

# 4

## Roman amphora cargoes in the sea of Chios—the 2008 mission

Theotokis Theodoulou, Brendan Foley, Dimitris Kourkoumelis and Kalliopi Preka-Alexandri

### 1 Introduction

Chios was a hub of ancient maritime routes plying the entire Aegean, the Black Sea, and the Mediterranean. Archaeological evidence of Chian maritime-related activities persist since early prehistory at coastal sites such as Agio Gala and Emporio (Hood 1981) and later colonies like Maroneia in Thrace (Archontidou-Argyri & Grigoriadou 2000: 63). Herodotus' descriptions of the Lade naval battle (*Historia* VI.15), the role of the Chians in Naukratis (*Historia* II.178), and other sources noting the famous Chian wine (Athenaeus *Deipnosophistae* 1.26b, 1.29e, 1.32f; Pliny *Historia Naturalis* 14.16.97), record Chian naval prowess and maritime commerce. This is also evident in the well-documented Chian transport amphorae, depicted on stamps and coins of the island's city state (Grace 1979: figs 44–51). This nautical tradition has remained vivid up to the present day with Chian ship owners being amongst the region's most well known.

### 2 Underwater surveys around Chios

Underwater archaeology has been practiced at Chios since the discipline's inception. In 1954 the British School at Athens conducted the first underwater mission on the island. Project archaeologists located traces of five shipwrecks at Komi, Kato Phana, and the islet of Agios Stefanos dated from Classical to Medieval times (Garnett & Boardman 1961). In 1988 the Hellenic Institute of Marine Archaeology (HIMA) initially and the Ephorate of Underwater Antiquities (EUA) afterwards explored a nineteenth century wreck attributed as the flagship of the Ottoman admiral Kara Ali, which was burned and exploded during the Greek Revolution (Vichos 1989).

Following the establishment of the EUA in 1976, several expeditions at Chios located a number of wreck sites around the island (for a list of those missions, see Theodoulou *et al.* 2009 forthcoming). In 2004 the EUA, along with the Hellenic Centre for Marine Research (HCMR), side-scanned the area of the straits between Chios and Oinousses (**Fig. 1**). This survey revealed an almost intact Classical wreck at a depth of 67m with a cargo consisting mainly of Chian and unattributed (possibly from Erythrae or Asia Minor) amphorae (Sakellariou *et al.* 2007). Both institutions returned the following year and were accompanied by the Woods Hole Oceanographic Institution (WHOI) to document the wreck in detail using WHOI's deep water mapping technology (Foley *et al.* 2009). For administrative reasons, in 2007 the EUA investigated under and around all 17 operating fish farms in northern

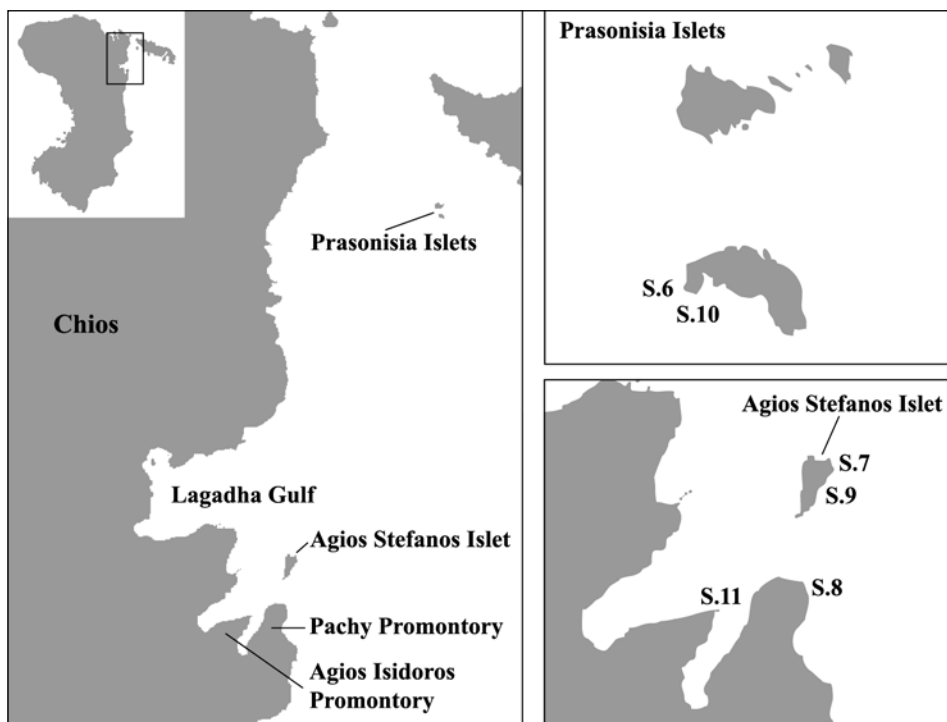


Figure 1. Map of the area around the Chios–Oinousses straits: Site 6. Southern Prasonisi islet, southwestern coast; Site 7. Agios Stefanos islet; Site 8. Pachi-Tholos promontory; Site 9. Agios Stefanos islet; Site 10. Southern Prasonisi islet, southern coast; Site 11. Agios Isidoros promontory

