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# Underwater excavation research in the ancient harbour of Samos: September–October 1988

**Angeliki Simossi**
*Department of Marine Antiquities Callisperi 30, 117 42 Athens*

**Situation and historical development of the island**
Located in the eastern Aegean and in a vital position for communication with the coast of Asia Minor, Samos was one of the major centres of political and cultural development from prehistoric times to the Middle Ages.

The ancient city of Samos, unconnected with the modern capital, was founded and developed in the south-eastern section of the island, at Pythagorion (Figs 1–3).

The settlement of the first inhabitants of Samos dates from the 4th millenium and, as early as the first half of the 6th century BC, Samos stood out as one of the most significant centres of fine art in the Greek world.

Under the tyrant, Polycrates, in the second half of the 6th century BC, Samos appeared as a great sea power. The walls of the city and the harbour installations were built at that time (Zafiropoulou, 1987; Kyrieleis, 1983).

After a period of political and artistic decline in the 5th and 4th centuries BC, Samos became a naval base for the Ptolemies and other kings during the Hellenistic period and enjoyed a significant economic revival.

During the second Mithraditic war, 88–84 BC, it was sacked by pirates while during the decade of 80 BC it was embodied in the Roman state as part of the province of Asia. The long period of peace after the end of the Roman Civil Wars in

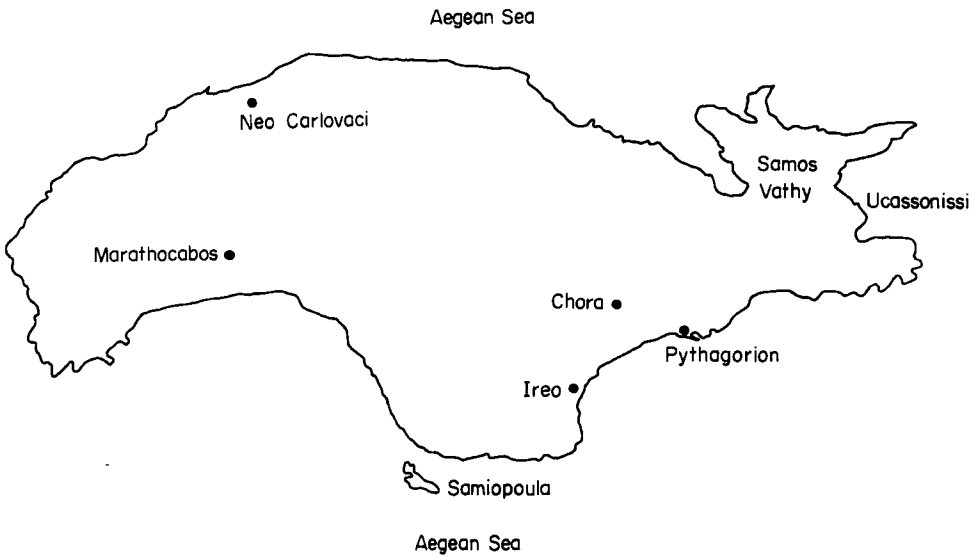


Figure 1. Map of the island.

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Figure 2. Aerial photograph of the region of Pythagorion and of the harbour.


Figure 3. Addition to the topographical plan of the ancient city of Samos. Area 19 shows the submerged ancient stone structure (breakwater). (Drawing: K. Tagonidou.) 1, Efpalinio tunnel; 2, theatre; 3, monastery of Spiliani; 4, ancient wall; 5, roman aqueduct; 6, western Necropolis; 7, L. Chr. cemetry; 8, Actemissio; 9, Archaic harbour; 10, L. Chr. Basilica; 11, Stadium; 12, baths; 13, ancient city; 14, ancient Agora; 15, Temple of Venus; 16, castle; 17, harbour wall; 18, Polycrates quay; 19, Hellenistic breakwater; 20, harbour; 21, N-E Necropolis; 22, Kasteli; 23 and 24, Hellenistic villa.

31 BC heralded a new but restricted blossoming for the city, and life continued in spite of the great destruction caused by the earthquake of 262 AD and the looting the island suffered during the raids of wandering German tribes.

**Underwater research: the ancient harbour installation**

Underwater excavation research in the ancient harbour of Samos was carried on from 8 September to 14 October 1988 and started as a result of the need to preserve the present-day harbour of Pythagorion.

For this reason it was necessary to rebuild an existing breakwater, which had collapsed because of the strong north winds which plague the area and cause stormy seas.

The research was undertaken by a diving team belonging to the EEA (Department of Marine Antiquities) directed by the writer.

The existence of an ancient harbour installation was confirmed south of the present windward mole of the harbour of Pythagorion. It consists of a submerged stone structure, 480 m in length and of so far unknown width, since its upper surface towards the inside has been covered by recent rubble from the disintegrating breakwater. Mixed with the contemporary rubble, one can distinguish here and there ancient architectural components whose provenance is known. Most of these, among them a fluted column (Figs 4 and 5), have been observed in the sea on a straight line from the eastward starting point of the modern protective wall of the modern mole (Figs 6 and 7). Even though the degree of cohesion of the architectural components is loose, it is desirable for a cleaning operation to take place so as to determine the reason for the accumulation in this area.

Figure 4. Ancient architecture and one column. Probably they formed part of rubble brought into the area and used in the construction of the contemporary breakwater. (Underwater photograph: P. Vezirztis.)

The upper surface of the stone structure, near its centre point is 2·75 m below the surface. Its outer end is 4·43 m below the surface, whereas its western end is at a depth of about 2·90 m.

At the outer end the talus on the south side reaches a depth of about 11 m, and it is not known how far it continues below the seabed (Figs 6 and 7).

On top of the stones of this structure there are embedded many pieces of pottery, both individually and also in clumps. The majority come from amphoras used for transport, but also from other objects, referred to below.

It is important to bear in mind the existence of a section of the stone structure under the inner cheek of the present mole. It is not visible today, however, since it has been covered by the recently constructed landing dock, and could not be planned.

An underwater inspection along the inner course of the 19th-century mole gave us indications only of the existence of the ancient stone

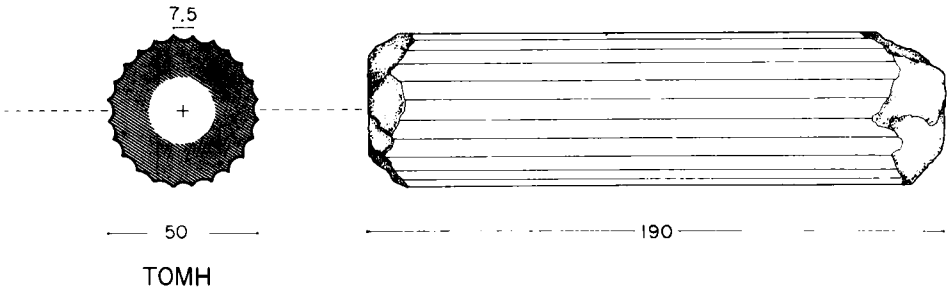


Figure 5. Plan of the column.

