Cultural biographies of Cretan storage jars (pithoi)

From antiquity to postmodernity

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CHAPTER 2. PRODUCTION AND DISTRIBUTION OF CRETAN EIA AND ARCHAIC PITHOI

'The jar is a human record; it is all there in the completed form: the clay, the kiln, the guild, the life of the craftsmen and that of the farmer, the life of an endless line of human beings.'

(Voyatzoglou, 1974)

The cultural biographies of Cretan pithoi begin with this Chapter dedicated to their production and distribution during antiquity. Ranging from the selection and the procurement of raw materials, to their formation and circulation of the end-product, this Chapter aims at elucidating hitherto understudied aspects of the production sequence of pithoi across Crete and beyond.

Until today, the production and distribution of Cretan pithoi have been the subjects of two different but complementary discourses. The first approach regards ethnographical and ethnoarchaeological explorations on the island. The second approach, which has been applied to a considerably lesser extent, concerns analytical studies applied to Cretan coarse pottery in the last two decades. The first part of this Chapter is a review of the ethnographic data concerning the Greek pithos with particular emphasis placed on the production and dissemination of Cretan storage jars. This evidence is used to formulate the main questions of the second part of this Chapter, which uses petrographic analysis to examine the production and circulation of select central Cretan pithoi of the EIA-Archaic period. The ultimate goal of this study is to bring these two approaches together and to promote the development of similar projects of ceramic studies in the future.

2.1. Ethnoarchaeology of Cretan pithos production

Since the late 19th c. AD, the disciplines of ethnoarchaeology, ethnography and ethnology have concerned themselves with an extensive variety of matters across the world[28]. Because ethnoarchaeology in particular constitutes a dialogue between ancient and modern cultures, it can serve as a valuable method by analogy for exploring the ways in which material culture forms part of the archaeological record, thus helping archaeologists to formulate questions and to apply advanced methodologies for the interpretation of the archaeological evidence. A less obvious and somewhat understudied aspect of the discipline is the fact that it can provide clues as to what we may be missing from an archaeological site (such as objects that are easily destroyed and materials that do not survive in excavation trenches). Perhaps most importantly, however, it offers tangible evidence for the complex relationship between humans and their material culture in ways which are not always easily identifiable and straightforward in an archaeological assemblage. The most prolific ethnoarchaeological studies are those on ceramic production, characterized indeed by an ever-increasing diversity of theoretical trends[29]. This diversity is particularly prominent in the literature of ceramic ethnoarchaeology from the 1990s onwards, which is symptomatic of the general scholarly orientation towards building more solid theoretical frameworks for the examination of a broad array of issues, ranging from technological considerations to historical and even philosophical concerns (see, for example, Gosselain 2000; Livingstone-Smith 2000; Sillar 2000, esp. 44, 57). Consistent with such diverse theoretical discussions, the foci of ceramic ethnoarchaeologists have been and continue to be notably wide. Research subjects include matters of ceramic technology (raw material procurement), behavioural factors potentially pertaining to the selection of raw materials, pottery workshops and the spatial patterning of pottery production sites, firing technologies (kilns, firing regimes), the organization of pottery production (specialization, labour division), issues of knowledge and technology transmission (apprenticeship), and the social status of potters and those involved in the production sequence.

Ceramic ethnoarchaeology has been widely applied in the Mediterranean. However, in the case of Greece and Crete, the oeuvre presents some idiosyncrasies.

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[28] *Ethnography, ethnology* and *ethnoarchaeology* are different but closely related branches of anthropology and archaeology. To avoid confusion I hereby provide a short definition of the three: *ethnography* involves social studies related to all aspects of traditional but contemporary cultures; *ethnology* uses ethnographic evidence to compare different cultures; *ethnoarchaeology* refers to ethnographic study carried out by archaeologists who aim at the interpretation of the past based on analogies drawn from living communities (cf. London 1989, 21; Skinner 2012, 6).

[29] For detailed bibliography and reviews on ceramic ethnoarchaeology, see Rice and Saffer 1982; Kramer 1985; Longacre 1991; Costin 2000; Hegmon 2000; Stark 2003.

This is because a considerable number of ethnoarchaeological studies share common ground with the discipline of the Greek *laographia* (the study of folklore) that records aspects of traditional life ways and popular crafts (Kyriakidou-Nestoros 1978). As a result, especially in the earliest years of the discipline in Greece, there have been many implicit or explicit references to direct continuities from the distant past, often used as the means to assert the idea of a coherent Greek Nation (*Ethnos)* (Herzfeld 1982; 1987; 2003). Inevitably, this tendency has many times lead to unsubstantiated hypotheses or anachronistic suppositions. Inquiries and motivations of this nature are particularly evident on the island of Crete, partly mirrored in the institutionalized forms they have acquired especially over recent decades[30].

The ramifications of ethnoarchaeology and *laographia* are traceable in the early works of late 19th – early 20th c. Greek and international scholars who focused on tracing strong, unbroken cultural links between past and modern Cretans through the craft of pottery making[31]. The fact that Cretan pithoi have a long, uninterrupted history of production from at least the Late Neolithic period (Cullen-Keller 1990, 187; Giannopoulou 2011, 35; fn. 127) was a very fortunate condition for ethnographers and thus attracted exploratory missions from the early 20th c. Consequently, Cretan pithoi became the leading ceramic shape in local ceramic ethnoarchaeology. By the time the first studies were published, the Cretan pithos already featured prominently as a material link between modern Cretans and the Minoans (see below). This link continues to be a salient quality attributed to these vessels for there is an undeniable superficial correspondence between ancient pithoi and their modern counterparts, known as *pitharia (πιθάρια*, more rarely also spelled *πυθάρια)*. Indeed, some of the main characteristics of storage jars have remained unchanged down the millennia: their large size and bulkiness; their relatively limited typological variation over time and their long lasting life-use by successive generations. All of the above render these vessels particularly familiar to islanders. And it is precisely this correspondence and the continuous limbo between the past and present which has captured the attention of scholars and the wider public alike, leading to a number of hypotheses on direct

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[30] Examples of this institutionalization include the Museum of Cretan Ethnology in Voroi at Mesara, the Cretan open-air Museum/traditional Cretan village 'Lychnostatis' in Heraklion, and the formation of the Historical-Folklore Society of Crete.

[31] For an overview of ethnoarchaeological approaches on early modern wares outside Crete, namely in the Aegean and Cyprus, see Vroom 2003, esp. 75-77.

continuities in pithos production, distribution and consumption. The same correspondence can also lead to considerable confusion regarding their identification and dating.

As mentioned, suggestions regarding the uninterrupted craft of jar-making are to be found in works by early ethnographers. Amongst the first scholars to deal with the Cretan pithos was Louis Franchet (1917) who incorporated ethnographic data from Cretan potters into his research on the Minoan potter's wheel. A decade later, Stephanos Xanthoudides (1927) built upon Franchet's work in his study of Minoan wheel discs adding some ethnographic parallels from the pithos makers of Thrapsano in Central Crete[32]. The idea that diachronic practices governed the making of Cretan pithoi was fairly well established in Xanthoudides' time: *'The modern potters in the island work in very much the same way as their remoter ancestors. They use similar tools and implements, and when it comes to the ordinary vessels of everyday use, such as pithoi for example, they turn out something that is not greatly dissimilar to the ancestral article'* (ibid. 120). Evidently, this idea was not restricted to Greek scholarship. During his expedition to Crete in the early years of the 20th c., the Italian scholar Federico Halbherr compared the ancient pithoi of the *necropolis* in Kourtes to the modern *stamnoi*, writing that '*[a]mong these vases of large proportions we have also some ossuaries similar in form to those of Cnossus and Stavrakia, but without ornaments, and several stamnoi not very different from those used to this day by the Cretan peasants'* (Halbherr 1901a, 293). More than half a century later, Hampe published a 7th c. BC potter's wheel from Aphrati which he associated with the portable equipment used by early modern itinerant pithos makers from Thrapsano. *'In any case'*, he concluded, *'the Minoan tradition of pithos making has been undoubtedly preserved until today. From a time-distance, we can observe the development of this ancient craft from the Minoan through to the Archaic period and until today'* (Hampe 1967-1968, 183; translated by the author).

The strong affinities between ancient and modern Cretan pithoi continued to be explored until recently. As I discuss in detail in Part II of this thesis, the pithos was often adduced as evidence of the Cretans' steadfast cultural identity, one which persisted in the face of 'intrusions' from outside, such as the Ottoman Empire. For example, Vasilis Kyriazopoulos, a collector and researcher of modern pottery and the

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[32] On Minoan potter's wheels and parallels from Thrapsano, see also Evely 1988, 116-118.

founder of the Laographical Museum of Mykonos, admired the continuity of pithos making in Crete as a proud mark of Cretan identity, free of Ottoman influences: '*[w]ith the malleable clay offered in abundance by the island of Theotokopoulos and Chortatzis, the Cretans created masterpieces from as early as the Minoan era. Cretans kept this ceramic tradition through the ages that followed and during the Turkish occupation, as attested by the vessels of this period which adorn the very rich collection in the Historical Museum of Heraklion...'* (Kyriazopoulos 1984, 40; translated by the author). He further attributed mythological connections to modern and ancient pithoi, describing them as vessels which host the spirit of King Minos and Ariadne: *'[w]hen, after many years, we first encountered the creations of modern Cretan pithos makers at Thrapsano and Margarites, which are similar or almost similar to Minoan ones, we assumed that the masters of this clay or their forefathers had copied what they saw at nearby archaeological sites. However, later on, when we discovered that similar large vessels were being manufactured during the Ottoman period and long before the first excavations that brought to light Minoan prototypes, with the aid of accidental findings we concluded that the forms of today's pithos on the island must have been preserved down to the present day, generation by generation, from the years of Minos and Ariadne'* (ibid. 40; translated by the author).

This idiosyncratic framework of the close ties Cretan archaeology enjoys with *ethnographia* and *laographia* is one of the reasons why pithoi, unlike any other ceramic vessel, maintain a prominent position in Cretan's collective memory and in Greek ceramic ethnoarchaeology studies. Yet, this particular framework also serves as a timely warning to researchers. The core of potential pitfalls was perceptively summarized and, in fact, strongly criticized, by Peter Day in the early 2000s, who addressed his colleagues by pointing out that studies which emphasise continuity have often used ethnographic evidence as archaeological interpretation: '*Working within a framework that emphasized continuity and change as natural concomitants of time, ethnographic evidence in Crete has often been used in archaeological interpretation, or as is the case in the volume, has appeared in archaeological books or periodicals with an implicit or explicit message* [i.e. for direct continuities] *for those dealing with pottery from the past'* (Day 2004, 109). With this warning reminder, modern theoretical viewpoints in ceramic ethnoarchaeology have begun to shift towards more systematic and cautious approaches to available evidence, a most exemplary such case being the work carried out on the potters of east Crete by Day himself (Day 2004).

Notwithstanding conceptual and methodological pitfalls, the traditional but rigorously systematic ethnoarchaeological studies of the Cretan pithos remain highly informative and, when critically assessed, they continue to provide important insights into the production and distribution of ancient and modern Cretan jars. The most noteworthy information to be drawn from these studies concerns the centres and modes of pithos production and distribution, including raw material procurement, clays, tempering, firing, the organization of labour and so on. I now review this evidence accordingly, before proposing an original analytical method designed to examine their validity on selected ancient pieces.

2.1.1. Cretan centres of pithos production

Thanks to the rigorous ethnographic work by Betty Psaropoulou (1996, 104), we know that from the end of the 19th c. AD until at least 1995, no less than 500 permanent and seasonal kilns and workshops had been established across Crete. Of these workshops, four main centres of pottery production have been the focus of ethnoarchaeologists: Kentri in eastern Crete (Hampe and Winter 1962, 11-12; Blitzer 1984), Thrapsano in central Crete (Hampe and Winter 1962, 4-10; Voyatzoglou 1972; 1973; 1974; 1984; Voyatzoglou-Sakellaropoulou 2009), Margarites in west-central Crete (Hampe and Winter 1962, 33-35; Gouin and Vogt 2002), and Nochia in the west (Hampe and Winter 1962, 43-45; Vallianos and Padouva 1986, 22-23) (map 2). The two villages specializing in the production of pithoi are Thrapsano and Margarites. The differences between the pithoi produced in these two sites are limited and mostly concern the final shape of the vessel and the preparation of clays (Voyatzoglou-Sakerallopoulou 2009, 207). However, Thrapsano has received greater attention from ethnoarchaeologists mostly due to two reasons: first, the village has a very long, almost uninterrupted, tradition in ceramic art but especially in the making of pithoi. In fact, the earliest reference on the potters of Thrapsano dates back to the 16th c. AD., in the religious book of the Cretan monk Agapios Landos who described the village as a potters hub, noting that 'most of them are potters' ('*και το περισσότερον είναι τζουκαλάδες*') (Landos 1798, 2nd ed., 399). Second, the potters of Thrapsano adopted the very characteristic working system of itinerant pithos makers, called *vendema (βεντέμα),* and they developed a market which was organized according to their seasonal basis. Although the same system has been recorded in other parts of Crete and Cyprus such as Karoti and Margarites (Hampe and Winter 1962, 40-42; Leondidis 1995, 9) and Phini respectively (Hampe and Winter 1962, 62-73; London 1989, 69-70), it was not as intensive and strictly organized as it was in Thrapsano.

