



The Antikythera Shipwreck Reconsidered

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THE ANTIKYTHERA SHIPWRECK RECONSIDERED

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INTRODUCTION

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In the attempt to reconstruct historical development a fixed date is the most welcome aid an archaeologist can hope for—and such a date is likely to be available as the result either of a celebration or a disaster. With the help of these extraordinary events, knowledge of the day-by-day progress of human life can be filled in.

Until the year 1900 the known disasters of ancient times from which useful information could be obtained were those which had taken place on land; in that year the first ancient shipwreck was discovered, just off the tiny island of Antikythera, halfway between Crete and the Peloponnesus.¹

The find was reported to the Greek government by some sponge divers from the island of Syme, and soon thereafter the difficult task of recovering objects was begun, with the assistance of a small warship and under intermittent archaeological supervision. Work continued for nearly a year, as regularly as the generally inclement weather permitted. The news of the discovery aroused tremendous interest, and the daily papers of Athens carried many reports (of varying accuracy) of the activity going on at Antikythera. Archaeologists naturally became excited over the developments; soon controversy arose among them as to the date at which the wreck had taken place. There was understandable eagerness—since this was the first wreck ever found—to correlate the Antikythera ship with some particular vessel mentioned in historical or literary sources. The majority of scholars (though not the most influential) believed in a first-century B.C.

¹ Our grateful thanks are due to Dr. Christos Karouzos, Director of the National Museum, to Mrs. Semni Karouzou, Curator, and to Mrs. Maria Petropoulakou of the Museum staff for facilitating this study. The wood of the ship's planks was identified from photographs by Mr. B. Francis Kuchachka, Forest Products Laboratory, U. S. Department of Agriculture, Madison, Wisconsin.

date,² and later an exact date of 30 B.C. was hit upon for the unique mechanism (long called an astrolabe) which had been found in the wreck.³

Considering the difficulties encountered—owing to cumbersome equipment, stormy weather, the envelopment of some of the objects in compacted mud and the weakening of many of them through action of the sea—a remarkable number of objects were recovered in relatively good condition. There was criticism at the time of the methods used, and from our present vantage point we may be even more critical, but given weather conditions, the depth of the wreck (some 180 feet, the deepest yet excavated), the divers' inexperience with such material and the general novelty of the whole problem, the results are rather better than might have been expected.

² The literature on the Antikythera wreck is considerable, and we shall list only the material which has a direct bearing on the present study. The first account which appeared in an archaeological journal was “Τὰ εὑρήματα τοῦ ναυαγίου τῶν Ἀντικύθηρων” in *Eph. Arch.* 1902: pp. 146–171. This appears to have been the combined effort of several people, and is not signed. K. Kourouniotes is known to have written the section on the pottery; the authorship of the rest of the article is doubtful. Brief factual accounts by P. Kavvadias also appeared in the *Journal of Hellenic Studies* 21 (1901): pp. 205–208 and in the *Rev. Et. Grecques* 14 (1901): pp. 122–126. Prior to this, reports had appeared in the daily papers, particularly the *Asty*. A complete list of these is given by J. N. Svoronos in “Ο θησαυρὸς τῶν Ἀντικύθηρων (pp. 1–86 in *Tὸ εἰν Ἀθῆναις Ἐθνικὸν Μουσεῖον* [Athens, 1903]). The next important publication to follow was that of V. Stais: *Τὰ ἐξ Ἀντικύθηρων εὑρήματα* (Athens, 1905). He attacked Svoronos' theory that the wreck was of fourth-century date and placed it, as had Kourouniotes, in the first century B.C. Numerous articles concerning the machine appeared from time to time, as well as studies of the sculpture, particularly the large bronze statue. But the pottery and the glass and the remains of the ship itself have not been discussed since the time of Stais' publication.

³ George Karo in *Archaeology* 1 (1948): p. 181.

Several years ago a new study of the so-called astrolabe was undertaken by Dr. Derek de Solla Price. This resulted in establishing the fact that this mechanism was a computer, the only one of its kind known from ancient times.⁴ Dr. Price came to the conclusion that the gears of the machine had been set in their present position about 80 B.C. (or 120 years earlier or later). He assumed that the machine had been made about two years before, and that it might have been taken on to the ship any time within the next thirty years. The new dating of this mechanism seemed to provide an opportunity to reconsider other objects found in the wreck, with the purpose of fixing the time of the disaster as exactly as possible.

The objects important for chronological purposes are, of course, not the valuable sculptures which constituted most of the ship's cargo and which could have existed for an indeterminate time prior to their shipment, but the objects of daily use carried for the benefit of the crew, or containers whose contents were more important than the vessels themselves. The glass vessels,

although in the category of luxury objects and not part of the ship's equipment, have also been included, as well as portions of the ship itself which were salvaged. A sample of the wood of which the ship was made has been dated by the Carbon-14 method; it proved to be at least a hundred years earlier than the actual shipwreck.

Miss Virginia Grace, who studied the amphoras, concludes that these date in or close to the decade 80-70 B.C.; G. Roger Edwards finds that the Hellenistic pottery belongs to the second quarter of the first century B.C., earlier rather than later in this period; Henry S. Robinson dates the Roman pottery about the middle of the century. We then have the limits 80-50 B.C. for the date of the shipwreck, with an earlier date more likely than a later one. The ship thus is seen to be one of the many which must have sailed from the Aegean at this time, bringing art works as spoils to Rome. Whether the ship came from Asia Minor, from the Greek islands, or from Athens, whether it touched at Alexandria on the way and loaded additional cargo there—all this must remain for the present in the realm of speculation. Combining the studies just mentioned with those of the ship itself (by Peter Throckmorton) and of the glass vessels, we present here our assembled effort.

⁴ Derek J. de Solla Price in *Year Book of the American Philosophical Society* for 1959: pp. 618-619; Price, "An Ancient Greek Computer," *Scientific American* 200, 6 (1959) : pp. 60-67.

THE COMMERCIAL AMPHORAS FROM THE ANTIKYTHERA SHIPWRECK

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THE variety of amphoras recovered from the wreck is remarkably well presented in Kourouniotes' original report.¹ So far as I can recall, his illustration of the jars is by at least ten years the earliest published photograph of ancient commercial amphoras, and it presents shape and surface clearly, with very little distortion. At this time, shapes of shipping containers in general had not been well distinguished, much less identified as those of particular places of production. An attempt to identify the differing local shapes had been made thirty years earlier by A. Dumont to illustrate his book on amphora stamps; he published a fairly accurate drawing of an actual Thasian amphora of the third century B.C., but his pictures of the Rhodian and Knidian shapes are hypothetical and misleading, and remained uncorrected until long after the date of the Antikythera report.² In view of the then current state of information about amphoras, Kourouniotes' brief sensible descriptive notes and very adequate photograph leave little to be desired, unless perhaps a state-

ment as to how many jars of each of the kinds illustrated made up the number ("about 20") found "in a heap" in this wreck.

The published photograph led in 1954 to a search for these amphoras in the storerooms of the National Museum in Athens, in the interests of a study of the Koan class of jars; and it has enabled individual identification of the four amphoras shown, which are numbers 10, 4, 6, and 11 of the present publication. One may be reasonably confident that the other jars here published (figs. 2, 4) have the same provenance, i.e., the wreck, since they had been stored with the attested ones, had a similar marine deposit on their walls, and are of classes and approximate date matching those illustrated by Kourouniotes. Further, in the store-room where they were, there was also other material from the Antikythera wreck, in labeled cases.³

In figure 1 are profile drawings of three of the jars originally illustrated and of the preserved part of the fourth. The assortment includes Rhodian and Koan (left and right in the middle), and Italian (right); the small jar to the left seems to be a small-sized Koan. Recognition features: the angular profile and nearly round section of the handles of the Rhodian jar; the double-barrelled handles of the full-sized Koan (see section), and the offset at the base of the neck on both large and small jars of this class; the heavy rim (of a kind often bearing a Latin stamp) and "shoulder stop" of the Italian jar, its drip-shaped foot (see fig. 4) being another frequent characteristic of wide-bodied Roman jars. The "shoulder stop" is not just an angle, but a ridge produced where the concave slope of the neck meets the convex slope of the body. In Hellenistic times, and until rather later than the period of this group, it apparently indicates a western origin (Italy or Spain) for a jar.⁴

¹ *Ephemeris Archaiologiki* 1902: pp. 145–172. In this article, the section on amphoras, 160–161, with supplementary pl. H, upper panel, along with the rest of the (unsigned) publication of pottery from the wreck, was the work of K. Kourouniotes, as we are several times told by Svoronos publishing in the following year; see I. N. Svoronos, 'Ο θησαυρὸς τῶν Ἀντικυθῆρων' (Athens, 1903), pp. 16, 80 and 83.

² In A. Dumont, *Inscriptions céramiques de Grèce* (Athens, 1871) p. 15, fig. 3, is a fairly accurate drawing of an actual Thasian amphora of the third century B.C. For a photograph of the same jar, see *Hesperia* 3 (1934): p. 202, fig. 1, 4. Dumont's Knidian jar (*op. cit.*, p. 14, fig. 2) is a reconstruction from representations of the shape in (not very accurately observed) Knidian stamps. His "Rhodian" (*op. cit.*, p. 13, fig. 1) has an outline traced from a drawing of an unstamped Roman amphora in Alexandria published by J. L. Stoddart, "On the Inscribed Pottery of Rhodes, Cnidus and other Greek Cities," *Transactions of the Royal Society of Literature*, second series, 3 (1850): p. 1. Dumont's version is differently shaded, and has different measurements entered. His readings of stamps on the handles permit identification of the jar he must have seen with an actual Rhodian jar, National Museum no. 2405; but the illustration, his figure 1, is unrelated to this or any other Rhodian amphora. It does look something like a Roman jar (National Museum no. 2404, stamped on the rim COPONI) which, until World War II, stood beside the Rhodian no. 2405 on exhibition in the National Museum. Thus deviously derived, Dumont's "Rhodian amphora" was canonized in Daremberg and Saglio (*Dictionnaire des antiquités grecques et romaines* (Paris, 1877) 1: p. 248, under *amphora*), from which it has continued to puzzle archaeologists, cf. *Revue Africaine* 87 (1943): p. 31; and V. Canarache, *Importul Amforelor Stampilate la Istria* (Bucharest, 1957), p. 222, fig. 44. Kourouniotes' clear factual illustration seems more than a generation removed from these beginnings.

³ The published photograph was noticed, and the investigation suggested, in 1954 by Miss Maria Savvatianou, now Mrs. J. Petropoulakou and a member of the staff of the National Museum; she has been of great assistance throughout the preparation of the present article. To Dr. Karouzos, director of the National Museum, and to Mrs. Karouzou, I owe not only permission to publish the Antikythera amphoras but generously arranged facilities to study them. I am grateful also to other members of the staff of the Museum who helped us make records.

⁴ Western jars displaying this feature in contrast with accompanying contemporary Greek jars may be seen in *Amphoras and the Ancient Wine Trade*, Excavations of the Athenian Agora, Picture Book No. 6 (Princeton, 1961), figs. 31, 38 and 36, groups, respectively, of the mid-second, late second and early first centuries B.C. in Corinth and Athens. The booklet is

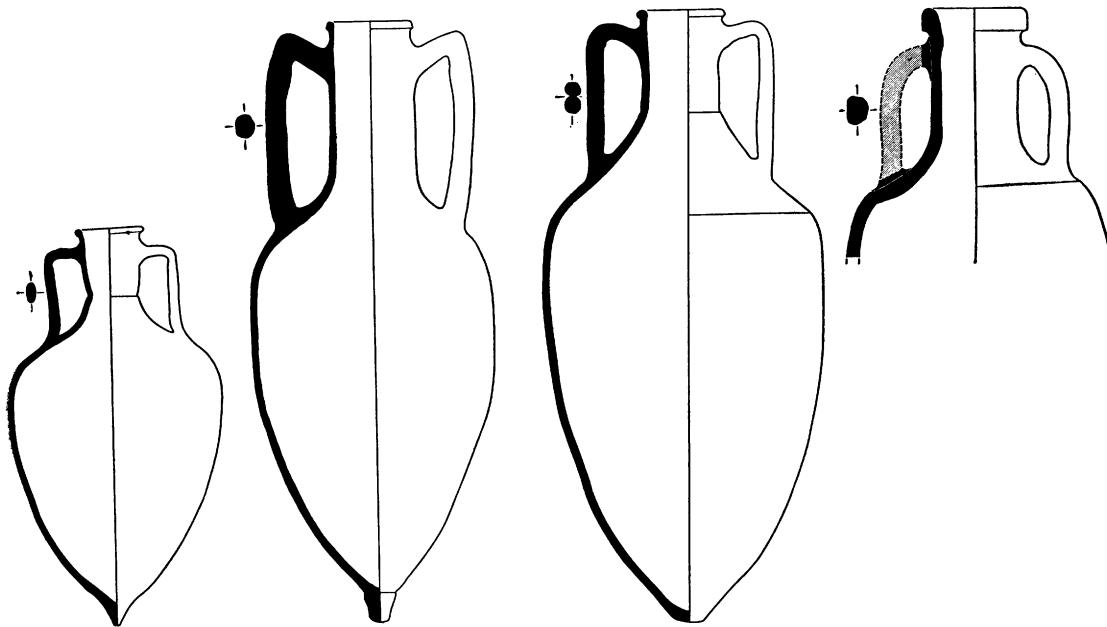


FIG. 1. Profiles of series of amphoras in Kourouniotes' plate H (*Eph. Arch.* 1902), nos. 10, 4, 6 and 11 of the present article. 1:10.

The identification of our 4 (figs. 1, 2), and the other angular-handled amphoras in figures 2 and 3 as Rhodian depends first of all on the frequent appearance of Rhodian coin-symbols, i.e., the so-called rose (*cf.* fig. 3, F and G) or the rayed head of Halios, in stamps impressed on handles of this shape (as well as on others more rounded in profile, but of the same distinctive clay, which belong to earlier jars of the same series). Names and dialect confirm the attribution; and more than ninety-five per cent of the stamped amphora handles found on the island of Rhodes belong to this series.⁵

Many whole, or wholly restorable, jars of this class have now been found, and the aspect of the Rhodian amphora at successive periods has been illustrated, though still sketchily.⁶ The relatively slim body of the Antikythera jars (fig. 2) places them in the first century B.C. rather than at any earlier stage in Rhodian development. Again, compared with third- and second-century B.C. amphoras of the same series, these show a tendency toward careless manufacture, lumpiness of

referred to below as *Amphoras*. See *Hesperia* 32 (1963) : p. 320, on a class of Spanish (?) jars with shoulder-stop.

⁵ The figure is based on material gathered in the Dodekanese in 1957 with the help of a grant from the Penrose Fund of the American Philosophical Society. See *Yr. Bk. Amer. Philos. Soc.* for 1959 (1960) : p. 476. On Rhodian stamps, still not superseded is M. P. Nilsson, *Timbres amphoriques de Lindos* (Copenhagen, 1909).

⁶ See V. Grace, "The Eponyms Named on Rhodian Amphora Stamps," *Hesperia* 22 (1953) : pp. 116-128, especially pl. 42, top panel, and text pp. 118-120; correct now the date of pl. 42, I, from "late 4th century" to "early 3rd century." Cf. also *Amphoras*, fig. 62; and *Hesperia* 32 (1963) : p. 323, fig. 1, for the earlier part of the sequence.

surface, indistinct articulation of neck and toe from body; but not to the degree shown in the Rhodian amphora of the Augustan period (see fig. 3, C).

The three jars in figure 3 are a series which must date from about the beginning to toward the end of the first century B.C. The interval between jars A and B is the place of the Antikythera jars, which, compared with B or C, are still relatively well made; while their handles are more fully adjusted to the narrower body than are those of A, which have kept the long tops of earlier times and have drawn in at the bottom the "vertical" parts to make them meet the shoulder firmly. A and C are from the excavations of the Athenian Agora; A, which is stamped (fig. 3, D and E), was found in a deposit of debris from the destruction of Athens by Sulla in 86 B.C., the unstamped C in an Augustan deposit.⁷ No very good context is available for jar B, but its shape approaches that of C, whereas the fact that it is stamped (fig. 3, F, G) probably puts it before the Augustan period; certainly, no evidence now suggests that Rhodian amphoras were stamped as late as the first century after Christ. The practice had begun to decline some time before this, and of the five jars from Antikythera (fig. 2) only three were stamped.

Unfortunately none of the stamps on these three jars can be identified, or the names in them might help with the chronology.

Relative capacities provide some indications as to

⁷ For documentation of all material shown in figures 2-5, see catalogue at the end of this article. For permission to publish material from the Athenian Agora outside the usual channels, I am grateful to Professor Homer A. Thompson, Field Director.

date. Such measurements are troublesome to take and unsatisfactorily prone to produce a variety of results on repetition, especially if the jar is not intact so that water cannot be used; and still more troublesome and unsatisfactory if restorations have been made in plaster. The data therefore are fewer than would be wanted to inspire full confidence. But some tendencies can be noted. Rhodian containers of toward the middle to the third quarter of the second century B.C. had apparently reached the maximum capacity of this class, 28 to over 29 liters filled to the brim.⁸ Thereafter they seem to have dropped off somewhat, though without abrupt change, for perhaps fifty years. The two intact Antikythera Rhodian, 1 and 3, gave results, respectively, of 26,790 and 25,410 cc. In contrast, jar B of fig. 3 held only 22,500 cc. (of barley); and a number of other Rhodians which must be about contemporary with B, as well as some of still later date, have given about the same results.⁹ Some time in the first century B.C. the capacity of the common Rhodian container was reduced

⁸ I list some capacity figures on stamped Rhodian amphoras, obtained in 1939 in the Cyprus Museum, Nicosia, with the help of a fellowship from the Guggenheim Foundation and by kind permission of the Cyprus Department of Antiquities. These jars were measured with water. The figures are perhaps consistently a little high (I think allowance may not have been made for absorption), but other Rhodian jars, of earlier and later manufacture, measured during the same work-period gave lower figures. The identifying numbers here given (201 etc.) are museum inventory numbers, all preceded by the letters CMC. The sequence here is fairly chronological, the first four jars belonging to the second quarter of the second century B.C. (or before 146), the last two to the third quarter. The figures: 201, jar of Hephaistion in the term of Pausanias III (for photographs, see *Classical Journal* 42 (1947) : p. 450, fig. 8), capacity 28,667 cc.; 191, jar of Hippokrates in the term of Pythagenes, capacity 28,500 cc.; 197, jar of Hieron in the term of Astymedes II, capacity 28,750 cc.; 194, jar of Eukleitos in the term of Astymedes II, capacity 29,000-plus cc.; 195, jar of Eukleitos in the term of Thersandros, capacity 28,600 cc.; 198, jar of Euphranor in the term of Nikasagoras II, capacity 30,000 cc.

It is possible that these large capacities are equalled in some of the earliest group of Rhodian stamped amphoras, datable in the early third and perhaps the late fourth century B.C. For notes identifying this "proto-Rhodian" group, see *Hesperia* 32 (1963) : pp. 322-324. Few capacity measurements are available, but other dimensions known suggest large capacities for some of the jars.

⁹ In addition to figure 3, B, the following three first-century B.C. stamped Rhodian amphoras, also from the Curium Excavations, Cyprus, have been published with capacity figures: *Amer. Jour. Archaeol.* 50 (1946) : p. 472, nos. 17 and 18; *Hesperia* 22 (1953) : pl. 42, III. Photographs of three more jars, of the first centuries before and after Christ, have been published without capacity figures which are here supplied: *Classical Journal* 42 (1947) : p. 448, fig. 6, the second jar from the left (which is the stamped one, correct the text), Curium P 1553, capacity 22,500 (barley), and the unstamped fourth jar, Curium P 1552, capacity 10,500 (barley; note this is a half-size); *Amphoras*, fig. 62, unstamped jar to the right, Agora P 18362, capacity 22,930 cc. (water). Figures are available of three more (unpublished) Rhodian amphoras of the first centuries before and after Christ (in Rhodes and Athens). Capacities of all jars mentioned in this note are below 23,000 cc.; the highest is that of Agora P 18362 given above.

to below 23 liters, and so far as we know it did not later go above this figure. The Antikythera jars precede this change.

From one more source comes an additional piece of evidence to be considered. In a tomb at Xanthos, Lycia, has been found a complete Rhodian amphora which by its shape must be of the first century B.C.¹⁰ The excellently sharp published photograph of this amphora fails to show it quite in profile, so that close comparative study must wait. The picture suggests, however, a jar much like Antikythera 4. The effect of greater proportional length, and a neck more contracted from the body, and a bit more bowing of the handles, can perhaps be attributed to the way the jar is tipped backward; it is very difficult to photograph large amphoras without distortion. The stamp on one handle of this jar names an eponym Lysistratos; the name is clear in the illustration. It has been assumed that the eponyms in Rhodian stamps (often there called "priest") are identical with the priests of Halios, the regular dating officials of the Rhodian state. In 1953 attention was called to a priest of Halios of the first century B.C. whose name, Lysistratos, though mentioned in inscriptions, had never been found in stamps.¹¹ Since then it has been identified on several handles (all of late appearance) in the Benachi collection in Alexandria, as well as on the jar from Xanthos. The term as priest of Halios of Lysistratos Moirageneus is not known precisely, but must have fallen rather soon after 82 B.C., the year when he was priest of Athana Lindia.¹² To identify him with the eponym

¹⁰ See P. Demargne, *Fouilles de Xanthos* (Paris, 1958), 1: pl. 21. The author suggests that the tombs of this cemetery, which resemble some in Sciatbi (Alexandria), were made in the early Hellenistic period. However, the Rhodian amphora in question (no. 1860), and two or three other pottery finds, appear to indicate a re-use of Tomb 18 rather early in the first century B.C. On the other published pots, I have consulted Professor G. Roger Edwards. I am grateful to M. Demargne for giving me photographs of the very important Rhodian amphora, no. 1860.

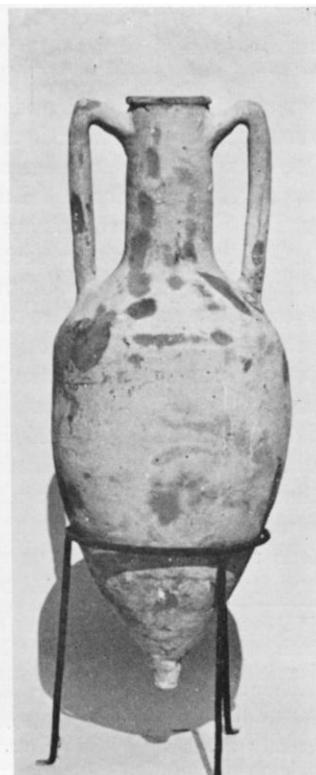
¹¹ See *Hesperia* 22 (1953) : p. 127, under Addenda, and correct the page reference there within the article from 118 to 121. From other names listed *Hesperia* 22: p. 121 as those of Rhodian priests of Halios not known as eponyms in stamps, delete Archestratos, now attested on Rhodian handles.

Note that the Rhodian eponym list published in the article just cited has been supplemented twice in recent publications: see *Hesperia Suppl.* X (1956), p. 139; and H. Dunscombe Colt and others, *Excavations at Nessana: Excavation Report* (London, 1962), 1: pp. 113-114, hereafter called *Nessana* 1. The latter includes the names in the former. To be corrected in these supplements: for Δωγένης read Διοπειθῆς; and delete Μεγακλῆς which had been incorrectly read on one early handle for Ἀρετακλῆς.