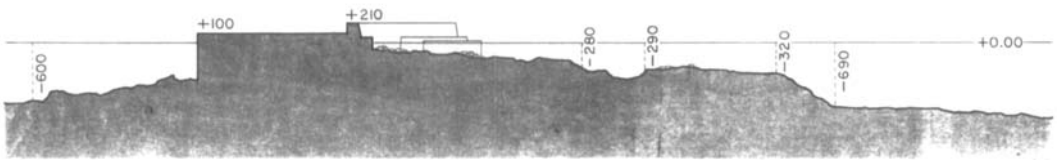


Figure 7. Section of the ancient stone structure in relation to the southern windward mole and the contemporary rubble. (Drawing: K. Tagonidou.)

structure below its foundations. To demonstrate this it would be necessary to open an excavation trench. The same conclusion was drawn from dives along the northern harbour wall and the small southern jetty which encircles the basin of the harbour and which appear to have their foundations set on the ancient harbour works. Thus excavation is necessary to establish the structural history.

**Excavation**

In order to determine the date of construction of the stone structure and, more important, to relate this to the harbour works which closed the harbour (Herodotus III, 60), and in addition to find the depth of the foundations, a trench was excavated (Figs 8 and 9). The excavation took place using a hydraulic dredge and individual breathing apparatus, as well as the system of air supply used by the sponge-fishermen (*narghile*). The dimensions of the original trench dimensions were 5 × 2·5 m and it was widened later to 25 × 2·5 m because the stone structure continued to some depth.

Excavation on the outer seaward talus of the stone structure, near its outer end, where the silting up of the bottom was less, reached a depth of 14 m though the stones used in its construction seem to continue below this depth. Thus the provisional height of the stone structure is approximately 11 m since its highest surviving section is 2·75 m below the surface.

**Finds from the excavation trench**

1. Intact amphora (Figs 10 and 11). Missing only a part of one of its handles and parts of its body, assembled from many fragments. It is 54 m tall, the diameter of its rim varies from 98 mm to 11 m and the greatest diameter of its body is 305 mm. The shoulder and the base of the vase are encircled by a series of comb-like grooves. Form LR1, dating between the 4th and 7th centuries AD (Empereur & Picon 1986: fig. 15; Riley, 1979: 212–16, fig. 42; Ballance *et al.*, 1989). Until a few years ago it was thought that they originated in Egypt, because a large number of them were found in that country. From the composition of their clay, however, and from other research, it has been shown that they can be found in Rhodian Peraia, in Cilicia, in the area of Antioch-on-Orontes and in Cyprus.
2. Neck of an amphora LR1 of the same type as above (Figs 12 and 13). The neck, the shoulders and two handles of the vase (one of which has been partially reconstructed) survive. The maximum surviving height is 16 cm and the diameter of the rim is 8·4 mm.
3. Almost complete amphora, incomplete towards its base (Figs 14 and 15). Maximum surviving height, 638 mm, maximum diameter of body, 313 mm and diameter of rim, 13 cm. It belongs to the category of Africana I amphoras, 2nd–4th century AD (Panella, 1972: 82, fig. 37).
4. Neck of an amphora (Figs 16 and 17). Surviving height 16 cm, width of rim 105 mm and height of rim 29 mm. Belongs to the type of Africana IIA, which date to the first quarter of the 3rd century AD.
5. Neck of amphora, 4th century AD (Figs 18 and 19).
6. Amphora. A section of rim, one handle and the body survive. Horizontal grooves encircle the shoulders below the neck and on the belly. Maximum surviving height 265 mm diameter of rim 10 cm, maximum surviving diameter of body, 22 cm. Probably dates to the second half of the 3rd century AD (Kapitän, 1972: 246–8, fig. 3).
7. Cup without handles, 3rd century AD (cf. Robinson, 1959: K10) (Fig. 20). Coarseware vessel, 2nd–3rd century AD.

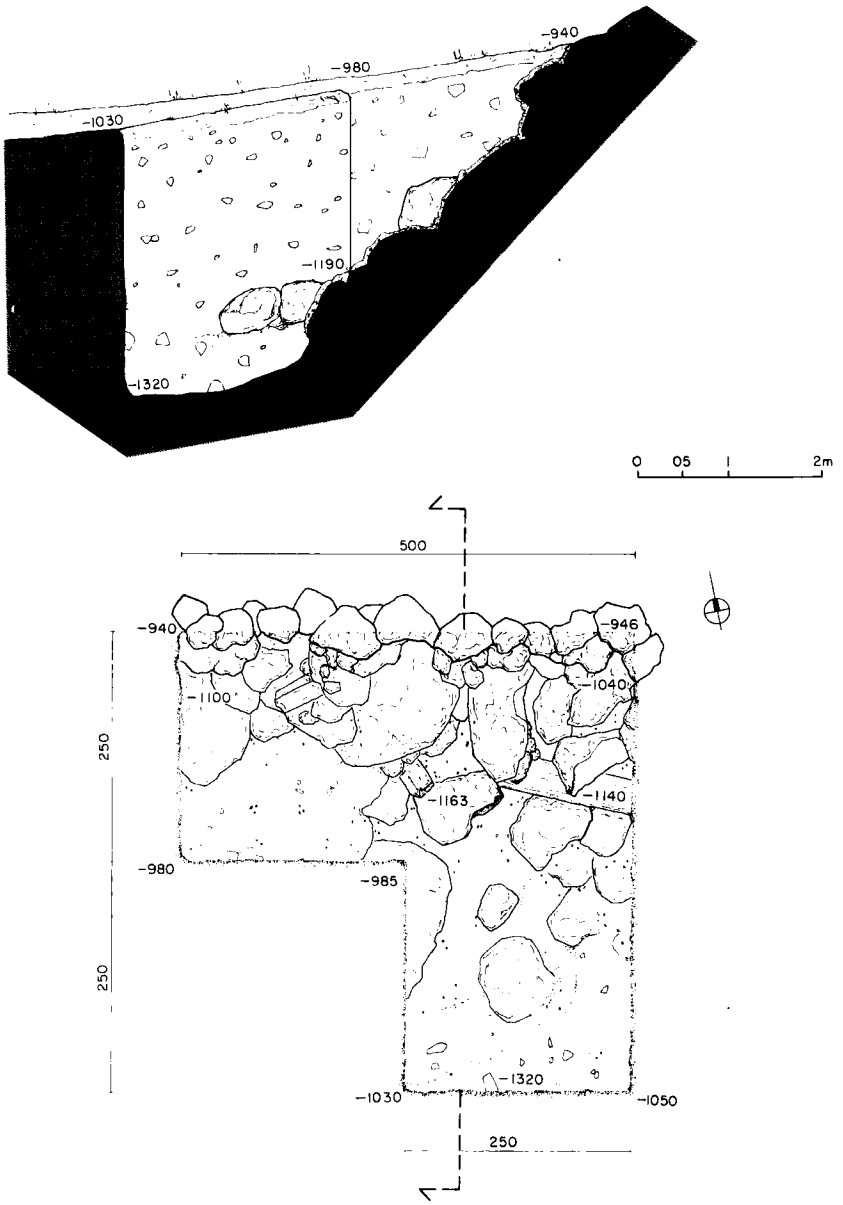


Figure 8. Plan and section of the excavation trench. (Drawing: P. Tagonidou.)