The most eminent ethnoarchaeological study on pithoi and the pithos makers of Crete, including Thrapsano, remains that of the Germans Roland Hampe and Adam Winter. An archaeologist from the University of Heidelberg and a professional potter from Mainz respectively, they published their thorough work on pots and potters of Cyprus, Messenia and Crete in 1962 (Hampe and Winter 1962). This was followed by a second volume in 1965, concerned with potters of Southern Italy, Sicily and other parts of Greece (Hampe and Winter 1965). In the meantime, Hampe focused exclusively on the pithos makers of Crete (Hampe 1963a) and also published the 7th c. BC portable (?) wheel disc from Aphrati (Hampe 1967-1968)[33]. In more recent bibliography, aspects of pithos production and the organization of the itinerant potters from Thrapsano have been investigated extensively by Voyatzoglou (1972; 1974; 1984; Voyatzoglou-Sakellaropoulou 2009).

These prolific studies have enriched our knowledge on pithos kilns and workshops, but it remains difficult to assess the determining factors for their location, be it kilns or pottery workshops in general and pithos kilns in particular. However, it appears that a number of reasons allowed and favoured the existence of pottery production centres across the island. These reasons seem to be connected to a) their geographical position in relation to the production of agricultural products that were stored in large vessels, b) the existence of neighbouring urban centres which ensured a market large enough to consume the pithoi produced and c) the existence of clay sources, raw materials and fuel. It may be particularly the first reason, geography and agricultural production, which can in fact justify the growth of Thrapsano as a major pottery centre specializing in the production of storage jars: the site lies in the centre of the municipality of Heraklion and just five kilometres from the urban centre of Arkalochori, in the heart of a very fertile area with a history of mass production in oil, wine and raisins. Similarly, Margarites, situated in the district of Rethymnon, is quite

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[33] Hampe's photographic archive has recently become available online: https://heidicon.ub.uni-heidelberg.de/search?p=172

rich in agricultural products but it is not as near to the homonymous urban centre (Psaropoulou 1996, 104).

Ethnographic information on the establishment of workshops also comes from outside Crete, specifically from the district of Koroni in the Peloponnese. There, at least four main villages with pithos workshops were in operation during the 19th and 20th c. (Vounaria, Petriades, Kombi and Charokopio), and Blitzer (1990, 677) noted that their coexistence and aggregation within the wider area was partly connected to the rich Pliocene clay beds on which these villages were built, and partly to the rich local production of olive oil[34]. Concerning the locale of workspaces in the wider area of each centre, ethnoarchaeological evidence from Kentri in east Crete suggests that these were traditionally situated in the outskirts of the village to protect residents from the smoke and debris pollution produced from the firing of the kilns (Blitzer 1984, 147). That said, Day suggested that in the case of Crete, the availability of clay was not the most determining factor for the setting of a temporary kiln: the geology of the island is repetitive and therefore those raw materials were easily accessible; instead, water and fuel for the firing seem to play a role in kiln location. In general, though ecological factors can facilitate the establishment or movement of potters, they appear to have played a secondary role (Day 2004, 129).

The archaeological evidence suggests that Greek pottery workshops of the Archaic and Classical periods were most frequently linked to urban nuclei, but they were set in their outskirts and next to cemeteries so as to delimitate the impact of the pollution emitted from the kilns. This pattern further supports the argument that raw materials and natural resources played a rather secondary role compared to social and economic factors (Villard 1992; Morgan and Coulton 1997, 99-103; Stissi 2012, 212-215)[35]. Concerning EIA and Archaic Crete, evidence for pottery production sites and kilns is extremely scarce. Exceptions include three locations identified as production sites: two small 8th c. kilns at Aghia Photini on the north-eastern slope of the Phaistos hills (Levi 1961-1962, 476-477; Tomasello 1996), some 7th c. pottery kilns found at Lato (Durcey and Picard 1969), and the pottery factory of Mandra di Gipari located outside the ancient settlement of Prinias which, according to the pottery found, dates to the second half of 7th – early 6th c. BC (Rizza et al. 1992). Of these three sites,

[34] On the establishment of workshops in Messene, see also Matson 1972, 212-213,215.
[35] On Minoan pottery workshops and factors determining their locale, see MacGillivray 1987, 266.

Mandra di Gipari stands out as the only fully excavated and published site which seemed to specialize in the production of pithoi, as well as turning out other smaller vessels such as cups and kitchenware. From this evidence, it appears that pottery production sites were located close to urban centres or cult sites, but in cases of intensive pottery industries they may have been built outside the settlements so as to allow space for the intensive specialized production (Sjögren 2003, 76-77). What we know so far, especially from the production site of Mandra di Gipari, seems to verify the ethnoarchaeological evidence: the workshop was built outside but very near the habitation site and the necropolis of Prinias, on rich clay beds and adjacent to water resources (Palermo 1992a, 42) and within the limits of the most fertile area of the island, the Mesara plain.

To conclude, in early modern Crete, the criteria for the setting of pithos workshops do not seem to have been very different than those applied for the setting of other pottery workshops specializing in smaller vessels. However, since the making of pithoi constituted a very specialized craft targeted at satisfying the consumers' needs for storage, I argue that it is particularly the nearby existence of agricultural and pastoral production which played the most prominent role in the establishment of pithos kilns or workshops. This is further supported by the ethnoarchaeological and ethnolinguistic evidence: the name *vendema* (from the Italian *vendemmia* meaning the harvest or the crop, usually of grapes) which was employed by the potters of Thrapsano to describe the practice of itinerant pithos makers, is also used to describe areas with rich olive oil production[36]. The pithos makers of Thrapsano would have been informed about the villages with rich seasonal olive oil production and they would set off to build their seasonal workshops accordingly. With these factors in mind, it is perhaps not surprising that the ancient site of Aphrati constituted one of the most prolific pithos production centres of the Archaic period. The site (which lies very close to Thrapsano) is situated within a production area rich in wine and olive oil and, although we lack kiln debris or traces alike, the geographical, ecological and social factors all justify its existence. Moreover, as the petrographic analysis of samples from Aphrati shows (see below), the local clay seemed to be particularly

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[36] To this day, the term *vendema* is used by farmers and islanders to mark a prolific olive harvest season (often phrased as '*έχουμε βεντέμα φέτος'* meaning *'this is a good olive-harvesting year'*).

fitting for the making of large vessels thereby making Aphrati a most appropriate locale for the establishment of pithos production.

2.1.2. Modes of production

This subsection examines the production sequence of Cretan pithoi as attested by the main ethnoarchaeological literature. Wherever possible, the discussion is elaborated by including information on pithos production in other parts of Greece and Cyprus.

Raw material procurement, clays and tempering

The selection of clays for the making of pithoi required particular familiarity with soils and the resources available. This is reflected in the special nomenclature that pithos makers used to describe raw materials, such as the clay used for the making of pithoi in Thrapsano called *pitharochoma* (pithos–soil)[37]. This specific kind of clay was usually mixed with dark blue-grey clay known as *lepida/lepidi* or *lepidochoma* (literally meaning blade-soil), a name used to describe its many thin platy and flaky layers[38]. Depending on its quality, this could be mixed with a lighter kind of *lepida* (Xanthoudides 1927, 126; Hampe and Winter 1962, 2), or with red earthenware soil called *kokkinochoma* (Voyatzoglou 1984, 133; Day 2004, 113). The use of *pitharochoma* as the main clay-body secured the plasticity of the vessel during the making process whilst *lepidi*, due to its composition rich in silica, strengthened its heat resistance during firing (Voyatzoglou-Sakerallopoulou 2009, 177). The potters took advantage of the properties of the coarse-grained, refractory clay that is commonly found in the phyllite-quartzite series across Crete, which also facilitated the evaporation of water during both drying and firing process, thereby eliminating the danger of breakage (Voyatzoglou 1972, 19; 1984, 133).

Clay preparation

The process of clay preparation involved four basic steps: a) the gathering and spreading of clay at a designated area (*aplotarea)*, b) the crushing and sieving of

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[37] *Pitharochoma* is still employed as a term for the mixture of clays used in the making of modern *pitharia* by the potters of Thrapsano.

[38] *Lepidi* was also used as a mixture with other local clays for pithoi made in Margarites, Crete (Vallianos and Padouva 1986, 76; Gouin and Vogt 2002, 9) and in Koroni in Messenia during the 19th and 20th c. AD (Blitzer 1990, 682).

the clay, c) the blending of clays (*charmani),* and d) the kneading of the clay paste with the addition of water (fig. 7). Contrary to what was practised in the case of the Koroneika storage vessels (Matson 1972, 214; Blitzer 1990, 681-682), in Crete the clay was not stored after kneading but was instead used straightaway (Xanthoudides 1927, 126, Voyatzoglou 1972, 20; 1974, 19; 1984, 133). It is estimated that about 60 kilos of clay were needed for the making of a single pithos and given that a day's production was roughly 10 to 12 pithoi, the amounts of clay needed for a single day's production totals to about 600 to 720 kilos (Xanthoudides 1927, 124; Voyatzoglou 1974, 19; Gouin and Vogt 2002, 6). This number is indicative of the hard labour required from the *chomatas* (the man who digs and prepares the mixture of clays) but also of the importance of rich clay sources available in places where the workshop would be installed.

The tournette

In general, Cretan potters of the 19th and 20th c. AD used two kinds of wheels: the kick-wheel, called *trochos,* which was employed mostly for the making of small vessels and the tournette, a low turntable called *trochi,* which was used exclusively for the making of pithoi (figs. 8-10). The existence of a specially designed wheel for the making of pithoi is a distinct phenomenon, typically encountered in Crete. Elsewhere in Greece, pithoi were mostly manufactured either in sections or with the use of a kick-wheel (Voyatzoglou-Sakellaropoulou 2009, 186). The tournettes were assembled in holes dug in the ground (*trocholakkoi)* and the number of tournettes used on a day's work was equal to the number of pithoi produced. *Pitharia* were not placed directly onto the tournettes; instead, a clay plate was attached to a wooden disc atop of the *trochi (kephalara*). Tournettes were operated by the wheeler who was the potter's assistant or an apprentice *(trocharis)* and according to the master potter's directions (fig. 9). They consisted of a wooden vertical axle (*kephalara),* onto which the disc *(adrachti)* was attached, an iron metal pivot at the bottom of the axle *(mochlos*), and the stone or metal base *(plithi)* with a small recess in the middle which facilitated the pivoting of the axle. A wooden horizontal board *(stavrosanido)* was placed beneath the base of the disc to further support the axle. Rotation was achieved by the spinning of a wooden horizontal bar passed through the axle, thus creating two grasping points *(perones)* (Xanthoudides 1927, 123; Voyatzoglou 1974, 20; 1984, 135)[39]. Based on the fact that the tournette discs used by the potters of Thrapsano measured between 0.29m to 0.40m in diameter, Xanthoudides (1927, 123) suggested that excavated Minoan wheel discs of similar size should be identified as parts of the tournette, while those with a smaller diameter should be identified as part of the wheel used for the making of smaller vessels[40]. Likewise, Simantoni-Bournia (1990, 45-46) suggested the use of tournettes for the making of Archaic Naxian, Tenian and Boeotian relief pithoi, as observed from the ridges or grooves on the inside of pithoi. These were identified as traces of the potter's fingers produced while the tournette was being turned.

Methods

As much in the ancient world as in the more recent periods, the technique of coil-building is widely known as one of the commonest methods of ceramics manufacture (Rice 1987, 24). In Thrapsano and Margarites, the pithoi were made in a highly standardized manner which involved the coiling technique and the gradual building of the pithos onto the tournette. The making of the vessel was done in specific sections, or brims, and each brim was made by the successive addition of usually two or three clay coils. Because every manufacturing stage required drying between successive sections, the master potter moved from tournette to tournette to build parts of each pithos, thus allowing sections time to dry before the next series of coils was added. By the time the final section was added to the last pithos of one batch, the first pithos in the row was dry enough to receive the next series of coils (Voyatzoglou 1972, 59; Gouin and Voigt 2002, 11-13).