Chios and Oinousses. During this investigation, isolated amphorae and anchors were located, confirming the existence of ancient anchorages and temporary shelters used by mariners, especially inside the Lagadha Gulf (Fig. 1). Meanwhile, following information provided by locals, the EUA team investigated four more previously unknown wreck sites. One of these dates to the Roman period, while the other three are earlier (Theodoulou *et al.* forthcoming; Preka-Alexandri *et al.* forthcoming. See also Table 1).

### The 2008 project

In 2008 the EUA and WHOI returned to the island to map and document the previously located wreck sites with high-resolution images and photomosaics, where possible and depending on the sea floor morphology and the scattering of the pottery. The team documented: the four shipwreck sites of the 2007 mission; one Late Roman and one Byzantine shipwreck, the latter of which had been imprecisely reported by the 1954 mission as Medieval; and a ballast pile, first documented during a 2005 EUA investigation (Theodoulou 2005: 1252, fig. 15) and which perhaps indicates a lading point (Table 1). In addition, during the 2008 project, the team located five more ancient shipwrecks (one Archaic, one Classical, three Late Roman) and three modern ones.

Six of these sites, including the possible lading point, date to the Roman period

and contained cargoes of LR 1, LR 2, and LR 13 amphorae. Of these six sites, the best preserved and most informative is a shipwreck on the southern coast of the southern Prasonisi islet (**Fig. 1, Site 10**). Two more well-preserved wreck sites were found on the eastern coast of the islet Agios Stefanos and the southeastern side of Cape Pachitholos (**Fig. 1, Site 8**). The southern Prasonisi (**Fig. 1, Site 6**) and northeastern Agios Stefanos (**Fig. 1, Site 7**) sites consist mainly of dispersed broken pottery, a result of their location in shallow waters: the waves broke the vessels, and the shallow depth encouraged salvage efforts. Thus, each site could be interpreted as a small vessel cargo, a jettison, or a partially salvaged cargo. **The site of Agios Isidoros promontory (Fig. 1, Site 11) is clearly an anchorage**, where traces of Late Roman pottery were also located.

This paper focuses on these six sites, which can provide useful insights into Chian commercial maritime activity during the Late Roman period despite the fact that only a small number of ceramic finds were recovered from the seabed. These few pottery sherds were recovered from three sites (**Table 1, nos 1, 2, 9**) in order to determine whether ancient DNA is preserved in ceramic fragments in the marine environment (The analysis of the recovered sherds produced no ancient DNA sequences). Other than these sherds, one jug and seven LR 1 amphorae from the Prasonisi LR 13 shipwreck had already been recovered during the 2007 mission (**Table 1, no 10**).

### 3 The Late Roman sites

#### Southwestern coast of southern Prasonisi islet (Site 6)

At a cape on the southwestern coast of the southern Prasonisi islet (**Fig. 1**), a pottery assemblage was located running down a slope from 2–15m deep. Among the conglomerated pottery, bowls with a ring base, part of a roof tile, several amphora sherds, and more than ten amphora necks were distinguished, indicating a **possible wreck site**. The amphora necks can possibly be attributed to a LR 13 amphora variant. LR 13s are considered of Aegean provenance and products of the seventh century AD (Riley 1979: 231–232; Opaıt 1980: 298, 320). Their typical features are a globular body with combed decoration on the shoulders, a conical neck with everted rim, and two vertical arched handles. The fragments of Site 6 look similar to those found on the Yassi Ada shipwreck, dated to the early seventh century AD (Bass & van Doorninck 1982: 157–160; van Doorninck 1989: 247–250).

Similar amphora sherds had been recorded in 2005 at a distance of only 250m to the north of the site (Dellaporta *et al.* 2005: 1250, fig. 14). It is possible that the two sites are remnants of the same shipwreck.

