (PK 14 169) from Room 4.10. were recognized.

Room 4.15 and 4.16 are very badly preserved and a little quantity of material was found there. Among the sherds coming from these spaces, it was possible to identify joins with pithoi from Space 4.13. All the pithos sherds identified in Room 4.15 belong indeed to specimens retrieved in the near Room 4.14A and B.

Space 4.14 – internally divided by a partition wall – had been dug into the bedrock. Its semi-subterranean nature favoured the conservation of several vases⁷⁹, despite the bad preservation of the external walls. In Room 4.14B a rectangular pit was identified with a lot of pithos sherds fallen inside.

⁷⁹Between the material from Room 14A and B several joins were found as well as with Room 15.

Three pithoi were identified in Room 4.14B. Two short-necked types belong respectively to Variety 17.1 (P 1784) and 18.2 (P 1788). Part of another one (P 1786) was found inside the pit and belong to the fifth typological family, probably to Type 24 or 25.

Fragments of a big pithos (P 1783) with red fabric and a very thick white slip with grooved decoration (both horizontal and wavy band) came from Room 14A and belongs to Variety 24.4. Two more vases – which types are not identifiable – came from the area of Room 14. The state of conservation of these vases that does not allow a precise type attribution, but it is important to underline that they belong to long-necked types. The analysis of body wall thickness and the diameters suggests that they were very big pithoi. In spaces 4.14 A-B at least one local jug, a wall bracket, and part of a stirrup jar were also identified.

The casemate line continues further south, and other spaces were identified despite the bad state of conservation of the walls.

In the area corresponding to Room 4.22 a short-necked pithos (P 1793) belonging to Variety 17.1 was identified. It was associated with a big three-handled jug, a base ring juglet, a large quern, a Syro-Palestinian tripod mortar and a rectangular stone seal described in Chapter 3.

Room 4.21 lies further south. At least two pithoi were found there: one long-necked pithos belonging to Variety 24.1_a (P 1791) and a pithos base. The spaces contained also a local Mycenaean kylix and a wall bracket (Caloi personal communication). In the same area two additional pithos bases were found; they were probably originally stored in Room 22 or 21.

Following the hypothetical casemate line two spaces south of Sector 4.1 were cleared and excavated during spring 2016. They were called New casemate wall (NCW) area. Only Room 1 was fully excavated, and a rich pottery assemblage came to light. The room contained at least five pithoi. One belongs to Variety 15.1 (P 1760) and another (P 1761) could be attributed to 15.2 or 17.3 due to the presence of an incised decoration on the body. A third one belongs to 24.1 (P 1762), and one (P 1763) to Type 24 or 25. The fifth pithos retrieved is a base (P 1764).

Considering all the pithoi retrieved so far in Sector 4.1 and in the NCW area most of them belong to short-necked types and varieties (Fig. 6.6). Among them there are more common vases provided with two vertical handles in comparison to the handleless types (i.e. Varieties 24.1). Long-necked specimens are also present both in the medium-size varieties as well as in specimens of big dimension and grooved decoration (Varieties 24.3, 24.4 and 25). The large quantity of pithoi retrieved in this sector and the number of rooms excavated allow to verify that the short-necked pithoi and the long-necked ones were stored in the same spaces and thus there was not a sharp spatial differentiation between small/medium and big- sized pithoi.

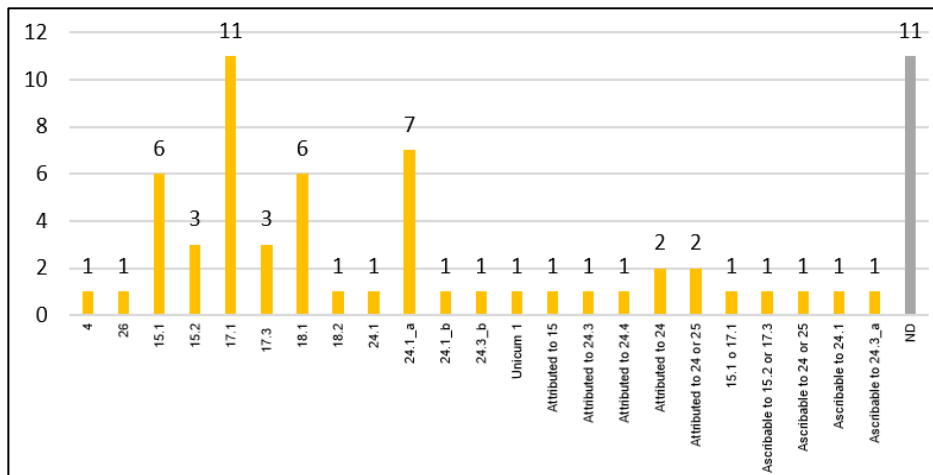


Fig. 6. 6 Type's Distribution of pithoi in Sector 4.1 and NCW (the X-axis reports the pithos types and varieties and the Y axis lists the quantity).

Sector 4.2

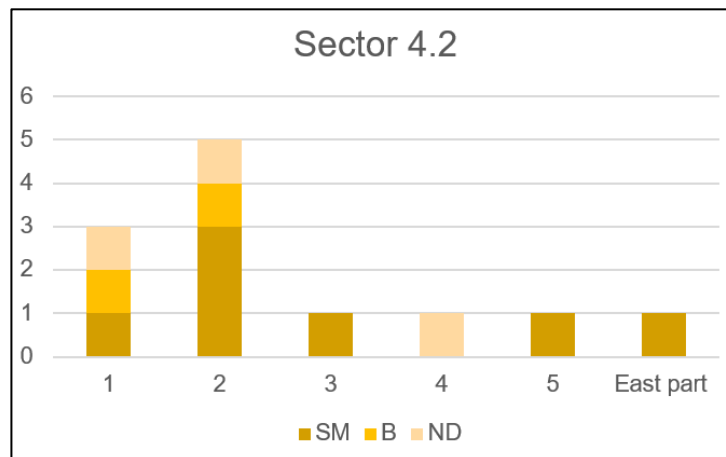


Fig. 6. 7 Quantity of pithoi for each room in Sector 4.2 in red (the X axis reports all the spaces considered while the Y axis represents the number of pithoi retrieved). Pithoi are classified according the dimension in Small-Medium (SM), Big (B). ND means not determined.

The preliminary study of materials coming from Sector 4.2 already shows that also this part of the plateau is characterised by a large presence of pithoi (Fig. 6.7)

In all the rooms excavated during the 2016 season, pithoi were found, but the highest number comes from Room 4.2.2.

Room 4.2.1 is preliminary interpreted as a courtyard, but further investigation is needed. Inside the space at least three pithoi were identified (P 1827 - P 1829) but it is impossible to attribute them to any types. The big neck P 1828 belongs to the fifth typological family and it is ascribable generically to Type 24 or 25.

Room 4.2.2 provided the richest assemblage so far in Sector 4.2. It contained at least five pithoi, four of which belong to short-necked types of the IV typological family: P 1832 belong to Variety 17.1, P 1833 to Variety 15.1. P 1830 was generically attributed to Type 15, while P 1831 cannot be classified at all. The fifth pithos (P 1834) belongs to Variety 24.1_b. It was found smashed on the floor; underneath it there were several other fragmented small vases, a quern and an alabaster vase (PK 16 578). In the room a small piriform jar was also found, likely imported from Crete. (Kanta 2017).

Between Room 4.2.2 and 4.2.3 an entire pithos belonging to Variety 17.1(P 1835 PK 16 609) was found. In room 4.2.4 a pithos base was found while in Room 4.2.5 a short-necked pithos belonging to Variety 15.1 (P 1837) was identified.

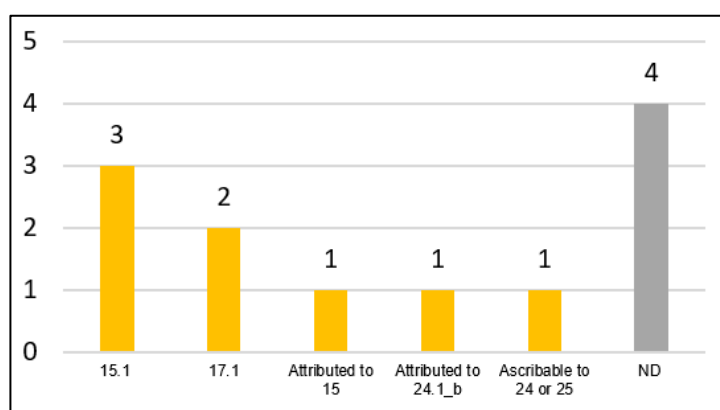


Fig. 6. 8 Type's Distribution in Sector 4.2 (the X-axis reports the pithos types and varieties and the Y axis presents their quantity).

At this point of the research, short-necked pithoi are more common in this side of the plateau (Fig. 6.8). However, the low number of vases considered, and the initial stage of the analysis doesn't allow to propose any kind of reconstruction.

The study of the material from the other casemate rooms will allow a better understanding of this part of the plateau. Until now it seems that also Sector 4.2 is characterized by a high frequency of pithoi. Particularly interesting is also the presence of imported pottery and valuable objects such as the alabaster vase.

Sector 5 (Pl. 124)

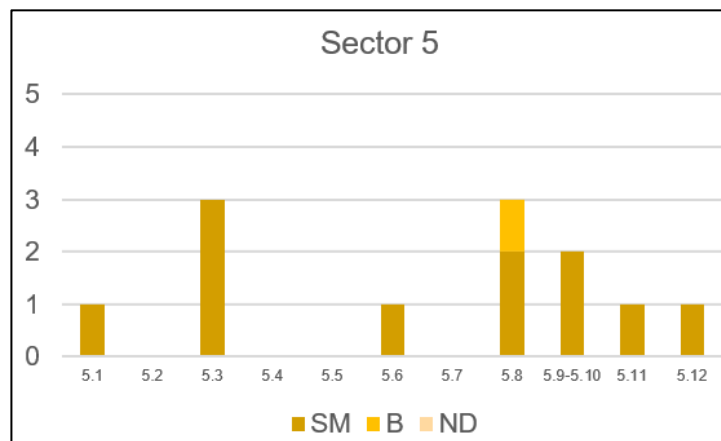


Fig. 6.9 Quantity of pithoi for each Space in Sector 5 in red (the X axis reports all the spaces considered while the Y axis represents the number of pithoi retrieved). Pithoi are classified according to the dimension in Small-Medium (SM), Big (B). ND means not determined.

Concerning Sector 5, among the 12 spaces uncovered during the 2014-2016 excavation, there are only two spaces displaying a certain concentration of pithoi: three pithoi were retrieved in Space 5.3 and 5.8 (Fig. 6.9). However, the excavation revealed a great dispersion of pithos fragments over the whole sector and points out the possibility that some spaces were originally provided with a larger number of pithoi than it appears now.

In Space 5.1 it was possible to identify only one complete pithos belonging to Variety 17.1 (P 1847) and a complete Canaanite-type jar – imported from Egypt - with its characteristic long neck (15/05/082/OB 001).

Space 5.9 contained a greater quantity of pottery than the previous one. In the space at least three pithoi were stored together. The pithoi were retrieved close to each other in the NW corner of the space: P 1888 belong to Variety 24.1_a and P 1889 to 15.1. The third one, which has very big thick body wall, could not be attributed to any type.

In this space other pithos fragments were identified, and the preliminary study of the material contained in the room led to the identification of one Canaanite-type jar, a shallow bowl and probable a cooking pot (Caloi personal communication).

Further north, Spaces 5.5 contained several fragments belonging to pithoi but no specimen could be reconstructed.

To the south, the digging of a military related trench deeply damaged Space 5.4 and probably, in part, the area of the edge between Spaces 5.3/5.6 and Spaces 5.8/5.7. This may have led to a dispersion of fragments over a wide surface. Between the materials from Space 5.8 and Space 5.7 there were, for example, several joints, and most of the pithoi (as well as other vases, see Caloi 2017) were reconstructed with fragments retrieved in Space 5.7.

Space 5.3 is fully excavated, and a rich and interesting assemblage was retrieved. Three almost complete pithoi were found, all belonging to Variety 17.1, P 1853 (PK 14 427), P 1852 and P 1860 (PK 14 428) The first displays also an incised CM sign on the body. In addition to these pithoi several other pithos fragments were retrieved. Among them some belong to big specimens with grooved decoration which may be allocated to Variety 24.4 or 25.3. A circular flat stone was found at the centre of the southern part of the space. It could have been used as a pot stand, maybe for housing pithoi. Among the pottery an almost complete local wheel-made spindle bottle decorated with Mycenaean-inspired motifs (PK14 170: Caloi 2015: fig. 22) and an incomplete hollow Base Ring II female figurine (PK15 421) were found, as well as two fragmentary alabaster vases and one bronze pin (Bretschneider *et al.* 2017).

In Space 5.6 a pithos (P 1865) belonging to Variety 24.1_a was found. Many other pithos fragments were identified, especially among the material fallen inside the pit, but no one is complete. Some of them display a grooved decoration and could be ascribable to big size pithoi of Varieties 24.3- 4 or 25.3.

Further south, Space 5.8 is interpreted as courtyard; on its floor level three pithoi were found: P 1880, a short-necked pithos in red fabric and ribbed handles belonging to Variety 18.1 as well as P 1881. Another fragmentary pithos (P 1886) belongs to Varieties 24.4. The space contained also a nearly complete greyish-black stone jar with handles (PK15 215), possibly an import from the Levant or Egypt and an amphoroid krater in Pictorial Style decorated with birds (PK15 422) (Bretschneider *et al.* 2017).

Space 5.11 is deeply disturbed by the modern cable trench as the other spaces described above. The excavation of the space brought to light a rock-cut pit where a complete pithos was found, (P 1848) belonging to Variant to 25.1_a.

In the western part of the room other vessels, including a Canaanite-type jar, were retrieved. Four lithic tools – probably pestles – and a bronze pin were also in this space (Bretschneider *et al.* 2017).

The last space examined is 5.12 lying on its floor there were some sherds belonging to a short-necked pithos (P 1850) classified ad Variety 17.1.

The most interesting vase from this space is the painted Minoan amphoroid krater mended in antiquity using six lead straps.

Considering the 54 specimens catalogued so far from all the spaces in Sector 5 (Spaces 5.1- 5.12), pithoi belonging to short-necked and long necked types seems distributed in equal number (Fig.6.10). Among the short-necked specimens Varieties 15.1, 18.1 and – in greater quantity – 17.1 are represented.

Opposite long necked types are present with Variety 24.1 and 25.1 (Variant). They all belong to medium-sized specimens

However, among the materials, other rim and thick body fragments (up 3 cm) – sometimes displaying impressed horizontal and wavy bands – were identified. They could belong to big pithoi (Type 24.4 and 25.3). The presence of these fragments suggests that big- sized pithoi were stored in this part of the plateau, despite the difficulty in understanding the precise number of vases which they belong to as well as their exact location.

The analyses of some sherds with horizontal grooves and coarse red fabric coming from spaces 5.3, 5.6 and the area south of Space 7 (*loci* 101, 191 and 122) suggests the possibility that they may reasonably belong to the same big pithos.

Among the fragments catalogues as ND, 17 could be generically attributed to the IV typological family while other 11 to the fifth one (for seven of them it is impossible a sure allocation into a typological family).

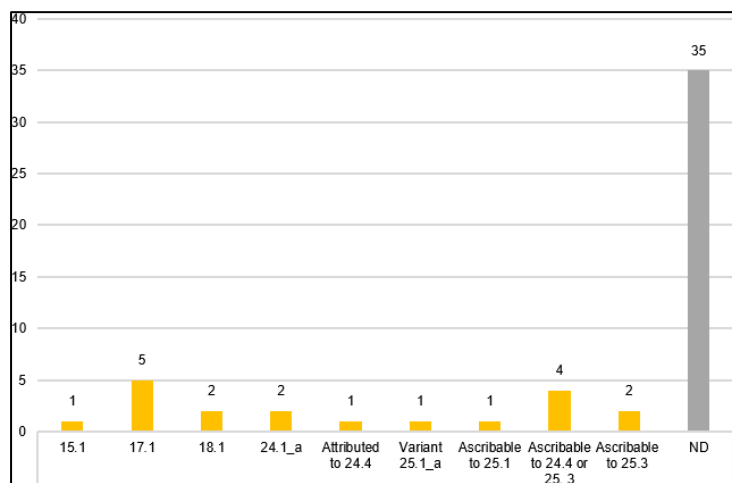


Fig. 6. 10 Type's Distribution of pithoi in Sector 5 (the X-axis reports the pithos types and varieties and the Y axis their quantity).

The detailed association of pithoi with other elements of the material culture is not possible but Sector 5 stands up for the great quantity of valuable materials retrieved so far. In addition to the metal hoard – composed by 28 metal objects – found in 2014 in Space 5.2 (Bretschneider *et al.* 2015), a particularly interest is raised by the presence of the Base Ring II female figure from space 5.3 (PK 15 421) and the amphoroid krater in Pictorial Style decorated with birds (PK15 422) (Jan *et al.* 2017; Caloi 2017). Other objects that could have been imported from Levant of Egypt were retrieved: this is the cases of the two handles stone jar from Space 5.8 and the long-necked Canaanite-type jar from 5.1.

6.3.2. Pithos distribution in old Excavation sectors on the plateau

6.3.2.1. Karageorghis and Demas (and Dikaios Excavation) Excavation in Sector 2 Complex A, B, C, D, E⁸⁰.

During the first excavation on Sector 2 pithoi were found in all the complexes, as shown in the graphic above (Fig. 6. 11). The lower quantity of pithoi from Complex E probably depends only on the extension of the excavation.

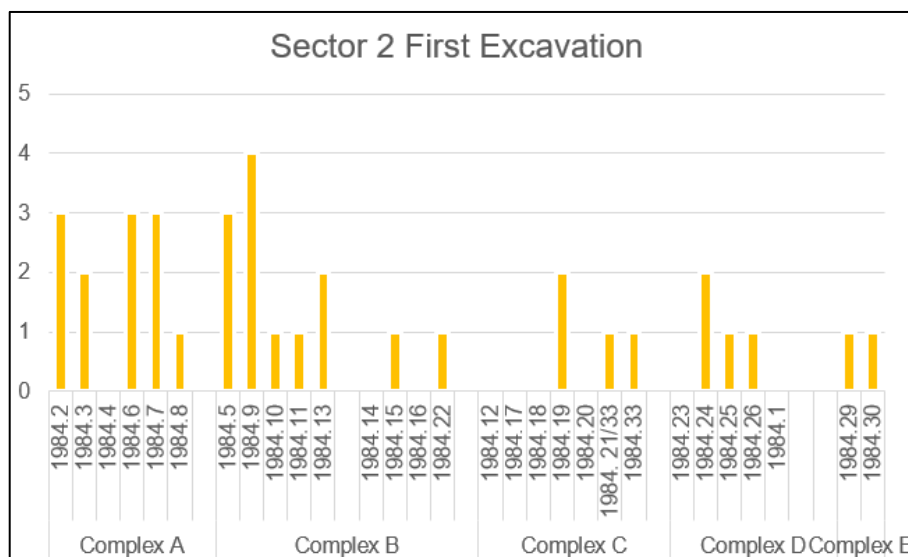


Fig. 6. 11 Quantity of pithoi for each Rooms in Sector 2 (Complexes A-E) (on the X axis are all the spaces considered while the Y axis represent the number of pithoi retrieved).

Taking into account the published specimens, the space with the largest number of pithoi is Room 9 in Complex B, where four pithoi came to light. Complex B presented 13 pithoi in total while Complex A 12.

Room 7 in complex A and Room 13 in Complex B were interpreted as Courtyards and, as in courtyards identified in current excavation, the presence of pithoi seems consistent.

Following the spatial distribution of pithoi and Canaanite jars published in 1984 (Fig. 6. 12), excluding the two courtyards mention above, the spaces more involved in storage are Room 2 in Complex A (and partially Rooms 3 and 6), Rooms 9 and 5 in complex B and finally Room 30 in Complex E where a lot of Canaanite jars and one pithos were found.

Taking into account the typology, it is possible to notice in the graph below (Fig. 6. 13) that short-necked vases (IV typological family) are more common than long-necked specimens. Among the short-necked pithoi, Variety 17.1 is the most represented followed by 17.3.

⁸⁰During the old excavation it is likely that only the complete or the mendable specimens were considered. Therefore, despite the accuracy in the excavations and in the publication of the materials, the quantity of pithoi could be underestimated.

Considering also Variety 18.1, it seems that medium-sized vases with handles are preferred to the handleless ones. All the long-necked pithoi here retrieved belong to Types 24 and in particular to Variety 24.3_a. The long-necked specimens are concentrated in Complex B (three vases on four).

At the moment it is impossible to know the typology of the 12 pithoi retrieved in Complex A excavated in 1952 by Dikaios.

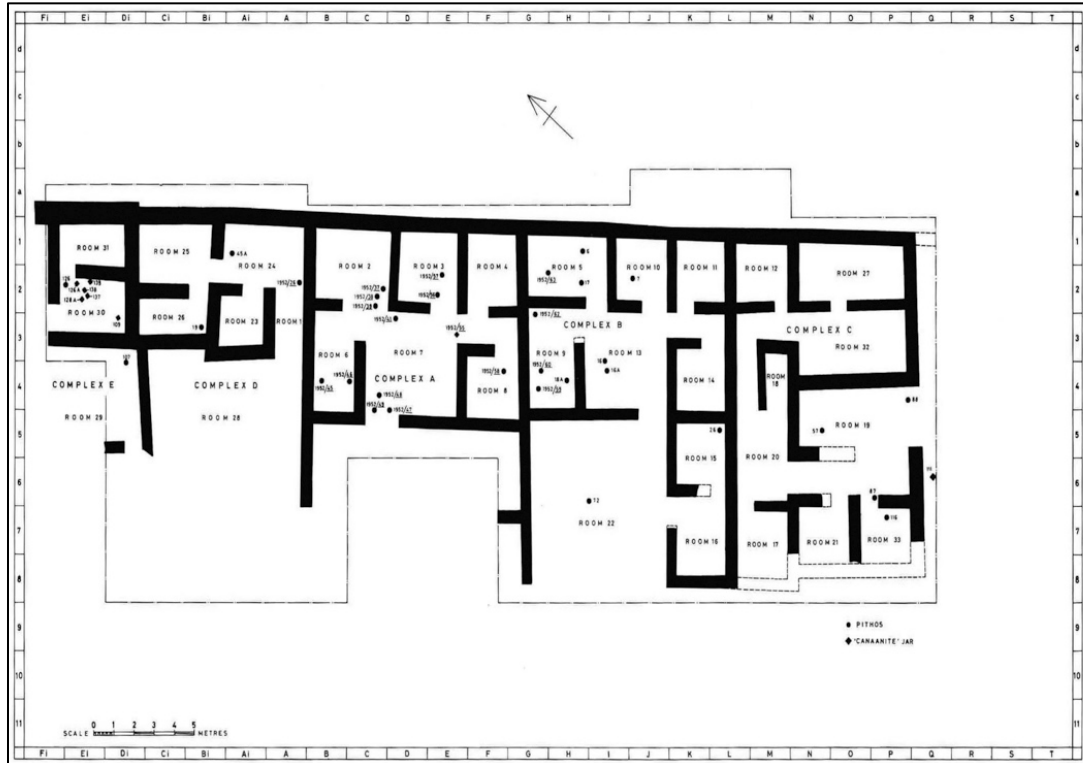


Fig. 6. 12 Spatial Distribution of Pithoi and Canaanite jars (Karageorghis and Demas 1984).

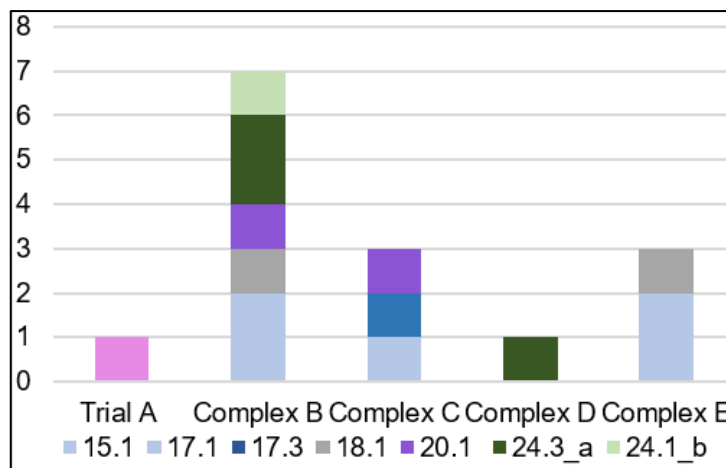


Fig. 6. 13 Type's Distribution in Complexes A-E.

6.3.2.2. Karageorghis and Kanta 2010-11 Excavation in Sector 2 Complex F, G, H and I.

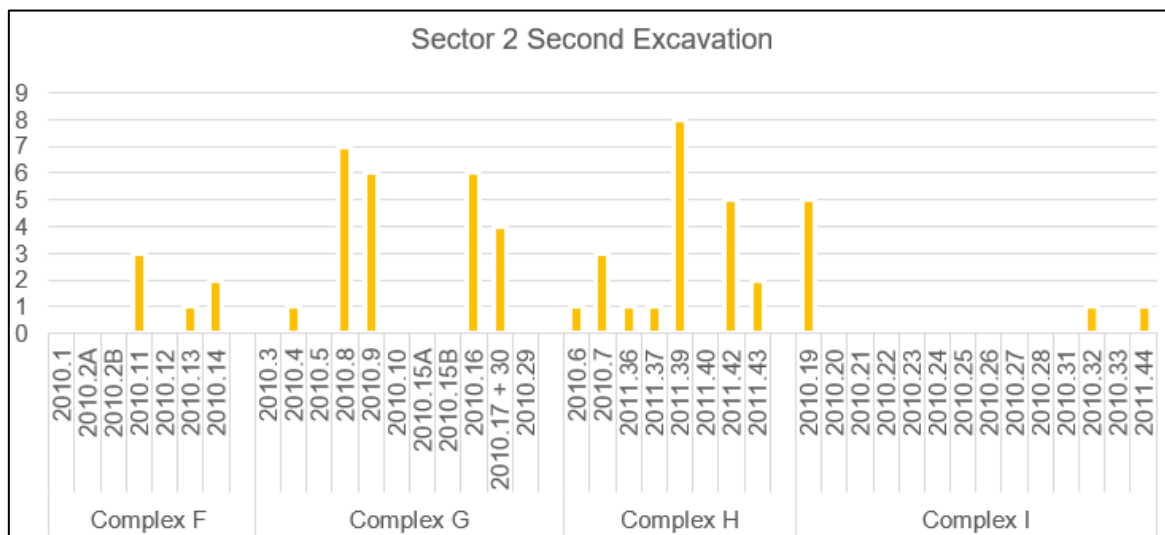


Fig. 6. 14 Quantity of pithoi for each Rooms in Sector 2 (Complexes F-I) (the X axis reports all the spaces considered while the Y axis represents the number of pithoi retrieved).

During the 2010-11 campaign several pithoi were brought to light, coming from each one of the excavated rooms (Georgiou 2014, p. 150). The published materials are listed in graph above according to their provenance (Fig. 6. 14).

The typological analyses conducted by Artemis Georgiou permits to ascertain that pithoi belonging to Keswani Group 1B1 were very common in Pyla, followed by specimens of Group 1B2. These two groups correspond respectively to the present Varieties 17.1 and 18.1⁸¹. Pithoi belonging to Type 24 are rather common especially in the medium-sized variant among the material of 2010-11 excavation. Some other body fragments could actually belong to Variants 24.4_b or 25.3_a.

Summing up, during the 2010-11 excavation a lot of pithoi were retrieved. According to the typology elaborated in the present research they belong in great instance to medium-sized both short and long-necked specimens. Some long-necked pithoi are bigger and could be classified inside Variant 24.4_b or 25.3_a.

As in the case of Sector 4.1 Complexes with the highest number of pithoi also present a highest variety of types.

⁸¹ The former contains pithoi with short neck and two vertical loop handles attached on the shoulder while in the second one there are pithoi with vertical ribbed handles from the rim to the shoulder.

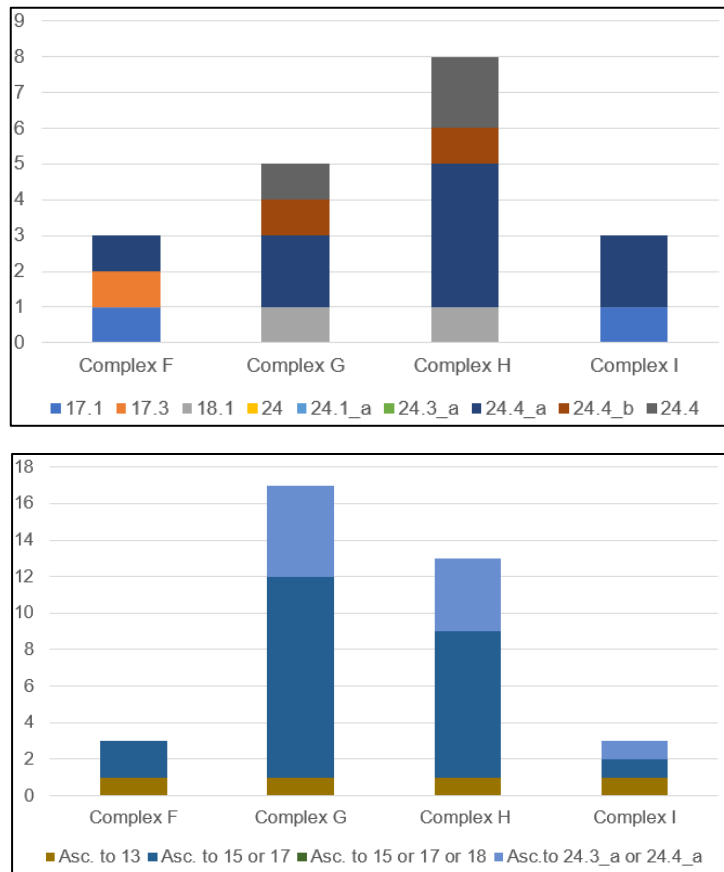


Fig. 6. 15 a and b Type's Distribution in Complexes F-I (a) and of pithoi of uncertain typology in Complexes F-I (b)

Inside these complexes, Rooms 8, 9 16 (Complex G), 19 (Complex I) and 39 (Complex H) stand out for the number of pithoi and seem more involved in storage than other spaces (Fig. 6. 15 a and b).

6.3.2.3. General remarks on pithos frequency analyses

The distribution of pithoi presented above confirms the great diffusion of pithoi in the settlement of Pyla.

Summing up, in total 59 unpublished spaces/rooms distributed in all the Sectors under excavation since the 2014 are considered in the present research (Trench 3.3, Trench 3.4, Sector 4.1, Sector 4.2 and Sector 5) (Fig. 6.16). Sector 4.1 – internally divided in Area North and South of the Gate – is the zone most densely investigated, with a total of 35 rooms uncovered.

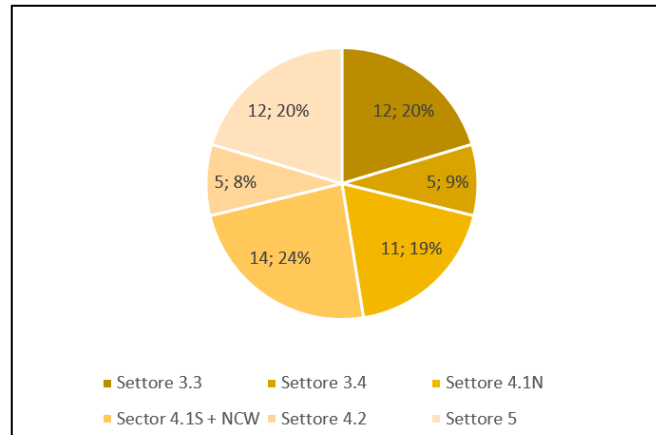


Fig. 6. 16 Number of Spaces considered for each Sector

Considering all these spaces and rooms, pithoi are generally present in most of the spaces excavated, corresponding to 68% of the total of room/spaces. The Graph in Fig. 6.17 shows the number and the percentage of spaces/rooms with and without pithoi among the 59 uncovered spaces.

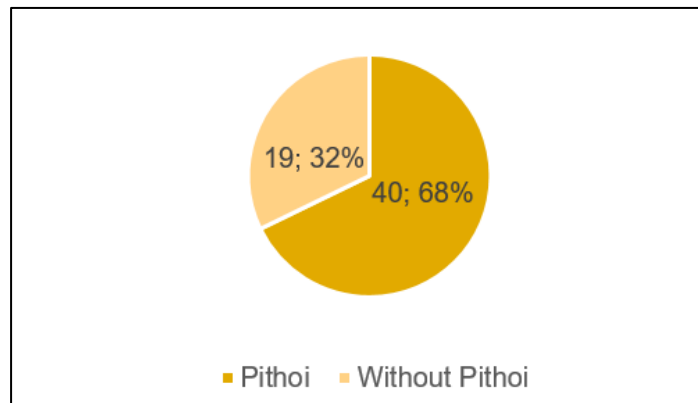


Fig. 6. 17 Quantity and the percentage of spaces/rooms with and without pithoi (total of spaces analysed 59).

The graph in Fig 6.18 shows in detail the quantity and the relative percentage of spaces with and without pithoi for each Sector. Only the mendable pithoi and pithos fragments whose provenience is clearly identifiable are taken into consideration. Those with uncertain allocation are not considered here. Spaces which were provided with at least one pithos are always outnumbered by the ones without them and in particular in Sector 4.2 – all the rooms excavated so far – presented pithoi. The only exception is Trench 3.4 where only one space (courtyard 3.4.2) displays the presence of (three) pithoi. In Sector 4.1 only few spaces do not present pithoi. Some of them – as Spaces 4.17 and 4.20 –, however, are very badly preserved and no archaeological deposit was retrieved there at all. It is not possible therefore to exclude that they were originally provided with pithoi.

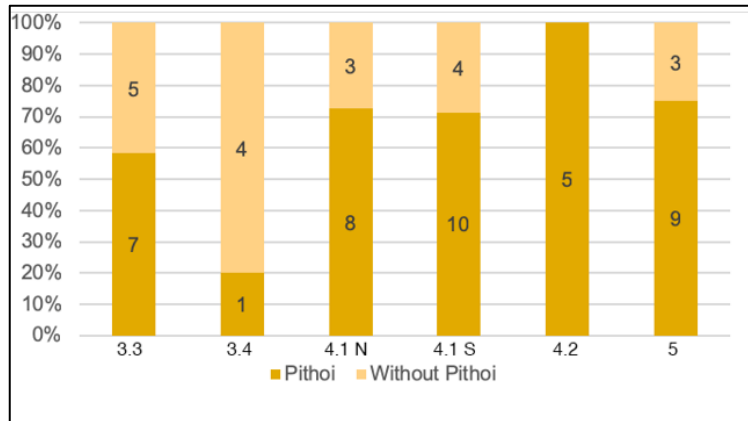


Fig. 6. 18 Number and Percentage of spaces with and without pithoi

Taking into account specifically the number of vases, the graph below in Fig. 6.19 reports the total amount of diagnostic pithoi retrieved in each sector currently under excavation. The highest number (more than 60%) of pithoi come from Sector 4.1 (North and South), in the western lobe of the plateau.

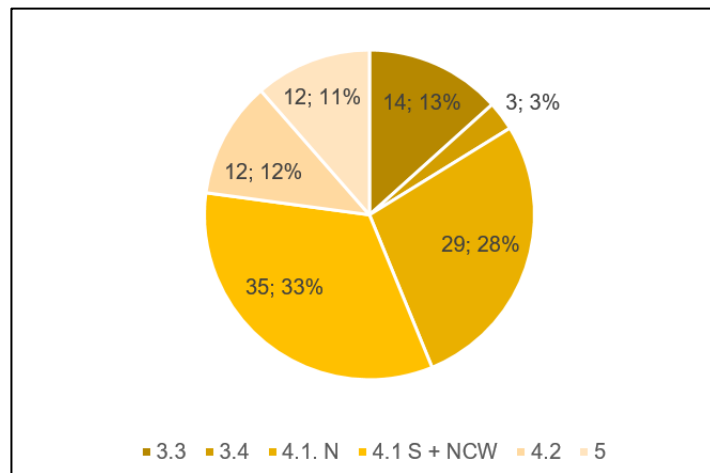


Fig. 6. 19 Quantity of pithoi in each sector.

Sector	N. of Spaces	N. of pithoi	Average Quantity of Pithoi
3.3	12	14	1,2
3.4	5	3	0,6
4.1N	11	29	2,6
4.1S + NCW	14	35	2,5
4.2	5	12	2,4
5	12	12	1

Tab. 6.2 Average Quantity of pithoi in each sectors of the current excavation

Considering the average of pithoi for each sector calculated on the basis of number of pithoi/total of spaces uncovered, Sector 4.1 North, South and 4.2 display a very similar pattern and an average quantity of pithoi more than double respect the other Sectors. Sector 4.1 displays, therefore, a high percentage of rooms with pithoi and also single spaces provided by a substantial number of pithoi.

In Sector 5, where, as in Sector 4.1, more than the 70% of rooms present pithoi, the average quantity is lower because of the lower number of pithoi retrieved.

To sum up, these analyses permits to ascertain that in Pyla there are sectors with:

- High average quantity of pithoi for each room (2,4-2,6 pithoi). In these sectors (4.1 and 4.2) most of the excavated rooms (>70%) present a significant number of pithoi.
- Low average quantity of pithoi for each room (0,6 -1,2). Trench 3.3, 3.4 and Sector 5 are part of this group. They, however present a different situation. Trench 3.3 presents a low average quantity of pithoi because pithoi were retrieved only in less than 60% of the excavated rooms⁸². However, in Trench 3.3 at least two of that spaces present four pithoi each and therefore the average quantity is higher than in Sector 5 where, on the contrary, most of the spaces excavated present pithoi but never more than three for single spaces. Trench 3.4 presents the lower quantity of pithoi, but it is also the less investigated sector and the data at our dispositional are probably not fully representative of the reality.

The largest number of pithoi, in Sector 4.1, seem actually related to the different nature of this compart in comparison to Trench 3.3 and Sector 5 and not depending only on the number of spaces uncovered.

To better understand this distribution and to isolate similarities and differences, all these data will be compared with the ones available for Sector 2. In this area architectural complexes were identified both in the first and second excavati

⁸²As noted before this part of the settlement is deeply damaged and therefore it is likely that pithoi were more widespread.