8. Neck of an amphora, cf. Dressel 43, maximum surviving height, 18 cm and diameter of the rim, 6 cm. A small part of the shoulders and two handles survive. This type of amphora comes from Crete and dates to the 1st and 2nd centuries AD (Panella, 1986: 614, Fig. 7).
9. Clay statuette of a bull turning to the right (Fig. 21). On the back of the bull is an unidentifiable object. Typologically this can be related to the Myr 371 and 673 type which dates to the 1st century BC (Mollard-Bresques, 1963: 147, pl. 180).
10. Lead ring with a right-angled projection with two holes (Fig. 22), outer diameter 9 cm (Gianfrotta & Pomey, 1980; 285–96).
11. Body of an amphora of the Dressel 1A type (Figs 23 and 24). The remains of some

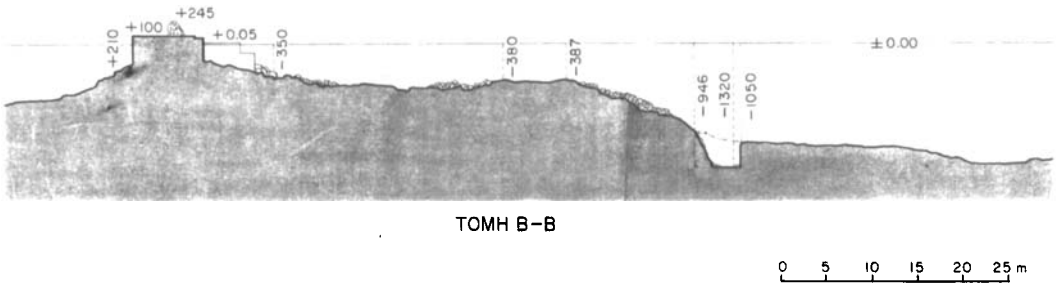


Figure 9. Section of the stone structure and the excavation trench in relation to the southern windward mole. (Drawing: K. Tagonidou.)

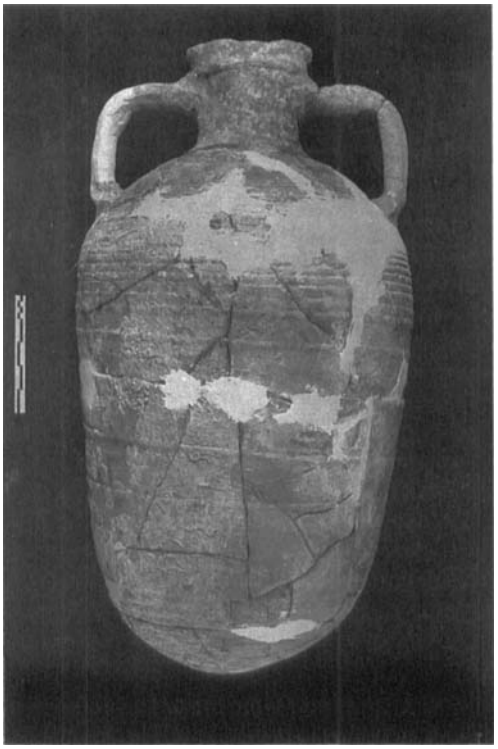

Figure 10. No. 1. Intact amphora, type LR1.

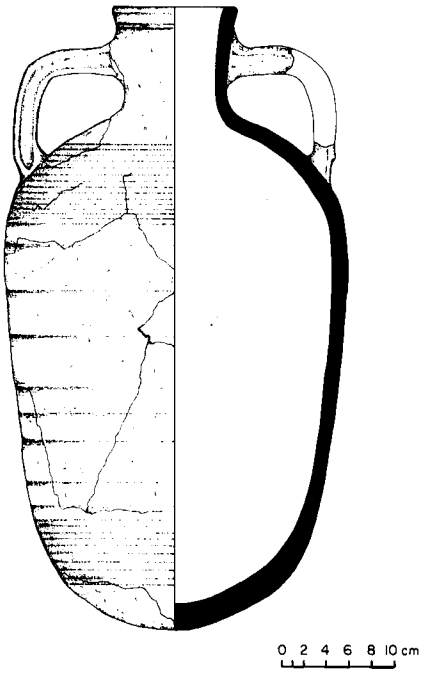


Figure 11. No. 1. Intact amphora, type LR1.

substance was found on the inner surface. It is probably rosin.[1]

12. Upper part of a Rhodian amphora (Figs 26 and 27). Surviving height 49 cm and diameter of the rim 13 cm. Chronologically it belongs to the third period of the Rhodian amphora which is that of the bothros of Pergamun—that is, 210–175 BC, and more precisely the period between 195–189 BC (Empereur & Hesnard, 1987: 19, fig. 11).

One of the two handles of the vase has been preserved, bearing an impressed stamp with the inscription ΔΙΟΚΛΕΙΑΣ (Fig. 28) (Grace & Savatianou-Pétropoulakou).

13. Neck of a stamped amphora (Figs 29 and 32). The shoulders and part of the body of the amphora have been preserved. Maximum existing height 40 cm, diameter of rim 124 mm, existing diameter of body 34 cm.

On the handles there are two Rhodian stamps of the *knopfstempel* type (button) with the names of the producer, Ιεροτέλης or Ιεροτελευς

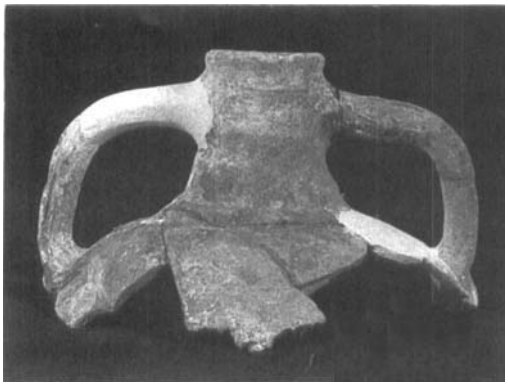

Figure 12. No. 2. Neck of amphora, type LR1.

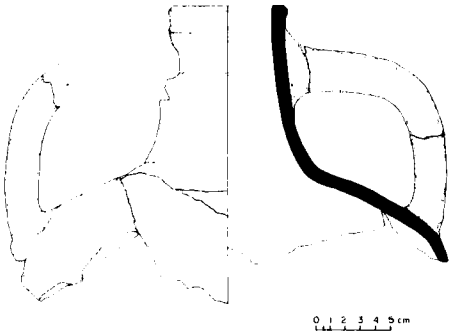


Figure 13. No. 2. Neck of amphora, type LR1.

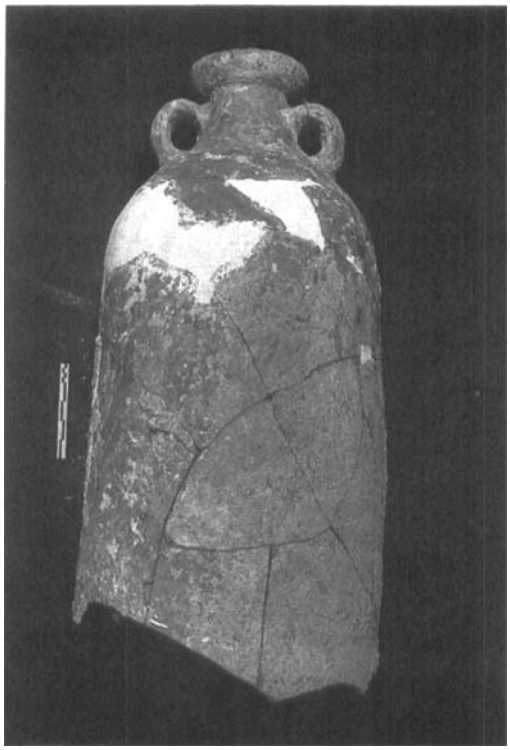

Figure 14. No. 3. Nearly intact amphora, type 'tripolitaines I'.

who worked from 269 to 255 BC and the chief magistrate, Αινησιδαμος.