¹² See C. Blinkenberg, *Lindos, Fouilles de l'Acropole 1902-1914, II, Inscriptions* (Berlin and Copenhagen, 1941), p. 24, for the listing with references. The priesthood of Athana Lindia was the highest position in the *cursus honorum* at Lindos, hence fell to a man advanced in years; certain priests of Athana Lindia were also priests of Halios in the city of Rhodes, in which case the latter office regularly came after the former.



1

1a and 1b, handles
of 1, at 1:1.

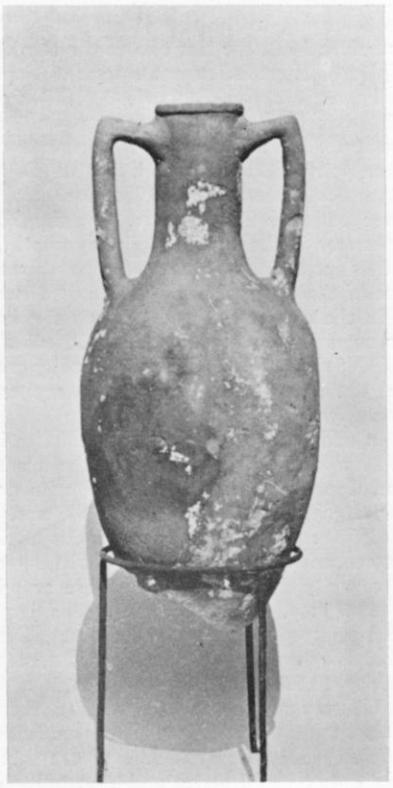
2



3

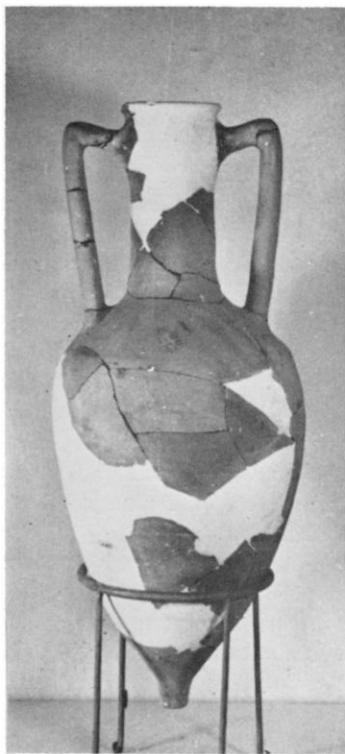


4

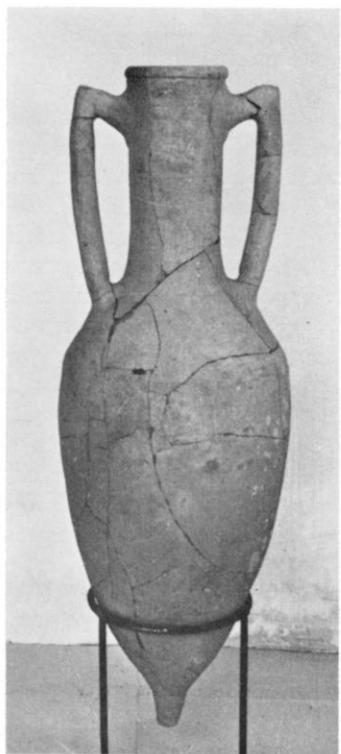


5

FIG. 2. Rhodian amphoras from the Antikythera wreck. 1:10.



A. Agora SS 8602
Before 86 B.C.



B. Curium SH 63



C. Agora P 21281
From Augustan deposit



D and E. Stamped handles of A.



F and G. Stamped handles of B.

FIG. 3. Rhodian amphoras, comparative series, early to late first century B.C. Amphoras 1:10, stamps 1:1.

who dates the jar from Xanthos would seem to push the (similar) Antikythera jars back to within ten or fifteen years after 82 B.C.

As an appendix to a comment on the Rhodian amphoras from Antikythera, attention may be called to the miniature Rhodian in alabaster illustrated by Kourouniotis "in isolation" as he says (*op. cit.*, p. 167) on *Suppl. pl. Θ*; the height of this amphoriskos is given (p. 168) as 0.13 m. Such alabaster flasks, probably for perfumed oil, often imitated more or less faithfully the well known local shapes of contemporary large containers. Probably most were made in Egypt. Many have been found in Cyprus.¹³

The attribution to Kos of jars with "double-barrelled" handles was first suggested because of the Koan coin-symbols (club, crab) often found in stamps on such handles, as well as the many names known in Koan inscriptions and coins also found in these stamps. An ethnic *Kω*(or *Kώϊον*) occasionally appears in them. Among finds in Kos itself, while Rhodian stamped handles are in the majority (as in most Mediterranean sites outside mainland Greece), the double-barrelled kind are in very much higher proportion than at other sites.¹⁴

Large fragments, and some whole jars, having stamped handles of this kind give us the characteristic amphora shape of the class, in particular a noticeable offset at the base of the neck. In later times there is a second offset, in jars usually no longer stamped but having the same twin handles and the same pale color; the second offset is really the shoulder stop of western jars, as explained above. Summaries on this class have recently been published, and a comprehensive volume is under way. Here it should be mentioned that Koan wine was certainly imitated, and Koan vines probably naturalized, outside the island, as early as the third century B.C., so that it is probable that jars approximating the recognized Koan shape came to be made in various places for local "Koan" wine. Since no traces of stamps were found on Antikythera 6-10 (fig. 4), and the characteristic pale surface coloring is missing from them, one cannot be certain that they are actually products of Kos. However, many Koan

Cf. L. Morricone, "I sacerdoti di Haliros," *Annuario della Regia Scuola Archaeologica di Atene* 27-29 (1952) : p. 375.

¹³ Cf. P. Dikaios, *A Guide to the Cyprus Museum* (2nd edition, Nicosia, 1953), p. 125, and pl. 32, 5. Some of the alabaster vases on exhibition in this museum are closer imitations of commercial container types than the one illustrated.

¹⁴ For the original attribution of amphoras with double-barrelled handles to Kos, see A. Maiuri, *Nuova Silloge Epigrafica di Rodi e Cos* (Firenze, 1925), pp. 245-249. On the high proportion of double-barrelled stamped handles found in the island itself, see *Yr. Bk. Amer. Philos. Soc.* for 1959 (1960) : 473-474. To my knowledge, only one site, Nessana (near the Egyptian border of Palestine), has produced a higher proportion of this class, and there the total number of handles found is very small and certainly does not indicate a production center: on these handles, see *Nessana* 1 (see note 11) : pp. 106-130.

amphoras were never stamped, and much of the surface of these jars may have been scoured off as they rolled at the bottom of the sea.¹⁵

For this class, as for the Rhodian, Augustan context at the Agora Excavations establishes the shape in use by the end of the first century B.C.¹⁶ It is a long jar (ht. 0.878 m.) with almost cylindrical body, narrower (0.32 m. in diameter) than the Antikythera Koan or any preceding them, and finishing above with the shoulder stop, which has not been found in pre-Augustan context. Apparently this was the shape adopted when Kos became part of the Roman province of Asia.

Unfortunately we have no Koan amphoras from debris of the destruction of Athens by Sulla, to help fix the shape used early in the century. However, the Antikythera jars can safely be dated within the century by the relatively long handles (*ca.* 0.20 m.) of all save 12, combined with steep shoulders and a baggy lower body. Handles of almost equal length appear on Koans datable in the latter part of the third century B.C., but here the shoulder slopes more gradually, to a greater diameter, and the lower body tapers with much less curve. In the course of the second century handles and neck become rather shorter, while the body narrows; but by some time probably in the second quarter of the first century B.C. a shoulder slope even steeper than that of the Antikythera Koan has drawn down the handles to a still greater length than theirs (0.23 m.), as witness a fragmentary stamped jar from post-Sullan first century B.C. context at the Agora.¹⁷ Recent finds at Delos suggest that the fragment of a steep-shouldered Koan once thought to have been broken there by Mithradates' soldiers in 88 B.C.¹⁸ may instead be refuse from the pirate raid twenty years later, since the top of a Koan jar found in 1959 with many large Knidian stamped fragments of Mithradatic period showed no such steep slope.¹⁹ Their position in stylistic

¹⁵ A recent summary on the Koan class is to be found in *Nessana* 1, pp. 118-119; in pl. 39 of this volume an Antikythera Koan (8 of the present article) is published to illustrate the approximate restoration of Nessana Koan fragments. Cf. also *Amphoras*, figs. 56-59 with accompanying text. On the imitation of Koan wine, see Pliny, *Natural History*, XIV. X. 79; and Cato, *On Agriculture*, CXII. On the naturalization abroad of Greek vines, in the third century B.C., cf. C. C. Edgar, *Cat. génér. des ant. égypt. du Musée de Caire* (Cairo, 1925), no. 59033.

¹⁶ See H. S. Robinson, *The Athenian Agora V, Pottery of the Roman Period, Chronology* (Princeton, 1959), p. 20 and pl. 3, F 93. Note that the jar is there illustrated at rather under 1:10; it is actually taller than the tallest of the Antikythera Koan. The same amphora appears, at a still smaller scale, in *Amphoras*, fig. 56, right end.

¹⁷ SS 14252, with a stamp of Lochos, from Agora deposit E 18 :3. On Agora deposits see, for instance, H. S. Robinson, *op. cit.*, p. 123.

¹⁸ See V. Grace, "Timbres amphoriques trouvés à Délos," *Bull. de Cor. Hell.* 76 (1952) : 539 and pl. 25, no. 36; and comment in *Nessana* 1 (see above, note 11) : p. 122, under no. 21.

¹⁹ Delos inv. no. TD 6511, with stamp of Dadas, found in 1959 in the "south shops." Ht. of handle, *ca.* 0.175 m. In

sequence with relation to the two Delos fragments suggests for the Antikythera Koan a date between 88 and 69 B.C., and, for all save 12, one rather nearer to the latter year. With its shorter handles, 12 is close to the Delian fragment of Mithradatic date, and seems to belong, shall we say, before 80 B.C.

Kourouniotes published graffiti seen on two of the Koan jars, one incised "on the upper part of the body of an amphora of Shape 3" (his shape example is our 6, fig. 4), and the other, which he considers to be in Latin, on an amphora of his Shape 1 (our 10, but perhaps he included our 9 in this shape). I have not been able to find the second of these on any of the Antikythera jars I have seen, so Kourouniotes' drawing is reproduced here in fig. 6. The first, however, has been the means of identification of our 12, and is shown here in a photograph (fig. 7), clear evidence on the accuracy of Kourouniotes' drawing.

On the Roman jar (figs. 1 and 4, no. 11) I quote the following comment kindly sent to me in January, 1962, by Mrs. Elizabeth Lyding Will, who is preparing a comprehensive volume on Roman amphoras found in the eastern Mediterranean :

The unbroken Italian-type amphora from the Antikythera wreck (plate H, 4 of *Ephemeris* 1902) has been found in pieces in the National Museum in Athens. Only the upper part of the jar can now be identified. This is 0.343 m. in height and consists of a narrow chipped rim with vertical, pillbox profile (height, 0.033 m.; diameter, 0.14 m.; mouth diameter, 0.109 m.); one narrow, short handle, oval in section (height, 0.16 m.; width and thickness at curve, 0.044 × 0.029 m.); the attachments of the other handle; the shoulder; and pieces of the upper belly. The fabric of all the fragments is pinkish-buff in color, is very micaceous, at least on the surface, and contains many large and small reddish bits and some small dark bits. The clay is frail and brittle, doubtless due to the long exposure to water, and the jar may have disintegrated soon after its discovery. No stamp can be found on any of the fragments as preserved, but the surface of the clay is so worn that a stamp would probably not have survived unless very deeply impressed.

The fabric of these fragments, and the dimensions and profile of the rim and handle, suggest a relationship to my Type 7, a type characterized by a narrow rim with small diameter and vertical profile; narrow, rather short handles; and pinkish-buff clay that usually contains many red bits. The handles and neck of the Antikythera piece are, however, shorter than is normal for Type 7, and the belly as pictured in *Ephemeris* 1902 [and cf. fig. 4] is longer and baggier than the characteristic belly of the type, which has its greatest diameter at the middle. The Antikythera jar cannot, then, be assigned to Type 7, but it is probably related

addition to the Knidian stamped fragments judged to be of the period of the destruction of Delos by Mithradates in 88 B.C. (because they match many from Sulla-destruction deposits of 86 B.C. in Athens), there was found in the same complex much other pottery, etc., consistent with the same date, including a lamp with the signature of Ariston, cf. G. Daux, "Chronique des fouilles de 1959," *Bull. de Cor. Hell.* 84 (1960) : pp. 856, and 854, fig. 4. I am grateful to M. Daux, and to the excavator M. Christian Le Roy, for permission to study and mention here the unpublished Koan fragment.

to the type and may be a later development of it. In certain other classes of Roman jars, the bellies of later examples tend to be baggy.

Type 7 can be dated with confidence as early as the first quarter of the first century B.C. on the basis of its frequent occurrence at Delos in recently-excavated levels dating from the destruction of the island by forces of Mithradates in 88 B.C. (One jar belonging to Type 7 has been found in a drain-filling of the last quarter of the second century B.C. at the Agora Excavations, but it has the outflaring rim characteristic of Roman amphoras of the second century B.C. and is certainly an ancestor of the other pieces known to me.) If the Antikythera jar is in fact a later development of Type 7, its date may be as late as the second quarter of the first century B.C. I would be surprised if rims with this profile were manufactured later than the middle of the century.

Evidence indicates that jars of Type 7 originated in southern Italy, probably in the neighborhood of Taranto or Brindisi. The Antikythera jar may well come from the same area.

Separate study of the three series has brought us, then, to tentative but consistent dates for the Antikythera amphoras: all might be assigned to a period in or close to the decade 80–70 B.C.

Comparative shape-sequences have not been illustrated here for the Koan or Italian series, but only for the Rhodian (fig. 3), since comprehensive volumes on the two former classes are well advanced toward publication. However, Koan and Italian jars are included in figure 5, which presents the amphoras brought up from the wreck discovered in 1907 off Mahdia on the east coast of Tunisia. Since the finds from the two wrecks have often been compared, it is of interest to reproduce here the amphoras from the Mahdia site, of which no drawings or photographs have to my knowledge been published before. A date of 86 B.C. or (recently) rather earlier has been suggested for the cargo of this ship.²⁰ Mrs. Will has expressed agreement with this approximate date for the two jars, figure 5, I and L, noting that the former is apparently of the same series as the large consignment of somewhat later date in the Titan wreck off the Île de Levant. The incomplete jar (fig. 5, K) must be the remains of a full-sized amphora of the same class, Dressel Type I, as the smaller-scale L. For the Koan (H), and the jar of Punic type (J), I might suggest a date as early as 100 B.C. Jars like J from Sulla-destruction groups at the Athenian Agora have more flaring and more elaborately profiled rims. The Koan (H) may be compared with an amphora of second half of second century B.C. context at the Agora, though it is clearly further advanced in slimness than that not very precisely dated jar (see below, documentation of fig. 5). From the Mahdia Koan (fig. 5, center top) looking leftward across the tops of figures 5 and 4 (Antikythera 12, 8, 7, 6) one sees, it seems, the direction of development of Koan in

²⁰ For a short bibliography on the Mahdia wreck, and notes on the jars shown in figure 5, plus references for comparative material cited here, see below, end of this article, documentation on items H through L.

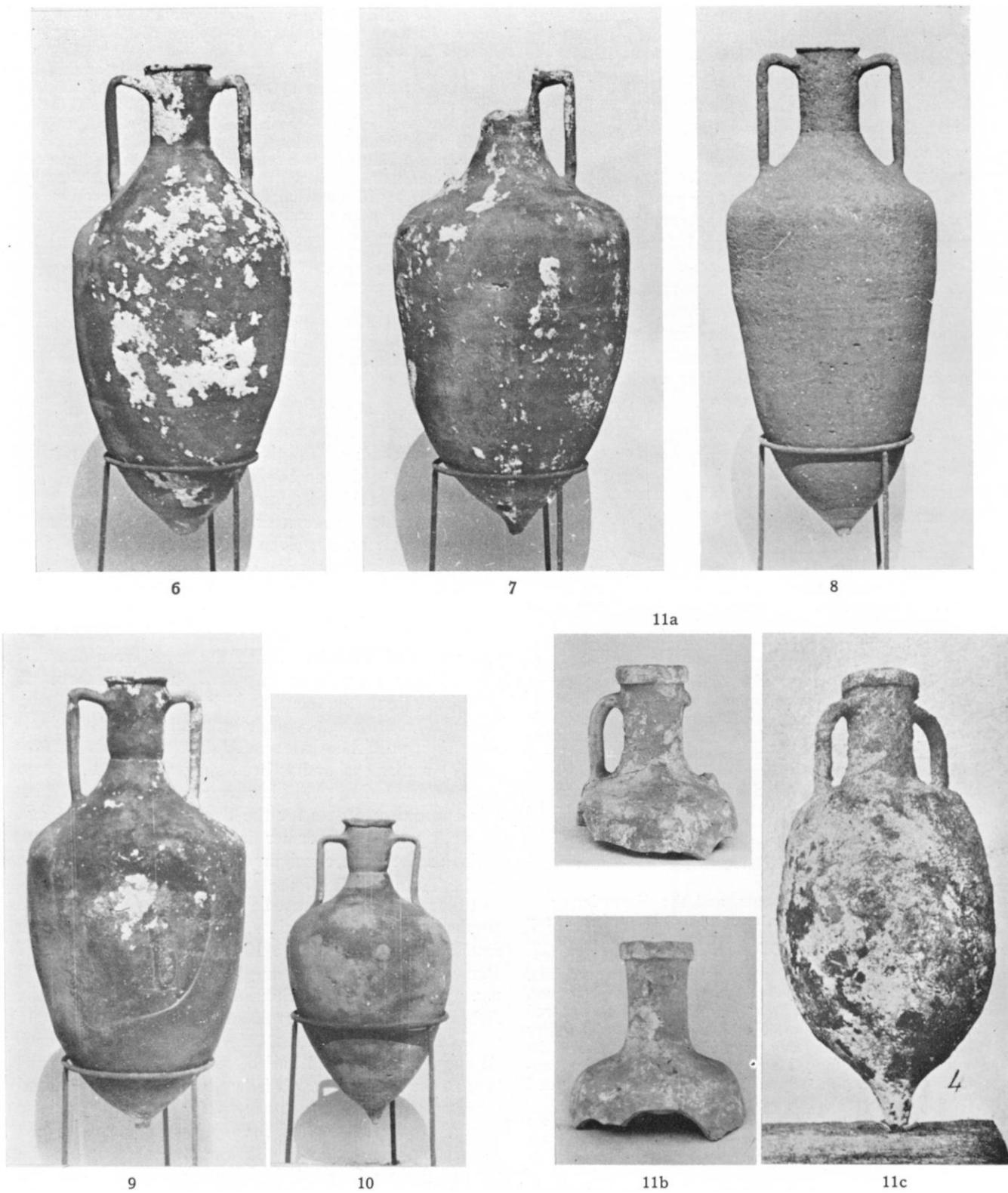


FIG. 4. Koan and (11) Tarentine(?) amphoras from the Antikythera wreck. 1:10.



Antikythera wreck, 12
Koan with graffito.



Mahdia wreck: Koan (H) and
Titan type (I)



Mahdia wreck: Punic(?) jar (J) and Italian jars (K and L),
large and small.

FIG. 5. Amphoras from the Mahdia wreck, with one Koan (12) from Antikythera. 1:10.

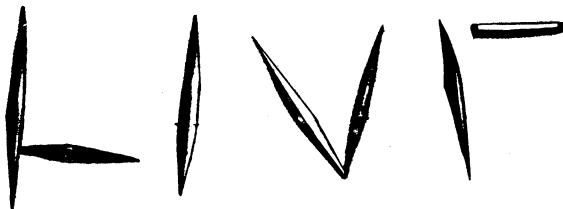


FIG. 6. Kourouniotes' drawing (*Eph. Arch.* 1902: p. 161) of a graffito on an amphora not found by us. 1:1.

the first quarter of the first century B.C., to longer handles, steeper shoulders, and a more baggy body.

Finally, it is of some interest to compare the *assortment* of jars from the wreck off Tunisia with that from Antikythera. In the former, probably all but the Koan are from western centers of production, while at Antikythera the reverse obtains. Kourouniotes (*op. cit.*) considered that these latter contained not a part of the cargo but simply ship's provisions, noting that olive pits had been found in one of the jars, it is not stated which one. The variety of containers might then just reflect recent ports at which supplies had been taken on board. The small number of amphoras reported from each one of these wrecks favors the interpretation.

One cannot however close a comment on material from the Antikythera wreck without calling attention to the fact that the investigation of its site is far from complete. A fairly recent account in a Greek popular journal (*Naftiki Ellas* of August, 1950) gives some reminiscences of a diver who took part in the original work of salvage. Of the amphoras he says that twenty-seven were lifted, but that there were at least fifty down there. Further exploration might discover a sizable consignment of Rhodian and/or Koan jars. This would put a somewhat different aspect on the amphoras from the wreck as evidence for port of origin.



FIG. 7. Graffito on 12, at 1:1.

DOCUMENTATION OF AMPHORAS ILLUSTRATED

Fig. 2. Rhodian amphoras from the Antikythera wreck.

1. Intact. Ht. 0.82 m.; diam. 0.33 m.; ht. of handles, ca. 0.262 m.; capacity 26,790 cc. (water). Clay like that of 3.

Stamps on both handles (fig. 2, 1a, 1b), of which one (1b) has a cluster of grapes to the right as device; neither type has been identified.

2. Ht. 0.785 m.; diam. 0.312 m.; ht. of handles ca. 0.25 m., 0.26 m.; capacity not taken because of cracks in the body. Remains of rather thick surface layer of buff clay, apparently cut away in places, perhaps for the removal of marine deposit, uncovering the darker red clay beneath.

Unstamped.

3. Intact. Ht. 0.805 m.; diam. 0.32 m.; ht. of handles ca. 0.25 m., 0.26 m.; capacity 25,410 cc. Clay reddish, darker than that of earlier Rhodian jars.

Traces of rectangular stamps on tops of handles.

4. Half lip gone, and body has holes. Ht. 0.80 m.; diam. 0.321 m.; ht. of handles ca. 0.25 m., 0.255 m.; capacity not taken. Clay dark, brownish.

Unstamped.

This is the jar of which the other side (with incomplete lip) appears in pl. H, 2, of Kourouniotes' publication. See also figure 1 of the present article for profile drawing.

5. Bottom gone, also a piece from the shoulder on the unphotographed side. Preserved ht. 0.695 m.; diam. 0.317 m.; ht. of handles ca. 0.23 m. Clay dark, brownish.

Slight traces of rectangular stamps on tops of handles.

Fig. 3. Sequence of Rhodian amphoras of the first century B.C., for comparison with Antikythera Rhodian.

A. Agora Excavations SS 8602 + 8691, from well F 19:3, containing debris of the destruction of Athens by Sulla. Restored in plaster. Ht. 0.80 m.; diam. 0.32 to 0.33 m. (as restored; would probably have been a little greater); ht. of handles ca. 0.26 m., 0.265 m. Clay reddish brown with worn light surface.