Complex	N. of Spaces	N. of pithoi	Average Quantity of Pithoi
Complex A	6	12	2
Complex B	9	13	1,4
Complex C	7	4	0,6
Complex D	5	4	0,8
Complex E	3	2	0,7
Complex F	7	6	0,8
Complex G	11	24	2,2
Complex H	8	19	2,6
Complex I	14	7	0,5
Total	70	91	1,3

Tab. 6.3 Average Quantity of pithoi in each sectors of the old excavations

Also, in this case, it is possible to identify single complexes with a high average quantity of pithoi (2 -2,6 pithoi) – Complexes A, G and H, where a high number of spaces present a high quantity of pithoi.

All the other spaces present a significantly lower quantity of pithoi because of the low number of spaces provided of pithoi or for the low quantity of pithoi retrieved in each single space. Considering Sector 2 in total the average is in line with the one of Trench 3.3 where only some spaces were provided with a significant number of pithoi. It is necessary to underline that this evaluation is based only on the published material and therefore it is possible that pithoi were not fully published providing us a slightly lower average.

Passing to the typological analysis it is possible to assess that in Pyla both short-necked and long-necked pithoi are present. However, in accordance to the classification proposed in Chapter 4 pithoi belonging to the IV Typological family – *pithoi with articulate profile and distinct short neck* – are more diffused (46%), among the material coming from the 2014-2016 excavation seasons (Fig. 6.20). Pithoi belonging to the fifth Typological family are also present in good percentage (33%), while only two specimens belong to the second Typological Family.

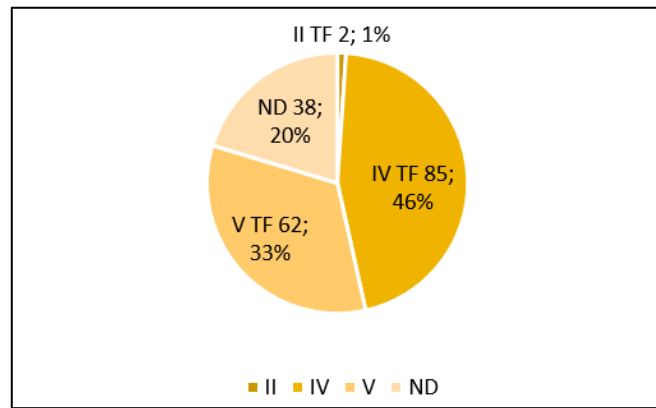


Fig. 6. 20 Short-necked and Long-necked pithoi at Pyla (TF: Typological Family).

The dimensional analysis of the pithoi presented (Fig. 6.21) confirms that in Pyla small/medium-sized pithoi are the most common. However, considering, in the analysis also pithoi retrieved in the topsoil levels and dispersed over the whole area of each sector the picture became more variegated.

The comparative analyses between small/medium and big-sized pithoi in all Sector (new and old excavations) confirm the prevalence in Pyla of medium size-specimens – namely belonging to short-necked varieties, fourth Typological family – on big-sized specimens. Inside this general prevalence, however, in Sectors 2 and 5, big-sized pithoi are in percentage more common than in the other sectors. The eastern (Sector 2⁸³) and southern-eastern (Sector 5) lobe of the Pyla plateau present therefore a higher number of big-sized specimens than the other areas. The lower average quantity of pithoi in Sector 5 can be imply that this lobe of plateau was involved in storage of substaces within big-sized pithoi differently from the other sectors where storage was performed inside (a high number of) small vases. The total storage capacity of Sector 5 may be not that different with respect to Sector 4.1.

⁸³Some of the specimens classified as ND could reasonable be big-size pithoi. However, the lacking of any kind of graphic documentation does not allow a more precise allocation.

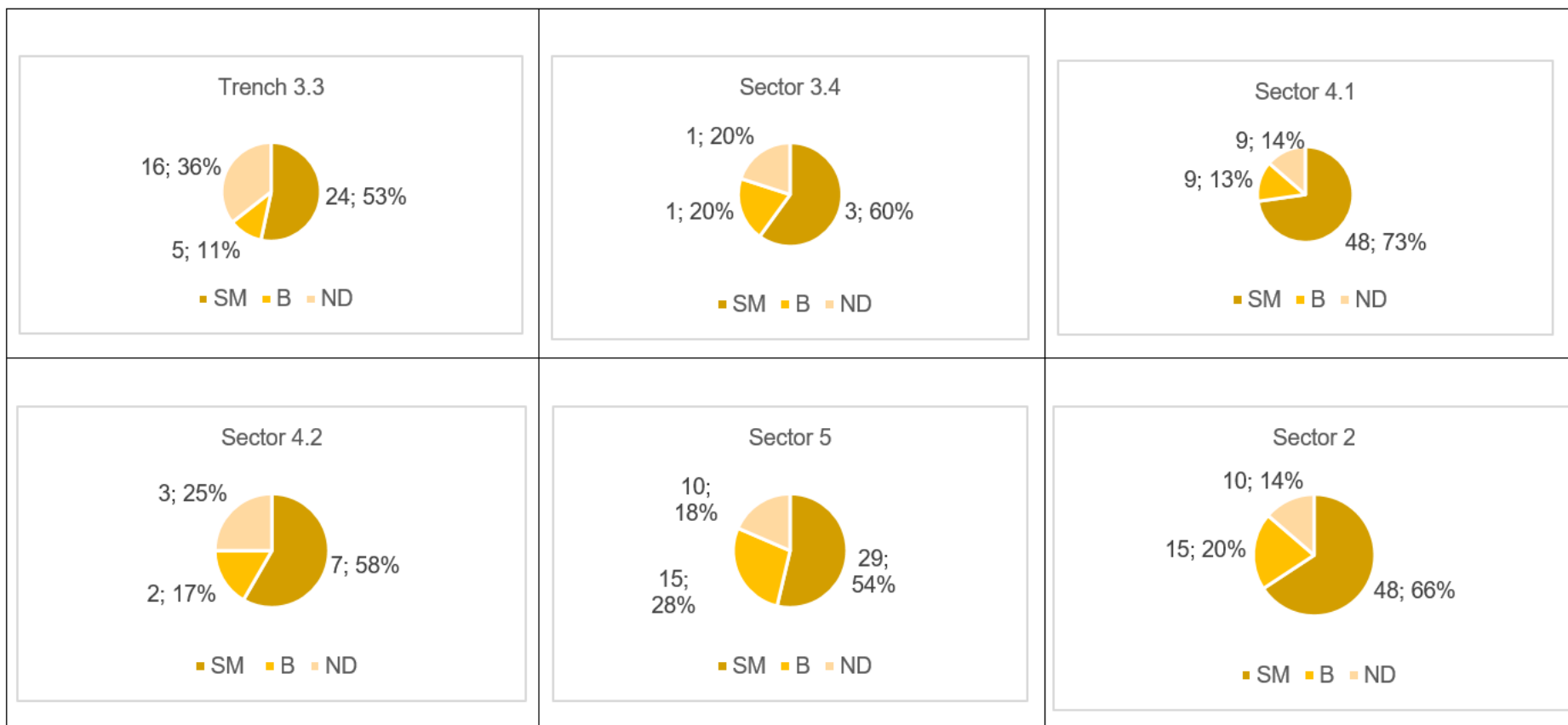


Fig. 6. 21 Short-necked and Long-necked pithoi at Pyla (TF: Typological Family)

Considering big-sized pithoi from a typological point of view, they present the typical grooved decoration as common in Cyprus during the LBA. However, among the material analysed, only few body sherds exceed the thickness of 3.5 cm. In the typology of the pithoi from Kalavassos, (Keswani 1984; 1989) they are classified into the Group III, which gathers examples tall up to 2 m. In Pyla, big pithoi (Varieties 24.4_a and 25.3) were therefore present, but probably only few of the “giant” version (24.4_b, Keswani Group III). From a functional point of view, pithoi of big dimension were traditionally related to centralized storage due to their presence in the monumental magazines discovered at Kalavassos, Maroni and Alassa. Differently from those contexts, however in Pyla none of the spaces analysed so far was specifically devoted to the storage of huge quantities of big-size specimens.

Going further into detail and considering the type’s diffusion (including all the varieties) in each sector (3.3, 3.4, 4.1 and 5), some additional suggestion can be made. Among the small/medium-sized vases, specimens characterized by wide mouthed and two vertical handles belonging to Variety 17.1 or 18.1 (fourth Typological family) are very common.

These data seem in line with the evidence from the eighties excavations where short-necked pithoi belonging to Type 15, 17 and 18 were common. This is true especially with regard to the first excavation in Sector 2 (Karageorghis and Demas 1984) while the situation which emerged during the excavation 2010-11 presents a substantially equal number of short- and long-necked vases.

The general diffusion of varieties of short-necked pithoi could be related to specific necessities. Medium- size pithoi with handles could be used to store a broad range of substances both liquid and arid and also moved from one place to another if needed. As specified in § 5.5.1.1 small pithoi could be used not only to store substances with a high rate of consumption but also substances that needs to be consumed shortly.

The sector with the greatest variety of Types is Sector 4.1. This is of course, a direct consequence of the high number of pithoi retrieved there. At the moment three specimens without comparison in other areas of the settlement come from this sector. The first is the *Unicum* 1, a probable import from Palestine, coming from Room 4.11, that until now has no comparison in the wider island panorama. The second, which comes from Room 4.42, belongs to Type 4. In this case a comparison was found among the material from Kition (Karageorghis and Demas 1985). The third specimen belongs to Type 26, it is a small pithos with long neck and big horizontal handles.

All the other types/varieties are spread generally in all the sectors. The absence of specimens of Type 15 or 17 in Trench 3.4 is, at the moment, interpretable more in term of excavation extension than from a function point of view. Future excavations will allow a clearer evaluation.

Summing up, Sector 4.1 is the area with rooms that stored more pithoi together, followed by complexes G, H and B of the previous excavations. The other sectors present a more dispersed presence of pithoi, despite in some spaces up to four pithoi were found. Considering the number of pithoi as an indicator of storage, single spaces with more than four pithoi are present in Sector 4.1 complexes G, H and B, that could have been used as storage spaces. This is valid also for space 3.3.12 in Trench 3.3. Space 3.4.2 is an open courtyard and the presence of three specimens there could be related to its multifunction nature rather than to storage *stricto sensu*.

In addition to the simple quantitative evaluation, an aspect that seems relevant is the presence in the same spaces of pithoi and other types of vases (e.g. cooking ware or tableware). All the vases recognized so far were preliminary listed in the pages above. It appears that some rooms (i.e. 4.8, 4.9 and 5.3) have a more variegate assemblage and pithoi were stored together with other pottery classes. Some of them are related to storage, as Canaanite jars or piriform jar, but others are tablewares (i.e. jugs, kylix, bowl and kraters). What seems interesting is the association in at least two contexts (Room 4.7 and 4.29) between pithoi and clay bathtubs. Until now it has not been possible to ascertain if bathtubs were simply stored inside those rooms or if their presence and their association with pithoi relates to the performance of specific functions.

The study of the other artefacts retrieved (pottery, lithic tools and metal finds) is still in process and may shed light on the reasons for the presence of other tools or implements. In some spaces it is possible to underline a general association between pithoi and quern/grinding tools related to the production and manipulation of food. Quern were found in Room 4.9, 4.13 and 4.22 as well as in the courtyards 4.10 and 3.4.2. A possible quern was also identified in space 3.11.

Regarding the way in which pithoi were stored, in spaces 3.4.2 and 5.3 pot stone stands that may have been used to house pithoi were retrieved. The use of stone bases for pithoi is well attested elsewhere in the island such as, for example, in the Pithos Hall at Kalavassos (Keswani 1992).

Some pithoi, with or without stone bases, were stored free standing in the rooms or in the courtyards. Some others were sunk in the floor, such as for example in Room 4.12 and 5.11. The use to embed pithoi in the ground is frequent in Cyprus and attested, for example, at Toumba Tou Skourou and Alassa (Keswani 2009). The different ways of housing pithoi could be related to the different substances contained and in accordance with their conservation needs.

In conclusion, none of the sector is related to the storage of a unique types/varieties of pithoi. Until now, as stated above, there aren't spaces used to store exclusively big-sized pithoi. However, the difference in terms of quantity and dimension of pithoi in the sectors analysed confirms the possibility of a functional differentiation among the areas of the settlement. At present, indeed, Sector 4.1 and 4.2 display a higher quantity of vases that the other sectors but in Sector 2 and especially 5 big-sized vases are more common. The courtyards display usually a significant presence of pithoi in association with other types of vessels and stone tools confirming that they were used to perform a wide range open air activity.

6.3.3. Analysis of the density of pithoi

With the goal to verify the existence or not of similar patterns in the different areas of the plateau, pithoi are distributed also with regard to the dimensions of each room (Tab. 6.4). The calculation of the density of specimens for sq m. permits to identify three different kinds of rooms.

Space	Area	N. of Pithoi	Density	Range
1984.22	45,601	1	0,02192934	
3.3.9	16,4	1	0,061	
4.22	14,42	1	0,069	
4.10	11	1	0,091	
3.3.11	10,08	1	0,099	
5.11	9,075	1	0,110	
1984.13	15,933	2	0,125	
2010.4	7,4902	1	0,133	
2010.13	7,2655	1	0,137	
1984.19	13,98	2	0,143	
1984.30	6,822	1	0,146	
2011.37	6,7975	1	0,147	
2010.14	13,075	2	0,152	
1984.8	6,426	1	0,155	
5.12	6,325	1	0,158	
1984.10	6,164	1	0,162	
4.33	6,09	1	0,164	
1984.7	18,135	3	0,165	
1984.15	5,89	1	0,170	
4.18-19	11,624	2	0,172	
4.11	11,3	2	0,177	
3.3.1	22,4	4	0,178	
2010.6	5,0208	1	0,199	

1984.26	4,951	1	0,201	I
5.1	4,875	1	0,205	I
1984.24	9,673	2	0,207	I
3.3.7	4,5	1	0,222	I
5.8	13,09	3	0,229	I
1984.3	7,881	2	0,253	I
1984.2	10,46	3	0,287	II
2010.7	10,01366	3	0,299	II
1984.5	9,355	3	0,320	II
5.3	9,35	3	0,321	II
2010.17 +30	12,3213	4	0,325	II
2010.11	8,7636	3	0,342	II
3.3.12	11,4	4	0,351	II
5.9	5,6375	2	0,355	II
1984.6	8,109	3	0,370	II
4.14 A	5,19	2	0,385	II
5.6	5,04	2	0,396	II
4.14 B	9,41	4	0,425	II
1984.9	9,366	4	0,427	II
3.4.1.2 -3.4.2	6,9	3	0,435	II
4.13	14,6	7	0,4795	II
2011.42	10,224	5	0,489	II
NCW1	9,1	5	0,549	II
2010.19	8,7385	5	0,572	III
4.12	7,3	5	0,684	III
3.3.2	4,09	3	0,733	III
2011.39	10,6361	8	0,846	III
2010.8	8,2533	7	0,848	III
4.9	6,8	6	0,882	III
2010.9	5,2868	6	1,135	III
4.7	13,332	17	1,27	III

Tab. 6.4 Contexts considered in evaluation of density of pithoi.

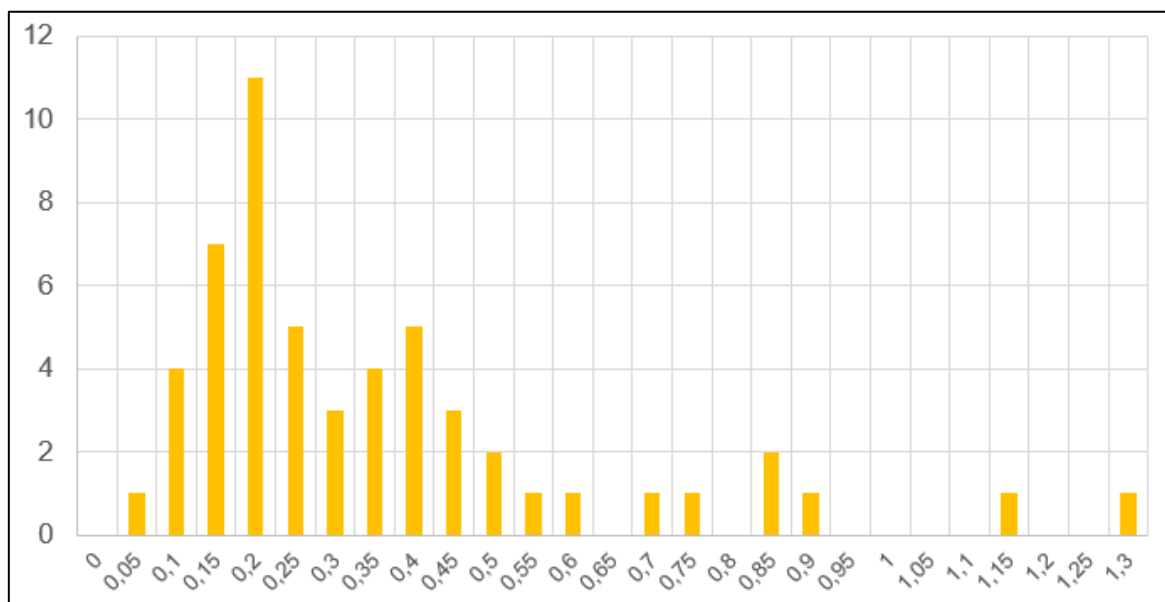


Fig. 6. 22 Frequency Distribution of Density Values in Pyla. On the X axis the values of density are reported., while the Y axis reports the number of specimens for each value.

1- Rooms with a low density of pithoi (range 0,0-0,25).

This group gathers the greatest number of spaces (29 rooms/spaces) among the ones analysed so far. In general, they are spaces provided with only one pithos (19 rooms on 29).

In these rooms medium-sized pithoi both short-necked or long-necked were present. Space 4.11 and 5.9 are two exceptions. Inside these spaces, two pithoi were stored and one of them is ascribable to Types and Varieties of big dimension.

The group also includes Space 3.3.1, Space 5.8 and Room 7 in complex A, three spaces interpreted as courtyard and provided with more than one pithos. The first, Space 3.3.1 is the open courtyard identified in Trench 3.3 where four pithoi of medium dimension were retrieved. Due to its big dimension, despite the high number of pithoi the general density is low. The same is true for Space 5.8 and Room 7 where three pithoi were found.

2- Rooms with a middle density of pithoi (range 0,30-0,70).

This second category gathers 17 rooms/spaces, with a number of pithoi between two and seven. Some of these rooms present only small-sized pithoi but other rooms contained small/medium and big pithoi associated together.

3- Rooms with a high density of pithoi (range > 0,60).

This group is more dispersed than the first two and presents a low number of spaces (eight on 30). They present between three and 17 pithoi. These rooms present more frequently only small/medium-sized pithoi but, for example, small/medium and big pithoi are associated together in Room, 2010.8, 2010.19, 2010.39.

The values of Density presented above underline once again the general diffusion of pithoi in all the plateau of Pyla. The available data from the previous excavation are in line with the ones emerged in the present project as for the quantitative and qualitative distribution presented above. The density computation was not possible for all the spaces considered in the quantitative and qualitative study of pithoi. Some of them indeed do not present clear spatial limits.

Trench 3.3 presents rooms with medium-low density, with the exception of 3.3.2, a small space provided with three pithoi. Sector 4.1 presents rooms with high, medium and low density. As expected, all the rooms with high density are located close to the casemate wall – the best preserve area – while the ones with low density are located in a more central position where the archaeological deposit is badly preserved. Sector 5 presents only spaces with low and medium density.

The presence of 29 spaces with low density of pithoi confirms the general distribution of pithoi in the whole plateau: indeed, despite in some of them only one pithos was present, this testifies the diffusion of this kind of vases in all the excavated context. The second and especially the third category hints on the contrary to the possibility that some of these spaces were devoted to storage.

In particular, spaces devoted – at least partially – to storage are the ones classified in the third range of density. Considering only the current excavation project, all the rooms in this range – with the only exception of space 3.3.2 – are located in Sector 4.1. Once Again sector 4.1 stands up for the huge quantity of pithoi.

The understanding of the meaning of this distribution is still difficult. Taking into consideration the current excavation, the evaluation of the complete archaeological assemblage retrieved in the spaces and the analyses of the architecture will allow a better understanding of the sectors and the identification of single complex or domestic unit. The identification of complexes and structures is, indeed, fundamental in the understanding of the scale of storage. At this point it is important to understand if Sector 4.1 needs to be considered as a unique complex where several spaces were – at least partially – devoted to storage or if it was internally divided in several distinct units as verified in Sector 2 (Karageorghis and Demas 1984; Karageorghis and Kanta 2014). The total storage capacity would be very different and also its meaning.

The residual analyses presented in § 5.3.3 underline a similar chemical compound in all the five fragments analysed. At present, considering also the low number of pithoi chemically investigated, precise information about the contents of pithoi are not available and it is thus not possible to verify differences among the Pyla's sectors. In particular, it will be interesting to

verify if small/medium-sized pithoi were used to store different substances from the big-sized one attested – more frequently – in the eastern lobe of the plateau.

It is therefore possible that Sector 4.1 was involved not only in productive activities, as underlined by the excavators (Kanta 2017), but also – at least in part – in storage.

In particular, Room 4.7, stands out for the exceptional quantity of pithoi retrieved there. Other spaces with a significant quantity of pithoi are Room 9 and 14A-B⁸⁴. In the other sectors of the plateau no rooms contained the same number of pithoi (Fig. 6.4).

6.3.4. Conclusions

In conclusion we would try to relate all the evidence collected in the study of pithoi with the history of Pyla and its socio-political organization.

Considering the data emerged by the excavation, it is possible to ascertain that the casemate layout, identified for the time in Sector 2 (Karageorghis and Demas 1984), enclosed the entire plateau (Bretschneider *et al.* 2017). Sectors 5 and 4.2 could be interpreted as bastion-like structures, located at the extremities towards the sea where the port may be had been located.

In addition, until now at least two gates were identified, one in Sector 4.1 in the western lobe (investigate by Athanasia Kanta during the 2012 season) and the other in Trench 3.3 in the northern area of the plateau.

The new excavation also confirmed the regularity in the architectural remains and installations such as shaft, pits and channels. All the elements seem to confirm the presence of a general plan in the Pyla layout which was not randomly built.

This points to the existence of some kind of central authority whose nature, however, is not clear at the moment. Analysing further all these data, the excavators also suggest the possibility that this authority may had been responsible for the functional organization of the settlement and maybe also for the metal and textile production (Bretschneider *et al.* 2017).

The storage-related data collected so far seem connected to a storage system that exceeded the domestic ones. All the sectors considered – with the exception of Trench 3.4 – pertained to the enclose casemate system of the site in the north, west and east lobes. It is therefore possible that these sectors were devoted to particular function different from the mere domestic ones. The particular character of the casemate sectors is visible also in the evidence of metal and textile production. In particular, some spaces seem clearly exceeding the single-family

⁸⁴In these spaces also imported storage vases like Late Minoan and Mycenaean amphoroid kraters and a great number of Canaanite-type jars were found.

storage needs (Room 4.7, 4.9, 4.13 and 4.14) and they could probably have been related to a collective or centralized storage system.

It seems important to underline that the total storage capacity of Pyla could increase reasonably if we consider the large amount of Canaanite-type jars present. In several spaces (i.e. 3.4.2, 4.9 and 5.1) they were found in association with pithoi but their analysis is still ongoing and it is not possible to make further hypothesis now. On the contrary, other types of storage facilities such as silos or granaries are totally absent. None of the pits identified during the excavation could be interpreted as a silo without any doubt. Their presence, however, could not be excluded at all and needs more detailed examination.

At this point, and considering the differences emerged in the pithos frequency distribution among the sectors, it is possible to suggest that this authority may have extended its control also over – at least part – of the stored goods.

At present, however, clay sealing (*cretula*) and any kind of sealing systems of the vases and rooms/spaces are completely missing. They could help in understanding the type of control carried out over the stored goods. The continuation of the excavation and the study of the evidence collected so far will allow a better understanding of the socio-economic organization of the site.

A final remark concerns the presence of water of Pyla. Water sources were not available in Pyla: during the excavation 2010-11, in particular, Athanasia Kanta (Kanta 2014a) identified cisterns/pits in several spaces of the settlement. These, sometimes in combination with channels (i.e. Room 4.7), were connected to the necessity of collect (rainy) water. Looking at the high number of pithoi also from this perspective, it is possible that some of the hundreds of pithoi recovered in Pyla may had served as water containers. If this last hypothesis will be confirmed, the interpretation of the storage capacity rate and its socio-economic implication will have to be rethought.

6.4. Kommos Frequency Distribution Analysis

Kommos is one of the main ports of trade of the LBA Mediterranean Sea, characterized by a rich repertoire of allochthonous ceramics. Its peculiarity, which distinguishes Kommos from other Mediterranean ports of trade, lies in the length of the period during which it received such ceramics (LMI-LMIII) and in the exceptional number of countries involved in its trade area: Anatolia, Near East (from Syria to Palestine), Cyprus, Egypt, Continental Greece, Aegean Islands and Sardinia.

Thanks to the work conducted by the archaeological team from the Toronto University led by Maria and Joseph Shaw, the site of Kommos had been widely published providing several data about the structures and a comprehensive description of all the pottery retrieved (Shaw 1996; Shaw 2006).

The analysis of the pithoi retrieved in Kommos is based on the publication of the LMIII materials made by L.W Watrous (1992), J. Rutter (2005) and on the recent publication about House X (Rutter *et al.* 2017).

6.4.1. Frequency Distribution Analysis of local pithoi

Actually, despite the extensions of the excavated areas not so many pithoi have been found in the whole settlement in Kommos.

Looking at the published material, only 13 LMIII pithoi can be recorded (Fig 6.23). They come from each sector of the settlement, both from the Civic Centre and from the residential areas of House X, Hillside and Hilltop (Pls. 125-130).

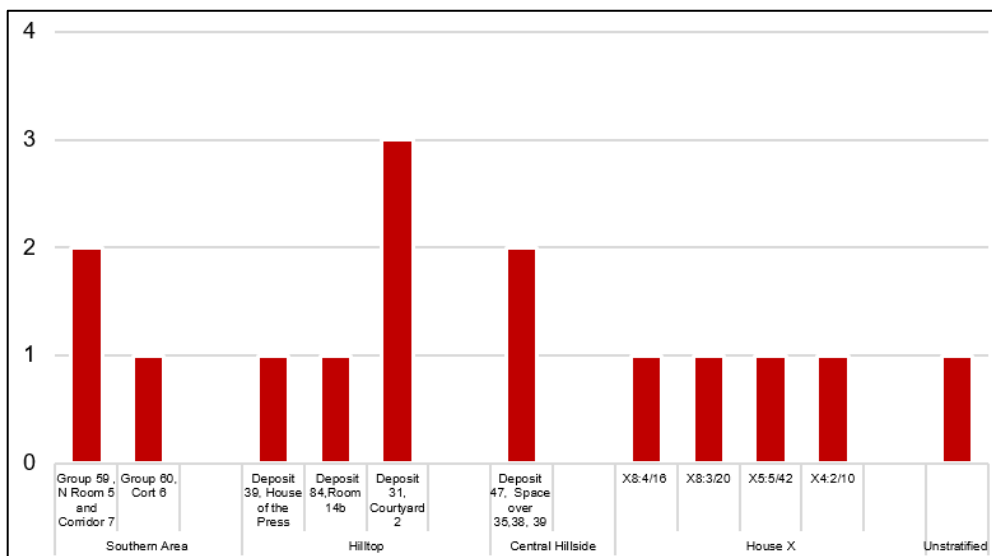


Fig. 6. 23 General Distribution of pithoi in Kommos. On the X-axis the Deposit (*sensu* Watrous, cf. footnote n. 14) and on the Y-axis the quantity.

Some other pithos fragments are just mentioned by Watrous in the Appendix of his volume about LMIII pottery (1992). However, none of these could clearly be attributed to any specific type or variety of the present Typology, because of the lack of graphic documentation. The following table lists (Tab. 6.5) all the Deposits recorded by Watrous (with their localization and chronology) where pithos fragments were retrieved. It is anyway not possible to ascertain the real number of pithoi (whether one or more) found in each of the listed Deposit.

Deposit ⁸⁵ /Group	Localization	Chronology
25	Central Hillside-House of the snake tube	LM IIIA1
37	Central Hillside-Debris from South House of the snake tube	LM IIIA1/2
31	Hilltop-Courtyard 21	LM IIIA2-B
39	Hilltop -House of the press_Room5	LM IIIA2-B
55	Hilltop-North House, Room N17a	LM IIIA2-B
58	Hilltop-Court 2	LM IIIA2-B
66	Hilltop-Courtyard O13	LM IIIA2-B
76	Hilltop-Court 11	LM IIIA2-B
82	Hilltop-Court 2	LM IIIA2-B
84	Hilltop-Room 14b	LM IIIA2-B
86	Hilltop-Room 6	LM IIIB
97	Hilltop-Room O19	LM IIIB

Tab. 6. 5 Deposits with unpublished pithos fragments.

As far as it was possible to ascertain, all the Kommos pithoi published so far are medium-sized specimens, generally plain. They are provided with both horizontal and vertical handles. Five of the specimens classified belong to Type 21 – *pithoi with ovoid or ovoid-elongated profile, provided with cylindrical neck and two horizontal handles interposed with small vertical little handles on the shoulder*. The only exception is P 1418 which bears a plastic decoration and can be classified as a medium-big sized pithos.

Taking into consideration typology and chronology, all the specimens retrieved in House X date to the early LM IIIA2. House X hosted the only specimen (P 1423) belonging to Type 3 of the first typological family known so far from Kommos. It was found in Room X8 with another pithos (P 1428) belonging to Variety 21.1. Another pithos belonging to Variety 21.1 was found

⁸⁵Watrous defines Deposit a wide range of contexts: any primary floor storage, any long-term accumulation of material on a floor, but also secondary deposits associated with a floor level and finally groups of ceramics dating the structures or otherwise of intrinsic interest (Watrous 1992). In the publication of the Southern Area, on the contrary, Rutter gathers the pottery into ceramics Groups.

in Room X5 (P 1421). Finally, (P 1422) is *Unicum 2* and comes from Room X4. They are all medium-sized specimens.

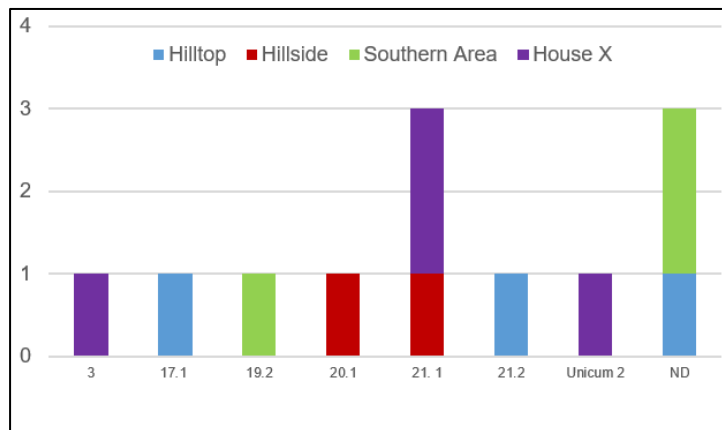


Fig. 6. 23 Type Distribution in each sector in Kommos.

All the pithos fragments published from the Southern Area date to LMIIIB. Two pottery groups dating to this phase are made of material clusters from floor deposit. The first Group, n. 59, corresponds to the floor deposit of Room 5-7 of Building N and hosted two pithos bases (P 1415 and P 1416).

Another pithos comes from Group 60 – namely floor level of Building N. It is the only (fragmentary) pithos from Kommos bearing a complex plastic decoration. The vase has been ascribed to Variety 19.1 in the present Typology.

Considering the Central Hillside in the LMIIIA1-2, a complete pithos sunken into the floor was identified in Room 6 of the House of the Snake Tube (Deposit 25). It was placed upside down and the base was cut at the floor level. It was used to store tableware and stone tools. The pithos dates to the construction phase of the House – LMI – but it was still in use during the LMIII. Other pithos fragments dating to LMIIIA1-2 were collected among the materials of Deposit 37, defined by the excavators as made of “debris” coming from the House of the Snake Tube (Watrous 1992). In this last case it is not possible to ascribe the fragments to any of the Types or Varieties nor to identify their original location inside the House.

Deposit 47 is the most interesting LMIIIB context in the Central Hillside. We refer in particular to the area over Rooms 35, 38 and 39, where two pithoi were identified. They belong respectively to Variety 20.1 (P 1419) and 21.1 (P 1420) and date to LMIIIB. Watrous (1992) points to the possibility that the area was devoted to storage. Indeed, in addition to the two pithoi, several local stirrup jars were retrieved there as well.

In the area of the Hilltop several houses were identified during the excavation. However, published pithoi come from only few of the them, dating to LMIIIA-B. Considering pithos fragments catalogued by Watrous in the Appendix (Tab. 6.2.) (Watrous 1992), it is possible to

notice that most of the pithos fragments come from spaces interpreted as courtyards. In particular, five pithoi were recognized in Court 2 (Deposit 82). The excavators date three of them to the LMIIIA2-B while the last two specimens are probably earlier and date to MM-LMI. They are all unpublished except one, which is described as a rim with *tenia* band (Watrous 1992, p. 38). The deposit is very interesting due to the presence of some Nuragic vases (three jars and one pithos).

The other published specimens from the Hilltop houses are all medium-sized vases with short neck and provided with handles. One pithos, P 1414, was retrieved in Room 5 of House of the Press (Deposit 39) and belongs to Variety 21.1. A second pithos was found in Room 14b (Deposit 84) and belongs to Variety 17.1 (P 1434).

6.4.2. Frequency Distribution Analysis of the Imported storage vases

The low number of published local pithoi does not allow a full comprehension of the storage systems active in LMIII Kommos. Due to the peculiarity of the site and the great quantity of imported vases coming from whole Mediterranean, also imported vases will be inserted in the analysis of storage practices. This will also permit to verify if imported vases were or not part of the local management of resources.

Canaanite and Egyptian jars, Cypriot pithoi, Cycladic pithoi, Nuragic pithoi/jars will also be considered in the analysis⁸⁶. Cretan transport vessels, Transport Stirrup jars (TSJ, FS 164)⁸⁷ and Short Necked amphoras were excluded, as well as Mycenaean painted Stirrup jars made in fine clay, as only certain imports were considered⁸⁸.

It is presumed that imported vases are fully published because of their importance in the reconstruction of the maritime traffics. The number of imported vases listed below, can therefore be considered very close to the real number of imported vases recovered in the excavated trenches in LMIII Kommos.

The following Table (Tab 6.6) lists all the published Deposits and Groups with imported storage vases.

⁸⁶Nuragic pithoi and jars will be considered here, despite recently Rutter (2017, p. 270) suggested that, differently from the other categories of foreign transport vessels these do not seem re-usable shipping containers, due to their technological characteristics (relatively low-fired *impasto*).

⁸⁷The TSJ, based on the Furumark classification, are (FS 164-Big Domestic) large closed vessels with an average capacity of 14 litres used to contain and transport liquids. Unlike other SJs they are made of coarse pottery.

⁸⁸In the present analysis Anatolian and Greek imports were not considered because they are not storage vases *stricto sensu*. At present no Anatolian pithoi are known from Kommos as well as pithoi from the Mainland. Most of the Anatolian imports are fragmentary trefoiled jugs. From the Mainland several fine clay Stirrup jar, Piriform jars and Alabastra were retrieved. They are not included in the analyses because they were used to store small quantities of scented oils and not staple.

