

## The Fabrics of Roman to Early Byzantine Cretan Amphorae from the Sphakia Survey

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### Introduction

The Sphakia Survey Project began in 1987 with the goal of recording and interpreting the environmental and cultural history of Sphakia, in southwest Crete, from the late-Neolithic period up to AD 1900. This interdisciplinary project integrates analyses of archaeological, historical, and environmental data across the c. 470km<sup>2</sup> of the eparchy.<sup>1</sup> Sphakia is a diverse and mountainous region. The White Mountains form its heart, rising 2400 meters out of the Libyan Sea. The Frangokastello Plain characterises southeast Sphakia, while the northeast includes the beautiful, well-watered, and fertile mountain plain of Askypou. The mountains of west Sphakia are split by dramatic gorges, often running down into the sea. The Survey divided this terrain into eight geographical regions (Nixon *et al.* 1988: 163) and identified 320 sites of human activity (Moody and Nixon, pers. comm.) (**Figure 11.1**). The history of this region was divided into three broad chronological phases: Prehistoric–early Iron Age, Greek–Roman, and Byzantine–Venetian–Turkish.

Ceramic analysis has formed a major part of the research of the Sphakia Survey. Along with traditional morphological studies, the project implemented an intensive and systematic program of macroscopic fabric analysis; petrographic analysis on key fragments has helped to answer questions about clay sources, manufacturing technologies, and imitation of Cretan prototypes (Moody *et al.* 2003). The methodologies and results of the initial fabric work are supplemented by our new studies in this article.

The Roman period in Sphakia saw settlement move from higher elevations down to the coast and a general economic boom, although this occurred at different times in various parts of Sphakia (Francis 2017). In the

late-Roman to early Byzantine era, large ports grew and developed at ancient Phoinix, known today as Loutro (Francis 2017; Price 2006), and at Tarrha, at the mouth of the Samaria Gorge (Buechner 1960; Perlman 2004: 1188, no. 991; Weinberg 1960).<sup>2</sup> Both these sites preserve multiple Roman inscriptions (e.g., IC II.xx.1–7; II.xxix.1–14) and are mentioned in the *Stadiasmus Magnis Mari* (328–329, 329–330).

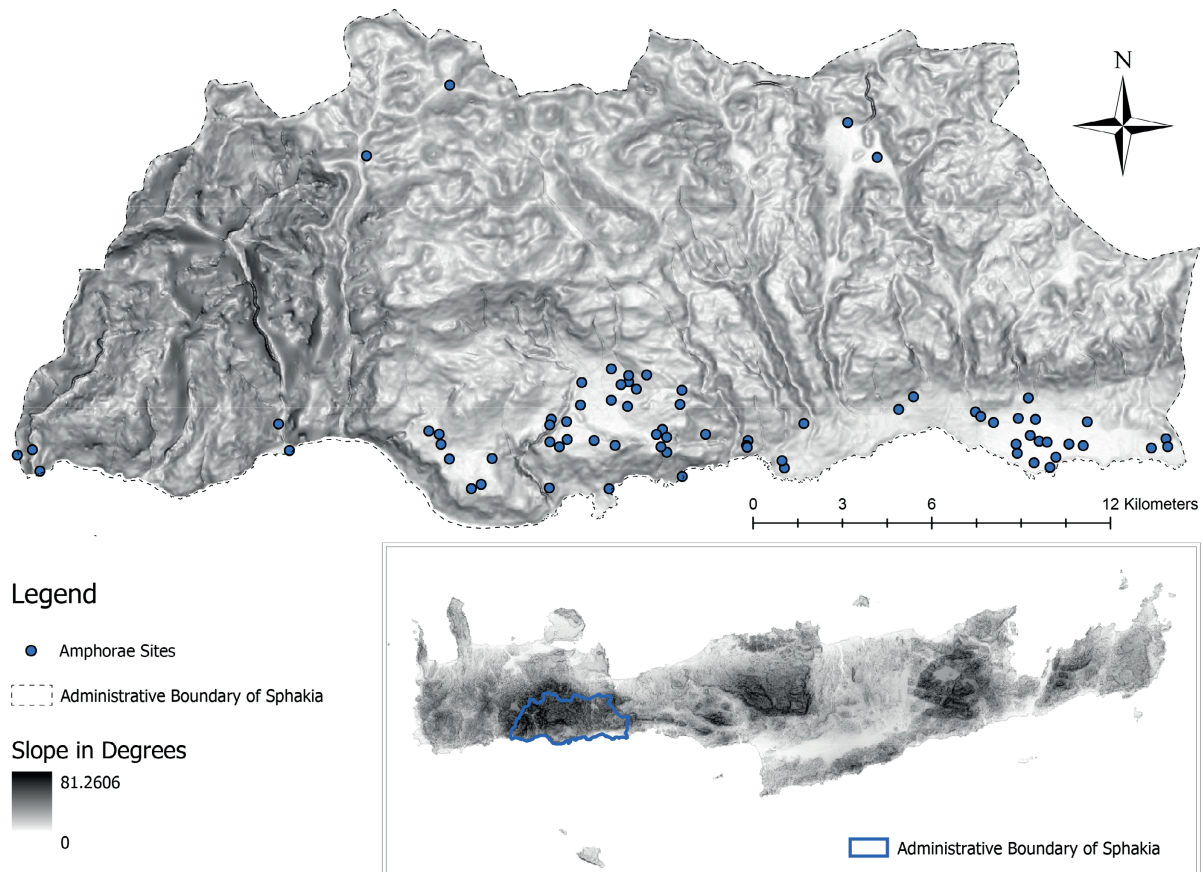
Among the many important Roman finds from the Survey are 381 fragments of Roman vessels identified as Cretan-made amphorae, and which come from 68 different sites across Sphakia.<sup>3</sup> Many of these vessels fall into the *Amphore Crétoise* 1 (AC 1), a shape first associated with Crete in the 1970s by John Riley (1979: 180–183), and *Amphore Crétoise* 3 (AC 3). Both types were described by a French/Greek study of kiln sites in the 1980s (Empereur *et al.* 1991, 1992; Marangou-Lerat 1995; Markoulaki *et al.* 1989). Further research has refined this typology, identified additional manufacturing sites, expanded the chronological range of these vessels, and widened their distribution off Crete (Gallimore 2018; Portale and Romeo 2000; Tsatsaki and Nodarou 2014). These containers are believed to have held Cretan wine, the sweet *passum* that was so popular around the Roman world, but they may have also, on occasion, transported olive oil, fish sauce, honey, or other commodities. Re-use of these vessels for other merchandise, including wine, during their lifespan is likely (Foley *et al.* 2012; Gallimore 2017: 143; Peña 2007), but the evidence for wine as the primary contents of these Cretan amphorae far outweighs, at present, information about other commodities. The distribution of these vessels around the Mediterranean and beyond is considerable, and a few examples appear even as far away as Roman Britain, an example of which displayed a *titulus picti* indicating the contents to be sorb apples (Gallimore

<sup>1</sup> The two-volume, final publication of this project is now nearing completion (Oxford University Press). For preliminary results, see, for example, Nixon *et al.* 1988, 1989, 1990; for research based on the project, see Francis *et al.* 2000; Moody *et al.* 1998; Moody 2012; Moody *et al.* 2003; Nixon *et al.* 1994, 2009; Nixon and Price 2001; Price *et al.* 2002.

<sup>2</sup> Ptolemy (*Geog.* 3.15.3) mentions Tarrha but wrongly situates it to the west of Poikilasion, beside Lissos.

<sup>3</sup> This total count does not include six fragments of Classical/Hellenistic date whose fabrics are related to later Roman amphorae; see below. These fragments are included in Appendix A (SSA 101–106).

## Distribution of early Roman to early Byzantine Amphorae Sites



Sources: DIVA-GIS, European Environmental Agency, European Digital Elevation Model (EU-DEM), version 1.1, and the Sphakia Survey Project

Author: Giulia Heinritzi

Figure 11.1. Map of Sphakia with sites mentioned in text (G. Heinritzi)

2017: 143; Williams 2003).<sup>4</sup> Service tree (*Sorbus*), however, is very rare on Crete today and was probably no more common in the Roman era, making it unlikely that sorb apples would have originated in Crete. Thus, the *titulus picti* was likely added later in a re-use of the original container.<sup>5</sup> Other amphora fragments are more ambiguous but belong to the late-Roman series of combed vessels, including fragments of the Late Roman Amphora 2 / TRC 10 form.

The manufacture of standardised, Cretan amphorae seems to have begun in the late-Hellenistic period, with examples from Trypetos in east Crete dating from the late-3rd/2nd century BC (Vogeikoff-Brogan and Apostolakou 2004: 425; Vogeikoff-Brogan *et al.* 2008).

<sup>4</sup> For distribution maps and detailed discussion of distribution, see Gallimore 2016 and fig. 12.1. Williams (2003) discusses the amphora from Britain. An amphora fragment of Cretan shape found at Carnuntum was examined in 2014 by one of the authors (Francis) but its igneous fabric did not appear to be Cretan, suggesting that Cretan shapes were imitated off the island. The authors thank Andreas Konecny and Catherine Leisser for facilitating the study of this vessel.

<sup>5</sup> There are two types of *Sorbus* in Crete, one confined to the White Mountains (*sorbus aria cretica*) and one found in the mountains of central and east Crete, especially the Asterousia (*sorbus umbellata*).

Two types have been identified: AC 5 and AC 7 in the earlier typology (Marangou-Lerat 1995: 66–67), and EC 1 and EC 2 (*Ellenistico Cretese*) in the Gortyn classification (Portale and Romeo 2000: 415); Callaghan (2014: 330) dates the inception of the AC 7 type later, in the reign of Nero (AD 54–68). These vessels are now known to have been produced at ten workshop sites, evidence that is beginning to change the perception of Crete's meagre off-island trade engagement in the Hellenistic period: Loutra (Tsatsaki and Nodarou 2014), Eleutherna (Kalpaxis 1994; Tsatsaki 2010; Tsatsaki and Nodarou 2014: 228), Gortyn (Portale and Romeo 2001: 264–66), Knossos (Eiring *et al.* 2002: 59–60), Kommos (Hayes 2000: 318–19), Matala (Hope Simpson *et al.* 1995: 336), Hierapytna (Gallimore 2015: 41–42), Keratokambos West (Marangou-Lerat 1995: 67), Lato pros Kamara, and Trypetos (Vogeikoff-Brogan and Apostolakou 2004: 420–22).<sup>6</sup>

The end point of this production is not secure. The longstanding interpretation that Cretan amphorae

<sup>6</sup> A good map with both the Hellenistic and Roman amphora kiln sites on Crete is published by Gallimore (2018: fig. 2).

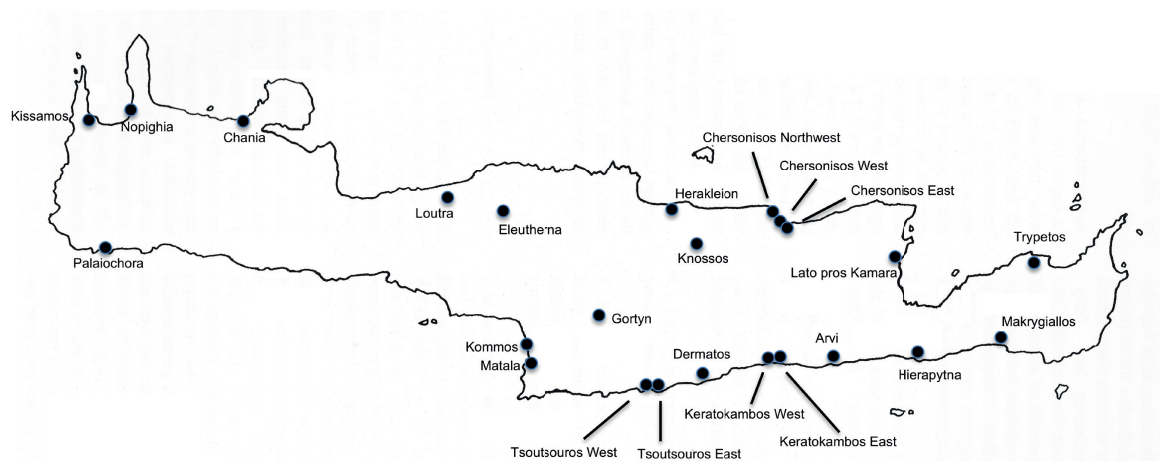


Figure 11.2. Map of known Hellenistic and Roman kiln sites in Crete (J. Francis).

ceased to be made after the early 4th century AD has been overturned by evidence from Gortyn and Eleutherna, which shows that the Cretan amphora tradition continued unbroken into the 7th century AD (Gallimore 2016: 182–184; Poulou-Papadimitriou and Nodarou 2014; Yangaki 2016: 216–221, 2005: 189, 194–197; Portale and Romeo 2000: 419–426, 2001: 260–261, 264–266, 269–279, 302–313). The later phase included the combed amphora type.

Five forms of Cretan amphorae dating to the Roman imperial period were identified by Marangou-Lerat and her colleagues and assigned to 17 production sites across the island. The re-evaluation of the typology based on amphorae from the Gortyn excavations now expands this to 18 imperial types: four early Roman, up to 250 AD (*Antico-Romano Cretese*: ARC 1–ARC 4); three mid-Roman, to the end of the 4th century AD (*Medio-Romano Cretese*: MRC 1–MRC 3); and eleven late-Roman to early Byzantine, between the 5th and 8th centuries AD (*Tardo-Romano Cretese*: TRC 1–TRC 11) (Portale and Romeo 2000).