Each brim had specific dimensions (thickness, height, diameter) and in the case of Thrapsano, even specific names: the first section was the circular base of the pithos (*patos)* shaped by the flattening of a clay lump (fig.10). This was followed by the addition of the lower part of the pithos, known as the *phytema* (meaning the planting) which constituted approximately one-sixth of the total height (fig. 11). After

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[39] On tournettes from Asomatos and Margarites, see Hampe and Winter 1962, 16-17, and Gouin and Vogt 2002, 16 respectively. For ethnographic parallels, modern replication studies and a review of the available archaeological, iconographical and textual evidence on potters' wheels from Greece, see Hasaki 2019.

[40] For the correlation of Thrapsano *trochia* and EM II wheel-heads, see also Hadzi-Vallianou 1995, 489.

the first brim, the second brim, called *stomosa,* was added. The following brims were 'the round' (*strongili)* stomosa, 'the straight' (*ntreti),* and 'the large' (*megali)*. The final stages of the making process were the addition of the collar *(cheiloma)* and of the handles *(aftia)* (Xanthoudides 1927, 124; Voyatzoglou 1972, 59-60; 1974, 20; 1984, 136). At the junction of each stomosa a clay band or strip (the *belt* or the *zonari*) was applied on the exterior, serving both as a means of reinforcement and as a decorative feature. Such bands were used in all following sections, and at Margarites these bands (called *zonaria* or *tseroukla*) were applied until at least the 1930s as indicators of capacity (Giannopoulou 2010, 73)[41] (table 2, figs. 12-13). This strictly standardized procedure followed by the Cretan potters is unique compared to the itinerant pithos makers of Phini or Kornos in Cyprus. The Cypriot pithoi were built in halves: the first coil-built half of pithos was made on a turntable and then left to dry, and later the additional coils were attached to complete the vessel (London 1989, 47, 62). The first part in the manufacturing process was the construction of the base which, in this initial phase, was supported by surrounding stones. At the end of each working day the final coil was covered with fig leaves in order to protect the unfinished vessel from over-drying and to preserve the necessary humidity for the addition of the coils the following day (ibid. 69). Comparing the two distinctive traditions which co-existed in Cyprus and in Crete, and taking into consideration that they were both practised by itinerant potters in places with no significant climatic differences, it seems that manufacturing techniques were not dictated by the non-sedentary nature of potters. Rather, it appears that the two pottery traditions were formed and maintained though cultural factors deeply imbued within the community of potters.

Regardless of the specifics of the forming method (coiling or building in halves), the building of pithoi in sections was dictated by its effectiveness for the production of such bulky and heavy vessels. If this technique was unknown amongst the potters of a certain area who produced other kinds of (usually smaller) vessels, the demand for storage wares was satisfied by the importation of pithoi from specialized workshops, in adjacent areas or further away. For instance, in Mandamados in Lesvos,

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[41] *Zonaria* was also a typical characteristic of the Koroneika jars which facilitated their transportation through rolling without breakage across relatively long distances (Blitzer 1990, 690).

a village with a rich and ongoing pottery tradition, the potters never adopted coiling or any other technique for making pithoi. For Giannopoulou and Demesticha (1998, 51), this explains the complete absence of storage-jar production in a community where at least 60 pottery workshops operated until the mid-20th c. AD. More interestingly so, despite the bulk olive oil production such as Lesvos, any storage jars found in oil presses and storage spaces within households were actually imported from other areas of the Greek world.

Drying

Since the making of pithoi was mostly done during the summer months, the drying of Cretan pithoi took place in open-air workshops. It was a fairly predictable but highly important and standardized procedure, organized to maximize the quality of the final product as well as to speed up the production. The finished vessels were left onto the turntables until the next morning, when they were removed and left to dry for another twenty-four hours (fig. 13). During the drying of one batch of pithoi, the next one was being produced. If weather conditions did not allow for adequate drying, potters would speed up the process by firing the vessels from the inside with the use of a crude torch or with burning charcoal put inside the pithoi (Voyatzoglou 1972, 81). In modern days, the torch is replaced by a blowtorch (fig.11). Drying had an immediate effect in the final shape of the pithos since as Giannopoulou (2010, 73) noted, 'Cretan *pitharia* lost 22% of their weight during the drying procedure and their overall dimensions shrunk by 7%'. The process must have been depended on nature of the workshop (open-air or indoor), as well as on the climatic conditions. The procedure was substantially different in the cases of indoor workshops such as in the Gulf of Messenia and in Cyprus, where drying could last from ten days to two months (Matson 1972, 222; London 1989, 70; Pilides 2000, 104; Giannopoulou 2010, 73).

Firing

Cretan potters used the typical updraft kiln which is also the most frequent type encountered archaeologically across the Mediterranean (Hasaki 2002, 72). As implied by the name of this structure, the heat in the updraft kiln moves up from the opening at the lower part towards the opening of the chimney at the top. The kind of updraft kilns known to us from Thrapsano and Margarites, *the kaminia*, were circular and had an average diameter of ca. 2.50-3m, with a large part of the kiln constructed beneath the surface of the earth[42]. Like most pottery kilns, the pithos kilns were most commonly built against of the slopes of hills. The potters benefited from the natural slope of the ground surface, thus avoiding the digging out of an entire pit (Guest-Papamanoli 1983, 54; Blitzer 1990, 695; Hasaki 2002, 73). Ethnoarchaeological studies on Cretan permanent workshops make note of kilns built in pairs for reasons of economy of space and for higher efficiency in the working process. These workshops involved a large kiln and a smaller one, the first used for the firing of pithoi and the second for smaller vessels (Hampe and Winter 1962, 8-9; Voyatzoglou 1974, 23; Guest-Papamanoli 1983, 53) (fig. 14)[43]. The early modern kilns were divided into two horizontal parts, the lower and the upper, and were lined on the inside with sandstone or volcanic slabs (Xanthoudides 1927, 127). Both parts were supported by a central large mudbrick pillar and arches in a radial arrangement. The lower part was the stoking channel and had a built entrance in the front through which the fuel was supplied. The top layer of the lower part was the firing platform, perforated with many small vents (holes) which facilitated the passing of the heat from the combustion chamber to the upper part of the kiln. The upper part, which was of greater height, was the main chamber into which the raw pots were placed (figs. 15-16).

Pithoi were usually placed into the kiln in two circular rows. The outer circle was filled in carefully to make sure that the vessels did not touch the walls of the kiln and then, the smaller inner circle was filled. The pots were separated from each other with the addition of broken pottery sherds, including pithos fragments or tiles, while the empty spaces were filled occasionally with complete smaller vessels[44]. Broken sherds were also used to cover the top of the kilns (Hampe and Winter 1962, 36; Voyatzoglou 1974, 23; Day 2004, 113) (figs. 17-18). From Blitzer's research at Koroni, we know that there the fuel comprised of bunches of vines, olive-wood

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[42] Outside Crete, in Koroni, Blitzer (1990, 695) recorded the difference in diameter between kilns built for the firing of pithoi and those built for wheel-made, smaller vessels, with the former having a diameter of 4-5m and the latter approximately 2.50m.
[43] It is of particular interest that such characteristics, namely the building of kilns against slopes, the range in diameter according to vessels produced and the building of kilns in pairs, are all attested at the kilns of the Mandra di Gipari workshop in Prinias (Rizza et al. 1992, 20-26).
[44] In Minoan Crete, there is evidence from a LM IA ceramic kiln found in Kommos which verifies the use of pithos fragments as separators between vessels or as fire supports that bridged the channels of the kiln; see Van De Moortel 2001, 84.

prunings, oak, sawdust and, in some rare occasions, crushed olive pits (Blitzer 1990, 696). However, no substantial evidence survives regarding fuel used in Cretan kilns. Firing time depended on the size and capacity of the kiln and could last from four to six hours. When the firing was finished, the kiln was left to cool off until the morning after when its door was demolished and the pithoi were taken out (Voyatzoglou 1974, 23). The day after the pots were taken out of the kiln, pithoi were either wrapped around with a wet cloth (Xanthoudides 1927, 127) or they were filled with water (Voyatzoglou 1974, 23). Though this, the calcite of the clay particles was neutralized and the porosity of the surface was reduced, thus making the walls of the pithoi more if not completely impermeable.

2.1.3. The distribution of Cretan and other modern Greek and Cypriot pithoi

Given the mass production of Cretan *pitharia* at Thrapsano and Margarites as well as their reputation across the island, it is peculiar that these vessels seem to not have reached areas overseas. One can speculate that perhaps Cretan pithoi were not strong and stable enough to be transferred over longer distances. Alternatively, this may be related to the fact that both villages are situated well enough away from the major ports of Heraklion and Rethymnon respectively[45]. However, ethnographic evidence from elsewhere suggests that pithoi were traded across large distances.

The quality of the Koroneika was valued so highly that they were exported throughout the Peloponnese, in other parts of western Greece and beyond. In fact, their marketing together with other smaller pots was a particularly profitable commercial activity. The very strong and durable manufacture of the *Koroneika* was accomplished by the careful selection of raw materials but mostly, by the addition of multiple *zonaria* which greatly enhanced their transportability by rolling which was further facilitated by the lack of handles. Blitzer recorded that pithoi from Koroni were sold in Tripoli, the economic centre of the Peloponnese which lies approximately 50km away from the centre of production. In fact, it appears that the greater the distance the more profitable the trading of pithoi was, for as Blitzer (ibid. 700) noted '[s]ome recall that they earned a greater profit (twice as much per vessel)

[45] See also discussion in Giannopoulou 2010, 149. We should note, however, that today Cretan pithoi travel to other Greek islands en mass; loaded up on trucks, they are exported to the Dodecanese (esp. to Karpathos and Rhodes) through the ferry that connects Crete with the Aegean islands.

making and selling their pottery at distant locations'. The traders and middlemen of the Peloponnese benefited from the production of high quality pithoi and developed a specialized marketing system, where local or visiting traders came from distant areas equipped with their own pack animals to transfer pithoi overland to nearby centres. On other occasions, middlemen brought pithoi to ship captains at the port Koroni who later transferred them to other areas. In particular, the largest type of *pithari* (fig. 19.1) was distributed in centres of the Peloponnese and beyond, including Crete, the Cyclades, the Dodecanese, northern Greece and the northern Aegean, the coast of Turkey and Constantinople, Cyprus, Italy and Sicily, North Africa, Egypt and Palestine (ibid. 700). As shown by Blitzer (1990, 679-700), the large unglazed *Koroneika pitharia* with ribbed walls produced in Koroni (fig. 19), gradually acquired a value as products in their own right; so much so, that the *pitharades* from Messenia travelled to Crete, Cyprus, Pyrgos, Sparta and Nauplion to produce there their special *pitharia*. Although the wide dissemination of the *Koroneika* must be related to their high degree of safe transportability, it appears that other, cultural factors also came into play. These factors include the ownership status attributed to the pithoi as vessels of the highest quality. It is perhaps for this reason that the *Koroneika* jars were also placed by the entrance of some houses well outside Messenia, such as in Mykonos and Heraklion. Perhaps they did duty as objects of display and household prosperity, being purchased by members of the rising commercial and middle class (figs. 20-21). Cretan pithoi do not seem to have received the same appreciation in areas outside Crete, be it due to their less sturdy manufacture or because outsiders did not identify with this Cretan ceramic tradition.

Further cases of pithos exports are attested in ethnographic literature. Large jars with pointed bases produced at Ainos in Thrace were transferred to the port of Mytilene in Lesvos. During the 19th and 20th c. AD these pithoi were distributed from Mytilene to other regions, mainly to those with a mass production of olive-oil, reaching as far as Rhodes, Karpathos, Pelion and the Pagasetic Gulf. Despite the fact that they were not originally made in Lesvos, these vessels acquired the name '*pitharia Mytilene's'* ('*pithoi of Mytilene*'), which highlights the importance of the port as a distributive centre of the vessels (Giannopoulou and Demesticha 1998, 71; *cf*. Korre-Zografou 1995, 175-176, fn. 8, 205).We also know that at least in the beginning of the 19th c. AD the pithoi from Ainos were imported to Siphnos and the early 19th c. traveller Auguste Viquesnel noted the massive exportation of not only pottery but also of raw materials to distant places, including to the islands of Thassos and Siphnos (Mystakides 1929, 48; Spathari–Begliti 1992; Papadopoulos 1999, esp. 70-71). Additionally, the Italian pithoi from Grottaglie and Livorno are known to have been imported to Corfu and to other Ionian islands by Maltese traders (Korre-Zografou 1995, 196).