Deposit	N. K III	N°Inv	Description	
27_2	Hillside, House of the Snake Tube, Room 10	C1780	Canaanite Jar	LM IIIA1
37	Hillside, Debris South of House of the snake tube	C5770	Cypriote Plain white pithos	LM IIIA1/2
37	Hillside, Debris South of House of the snake tube	C2924	Canaanite Jar	LM IIIA1/2
37	Hillside, Debris South of House of the snake tube	C5733	Canaanite Jar	LM IIIA1/2
43	Hillside, Area South of Room 30	C3171	Cypriote Plain white pithos wheel-made	LMIIIA2
60	Hillside, Room 21	C1769	Sardinian closed shape	LM IIIB
75	Hillside, House of the Snake Tube, Room 3	C1699	Sardinian closed shape	LM IIIB
75	Hillside, House of the Snake Tube, Room 3	C1845	Canaanite Jar	LM IIIB
75	Hillside, House of the Snake Tube, Room 3	C1474	Egyptian Jar	LM IIIB
ND	Hillside	C2556	Canaanite Jar	ND
ND	Hillside	C1053	Canaanite Jar	ND
ND	Hillside	C4527	Canaanite Jar	LMIIIB
ND	Hillside	C287	Egyptian jar	LMIIIA1
ND	Hillside	C1649	Egyptian jar	LMIIIA
ND	Hillside	C4107	Egyptian jar	LMIIIB
29	Hilltop, North House, Room N6-8	C5977	Egyptian jar	LM IIIA1/2
29	Hilltop, North House, Room N6-8	C5984	Canaanite Jar	LM IIIA1/2
36	Hilltop, Room 26	C1172	Canaanite Jar	LM IIIA2-B
52	Hilltop, Room N11	C2646	Canaanite Jar	LMIIIA1-2
52	Hilltop, Room N11	C2764	Canaanite Jar	LMIIIA1-2
53	Hilltop, Room N12-13	C5960	Egyptian jar	LM III2
66	Hilltop, Courtyard 013	C1564	Canaanite Jar	LM IIIA2-B
66	Hilltop, Courtyard 013	C4143	Cypriote Pithos plain white	LM IIIA2-B
72	Hilltop, Courtyard 21	C1573	Sardinian closed shape	LM IIIA2-B
76	Hilltop, Court 11	C4625	Sardinian closed shape	LM IIIA2-B
81	Hilltop, North House, Room 17a	C1147	Sardinian collar necked jar	LMIIIB
82	Hilltop, Court 2	C5349	Sardinian swollen lipped jar (dolio)	LMIIIB
82	Hilltop, Court 2	C5348	Sardinian collar necked jar	LMIIIA2-B
82	Hilltop, Court 2	C5464	Sardinian collar necked jar	LMIIIA2-B
82	Hilltop, Court 2	C847	Sardinian collar necked jar	LMIIIA2-B
83	Hilltop, Room 3	C157	Sardinian collar necked jar	LMIIIB
83	Hilltop, Room 3	C3311	Sardinian collar necked jar	LMIIIB
83	Hilltop, Room 3	C3310	Sardinian swollen lipped jar (dolio)	LMIIIB
84	Hilltop, Room 14b	C3953	Sardinian closed shape	LMIIIA2-B
86	Hilltop, Room 6	C4077	Cycladic pithos	LMIIIB
96	Hilltop, Street 018	C2137	Sardinian closed shape	LMIIIB

96	Hilltop, Street 018	C4411	Sardinian closed shape	LMIIIB
97	Hilltop, Room 019	C4325	Sardinian closed shape	LMIIIB
ND	Hilltop	C5591	Canaanite Jar	LMIIIA!
ND	Hilltop	C4646	Egyptian Jar	LMIIIA1
ND	Hilltop	C5592	Sardinian collar necked jar	LMIIIB
51/4	Southern Area, Building N, Room 9, Construction Filling	C10744	Cypriot Pithos	LMIIIA2 Early
52a/10	Southern Area, N terrace, Construction filling	C7074	Canaanite Jar	LMIIIA2 Early
52a/11	Southern Area, N terrace, Construction filling	C7073	Cypriot Pithos	LMIIIA2 Early
52a/9	Southern Area, N terrace, Construction filling	C7072	Egyptian Jar	LMIIIA2 Early
52c/4	Southern Area, N terrace, Construction filling	C7448	Egyptian Jar	LMIIIA2 Early
52c/5	Southern Area, N terrace, Construction filling	C7336	Canaanite Jar	LMIIIA2 Early
52c/6	Southern Area, N terrace, Construction filling	C7428	Canaanite Jar	LMIIIA2 Early
52e/2	Southern Area, N terrace, Construction filling	C7476	Egyptian Jar	LMIIIA2 Early
52e/3	Southern Area, N terrace, Construction filling	C7440	Canaanite Jar	LMIIIA2 Early
52g/1	Southern Area, N terrace, Construction filling	C7638	Canaanite Jar	LMIIIA2 Early
52g/2	Southern Area, N terrace, Construction filling	C7639	Canaanite Jar	LMIIIA2
52h/1	Southern Area, N terrace, Construction filling	C8053	Canaanite Jar	LMIIIA2 Early
55/6	Southern Area, Gallery P6, Construction filling	C11232	Canaanite Jar	LMIIIA2
56a/2	Southern Area, Gallery P2, Construction filling	C10218	Egyptian Jar	LMIIIA2
56e/9	Southern Area, Gallery P2, Construction filling	I 47	Canaanite Jar	LMIIIA2 Early
57c/1	Southern Area, Gallery P3, Fill and floor Deposit	C3350	Egyptian Jar	LMIIIA2
57d/6	Southern Area, Gallery P3, Fill and floor Deposit	C10065	Egyptian Jar	LMIIIA2
57f/2	Southern Area, Gallery P3, Fill and floor Deposit	C9489	Egyptian Necked jar	LMIIIA2
57h/1	Southern Area, Gallery P3, Fill and floor Deposit	C9504	Egyptian Jar	LMIIIA2
57i/3	Southern Area, Gallery P3, Fill and floor Deposit	C10656	Canaanite Jar	LMIIIA2
59/21	Southern Area; Building N, Room 5-7, floor Deposit	C2928	Sardinian Pithos	LMIIIB
59/22	Southern Area; Building N, Room 5-7, floor Deposit	C6552	Sardinian jar	LMIIIB
60/30	Southern Area; Building N, Court 6 fill and floor Deposit	C5140	Canaanite Jar	LMIIIA-B/LB IIB
60/33	Southern Area; Building N, Court 6 fill and floor Deposit	C6444	Sardinian collar necked jar	LM IIIA2-B
61/7	Southern Area; Building N, Court 6, fill and floor Deposit	C6392	Egyptian Necked jar	LMIIIB
64/5	Southern Area; Building N, Construction fill	C4203	Egyptian Jar	LMIIIB
67b/3	Southern Area, Gallery P2, Floor level	C8336	Egyptian Jar	LMIIIB/
67d/3	Southern Area, Gallery P2, Floor level	C4134	Cycladic pithos	LM IIIA2-B

72/6	Southern Area, Gallery P5, fill and floor Deposit	C9941 +C12086	Canaanite Jar	LMIIIB
72/7	Southern Area, Gallery P5, fill and floor Deposit	C10362	Canaanite Jar	LMIIIB
74/1	Southern Area, Gallery P5, fill and floor Deposit (post main use phase)	C10360	Canaanite Jar	LMIIIB
75/5	Southern Area, Gallery P6, first-laid floor	C11240	Cypriot Pithos	LMIIIB
77/7	Southern Area, low terrace, construction filling	C11141	Canaanite Jar	LMIIIB
78/25	Southern Area, sloping wash level (close to Court N6)	C6695	Sardinian collar necked jar	LMIIIB-C
78/26	Southern Area, sloping wash level (close to Court N6)	C6715	Sardinian collar necked jar	LMIIIB-C
78/27	Southern Area, sloping wash level (close to Court N6)	C6696	Sardinian collar necked jar	LMIIIB-C
	Southern Area	C4064	Canaanite Jar	Mixed Minoan historic
	House X, Room 4	C9013	Pain white pithos	LMIIIA2Early
		C6990	Canaanite jar	LMIIIA2Early
	House X, Room 4	C7061	Canaanite jar	LMIIIA2Early
		C8058	Canaanite jar	LMIIIA2Early
	House X, Room 4	C8069	Canaanite jar	LMIIIA2Early
		C9152	Canaanite jar	LMIIIA2Early
	House X, Room 4	C9167	Canaanite jar	LMIIIA2Early
		C9621	Canaanite jar	LMIIIA2Early
	House X, Room 9	C9625	Egyptian Jar	LMIIIA2Early

Tab. 6. 6 Published Deposits and Groups with imported storage vases

Taking into account the distribution of imported transport vases, the first element to underline is that the foreign vases were diffused in each sector of Kommos and not only in the Southern Area, the one related to the port. The closed shape that could be used in the transport of goods on ships enter therefore into the repertoire used by the inhabitants of Kommos in the houses as storage vases aside the local pithoi, stirrup jars and short necked amphoras.

6.4.2.1. Frequency Distribution Analysis of the Imported storage vases during the LMIIIA1-2

The graph in Fig 6.25 shows the quantity of imported transport vases in each sector of Kommos during the LMIIIA1-2. Considering the absolute quantity of imports, the Southern Area (in green in the graph above) – with the large buildings of the Civic Centre – proves to be the richest in transport vessels during the LMIIIA1-2.

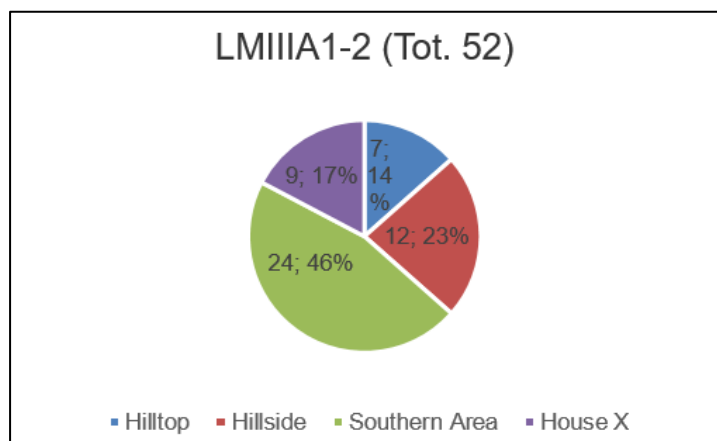


Fig. 6. 25 Number and Percentage of imported storage vases in each sector of LMIIIA1-2 Kommos.

House X hosted nine imported storage vases. They are mainly dated to the early LMIIIA2. In Room 4 at least three Canaanite Jars were found aside a Cypriot pithos. In the same space also a local pithos was found. Finally, an Egyptian Jar was found in Room 9. Other four Canaanite jars were retrieved among the materials scattered over the area of the House and it is not possible to locate them more precisely (Fig 6.26).

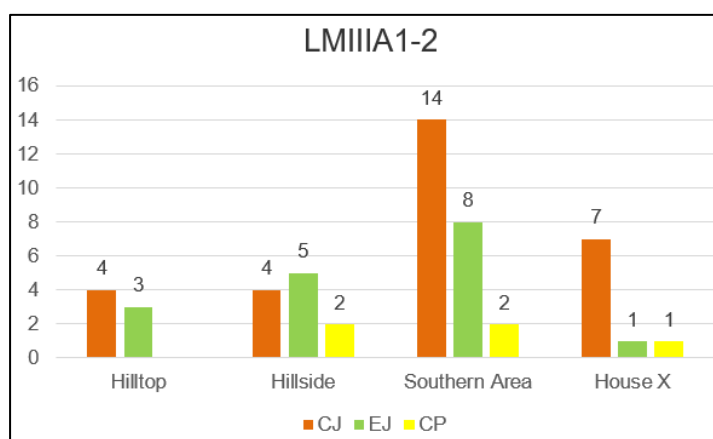


Fig. 6. 26 Origin of the imported storage vases in each sector of Kommos during the LMIIIA1-2.

As stated above, the Southern Area provided the richest number of imported vases during the LMIIIA1-2. However, in the phase corresponding to LMIIIA2, huge building activities took place and most of the fragments were indeed found in the levelling layers below the floor of the new Buildings N and P.

As Rutter points out, many of the materials found in the fills used for the construction activities (i.e. Group 51, 52 and 56) are not in their original position and could be earlier in date (Rutter 2006). Their presence cannot therefore be used in the evaluation of the Kommian storage systems, as they are not in their original location. They however confirm the involvement of Kommos in the maritime trade, especially – and until this phase – with the East Mediterranean.

The only floor level dated without any doubt to this phase comes from Gallery P3 (Group 57). Four Egyptian and one Canaanite Jars were retrieved in that Group. They are all dated to LMIIIA.

According to the evidence provided by House X, most of the imported storage vases retrieved in the Civic Centre complex (floor level of Gallery P3 and Construction fills) comes from Levant (14 Canaanite Jars), followed by Egypt (eight Egyptian Jar) and finally from Cyprus (two imported Cypriot pithoi) (Fig. 6.26).

Considering the Central Hillside, a Canaanite Jar dated to LMIIIA1-2 was retrieved in Room 10 of the House of the Snake Tube.

In this sector of the settlement, Deposit 37, dating to LMIIIA1-2, is very rich in imported storage vessels. However, the Deposit corresponds to the debris coming from the House of the Snake Tube and it is impossible to locate the original position of all these vases. In Deposit 37 one Cypriot Pithos and two Canaanite Jars were retrieved.

One Cypriot pithos comes from the area south of Room 30. The pottery assemblage of this area is not very rich and Watrous (1992) reports only the presence of two other open shapes, one local and one Cypriot Milkbowl.

Egyptian Jars dated to LMIIIA were retrieved in the area of the Central Hillside, but it is not possible to locate them more precisely.

Finally, in the Hilltop, during this first stage, Corridor N6-8 of the North House hosted a Canaanite jar in a context of LMIIIA1/2 together with an Egyptian jar. From the same use phase of the house – LMIIIA1/2 – two other Canaanite jars were found in Room N11.

6.4.2.2. Frequency Distribution Analysis of the Imported storage vases during the LMIIIB

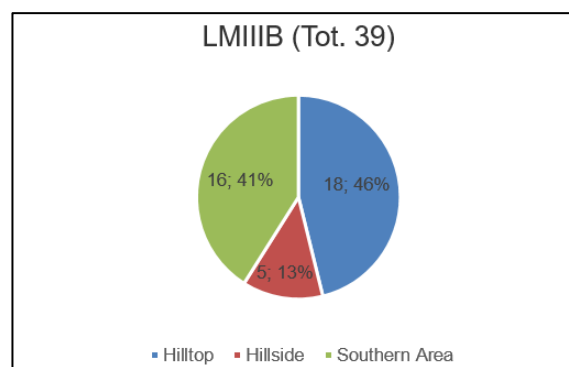


Fig. 6. 27 Number and Percentage of imported storage vases in each sector of Kommos in LMIIIA2-B.

In the LMIIIB (Fig. 6.27) the proportion of transport ceramics drops slightly, within a more general drop in imports in the site⁸⁹. In this phase the major quantity of storage imported vases comes from the Hilltop (in blue in the graph above), even if the Southern area is still important. This situation depends substantially on the presence of 15 fragmented Sardinian Jars, spread throughout the whole sector. Another interesting fact is that in five cases the Sardinian storage shapes are associated with a corresponding open shape (i.e. a bowl which in the Sardinian typology is called “conca”, Campus Leonelli 2000). The excavators suggest the possibility that these bowls were used as jar lids (Watrous 1992).

In general, Nuragic pots are the most common imports in the settlement during the LMIIIB phase (Fig. 6.28), representing more the 50% of the total of the imported pottery retrieved.

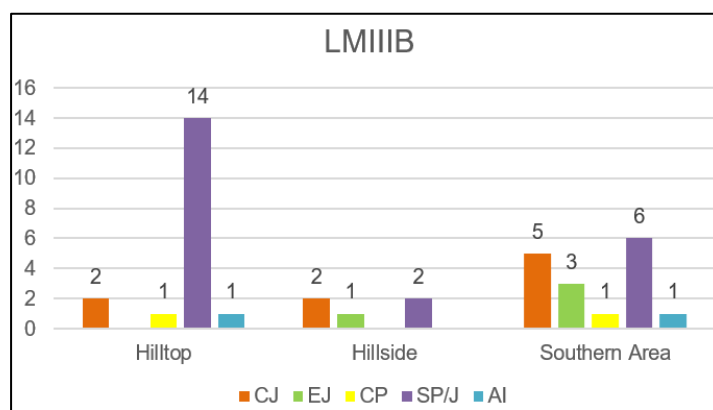


Fig. 6. 28 Origin of the imported storage vases in each sector of Kommos during the LMIIIA2-B.

In the Civic Centre, in this second period, some storage vases come from floor levels of both Building N and the Galleries of Building P.

Both groups 59 and 60 come from Building N and are dated to LMIIIB. Among the vases from Group 59 two Nuragic vases (one jar and one pithos) were identified. In this case they were associated with the two pithos bases of local origin mentioned above. In Group 60 a Sardinian Jar and a Canaanite Jar were retrieved. The same Group 60 includes the pithos with plastic band decorated with rosettes (see above). Another Egyptian Jar (Group 61) dating to the LMIIIB comes from the same area – Court 6 of Building N.

An Egyptian Jar and the Kytheran pithos were retrieved in the floor level of Gallery P2 during the LMIIIA-B (Group 67). Three more Canaanite Jars come from the Gallery P5 (Groups 72 and 74).

Rutter underlined that the Sardinian vases were never found inside the Galleries of Building P but only outside it and in the Building N (Rutter 2006). It is difficult to understand the meaning

⁸⁹Moreover, House X went out of use after the LMIIIA.

of this peculiar distribution, but it is necessary to bear in mind that only Gallery 3 is completely excavated, and the picture remains therefore partial.

In the Central Hillside, a Sardinian LMIIIB Nuragic closed shape was found from Room 21 (Deposit 60). A second Nuragic closed shape was retrieved in the Room 3 of House of the Snake Tube in association with a Canaanite jar and an Egyptian jar (Deposit 75). Out of context, other Canaanite and Egyptian jars were also retrieved.

Most of the LMIIIB imported storage vases retrieved come from the area of the Hilltop. Considering all the Deposits dating to this phase, it is important to note that the majority of the imported storage vases comes from courtyards, as already noted for the local pithoi.

One Canaanite Jar and one Cypriot pithos were retrieved in courtyard 013 (Deposit 66). From the same context Watrous (1992) reported in Appendix the presence of local pithos fragments.

The richest assemblage comes from Court 2 (Deposit 82) where three Sardinian collar necked jars and one Sardinian pithos dating to LMIIIB were found. Watrous mentioned the presence of five local pithoi in the same space (see above).

Closed shapes from Sardinia were also retrieved in Courtyard 21 (Deposit 72) and Court 11 (Deposit 76). They all date to LMIIIB. In Court 11 also a local pithos was identified (Watrous 1992, Appendix).

A Sardinian collar necked jar was instead found in the LMIIIB context in Room N17 of the North House. Room 3 in the Cliff side hosted two LMIIIB Sardinian collar necked jars and a Sardinian pithos. LMIIIB Sardinian closed shapes were also retrieved in Room 14b (Deposit 84) and in Room 019 (Deposit 97).

A Cycladic (probably Kytheran) pithos was found in Room 6 (Deposit 86) and finally a Canaanite jar comes from Room 26 (Deposit 36)

Among the material scattered over the whole area of the Hilltop, a Canaanite jar was identified while two fragments belonging to Nuragic closed shape were found on Street 018.

Summing up and considering the origins of the imports in each area, in the LMIIIA1-2 phase, the highest percentage of transport vases comes from the Levant (Fig. 6.26). Comparing the data of the frequency of transport vases with the general frequencies of imported pottery (not only transport vessels but also tableware) an important difference emerges. From each Mediterranean area, in general, transport shapes are always more numerous than tableware. An exception is represented by the Cypriot pottery: the most common shapes in this case – despite the presence of pithoi – belong to tableware, in particular White Slip II Milk bowl.

In the LMIIIB, on the contrary, the major quantity of storage imported vases comes from Sardinia. Imports from Egypt, Levant and Cyprus were still present but with lower frequencies.

6.4.2.3. Observation on the Frequency Distribution Analysis of the Imported storage vases

Some considerations arise from the exam of local pithoi and imported storage vases together. Despite the good state of the publication of the Komman pottery, we can assume that the quantity of pithoi in the site was greater than the picture that emerged in the present analysis. It is probable that medium-coarse and coarse ware were published less completely than fine tableware and therefore the number of pithoi is – at the moment – underestimated.

However, it seems interesting that some of the storage vases (both local and imported) come from courts where probably several activities regarding food processing were carried out.

Monumental storage spaces as well as granary or silo seem completely absent in the settlement, both in the so-called Civic Centre and in the Hillside or Hilltop areas, and the identification of rooms/spaces connected to storage is not straightforward.

An exception is provided by the evidence from House X where several storage vases were stored inside Room 4. House X is the largest private and high-level house found in Kommos during the LMIIIA. Considering both local and imported specimens, a total of 13 storage vases was found in the house.

Besides Courts, which provided a huge number of storage vases, one of the most interesting contexts is Group 59 from Room 5 and Corridor 7 in Building N. In this Group, two Sardinian jars were retrieved together with two local pithoi. Rutter underlines that this Room was found full of partly mendable vases. In addition to storage vases indeed, the Room also contained tableware in fine clay, cooking pot, stirrup jars and feeding bottles. According to Rutter the pottery assemblage of this Room is comparable to the one retrieved in Room 14b of the Hilltop (Deposit 84) and has to be related to domestic activities.

Another context particularly interesting is Deposit 83 from Room 3 in the Hilltop where two jars and one pithos all of Nuragic origin were found in association. The Deposit is very rich both in fine tableware and cooking pots. Watrous interpreted it as debris and several joints were found with the materials from Deposit 84. At present it is not possible to be sure that all the Sardinian vases were actually stored inside the room.

In Room 3 of the House of the Snake Tube (Deposit 75) in the same LMIIIB context, a Nuragic vase, a Canaanite jar and an Egyptian jar were found. Deposit 75 is very rich and also comprises a large number of tableware as well as cooking pots and cooking dishes. The great amount of other types of vessels connotes the space as not only devoted to storage.

This scenario allows, once again, to confirm that imported transport vases were converted into storage vases and entered in the daily use of the Komman community with local pottery.

Moreover, storage vases of the same origin were often stored together (e.g. Group 59, Deposit 52 or Deposit 83).

In all the spaces where pithoi and imported storage vases were retrieved also other kinds of pottery were found. The Deposits and Groups isolated respectively by Watrous (1992) and Rutter (2006) included always a great variety of tableware and cooking ware in addition to storage vases. None of them is characterized uniquely by storage vases.

The picture which emerged above seems therefore related to a small-scale, probably domestic, storage system. Pithoi were not the unique type of storage vases used: staples were stored also inside many types of imported jars.

Considering also local vases, such as amphorae and jars, the storage capacity of each sector increases slightly but not enough to define a large-scale storage. Liquide stuff were probably stored inside Stirrup Jars and Short-necked amphorae. Medium and small-sized Stirrup Jars were indeed very common in the site in each sector investigated so far; Short-necked amphorae were the most common type of coarse closed shape in the LMIII, especially in Building P – which is interpreted as a ship shelter – differently from pithoi, more common in domestic context. (Rutter 2018, p. 276). Short-necked amphorae are therefore interpreted as the local transport shape used on the ships (Rutter 2000).

The domestic character of the storage also seems to be confirmed by the capacity of the vessels and not only by their quantity. Pithoi of big size are absent, and jars have an average capacity around 20 and 30 l.

6.4.3. Analysis of the density of storage vases

The study of the storage practice in the site was also performed through an evaluation of the density of both local and imported storage vases in each space. Vases retrieved out of context in the construction filling of the Civic Centre were not included. This analysis permits to verify more in detail the evidence provided by the quantitative analysis presented above.

The Table below lists all the Deposits considered, in terms of extension (in sq.m), number of pithoi/imported storage vases retrieved and their ensuing density.

Space	Area	N. of Pithoi	Density	Range
Gallery P 1	205,79	0	0	I
Gallery P 4	210, 87	0	0	I
Gallery P 5	204, 37	3	0,005	I
Gallery P 6	174,85	1	0,006	I
Gallery P 2	213, 43	2	0,009	I
Gallery P 3	223,68	5	0,022	I
Building N, Court 6	69,98	4	0,057	I
House X9	16,71	1	0,056	I
Hilltop, Courtyard 21	16,26	1	0,061	I
Building N, Room 5-7	56,62	4	0,070	I
Hilltop, Court 11	13,54	1	0,073	I
Hilltop, Courtyard 013	25,34	2	0,078	I
Space over 35,38 and 39	10,6	1	0,094	I
Hilltop -House of the press_Room5	9,06	1	0,110	I
House X8	16,76	2	0,119	I
House X5	7,34	1	0,136	I
Hilltop, Room 6	7,04	1	0,142	I
Hilltop, Room N12-13	5,94	1	0,168	I
Hillside, Area South of Room 30	5,6	1	0,178	I
Hillside, House of the Snake Tube, Room 3	14,89	3	0,201	I
Hilltop, North House, Room 17a	4,28	1	0,233	I
Hillside, Room 21	3,23	1	0,309	II
Hilltop, Room 14b	6,39	2	0,312	II
Hilltop, Court 2	19,16	6	0,313	II
Hilltop, Room N11	6,03	2	0,331	II
Hillside, Debris South of House of the snake tube	9,02	3	0,332	II
Hillside, House of the Snake Tube, Room 10	2,82	1	0,354	II
House X4	10,9	5	0,458	II
Hilltop, Room 26	1,54	1	0,649	II
Hilltop, North House, Room N6-8	1,92	2	1,041	III
Hilltop, Room 3	1,88	3	1,595	III

Tab. 6. 7 Contexts considered in evaluation of density of storage vases.

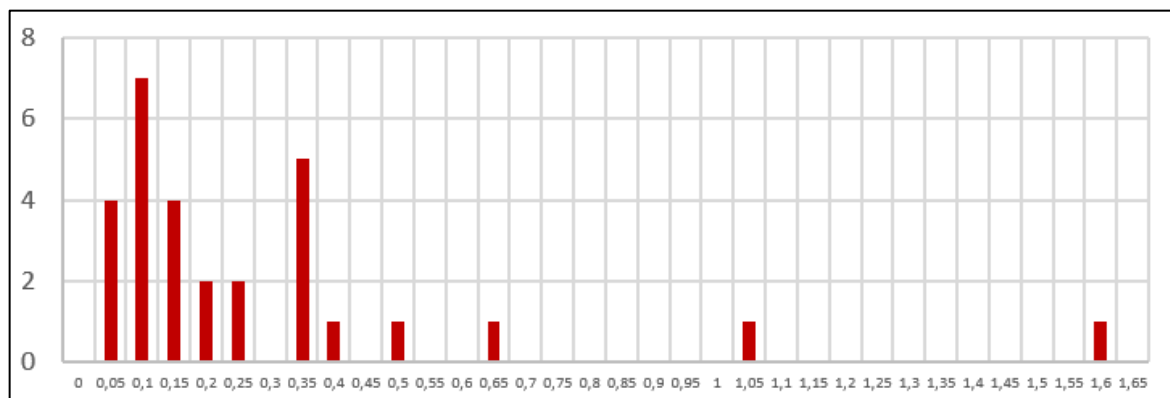


Fig. 6. 24 Frequency Distribution of Density Values in Kommos. On the X axis the values of density. On the Y axis the number of specimens for each value.

The frequency distribution of the density values permits to underline three different kinds of rooms. Differently from Pyla, however, the ranges are less clear and only the first one (low values of density) is well defined.

1- Rooms with a low density of pithoi (range 0,0-0,25)

As expected, the density of storage vases in the Southern Area, and especially in the huge Galleries of Building P is very low. This is related, of course, to the dimension of the Galleries themselves, which are bigger than the other spaces and houses of the settlement. However, despite the important role of the dimensional factor, this permits to ascertain that the Galleries were not used to store vases in huge quantity in accordance with what was claimed by the excavator (Rutter 2006).

In Gallery 3, the only one completely excavated, only four storage vases were retrieved. Building P was therefore not used as a centralized storage building for staples or traded goods. Size plays a significant role also for Room 3 inside House of the Snake Tube, where, despite the presence of three storage vases, the value of density is quite low.

The analyses presented above show that the courts are, in general, provided with a high number of storage vases. Considering density, the presence of storage vases in Courts is apparently less significant. This depends on the larger dimension of courts than rooms and spaces but also confirms that they were multifunctional spaces not uniquely used for storage. All the courts excavated in Kommos present very similar density values and are clustered together in this first range, possibly reflecting a similar functional pattern. The only exception is Court 2 in the Hilltop which displays a major concentration of storage vases. Finally, it is important to bear in mind that the pottery coming from some of these contexts is not fully published and other storage vases are simply listed in the Appendix of the Watrous volume (Tab. 6.4). The data analysed here represent probably only part of the storage vases retrieved and the density is probably lower than in reality.

2- Rooms with a middle density of pithoi (range 0,35-0,55/0,65).

This second range is less defined than the previous one, especially with regard to its upper limit. In this range there are rooms which present from one to six storage vases. Court 2 is clustered in this group and not in the previous one as the other courtyards, thanks to the presence of six storage vases, despite its wide dimension.

3- Rooms with higher density of pithoi (range > 1,05)

The spaces with the highest values of density of storage vases are very small rooms or corridors with anyway only two (Deposit 29 in the North House in Hilltop) or three (Deposit 83, Room 3 in Hilltop) storage vases. The high value depends more on their small dimension than on the real quantity of vases.

Considering the global density of the houses (the sum of the density values of each space with storage vases), the space with the highest density of storage vases is the North House in the Hilltop during the LMIIIA1-2. In this phase a total of five storage vases were retrieved in the House. The density value is very high because they were stored inside small spaces. On the contrary, the density of House X, in the same period, – despite a higher number of storage vases – is lower than the North House because its rooms are quite large.

The frequency distribution of the density values confirms that the storage of staples in Kommos seems of a domestic type probably linked to the needs of single domestic units. As stated above the spaces with high density are small domestic spaces provided with one or two vases. Spaces devoted to massive storage of staple are not present both in the Civic Centre and in the residential area of the settlement in all the period examined (LMIIIA-B).

6.4.4. Conclusions

The situation that emerged at Kommos needs to be considered in a wider regional perspective. Differently from Kommos, storehouses and long-term granaries have been identified in the near site of Haghia Triada dating to the LMIII (Privitera 2014; Privitera 2010).

Excavators retrieved a number of local pithos fragments in Haghia Triada; at least one of these come, on the contrary, from Kythera and is of the same type of the one retrieved in Kommos (P 1431, Variety 17.5). However, most of the material coming from Haghia Triada have gone lost and it is thus impossible to have a clear idea of the quantity and type of pithos that were present in the site.

From a political point of view, during the LMIIIA period Haghia Triada was part – as Kommos and Phaistos – of the Knossian state which life was very short and ended towards the end of the period itself (LMIIIA2).

During LMIIIA2-B Haghia Triada underwent a monumental urban development (coevals with construction of the Complex of the Civic Centre in Kommos). The first building activities took place in the early LMIIIA2 and concerned the construction of the so-called *Casa delle Camere Decapitate* which life-span does not go beyond the end of the LMIIIA2. The structures occupied the area where the so-called Agora was later laid out.

The *Casa delle Camere Decapitate* consists of an L-shaped corridor and two groups of three doorless rooms. These six rooms – located in the basement – were interpreted as aboveground silos for the long-term storage of cereals. The total capacity of the basement was estimated as at least 108,500 litres (Privitera 2014, 438-339). The first floor above the basement was probably devoted to storage as well. During the excavation, indeed, several fragments of storage jars were found in the collapse debris.

The *Casa delle Camere Decapitate* could be interpreted as a granary for long-term storage of cereals produced in the Mesara and controlled by the local elites.

It was razed to the ground in late LM IIIA2. The north sector of the settlement was transformed, and the so-called Agora was built. The Agora was bordered on the east by a large building labelled *Stoa dell'Agora* or *Stoa del Mercato*. The structures comprised eight large rectangular rooms facing a pillared portico. Several fragments of pithoi and jars were retrieved in this area, pointing to the possibility that the complex had storage functions. Privitera related this Building to short-term storage performed inside jars along the LM IIIA2 and LM IIIB. However, in the same period a new group of aboveground silos was built on the slope to the west, the *Edificio P/Nord-Ovest* (Privitera 2014, p. 440-441). This was a huge building consisting of two sectors divided by a corridor. The east wing consists of a pillared vestibule and a large hall while the western wing is composed by two groups of three and six quadrangular doorless rooms.

One additional building complex was built in the late LM IIIA2: the *Edificio ovest* composed by six quadrangular and doorless spaces.

Considering all the evidence together, it seems that since LM IIIA2 at Haghia Triada at least 11 new aboveground silos were built and used in the long-term storage of cereals.

Privitera linked the increase of the storage capacity at Haghia Triada during the LM IIIA2 with the political change after the collapse of the Palace of Knossos and the end of its domination in Central and Central-Eastern Crete, the emergence of several polities on the island – as part of the Mycenaean state (D'Agata 2017, Bennet 1990, Halstead 1999, Nakassis *et al.* 2010). During this period Haghia Triada seems to have played an important role in the economic management of the cereals produced in the surrounding areas⁹⁰. Privitera claims that the increase in capacity should be connected to the “attempt to set up a well-defined palatial farming strategy” (Privitera 2014, p. 445) by the local elite in the western Mesara.

Evidence of occupation during the LM IIIB are now clearly identifiable also in Phaistos⁹¹ (Borgna 2017), confirming that this area was densely occupied also during the last palatial phase. The increase in storage capacity represents therefore a local economic strategy of a small and newly born state centred around Haghia Triada.

The different type of storage evidence – despite the impossibility of a complete pithoi use comparison – between the close sites of Haghia Triada and Kommos can be interpreted in light of the political and economic situation of the Mesara during the LM III. The two sites would have therefore played complementary economic functions in the Mesara during the LM IIIA-B.

⁹⁰The extension of the land under the control of the site is still to be defined.

⁹¹The site was not abandoned at the end of the LM IIIB, but it was still occupied during the post-palatial period, differently from Kommos and Haghia Triada.

Kommos, as already stated, confirms its role as the main port of the southern coast of Crete within a more complex political-economic polities centred around Haghia Triada.

The analysis of the storage evidence from Kommos, the huge amount of allochthonous storage vases confirms its involvements in the international maritime trade also during the last palatial phase. The origin of the imported vases in Kommos testifies connections⁹² with the Levant – from modern Syria to Palestine – Egypt, Anatolia, Cyprus, Greek Mainland, Aegean Islands and Sardinia.

The presence of Sardinian pottery during the LMIIIB is of course one of the most interesting aspects. As already specified, their presence strongly supports the existence of a southern route directed to the central, and western Mediterranean, which linked Cyprus (as marked by some evidence, such as the presence of Nuragic vases at Pyla-Kokkinokremos), Crete and Sicily (i.e. the presence of Nuragic vases at Cannatello) and Sardinia.

⁹²Their presence may be connected also to the local settling of men – maybe traders of Cypriot, Greek and Sardinian origin – in the site. The presence of some open shape Sardinian pots could speak in favour of the presence of foreigners in the site.

6.5. Broglio di Trebisacce Frequency Distribution Analysis

Fragments belonging to pithoi were found in all the sectors of the Acropolis investigated so far and several are also those found sporadically both in the Acropolis and on its slopes. More difficult is to try to understand the minimum number of pithoi to which these fragments belong. As already noted by Levi (1999, p. 254 footnote 117) the estimation of the minimum number of vessels in the case of pithoi is extremely difficult due to their size and it is therefore highly possible that different diagnostic fragments (i.e. rims or grooved bands) belong in reality to the same vase.

Furthermore, we must consider the impact of erosive phenomena and agricultural activities that took place on the Acropolis, which have led to the dispersion of materials over large areas and contributed even more to their fragmentation.

Aside this widespread diffusion, it was however possible to identify two particular structures devoted to the storage of staples inside pithoi thanks to excavation of several areas of the Acropolis (§ 3.2.4.1). All the storage structures discovered so far in Broglio are dated from the FBA to EIA⁹³. Storehouses are, on the contrary, absent in the RBA levels.

Despite the fragmentary nature of the archaeological stratigraphy, at least since the early phases of the FBA, it is possible to clearly ascertain the presence of areas functionally distinct from the others (Moffa 2002, p. 126).

Moffa, in his functional study of the whole Acropolis, made a preliminary distinction of all the areas likely occupied by structures – made of wooden and daub – from areas without structural evidence. He thus analysed structural evidence and the spatial distribution of all the retrieved artefacts classes (i.e. daub, pottery, metal finds, stone finds). The structures identified thanks to the frequency distribution of the artefacts were classified into three large groups: *housing structures*, *storehouses* and *areas for craft production*.

According to these analyses, as expected, storehouses – are characterized by the clear prevalence of closed shapes – in particular pithoi – as well as by the total absence of other kind of metal or stone tools. Storehouse 2, however, represents a partial variation to this norm because of the presence of several open shapes.

Storehouses' identification is clear also in opposition to domestic spaces. Housing structures are indeed characterized by the presence of a much more variegated pottery assemblage (open

⁹³In the present research the EIA storehouse will be not considered.

and closed vases of different shapes and dimensions, including cooking ware) and by the presence of several tools (querns, pestles as well as loom weights and spindles whorls).

6.5.1. Storage evidence at Broglio: Pithos Storehouses

Considering storehouses, the most important storage evidence comes from the so-called Pithos Storehouse 1 identified in Sector D north (§ 3.2.4.1). It is a partially sunk rectangular structure dated to the early FBA built close to a likely housing structure. Opposite the entrance – provided with a ramp – five complete grooved pithoi (Type 7), broken *in situ*, were found.

The total capacity of the structure according to the pithos volume estimation is around 4000 litres.

The archaeological assemblage of the storehouse appears very relevant. Aside pithoi only a bucket-shaped pot and some botanical remains were indeed found. The structure seems therefore functionally devoted almost uniquely to storage and it is not a multifunctional space subsidiary to the house.

Considering the botanical remains retrieved during the excavations, seven non-carbonized olive stones were identified in connection with Pithos C, in layer 3. This layer belongs to the use phase of the storehouse and is specifically connected to the supposed pithos contents. Moreover, a *Juniperus* seed was found inside Pithos E. In layer 3, in connection with Pithos A *Triticum* sp., *Lepidium* and *Olea* sp. were found.

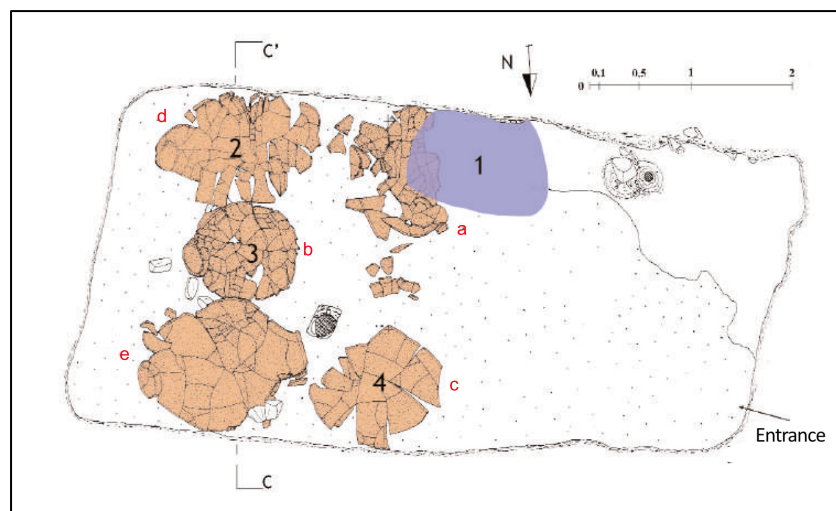


Fig. 6. 30 Frequency Distribution Storehouse 1: General Plan with pithoi in loco. In lilac the FBA 3 pit (Author elaboration after Peroni et al. 2008).

The second storehouse is less preserved and less characteristic than the former one. However, its not-housing nature seems certain. The structure is partially sunken as the former, and many pithos fragments were retrieved there, while the identification of the real number of

pithoi remains however uncertain. During the excavation some pits probably used to house pithoi were also identified. However, unlike Storehouse 1 some open shapes and two beads were also found. No botanical remains are known from this context.

