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Early Helladic II sauceboat from Dokos

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A NEW BEGINNING

The Institute of Marine Archaeology was founded in August 1973 with the object of furthering underwater archaeology in Greece. It is a private scientific, technical, and non-profit organization.

The Institute's journal, which was one of the projects laid down in its charter, was published for the first time in 1989 under the name ENALIA. Four issues will appear each year in Greek, reporting on the Institute's research activities, publishing original articles by Greek and foreign scholars and giving news about the underwater archaeological scene. Another of ENALIA's aims is to become a specialized scientific journal on underwater archaeology, something that is lacking in Greece.

However, in order to make itself more accessible to our corresponding members, our friends and everyone connected with underwater archaeology abroad, we have decided to publish an Annual version of ENALIA in English. It will contain English translations of the most important articles from the previous year's issues of ENALIA, original contributions by foreign colleagues, and information about the underwater archaeological happenings of the previous year in Greece.

We hope that this endeavour of ours will be welcomed and that the ENALIA Annual, in addition to being a specialized journal, will serve as a forum for scientific dialogue and the exchange of information with colleagues outside Greece to promote scientific knowledge in the field of underwater archaeology generally.

In the event that a contribution is very long or in the form of a monograph, it will be published as a supplement to ENALIA in its original language provided that this is Greek, English or French. If it is in any other language, a translation, for which the author is responsible, must be submitted in one of these three languages. A synopsis will be published in either the Greek quarterly journal or the English Annual. The publishers will select the articles to be published in accordance with the possibilities of the moment and the amount and kind of the material in their hands.

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Over the last three years HIMA has radically increased its activities and this has had a marked impact on underwater archaeological research in Greece; we therefore think that this is an appropriate moment for us to seek the assistance and support of the whole international scientific community, in order that underwater archaeology in the Aegean, which holds so many new discoveries in store, can occupy the important place that it merits in Greek and international scientific research.

Unfortunately our happiness at these new developments has been marred by the absence of two great figures in underwater archaeology, both of whom died recently: Peter Throckmorton and Harold Edgerton.

Peter Throckmorton was a founder member of the Institute and one of the leading figures behind the awakening of interest in underwater archaeology in Greece as elsewhere. He was the teacher and mentor of many of us who today form a part of the archaeological diving scene.

Professor Harold Edgerton was one of our corresponding members and a close friend; he was our inspiration and tireless colleague in the difficult task of finding our feet, and it was his inventions that brought final solutions to so many complex technical problems on an international level.

Both of these men travelled the world, proffering their knowledge, help and experience. Their warm human personalities succeeded in transforming cold, impersonal, scientific reality into a personal passion for the subject under research. In this way they nurtured a generation of young scientists and scholars, instilling in them a love for the great adventure of marine science.

We profoundly regret that both of these men are not with us today to take this volume in their hands and join us in celebrating the coming of age of underwater archaeology in Greece.

Athens, September 1990
Nikos N. Tsouchlos

SEARCHING FOR THE WRECK OF KARA-ALI'S FLAGSHIP*

- by Yannis Vichos -

1. Introduction.

In the autumn of 1987 the training started on Chios of thirteen young divers in the techniques of underwater archaeological research as part of a programme organized by the prefecture of Chios and financed by the European Community Fund and the Ministry of Culture.

In February 1988 HIMA announced the formation of a branch of the Institute on Chios and requested the collaboration of the prefecture in three underwater surveys within its district, one of which concerned the location, excavation and raising of the wreck of Kara-Ali's flagship. To carry out the search for the wreck a team was formed consisting of an archaeologist representing the prefecture, two picked students from the Programme and the writer.

2. Historical research and collection of information.

Information from historical sources and archives about the type and size of the flagship was scanty and contradictory. Most probably, however, the flagship was a two-decker sailing vessel (see Nikodemos 1862, 192) carrying 80 to 84 cannon. There is a discrepancy of views in the references over the number of the Turks and their prisoners on board, as well as over the number of the dead. According to most sources the flagship was lying at anchor off the port of Chios. In regard to the actual site of the wreck, particular attention was paid to the verbal testimony of the inhabitants of Chios and the information supplied by the fishermen. The evidence from the different sources tallied, and a specific area was chosen in which to begin the search. In the course of tracking down information the team came across and photographed a sheet of copper in the house of the fisherman Michalis Maris, which had formed part of the copper sheathing on the bottom of an old wooden ship *(Fig. 1)*. Four holes can be seen at one end for the copper nails, two of which are still in place. The nails are conical, square in section and 3.5 cm long. They were for fastening the copper sheet to the ship's planking. According to the owner, the sheet was brought up in his nets at a certain spot, which he pointed out to us. In the same place, according to the fisherman Dimitris Mytakidis, a bronze rudder pintle from an old ship had been brought up, weighing 300 kilos or okades (Mr Mytakidis could not remember which).

Photo: Y. Vichos

Fig. 1. Part of the ship's copper sheating.

3. Underwater search.

In the subsequent search of the seabed in the chosen area, the established methods of locating historical wrecks were followed, with careful adherence to archaeological principles. Traditional means were used (grapnel dragging, floating markers, etc.) together with modern instruments such as depth-finders, an underwater video camera and underwater photographic cameras. The necessary equipment was supplied by the prefecture of Chios, the Armed Forces and members of the team.

On 10 April 1988 the team member Elias Mastorakis and the writer were taken by the fisherman Yeoryis Hadziathanasis in his boat to the place where he said there was a large shipwreck. The two members of the team confirmed on the spot that it was the same place that had been pointed out by the other fishermen. After sounding the bottom with an old depth-finder they registered a slight bump on the seabed at a depth of about 50 m *(Fig. 2)*. After a consultation by the writer with the prefect of Chios, Christos Pachtas, it was decided to carry out an underwater survey at the spot where the bump had been located. On 14 April HIMA sent a fax to the prefecture of Chios with a list of the equipment needed for the survey.

On 27 April the team searched the seabed at the place indicated from one of the harbour vessels with a party that included, among others, the prefect, the harbour master Yiannis Alexandropoulos, the commander and second-in-command of the 3rd Armoured Battalion together with two instructors, and the battalion doctor. First an underwater television camera was lowered to inspect the seabed. As no sign of a wreck appeared on the screen, the bottom at this point was investigated by two pairs of divers, who did not,

Fig. 2. Profile of the seabed recorded by the depth finder (N=the bump caused by the wreck).

however, succeed in finding the wreck. The state of the sea and the late hour were the principal reasons for breaking off the search on that first day.
On Saturday 30 April the team returned to the spot to continue the search. In order to locate the bump on the seabed more precisely, a series of transits were run over the area from different directions. During the transits the depth-finder registered the same small steep bump on the seabed. The place, some 150 m in area, was marked with three buoys. In the afternoon a video survey of the bottom was carried out, starting from the centre of the triangle formed by the three buoys. Every time the camera was moved, rotten wood, bronze objects and bones appeared on the monitor screen.
It was decided to send down a pair of divers to inspect and photograph the site and bring up a few objects. A second pair of divers (for safety cover) descended to 30 m in order to supervise the duration of the dive and to give assistance to the first pair if necessary. The time on the bottom and the decompression stages of the first pair were calculated according to the diving tables issued by HIMA. The total diving time of the first pair (at 48 m) was 16 minutes, with a three-minute decompression stop at 6 m and a six-minute stop at 3 metres.
The divers brought to the surface three objects, which were handed over to the prefect on the same day. They need to be studied by an archaeologist who is a specialist in the Ottoman period, but we can give a preliminary description of them here:
a. A small clay vase covered with greenish glaze, with walls 4 mm thick. Inside the pot, mixed with mud, were found fragments of bone and burnt wood. These fragments were probably carried there by sea creatures from the general area of the wreck.
b. A bronze candlestick: h. 21 cm, diam. of base 11 cm *(Fig. 3)*.
c. A round bronze lid from a vessel: h. 21 cm, diam. of base 11 cm *(Fig. 4)*. The vessel from which the lid came was Turkish and known as a sefer-tas (container for carrying food).

4. Preliminary conclusions and comments.

a. 1.5 miles from the port of Chios lie the remains of an old wreck at a depth of 47 m.
b. The remains are scattered over a considerable area.
c. There is a considerable number of timbers, many of which show traces of burning. There are also many bones, probably human.

Fig. 3 The bronze candlestick.

d. Many bronze and clay objects were located as well as gear from a sailing ship's rigging.
We can tentatively conclude from the above that our team has located the remains of a large sailing vessel, which was probably carrying a numerous complement of men and muchmaterial.
We also found out that the wreck is at some distance from the shore and reefs and within the general locality of the harbour of Chios, and that it contains objects of Ottoman origin, probably of the 19th century.
The remains appear to be those of a large sailing vessel which sank under violent conditions, apparently in the last century. The exact date and provenance of the wreck must await the completion of a careful study of a sufficient number of finds.
Meanwhile, all the evidence so far and the fact that the historical documents and oral tradition make no mention of any other large wreck in this area, point to the probability that the remains belong to Kara-Ali's flagship.
The survey team consisted of the following members of HIMA: Yannis Vichos, Petros Nikolaïdis, Yannis Karavas, Elias Mastorakis, Tasoula Mandala and Thodoros Tsatsaronis. The depth-finder belonged to Mr G. Hadziathanasis and the video camera to P. Nikolaïdis.

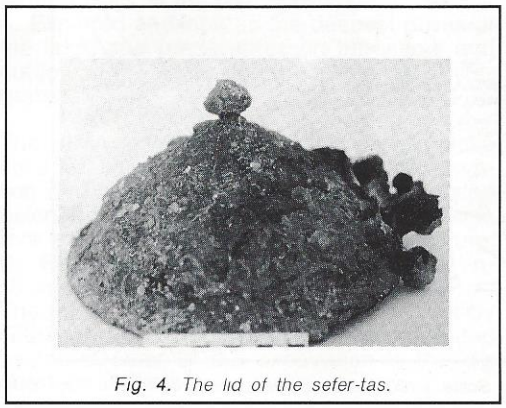

Fig. 4. The lid of the sefer-tas.

* The Turkish flagship was set on fire by Konstantinos Kanaris on the 7th June 1822 outside the harbour of Chios during the Greek War of Independence (1821-1829). This occured after the destruction of Chios and the slaughter of its inhabitants by the Turkish troops that had sailed with Kara Ali's fleet.