There is some – even if limited – archaeological evidence for the wide transportation of pithoi as objects of value *per se*; however, we should take caution in assuming that the vessels travelled empty of content. For instance, findings from the shipwreck of Ulu Burun suggest that Cypriot pithoi served both as storage containers used in shipping and as items of export (Bass 1984, 270, 293; Hirschfield 2005). Also, imports in Late Cycladic I Akrotiri at Thera include some storage vessels from Mainland Greece, Aegina, the northern Cyclades or the Dodecanese, as well as pithoi and pithoid jars from various parts of Crete (Nikolakopoulou 2001, 257). Pithoi from the so-called 'Lustral Basin fill' and from House D at Pseira in Crete of the Late Minoan IA period were identified as possible imports shipped from a Knossian workshop (Christakis 2003, 156). Iron Age pithoi of the Cypriot 'Wavy-band' style were found in abundance along the southern Phoenician coast and, although most of them were locally produced in imitation of their Cypriot counterparts, a few were actually imported from Cyprus (Gilboa 2005, 54). Similarly, at Kommos, imports from Cyprus include some Late Bronze Age 'Plain White' pithoi (Knapp 2013, 422).

Finally, the petrographic work concerning Cretan EIA coarse and semi-coarse pottery suggested the possibility of pithoi being imported from the Mesara or even from the Cyclades to Knossos (Boileau and Whitley 2010, but see petrographic analysis below). Suggestions for distribution of pithoi from Aphrati to Knossos and other sites in central and east-central Crete have been put forward by Brisart (2007, 117-118; 2009, fig. 6). Although contemplating the possibility that storage vases were transported for afar, Brisart draws from ethnographic evidence on the existence of itinerant pithos makers in Crete (see below) to suggest that this wide distribution of the Aphrati pithoi is more plausibly explained by the existence of itinerant pithos makers which were based at Aphrati but travelled seasonally over long distances to establish temporary production structures, wherever demand for storage was high (Brisart 2007, 118-119). This possibility has also been discussed by Kotsonas (2017, 20) who observed a growing number of probable 7th c. Cretan imports to Knossos which also include some pithos fragments. These fragments match the fabric of pithos fragments from Lyktos and Afrati collected by Sinclair Hood in the 1960s (some of which were subjected to petrographic analysis in the present thesis), thus strengthening the idea that pithoi from Aphrati were imported to Knossos and perhaps elsewhere. This distribution, argues Kotsonas, could also be associated with itinerant pithos makers who were probably based at the district of Pediada. In support of this argument, he also drew attention to the 7th c. wheel disc from Aphrati which Hampe (1967-1968) identified as a portable tournette, as part of the mobile equipment used by travelling pithos makers.

2.1.4. Itinerant pithos makers in Crete

The weight of pithoi constrained their movement from production centres to consumers afar and the seasonal itinerant basis of the potters was a logical adaptation to the needs of the market. The seasonal mobility of potters enabled them to satisfy a localized demand for storage vessels and to bypass middleman involved, thereby maximizing their profits. Teams of pithos potters worked on an itinerant basis in the Gulf of Messenia, at Thrapsano and Margarites in Crete, at Phini in Cyprus and at Ainos in Thrace. The potters of Phini in Cyprus travelled to areas with rich wine production to make pithoi and sell them wherever needed, particularly across the Troodos Mountain foothills where wine produced in bulk. The potters carefully selected their workspaces and settled in villages where smaller vessels were not produced (London 1989, 24, 69)[46].

In Crete, itinerant pithos-making known as *vendema* was a widely practised system of production. Betty Psaropoulou (1996, 103) estimated that the number of kilns at Thrapsano during the 20th c. was 167, whilst those built across the island for seasonal work were 134. In the 1970s, Voyatzoglou (1974) recorded about 30 to 35 groups of potters and their assistants setting off annually, each guild to a different destination. The potters of Thrapsano not only travelled across the island seasonally (to return later to their village), but also settled and started up new permanent workshops in distant areas, for example in eastern Crete, where they continued their tradition of making pithoi (Day 2004, 118). The best documented case for *vendema* remains that of the Thrapsano potters. The itinerant potters were the *vendemaroi* and

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[46] Siphnian potters also toured across island of Siphnos and beyond but their ceramic repertoire did not include pithoi (Spathari-Begliti 1992).

the bands of potters were called *takimia*. Each group usually consisted of six members and operated on a strictly hierarchical system consonant to the duties of each man. *Vendema* officially started on the 21st of May and lasted until the 14th of September with both dates connected to religious celebrations of the Orthodox calendar. The team consisted of six main members: 1) the master potter *(mastoras),* who was the team's leader and the one who actually shaped the pithoi. He also was responsible for choosing the working areas in advance and for managing the economics of the *vendema;* 2) the second master *(sotomastoras),* the potter's assistant, was responsible for preparing the coils for each brim and for the addition of handles at the final stages of the making process; 3) the wheeler *(trocharis)* or kiln worker *(kaminaris),* who was the one turning the tournettes according to the master potter's directions and the one responsible for the building, loading and firing of the kiln; 4) the clay worker *(chomatas*, who identified, dug and processed the local clay; 5) the woodcutter *(ksilas)*, who cut and collected the wood to be used as fuel for the kiln and, 6) the carrier *(kouvalitis),* who was responsible for carrying the dry clay and the wood, for loading finished pithoi onto donkeys and for carrying them to the residence of the buyers (Voyatzoglou 1972; 1973).

The *vendema* was particularly interesting to the scholars who produced the earliest pithos studies, who generally postulated that ancient pithoi were not imported from distant areas but were produced by itinerant potters who worked on a system similar to that of the 19th – 20th c. *vendema*[47]. As I discussed in the previous section, some of the recent scholarship (Brisart 2007, 117-119, Kotsonas 2017, 20) also draws from ethnographic evidence to discuss the possibility that itinerant pithos workshops operated across central and east-central Crete during the EIA-Archaic period. Others, however, most notably Palermo (1992a, 109), reject direct parallelism between ethnographic observations and archaeological evidence, because, as he believes especially for the case of Prinias but also for other *poleis* of Archaic Crete, the mobility of ceramicists was not necessary or even allowed due to their lack of status

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[47] A notable example of such hypotheses is included in Thomas Dunbabin's conclusions regarding the production of Cretan Archaic pithoi: *'...archaic Cretan pithos-potters were mobile, like their modern successors who work at home in the winter, at Thrapsanos or Margarites or other potter-villages, and travel in summer, often taking up their abode year after year by some clay-bed in the open country'* (Dunbabin 1952a, 158).

and/or independence (*contra* Brisart 2007, 118; see also discussion in 4.1.1, where I argue for the social recognition and status of ancient Cretan pithos makers).

The short- or long-distance trade of pithoi versus itinerant pithos makers remains a continuously intriguing question in pithos studies. Most probably, the question persists because beyond the ethnographic evidence on itinerant potters, some other ethnographic and archaeological data point towards the possibility of specialized pithos workshops and wide trade networks. Also, perhaps the question continues to arise because of the challenging size of storage jars and any evidence for the long-distance trade of such heavy and tall vessels would tell against some long-held ideas on the restricted mobility of some ceramics or specialized potters (see, for example, Arnold 1985, 58-59). These questions surrounding the circulation of pithoi invite for the application of analytical studies and especially thin section petrography. This is well stated by Christakis (2005, 57) whose comments on the distribution and use of Cretan Bronze Age jars is as follows: '[t]he scale and frequency of regional and intra-regional movement of storage containers, however, is still to be proven with a systematic and extensive petrographic project'. Christakis also postulated that some of the ethnographic evidence prompts us to consider both the possibility of long-distance trade of pithoi as well as the transportation of raw materials, as we have seen for example in the case of Ainos and Siphnos. Although the latter scenario would suggest a serious re-consideration of some fundamental assumptions behind ceramic petrography such as methods of sampling and interpretation of thin sections, Christakis believes this to be worthwhile: '[t]he case of the transportation of raw materials over long distances has received little attention from ceramic specialists because of the implications for provenance studies. Ethnographic information, however, shows that in some cases pithos makers in preindustrial Crete extracted the clay from a distance of 15 km to 30 km from their base [...] while in the middle of the 19th century, Cretan clay extracted from the area of Smari, Asites, Geraki, and Silamos was shipped to Egypt for brick production [...] Additionally, pithos makers from Phini, Cyprus travelled over great distances with their prepared clay stored in wooden barrels' (ibid. 58). The overview of ethnographic evidence presented above shows that indeed there are indications both for the transport raw materials and of the pithoi. This discussion deserves further elaboration as it will enable us to view ancient pithoi in a whole different context, free of possible constraints posed by the ethnographic record and studies of Cretan folklore traditions. The second part of this

Chapter below, deals with the issue of the distribution of ancient pithoi by collecting original data from selected pieces and by subjecting them to scientific analysis.

2.2. Petrographic analysis of EIA-Archaic pithoi from Central Crete: Knossos, Prinias, Aphrati and Lyktos

The first steps toward integrated approaches on petrographic analysis resulted from ethnoarchaeological/ethnographic research and it is therefore not coincidental that the two disciplines developed hand in hand. Most indicative examples of this fruitful collaboration are the groundbreaking publications by Frederic Matson (1965, 1981) and Anna Shepard (1936, 1965) which shaped and refined the methodology for the application of petrology in ceramic studies, thus rightfully gaining their honorary place in relevant literature. Since then, ceramic petrography has followed the advances of archaeological methods and theory and has broadened its potentials to include the investigation of subjects which vary from provenance and provenience (i.e. origin and chain of ownership respectively), to the procurement of raw materials, forming methods and technological characterization of ceramics, and the tracing of cultural, regional and intra-regional networks. Petrographic analysis has been applied extensively in Aegean archaeology. The history of ceramic analyses and current research themes in the Greek world were relatively recently outlined by Jill Hilditch (2016) and will not be covered here anew[48]. However, for the purposes of the present analysis, an overview of existing petrographic research on Cretan pithoi and Cretan EIA-Archaic ceramics seems necessary and is provided in the following section.

2.2.1. Past scientific analyses

No previous project petrographic analysis has focused exclusively on Cretan pithoi of the historic period[49]. In general, petrographic studies conducted in Crete and the Aegean have incorporated samples of storage jars but the identification and characterization of pithos fabrics has been very broad and confined to assemblages

[48] For a general introduction on ceramic petrography and a brief history of the discourse, see also Quinn 2013, 4-16. For a summary of early analyses specifically in Crete see Jones 1986.

[49] Two petrographic studies on pithoi which are not strictly related to the present analysis but are worthy of note, regard material from the Peloponnese: the analysis of pithoi from Ancient Messene and the area of the Gulf of Messene by Evangelia Kyriatzi (2010), and the preliminary results of a petrographic, SEM and XRD analysis of pithoi from the Early Helladic settlement of Helike in Achaea by Katsonopoulou et al. 2016.

from the Bronze Age[50]. This narrow chronological spectrum of applied analyses is the result of the general trends in archaeological studies on Crete which have long concentrated on the Minoan period.

However, a number of past analytical studies have paved the way for the present analysis. The only petrographic study specifically targeted at the analysis of Cretan Bronze Age pithoi was carried out by Peter Day in the late 1980s (Day 1988). This is a preliminary examination of storage vessels of the Neopalatial period from the Mesara plain in south-central Crete and from the region of Knossos and Archanes in the north-central part of the island. In this study, the importance of the interrelated role of ethnography and thin section analysis became once again crystal-clear, particularly in the case of Crete. To overcome any potential research bias, Day suggested a broader array of questions archaeologists and archaeological scientists can ask: rather than restricting inquiries to matters of provenance, his research focused on how scales of production can vary according to the type of pottery produced and to potters' organization systems (*sedentary* vs *non-sedentary*)[51]. The aim of the analysis was to investigate ceramic variation and to assist petrographers in their decision making when it comes to the grouping of thin sections. Day introduced ethnographic information in his analysis by interviewing locals and potters and sampled ceramic raw materials from geological deposits and actual kiln products. He further conducted an initial clay prospection in the Neogene deposits around Knossos and produced experimental briquettes for a comparative analysis. Results showed that these Neogene clays are mostly not that suitable for pottery making due to their poor malleability, easy breakage and low resistance to high firing (ibid. 504). Certain locations were identified as possible sources of adequate, good quality raw materials with the best candidate being mount Juktas [previously also reported by Xanthoudides (1927)] and the area south of Juktas where Minoan pottery kilns had been excavated by Marinatos at Vathypetro and Kanli Kasteli (modern Prophitis Ilias) in 1955 (Marinatos 1955, 310). Day also identified differences in clay-mixing technologies of Bronze Age storage jars: in the Mesara there is a prevailing sand-tempering tradition

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[50] E.g. Day et al. 2006 (fabrics 3 and 4) for LM III in Kavousi; Whitelaw et al. 1997 for EM II B Myrtos, Fournou Korifi, and Pilides 2002 for a limited number of analyzed samples (34) of Late Bronze Age Cyprus.