#### Agios Stefanos (Site 7)

On northeastern Agios Stefanos, a similar site was found. At a depth of 4.5m, large amphora body fragments with grooved decoration were found scattered along a rocky bottom. More than five amphorae necks can be attributed clearly to the LR 2 amphora type, although no proper recording took place due to lack of time. However, the amount of the pottery is too small to justify a shipload. As the scatters above were interpreted, this site could be seen as a small vessel cargo, **a jettison, or a partially salvaged cargo**.

4. Roman amphora cargoes in the sea of Chios — the 2008 mission

	Site	Diagnostic finds; date	Date of first survey
1	Agios Stefanos islet (South)	Halicarnassos amphorae; sixth century BC	2008
2	Agaloudes bay	Chian amphorae; fifth century BC	2007
3	Pachi-Tholos cape (South)	Chian and unidentified amphorae; fourth century BC	2008
4	Vamvakas bay	Rhodian amphorae; third century BC	2007
5	Strovili islet	North Aegean amphorae; Hellenistic	2007
6	Southern Prasonisi islet (Southwest)	LR 13 amphorae	2008
7	Agios Stefanos islet (Northeast)	LR 2 amphorae	2008
8	Pachi-Tholos cape (Southeast)	LR 13 amphorae	2008
9	Agios Stefanos islet (East)	LR 1 amphorae	1954
10	Southern Prasonisi islet (South)	LR 1 amphorae	2007
11	Agios Isidoros promontory	Anchorage ballast; pottery of various periods, Late Roman included	2005
12	Agios Stefanos islet (East)	Byzantine amphorae	1954
13	Reef east of Prasonisia	Roof tiles; modern/twentieth century	2008
14	Southern Prasonisi islet (Southeast)	Hull remains of metal ships; modern/twentieth century	2008
15	Strovili islet (Southwest)	Hull remains of metal ships; modern/twentieth century	2008

Table 1. Underwater sites recorded during the 2008 mission at the island of Chios

Like LR 13s, LR 2 amphorae are generally considered of Aegean provenance, and they are often described as oil containers (Riley 1979: 217–219; Peacock & Williams 1986: 183–184; Karagiorgou 2001), although the LR 2 amphorae of the Pagasitikos Gulf—Shipwreck 7—preserved traces of resin (Demesticha 2010). However, it is generally accepted that discussion of amphora contents requires re-evaluation to account for multiple re-use, and a broader range of contents beyond oil and wine (Koehler 1986: 50–51).

#### Pachi-Tholos promontory (Site 8)

East of the Pachi-Tholos promontory, at a depth inclining from 4–5.5m, an area of

circa 15x20m is covered by a dense concentration of concreted lumps of broken LR 13 amphorae (Fig. 2). The clusters range in size from 1x1m to 2x2m, and they are circa 0.5m thick. At the northern side of the assemblage, a roof tile provides additional evidence that this is a wreck site. Site formation processes are not immediately evident, but the ceramics may have concreted rapidly while the vessel structure persisted; later, as the hull structure disintegrated, the concretions cracked and dispersed along the shallow, rocky sea floor.

The amphorae bear LR 13 characteristics (Riley 1979; Opaît 1980) as discussed above in reference to Site 6, and they testify to the certain presence of LR 13 amphorae cargos transported around the island.

#### **Agios Isidoros promontory (Site 11)**

A stone ballast pile was found in 2005 during an EUA investigation (Theodoulou 2005: 1252). The site lies at a depth of 4m on a sandy bottom by the promontory of Agios Isidoros, inside the protected Lagadha Gulf. During the 2008 mission, various sherds were located adjacent to the ballast pile: amphora fragments of globular bodies and combed decoration; sections of smaller vessels, such as part of a bowl; and a base and two necks, possibly from Tripolitanian II amphorae (Panella 1973; Arthur 1982; Keay 1984; Peacock & Williams 1986). The general picture suggests an anchorage, although the predominance of Late Roman finds may be indicative of a shipwreck. The ballast pile, found at shallows in a protected area, hints that the site was perhaps used as a cargo loading point where the ballast was unloaded so that cargo could be loaded instead.

#### **Agios Stefanos islet (Site 9)**

Midway down the eastern coast of Agios Stefanos, at a 3–5m depth, a thick stratum



Figure 2. Pachi-Tholos promontory site (Site 8) (© EUA)

(circa 0.5m) of concreted broken amphorae mostly covers a large area of the sea floor (**Fig. 3**). The sherds sit on a rocky bottom that slopes gradually deeper to the east. The most densely covered area measures approximately 10x15m, whereas concreted amphorae sherds are scattered across a much larger area amongst the rocks. The oblong axis of the dispersed load runs from east to west, perpendicularly to the coast. The cargo consists of LR 1 amphorae, also known as Bii (Thomas 1959: 92), Egloff 164–169 (Egloff 1977: 112–113), and Keay 53 (Keay 1984: 268–269). They have a hemispherical base, ridged oblong body, thick grooved handles, and cylindrical neck with simple rim (**Fig. 4**). Garnett and Boardman (1961: 107), who conducted the 1954



Figure 3. Agios Stefanos LR 1 amphora wreck site (Site 9) (© EUA)



Figure 4. A conglomerated LR 1 amphora, broken in situ at the Agios Stefanos LR 1 wreck site (Site 9) (© EUA)

survey and first located the wreck, refer to a black tarry deposit inside some of them, which may indicate wine as content.