On tops of handles, stamps of the potter Menandros in the term of Archembrotos, month Artamitios. See under D, E, below.

See *Amphoras*, figs. 36 (left) and 62 (middle).

B. Curium Excavations (Cyprus) SH 63, from the upper filling (intruded) of Ayios Ermoyenis Tomb 8. Ht. 0.86 m.; diam. 0.302 m.; ht. of handles ca. 0.26 m.; capacity 22,500 cc. (barley). I am obliged to Mr. J. S. Last for these corrected measurements (save the capacity, which is that taken by myself in about 1940).

On tops of handles, rose stamps of the potter Apollophanes in the term of Aristophylos. See under F, G, below.

See G. H. McFadden, "A Tomb of the Necropolis

of Ayios Ermoyenis at Kourion," *Amer. Jour. Archaeol.* 50 (1946) : p. 478, under no. 56; a profile drawing is there given in figure 14. I am grateful to Professor G. R. Edwards and the University of Pennsylvania for permission to republish this jar with photographs.

C. Agora Excavations P 21781, from well R 10:1, filling of the Augustan period. Restored in plaster, toe missing. Preserved ht. 0.834 m.; diam. 0.311 to 0.32 m. (irregular); ht. of fully preserved handle 0.25 m.

Unstamped.

On the deposit, see most recently J. Perlzweig, *The Athenian Agora, VII, Lamps of the Roman Period* (Princeton, 1961), p. 228. P 21781 is cited by H. S. Robinson, *op. cit.* in note 16 above, p. 20, under F 94.

D and E. Stamped tops of handles of jar A, of which the stamps read:

D) 'Επι Αρχει
βρότου Αρ
ταμιτίου

E) herm of Halios
Μενάν(δρου)

A plausible but (as it turns out) invalid argument formerly dated the Rhodian eponym Archembrotos, with numerous others, shortly before 220 B.C., cf. V. Grace, "Stamped Amphora Handles Found in 1931–1932," *Hesperia* 3 (1934) : p. 215 and 219, following the works of Bleckmann and Hiller von Gaertringen there cited. The error lay in a failure to take into account the shape-development of the jars and the possibility of repetitions in eponym names. There is at present evidence to indicate the existence of two eponyms Archembrotos perhaps two generations apart, (I) soon after the middle of the second century B.C., and (II) in the early first century B.C. The context (as yet unpublished) of jar A is the best now available for Archembrotos II.

On the herm of Halios in stamps, see recently G. Roux, "Qu'est-ce qu'un Κολοσσός?", *Revue des Et. Anc.* 62 (1960) : pp. 17–18; M. Roux suggests this device represents schematically the famous Colossus of Rhodes; this is possible, though the great figure lay in pieces on the ground long before the date of the fabricant of this stamp or of the other fabricants whose names he cites. For Menandros who uses a herm, appearing always on handles of late appearance, there is no context better than that of jar A, and no other fabricant-eponym combination on record. He may however be identical with Μένανδρος Λαοδικεύς, known in stamps in combination with a series of eponyms who should be still later than Archembrotos II according to the more degenerate appearance of the handles bearing the pairs of names. For one of these, see *Hesperia* 3 (1934) : p. 232, no. 66, a stamp of Μένανδρος Λαο[δικεύς] (wrongly restored in the text with the name of the month Δα[λιον]) which names an eponym Ζηνόδοτος on a handle that is roughly made and acutely angular. This eponym may be Ζηνόδοτος Διοσάντον τοῦ Ζηνοδότου, a citizen of Lindos known to have been priest

of Halios before 67 B.C. (presumably not many years before), see C. Blinkenberg, *op. cit.* in note 12, p. 24. On the numerous Laodiceans who were residents of Rhodes, see P. Fraser, "The Cults of Sarapis in the Hellenistic World," *Opusc. Athen.* 3 (1960) : p. 40, with note 6.

F and G. Stamped tops of handles of jar B, of which the stamps read, respectively:

rose
('Επι?) [Αριστοφύ]λον (retr.) [X]

rose
Α[πολλο] φάνεψ (retr.) &

These are both types known in few examples. Since there are two or three other rose types with the name of Apollophanes, all on very late handles, it appears that of the pair he is the fabricant, who probably used rose stamps during the terms of several different eponyms; while Αριστόφυλος is to be understood as the eponym, named, as seems quite common in the first century B.C., without the preposition. (In another example, Agora SS 614, the beginning of the reading is clear, and certainly there was no preposition.) The *lambda* of the eponym's name is a correction in the die, appearing on a raised place in the impression (visible to the right in fig. 3, F). The *phi*, also a correction, is less obviously so. Two examples of the original die, with name Αριστώνυμος, have been identified in the Benachi Collection, Alexandria. Neither of the two presumed eponyms is known in other types; a priest Αριστώνυμος who dates a jar of Δῶρος II in the museum of Paphos, Cyprus, must apparently be some two generations earlier. For the monograms in the two types impressed on jar B, unfortunately hardly visible in these examples, I have no satisfactory interpretation. That in G may perhaps stand for the name of the month Artamitios, especially since one of the other types of this fabricant has a *beta* in place of our monogram, which might then stand for another month, Badromios. The monogram in F remains unexplained.

Another example of the fabricant type (G), Agora SS 9329, comes from the upper filling, of the first century B.C., of Agora well B 21:24; in the earth nearby was found perhaps the other handle of the same jar, SS 9290, bearing a duplicate of our eponym type (F).

Fig. 4. Koan and Roman amphoras from the Antikythera wreck. The handles of 6–9 are double-barrelled. See also figure 5, no. 12 for one more Koan from Antikythera.

6. Toe missing; body has holes. Preserved ht. 0.825 m.; diam. 0.38 m.; ht. of handles ca. 0.20 m. Dull red clay.

Unstamped.

This is the jar of which the other side appears in

pl. H, no. 3, of Kourouniotes' publication. See also figure 1 of the present article for profile drawing.

7. Rim and one handle missing, and toe incomplete; body has holes. Preserved ht. 0.813 m.; diam. 0.396 m.; ht. of handle ca. 0.20 m. Offset at base of neck shows slightly better on unphotographed side; it is just above the long vertical patch of marine deposit, and is actually distinct. Dull red clay, quite fine.

Unstamped.

8. Toe incomplete, and much of rim and top of neck missing from unphotographed side; the fabric of the jar is rather disintegrated. Preserved ht. 0.85 m.; diam. 0.355 m.; ht. of handles ca. 0.205 m. Clay a brighter red than in the others.

Unstamped.

This photograph appears also in pl. 39 of *Nessana* 1, see note 11 above.

9. Toe perhaps incomplete; a large piece of the shoulder has come off (from the unphotographed side) and is not all preserved. Ht. 0.785 m.; diam. 0.372 m.; ht. of handles ca. 0.195 m. Neck offset emphasized by a groove above; the shoulder-edge is less sharp than in the other full-sized Antikythera Koan. Clay brownish with darker streaks and some white bits.

Unstamped.

10. Intact. Ht. 0.53 m.; diam. 0.28 m.; ht. of handles ca. 0.115 m., 0.12 m.; capacity 12,650 cc. (water). Neck offset, cf. that of 9; handles are *not* double; mouth bent somewhat out of shape before firing. Clay yellower than that of 9, but this may be a difference in firing a smaller pot.

Unstamped.

See profile drawing, figure 1.

11. For detailed measurements and description of the preserved parts of the Roman jar, see above, Mrs. Will's text. Kourouniotes in *Eph.* 1902 does not give individual measurements of the amphoras, but states that the height of the full-sized ones is about 0.80 m. This is actually the height of our 4, his 2 in pl. H; and as in this photograph the Roman jar, his 4, looks about the same height, it must also have been about 0.80 m. In figure 4, 11a and 11b show the preserved top of the jar, turned in the latter to show more truly the rim profile, since over the handles the rim is rather chipped. See also profile drawing, figure 1.

Fig. 5. Antikythera 12 (Koan), and amphoras (H-L) from wreck off Mahdia on the east coast of Tunisia.

12. Toe incomplete; otherwise apparently intact. Pres. ht. 0.83 m.; diam. 0.37 m.; ht. of handles ca. 0.175 m. Neck offset clear. Clay brownish, with white and dark bits and fine particles of mica.

Possible traces of stamps on the two ribs of one handle, (a) a small club (?) alone and (b) a longish depression still obscured by marine deposit possibly covering a name. On the shoulder is the graffito illus-

trated in figure 7, matching that published by Kourouniotes, *op. cit.*, p. 161.

This jar had been stored with other items from the pre-war Museum exhibition, hence separately from the main lot of amphoras from Antikythera, and came to my attention after the present article was well advanced.

The two main sections of fig. 5, showing amphoras H-L, are taken from a single fine photograph which I owe to Dr. Abdelaziz Driss, Conservateur du Musée du Bardo in Tunisia. The height measurements given below were also provided by Dr. Driss. For a published report on presumably these jars, see A. Merlin and R. Lantier, *Catalogue du Musée Alaoui, Suppl. II* (Paris, 1922), pp. 286-287. Catalogue numbers from this volume are quoted tentatively below under the individual items H-L, though absolute identification cannot be made since the authors of the catalogue did not illustrate the amphoras, and their measurements do not fully correspond with those of Dr. Driss.

For the basic report on the Mahdia wreck, see A. Merlin and L. Poinsot, *Cratères et candelabres de marbre trouvés en mer près de Mahdia* (Tunis and Paris, 1930). The book begins with an account of the wreck and its investigation, with much bibliography. The cargo, demonstrably from Athens, is taken to be loot, so the ship is thought to have gone down soon after the destruction of Athens by Sulla in 86 B.C. To others however, the finds have suggested merchandise rather than loot, and stylistic considerations have indicated a date rather earlier than 86 B.C. See M. Rossoff, *Social and Economic History of the Hellenistic World* (Oxford, 1941), pp. 745, 746; W. Fuchs, *Die Vorbilder der neuattischen Reliefs* (Berlin, 1959), pp. 183-186, Exkuz I, Zur Datierung des Mahdia-Schiff-fundes (I owe the reference to Homer Thompson). Dr. Fuchs publishes for the first time a few samples of the pottery (not amphoras) from the wreck, which he compares with pieces in Thompson's Hellenistic Groups D and (mainly) E; see H. A. Thompson, "Two Centuries of Hellenistic Pottery," *Hesperia* 3 (1934): pp. 369-427. Dr. Fuchs would like to date the Mahdia wreck about 100 B.C. or very soon afterward.

A date in the mid-first century B.C. is proposed in another recent publication, see H. Küthmann, *Beiträge zur späthellenistischen und frührömischen Toreutik* (Kallmünz-Opf., 1959), pp. 11-14. The argument, based on sculptural style, seems less convincing than that of Dr. Fuchs. I owe this reference also to Homer Thompson.

Addendum. Since this article went to press, a new volume on the Mahdia wreck has appeared, Werner Fuchs, *Der Schiffsfund von Mahdia* (Tübingen, 1963). This fine "picture book" illustrates chiefly the bronzes and marbles from the wreck, but includes also a small supplement to the pottery published in Dr. Fuchs' earlier work on the wreck cited above. The date of

the final voyage of the ship is set at about 100 B.C. (see pp. 11, 47).

H. Toe and one handle missing; repaired. Preserved ht. 0.78 m. Perhaps Merlin and Lantier no. 961, of which the handles are said to be "formées chacune de deux boudins." In that case the jar has been damaged since 1922, since it is described as having both handles and its toe, and a height of 0.85 m.

Of whole Koan amphoras known to me, the closest parallel is P 3981 from Agora cistern G 11:1, datable in the second half of the second century B.C. See *Amphoras*, figure 56, third jar from the left. Dimensions of this jar: ht. 0.825 m.; diam. 0.402 m.; ht. of handles ca. 0.16 m. The Mahdia jar is distinctly slimmer, which indicates relative lateness in Koan jars of the second century B.C.

I. Tip of toe seems to be missing. Preserved ht. 0.90 m. Apparently Merlin and Lantier no. 958, for which the same height is given. For the jars from the Titan wreck to which Mrs. Will referred me for parallels (see above, p. 11), see F. Benoit, "Épaves de la côte de Provence, Typologie des amphores," *Gallia* 14 (1956) : pp. 29-30, with fig. 1, 11-13, and fig. 3. Several of the Titan jars, of which stoppers were found in place, contained small bones, the remains of identifiable fish pickled in brine; the Mahdia jar may have held the same. I do not know the provenance of this type of jar. The proportions of the Titan jars are rather different from those of figure 5, *I*, so a difference in date would be assumed.

J. Toe missing. Preserved ht. 0.67 m. Certainly of the same class as Merlin and Lantier, no. 960, according to the detailed description; but the height, with toe preserved, is given as 0.65 m. by these authors.

For the class of jar, see V. Grace, "The Canaanite Jar," in *The Aegean and the Near East, Studies Presented to Hetty Goldman*, S. S. Weinberg, editor (Locust Valley, 1956), pp. 95-97 and 108-109, with pl. 12, 1-8 and fig. 6. Some of these jars are stamped,

and Punic script has been identified by Albright in a stamp on one datable about 200 B.C., see *ibid.*, p. 96. In the late second century B.C. Carthage was in ruins, but no doubt its colonies in the western Mediterranean area continued to produce the familiar jars. One found in the Dramont wreck with its stopper in place contained olives, see F. Benoit, "Nouvelles épaves de Provence," *Gallia* 16 (1958) : pp. 20, 21. Perhaps this was the content also of the Mahdia jar. However, olive pits were found also in one of the Antikythera jars; the shape is not specified, but the group does not include a Punic (?) jar.

K. Neck and handles missing, also perhaps end of toe. Preserved ht. 0.78 m. This should be Merlin and Lantier, no. 963, since there is nothing else with which to identify it in the catalogue, and 963 is said to have a "panse conique" and to lack handles and top of neck; however, it is also described as small, having a height of 0.33 m., which may or may not be simply a mistake. Jar *K* is evidently an incomplete full-size example of the same class as Jar *L*, that is, Dressel's Type 1, the general type of the now rather well known jars of Sestius. On these, see E. L. Will, "Les Amphores de Sestius," *Revue Arch. de l'Est et du Centre-Est* 7 (1956) : pp. 224-244; F. Benoit, *Fouilles sous-marines, l'épave du Grand Congloué à Marseille*, *Gallia Suppl.* 14 (Paris, 1961), pp. 42-48, 56-70.

L. Apparently complete. Ht. 0.95 m. Evidently Merlin and Lantier, no. 959, though the height of that is given as 1.00 m. The difference between the bodies of jars *K* and *L* (fig. 5) shows that *L* is a fractional container in its class (half-capacity?) and thus warns against difficulties in placing it in a stylistic sequence, since there are always differences in proportion between full-sized and fractional container-amphoras. Note the oblique profile of the rim, which possibly suggests a date before 100 B.C.: see Mrs. Will's comment above (p. 11) on the ancestor-jar of her Type 7.

THE HELLENISTIC POTTERY FROM THE SHIPWRECK OF ANTIKYTHERA

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In two other sections of this publication other categories of pottery from the Antikythera wreck originally published by Kourouniotes¹ are republished: the wine amphoras by Virginia Grace, and the red-glazed pottery, early examples of Roman types, by Henry S. Robinson. That which is included in the catalogue below may best be defined as household pottery in the Hellenistic tradition. The single lamp from the wreck is also included. Except as stated in the individual entries, all this material has been seen and reconsidered. It should be noted that a few pieces are included (14, 18-23) which were not published by Kourouniotes. Of these some bear the same inventory number as the pieces which he published. In one case (14) the inventory number was not present, but since it was stored with the Antikythera pieces there is a possibility that it also may have been part of the find.

The impetus toward reconsideration of this pottery in the light of present-day evidence was provided by Mrs. Gladys D. Weinberg, whose interest in the glass from the wreck prompted the question as to whether or not the long current date for the disaster, ca. 30 B.C. or later,² was still tenable. The remarks below are limited to this question and to such comment as now seems possible with regard to the port of origin of the main cargo.

In reconsidering the date of the pottery it should be emphasized that the Antikythera pieces are with a high degree of probability closely contemporary in time of manufacture one with another, very likely as closely contemporary in this respect as one supposes most single burial grave groups to be. That pottery vessels of comparatively fragile fabric should have had a long period of use in the rough and tumble of shipboard life is, of course, improbable. It seems, accordingly, a reasonable assumption that all were manufactured and acquired within a short time of the disaster.

Indications for the dating of the pottery from the wreck are provided at the present time by deposits of pottery from the excavations of the Athenian Agora. Although not all of the types of vessels from the wreck

are paralleled in these deposits, it is possible to say in a general way that the parallels which exist do confirm a dating within the first century B.C., and that certain of the pieces suggest, in fact, that a dating earlier in the first century is likely. This century witnessed a general change in the character of pottery quite comparable to such sharply defined changes as occurred earlier in Greek ceramic history, for instance that from Mycenaean to Protogeometric or from Classical to Hellenistic. The contrast between the pottery of the dying Hellenistic tradition and that of the vigorous new Roman tradition is clearly evident in deposits from the Athenian Agora considered to be connected with the destruction of the city by Sulla in 86 B.C. and others probably to be related to new construction in the city in the years of Augustus' reign. It is with the Sullan deposits, laid down in the years after the destruction, that the sharply defined group from Antikythera finds its closest connections.

Study of the Athenian deposits of the first century B.C. has not yet reached a definitive stage, but the relative position of the Antikythera group may be ascertained from several of its pieces. These are characteristic of the Sullan groups but no longer evident in those of early Imperial times. One of these is the fragment of a Megarian bowl, 1, whose relatives are still present in the Sullan deposits. The manufacture of this type of bowl would seem to have died out in the course of the first century B.C. as far as Athens is concerned. Such bowls, except as strays, do not characterize Augustan deposits. Fusiform unguentaria such as 11 and 12 occur in Sullan deposits. In Augustan they are replaced by onion-shaped unguentaria which presumably reflect the invention of blowing as a new technique of glass manufacture. Sharply articulated white-ground lagynoi such as 9 and 10 are ubiquitous in Sullan groups but not in Augustan. Other varieties have replaced them by that time.

A closer pinpointing of the moment of the wreck seems to be provided by vessels of two other shapes. The first is a variety of two-handled cup represented in the wreck by 7. Such cups make their first appearance in Athens in the Sullan groups, continuing in production into early Roman times. The second is the coarse lagynos such as 24-26 and the numerous others not catalogued here. Such lagynoi were in production from the early third century B.C. into the Roman period. In both series of vessels shape development, from early broad and low to later taller and constricted, a phe-

¹ *Ephemeris Archaiologiki* 1902: pp. 145-172. Hereafter referred to by the author's name.

² This dating was evidently first proposed by A. Rehm, according to Mr. Derek J. Price in a letter of Jan. 5, 1960. It appears in Gabriel Leroux, *Lagynos: Recherches sur la céramique et l'art ornamental hellénistiques* (Paris, 1913), p. 102. Georg Lippold, *Kopien und Umbildungen griechischer Statuen* (Munich, 1923), p. 71, favored a date around the middle of the first century B.C.

nomenon well attested in Classical times and still operative in Hellenistic, seems, on present evidence, to be chronologically significant. The relatively broad Antikythera cup is closer in form to the Sullan examples than to the early Roman, as may be seen by comparing the illustrations below (figs. 5-6). If strict principles of shape development be applied, the Antikythera cup should be slightly later than the time of Sulla. The position of the Antikythera coarse lagynoi is similarly close to Sulla, again perhaps slightly more advanced in time. The illustration of three lagynoi from the Athenian Agora, representing the earliest example, of the early third century B.C., a Sullan example, and a much more strongly constricted one of the Augustan period, is provided below (figs. 21-23) to make this evident. From Delos (*Bulletin de Correspondance Hellénique* 77 (1953): p. 599, fig. 93) comes an example nearly as constricted as the Augustan lagynos. If, as may be supposed on the basis of probability in the tumultuous history of that island in the first century B.C., this example is considered to be not later than the middle of the century, i.e., at the time of the decease of the island's commercial activity, then it may be assumed that the strongly constricted stage of the lagynos was already reached by mid-century or thereabouts. The Antikythera lagynoi would then lie in point of view of stage of shape development between 86 B.C. and mid-century. On this basis (admittedly subject to modification on fuller study) it would seem that the Antikythera lagynoi incline us to a date within the second quarter of the first century B.C. for the wreck, probably closer to the time of Sulla's destruction than to the middle of the century.

With regard to the port of origin of the ship of Antikythera on its last voyage the pottery provides some, though by no means conclusive, indications (for all too little is known of the particular characteristics of local fabrics of Hellenistic times) that it is to be sought perhaps in the vicinity of the central part of the coast of Asia Minor. For such a source the white-ground lagynoi, the coarse lagynoi, and the lamp are to some degree suggestive. For the white-ground lagynoi there is evidence that some at least were manufactured at Pitane (Tschandarli) and Pergamon. The coarse lagynoi, it is thought, were originally at least produced in Chios. The lamp is of the Ephesos type, found in great quantities in that city and believed to have been produced in Asia Minor.

It has already been remarked that shipboard conditions conducive to frequent breakage make it likely that the assemblage of pottery from the wreck is a closely contemporary group. Similarly they may also assist in determining what may have been the last port of call from which the main cargo was embarked. It is likely that those vessels which are preserved to us in the largest number of examples represent the latest purchases for the ship's crew. If this be true the coarse

lagynoi would seem to provide the best indication at present. Other shapes represented in multiple examples, but whose place of manufacture is not yet known, may well, when more is known of the special characteristics of the pottery of the numerous centers of manufacture of the Hellenistic world, provide supplementary information. In this aspect the jugs, 2-4, 18-23, and the small chytrai, 28-32, should be pertinent. At this time, on present evidence, it seems improbable that the ship sailed from Athenian waters, for none of the pieces seems to be of Athenian manufacture or in the Athenian tradition.

THE CATALOGUE

1. Megarian bowl, rim and wall fragment.
Kourouniotes, pl. H, 10. *Jahrbuch des deutschen archäologischen Instituts* 70, 1955, p. 144, figure 8. Figures 1 and 28.
P.Ht. 0.062. Est. diam. 0.12 m.

Hard, reddish-buff clay. Glaze fired part red, part black. Just below the inturned rim is a zone of eight-petal rosettes. On the wall, imbricate pointed, veined leaves.



FIG. 1. 1. Megarian bowl fragment. 1:2.

- 2.-4. Three jugs, arched handle.
2. Kourouniotes, pl. Θ, 14. Figures 2 and 28.
P.Ht. 0.15. Gtst. diam. 0.045. Diam. base 0.057 m.
3. Figures 3 and 28.
P.Ht. 0.145. Diam. base 0.065 m.
4. P.Ht. (to mid-body) 0.10. Diam. base 0.055 m.

These three little jugs are of the same fabric, soft dull orange-buff clay. There are no certain traces of glaze on them except possibly of dull red on 2. On 2 and 3 the stubs of the arched handle, which in outline probably resembled a question-mark, remain. There is a wheel-run groove around the bottom of the wall of all three. The underside of the bottom is recessed within a resting surface on 2 and 4, but merely grooved around the edge of the nearly flat bottom on 3. The mouth, where preserved, is circular in plan.

There is no good parallel to this shape among the pottery found in the Athenian Agora, but it is worth noting that a similar loop handle is probably also to be restored on a small jug found there. P 5644, in a

context connected with the destruction of Sulla in 86 B.C., a jug probably a foreign import to Athens.