Addendum:
From 25 August to 10 September 1988 the Ephoria of Underwater Antiquities conducted a survey of the wreck. It was carried out in collaboration with the prefecture of Chios, which supplied four picked students from the training programme for young people in underwater archaeology, and of the Greek Navy, which made available the oceanographic vessel Pytheas and four instructors from the Naval Underwater Demolition Unit. The team was led by the archaeologist from the Ephoria and member of HIMA Dimitris Chaniotis. Many interesting finds were raised from the wreck, including bronze and clay vessels and an iron cannon some 2.5 m long, which weighed three tons.

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UNDERWATER INVESTIGATION OF THE 17th c. WRECK OF "LA THERESE"

- by Nikos Lianos, Department of Underwater Archaeology, Ministry of Culture -

Historical introduction

The long War of Candia (1646-1669) held a special significance for contemporary Europe, who saw it as a struggle to preserve the last bastion of Christianity against the onslaught of Muhammadanism.

Reinforceents were sent by the Papal States, Naples, Malta, Tuscany, Spain and, towards the end, France to aid the Venetian occupiers of Crete against the Turks, who had been besieging Candia (modern Heraklion) for over twenty years.

On the 19th of June 1669 a French naval squadron commanded by the Duc de Beaufort arrived off Candia. "La Thérèse", which had been built at Toulon (1662-1665), was the vice-admiral's flagship and one of the finest ships in Louis XIV's navy.

By the beginning of July the fortress of Candia was in a desperate plight due to the ceaseless Turkish assaults, and on the 10th of that month a general council of the combined forces decided to carry out a sortie, which was to be accompanied by a general bombardment of the Turkish camp by the fleet. After some three hours of continuous bombardment an explosion occurred in the powder magazine of "La Thérèse" and the ship sank; of the 350 crew and soldiers on board only seven survived. This blow to the morale of the besieged resulted in the failure of the sortie, the withdrawal of the French forces and shortly afterwards the surrender of the city.

Investigation of the wreck

In 1976 in the course of an underwater survey of Greek waters organized by the Ministry of Culture and HIMA with the collaboration of Jacques-Yves Cousteau, a wreck was pointed out to the Greco-French team by a local scuba diver, Manolis Voutsalas. It was at first named the "skull wreck" because of the macabre nature of the finds. A number of objects were raised, including a bronze cannon, objects of everyday use including personal possessions of the Duc de Navaille, who was on board "La Thérèse", and the crew, and parts of the ship. Also among the finds was a gold coin of Louis XIII and a whetstone with the date Mar.1666, which gives a terminus post quem for the wreck.

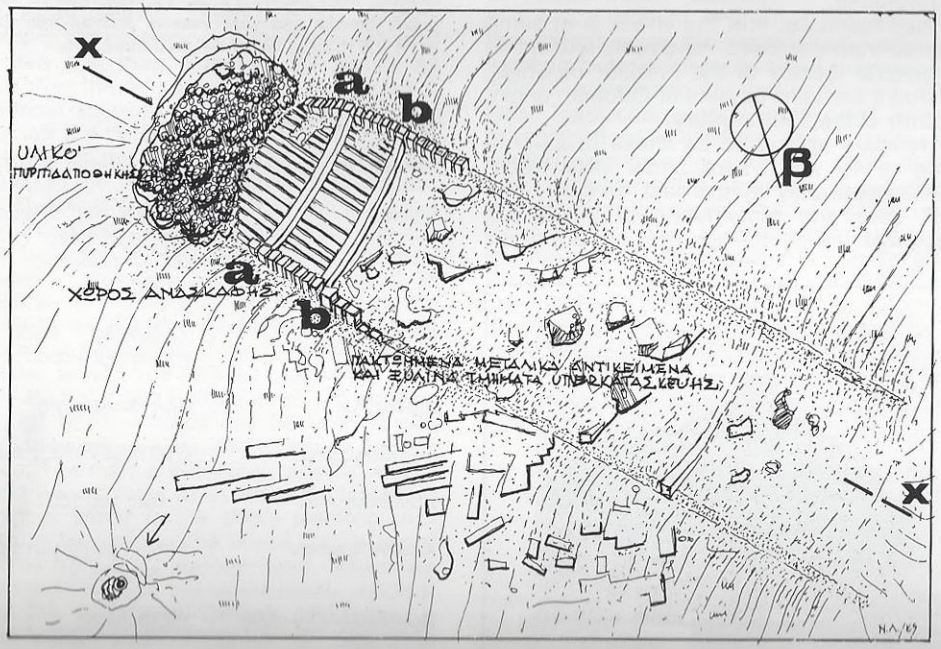


Fig. 1. Axonometric plan of the wreck. Scale 1:100 (drown by N. Lianos).

Photo: N. Lianos

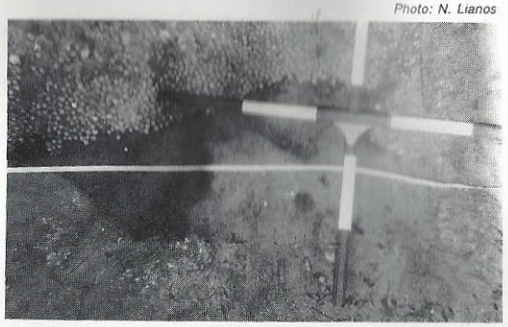


Fig. 2. Part of the wreck. The lead shot from the magazine can be seen.

The date and the spot where the wreck was found, which according to the plan of battle was where the French ships were deployed, identified the wreck as that of "La Thérèse", the only French ship to have sunk in this area during the siege of Candia.

A systematic survey of the wreck was begun in October 1987 to examine its present condition and determine the area of the site to be investigated in order to map and photograph the wreck. It lies in 17 m of water on a sandy bottom with sparse seaweed. The only mound visible on the flat bottom is an amorphous mass, 1.50 m high and 2 m across, of iron cannon balls that are 0.20 m in diameter. From this mass the wreck stretches in a northwesterly line for some 30 m *(Fig. 1)*. It is about 8 m wide and is approximately 24 m in extent. There are many small bumps on the surface caused by metal (chiefly iron) objects. The continuous shifting of the sand due to the frequent rough seas an marine currents causes almost daily changes in the picture of the wreck and makes excavation difficult.

A wider area of the surrounding seabed was also surveyed to check for the existence of scattered parts of the wreck and to mark them on the plan.

Excavation began in the stern section of the wreck; all the timbers on the port side of the inner stern were uncovered and plotted on a scale of 1:10., and a general overall plan of the area of the wreck was made on a scale of 1:100.

According to this, the wooden parts of the stern section end just beneath the mass formed by the cannon-balls; this would have been the position of the ammunition store, since the heavy cannon-balls, were stowed in the steadiest part of the ship where the motion was least. At a distance of 5 m from the mass of cannon balls the first of the vessel's beams was uncovered *(Fig. 1, A-A)*, the cen-

Photo: E. Katsaros

Fig. 3. Detail of the decoration on the cannon

tral section of which is quite straight *(Fig. 1, X-X)*; it starts to curve upwards at the ends, thus governing the angle of the bottom planking at that point. It is rectangular in section, measuring 0.20 x 0.30 m and some 8 m in length. 2 m away we found another beam similar to the first but with a more pronounced curvature. The scale plan of this one could not be completed because most of its surface was covered with thousands of small lead bullets, about 1.5 cm in diameter.

From the second beam *(Fig. 1, B-B)* to the other end of the wreck, a distance of some 25 m, only shapeless lumps of metal objects were visible. These will be examined in the next season. In 1988 the investigation continued, with the collaboration of the archaeologist Maria Anagnostopoulou.

In addition to the work that had been scheduled in the previous year, a second bronze cannon with particularly fine ornamentation was raised. It bears the royal crown, the escutcheons of France and Navarre (the insignia of the Bourbons) *(Fig. 2)* and an "L", standing for Louis XIV. Immediately below is the inscription: "LE DUC DE VANDOSME 1666" on a relief band with a group of two anchors. Lower down to the left of the touch-hole is the number 1787, indicating the weight of the cannon in pounds. Directly below this are the name of the maker and the place where it was made: "HONORATUS SUCHET F(ecit) TOLONI".

The Duke of Vandosme in the first inscription was none other than Francois de Beaufort, Duc de Vendôme, the admiral of Louis XIV and commander of the French naval forces that arrived off Candia in 1669, who lost his life during the first sortie from the Fortress.

Honoré Suchet was the maker of the cannon and the "Maître fondeur" at the naval base of Toulon until 1668.

SURVEYING THE CAVE LAKE OF "ALEPOTRYPA" AT DIROS IN THE MANI

- by Yannis Vichos, Vaso Kyriakopoulou and Dimitris Papadas -

In August 1988 the Honorary Ephor of Antiquities and consultant to the Ministry of Culture and Science, George Papathanasopoulos, invited HIMA to take part in the archaeological excavations he is directing in the cave of Alepotrypa at Diros, in the Mani (Peloponnese).

Dr Papathanasopoulos proposed that the Institute should send a team of its members to carry out a survey of and map the lake in the cave. The Committee of HIMA agreed and assembled a team of the following members of the Institute:

Yannis Vichos, marine archaeologist; Vaso Kyriakopoulou, topographical surveyor and diver; Dimitris Papadas, naval officer and diver; and Alexis Kourtesis, a student of underwater archaeology.

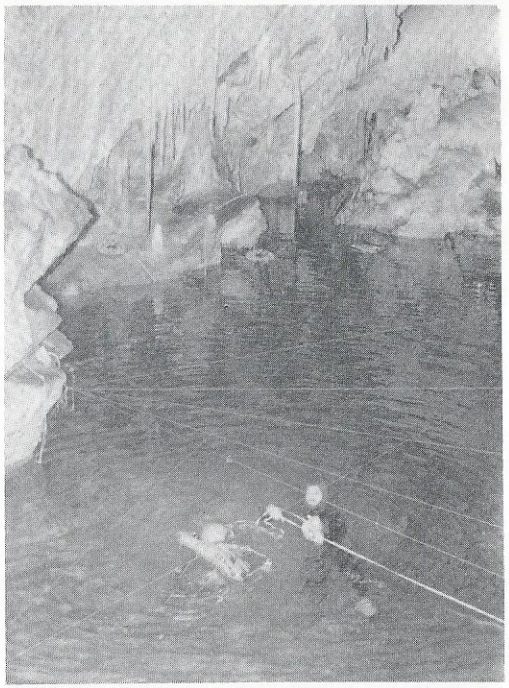
The team went to Diros, and between the 16th and 20th of September 1988, under the direction of Dr Papathanasopoulos, they:

1. Made a topographical plan of the lake with a horizontal section at the waterlevel (horizontal plan using the topometric method), and took sample soundings at selected points along the string-lines used for sectioning the horizontal plan.
2. Located and photographed archaeological finds on the bed of the lake and marked their positions on the plan.
3. Located and photographed geological features (stalagmites, fractures, landslips, etc.) and marked their positions on the plan.
4. Determined the magnetic north at surface of the lake with the aid of a bearing compass.
5. Took samples of mud and water from different points on the lake bed.
6. Explored and located the deepest points of the lake, and made notes on the inflow and outflow of the water and the existence of currents.