On the western side of the area, towards the beach, bodies of two jars were located, one with a flat and the other with a concave base, concreted remnants of a bronze pan, a thick body fragment and large rim of a pithos, and two roof tiles. An oil lamp found at the site was the only object recovered. The concentration of all of these objects at the western side of the wreck may be interpreted as the location of the galley and therefore the stern of the ship, further implying an idea of the wreck event.

#### Southern Prasonisi islet (Site 10)

The best preserved of the recorded wrecks was found south of the southern Prasonisi islet (Fig. 5). It lies at a depth of 32m surrounded by sea grass on a sandy bottom, near the toe of a rocky slope. The amphora assemblage extends to an area measuring 13x10m, on a northwest axis. The amphorae are almost free of encrustations and concretions. Many are broken, probably because of natural factors or the wrecking event itself, since the wreck does not seem to be looted. Some of the amphorae appear to be in their initial loading positions. Combined with the ovoid shape of the cargo assemblage on the sandy bottom, this suggests that parts of the wooden hull, as well as more amphora layers, may be preserved in lower strata. A section of a roof tile



Figure 5. Photomosaic of the southern Prasonisi shipwreck (Site 10) (© EUA)

among the remnants of the shipwreck provides evidence of a roofed galley.

Seven amphorae and a jug were recovered from the wreck (see **Table 2** for numbering, measurements, and shapes). Five of the amphorae (A–E) are of LR 1 type (Riley 1979: 212–216; Demesticha 2003: 470–476; Pieri 2005: 69–81, with detailed relevant bibliography), but none is identical to another. The other two amphorae (F–G) can be attributed to the Samos Cistern Type (Arthur 1989: 83; 1990: 284; Pieri 2005: 135–137) and Sinopean type D.II respectively (Erten *et al.* 2004: 106, fig. 1c; Kassab Tezgör 2010: 171–172, fig. 99.4). So far the first five amphorae can be divided into three main groups.

Group i (**Fig. 6**): Amphorae A–C are quite similar in shape even though the body of B is more globular than its counterparts. They are also of similar size, ranging from 0.49–0.52m in height and 0.26–0.29m in diameter. This group, especially variant B, composes the main cargo of the ship.

Group ii (**Fig. 7**): A second group is represented by amphora D. These amphorae are smaller with a more elegant, cylindrical body. Among the visible cargo, five examples of this type were identified.

Group iii (**Fig. 8**): Amphora E and three other similar specimens from the wreck site can be distinguished from the other groups by a groove on the lower third of the body that divides it into two sections.

It is apparent that numerous variants of LR 1 amphorae exist. This may be because they were produced in a number of areas: especially along the Cilician coast, northern Syria (Empereur & Picon 1989: 242), Cyprus (Demesticha 2003, 2013),

Amphora no.	EUA inv. no.	Amphora type	Dimensions				
			Max Ht	Max D	Rim D	Rim Ht	Handle Ht
A	BE2007/21-1	Intact LR 1	0.52	0.26	0.08	0.025	0.12
B	BE2007/21-4	Intact LR 1	0.49	0.29	0.11	0.03	0.105
C	BE2007/21-5	Intact LR 1	0.49	0.26	0.105	0.03	0.115
D	BE2007/21-3	Intact LR 1	0.44	0.20	0.09	0.03	0.10
E	BE2007/21-8	Almost intact LR 1, one handle missing	0.52	0.21	0.13	0.06	0.01
F	BE2007/21-7	Samos Cistern Type, almost intact, part of the knob missing, modern crack	0.51	0.24	0.075	0.105	0.02
G	BE2007/21-6	Upper half of a Sinopean DII	0.25	0.21	0.13	0.06	0.01
H	BE2007/21-2)	One-handled jug, part of rim and neck missing	0.215 MD:	0.16	Max Base D 0.115		