[51] Further ethnographic work by Day (2004) demonstrated the valuable complimentary role of ethnography in studies of ancient ceramic production in the case of Pseira, east Crete.

during the Neopalatial period, contrary to the area of Knossos where the evidence points towards 'the use of untempered clays, complex clay mixing and fabrics tempered with crushed rock' (Day 1988, 505)[52]. Overall, this first trial analysis provided a framework for similar projects and it enriched our understanding for the variables included in the methodology, sampling, grouping and interpretation of thin sections especially in areas with rich ethnographic information such as Crete. Day's important contribution in coarse wares and pithoi remains pioneering to this day.

From the early 1990s onwards Cretan pottery of the historical period increasingly attracted analytical research. This research follows the general academic interest in socio-political developments on Crete during the transition from the EIA to the Archaic period, a task which calls for more diachronic, regional and intra-regional approaches. This has had a slow but evident impact as much on excavations and projects dealing with macroscopic fabric analysis[53], as on the application of science-based analytical techniques. Some rare examples of applied archaeometry on pottery from this period include the chemical analysis of EIA pottery from the Knossos North Cemetery (Liddy 1996), Neutron Activation Analysis on pottery from an Early Orientalising kiln in Knossos (Tomlinson and Kilikoglou 1998), chemical characterization of Geometric pottery from Chania and from east Crete (Jones 1997 and Jones 2005 respectively). However, the application of ceramic petrography on EIA to Archaic pottery remains dramatically scarce, despite the fact that it continues to be the most economical and the least destructive method of analysis available. The few exceptions include the first analysis of Cretan EIA fine to coarse pottery from tomb A1K1 of Orthi Petra at Eleutherna conducted by Eleni Nodarou (2008)[54] and Antonis Kotsonas (2008), the petrographic analysis of coarse, semi-fine and cooking wares from Thronos Kephala (ancient Sybrita) by Anna-Lucia D'Agata and Marie-

[52] The analysis included samples from the two kiln sites of Thrapsano potters who were seasonally based on Tholoi (above Houdetsi and at Galeni near Roukani), yet the official final report remains unpublished.

[53] Indicative of this revived interest on diachronic studies are excavation, survey and macroscopic analysis projects which have been initiated in the last two decades. These include 'the Sphakia Survey Project' in west Crete (Moody et al. 2003); the archaeological projects at Kavousi and Azoria (Haggis 2005; Haggis et al. 2004 respectively), the 'Vrokastro Regional Survey' and the 'Praisos Project' (Hayden 2004; Whitley et al. 1995 respectively) in the east; and the Knossos Urban Landscape Project in central Crete (Kotsonas et al. 2012).

[54] Nodarou further contributed to a series of petrographic analyses of Cretan material from the historical periods; see Vogeikoff-Brogan et al. 2008 for Hellenistic transport amphorae from Trypitos, East Crete (including samples from pithoi), and Poulou-Papadimitriou and Nodarou 2007 for Protobyzantine pottery from Pseira, East Crete.

Claude Boileau (2009), the analysis of coarse and semi-fine pottery from EIA Knossos by Boileau and Whitley (2010), a study of pottery from both Sybrita and Knossos (Boileau et al. 2009). The thin sections of the material from Knossos were made available to my study for comparative purposes, and the same applies to thin sections of unpublished material from the regional survey project at the Pediada in central Crete, which is currently under examination by Nodarou[55]. Insights gained from these works are assessed below in the relevant parts of my own analysis of material from central Crete.

2.2.2. Research aims

The aim of the present petrographic analysis is threefold: a) to formulate a compositional and technological characterization of pithos fabrics represented by the assemblage, b) to assess trends in the production sequence of Cretan pithoi of the EIA-Archaic period and c) to assess any evidence for the circulation of pithoi and pithos potters in the areas covered by the assemblage. Within a wider archaeological context this analysis aims at providing insights for future investigations of storage jars in particular and coarse wares in general, to allow for the identification of fabrics for as yet understudied periods and areas of Crete, and to enrich the current fabric database, thereby contributing to the understanding of the range of mineralogical and technological fingerprints on the island. Ideally, future petrographic results of Cretan storage vessels from later and earlier periods combined will prove to be valuable for the examination of diachronic trends in the making of pithoi. The development of such studies will also contribute towards bridging the gap between ethnographical and scientific approaches and it will calibrate the rich ethnoarchaeological information whilst setting it in fresh, better informed and more realistic frameworks.

2.2.3. Methodology

101 pithos sherds were selected for petrographic analysis. The samples were selected after the macroscopic examination of pithos fabrics from four sites of Central

[55] For the Pediada Survey Project, see Panagiotakis 2003; Panagiotaki and Panagiotakis 2011.

Crete (maps 3a-b)[56]. A detailed list of the samples can be found in Appendix I. A varying number of samples were taken from different sites, depending on the availability of the material:

Aphrati (ancient Arkades?): 28 samples

Lyktos: 17 samples

Knossos (Unexplored Mansion): 33 samples

Prinias (Mandra di Gipari, EIA-Archaic Town, Necropolis): 23 samples

The choice of these four sites is connected to the research aims of this study and was also informed by the existing state of research and to some favourable factors regarding the availability of material. Firstly, these sites have been excavated to a varying extent and have yielded evidence for habitation and production activities during the periods under examination. Secondly, they have yielded abundant pithos finds which were collected and stored in the Archaeological Museum of Heraklion, the Stratigraphical Museum of Knossos and the storerooms of the excavation mission in Prinias. Thirdly, we assume that at least three of the four sites, namely Aphrati, Lyktos and Prinias, specialized in pithos production. Lastly, the choice of sites is aimed at providing a regional perspective on the circulation of pithoi.

Most of the pithos sherds sampled do not come from closed or stratified deposits and so they can only be dated very broadly. Additionally, the dating of pithoi is often broad as this class of pottery is particularly resistant to typological changes. Although not entirely static, this class shows relatively restricted decorative, technological and stylistic variation, which does not usually allow for narrow dating. For these reasons, the selected pieces are classified under very broad chronological periods, i.e. Subminoan (ca. 1100-1000 BC), Geometric (ca. 1000-700 BC), Orientalizing (ca. 700-600 BC) and Archaic (ca. 600-500 BC). Admittedly, this chronological classification is not without its problems since a number of relative and

[56] Following the selection and detailed recording of selected samples, permits for petrographic analysis were obtained from appropriate departments, institutions, foreign schools and excavators. Specifically: the Greek Ministry of Culture and the Department of Conservation of Antiquities and Works of Art, the 13th Ephorate of Antiquities in Heraklion, the Archaeological Museum of Heraklion, Professor Dario Palermo, University of Catania and the Italian Archaeological School at Athens (for samples from Prinias), the British School at Athens and the Stratigraphical Museum of Knossos, Professor Hugh Sackett (for samples from Knossos and Aphrati and Lyktos stored at the Stratigraphical Museum) and Angeliki Lebessi (for samples from Lyktos and Aphrati). I am most grateful to all the above scholars and institutions involved for entrusting me with their material.

absolute chronologies have been proposed for EIA-Archaic Crete[57]. One of the problems with the case pithoi concerns the widely applied term 'Orientalizing'[58]. On the one hand, there has been a general tendency to ascribe pithos and pithos fragments with traces of relief decoration as pots dating from the Orientalizing period rather as pots which are orientalizing in style. On the other hand, the distinction between phase and style is not made in publications of associated pottery assemblages or in the labels given to pithos fragments. Nevertheless, for the purpose of this analysis and for reasons of consistency, I have largely relied on the Knossian periodization established by Nicolas Coldstream (2001, table at 22).

Knossos, situated approximately 5km south of Heraklion, has been extensively excavated for over a century. The site is mostly known for its Minoan palace but the immediate and the wider vicinity has traces of occupation from the Neolithic to the Byzantine period. Research on EIA-Archaic Knossos has been conducted at various periods of the site's long archaeological history. The majority of EIA and Archaic findings at Knossos come from cemeteries, groups of tombs, and a few domestic deposits (primarily consisting of filled-in wells), excavated and published by the British[59]. Since 2005, the Knossos Urban Landscape Project (KULP) has been dedicated to the investigation of the diachronic activity at Knossos, involving both extensive field survey and assessments of earlier excavations carried out in the area (Kotsonas et al. 2012). The project also involves macroscopic study of pottery fabrics from the EIA, including coarse wares and pithoi (Kotsonas 2019a, esp. 3, fig.1) Macroscopic observations by KULP have been extremely helpful for the selection and the analysis of the 33 pithos samples from Knossos analysed here[60], which include published and unpublished sherds from the excavations at the

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[57] See relevant discussion in Kotsonas 2008, 40-41.
[58] Throughout the Greek world, the term 'orientalizing' has been interchangeably applied to describe a chronological phase (largely confined to the 7th c. BC), a particular pottery style with iconographic and shape features derived from the Near East and the overall the artistic renaissance of this period. On the 'orientalizing phenomenon' in general, see Burkert 1984; 2003; for aspects of the wider process see Horden and Purcell 2000; Gunter 2009. For a comprehensive summary including definition of the term, chronologies, regional variations and basic interrelated themes, see Whitley 2014a. For a comparative assessment of the term and proposal for its theorization, see Whitley 2013b, 409-412.
[59] For EIA-Archaic material excavated from various areas at Knossos, see Coldstream 1960; 1963; 1972; 1973; 1992; 2000; Coldstream and Sackett 1978; Coldstream and Catling 1996; Coldstream and Hatzaki 2003.
[60] Correspondance with KULP coarse fabrics is noted in Appendix I.

‘Unexplored Mansion’, conducted by Mervyn Popham and Hugh Sackett in the years 1967-1972 (Sackett 1992).

Twenty-three samples come from the area of Prinias. The homonymous modern village is situated among three modern eparchies of Kainourgiou, Malevizi and Monofatsi (ca. 33km southwest of Heraklion). The ancient site of Prinias is located atop of the modern area and it includes three distinct but probably connected sites: the pottery factory of Mandra di Gipari, the EIA-Archaic Town on the plateau called the Patela, and the Necropolis, also known as Siderospilia. First discovered by Halbherr (1896; 1901b, 399-403) at the end of the 19th c., Prinias was systematically excavated by Luigi Pernier in the 1910s (1914; 1934) and since 1969, by Giovanni Rizza and Dario Palermo[61]. The samples studied here derive from the excavations lead by Rizza and Palermo. Seven samples come from the pottery workshop at Mandra di Gipari, six from the EIA-Archaic Town at the Patella and 10 from the Necropolis of Siderospilia.

Twenty-eight samples are from the site of Aphrati (ancient Arkades?). The site lies south of Kasteli Pediada (ca. 44km southeast of Heraklion), in the modern municipality of Viannos. Five pithos sherds from Aphrati are from Sinclair Hood’s travels on the island (Hood et al. 1964) (these are stored today at the Stratigraphical Museum of Knossos), and 23 come from the rescue excavations conducted by Angeliki Lebessi in 1969, who, however did not find a good stratigraphy due to the severe plundering of parts of the site (Lebessi 1969a; 1970; 1971a).

Seventeen samples come from the ancient site of Lyktos (also spelled Lyttos from the Classical period). The site is approximately 1km northeast from the modern village of Lyttos, also known as Xidas, which belongs to the eparchy of Pediada. From these 17 samples, seven derive from the rescue excavation conducted by Lebessi in the late 1960s-early 1970s (Lebessi 19769b; 1971b), close to where Nikolaos Platon (1955a, 567) had previously unearthed the first pieces of Archaic pithoi. The pithos fragments were found on the Hellenistic floor levels of a room unearthed at the excavation area conventionally named ‘*Dokimastiki Ereuna I’*. The

[61] Reports from the excavations at Prinias can be found in: Rizza 1991; 2008; Rizza et al. 2003; 2005; Palermo et al. 2004; 2007; 2008; 2012. For Mandra di Gipari specifically, see Rizza et al. 1992. Siderospilia remains largely unpublished, but preliminary observations can be found in: Rizza 1991, 331-334; Rizza 2019; Biondi 2019; Gigli Patané 2019; Palermo 2019; Pautasso 2019. For excavations at Prinias with a focus on pithoi from Temple A and surrounding areas, see relevant section in Chapter 3.

remaining 10 samples from Lyktos are surface finds collected at the site by Hood (Hood et al. 1964) (currently stored at the Stratigraphical Museum of Knossos)[62].

The material under examination presents a certain bias related to past selection policies which should be taken into consideration. Until some decades ago, plain pithos sherds (like other coarse wares) were often not collected or preserved, unlike fragments from decorated pithoi and fine wares. We are therefore probably lacking a fully representative or accurate picture of the full spectrum of pithos fabrics and coarse wares. In all, the limitations mentioned so far, namely the broad dating of pieces, the poor stratigraphy and the selective nature of pithoi stored at the available collections, do not restrict the potentials of this group of samples. This is because my work is not aimed at solving problems of archaeological context or chronology, but at clarifying issues of production and distribution, with a focus on fabrics, technology and ceramic recipes. That said, future contextual and mineralogical data combined, will certainly assist in providing more comprehensive understandings of pithoi of the EIA-Archaic periods.