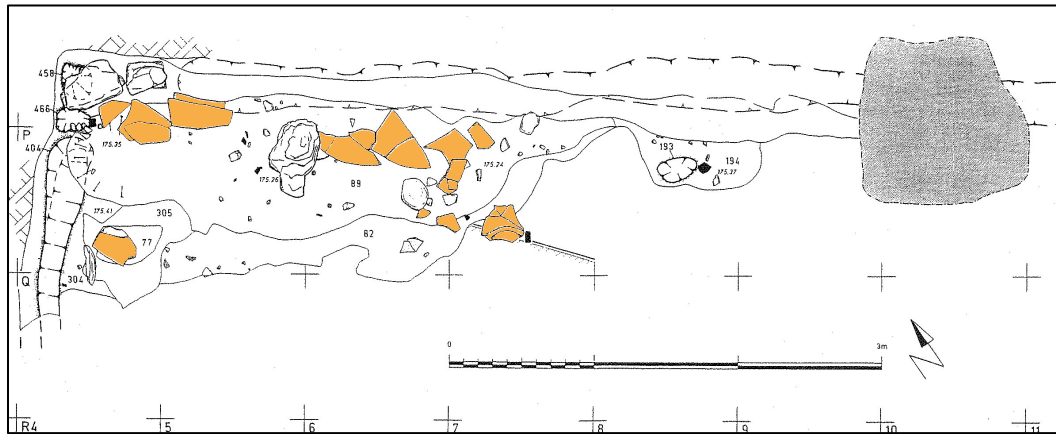


Fig. 6. 31 Frequency Distribution Pithos Storehouse 2, general plan. In orange pithos fragments (Author elaboration after Peroni and Vanzetti 1998).

6.5.2. Storage evidence at Broglio: Trial calculation of the minimum number of pithoi

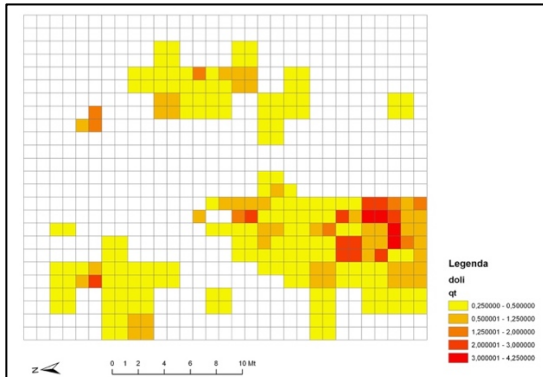


Fig. 6. 25 Pithoi Distribution in Sector 2

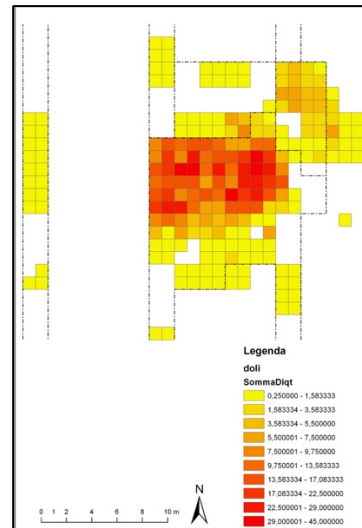


Fig. 6. 33 Pithoi Distribution in Sector 7

Images above show (Figs 6.32 and 6.33) the diagnostic pithos fragments for sq m of Sectors 2 and 7. The GIS distribution takes into account all the diagnostic fragments presented in the Broglio database. Images clearly show how pithos fragments are spread in the excavated parts of each sector. In some cases, there are higher concentrations, that cannot be connected to specific structures but are probably related to spaces originally provided with a high number of pithoi as the storehouses. Aside these, other areas display a lower concentration of pithoi compatible with structures – as the domestic ones – where only few pithoi were stored.

Starting from the widespread presence of pithoi throughout the area of the Acropolis, we tried to establish the minimum number of vessels to which these belong. This is not, however, a simple operation, due, according to the previous exposition, to the great dispersion of fragments caused by erosion and agricultural activities.

An additional problem in the determination of the minimum number of pithoi concerns the number of specimens reused as building material. In this case the pithos fragments should not be counted in the use-phase as exemplars for storage use. For example, in Storehouse 2 second use phase, several fragments belonging to the pithoi previously housed there were reused as building materials. Anyway, it is not straightforward to differentiate them especially in compromised contexts.

In this context it was not even possible to make a distribution based on the weight of the fragments compared to the weight of the complete specimens found the impossibility of

weighting the reconstructed vases from the Storehouse 1 now exposed at the National Museum of Reggio Calabria. The data obtained in that way – compared with those of quantitative evaluation – would have allowed to better calibrate the estimates.

The estimate of the minimum number of vases will be performed only for the FBA phase for which a major number of evidence and complete vases are available.

The minimum pithos number was then calculated based on the comparison with the pithoi found in the Storehouse 1. Considering that the storehouse is a particularly well-preserved context and that the pithoi were found in fragments but practically complete, the estimates have been slightly expanded in assessing the minimum number of specimens found in contexts that are more widespread by erosion or agricultural activity. It was therefore considered prudent to consider as plausible a mean of eight rim fragments as equivalent to a pithos.

It is more difficult to calculate a minimum number of vessels based on the number of bands and fragments with grooved decoration. This is certainly a major problem because most of the diagnostic fragments of pithoi found in Broglio belong to body fragments with decoration.

From a trial calculation based also in this case on the pithoi from the Storehouse 1, the ratio between rim fragments and body fragments with decoration oscillates between 1 and 5. It is necessary to bear in mind that grooved bands or applied bands recurred on the vessel's body two or three times.

Starting from the diagnostic pithoi catalogued in the Broglio di Trebisacce database, FBA pithos rim fragments of Sectors 2 and 7 have been counted.

Passing to Sector 2, and excluding fragments found in Storehouse 2, we find 43 pithos rim fragments, making a total of at least five pithoi, following the reasoning presented above. If one considers instead 86 decorated fragments (i.e. applied band with ribs, bands with engraved decorations and fragments with bundles of grooves made directly on the surface) the number of vases decreases to two specimens. The difference between the number based on rim and body fragments is problematic but it should be explained by the widespread of fragments by plowing activities.

Some of the fragments just described come from areas identified as pertaining to two FBA huts (Vanzetti 2000; Moffa 2002). It is not clear if these two huts – called *Casa dei fornelli* and *Casa dei concotti* – were in use at the same time, but the presence of pithoi fragments in the area of these structures confirms the probable pithos use also in domestic contexts or special function structures as *Casa dei fornelli* probably is⁹⁴.

⁹⁴Pithos fragments were also found inside the RBA Central Hut. One of them was re-used in connection to the hearth.

As far as Sector 7 is concerned, the excavation catalogue counts 29 rim fragments, corresponding to at least three different pithoi. Considering the 96 fragments with decorations we would have in this case a total of two pithoi, a number which is coherent with the other kind of computation.

A last consideration has to be made in relation to the archaeological context integrity, as almost all structures discovered in Broglio are preserved in their upstream half. It is thus very likely that the number of pithoi just computed has to be doubled. The presence of at least seven pithoi in Sector 2 and five or six in Sector 7 is thus more realistic.

Some other elements concerning Sector 7 are available from the study made by Schiappelli in the ambit of his Ph.D. Schiappelli made indeed a preliminary analysis of the diagnostic pithoi fragments found inside the stone structure of Sector 7 – which excavation is still unfinished. During the excavation, 407 pithos fragments (both diagnostic fragments and undecorated body sherds) were brought to light detecting the existence within the structure – which presents a complex layout – of at least one space used to house pithoi. The identification of periods and phases related of the structure's use was made thanks to the comparison with the Oenotrian protogeometric pottery chronological classification made by Dora Gatti and Luca Alessandri (Schiappelli 2003).

The distribution of pithos fragments in all the use sequences follows a particularly interesting trend. Briefly, the distribution of pithoi in the sequence revealed that in the upper levels (*Period I*) there are no pithos fragments decorated with plain bands. Their presence is generally scanty in all the phases of the structure. On the contrary raised bands with incised decoration were very common⁹⁵. Pithoi decorated with horizontal grooves seem to grow over time, contrary to those with plain bands that show a greater diffusion in the oldest levels (*Period III*, Phases 2 and 3). Pithoi with ribbed band (and especially with three ribs) are widely attested in all the layers. Summing up, it seems that at least one space inside the stone structure was characterized by the presence of several pithoi: among them some present the typical FBA band with grooved decoration (three ribs) while others present bands with incised/impressed motifs characteristic of the southern Sybaris plain production.

The importance of this preliminary analysis confirms how pithoi, during the FBA, were present in several structures of the settlement and thus the probable existence of other storehouses and storage spaces in addition to the ones noted so far. During the FBA pithoi were also stored

⁹⁵According to the archeometric analyses carried out by Levi (1999) they were characteristic of specimens imported from the southern part of plain of Sybaris.

in domestic contexts or in special functional structures as proved by the evidence coming respectively from the *Casa dei Concotti* e the *Casa dei fornelli*.

6.5.3. Types of substances stored

The identification of the substances contained in pithoi is one of the most important aspects of the storage evidences analysis in Broglio, and more in general in the whole southern Italy. To identify the type substances stored in pithoi, among all possible substances, it is necessary to make some environmental considerations.

Broglio is located in the Mediterranean vegetative belt *Oleo-Ceratonion siliqua* characterized by the prevailing association between olives and carob-tree. Olives-tree exploitation and its importance for Broglio inhabitants, also as a construction material, is hinted by several paleobotanical data. Anthracological analyses show, indeed, a sharp prevalence of *Olea* sp. carbons in the whole occupation period from the MBA to the FBA (Fig. 6.34) Recent analyses of pollen samples collected intra-site (Mazza 2016) have confirmed the presence of *Olea* already in MBA levels.

The widespread diffusion of the olive tree is further testified by the presence of several daubs' fragments and a vase body fragment (Fig 6.35) with an olive leaf impression. However, these data do not allow to distinguish the wild species from the domestic olive tree, leaving unsolved the issue of its cultivation.

The presence of oil in the archaeological levels, and its exploitation by Broglio inhabitants are therefore a logical consequence of Broglio localisation in the Mediterranean vegetative belt *Oleo-Ceratonion*. However, the presence of olive stones in different RBA site sectors and in Storehouse 1⁹⁶ ascertains the existence of arboriculture practices (Vanzetti 2013). Moreover, also in the site Torre del Mordillo, located in a different vegetative belt, characterised by the presence of *Quercus*, there was an increase in *Olea* sp. carbons in the RBA, moment in which also pithoi production started and the contact with the Aegean was more intense.

⁹⁶Olive stones found in the Storehouse are not-carbonised, differently from all the others found in Broglio. This anomaly opened the possibility of a contamination of modern olive trees material still present in the site.

	MBA	RBA	FBA
n. Charcoals	78	152	132
<i>Olea sp.</i>	88%	88%	68%
<i>Quercu Ilex</i>	4%	5%	4%
<i>Acer</i>	1%	1%	
<i>Phyllirea</i>	3%	6%	2%
<i>Juniperus</i>			24%
<i>Pistacia (Lentiscus)</i>	4%		2%
<i>Euonymus</i>			1%

Fig. 6. 34 Frequencies distribution of Charcoals in the occupation sequence at Broglio (Author elaboration after Peroni et. al 2008).



Fig. 6. 26 Vase fragment with olive leaf impression from Broglio

In relation with the olive tree and other arboreal culture introduction, what is most interesting is their implication in terms of production means ownership, and in particular land ownership. It has been already underlined how these cultivations implied the overcoming of the collective land ownership towards more controlled (elite) or private forms of management (Vanzetti 2000; Pacciarelli 2009). This change is necessary because these crops need a long-term planification with not-immediate economic returns.

The emerging picture coming from the study of the environment and botanical remains in the site is thus characterised by anthropic activities and a production system – elite driven – which start to modify the original environmental frame characterised by the *Olea–Ceratonion*.

As described in § 5.3.3, the present study includes gas–chromatographic analyses of both Pithos D from Storehouse 1 and Pithos P from Storehouse 2. The results, differently from the first analyses carried out by Professor Peroni in 1990 (Peroni 1994) identified as more probable contents for these pithoi cereals rather than olive oil. These results seem to go against the described trend. However, even if all the analysed samples were characterised by ricinoleic acid and thus cereals, the samples remain statistically insufficient to assure that all Broglio pithoi exclusively contained cereals. It is still very likely that pithoi also served to store several different substances. Some proofs confirm this hypothesis. First of all, olive stones were retrieved in Storehouse 1, and also in other RBA contexts, confirming the exploitation of the olive trees not only as construction wood. A further confirmation derives from the macroscopic traces of an oily substance of some pithoi walls (Schiappelli 2003). Aside these botanical evidence, the Pithos P residual analysis also showed pine pitch presence. Vegetable resins were indeed frequently used to coat the vases' inner walls especially if they were used for liquids conservation. The presence of vegetable resins is also reported for fragments of

impasto pithoi found in the area of Serre di Altilia (Calabria, Carpiiglione *et al.* 2012). As underlined by the authors, the presence of terpene resins (no specie identified in that case) opens interesting scenarios. We already mentioned the practice of adding vegetal resins as a preservative for wine in § 5.3.3.1. Resins, especially those of pine, lentisk, terebinth⁹⁷ and myrrh were indeed frequently used in the practice of wine resins (see for example the reference made by Pliny the Elder in the XIV book of the *Naturalis Historia* where he reports the common use to add resins to avoid its acidification). The presence of pine resin in a vase would then indicate indirectly that of wine, and thus point to the existence of viticulture practices⁹⁸.

However, some scholars (Carpiiglione *et al.* 2012) suggest a further implication related to the presence of pine resins. In historical times, in the mountain Sila region, pines (*Pinus brutia*) were used to extract the famous and precious *pix brutia*, used as a coating for boats and vases, but also in cosmetics and medicines. Data about the exploitation of *pix brutia* before the historical period are not available, but its production cannot be excluded, maybe on a small scale, already in late prehistory.

In conclusion, as far as Broglio is concerned, we can conjecture – according to the present residue analyses – that pithoi were used for storing cereals (Luceiko *et al.* 2018). The presence of pine pitch hints to their use as containers of liquid stuff, and especially wine. Finally, the presence of macro-botanical remains such as olive stones let us hypothesize their use also as olive oil containers.

6.5.4. Discussion on storage evidence at Broglio during the FBA

All the evidence gathered so far permits to develop a general pattern in the storehouse's layout in Broglio:

- foundation during the early FBA phase, and use abandonment before the end of the FBA3.
- they are free standing structures built close to other structures with housing function. If the excavation of stone structure of Sector 7 aside the study of the material retrieved which confirms the presence of a room devoted to storage it is necessary to consider the existence of other kinds of storage spaces in addition to one noted so fare.

⁹⁷Half of the 150 Cannanite jars found in the Uluburun cargo contained exactly terebinth (*Pistacia atlantica*) (Pulak 2008).

⁹⁸ It is also worth remembering - as a further suggestion - that the resin of *Pinus halepensis* is used in the production of Retsina - resinated wine still produced in Greece today

- presence of grooved pithoi. At present indeed, all the FBA imported pithoi identified in Broglio were never retrieved inside storehouses which usually were used to store locally produced grooved type pithoi (Type 7).
- general absence of other types of facilities, implements or tools (i.e. quern, or stone–press). Tools connected to food processing are completely absent inside the storehouses⁹⁹. Food processing thus took place in different spaces and areas rather than those dedicated to storage.
- absence of any kind of sealing system.

Aside the presence of containers in perishable material, unfortunately not preserved, storage structure such as silos and underground containers – generally used for the preservation of cereal products – seem to be completely absent¹⁰⁰. It therefore appears that the storage of food substances (arid, solid and liquid) occurred in good percentage in ceramic containers in all life stages of the site. Pithoi are therefore used as a multipurpose containers responding to the community needs. The unique presence inside of the storehouses of the grooved type could hint to the possibility of a functional differentiation among the different types of FBA pithoi. At this stage of the research it is however impossible to propose more precise inferences.

During the FBA there was a huge change in staple management, with the production of very large vases (capacity higher than 700 litres, except P 0936 which capacity was estimated to 350 litres) and the establishment of dedicated storehouses.

It is necessary to look for more convincing evidence of the status of this storage space, to understand if it was really supra–domestic and to understand the reasons behind this new increasing storage need. Both the dimension of vases from Broglio storehouse and their comparison with those ones found in Roca Vecchia could provide suggestions to understand the storage scale.

Italian FBA pithoi usually have very high storage capacity: they belong to the fourth dimensional group (§ 5.4) together with giant pithoi from Cyprus and Crete, used in supra–domestic (and centralised) contexts. On the contrary RBA pithoi (no complete vases are available), on the basis of Broglio specimen's reconstruction, should be characterized as medium–sized vases. Considering the capacity calculated for FBA complete specimens retrieved in Broglio, Roca, and Timmari, we propose a trial evaluation of the quantity of substances stored and their comparison with an individual annual requirement. The table below shows the capacity of the pithoi and the relative quantity of olive oil, wine, wheat, and

⁹⁹They were retrieved for example in some of the spaces uncovered in Pyla.

¹⁰⁰Only one MBA pit could have been used as a silo (Peroni Vanzetti 1998).

barley – considered as the most probable substances stored (see above). Based on the estimation of nutritional needs proposed by Andrea Cardarelli (2010) for the Terramare inhabitants we will attempt to understand the scale of the storage capacity of Storehouse 1. Cardarelli considers as likely a daily individual ration of 470 g of flour, this corresponds to 172 kg of flour in one–year per capita¹⁰¹.

Taking into account olive oil, on the basis of the consideration proposed by Priscilla Keswani for the Late Bronze Age Cyprus, an average on 15 litres per person may be considered probable (Keswani 2015). In the evaluation, the scholar considers the nutritional, cosmetic and practical use of the oil (i.e. oil for lamps).

Pithos¹⁰²	Capacity (l)	Wine (l)	Olive Oil (l)	Wheat (Kg)	Wheat Flour (Kg)	Barley Kg
BT C (P 0936)	350,2	336,2	320,8	262,6	197	217,1
BT D (P 0937)	747,5	717,6	684,78	560,6	420,4	463,4
BT E (P 0938)	1040	998,4	952,68	780	585	644,8
TM (P 1929)	679,5	652,3	622,48	509,6	382,2	421,3
RV (P 1894)	792	760,3	725,5	594	445,5	491

Tab. 6. 8. Contents' evaluation.

If we consider flour, the quantity stored inside one pithos is less than the supposed annual single–family need. However, if all the five pithoi inside Storehouse 1 were used to store uniquely cereals and flour, the quantity surely exceed the annual family needs. Taking into account oil and wine, on the contrary, it can be said with a certain confidence, that they exceed the annual family requirements.

Despite some uncertainties in the evaluation of the scale of the storage, especially for cereals and flour, we conjecture that a typical domestic storage does not use that number of containers of such big dimensions. It is likely that if a single family needed to store large quantity of a certain products (maybe as social storage in the case of shortage and famine), it would have done so in medium capacity containers to avoid the content deterioration once the vase was open¹⁰³.

¹⁰¹ The estimation of the quantity of substances stored was made considering the specific weight of each substance. The quantity of flour is calculated considering an average loss of 25% on the grain weight.

¹⁰² Pithos A and B from Broglio are not considered in the volume evaluation due to their fragmentary state of preservation.

¹⁰³ Similar considerations were made by Thalmann (2007) in the analysis of storage cellars and jars found in Tell-Arqua site. Moreover, he underlines that for the middle-term storage of cereals were used

In this sense it is plausible that the substances stored in Storehouse 1 globally exceeded the normal family requirements. In that sense we have suggested different reasons behind this increased storage necessity (see *infra*). Other storehouses containing a significant number of pithoi were also found in Rova Vecchia where four grooved pithoi were found inside a big structure (Guglielmino 2002) and at Madonna di Ripalta where a rectangular structure recovered at least four or five pithoi in association with other vases (Schiappelli 2003). This evidence confirms the common practice in southern Italy to store several grooved pithoi inside specific structures.

6.5.5. Broglio and the Archaeological evidence of social complexity

Several data confirm that the FBA was a structurally important period for what concerns the Sybaris Plain and southern Italy indigenous communities' organisation (Vanzetti 2000; Peroni and Vanzetti 1998). The process involving the social organization change from a society based on tribes with a marked territorial connotation – characteristic of the MBA – to a gentilitia–patronage community was then fully completed.

- New fortifications which structure seem remarkably more massive and monumental with respect to previous phases fortifications (MBA–RBA)
- New settlement structure: even if there are elements of continuity between the RBA and the FBA, during this last stage a rearrangement of the settlement pattern with structures that took a parallel orientation and also with the monumentalities of internal paths is clearly visible (i.e. *Lastricato* in Sector 2)
- Need to centralize in a single space pithoi which global capacity is supra–domestic. Notwithstanding the pithoi content, it is certain a change in staple management with respect to the previous phases
- Increasing both in terms of quality and quantity of land activities, some of which also require a change in land ownership management, as explained above.

All these data are in line with the existence of a sharp social differentiation within FBA communities. There was indeed a central role of the ruling elite, which became the centre of production activities since the RBA (see the oil tree and viticulture). A similar evolution regards the cattle herds ownership, which likely became more and more concentrated in the ruling elites, while its management was delegated to foster families (Peroni 1994).

jars with a capacity estimated around 80-100 litres. The jars used for oil have, on the contrary, a capacity of 250 litres – probably corresponding to the quantity used by a single family in one year.

Moreover, as better examined in § 8.5.3 ruling elites also controlled highly technological ceramics production – like the Italo–Mycenaean, Grey ware and pithoi – and also metallurgic activities related to iron. A forge for iron dating to the FBA was indeed retrieved in Sector 2.

6.5.5.1. The Sybaris Plain

Broglio related picture has to be integrated within the general panorama of the Sibaritide FBA evidence. Concerning the Broglio surrounding territory study, the results of a decennial survey – the Raganello Project (RAP) – made by Groningen University are now available. RAP recorded 255 new sites¹⁰⁴ in the basin of the seasonal Raganello River, which connects the mountainous area of the Pollino range to the coastal plain of Sybaris. Evidence was collected in a very wide area from the agricultural areas in the foothills and upland valleys to inland compounds and mountain tops (de Neef *et al.* 2017). Among these 255 catalogued sites, 155 present more or less rich concentrations of late pre–historic ceramics. The territorial occupation of the Sybaris Plain was thus extended also to internal and mountain areas, more than what was thought until today.

Project managers underline how this represent a clear advancement in the knowledge of this territorial district (de Neef *et al.* 2017). Only 36 sites were known so far (Peroni 1994) and mainly concentrated in the coastal plain area. Such a systematic occupation of different landscape, and thus a differentiation of settlement areas, could also be related to a function differentiation among sites where different human activities were performed. For example, internal regions were suited to grazing land for cattle.

It is here important to recall that *figulina* pithoi fragments represent a significant sample of materials retrieved during the survey. 22 *storage vessels sites* were indeed identified¹⁰⁵. The most significant evidence come from Contrada Damale and Portieri, two rural contexts in the municipality of Cerchiara where several fragments of *figulina* grooved pithoi were brought to light. The life–span of the evidence in Contrada Damale and Portieri seems related only to FBA.

Based on the distribution of the sites known before the RAP investigation, Renato Peroni (Peroni 1994) postulated the existence during the FBA, for the first time, of a hierarchical organization of the territory centred around major sites and secondary sites (Peroni 1994; Vanzetti 2000; Schiappelli 2003; Vanzetti 2013). Drastic changes in the settlement pattern are

¹⁰⁴According to the authors site definition is not based “on absolute density thresholds but rather on local increases with respect to general background levels; even very diffuse scatters of only a few artifacts could therefore be defined as a site” (de Neef *et al.* 2017, p 285).

¹⁰⁵Pithos fragments were well known in important sites such as Timpone della Motta and Timpone della Fave (Schiappelli 2003; Ippolito 2016).

visible in the FBA, when seven of the 16 sites from the RBA were abandoned and only five new ones were occupied (Peroni 1994, 855–568).

According to Peroni, major sites are of large dimensions and located in dominant positions, thus naturally protected. Minor sites were instead located in less relevant positions and were of smaller dimensions with lower settling continuity with respect to the major ones (which lifespan ranges from the MBA to the FBA/EIA). Other sites in dominant positions but of very small dimensions were considered outposts of major sites, located in more strategic geographic positions.

Peroni also proposed a model of socio–political organization of the Sybaris plain based on the presence of a ruling elite who controlled some the productive activities – agricultural, pastoral and artisanal (see above) as well the storage of staple localized in the major centres.

However, on the basis of the materials collected and on the presence of rectangular structures at Contrada Damale, the authors (de Neef *et. al* 2017) consider it a dispersed settlement localized in the foothills and thus criticized the reconstruction made by Peroni based on the dichotomy between major costal sites and internal minor sites in which – they said – there is no space for large sites like Contrada Damale. Moreover, they underline that in Peroni’s view access to valuables such as pithoi – as wells as ivory and imported Mycenaean vases – was not admitted except in major sites.

There would not be room in Peroni’s model for more dispersed and big settlement (dozens of hectares) – as those identified in Dutch recognition in the municipality of Cerchiara – located in agrarian areas not well protected. However, rather than invalidating the model, these new evidence seems to confirm an increasing complexity in the Sybaris Plain settlements in the FBA (Vanzetti 2013). Sites such as Contrada Damale, in accordance with the presence of many pithos grooved fragments and with the discovery of a small rectangular structure, could imply the presence of areas dedicated to agricultural production and maybe to storage, placed in hilly agricultural areas¹⁰⁶. It must be underlined that all the housing structures known so far are not rectangular and they usually present an apsidal on one of the short sides. The rectangular structure in the Cerchiara municipality finds its best parallel in the known storehouses structure which present usually rectangular shape and small dimension in comparison to the housing huts.

As already stated (Attema *et al.* 2010, p. 94), the evidence from Contrada Damale confirms indeed that storage in the Final Bronze Age “was no longer restricted to elite families living in

¹⁰⁶ If this hypothesis was confirmed by further discoveries, one could also imagine that some of the pithoi (which number is uncertain) were used to store not only staple but also grain to be sown the following year.

the main settlements, but was also practiced by families living in the countryside, although these may still have been controlled by elite families”.

Moreover, they also noticed that some of the internal sites with pithoi are within the catchment area of the centralized centre of Timpone della Motta. If we accept this hypothesis and we extend it also to sites like Broglio and Torre del Mordillo, we deal with “an early form of a rural infill that would stand in close relationship with centralized settlement” (Attema *et al.* 2010, pp. 114–115).

In conclusion, the presence of settlements of tens of hectares such as Contrada Damale, makes it necessary to rethink the level of complexity reached by the Sybaris Plain during the last stage of the FBA. Moreover, these new evidence could open the possibility of the existence of articulated system of production and storage (Vanzetti 2013).

6.5.6. Discussion

How to integrate this new archaeological and territorial analysis evidence with the analyses of pithoi and their storage practices?

Starting from Broglio, where we have ascertained with a reasonable certainty that at least Storehouse 1 corresponds to a storage level which exceeds the normal consumption of a domestic unit, we have to think to the reasons of these qualitative and quantitative changes in staple management. As stated in § 2.5 these evidences were differently interpreted by scholars over the time. The main hypotheses concerning the use of pithoi and the socio-economic organization related could be summarized as:

- Establishment of some kinds of redistributive practices controlled by socially relevant groups within the community (Peroni 1994; Schiappelli 2003; Schiappelli 2006; Schiappelli 2013).
- Exchange networks with the Aegean (Borgna and Càssola Guida 2004; Borgna Càssola Guida 2005). The scholars underlined also that the existence of redistributive practices on the model of the traditional Aegean Palaces is unlikely for contexts as the Italian ones where the levels of social differentiations existed but are not sufficient to support a redistribution-type system.

As the previous analysis shows (§ 6.5.5), in the local communities a certain degree of social complexity was visible, with the presence of elites who were able to control the production of some substances and probably also their distribution both internally and externally to their communities. It is thus possible to imagine that at least part of these substances was redistributed to specific groups (i.e. pottery specialists as the pithos makers, agricultural and

pastoral workers and probably auxiliary troops (Peroni 1994, p. 843-846 and 855-856; Pacciarelli 2009).

Considering the second option – despite the absence in the Aegean of Italian pithoi and their ascertained regional circulation – the possibility of a social storage exchange directed to the Aegean cannot be ruled out. The storehouses known so far (i.e. Broglio, Roca Vecchia, Madonna del Petto e Doppo Daguzzo) are indeed located in areas of certain contact with the Aegean.

Further territorial research – as the ones made by the Dutch scholar in the Sybaris Plain – are surely needed in the understanding of the land control and productive system in southern Italy. This data will help in the elaboration of more precise pictures of the LBA storage practices

6.6. Conclusive considerations on storage practices

In conclusion, the present comparative analysis permits to ascertain that to evaluate the storage capacity of a site and of a space, several factors have to be taken into account. None of these parameters alone permits a full comprehension of the storage practices and, when possible, they need to be considered together. Their analysis provided indication upon the type and scale of storage (domestic or not-domestic, centralized or collective), the modality (short, middle and long term) and finally also to the type of substances stored:

- pithoi quantity (or storage vases);
- dimension and capacity of pithoi;
- dimension and layout of the storage spaces;
- total surface of the areas devoted to storage with respect to the dimension of the site (or to the extension of the excavated areas).

The quantity of pithoi as well as of the other storage vases permits to reach a first understanding of the scale and type of storage. This first evaluation permits to broadly divide domestic and non-domestic storage. However, this quantitative evaluation needs to be coupled with the typological and dimensional aspects. In a domestic storage system, it is more likely to find small-medium sized vases while in a centralized system aside there are also large specimens. As already stated, to avoid the risk of simple inferences between archaeological assemblage and storage practices also the general layout of the structures needs to be taken into account with the analysis also of other storage and productive installations (e.g. silo, storage cellar, quern, tank) as well as bureaucratic tools (e.g. sealing systems and registers). Finally, a complete understanding of the storage system of an archaeological context needs to be extended to the whole context. This means an evaluation of the total surface of the areas

devoted to storage as well as their internal comparison. The density evaluation of storage vases goes indeed in this direction. The comparative analysis between single structure inside the same settlement also permits to distinguish the rate of storage and thus give hints on the socio-economic organization of the settlement.

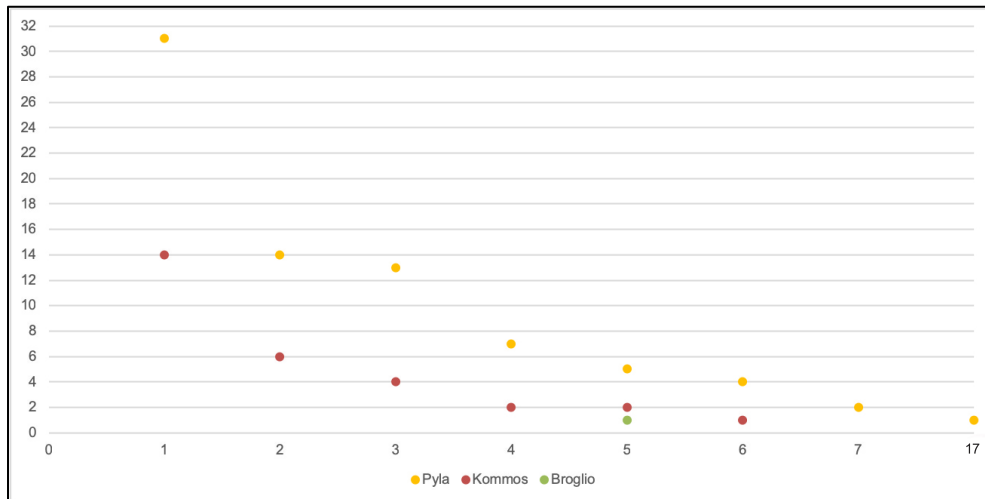


Fig. 6. 27 Comparative analyses of number of pithoi (on the X axes) for single spaces. The Y axis represents the quantity of spaces with X number of pithoi. (Pyla in yellow, Kommos in red and Broglio in green).

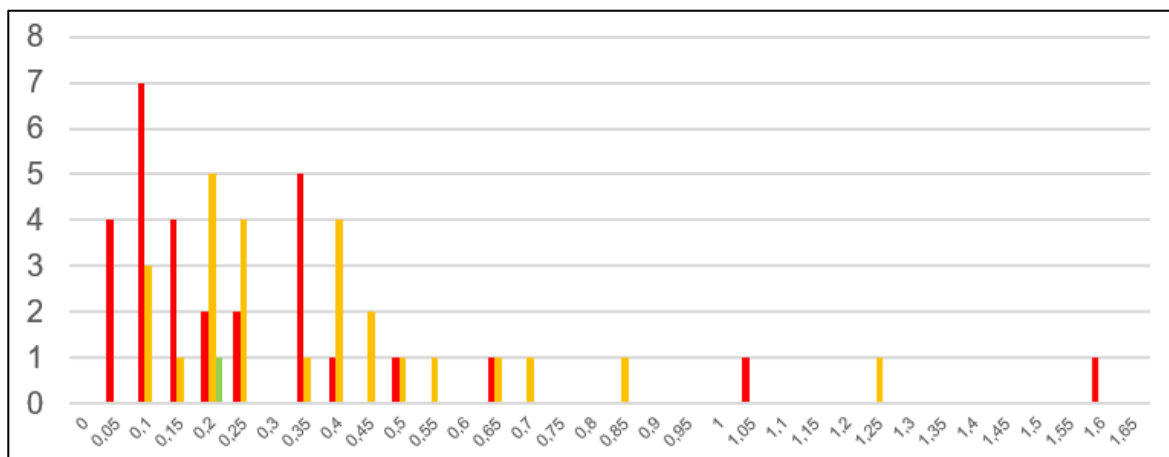


Fig. 6. 28 Comparative analysis of the density frequency distribution among Pyla (in yellow), Kommos (in red) and Broglio (in green).

Starting from the frequency distribution analyses of pithoi in Pyla, Kommos and Broglio, summarised in Figs. 6.37, it is possible to underline certain general considerations about the pithoi storage practices in the contexts under analyses.

Concerning Pyla, the analysis identified:

1. rooms with high pithoi concentration (≥ 4) and few additional materials;

2. rooms with high pithoi concentration (≥ 4) together with other materials;
3. rooms with medium pithoi concentration (2/3);
4. rooms with low pithoi concentration (1/2)
5. courts with a significant number of pithoi but also characterised by materials used for several activities.

In Pyla, it globally emerges a picture with a rich pithoi presence in each of the excavated sectors, both in recent and old excavations. Some of these contexts (n. 1 and 2) seem more specifically dedicated to storage. Other rooms with a number of pithoi comprised between two and three were at least partially used as small-scale storage spaces but also probably devoted to the performance of several activities.

As specified in § 6.3.4, at the moment it is not possible to identify topographic units within single sectors which could clarify the evidence dimensional scale, as happened for Sector 2. However, it seems that a supra-domestic storage characterised all the sectors pertaining to the site casemate wall. Further excavation will surely help in understanding the evidence gathered until today and therefore better understand the storage network in Pyla, perhaps through a more precise comparison between the areas.

Kommos distribution analysis builds a completely different picture, maybe also because for Kommos all allochthonous storage ceramics were considered, and not just pithoi. The quantitative analysis and the density exam let us identify in Kommos:

1. several spaces characterised by the presence of few storage vases;
2. few spaces characterised by a number of pithoi equal or higher than four;
3. courtyards characterised by a high number of storage vases, but also by many additional materials.

In this case, differently from Pyla, the analysis points to an almost exclusively domestic storage. All storage vases found in Kommos were indeed of small-medium size. A partial exception could be represented by House X, where eight storage vases were found in total. House X, as already stated, is the best appointed in Kommos: excavators suggested that some of its spaces could have been dedicated to public events. In this case, the higher storage capacity could be related to the House special function but cannot be compared with other example of monumental storage found elsewhere in Crete.

For what Broglio concerns, the research already highlighted how Storehouse 1 could be reasonably interpreted as a supra-domestic storehouse. The elements which support this hypothesis are the number of pithoi and their dimensions. Considering the density, however,

Broglio storehouse falls into the low-density range of spaces (Fig. 6.37). However, as happened in other cases, the relative large dimensions of the storehouse have to be included in the evaluation. The absence of other well-preserved storehouses (Storehouse 2 is not very well preserved, and the minimum number of pithoi is difficult to calculate) makes it impossible to adequately compare spaces dedicated to storage and thus verify the relative scale within them, as well as to establish if Storehouse 1 was an exception or the norm.

Available data for Roca Vecchia and Madonna di Ripalta seem to be in line with those of Broglio for quantity, typology and capacity of retrieved pithoi, even if the space was larger and characterised by the presence of additional tableware.

As expected, despite the large storage capacity found in Broglio's storehouse, the total capacity of the site, considering the total number of pots, seems however to be medium-low and much lower than the one visible for example in Pyla and compatible with the dimension and the organization of this Oenotrian community.

7. POTTERY MANUFACTURING PROCESS

7.1. Pottery technological studies

Pottery is one of the most common finds in archaeological excavations and it is a powerful tool for historical investigation providing multiple information about ancient societies.

Until some decades ago the ceramic assemblages were mainly studied from a morphological and stylistic point of view in order to elaborate relative chronologies, define inter-sites correlation and relationships among social groups (Roux 2011, p. 80; Vacca 2018 p. 9).

However, more recently, archaeology included in its main interests the investigation of the socio-economic organization, exchange, use and appreciation of pottery by consumers. For these reasons, besides traditional typological approaches, technological investigation has become a fundamental part of ceramic studies (Levi 1999; Caloi 2011; Brunelli *et al.* 2013; Thalmann and Sowada 2013; D'Andrea 2014; Jones *et. al* 2014; Borgna and Levi 2016; Vacca 2018; Todaro 2018). On the one hand, this change is due to the past elaboration of long chronological sequences, which constitutes an element on which current research can build. On the other hand, it has become clear that typological differences are just one element of synchronic and diachronic variability in the material culture, and thus traditional investigation has to be complemented by new elements. The comprehension of synchronic or diachronic changes in material culture needs to pass through the analysis of the production process and studies which reveal the use of pottery (Roux and Rosen 2009, p. 11).

Technological studies are focused on the definition of the different aspects related to the production, distribution and use/consumption of vessels. In other terms, technological studies look at where the production took place and how it was organized (Rice 1987, p. 176). Provenience studies investigate, for instance, the place of production and the origin of raw materials, while studies on the manufacturing process focus on the observation and analysis of recognizable surface features or macro-traces on vessels, produced by distinct manufacturing techniques.

However, in prehistoric contexts, like the ones under analyses, trying to answer to the “how and where questions” might be not a simple task.

Understanding “how the production was” concerns the investigation of the proper manufacturing sequence used to produce vessels but also of production organization.