Table 2. Vessels recovered from Site 10



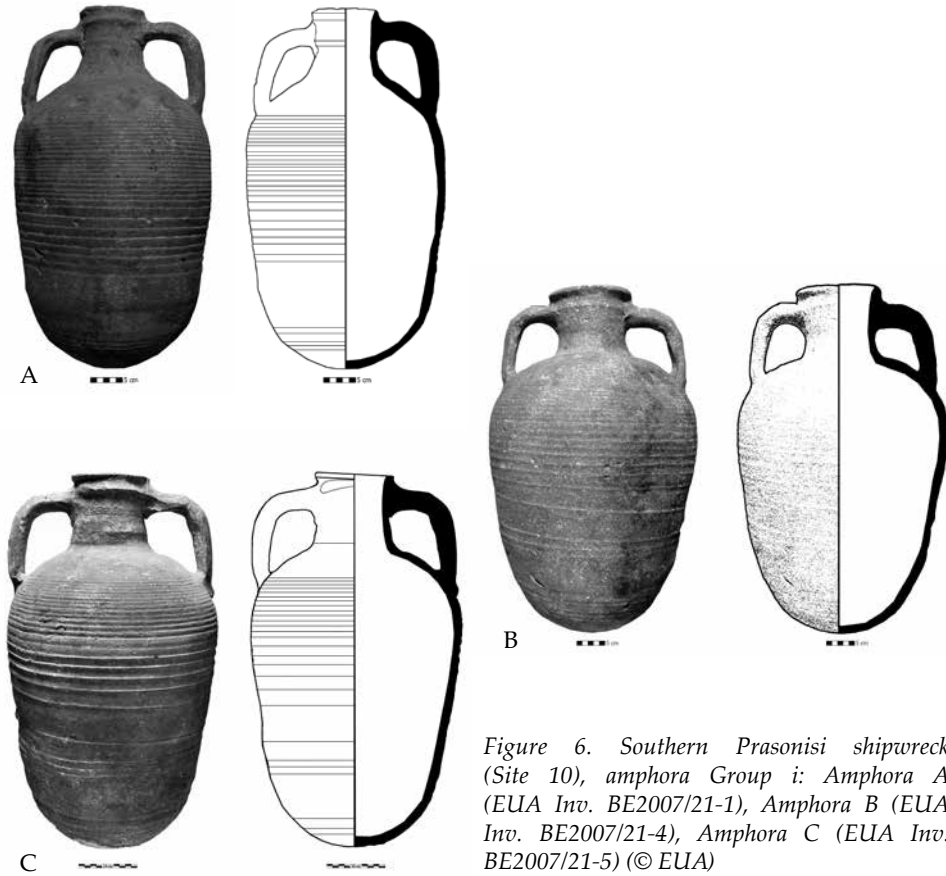


Figure 6. Southern Prasonisi shipwreck (Site 10), amphora Group i: Amphora A (EUA Inv. BE2007/21-1), Amphora B (EUA Inv. BE2007/21-4), Amphora C (EUA Inv. BE2007/21-5) (© EUA)

and Rhodes (Peacock & Williams 1986: 186; Sciallano & Sibella 1994: 100), but also in the Aegean islands, as the Coan (Diamanti 2010) and Parian workshops suggest (Diamanti *et al.* 2014). The primary type evident in the Prasonisi LR 1 cargo (Amphora B) has a cylindrical bulged body and, based on preliminary observations, could be attributed to several workshops ranging from Cyprus (Demesticha 2003: 471, fig. 2) to Paros (Diamanti *et al.* 2014: 184). Future studies of these jars will provide a better understanding of their place of origin and use.

Amphora F (Fig. 9) has a teardrop-shaped body, with its maximum diameter at the lower part of the vessel. It can be attributed to the Samos Cistern Type, which may have originated in the area of Samos or Halicarnassus and which dates from the second half of the sixth to first half of the seventh centuries AD (Arthur 1989: 83; 1990: 284; Pieri 2005: 135–137). According to Tsavaropoulos (1986: fig. 19, table 38, n. 13a–c) though, a workshop in Chios produced this type of amphora. Hence, with just one exemplar of this vessel type and without further analysis, a connection between amphora, workshop, and shipwreck cannot be established.