These stamps have also been found on the handles of amphoras discovered at Heraion (Figs 33, 11 and 13) (Jöhrens, 1986: 497 ff; Grace & Savatianou-Pétropoulakou, 1970; Grace, 1963). Amphoras of this type are problematic because they bear stamps which are undoubtedly Rhodian, but they also have on their base the termination of a moulded knob of Cnidean type, and their clay differs from that of Rhodian types (Empereur & Tuna, 1989: fig. 9a,b; Museteanu *et al.*, 1978: 173–99).

The problem of the source of these amphoras was solved with the discovery of kiln wasters of this form in Rhodian Peraia.

The objects referred to above are the most characteristic of those lifted from the trench. They were found embedded in a layer of organic material which had formed immediately above the foundation stones of the breakwater.

In any case, the fact remains that the creation of this organic layer took place during a particular period of time and can be related to an archaeological event. The difference in date of the finds which did not relate to depth and the formation of this organic layer above the building stones of the stone structure is considered to indicate continuous intervention on the structure.

These interventions are both human and natural. Human activities consist of constant efforts to maintain the breakwater in the face of natural catastrophes and various physical phenomena. Thus, when the breakwater collapsed as a result of rough seas or less frequently of earthquakes, but also as a result of the phenomenon of local subsidence, the Samians repaired the various types of damage by piling new stones on top of the already existing stone structure. When, with the passage of time, these interventions stopped

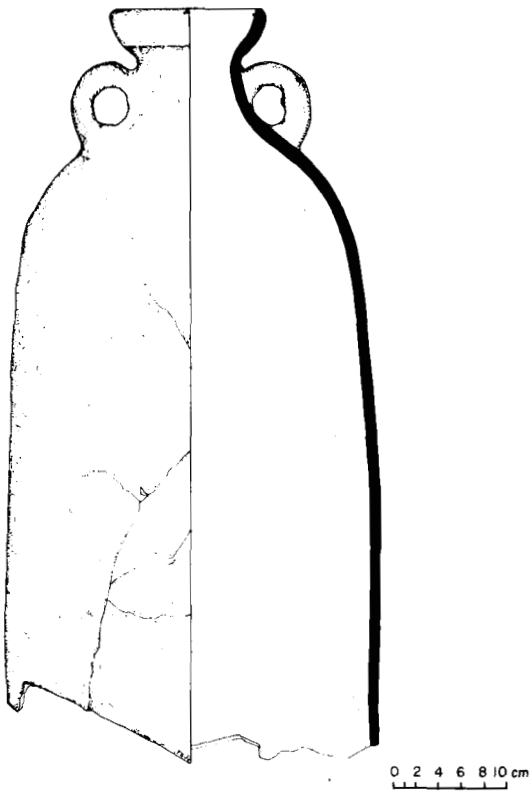


Figure 15. No. 3. Nearly intact amphora, type 'tripolitaines I'.

Figure 16. No. 4. Neck of amphora with horizonal grooving.

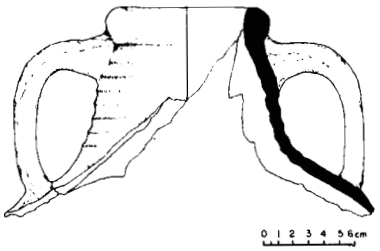


Figure 17. No. 4. Neck of amphora with horizontal grooving.

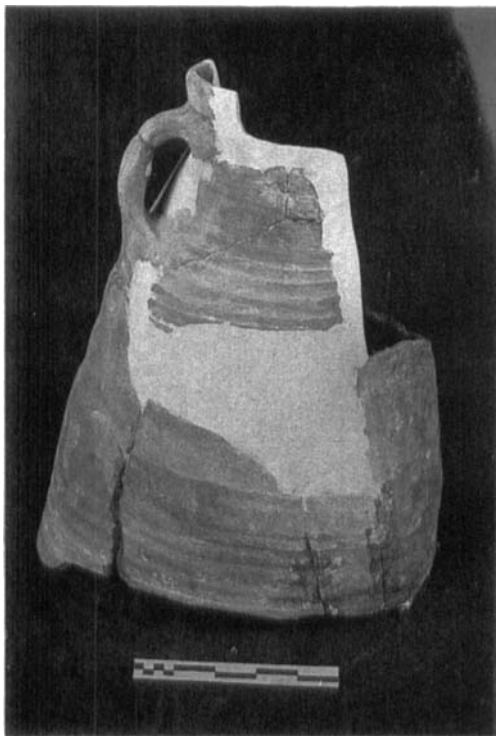

Figure 18. No. 5. Upper part of amphora.

and consequently the use of the stone structure slowly declined, the layer of organic material was created by the constant sedimentary action of the sea. This layer sealed in the various objects that came to rest there, mainly consisting of the unwanted objects thrown overboard from ships before their entrance to the main harbour, thus giving us a *terminus post quem* for the duration of function of the harbour installation.

That this harbour functioned for many centuries is clear from the deposition of objects

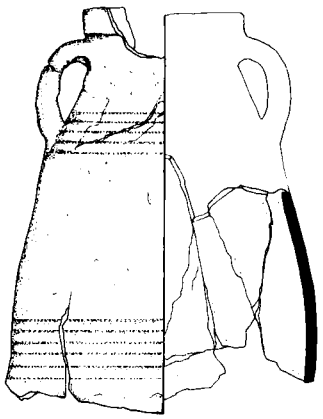

Figure 19. No. 5. Upper part of amphora.

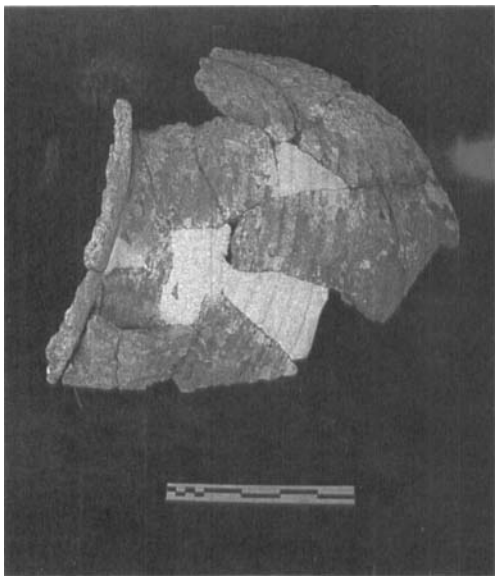

Figure 20. No. 7. Part of an open vessel for everyday use.

dating from varied periods of time on the outer slope, which is not covered by sea sediments today. The importance of the harbour over the centuries is shown by the diverse origin of many of the finds.