The HIMA team carried out the work in close collaboration with the director of the excavation and his colleagues. The equipment used belonged to the members of the team who took part in the expedition and to the Institute; Dr Papathanasopoulos provided certain instruments that were lacking.

The travel expenses of the team were met by HIMA and the members were accomodated by the director of the excavation in the dig quarters at Diros.

Ph. Vaso Kyriakopoulou



Cave lake of Alepotrypa. The grid used for the horizontal plan at the surface of the water and for the soundings.

Yannis Vichos was responsible for the archaeological side of the expedition, and Vaso Kyriakopoulou for the topographical survey; the technical organization was in the hands of Dimitris Papadas.

At the end of the survey the team presented the director of the excavation with the work log, reports on the survey results and photographs. Copies of these were also given to the Institute. It should be mentioned that HIMA had already carried out three previous surveys of the cave lake, in 1974, 1976 and 1978.

The excavation director Dr Papathanasopoulos expressed his satisfaction with the results of this latest survey by HIMA and plans to invite the Institute to continue the survey at some time in the future with the aid of more accurate instruments in order to complete the mapping of the whole cave.

THE GOLD CHALICE FROM THE LATE BRONZE AGE WRECK AT *AKROTERION* (ULU BURUN) IN LYCIA

*- by Yannos G. Lolos * -*

A large gold chalice, whose general shape recalls a communion cup, *(Figs. 1a, 2, 3)* was one of the unexpected finds from the wreck of a 14th c. BC merchantman that was excavated from 1984 onwards by an expedition from the Institute of Nautical Archaeology of the University of Texas under the direction of Professor George Bass. The site is close to Ulu Burun, one of the southernmost points on Turkey's Mediterranean coast (for the wreck generally, see Bass 1986; 1987; Pulak 1988; Bass *et al.* 1989; and the annual reports of the excavations in *INA: Newsletter*. For the chalice, see Bass 1986, 286, ill. 24; 1987, 714, 719-720).

Ulu Burun (in Turkish, "large promontory") must be the *ακρωτήριον* (promontory) mentioned in the old work *Σταδιασμός ήτοι περίπλους της Μεγάλης Θαλάσσης* (241-242) as lying between Aperlae and Antiphellos (the modern Turkish township of Kas, formerly Andiphilo or Andifli) in the central part of the Lycian coast (see Müller 1855, Tab. 25; 1861, 493-494; Denham 1973, 23-25; Carter 1978; Bean 1978, 92-100, 101-103).

In his first long report on the underwater excavation at Ulu Burun in 1984, Bass comments (1986, 286): "The chalice is one of the few objects on the wreck to have defied even tentative attribution of provenance, although its shape would not have seemed out of place at a site such as Ugarit ...". Subsequently he refers to two faience goblets with similar shapes published earlier by C. F. A. Schaeffer from Ras Shamra (Ugarit) and the port of Minet-el-Beida in Syria. In an article by him on the wreck published in December 1987 the excavator contented himself with the remark that the date and provenience of the gold chalice remained unknown (Bass 1987, 714, 720).

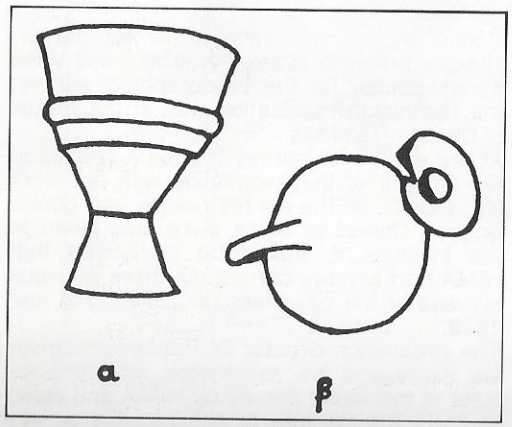


Fig. 1. The gold chalice (a) and the Mycenaean kylix (b), as found in area K-12 (from the photograph in Bass 1987, 714).

The chalice, 13.1 cm high, has a conical body with a pronounced raised band about halfway up *(Figs. 2-3)*, a high conical foot made separately and no handle.

Although this precious gold chalice has no exact parallel among the gold vessels of the Late Bronze Age hitherto known in the Aegean, we should like to draw attention here to some morphological similarities, which in our opinion are quite close to the shapes of cups in metal or other materials from this region, similarities that point to an Aegean origin.

Firstly, the typical high-footed goblets of Pyrgos type from the Early Minoan I period may in principle be considered distant ancestors of the gold cup from the Lycian wreck (Ξανθουδίδης 1921, 156-159, figs, 6: 22, 8: 42-45, 9: 56-58, 10: 75-77, 82, 11, pl. B; Hood 1971, 37, 38, fig.14; 1978, 31, fig. 5. For metal and clay footed cups and chalices in the same general category from Crete and the Cyclades belonging to the Early Bronze Age, see also Μαρινάτος 1929, 127-128, fig. 18: left).

The shape of this gold chalice is also generally similar to the characteristic tall handleless goblets of stone from the Middle Minoan III - Late Minoan I period which are known from the palaces and other sites on Crete, and from Mycenae, Kea and Thera (see Warren 1969, 36-37, Type 15: Chalices with bases and bodies sometimes made separately; Platon 1971, 142-143 ("sacred-communion chalices"); and Marinatos 1972, 32, pls. 67-68, in which, as with our chalice, three small rivets were used to attach the body to the foot). The use of ornate handle-less chalices in religious ceremonies is attested by representations like that of the seated goddess and four daemons on the large Late Helladic II gold ring from Tiryns (Higgins 1967, 186,188, fig.241).

There are two early Mycenaean gold cups whose general form approaches ours: the first, also made in two parts (body and foot), is exhibited in the Royal Museum of Art and History in Brussels and is dated to the Late Helladic I - II period; the second came from Grave IV of Grave Circle A at Mycenae (Davis 1977, fig. 174; Laffineur 1977, fig. 11, 45-46).

A feature linking the chalice from the Lycian wreck with a series of gold cups of Keftiu type from graves in the two Grave Circles at Mycenae and from the Late Helladic I Tholos Tomb 3 at Peristeria in Messenia is the finely modelled band around the middle of the cup's body (Davis 1977, figs. 102, 110, 111, 112, 136-137, 185, 196, 197).

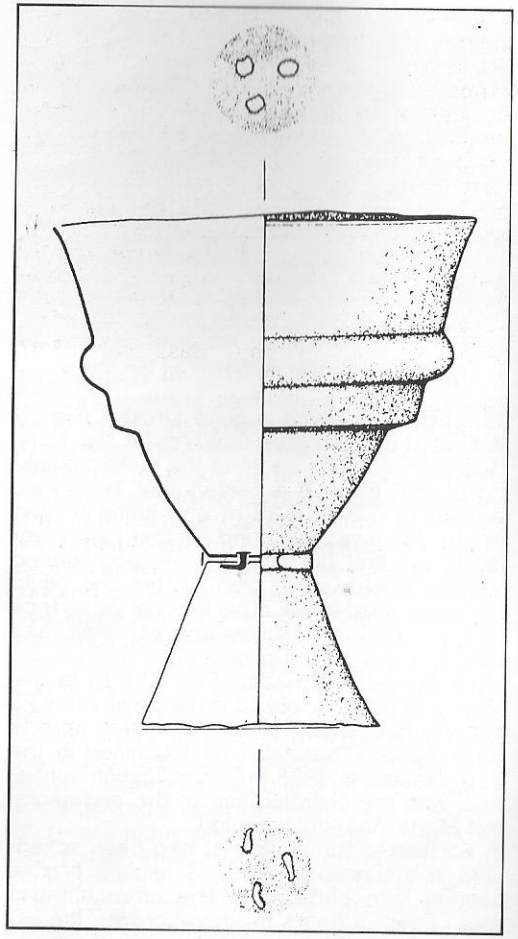


Fig. 2. Gold chalice KW 99 (after Bass 1986, 286, 289, ill. 24). Height:13.1 cm.

This feature is also found on the clay Keftiu cups of the Cretan Late Minoan IA, and it is predominant on those of the Kytherian Late Minoan IA and Late Helladic I-IIA (for a critical comparison of the metal and clay examples from the two Grave Circles at Mycenae, see Schachermeyr 1976, 222-228, pl. 56).
Lastly, the shape of the middle section of the gold cup with its two raised bands, the upper one rounded and the lower one carinated *(Fig. 2)*, shows similarities with the profile of the walls of two gold one-handled cups from Grave IV in Grave Circle A at Mycenae (Davis 1977, figs. 140, 141).
"A cup fit for a king", as G. Bass wrote (1987, 714). Whoever the anax (ἄναξ) may have been, however, who originally owned it, or the person who inherited it after him, or who received it (or rather, would have received it, had it not been for the shipwreck) as a precious gift or an exchange[1], the gold chalice from the Lycian wreck must have been made in a place where metal-working flourished and there were skilled goldsmiths *(χρυσουργοί)* specialized in the manufacture of gold cups.
It is very probable that the chalice was made by a craftsman working in some palatial centre on Crete or at Mycenae. In spirit, if not in fact, it falls within the limits of the Late Minoan I and Late Helladic I-II periods (from about the middle of the 16th until the end of the 15th c. BC, according to current dating).
The gold chalice could well be much earlier than the painted clay kylix of the Late Helladic IIIA:2 period that was found beside it (here Fig. 1b; also Bass 1986, 285, 293, fig 23; 1987, 714, 720-721 and the figure on p. 715, centre) and the other Mycenaean vases that have so far been brought up from the wreck.
Recognition of it as being the product of an Aegean workshop, if it is accepted, may apart from everything else prove useful in the search to discover the ship's "nationality".

For an Addendum see below page 46

* Yannos Lolos is an archaeologist with a PhD from the University of London.
Note 1. Cf. the colour reconstruction of the Ulu Burun ship with the hypothetical scene of the chalice's delivery painted by Ned and Rosalie Seidler (Bass 1987, 694-696).
the University of London.