Seventeen production centers were originally identified by the French/Greek project, but five additional centers are now known, and this number will undoubtedly increase: Kissamos (Marangou-Lerat 1995: 36–39); Nopighia (Marangou-Lerat 1995: 39); Herakleion (Marangou-Lerat 1995: 40–44); Chersonissos East (Marangou-Lerat 1995: 44–46); Chersonissos West (Marangou-Lerat 1995: 47); Chersonissos Northwest (Marangou-Lerat 1995: 47–48); Trypetos (Marangou-Lerat 1995: 48); Lagada (Marangou-Lerat 1995: 49); Makrygialos (Marangou-Lerat 1995: 49–50); Arvi (Marangou-Lerat 1995: 50); Keratokambos East (Marangou-Lerat 1995: 50–52); Keratokambos West (Marangou-Lerat 1995: 52–53); Dermalos (Marangou-Lerat 1995: 53–55); Tsoutsouros East (Marangou-Lerat 1995: 55–57); Tsoutsouros West (Marangou-Lerat 1995:

57); Matala (Marangou-Lerat 1995: 57–58); Palaiochora (Marangou-Lerat 1995: 59–60); Kommos (Hayes 2000: 318–19); Eleutherna (Yangaki 2004–2005: 509); Chania (Limantzaki 2011); and Knossos and Gortyn (Gallimore 2018: 327) (**Figure 11.2**).

Not all these kiln sites manufactured the amphora forms found in Sphakia. *Amphore Crétoise* 1, the most recognised form in Sphakia, was made at 16 kiln sites (Kissamos, Dermalos, Palaiochora, Trypetos, Lagada, Arvi, Tsoutsouros East, Tsoutsouros West, Keratokambos East, Chersonissos East, Chersonissos West, Makrygialos, Matala, Kommos, Chania, and Eleutherna), while AC 3 forms, also common in Sphakia, were made at only two (Trypetos and Dermalos). Since none of these production centers are located in Sphakia, it was important to try to identify which centers, if any, could have made the amphorae found in Sphakia, as a means of understanding the region's economy and trading networks during the Roman period. Unfortunately, there continues to be a disconnect in modern scholarship between the identification of kiln sites, the examination of the amphora fabrics and shapes within them, and studies of amphorae found in excavated contexts or on survey sites. Few studies of Roman kiln sites on Crete include precise and systematic fabric analysis, making it extremely difficult to assign vessels to a particular workshop (Gallimore 2015: 209; Yangaki 2016: 13–14). Limited petrographic fabric descriptions are available from Keratokambos (Krywonos *et al.* 1982; Riley 1979: 180–183) and Eleutherna (Joyner 2000: 230–234, nos 5 and 6) but they are hard to match up with macroscopic descriptions of Sphakiote amphorae fabrics (see below). We have, however, been able to rule out some kiln sites on the basis of local geology and macroscopic analysis of their ceramic fabrics: for example, one of the authors (Francis) analysed the amphorae from the kilns at Nopighia and Kissamos and was able to confirm that

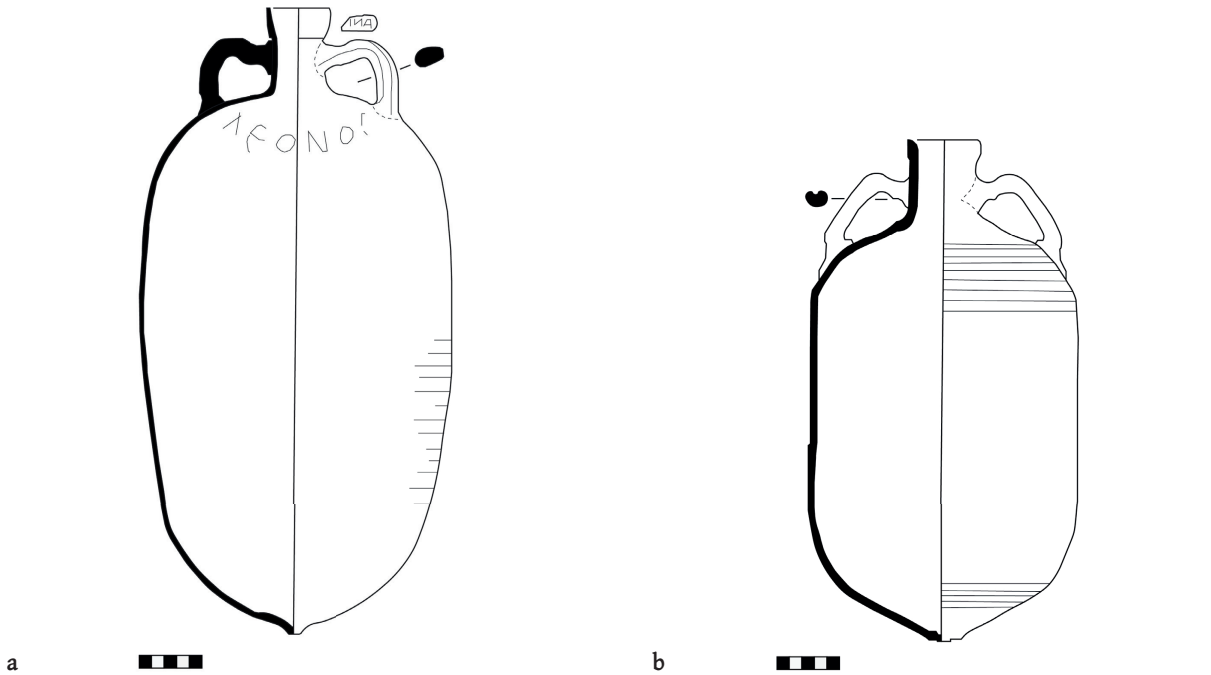


Figure 11.3a–b. a) AC1 amphora, from Chania (after Marangou-Lerat 1995: pl. III, fig. 30, A19); b) AC1 amphora, from Knossos (after Sackett 1992: pl. 189, S1,22).

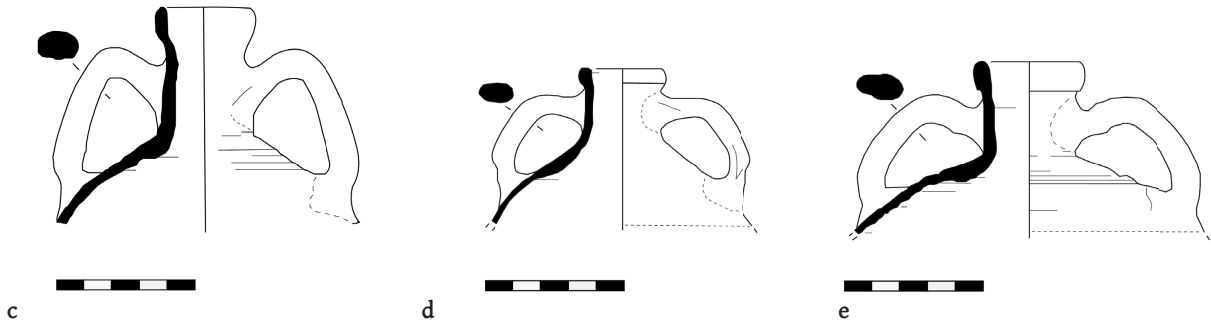


Figure 11.3c–e. c) ARC 1c amphora, from Gortyn (after Portale and Romeo 2000: 420, fig. 2, no. 18); d) MRC 2b amphora, from Gortyn (after Portale and Romeo 2000: 421, fig. 3, no. 25); e) MRC 3 amphora, from Gortyn (after Portale and Romeo 2000: 420, fig. 2, no. 21).



Figure 11.3f–g. f) MRC 1 amphora, from Gortyn (after Portale and Romeo 2000: 420, fig. 2, no. 19); g) AC 1 amphora, from Phoinix-Loutro, Sphakia Survey (A. Bowtell).

Marangou-Lerat 1995	Portale and Romeo 2000	Date
AC 1a	ARC 1a–c	early 1st to early 3rd centuries
AC 1b	ARC 1	2nd century
AC 1c	MRC 3	3rd- to 4th-century contexts
AC 1d	MRC 2	mid-2nd to mid-3rd centuries
AC 1e	None	late-3rd century (?)

Table 11.1: Concordance of AC 1 Amphora Forms



the Sphakiote vessels were not made in these centers. Our multi-disciplinary project on Sphakiote fabrics, the preliminary results of which are presented below, provides further insights.

### Cretan amphorae in Sphakia

The following discussion is based on material from the Sphakia Survey (Appendix 11.1).<sup>7</sup> The shapes of these vessels were analysed before the publication of the revised Italian typology from Gortyn. Although most of the Sphakiote examples could not be more closely identified than the broad types listed in Marangou-Lerat (1995), a small number could be assigned to the now-multiple types. In this article we split the material into two chronological sections: Roman (1st through 3rd/4th centuries AD), which includes the standardised early to mid-Roman shapes, as identified by Marangou-Lerat (e.g., 1995) and Portale and Romeo (2000); and late-Roman to early Byzantine, which comprises the combed amphorae. A final group includes Sphakiote amphora fragments that could not be identified by form.

### Early to middle-Roman amphorae

#### *Amphora forms*

*Amphore Crétoise* 1 is also known as Peacock and Williams Class 41 (Peacock and Williams 1986: 177–179), Knossos Type 2 (Hayes 1983: 143, type 2, fig. 20), and Benghazi Type MR 2 (Riley 1979: 180–183, D222–227, fig. 82). The standard version of this container has a cylindrical or oval body with rounded bottom displaying a small button at center. The neck is somewhat short and round. Curved handles are attached to the neck just below the rim and reach to the upper shoulder (**Figure 11.3a–g**).

Shallow ribbing is present on the body or shoulder in some examples. The rims take the form of an upright, moulded collar, slightly thickened and elongated along their length. AC 1 amphorae were mainly produced from the 1st to the late-3rd centuries AD but have been found in contexts as late as the early 5th century (Portale and Romeo 2000: 419). *Amphore Crétoise* 1 is certainly the most common and longest-lived Cretan amphora type (Hayes 1983: 143; Marangou-Lerat 1995: 67–77). The capacity of these vessels is estimated at 20–25 liters; Gallimore (2018: 380) cites capacities of 24–25 liters, while Vogt (2000: 90) gives a broader range of 20–25 liters.

*Amphores Crétoises* 1 are extremely common on Crete and occur at a large number of sites; it is clear that their contents were distributed and consumed on the island as well as exported. Published examples come from the Akrotiri Peninsula (Raab 2001: 106, no. 149, 114, no. 201, 131, nos 358–359, fig. 49), Gortyn (Portale 2011: 127–128, fig. 36; Portale and Romeo 2000: 419–422, figs 2–5, 2001: 270–272, no. 10, 276–277, no. 15, 307–308, no. 67), Eleutherna (Vogt 2000: 90–92, figs 41–43; Yangaki 2005: 183–188), Knossos (Forster 2009: 156–157, 159–160, nos 259–268, fig. 4.41; Frend and Johnston 1961: 228, no. 101, fig. 19; Hayes 1983: 143, Type 2, A11–A15, fig. 20; Sackett 1992: 178, N1,49, fig. 6); Ierapetra (Gallimore 2015: 211, 214–218, nos 382–395), and Argyroupoli (Gavrilaki-Nikoloudaki 1988: 38, fig. 5). *Amphore Crétoise* 1 is the most common Roman amphora identified at Kommos (Hayes 2000: 320, no. 53, pl. 4.67). The type is the most frequent ‘local amphora’ in the Gournia survey area (Hayes and Kossyva 2012: 168) but is uncommon in the Galatas and Kavousi survey areas (Gallimore 2017b: 237; Haggis 2005: 58, fig. 25, site 1.15). Examples also appear at Kastelli Kissamou, Phalasarna, Nopighia-Drapania, Aptera, Kouphonisi, Makrygialos (Marangou-Lerat 1995: 68–72, A9–A79, pls I–X), Chania (Limantzakis 2011), and the cave of Eileithyeia at Tsoutsouros (Grigoropoulos 2011: 166–167).

Marangou-Lerat (1995: 67–77) divided this form into five sub-types (AC 1a–e), while the Gortyn typology splits them between ARC 1, MRC 1, MCR 2 and MRC 3 shapes, with the latter forms running into the 4th century AD (Portale and Romeo 2000: 419). **Table 11.1** presents a concordance of the two current systems for these amphora types and their dates.

*Amphore Crétoise* 1 fragments are relatively common in Sphakia, with 90 identified fragments, mostly rims and handles (**Figure 11.4**); unaffiliated body sherds are not included in this number, as they cannot be assigned to a specific shape with confidence. In addition, the publication of the revised Gortyn typology appeared after the Sphakiote amphorae had been studied, so only those that were drawn or photographed have been reclassified (**Appendix 11.1**); the remainder are identified broadly as AC 1 vessels.

The second type of Roman Cretan amphora identified in Sphakia is the *Amphore Crétoise* 3, also referred to as Knossos Type 1 (Hayes 1983: 140–143; Marangou-Lerat 1995: 82–84; Portale and Romeo 2000: 419). This amphora has a slightly smaller capacity than AC 1 vessels and displays flattened, more angled handles, a demarcated join of neck and shoulder, and a pronounced, moulded rim often with a flat top surface (**Figure 11.5a–b**). The neck is sometimes lightly ridged, and the vessel can be surprisingly thin walled. These amphorae were produced from the early 1st to the end 2nd/early 3rd

<sup>7</sup> The catalogue numbers for the fragments listed in the Concordance (Appendix A) are bolded throughout this text. The abbreviation ‘SSA’ refers to ‘Sphakia Survey Amphora,’ the numbering series of the fragments addressed in this article.