FIG. 2. 2. Jug, arched handle. 2:5.



FIG. 3. 3. Jug, arched handle. 2:5.

5. Feeder.

Kourouniotes, pl. Θ, 13.

Not seen. Described by Kourouniotes (col. 162) as of ash gray clay with fugitive black glaze of poor quality; a ridge(?) a little below the lip; set inside the neck a pierced (i.e., presumably sieve-like) disk; on the wall beside the handle a small spout. He compares (col. 164) the clay of 6 below (his pl. Θ, 17) and of the lamp, 34 (col. 166, his pl. H, 28).

6. Mug.

Kourouniotes, pl. Θ, 17. Figures 4 and 28.
P.Ht. 0.085. Diam. 0.095 m.

Lip and handle missing, otherwise intact. On the wall, incised reeding, set off above by an incised line. Around the upper shoulder are two wheel-run grooves.

A vertical strap handle and an outcurved lip, probably circular in plan, are no doubt to be restored. Hard, pale gray clay. No glaze evident. Kourouniotes reports the clay of this piece as similar to that of the feeding bottle, 5, and the lamp, 34.



FIG. 4. 6. Mug. 2:5.

7. Two-handled cup.

Kourouniotes, pl. Θ, 25.

Not seen. Described by Kourouniotes as being similar (presumably in fabric) but of redder clay and more delicately made than the small red-glazed cup, his pl. Θ, 24, republished in the section by Henry S. Robinson. On the upper part of each handle was an applied thumb-rest in the form of an ivy leaf.

Cups of this general shape appear first, in versions which are also probably non-Attic, in the early first century B.C. Among those found in the Athenian Agora the Antikythera cup is most nearly related to

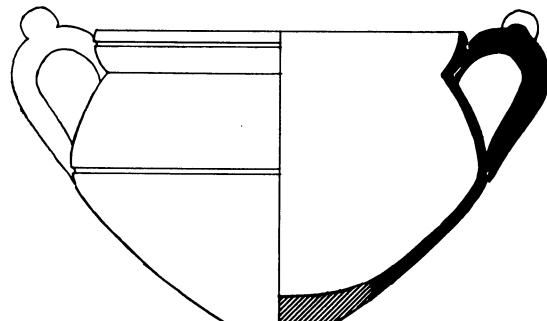


FIG. 5. Two-handled cup. Athens, Agora, P 12090. 1:2.

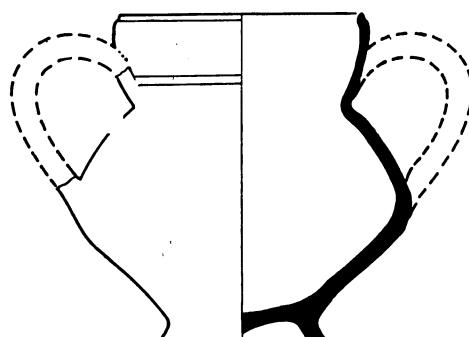


FIG. 6. Two-handled cup. Athens, Agora, P 11502. 1:2.

P 12090 (fig. 5) and P 19114, of the first quarter of the first century B.C. The subsequent development of the shape would seem to be in the direction of increase in height and toward constriction of the outline, as in P 11502 (fig. 6. Henry S. Robinson, *Pottery of the Roman Period* [Princeton, New Jersey, 1959], G 81) of the first half of the first century A.D.

8. One-handled cup.

Kourouniotes, pl. Θ, 27. Figures 7 and 28.
Ht. 0.055. Diam. 0.07. Diam. of foot 0.035 m.

Intact. Rounded strap handle; ring foot. Thin fabric, reddish-buff clay. No trace of glaze.



FIG. 7. 8. One-handled cup. 1:2.

9. White-ground lagynos.

Kourouniotes, pl. H, 5. Figures 8 and 28.
Ht. 0.29. Diam. ca. 0.25. Diam. base 0.105 m.
Slightly rounded lip. Gritty, light brown clay.
Kourouniotes (col. 162) reports many traces of cream-colored slip.

Generally similar in shape is a lagynos from the Athenian Agora, P 14449 (fig. 9) from a destruction fill associated with Sulla, of 86 B.C.



FIG. 8. 9. White-ground lagynos. 1:4.

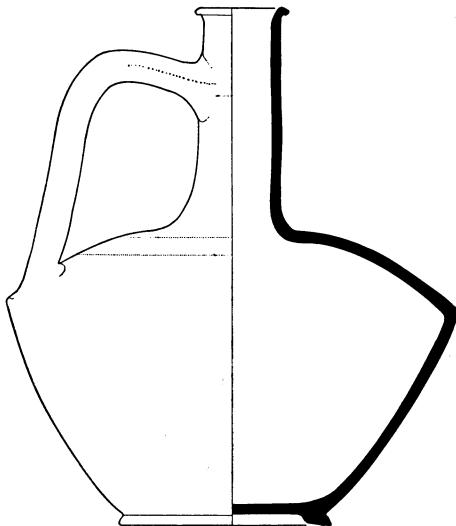


FIG. 9. White-ground lagynos. Athens, Agora, P 14449. 1:4.

10. White-ground lagynos.

Kourouniotes, pl. H, 8.
Seen, but now very fragmentary.
Diam. of base ca. 0.15. Diam. of body ca. 0.22 m.

Twisted rope handle. Traces of cream-colored ground reported by Kourouniotes (col. 262).

Most closely comparable in shape are two found in the Athenian Agora, P 14426 (fig. 10) and P 14427, from a destruction fill associated with Sulla, of 86 B.C.

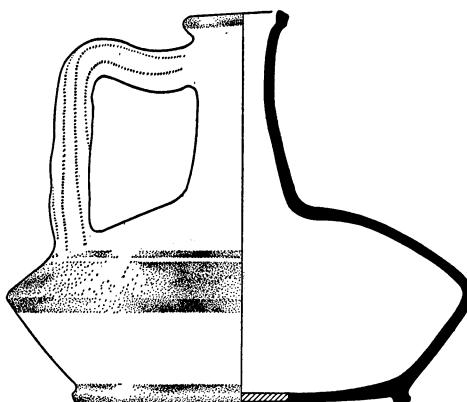


FIG. 10. White-ground lagynos. Athens, Agora, P 14426. 1:4.

11–12. Unguentaria

Kourouniotes, pl. Θ, 18. Figures 11 and 28.
P.Ht. (lip missing) 0.17. Diam. 0.06 m.
12. P.Ht. 0.14 m.

These are of similar form and fabric, of hard, reddish-buff clay. Unguentaria comparable in shape with narrow foot and sloping shoulders have been found in



FIG. 11. 11. Unguentarium. 2:5.

graves in Chios. J. K. Anderson (*The Annual of the British School of Athens* 49 [1954] : p. 164) indicates that this form was in vogue a little prior to the middle of the first century B.C. Three of the same general form (*ibid.*, p. 179, fig. 18, nos. 327–329) were found in a grave with a coin of "M. Porcius Cato (B.C. 90?)."

13. Unguentarium, with base.

Kourouniotes, pl. Θ, 19. Figures 12 and 28.
P.Ht. (foot to base of neck) 0.095. Diam. 0.065.

Diam. of foot 0.03 m.

Warm reddish-buff clay surface, pale gray core.

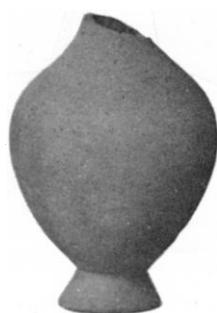


FIG. 12. 13. Unguentarium, with base. 2:5.

Of similar form: Athens, Agora, P 8790 (fig. 13. Robinson, F 49) and P 22096 (*op. cit.* G 96). A closely related example, complete but more slender, from the vicinity of Smyrna (*Mitteilungen des deutschen archäologischen Instituts, Athenische Abteilung* 37 (1912) : p. 392, fig. 10, no. 7).

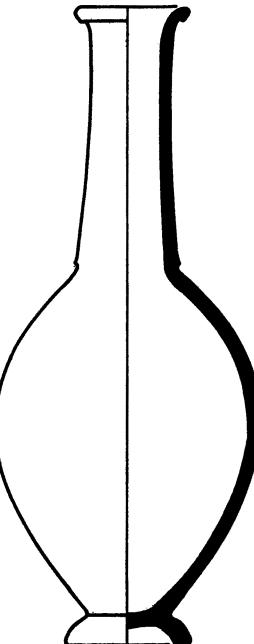


FIG. 13. Unguentarium, with base. Athens, Agora, P 8790. 1:2.

14. Amphora.

Not included in Kourouniotes. Figures 14 and 28.
Ht. 0.38. Diam. ca. 0.27. Diam. of lip 0.115.
Diam. of base 0.115 m.
Surface nearly orange.



FIG. 14. 14. Coarse amphora. 1:4.

15. Pitcher.

Kourouniotes, pl. Θ, 11. Figures 15 and 28.
 Ht. 0.28. Diam. *ca.* 0.20. Diam. lip 0.135. Diam. base 0.10 m.
 Rolled lip, ring foot. Hard pinkish-buff clay, tan surface.

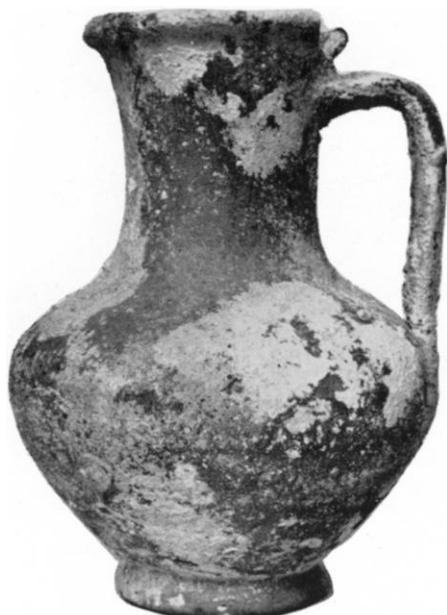


FIG. 15. 15. Coarse pitcher. 1:4.



FIG. 16. 16. Coarse pitcher. 1:4.

16. Pitcher.

Kourouniotes, pl. Θ, 12. Figures 16 and 28.
 Ht. 0.30. Diam. body 0.21. Diam. lip 0.135.
 Diam. foot 0.105 m.

The lip is merely the thickened termination of the neck. The handle is tripartite in section, resembling that of many white-ground lagynoi. Ring foot. Clay pinkish-buff with white grits, the surface buff.

17. Jug.

Kourouniotes, pl. H, 9.
 Seen, but now fragmentary.
 P.Ht. (to shoulder) 0.16. Diam. of foot 0.09 m.
 Ring foot.
 Coarse buff clay.

18.-23. Six small jugs.

18: Figs. 17 and 28.

Not included in Kourouniotes. One, however, has the same inventory number as other pieces from the wreck.

Ht. from 0.145 to 0.155. Gtst. diam. *ca.* 0.10. Diam. of lip 0.05 to 0.055. Handle *ca.* 0.02 m. wide.

Torus mouth, strap handle, ring foot.

These jugs are of the same shape and fabric. Since all are intact only the surface color of the clay can be seen: fired pale buff to pale red.



FIG. 17. 18. Coarse small jug. 2:5.

24.-26. Lagynoi.

24. Kourouniotes, pl. H, 6. Figures 18 and 29.
 Ht. 0.295. Diam. *ca.* 0.22. Diam. lip 0.043. Diam. foot 0.11 m.

Strap handle, ring foot. Fine pinkish-buff clay resembling the fabric of Rhodian wine amphoras.

25. Kourouniotes, pl. H, 7. Figures 19 and 29.
 P.Ht. 0.32. Diam. *ca.* 0.31. Diam. of base 0.13 m.

Neck and handle (except lower attachment) missing. Of extremely large size. Strap handle, ring foot. Gritty dark buff clay.

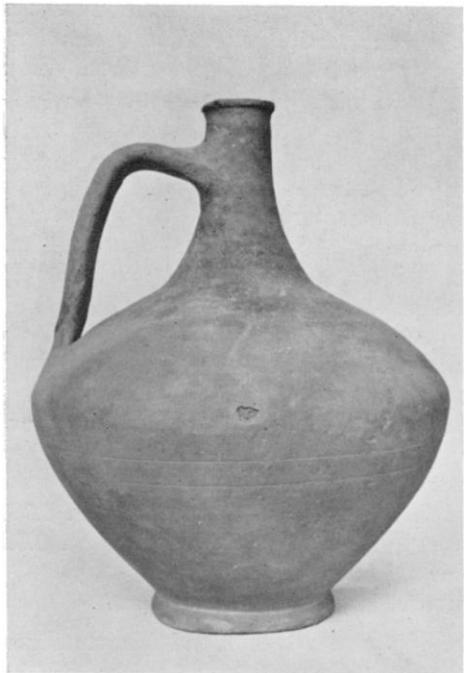


FIG. 18. 24. Coarse lagynos.



FIG. 19. 25. Coarse lagynos.



FIG. 20. 26. Coarse lagynos.

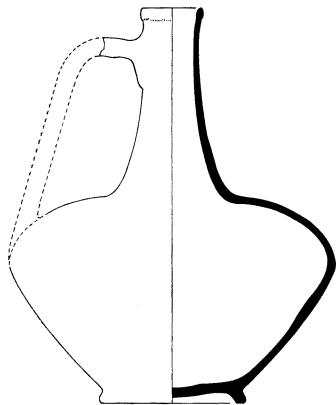


FIG. 21. Coarse lagynos. Athens, Agora, P 26878. Early third century B.C. 1:6.

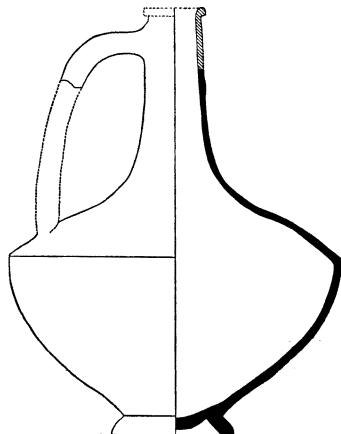


FIG. 22. Coarse lagynos. Athens, Agora, P 16395. Early first century B.C. 1:6.

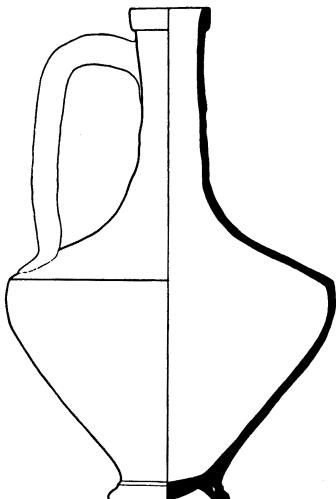


FIG. 23. Coarse lagynos. Athens, Agora, P 11329. Late first century B.C. 1:6.

26. Not illustrated in Kourouniotes. Figures 20 and 29.
Ht. 0.33. Diam. 0.24. Diam. of base 0.10 m.
Clay brownish.

Kourouniotes reported about 35 lagynoi from the wreck. Very nearly this number have been examined in the storage of the National Museum in Athens. The variation in shape among them is considerable, to such a degree as to indicate (along with differences in fabric) that several centers of production are represented. The

three selected above represent the extremes. The great majority are, however, roughly on the order of 24; that is, of generous proportions as compared with the constricted outline of 26. Size among them is in a very general way uniform except for 25, which is much larger than normal.

A series of dated examples from the Athenian Agora is given in Figures 21–23 to indicate the relative chronological position of the lagynoi from Antikythera. P 26878 is of the early third century B.C., P. 16395 of the time of Sulla, P 11329 of the Augustan period.

27. Coarse dish, glazed inside.
Kourouniotes, pl. Θ, 26.

Not seen. Described by Kourouniotes as of ordinary, heavy clay, dirty white in color and glazed on the inner surface.

Cooking Pots

- 28.-32. Five two-handled miniature chytrae.
28. Kourouniotes, pl. Θ, 15. Figures 24 and 29.
29. Figures 25 and 29.
29-32 were not illustrated by Kourouniotes.
See, however, his col. 163, where it is reported that many were found.
Ht. ca. 0.10. Gtst. diam. 0.062. Lip 0.08-0.085 m. in diam.
Handle 0.02 m. wide.



FIG. 24. 28. Miniature chytra. 2:5.



FIG. 25. 29. Miniature chytra. 2:5.

These are closely alike in form and fabric. The clay is buff, a coarse clay rather than a typical cooking fabric. All have small strap handles. Three have a groove around the top of the lip, two have a slight ledge around the inside of the lip, both probably devices for holding a cover in position. The rudimentary handles would serve for tying a cover, perhaps with a loop around its knob. The bottom is nearly pointed.



FIG. 26. 33. Chytra, one handle. 2:5.

33. Chytra, one handle.
Kourouniotes, pl. Θ, 16. Figures 26 and 29.
Ht. 0.085. Gtst. diam. ca. 0.11. Diam. lip 0.077 m.
Intact. Strap handle. The bottom is flattened (a circular area ca. 0.045 m. in diam.). The lower part is distinctly set off from the upper but the point of juncture is rounded off. Thin, red cooking fabric with fine but not abundant mica.

Lamp

34. Kourouniotes, pl. H, 28. Figures 27 and 29.
L. 0.09. Diam. 0.055. Diam. base 0.035 m. Diam. of top 0.05.
Collar 0.01 m. high.

Triple handle. The discus has a central hole with three small holes around it.

Classified by Richard H. Howland, *Greek Lamps and Their Survivals* (Princeton, New Jersey, 1958), p. 166, note 150, as of Type 49A, an "Ephesos" lamp. The range of date for this type is from the last quarter of the second century B.C. into the first quarter of the first century after Christ. It is considered a variety imported into Athens, presumably from Asia Minor. Kourouniotes compares the clay of this lamp with that of the mug and feeder, nos. 5 and 6 above.



FIG. 27. 34. Lamp. 3:5.

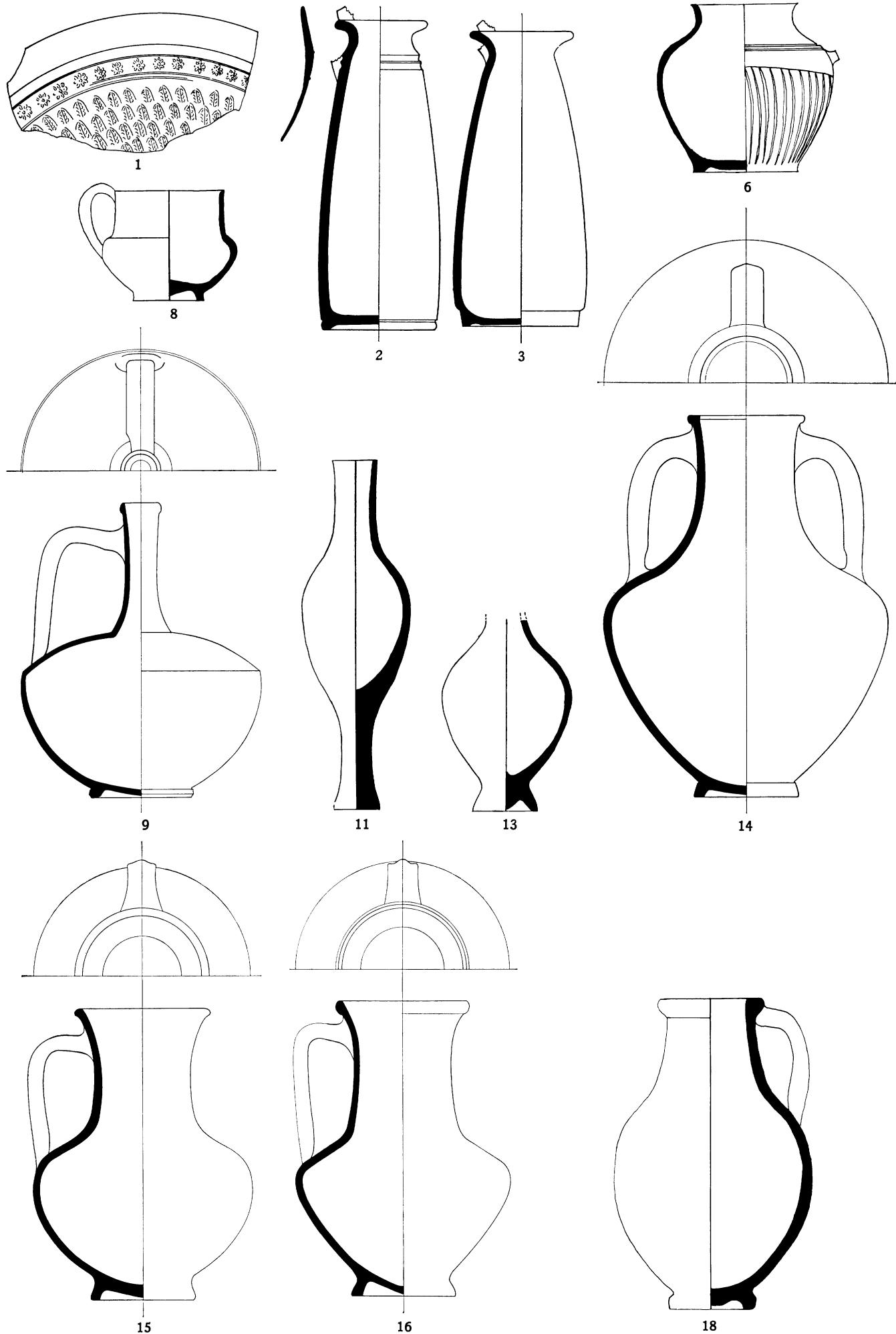


FIG. 28. Profile drawings of pottery from the Antikythera shipwreck. 1, 2, 3, 6, 8, 11, 13, 18: 2:5. 9, 14, 15, 16: 1:5.