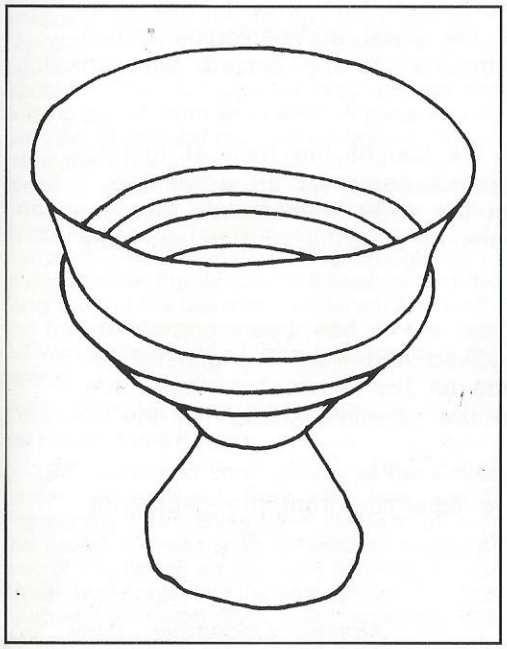


Fig. 3. Gold chalice KW 99 (from the photograph in Bass 1987, 714).

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THE YEAR OF DOKOS

In the year that has passed, a good year for the Institute, the first phase of a complete underwater excavation at Dokos was successfully accomplished. The project has been described as the most important underwater excavation in the Aegean, and it may turn out to be one of the most important in the Mediterranean.

Apart from its purely archaeological and historical interest, however, it has another important aspect: it is the first time that an excavation of this magnitude has been organized in Greece, and it is perhaps the first time in Europe that such advanced technological means have been employed in an enterprise of this kind.

It therefore seemed appropriate to devote this issue of ENALIA, as we had promised, to the work that has been accomplished in this first full season of excavation at Dokos. In the following pages we present briefly but comprehensively the history of the 1989 project, the techniques used, the first results and our evaluation of this season's work. A great deal of serious organization and preparation was needed to carry out this enterprise. We had to assemble a large and diverse amount of equipment and to ensure the necessary services and cooperation, as well as regular supplies and communication, and the full and wholehearted committment of everybody taking part in the expedition.

The realization of these goals called for two essential preconditions: the first was to secure the consent and full cooperation of the state, and the second was to procure the necessary financial backing for the project. It may appear strange (or perhaps it does not) that the major part of our efforts and time should have gone into realizing the first precondition. We hope that this year and in the future the great archaeological importance of the Dokos excavation will be properly understood and HIMA's contribution to the project fully appreciated.

By contrast, the understanding and enthusiastic response we met with when we sought the help of foundations, institutions, business enterprises and private individuals in funding the project came as an agreeable surprise. We owe to all those who assisted us a great part of the success of the 1989 season. We look to these same sponsors, and hopefully to new ones as well, to give us the means to continue and to complete the project.

The reception that has greeted the enterprise in the international archaeological world has been considerable, and the interest it has aroused is apparent from the letters we have received and from the general expressions of willingness to support our efforts; it is also reflected in the reports on the excavation that have appeared in the international press, the high spot being a frontpage article in the scientific section of the *New York Times*. We pray that the same thing will happen in Greece.

A record of four thousand years of Greek maritime presence in the Aegean is emerging from the depths of the Dokos waters.

Nikos N. Tsouchlos
Athens, December 1989

HISTORY OF THE DOKOS PROJECT

PRELIMINARY SURVEY (1975)

Towards the end of August 1975 the underwater archaeologist Peter Throckmorton, a founding member of HIMA, located piles of broken prehistoric vases in the small bay of Skindos. He immediately informed the ephor of antiquities George Papathanasopoulos, also a founding member of HIMA. Thus began a long train of events that has finally culminated in the present programme for a complete archaeological excavation of the site by the Institute.

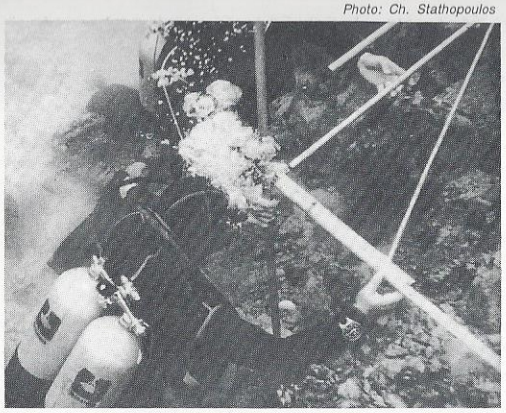
A brief description of the first steps after the discovery of the site will put the early history of the Dokos project into perspective. Immediately after its discovery, Dr Papathanasopoulos and N. Tsouchlos, general secretary of the Institute at the time, paid a visit to the site. From their observations on this first visit and from some fragments of vases that had been recovered from it, Papathnasopoulos concluded that the pottery belonged to the Early Helladic period, dating to some two and a half thousand years BC, and had probably formed part of the cargo of a ship that had been wrecked here. The importance of this unique discovery led to the organization in November of that year of a preliminary investigation by HIMA directed by Dr Papathanasopoulos. The investigation was carried out with a permit from the Greek Archaeological Service. A general plan was made of the underwater area of the site and of the headland close to which the wreck lay. Individual finds and the general area of the site were photographed, and a rough photomosaic was attempted. Sample objects were brought up in order to date the wreck. The seabed and the land around the bay were explored. And lastly the technical aspects of the site were recorded with a view to the future excavation of the wreck.

PRELIMINARY INVESTIGATION (1977)

by Haralambos Kritzas

In 1977 a second short survey of the Dokos site was carried out. During the two days of the survey three dives were made in all with the object of making as detailed an examination of the wreck as the time allowed. To exclude the possibility that the pottery on the seabed had come from a settlement on the narrow headland, the seabed along its southern side was explored from the end of the point to the head of the bay where the wreck

Photo: Ch. Stathopoulos



Members of HIMA measuring to level up the grid during the 1975 reconaissance survey.

lay. It was found that as far as roughly the middle of the shoreline no pottery fragments were visible. At a depth of some 18-26m there was a large concentration of Early Helladic pottery, amongst which was more recent material, including Byzantine sherds. In all probability these two concentrations, excluding the later objects, were parts of the cargo of the same vessel, which struck the rocks and sank, causing the cargo to be scattered on either side of a large rocky outcrop projecting from the shore. Most of the fragments of pottery have been concreted to the rocks by the action of the sea, and will be hard to remove and raise safely. Among the objects noted were numerous grindstones from prehistoric querns, made of rough coarse-grained stones and part of a clay vase decorated with multiple impressed concentric circles. After consultation with the director the vase was brought up and taken to Athens. It should help to identify the ship's provenance or ports of call before it was wrecked, because this form of decoration is chiefly found in the western Cyclades (Kea, Milos, etc.). Northeast of these two concentrations another smaller one was observed at a depth of 8-12 m, also consisting of EH or other prehistoric sherds. Since it is some distance from the first two concentrations, it is not sure whether it comes from the cargo of the same wreck; a study of the pottery in the concentrations should settle this question.

Still further to the NE there is a pile of ballast stones, probably thrown overboard from the sponge fishing boats that sometimes used to anchor in the bay, according to local sailors.

Bottom soundings

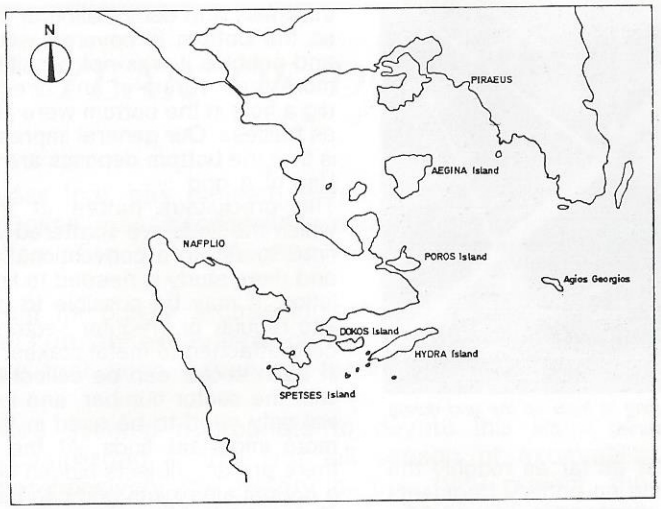
An attempt was made to probe the bottom with a thin iron rod in order to establish the thickness and composition of the seabed, but as the bottom is covered with coarse sand and pebbles it was not possible to penetrate more than 10 cm in any direction. Efforts to dig a hole in the bottom were also abandoned as fruitless. Our general impression, however, is that the bottom deposits are not very deep.

Use of a grid

The precipitous nature of the bottom on which the finds are scattered will make it difficult to set up a conventional aluminium grid and more study is needed to find the right solution. It may be possible to divide the area into regular or irregular sectors using plastic cord attached to metal stakes. All the objects in each sector can be collected and marked with the sector number, and individual labels will only need to be used in the case of the more important finds. At the same time, if there are any objects hidden under the sand, a normal aluminium grid can be set up in that place. A small lump of concretion that had broken away and rolled to the bottom was chosen and photographed. Part of the team explored the shoreline underwater, but came across no pottery apart from a few sherds that were mainly medieval in date. They found and raised a schist anchor-weight of the Archaic or Classical period and a medieval jug. Between the dives we walked over parts of the island. We identified the ancient Classical site again; it appears to have been quite extensive and at one point there was a wall or retaining wall of Cyclopean masonry. Thin obsidian blades were also found on the point above the lighthouse; on the precipitous hill of the fortress, outside the walls, there are cisterns and many medieval buildings. Lastly, reused Early Christian architectural fragments were discovered built into many of the chapels on the island.