## Distribution of AC1 Roman Amphorae Fragments

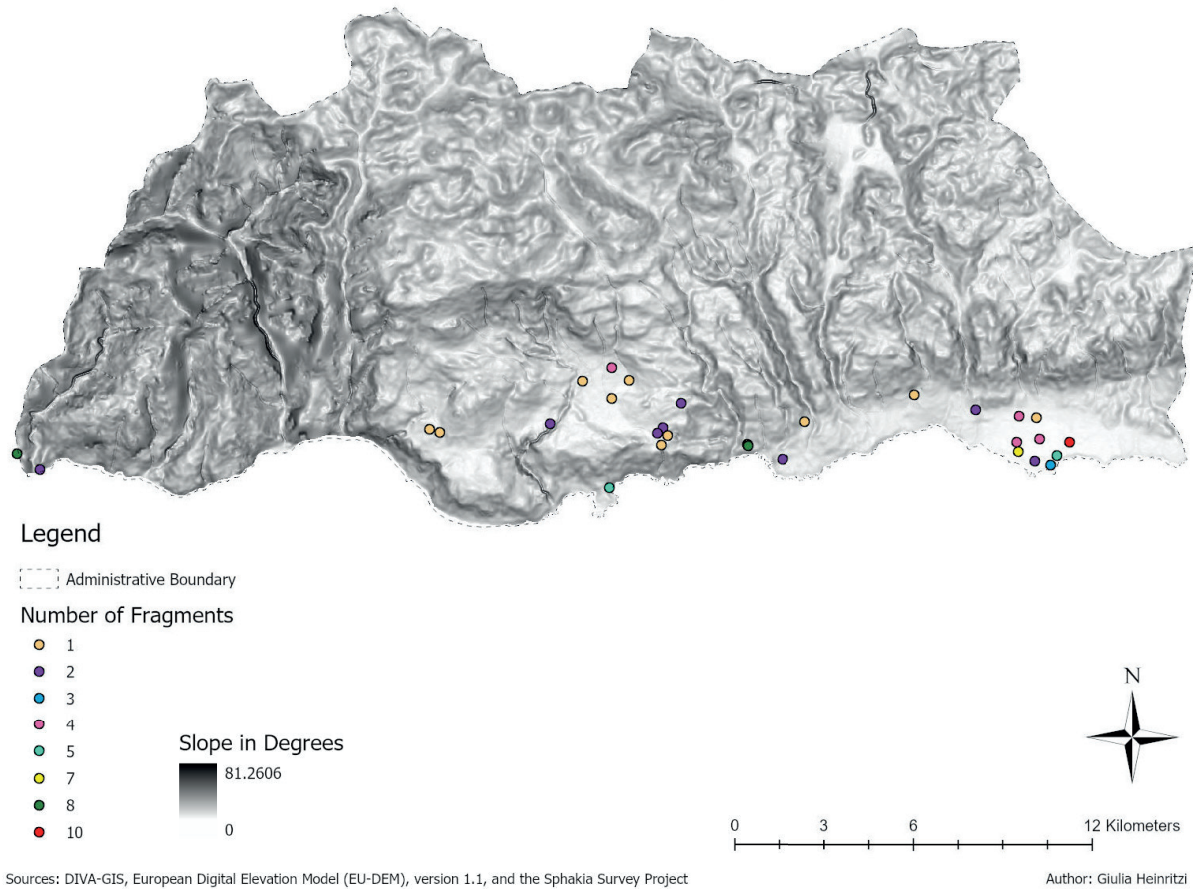


Figure 11.4. Distribution of AC 1 amphorae in Sphakia (G. Heinritzi).

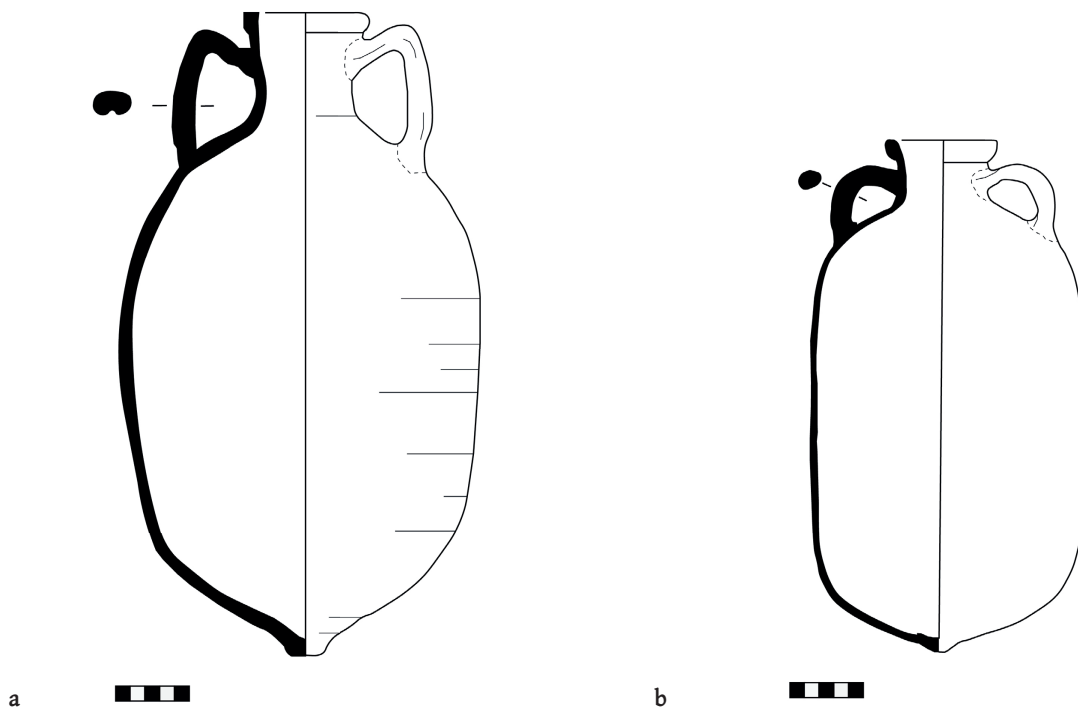


Figure 11.5a–b. a) AC 3 amphora, from Pompeii (after Marangou-Lerat 1995: pl. XVIII, fig. 68b); b) AC 3, composite (after Marangou-Lerat 1995: pl. XVII, fig. 64).

## Distribution of AC3 Roman Amphorae Fragments

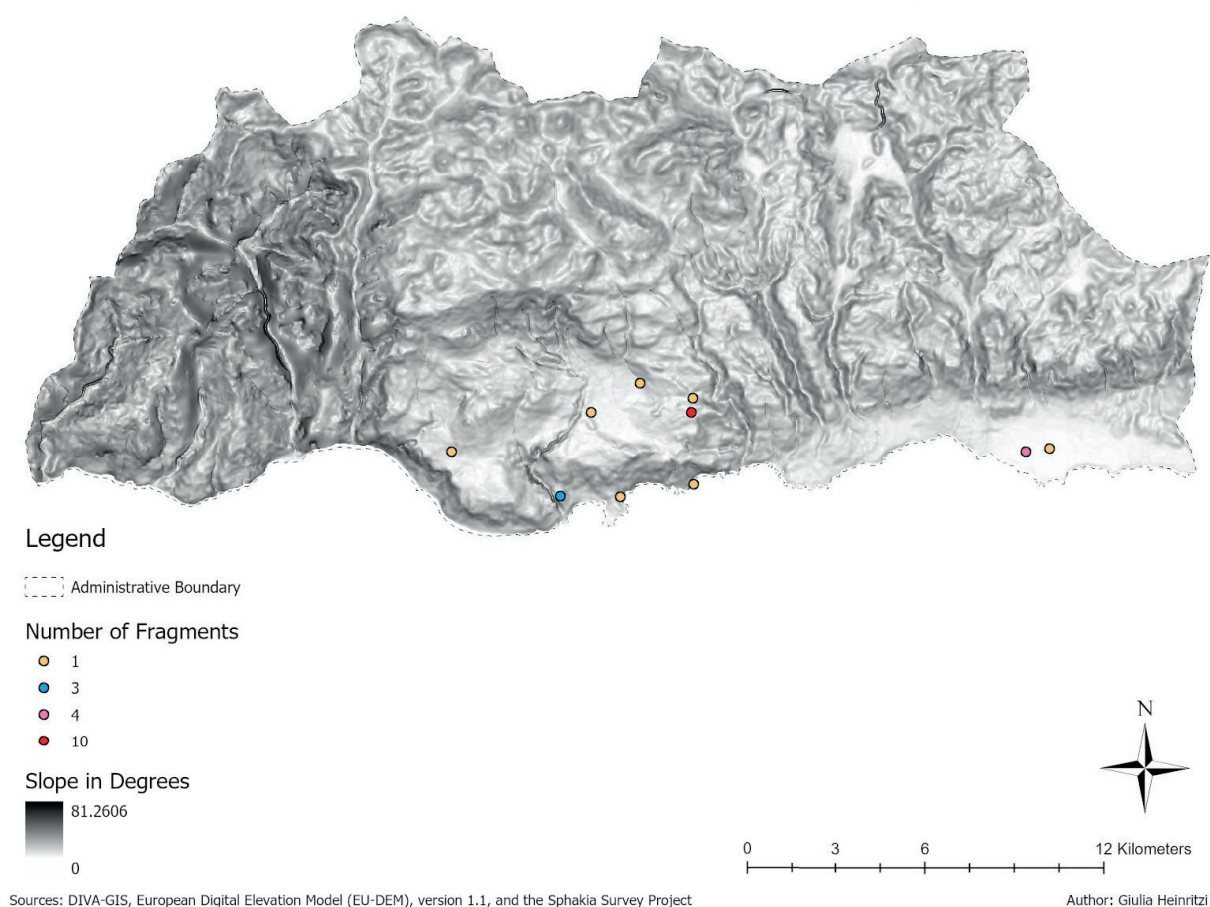


Figure 11.6. Map: distribution of AC 3 amphorae in Sphakia (G. Heinritzi).

century AD. In the Gortyn typology, AC 3 amphorae are termed ARC 3 (Portale and Romeo 2000: 419).

*Amphore Crétoise* 3 fragments have a restricted distribution on Crete, but the form is well represented off the island (Marangou-Lerat 1995: 84). It is known in east Crete at Ierapetra (Gallimore 2011: 334, no. 413, fig. 5.35), and Agios Nikolaos (Marangou-Lerat 1995: 83). In central Crete, examples are cited at Knossos (Hayes 1971: 269, no. 52, pl. 39b, 1983: 141–143, Type 1, fig. 20; Sackett 1992: 190, A2,102–104), Herakleion (Empereur *et al.* 1991: 492, fig. 9; Marangou-Lerat 1995: 83), Kommos (Hayes 2000: 319, no. 46), Kaloi Limenes (Marangou-Lerat 1995: 82), Gortyn (Portale 2011: 129; Portale and Romeo 2000: 419, 2001: 274–275, no. 12), and Tsoutsouros (Grigoropoulos 2011: 166). In west Crete, AC 3 vessels have been identified at Chania (Raab 2001: 72, no. 101, fig. 17, 72, no. 103, fig. 17), and from the sea at Loutro prior to the work of the Survey (Marangou-Lerat 1995: 82).

In Sphakia, only 24 fragments of AC 3/ARC 3 amphorae were identified (Figure 11.6), far fewer than the 90 AC 1 types. *Amphore Crétoise* 3 shapes have not yet been

divided into sub-forms, and only a few of the Sphakia examples find direct, published parallels (Table 11.2).

SSA No.	Parallels (Marangou-Lerat 1995)
28	Fig. 54 A108
33	Fig. 67 A113–A115
32	Fig. 66 A109–A110
29	Fig. 67 A116
27	Fig. 67 A113–A115

Table 11.2: AC 3 Forms identified in Sphakia

*Macroscopic Fabric Analysis (MACFA)*

Fourteen fragments (15%) of AC 1 amphorae were analysed macroscopically. Many fabrics were too fine to identify any inclusions other than ‘sand’ (SSA 6, 20, 21, 24, 25). We were, however, able to distinguish one consistent fabric that we call ‘Cretan Sand’ (SSA 7, 17, 23). ‘Cretan Sand’ has a sand-based paste with abundant, small to tiny, calcareous grits, occasional silver mica, and/or a fine mixture of metamorphic grits. They are usually fired to a pale colour, which ranges from buff



to buff-tan to pink. One example of an AC 1 sherd made of 'Cretan Sand' (**SSA 7**) was included in the analytical program (presented in detail below) and belongs to Group A. Since the beneficial properties of adding calcareous material to wine to control acidity and ageing was well known in antiquity (Columella 12.20.8), it may be that the frequent use of calcareous fabrics for amphorae intended to hold wine was intentional.

Three other AC 1 fabrics were isolated macroscopically: one with abundant calcitic pseudomorphs (**SSA 13**), a quartz-rich, metamorphic clay (**SSA 11**), and one with milky quartz and red ferrous in a metamorphic sand paste (**SSA 16**). This last fragment was included in the analytical fabric program and belongs to Group B.

Three fragments (12.5%) of AC 3 amphorae were analysed macroscopically and each sherd was a different fabric. One is a mixed sand paste (**SSA 29**) and belongs to our analytical fabric Group A. Another is an iron-rich paste with large amounts of sandstone and milky quartz (**SSA 31**) and belongs to our analytical fabric Group B. A third sample contains some gold mica (**SSA 33**) and was not part of the analytical fabric program.

As noted previously, linking any of the above-defined fabrics to known Cretan amphora production centers is problematic because there are so few petrographic or macroscopic descriptions of fabrics from kiln sites. Keratokambos and Eleutherna,<sup>8</sup> both of which produced AC 1 but not AC 3 forms, are exceptions. Keratokambos fabrics are characterised by chert and limestone with no mica (Krywonos *et al.* 1982). Eleutherna fabrics are characterised by abundant mica and a peculiar mix of metamorphic grits (Joyner 2000: 230–234, nos 5 and 6). Neither of the above fabrics corresponds to Sphakiote ones.