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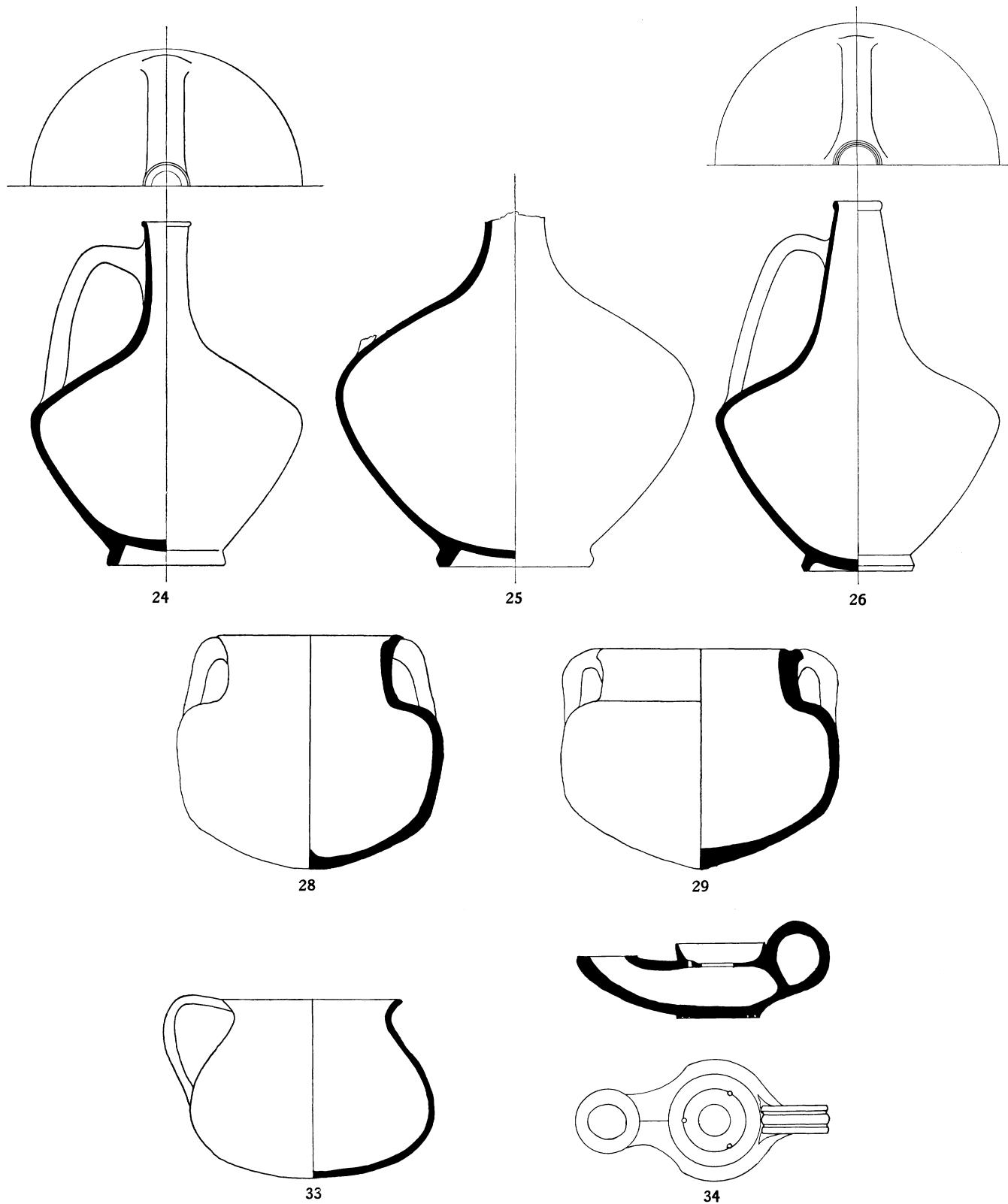


FIG. 29. Profile drawings of pottery and lamp from the Antikythera shipwreck. 24–26: 1:5. 28, 29, 33, 34: 2:5.

THE EARLY ROMAN POTTERY FROM THE ANTIKYTHERA WRECK

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Some of the vases recovered from the Antikythera wreck belong to categories generally classified as "Early Roman" on the grounds of technical characteristics which are more akin to those of Roman than of Hellenistic ceramics. Nine pieces are of the fabric known as "Pergamene," which was probably manufactured in the eastern Mediterranean, in Syria or lower Egypt.

Nos. 1-5¹ (figs. 1-4) are examples of a flat-floored Pergamene plate with low rim and heavy ring-foot.² The floor (in these examples frequently obscured by marine incrustations) is generally marked by a circular band of five stamped palmettes enclosed by circular

bands of rouletting, two outside and three inside; at the center is usually a stamped palmette. The stamped ornament of No. 3 (fig. 3) and No. 4 (fig. 1) was struck from the same dies. These five plates are of medium size, ranging in diameter from 0.21 m. to 0.275 m.; their shape is similar to that of a larger plate from the Athenian Agora which can probably be dated around the middle of the first century B.C.³

No. 6 (fig. 5) and No. 7 (fig. 6) probably belong also to the Antikythera find although they do not bear the National Museum inventory number; they are partly covered with marine incrustation and No. 7 has been in contact with objects of bronze. These

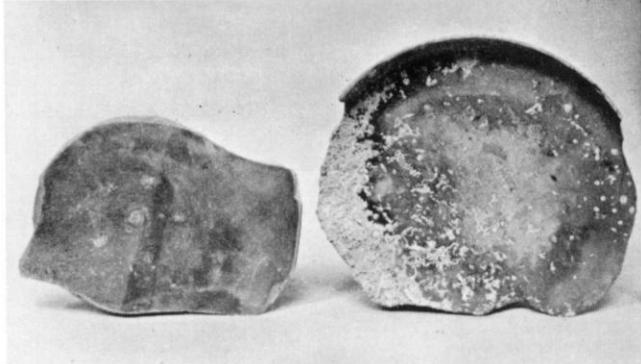


FIG. 1. Early Roman plates, Nos. 1 and 4.

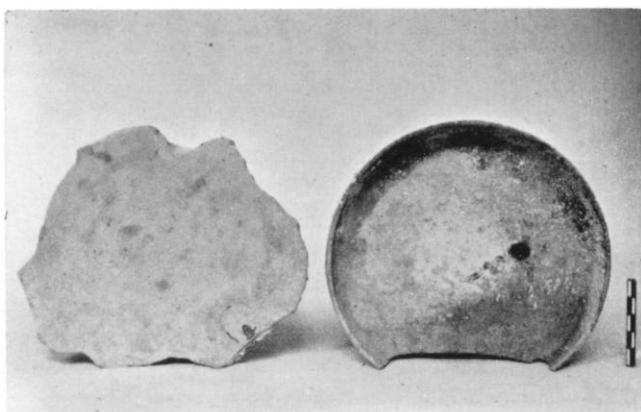


FIG. 2. Early Roman plates, Nos. 2 and 8.

¹ All these vessels bear the National Museum inventory number 15113.

² V. Stais, Τὰ ἐξ Ἀντικυθήρων εἰρήματα, figure 7, nos. 20-22.



FIG. 3. Early Roman plate, No. 3.



FIG. 4. Early Roman plate, No. 5.

³ H. S. Robinson, *The Athenian Agora 5* (Princeton, 1959), p. 11, F 1.

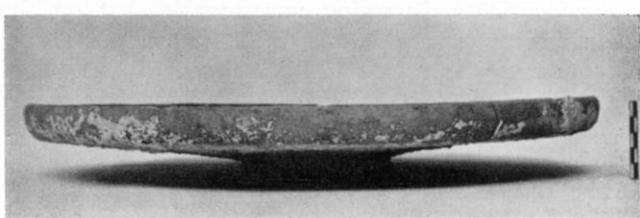
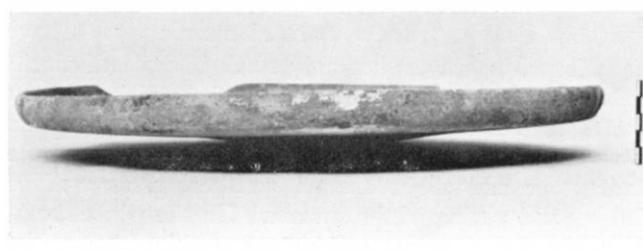
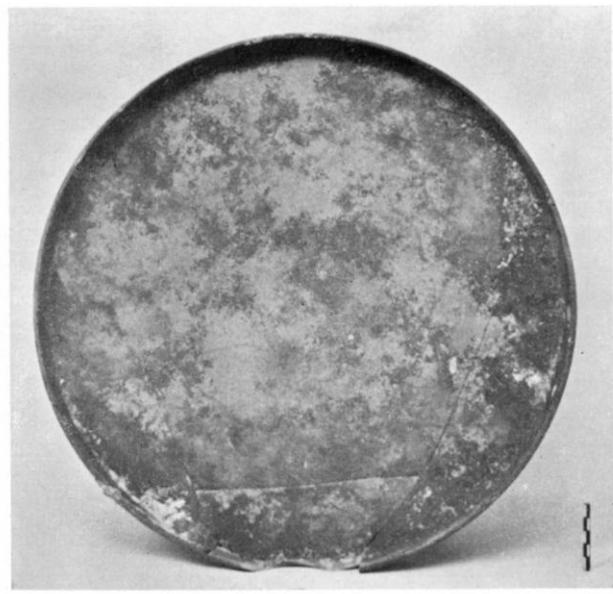


FIG. 5. Early Roman plate: two views, No. 6.

FIG. 6. Early Roman plate: two views, No. 7.

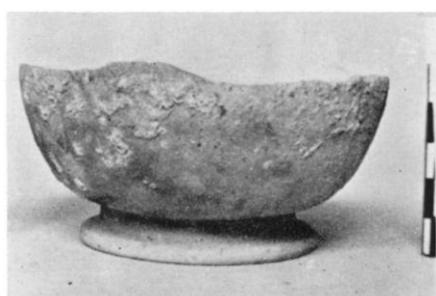


FIG. 7. Early Roman cup, No. 9.

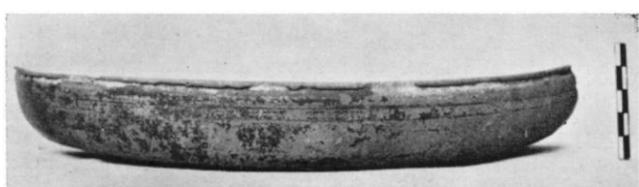


FIG. 8. Plate of "Gray Ware," No. 10.

plates are of the same shape as those noted above but are much larger (diam. 0.36 m. and 0.412 m.).

No. 8 (fig. 2) is a small plate of Pergamene fabric similar to one from the first century group of the Athenian Agora mentioned above.⁴ No. 9 (fig. 7)⁵ is a Pergamene hemispherical cup also paralleled in the Agora group.⁶

Two vessels are of an Early Roman fabric known as "gray ware": No. 10 (fig. 8), a large flat-floored plate without foot; and No. 11, a jug with gouged ornament on the body. "Gray ware" is not yet known from enough datable contexts to enable scholars to establish firmly its chronological limits, but it is clear that these two pieces are not inconsistent with the date of the Pergamene vessels from the same find.

These eleven vases thus suggest a date for the Antikythera wreck around the middle of the first century B.C.

⁴ Robinson, *op. cit.*, p. 11, F 2.

⁵ Staïs, *op. cit.*, figure 7, no. 24.

⁶ Robinson, *op. cit.*, p. 11, F 11.

THE GLASS VESSELS FROM THE ANTIKYTHERA WRECK

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In the wreck off Antikythera were found eleven glass vessels, some of them intact or almost complete, all of them luxury glasses of the highest quality. It seems astonishing that they were recovered from the depths of the sea. Looking at them, in their pristine, almost flawless condition, one thinks it impossible that they could have been found on the sea bottom, and how they survived seems a mystery. The matter becomes clearer when one realizes that each of the vessels when found was covered with a hard lime incrustation of the sort common on objects retrieved from the sea. This durable casing remains on one or two pieces; from the others it has been removed since their discovery, and no trace remains. The destructive qualities of this casing prove deleterious to marbles and it penetrates pottery surfaces, becoming unremovable, but on the smooth glass surface it can find no hold. The only exception is glass vessels which are made of sections of canes fused together. Here, in the interstices which sometimes occur, a bit of this incrustation may be noted.

The Antikythera group of vessels is remarkable for its high quality. In contrast to the pottery found in the wreck, which is quite mediocre, the glass is of rare, expensive types. One piece is, in fact, unique. The glass vessels were, then, part of the cargo rather than of the ship's equipment, and must be considered in that light. It would seem likely that many more glass vessels were carried on this ship than have been found, and doubtless more could still be rescued from the depths.

The date of the shipwreck, as established chiefly by the pottery and by the mechanism mentioned in the introduction (p. 4) is of the greatest importance for the chronology of the glass. Up to now hardly any definite date as early as this, based on context, could be assigned to any of the glass types except No. 2, and the *terminus antequem* which the wreck provides is exceptional.

There is also the added virtue of the vessels' being recovered from a ship. When found in graves they are often suspected of having been heirlooms, or even robbed from earlier burials.¹ Here it is likely that

¹ A grave at Sackrau, in Schleswig, contained millefiori and marbled cups as well as coins of Hadrian (117-138), Septimius Severus (193-211) and Claudius Gothicus (268-270). For a description see H. J. Eggers, *Der römische Import* (Hamburg, 1951), p. 109 and pl. 16, nos. 240 and 241; also Anton Kisa, *Das Glas im Altertum* (Leipzig, 1908), p. 255 and fig. 50, p. 254 and fig. 197. Fremersdorf (*Altschlesien* 8 (1939): pp. 85-90) believes that these vessels were actually made in the third century, but this seems unlikely.

these were newly manufactured objects being shipped for sale.

Some light is also cast on the provenience of the types of glass represented. The ship, it is generally agreed, must have been on the way to Rome; therefore the glass vessels were made somewhere east of that city. It is not impossible that the cargo was assembled from several different spots, either involving a long journey for the ship, or transshipment at one or more points. According to the literary tradition, Alexandria is the most likely place of origin for molded and cut glass. We can be reasonably sure, at any rate, that these vessels were not made on the Greek mainland or islands. With the exception of a few fragments, the Antikythera pieces are the only vessels of their kind found in Greece. A few marbled mosaic vessels have been found in graves, but only small bits of millefiori.²

1. The finest piece of glass from the wreck, without doubt, is a molded and carved bowl of a blue-green glass of good quality (figs. 1-4).³ There is now some iridescence and slight enamel weathering, as well as dulling and pitting of the surface. On the whole, however, the vessel, intact and not even chipped, may be considered as in perfect condition. The bowl, which is approximately hemispherical, was made by casting. That it was cast upside down is shown by the presence of two large bubbles near the bottom and only very small ones near the rim (see below, pp. 32-33). After being cast the surface was carved, and also rotary-polished inside and on the rim. Two horizontal grooves were cut inside, just below the rim. On the outside is an elaborate, carved design consisting of a sketchily depicted vase from which spring two branches, probably of olive. These spread out over the whole surface of the vase, almost meeting on the opposite side. A fillet joins the sprays on the lower part of the bowl. On the bottom of the bowl is an eight-pointed rosette, rather uneven but with well-shaped petals. The design

² Gladys R. Davidson, *Corinth 12: The Minor Finds* (Princeton, 1952), no. 604; Agora Excavations, nos. G252, G258, G284, millefiori) G164, G240, G543 (marbled); G163 (reticella)—all unpublished; National Museum, Athens, nos. 14261, 14262 (marbled), found at Karditsa, Thessaly (unpublished). Other small fragments, likewise unpublished, are in various museums of Greece. Recently, however, a complete millefiori bowl was found in a grave in Messenia, apparently of the early first century B.C. (*Arch. Deltion* 17 (1961/2) *Chronika*: pp. 98-99, pl. 104).

³ NM 15113 (this number was given all the objects from the wreck). Ht. 0.12 m.; diam. of rim 0.159 m.; thickness at rim 0.002 m.-0.004 m.



FIG. 1. Bowl of blue glass, from the wreck (no. 1).

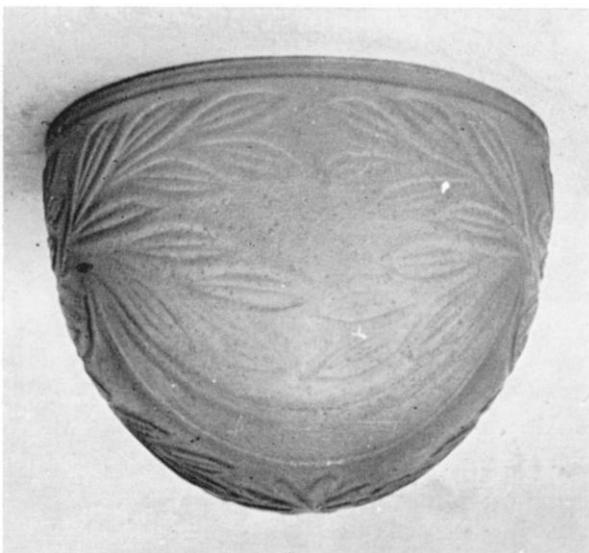


FIG. 2. Blue glass bowl, reverse (no. 1).

described is cut neither in relief nor intaglio but, rather, obliquely into the surface of the vase. All the cut lines are broad and sloping; thus the effect of relief is given without the necessity of cutting away a large amount of background. The ribs of the leaves are sharply delineated. The exterior may have been polished after cutting—this is difficult to determine, as only the high spots have a polished look. The rim, above the design, is cut down to a surface lower than the rest of the bowl.

Dr. Frederic Schuler, who has examined photographs, points out that the design could, technically speaking, have been molded together with the bowl, but the sharp relief seems to preclude that possibility. Any remains of the molding process,⁴ which would be seen on the bottom, were removed when the rosette was carved.

⁴ Frederic Schuler, "Ancient Glassmaking Techniques: The Molding Process," *Archaeology* 12 (1959) : pp. 47–52.

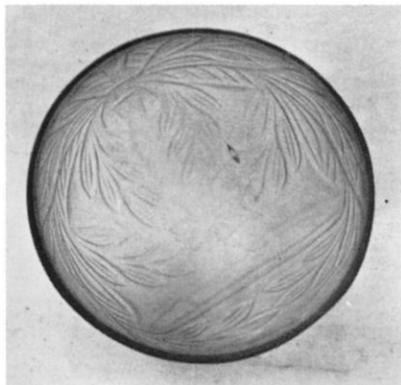


FIG. 3. Blue glass bowl, view from above (no. 1).

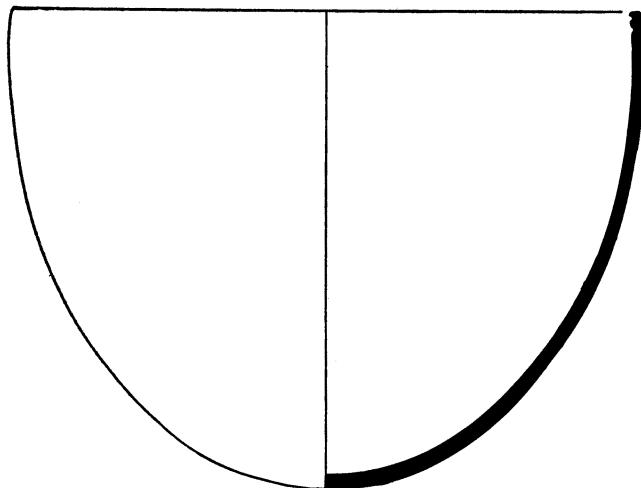


FIG. 4. Blue glass bowl, profile drawing (no. 1).

A parallel for the decoration of this bowl in glass has proved impossible to find, although the shape is simple and not uncommon. In metal (particularly silver), however, there are a good many rather similar vessels which could have been prototypes of the glass, and which are approximately contemporary. A gold bowl from Siberia, now in Leningrad,⁵ is somewhat shallower in shape and has a very much more elaborate form of decoration, but the theme of the tendrils springing from a calyx reminds one of the "vase" on the Antikythera bowl. Küthmann dates the Leningrad example to about 100 B.C.

Two silver bowls in the British Museum⁶ (fig. 5) are more like the Antikythera example in shape but much freer and more elaborate in their decoration. Each originally had a foot and handles, as the glass bowl did not, but without these the resemblance is striking.

⁵ H. Küthmann, "Beiträge zur hellenistisch-römischen Toreutik," *Mainz. Jahrb.* 1958: pp. 110–111, pl. 9; also M. Rostovtzeff, *Social and Economic History of the Hellenistic World* (Oxford, 1941) 1: pl. 61,3.

⁶ P. E. Corbett and D. E. Strong, "Three Roman Silver Cups," *Brit. Museum Quarterly* 23 (1961) : pp. 68–83.



FIG. 5. Silver bowl in the British Museum. Photograph courtesy of the Trustees of the British Museum.

The two cups have been dated between 100 B.C. and the death of Augustus, earlier rather than later in this period of time.

Another parallel in silver is the well-known skyphos found at Alesia, in France (fig. 6).⁷ Except for the handles and foot, and allowing for differences in technique, it is rather like the Antikythera bowl. Particularly reminiscent is the decorative fillet which joins the branches, here of myrtle. The skyphos was dated by Héron de Villefosse in the first half of the first century B.C. (before the siege of Alesia, 52 B.C.). This date has been rejected by others as too early, but it seems to agree fairly well with that of the Antikythera bowl.



FIG. 6. Silver skyphos found at Alesia, France.
From *Monuments Piot* 9 (1902).

⁷ A. Héron de Villefosse, "Le canthare d'Alise," *Mon. Piot* 9 (1902): pp. 179-188.

Corbett and Strong⁸ believe the Alesia vessel is a product of the same workshop as the bowls in the British Museum. Kuthmann⁹ dates it early in the first century B.C. because of the handle, comparing it to a jug in the British Museum from Arcisate.

From these metal parallels—and others might be added—we gain a definite impression of a luxury industry flourishing early in the first century. Our glass bowl happens to be the only example extant of such a vessel in this material, and probably there never were very many. Unfortunately, from the metal examples we gain no idea of the ultimate provenience of the bowls, either in silver or metal. We can guess that the Antikythera bowl was made in Egypt, but that is only a surmise which must wait for confirmation from some other source.

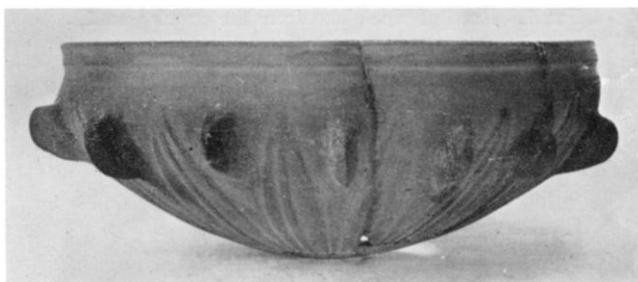


FIG. 7. Brown glass bowl from the wreck (no. 2).

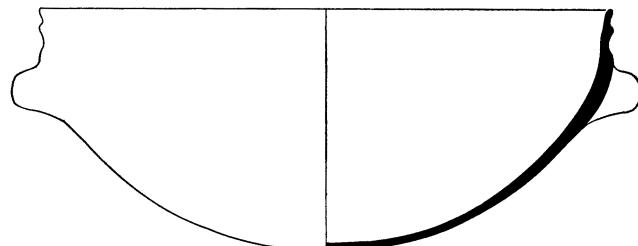


FIG. 8. Brown glass bowl, profile drawing (no. 2).

2. The largest of the glass vessels did not emerge from the wreck intact, but most of it is preserved (figs. 7, 8).¹⁰ Golden-brown in color, and with practically no weathering, the bowl was made by casting. This must have been a difficult problem because of its large size and the relative thinness of the wall. Dr. Schuler describes its probable manufacture (which also applies to the preceding bowl) as follows:

Possibly the bowl was made completely by mold-casting, with a minimum of carving to finish it. The steps would have been (1) to shape an inner refractory form, upside down, (2) to build up the bowl form with clay (or wax), (3) cast the outer refractory mold form over this, (4) separate the two-part mold and remove the clay (or melt out

⁸ *Op. cit.*: p. 82.

⁹ *Op. cit.*: p. 121.

¹⁰ Ht. 0.101 m.; diam. of rim 0.236 m.; thickness at rim 0.003 m.

the wax) and (5) heat the mold filled with glass frit in a furnace so that the glass runs down and fills the void space.

Dr. Schuler made actual experiments in an attempt to reproduce this bowl, and was partially successful. The amount of glass frit he used was insufficient to fill the mold entirely, and several holes remained in the finished bowl. Apart from this, however, the experiment was successful.

There are no very large bubbles in this bowl. A few small ones are found near the rim but most are near the bottom, the largest having a diameter of 2 mm. It is therefore likely that the bowl was cast upside down, as described. In many places air bubbles prevented the filling of the mold, and small depressions consequently appear on the outer surface. Inside the bowl there are fewer such depressions.