Amphora G (Fig. 10) preserves only its upper half. The remaining part of the body is grooved, the neck narrow and tall, and the rim everted. It can be attributed to Sinopean type DII produced in the area of Dimirci, Sinope on the Black Sea during the sixth century AD, which had a wide distribution in the Black Sea and eastern



Figure 7. Southern Prasonisi shipwreck (Site 10): Group ii/Amphora D (EUA Inv. BE2007/21-3) (© EUA)

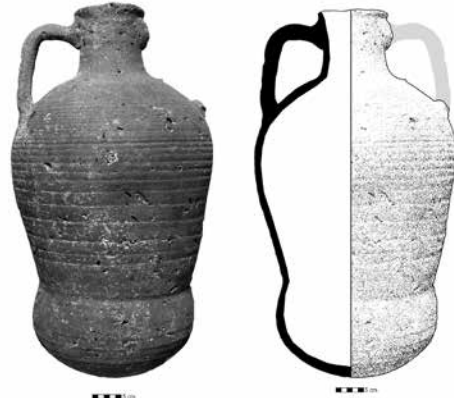


Figure 8. Southern Prasonisi shipwreck (Site 10): Group iii/Amphora E (EUA Inv. BE2007/21-8) (© EUA)



Figure 9. Southern Prasonisi shipwreck (Site 10): Amphora F (EUA Inv. BE2007/21-7) (© EUA)



Figure 10. Southern Prasonisi shipwreck (Site 10): Amphora G (EUA Inv. BE2007/21-6) (© EUA)

Mediterranean regions (Erten *et al.* 2004: 106, fig. 1c; Kassab Tezgör 2010: 171–172, fig. 99.4). As this is the only example of this type found in the assemblage thus far, more work is necessary before any further conclusions are drawn about the amphora types transported on the ship and their importance for the cargo.

## 4 Conclusions

The chronological and geographical range of the shipwrecks located around Chios before 2008 had demonstrated that at least from the sixth to the first centuries BC, Chios was on a maritime crossroad. The five Late Roman sites investigated during the 2008 survey indicate that maritime activity was also intense during this period (sixth to seventh centuries), a fact most probably connected to the foundation of

Constantinople and the transport of supplies to and from the new capital. The island participated in this renewed network of commercial activities, trading commodities like wine and olive oil, as the amphora kiln sites testify (Tsaravopoulos 1986; Opaït & Tsaravopoulos 2011: 280, 290, 303) at well-protected landing points.

The difficulty of navigation in the narrow strait between Chios and Oinousses, further choked by the Prasonisia islets, resulted in many nautical accidents in antiquity. Ships attempting to find safe harbour in the Lagadha Gulf had to sail past these obstacles before encountering the final hurdle, the islet of Agios Stefanos. This navigational challenge is attested by the fact that 12 of the 15 shipwrecks (80%) are located in northern Chios and Oinousses. Four of these, two ancient (Sites 6 and 10) and two modern, were found adjacent to these rocky hazards.

The several variants of LR 1 amphorae at the shipwreck south of the southern Prasonisi islet (Site 10), along with the LR 13 and LR 2 loads of the other shipwrecks under discussion, show multiple origins from the eastern Mediterranean and Aegean areas. The various shapes of amphorae, seen even in those of the same type, may indicate diversity of transported goods or diversity of workshops. These ships not only passed by Chios but made stops at the island to load and unload cargoes transported in LR amphorae.

Other than the known Roman amphora workshop in Chios (Tsaravopoulos 1986; Opaït & Tsaravopoulos 2011), two Late Roman workshops have also been partly uncovered in recent rescue excavations near the harbour of Limia at Volissos, northwestern Chios, and at Komi in southeastern Chios (personal communication with D. Tsardhaka, Chios Ephorate of Antiquities). However, further analyses are needed to link local production to amphorae sampled from the shipwrecks under discussion, especially the LR 1 at Prasonisi, where the Samos Cistern Type amphora that was also produced in Chios (Tsaravopoulos 1986: fig. 19, table 38, n. 13a–c) was located. The cargo of the shipwreck, as far as commodities and amphorae are concerned, could either be transported from abroad or produced locally at Chios. Lacking further analysis, *terra* and *mare* may not exactly identify the amphora provenances in this case, but studies so far do reaffirm the participation of Chios in amphora production, transportation, and the Late Roman commerce network.

### Acknowledgements

Our acknowledgements must be expressed to the members of 2007 and 2008 teams: EUA divers Manolis Tzefronis, Petros Tsampourakis, and Loui Merscenie; volunteer diver Giorgos Katsikoyiannis; volunteer photographer Fred Dion; archaeologist Xanthi Argyri, who directed a large part of the 2007 mission; molecular biologist Maria Hansson for DNA analysis; archaeologist Alexandros Tourtas for his help with drawings; personnel of the Conservation Laboratory of the Ephorate; and also the local inhabitants of Chios, who provided information that helped locate the sites. Many thanks are also owed to the Port Fund Authority of Chios and the Prefecture of Chios for sponsoring the 2007 and 2008 missions.