**Finds embedded in the outer slope of the stone structure**

While tracing the course of the ancient stone structure, a number of characteristic objects were detached from the visible surface of the slope, a few of which are noted below. Many of these objects correspond both in type and in chronology to those collected from the trench. Many clumps of sherds, mainly from storage amphora with pointed bottoms, were located all along the visible surface of the stone structure (Fig. 34). Two disparate but typical architectural components were also located, one with four square depressions on one of its sides and the other with a circular cavity, 85 cm deep, on one side which seems to have been used to secure a mooring-post (Fig. 35). Among the objects that were collected from the stone structure are: 1. a cup without handles (Figs 36 and 37) (Robinson, 1959: 101–3) dating to the 3rd century AD; 2. neck of an amphora whose type dates from the 4th to the early 6th century AD (Figs 38 and 39) (*op. cit*: 105–6, 114); 3. neck of an amphora whose type dates to the same period with the preceding one (Figs 40 and 41); 4. neck of an amphora dating from the 1st to the 3rd century AD (Figs 42 and 43) (Panella, 1986: 614, fig. 4; Riley, 1979: 180–82; Simossi, 1988: pl. 3a, fig. 4a); 5. mortar with spout (Figs 44 and 45) (Robinson, 1959: 85, pl. 38) from the middle of the 1st century AD.

**Function of the stone structure—chronology**

The existence of this harbour work (the stone structure) not only outside the harbour basin, but also outside the perimeter of the sea walls of the ancient city shows that it had a protective purpose. It protected the main harbour from the south winds and rough seas which afflict the area, thus making the anchorage safer.

In addition it could certainly provide a form of defensive fortification beyond the walls for the inner space of the harbour, which was without any doubt an integral part of the city. Thus we can determine the function of the stone structure as a breakwater, comparing it to similar works in other harbours, as for example in Eretria, in Kechreai and in Istiaia.

However, it is not possible at present to identify with certainty this breakwater with the archaic period Polycration referred to by Herodotus (III, 60) 'there is the artificial harbour enclosed by a breakwater which runs out into 20 fathoms of water and has a total length of over a quarter of a mile' (Selincourt, 1954: 200) and which made up one of the three large-scale building enterprises of the tyrant.

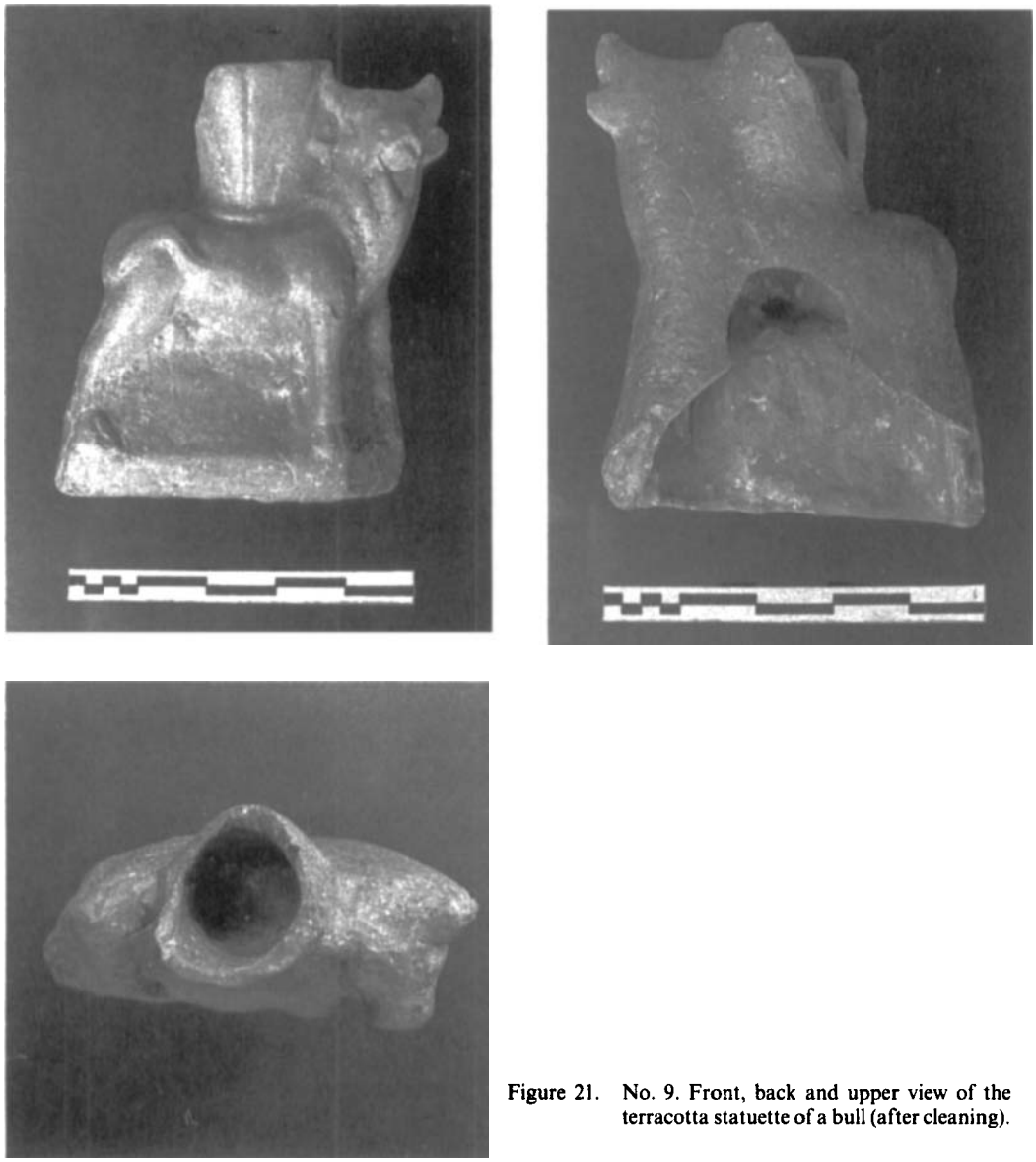

Figure 21. No. 9. Front, back and upper view of the terracotta statuette of a bull (after cleaning).

To date our excavation research on the outer slope of the breakwater has yielded us findings whose earliest date is the Early Hellenistic period (300 BC); however, we have not yet excavated the foundations to complete the chronology.

Moreover, Herodotus' testimony relating to the dimensions of the Polycratian harbour installation: that it had a depth of 20 fathoms (about 35 m) and a length of two stadia (about 370 m) does not seem to correspond to the dimensions of the breakwater as discovered. Even though the excavation was interrupted, before the foundations were reached to establish the actual depth-height of the breakwater, it is likely that this reference by Herodotus is somewhat exaggerated on account of the fact that the ships of that time probably did not draw more than 1 m of water.