The decoration is as follows: on the outside sixteen long petals are carved in relief, each with a central rib and each extending from concentric circles carved on the bottom almost to the rim of the bowl. Alternating with the petals are sixteen short projecting knobs. On the bottom is an engraved eight-point "star" composed of straight grooves. Inside there is no carving; the surface is rotary-polished.

Since the knobs, or lobes, on the outside are of different sizes and shapes it is obvious that after molding they were pared off. The petals are likewise of uneven length and are not quite regularly placed. In technique of carving this bowl is very like the blue bowl described above; that is, the petals stand out in relief because the surface is cut away around them, but the entire surface is not cut down to the same depth. In general, the work is not so careful as on the blue bowl.

One of the finest examples of this type of bowl is that found at Xanthos, in Lycia.¹¹ It comes from a tomb which has been dated to the later third or second century B.C. although it may have been re-used in the early first century B.C. (see V. Grace, p. 7, note 10). The color of the Xanthos bowl is unusual—"bottle green" with spots of purple in it. There is considerable difference between this bowl and the Antikythera example; the former has twelve petals and corresponding knobs, the form is fuller, the knobs are above the petals in a separate zone, and the work in general is much finer and more delicate. Very like the Xanthos bowl are two found at Canosa, one in the British Museum (with twenty knobs to its twelve petals),¹² the other at Tarentum.¹³ It seems possible that the bowls

¹¹ P. Demargne, *Fouilles de Xanthos* (Paris, 1958) 1: pp. 68–69 and pl. 20. Ht. of bowl 0.12 m.; diam. of rim 0.24 m.

¹² Axel von Saltern, "Glass Finds at Gordion," *Journal of Glass Studies* 1 (1959) : p. 39, figs. 22 and 23.

¹³ R. Bartoccini, "La tomba degli ori di Canosa," *Iapigia* 6 (1935) : pp. 246–247 and pl. 2. The tomb is dated to the first quarter of the third century B.C., but the circumstances of excavation left much to be desired, and two or three tombs seem to have been involved. Bartoccini notes (p. 225) that some of the glass fragments were collected later.

of the Xanthos-Canosa type are early forerunners of the more common variety, such as that from the wreck. Fragments of cut bowls found at Gordion¹⁴ have been dated to the late third or early second century B.C., but the pieces are so small that they are not too reliable for dating. A bowl in a private collection,¹⁵ though differing from the Antikythera example in shape (it has an outsplayed rim), is most similar in decoration. As von Saltern points out, these bowls must have been derived from metal prototypes such as one in the Metropolitan Museum of Art, with twenty-four lobes and twenty-four petals.¹⁶

3. The third large-sized glass vessel found in the wreck was a skyphos, a type well known both in molded

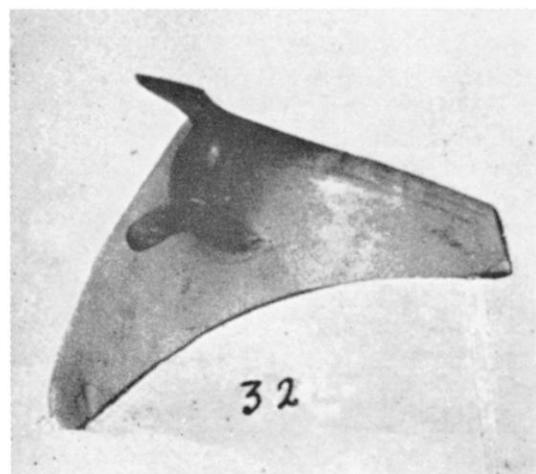


FIG. 9. Fragment of glass skyphos from the wreck (no. 3). From *Eph. Arch.* 1902: pl. H.

and in blown glass. A fragment of this vessel is shown in figure 9.¹⁷ Whether other pieces of it were found is not known, for the fragment disappeared after its discovery and cannot now be located. To judge from the scale of the photographs, the cup must have stood about 0.15 m. high. The type of vase is shown in figure 10, an example from Kerch in the Brussels Museum.¹⁸ Like this one, the Antikythera example appears to have been molded and then to have had the handles cut, although this cannot be definitely determined from the old photographic reproduction which is our only record.

Another example, in the Sangiorgi Collection, was found at Cumae.¹⁹ Eisen, illustrating an example in

¹⁴ von Saltern, *op. cit.*: pp. 34–38 and fig. 19.

¹⁵ von Saltern, *op. cit.*: p. 39, fig. 21.

¹⁶ G. Eisen, *Glass* (New York, 1927) 1: p. 179, pl. 39.c.

¹⁷ From *Eph. Arch.* 1902; pl. H, no. 32. See also V. Staïs, *Ta ἔξ Ἀντικύθηρων εἴρεματα* (Athens, 1905), p. 16, fig. 8.

¹⁸ Anne-Marie Berryer, *La Verrerie ancienne aux musées royaux d'art et d'histoire* (Brussels, 1957), p. 7 and fig. 3.

¹⁹ Giorgio Sangiorgi, *Collezione di vetri antichi dalle origini al V sec. D.C.* (Milan-Rome, 1914), no. 138, pl. 27. The height of this vase is 0.09 m.



FIG. 10. Glass skyphos in Brussels. Photograph courtesy of Musées Royaux, Brussels.

the Metropolitan Museum,²⁰ states his belief that the type did not last beyond the first century of our era, which is probably correct. On blown examples, which are fairly common, the handles were added separately and sometimes bear the maker's name, impressed with tongs while the glass was viscous.²¹

Of the smaller bowls from the wreck, five are of the mosaic type and three of reticella or "lace-work."

Dr. Schuler describes the probable method by which the mosaic bowls (nos. 4-8) were made as follows:²²

The technique is one of mold-fusion. The small sections of cane were placed carefully in a hemispherical refractory mold; the inside hemisphere mold was lowered in place on top of them; mold and glass were placed in the furnace and heated until the glass deformed and fused together. The upper edge of bowl no. 4, and others to be mentioned below, was left uneven owing to the placing of round canes in contact with each other. To this was sealed the rim cone. The applied rim is difficult to make by mold-fusion techniques; it would involve pre-shaping several pieces to the curvature of the rim and then another fusion step with new molds.

Careful observation of intact specimens reveals only one join, so that a single cane must have been used for the rim. One bowl (no. 9) is a combination of mosaic and reticella work. Of this specimen Dr. Schuler says:

²⁰ Eisen, *op. cit.*, p. 154 and pl. 15. This skyphos is also published in W. Froehner, *Collection Julien Gréau* (Paris, 1903), no. 1660. The height is 0.154 m. A similar skyphos, somewhat smaller (ht. 0.098 m.), in the same museum, is said to be from Cumae (W. Froehner, *La Verrerie antique, Collection Charvet* [Le Pecq, 1879], pl. 13, no. 77). This information was kindly furnished by Brian F. Cook.

²¹ G. R. Davidson, *Corinth* 12, no. 650; F. Fremersdorf, "Römische Gläser mit buntgefleckte Oberfläche," *Festschrift August Oxé* (Darmstadt, 1938) : pp. 116-121.

²² See also Frederic Schuler in *Archaeology* 12 (1959) : pp. 47-52. Dr. Schuler conducted actual experiments and made successful copies of ancient mosaic bowls. Other descriptions of method, while presuming a similar process, are not based on experimentation (e.g., R. J. Forbes, *Studies in Ancient Technology* [Leiden, 1957] 5, p. 154; W. A. Thorpe, "Codes of Work in Glass History," *Journal of Royal Society of Arts* 96 [1948] : p. 470; Ludwig Berger, *Römische Gläser aus Vindonissa* [Basel, 1960], p. 11).

It was made by mold-fusion techniques and is more difficult than the type previously discussed. The long canes could have been pre-shaped, perhaps by sagging over a mold, and then placed in the hemispherical mold, with its inner hemisphere lowered in place on top of them, as described above. The procedure must have been somewhat more elaborate, for the strips were laid on a thin base of light green glass, which is on the outside only. Thus, while several procedures can be proposed, it is by no means obvious how the bowl was made.

Of the two bowls entirely of lace-work, Nos. 10 and 11, Dr. Schuler says:

This is the most difficult type to make. Remarkable as the other bowls are, this must have been a fantastic achievement for the ancient craftsman. The method of making the spiral is by no means clear. It is possible to make this by punty techniques, but this would have been a new technique development for a type which seems to fit into the family of mold-fused bowls. While this is possible, it is more reasonable to suppose that a very clever evolution of techniques took place within the mold-fusion methods.

Despite the difficulties of the techniques involved, bowls such as these are not at all rare. They have been found all over the continent of Europe as well as in the Near East. As yet there is no agreement as to where millefiori vessels originated, although Alexandria seems to be the likeliest place.²³ "Rome or Alexandria" is a designation frequently found in catalogue descriptions of such glass, as large numbers of fragments have been found in both these places.²⁴ For the bowls from the Antikythera wreck the choice is undoubtedly Alexandria, as the ship must have been on its way to Rome, not from it. It is quite likely, however, that such bowls were later manufactured in Italy as well. In the publication of the Colchester glass Dr. Harden assumes that the millefiori vessels found at that site are of Italian manufacture. He says: "Perhaps the glass-houses which produced them were in Venetia or Histria."²⁵ It seems probable that at the time when the Antikythera ship sank, such factories had not yet been established in Italy: perhaps the Antikythera bowls were among the first to be imported there. (Of course these particular ones did not reach their destination.)

We can be reasonably sure, as we have said earlier, that this kind of glass was not made in Greece or the Greek islands, for with the exception of a few fragments, the Antikythera pieces are the only vessels of the kind found in Greek territory (but see note 2, above).

²³ Strabo 16.2.25.

²⁴ Ray W. Smith, *Glass from the Ancient World* (Corning, 1957), p. 47. Eisen says (*Glass*, p. 174) that "certain types were certainly made in Syria, probably in Tyre or Sidon; some come with certainty from Egypt, and others perhaps were actually made in Rome. . . . In the time of Winckelmann, in the middle of the last century, a large hoard of mosaic glass fragments was found on Isola Farnese, not far from Veii, near Rome. Another hoard was found outside of Porta del Popolo. . . ." No proof is offered of the Syrian origin he postulates.

²⁵ D. B. Harden, "The Glass," *Camulodunum, First Report on the Excavations at Colchester 1930-1939* (London, 1947) : p. 288.

The manufacture of mosaic glass vessels seems to have extended over a relatively long period, perhaps nearly throughout the first centuries B.C. and A.D. Harden observes:

The exact dating of millefiori is not easy, as the pieces were costly and tended to be kept as heirlooms. It seems clear, however, that the more elaborate types of floral designs were made from the first century B.C. to ca. A.D. 40, and were succeeded during the later first century A.D. by the marbled and dappled types. . . .²⁶

Kisa believed that the *floruit* of the mosaic glass industry was the first half of the first century A.D.²⁷ He cites a number of parallels to our vases as well as variations on the types which they represent.²⁸

A number of mosaic bowls are illustrated by Eisen, none with a recorded provenience.²⁹ His classification of the types of mosaic glass is fantastically confusing, and his description of the method of manufacturing them even more so.³⁰ He recognized, however, as Kisa did not, that these glass bowls were not the original *murrina*, a fact later proved by Harden and Loewental and confirmed by Bromehead.³¹

Fremersdorf has recently published mosaic glass in Cologne³² and includes some discussion of various types as well as their dating.

The subject has most recently been treated in the publication of the glass found at Vindonissa.³³ The author has assembled a great deal of evidence and presented it in a clear and logical manner. From the data he offers we learn that mosaic glass of the kinds in the Antikythera deposit has been found in Augustan contexts and is particularly plentiful in the first half of the first century of our era. He cites pieces from a number

²⁶ *Op. cit.*, p. 293.

²⁷ Kisa, *Das Glas im Altertum*, p. 519.

²⁸ A hemispherical bowl in the Metropolitan Museum (Kisa, *op. cit.*, p. 523 and figs. 203 and 203a [pp. 418-419]) has a rim of twisted cane like the Antikythera bowls but differs in that the edge of the bowl was ground down all around before the rim was applied, whereas the Antikythera bowls have uneven edges to which the rim was adjusted. This particular specimen is from the Roman Campagna. A type not represented among the Antikythera finds is the mosaic bowl with the design divided into four quarters. An excellent example is one in Luxembourg (Kisa, *op. cit.*, p. 441, fig. 213), and there is another in the Walters Art Gallery (see *Archaeology* 10 [1957]: p. 24). Eisen shows another (*Glass*, pl. 34,b) and the Sangiorgi Collection includes still another (Sangiorgi, *op. cit.*, no. 214) found with a reticella bowl (no. 221) at Agro Adriese.

²⁹ Eisen, *Glass*, pls. 29-36.

³⁰ *Op. cit.*, pp. 170-206.

³¹ D. B. Harden and A. I. Loewental, "Vasa Murrina," *Jour. Roman Studies* 39 (1949): pp. 31-37; C. N. Bromehead, "What was Murrina?," *Antiquity* 36 (1952): pp. 65-70. Forbes, however (*Studies in Ancient Technology* 5: p. 168), continues to use murrine as a general term including glass as well as semiprecious stones.

³² F. Fremersdorf, *Römisches Buntglas in Köln* (Cologne, 1958).

³³ Ludwig Berger, *Römische Gläser aus Vindonissa*, pp. 9-16.



FIG. 11. Mosaic glass bowl from the wreck (no. 4).

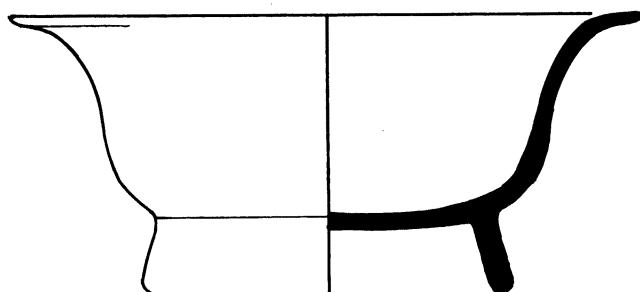


FIG. 12. Mosaic glass bowl, profile drawing (no. 4).

of sites in Germany as well as others in France, Switzerland, England, and Dalmatia.

Reviewing the available evidence, we find that most of the mosaic bowls that can be dated do not go back before the beginning of the Christian era. There are a few exceptions: some fragments found at Chatby, near Alexandria, which were turned up in the fill above the graves but which are to be dated within the Ptolemaic

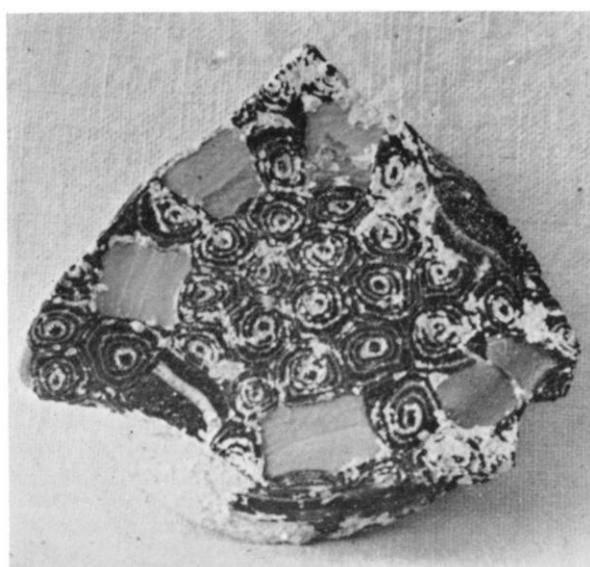


FIG. 13. Fragment of mosaic glass bowl from the wreck (no. 5).



FIG. 14. Fragment of mosaic glass bowl from the wreck (no. 6).

period;³⁴ a few specimens found at Caceres (Spain) which are dated 79–78 B.C.;³⁵ a plate from a tomb at Cumae which is dated to the second half of the third century B.C.³⁶ In the last case, as well as in others not mentioned here, the evidence seems rather dubious. The Antikythera bowls, if not the very earliest, are certainly among the earliest, and their dating is more reliable than that of most other examples. It should be noted that they do not represent an undeveloped phase of the type of vessels found in Augustan and later contexts; to all appearances they are identical with the later pieces. Hence we know that glass vessels of this kind were made much earlier than heretofore supposed, and if there was any experimentation or development of the type, it must have occurred before the time of the Antikythera wreck.

4. The best preserved of the mosaic bowls (figs. 11, 12) is a shallow vessel with outsplayed rim and low base. The body is composed of cane sections of royal blue, with purple, white, and green stripes wound around them, interspersed with irregular pieces of yellow, aquamarine blue and rose-colored glass. The rim is a strip of green and purple, with a bit of reticella (white and colorless spiral) added just inside it on one side, to fill in the space. The base is a separate coil of streaky green, yellow and white, with traces of other colors.³⁷

³⁴ E. Breccia, *La Necropoli di Sciati* (Cairo, 1912), nos. 323 ff.; Poul Fossing, *Glass Vessels Before Glass Blowing* (Copenhagen, 1940), p. 103.

³⁵ *Arch. Anz.* 1928: p. 25.

³⁶ *Not. Scavi* 1925: p. 88. The millefiori bowl is described ("di vetro marrone con zone biancastre ondulate, che pure imita l'agata") but not illustrated. The tomb is dated in the third century B.C., but it is stated that its form can be as late as the early first century B.C., and there was a Roman imperial coin "perhaps brought in by visitors." On the whole the evidence seems shaky.

³⁷ Ht. 0.048 m.; diam. of rim 0.095 m.; diam. of base 0.055 m.

5. This fragment (fig. 13) is similar to the preceding as far as preserved. It is still partially covered with lime incrustation. Irregular white, yellow, blue, and aquamarine pieces of glass are set among spiral cane sections of purple, white, and some other color now indeterminable. The base is a separate coil of streaky purple, white, and green.³⁸

6. This fragment (fig. 14), similar to Nos. 4 and 5, includes the base and part of the body. (This is the only piece which shows weathering to any extent.) The body is made of cane sections of royal blue spirals wound with white, with central dots of purple. Irregular yellow, blue, aquamarine, and opaque white pieces are set in at random. The base is a separate coil of streaky green, red, blue, yellow, and white.³⁹

A dated parallel to this shape, which is much less common than the simple hemispherical bowl, does not seem to exist. An identical bowl is in the Smith Collection,⁴⁰ and another which may be the same (the



FIG. 15. Mosaic glass bowl from the wreck (no. 7).

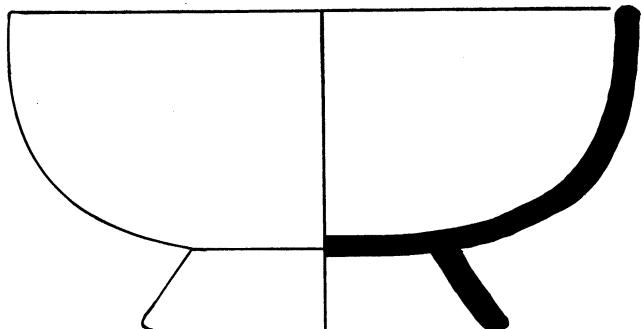


FIG. 16. Mosaic glass bowl, profile drawing (no. 7).

³⁸ Diam. of base 0.055 m.

³⁹ Diam. of base 0.055 m.

⁴⁰ R. W. Smith, *Glass from the Ancient World*, pp. 85–86 (no. 140). The background is lilac, with opaque white circles and rods. There is a separate base ring.

shape is not clearly shown) is in the Sangiorgi Collection.⁴¹ In both cases the origin is thought to be Alexandria.

7. This almost complete bowl (figs. 15, 16) is of a simple hemispherical shape, with a low base. The surface is quite rough, as it is partially eaten away, and the lime incrustation has worked into the interstices between the fused mosaic canes. The body is formed of sections of spiral canes of purple and white, with a blue dot in the center of each. Irregular pieces of opaque white glass are laid in at random. The rim is a spiral strip formed of yellow, white, and colorless threads entwined. The base is a separate, added coil of blue with streaks of yellow and white.⁴²

8. This fragment (fig. 17) is from a bowl like the preceding; only the base and part of the body are preserved. The surface is partially destroyed. The mosaic pattern is composed of spiral cane sections of two shades of blue, as well as a few of green, all with yellow or white centers. Irregular white pieces are introduced here and there. The base is a blue coil with streaks of yellow.⁴³

Many bowls of this shape, more often without a base, are known, but only fragments have been found in datable contexts. Some from Haltern (Germany) come from an early first-century context;⁴⁴ some from Vindonissa are dated in general A.D. 10–65;⁴⁵ others from Colchester are assigned to the period A.D. 49–61.⁴⁶

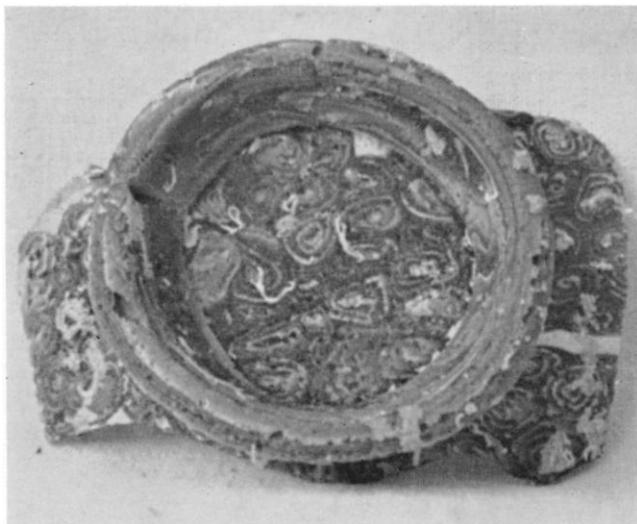


FIG. 17. Fragment of mosaic glass bowl from the wreck (no. 8).

⁴¹ Sangiorgi, *Collezione di vetri*, no. 218, pl. 41. The canes are more regularly arranged than in the Antikythera piece, and the rim is of reticella work.

⁴² Ht. 0.047 m.; diam. of rim 0.089 m.; diam. of base 0.056 m.

⁴³ Diam. of base 0.057 m.

⁴⁴ *Ath. Mitt.* 2 (1901): p. 171 and pl. 33.

⁴⁵ Berger, *Vindonissa*, p. 14.

⁴⁶ Harden, *Camulodunum*: p. 294, no. 5 and pl. 87 (yellow spirals with red centers in a dark green ground).

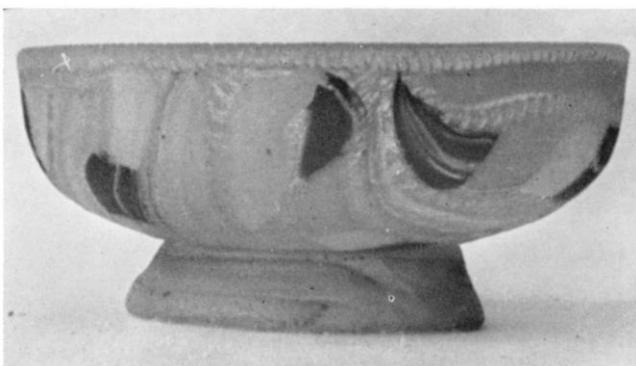


FIG. 18. Glass bowl of strip-mosaic from the wreck (no. 9).