### Bibliography

Archontidou-Argyri, A. & M. Grigoriadou 2000: History, in A. Archontidou-Argyri & T. Kyriakopoulou (eds), *Chios t'enalos polis Oinopionos*, 50–87, Chios (in Greek)

4. Roman amphora cargoes in the sea of Chios — the 2008 mission

- Arthur, P. 1982: Amphora production in the Tripolitanian Gebel, *Libyan Studies* 13, 61–72
- Arthur, P. 1989: Aspects of Byzantine economy: an evaluation of amphora evidence from Italy, in V. Deroche & J.-M. Spieser (eds), *Recherches sur la céramique byzantine (Bulletin de Correspondance Hellénique Supplément 18)*, 79–93, Athens, Paris
- Arthur, P. 1990: Anfore dall'alto adriatico e il problema del 'Samos cistern type', *Aquileia Nostra* LXI, 281–295
- Bass, G. & F. van Doorninck 1982: *Yassi Ada. A Seventh-Century Byzantine Shipwreck*, College Station, TX
- Dellaporta, A., D. Evagelistis, T. Theodoulou, D. Kourkoumelis & P. Micha 2005: East Aegean. The island of Chios, *Archaeologikon Deltion* 60, 1251 (in Greek)
- Demesticha, S. 2003: Amphora production on Cyprus during the Late Roman period, in Ch. Bakirtzis (ed), *Actes du VIIe Congrès international sur la céramique médiévale en Méditerranée, Thessaloniki, 11–16 October 1999*, 469–476, Athens
- Demesticha, S. 2010: The cargo of shipwreck 7 at the Gulf of Pagasai. First interpretation approach, in D. Papanikola-Bakirtzi & N. Kousoulakou (eds), *Proceedings of the Conference 'Pottery of Late Antiquity from the Area of Greece', Thessalonica 12–16 Nov. 2006*, Volume II, 131–142, Thessaloniki (in Greek)
- Diamanti, C. 2010: *Local Production and Import of Amphorae in Alasarna of Kos (5th–7th c.). Contribution to the Research of Production and Circulation of Late Roman/Early Byzantine Amphorae of the Eastern Mediterranean (S. Saripolos Library 115)*, Athens (in Greek)
- Diamanti, C., K. Kouzeli & P. Petrides 2014: Archaeology and archaeometry in Late Roman Greece: the case of mainland and insular settlements, workshops and imports, in N. Poulou-Papadimitriou, E. Nodarou & V. Kilikoglou (eds), *LRCW 4. 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.I)*, 181–192, Oxford
- Egloff, M. 1977: *Kellia: La poterie copte: quatre siècles d'artisanat et d'échanges en Basse Egypte*, Genève
- Empereur, J.-Y. & M. Picon 1989: Les régions de production d'amphores impériales en Méditerranée orientale, in *Amphores romaines et histoire économique: dix ans de recherche (Collection de l'École française de Rome 114)*, 223–248, Rome
- Erten, H.N., D. Kassab Tezgör, I.R. Türkmen & A. Zararsiz 2004: The typology and trade of the amphorae of Sinope. Archaeological study and scientific analyses, in J. Eiring & 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)*, 103–115, Aarhus
- Foley, B., M. Hanson, D. Kourkoumelis & T. Theodoulou 2012: Aspects of ancient Greek trade re-evaluated with amphora DNA evidence, *Journal of Archaeological Science* 39, 389–398
- Foley, B., K. Dellaporta, D. Sakellariou, B. Bingham, R. Camilli, R. Eustice, D. Evagelistis, V. Ferrini, K. Katsaros, D. Kourkoumelis, A. Mallios, P. Micha, D. Mindell, C. Roman, H. Singh, D. Switzer & T. Theodoulou 2009: The 2005 Chios