In addition, the main modern accounts of the topography of the harbour are hypothetical since they are not based on excavation data (Lehmann-Hartleben, 1923: 55–8; Jantzen, 1968:

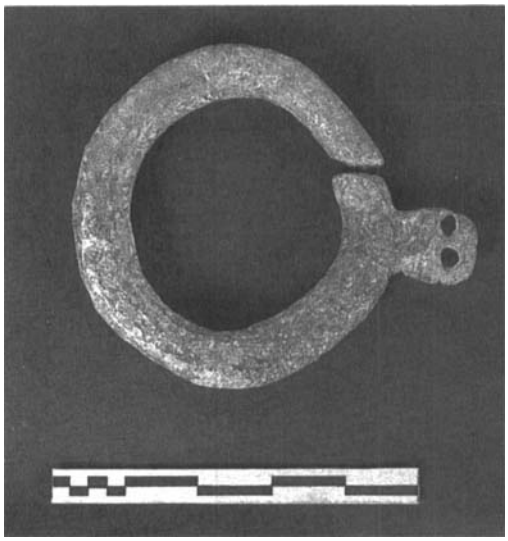

Figure 22. No. 10. Lead ring after restoration.

692; Stamatiades, 1986: 64–5; Jantzen, 1970: 374–5; Tolle, 1969: 48–51; Keinast, 1978: 38). The conclusion, based on the excavation data available so far, is that the breakwater under discussion is a later addition to the archaic harbour-works, constructed in the Early Hellenistic period. On the other hand, it is not possible to determine beyond any doubt whether the archaic Polycratian harbour works are beneath the currently existing mole, built in the last century, since there are no excavation data.

Therefore, it is most likely that the 19th-century mole was built on the northern part of the breakwater, where there have been various repairs at different periods over the centuries. Somewhere below the Hellenistic breakwater must be the Polycratian harbour. As evidence there are the two bowls (lekanides) which were found embedded in the outer slope of the Hellenistic breakwater (Figs 33, 46 and 47) (Isler, 1978: 159, pl. 19, 597).

One of the bowls dates to the 5th century BC and the other dates to the middle of the 6th century (550 BC) (No. P30983, P29931 from the calendar of the ancient Agora).

However, continuation of underwater research in the ancient harbour is absolutely necessary to substantiate what has been stated or conjectured in this report. The continuation of the excavation will help to confirm the topography of the harbour, which can only be conjectured at present.

A characteristic example of what can be achieved is the 5 years of research undertaken in the naval harbour of Thasos by the Department of Marine Archaeology in co-operation with the Ecole Francaise d'Athenes which has radically changed the formerly accepted topography of the harbour and discovered its archaic phase (Archontidou & Empereur, 1987*a*: 622–26; 1987*b* 73 ff; Lianos *et al.*, 1988: 119–34; Empereur & Simossi, 1988: 736–42; 1989; 734–40; 1990: 881–87; Archontidou *et al.*, 1989: 51–9).

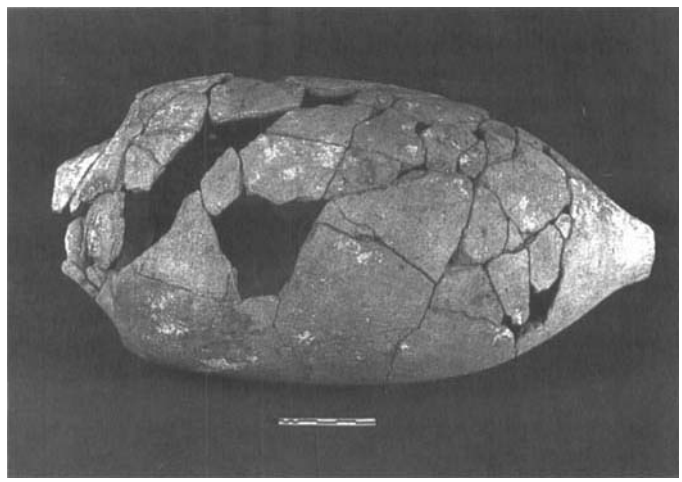

Figure 23. No. 11. Body of amphora, Dressel IA.

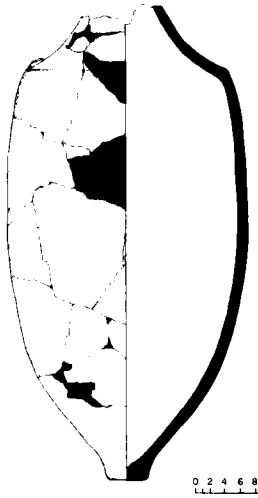


Figure 24. No. 11. Body of an amphora, type Dressel 1A.

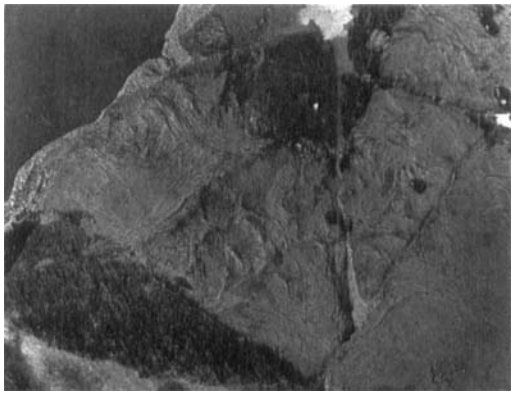

Figure 25. Interior of a vessel, showing the remains of pine resin.

It is obvious that a programme of investigation is necessary for Samos, especially if the plans of the harbour are compared with those that will be published after this research.

It is to be hoped, therefore, that this research will be continued as it can only bring positive results as regards the discovery of the topography of a most important harbour in antiquity.

**Acknowledgements**

I thank the Head of EEA, Mr. Dimitri Kaziani, for allowing me to use this publication, as well as the diving team of EEA, who worked tirelessly for about 40 days underwater, in particular the architect-diver, Katie Tagonidou, the technician-divers, Costa Constantopoulos and Vassilis Glezos, the photographer-diver, Petros Vezirtsis and the divers, Panayiotis Antoniou, Panayiotis Chronopoulos, Louis Mersenie and Elias Kouvelas.

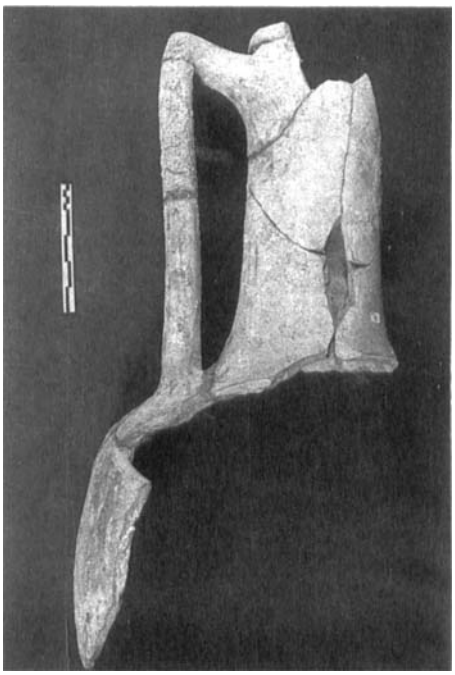

Figure 26. No. 12. Upper part of a Rhodian amphora, with an impressed stamp on the handle.