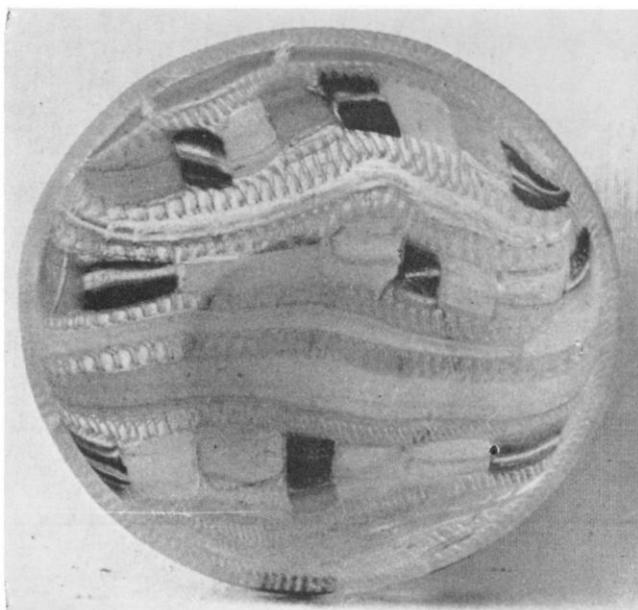


FIG. 19. Strip-mosaic bowl, seen from above (no. 9).

A millefiori bowl was found in a first century A.D. grave at Minusio (Switzerland).⁴⁷ The earliest dated fragment like these bowls is that already mentioned from Chatby;⁴⁸ many others might be cited but as they are generally without provenience and undatable, there is not much information to be gained from them.⁴⁹

9. This intact bowl of "strip-mosaic," entirely unweathered, is of a simple hemispherical shape, with a low base (figs. 18, 19). It differs from the others, how-

⁴⁷ Christoph Simonett, *Tessiner Gräberfelder* (Basel, 1941), p. 136. Berger (*op. cit.*, p. 92) points out that the date of the grave in which this piece was found can be narrowed down to Augustan and early Tiberian times.

⁴⁸ See note 34. No. 323 is very similar, with spiral canes interspersed with solid quadrangular blocks of turquoise or turquoise and white or turquoise and orange. The rim is a spiral band of "bleu gendarme" and white.

⁴⁹ The millefiori bowl recently found in Messenia (see note 2) is somewhat deeper but essentially the same, and is the first complete specimen from a dated context in Greece.

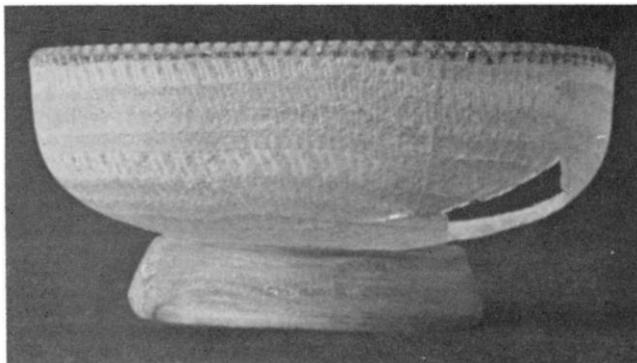


FIG. 20. Glass bowl of lace-work from the wreck (no. 10).

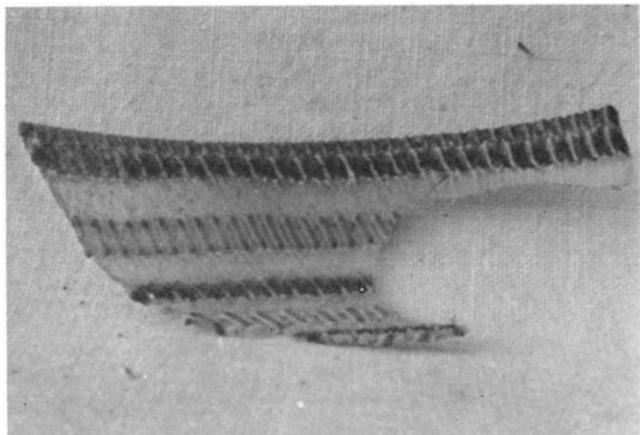


FIG. 23. Fragment of lace-work bowl from the wreck (no. 11).

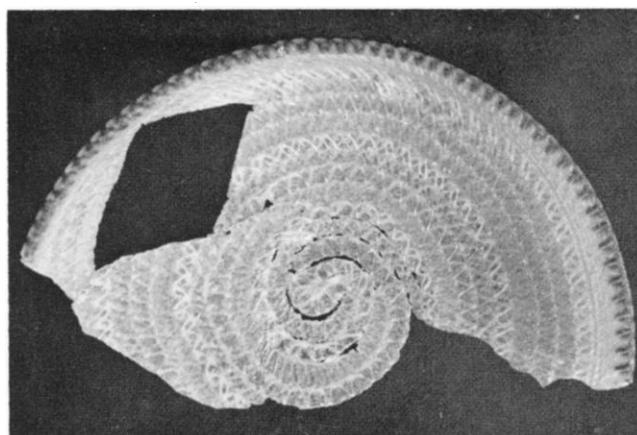


FIG. 21. Lace-work bowl, from above (no. 10).

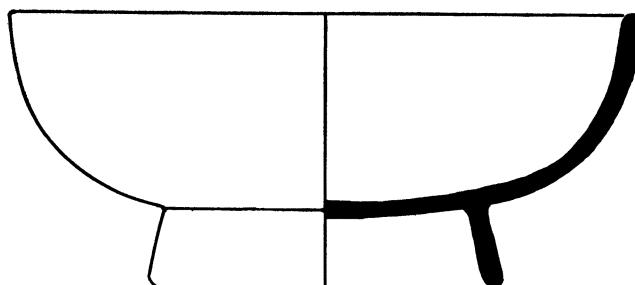


FIG. 22. Lace-work bowl, profile drawing (no. 10).

ever, in that the canes and the pre-wound spiral strips of which it is composed were laid in a thin shell of light green glass.⁵⁰ Irregular blocks of yellow, light blue and purple with a white stripe alternate with strips formed of two threads twined together extending across the bowl. The rim is formed by a similar spiral strip which seems to be continuous though the ends must have joined somewhere. The rim strip conforms to the ir-

⁵⁰ Kisa (*op. cit.*, p. 509) states that no ancient mosaic vessel ever had an outer shell of plain glass, that such a shell is a sign of a Venetian copy. This criterion is probably correct in general, but not always, as our bowl shows.

regular edge of the top of the bowl; at one point an extra short strip was added beneath the rim coil, to fill in a space.⁵¹

The Smith Collection contains an excellent parallel to this piece which, it is interesting to note, was acquired in Egypt.⁵² Other specimens (fragmentary) of the same general sort have been found at Vindonissa and at Novaesum.⁵³ All these are dated in the first century of our era.

10. Of the same shape as the preceding, the reticella, or lace-work bowl (figs. 20-22) is made entirely of long canes wound spirally. Four separate coils were used, each consisting of pre-wound threads, one of colorless glass wound with purple, another colorless with yellow, a third colorless with opaque white. For the fourth the pattern repeats, yellow and colorless being used again. Each of these canes begins at a different point near the center of the bowl, and each ends at a different place just below the rim. The rim itself is a separate coil of purple and colorless glass wound together. The base is a separate coil of colorless glass containing yellow and purple streaks.⁵⁴

11. This fragment of a similar bowl (fig. 23) still has remains of lime incrustation inside. The canes are of entwined white and dark blue, light blue and white, blue and yellow and white, and white alone. As in the preceding, there were four strips, two of white, one each of other colors. This bowl seems to have had a shell of almost colorless greenish glass, like that of No. 9.⁵⁵

⁵¹ Ht. 0.04³ m.; diam. of rim 0.093 m.; diam. of base 0.053 m.

⁵² Smith, *Glass from the Ancient World*, pp. 83-85 (no. 136).

⁵³ Berger, *Vindonissa*, p. 13, pl. 1,1, dated before A.D. 60-75. (Plates 1,2 and 1,3 are also of the same kind; no definite dates are given). H. Lehner, "Die Einzelfunde von Novaesum," *Bonner Jahrb.* 111/112 (1904) : p. 416 and pl. 35, no. 23 (dated "post-Haltern" but pre-Flavian).

⁵⁴ Ht. 0.04 m.; diam. of rim 0.091 m.; diam. of base 0.056 m.

⁵⁵ Diam. of rim ca. 0.093 m.

Two Vindonissa pieces are made of similar threads, although one has them placed vertically instead of horizontally.⁵⁶ Other specimens with horizontal threads have been found in Cologne,⁵⁷ Colchester,⁵⁸ and Hal-

⁵⁶ Berger, *Vindonissa*, p. 13, pl. 1,4—hemispherical bowl with vertically placed threads, the rim adjusted to an irregular top; pl. 1,5—a similar bowl with horizontal threads, dated A.D. 41–68.

⁵⁷ Fremersdorf, *Buntglas*, p. 21, pl. 5—a colorless bowl with opaque white and yellow threads, dated “earliest imperial.”

⁵⁸ Harden, *Camulodunum*: 293, no. 1 and pl. 87, 1—with yellow threads in a colorless ground, dated A.D. 49–61.

tern,⁵⁹ and one is in the Gréau Collection, without provenience.⁶⁰

This ends the list of glass vessels recovered from the wreck off the island of Antikythera. As we have said, they form a most interesting and valuable group, and with the date of 65 B.C. ± fifteen years which can be attributed to them by virtue of the associated objects, they constitute an important fixed point in our knowledge of the development of ancient glass.

⁵⁹ *Ath. Mitt.* 2 (1901) : p. 171 and pl. 33.

⁶⁰ Froehner, *Collection Gréau*, pl. 108,3 (no. 778).

THE ANTIKYTHERA SHIP

PETER THROCKMORTON

Although a good deal of information exists about the rig and general shape above the waterline of ancient ships, little is yet known of their most important and interesting characteristics, their lines and the techniques used in their construction. Traditional ship construction before the day of the slide rule was characterized everywhere by extreme conservatism, especially in the building of cargo or fishing boats. In traditional maritime societies these vessels are built without plans or models by simple rule of thumb formulae handed down from master to apprentice through the generations.

The shipwright begins by setting up the keel, which is the key to the other dimensions. The stem and sternposts are then set up, and the builder begins to shape the hull. This can be done in several ways. One, the "shell-first" technique (fig. 1), is done by building up a shell of planking from the keel with long planks which are attached to one end of the ship, bent to the desired curve, then fastened to the other end. The shipwright can adjust each plank so that it corresponds precisely to its opposite on the other side of the ship. Once the shell of the hull is built, frames (ribs) and timbers, which can give the hull added strength, may be fitted inside it. The basic principle of shell-first building is that the longitudinal curve of the planks gives the ship its shape. The technique is typical, e.g., of Scandinavia, where it originated centuries before Christ, and where its subsequent development is well documented.

In Egypt the builder of early dynastic times also constructed the shell of the hull first, but he was faced with the problem of lack of timber for long flexible planks. Using the short planks available, he placed one above the other, their edges flush with each other. The Egyptian shipwright fastened these short planks together with rectangular tenons, mortised into the edges of the planks, and with dovetails cut into the inner

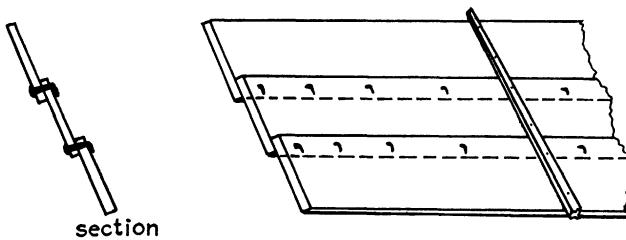


FIG. 1. Planking of a ship built by the "shell-first" method.

surfaces. This technique has a long history, from early dynastic times to the present.¹

Shell-built ships made with long planks permitted natural curves which shaped the shell of the hull, but it is difficult to understand how the Egyptian builders got fair curves into their ships unless one assumes that the short planks were set up with the aid of longitudinal battens, long flexible sticks curving from stem to stern, which established the desired curve.

In most of the world today, the shell-first construction has given way to carvel building on frames (fig. 2). In this method the shipwright builds a skeleton of

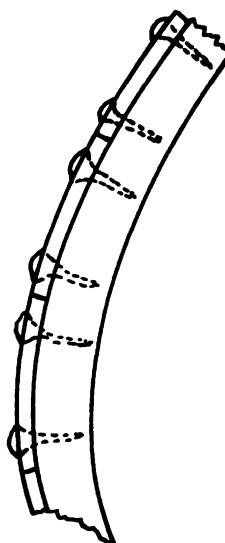


FIG. 2. Planking of a carvel-built ship.

keel and frames and then fastens his shell to this. The key points of the hull's shape are laid down full size on a level surface. These are connected by lines drawn with the aid of a flexible stick or batten which, like a long plank in a shell-built ship, forms a natural curved line. The shape of the ribs or frame is taken from these lines and the ribs shaped and set up on the keel, forming a skeleton over which the planks can then be fitted. This system allows much more flexibility of design than the shell-first system, and is faster and easier for building large vessels. This method, how-

¹ James Hornell, "The Sailing Ship in Ancient Egypt," *Antiquity* 17 (1943) : pp. 27 ff.

ever, developed subsequent to the time of the Antikythera ship, which was constructed, as we shall see, in the shell-first manner.

Remains of the Antikythera ship which were salvaged are extremely fragmentary, but these few fragments provide substantial information as to the ship's construction.

More than a dozen fragments of planks of elm wood (*ulmus*) have survived. This planking probably comes from below the waterline, for elm is liable to dry rot in areas which are alternately wet and dry.² The unusual nature of the planking was noticed at once, for in 1902 it was stated: "They also raised a few pieces of wood which probably came from its sides. These show a strange kind of ship construction. . . ." ³ The text goes on to describe how each plank must have been fastened to its neighbors on each side by close-set mortises and tenons.

Owing to shrinkage and warping, it is difficult to be quite sure of the original dimensions of the planking. When it was measured in 1902, the following statement was made: "It is not possible to say how thick the wood was, but it is now [italics mine] 7-9 cm. thick and 15 cm. wide."⁴ As most of the wood was raised in August of 1901,⁵ it had probably not been more than six months out of the water when it was measured. If it had been kept in a damp place, or wrapped, it would not have dried out much. Present dimensions of the plank are somewhat different. Exact measurements have been made of the eight largest pieces. The one that seems least distorted (figs. 3, 4) has been drawn to scale from all angles (figs. 5-10). The average size of the eight large pieces is 4.50 m. × 0.16 m. Some of the smaller pieces seem to be thinner. One small, badly preserved piece was perhaps triangular in

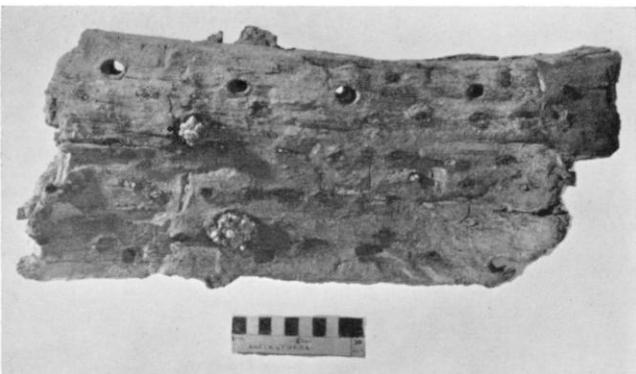


FIG. 4. The best preserved plank from the Antikythera wreck: outside view.

cross section; it may have been part of the garboard strake (the plank next to the keel). The Île de Levant wreck (fig. 11) has a triangular garboard.

The planks were fastened to frames by heavy bronze nails, stumps of which survive in all the large sections of planking. Where they have fallen out their presence can be deduced from the discoloration of the wood. Since the remnants of these nails have been attacked by "bronze disease," it is not easy to measure them. They seem to be about 15-20 mm. in diameter, with round heads 30-35 mm. in diameter. None of the nails is preserved intact; usually all that remains is the part of the nail held together by the wood around it. Where the nailheads have not broken off, they protrude noticeably from the wood (fig. 12). The distances from the surface of the wood to the upper part of the nailhead in four cases are 10, 12, 20, and 23 mm. It would thus appear that the planks have become thinner through shrinkage by about 10-16 mm. on each side. The question of the original thickness of the planks can really be solved only by the recovery of a small sample of "fresh" wood from the mud of the wreck site. If the ship's planking was really 9 cm. thick, then she was very heavily built. Planking from the Nemi barges, much bigger craft, was just under 10 cm. thick (fig. 13).

The most remarkable and interesting thing about the planks is the fact that they are edge-joined by means of mortises. The tenons are of live oak (*Quercus*); they fitted into mortises cut in the edges of the planks and were held in place by live-oak treenails driven into holes drilled after the tenons had been fitted into the planks. Bronze nails in turn were driven through the treenails. The fit was so tight that the wood shows appreciable compression. In some cases the planking to frame fastening was driven through mortises which were already in place. The mortises were staggered, 2-4 cm. apart between centers, to avoid splitting the planks by putting them along the same grain of the timber. The fact that nails were driven through tenon assemblies indicated that the frames were put into the hull after the planking was assembled. This is ex-

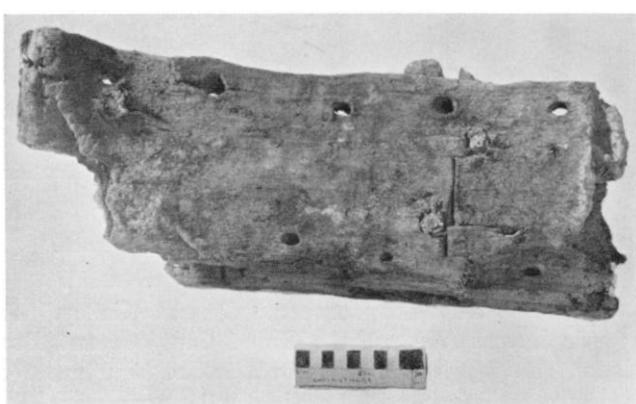


FIG. 3. The best preserved plank from the Antikythera wreck: inside view.

² I am indebted to Captain Samuel Barkely for advice on this question.

³ *Eph. Arch.* 1902: p. 171.

⁴ *Eph. Arch.*, *ibid.*

⁵ J. N. Svoronos, *Ethnikon Mouseion* (Athens, 1903), p. 13.

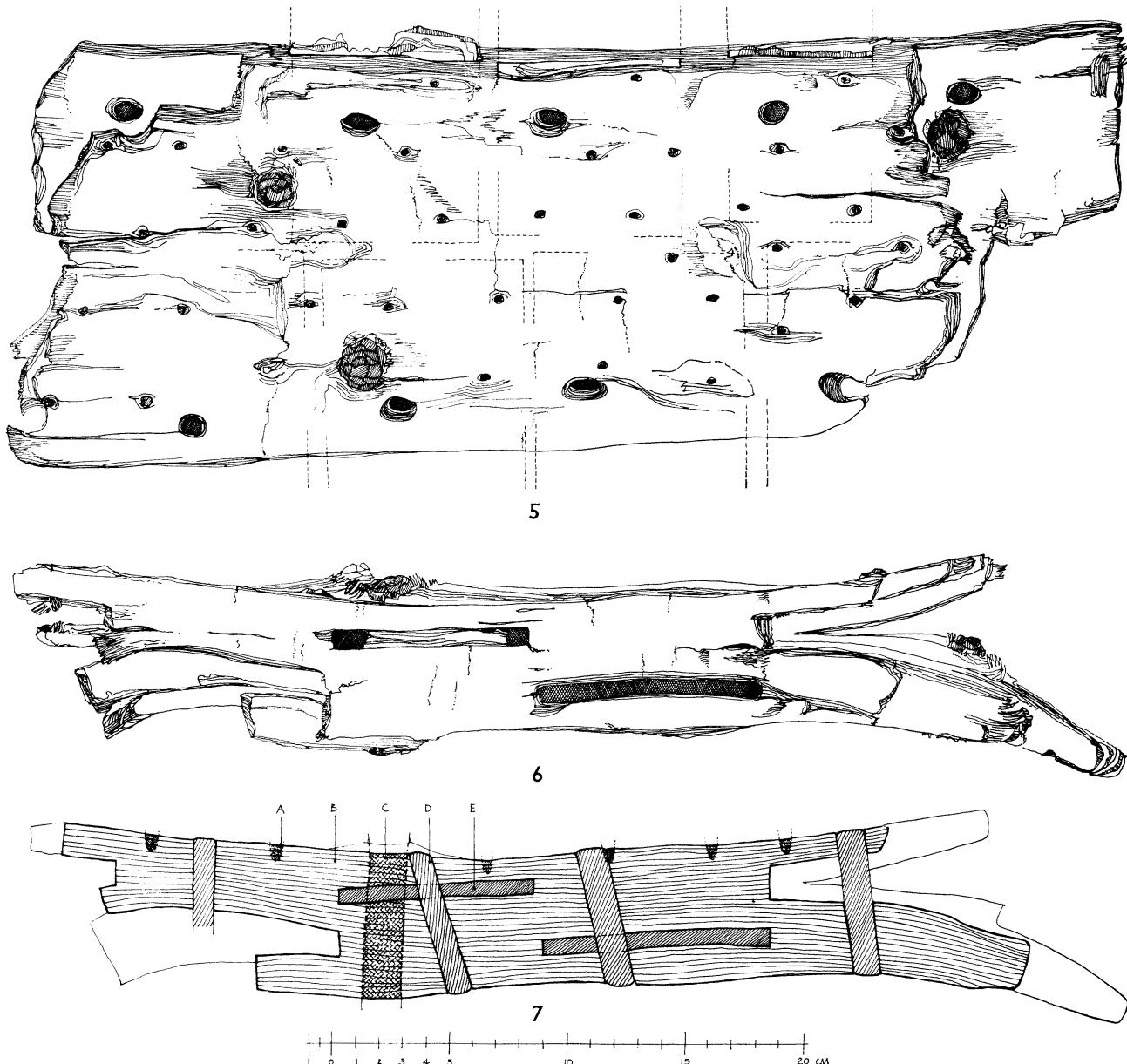


FIG. 5. The best preserved plank from the Antikythera wreck, seen from outside. The black dots represent copper sheathing nails. Drawings by W. W. Wurster.

FIG. 6. The upper side of the plank shown in figure 5.

FIG. 7. Upper side of the plank, seen in section. A: copper nail; B: plank; C: bronze nail; D: treenail; E: tenon.

tremely important, as it shows that this vessel, unlike the carvel-built ships of modern times, which are planked onto a "skeleton" of frames, was assembled according to the "shell-first" system. The tenoned shell of planking was built up, as explained above, and the ribs inserted afterward. Many examples of Graeco-Roman ships built in this way have turned up since the Antikythera wreck was found, particularly in the south of France.⁶ Professor Benoit was the first to note the

structural similarities between "Caesar's Galley," the Île de Levant ship and the Grand Congloué and Draumont 'A' wrecks, all four of which had hulls made of planks edge-joined with mortises and tenons (fig. 14).⁷ In Italy examples of this construction have also been

given; and Lionel Casson, "New Light on Ancient Rigging and Boat Building," *The American Neptune* 24 (1964) : pp. 81-94. I am indebted to Dr. Casson for this reference and for his advice during preparation of this manuscript.

⁶ See F. Benoit, "L'épave du Grand Congloué," *Gallia Supplément* 14 (1961), Chapter 3, where many references are

⁷ F. Benoit, "Nouvelles épaves de Provence II," *Gallia* 18 (1960) : pp. 10-17.