2.2.4. Geology of the areas under analysis

The geology of the areas around the sites sampled does not present significant diversity as indicated by the following overview. However, the geological maps available are by no means exhaustive and no detailed clay sampling has been conducted. For this reason, all fabrics mentioned below are identified as broadly local.

Knossos: the area of Knossos is basically characterized by Neogene limestones, marls and clays. Low grade metamorphic outcrops of the Permian-Upper Triassic phyllites-quartzite series occur west and south of Knossos, near Archanes and on the east side of Mount Juktas. Previous petrographic analyses of Knossian samples have enriched the geological information available (Riley 1983, 289; Jones 1986, 225-226; Wilson and Day 1994) but we hitherto lack a detailed geological prospection.

Prinias: Prinias is situated in an area dominated by Flysch deposits containing pelitic sandstones with intercalations of calcareous turbities of the

[62]For excavations at Lyktos and Aphrati, see also Chapter 5.2.

Priabonian-Oligocene Age in the Tripoli Zone. A small area of regular alternations of grey-greenish and brown clays of the Middle Miocene extends just northeast of the site and it is succeeded further north by an equally small area of marls and limestones (IGME 1989).

Aphrati: the area of Aphrati is dominated by the Viannos formation of the middle Miocene and it generally consists of well-bedded, fluvio-lacustrine clays, silty clays and brownish sands. There are intercalations of conglomerates, especially in the basal part of the formation. At some levels, there are also limestone and lignitic interbeds. East and west of the site lies a small area dominated by Flysch which contains (psammito-peletic, folded, locally rich in olistoliths from limestones) radiolarites and basic igneous rocks, metamorphosed or not (IGME 1989, 2002).

Lyktos: Lyktos is situated in the centre of the tectonic nappe of the phyllite-quartzite series of the Permian-upper Triassic. It consists of a rock unit of low metamorphism, which is attributed to the phyllites, quartzites and sericitic schists, intercalated within the platy limestones or the metaFlysch and the carbonate rocks of the Tripolis zone. Dominant rocks and minerals are mica-carbonate schists with micro-schists, and quartzose meta-sandstones with micropsammitic texture, consisting mainly of quartz grains, and a very small amount of feldspars and chert (IGME 1989).

2.2.5. Petrographic analysis and fabric groups

All sherds were macroscopically characterised according to their technology of manufacture and clay fabric including the size, colour and frequency of inclusions and voids. The number of samples analyzed was selected based on the number of available sherds in the various collections but in compliance with the necessary qualitative and quantitative criteria of a ceramic analysis. The thin sections were prepared at the W.A. MacDonald laboratory of petrography at the INSTAP Study Center for East Crete (for samples stored at the store rooms of the Archaeological Museum of Heraklion) and at the Fitch Laboratory of the British School at Athens (for samples stored at the Stratigraphical Museum of Knossos). The analysis was carried out at the two laboratories using a Leica DMLP polarizing microscope

(MacDonald laboratory) and a Zeiss Axioskop 40 and Leitz Laborlux 12 Pol (Fitch laboratory).

The petrographic analysis resulted in the identification of four main fabric groups: Fabric Group 1: with grey siltstones and quartzites, Fabric Group 2: with phyllites, volcanic rock fragments and chert ('Aphrati fabric'), Fabric Group 3: with red sedimentary rocks ('Prinias fabric') and Fabric Group 4: micaceous fabric.

Fabric Group 1: with grey siltstones and quartzites (fig. 22; table 3).

Samples: PR.MG4, PR.MG5, PR.MG7, PR.MG8, PR.CA4, AF3, AF15, AF30, KN3, KN5, KN6, KN10, KN11, KN22, KN24, KN25, KN26, KN27, KN28, KN29, KN30, KN31, KN33.

This group is represented by thin sections from Knossos, Prinias and Aphrati, and is characterized by the bimodal distribution of grain size and by dominant inclusions of grey colour set in red groundmass. Inclusions are composed of many large, well rounded to sub-angular sandstones (quartz arenites), siltstones and quartzites, common quartz, dark red and brown phyllites, chert, quartzites which occasionally grade into schists, and clay pellets. Less common inclusions are volcanic rock fragments, mostly basalts (e.g. KN5, KN10, and KN28), biotite-rich mudstones (e.g. KN24) and serpentine. The fine fraction consists mostly of monocrystalline quartz and rare biotite mica. Inclusions are set in a fine, optically inactive matrix which ranges from dark brown to red-brown (XP) and dark brown to light brown (PPL). In some samples [e.g. KN24, KN28(?), PR.MG5, PR.MG8, AF3, PR.NE1, PR.NE2, PR.NE10, PR.C4] there are micro- and meso-planar voids which may indicate the addition of organic, vegetal matter used as temper. In general, voids appear to follow the orientation of the coarse inclusions which show very limited to no preferred orientation (e.g. KN27, A4), and are not strongly paralleled to the margins of the sherds. It is therefore most probable that these voids are the result of cracking caused during the firing stage and from the burning of organic temper rather than an indication of an exclusive use of the wheel. That said, we cannot exclude the possibility of a wheel-assisted technique, such as that of wheel-finishing, but at this stage the petrographic analysis is inconclusive.

This is a fairly homogenous group, although some samples display slight differences, for example the less strongly bimodal nature of samples KN5, KN10, AF3 and the siltier texture of the two Knossian samples KN10/11, or differences in the amount of inclusions (e.g. samples AF3 and AF15 are generally finer than the rest). In all, however, Fabric Group 1 represents a well-defined ceramic recipe where a processed (i.e. levigated, sieved) or naturally occurring fine clay was tempered with large silica-rich inclusions. This group overlaps with and is directly comparable to some coarse-ware samples from Knossos previously analyzed by Boileau and Whitley (2010) (hereafter B/W Fabric Groups). More specifically, it is comparable to four pithos samples from Knossos in W/B Fabric Group 5 (Coarse-grained fabric with grey siltstone) and to four pithos samples included in W/B Fabric Group 2 (Fine grained fabric with siltstone) (see detailed discussion below).

Fabric Group 2: with phyllites and volcanic rock fragments ('Aphrati group') (figs. 23-25; table 4).

Samples: AF1, AF2, AF4, AF6, AF8, AF11, AF12, AF14, AF16, AF27, AF29.

This group is only represented by samples from Aphrati and is characterized by coarse inclusions of phyllites, sandstones and coarse volcanic rock fragments (basalts) set in a fine, dark red to brown matrix. It was divided into three subgroups: 2a) in red clay matrix, 2b) with quartz in calcareous matrix, 2c) with dark mudstones and siltstones. Since all samples of the group are from Aphrati, it is reasonable to deduce that Fabric Group 2 represents a local fabric of the area.

Subgroup 2a: red clay matrix (fig. 23)

Samples**:** AF1, AF4, AF6, AF8, AF14, AF29.

This group is characterized by a diversity of rounded, coarse and semi-coarse inclusions. They comprise many dark brown and dark red phyllites, sandstones and siltstones (some of which are cemented into dark red clay matrix), frequent chert, rare, highly altered volcanic rock fragments (basalts), clay pellets, serpentine and calcimudstones. Sample AF14 has 'clouds' of calcareous accumulations which, in combination with the existence of clay pellets, may be indicative of clay mixing. The grain size distribution is bimodal, with the exception of AF14 which displays a rather unimodal nature. The clay matrix is dark red to brown (XP) and golden-brown (PPL). Voids and inclusions do not display a strong preferred orientation.

Subgroup 2b: with quartz in calcareous matrix (fig. 24).

Samples: AF2, AF12, AF27.

These three samples were grouped together because of their silty texture. Grain size distribution is unimodal and, similarly to subgroup 2c below, the matrix is fairly calcareous. Inclusions are analogous to the main group, namely frequent siltstones cemented in red clay matrix (some of which grade into mudstones), chert (including radiolarian), some volcanic rock fragments (basalts) and brown to dark brown phyllites. Rarer inclusions are serpentine and calcimudstones. Another characteristic of this subgroup are the many red clay pellets and the pockets of micrite. There is evidence of secondary calcite accumulation on the edge of the sherds. However, because of the presence of red clay pellets and micrite, there is a possibility of a red clay mixed with a more calcareous one. Particularly sample AF27 has highly calcareous concentrations which are easily distinctive in the matrix. There are a few micro-planar voids, the matrix is optically inactive and its' colour is yellowish-brown (XP) to greenish-brown (PPL).

Subgroup 2c: with dark mudstones and siltstones (fig. 25).

Samples: AF11, AF16.

This pair of samples is closely related to the main fabric group but it was subdivided on the basis of frequent inclusions of dark red to brown mudstones and siltstones and the calcitic environment of the sections. Samples display a weakly bimodal grain size distribution and inclusions are similar to the main group, namely coarse, sub-rounded dark red/brown phyllites and mudstones, frequent chert, siltstones (mostly cemented into calcareous matrix) and calcimudstones, frequent clay pellets and rare, highly altered igneous rocks and serpentine. Inclusions of the fine fraction are quartz and clay pellets. Another characteristic of this pair are the many planar voids which follow the orientation of the coarse inclusions and have a characteristic filling of calcite which is indicative of secondary calcite accumulation. The inclusions are poorly sorted with no distinctive orientation preference. The colour of the matrix is light reddish-brown (XP) to yellowish-brown (PPL) and it is optically inactive. Sample AF11 includes microfossils.

Loners related to Fabric Group 2

The samples below are four loners. Their distinctive characteristics necessitated their separation from the main group but they remain closely related to Fabric Group 2 and are considered to be representative of Aphrati. For this reason, they are presented here under the main fabric.

Sample AF10 (fig. 26): this fine sample is characterized by the optically active, orange clay matrix. The few coarse inclusions are poorly sorted in a very fine clay matrix, thus presenting a bimodal distribution of grain size. Inclusions consist of well-rounded siltstones, some of which are cemented in light red and orange clay matrix similar to the matrix of the sample. When inclusions in siltstones are visible, they comprise of large grains of mono- and poly-crystalline quartz and fragments of chert. Other inclusions are common red clay pellets, siltstones of orange to light brown colour which grain into phyllites and may include larger grains of quartz, and rare red mudstones. There are common meso-vughs and few micro-planar voids, some of which are filled with calcite. The colour of the matrix is very light brown (XP and PPL).

Sample AF17 (fig. 27): this sample is characterized by the presence of frequent, sub-angular, poorly sorted red and orange phyllites, siltstones cemented in red clay matrix, rare siltstones which grade into chert (or quartz- rich mudstones), red mudstones, and calcimudstones. The grain size distribution is bimodal and the colour of the matrix is light red with a darker, greyish-red core (XP) to light brown with yellowish-brown core (PPL).

Sample AF26 (fig. 28): this sample is characterized by the frequency of quartzites, quartzite schists and chert (including chalcedonic chert) and common dark red mudstones. There are micro- and meso-planar voids, predominately filled with calcite. The grain size distribution is weakly bimodal and the colour of the matrix is dark red (XP) to light brown (PPL).

Sample AF28 (fig. 29): this sample is characterized by its calcareous matrix and silty texture. The grain size distribution is unimodal and inclusions are phyllites of various types (i.e. rich in mica or quartz), quartzites, and very fine grained siltstones some of which display schistosity and grade into schists, frequent ‘stained’ chert, and few highly altered igneous rocks (basalt, gabbro?). There is abundance of fine quartz particles dispersed into the matrix which give a silty texture to the sample. The colour of the matrix is greyish-brown (XP) to yellowish-brown (PPL).

Sample AF42 (fig. 30): this sample is characterized by its semi-calcareous matrix and silty texture. It is very close to sample AF28 above but the quartz particles in AF42 are coarser. The grain size distribution is unimodal. Inclusions are dark brown phyllites, siltstones which may grade into mudstones, and chert which is mostly cemented in light brown clay matrix (similar to that of the sample). There are many micro- and meso-vughs. The clay matrix is light brown to red (XP) and reddish-brown (PPL).

Fabric Group 3: with red sedimentary rocks (‘Prinias’ fabric) (fig. 31; table 5).

Samples: PR.NE1, PR.NE2, PR.NE3, PR.NE4, PR.NE5, PR.NE6, PR.NE7, PR.NE8, PR.NE9, PR.NE10, PR.CA1, PR.CA2, PR.CA3, PR.CA5, PR.CA6, PR.MG6, PR.MG1.