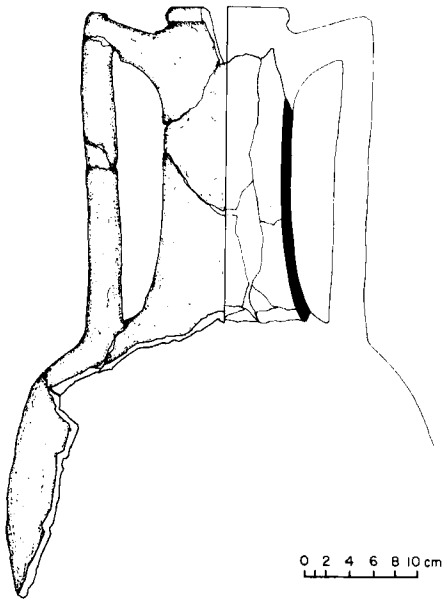


Figure 27. No. 12. Upper part of a Rhodian amphora with an impressed stamp on the handle.

Figure 28. Detail of No 12. Impressed stamp with the inscription ΔΙΟΚΛΕΙΑΣ.

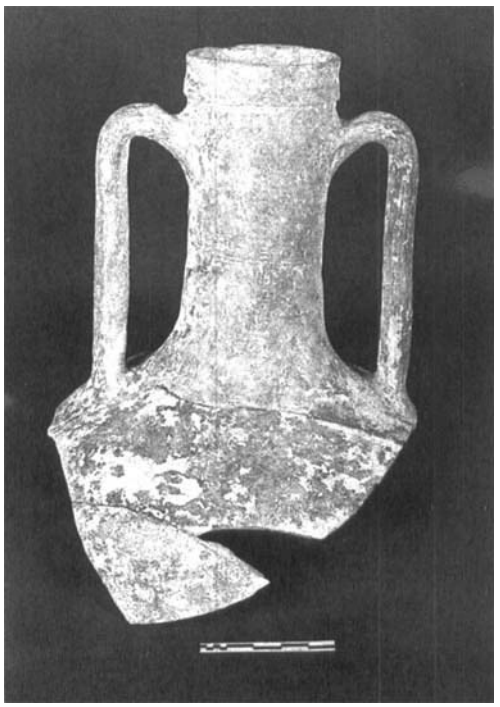

Figure 29. No. 13. Neck of the Rhodian amphora.

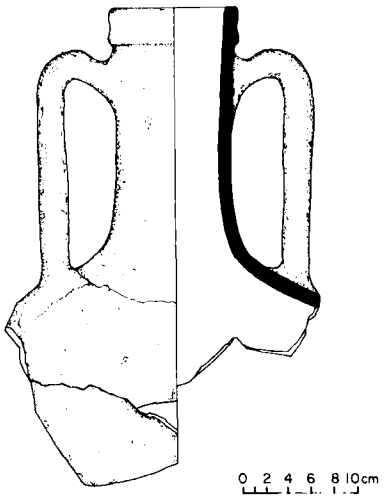


Figure 30. No. 13. Neck of a Rhodian sealed amphora.

Figure 31. Seal with inscription Ιεροτέλης.

I owe sincere thanks to the Hungarian archaeologist-diver, Dr. Arpad Nagy, and to the architect-diver of the Ministry of Culture, Mr. Thanassi Nakasi, for their participation and their significant contribution to the research. I thank the then Nomarch of Samos, Mr Hari Tsioka, and the Community Official of Pythagorion for the valuable help they offered us during my research.

Figure 32. Seal with inscription Ανησίδαμος.

Figure 33. No. 21. Small archaic bowl embedded in outer breakwater (*c.* 560 BC).

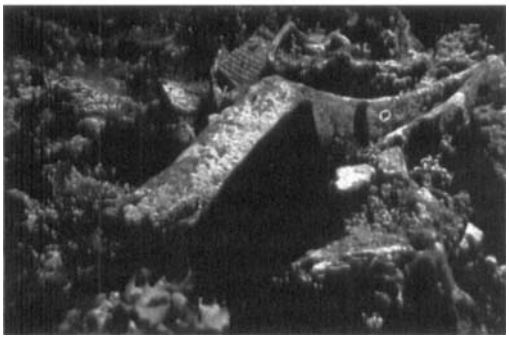

Figure 34. Details showing vessels embedded in the stone structure.

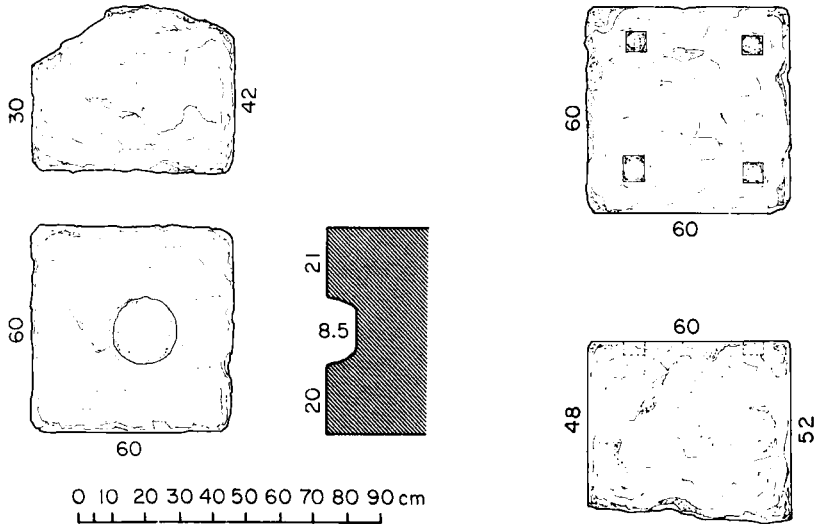


Figure 35. Architectural components embedded in the stone structure.

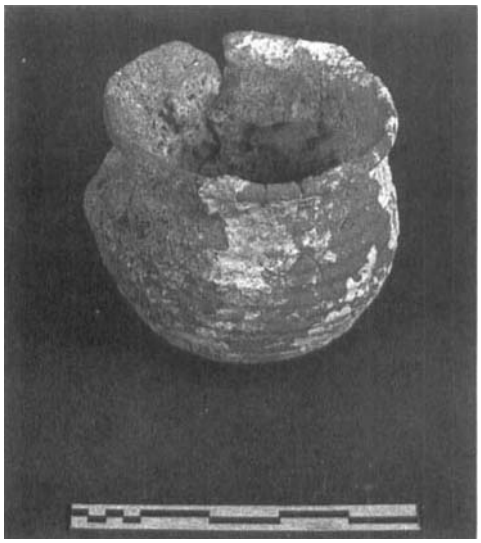

Figure 36. No. 15. Intact cup without handles.

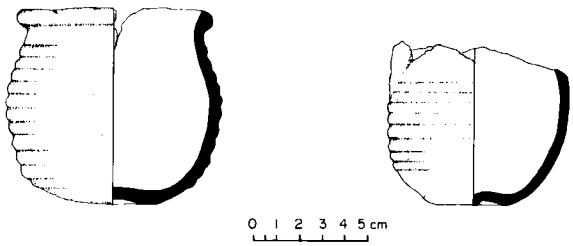


Figure 37. No. 15. Intact cup without handles.

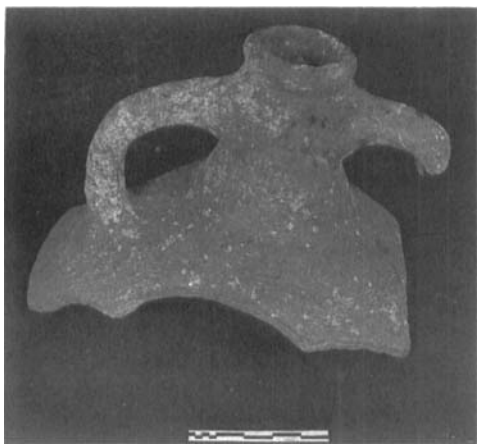

Figure 38. No. 16. Neck of an amphora, dating between the 4th and the early 6th century AD.