With regard to the investigation of manufacturing sequences, in addition to the macroscopic visual autopsy of the vessels, some laboratory analyses are often used both to determine the origin of raw materials (i.e. XRF, AAS, INAA) and to study the different steps or the

temperatures reached during the baking process (i.e. X- Ray analysis and XRD) (Levi 1999; Brunelli *et al.* 2013; D'Andrea 2014; Jones *et. Al* 2014).

Despite the introduction of technological data into the pottery classification related to the use of the ware concept¹⁰⁷ (Rice 1987, p. 287), and the increasing number of scholars interested into it, the incorporation of manufacturing aspects continues to be quite uncommon. Studies usually include information about the origin of raw materials and/or on clay recipes (petrofabrics), whereas information about forming methods remains still rare or assumed only on macroscopic visual inspection without an in-depth study that can support such inferences.

The results of technological studies allow the comprehension of the production variability and complexity as well as its evolution over time. As pointed out before, technological studies can be used both from a synchronic and a diachronic perspective. In the first case, they allow to recognize differences in the production sequence – at intra and inter site level – for each class of material and within it. As a consequence, they also provide useful elements for the identification of the circulation of finished products on the wide regional level (Levi 1999, p. 17). In the second case, i.e., in a diachronic perspective, technological studies allow evaluating the changes over time of technological processes and tools.

The long-term insight permits to observe the technological paths undertaken by different ancient societies and to evaluate if products changes are due to a progressive and autonomous development of new technologies or if they are borrowed from other areas. In the last case, these results open the possibility to investigate what kind of interaction occurred between different areas and what consequences that relationship had.

Since technological changes are strongly related to the social context, studies focussing on the production systems help to shed light on the socio-economic systems in which that production took place, as, for instance, if we are dealing with a specialized production or with a non-specialized one.

In his analysis of the introduction of wheel-throwing technique in Minoan Crete, for example, Knappett (1999), considered not only economic (i.e. population growth, agricultural intensification or maximization of profits) but also political (i.e. elite control over the production, organization of the production) and cultural factors as driving force for technological changes.

¹⁰⁷Here we recall the consideration and the definition of ware reported by Thalmann as a “Recurrent association, in a group of ceramic artefacts, of complex set of traits or attributes such a fabric, tempering materials, mode of manufacture, firing, surface treatment and decoration, morphological or functional features or any combination of these” (Thalmann and Sowada 2014, p. 323 with references).

7.2. Organization of ceramic production

Ceramic production is organised on the basis of two important variables: the scale and the mode of production. The first term “refers to levels of labour and resources used and the quantity of output” (van der Leeuw 1977; Rice 1987, p. 180; Costin 1991; Costin 2005; Sinopoli 1991, pp. 99–102;). The mode of production deals specifically with how pottery is made, relating to the kind and level of technologies used and to the internal organization of the production itself (gender and number of workers, composition and vertical or horizontal division of labour).

With regard to the latter, it is also important to understand who made pottery in terms of his/her position in the society (Borgna 2011b). Also the number of producers has to be taken into account, as a restricted number could point to specialisation (see *infra*). Another possibility concerns some forms of control by a central authority: this could have influenced the status of the producers. It is therefore possible to identify in this way the distinction between independent or attached specialists. In the first case the producers responded to a general consumers’ demand while in the latter they essentially met the elite requirements.

In recent times this dichotomy has been questioned in favour of a more nuanced scenario: the concept of semi-attached artisans permits indeed to postulate an elite control over the production but also the possibility that part of the production or some specific products were simply linked to the craftsmen’s entrepreneurship and targeted to a wider part of population.

The status of craft artisans has also implications on the different kinds of technological mobility and know-how transfers (see *infra*) among different regions (Kiriati and Knappett 2016).

At this point, it seems useful to explain more in detail the meaning of the terms variability, standardization, and specialization in pottery technological studies.

Despite all these concepts drew the attention of many archaeologists, it is now clear that the pure economic definition remains partial and can not adequately represent the archaeological reality (Flad and Hruby 2007).

7.2.1. Variability

Each mode of production influences the variability in locus, personnel and resources in a different way (Rice 1987, p. 201).

Based on ethnographic studies, several models of organization have been postulated. These models are currently used for archaeological contexts as they have surely allowed a better understanding of the variables related to the ceramic production. On the other hand, models

do not completely fit the archaeological reality, as they sometimes allow only the generic allocation of archaeological contexts into one category rather than others.

These models incorporate technological considerations (tools used and formal and functional variability of pots) with economic variables (time dedicated to production, professional pottery status, labour division etc.).

The classification ranges¹⁰⁸ from the simple to the more complex forms (i.e. from household production to large scale workshop industry). Broadly speaking, household production implies a close relation between producer and consumer, who could in some case be the same subject. In the subsequent step, the so-called household industry, the potting activity starts to represent a supplementary source of income (Rice 1987, pp. 180-186).

The mode of production may also be related to the gender of the workers (Borgna 2011). In a domestic production or in middle scale pottery production systems woman are more involved than in the large-scale production¹⁰⁹.

Generally, large scale of production is possible only with full time specialists while a small scale of production can be achieved by full time, part time but also by no specialized potters. Thus, specialization and intensive production need what Rosen calls “minimum population thresholds” (Roux and Rosen 2009, p. 19).

It is thus clear that to understand and describe production systems it is necessary to identify and assess the degree of standardization and specialization, but these concepts are still often mixed up or used in a modern way which is far from the prehistoric reality.

7.2.2. Standardization

Standardization implies a variability reduction – or an increase in homogeneity – in the production modes, in the products themselves as well as in their use and distribution. With regard to the distribution, as underlined by Rice (1987, p. 201), standard-size vessels are easier to move. This is the case of transport vessels, like pithoi or jars, for which standard size (dimensions and volume) is the *condition sine qua non* for their use and distribution.

In the past standardization was traditionally used to build up evolutionary models in which highly-standardized products, mass production and the ratio between producers and

¹⁰⁸For a complete examine see Peacock 1981 and van der Leeuw 1984. See also Rice 1987 p. 180-186.

¹⁰⁹Ethnoarchaeology has clearly underlined the relationship between the use of the wheel and male artisans. This seems related, in first instance, to a “strength matters” but the economic reason behind it is prevalent according to more in-depth analyses. When the pottery production gets out from the domestic or household production and starts to represent a source of income it generally passed under the male control (Stark 2004, p. 204).

consumers were all taken into consideration as indicators of the social complexity and increasing crafts specialization.

To be more precise, greater production uniformity was considered as a consequence of high production rate, leading to economic specialization with the presence of full-time artisans¹¹⁰.

However, some ambiguities in the comprehension of standardization derives from the possibility to connect standardization to all the different stages of production sequence: from raw materials selection and composition, to manufacturing techniques and surface decoration (Roux 2003a, p. 768). form, dimensions

Since standardized objects are considered the products of mass production with a routinized manufacture process, one of the most common method used in archaeology in defining standardization considers the degree of dimensional variation within a formal type (Vacca 2018, p. 4). This method of analysis is sometimes questioned since different materials allow different degrees of standardization – for example, pottery is more standardized than lithic (Berg 2002, p.75) – and without mechanical aid it is very difficult to produce two identical objects¹¹¹.

Ethnographic studies have attempted to isolate other parameters connected with standardization and to discover in which way the intensity of production affects it. A comparative study carried on by Valentine Roux (2003b) explores the relationship between metric variability of vessels and intensity of production in three different contexts with the final aim to quantify specialization¹¹². The author tries to investigate how high production rates affect the motor and gesture habits and the final product homogeneity. As expected, results confirm that high production rates lead to lower variability. However, potters can develop motor habits sufficient to produce standardized vessels also in a small-scale production while only high rates lead to the development of motor habits that permit to exceed the emic concept of standardization¹¹³.

To adequately assess standardization, it is necessary to look also beyond the objects (i.e. the metric variability of pots dimensions) and bear in mind the importance of the production

¹¹⁰As a consequence, in modern societies, standardization in a production system is something positive and its lack is viewed as typical of pre-industrial societies.

¹¹¹It is important to note that technology itself and its level affect the possibility to control and to erase the errors occurring during the production (Eerkens 2000, p. 667).

¹¹²Three ethnographic contexts were analysed, two of them are located in India and one in Spain. The first context in India is a rural one with a low rate of production and the second is an urban context with a high rate of production. The Spanish context is a high rate one. In this way, it was possible to compare contexts in the same cultural environment (India) but characterized by two different scales of production and two high rates of production within different cultural boundaries (Roux 2003b).

¹¹³Already Arnold (1985) and London (1991) demonstrated that a certain level of homogeneity can be achieved in both domestic and industrial contexts.

context. The estimate the real extent of standardization in a pre and protohistoric contexts is still difficult, and many – indirect – variables need to be considered on a case-by-case basis. The most common features that are taken into account are, for example, the use of specific tools, the evaluation of the skills required to artisans, the assemblage variability and the consumers' demand.

Some scholars also underline the importance of considering the human perception of variability. According to the so-called Weber's fraction indeed, we perceive as identical two artefacts even though they differ in weight and dimension up to 3 %. Visual perception, memory and motor skills can be considered as factors that contribute to variation in production and products (Eerkens 2000).

In summary, the analysis of the organization of production is based on the study of the variability and standardization both in shape and dimensions of the pots, and in the manufacturing process itself, but also on a broad context analysis.

Thanks to the investigation of all these parameters it is possible to define the degree of specialization in pottery production (for each pottery class in a single context).

7.2.3. Specialization

Specialization is connected to complex societies both from a social and technological point of view¹¹⁴. In these societies some people are devoted to the transformation of raw materials in specific goods during the full (or most part) of the year, and for that reason their subsistence depends on other people. This purely economic explanation leads to defining every artisan working on seasonal bases as less specialized or not specialized at all.

This explanation, in which the intensiveness in term of time-labour plays a relevant role, has been challenged on the basis of ethnographic observation (Vidale 1995 pp. 12-15; Rice 1987, pp. 189-191). The existence of seasonal potters that made vases during the non-agricultural seasons and for whom that activity may had represented only one form of income should open the possibility of a different interpretation of specialisation as not related to a full-time activity¹¹⁵.

An additional specification regards the possibility of both site or producer specialization. It is only in the latter case that specialization could be defined by the time devoted to an activity

¹¹⁴Renfrew (1972) considers specialization as a causal factor in the emergence of the complex societies.

¹¹⁵As stressed by Rice (Rice 1987, pp. 189), full-time specialized personnel may be seen only in state level societies where the presence of dense population generates a constant demand. At Pylos, for example, different pottery producers engaged in different mode of production are mentioned in the tablets. Some of them were hired by the palace while other were involved on multiple activities on a seasonal base (Hruby 2013, pp. 423-425).

and related to “the allocation of labour (or labour force) in a particular economic pursuit” (Rice 1987, p. 189).

One of the main contributions about specialization is the study carried out by Costin at the beginning of '90 (Costin 1991). The scholar defines specialization as “a differentiated, regularized, permanent, and perhaps institutionalized production system in which producers depend on extra-household exchange relationships at least in part for their livelihood, and consumers depend on them for acquisition of goods they do not produce themselves” (Costin 1991, p. 4). She relates specialization to the ratio between producers and consumers. Following this definition specialization occurs when a restricted number of skilled producers make particular goods for a large “consuming population” (Costin 1991, p. 4)¹¹⁶.

Despite the extensive discussion and the focus on the broad context some elements are still missing from the research panorama.

In the definition of craft specialization, the use of specific tools (i.e. the wheel) is sometimes considered. But again, this explanation remains partial: the use of the wheel, for example, implies craft specialization in terms of difficulty, length and mode of apprenticeship (see *infra*) but does not mean that a no wheel artisan is less specialized than one who is able to use the wheel.

To avoid the risk to consider only an economic definition of specialization it is necessary to look at specialization as a complex process. Following the definition proposed by Massimo Vidale (Vidale 1996 p. 13), specialization is a process of social adaptation through which a producer concentrates his expertise to a restricted number of specialised technical operations. In conclusion, the degree and the kind of specialization may vary from a context to another (on within the same context, between productions) but it is necessary to look at it with different level of analysis: from the required skills to the social-context in which production took place.

7.2.4. Productive areas

Turning to where production took place, it is necessary to identify the location of all the equipment used to make pottery: tools and fixed and semifixed installation (i.e. kilns). Concentration of raw material, debris and mislead objects should also be included in the analysis¹¹⁷.

¹¹⁶The producers number also needs to be compared with the total number of products and the total market.

¹¹⁷All these elements can also be used to identify the techniques used during the manufacturing process.

The question relates to the archaeological visibility of the pottery productive areas, especially in prehistoric contexts. Some factors like post-depositional processes or the perishable nature of some implements play a key role in the low visibility of workspaces. Moreover, some scholars underline (Jeffra 2011) the great variability of the layout of productive areas in ethnographic contexts and the resulting difficulty to elaborate comparative models for the archaeological record. Moreover, the workshops and productive areas arrangement is variable and there is no general rule in spatial setting.

However, some interesting suggestions have been recently discussed and new useful elements in the identification of potting areas emerged. The starting point is the evaluation of common traits shared by some archaeological productive site/areas and their comparison with ethnographical and experimental material. The aim of this approach is twofold: to understand the archaeological evidence and to analyse the “cultural choice made by potters” (Sotgia 2018 in press).

Sotgia identifies the general location of these areas in marginal and, most of the time, inhabited zones but close to water sources as a common trait. In the absence of spring water sources, it was necessary to create tanks to collect water.

The layout of pottery productive areas includes the presence of trenches for clay settling, workspaces and usually the presence of more than one kiln – sometimes protected by roof structures (Sotgia 2018 in press).

The survival of productive indicators in an area also depends on the production scale. Evidence is usually more visible in a large-scale production setting, while it is more ambiguous and scattered in a domestic one.

7.2.5. The mobility of artisans

As pointed out before, the analysis of the production processes also sheds light on the interactions that have affected the communities both at local and inter-regional level and allows to develop hypotheses about their organization.

In addition to the circulation of finished products between one region and another, it is necessary to consider the mobility of skilled craftsman and of their know-how as well.

The main question is now how to relate human mobility with the objects spread among different areas (Kiriati and Knappett 2016).

Information about human mobility was available until some years ago only from written sources¹¹⁸ while now biological and genetic studies have been embodied in the archaeology field with the attempt to deepen the understanding of ancient mobility.

The main goal of these new researches is to define the circulation of people (i.e. artisan, mercenaries, merchants, slaves and women) and to understand how this mobility affected the socio-organization of the community.

Circulation of products and people affects the way in which technological transmission occurred. New studies have focused exactly on the transmission of morpho-functional and technological traits in the recent prehistory (Kiriati and Knappett 2016).

Broadly speaking, two modes of transmission are possible (Roux 2015). The indirect mode is based only on copy mechanism. In this mode, that occurred without any guidance, morphological traits could be diffused between different areas and social groups. The spread of these traits does not imply geographical proximity or the existence of networks.

The second mode of transmission is direct, and the guidance can occur in verbal or technical way. Technical guidance necessarily means the demonstration of the traits by potters.

An open question regards the status of these skilled and globetrotter artisans: were they itinerant entrepreneurs or attached artisans? And again, how long did they stay in the host places? Was migration a single event or a continuum exchange?

Given this theoretical context, analysing pithoi production among different Mediterranean areas (Cyprus, Crete and Southern Italy), it will be possible to get a better understanding of their appearance and production in southern Italy and thus to shed new light on the Mediterranean network(s) that characterized the final stages of the Bronze Age.

Moreover, the study of the pithoi manufacturing sequence permits to analyse the invention or introduction of the potter's wheel and all the implications in terms of apprenticeship and craft specialization related to its use. The comparative dimension here proposed aims at deepening the comprehension of such a complex phenomenon.

7.3. Manufacturing process

The pottery manufacturing process consists of a series of steps and operations clearly distinct from each other. As noted in the literature, this natural separation of the process' steps is a

¹¹⁸For the period under analysis, for example, a complex pattern of human mobility, trade and diplomacy in the Mediterranean area is described in the Amarna Letters. What emerged from these sources was the great mobility against the traditional modern image of a static prehistoric world.

huge advantage for those who wants to study it (Van der Leeuw 1981; Pelegrin et al 1989; Levi 1999, p.19).

Manufacturing operations can be easily schematized in the following five phases:

1. Raw material supply;
2. Paste Preparation;
3. Forming Shaping;
4. Finishing / decoration;
5. Cooking.

Each step of the *chaînes opératoire*¹¹⁹ demands specific skills and the use of certain technologies. However, as pointed out by Gosselain,¹²⁰ many of these are functionally equivalent and allow to achieve the same final results. In this sense, the ceramic production sequence should not be seen as a “static and functionally oriented system” (Gosselain 2000, p. 190).

Gosselain argues that there is little interdependence among the phases in the production sequence: technological choices made at one level do not necessarily determine the subsequent ones.

In addition, both the manufacturing and the use of a pot allow some degrees of flexibility in the selection and processing of raw materials. Consequently, changes can happen ideally at each of the different steps without the risk of compromising the whole system.

However, each stage responds differently to change. Dividing these stages into three categories based on the importance, ease of change and the context in which the different techniques need to be learned and developed, it is possible to note that some steps of the *chaînes opératoires* are much more easily transmissible and alterable by ceramists compared to others.

Gosselain's analysis in sub-Saharan Africa contexts ascertained that the forming phases (the third Gosselain's manufacturing stage¹²¹) and the related techniques are the less sensitive to

¹¹⁹The concept of *chaînes opératoire* was coined for the first time by Leroi-Gourhan as “La technique est à la fois geste et outil, organisés en chaîne par une véritable syntaxe qui donne aux séries opératoires à la fois leur fixité et leur souplesse” (Leroi-Gourhan 1964, p. 164). According to the definition proposed by Creswell *chaînes opératoire* could be seen like a “série d'opérations qui transforment une matière première en un produit, que celui-ci soit objet de consommation ou outil” (Creswell 1976, p. 13).

¹²⁰Gosselain tried to verify the relationship between technological attributes, social identity and boundaries through the analysis of *chaînes opératoire* in African pottery at a subcontinental scale.

¹²¹The fashioning stage corresponds to the primary forming phased (Rye 1981, p. 62) or to the creation of the so-called rough out (Roux and Courty 1998, p. 763).

change as they are deeply internalized by each potter (which has learned them during his training process) and representative of the social identity of the group to which he belongs¹²².

7.4. Analytical Procedures

Different methods can be used in order to identify the pottery manufacturing process, from macroscopic ones to specific archaeometric analyses. In more recent years, new approaches are tentatively conducted with 3D reconstruction. Finally, archaeological replicas of *chaînes opératoire* and artefacts represent significant tools in this research field.

7.4.1. Visual Inspection

Visual inspection and macroscopic observation are fundamental in defining the degree of variability (or homogeneity) of pottery assemblages. They provide useful information about technological choices made by potters: it is possible to define paste macro-classes, identify forming methods, secondary surface treatments and firing conditions. Moreover, visual inspection is the preliminary step for any kind of classification: other analytical methods can be used only after an accurate examination of the vessels allowing the evaluation and the selection of samples for archaeometric analyses (Fagnoli 2014, p. 295).

Regarding the identification of primary forming methods – one the main topic of this research – visual examination is used to identify elements on the surfaces (internal, external and in the profiles) related to the manufacture stage.

Some studies were conducted with the aim of relating the macro traces visible on the surfaces with different forming methods or with secondary operations.

One of the first study in this field of research was conducted by Valentine Roux and Marie-Agnès Courty in the 90's and specifically addressed the forming methods that used the wheel or combined it with manual techniques (Courty and Roux 1995; Roux and Court 1998).

However, results clearly show that it is very easy to misunderstand the forming methods used to produce ancient pottery especially when they imply the use of the wheel (wheel-throwing and wheel-coiling). Traces like rilling or groves on body vessels simply point to the use of the wheel but they are ambiguous regarding the specific forming method.

¹²²According to the work conducted in New Guinea by Anne-Marie and Pierre Pétrequin potters have little interest in changing the forming techniques because similar vessels can be made using different techniques and tools. The most important thing is that the vessels are made in the “right way” (Pétrequin and Pétrequin 1999).

In this research attempts have been made to integrate and relate visual examination with X-radiography in order to link macro traces on the surfaces to internal elements invisible to the naked eye.

7.4.2. X-Radiography

As pointed out by Berg (2008, 2009, 2011a-b and 2013) the X-radiographies (hereafter X-rays) are a useful tool for everyone who is interested in pottery technologies analyses.

In particular, they can be used both to characterize clay fabric composition and to identify primary forming methods¹²³. With regard to the latter aspect, X-rays can provide hints, for example, to analyse the attachment of handles and spouts and for the identification of repairs and breaks (Berg 2011a p. 57)¹²⁴.

It was only during the 1930's that the potential of X-rays was exploited also for artefacts and not only for human and animal bones. The first application of radiography on ceramics was to investigate the fabric composition. Titterington (1935) analysed and published seven fragments from North American Indian burials with the aim to underline differential proportion of inclusions.

Ten years later Digby (1948) used radiography to investigate problems and weakness of a particular type of Peruvian stirrup-handled pot.

The first application of X-rays to the investigation of vessels forming methods was in 1969 by van Beek (1969) but it was only in 1977 – thanks to the work of Rye – that X-ray was fully legitimized in pottery technological studies¹²⁵.

The basic principle recognized by Rye is that “the application of pressure to plastic clay causes mineral particles, voids and organic fragments to take up a preferred orientation” (Rye 1977, p. 206). Moreover, this orientation shall normally not be obliterated by secondary forming stages (with the exception of paddle and anvil technique which applied considerable pressure on the clay able to delete the traces related with primary forming methods) or decorations. Each primary forming method produces therefore a specific and identifiable alignment. X-ray allows to look into the internal structure of the vessels and to see the orientation of inclusions and orientations and shape of voids imprinted by the primary forming methods.

¹²³In a broad perspective X-ray can also be used to identify materials and forgeries (Berg 2009, p. 137)

¹²⁴In this research, X-rays are used only with the aim of identifying the forming methods. The investigation of clay recipes was undertaken through petrographic analysis.

¹²⁵ For a detailed bibliography for the use of X-ray, please see Carr (1990), Carr and Riddick (1990) and more recently the work of Ina Berg (2008, 2009, 2011 and 2013). See also Levi 1999 and Laneri 2009.

X-rays are now considered a powerful, non-destructive, quick and economic tool of investigation in pottery technology studies, with a success rate in the identification of manufacturing techniques and methods ranging between 60 and 80% (Berg 2011a p. 58).













However, some pieces present an unclear pattern of distribution of voids and inclusions. The possibility to understand the internal structure depends on the contrast between the clay matrix and inclusion/voids inside it. The use of very fine clay matrix or the excessive quantity of temper can both obscure the manufacturing traces and preclude the identification of manufacturing technique (Laneri 2009, p. 49; Berg 2008, p. 1186).

The modern industrial clay, for example, has a very fine matrix and this represents a problem in terms of visibility of manufacturing traces. In the experimental part of this research the reproduction of some manufacturing methods was made with modern industrial clay to which it was necessary to add tempers and X-ray markers to easier the identification of technological traces.

The artefacts, both fragments and complete vessels, are irradiated with an X-ray beam, a type of electromagnetic radiation. X-ray beams go from a source to a receiver, and between these two points there is the object to be analysed. The X-ray penetration is influenced by the thickness of the objects and the atomic density of the material. The result is an image impressed on a film or digitalized and recorded on a computer. The image depends on the exposure time and the quantity of X-rays that reach the object. Each image presents discontinuities related to the different ways of penetration of X-rays due to the atomic number of the material under analysis.

In order to make the X-ray images, usually in grey shades, suitable to technical analyses, some modifications on the contrast parameters are necessary. Modifications make the images clearer (white) or darker (black) in order to easier the reading of the voids and inclusions (on the dark/black ones, porosities and cracks get very dark, on the white ones, they get very clear).

Following the basic diagram proposed by Ina Berg (Berg 2008, p. 1178), it is possible to obtain general guidelines to understand the features characterizing each of the main forming method used in vessels production.

	Section	Front	Diagnostic X-ray elements.
Pinching			Accidental orientations of voids and inclusions in the frontal view. In the section, elements have a preferred vertical alignment
Drawing			In both views, elements take a slightly vertical orientation.
Slab-Building			Accidental orientations of voids and inclusions in the frontal view. In the section view, elements take a vertical orientation.
Moulding			Accidental orientations of voids and inclusions in the frontal view. In the section view, elements take a slightly vertical orientation.
Coiling			Horizontal orientation of voids and inclusions in frontal view. In the section view, the elements have a chaotic orientation with some elements vertically and other diagonally oriented
Wheel-Throwing			Diagonal orientation of voids and inclusions in frontal view. Voids have an elongated shape. The direction of the alignments depends on the direction of the rotation of the wheel.

Tab. 7 1 Characteristic features of the main forming methods (Berg 2008).

Some questions are still open. As Ina Berg pointed out (Berg 2008), the difference between wheel-throwing and wheel-shaping needs more investigations ¹²⁶. Finally, one of the most problematic issues is whether the speed of rotation and lifting can be related to the angle of the inclusions inside the clay matrix (Desogus *et al.* 1995; Berg 2008).

Recently also other radiological techniques like stereoradiography or computer-assisted tomography (CAT) have been used¹²⁷.

7.4.3. Microscopic analyses

Microscopic analyses are used to characterize ceramic micro-fabrics. Observation can be made with binocular microscopy, petrographic microscopy, and SEM sub-microscopy. The observation of ceramic micro-fabrics permits to observe “the plastic deformations of clay materials that are interpreted with the help of the empirical and theoretical knowledge of soil mechanics” (Courty and Roux 1995, p. 24).

The scholars observed the clay microstructure of vases experimental produced with same type of clay but using three different forming methods – wheel-thrown, coil-built and moulded. The results underlined how the microfabrics differ from each other according to the mechanical and hydric stress exerted on the clay mass. In conclusion different forming techniques produce specific modifications on the clay and it is thus possible to establish clear correlation between the forming techniques and clay arrangements (Roux and Courty 1995, p. 42).

7.4.4. 3D technologies

In recent years, 3D technologies have developed very fast and have been increasingly used also in archaeological studies of ancient materials and architectures.

Some researchers focused on computerized and automatic estimation of the profile of vessels and sherds. Starting from these reconstructions Mara and Sablatnig (2007) tried to evaluate the manufacturing methods used to produce vessels.

The basic point is that vessels “were generally manufactured on rotational plates, the profile line is theoretically identical for a complete (symmetric) vessel” (Mara and Sablatnig 2007, p. 91).

¹²⁶It should be noted that, in theory in the case of coil made vases, inclusion and voids should not exceed the coils edge (Laneri 2009, pp 72). This could also be the case of wheel-coiled pottery but further investigations are needed.

¹²⁷Some pithos fragments from Broglio di Trebisacce and Cannatello were analysed both with normal X-Ray and CAT with the aim of comparing the two approaches from a technical point of view.

Actually, it is possible to observe a deviation from this theoretic symmetry due to the manufacturing methods used by ancient potters. It is possible to identify hypothetically the manufacturing methods estimating the variances of the shape of the profile.

7.4.5. Ethnoarchaeology

Pottery production studies in the last decades have included some instances coming from technological studies in living populations (Roux and Corbetta 1989; Gosselain 2000; Roux 2003b). Despite the critiques to the use of the ethnographic analogies (and the anomalies) in the interpretation of archaeological data, thanks to ethnoarchaeology it is possible to better understand the relationship between production, technological choices and socio-organization of the production itself. Ethnoarchaeology became fundamental in the investigation of the causal relationship between material cultures and their formation.

In the present research, an ethnoarchaeological observation was carried out in two potters' villages: Thrapsano at Crete and Kornmos in Cyprus. In both contexts ceramics are still produced with traditional techniques. The observation put great attention to Thrapsano context, for its specialisation in pithoi and big jars production. Chapter 8, in § 8.3, describes in detail the observation made in Thrapsano.

7.4.6. Experimentation

Archaeological replicas and technological experimentations are now widely used in archaeological studies. The main goal of this kind of approach is to understand all the steps of the *chaînes opératoire* and the gestures connected to them.

The result is the creation of a comparison collection for the archaeological artefacts. In general, the experimentation is based on an experimental protocol. Following the protocol permits to check the different parts of the *chaînes opératoire* and to relate them to the traces on the objects.

In this research, the experimental data set aims at providing a correlation between forming methods and macrotraces detected on pithoi surfaces. All the wheel-coiling forming methods known in the archaeological literature will thus be tested (Roux and Courty 1998; Jeffra 2011), in addition to some forming methods traditionally connected with the pithos manufacture.

7.5. The potter's wheel and the Wheel-made pottery

7.5.1. The potter's wheel

Before explaining in detail all the forming techniques that imply the use of the wheel, it will be necessary to describe and classify the ancient potter's wheels.

The wheel is probably the most important invention/innovation in the ceramic production techniques. The use of the wheel reduces indeed the manufacturing time and permits to produce vessels with a higher degree of symmetry (Roux, de Miroschedji 2009, p. 155).

However, the introduction of an innovation is not a linear process and it is possible for it not be followed by its immediate generalized long-term adoption (Roux and Jeffra 2015).

The nature of first wheels is still elusive due to the scanty presence of wheel devices in the archaeological contexts, especially in the early periods¹²⁸ as the ones under analyses.

Very Gordon Childe (1954, p. 195) underlined already the perishable nature of the wheel devices as a reason for their exceptional presence in archaeological contexts. Most of the wheelhead known are indeed made of wood or clay¹²⁹.

This material condition implies that the "presence" of the wheel in an archaeological context is most of the time postulated only from manufacturing traces on the surfaces of the vessels. The following pages will describe more carefully the different types of surface macro-traces and rilling and their relation with the forming methods.

In addition, some information about wheels could be found in the Egyptian tombs paintings from Beni Hassan dating to the beginning of the second millennium B.C. The images depict wheels and the potters in front of them engaged in a sort of mass-production (Desbat 2004, pp. 137-138).

In the potter's workshop A.XI in Gouves (Crete) the excavator reports the presence of two stone bases of kick-wheel found together with other bases of hand-wheel (Vallianou 1997, pls CXXVIIIc, CXXXIXb; Chatzi-Vallianou 1997, pp. 488-48).

However, the predominant presence of hand wheels in LBA contexts suggests that the potters needed the aid of an assistant to regulate and maintain the wheel speed, especially to rise big size vessels.

¹²⁸For a detailed overview of the first wheel devices in southern Levant see Roux-Miroschedji 2009. For Crete, see Xanthoudides 1927 and Evely 1988, 2000. For Greece mainland the evidences are scanty: only two wheel-head are known, one from Aegina and one from Mycenae (Georgiou 1986).

¹²⁹Evely (1988, p. 83) classified the fabrics of Minoan wheelhead as very similar to the one used to produce pithoi.

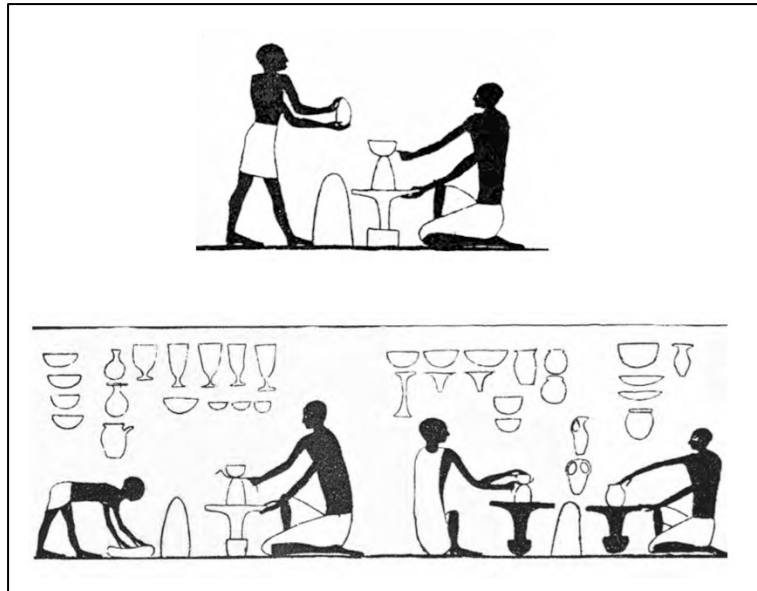


Fig. 7 1 Egyptian potters depicting in a Tomb of Beni Hassan.

A wheel-device is composed by a flat surface (the head) that is the rotating part where the clay or the vessels are worked. The rotation is produced through the inclusion of a rotational point (socket and pivot point) most of the time put into the base of the wheel.

There are still many problems in the classification of wheels and in the development of an appropriate nomenclature.

For prehistory, in literature, the main dichotomy is between slow or simple wheel in contraposition to the fast and true wheels (Orton *et al.* 1993 p. 120-125; Rice 1987 p. 132-135; Rye 1981 p. 74; Childe 1954). This classification emphasizes the complexity of the devices, their capability to store energy and their speed.

Another problem is the difference between the tournette and/or turntable and the aforementioned slow wheel. The key point in this kind of differentiation is the speed reached by the device and its ability to store energy.

Evely (1988, pp. 270-271) distinguished between non-freely revolving specimens, that he called mat, and wheel and wheelhead able to turn. Following Evely turntables are those intermediate specimens where the rotational point is included but could not exploit the centrifugal force (to thrown and lift the clay).

Jeffra, in her study on the first introduction of the wheel in Crete and Cyprus (2011, p. 46), highlights the differences between steady and non-steady wheel-devices. The crucial point is, in this case, the maintenance of stored rotational energy rather than the speed of rotation. Thanks to their steadiness this kind of wheels made it possible to produce wheel-thrown vessels.

According to this definition turntables, tournettes, simple and slow wheels may belong to the non-steady devices' category. On the contrary, the so-called fast wheel and true wheel could be classified as steady devices.

A further classification is based on the nature of the rotation point: socket or pivot wheels (Jeffra 2011 p. 44). In the socket wheel the rotation point projects upward from the base and finished in a hole in the downside of the wheel head. In the pivot wheel, on the contrary, the rotation point is a small projection going downward from the underside of the wheelhead to a hole in the base. The projection could also be an axel termination.

The rotational momentum may be maintained thanks to the use of a second and heavier disc called flywheel fixed to the axle between the wheel head and the base. The possibility to store energy for a long period of time allows the potter to raise vessels of big dimensions in addition to small or medium size vases.

Among the tools related to the use of the wheel some bats were found. Bats are rounded clay discs that acted as throwing surface over the wheelhead. The best-known specimens come from Crete, in particular from the sites of Phaistos (Caloi 2011; Puglisi 2018 for the classification of LMI specimens) and Mallia dating to MM I (Evely 1988; 2000). They are discernible upon the wheelhead because of the absence of any central depression on their underside. Bats easier the movement of the vase: they permit the motion of the vase before it is completely dry and therefore to continue to use the wheel for other works.

To sum up, it is possible to identify different kinds of wheel: two types of hand wheel (socket and pivot wheel), the kick wheel and the so-called stick wheel in which the rotation is performed by a wooden stick.

7.5.2. The wheel-made pottery

Despite the scanty presence of wheel devices, until some decades ago, the presence of wheel-made pottery in an archaeological context was directly connected with the invention of the potter's (fast) wheel and with the wheel-throwing technique. The introduction of a potter's wheel was also connected with (full-time) craft specialization, mass-production and standardization (Knappett 1999; Choleva 2012).

This evolutionary model has been challenged by new studies that shed light on the first wheel-made pottery in southern Levant and Aegean. It is now possible to have a better understanding of the ancient pottery production and a more nuanced picture of the wheel techniques (Courty and Roux 1995; Roux and Courty 1997, 1998; Roux 2003a; Caloi 2011; Choleva 2012, Berg 2013, Todaro 2018).

All the evidence (i.e. tools or traces on the surfaces) was traditionally linked with the wheel-throwing technique without any kind of further clarification. It is only in a relatively recent time that wheel-made vases started to be investigated from a technological point of view.

The term wheel-made refers indeed to all pottery with surface traces connected with the use of the wheel and the *Rotative Kinetic Energy* (henceforth RKE). Thanks to new technological investigations¹³⁰, it has been possible to identify that some vases were not thrown directly by a lump of clay – the wheel-thrown technique – but made with a combination of handmade technique and throwing-the wheel-fashion (or wheel-shaping) techniques (Berg 2008, p.1181)¹³¹.

The two techniques used both RKE generated by a rotary device, but they differ on the basis of clay state at the beginning of the process (lump of clay or an object composed by joined elements) and at the moment on which RKE is introduced in the process.

A further distinction needs to be made between wheel-fashioning and wheel-finishing vessels. In latter case the RKE is used only to refine and smooth the surfaces and not to join different elements (Speziale 1999; Speziale 2001; Caloi 2011).

It is traditionally thought that wheel-throwing and wheel-fashioning techniques produce morphologically identical vases and very similar surfaces features. However, following the analyses carried out by Choleva (2012) and Berg (2008) and looking more carefully through the surface features, it is possible to distinguish them. The crucial point is to identify traces related only to wheel-fashioning techniques (Choleva 2012, pp. 353-354). This kind of traces are therefore connected to the presence of coils, to their deformation by RKE during the forming process as they are consequently absent in totally wheel-made vases.

Despite this difference, the conceptual framework related to wheel-shaping and the necessary skills are comparable with the motor skills used in the wheel-throwing and consequently they are totally different from the ones required in a handmade production.

Wheel-fashioning techniques are time-consuming. It is reasonable to assume that only in the wheel-throwing techniques all the advantages in the use of the wheel are fully exploited. Both wheel-throwing and coiling productions are faster than wheel-fashioning. The use of wheel-fashioning represents therefore, according to some (Choleva 2012, p. 344), an adaptive

¹³⁰For the 4th-3rd Levant, please refer to Roux (2003a, 2010, 2013), Laneri Vidale (1998), and Laneri (2009). For the MM please see Crete Speziale (1999, 2001), Knappet (1999, 2004) Van de Moortel (1998, 2002, 2006) Caloi (2011), and more recently in the Greek Mainland Choleva (2012).

¹³¹These studies let Maria Choleva to suggest the hypothesis that the potter's wheel was firstly introduced and adapted to an existing production sequence (coiling) in a conservative way (Choleva 2012, p. 344).

behaviour to a pre-existing and known productive sequence or a technological choice use in the production of specific vessel.