This group is only represented by thin sections from Prinias and from all three different contexts at the site (Necropolis, the EIA-Archaic Town and Mandra di Gipari). It is the finest group of the assemblage, with significantly less inclusions in comparison to the rest of the samples. Inclusions are set in a semi-fine to fine matrix and they are composed of well-rounded sedimentary rocks, predominately siltstones cemented in red clay and silica-rich clay matrix, frequent sandstones, some of which grade into mudstones, and some light red mudstones. Some siltstones occasionally appear strained and grade into phyllites. Rare inclusions are micrite, calcimudstones, and well-rounded fragments of chert, although these are mostly found in the fine fraction. The grain size distribution is bimodal and the fine fraction consists of common red clay pellets and chert. With the exception of sample PR.CA2, the matrix is optically inactive and it is red to grey-red (XP) and light brown to light grey (PPL). Another characteristic of this group is the frequent, micro- and meso-planar voids which are indicative of vegetal tempering, and the colour differentiation in the matrix and the core of the sample, the first being red and the latter grey to reddish-grey, which is indicative of insufficient oxidization. Additionally, there are patches of slightly more calcareous clay in the matrix and an abundance of clay pellets (e.g.

CA5). The combination of clay pellets and calcareous concentrations could be indicative of clay mixing (e.g. a red-firing with a calcareous clay), however, it is equally possible that this reflects the composition of a naturally occurring clay of the area which is compatible with the Flysch deposits and the pelitic sandstones that are dominant in Prinias. The later hypothesis is further strengthened when the samples are studied in comparison to the thin sections from the internal finish of a kiln from Mandra di Gipari (samples PR.MG1, PR.MG3) which are most probably made of local clay and show a similar composition.

Since all samples of the group are from Prinias, we can deduce that Fabric Group 3 represents a local fabric at the site. Fabric Group 3 is very close to Group 1 and the two occasionally overlap. This explains why the five samples from Prinias (four from Mandra di Gipari, one from the EIA-Archaic Town) are classified under Group 1. The main difference between the two groups is in the colour of siltstones: in Fabric Group 3, they have a distinct reddish colour which differs from the greyish appearance of the silica-rich siltstones of Fabric Group 1.

Fabric Group 4: with mica (fig. 32; table 6).

Samples: AF39, AF49, AF51, AF52, AK1, AK2, AK3, AK4, LT1, LT2, LT3, LT4, LT5, LT6, LT7, LY1, LY2, LY3, LY4, LY5, LY6, LY7, LY8, LY9, KN4, KN7, KN8, KN12, KN14, KN15, KN16, KN17, KN18, KN19, KN20.

This is a very distinctive fabric group which includes samples from Lyktos, Aphrati and Knossos. It is characterized by the abundance of biotite and muscovite mica in the groundmass and by a diversity of inclusions, namely metamorphic, sedimentary and igneous rock fragments. Dominant inclusions are white mica-rich and biotite-rich phyllites, quartz- and mica-rich schists (some of which grade into phyllites), quartzites cemented in biotite mica, siltstones which may occasionally appear strained, and mono- and poly-crystalline quartz. Other common inclusions are well-rounded grains of chert (occasionally strained), common to few serpentine (occasionally weathered or yellow-stained), and clay pellets of various sizes (>6μm), which may contain both angular and rounded monocrystalline quartz. Rare inclusions are highly altered igneous rocks (basalts), quartz, and mica-rich shales which may alternate to quartzites, fresh and weathered feldspars, chlorite (?) (sample LY7) and very rare pyroxenes or epidotes. Depending on the sample, there are common to few iron-rich opaques (>1μm) dispersed into the matrix. Opaques are also present within some rock fragments. The inclusions are mostly rounded to sub-rounded and the grain size distribution is unimodal. The colour of the matrix ranges from light orange to dark red (XP) and reddish-brown to dark brown (PPL) and it is optically inactive to moderately active, suggesting that most samples were well-fired. There are few meso-planar voids and micro- and meso-vesicles and vughs. Voids and non-plastic inclusions are randomly orientated and, although in most samples there is a slight preferred orientation of the mica, there is not sufficient evidence to identify any exclusive use of the wheel or of some wheel-assisted technique. Samples of this group come from three of the four sampled sites. With the exception of minor differences in granulometry and the quantity of inclusions, similarities in their mineralogy do not justify any further subgrouping. It is worth noting however, that there is a slight difference in the five samples from Lyktos (LY1, LY2, LY3, LY6, LY7) which appear slightly siltier in texture and present an abundance of well-rounded quartz and frequent fragments of 'stained' yellowish chert.

Loner related to fabric group 4.

Sample KN7 (fig. 33): this sample from Knossos is not far apart from the main Fabric Group 4 in terms of its micaceous matrix and inclusions. It was, however, separated as a loner due to the high amount of biotite in the aplastic inclusions and in the matrix which give to the sample a characteristic orange to light brown colour. Additionally, this sample has inclusions set in a slightly more calcareous environment. Inclusions are mainly quartzites, siltstones, biotite schists and polycrystalline quartz, and less frequently calcimudstones and microfossils. There are few micro- and meso-vughs. The grain size distribution is unimodal and the colour of the matrix is orange to light brown (XP) to yellowish-brown (PPL).

Minor groups and loners

Minor group with biotite schist (fig. 34).

Samples: KN2, KN21, KN32.

These three samples from Knossos are closely related to Fabric Group 4 but they display a characteristic presence of biotite-rich rock fragments set in calcareous matrix and they are accompanied by calcitic accumulations within the few micro-planar voids. Other inclusions are quartzites, siltstones, biotite schists, light brown and red phyllites, serpentine, red clay pellets and microfossils. Samples KN2 and

KN32 display a stronger bimodal nature of grain size distribution than sample KN21, whilst sample KN21 has coarse grained volcanic rock fragments and epidote (?). The colour of the matrix is yellowish-brown (XP) to yellowish-grey (PPL). A finer but closely related version can be found in one pithos sample from Knossos from the petrographic analysis by Boileau and Whitley (W/B KN78).

Sample KN1 (fig. 35): this sample is characterized by the many meso-planar voids, the fairly calcareous matrix and the coarse inclusions of dark red and brown phyllites, brown and red siltstones, siltstones cemented in calcite, calcimudstones and micrite, and biotite-quartz schists. The grain size distribution is bimodal and inclusions of the fine fraction are predominately quartz, chert and biotite. The colour of the matrix is golden-brown (XP) to very light brown (PPL).

Sample KN9 (fig. 36)**:** this sample is characterized by the predominance of quartz in the fine fraction and few coarse inclusions of quartzites, chert, quartz-rich siltstones and phyllites and polycrystalline quartz. There is a colour differentiation, with the margins being dark red and the edges grey (XP) and light brown to grey (PPL). Very few micro-planar voids which display a slight preferred orientation.

Sample KN34 (fig. 37): this sample is characterized by a diversity of inclusions, namely metamorphosed igneous rocks (basalts/gabbros), quartzites and quartz- biotite siltstones which may display schistosity, quartz arenites, dark brown and dark grey mudstones, mono- and poly-crystalline quartz, red clay pellets and rare serpentine. The grain size distribution is unimodal to weakly bimodal. There are few micro-planar voids. There is colour differentiation in the clay matrix with the core being red and the margins yellowish-red (XP) and dark brown to grey (PPL). This differentiation is probably the result of secondary calcite accumulation in the margins of the sherds and in the voids. Note that this does not exclude the possibility of clay mixing of a red-firing with calcareous clay.

Sample KN35 (fig. 38): this sample has a unimodal grain size distribution and is characterized by its silty texture. Inclusions are quartz- and biotite- rich siltstones and schists, biotite-rich phyllites, quartz arenites and quartzites, and shale.

The matrix is rich in biotite and the colour is brown (XP) to golden-brown (PPL). Few meso- vughs.

Sample LY10 (fig. 39)**:** this sample is relevant to the micaceous group of the analysis and especially to the Lyktian samples. However, it was separated from the assemblage due to the difference in texture and the clay matrix. The clay matrix is greenish-brown (XP) in contrast to the rest of the samples from Lyktos which are predominantly red or bright red (XP). This is probably suggestive of a very high-fired sherd. Inclusions are of similar nature to the Lyktian samples and the main group (siltstones, sandstones, phyllites and chert) but there is a predominance of well-rounded chert fragments which give a silty texture to the sample. Grain size distribution is unimodal.

Sample AK5 (fig. 40)**:** this sample is particularly micaceous (similar to some other Aphrati samples in Fabric Group 4) but it was separated due to its darker clay core which is suggestive of a difference in the firing temperature. Additionally, the sample displays characteristic coarse-grained (>6μm) dark brown and well-rounded clay pellets with quartz and mica. Other inclusions are phyllites, chert, mono- and poly-crystalline quartz, rare feldspars and iron-rich opaques. There is abundance of muscovite and biotite mica and a notable absence of voids. The grain size distribution is unimodal.

2.2.6. Petrographic perspectives on pithos production and distribution

In this part of the study I discuss the technological features of the four fabric groups, subgroups and related loners, from a regional and site-specific perspective. The scope of this section is to further analyze the resulting fabrics groups in the context of the production sequence and distribution of pithoi and to reach conclusions regarding specific ceramic recipes. Wherever possible, my results are set against the results of other petrographic analysis of Cretan pottery.

Fabric group 1 (with grey siltstones and quartzites) is a homogeneous group and the second largest of the assemblage. This homogeneity and the bimodal grain size distribution indicate a standardized ceramic recipe of processed, levigated clay tempered with coarse, silica-rich rock fragments. This recipe is detected in three of the four sampled areas, namely in Knossos, Prinias and – less frequently – in Aphrati.

The clay-base of the samples and inclusions in Fabric Group 1 do not leave much room for comments on provenance; inclusions such as quartz and siltstones are widely spread and abundantly found across the island and the red-fired (medium to highly calcareous) clay can be consistent with the Flysch-related clays found extensively in Crete[63]. However, the technological characteristics of the group and comparisons with previous petrographic analyses provide valuable information regarding aspects of production and circulation. Fabric Group 1 corresponds with two fabric groups identified by Boileau and Whitley (2010) for the Knossian coarse wares. The group is comparable to the four pithos samples of B/W Fabric Group 5 (with grey siltstone) and the four pithos samples of B/W Fabric Group 2 (subgroup 2b, fine grained fabric with siltstone) (ibid. 232, 234). In their study of Knossian fabrics, the authors discussed the possibility of a Mesariot provenance for samples in B/W Fabric Group 5 and noted their similarity to Bronze Age fabrics of stirrup jars from north and south-central Crete. B/W Fabric Group 2 was identified as local to Knossos since it is consistent with the geology of the area and it relates to earlier Bronze Age fabrics. The analysis of the pithos fabrics presented here shows this to be a widely applied ceramic recipe which is not restricted to the area of Knossos. However, any differences between samples analyzed here and the available comparanda from Knossos are not distinct enough to point to a single workshop of production.

Notwithstanding inconclusive results in terms of provenance, the identification of Fabric Group 1 and its correspondence with comparative material assists in formulating questions regarding potting traditions in the making of pithoi. For example, is this recipe the result of the wide availability of raw materials or does it represent a conscious technological and cultural choice? Is it a combination of both? Can this ceramic recipe, which is attested in Bronze Age stirrup jars and EIA-Archaic pithoi from Knossos, Prinias and Aphrati, represent a case of accumulated technological knowledge and shared practice amongst Cretan pithos makers? Does it indicate a case of moving pithos-makers? Existing petrographic analyses cannot provide an answer to these questions. However, the results advance this discussion and strengthen the hypothesis for moving potters who practised and continued a successful ceramic recipe through time and space.

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[63] Flysch-related clay has been identified through petrographic and SEM analyses in Karphi in east Crete (Nodarou and Iliopoulos 2001).

Fabric Group 1 and B/W fabrics 2 and 5 elucidate yet another aspect of pithos making which is relevant to the potters' deep knowledge (or experience) on the manipulation of raw materials and clays. The tempering of clay with coarse non-plastic inclusions is a common cross-cultural practice known to optimize vessel performance and mechanical characteristics. For example, it enhances clay-malleability, reduces the pre- and post-firing shrinkage and promotes a most effective drying process (Rye 1976; Rice 1987). More specifically, quartz-based temper attested by Fabric Group 1 is known to enable the high-firing of vessels (from 800 to 1080 °C) and to strengthen their ability to withstand large loads (Maniatis et al. 1984). These optimizing effects have been experimentally tested (Kilikoglou et al. 1998; Vekinis and Kilikoglou 1998) and results showed that quartz enhances two necessary mechanical and physical properties of a pot: strength and toughness. Strength can be a priority for storage jars given their limited but necessary transport (Kilikoglou et al. 1998, 278). In the case of Cretan pithoi, quartz-tempering is a practice which can be traced back to the Early Minoan Period in the Mirabello area (Whitelaw et al. 1997). The present thin section analysis not only provides further evidence for this practice but also shows that it is a recipe which continued well into the Archaic period, spreading beyond the east coast of the island.