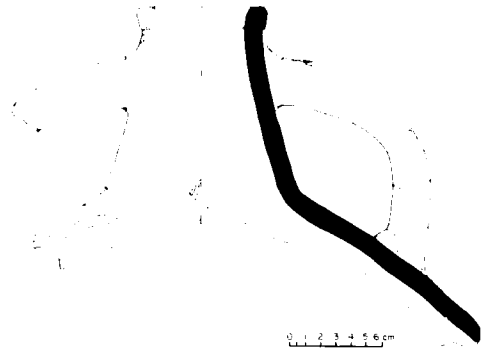


Figure 39. No. 16. Neck of an amphora, dating between the 4th and the early 6th century AD.

Figure 40. No. 17. Neck of an amphora.

The drawings of the pots were made by Ms Katie Tagonidou, and the photographs of them were taken by Mr Petros Vezirtzis. I owe the identification of the pottery to the valuable advice of the General Secretary of the French Archaeological School in Athens, J-Y. Empereur.

The relating of the topographical survey to the national survey network for the ancient harbour installations was provided by the topographer of the Technical Services Department of Samos, George Vasiliou. The restoration and reconstruction of the vases was undertaken by the restoration specialists, Roula Maninou and Roula Prousali.

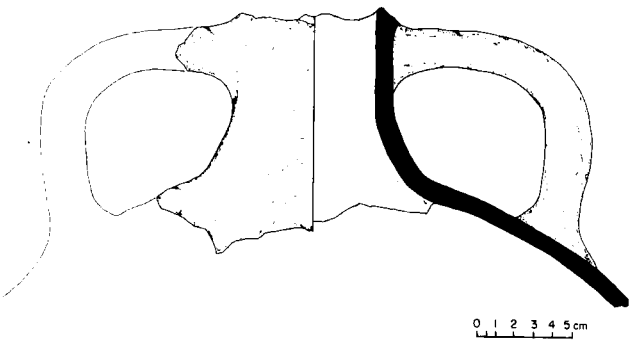


Figure 41. No. 17. Neck of an amphora.

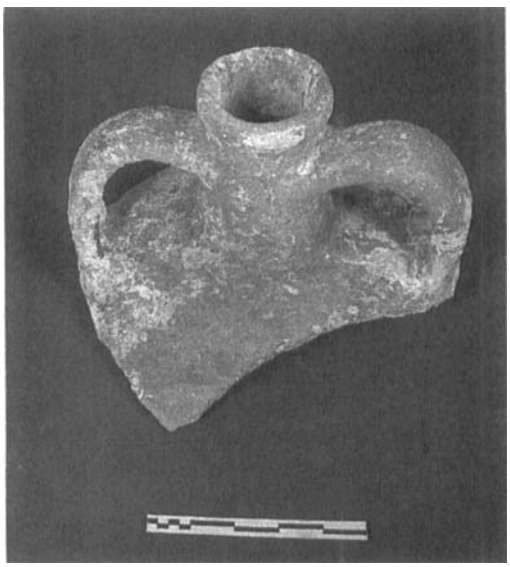

Figure 42. No. 18. Neck of an amphora, dating from the 1st–3rd centuries AD.

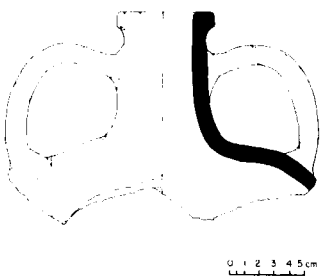


Figure 43. No. 18. Neck of an amphora, dating fron the 1st–3rd centuries AD.

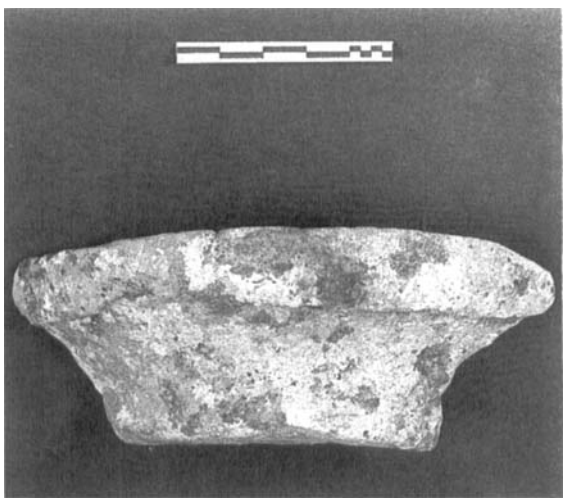

Figure 44. No. 19. Mortar with spout.

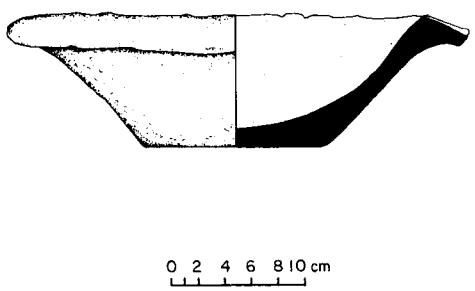


Figure 45. No. 19. Mortar with spout.

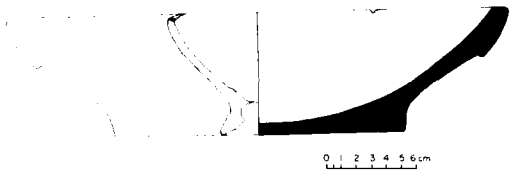


Figure 46. No. 20. Small bowl of the 5th century BC.

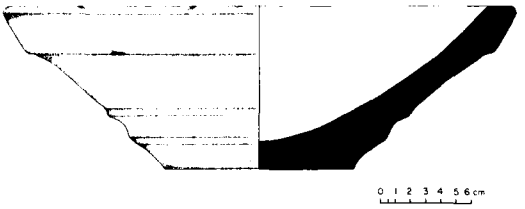


Figure 47. No. 21. Small archaic bowl (*c.* 560 BC) embedded in outer breakwater.

## Note

[1] I should like to thank the chemist of the Ministry of Culture, Mr Costi Asimenos, for the analysis of the three samples of the substance found in three amphoras from the Samos harbour excavations. These were resinous substances which can melt and burn, giving off the characteristic scent of burnt pine wood.

A sample of the organic material was sent to the Laboratory of Archaiometrias of the Natural Science Research Centre 'Democritos' and the result of the study made by Mr John Maniatis was the following:

'The sample of natural sea cement from Pythagorion, Samos, is made up of coastal marine biogenetic forms whose chemical basis is Calcium carbonate ($CaCO_3$). This substance can be dated on the condition that these forms developed during a specific period which can be related to some archaeological event.

Seaweeds can also be found amongst these forms, which can also be dated by the same method, if a sufficiently large quantity can be extracted during the processing of the sample.' (Yannis Maniatis, Laboratory of Archaeometry, EKEFE, Democitos, 22/6/89.)

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