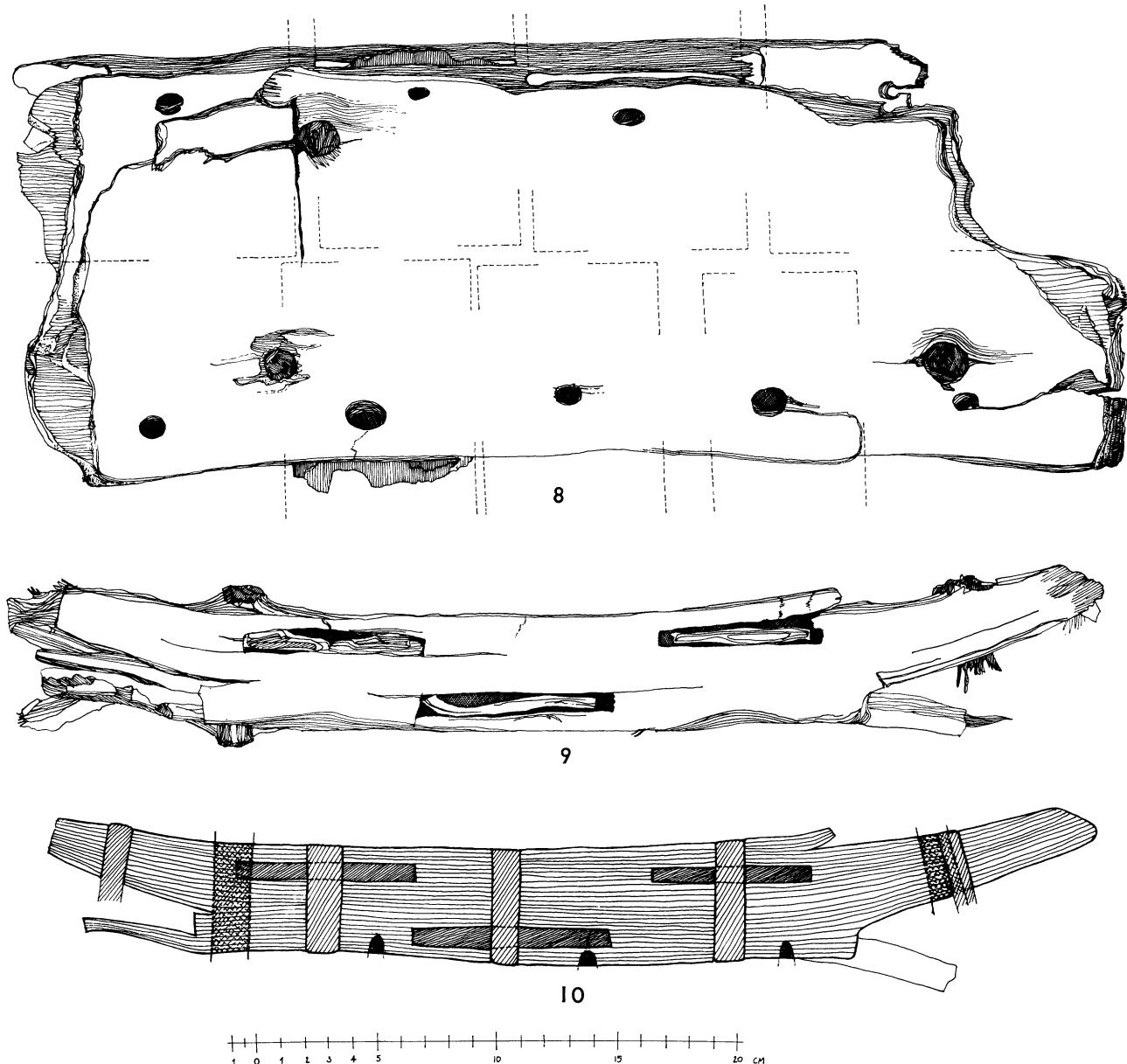


FIG. 8. The best preserved plank from the Antikythera wreck, seen from inside.

FIG. 9. The same plank seen from below.

FIG. 10. Bottom of same plank, seen in section. Only the lower treenails appear (*cf. fig. 7*).

noted. The Nemi barges were so constructed,⁸ and so was the Albenga ship,⁹ which is being systematically excavated by N. Lamboglia.

All of the large pieces of planking are patterned on one side with the remnants of copper nails. These fastened the lead sheathing that once covered the hull below the waterline. None of the sheathing has been preserved, but the pattern of the nail stumps is identical to that of similar nails in sheathing found in the Grand

Congloué,¹⁰ Albenga¹¹ and Mahdia¹² wrecks. The Nemi barges were also similarly sheathed. On the four planks which retain the heads of bronze fastening nails, the sheathing nails are, as one would expect, on the same side of the plank as the bronze nailheads (fig. 12).

J. Y. Cousteau has remarked that the builders of the Congloué ship, which he excavated in collaboration with Professor Benoit, employed woodworking tech-

⁸ G. Ucelli, *Le Navi di Nemi* (2nd ed., Rome, 1950), pp. 152-159.

⁹ *Rivista di Studi Liguri* 18 (1952) : pp. 207-208.

¹⁰ *Gallia* 14: p. 170.

¹¹ N. Lamboglia, *Rivista di Studi Liguri* 18 (1952) : p. 209.

¹² *Gallia* 14: p. 142.

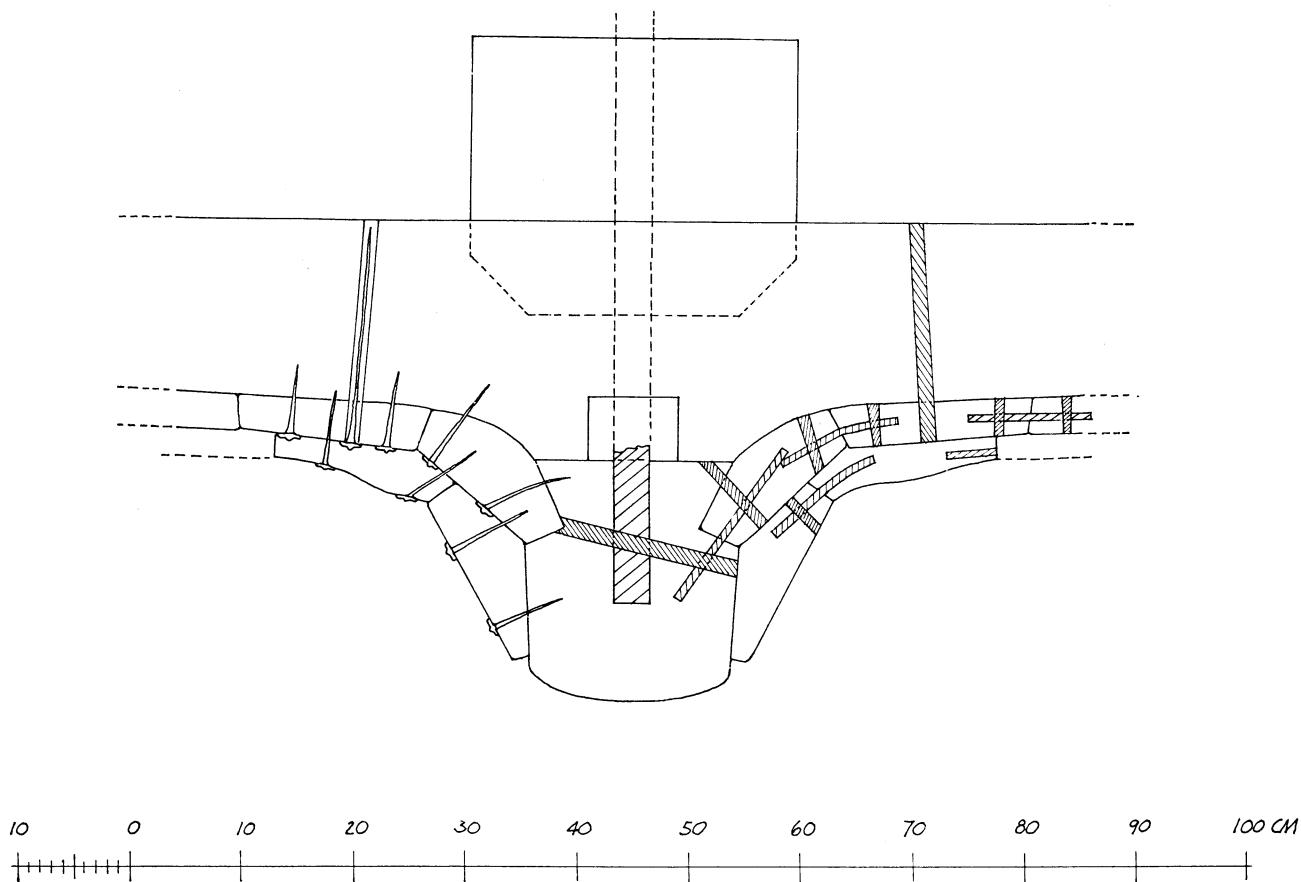


FIG. 11. The Île de Levant wreck, section through the keel.

niques more akin to cabinet making than to ship carpentry.¹³ This applies to the Antikythera ship as well.

Unfortunately it has not been possible to obtain permission to export specimens of the wood from the Antikythera wreck for analysis. It is certain, however, that the woods employed in the construction of the hull came from the northern Mediterranean. Identification of the sub-species involved might give better clues to the origin of the hull. In fact, a comparative study of all the wood found in ancient wrecks in the Mediterranean would be a useful undertaking.

In addition to the remains of wood from Antikythera there is a piece of lead pipe which has an average interior diameter of 6.5 cm. and an average thickness of 6 mm. It is 68 cm. long and is bent all around to form a crude flange at one end. It resembles pipe from Albenga,¹⁴ which was 6 and 8 cm. in diameter, and another from Grand Congloué.¹⁵ Although there is evidence that large Roman ships had elaborate plumbing or draining systems which are not yet understood,¹⁶ it seems reasonable to propose that this pipe was a

scupper, for draining water off the deck, which led from one side of the deck out the side of the ship. Pipes of this kind are used for this purpose in modern caiques.

The reports of the 1901 expedition to Antikythera make it clear that a good deal of material remained under the mud when the divers left the site. In 1953 some dives were made on the site by the men of the French vessel, *Calypso*. Chief diver Frédéric Dumas reports that the sponge divers of the early expedition seem to have cleared only the surface of the wreck and that a great deal of the ship's structure must still re-

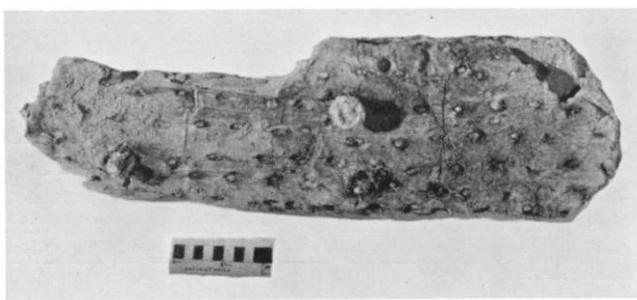


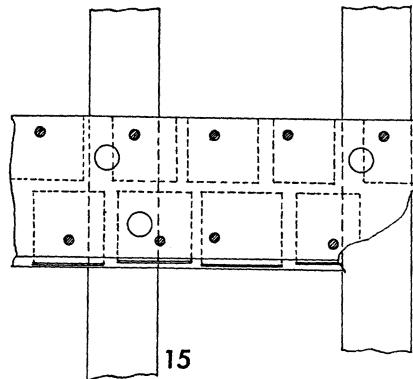
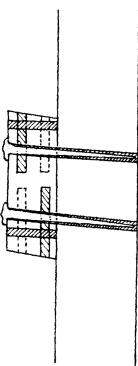
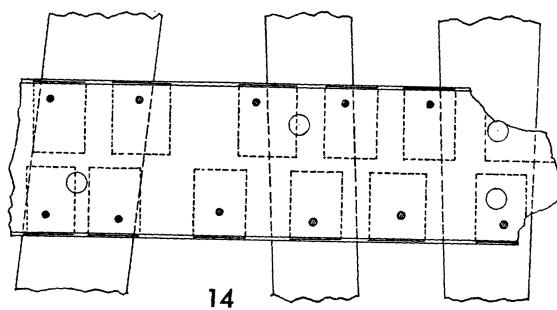
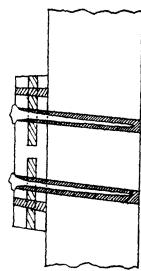
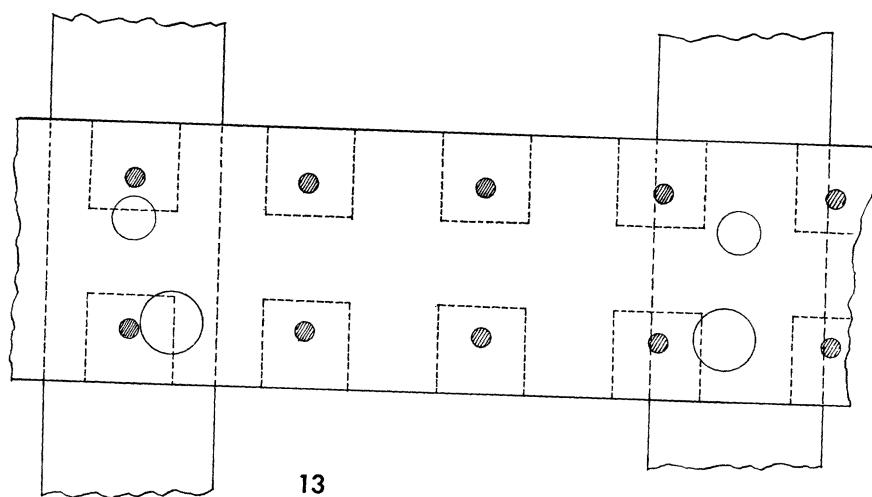
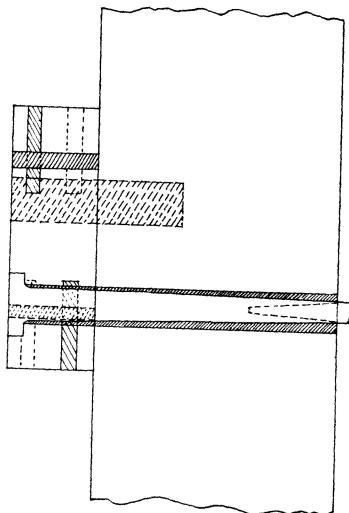
FIG. 12. Part of a plank from the Antikythera wreck, showing nailheads and sheathing nails.

¹³ J. Y. Cousteau, "Fishmen Discover 2200 Year Old Greek Ship," *National Geographic Magazine*, January, 1954.

¹⁴ N. Lamboglia, *op. cit.*: p. 199.

¹⁵ *Gallia* 14: pp. 174 ff.

¹⁶ Discussed by G. Ucelli, *op. cit.*

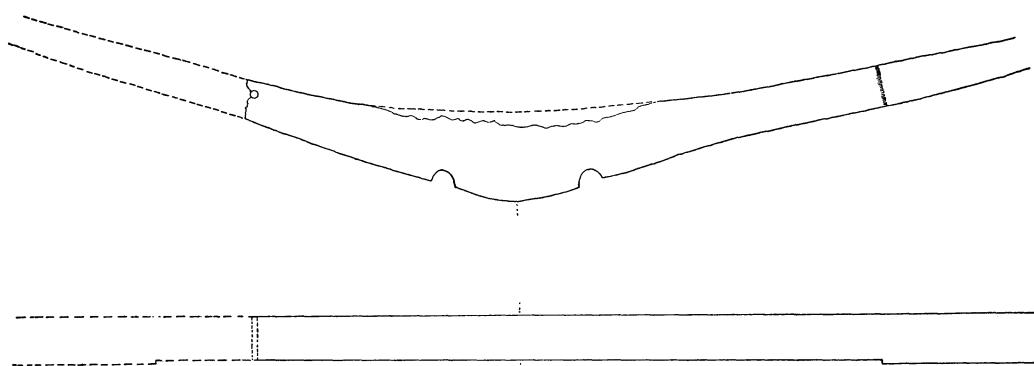


10 0 10 20 30 40 50 60 70 80 90 100 CM

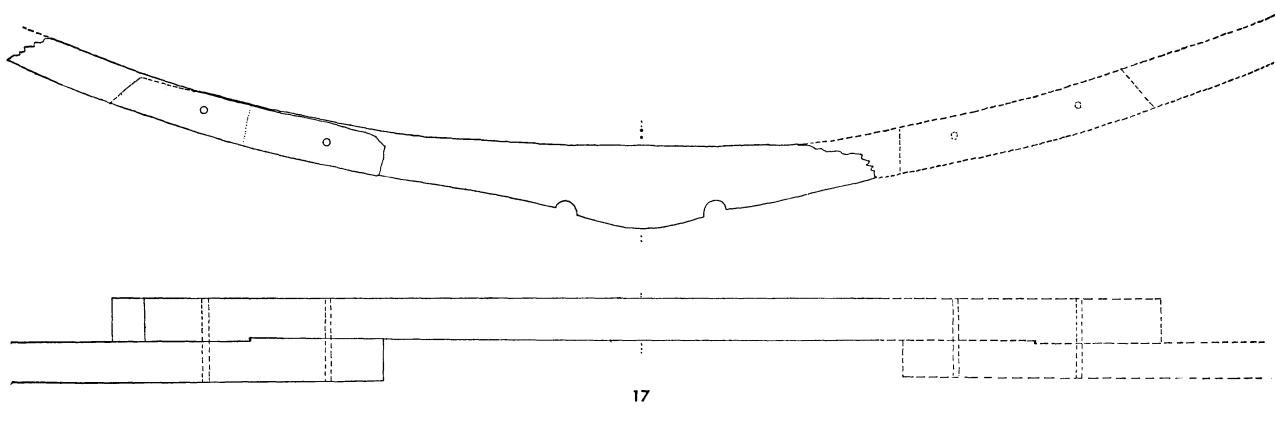
FIG. 13. Plank from one of the Nemi barges.

FIG. 14. Plank from the Île de Levant wreck.

FIG. 15. Plank from the Antikythera wreck.

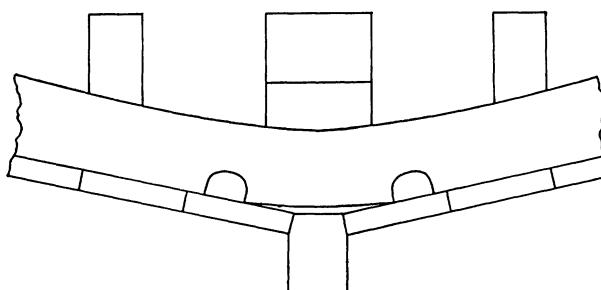


16



17

10 0 10 20 30 40 50 60 70 80 90 100



18

cm. 0 10 20 30 40

FIG. 16. Foot timber, possibly from the Antikythera wreck, view (above) and plan (below).

FIG. 17. Timber from the Antikythera wreck, view (above) and plan (below).

FIG. 18. Midship section of a modern thirty-ton *perama* caique, drawn to the same scale as figures 17 and 18.

main beneath the sand. A properly organized and well-equipped expedition, besides finding missing parts of bronzes, might turn up evidence that would settle the problem of the ship's home port and answer many questions about her actual construction. Underwater archaeology has made great strides since the heroic

days at the turn of the century when Demetrios Kondos and his bold crew of helmet divers struggled to salvage what they could from the great depth of 180 feet. Their work still poses many questions; the answers to most of them are still on the bottom, off the savage northwest coast of Antikythera.

APPENDIX

Associated with the material which we know came from Antikythera are five pieces of pitch pine which seem to have come from the sea (figs. 16 and 17). They look like ship's timbers, but there is no mention of them in any of the early publications. The wood is very fragile, like the rest of the Antikythera wood, and the upper parts of the timbers have been attacked by shipworms. As there is no record of ancient ship timbers having been recovered from any other wreck in Greece, it seems likely that they are from the Antikythera wreck.

It is difficult to say exactly what these were and where they fitted in the structure of the ship. They look like ribs, yet do not have the stumps of bronze fastening nails at regular intervals that one would expect. There is a trace of what might be a bronze nail in one of the timbers, and there are what might be treenails but are more probably knots. There are four of these possible treenails, respectively 29, 43, 50, and 59.5 cm. from the outer cut end of the timber. This spacing can be interpreted so as to hint that the timber had planks of the Antikythera type fastened to it. If the timbers were "floor timbers" they might have been fastened from the outside with treenails, although this is not normal practice today. All of the timber "assemblies" (there are parts of three—one, badly worm-eaten, is not illustrated) have half-round holes the insides of which are lightly calcined. They are not otherwise overgrown, and it seems possible that the growth occurred while the ship was still afloat. These were probably limber holes, cut to facilitate drainage of bilge water into a central sump. The timbers were covered

with pitch: it still smells strong and, by smell at least, seems similar, e.g., to the pitch from amphoras often recovered off Cape Krio, sixty miles from Rhodes, by Turkish trawermen. This is sometimes used by them to soak the bilges of their own boats. Chemical analysis of this material would be interesting, as the bilge of the Mahdia ship was covered with pitch.

If the timbers belong to the Antikythera ship, the most logical explanation for them is that they were floor timbers—timbers set between the ribs which ran only to the turn of the bilge, and served to support the lining of the hold. Their shape is almost exactly that of similar timbers from a modern thirty-ton *perama* (fig. 18), and it seems more probable than not that they are modern, although the possibility that they are ancient cannot be discounted. They are unlike equivalent timbers in the Titan and Dramont wrecks in that they have no place cut for a large keelson and are more V-shaped in section.

The iron grapnel shown in the 1902 publication¹⁷ is at present not available for study, but examination of the photograph and inspection of remnants of iron objects unquestionably salvaged from the wreck lead to the conclusion that this object is modern. No other iron survives from the wreck: only molds made by iron objects in the sea growth which formed around them. There is no case on record of iron surviving more than one thousand years of immersion in salt water. The shape of this grapnel is exactly that of modern ones, for sale in any Mediterranean ship-chandler's shop today, and it seems safe to assume that its presence on the wreck site was entirely fortuitous.

¹⁷ *Eph. Arch.* 1902: p. 171, fig. 18.

CARBON-14 DATE FOR THE ANTIKYTHERA SHIPWRECK

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A fragment from the Antikythera wreck was submitted to the Radiocarbon Laboratory of the University Museum, Philadelphia, by Peter Throckmorton. On the basis of study of several categories of objects recovered the ship is believed to have been sunk in the years soon after 80 B.C.

The sample consisted of pieces of planking, identified as elm (*Ulmus*) by the Forest Products Laboratory, U. S. Department of Agriculture. The C-14 results are as follows:

Sample No.	Christian Calendar Age	
	Calculated with 5568 half-life	Calculated with 5730 half-life
P-846	155 ± 42 B.C.	220 ± 43 B.C.

The 5730 (or "new") half-life is considered to be closer to the true value of the C-14 half-life than the previous value (5568) chosen by Dr. Libby more than 15 years ago. The preferred C-14 date is, therefore, 220 B.C. or within the approximate range of 260 to 180 B.C.

It is not surprising that the C-14 date is earlier than the estimated date of sinking because the C-14 date represents the time of the cutting of the trees which furnished the timber for the planking. This, of course, antedated the sinking of the ship. Additionally, if large logs were used, the particular sample which was dated may have come from the center of a log and would, therefore, have been earlier than the cutting of the tree by an amount equal to the age of the tree.