- ancient shipwreck survey: new methods for underwater archaeology, *Hesperia* 78, 269–305
- Garnett, R.J. & J. Boardman 1961: Underwater reconnaissance off the island of Chios, 1954, *Annual of the British School at Athens* 56, 102–113
- Grace, V. 1979: *Amphoras and the Ancient Wine Trade* (Agora Picture Book 6), Princeton
- Hansson, M. & B. Foley 2008: Ancient DNA fragments inside Classical Greek amphorae reveal cargo of 2400-year-old shipwreck, *Journal of Archaeological Science* 35, 1169–1176
- Hood, S. 1981: *Excavations in Chios 1938–1955: Prehistoric Emporio and Ayio Gala* (The British School of Archaeology at Athens Supplementary Volume 15–16), London
- Karagiorgou, O. 2001: LR2: a container for the military *annonna* on the Danubian Border? in S. Kingsley & M. Michael (eds), *Economy and Exchange in the East Mediterranean during Late Antiquity, Proceedings of a Conference at Somerville College, 29 May 1999*, 129–166, Oxford
- Kassab Tezgör, D. 2010: Le réseau commercial des amphores sinopéennes entre les IIe–IIIe et le Vie s. de notre ère, in D. Kassab Tezgör & N. Inaishvili (eds) *PATABS I. Production and Trade of Amphorae in the Black Sea. Actes de la Table Ronde Internationale de Batoumi et Trabzon, 27–29 April 2006* (*Varia Anatolica* XXI), 169–173, Istanbul
- 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
- Koehler, C.G. 1986: Handling of Greek container amphoras, in J.-Y. Empereur & Y. Garlan (eds), *Recherches sur les amphores grecques* (Bulletin de Correspondance Hellénique Supplément 13), 49–67, Paris
- Opaiț, A. 1980: Consideratii preliminare asupra amforelor romane si Romano-Bizantine din Dobrogea, *Peuce* VIII, 291–325
- Opaiț, A. & A. Tsaravopoulos 2011: Amphorae of Dressel 24 similis type in the central Aegean area (Chios–Erythrai–Kyme), *Annual of the British School at Athens* 106, 275–323
- Panella, C. 1973: Appunti su un gruppo di anfore della prima, media e tarda età Imperiale, *Ostia III: Le Terme del Nuotatore. Scavo dell’Ambiente V et di un Saggio dell’Area* (*Studi Miscellanei* 21), 460–633, Rome
- Peacock, D.P.S. & D.F. Williams 1986: *Amphorae and the Roman Economy: An Introductory Guide*, London, New York
- Piéri, D. 2005: *Le commerce du vin oriental à l’époque byzantine* (Bibliothèque Archéologique et Historique 174), Beirut
- Preka-Alexandri, K., X. Argyris & T. Theodoulou forthcoming: Underwater survey at Chios island—preliminary results, in H. Tzalas (ed), *Tropis X. 10th International Symposium on Ship Construction in Antiquity, Hydra, Aug. 28–Sept. 2, 2008*
- Riley, J. 1979: The coarse pottery from Berenice, in J.A. Lloyd (ed), *Excavations at Sidi Khrebish, Benghazi (Berenice) II* (*Supplements to Libya Antiqua* V), 91–476, Tripoli

4. Roman amphora cargoes in the sea of Chios — the 2008 mission

- Sakellariou, D., P. Georgiou, A. Mallios, V. Katsimalis, D. Kourkoumelis, P. Micha, T. Theodoulou & K. Dellaporta 2007: Searching for ancient shipwrecks in the Aegean Sea: the discovery of Chios and Kythnos Hellenistic wrecks with the use of marine geological-geophysical methods, *International Journal of Nautical Archaeology* 36.2, 365–381
- Sciallano, M. & P. Sibella 1994: *Amphores, comment les identifier?* Aix-en-Provence
- Theodoulou, T. 2005: Autopsies at Chios island, *Archaeologikon Deltion* 60, 1252 (in Greek)
- Theodoulou, T. forthcoming: Autopsies at Chios–Oinousses area, *Archaeologikon Deltion* (in Greek)
- Theodoulou, T., B. Foley & D. Kourkoumelis forthcoming: Marine research and its results at the area of Chios, in “100 Years of Archaeological Work in Chios”, *Chios, 19–20 Oct. 2012* (in Greek)
- Theodoulou, T., D. Kourkoumelis, K. Preka-Alexandri & B. Foley 2009: Underwater archaeological surveys at the area of Chios. The development of underwater investigation, 1954–2008, in *9th Pan-Hellenic Congress of Oceanography and Fishing, Patras, 13–16 May 2009*, 140–145, Athens (in Greek)
- Thomas, C. 1959: Imported pottery in Dark-Age western Britain, *Medieval Archaeology* 3, 216–234
- Tsaravopoulos, A. 1986: The ancient city of Chios, *Horos* 4, 124–144 (in Greek)
- van Doorninck, F.H. 1989: The cargo amphoras on the 7th century Yassi Ada and 11th century Serçe Limani shipwrecks: two examples of a reuse of Byzantine amphoras as transport jars, in V. Deroche & J.-M. Spieser (eds), *Recherches sur la céramique byzantine (Bulletin de Correspondance Hellénique Supplément 18)*, 247–250, Paris
- Vichos, Y. 1989: The investigation for locating the shipwreck of Kara Ali’s flagship, *ENALIA* 1, 12–13 (in Greek)