Differences in the spread and the use of wheel – to thrown or to shape vessels – could also depend on the nature of its presence. We can presumably suppose that if the wheel is invented in one area, the possibility to fully exploited its potential take more time (i.e. the necessity to adapted it to an existing production sequence or the gradual increase of wheel-made vessels dimensions) while in the case its introduction depends on a contact with other areas, despite the necessity of a long apprenticeship, development is usually faster.

These are general considerations, while in the analyses of the archaeological contexts other elements have to be taken into account, such as for example the socio-economic context, the status of the artisans and the type of wheel-made vessels.

7.5.2.1. The wheel-fashioning pottery

In the wheel-fashioning techniques a vessel made of assembled elements (i.e. coils) is created on the wheel, with the help of RKE, during the rough-out or preform stage.

Valentine Roux and Marie-Agnes Courty (1998) identified, from a theoretical point of view, four different wheel-fashioning methods on the basis on the moment when the RKE is introduced in the process to shape the clay (forming the coils, joining the coils, thinning the wall or just shaping them).

	<p>Method 1: RKE is used only to shape the body (preform stage). Coils are built, joined and thinned with discontinuous pressure (without RKE).</p>
	<p>Method 2: RKE is used to thin the wall and to shape the body (preform stage). Coils are built, joined without RKE</p>
	<p>Method 3: RKE is used to join the coils, to thin the wall and to shape the body (preform stage).</p>
	<p>Method 4: all the passages are made with the use of RKE. Each coil is joined to another with the use of RKE.</p>

Fig. 7 2 Wheel-Coiling Methods (Roux and Courty 1998).

These four methods correspond to as many discrete steps between totally handmade and fully wheel-throwing methods¹³². They progressively include in the process more RKE (from the minimal use in Method 1 to the great and performed use of RKE in Method 4)

Some surface features (i.e. parallel striations, rilling, axial symmetry) are common to all methods but each of them bears surface traces which reflect its own specific technical and mechanical traits (Roux and Courty 1998, pp. 752-753):

- **Method 1:** low modification of the wall by RKE. The wall presents variation in thicknesses on spot occurring in parallel pattern (so-called blister). No trace of joints of coils. Rillings are rare. It is classifiable as wheel-finishing.
- **Method 2:** low modification of the wall by RKE; wavy grooves on no-stretched walls. The wavy grooves are related to join lines between coils. They remained visible because the operation of thinning and shaping with RKE are not well performed. Rillings are rare.
- **Method 3:** strong modification of the wall by RKE. Great variety of rillings depending on “the intermittent differential pressures” on the clay at different intervals. One type (a band crossed by a groove) corresponds to the application of continuous pressure by RKE in the binding areas.
- **Method 4:** strong modification of the wall by RKE. Regular ridges and parallel grooves on stretched wall. The scholars underline that those features correspond to a “differential movement of the coils when placed above each other”. Parallel grooves are related to joins of coils. More recently Jeffra (2011) in her doctoral research experimented these methods exploring in detail some aspects related to wheel-coiling methods and creating a typeset of RKE traces (see below).

7.5.3. Typology of RKE formation surface traces

The main work conducted on the classification of RKE macro traces and their relation with single stage in the forming process is due to Courty and Roux (1995; 1998). The results of their experimentation underline that the most significant RKE traces groove and rilling while crack and compression undulation could be polysemic.

Caroline Jeffra (2011) groups traces visible both on experimental and archaeological materials in three main sets: traces related to forming actions, traces related to errors and error correction and finally traces derived from the finishing process.

¹³²Since the focus is on the use in forming of RKE, the scholars ruled out the possibility of shaping the preform without RKE in Methods 2, 3 and 4.

Moreover, each part of vase bears its own traces related to its production sequence. Different vessel shapes have different kinds of traces. Differences can be found for example between open and closed shape: since the lower part of closed shapes is not visible, the surface could be less-worked and bears more and more pronounced forming traces. In general, in the hidden part of the vessel it is possible to observe more traces than the ones present in visible part of the vessel, usually well smoothed.

Other areas with visible forming traces are generally those related to the main joining point in the vessel: the neck join or every kind of curvature or points where there is a sharp reduction in diameter.

7.5.3.1. Wheel-shaping construction traces

As pointed out before the problem is the identification of RKE traces which relate uniquely to wheel-shaping techniques and totally absent in the wheel-thrown vessels. The most significant traces are those connected to the presence of coils and their modification with the use RKE. The coils, depending on when RKE is introduced in the process (forming-joining the coil, thinning and shaping) react in different ways to the continue pressure bearing the formation of new traces (Choleva 2012, p. 353)

In a wheel-coiled vessel the operation related to the joining of the coils is very important as it provides steadiness to the vessel and it is important to avoid the risk that coils split apart during the turning operation. The joining points are always the areas of the vase with the major degree of weakness and for this reason they are worked with particular attention (see *infra*).

As pointed out by Jeffra (2011), the coil joining could occur basically in three directions: horizontal, vertical or diagonal.

Jeffra defines horizontal joins as “smoothing motions which parallel the base of the vessel having a clockwise or anti-clockwise direction”.

Vertical joins consist in movement upwards (from the base to the rim) or downwards (from the rim to the base) and finally vertical joins consist in smoothing the clay in a diagonal direction with downward or upward movement.

In a technological study of coiled or wheel-coiled vases it is also important to evaluate the dimensions of the coils used. In order to calculate the original coil's diameter, it is necessary to consider that what we usually evaluate in the vase is the coil flattened during the forming

process¹³³. The coil became a rectangular band with a rectangular section. Therefore, the calculation passes by the transformation of the area of the rectangle in a circle area.

Diameter = $\sqrt{H \times \text{Thickness} / 3,14 \times 2}$

Thinning operation could generate thickness discontinuities. Moreover, in a vessel produced almost entirely with handmade techniques the thinning operation with RKE is likely more difficult and as consequence the vase could present areas with different thickness, the so-called spot blister. Roux and Courty related this to vessel made with Method 1 while Jeffra did it with the one made with Method 2 (Roux and Courty 1998, p. 752; Jeffra 2011, pp. 125).

However, the presence of different thickness zones could also depend on the degree of uniformity in preparing coils and finally on the skills of the artisans. This means that also a handmade vessel could present a high degree of uniformity in wall thickness. The beam between two coils is thinner than its central part and therefore the vessel presents rhythmic discontinuities along its entire profile.

Some traces are related to the joining of several components. The most common case is the later attachment of the neck on the shoulder, especially when its diameter differs considerably from the body diameter (Jeffra 2011, p. 127).

The Table below lists all the wheel-shaping construction traces based on the work of Roux and Courty (1998), Jeffra (2011) and Choleva (2012).

Trace	Description	Operation	Method (M)
Coils seam	Two convex areas divided by an acute angle	Joining	
Not completely joined coils	Errors in the joining operation. Generally, the joining is made by horizontal pressure	Joining	M3 (Roux and Courty 1998) Jeffra 2011
Direction of clay not parallel to coils	Direction of smoothing during the joining of coils (Upward/Downward)	Joining	
Slip extrusion from seams or Clay barbs	Slip and water pass from the potter's hand to the vessel surface and in closing the gap between the coils	Joining	

¹³³Moreover, it is important to note that during the drying and cooking process the clay undergoes a reduction of the overall volume up to 10%. As pointed out Levi (2010, p. 91) it is important to examine the coil's dimension in the whole vase profile.

Coils termination	The end of the coil is still visible on the surfaces.	Adding a coil to another in order to complete the diameter	
Coils not parallel to striation-rilling		Modification of coils with RKE	
Undulation in the surfaces	Band of different thickness	Joining and thinning the coil with RKE	
Difference in wall thickness in the vertical axis	Presence of coil	Thinning	
Blister	Difference in wall thickness in the horizontal axis	Thinning	M1 (Roux and Courty 1998) M2 (Jeffra 2011)
Torsional Strain Torsional Rippling Torsional Tearing	Diagonal undulation at the lower walls	Rotational Shaping Errors during the shaping; application on the high part of the vessel that cause deformation in the lower part	
Torsional Rippling		Rotational Shaping Errors during the shaping; application on the high part of the vessel that cause deformation in the lower part	
Torsional Tearing		Rotational Shaping	
Seam, curvature, angle long the vertical profile	Joining of different part of the vessel	Attachment of several parts	
Clay reinforce in the inner wall	Reinforce the joints	Attachment of several parts	
Rilling	Raised ridge with concentric to low spiralling path along the wall	Contact between potter's finger and wet surface of the vase	
Drag	Small hollows in the surface of the vessel excavated by inclusion during shaping and finishing and can indicate direction of rotation.	Shaping and finishing	

Tab. 7.2 Wheel-shaping traces construction traces (Green: coils; Yellow: Thinning operation; Orange: Shaping and Component Construction; Rotation: Light blue) (after Courty and Roux 1995, Roux and Courty 1998, Jeffra 2011, Choleva 2012).

8. PITHOI MANUFACTURING PROCESS: TECHNOLOGICAL ANALYSIS

8.1. Introduction

The characteristics of the manufacturing process proper to each of the geographic areas under examination (southern Italy, Crete and Cyprus) are here presented as an integral part of the analysis of the relations reflected in the distribution and technological know-how related to pithoi in the Late Bronze Age Mediterranean.

Due to their large size, pithoi production requires considerable technical expertise. (Jones *et al.* 2014).

The comparative analysis of the data from different Mediterranean areas has demonstrated to be of great interest for the understanding of the technological connections that can inform us about craftsmen mobility and connections between social and political systems. In fact, the likely derivation of the production of Italian *figulina* pithoi from the Aegean or Levant is a good case of the need for a deeper understanding of the technological know-how implied, beyond the stylistic aspect of pithoi alone. Aside the Italian case, also the connections in the Eastern Mediterranean are scarcely understood in terms of technological interconnections, giving a different perspective to the study of the LBA networks.

Alongside the analyses of the archaeological materials, a series of experimental replicas have been carried out, working with Italian potters, in order to evaluate the possibility to identify the wheel-coiling methods proposed by Marie-Agnès Courty and Valentine Roux (1998), and to check their relevance. Great attention has also been paid to the observation of potters in Italian, Cretan and Cypriot traditional workshops.

Archaeological materials and experimental replicas were examined from a macroscopic point of view, with naked eye observation of surfaces and sections. This study allowed the identification of macroscopic and microscopic traces present on the surfaces that could be linked to manufacturing methods or techniques. In addition to visual observations, X-radiography was used.

The radiographic analysis of the fragments, both on archaeological and experimental materials, and its comparison with the macroscopic traces present on the surfaces proved to be an extremely useful method of investigation in the understanding of vessels manufacture (Berg 2008).

Radiographies on part of experimental materials and part of Italian Broglio pithoi were made in the Radiology Department of the Trebisacce Hospital by Dr. Francesco Odoguardi. Radiographies of Cypriot pithoi coming from Cannatello have been instead made in the Agrigento Radiographic Study of Dr. Alfonso Lo Zito. I'm very grateful to Dr. Odoguardi and Dr. Lo Zito for their interest, their availability and their precious advice and suggestions in the radiography's interpretation. An important part of the present reesearch would not have been possible without their precious collaboration.

The technological investigation of the pithoi from Pyla included also some petrographic analyses (only one analysis of a Pyla pithos was available so far, Pilides 2000). During the study season 2016-2017 some pithos fragments were selected for the analyses. The selection included samples from all the diagnostic part of the vase, from the rim to the base. For the Italian material from Broglio this study refers to the results from the huge work made by Levi (1999; Jones *et al.* 2014) which made new samples not necessary.

8.2. Methodological approach

The comparative use of visual inspection and X-rays also involved a methodological study concerning the possibility to relate in a direct way traces visible on the surface with diagnostic X-ray elements. This correlation was very useful especially because it made it possible to better understand macro traces also in those cases in which it is not possible to perform X-ray analyses.

As already pointed out (§ 7.4.2), in order to make the X-ray images suitable for technical analyses, some modifications on the contrast parameters were applied. These modifications made the images clearer (white) or – as a reverse – darker (black) in order to obtain an easy reading of the voids and inclusions (on the dark/black ones, porosities and cracks get very dark, while on the white ones they get very clear).

Even if all the images were treated with colour and contrast calibration, some of them were not readable or simply did not present any particular evidence of the construction processes. These particular items were thus not considered.

It was not possible to carry on X-ray analyses on all Cyprus and Crete materials, which were analysed only from a macroscopic point of view. However, some imported Cypriot pithoi retrieved in Cannatello (Agrigento, Sicily) were analysed with X-rays. Therefore, the only materials totally lacking X-ray analyses are Cretan Pithoi.

The results, despite coming from the study of different pithoi, are very useful and permitted to compare the hypotheses made from a macroscopic point of view for the Pyla pithoi¹³⁴.

The pithoi from Cannatello considered in this study date to LCII. All the specimens were also examined petrographically: their origin is in the south-central coast of Cyprus in the area of Kalavassos-Ayios Dhimitrios (Jones *et al.* 2014; Cannavò and Levi, personal communication).

N.	Inv.	Part of the vessel
1	Can 333	Body fragment with grooves
2	Can 704	Body fragment
3	Can 1118	Body fragment
4	Can 1120	Rim fragment
5	Can 1239	Rim fragment

Tab. 8. 1 Cypriot pithoi from Cannatello analysed

8.2.1. Visual Inspection: some methodological notes

Prior to the technological analyses of the archaeological materials, it is necessary to understand the degree of alteration of the technologically related traces due to post-production traces (use-wear traces, post-depositional alterations as abrasions or concretions) that may compromise the understanding of forming traces, particularly from a macroscopic point of view. Every fragment was therefore preliminarily examined in order to evaluate its informative degree and the most meaningful items were isolated and studied more in depth.

The visual autopsy took place observing the vases and the fragments from three main observation points, from the general to the most specific one (cf. with Choleva 2012, p. 352) as explained below. Different parts of the vases have indeed different informative features and levels. The mere analysis of the stylistic diagnostic components (rim, handle, base and decoration) is not sufficient because, even if these are certainly very significant from the stylistic-chronological and functional point of view, they do not always show representative signs of manufacturing processes. This can be related to their being parts that were usually over-worked or finished with particular care, a fact making them not exemplary of all the vase manufacturing features. Moreover, a single vase could be made with a combination/succession of more than one forming methods, and therefore the evaluation of the forming stages needs to include – when possible – the whole vase.

¹³⁴I hope to be able, as soon as possible, also in light of the positive results achieved, to analyse directly the materials from Pyla.

The following three observation points permit to perform a general survey of the vessels and to isolate the highest number of diagnostic traces for each level.

Moreover, this methodological approach, implying specific analyses of all the vase zones, allows to include single sherds in the final evaluation, rather than just complete specimens. Furthermore, sherds are often useful, as they allow an easy evaluation of all the surfaces and fractures and are also better suited for X-rays.

1. Wall and section: macro traces such as rilling, grooves, coils and type of joints between coils (simple, fingerprint or toothed joints). The direct observation of fractures allows the identification – if present – of different clay bodies that may have been used in the vase construction.
2. Fracture: position of fractures in the body vessel, their inclination, shape and edge.
3. Overall appearance of the vessel: profile analysis, changes in wall thickness.

The first two parameters have been used in the analysis of the different parts of the vessels (rim, neck, body, handles and base). This approach allows to identify the forming sequence of each single part of the vase and to verify how parts were assembled. This is the case, for example, for the frequent later assembling of body and neck and relates to the necessity to take breaks during the forming stage in order for the clay to dry and to support the weight of the upper part. In the case of pithoi, these breaks are sometime needed also between one coil and another, to avoid the vase collapse due to the weight of the new added element (§ 8.3).

Following Jeffra (2011, p. 130), another secondary formation process regards the lip shaping and the handle joins. Their inclusion in the manufacturing sequence was thus investigated and included in the general study of the archaeological material.

Some scholars questioned the validity of the pattern of breakage analysis as a way to identify the forming methods. On the contrary, in the present research the analysis of the fractures and the patterns of breakage are considered very informative. Each forming method leaves indeed weakness zones related to the imperfect conjunction of the different parts of the vessel. A careful analysis of the breaking mode, the shape of the fractures and their relationship with the profile of the vase provides valid hints in the identification of the forming method used. Generally, it can be assumed that oblique or petal-shaped fractures (for the definition of petal-shaped see Levi 1999) are connected to the use of the wheel during the forming stage, whereas horizontal fractures mainly occur at the joint points between the different parts of the vessel or between individual coils.

Levi's research (1999) ascertained the relation between the structural use of the wheel in the vases' production (verified through visual analyses and X-ray images) and a higher incidence of oblique or petal-shaped fractures with respect to the coil-made vessels.

In addition to visual inspection, 3D reconstructions were used to verify the fracture's trend on the vessel's body as well as to get a better understanding of the general appearance of the whole vase.

The first operational step in our analysis was the distinction between vessels supposedly totally handmade and vases in which the use of the RKE (*Rotational Kinetic Energy*) was macroscopically recognized. A vase was considered completely handmade in case of absence of salient traits related to wheel-made productions: rilling, grooves, cracks and type and modality of fracture. In the case of pithoi, the use of the wheel could only be related to wheel-fashioning methods as the production of such large-sized vases through wheel-throwing is considered impossible.

8.3. Ethnoarchaeology at Thrapsano (Crete)

In August 2017, an ethno-archaeological observation was carried out in the Cretan village of Thrapsano, 30 Km south-east of Heraklion. The Cretan village is one of the most famous potters' villages in the island and it is specialized in pithos production. Plenty of papers and videos available on the web testifying its renown importance and the relevance of these productions for the shaping of an idea of pithos production in archaeological studies. Even if this is only one of the possible manufacturing techno-sequences, a clear sequencing of the process and of its traces can result in a valuable tool also for the other cases, using similarities and differences of the traces as a key for the understanding.

The Thrapsano production of pithoi and jars has a very long story. Traditionally, in the past decades the pithos makers were grouped in guilds, and they were involved in a tour in the neighbouring districts of the island where they made, as itinerant labourers, and sold their jars. This system was named *Vendema* and the potters *vendemaroi*; the *vendema* started in May and finished in September (Voyatzoglou 1984).

Each guild consisted in six potters, everyone with his own specific task. The master potter made the pithoi with the support of his personal assistant. The wheeler was the third partner and turned the wheel during the forming operation sitting in front of the master at a lower level. Other tasks of the wheeler also included all the operations connected with the preparation of the kiln and the firing process. The fourth member of the guild was the clay worker and finally there were the woodcutter and the carrier (Voyatzoglou 1984).

Despite the potters now work in stable workshops in Thrapsano, without touring anymore, and some modernisms have been introduced into the forming sequence (i.e. electric kiln, clay extruder), the pithos production is still traditional, and the wheel is still hand-operated.

The observations took place in *Kretika Ceramica* workshop thanks to the collaboration of Andreas Dorgiomanolakis, pithos-maker. In the workshop Andreas works with a young assistant, acting also as wheeler, and with another potter, dedicated to the production of small and medium size vessels on a kick-wheel.

The production of pithoi and big jars is totally made by Andreas, the master. Andreas learned the art from his family, active in the pottery production since 1950.

Each phase of the production has been documented through pictures and videos.

The pithos production takes place through a wheel-coiling method that involves the realization of pithoi through the progressive throwing of large coils with a diameter of 10 cm. Coils are formed mechanically with a clay extruder.

A traditional non-motorized wheel is used. The wheel is turned, to a constant speed and in an anti-clockwise direction by the young apprentice, who sits on the floor in front of the pithos-maker, sitting on a higher chair, and occasionally standing. The wheels are organized in arrays of five. Each array is used for the production of the same type of pithos and the potter performs the same operation in each wheel of the array. At the end of the working sequence each array has the same type of pithos at the same level of realization.

The first operation concerns the base production starting with a manual flatter of a clay mass which becomes a clay disk. This operation is directly made on the wheel head, turned at a very low speed. The first coil is then posed just on top of the base to start the vase wall production. The coil is worked with the wheel, turned by the assistant.

The observation concerns the posing of the second coils over the bases (Fig. 8.1 e-f). The bases were 27 cm high. The coil (diameter 10 cm) reached the height of 16 cm after the throwing and vases reached the total height of 43 cm with wall thickness of 1 cm. All the examined vases had the same dimension, testifying a great degree of standardization in the manufacturing process.

The coils were posed turning – at lower speed – the wheel in clockwise direction and without any kind of joining solution (no fingering, indenting or else). During this operation Andreas worked alone and turned the wheel with his foot.

During the raising operation of the coil with the wheel, the potter over-worked the upper side of the coil in order to facilitate the seam of the new coil. The edge was worked until it reaches the shape of an inverted C.

Once one section was dried, it was possible to add the next coil. In order to facilitate this operation and to reduce the drying time, the apprentice used to pass a flame on vases. When the coil was raised enough, the potter works again the joint area between the two coils, strengthening it and controlling its thickness.

At the end of the process, the master potter analysed the pithoi in order to verify the degree of deformation of the coils during the throwing operation and the dimensional uniformity of the vessels.

Beside vases production observations, also some already-made vase stored in the workshop have been examined. Some of the pithoi made in Thrapsano bear clay plain bands or cordons in the joint area between two coils. Their function is not only aesthetic, as they also provide structural stability to the vessel.





e)



f)



g)



h)



i)



l)

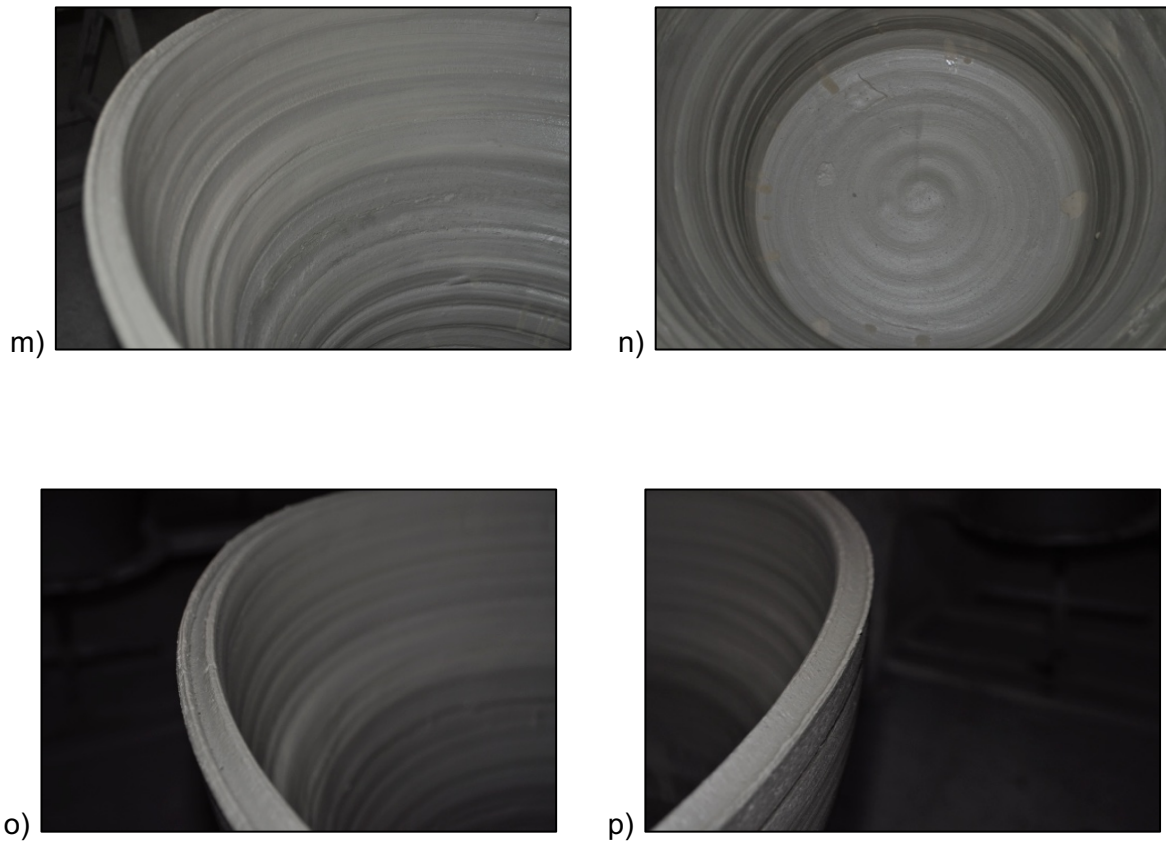


Fig. 8. 1 Thrapsano workshop

8.3.1. Discussion on the Thrapsano pithoi

The observation of the production system was followed by the analysis of a pithos fragment broken during the cooking phases (Pl. 82).

The surfaces of the fragment are characterized by the presence of medium-sized rilling, uniform throughout the width of the fragment as in the pithoi observed in the workshop (Fig. 8.1 m, n, o and p).

The walls are quite regular and 1.2 cm thick (2 cm at the cordon). Fractures run obliquely, and the edges are regular.

In the radiographic image the use of the wheel is well evident: voids and inclusions are arranged obliquely with a spiral pattern from the bottom left to the right. This particular trend of the elements also confirms the anti-clockwise direction of the wheel during the rotation. This effect is due to the contrast action exercised by the potter on the clay mass during the wheel rotation to give the vase the desired shape.

Below the clay cordon, a horizontal micro fracture can also be seen, corresponding to the jointing point between two bands. The clay cordon, although not essential to the stability of the vase, has a reinforcing function and is not purely decorative.

8.4. Archaeological Experiments

The experimentations carried out during the present research are part of a broad experimentations set conducted in the last years by the Broglio di Trebisacce research team, during the works for the realization of the Broglio Archaeological Park and through cooperation with professional standard and replica potters.

The potter Giuseppe Pulitani made as first the experimental reproduction both of local Handmade Burnished ware (*impasto*) and Aegean-derived pottery (Grey ware and Italo-Mycenaean painted pottery) (Vanzetti 2014)

The activity took place in September 2006 in the archaeological park of Broglio and concerned the replica of each step of the manufacturing sequence (from local clay and temper selection/processing to finishing and firing). The detailed description of the experimentation with a deep commentary is provided in the recent team publication (Jones *et al.* 2014, pp. 393-402).

A further replica has been planned and realized in 2015 and will be thoroughly discussed below: it was specifically addressed to pithos production and to the connected wheel-shaping methods, representing an integration of the previous work. The reproductions included the selection of raw materials, based on archaeological local pithoi, the forming stage and did not concern the firing process: a proper kiln was realized, but the pithos was anyway never fired.

The other two experimentation sessions took place in a workshop in Rome – in two distinct moments – with the collaboration of Tonino Calò. The experimentation concerned, in particular, the evaluation of the methods proposed by Roux and Courty (1998). Following an in-depth bibliographic study of the wheel-coiling methods proposed by the two scholars I decided to verify which of the described methods could be used as a comparison term for the production of pithoi, if any. They represent an experimental typeset allowing to define relations between forming methods and macroscopic features on the archaeological vessel's surface. Due to technical reasons as well as economic and time constraints, the experimentation concerned the replica of single coiled/band rings composed of three or four coils each (and for each method) rather than complete pithoi. The rings represent therefore in small-scale the coil sequence used to form both the bodies and the necks in the archaeological materials, as identified through macroscopic observation.

The experimentation therefore involved only the wheel-coiling methods identified from the theoretical point of view by the two researchers together with the replica of a wheel-band of clay instead of a coil.

All the experimental sessions were filmed and photographed, and all the parameters used were recorded (i.e. amount of clay used, time taken in manufacturing, turning speed of the electric wheel).

8.4.1. First Experimentation: whole pithos replica and wheeled band construction

The first experimentation was realised by the potter Giuseppe Pulitani in a work session that took place at the archaeological park of Broglio in February 2015. In that occasion Pulitani made replicas of *impasto* pottery, Italo-Mycenaean pottery and a *pithos* within a broader archaeological project in the park of Broglio.

All the experimental items were produced with local clay extracted from the Trebisacce Pliocene clay quarry, still used by local potters and brick manufacturers, until the end of the 20th century. This clay is very similar to the one used in the production of the local pottery discovered in Broglio, as demonstrated by petrographic and chemical analysis (Levi 1999; Jones *et al.* 2014).

In the case of the pithos, crushed siltstone was added to the clay as temper, in accordance with the archaeological finds.

The potter made the pithos in a progressive assembling sequence of bands of clay, joined with each other with the use of a traditional low wheel without motor¹³⁵.

The clay bands were made out of a large clay coil that he manually flattened inside a rectangular wooden frame, in order to produce a band large more or less 15 cm.

During the manufacturing process of an experimental replica of pithos Pulitani produced a band specifically devoted to X-ray analysis. This band was placed over the top of the previous band in a regular progressive sequence of assembling. Pulitani joined the band, raised and thinned the wall of the pithos with the use of wheel, as if it was a simple phase of the production process. At the end he removed this band and went on with the manufacturing process.

¹³⁵Pulitani was assisted in the use of the wheel by Agostino Sotgia, who during the whole experiment turned manually the wheel. I would like to extend my very warm thanks to both of them. During the turning operation the wheel ran at an average speed of 19,10 rpm with a peak speed of 28,67 rpm.



Fig. 8. 2 Replica of Broglio di Trebisacce FBA Pithos. Break during the forming operation to dry the clay. During the break the band for X-Ray was cut



Fig. 8. 3 Replica of Broglio di Trebisacce FBA Pithos. On the left the pithos during the forming operation. On the right the pithos ready for the firing (that never took place)

The band used in this analysis (Pl. 83) was not subject to the complete finishing operation before its removal from the vase. On the internal surface of the band, one clearly saw grooves and concentric striation made by a cloth used by Pulitani in order to enlarge the vessels diameter and slightly smooth the surfaces. The grooves are due to the RKE during the lifting and thinning operation.

The external surface of the pithos is characterised by rillings. Before the finishing operation and the smoothing of the body, it was still possible to identify the main horizontal joint points between the bands and the vertical ones at each band termination. In the finished vase, joint points and band terminations were completely erased and hidden by the careful smoothing operation.

In the X-ray image the use of the wheel in the manufacturing process is only underlined by the presence of few diagonally oriented elements. Most of the inner traces (voids, inclusions, thickness changes), however, maintained a preferred horizontal orientation. The general pattern is chaotic; this probably depends on the original manual flattening of the original coil made by Pulitani (in order to produce the band) before putting it on the wheel. This basic orientation was therefore only marginally transformed by the wheel-throwing process.

This method can be classified as a hybrid between the slab construction and the (wheel) coiling. Further experimentation of this kind of forming method is necessary for a better comprehension.

Macrotraces on the surfaces	X-ray
<ul style="list-style-type: none"> - Fine type rilling on the external surface - Grooves on the internal surface 	<ul style="list-style-type: none"> - Preferential horizontal /chaotic orientation of voids and inclusions. - Few diagonally oriented elements are also present

8.4.2. Second Experimentation: single rings following Roux & Courty (1998) methods

The experimentation took place in two phases, replicating twice each of the 4 methods proposed by Roux and Courty § 7.5.2.1. The second experimentation session was carried out to verify the internal variability of results obtainable from the work of a single potter. In this second session some corrections have also been introduced, such as for example, the use of clays of different colours since their overlap make their joint more visible.

Secondary operations like refining or decoration were not applied to the experimental rings in order not to obliterate all the primary forming traces on the surfaces. Unlike the Broglio session, during which clay from the Trebisacce Pliocene clay quarry and a foot-operated traditional inertial wheel were used, in this second one, modern industrial clay and an electric were used.

For that reason, before the turning operation a wheel speed test was performed for each of its five gear. In this way, having a speed reference, it was possible to see how much the speed decreases according to the force impressed by the potter during the work.

Gear	Speed (rpm)
1	49,53
2	76,07
3	95,54
4	132,69
5	168,08

Tab. 8. 2 Electric wheel's gears

Due to technical reason Tonino Calò chose to start from Methods 4 and 3 in which the use of RKE was greater than in first two methods by Roux and Courty (1998). The potter said that Method 4 represents, for him, the most natural way to produce a band or a vase and for this reason he decided to start with it.

The description which follows will instead proceed orderly from Method 1 to Method 4.

First Roman Session

The first operation was the preparation of the clay that took place by mixing 5 kg of modern industrial clay (San Sepolcro type). This operation was necessary to make the clay uniform as the external part of the clay is usually drier than the internal one.

Once the clay was ready, part of it was used to create the vessel wheel-thrown base for the experimentation of the wheel-coiling methods. The base was fully wheel-thrown, and it was not intended as a replica of the forming methods of archaeological materials.

To form the base, the clay was placed on the wheel, centred and then turned. The centring took place with the wheel at maximum speed.

The base obtained had a diameter of 30 cm and a height of 18 cm. Thickness at the base was 2 cm, thickness at half height of the wall and in its upper part was 1.5 cm.



Fig. 8. 4 Wheel-thrown base on the wheel

Then the potter further worked the mixture again adding 0,50 g of manganese oxide powder and 200 g of quartz sand to the clay. Manganese oxide was added as a tracer for the X-rays while the quartz sand was used as a temper.

Since the clay was very wet, we let it rest in order to reach the optimum consistency to continue the work. The experimental session continued three days later. As a first operation, the clay was re-affixed. The coils formation took place with a clay extruder and not made by hand as in the Broglio session.

The diameter of the coils was 2 cm. The dimension was smaller than the diameter postulated for the archaeological pithos but for technical reasons (mainly related to the potter's attitude) it was impossible to use coils of greater dimension¹³⁶. The preparation of the 20 coils took 1 h of time.

Each ring was produced – according to the guidance of Roux and Courty – adding four coils each and subsequently detached from the clay base, which mimicked the base of the pithos.

Rings were cut in half before the drying phase in order to produce two half-ring bands. This operation was performed to obtain items with fresh section where the visibility of coils and the disposition of tempers could be assessed. Moreover, the bands have a shape more suitable for X-ray. After a drying time of three days all the bands were fired in an electric muffle-kiln for 30 hours at 960° C.



Fig. 8. 5 Tonino Calò working at the wheel.

¹³⁶In the bodies of Italian archaeological pithoi generally, we can presume an original diameter for the coils between 2.8-4.5 cm.

Second Roman Session

As in the previous session, the first operation was the preparation of the clay that took place by mixing 3 kg of modern industrial clay (San Sepolcro type).

Less clay was needed in this case because the rings were realized directly on the wheel, without a base.

A quantity of 0,50 g of manganese oxide powder and 200 g of quartz sand were added to the clay.

The coils formation took place with a clay extruder and the diameter of the coils was 2 cm. The preparation of the 20 coils took 1 h of time.

Each ring was produced adding four coils each directly on the wheel head according to the guidance provided by scholars for each method and subsequently detached from the wheel.

Finally, rings were cut in half before the drying phase in order to produce two half-ring bands.

Method 1 (PI. 84)

Session 1

The ring was realized with four coils with a diameter of 2 cm.

The potter used the second gear.

Working time: 9 min (average time for coil 2.25 min).

Macrotraces on the surfaces	X-ray
<ul style="list-style-type: none">- Join between coils- Fine type rilling on both surfaces- Wall thickness from the base to the top 1.6-1.5- Slight modification of the band by the RKE.	<ul style="list-style-type: none">- Join between coils- Horizontal alignments of temper and voids

Session 2

The ring was realized with four coils with a diameter of 2 cm alternating grey clay coils with the green ones. The first coil was always the grey one.

The forming operations were made directly on the wheel disc and not on the simulated vase base like in the previous session.

The potter used the first gear.

Working time: 16 min (average time for each coil 4 min).

Macrotraces on the surfaces	X-ray
<ul style="list-style-type: none"> - Join between coils - Fine type rilling on both surfaces - Wall thickness from the base to the top 1.9-1.6 cm - Slight modification of the band by the RKE. 	<ul style="list-style-type: none"> - Join between coils - Horizontal alignments of temper and voids

Method 2 (PI. 85)

Session 1

The ring was realized with 4 coils with a diameter of 2 cm.

The potter used the second gear.

Working time: 13,04 (average time for each coil 3.26 min).

Macrotraces on the surfaces	X-ray
<ul style="list-style-type: none"> - Join between coils. Errors in joining two coils - Fine type rilling on external surface - Medium type rilling on the internal surface. - Errors - Rilling not parallel to the coil joints - Wall thickness from the base to the top 1.6-1.5 cm - Slight modification of the band by the RKE 	<ul style="list-style-type: none"> - Join between coils - Horizontal alignments of temper and voids

Session 2

The ring was realized with four coils with a diameter of 2 cm alternating grey clay coils with green ones. The first coil was always the grey one. The forming operations were made directly on the wheel disc and not on the simulated vase base like in the previous session.

The potter used the second gear.

Working time: 16 min (average time for coil 4 min).

Macrotraces on the surfaces	X-ray
<ul style="list-style-type: none"> - Join between coils. Errors in joining coils: the coils remained not joined at all. - Fine type rilling not parallel to the coil joint. - Fine type rilling on the external surface 	<ul style="list-style-type: none"> - Join between coils - Horizontal alignments of temper and voids

Method 3 (PI. 86)

Session 1

The ring was realized with three coils with a diameter of 2 cm.

Mr. Calò underlined that, during the throwing operation, the coils remained still non-joined.

The potter used the first and the second gears.

Working time: 7 min (average time for each coil 2.33 min).

Macrotraces on the surfaces	X-ray
<ul style="list-style-type: none"> - Join between coils. - Errors in joining coils. This brings to the formation of very irregular rilling - Fine type rilling on the external surface - Wall thickness from the base to the top 1.6-1.2 cm 	<ul style="list-style-type: none"> - Join between coils - Horizontal alignments of temper and voids

Session 2

The ring was realized with four coils with a diameter of 2 cm alternating grey clay coils with green ones. The first coil was always the grey one. The forming operations were made directly on the wheel disc and not on the simulated vase base like in the previous session.

The potter used the second gear.

In order to join the coils, it was necessary to over-work the band for a longer time.

Working time: 19 min (average time for each coil 4.75 min).

Macrotraces on the surfaces	X-ray
<ul style="list-style-type: none"> - Join between coils. Error in joining coils: the coils remain not joined at all. - Fine type rilling on internal and external - Wall thickness from the base to the top 1.6-1.4 cm surfaces. 	<ul style="list-style-type: none"> - Join between coils - Horizontal alignments of temper and voids - Some elements take an oblique inclination

Method 4 (Pl. 87)

Session 1

The ring was realized with three coils with a diameter of 2 cm.