Proposals

This short survey confirmed the unquestionable need to excavate the wreck or wrecks at Dokos, and it provided an assessment of the technical and logistical difficulties to be overcome, for which careful planning and preparation will be necessary. Among other points it stressed the need for the collaboration of two trained archaeologists, to take turns working underwater and ashore, and for the assistance of experienced conservators for the immediate on-the-spot treatment of the finds brought up. The first phase should be devoted to plotting on the site plan and raising the visible finds, which are at risk from illegal divers. Systematic excavation of the seabed, which will require careful and detailed planning, can be left until later.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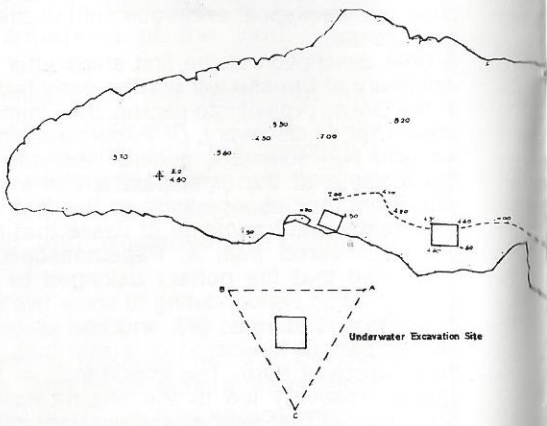
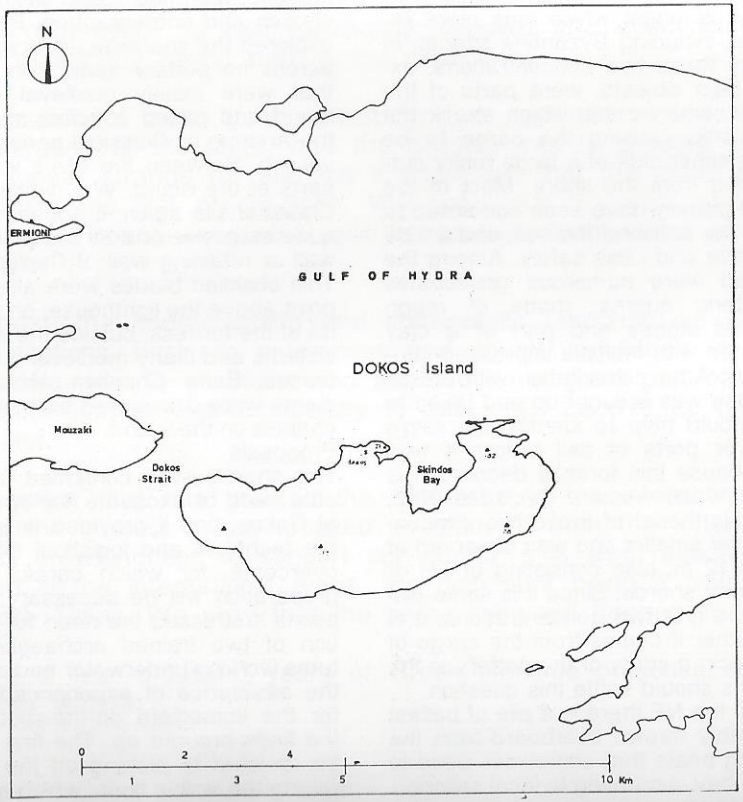
HYDRA Island
SPETSES Island


Underwater Excavation Site


N
ERMIONI
GULF OF HYDRA
DOKOS Island
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Dokos Strait
Skindos Bay
0
2
4
1
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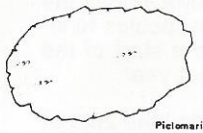
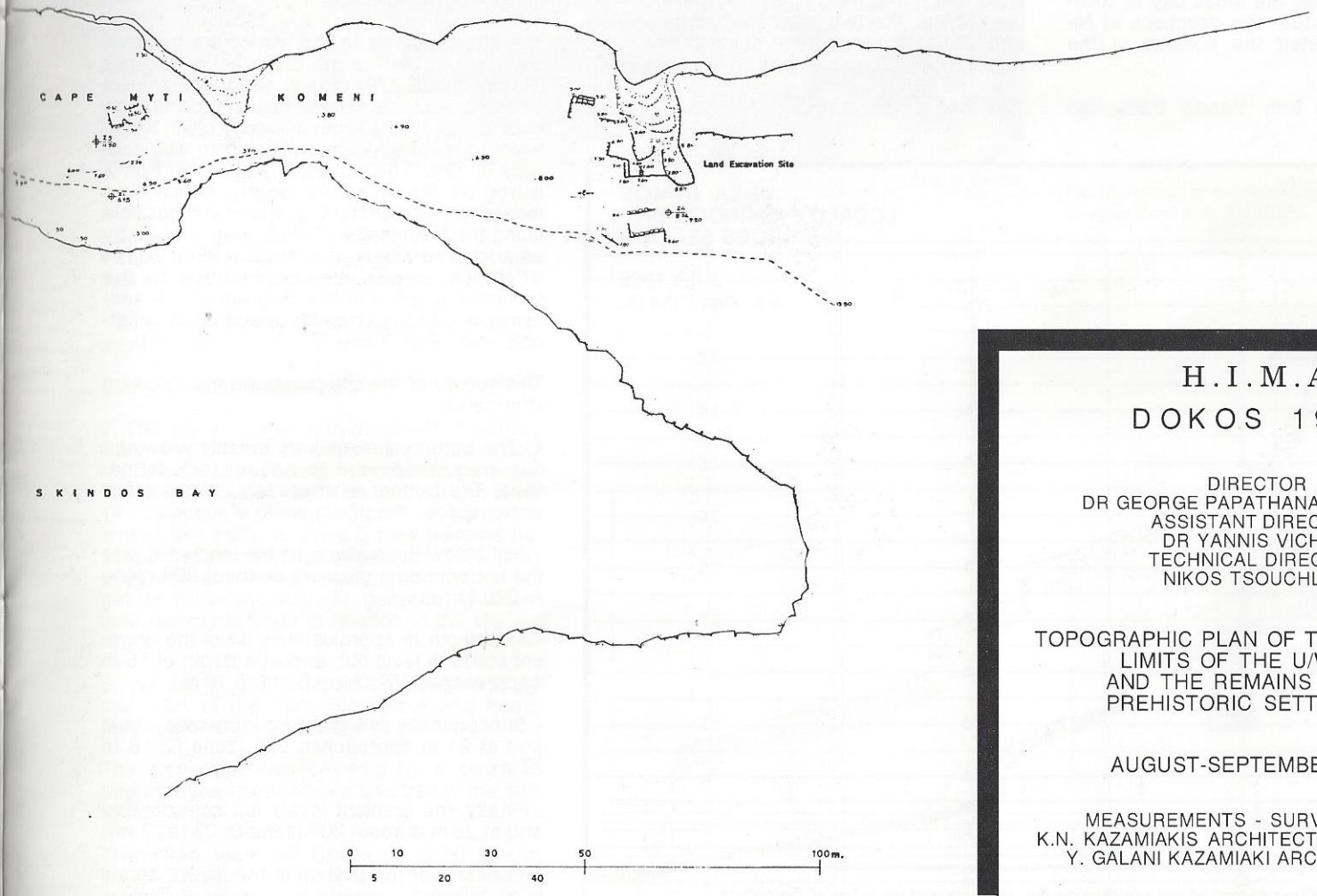
10 Km





H.I.M.A.

DOKOS 1989

DIRECTOR
DR GEORGE PAPATHANASOPOULOS
ASSISTANT DIRECTOR
DR YANNIS VICHOS
TECHNICAL DIRECTOR
NIKOS TSOUCHLOS

TOPOGRAPHIC PLAN OF THE SURVEYED LIMITS OF THE U/W SITE AND THE REMAINS OF THE PREHISTORIC SETTLEMENT

AUGUST-SEPTEMBER 1989

MEASUREMENTS - SURVEY - PLAN
K.N. KAZAMIAKIS ARCHITECT/TOPOGRAPHER
Y. GALANI KAZAMIAKI ARCHAEOLOGIST

INSPECTION OF THE DOKOS SITE (MAY 1989)

- by Yannis Vichos and Vaso Kyriakopoulou -

In May 1989 it was decided to carry out a one-day inspection of the Dokos site with a team of seven members of HIMA under the direction of George Papathanasopoulos to investigate its condition prior to the start of the main excavation in August of that year.

The team spent the night of Friday the 26th at Ermioni and next morning were taken to Dokos by a harbour patrol launch kindly provided by the Harbourmaster of Ydra in response to a request by HIMA to the Ministry of the Marine. They reached the small bay of Skindos at 11.50 and under the directions of Nikos Tsouchlos located the position of the wreck.

Papathanasopoulos with Yannis Baltsavias and Vaso Kyriakopoulou landed on the shore near the wreck to measure the terrain with a view to setting up a land base there for the excavation.

At 13.05 under the supervision of Papathanasopoulos, Nikos Tsouchlos and Phaidon Antonopoulos dived from the Institute's inflatable boat, found the wreck and began measuring its visible extent.

At 13.18 a second pair of divers, Yannis Vichos and Yannis Baltsavias, joined them on the bottom. The two pairs finished measuring and Vichos photographed some of the more representative objects lying on the seabed.

The four divers surfaced at 13.45 and the whole team then made a measured traverse of the seabed perpendicular to the shoreline with the help of a portable echo sounder. The method followed was devised by Vaso Kyriakopoulou under the guidance of and with the equipment provided by the topographical surveyor and member of HIMA, Lefteris Tsavliris *(Figs. 1 and 2)*.

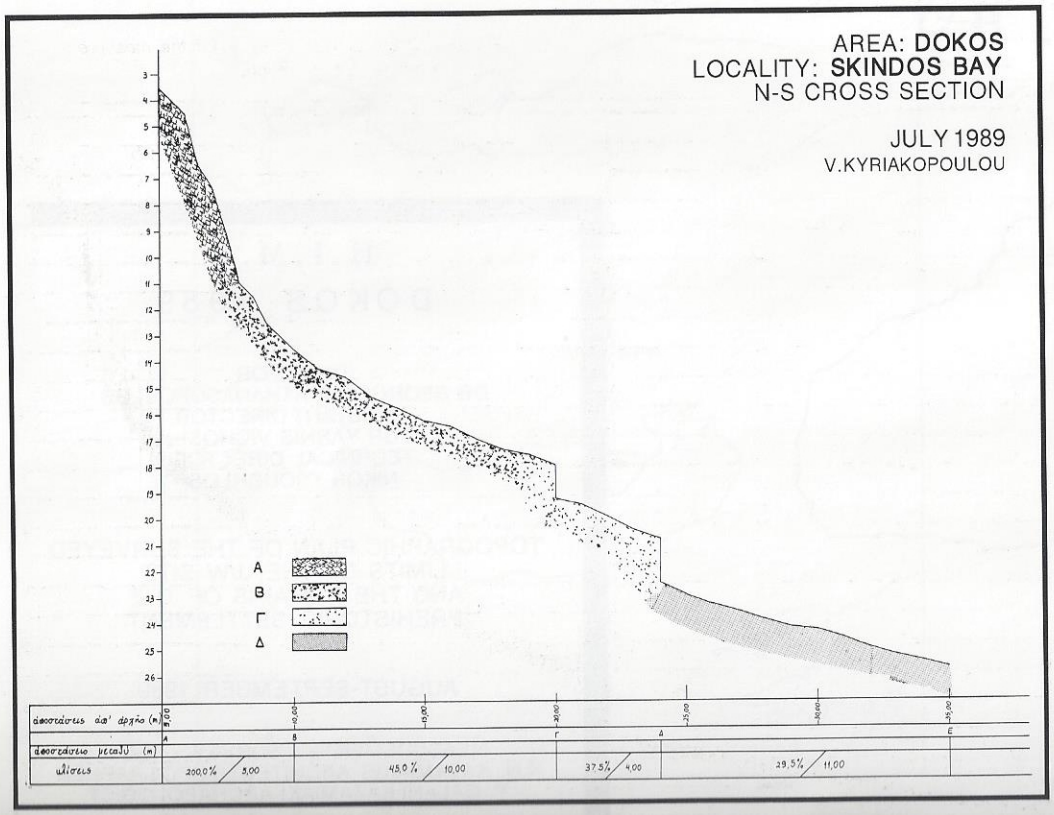


Fig. 1. Cross section of the site showing the gradients and formation of the bottom.