#### *Distribution and use in Sphakia*<sup>9</sup>

*Amphore Crétoise* 1 and AC 3 amphora have distinctive distributions in Sphakia. *Amphore Crétoise* 1 vessels were widespread: 90 fragments scattered at 31 sites across coastal, lowland, and middle Sphakia (**Figures 11.4, 11.6; Table 11.3**). Upland Sphakia, which includes the Madhares (the high mountain pastures of the White Mountains) and the Askyphou plain, preserved no AC 1 fragments. This suggests that AC 1 amphorae arrived in Sphakia by boat through harbours like Phoinix-Loutro (5.11), or smaller ports and/or anchorages like Ag. Nikolaos (Trypiti) (1.01) in the far west at the mouth of the Trypiti Gorge, Khora Sphakion: Tholos (6.19)

in central Sphakia, or Ag. Nikitas (8.50) in the east on the Frangokastello plain. Curiously, AC 1 amphorae are scarce at these sites, preserving only five, two, two, and three fragments respectively. Instead, most AC 1 sites are small, one- or two+ -house habitations located in east Sphakia (36 fragments from nine sites: 8.07, 8.17, 8.35, 8.37, 8.39, 8.40, 8.44, 8.52, 8.56) and central Sphakia (25 fragments from 11 sites: 4.17, 4.27, 4.34, 4.40, 4.41, 4.42, 4.46, 4.66, 6.06, 6.19, 6.25). All of these sites are in the hinterlands of the ports and typically preserve one to four fragments. The only exceptions are the single-house site Bungalows NE (8.56) and the two+ house site Ag. Pelagia Structure (8.40), with 10 and seven fragments respectively. Both of these collections, however, could represent single vessels as all the sherds were grouped together and are likely to have been made of the same fabric; one example from the latter site belongs to analytical fabric Group B (**SSA 18**).

Larger settlements (10 and >20 houses) also have AC 1 amphorae but the number of fragments is proportionally little more than that found at small sites — 14 fragments from five sites: 3.03, 4.28, 5.11, 8.38, 8.50 — indicating that site size was not an important factor in the final use (or re-use) of these amphorae.

We also note a strong association between AC 1 amphorae and beekeeping equipment. Two sites with a lot of beekeeping vessels also preserve relatively high numbers of AC 1 amphorae: Beehive Area (1.07) had eight AC 1 fragments and 17 beekeeping, and Ag. Triadha (6.06) had eight AC 1 fragments and 22 beekeeping. Sixteen other sites scattered across Sphakia also preserved AC 1 amphorae and ceramic beekeeping equipment, albeit in smaller proportions: 3.03, 3.05, 4.17, 4.27, 4.34, 4.40, 4.41, 5.11, 6.19, 6.25, 8.07, 8.17, 8.38, 8.39, 8.44, 8.50. Although it is hard to prove that these two types of vessels were entirely contemporary (beehives are notoriously difficult to date with precision), this association occurs at 63% of all sites in Sphakia with AC 1 amphora, which is a high proportion and likely to be meaningful.

The distribution of AC 3 amphorae in Sphakia is similar to AC 1 vessels but not identical. Twenty-seven fragments of AC 3 amphorae were found at 10 sites (**Figure 11.4; Table 11.3**). Like AC 1, no AC 3 fragments were found in upland Sphakia, but unlike AC 1, the vast majority of AC 3 amphorae come from central Sphakia (19 out of 24, 79%); No AC 3 sherds were found in west Sphakia and only five fragments were found in the east, suggesting that most AC 3 vessels arrived through the ports and small anchorages of central Sphakia; in fact, the only port with AC 3 amphorae is Phoinix-Loutro (5.11, 1 fragment) in central Sphakia.

<sup>8</sup> Although no kiln has been found at Eleutherna itself, the unique character of the Eleutherna fabric indicates a source in the northern part of the Mylopotamos Mountains and has been used to argue for the existence of an unknown kiln site there (Vogt 2000: 90).

<sup>9</sup> Unbolded numbers in brackets following site names represent the Sphakia Survey site numbers; see **Table 11.3**.



Again, like AC 1, the majority of AC 3 sherds come from small one- or two+ -house habitations; however, they were represented by only one fragment. The exception is Kastri (4.66), a one-house site on the Anopolis Plain, with 10 AC 3 fragments. This is, however, likely to be a single vessel, as the sherds are grouped together and described macroscopically as the same fabric; one sherd studied in depth belongs to analytical fabric Group A (SSA 29).

Six out of the 10 known AC 3 sites include beekeeping equipment (60%, 4.37, 4.67, 5.01, 5.11, 8.38, 8.39), a significant association and percentage that is again similar to AC 1.

Only four sites preserved both AC 1 and AC 3 amphorae fragments: two sites in central Sphakia — the large harbour town Phoinix-Loutro (5.11: 5 and 1 fragments, respectively) and a single-house site on the Anopolis plain above the harbour, Kastri (4.66: 2 and 10 fragments, respectively); and two sites in east Sphakia both on the Frangokastello Plain — the large settlement Hood B7 (Ag. Astratigos) (8.38: 4 and 4 fragments, respectively), and a single-house site Sheepshed (8.39: 4 and 4 fragments, respectively).

The foregoing discussion presents a dilemma: although AC1 and AC 3 amphorae must have entered Sphakia via its ports and anchorages, mainly in central and eastern Sphakia, most examples come from small sites in the hinterland. What drove the movement of these vessels out of their ports of entry and into the hinterland? Does this distribution result from a desire for the original contents of the pots, or from a desire for the pots themselves?

Although it may not explain every findspot, the strong association between AC 1 and AC 3 amphora fragments and sites with beekeeping equipment suggests that re-use of the vessels, rather than a desire for their contents, could account for as much as 60% of the depositional pattern. For example, it seems probable that at sites with beekeeping and AC 1 and/or AC 3 vessels at least some amphorae were re-used to bring water to bees or to store honey after harvesting hives on site, perhaps for future export (Francis 2016: 96). A Cretan amphora found at Pompeii has a *dipinti* interpreted as referring to the contents as thyme-flavored honey (CIL 4.5741; Peña 2007: 103–104). Some amphorae may even have been re-used as beehives. Transport amphorae and beehives are similar in size and construction and have similar requirements: hives, like amphorae, are moved around a lot, so both vessel types need to be durable enough to withstand considerable and frequent movement, but light and small enough to be portable (Francis 2016: 7). The importance of pot re-use and recycling when considering the final resting places of these amphorae

should not be underestimated (Abdelhamid 2016; Peña 2007).

### *Late-Roman to early Byzantine combed amphorae in Sphakia*

This section examines the amphorae from Sphakia dating from the 4th through the 7th centuries AD and thus spanning the late-Roman into early Byzantine periods. One hundred and ninety-three fragments were identified as belonging to these vessel types; this number does not include a large amount of undefined body sherds, so the net count may well be higher.

#### *Amphora forms*

Sixty-six of the Sphakiote combed fragments are tentatively identified as LRA 2 amphora types, also known as Peacock and Williams Class 43 (1983: 182–184), Benghazi LR 2 (Riley 1979: 217–219), and Keay Type LXV (Keay 1984: 352–357; Yangaki 2005: 201–203). This is the only shape that can be securely identified among this assemblage because the overwhelming majority of fragments are body sherds that cannot be associated with specific shapes. This is also the case for the combed fragments from excavations at Ierapetra (Gallimore 2015: 228).

Late Roman 2 amphorae were manufactured at a variety of centers, with workshops identified in the Aegean, Greece, and the Black Sea region (Gallimore 2015: 228; Peacock and Williams 1986: 182; Vogt 2000: 83). A more precise workshop can sometimes be identified based on shape, such as Kounoupi in the Argolid (Zimmerman Munn 1985: 342–343). Crete can now be added to this list: the TRC 10 amphora, made in recognisably local clays at least at Gortyn, is an imitation of this international type (Portale and Romeo 2000: 422–426). The LRA 2 is a globular vessel with dense, horizontal combing on the upper body/shoulder area; this can be horizontal or wavy. The relatively short neck splays outwards to the shoulder, and the rim has a rounded top and concave interior surface. Handles are short, oval in section, and attached to the upper shoulder and lower neck (Figure 11.7a–b).

These amphorae flourished between the 4th and early 7th centuries, approximately a century after the cessation of the AC types classified by Marangou-Lerat and discussed above. The later dating of MRC 2 and MRC 3 amphorae to the 3rd century, however, narrows the gap between these two amphora series. *Tardo-Romano Cretese* 1 starts in the late-4th century (Portale and Romeo 2000: 419–422).

Late Roman Amphora 2 amphorae are said to have contained oil, which, if also the case for Crete, sets them apart from the earlier AC, ARC, and MRC vessels

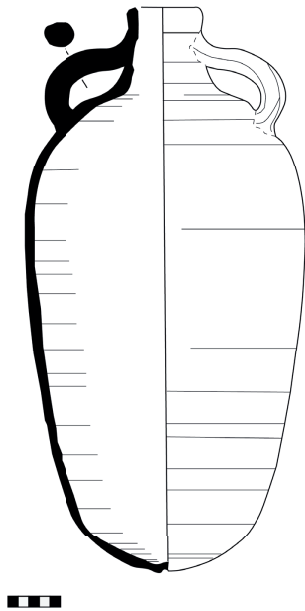


Figure 11.7a. LR 2 amphora, from Gortyn (after Portale and Romeo 2001: pl. LVd).

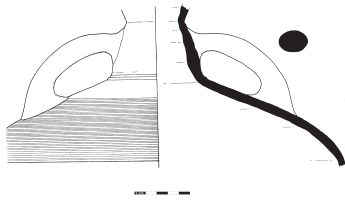


Figure 11.7b. LR 2 amphora, from Wells, Sphakia Survey (A. Bowtell).

whose manufacture was probably tied to Crete's wine export industry (Karagiorgiou 2001: 147; Vogt 2000: 83–84). Little is known about olive oil production in Roman Crete, although the ongoing identification of olive presses, mostly through survey projects as at Gournia (Vogeikoff-Brogan 2012: 87), suggests that a re-assessment of this enterprise is warranted (Gallimore 2017a: 143–144).

#### *Macroscopic fabric analysis (MACFA)*

Macroscopic fabric analysis was performed on forty-three fragments of Sphakiote combed amphorae, a group that includes LRA 2 fragments. Interestingly, many of our combed amphorae fabrics are macroscopically very similar to 'Cretan Sand', the common AC 1 fabric described above: 'Orange Calc Sand' (SSA 35, 53) "'Cretan" Buff-Tan Fine Calc Sand' (SSA 43, 49, 50, 51, 71), 'Tan with Calc' (SSA 40, 77, 78), "'Cretan" Buff-Tan Sand' with dark ferrous (SSA 52, 56) and with mixed metamorphic grits (SSA 50). Four of these sherds were included in the analytical fabric program and all belong to Group A (SSA 35, 51, 52, 53), as did some AC 1 and AC 3 shapes. This suggests that the same production source was used to make amphorae for hundreds of years.

Other combed amphorae sherds are made of very fine clays fired orange (SSA 45, 55, 56, 60, 74, 76) and buff-tan (SSA 38, 48, 59, 66). Some contain visible sand but nothing distinctive (SSA 36, 37, 58, 62, 63, 65, 67).

One fabric has a mixed metamorphic paste with dark ferrous grits (SSA 54); another is characterised by fine quartz, silver mica, and soft-red inclusions (probably siltstone/sandstone), a fabric we call 'QMSR' (SSA 64).

Three sherds contain a lot of silver mica (SSA 42, 70, 47); another has enough gold mica to suggest an off-Crete source (SSA 61). Other fabrics have dominant calcitic pseudomorphs (SSA 44, 73, 75, 79), glassy quartz (SSA 46), and soft red (probably siltstone) inclusions (SSA 72, 69). An oddity is a semi-lustrous fabric with metamorphic inclusions (SSA 57).

#### *Distribution and use in Sphakia*

One hundred and ninety-three combed amphora fragments, including the LRA 2 vessels, have been identified from 49 sites in Sphakia, but not all of these fragments are believed to be Cretan (Figure 11.8; Table 11.3).

Their distribution in Sphakia differs significantly from that of the AC 1 and AC 3 vessels. They are more abundant and more widespread across the eparchy than the earlier amphorae, and now appear in greater numbers in the west (12 sherds) and upland Sphakia: the Madhares (2 sherds); the Askyphou Plain (2 sherds). Although the numbers in the uplands are low, compared to the complete absence of the earlier amphora types, this distribution may be significant. The increases seen in west Sphakia — a dozen fragments identified at four sites — are also noted across the eparchy: 107 fragments at 28 sites in central Sphakia, and 75 fragments at 17 sites in the east. The overall greater numbers of examples as well as their wider distribution shows an increased circulation of Cretan amphorae but may also indicate shifts in production and circulation of various goods, especially if the earlier AC amphorae were used predominately for wine and the later combed vessels for oil.

One-house sites have the lowest concentrations of combed amphora fragments — one to four sherds; exceptions are Ag. Ioannis Vokolos S (8.44: nine fragments) and Whispering Pines (4.59: 13 fragments). Sites with two or more houses preserve one to 13 sherds; larger assemblages are at Kombitsi (4.30: seven fragments), Limnia 2 (4.41: 13 fragments), and Lime-Kiln (8.36: 14 fragments). Ten to 20 or more house sites had consistently slightly larger numbers — around three to four fragments each, while Tarrha (1.28) and Hood B6 (8.23) both have seven, Phoinix-Loutro (5.11) has 21, and Hood B7 (Ag. Astratigos) (8.38) contains 20.