Each coil is thrown on the wheel. After the throwing operation, to prepare the coil for the positioning of new one, its upper side was slightly smoothed. To facilitate the joining operation Mr. Calò made a light nail impression.

Working time: 13 min (average time for each coil 4.33 min)

The potter used the second gear.

Macrotraces on the surfaces	X-ray
<ul style="list-style-type: none"> - Join between coils. Errors in joining two coils - Medium type rilling on the internal surface. - Grooves - Wall thickness from the base to the top 1.6 -1.4 cm 	<ul style="list-style-type: none"> - Join between coils - Horizontal alignments of temper and voids. Few elements take an oblique inclination

Session 2

The ring was realized with four coils with a diameter of 2 cm alternating grey clay coils with green ones. The forming operation were made directly on the wheel disc and not on the simulated vase base like in previous session. The first coil was the grey clay one. In this case in order to facilitate the throwing of the coil Mr. Calò used an extra coil on the wheel on which afterwards he fixed the first coil of the band.

Each coil was thrown on the wheel. After the throwing operation, to prepare the coil for the positioning of a new one, its upper side was slightly smoothed. To facilitate the joining operation Mr. Calò made a light nail impression.

The potter used the second gear.

Working time: 26 min (average time for coil 5,2 min).

Macrotraces on the surfaces	X-ray
<ul style="list-style-type: none"> - Join between coils - Slip extrusion from the seam - Rhythmic changing in wall thickness on correspondence with the joints - Grooves on the joining point between coils - Medium type rilling on the internal surface. - Wall thickness from the base to the top - 1,5-1,3. 	<ul style="list-style-type: none"> - Join between coils - Horizontal alignments of temper and voids. - Some elements take an oblique inclination.

8.4.3. Discussion of experimental materials

According to Roux and Courty (1998) all the methods used could lead, theoretically, to the realization of vases with a similar final appearance. Moreover, the processing allows to cancel the traces of joints between the coils and to obtain products with regular surfaces. Each method led to the production of vases which present rilling on their surfaces. Despite all these general similarities it is possible to isolate specific elements of each shaping method as shown above. The table below summarizes all the surface and X-ray features identified in each Method.

Method 1	Joins between coils remain still visible in the final product. The RKE energy produces a slight modification of the band, while in the X-ray image tempers and voids maintain a preferential horizontal alignment. The surfaces present a fine rilling.
Method 2	Joins between coils remain still visible in the final product. The RKE energy produces a slight modification of the band, while in the X-ray image tempers and voids maintain a preferential horizontal alignment. Differences in wall thickness in the horizontal axis are visible (<i>blister</i>). The surfaces present rilling, sometimes not parallel to the coils.
Method 3	Joins between coils remain still visible in the final product. Errors in the joining operation were more frequent than in the other Methods. This led to the formation of a very irregular type of rilling in the internal wall. The RKE energy produces a slight modification of the band, while in the X-ray image tempers and voids maintain a preferential horizontal alignment. The external surfaces present fine rilling.
Method 4	Joins between coils remain still visible in the final product. Formation of medium type rilling on the internal surface and grooves. The RKE energy modified the wall and led to rhythmic changing in wall thickness on correspondence to the coils. In X-ray image some elements take an oblique inclination.

Tab. 8. 3 Diagnostic features visible on the surfaces and through X-ray for each of the analysed methods

The two sessions, made by the same potter but in two separated moments, led to the creation of products that are strongly different from each other. The two experimentation sessions allowed to verify that the presence of macro-traces on the surface and the quality of the final product are strongly conditioned by the work performed by the ceramist.

Despite the potter was an expert in vase production and proficient in the use of the wheel, the differences visible in the final products could depend on the fact that the experimentation involved a series of methods partially unknown to him and he needed to force himself in following the methods rules. This is in line with the well-known difficulties of artisans to change their habits. Helen Loney underlined that motor skills related to production – once acquired by a ceramist – can hinder the receptiveness of new techniques, generating forms of technological conservatism. Highly experienced and skilled artisans produce objects through a repeated series of actions and specific strategies. These behaviours, learned when young, have a negative fallout when new techniques have to be learned, especially when these are profoundly different from those normally used (Loney 2007, pp. 201-202)¹³⁷.

¹³⁷Moreover, once the apprenticeship is finished and the skills learned by each potter, he directly acts in the maintenance of the technological tradition to which belongs, since it becomes difficult for him to execute the manufacture in a modality different from the one he learned (Roux 2011, p.82).

All these considerations underline the need of carrying out more experimentation sets through which to verify more in detail the internal variation of the production. From an archaeological point of view this observation could imply that some differences visible in the archaeological materials do not depend on different technological operations but are instead the result of internal (and casual) variation inside the same *chaînes opératoires*.

Considering in detail the four methods, the main difference between methods 1, 2 and 3 is in the progressive increase in the use of the wheel. Method 4 differs from all the others because of the consistent use of the wheel to throw each coil. It is rather closely comparable with the method used by the Cretan potters of the Thrapsano village.

In general, the second session, despite the low quality of the bands in terms of regularity and joining ¹³⁸, has an average working time higher than the first session; that is, working on rings is more complex than working on a real “growing” pot.

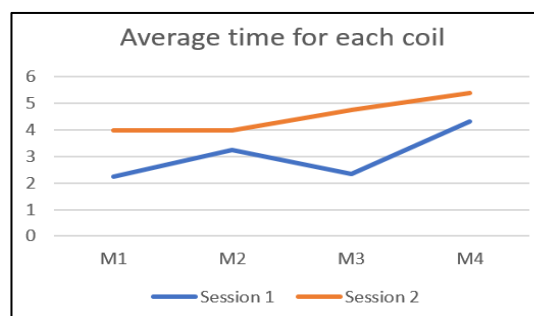


Fig. 8. 6 Average Working time for method. X axis reports the methods; Y axis the working time (min).

Method 4 is, in both experimental sessions, the one implying the longest average time. Thus, despite being the method which best exploits the wheel potential most, it does not represent a time saving method. The measurement considers only the time of placing and working of each coil and not their preparation because they were prepared before the start of the wheel operations.

It seems necessary to underline that some differences in time are also related to the need to add more clay to coils to complete the diameter of the ring. This happened randomly and was not correlated to a specific method. This depends on the fact that coils didn't have the same length and therefore sometimes they were not sufficient to complete the diameter of the ring¹³⁹.

In all the experimentations set out, the potter used to join the coil with a diagonal or vertical direction, except in Method 3 which imposes the horizontal joining, and resulted in some failure. In our case. Mr. Calò considered the horizontal joints too weak and the main consequence in

¹³⁸In the first session all bands have more regular surfaces with a better union between coils.

¹³⁹The coils-terminations were completely erased, and they are not visible in the final product.

the use of this kind of joining would have been the production of a fragile vase. This method leaves a weakness in the main junction points. With the aim to facilitate the joint and make it stronger, the potter made a light incision (with a wooden tool) or a nail impression in the upper part of the lower coil.

The experimentation also underlines that the speed required is not an absolute value even in wheel-coiling methods. The potter indeed intended to change the gear also between one coil and the following. He worked, generally, at low speed – first and second gears – and sometimes shortly increased the gear in order to better join the coils or to refine the surface. In the manufacturing of the wheel-throwing base, on the contrary, he used the last gear and worked at a very high speed, especially during the centring operation.

This experimentation seems to confirm that the speed varies according to the type of activities performed as well as to the part and the typology of the vessels. Probably, also the potter's skills play an important role in the determination of the working speed.

During the experimental replica of the wheel-coiling methods proposed by Roux and Courty (1998) some criticalities emerged. First of all, the main difficulty for the potter was to replicate forming methods not corresponding to his ceramic tradition. This - on the one hand – certainly confirms how an expert ceramist has serious difficulties in executing techniques that are alien to his own (and in producing completely different vases from the repertoire). On the other hand, this also emphasizes how the four methods proposed by the scholars are likely to be excessively schematic and perhaps valid more as a theoretical scheme than in the real practice, as they didn't provide a direct ethnographical evidence for their effective use.

This last aspect could also be connected to the recognized difficulty to clearly relate the archaeological materials to one of the aforementioned methods. The archaeological materials display indeed more variegated trace patterns that suggest the need to investigate the existence of other forming methods (Betancourt 1979; Laneri and Vidale 1998; Todaro 2017); a regional or chronological variability within the forming methods has also been already noted by scholars (Caloi 2011; Levi 1999).

Through these experimentations, it was also possible to verify the weaknesses of each method. Both the opinion of the ceramist and the analysis of the bands permits to identify Method 3 (in which the union between coils is made only through a movement on the horizontal axis) as the most problematic. This led to the production of vessels in which the coils are not properly joined and which are therefore more subject to fractures and detachment.

Finally, these methods are certainly designed mainly for the construction of small-medium sized vessels and not for the construction of large vessels such as pithoi, which require technological precaution due to their size. The experimental replica of one pithos of the FBA

conducted at Broglio allowed to evaluate a further technical option, namely the progressive assembly and wheel-turning of bands and not of coils. In this case, the advantage seems to be the assembling of elements that do not have to be completely modified by the RKE energy. This last method needs to be explored more in detail, also through new experiments in order both to verify its suitability for the interpretation of archaeological materials and to compare the final appearance of fragments and vases produced with this method and those made with coils.

8.5. Analysis of the Archaeological Pithoi

The study of the archaeological items started always with the visual inspection of the material, where possible followed by X-ray analyses, and their comparison with the experimental items.

8.5.1. Cyprus: Pithoi from Pyla-Kokkinokremos

The technological analysis was based upon the pithoi retrieved during the 2014-2016 excavation seasons. The specimens studied come from all the sectors investigated so far (Trench 3.3, 3.4, 4.1 4.2 and 5). The study allowed to identify 189 complete or semi-complete specimens and hundreds of pithos fragments scattered over the entire plateau.

8.5.1.1. Rims and necks

Rims and necks (Pls. 88-89) show evident traces of superficial and fine rilling connected to the rotation on the wheel. In section it is possible to identify the presence of coils and their joints. The presence of coils is visible also in the fragment sections as distinct masses of clay. The joint point takes the shape of an inverted U.

The number of coils and their dimensions depend on the length of the neck. The average dimension of coils is 2 cm height in medium-sized specimens while it can reach 3-4 cm in big-sized vessels.

The fractures have an oblique inclination, and in general a curvilinear shape with regular edges. In some cases, the lip breaks apart suggesting its being also shaped apart with another coil during the production of the vase.

A common fracture line is that between the neck and the shoulder. In this case, compared to the other parts of the vessel, the fractures run horizontally. The joint point is usually reinforced by a plastic cordon. All this evidence suggests that neck and body were built separately and then assembled when the clay was of the right consistence to avoid the risk of collapse.

The general regular aspect of rims and necks suggests the use of the wheel in the forming stage and not only in the finishing operation.

Two Cypriot rims from Cannatello (CN 1120, CN 1239) were analysed with X-rays. They belong typologically to medium-sized specimens ascribable respectively to Type 15 and Type 24. The X-ray images clearly show the presence of coils underlined by a small horizontal crack in the joint point.

CN INV. 1239 (PI. 90)

Rim of short-necked pithos (ascribable to Type 15). On the X-ray image some elongated voids are located just below the rim in the joint point between the two coils that formed the neck. The presence of elongated voids and the general regular aspect of the fragments hint at the use of the wheel in the manufacture.

CN INV.1120 (PI. 91)

Rim of long-necked pithos (ascribable to Type 24.1). The fabric presents several small inclusions and some larger elements up to 5 mm. Inclusions and voids are slightly obliquely oriented from right to left. The shape of the voids is sometimes elongated suggesting the use of the wheel in the manufacturing.

8.5.1.2. Handles

The handles (PI. 92), when present, are generally attached – before finishing operations – without joining or special insertions but probably with the aid of a layer of diluted clay. They usually break apart from the walls. In a single case, it was possible to identify a wall fragment with incised marks used to ease the handle insertion.

8.5.1.3. Body

In the body wall (PI. 93) the most evident traces are visible in the fragment sections. It is possible to identify coils and joints between them. The presence of coils is identifiable also in frontal view through a series of slight rhythmic changes in wall thickness.

Coils are of dimensions which differ depending on their location in the vase. Coils used in the maximum diameter of the vase are bigger than coils used in base or shoulder zone. The average height of coils in body sherds is 5/6 cm in medium size specimens while it can reach 10 cm in big size vessels.

Considering the general breaking pattern, fractures usually have an oblique inclination and, in some cases, take a petal-shape with a very curve edge.

Three Cypriot body fragments from Cannatello (CN 333, CN 704 and CN 1118) were analysed with X-rays. They belong typologically to medium-big sized specimens with grooved decoration. The X-ray images clearly show the presence of coils underlined by a small horizontal crack in the joint point.

CN INV. 333 (Pls. 94-95)

Large body fragments with grooved decoration. In the X-ray image some diagonal elements are visible. They suggest that this vessel was made using RKE. Some voids run horizontally, as they are probably located on the joint point between two coils.

CN INV. 704 (PI. 96)

Large body fragments with grooved decoration. Despite the high concentration of voids, the fabric is very dense and rich in inclusions and the identification of the coil seam is problematic. However, some voids aligned along a horizontal line are visible: they correspond to the presence – identified in the section – of a coil. The presence of some diagonal oriented elements suggest that coils were added with the use of the wheel.

Some body thick fragments present what it looks like an outer layer of clay.

This feature is characteristic of body fragments belonging to big-sized pithoi that usually displayed grooved decoration (Type 24.4 and 25.3). This layer could be added to enlarge the wall thickness in order to produce very big vases as well as to reinforce them. Slab construction is indeed a typical feature of pressure techniques, like paddle and anvil (see Iserlis *et al.* 2015 as a comparison) In the case of the wheel-throwing or wheel-coiling the dynamic process of throwing allow us to add ceramic paste in order to mend, thicker or smoother uneven surfaces. This addition can well result in a layering effect such as notice by Todaro (Todaro 2017). The implication of layering in associations with the wheel for the production of big pots and pithoi need more investigation¹⁴⁰.

CN INV. 1118 (PI. 97)

These body fragments are very thick for the penetration of a normal X- ray beam and the X-ray image doesn't provide clear information about the joints between coils. The outer layer, however, displays evident sign of the use of the wheel with oblique orientation of voids and tempers. Horizontal voids run in the upper side of the grooved band. The band was realized on a thin layer of clay added on the pithos wall

¹⁴⁰In Pyla, however, they are not very common, as already underlined in Chapter 6.

8.5.1.4. Joints

Coils were more frequently assembled through simple joints (Pl. 98). However, fingerprints and tooting joints were identified in few fragments. These types of joints are in general located at the level of the maximum diameter of the vessels. They were used to join two distinct parts of the vase in points with a sharp reduction of diameter. The use of simple joints could also imply that the clay was not very dry and consequently the forming process took place in a sequential way without long process breaks.

In some mended vases it is possible to identify also main horizontal fractures that, as in the case of necks, could correspond to the main sections that composed the pithoi, as assembled separately but consequently. In the internal wall of one pithos (P 1809) a cordon of clay was used to reinforce the joint point between two different parts.

8.5.1.5. Bases

The base is composed by a first layer, laid flat and dish-shaped; a first coil is attached externally to form the start of the wall; afterwards, a second layer is placed in the centre of the vessel, and enlarged to cover the joint between the base and the first wall coil (Pl. 99-101). The breakage mode reflects this forming system. The second flat layer, used to join the wall to the bottom, often breaks off separately. Base diameters are very standardized and range between 23 and 26 cm independently from the pithos dimension, a fact that could hint at some standard procedure/device determining the size.

The bases present a lithic-rich layer on their lower surface. It is possible to assume that this layer was added to facilitate the separation of the vessel from the wheel. The detaching operation must take place at an advanced drying stage, to avoid the risk of breakage, in case of large containers (Jeffra 2011 p. 144, Levi 1999).

In one case the base and lower part of the vessel were made with a coarser mixture than the top. This could be related to the necessity of making the lower part of the vessel more stable and increase the resistance to mechanical shock (Pedrazzi 2003; Levi 1999 for the use of particular clay mixtures in order to increase the resistance of pithoi and Todaro 2017 for the use of layers of different clay in vases production).

8.5.1.6. Finishing operations

Pithoi are finished with a white slip, after firing (Pl. 102); in some cases this layer is thick and still clearly visible on the vessel surface. The slip is likely put on the wheel as testified by visible thin and concentric striation.

When present, the decoration is made by engraving or realized through finger impression. In accordance to the typology presented in Chapter 4 the most common decoration in small-medium sized vessels consists in two incised horizontal lines and a wavy line incised between them. The incision has different depths and is made with pointed tools.

Specimens of medium-big dimension are instead characterized by finger impressed grooves. The motifs are recurring and repeated among the vases displaying a certain degree of standardization in the decorative pattern. The decoration seems made on the wheel and is usually not made with great accuracy, thus resulting in frequent cases of "errors" in the basic pattern.

8.5.1.7. Petrographic Analysis of Pithoi from Pyla-Kokkinokremos

In order to complete the study of the pithos manufacturing process some fragments were selected for petrographic analysis.

The materials analysed were chosen among the hundreds pithos sherds studied in the present research. The starting point of the sampling was the macroscopic division (by naked eye) of the fabrics, defining a preliminary correspondence between the fabrics identified and formal types or varieties.

After this first classification, some samples were selected for archeometric analyses from each fabric Group identified. The sample – which consists of 79 specimens – includes also non-pithos fragments as mudbricks, cooking pots, wall brackets, Canaanite-type jars, Plain White jugs and a basin. Mudbricks were selected as reference material since in their production only local sources of raw material were most likely used.

Before this sampling only one pithos fragment from Pyla had been analysed petrographically (Xenophontos *et al.* 2000) and more generally archeometric analyses of all the Cypriot pithoi are very rare. The present analyses are therefore of extreme importance both to evaluate the local production at Pyla – where Karageorghis reported the presence of a misfired pithos as proof of local production in the site itself (Karageorghis and Demas 1984) – and to compare their production to the wider island panorama.

Among all the selected fragments, this first set of analyses includes 21 pithoi, one basin, one cooking pot and three mudbricks. The pithoi considered in these first analyses represent the main petrographic groups identified macroscopically but also include all the typologically different specimens.

Analyses were performed by Dr. Valentina Cannavò in the Laboratory of the Dipartimento di Scienze Chimiche e Geologiche at the Università degli Studi di Modena e Reggio Emilia.

The analyses ascertained that 18 samples have a local origin and let us identify five major groups based on the main components (i.e. *Intrusive*, *Effusive*, *Effusive-Sedimentary*, *Sedimentary*, *Sedimentary calcareous*) further subdivided in fabrics.

This first set of analyses is quite detailed, and the division in different fabrics risks to be too artificial with respect to reality. Increasing the sample, further analyses may indeed lead to the construction of groups of fabrics, of which the present divisions may represent internal varieties.

However, it is possible to ascertain that there is a good match between the fabric identified petrographically and the local geology formations around the site.

According to the scientific report provided by Dr. Cannavò the intrusive fabrics, in particular, are related to Troodos Ophiolite complex, which outcrop at the southern foothills of the Troodos mountain range (Dikomitou-Eliadou *et al.* 2014). However, there is not a direct comparison between the mafic intrusive rocks of our sample with those identified in a previous analysis made by Fragnoli and Levi. (Group 1, Fragnoli and Levi 2011) pointing to the possibility that they come from different sources.

The effusive and the effusive-sedimentary fabrics are compatible with the fabric composition of Group III identified by Xenophontos in his trial classification of the Cypriot pithos fabrics (Xenophontos *et al.* 2000).

The sedimentary fabrics identified among the Pyla samples – S1 (PYK4, P1854) and S2 (PYK59) – are extremely important because they are compatible with the rocks' type of the Mamonía complex that outcrops in the Paphos region. The two Pyla samples were selected in light of their very different fabrics from the other pithos fabric present at Pyla, both in terms of clay and tempers. Parallels can be found between our samples and fabric Group I (Xenophontos *et al.* 2010), but they still differ for the absence of calcareous and lava inclusions.

One of the two Paphos sample (PYK4) is a rim fragment retrieved in the topsoil level of Sector 5. It could belong to a medium-sized specimen, but its fragmentary status does not allow a more precise allocation.

The second one (PYK59) is a very particular pithos which differs from all both in terms of shape and decoration. It was found smashed but probably almost complete in Sector 5 during the excavation season 2017 and for that reason it is not included in the present research.¹⁴¹ It presents a plastic decoration with two horizontal bands and a serpentine plastic band in-between with impressed circles. Close to the serpentine band also plastic *bucrania* were

¹⁴¹Despite it was not possible to make a complete typological analysis, this pithos was however sampled because of its macroscopic differences with all other pithos under study.

present. Plastic bands and *bucrania* were made with a very depurated and fine clay. The pithos presents a ring footed base very restricted in comparison to the maximum diameter. No close parallels are published in Cyprus so far.

Finally, the sedimentary calcareous fabric should be compared to the fabric description of Group III (Xenophontos *et al.* 2010).

Mudbricks are strongly characterized by calcareous fossiliferous clay and their composition is compatible with the Troodos sedimentary succession and parallel to sedimentary calcareous fabrics.

One sample can be likely considered as an import: PYK18, *Unicum* 1 in the formal classification presented in Chapter 4, presents indeed a unique fabric which contains clean quartz sand, maybe from alluvial or beach source. According to Xenophontos (Xenophontos *et al.* 2000) high relative abundance of quartz may not be present in Cyprus but on the contrary is typical of Palestinian coast.

Three additional samples (PYK 25, 56, 95) are characterized by the abundance of quartz and their provenance is uncertain.

In particular, PYK56 (P 1744) was selected because of its peculiarity in terms of rim shape and decoration. It presents a long neck and for that it has been ascribed to Variety 24. The analysis underlines a high quartz content that could not be related with the Troodos detrital assemblage. PYK56 seems thus to have a not local origin but, differently from PYK18, it is not possible at present to locate its origin more precisely¹⁴².

On the contrary, PYK 25 (P 1778), despite an uncertain petrographic origin, displays formal features that can be attributed to Cypriot pithos production. Finally, PYK 95 (cooking pot) presents a fabric of uncertain origin: the high quartz content could not be related with the Troodos detrital assemblage and therefore its origin should be not local. The typology classification of the vase is outside the scope of the present study but currently under investigation by other team members.

Summing up, the analyses revealed that 18 samples (pithoi, a Plain White basin and mudbricks) present characteristic compatible with the geological formation around Pyla. Among the five petrographic group identified the *sedimentary calcareous* gathers pithoi with a composition very similar with the reference's materials – which are considered made with

¹⁴² As in the case of *Unicum* 1, it could come from the south-central Levant, where pithoi with long neck and grooved decoration are noted since the local EIA (Pedrazzi 2007).

strictly local sources. This point the possibility that these pithoi were made with raw materials available close to the site.

The presence of two sedimentary fabrics that can be related to the Paphos geological formation is noteworthy. Their presence confirms indeed the existence in Pyla of imported pithoi from other regions and the circulation of pithoi in the island between one district and another.

The presence of a likely imported pithos from Palestine is very interesting. It provides a further proof of the contacts between Pyla and the Near East. As stated above (§ 4.6.3), pithoi did not circulate so much in comparison to other pottery classes and therefore the presence of an imported Palestinian pithos gained more importance. To the knowledge of the author no comparable specimens were found (or published) in Cyprus so far.

As far as Pyla is concerned, these first results show a great degree of variability in terms of petrofabric and/or provenance of the vases. This implies a certain degree of selection in raw materials with the use of local sources – the *sedimentary calcareous* – as well as exploitation of different and specific raw materials but also a probable circulation of vases as attested by the Paphos' specimens.

Despite these positive results, at this stage of the research it is not possible to identify specific match between petrofabric and types or varieties. Further analyses will be provided more data also in this direction.

8.5.1.8. Discussion of Pyla-Kokkinokremos pithoi

Summing up, the technological analyses performed permit to ascertain that pithoi from Pyla present:

1. Rilling on their surfaces, especially in the rims and necks.
2. Coils visible in the sections of neck and body fragments.
3. One main horizontal fracture between neck and shoulder.
4. Oblique and petal shape fractures on the body.

Considering all the elements reported above, the forming method suggested for the production of pithoi implies the progressive construction through coils and their assemblage through the use of the wheel. In order to permit the consolidation of the clay, breaks in the process were

necessary. They correspond to the horizontal fractures in the vase. Rim and neck were probably shaped directly on the body after the break¹⁴³.

The main indicators of the use of the wheel, not only in finishing operation for neck and rims, are the breakage mode and the presence of some obliquely oriented elements in X-ray images.

The study of the breakage mode was performed on all the vases and fragments analysed with the evaluation of the direction of fractures and shape of the fragments. In cases of mended vases, the 3D (Pls. 103-104) reconstruction allowed to check the general pattern of the fractures and identify the main joint points of the vases.

The fractures run with oblique direction in all the cases examined. In P 1824 a main horizontal fracture could be identified on the shoulder, at the point of maximum expansion.

Pithoi rarely break in the joint point between two coils. They were added to each other through the use of the wheel and worked with particular care: the turning operation permitted to join the coils better.

The horizontal fractures, as the one identified in P 1824, are located in main joints point of vases and correspond to the main break in the manufacturing process, the one taken to permit the consolidation of the vase.

Until now, none of the specimens analysed show toothing or fingerprint joints in the point between necks and shoulder. The fingerprint joint identified (P 1817) is located exactly in the point of maximum expansion. The vase is not mended but in that point the fracture runs horizontally. It is likely to be a major joint location.

The lower number of specimens of big dimension, belonging to Type 24 and 25 doesn't permit to ascertain if they were produced exactly with the same *chaînes opératoires*. However, the use of the wheel is strongly suspected also in the case of big pithoi because of the breakage mode and of the presence of oblique elements in the X-ray images.

8.5.2. Crete: Pithoi from Kommos

The materials under analysis from Kommos are dated to LMIIIA-B and were retrieved in all the sectors of the site: Hilltop, Central Hillside and Southern Area. Until now only 10 specimens have been analysed as for manufacture. The low number of vases analysed and the impossibility to carry out X-ray analyses lead to the necessity to increase the study sample.

¹⁴³The possibility that rim and neck were shaped separately and only after joint to the body, however, cannot be completely ruled out. Some modern potters produce large jars and pithoi through the progressive assembling of large wheel-made segments made separately on the wheel and thus joined to the previous.

However, despite the need to study other materials, the analyses performed seem very useful as a comparison for the Cypriot and Italian pithoi, even if they cannot be considered as fully representative of the Cretan pithoi.

The Cretan pithoi in Kommos are medium size vessels, less than 1 m tall. They are usually plain without the complex decorative pattern with clay horizontal and serpentine bands common in LMIII Crete.

8.5.2.1. Rim and necks

Rims and necks show evident traces of rilling connected to the rotation on the wheel (Pl. 105). The presence of coils is visible in the fragment sections as distinct masses of clay. The joint point takes the shape of an inverted U.

In some cases, the lip breaks apart suggesting, as for Cypriot items, that it was shaped separately.

The fractures are vertical and oblique with irregular edges due to the presence of great amounts of temper. A main horizontal fracture line is between the short neck and the shoulder. As noted for the material from *Pyla-Kokkinokremos*, this fracture between neck and body suggests that these two parts were built after a break in the working session in order to consolidate the clay. In some specimens this main joint point is underlined and reinforced by the presence of a cordon

8.5.2.2. Handles

The handles (both horizontal and vertical ones), were attached on the shoulder before the finishing operations, and usually don't break apart from the body. This suggests a consistent fixing procedure (Pl.106).

8.5.2.3. Body and joints

Bodies were manufactured adding large coils one above another using the wheel (Pl. 107).

The body wall, generally thick 1.2-1.4 cm, always displays large and deep rilling.

The most significant example in Kommos is pithos P 1421 (variety 21.1), composed by seven sections from the base up to the rim. As it is possible to note in the Pl. 107 the main fractures run horizontally at the joint point between the coils. The coils were joined with each other with simple inverted U-shaped joints. The joint points between the sections are not reinforced by a clay band as attested elsewhere in Crete and in RBA Italy.

The fracture edges are irregular, as probably due to a large amount of inclusions. Some minor fractures have instead an oblique inclination. On the inner surface an irregular and deep rilling of large dimensions is visible. The potters did not delete it at all with secondary finishing operations.

8.5.2.4. Base

The bases are usually simple and flat (Pls. 108-109). They are formed using a clay disk (in one case composed by two layers). The walls are placed directly on the base disk. The base disk has a diameter smaller than the real one of the bottoms. The flat clay disk is indeed enlarged by the adding of the coils used to build the body's wall.

Unlike the Cypriot ones, the second disk – if present – does not surmount the wall, that instead simply leans against the base. In one case the base disk is composed of two different overlaid layers of clay, but without wall-fixing.

On the outer surface of the base, it is sometimes possible to identify the presence of a layer of temper (not so rich as in the Cypriot ones) used to facilitate the detachment from the wheel.

8.5.2.5. Finishing operation

Pithoi are finished with a white slip, after firing; in some cases, this layer is thick and still visible on the vessel surface.

Only specimen P 1418 (Fig. 8.7), among the materials analysed, shows a decoration with plastic bands. The body fragments present applied a horizontal clay band with stamped rosettes and a serpentine band decorated with oblique lines and impressed semicircles. The band in one case broke apart and it is possible to see that it was attached through a shallow incision – as a guidance – made with a pointed tool in order to facilitate the adherence to the wall.



Fig. 8.7 Body fragments with clay band decoration.

8.5.2.6. Discussion on Kommian Pithoi

The Cretan pithoi analysed present a clay fabric very rich in temper. The inclusions are of medium-big sized (up to 5 mm) and with angular and sub-angular edges. They were crushed and added intentionally into the clay.

Summing up, the technological analyses performed permit to verify that pithoi in Kommos present the following characteristics:

1. Rilling on their surfaces, especially in the rims and necks.
2. Coils are clearly visible in the sections of rims and necks
3. Main horizontal fracture between neck and shoulder.
4. Main horizontal fractures with other smaller vertical oblique fractures on the body.

The careful analysis of the sections made it possible to identify coils in the construction of rims and necks. However, due to the high coarseness of the clay, identification of the joints between coils is not always easy.

The presence of rilling on all the analysed walls provides a clear indication of the use of the wheel.

The vessels are characterized by the presence of some horizontal fracturing points, from which oblique fractures, with strongly irregular margins (perhaps due to the presence of a large amount of inclusions), arise.

The most probable method used in the production of Cretan pithoi seems therefore to be comparable with the one observed at Thrapsano, in which the pithoi are formed through the progressive assembly of large coils through the wheel. This forming method is also mentioned for the production of LMIIIA-B pithoi retrieved at Mochlos, Sissi, Kavousi Vronda¹⁴⁴ (Smith 2010, pp. 106-108; Langohr 2017).

The seam between a coil and another is instead usually made with a simple type joint with the creation of an inverted U-edge in the lower band, exactly the opposite of what we saw in Thrapsano. In one case the joint between the rim and the shoulder was made by toothing type joints as attested in Kavousi Vronda (Fig 8.8).

The large diffusion of decorative patterns formed by horizontal plastic bands, sometimes accompanied by the serpentine one, could indeed be connected to this forming method. The

¹⁴⁴The LMIIIB pithoi retrieved at Sissi are described “with numerous and regular deep rilling marks on the interior surface and distinct horizontal breaks at the location of coil-joints” as a demonstration of the “combined use of the coil-building and wheel-fashioning techniques” (Langohr 2017, p. 206).

bands assume, also according to what seen in Thrapsano, a function of reinforcement of the points of juncture between the bands.

However, the materials of Kommos analysed up to now are characterized by the total absence of plastic bands, with the sole exception of the decorated fragment with wavy band with rosette-patterned motifs, previously described.

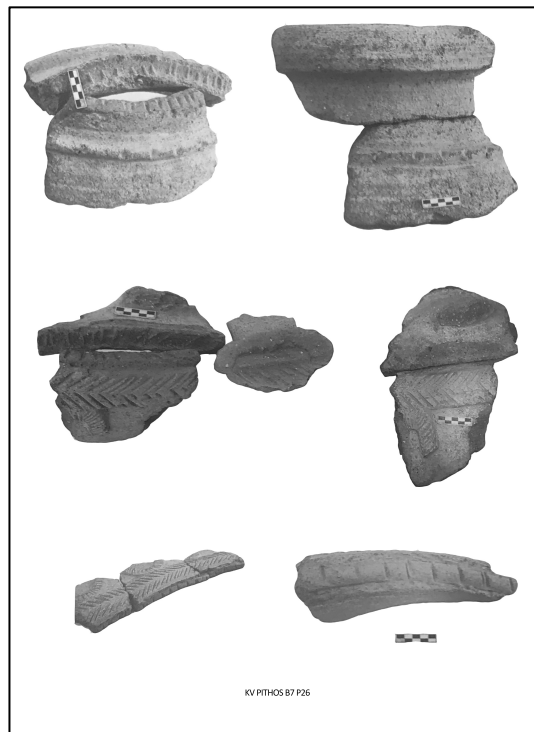


Fig. 8. 8 Joints in Pithos P26 from Kavousi Vronda (Smith 2010).

8.5.3. Southern Italy: pithoi from Broglio di Trebisacce

The study of pithos fragments from Broglio involved not only the visual inspection but also X-ray analyses. Some fragments were selected for this analysis among some hundred fragments of pithoi stored in the storehouse in Trebisacce. The selection includes 30 big body and rim fragments dating from Italian RBA to FBA; this choice was made in an attempt to identify continuity or discontinuity in the use of the wheel during the whole period. Not all the X-ray images display relevant forming traces¹⁴⁵, in the following pages only the most significant X-rays will therefore be presented.

¹⁴⁵Ina Berg underlined a success range between the 60-80% in the visibility of forming traces in X-ray images (Berg 2011a).

8.5.3.1. Rims and shoulder

On the surfaces, rilling connected to the rotation during the forming stage on the wheel is evident (Pls. 110-112).

Rims and shoulders are made with coils. The lip is shaped apart with another small coil, as in the cases examined above. The coils are clearly visible in the sections as distinct masses of clay. The joints points between the coils take the shape of an inverted U.

Due to the absence of a distinct neck, especially in the RBA specimens, the rims usually break just under the lip. In the RBA vases the joint point is reinforced by a plastic cordon. The fracture is horizontal and represents one of the main joint points of the vase (see *infra*).

The general regular aspect of rims and necks also suggests the use of the wheel in the forming stage and not only in the finishing operation.

BT 82 INV. 773 – RBA (Levi 1999, fig. 190) (PI. 110)

In this fragment it is possible to identify the traces of tothing joints at the rim and near the cordon. These represent two of the main joint points in the construction of the vase. On the X-ray image it is also possible to see a preferential horizontal orientation in the inclusions and voids that lets us confirm the presence of three coils. These coils are also clearly visible in the rilling on the internal surface of the vase and through the thickness variations of the wall. The rilling runs parallel to the coils. The presence of diagonally oriented inclusions and voids indicates the use of RKE for shaping the body after the coil assembling. The use of RKE did not produce however a strong modification in the clay mass.

BT 98 INV. 6751 – FBA (PI. 111)

The X-ray image shows the presence of four elongated horizontal tothing joints used to fix together the rim to the body. Two distinct masses of clay are clearly visible in the sherd section indicating the presence of coils. On the body, the inclusions and the voids are diagonally oriented and confirm the rotation on the wheel.

8.5.3.2. Handle

The handles are only vertical and in general of small dimension; when present, they are directly attached from the rim to the shoulder (PI. 112).

8.5.3.3. Body

Coils are identifiable in the body walls and the joint between them is present both in RBA and FBA pithoi. The coils are visible especially in section but also in frontal view through a series of slight rhythmic changes in wall thickness.

Coils are of different dimension depending on their location in the vase. Coils used in the maximum diameter of the vase are bigger than those used in base or shoulder zones, similarly to the Cypriot pithoi. The average of the original diameters of coils in body sherds is around 4-5 cm.

Considering the general breaking pattern in the RBA pithoi, the fractures have a preferential horizontal direction and in general curved and regular edges. Additional small vertical fractures depart from the main fractures. On the contrary, the FBA specimens are characterized by a high number of oblique or petal-shape fractures.

BT INV. 14801 - FBA (PI. 113)

Body fragment. In the frontal view, prevailing horizontally oriented elements emerge. However, some diagonal voids indicate that this vessel was made using RKE.

BT 98 INV. 6647 - RBA-FBA (PI. 114)

Large body fragment with two cordons with finger impressions. The remarkable quantity of inclusions is almost completely diagonally oriented.

The shape of the fractures – obliquely oriented – also seems to confirm the RKE use in the manufacturing process. There are a lot of cracks on the surface, that could be connected with the heterogeneous hydration of the clay¹⁴⁶.

8.5.3.4. Joints

The types of joints identified are simple, fingerprints and tothing joints. The joint points are usually reinforced by the presence of clay bands (plain or decorated) or grooved decoration. Fingerprint and tothing joints are more frequently attested in RBA vases and occurred along the whole body in order to join the different sections. In the FBA vases these joints are used less common and used, for example, in joining the rim (Levi 1999).

BT 82 INV. 314 - RBA (Levi 1999, fig. 192) (PI. 115)

Fragment with plain band. Two main fractures run horizontally. On the X-ray image it is possible to see finger impressions made under the clay band in order to join two distinct sections of the vase. Each of these sections was made by several coils. The coils are visible in X-ray thanks to the presence of elongated voids in the joint points. Some oblique alignments suggest the use of the wheel in the forming operation.

¹⁴⁶Courty and Roux connected them with the high quantity of water necessarily added with the wheel-throwing. The scholars in their research never found this feature on wheel-coiled vases.

BT 98 INV. 6723 – RBA (PI. 116)

Two joined body fragments from the same pithos with plain band. The presence of diagonally stretched voids indicates the use of RKE.

Looking at the sections, it is possible to see the joints between two coils – in correspondence of the band. In this case the RKE produce a high modification in the clay past and both tempers and voids have an oblique orientation.

BT 04 INV. 13490 - FBA (PI. 117)

Body fragment with band. The X-ray image displays the diagonal orientation of voids and inclusions. Under the band it is possible to identify at least four short diagonal and elongated voids that confirm the use of the wheel.

BT 79 INV. 17484 - FBA (PI. 118)

Body fragment with band. Marks of six toothing joints are visible under the cordon and at least three of them are in the lower part of the fragment. In the upper line they are at the average distance of 3.5 cm whereas in second line the distance is more or less 5 cm.