The area of the site with the archaeological remains was marked off on the surface with buoys and, because of the limited time available, a single traverse was run roughly through its centre to measure the depths. The North-South orientation of the traverse cuts the area transversely and is representative of the morphology of the bottom.

The soundings along the line of the traverse were taken with a portable echo sounder (Raytheon DE-179) of high sensitivity, thanks to the projector's narrow beam and the high frequency of the transmission (200 KHz), which gives the measured depth to an accuracy of 5%. The projector was trained on a mirror on the inflatable dinghy, which was moved at as constant a speed as possible along the traverse line, which was marked by an anchored wire rope every 5 m *(Fig. 2)*. The difference beween the picture given by the recorded graph and the diagram of the section is due to the irregular speed of the inflatable craft *(Figs. 1 and 3)*.

This survey of the site produced the following information:

1. The bottom shelves very steeply with various irregularities due to natural rock formations. The bottom relief presents slight differences across the whole width of the site:

- Just below the surface on the landward side the bottom has a gradient of about 80° (zone A: 0 to 11 m).

- At a depth of approxiamtely 11 m the gradient starts to level out, and at a depth of 15 m it approaches 35° (zone B: 11 to 18 m).

- Subsequently the gradient increases again and at 21 m approaches 85o (zone C: 18 to 27 m).

- Finally, the gradient levels out considerably and at 26 m is about 20° (zone D: 23 to 27 m).

The nature of the bottom in the above zones is as follows:

Photo: N. Tsouchlos

Fig. 2. Working on the measured traverse

- Zone A: solid rock.
- Zone B: rocky bottom with scattered stones and a few patches of coarse sand.

- Zone C: similar to B but with larger expanses of sand.

- Zone D: coarse sand (gravel).

2. The site is littered with hundreds of pottery fragments, many of which are immediately identifiable as having prehistoric shapes. There is a scatter in the middle of zone B (at 14 m), and they become thicker towards the end of this zone. In Zone C they become noticeably scarcer, to increase again in D. They occur either in small clusters concreted together or individually. In general, however, their density is lower in relation to the stones, rocks and sand.

3. We found that it would be possible to install part of the expedition base and headquarters on the shore close to the site.

The inspection was covered by a series of photographs taken above and below the surface.

The HIMA team left Dokos at 17.50 and at 18.20 arrived in Ermioni; on the following morning it returned to Athens.

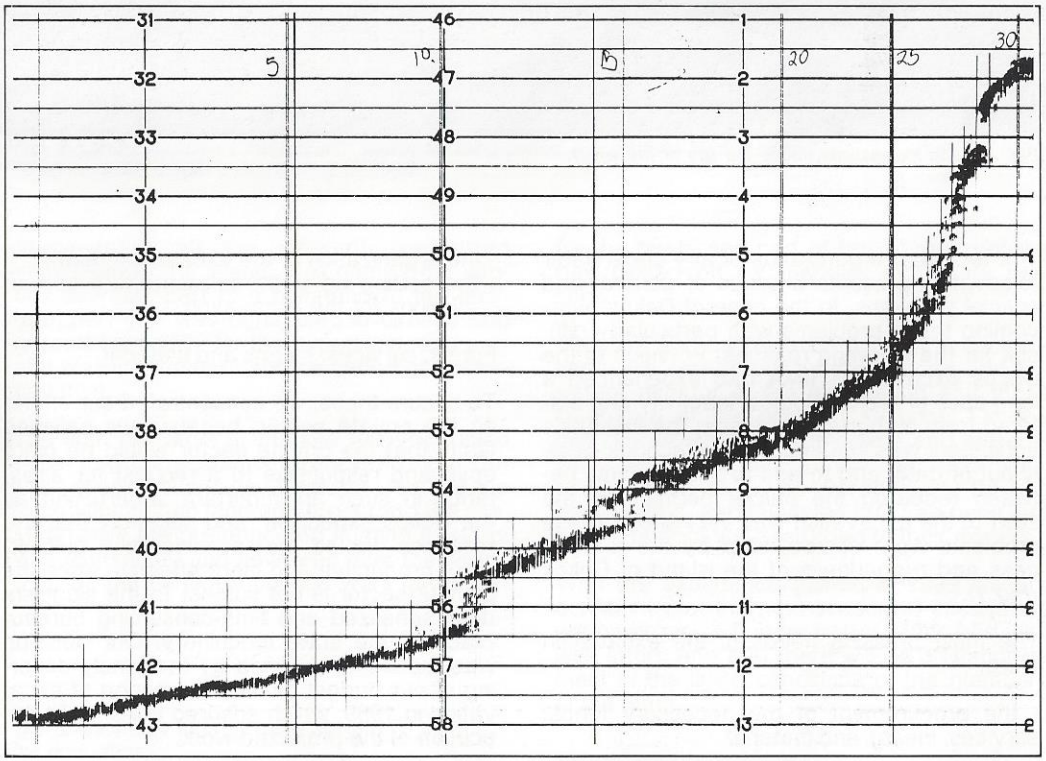


Fig. 3. Printout of the recording of the measured traverse (land is on the right).

DOKOS 1989: TECHNICAL ORGANIZATION

- by Nikos Tsouchlos -

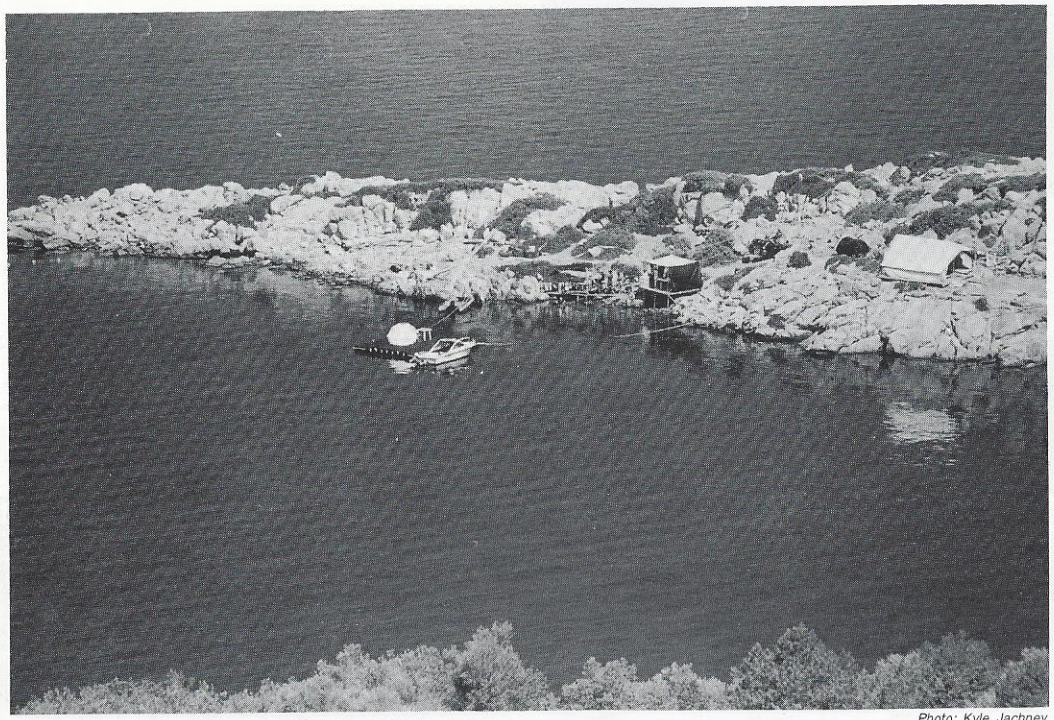


Photo: Kyle Jachney

Fig. 1. *Land installations above the site of the wreck.*

The technical organization of any underwater excavation presents a series of general and special problems. In the case of Dokos overcoming these problems was particularly difficult for the following reasons: Previous to the Dokos excavation HIMA had experienced a long spell of archaeological inactivity and suffered from a shortage of funds; the Institute's equipment was inadequate and technologically out of date; and to add to this, the time between receiving the official permit and the start of the excavation was very short. These problems were compounded by the remoteness and ruggedness of the island of Dokos *(Fig. 1)*.

The most pressing needs of the excavation were:

- the procurement of the necessary funds, services, means and material.
- the organization of the excavation team.
- the setting up of the infrastructure and installations for the excavation.

Funds, services, means and material

To secure these, we concentrated our efforts on the private sector, because we believed firstly that the private sector would be more open and responsive to a request for assistance in such an important undertaking as the Dokos expedition, and secondly that the response would be considerably quicker, more productive and more effective since the priviate sector is not subject to the sluggish, depersonalized and time-consuming bureaucracy of the state machinery. Our decision was more than justified by the timely covering of our budget for the first period of excavation in 1989, which ensured the smooth execution of the projected work.

Organization of the excavation team.

An excavation of the size and archaeological significance of Dokos calls for a multidisciplinary, coordinated team with specialists to cover the different scientific and technical aspects. The members of the Dokos team numbered forty-five persons in all; forty of these were divers, and thirty-three of the forty were members of HIMA. Seven people were responsible for the different scientific and technical sections, and they remained on Dokos for the duration of the excavation; two more, one in Ermioni and the other in Athens, were constantly available to coordinate the needs and movements of the team.

The remaining members of the team took turns to be on Dokos, so that there were always 15 to 20 members at the site each day. The team consisted of:

- Nine archaeologists
- Three surveyors
- Six architects
- Three photographers
- Three computer experts
- Two diving instructors
- Four technicians
- Three archaeological students
- Five divers from the Greek Naval Underwater Demolition Unit
- Two coordinators liasing with the team

Technical infrastructure - installations

The organization of the technical infrastructure was the most difficult and complicated part of the project and entailed the greatest problems.