## Distribution of Combed Roman Amphorae Fragments

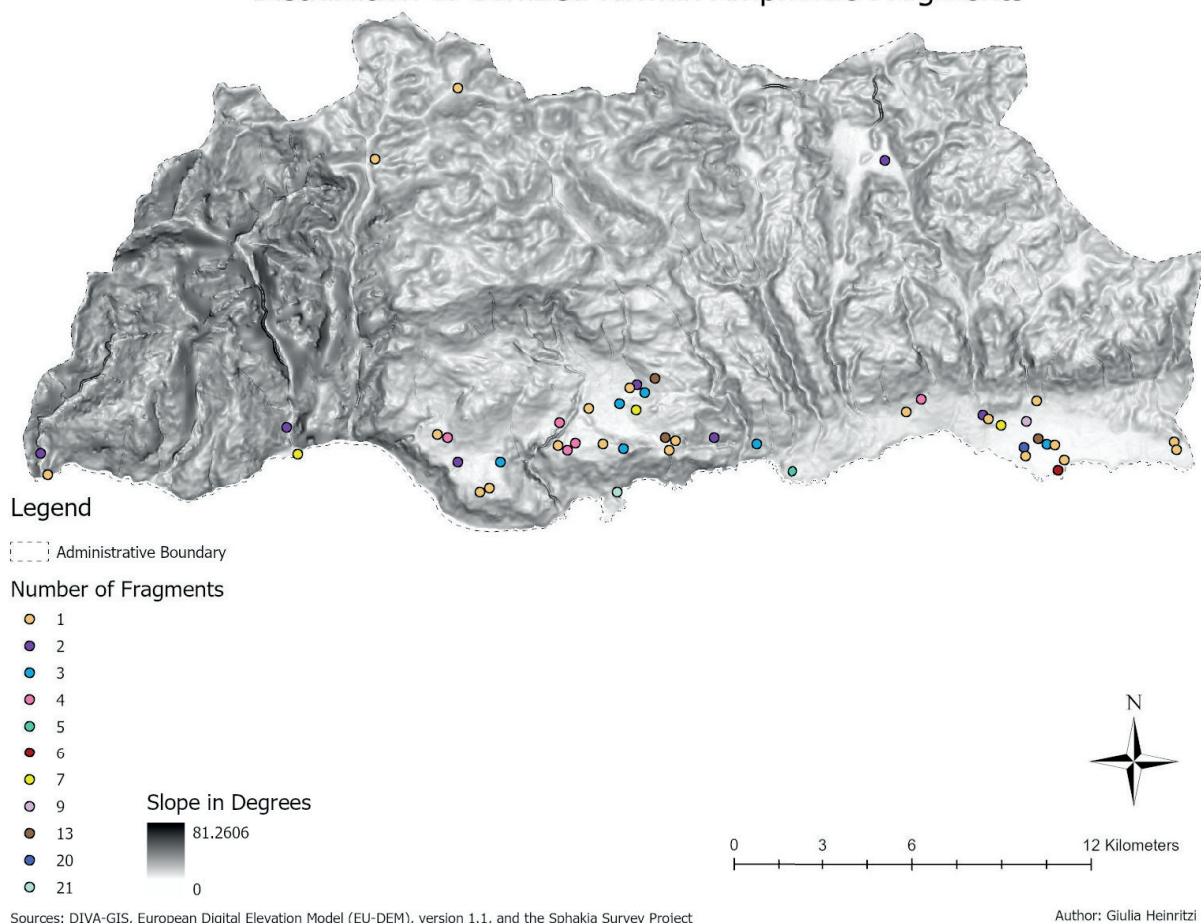


Figure 11.8. Distribution of combed amphorae in Sphakia (G. Heinritzi).

Although larger sites tend to have greater numbers of fragments, this is not a consistent pattern, and several large estate centers, like Gourounokephalo 3 (3.12) and Assokephalo (4.03), both in central Sphakia, had only one and four fragments, respectively. Nevertheless, unlike AC 1 and possibly AC 3 amphorae, larger concentrations of combed amphorae tend to be found at larger sites.

The important harbour site of Phoinix-Loutro has the largest collection of combed amphora fragments in Sphakia (21 sherds), contrasting with the few AC 1 (5 sherds) and AC 3 (1 sherd) fragments found there. It may be that the vessels were awaiting transshipment through the site's harbour rather than redistribution inland, marking a significant change from the earlier period. Two other anchorages or ports had moderate numbers of combed amphorae: Tarrha (1.28: seven fragments) and Ag. Nikitas (8.50: six fragments).

Once again, a strong correlation exists between ceramic beekeeping equipment and amphorae: 32 of the 49 sites (65%) contain both shapes. The utility of large, closed vessels for carrying water to apiaries or decanting or

storing honey during harvest can be emphasised once again. Some of these amphorae may also have contained honey for export (Francis 2016: 96).

Only three sites preserve all three types of amphorae — AC 1, AC 3, combed — demonstrating a continuity of use of Cretan transport containers throughout the Roman period. One is the major harbour site in central Sphakia, Phoinix-Loutro (5.11), where such an array is not unexpected. The other two sites are in east Sphakia on the Frangokastello Plain: the large settlement Hood B7 (Ag. Astratigos) (8.38) and the single-house site Sheepshed (8.39).

#### *Cretan amphorae of unknown form*

Not all Roman amphorae fragments deemed to be Cretan products could be associated with specific forms nor did they display combed surfaces. Nevertheless, the fabric, possible origins, and findspots of these amphorae enhance the patterns revealed by those with known shapes. This group contains 70 fragments, 27 of which were examined macroscopically (Table 11.3); five received petrographic analysis. All studied



## Distribution of Unknown Roman Amphorae Fragments

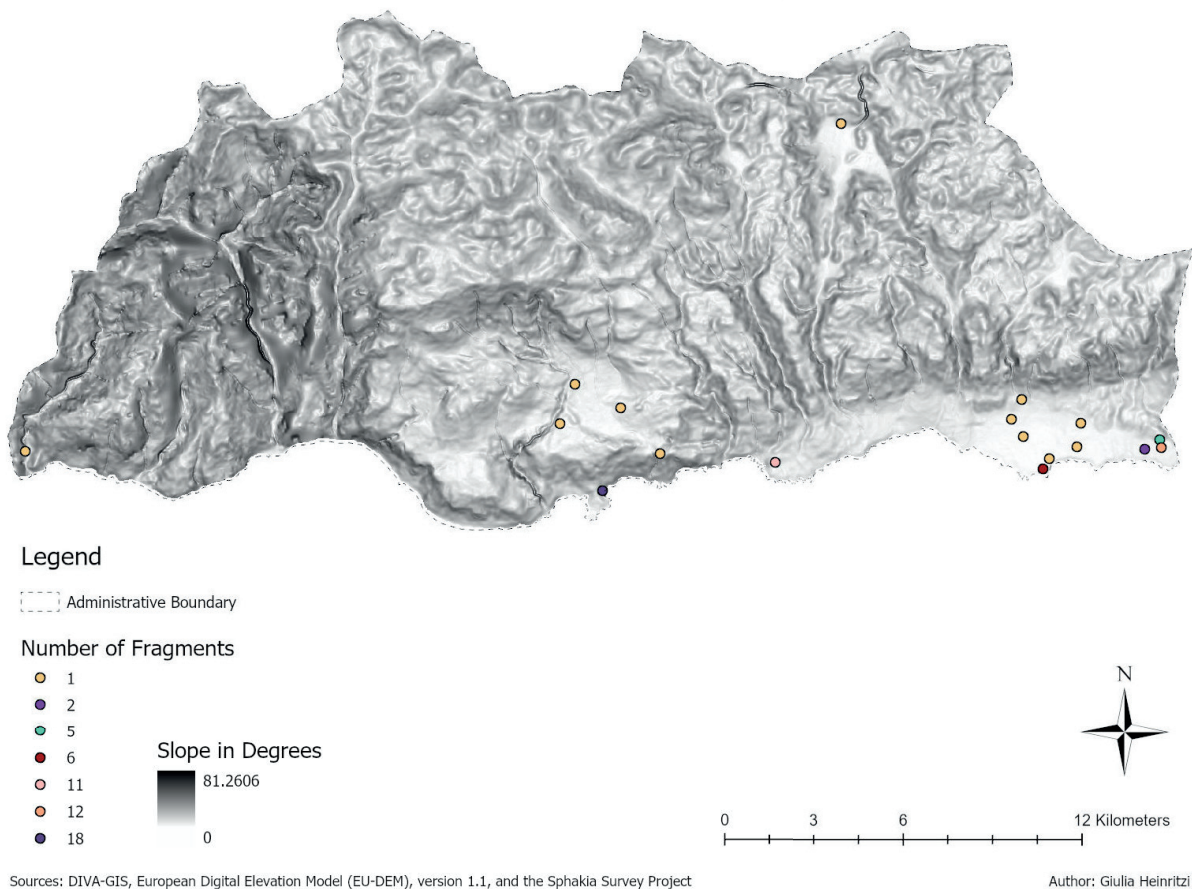


Figure 11.9. Distribution of Cretan amphorae of unknown form in Sphakia (G. Heinritzi).

examples were made of fine to medium clays fired to buff-tan, orange, and/or pink colours. One amphora (SSA 94) has a fine, calcareous, sand paste and is probably related to the 'Cretan Sand' fabric discussed for AC 1, AC 3 and combed amphora above.<sup>10</sup> Another (SSA 84) is similar to the fabric of an AC 3 amphora (SSA 31), which has been assigned to analytical fabric Group B. Four other Cretan amphorae of unknown form have also been assigned to analytical fabric Group B (SSA 80, 81, 83, 85), but have no corresponding MACFA data. An oddity is an amphora (SSA 97) made of a clay with sponge spicules, which do not naturally occur in Sphakiote clays; a nearby source is Apokoronas, to the north (Moody *et al.* 2003: 97–100).<sup>11</sup> Another oddity is a micaceous fabric (SSA 100), which is unusual for Crete, but not unknown. Micaceous clays have been identified from the amphora kiln at Kissamos (Markoulaki *et al.* 1989: 556; Raab 2001: 67), but the origin of this vessel — Cretan or not — is ambiguous.

The largest fabric group observed in amphorae of unknown form is 'QMSR' (SSA 86, 88, 92, 95, 96), characterised by fine quartz, mica, and soft-red inclusions; this combination of inclusions was previously discussed in the section on combed amphorae. This fabric appears in buff-tan, orange, and pink pastes with a sandy core, and all but one (SSA 95) have powdery surfaces. These amphorae were all found at the same site Khora Sphakion: Tholos (6.19) and may derive from the same clay source. None of these sherds were included in the analytical fabric program.

Of particular significance is a group of six amphora fragments of unknown shape that belong to pre-Roman vessels (Classical/Hellenistic) or amphorae of uncertain date (Classical through Roman), with MACFA and petrographic data. One sherd (SSA 103) is made of 'Cretan Sand' and, like other 'Cretan Sand' examples that were analysed, falls into analytical fabric Group A. Three early sherds were made of different MACFA fabrics: Fine Pink (SSA 101); Fine Orange Silver Glitter Calc (SSA 102); and Fine Orange Calc Sand (SSA 106); all were assigned to analytical fabric Group B. Two other sherds (SSA 104, 105) were made in similar

<sup>10</sup> This vessel was published as an example of 'Cretan' Tan Fine Calc Sand fabric (Moody *et al.* 2003: 84–85).

<sup>11</sup> Sponge spicules also occur in some of the amphorae from the kiln at Loutra (Fabric 1), east of Rethymnon; see Tsatsaki and Nodarou 2014: 300–301.



MACFA fabrics, Fine Orange to Orange-Pink Sand, but were not assigned to an analytical fabric Group. The discrepancies between MACFA and analytical fabric groups may be attributed to the difficulty of doing MACFA on very fine ceramic fabrics. Nevertheless, these fabric classifications testify to the long-term use of the same clay sources, from possibly as early as the Classical period through Roman and into the early Byzantine period.

The amphorae of unknown form come from 26 sites, few of which preserve more than a single fragment (**Figure 11.9**); exceptions are Phoinix-Loutro (5.11: 17 frags), Khora Sphakion: Tholos (6.19: 11 frags); and four sites in east Sphakia: Ag. Nikitas (8.50: 6 frags), Katalimata (8.75: 2 frags), Cliff Shelter (8.80: 5 frags), and Lakkos Enclosure (8.81: 12 frags).

With a few exceptions, the amphorae of unknown form occur as individual fragments at their sites (**Table 11.3**). Of the 20 sites identified with these vessels, they are the only type of amphora found at seven (4.04, 4.44,

7.19, 7.24, 8.57, 8.58, 8.75). Assemblages of two or more fragments come from only six sites: 5.11, 6.19, 8.50, 8.75, 8.80, 8.81. These vessels most frequently coincide with combed amphorae (1.06, 4.15, 4.30, 5.11, 8.36, 8.43, 8.44, 8.50, 8.52, 8.80, 8.81), which may suggest a late-Roman date for many of them. Fewer are found at sites that preserve the earlier AC 1 (4.34, 5.11, 6.19, 8.44, 8.50, 8.52) and AC 3 (4.15, 5.11) amphorae. The largest collections come from Phoinix-Loutro (5.11: 20 fragments), Khora Sphakion: Tholos (6.19: 11 fragments), Ag. Nikitas (8.50: 6 fragments), Cliff Shelter (8.80: 5 fragments), and Lakkos Enclosure (8.81: 12 fragments). They are most prevalent at sites in central (36 fragments) and east (33 fragments) Sphakia; only one fragment has been identified in the west.

There is, again, a very strong association between sites with beekeeping equipment and those with Cretan amphorae of unknown form — 14 of the 18 sites (78%) — giving further support to the importance of re-use and recycling in amphorae discard patterns.