These marks underline the joint between two coils, characterised by horizontal orientations of voids and inclusions. In section it is possible to note the presence of two distinct clay masses under the decorated band which permits to confirm the presence of these coils. The presence of sporadic elements with diagonal orientation attests the use of RKE for the body shaping.

8.5.3.5. Bases

The bases are usually flat but distinct from the body (PI. 119-120). They are formed using a clay disc-shaped layer, sometimes very thick, up to 4 cm. The walls are placed directly against the base layer. Unlike the Cypriot ones, the second disk – if present – does not surmount the wall that simply leans against the base. Some bases present on the lower surface a layer of temper (not so rich as in the Cypriot one) used to facilitate the detachment from the wheel.

8.5.3.6. Finishing operation

The body walls of pithoi are always well smoothed and present on their surfaces fine type rilling connected to the finishing operations.

In the RBA pithoi the most common decoration is the presence of plain clay bands. The bands – as stated above – have a static function as they are located in the joint point between the different sections constituting the vase. The FBA specimens on the contrary present grooved decoration in the corresponding position. The decoration seems made on the wheel.

Some FBA specimens present applied bands, but, differently from the RBA pithoi, they bear grooves or incised/impressed motifs (§ 4.3.3, Tab 4.1).

8.5.3.7. Discussion on Broglio's Pithoi

Regarding the production of pithoi in southern Italy – between RBA and EIA – the study conducted by Sara Tiziana Levi (1999) has made available a huge amount of data¹⁴⁷.

Considering Broglio and the Sybaris Plain, the large number of analysed pithoi allowed not only to identify, with a good degree of precision, the raw materials used, but also to evaluate their use in a diachronic perspective (from Italian RBA to EIA).

According to the results of the analyses carried out by Levi, in the production of pithoi specific raw materials were selected. The clay used in the production of pithoi was likely extracted from deposits analogous to the modern clay quarry located 1.2 km east of the site (so-called *Argilla di Trebisacce*) while for the production of the *impasto* pottery the clay could be extracted at a few hundred meters from Broglio. *Argilla di Trebisacce* was anyway used also for other specialized productions, such as Italo-Mycenaean pottery, Grey ware and FBA Protogeometric pottery.

As far as the tempers are concerned¹⁴⁸, siltstone, calcite, sandstone and sand (quartz and feldspars) were identified in Broglio¹⁴⁹. In the production of pithoi, on a general level, two types of siltstone (brown siltstone and fossil-bearing siltstone) were clearly prevalent on all the other types of temper. Calcite stands up among the other tempers while sands and sandstone are not so common. On the contrary, sandstones and sands were very commonly used in the production of *impasto*.

In this general trend, it is possible to isolate some chronological variations (Levi 1999, p. 24). Calcite and sandstone, for example, have their maximum use in RBA, which is followed by a sharp decrease in subsequent phases. The brown siltstone remains in use in all phases with a frequency peak in the phases of advanced FBA. The fossiliferous siltstone, on the other

¹⁴⁷Although the main focus of her technological analyses, primarily petrographic, mainly involved Broglio, samples were also collected from other regions of southern Italy, such Basilicata and Apulia (Jones et al. 2014).

¹⁴⁸Tempers were found in water courses close to the sites or in deposit of conglomerate on which the site stand (Levi 1999)

¹⁴⁹The Sybaris Plain, from a lithological point of view, is divided into 6 main zones: 3 are located into its northern sector (where Broglio is located) while the other three to the southern one. Areas A, B and C of the northern sector are characterized by sedimentary rocks (arctic sandstones, siltstone, calcite and calcareous sandstones). The zones of the Southern area - D and F - are instead characterized by crystalline rocks (miches, pyroxene and metamorphic rocks).

hand, characterizes mainly the phases of the FBA and then decreases in the subsequent ones. Quartz-feldspar sand was used in small percentages in FBA.

These chronological variations in the use of the tempers take more importance if they are observed in parallel with the production of the local *impasto* ware. In fact, it can be observed that these two productions are characterized by the use of different tempers in all the phases under examination. Only in few cases the use of fossil-bearing siltstone (especially for the closed forms) is attested in the *impasto* production from the advanced phases of the RBA¹⁵⁰.

Considering the manufacturing process, the beginning of the production of the pithoi during the RBA involved the introduction of the use of the wheel. The novelties are not only related to the use of the wheel, but they concern, more in general, the whole manufacturing sequence.

In order to get a better understanding of it, the pithoi manufacturing process should not be treated apart from that of Italo-Mycenaean and Grey ware. Table 8.4 summarizes the types of raw materials used in the production of each class, the forming methods, type of decoration and firing temperatures for each class.

	Clay Processing	Forming	Decoration	Firing
Impasto	Coarse	98%Handmade	X	750 °C
Pithoi	fine-textured	Wheel-coiling	Applied Clay Band/ Grooves	> 900°C/ Oxidizing atmosphere
Italo-Mycenaean	fine-textured	mainly Wheel-coiling	Painted	>800 °C Oxidizing atmosphere
Grey ware	fine-textured	mainly Wheel-made	X	>800 °C Reducing atmosphere

Tab. 8.4 Forming sequence of each pottery classes identified at Broglio.

For a more detailed examination of the *chaînes opératoires* of Italo-Mycenaean and grey ware, please refer to the work carried out by Levi, largely discussed in the recent publication about Italo-Mycenaean pottery (Jones et al. 2014). For the production of local *impasto* Levi (1999) remains the main reference.

Pithoi and Aegean-derivative *figulina* pottery share the use of the wheel and very high firing temperatures in controlled atmospheres. However, the analyses carried out on some fragments show that the control of firing over these classes was not uniform. The presence of

¹⁵⁰In EIA – period beyond the chronological limits of the present research, for example, the raw materials of the two classes are completely different, highlighting extremely different production circuits (Levi 1999).

some Grey ware and Italo-Mycenaean fragments with no vitrification allows to ascertain a firing process with temperature between 750°C and 800°C (Jones *et al.* 2014, pp. 377-386).

Starting from the examination carried out by Levi (1999, 2014), Table 8.5 reports in detail all the manufacturing forming techniques found in Broglio di Trebisacce from the Middle Bronze Age to the Final Bronze Age.

As pointed out by Levi (Levi 1999, p. 255; Jones *et al.* 2014, p.), wheel-made or wheel-finished *impasto* is rare but more common in the period when the wheel is more attested and used – RBA and EIA, and present also in FBA.

The presence of some wheel-thrown vases (mainly Grey ware) points to the presence of at least some potters able to produce a completely thrown vase. Given this evidence, we have to consider a situation partially different from the one proposed for the introduction of the wheel and the use of the wheel-fashioning technique in the Early Bronze Age at Lerna IV (Choleva 2012). The wheel-coiled vases are not to be considered as conservative responses given by local artisans to adapt their habits to the new devices, but as a precise technological choice. They used mixed techniques (coils and wheel) to produce exactly those vases that, for example for their dimensions, cannot be produced otherwise (throwing from the hump). It is not to be excluded that, especially in the learning stages in the use of the wheel, the local craftsmen experimented mixed techniques in an adaptive and conservative sense, but the presence in the same contexts of full wheel-thrown vases made the LBA Italian situation and the introduction of the wheel a proper technical adoption.

	Impasto open shape	Impasto closed shape	Grey ware Open/closed shape	Italo-Mycenaean Open shape	Italo-Mycenaean closed shape	Mycenaean Imports	Protogeometric Open shape	Protogeometric Closed shape
MBA	Paddle and anvil / Mould Coils	Coils	X	X	X	X	X	X
RBA	Paddle and anvil / Mould Coils	Coils Wheel-coiling Wheel-thrown	Wheel-thrown	Wheel-thrown	Wheel-thrown Wheel-coiling	Use of the wheel	X	X
FBA	Coils	Coils Wheel-coiling	X	X	X	Use of the wheel	Coils	Wheel-coiling

Tab. 8.5 Forming methods attested at Broglio di Trebisacce from the MBA to the FBA

Considering pithoi, it is necessary to make a distinction between the earlier production of the RBA from the latter of the FBA. In the same way as they differ from a typological point of view, they also display technological differences.

The RBA materials seem made through the progressive assembling of large sections with an average dimension of 20-25 cm width, each made up by different coils.

The joint point between these sections are underlined by the presence of the plain clay band that have, as stated above, a static function. Joints between sections are made with finger impression or with knife incisions (toothed type joints). On the contrary the joints between the single coils which composed the section are of the simple type.

This forming method has a clear reflection in the breaking pattern. Fractures usually run horizontally in correspondence of the seam between coils.

The presence of rilling on the surfaces suggests the use of the wheel in the vase construction. This is also confirmed by the presence of some obliquely oriented elements visible in the X-ray image. The type of rilling identified in some vase is connected to the deformation of the coils under the effects of the RKE. Coils indeed are not parallel to the striations and rilling caused by the rotation on the wheel. On the same wall another type of rilling is also visible, finer than the previous one, and connected to the smoothing and finishing operation on the wheel.

At least one RBA specimen in Broglio was likely made differently. Pithos P 0438 displays in the section a clearly identifiable coil seam just in correspondence with the plain band. However, either in the section and in the X-ray image, coils are not visible. This raises the possibility of a forming method similar to the one identified in Kommos, where pithoi are formed through the progressive assembly of large coils through the wheel.

The FBA vases are, like their predecessors, made by coils but the forming method does not imply anymore the creation of sections, each composed by several coils.

The coils were therefore added progressively one upon the other with use of the wheel. Breaks in the manufacturing process were, in any case, necessary in order to consolidate the clay.

This more continuous forming sequence has reflection in the breaking pattern. The fractures are obliquely oriented or petal-shaped suggesting a more intensive use of the wheel. In the body some horizontal fractures are also identifiable that probably correspond to the break in the manufacture necessary to consolidate the clay. Finger or toothed type joints are here used with certainty only to join the rim.

The use of the wheel is confirmed also by the X-ray images, where both voids and tempers take a preferential oblique direction.

8.6. General Discussion

Jones (2014, p. 363) claimed that technological studies “are no longer solely focused on describing the *chaînes opératoire* strictly in technical terms but are combined with viewing technology in a wider, socially-based context”. Following the same line of thoughts, I would like to conclude this part with some considerations about the social-contexts in which pithoi were produced and used.

Analysing the data emerging from the analysis of the archaeological fragments of Pyla-Kokkinokremos, Kommos and Broglio di Trebisacce, it seems reasonable to assume that the pithoi were produced assembling coils with the use of the wheel in all the contexts analysed so far.

Comparing the archaeological evidence with the experimental and the ethnoarchaeological ones, it is possible to relate the forming method used in Kommos with methods used still today in Thrapsano where pithoi were made by the progressive adding of large coils with the wheel. Regarding the Cypriot pithoi it is suggested that pithoi were made by the progressive addition of each coil with the use of the wheel. The main indicator of the use of the wheel – not only for the finishing operation – is the typical breakage mode. Fractures are always oblique, or petal-shaped, and pithoi never break horizontally in the joint point between one coil and another. In the X-ray images analysed, some obliquely oriented elements support this hypothesis.

Considering the Italian pithoi both dating to the RBA and FBA, they are made with the progressive assemblage of coils with the use of the wheel. However, differences can be noticed. As stated above, RBA pithoi were probably made assembling large sections composed internally of coils. On the contrary, in the FBA pithoi, probably each coil is assembled to the previous one with the use of the wheel.

While Kommian pithoi could be reasonably compared with the Thrapsano method, the other materials analysed lack a precise reference, and the match with experimental specimens is more complicated. For the Cretan pithoi, the most comparable wheel-coiling method (Courty and Roux 1998) is the fourth involving the progressive assemblage of single coils with the wheel.

The RBA Italian material could be tentatively associated to a hybrid between Courty and Roux Methods 2 and 3. The wheel was therefore used probably to join coils and shape the wall. The Cypriot and the Italian FBA pithoi were, on the contrary, made with a method similar to Method 4 but, differently from the Cretan pithoi, the diameter of the coils was smaller.

Despite the Cretan vases seem apparently to be fully exploiting the use of the wheel, these pithoi are more fragile than the Cypriot and the FBA Italian ones. The forming methods of the

latter ones, which imply the use of smaller coils and consequently a longer time on the wheel, made the seam between the coils stronger and thus pithoi more resistant.

Site	Forming Methods	Type of Analyses
Pyla-Kokkinokremos	Wheel-coiling	Visual Autopsy X-Ray (Cypriot pithoi from Cannatello)
Kommos	Wheel-coiling (Thrapsano)	Visual Autopsy
Broglio di Trebisacce	Wheel-coiling	Visual Autopsy X-Ray

Tab. 8.6 Forming methods identified in the archaeological and types of analyses

Summing up the evidence collected in all the contexts analysed, some general consideration can be made – despite differences in the *chaînes opératoire*. The production of pithoi – due to the dimensions of the vases – is technologically very demanding and implies a high level of expertise owned by the potters.

Considering the ethnographic observation in Thrapsano, the potter devoted to pithos production is not involved in the manufacturing of other types of vessels, which at Thrapsano is performed in the same workshop by another potter.

This is in accordance with the noted difficulties in the manufacture of pithoi; not every potter can make them, and the apprenticeship of the technique is somehow different from the one of the other vessels¹⁵¹. The pithos-makers were, probably, able to produce any kind of vessel on the wheel but on the contrary potters devoted to the production of other types of vases were not necessarily able to produce pithoi.

The pithos-maker starts her/his training during the childhood helping the master in the production. According to the evidence collected in Thrapsano she/he probably starts turning the wheel during the forming stage and being responsible of other collateral technical operation.

This separation of the pithos-makers from other potters could also imply a different organizing mode of the production. As first instance, it is possible to consider the pithos production as a specialized one, in terms of the ratio between the restricted number of producers and the larger number of consumers. Some additional considerations support this possibility: pithoi have a long life in comparison with tableware and already London (1989a, p. 78) noted that also in the

¹⁵¹The difficulties in the pithos manufacturing were well noticed also in antiquity; indeed, Plato said: "Is not this, as they say, to learn the potter's craft by undertaking a pithos? and does this not seem foolish to you". PL., Grg.514, e, 6.

recent past pithoi and large jars remained in use for over a century. This means that despite an increase of need of storage vases, few potters could be enough to satisfy the requests in a broad region.

The separation of the pithos producers from the other potters and their probable restricted number can also imply the possibility that they were – at least partially – itinerant (Guglielmino 1999). Ethnographic evidence, such as the one from Thrapsano, confirms that the pithos production was traditionally performed by itinerant potters grouped in guilds. Potters were involved in a tour in the neighbouring districts around Heraklion of the island where they made and sold their jars.

All these considerations applied to the contexts under analysis lead to some conclusive suggestions.

The low number of specimens analysed so far at Kommos and in Crete do not allow an evaluation of the organizing mode(s) of production active in the LMIII Kommos. Further and more detailed analyses are therefore needed in order to complete the study.

Regarding Cyprus, only few provenance studies on pithoi are available in addition to the ones carried out in the present research (Xenophonos *et al.* 2000). The results of all these analyses underline differences in the petrographic composition of the specimens coming from different sites. The data available from the Cypriot pithoi retrieved from abroad confirm differences in the composition that allow the identification of different petrographic district in the island.

This can indicate the existence of a local pithos production in – at least – some of the centres active during the 13th century BC.

As stated by Shuster Keswani (2009) in theory it is possible to postulate at least three different modes of production:

- Centralized: one or few production centres in the island
- Localized: several production centres in the island
- Itinerant potters

Each of these of the organizing mode of production is related to different degrees of uniformity in the raw materials, formal typology and decoration patterns.

Differences in the chemical composition of raw materials and a regional variation in decoration patterns as well as in morphological attributes – but within a general uniformity of shape types over the whole island – can be explained either by the presence of few productive centres or, to a lesser extent, by the existence of itinerant potters.

Until now, no certain evidence of centres devoted to the production of pithoi is known. Traditionally the LCI-II site of Toumba tou Skourou was interpreted by the excavators

(Vermeule and Wolsky 1991) as a pithos production centre. However, despite the huge quantity of pithoi retrieved, areas devoted to the pottery manufacture are not so evident. As pointed out by Shuster Keswani (2009), the data collected in Toumba tou Skourou could also be linked to the presence of one or more storage monumental building(s) – as in other sites of the island – and not to pottery manufacture.

The presence of misfired pithoi in Pyla (Karageorghis and Demas 1984, pls. XXII, XXXIX), Kition (Pilides 2000), pieces of vitrified clay, misfired pithos fragments, and a deformed pithos at Maa-Palaeokastro (Karageorghis and Demas 1988, pls. CLXXXIV) suggest the existence of local production in these sites¹⁵².

These data could confirm the existence of some productive centres active during the LCIIIC late and early LCIIIA. However, in all the just mentioned sites, evidence of pottery production areas is still missing. At present, none of the two hypotheses mentioned before can be excluded, namely the presence of itinerant artisans (involved in regional circulation) and of some productive centres with stable workshops. On the contrary, due to the technological difficulties in the pithos manufacture –that make them a high specialized pottery production – as well as to their long-life span, a very localized production in each site is, at the present, a less likely hypothesis.

Future investigations regarding the raw materials used, the elaboration of a more detailed pithos typology focused on chronological and regional variation and the excavation – hopefully – of productive areas will enrich the present picture.

Finally, it is also necessary to think that more than one productive mode could be active in the same area (Shuster Keswani 2009) and for example that the production mode may be different between the small-medium size specimens and the big ones.

Turning to the LBA Italian contexts, all these data allow us to make some considerations regarding the organization of the production.

As pointed out by Levi (1999, p. 259) pithoi (and the other two Aegean-derivative wares), differently from the *impasto* ware, are specialized productions that fall in the *workshop production* organization, according to the classification proposed by van der Leeuw (1994). The elements that permit to locate their production in the *workshop* and not in the *domestic* type of production are the use of standardized raw materials (clay and tempers), the use of the wheel and kilns that permitted fire and atmosphere control as well as a regional circulation of finished products.

¹⁵²It is assumed that misfired vases or wasters, generally, were not moved far from the area of their production.

During the RBA, therefore, it is possible to ascertain the existence of different circuits of production in southern Italy, connected to the manufacture of different wares.

Among the elements that have permitted to locate pithoi in a *workshop production* organization, there is the wheel. Having ascertained the use of the wheel in production and considering that at earlier chronological stages it was totally absent into the Italian productions, we must therefore think about the modalities of its insertion within the productive sequence.

As already noted, the introduction and the use of the wheel implies a direct type of transmission which includes the practical demonstration of the technique by the ceramists. In this sense we can ascertain that the contacts between Italy and the Aegean involved the mobility of craftsmen – at least in the starting stage of their production (Jones *et al.* 2014, pp. 402-405).

The observation of a wheel-made vase as well as the vision of a potter at work is not enough to learn how to make a pithos and to master the technique. The development of a local pithos production has therefore concerned the learning of the technique by local craftsmen. The best proof that the technique penetrated into the local ceramic tradition is the continued use of the wheel in the pithos manufacturing process during the later FBA (and EIA) periods, when the contact with the Aegean decreased.

The production of pithoi, Italo-Mycenaean, and Grey ware has involved forms of transmission and apprenticeship that imply:

- interaction between potters
- existence of a stable context of apprenticeship
- long training of local potters in workshops where also Aegean-trained potters worked.

At present there is no agreement about the stable presence of Aegean potters in the Italian indigenous contexts. Some scholars (Jung 2017) consider more probable the temporary presence of Italian artisans in the Aegean workshops. In those contexts, they may have learned the techniques that they also applied once back in Italy to locally produce the Aegean-derivative ware.

In any case, it seems reasonable to suggest the existence of specific figures almost fully dedicated to the pithos manufacture and therefore the practice of different learning chances because of the technological difficulties in their realization.

This high specialization of the pithos production (i.e. segregation using the definition proposed by Vidale, 1995) is probably one of the reasons of the continuity in the use of the wheel during the FBA and also in EIA in Italian contexts, in producing pithoi. This scenario therefore implies that pithoi were produced by different potters and probably in different areas/workshops from the other Aegean-derivative wares. Aside these considerations, we are aware that the issue

concerning who and where pithoi were produced is not easy to resolve, especially in first stage of their production during the RBA.

Also in the case of Italy, it is not possible to exclude the existence of itinerant pithos-makers. As already pointed out by Guglielmino (1999), several data could suggest the presence of itinerant highly specialized pithos makers; this hypothesis would permit to easily explain the great typological uniformity in the FBA materials (Type 7 in the present typology). However, the presence of pithoi with a different decorative pattern (i.e. herringbone pattern) and produced with a different technology (i.e. clay recipes closer to the *impasto* tradition) as well as different forming methods in base's shaping (cf. Broglio with Roca Vecchia, Guglielmino 1999) points to the existence of different potting traditions active more or less simultaneously. In this cases, itinerant potters – if active – would have been involved only in regional circulation.

A final question concerns the time and the modalities of the possible circulation of the Aegean artisans. Did the movement happen only at the beginning of the production – during the RBA? Or shall we, on the contrary, postulate a continue interaction and mobility of artisans? Or do we need just to think at a second arrival during the post-palatial period, when there was a re-collocation of some Aegean artisans looking for new possibilities?

Considering also the Italo-Mycenaean pottery, recently it has been underlined that the high quality of the Italo-Mycenaean ware at Roca Vecchia is consistent with the presence of Aegean potters in the settlement (Jones *et al.* 2014 p. 455). The presence of Aegean artisans did, of course, not regard all the Italian communities. Aside the high rate of quality attested in Roca Vecchia, other contexts show a different situation both in terms of quantity and quality of pottery. The most impressive example is the case of Antigori in Sardinia where the local production of Aegean-inspired ware (especially imitating Cretan shapes and motifs) shows “lack of familiarity with either the wheel or the painting technique” and “suggests an occasional and much looser connection between local and Aegean potters” (Jones *et al.* 2014 p. 455). The local production of Italo-Mycenaean pottery displays, indeed, a very local characterisation, where beside Aegean stylistical influences, also the ones of the local community who received the products are clearly visible. Thanks to the more recent typological studies conducted in the Italian Peninsula, it was possible to identify a regional differentiation that led the scholars to speak in terms, for example of a ‘Broglio style’, or ‘Termitito style’ (Jones *et al.* 2014, p. 456). It is difficult to ascertain if this mix between Aegean and local elements is the product of Aegean potters (as likely in Roca Vecchia) or of native potters formed in the Aegean tradition. Of course, there also remains the possibility that these two hypotheses were both true, as part of the well-established bidirectional network of traders and craftsmen between the western Mediterranean and the Aegean.

As stated by Borgna and Levi (2015, p. 131), however, this variegated scenario implies several levels and modes of interaction between southern Italy and the Aegean and likely the technological transfer “was subject neither to dynamics of a planned monolithic acculturation strategy nor to a structured exchange of skilled artisans working according to a systematic administered pattern”.

During FBA indeed, the production of Italo-Mycenaean and Grey ware respectively stopped (Italo-Mycenaean) and decreased and almost stopped, (or finally did stop: Grey ware) while only pithoi certainly continued to be produced and used. Moreover, their production was not characterised by a contraction but, on the contrary, increased both in quantitative and qualitative terms. The wheel, therefore, continued to be used only in the manufacture of vases related to the economic management of resources and no more in the production of tableware.

During the FBA there was a change in the elite social representation. In the RBA the elites showed their status through the use of Aegean-inspired tableware. The collapse of the Mycenaean palaces and the contraction in the contacts implied a change in the elites' behaviours and in the representation of their power. It was not necessary anymore to display one's own social status through the use of Aegean-style tableware that were not produced anymore in large scale¹⁵³.

The disappearance of these pottery classes and the disuse of the wheel for tableware could be explained with the existence of a small number of wheel-using artisans – attached to the indigenous elites – that ceased their activities with the collapse of the interconnection with the Aegean and the changing needs of the elites (Roux and de Miroschedji 2009).

Summing up the technological continuity in the use of the wheel in the pithos manufacturing can be explained as:

- Presence of specialized native potters separated from the ones who were in charge of the production of the other Aegean-derivative wares. This different organisation modes of production permitted the maintenance of the wheel technology for pithoi, also in the Italian FBA. With regard to this hypothesis, the visible changes in the shape, decorative motifs and technology have to be explained, to a large extent, in terms of local development of the production.
- Second arrival – after the collapse of the Palaces – of potters able to use the wheel from other Mediterranean regions (mainly Cyprus) that took over the production of

¹⁵³Grey ware ware during the FBA is attested for example in some site of the Plain of Sybaris (Belardelli 1994; Belardelli, Capoferri 2004), Roca Vecchia (Guglielmino 2005a, pls. CLXV: d,1-3) and Otranto (Orlando 1996, fig. 19,15).

pithoi. The involvement of Cyprus in these last stages of the LBA and the affiliation of the Italian FBA pithoi to Cypriot models was already postulated (Chapter 4). The changes visible in the FBA pithoi both in terms of shape and technology can be linked thus with the rooting of a newly imported ceramic tradition.

At present it is not possible ascertain which of the hypotheses is more probable, but as already suggested in § 4.6.2.1, further typological and technological analyses embracing also other Mediterranean regions are needed.

However, it is also important to underline that – independently from the presence of specialized native potters or of foreign ones – what seems to be, during the FBA, a technological decline in the pottery production (with the decrease of the levigated-clay productions), could be on the contrary considered as a specific convergence on specific classes connected to the new need of the communities.

9. CONCLUSIONS

Storage is a necessity shared by all societies and concerns the control upon goods that people produce for a delayed use in terms of their direct consumption, redistribution or transformation into other products (Rothman and Fiandra 2016, p. 39). Storage systems are not just a practical economic means but represent a complex twine of social, political and ideological factors (Rothman 2016, pp. 19-34).

In the present research, storage had been investigated through the analyses of a particular type of storage containers, pithoi. Pithoi are big storage (and transport) vases, generally higher than 50 cm and made with physical and technological features that made them resistant to mechanical shocks.

Pithoi – as other storage vessels – play an important economic role in the sequences of food production, manipulation, storage and consumption. Despite this important economic value, pithoi and coarse ware were traditionally considered with less attention than fine wares because of their low value in the building of chronological sequences.

The material under analysis come from three sites: *Pyla-Kokkinokremos*, Kommos e Broglio di Trebisacce located respectively in Cyprus, Crete and Italy. The analysis has focused both on pithoi functional and economic aspects, and on technological and typological features specific of each of the site under examination.

The choice of adopting a Mediterranean perspective derives from the need of deeply understanding the supposed Aegean derivation of the Italian LBA (RBA and FBA) levigated-clay pithoi.

First of all, we started from the hypothesis proposed by Lucia Vagnetti (1999), later taken up also by other scholars (Levi 1999; Bettelli 2002; Schiappelli 2003), about the Aegean derivation of Italian materials. Some morphological and decorative features found in the RBA Italian pithoi indeed, according to the authors, refer to the Cretan materials of the LMIIIB. During the subsequent FBA productions, on the contrary, Italian materials appear to be more closely related to Cypriot prototypes dating to the LCIIIA.

In order to better identify connection elements, a Mediterranean typology has been developed that incorporates the materials coming from each of the three regions at issue (Chapter 4). The typology allowed an easier comparison of the single regional productions. A large number of unpublished pithoi found during the 2014-2016 excavation campaigns at *Pyla-Kokkinokremos* have been added to the published materials. They represent the main material *corpus* of the present research.

The typological classification clearly shows how all the types and varieties identified (67 in total) preferentially group vessels from a single Mediterranean region. Only in two cases varieties mixed Cretan and Cypriot vases.

This formal framework has substantially allowed to confirm a greater adhesion of the Italian pithoi to the RBA to LMIIIB-C Cretan models. The strongest element in this regard is the presence of plain bands arranged on several registers on the vessel's body. As highlighted in Chapter 8, however, the plain bands are not a simple decorative expedient but also perform a static function inside the vase because of their location at the joint points between the different segments of which the vase is composed.

Other elements that can be related to Cretan models are the generic (supposed) barrel shape and the presence of a squat rim with rectangular profile visible in some Italian pithoi.

With the beginning of the FBA, there was a sharp change in the shape and the decorative syntax of Italian pithoi. Also in this case the best parallels can be traced in terms of decoration. It has been confirmed a certain degree of similarity between the grooved decoration of Cypriot pithoi and FBA Italian ones, but they remain quite different in terms of shape.

LMIII Cretan pithoi are ovoid in shape and usually without neck or with a very short neck and thus wide-mouthed. They are provided with handles (vertical or horizontal) both on the shoulder and often also close to the base. The presence of handles in the lower part of the vessels is one of most characteristic features of the LMIII Cretan pithoi. They are usually also characterized by a complex decorative pattern with applied horizontal and serpentine bands recurring on the whole body's vessel. Bands can be plain or decorated with incised/impressed motifs.

The Cypriot pithoi are, on the contrary, piriform-shaped and characterized by the presence of a distinct neck sometimes very long. When handles are present, they are only vertical and put on the shoulder or from the rim to the shoulder. The decoration is located on the upper part of the body and is realized – in the smaller specimens – by engraving while in the bigger ones consists in general of a grooved decoration.

The known Italian RBA specimens are probably barrel-shaped and decorated with wide plain bands. Sometimes these bands could show an incised pattern such as zig-zag or chevrons. Other types of decorations are also identified: circles, crisscross and herringbone decoration. Schiappelli isolated the latter as a quite common feature also after the end of RBA.

During the FBA, pithoi became larger than in the previous phase and they were globular. The decoration consisted of horizontal grooves or band with two, three or four ribs. Other specimens show ropes with impressed decoration. Italian pithoi with the exception of the RBA

pithos from Monte Belvedere (both RBA and FBA) belong all to the second typological family, *with pithoi with articulated and restricted profile, without neck and wide mouthed*.

The typological classification also permitted to deepen the understanding of some functional-related features of the vases (Chapter 5).

Some morpho-functional (and in part also technological) elements were isolated in order to deeply investigate the pithoi functions. This allowed studying more in detail the intended storage function distinguishing static storage from transport and maritime storage. Moreover, some elements were also used to differentiate storage in terms of short, middle and long-term conservation.

The most interesting result is that morpho-functional features have also a particular geographic diffusion and Cypriot pithoi seem more suitable for maritime transports than the Cretan or Mycenaean ones. This is also confirmed by their presence on the cargo of Uluburun – where they were actually used as containers –, Cape Gelidonya and Point Iria as well as their circulation in the Mediterranean in greater quantity with respect the Creto-Aegeans ones. In some Mediterranean contexts such as, for example, Marsa Marthu and Ugarit, Minoan pithoi are completely absent despite the presence in the context of important quantities of Minoan pottery. The preferential use of Cypriot pithoi on the ships and their broader circulation appears therefore a matter of fact and probably related to their intrinsic value.

The functional analysis of pithoi was also coupled with the study of organic residues. Five fragments from Pyla and five from Broglio were thus analysed.

In the case of Pyla the results underline the presence of a mixture of both plant and/or animal origin. At present it is not possible to ascertain if lipids and resins identified were used as a sealant or added to the material present inside the pithoi as a preservative.

As far as Broglio is concerned the residue analyses provided hints about the presence of cereals inside them. The results are of extreme importance: cereals are, indeed, very difficult to identify in archaeological contexts. In addition to cereals, one pithos presented residue of terpene resins used as a sealant or added to the substance stored (e.g. wine).

In both the cases further analyses are needed in order to examine the broad range of substances stored and also to verify the possible relationship between pithos typology and contents.

The functional investigation was followed by a frequency distribution analysis of the vases within each site considered – Pyla-Kokkinokremos, Kommos and Broglio di Trebisacce (Chapter 6).

Pithoi were distributed according to the typological classification presented in Chapter 4. The aim of spatial analyses was to identify the type of storage and the staple management

modalities. The simple quantitative analysis was also combined with the evaluation of the density of pithoi (or storage vases in the case of Kommos) in each excavated space.

The analysis of the density allows to investigate the storage going beyond the simple counting of the vessels and relating this to the storing space, thus allowing the comparison between different structures and providing other clues about the scale of storage.

In Pyla, it globally emerges a picture with a rich pithoi presence in each of the excavated sectors. The evidence collected seems related – in most of the contexts examined – to a supra-domestic storage, despite is still elusive the type of control and the related authority.

Further excavations could allow a more precise evaluation of the scale of the storage at Pyla, as well as of the type of control upon goods and finally a better comprehension of the reasons behind the huge quantity of pithoi found in the plateau.

Differently from Pyla, for Kommos the analysis points to an almost exclusively domestic storage. All the storage vases found in Kommos were indeed of small-medium size and no space contained a high quantity of storage vases. Considering density at Kommos, most of rooms are characterized by a very a low density, which represents a further confirmation of a domestic small-scale storage performed in different spaces without the presence of storage clearly allocated to storage.

For what concerns Broglio, the research already highlighted that Storehouse 1 could be interpreted as a supra-domestic storehouse. The elements which support this hypothesis are the number of pithoi found there and their dimensions. The great diffusion of pithoi in the plateau suggests the possibility of the existence – during the FBA – of other storage spaces in addition to Storehouses 1 and 2.

The table below briefly summarize the storage evidence collected and the hypotheses about the type of control.

Site	Storage	Global storage capacity	Storage System
Pyla-Kokkinokremos	Supra-domestic	High	Centralized?
Kommos	Domestic	Middle-low	Non-centralized
Broglio	Supra-domestic	Middle-low	Centralized?

To analyse the manufacturing process (Chapter 7 and 8), the technological investigations of the archaeological material were coupled with experimental replicas of the wheel-coiling methods described in the literature. Observations in the Cretan workshop di Thrapsano specialized in pithoi and jars manufacture were also performed.

The study of the pithos fragments was carried out through visual inspection and X-ray analyses. The comparative study permitted to ascertain that the pithoi were produced with the use of the wheel in every context analyzed. However, the *chaînes opératoire* is different from

one site to another. These different forming methods led to the realization of vases characterized by different technological properties.

Regarding the Cypriot pithoi it is suggested that pithoi were made through the progressive addition of each coil with the use of the wheel. The main indicator of the use of the wheel – not only for the finishing operation – is the typical breakage mode. Fractures are always oblique, or petal-shaped, and pithoi never break horizontally in the joint point between one coil and another. In the X-ray images analysed, some obliquely oriented elements support this hypothesis.

Kommian pithoi could be reasonably compared with the Thrapsano method, where pithoi were made by progressively adding large coils with the wheel. Pithoi generally break horizontally in the joint point between coils. The breakage mode is thus different with respect to Cypriot pithoi for the reasons explained in Chapter 8 but in both cases the use of the wheel appears clear.

Considering the Italian pithoi, dating both to the RBA and FBA, the research ascertains that they were made with the progressive assemblage of coils with the use of the wheel. RBA pithoi were probably made assembling large sections composed internally of coils. On the contrary, in the FBA pithoi, probably each coil is assembled to the previous one with the use of the wheel. The breakage mode reflects these differences in forming methods, as in the RBA specimens the main fractures run horizontally and are located in the joint point between the sections. On the contrary FBA pithoi breaks tends to be oblique or petal-shaped as the Cypriot ones.

Despite the differences underlined in the *chaînes opératoire*, pithoi, due to their dimension, are technologically very demanding and their production requires highly skilled artisans. For these reasons, pithoi production fall into the specialized pottery manufacture in all the contexts analysed.

Pithos-makers were probably distinct from the other potters active in pottery production. This separation of the pithos-makers from the others could also imply a different organization mode of the production. In theory it is possible to postulate at least three different modes of production: *centralized*, *localized* and *itinerant potters*. Each of these organizing modes of production is related to different degrees of uniformity in the raw materials used, formal typology and decoration patterns.

The analyses of the archaeological material permit to assume the possibility of the existence of more than one production site (with stable workshop) both in Cyprus and southern Italy. The presence of itinerant artisans involved in regional circulation cannot be discarded while, on the contrary, a very localized production – with pithos production active in each site seems – at

present, a less likely hypothesis according to the well-known technological difficulties in their production.

The low number of specimens analysed for Kommos doesn't allow to suggest precise inferences.

Considering in particular the Italian contexts, the beginning of the production of *figulina* pithoi marks some important technological innovations, from the selection of raw material to the firing process passing through the forming methods with the introduction of the wheel in the *chaînes opératoire*.

The introduction and the use of the wheel implies a direct type of the technique transmission which includes its practical demonstration by the ceramists. In this sense we can ascertain that the contacts between Italy and the Aegean involved the mobility of craftsmen – at least in the starting stages of their production. At present there is no agreement about the mode and type of interaction. However, the variegated archaeological scenario of the LBA southern Italy implies several levels and modes of interaction and likely the technological transfer did not happen through a unique and systematic administered pattern of circulation.

A final remark concerns the Mediterranean scale of interaction and its socio-economic implication. The contexts analysed, indeed, differs deeply in terms of socio-political organizations and potting traditions. Differences were underlined also in terms of pithoi manufacturing sequence as well as in the type and scale of storage systems.

It has already been mentioned that there is no agreement about the modalities of interaction between Italian communities and the Aegeans, not only concerning the issue of the technological transfer but more in general regarding the exchange modalities themselves.

However, the exchange took place and favoured – providing new tools – phenomenas, such as the beginning of the production of wheel-made *figulina* wares and different storage systems (Vanzetti 2011). How was the development of these phenomena possible? Regarding technological production how was it possible to develop highly specialized production like those of the pithoi and other the other *figulina* wares in contexts where the ceramic production rarely derived from the *domestic workshop* (Levi 1999)?

At this point it is possible to assume that the development of these specialized manufacturing practices was possible only on the basis of a structural compatibility between the indigenous communities of southern Italy and the Aegean. Indeed, despite the differences underlined in the *chaînes opératoire*, it is not possible to consider pithoi production in Italy as less specialized than in the Aegean contexts. Differences in the socio-economic organization did not bias the possibility of the exchange of artisans and know-how. The socio-economic organization of the

gentilital-patronage communities of southern Italy was therefore compatible with the development of specialized pottery production, with the Aegean partners providing tools and inputs in this direction.

The evaluation of changes which affected the storage systems is more complicated. Despite the sharp change in resource management which happened during the LBA and especially in the FBA, with pithoi production and the establishment of (likely) centralised storehouses, it seems not possible to identify in the Italian contexts the same level of organisation found in Aegean ones – both in terms of scale and type.

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