The most serious of these was presented by the nature of the place where the base camp was to be installed. Dokos is today a more or less uninhabited island without water, electricity or telephone, and is 5.5 nautical miles from the nearest harbour, Ermioni. The shore in the vicinity of the wreck is rocky and uneven, and this was where the machinery, computer, air compressors, diving equipment and all the material necessary for the excavation had to be installed. Electric power was needed for the computer and various machines and instruments. Telephonic communication with Ermioni and Athens had to be established for the safety and needs of the excavation team, and sea transport for the supply of water, food, and materials and the ferrying of the personel. Lastly, among the paramount

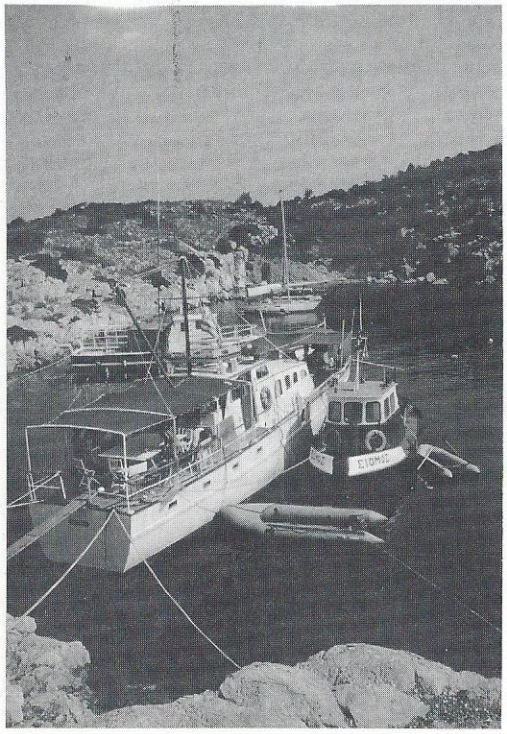
necessities was a place for eating, sleeping and working.

The problem of the land installations was met by constructing platforms on which awnings were erected to protect the machinery from the sun and rain. Here we installed the computer, compressors and a large tent to house part of the team *(Fig. 3)*. The rest lived on the yacht "Pnoe", which was lent to us for the duration of the excavation.

The necessary electric power was supplied by three generators of 220, 24 and 12 volts. Telephone communication with Ermioni was maintained by radiotelephone, and with Athens by the radiotelephone on "Pnoe". Sea communication with Ermioni and the ferrying of people and supplies were effected by three small speedboats at our disposal. Water was supplied by a small barge that was also lent to us for the duration of the excavation. It took on water at Ermioni and unloaded it at Dokos into plastic tanks that had been specially bought for the purpose.

Another problem was the preparation and transport of all the different specialized equipment to the island. This came from various sources: part of it belonged to the Institute, part of it was purchased in Greece and abroad especially for the expedition, and part of it was loaned to us for the period of the excavation.

Photo: N. Danielidis



The first four days at the site were occupied in ferrying the equipment from Ermioni to Dokos, building various structures, setting up the equipment on land and organizing the site. Meanwhile the prefabricated floating platform was assembled and anchored over the wreck *(Fig. 3)*, permanent moorings were laid down for the boats and part of the entrance of the bay closed off by markers for safety reasons.

Planning and coordination during the excavation were carried out by the director and assistant director of the excavation and those in charge of the different sections. On the last day of work the equipment and material were packed up and transported to Ermioni, where much of it was stored ready for use next season, and the items that had been lent for the project were returned to their owners.

With the experience gained in 1989 we are confident that the next season of excavation will be organized under better terms and with less effort, and that there will be an imporvement in the living conditions of the members of the team.

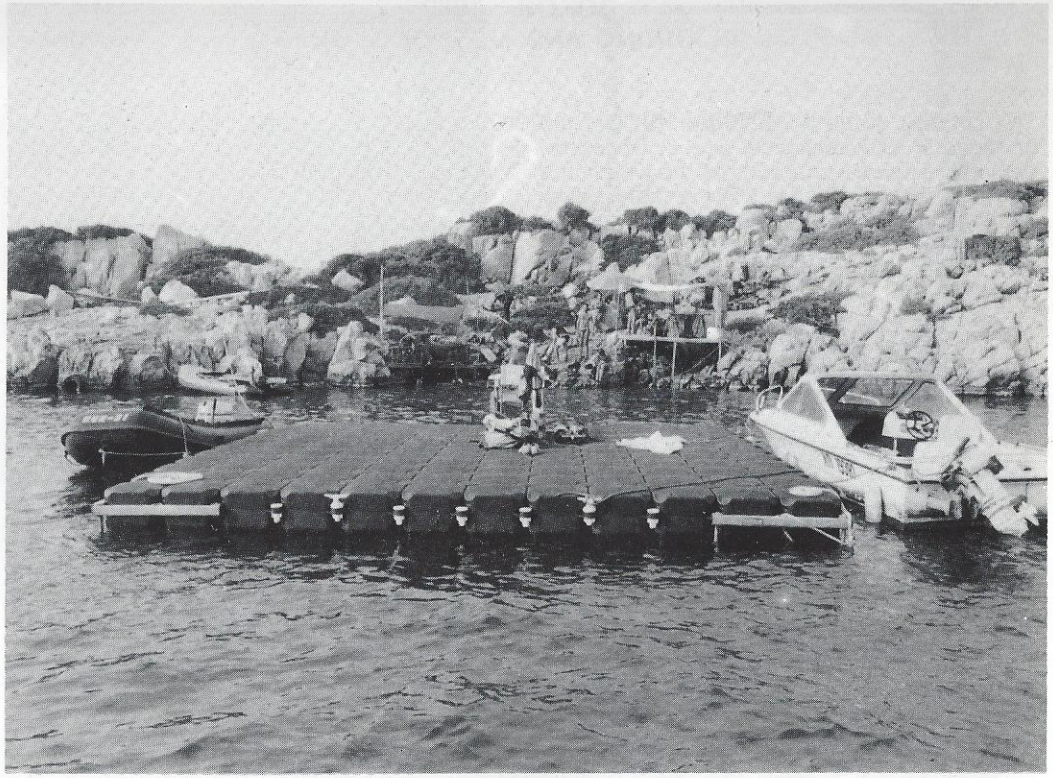


Fig. 3. *Land installations. Background: station for filling bottles and platform for the computer; foreground: the prefabricated floating platform.*

Photo: Kyle Jachney

Fig. 2.
The different craft used by HIMA during the excavation

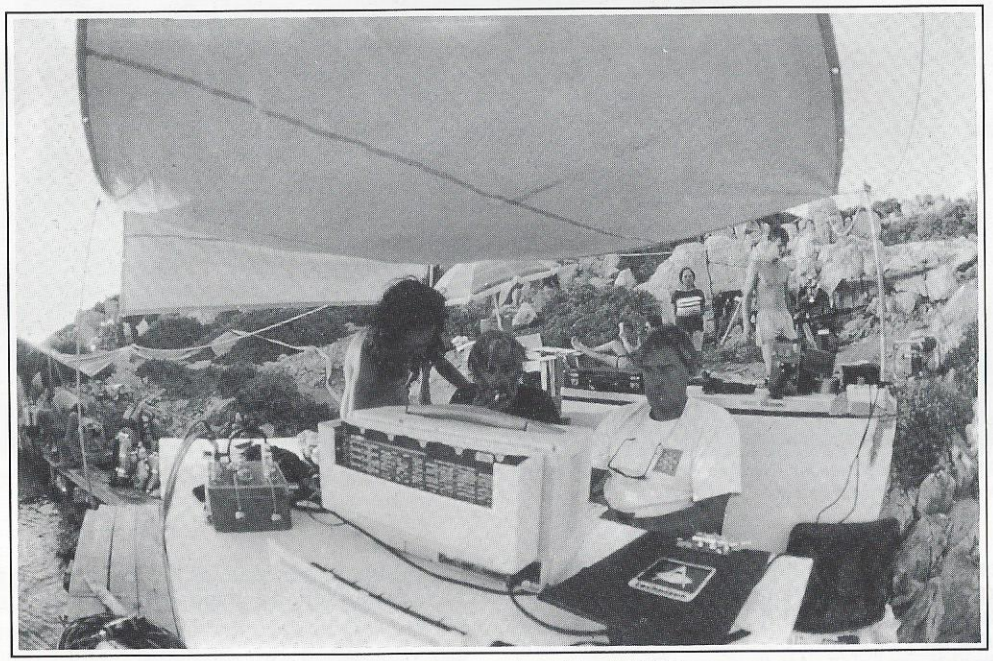
DOKOS 1989: PLANNING AND METHODOLOGY

- by Yannis Vichos -

The surveys made in 1975 and 1977 of the underwater archaeological site at Dokos revealed the special character of the wreck and the difficulties involved in a full archaeological excavation of it. It became apparent that although the greatest depth of the site did not exceed 32 m, the time required to set up a grid of the traditional type and to record the positions of the finds by any of the known surveying methods would be excessive in the case of a full-scale excavation. Taking into account the large number of finds and the fact that many of them were concreted to each other and to the rocks, it was clear that the total time needed to finish the excavation would in this case be almost prohibitive. The magnitude of the problem had been well stated by the archaeologist in charge of the 1977 survey, Haralambos Kritzas (see above).

The results of the one-day survey carried out in May 1989 (see above) confirmed Kritzas's observations, and the traverse section of the site was of great assistance in planning the 1989 campaign, espeically for the design of the stereophotographic grid.

Photo: N. Danielidis



The supporting computer of the SHARPS

In view of the impracticability of using the conventional grid and survey method, mainly because of the steep gradients and irregularities of the seabed in the area of the excavation, we turned to a new system for mapping and plotting the positions of finds underwater which I had heard of in February 1988 from the then president of the Institute of Nautical Archaeology, Donald Fray.

This system, known as the Sonic High Accuracy Ranging and Positioning System (SHARPS), had been designed by INA scientists especially for use in underwater excavations for mapping the seabed and plotting the positions of finds by means of a computer through the transmission of high-frequency sound pulses (the details of the system are described below in an article by Vaso Kyriakopoulou). After communicating with the company that manufactures the SHARPS and studying the technical information they sent us, we decided to use their system on the Dokos expedition for mapping the site and recording the positions of the finds. The Institute payed the first deposit for the purchase of the instrument and Marine Telepresence sent us the SHARPS for the duration of the excavation. Kyle Jachney, an American who was a leading member of the Dokos excavation team, was trained in the use of the system.