Site No.	Site Name	Site Type	AC 1	AC 3	Comb.	Unkn.	Total
1.01	Ag. Nikólaos (Trypití)	Harbour, anchorage	2		1		3
1.06	Poikilásion Peradhoró	2+ houses, beehives			2	1	3
1.07	Beehive Area	Beekeeping centre	8				8
1.19	Near Old Ag. Roumeli	>20 houses, beehive			2		2
1.28	Tárrha	>20 houses, beehive			7		7
2.13	Klisidhia 3	Field house/seasonal			1		1
2.30	Livádha 3	Field house/seasonal			1		1
3.02	Perianá	1 house			2		2
3.03	Panagía	10+ houses, beehives	1		4		5
3.05	Bardhastérna 1	Watchtower, beehive	1		1		2
3.07	Révma	1 house		1			1
3.10	Gourounoképhalo 1	1 house, beehives			1		1
3.12	Gourounoképhalo 3	Estate center, beehive			1		1
3.14	Prophitis Ilias	2+ houses, beehive			3		3
3.20	Arádhena	>20 houses, beehives			4		4
3.21	Rock-cut Area	Unknown	2				2
4.01	Ts'Ási	1 house, beehives			4		4
4.02	Pátrou Kepháli	2+ houses			1		1
4.03	Assoképhalo	Estate center, beehive			4		4
4.04	Miloniés	1 house				1	1
4.06	Ridge W	1 house			1		1
4.15	Vikolídha	2+ houses		1	1	1	3
4.17	Terraces	1 house, beehives	1				1
4.21	Ancient Anópolis	>20 houses, beehives			3		3
4.27	Prínaka 1	2+ houses, beehives	1		2		2
4.28	Limniá 2	10+ houses	1		3		4
4.30	Kombítsi	2+ houses, beehives			7	1	8
4.32	Limniá 4	1 house			1		1

Table 11.3: Sphakia Survey Sites with Roman and Early Byzantine Cretan Amphorae

Site No.	Site Name	Site Type	AC 1	AC 3	Comb.	Unkn.	Total
4.34	Cistern House	1 house, beehives	4			1	5
4.37	Prínaka 3	1 house, beehives		1			1
4.40	Kambiá 1	1 house, beehives	2				2
4.41	Kambiá 2	2+ houses, beehives	2		13		15
4.42	Kambiá 3	2+ houses	1		1		2
4.44	Trouílos	Unknown				1	1
4.46	Kambiá Koulé W	1 house	1		1		2
4.58	Limniá Basin W	2+ houses, beehive			3		3
4.59	Whispering Pines	1 house, beehives			13		13
4.63	Xerovóthonas	Beehive site			2		2
4.66	Kastrí	1 house	2	10			12
4.67	Makryvóthonas	2+ houses, beehive		1			1
4. Offsite	None	None	1				1
5.01	Liviananá Akropolis	>20 houses, beehive		3			3
5.11	Phoínix-Loutró	>20 houses, beehives	5	1	21	20	47
5.19	Tímios Stavros E	1 house		1			1
6.04	Ag. Triádha 1	1 house, beehives			3		3
6.05	Ag. Triádha 2	Unknown	1				1
6.06	Ag. Triádha	2+ houses, beekeeping	8				8
6.13	Khóra Sphakíon 1	1 house			5		5
6.19	Khóra Sphakíon: Thólos	1 house, beehives	2			11	13
6.25	Ergastíria	1 house; beekeeping	1				1
7.19	Skógiós 3	None				1	1
7.24	Askyphou: Karés	Unknown				1	1
7.25	Askyphou: Méssa Goní	1 house			2		2
8.05A	Ta Livádhia	1 house, beehives			1		1
8.07	Nomikianá S	1 house, beehives	1		4		5
8.17	Hood B4	2+ houses, beehives	2		2		4
8.22	Hood B5	1 house			1		1
8.23	Hood B6	10+ houses			7		7
8.35	Vitex	1 house	2				2
8.36	Lime-Kiln	2+ houses, beehives			14	1	15
8.37	Khálasma	2+ houses	1				1
8.38	Hood B7 (Ag. Astrátigos)	>20 houses, beehives	4	4	20		28
8.39	Sheepshed	1 house, beehives	4	4	3		11
8.40	Ag. Pelagía Structure	2+ houses	7		1		8
8.43	Patsianós 1	Settlement, beehives			1	1	2
8.44	Ag. Ioánnis Vókolos S	1 house, beehives	4		9	1	14
8.50	Ag. Nikítas	>20 houses, beehives	3		6	6	15
8.52	Bungalows W	1 house	5		1	1	7
8.54	Wells	1 house, beehives			1		1
8.56	Bungalows NE	1 house	10				10
8.57	Koúlis Lákkoi	1 house				1	1
8.58	Rockpile	1 house, beehives				1	1
8.75	Katalímata	1 house, beehives				2	2
8.80	Cliff Shelter	1 house, beehives			1	5	6
8.81	Lákkos Enclosure	1 house, beehives			1	12	13
<b>Total</b>			90	27	194	70	381

Table 11.3 *cont.*: Sphakia Survey Sites with Roman and Early Byzantine Cretan Amphorae

### Analytical approach to Cretan amphorae

Many categories of Greco-Roman ceramics collected by the Sphakia Survey were sampled for archaeometric analysis within the confines of a multi-disciplinary project.<sup>12</sup> The aim was to study ceramic fabrics and technology(ies) of pottery manufacture, and potentially identify Cretan productions and imitations of foreign prototypes against off-island imports. An array of amphorae was included in the analysis so that all forms and macroscopic fabric classes would be represented. All samples were analysed by thin section petrography and some of these were selected for further analysis with X-Ray Diffraction (XRD) and Scanning Electron Microscopy (SEM). The fineness of the fabrics and the absence of comparative archaeological material from the area made this approach necessary.

The majority of the Sphakiote amphorae considered to be of Cretan origin fell into two petrographic fabrics that are compositionally and texturally connected to each other. The first (Group A) is characterised by a brown to dark brown firing matrix and the non-plastic inclusions include primarily micritic limestone, quartz, biotite, and occasionally some chert (**SSA 4–7, 29, 41, 42, 51–53**, and possibly **SSA 35**; also the earlier Classical/Hellenistic **SSA 103**). The second (Group B) is also characterised by a dark firing matrix but the non-plastics comprise considerably larger amounts of quartz along with some decomposed micritic calcite (**SSA 2, 3, 8–10, 12, 14–16, 18, 19, 26, 28, 31, 32, 34, 39, 74, 80, 81, 83, 85**; also the earlier **SSA 101, 102, 106**). In terms of their technological characteristics, XRD and SEM analysis showed that Group A is lower fired than Group B, with firing temperatures around 850 °C for the former and 950–1000 °C for the latter. The connection between shapes and fabrics is also of interest since the samples of late-Roman/early Byzantine combed amphorae are equally split between the two groups. The situation is more complex for the Roman amphorae: Group A comprises primarily (but not exclusively) AC 1 type amphorae; Group B is more varied, including AC 1 and AC 3 type amphorae as well as amphorae slightly earlier in date (late-Hellenistic/early Roman) that had also been identified typologically as Cretan.

The preliminary results of our analytical approach to Sphakiote Cretan amphorae can be summarised as follows:

Although the mineralogical composition is not diagnostic of origin due to the fineness of the fabrics, the homogeneity of the amphora fabrics in both

petrographic groups favours Cretan manufacture. The fact that they do not match any other petrographically identified fabrics, indicates that they were probably made at a presently unknown manufacturing center — possibly one somewhere in southwest Crete (see next section on pottery production in Sphakia).

Although it is not possible to definitively identify workshops based on our present data, several observations can be made. The two fabric recipes (Groups A and B) are compositionally and texturally very similar, suggesting that the raw material sources used for both fabrics were geographically very close to one another. The small differences in composition, such as the presence of frequent quartz fragments and higher firing temperatures in Group B, could be indicative of two different workshops using similar raw materials but somewhat different processing and manufacturing techniques. There is little correlation between these amphorae fabrics and date: the late-Roman/early Byzantine combed amphorae are manufactured in both fabrics, as are the Roman AC 1 and AC 3 amphorae. AC 1 shapes have a slight tendency for the Group A recipe. The Group B recipe seems more widespread, incorporating a larger variety of amphorae (AC 1, AC 3, Cretan unknown form, and combed) and covering a broader date range, stretching from Classical/Hellenistic to the early Byzantine. Furthermore, all later forms of AC 1 (MCR 1, 2 and 3) are only made in Group B fabric, suggesting that this center may have produced pottery more or less continuously for over 1000 years.

In addition to the two main fabric groups, there are a number of petrographic loners (i.e., samples that are not incorporated in any of the groups) some of them clearly reflecting off-island imports. Among them is an AC 3 fragment (**SSA 27**), identified petrographically as a Phocian import (Group D), testifying to the production of Cretan amphora shapes off the island and their circulation to Mediterranean markets, a situation that also explains a petrographic loner of a so-called Cretan amphora from Carnuntum (above, n. 4). The popularity of Cretan *passum* wine, or other commodities transported in these containers, must have led non-Cretan workshops to produce the distinctive Cretan shapes much in the way that Koan amphoras, for example, were replicated at multiple Mediterranean centres (e.g., Lawall and van Alfen 2011). One wonders how many other Cretan shapes on the island were made elsewhere? The value of systematic fabric analysis and publication should not be underestimated in this regard.

### Evidence for pottery production in Roman Sphakia

<sup>12</sup> A multi-disciplinary analytical project on ceramic material collected by the Sphakia Survey is being carried out in collaboration with I. Iliopoulos and A-M. Pollatou (University of Patras). We are grateful to the Ephorate of Chania and the Greek Ministry of Culture and Sports for sampling permits.

No conclusive evidence was identified by the Survey for Roman (or Greek) pottery production in Sphakia. No kiln remains were found and only minimal finds from three sites hint at ceramic production; the negligible nature of this evidence must be emphasised.

The site of Livaniana Akropolis (5.01), in west-central Sphakia, contains a small fragment that may be a firing stilt, and shape comparisons suggest a late-Roman date. This object, however, does not show any traces of burning and thus of use in a kiln.<sup>13</sup> Its fabric, a mixed-metamorphic sand, is different from the greasy-feeling, phyllite-based local clay, though not incompatible with clay sources in the Frangokastello Plain used during the Bronze Age (Moody *et al.* 2003). We thus conclude that this stilt was not manufactured locally and cannot be used to argue for pottery production at the site. A comparable stilt from Hierapytna is not recorded as burned and, as at Livaniana, 'there was no associated kiln debris or wasters' (Gallimore 2015: 257, no. 519).

In east Sphakia, at the site of Ag. Nikitas (8.50) on the Frangokastello Plain, two wasters were identified as pieces of ceramic beekeeping equipment. Although both fragments were vitrified, macroscopic analysis showed that one contained quartz, while the other was a coarse sand fabric, also with quartz.<sup>14</sup> No other wasters were found at this site nor were any remains of a kiln seen.

The third site with a suggestion of ceramic production is Lakkos Enclosure (8.81), at the far, east end of Sphakia. Here were found three tile wasters and several shapeless clumps of burnt earth.<sup>15</sup> Subsequent investigations of the area revealed a nearby, good quality, Pleistocene-era clay that could have been used, but this clay has not yet been analysed; again, however, the existence of a kiln cannot be confirmed. Although the second largest collection of Cretan amphorae of unknown form (12 fragments) comes from this site, none of these sherds were included in the analytical fabric program and only three have MACFA data.

The limited nature of the Sphakiote evidence when compared to a known amphora workshop was sharply drawn in 2017 when Francis and Moody visited Marangou-Lerat's kiln site AT17 east of Palaiochora, near the southwest coast (Marangou-Lerat 1995: 58–60). The olive grove to the south of the modern road was littered with hundreds of amphora fragments, including one waster. A similar profile of amphora fragments on the ground has been observed at the two Tsoutsouros

production centres (Marangou-Lerat 1995: 55–57, site AT14 and site AT15). No site in Sphakia resembles these production sites, which preserve abundant examples of the amphorae that must have been made in their kilns as well as ceramic wasters; Cretan amphorae are not present in large enough numbers anywhere in Sphakia to suggest local manufacture (see **Table 11.3**). The production centre posited on the basis of the homogenous fabrics used over several centuries thus may lie just outside Sphakia, perhaps to the east of the Frangokastello Plain, near the area of the Pleistocene clay source and just beyond Lakkos Enclosure (8.81) where tile wasters and burnt earth were found. Hopefully, further research focused on the question of Greco-Roman ceramic production in this part of Crete will reveal more precise information.

## Conclusions

Our macroscopic and analytical fabric studies show that the same fabrics were used to make AC 1, AC 3 and combed amphorae, from the early Roman through the late-Roman to early Byzantine period. A small number of earlier, Classical/Hellenistic amphorae were also made in the same fabrics, indicating that the same clays and ceramic traditions were used for over 1000 years. The extraordinarily long use of these clay sources, in spite of changes in amphorae shapes and capacities, and important changes in markets for transport vessels — is remarkable.

At present, the ceramic fabrics we have identified are unique and unconnected with known workshops, demonstrating the existence of one or more heretofore-unknown production sites. The lack of evidence for Roman kilns in Sphakia combined with the consistency and longevity of the fabrics identified in this study, hint that the unknown production center(s), or at least the clay source(s), may be nearby — perhaps somewhere along the southwest coast.

Such results highlight the need for new research into viable clay sources and pottery production centres for Roman Crete. Exploration for and analysis of additional clay sources, especially in southwest Crete, might be able to pinpoint the origins of the fabrics we have identified. While a combined analytical study (e.g., macroscopic, petrographic, chemical) of amphorae from well-established kiln sites would streamline the attribution (or not) of amphorae found in settlements with known production centers.