The identification of Fabric Group 2 (with phyllites and volcanic rock fragments) and of subgroups and related loners, is equally informative concerning the ceramic fingerprints of the site of Aphrati. Fabric Group 2 represents exclusively samples from the site and the inclusions are compatible with the geology of the area. We may therefore safely conclude that this constitutes a broadly local fabric, hence my designation of it as the 'Aphrati Fabric'.

Fabric Group 3 (with red sedimentary rocks) comprises the finest group of the assemblage and includes exclusively samples from Prinias. More specifically, it includes samples from the Necropolis, the EIA-Archaic Town and two samples from the kilns of Mandra di Gipari. The bimodal distribution of inclusions indicates the processing and tempering of the clay with predominately sedimentary and few metamorphic rocks which are all compatible with the geology of the site and the Flysch deposits. The technological characteristics of Fabric Group 3 attest to a levigated local clay, tempered with non-plastic inclusions and most often with organic matter. The technological and mineral traces of Fabric Group 3 and of the seventeen samples included make this a typical ceramic fabric of pithoi (and possibly of other coarse wares) from the area of Prinias.

Fabric Group 4 (with mica) is the largest group of the assemblage. It is a homogeneous group which includes coarse and semi-coarse samples from Knossos, Lyktos and Aphrati. The unimodal distribution of grain size and the optically inactive matrix of the samples, reveal no special processing of the clay or the raw materials (i.e. levigation or sieving, crushing of inclusions) and show that vessels were well-fired. It appears that pithos makers took advantage of the naturally occurring inclusions in the soil which were effective enough to achieve the desirable end result. The random orientation of inclusions and voids leaves no identifiable traces of any wheel use or of any wheel-assisted method. However, the frequent clay pellets may be indicative of clay mixing.

From a strictly mineralogical perspective, there is not enough evidence to identify a unique source for any of the samples included in Fabric Group 4. Inclusions such as mica-rich phyllites, quartzites, siltstones and quartz, may well be compatible with all three sampled areas and can be part of the phyllite-quartzite series of the wider vicinity of Knossos and Lyktos and of the Flysch melange that surrounds Aphrati. However, when viewed in the light of available comparanda, the identification of Fabric Group 4 deepens our knowledge on EIA-Archaic coarse ware fabrics in general. Two sets of complementary data assist in completing the picture: the first derives from the petrographic analysis of EIA coarse wares from Knossos and the second comes from the petrographic analysis of the material from the Pediada survey. In Knossos, Boileau and Whitley (2010, 233) have identified a similar micaceous fabric (B/W Fabric Group 4, coarse-grained red fabric with mica, feldspar and shimmer aggregates). The 14 samples of this group are mainly cooking vessels and a couple of Protogeometric/Early Geometric sherds from painted vessels. This Knossian group was somewhat puzzling for Boileau and Whitley: 'since clay mixing was practised, as evident by the large brown clay porphyroclast rich in yellow mica and shimmer aggregates in KN92, 139, it is difficult to assign a precise area of production, but it is likely to be of off-island origin' (ibid. 233). The authors suggested a Cycladic source of provenance, but the existing fabrics database remains poor for a detailed cross-examination: '...a close examination of different Cycladic fabrics, including fabrics from Naxos, has, so far, not been successful in finding a good match. One possible source we have considered is Kythera, but the presence of volcanic inclusions rules this out.' (ibid.234). This 'enigmatic' group can be illuminated by material from the Pediada, currently under analysis by Nodarou. A personal examination of the samples proved highly informative since a similar fabric group was identified in the pithos samples of the assemblage. The comparative examination of thin sections from Knossos, Pediada, Aphrati and Lyktos showed that they all share a characteristic micaceous clay paste with similar technological and mineralogical features (i.e. abundant mica, coarse shimmering aggregates, phyllites, siltstones, quartzites, no evidence for special processing of clay, etc). This suggests that a micaceous fabric was dominant in central Crete of the historical period and it is therefore unlikely that samples with similar characteristics represent off-island imports. Instead it appears that this fabric is in fact Cretan in origin and that it was predominantly used for the production of coarse wares, including storage and cooking vessels. Surely, the possibility of clay mixing or of an exchange network existing between the sampled areas cannot be ruled out, but at this stage the analysis does not point towards such a hypothesis.

The identification of this micaceous fabric might shed light on other Cretan coarse wares too. This concerns EIA juglets made similar coarse red micaceous fabric, which are copies of Cypriot Black slip and are found across central Crete. There has been notable difficulty in localizing their production areas (Kotsonas 2012, esp. 162-164)[64]. Due to the absence of sufficient petrographic results, it has been argued that the origin of these vases may be traced either in the east of Crete and the Gulf of Mirabello or the area around Knossos. Chemical analyses of some samples from Knossos and Kavousi (Liddy 1996, 473, 478-479 and Jones 2005, 525-546 respectively), however, proved inconclusive. The hypothesis that this coarse fabric is Cycladic in origin, as assumed by Boileau and Whitley (2010, 233), is rather improbable, as this study of the pithos Fabric Group 4 shows. The petrographic evidence presented here, therefore, aligns with Kotsonas' macroscopic observations, who suggested that 'most of the vases in question [i.e. Creto-Cypriot imitations] were produced in one or more manufacturing centres in central Crete and that the relevant clay beds have simply been missed by geological prospection which is far from satisfactory' (Kotsonas 2012, 164). The present study of Fabric Group 4 complies with Kotsonas' suggestion that Lyktos may have been a major production centre of

[64] Sincere thanks to A. Kotsonas for bringing his observations on this micaceous fabric to my attention.

these juglets because of the correspondence of this fabric with Late Classical and Hellenistic pottery from the same site[65].

Although it has not been possible to trace specific pithos manufacturing methods (i.e. traces of coiling), the analysis of EIA-Archaic pithos samples provided evidence for the identification of organic (perhaps vegetal) tempering in the clay used for pithoi. The macroscopic analysis revealed that a considerable number of sherds had a porous clay paste (see descriptions in Appendix 1) which was suggestive of vegetal-tempered fabrics. This was tested through the thin section analysis in an attempt to define the microscopic traits of this process. The tempering of clay with organic matter is known to enhance certain performance characteristics of vessels such as impact, abrasion and thermal shock resistance, portability, cooling, drying and heating effectiveness, and the overall workability of clay (Skibo et al. 1989). In the case of vegetal matter such as chaff or straw, the plant burned during the firing process leaves voids in the clay matrix of the final product. These voids enhance the porosity of the vessel thereby favouring heat conductivity, while thickening and strengthening the vessels walls (Rye 1976; Albero 2010). A total of 20 samples from Aphrati, Knossos and Prinias (AF1, AF3, AF27, KN3, KN6, KN10, KN22, KN24, PR.MG1, PR.MG4, PR.MG6, PR.MG8, PR.NE1, PR.NE2, PR.NE3, PR.NE4, PR.NE5, PR.NE6, PR.NE7, PR.NE8) showed some of these characteristic voids left in the matrix[66]. The voids have an elongated angular shape with clear, regular boundaries and are more easily identified in Plain Polarised Light. The photomicrographs in PPL and in XP (plate 1a-a) are considered to be representative of organic, perhaps vegetal-tempered, samples.

The very broad dating of most pithoi sampled does not allow for safe conclusions on the dating of this particular technique of organic tempering (table 7). However, macroscopic analysis of Knossian fine and coarse wares conducted through the KULP project suggests that whilst not unknown in the EIA, this technique sees a marked rise from the 7th c. onwards (Kotsonas et al. 2018, 63-64). Perhaps a future technological study of more accurately dated sherds can shed more light on trends in the potting techniques of Cretan coarse wares. That said, the plant-tempering of pithoi

[65] For which, see Erickson 2002, 47-48, n. 21, 71, n.69; Erickson 2010a, 34-35.

[66] Eleni Nodarou has kindly reviewed my grouping of the thin sections. Her expertise and advice proved invaluable; she observed that some of the samples (e.g. AF49, PR.CA3, PR.MG5) are less likely to be tempered with organic material.

may be indicative of a site-specific technology. From the 20 samples identified as organically tempered, the majority (10 samples) belongs to Fabric Group 3 (the 'Prinias fabric'), eight samples fall under Fabric Group 1 (with five samples from Knossos, two from Mandra di Gipari in Prinias, and one from Afrati), two samples are under Fabric Group 2 (both from Aphrati) and only one sample (from Aphrati) belongs to Fabric Group 4 (table 7). The association of fabrics and plant-tempering technology allows us to assume that this was a technique more widely applied in Prinias and perhaps less frequently in Aphrati and Knossos. The technique does not seem to have been applied to material from Lyktos, even though it is the site closest to Aphrati.

Conclusion

The Cretan pithos has constituted a leading ceramic shape in ethnoarchaeological studies. However, the strong affiliations of ethnoarchaeology in Greece with the Greek *laographia* have often led to unsupported hypotheses which presuppose direct links between ancient pithoi and modern *pitharia*. These hypotheses primarily revolve around an assumed unchanged craftsmanship of Cretan pithoi and modes of their production and distribution; several scholars have argued that like the early modern Cretan *pitharia* from Thrapsano, ancient Cretan pithoi were produced by itinerant potters. The petrographic analysis of EIA-Archaic pithos fabrics from central Crete presented here aimed at validating this ethnographic and ethnoarchaeological evidence and at further exploring the production and distribution of ancient Cretan pithoi.

The characterization of the pithos fabrics from four sites in central Crete resulted in the identification of four main fabric groups and related subgroups and loners. From a technological perspective, results showed the long-term use of a pottery recipe, employed throughout the EIA-Archaic periods (Fabric Group 1). This leads to two fundamental conclusions: first, when seen from a spatial and regional perspective this homogeneity relates either to artisan mobility or to a close relationship between potters from the sites. Second, comparative material from the Bronze Age suggests that a successful pithos recipe was used for a long period, be it due to the availability of raw materials or to strong potting traditions. The full chronological range of this recipe remains to be explored but we should not be surprised if future analysis shows this to extend further both geographically and chronologically. Additionally, the analysis promoted the characterization of local and site-specific petrographic groups from two main pithos production centres, namely Aphrati and Prinias (Fabric Groups 2 and 3 respectively). The benefits of this identification are twofold: first, it helps future analyses of coarse-ware imports and exports and therefore examinations of ceramic exchange within and outside central Crete. Second, it provides safer grounds for the characterization of the pottery from the sites themselves, including fine wares. Moreover the identification of Fabric Group 4 allows us to re-examine the hypothesis of off-island pithos imports and of some Cretan imitations of Cypriot pots. Like Fabric Group 1, this fabric raises the possibility of itinerant pithos makers and/or local variations of standardized manufacturing technologies. Further soil and clay sampling from the area coupled with experimental reproduction of fabrics, may reveal more on the matter. Lastly, the analysis proved particularly informative in the case of organically-tempered vessels. The microscopic examination assisted in refining our knowledge regarding traces of organic tempering in coarse wares and the photomicrographs provided in this thesis can serve as a yardstick for future archaeological or experimental studies.

The results summarized above allow us to return to the one of main questions of this Chapter, namely the correlation between ethnographic-ethnoarchaeological and science-based observations in general, and the production and distribution of Cretan pithoi in particular. The petrographic analysis showed that the connection between these two approaches remains relevant and that, despite their drawbacks, ethnography and ethnoarchaeology can be relevant to archaeometry. This is evident by a comparison of ancient and modern potting traditions. For example, we know that the early modern *pitharades* of Crete had a deep knowledge of raw materials and clays as is reflected in their clay mixing technique of *pitharochoma* with *lepidi*. This technique, which remained unchanged throughout the 19th and 20th c. AD, optimized the end-result: the coarse-grained refractory clay (found throughout the phyllite-quartzite series across Crete) and the silica-rich *lepidi* combined, strengthened the vessels' walls and facilitated their drying and firing process. We see a correspondence of such embedded knowledge in the EIA-Archaic pithos fabrics, which are predominantly of phyllite-quartzite and quartz inclusions and which remained the basic pithos-making recipe for centuries. Moreover, this study has indicated that the assumption that ancient Cretan pithoi were produced by itinerant potters, in a manner similar to the early modern itinerant pithos makers from Thrapsano, can be explored by thin section analysis. The analysis did not show any evidence for the wide trade of pithoi or of pithoi imported from outside Crete. Rather, it showed the long use of a very similar recipe across central Crete (in Knossos, Aphrati and Lyktos). Thus, in contrast to the production and trade of the *Koroneika* jars, the production model of Thrapsano may have been familiar to the ancient Cretan pithos makers too. If this was the case, ethnography, and especially the ethnography of Crete, displays potential enough to surpass its pitfalls and it can be combined with modern integrated methodologies to generate novel understandings of pots and pithoi.