Our distribution studies show that the final resting places of most AC 1 and AC 3 vessels were small, inland habitations at low and middle elevations, often associated with beekeeping. AC 1 vessels occur in fairly equal numbers in the Anopolis area in central Sphakia

<sup>13</sup> For a comparable stilt from Crete, see Gallimore 2015: 257, 260, no. 519, fig. 8.2; for mainland Greece, Papadopoulos 1992: 208–209). The Livaniana fragment was catalogued as 5.01:G01.

<sup>14</sup> The Sphakia Survey catalogue numbers for these wasters are 8.50:GBH-147 and 8.50:GBH-148, respectively.

<sup>15</sup> Catalogue numbers 8.81:UncatG24, 8.81:UncatG29, 8.81:UncatG03.



and on the Frangokastello Plain to the east. AC 3 vessels were mostly found in central Sphakia. It is therefore probable that both amphorae types arrived mainly through the large harbour at Phoinix-Loutro (5.11) in central Sphakia and, in the case of AC 1 vessels, the many small anchorages scattered along the Sphakiote coast from the mouth of the Trypiti Gorge in the west, to Ag. Marina in the east. It must be emphasised, however, that very few examples were actually found at port sites, indicating that once they landed, they were either shipped back out or distributed inland.

The maritime delivery of AC 1 and AC 3 vessels to Sphakia is indirectly supported by the coastal position of most known amphora kiln sites. Although these amphorae may also have come into Sphakia via land routes from sites outside the eparchy, there is no evidence.

Late-Roman combed amphorae have a significantly different distribution pattern to the earlier AC 1 and AC 3 vessels. They are much more abundant and found throughout Sphakia from the coast to the high mountains. Although they too entered Sphakia through its harbours and ports along the south coast, especially Phoinix-Loutro (5.11), there is also reasonable evidence that they came into the eparchy via overland trade routes from the north. Furthermore, these amphorae are more frequent at larger, rather than smaller, habitations and a much higher proportion remained at their ports of entry, rather than were re-distributed inland.

Nevertheless, late-Roman combed amphorae, like AC 1 and AC 3 vessels, are frequently found at sites that also contain ceramic beehives. This strong association, which lasted for nearly 1000 years, reveals the importance of amphora recycling and re-use in ancient apiculture.

This research demonstrates the value of combined approaches to ceramic analysis and we hope will inspire future projects.

### Acknowledgements

The material presented in this article was collected in the 1980s and 1990s by the Sphakia Survey (SS), a project directed by Jennifer Moody and Lucia Nixon. A preliminary version of this paper was presented at the 11th Cretological Congress in Rethymnon, in 2011. The Survey has benefitted from the collaboration of many experts, colleagues, and friends over several decades, to whom we are all indebted: Maria Andreadaki-Vlasaki, Pamela Armstrong, Phil Betancourt, Tom Brogan, Gerald Cadogan, Anna Lucia D'Agata, Birgitta Hallager, George W. M. Harrison, John Hayes, Alan Johnston, Athanasia Kanta, Katerina Kopaka, Mark Macklin, Stavroula Markoulaki, Margaret Mook, Jerolyn Morrison, Vanna

Niniou-Kindeli, Lucia Nixon, Krzysztof Nowicki, George Postma, Natalia Poulou-Papadimitriou, Simon Price†, Oliver Rackham†, Harriet Robinson, Anaya Sarpaki, Joe Shaw, Maria Shaw, Yannis Tzedhakis, Peter Warren, Vance Watrous, Tomasz Wazny. Financial support has come from Baylor University, Concordia University, INSTAP, HRCC, NSF, and the MacArthur Foundation. Drawings are by Matthew Buell and Anne Bowtell; maps are by Giulia Heinritzi and Jane Francis.

### Appendix 11.1: Concordance of Sherd Numbers

This table contains all Roman Cretan amphorae collected by the Sphakia Survey for which fabric data was collected, either macroscopic or petrographic. These two series represent the numbers assigned to the amphorae fragments for this study (Sphakia Survey Amphora = SSA No.) and the catalogue numbers originally assigned to them during the study of the Sphakia Survey pottery (Sphakia Survey Cat. No. = SS Cat. No.) Amphora forms have been provided for ease of integration with the text. This chart also includes examples of Classical/Hellenistic amphorae for which there is petrographic information; these are mentioned in the text but have not been included in Table 11.3, which contains only amphora fragments dated to the Roman era.

SSA No.	SS Cat. No.	Amphora Comment
1	1.07:UncatG05	ARC 1a
2	4.42:UncatG11	ARC 1a
3	8.38:UncatG37	ARC 1a
4	5.11:UncatG298	ARC 1b
5	6.06:UncatG51	ARC 1b
6	4.27:UncatG28	ARC 1c
7	6.19:UncatG24	ARC 1c
8	8.39:UncatG28	ARC 1c
9	1.01:UncatG08	ARC 1
10	4.34:UncatG15	ARC 1
11	8.38:UncatG36B	ARC 1
12	8.39:UncatG31	ARC 1
13	8.52:UncatG15	ARC 1
14	4.46:UncatG11	MRC 1
15	6.06:UncatG48	MRC 2b
16	6.25:GBE-49B	MRC 2b
17	5.11:G06	MRC 2b
18	8.40:UncatG12	MRC 2b
19	18/25 Offsite	MRC 3
20	5.11:UncatG485	AC 1
21	6.05:UncatG02	AC 1
22	6.06:UncatG47	AC 1
23	6.19:UncatG23	AC 1
24	8.07:UncatG09	AC 1
25	8.52:UncatG10	AC 1
26	4.67:UncatG16	ARC 3
27	3.07:UncatG14	MRC 3
28	4.37:UncatG13	MRC 3
29	4.66:G02	MRC 3
30	5.01:UncatG100	MRC 3
31	5.11:UncatG484	MRC 3
32	5.19:UncatG24	MRC 3

SSA No.	SS Cat. No.	Amphora Comment
33	8.38:G05	MRC 3
34	8.39:UncatG30	MRC 3
35	1.19:UncatG48	LR 2
36	2.13:G06	LR 2
37	3.14:UncatG23	LR 2
38	3.14:UncatG24	LR 2
39	4.59:UncatG13	LR 2
40	8.22:UncatG04	LR 2
41	8.36:UncatG06	LR 2
42	8.38:G06	LR 2
43	8.38:UncatG17	LR 2
44	8.39:UncatG19	LR 2
45	8.39:UncatG20	LR 2
46	8.52:G01	LR 2
47	8.54:G02	LR 2
48	1.01:UncatG07	Combed
49	1.19:UncatG49	Combed
50	1.28:UncatG42	Combed
51	1.28:UncatG43	Combed
52	1.28:UncatG44	Combed
53	1.28:UncatG44A	Combed
54	1.28:UncatG56	Combed
55	1.28:UncatG56A	Combed
56	1.28:UncatG56B	Combed
57	2.30:G03	Combed
58	3.12:UncatG06	Combed
59	3.14:UncatG30	Combed
60	7.25:UncatG61	Combed
61	8.05A:G12	Combed
62	8.36:UncatG09	Combed
63	8.36:UncatG09A	Combed
64	8.36:UncatG09B	Combed
65	8.36:UncatG09C	Combed
66	8.36:UncatG09D	Combed
67	8.36:UncatG24	Combed
68	8.36:UncatG28	Combed
69	8.38:UncatG18	Combed
70	8.38:UncatG23	Combed
71	8.38:UncatG43	Combed
72	8.38:UncatG43A	Combed
73	8.38:UncatG43B	Combed
74	8.39:UncatG22	Combed
75	8.40:UncatG09	Combed
76	8.50:UncatG065	Combed
77	8.50:UncatG114	Combed
78	8.50:UncatG137	Combed
79	8.81:UncatG06	Combed
80	4.04:UncatG06	Unknown
81	4.15:UncatG11	Unknown
82	5.11:UncatG170	Unknown
83	5.11:UncatG296	Unknown
84	5.11:UncatG368	Unknown
85	5.11:UncatG434	Unknown
86	6.19:UncatG25A	Unknown
87	6.19:UncatG25B	Unknown
88	6.19:UncatG25C	Unknown
89	6.19:UncatG25D	Unknown
90	6.19:UncatG25E	Unknown
91	6.19:UncatG45A	Unknown
92	6.19:UncatG45B	Unknown
93	6.19:UncatG45C	Unknown
94	6.19:UncatG45D	Unknown
95	6.19:UncatG45E	Unknown

SSA No.	SS Cat. No.	Amphora Comment
96	6.19:UncatG45F	Unknown
97	7.24:UncatG14	Unknown
98	8.52:UncatG11	Unknown
99	8.81:UncatG11	Unknown
100	7.19:G02	Unknown
101	4.29:G01	Unknown: Late Class–Roman
102	1.19:G04	Unknown: Class/Hell
103	6.25:GM-66	Unknown: Class/Hell
104	5.01:G05	Unknown: Class/Hell
105	8.61:GA-482	Unknown: Class/Hell
106	1.28:UncatG38	Unknown: Hell–Roman

## Bibliography

### Primary Sources

- Anonymous. *Stadiasmus Maris Magni. Geographi Graeci Minores*. Edited by K. Müller. Cambridge: Cambridge University Press, 2010.
- Columella. *On Agriculture*, Vol. 3: Books 10–12. Translated by E.S. Forster and E.H. Heffner. Loeb Classical Library 437. Cambridge: Harvard University Press, 1955.
- Ptolemy. *Geography of Claudius Ptolemy*. Translated and edited by E.K. Stevenson. New York: New York Public Library, 1932.

### Secondary Sources

- Abdelhamid, S. 2016. Against the throw-away-mentality: the reuse of amphoras in ancient maritime transport, in H.P. Hahn and H. Weiss (eds) *Mobility, Meaning and the Transformations of Things*: 91–106. Oxford: Oxbow Books.
- Aloupi, E., V. Kilikoglou and P.M. Day. 2000. Provenance and technological characterisation of fine tableware, in P. G. Themelis (ed.) *Πρωτοβυζαντινή Ελεύθερνα, τομέας I*, Vol. 2: 209–222. Rethymnon: University of Crete.
- Buechner, T.S. 1960. The glass from Tarrha. *Hesperia* 29: 109–117.
- Callaghan, P.J. 2014. Roman Kommos: a reappraisal. *Annual of the British School at Athens* 198: 317–333.
- Eiring, J., M.-C. Boileau and I. Whitbread. 2002. Local and imported transport amphorae from a Hellenistic kiln site at Knossos. The results of petrographic analyses, in F. Blondé, P. Ballet and J.-F. Salles (eds) *Céramiques hellénistiques et romaines: productions et diffusion en Méditerranée orientale (Chypre, Egypte et côte syro-palestinienne)* (Travaux de la Maison de l'Orient 35): 59–65. Lyon: Maison de l'Orient Méditerranéen-Jean Pouilloux.
- Empereur, J.-Y., C. Kritzas and A. Marangou. 1991. À la recherche des ateliers d'amphores en Crète centrale. *Bulletin de Correspondance Hellénique* 115: 481–523.

- Empereur, J.-Y., A. Marangou and N. Papadakis 1992. Recherches sur les amphoras crétoises III. *Bulletin de Correspondance Hellénique* 116: 633–648.
- Foley, B.P., M.C. Hansson, D.P. Kourkoumelis and T.A. Theodoulou. 2012. Aspects of ancient Greek trade re-evaluated with amphora DNA evidence. *Journal of Archaeological Science* 39: 389–398.
- Forster, G. 2009. Roman Knossos: The Pottery in Context. A Presentation of the Ceramic Evidence provided by the Knossos 2000 Project (1993–1995). Unpublished PhD dissertation, University of Birmingham.
- Francis, J. E. 2016. Apiculture in Roman Crete, in J.E. Francis and A. Kouremenos (eds) *Roman Crete: New Perspectives*: 83–100. Oxford: Oxbow Books.
- Francis, J. 2017. Roman influence on Greek Sphakia, in D.W. Rupp and J.E. Tomlinson (eds) *From Maple to Olive. Proceedings of a Colloquium to Celebrate the 40th Anniversary of the Canadian Institute in Greece. Athens, 10–11 June 2016* (Publications of the Canadian Institute in Greece 10): 505–533. Athens: Canadian Institute in Greece.
- Francis, J., S. Price, J. Moody and L. Nixon. 2000. Agiasmatsi: a Greek cave sanctuary in Sphakia, SW Crete. *Annual of the British School at Athens* 95: 427–471.
- Frend, W.H.C. and D.E. Johnston. 1962. The Byzantine basilica church at Knossos. *Annual of the British School at Athens* 57: 186–238.
- Gallimore, S. 2011. An Island Economy: Ierapetra and Crete in the Roman Empire. Unpublished PhD dissertation, State University of New York at Buffalo.
- Gallimore, S. 2015. *An Island Economy. Hellenistic and Roman Pottery from Hierapytna, Crete* (Lang Classical Studies 18). New York: Peter Lang.
- Gallimore, S. 2016. Crete's economic transformation in the late Roman Empire, in J.E. Francis and A. Kouremenos (eds) *Roman Crete: New Perspectives*: 175–188. Oxford: Oxbow Books.
- Gallimore, S. 2017a. Food surplus and archaeological proxies: a case study from Roman Crete. *World Archaeology* 49: 138–50.
- Gallimore, S. 2017b. Early to late Roman pottery, in L. V. Watrous, D. M. Buell, E. Kokinou, P. Soupios, A. Sarris, S. Beckmann, G. Rethemiotakis, L.A. Turner, S. Gallimore and M.D. Hammond (eds) *The Galatas Survey. Socio-Economic and Political Development of a Contested Territory in Central Crete during the Neolithic to Ottoman Periods* (Prehistory Monographs 55): 235–240. Philadelphia: INSTAP Academic Press.
- Gallimore, S. 2018. The relationship between agricultural production and amphora manufacture on Roman Crete. *Journal of Roman Archaeology* 31: 373–386.
- Gavrilaki-Nikoloudaki, I. 1988. Κεραμική του 3ου αι. μ.Χ. απο την Αργυρούπολη Ρεθύμνης. *Kritiki Estia* 2: 30–72.
- Grigoropoulos, D. 2011. Ρωμαϊκοί Αμφορείς, in A. Kanta and C. Davaras (eds) *ΕΛΟΥΘΙΑ ΧΑΡΙΣΤΗΘΙΟΝ. Το Ιερό Σπήλαιο της Ειλειθυίας στον Τσούτσουρο*: 166–167. Herakleion: Demos Minoa Pediadas.
- Hayes, J.W. 1971. Four early Roman groups from Knossos. *Annual of the British School at Athens* 66: 249–275.
- Hayes, J.W. 1983. The Villa Dionysos excavations, Knossos: the pottery. *Annual of the British School at Athens* 78: 97–169.
- Hayes, J.W. 2000. Roman pottery from the sanctuary, in J. Shaw and M. Shaw (eds) *Kommos IV. The Greek Sanctuary*: 312–335. Princeton: Princeton University Press.
- Hayes, J.W. and A. Kossyva. 2012. Roman pottery, in L. V. Watrous, D. Haggis, K. Nowicki, N. Vogeikoff-Brogan and M. Schultz, *An Archaeological Survey of the Gournia Landscape: A Regional History of the Mirabello Bay, Crete, in Antiquity* (Prehistory Monographs 37): 167–174. Philadelphia: INSTAP Academic Press.
- Hope Simpson, R., P.P. Betancourt, P.J. Callaghan, D.K. Harlan, J.W. Hayes, J.W. Shaw, M.C. Shaw and L.V. Watrous. 1995. The archaeological survey of the Kommos area, in J.W. Shaw and M.C. Shaw (eds) *Kommos I. The Kommos Region and Houses of the Minoan Town*: 325–402. Princeton: Princeton University Press.
- IC = Guarducci, M. 1935–1950. *Inscriptiones Creticae*, 4 vols. Rome: Libreria dello Stato.
- Joyner, L. 2000. Appendix. Petrographic analysis of domestic pottery from Byzantine Eleutherna, in P. G. Themelis (ed.) *Πρωτοβυζαντινή Ελεύθερνα, τομέας Ι*: 223–235. Rethymnon: University of Crete.
- Kalpaxis, Th. 1996. Ελληνιστικός κλίβανος κεραμικής στην αρχαία Ελεύθερνα, in I. Gavrilaki (ed.) *Κεραμικά εργαστήρια στην Κρήτη από την αρχαιότητα ως σήμερα: πρακτικά ημερίδας, Μαργαρίτες, 30 Σεπτεμβρίου 1995*: 41–45. Rethymnon: Historical and Folklore Society of Rethymnon.
- Karagiorgiou, O. 2001. LR2: A container for the military *annona* on the Danubian border?, in S. Kingsley and M. Decker (eds) *Economy and Exchange in the East Mediterranean during Late Antiquity*: 129–166. Oxford: Oxbow Books.
- Keay, S.J. 1984. *Late Roman Amphorae in the Western Mediterranean: A Typology and Economic Study: The Catalan Evidence* (British Archaeological Reports International Series 196). Oxford: Archaeopress.
- Krywonos, W., G.W.A. Newton, V.J. Robinson and J.A. Riley. 1982. Neutron activation analysis of some Roman and Islamic coarse wares of western Cyrenaica and Crete. *Journal of Archaeological Science* 9: 63–78.
- Lawall, M. and P. van Alfen (eds). 2011. *Caveat Emptor: A Collection of Papers on Imitations in Ancient Greco-Roman Commerce* (Marburger Beiträge zur Antiken Handels-, Wirtschafts- und Sozialgeschichte 28). Rahden: Marie Leidorf.

- Limantzaki, L. 2011. Κεραμικοί κλίβανοι της εποχής της ρωμαϊκοκρατίας στην Κυδωνία, in M. Andreadaki-Vlazi and E. Papadopoulou (eds) *Πεπραγμένα του 1' Διεθνούς Κρητολογικού Συνεδρίου (Χανιά, 1-8 Οκτωβρίου 2006)*, Vol. A5: 263-276. Chania: Philologikos Syllogos 'O Chrysostomos'.
- Marangou-Lerat, A. 1995. *Le vin et les amphores de Crète de l'époque classique à l'époque impériale (Études crétoises 30)*. Thessaloniki: Fondation Fany Boutari.
- Markoulaki, S., J.-Y. Empereur and A. Marangou 1989. Recherches sur les centres de fabrication d'amphores de Crète occidentale. *Bulletin de Correspondance Hellénique* 113: 551-580.
- Moody, J. 2012. Hinterlands and hinterseas: resources and production zones in Bronze Age and Iron Age Crete, in G. Cadogan (ed.) *Parallel Lives: Ancient Island Societies in Crete and Cyprus* (British School at Athens Studies 20): 233-271. London: British School at Athens.
- Moody, J., L. Nixon, S. Price and O. Rackham. 1998. Surveying poleis and larger sites in Sphakia, in W. G. Cavanagh and M. Curtis (eds) *Post-Minoan Crete: Proceedings of the First Colloquium on Post-Minoan Crete held by the British School at Athens and the Institute of Archaeology, University College London, 10-11 November 1995* (British School at Athens Studies 2): 87-95. London: British School at Athens.
- Moody, J., H.L. Robinson, J. Francis, L. Nixon and L. Wilson. 2003. Ceramic fabric analysis and survey archaeology: Sphakia Survey. *Annual of the British School at Athens* 98: 37-105.
- Nixon, L., J. Moody and O. Rackham. 1988. Archaeological survey in Sphakia, Crete. *Echos du monde classique/Classical Views* 32: 159-173.
- Nixon, L., J. Moody, S. Price and O. Rackham. 1989. Archaeological survey in Sphakia, Crete. *Echos du monde classique/Classical Views* 33: 201-215.
- Nixon, L., J. Moody, V. Niniou-Kindeli, S. Price and O. Rackham. 1990. Archaeological survey in Sphakia, Crete. *Echos du monde classique/Classical Views* 34: 213-220.
- Nixon, L., S. Price, J. Moody and O. Rackham. 1994. Rural settlement in Sphakia, Crete, in P. Doukellis and L. G. Mendoni (eds) *Structures Rurales et Sociétés Antiques. Actes du colloque du Courfou (14-16 mai 1992)* (Annales Littéraires de l'Université de Besançon 508): 255-264. Paris: Les Belles Lettres.
- Nixon, L. and S. Price. 2001. The diachronic analysis of pastoralism through comparative variables. *Annual of the British School at Athens* 96: 395-424.
- Nixon, L., S. Price, O. Rackham and J. Moody. 2009. Settlement patterns in Medieval and post-Medieval Sphakia. Issues from the archaeological and historical evidence, in J. Bintliff and H. Stöger (eds) *Medieval and Post-Medieval Greece. The Corfu Papers* (British Archaeological Reports International Series 2023): 43-54. Oxford: Archaeopress.
- Papadopoulos, J.K. (1992). ΛΑΣΑΝΑ, tuyères, and kiln firing supports. *Hesperia* 61: 203-221.
- Peacock, D.P.S. and D.F. Williams. 1986. *Amphorae and the Roman Economy: An Introductory Guide*. London: Longman.
- Peña, J.T. 2007. *Roman Pottery in the Archaeological Record*. Cambridge: Cambridge University Press.
- Perlman, P. 2004. Crete, in M.H. Hansen and T.H. Nielsen (eds) *An Inventory of Archaic and Classical Poleis. An Investigation Conducted by the Copenhagen Polis Centre for the Danish National Research Foundation*: 1144-1195. Oxford: Oxford University Press.
- Portale, E.C. 2011. Contenitori da trasporto, in A. Di Vita and M.A. Rizzo (eds) *Gortina Agorà. Scavi 1996-1997* (Studi di archeologia Cretese 9): 123-182. Padua: Bottega d'Erasmus.
- Portale, E.C. and I. Romeo. 2000. Le anfore locali di Gortina ellenistica e Romana. *Rei Cretariae Romanae Fautorum Acta* 36: 417-426.
- Portale, E.C. and I. Romeo. 2001. Contenitori da trasporto, in A. Di Vita (ed.) *Gortina V.3. Lo Scavo del Pretorio (1989-1995)*, t. 1. *I Materiali* (Monografie della scuola archeologica di Atene e delle missioni italiane in Oriente 12): 260-410. Padua: Bottega d'Erasmus.
- Poulou-Papadimitriou, N. and E. Nodaro. 2014. Transport jars and maritime trade routes in the Aegean from the 5th to the 9th century AD. Preliminary results of the EU funded project 'Pythagoras II': the Cretan case study, in N. Poulou-Papadimitriou, E. Nodaro and V. Kilikoglou (eds) *LRCW4 Late Roman Coarse Wares, Cooking Wares and Amphorae in the Mediterranean: Archaeology and Archaeometry. The Mediterranean: A Market without Frontiers* (British Archaeological Reports International Series 2616): 873-883. Oxford: Archaeopress.
- Price, S.R.F. 2006. The Loutro peninsula and its resources in context, in *1' Διεθνούς Κρητολογικού Συνεδρίου (Χανιά, 1-8 Οκτωβρίου 2006)*, Abstracts: 85-86. Chania: Philologikos Syllogos 'O Chrysostomos'.
- Price, S.R.F., T. Higham, L. Nixon and J. Moody. 2002. Sea-level changes in Crete: reassessment of radiocarbon dates from Sphakia and west Crete. *Annual of the British School at Athens* 97: 171-200.
- Raab, H.A. 2001. *Rural Settlement in Hellenistic and Roman Crete: The Akrotiri Peninsula* (British Archaeological Reports International Series 984). Oxford: Archaeopress.
- Riley, J.A. 1979. The coarse pottery from Berenice, in J. Lloyd (ed.) *Excavations at Sidi Khrebish, Benghazi (Berenice)*, Vol. 2 (Supplements to Libya Antiqua 5): 91-467. Tripoli: Department of Antiquities, Ministry of Teaching and Education, People's Socialist Libyan Arab Jamahiriya.
- Sackett, L.H. 1992. Roman pottery, in L.H. Sackett (ed.) *Knossos from Greek City to Roman Colony: Excavations at*



- the Unexplored Mansion II* (British School at Athens, Suppl. 21): 147–256. London: British School at Athens.
- Tsatsaki, N. 2010. Residences, workshops or both? A study of Hellenistic houses at Nissi-Eleutherna (Crete), in S. Ladstätter and V. Scheibelreiter (eds) *Städtisches Wohnen im östlichen Mittelmeerraum 4. Jh. v. Chr.–1. Jh. n. Chr.: Akten des internationalen Kolloquiums vom 24.–27. Oktober an der Österreichischen Akademie der Wissenschaften*: 67–79. Vienna: Österreichischen Akademie der Wissenschaften.
- Tsatsaki, N. and E. Nodarou. 2014. A new Hellenistic amphora production centre in west Crete (Loutra, Rethymnon): study and petrographic analysis of the pottery assemblage. *Annual of the British School at Athens* 109: 287–315.
- Vogeikoff-Brogan, N. 2012. Hellenistic and Roman periods: expansion of the isthmus in an international era, in L. V. Watrous, D. Haggis, K. Nowicki, N. Vogeikoff-Brogan and M. Schultz, *An Archaeological Survey of the Gournia Landscape: A Regional History of the Mirabello Bay, Crete, in Antiquity* (Prehistory Monographs 37): 81–93. Philadelphia: INSTAP Academic Press.
- Vogeikoff-Brogan, N. and S. Apostolaki. 2004. New evidence for wine production in east Crete in the Hellenistic period, in J. Eiring and J. Lund (eds) *Transport Amphorae and Trade in the Eastern Mediterranean: Acts of the International Colloquium at the Danish Institute at Athens, September 26–29, 2002* (Monographs of the Danish institute at Athens 5): 417–427. Aarhus: Aarhus University Press.
- Vogeikoff-Brogan, N., E. Nodarou and M.-C. Boileau 2008. New evidence for wine production in east Crete in the Hellenistic period: an integrated approach of stylistic study and thin section petrography, in Y. Facorellis, N. Zacharias and K. Polikreti (eds) *Proceedings of the 4th Symposium of the Hellenic Society for Archaeometry, National Hellenic Research Foundation, Athens, 28–31 May 2003* (British Archaeological Reports International Series 1746): 327–334. Oxford: Archaeopress.
- Vogt, C. 2000. The early Byzantine pottery, in P.G. Themelis (ed.) *Πρωτοβυζαντινή Ελεύθερνα, τομέας Ι*: 39–199. Rethymnon: University of Crete.
- Weinberg, G.D. 1960. Excavations at Tarrha, 1959. *Hesperia* 29: 90–108.
- Williams, D. 2003. Cretan wine in Roman Britain. *Journal of Roman Pottery Studies* 10: 26–31.
- Yangaki, A.G. 2004–2005. Amphores crétoises: le cas d'Éleutherna, en Crète. *Bulletin de Correspondance Hellénique* 128–129: 503–23.
- Yangaki, A.G. 2005. *La céramique des IV<sup>e</sup> - VIII<sup>e</sup> siècles ap. J.-C. d'Eleutherna*. Athens: University of Crete.
- Yangaki, A.G. 2016. Pottery of the 7th–early 9th centuries AD on Crete: the current state of research and new directions, in J.E. Francis and A. Kouremenos (eds) *Roman Crete: New Perspectives*: 199–234. Oxford: Oxbow Books.
- Zimmerman Munn, M.L. 1985. A late Roman kiln site in the Hermionid, Greece. *American Journal of Archaeology* 89: 342–343.