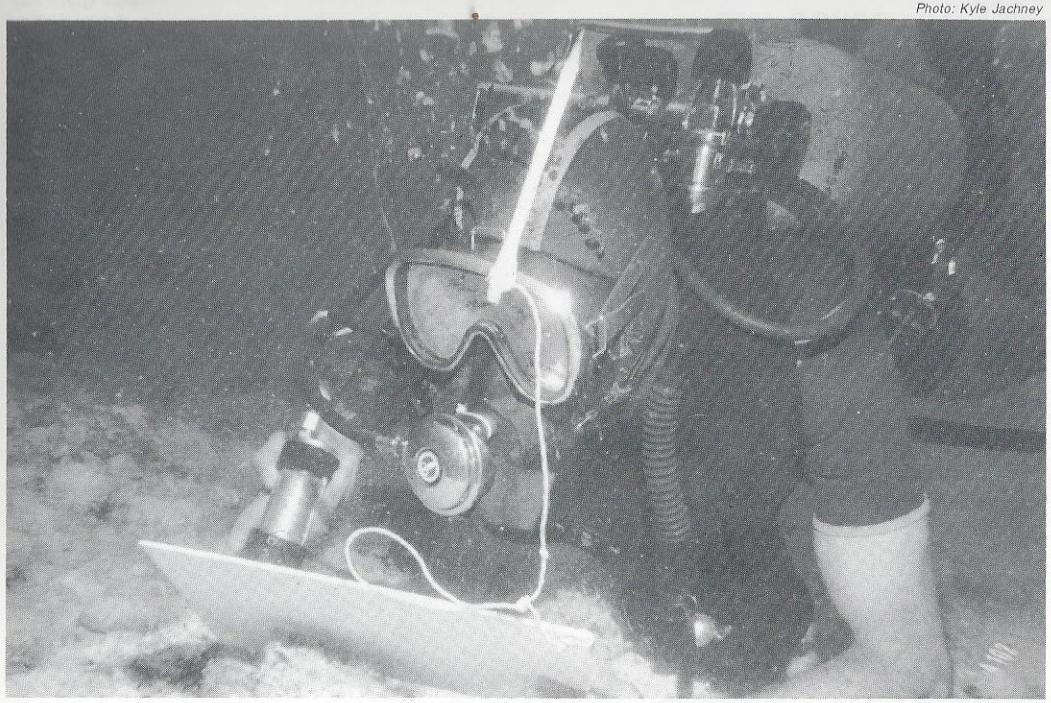
Since this was the first time in the world that the SHARPS was to be used as the principal survey instrument on an underwater archaeological excavation, we also decided, profiting by the past experience of foreign excavation teams, to make a photomosaic and to construct a stereophotographic plan of the site (the details are described below in an article by Nikos Tsouchlos).

By choosing these two topographical systems, the SHARPS and the stereophotographic grid, we were sure that the topographical requirements of the excavation would be largely taken care of. We decided to use both systems so that if the results from one of them were not as reliable as expected we could always fall back on the other.

The adoption of these two systems also solved the most difficult problem of the excavation: how to make a scale plan of the underwater site and to record the positions of the finds accurately. The other projects for the 1989 season concerned the delimitation of the archaeological zone, recording the visible objects on the seabed, attaching numbered labels to each cluster of finds or to important single finds, and raising and transporting them all safely to a museum.

It was decided that the delimitation of the archaeological zone would be carried out by two archaeological divers, and they would also be responsible for locating the finds. To mark all the objects we had made plastic labels with white numbers on a black ground, which would be visible by ordinary light to the

Photo: Kyle Jachney

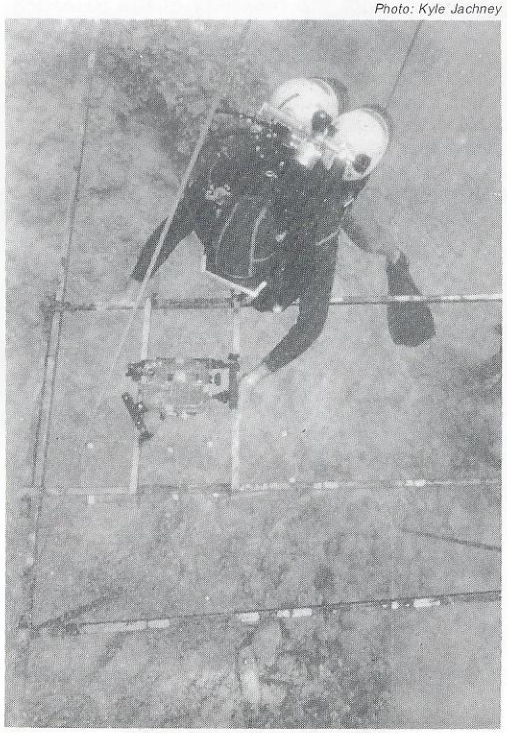


Recording the positions of artifacts with SHARPS.

eye and in photographs. We also decided because of the large number of objects, chiefly small sherds, to label clusters of sherds rather then individual pieces. Every cluster would comprise all the objects in the immediate vicinity of a feature find. Each cluster would be placed in a plastic bag with its label and raised to the surface, and for their safe transport the plastic bags with the finds would be placed in buckets and bowls of water.

The methodology was planned not only with an eye to correct archaeological excavation procedure, but also with the aim of conducting a model underwater excavation that would yield worthwhile results thanks to the use of advanced technology and to the training of as many archaeologists and scientists engaged in underwater archaeology as possible.

Photo: Kyle Jachney



Stereophotography on the Dokos site

Photo: Kyle Jachney

Fig. 1.
Positioning a SHARPS transmitter-receiver on the bottom

DOKOS 1989: THE EXCAVATION:

- by Yannis Vichos -

The 1989 season began on the 20th of August with the transport to Dokos of the equipment and material needed for the excavation and the setting up of the floating and onshore installations. This task was undertaken by a team of HIMA members with technical qualifications aided by three professional mechanics.

Their chief tasks were to moor the yacht "Pnoe", which was to house the excavation team and take part of the portable equipment, to moor the floating platform over the main area of the site, to set up the electric generators and the air compressors for filling the tanks, and to construct the shore platform on which to install the computer for the SHARPS system.

During the three first days (25/8 - 27/8) the archaeologist Elpida Hadzidaki and the writer explored the site of the wreck, covering a total area of 800 m^2. The archaeological finds were found to extend over an area from about 15 to 30 m in depth. A few isolated finds were also located beyond the 30 m mark, but it was decided to confine the work in the 1989 season to the main archaeological zone, which occupies an area of 650 m^2.

The zone was marked off with a cord fastened to 18 numbered iron stakes. It was polygonal in shape and the perimeter was initially plotted in the traditional way in a series of dives by the topographer Vaso Kyriakopoulou and a number of archaeologists and divers. Later on the perimeter was also plotted using the SHARPS.

Both plotting methods were used in order to compare the time needed for each of them and to check the measurements given by the SHARPS, since it was being used for the first time. The results were most interesting and confirmed both the reliability of the SHARPS and its much greater speed.

The following seven days (28/8 - 3/9) were chiefly spent in setting up and adjusting the SHARPS. This required the positioning of the three transmitter-receivers at fixed points on the seabed so as to form as nearly as possible an isosceles triangle. In order to find the best positions for the transmitter-receivers for the system to function properly without any reflections due to the irregularities of the bottom, the transmitter-receivers had at first to be moved around a great deal. They were mounted on iron poles about 2.5 m high embedded in cement-filled cans *(Fig. 1)*.

The system was calibrated and the speed of the sound pulse through the water measured; this is about 1518 m per second. The three transmitter-receivers were labelled A, B, and C, and the distances between them and from them to the surface were measured.

While the SHARPS was being installed and adjusted other jobs were carried out, and the area within the perimeter was divided by cords into nine separate sectors in order to simplify the work of recording and plotting the sherds.

Photo: Kyle Jachney

Fig. 2.
Recording the perimeter with SHARPS.

As soon as the SHARPS was functioning properly, the perimeter of the working zone and the dividing cords of the nine sectors were plotted *(Fig. 2)*. Afterwards pairs of divers, each under an archaeologist, began marking the objects and clusters in each sector with numbered labels from A1 to A250 (the letter A indicates the stratum, in this case the surface of the seabed, to which the 1989 excavation confined itself) *(Fig. 3)*. When the marking of the finds in each sector was completed, another pair of divers made a list of the numbers of the labels together with a short description of the objects. Meanwhile the first group or another one photographed all the finds and clusters that had been marked.

When the task of marking the objects was finished, plotting their positions with the SHARPS began (see below the article by Vaso Kyriakopoulou) *(Fig. 4)*. While this was in progress, the stereophotography of selected parts of the delimited zone, where the bulk of the finds was concentrated, began (see

Photo: N. Danielidis

Fig. 3. The cluster of finds no. A94. The ring-base of an EH pot and other sherds can be seen.

below the article by Nikos Tsouchlos) *(Fig. 5)*. Before taking the photographs, the surface of the objects under the frame was cleaned.
During these activities two stone slabs of greenish schist with a hole at one end were brought to the surface after they had first been photographed in place and their positions in relation to the perimeter of the archaeological zone had been fixed. These slabs, which had been located during the reconnaissance dives at depths of 34 and 38 m respectively and some 40 m away from the main site, must be prehistoric anchors and may be directly related to the wreck.

The next step was to map the area with the SHARPS, and particularly to plot the rocks within the delimited zone and fix the archaeological site in relation to the shore in order to incorporate it into the general topographical map for which a land survey was being made.

After completing the marking and plotting of the finds with the SHARPS, the stereophotography and the photography of the finds, we bagan the task of raising methodically both the separate pieces and the clusters, according to how they had been marked on the bottom and recorded by the SHARPS.

The finds were raised by sectors after being placed together with their labels into plastic bags. The bags were then carried up in a perforated iron basket attached to a lifting balloon *(Fig. 6)*. When there were enough finds in the basket, the balloon was filled with air from one of the diver's tanks and hauled up to the floating platform at a point where part of it had been removed to make it easier to take the finds from the basket.

Photo: Kyle Jachney

Fig. 4. Recording the position of a find with the SHARPS.

On the platform the director of excavations Papathanasopoulos with other archaeologists made a preliminary catalogue of the finds, which were then placed toether with the bags and labels in buckets of seawater.
All the work on the bottom and ashore was photographed, and parts of it were recorded on video for the archives of the Institute.

On the last day of the excavation all the finds that had been raised were carried on board the Energy to Spetses, accompanied by the director of excavations. There they were put in the Archaeological Museum in the charge of the museum guards.

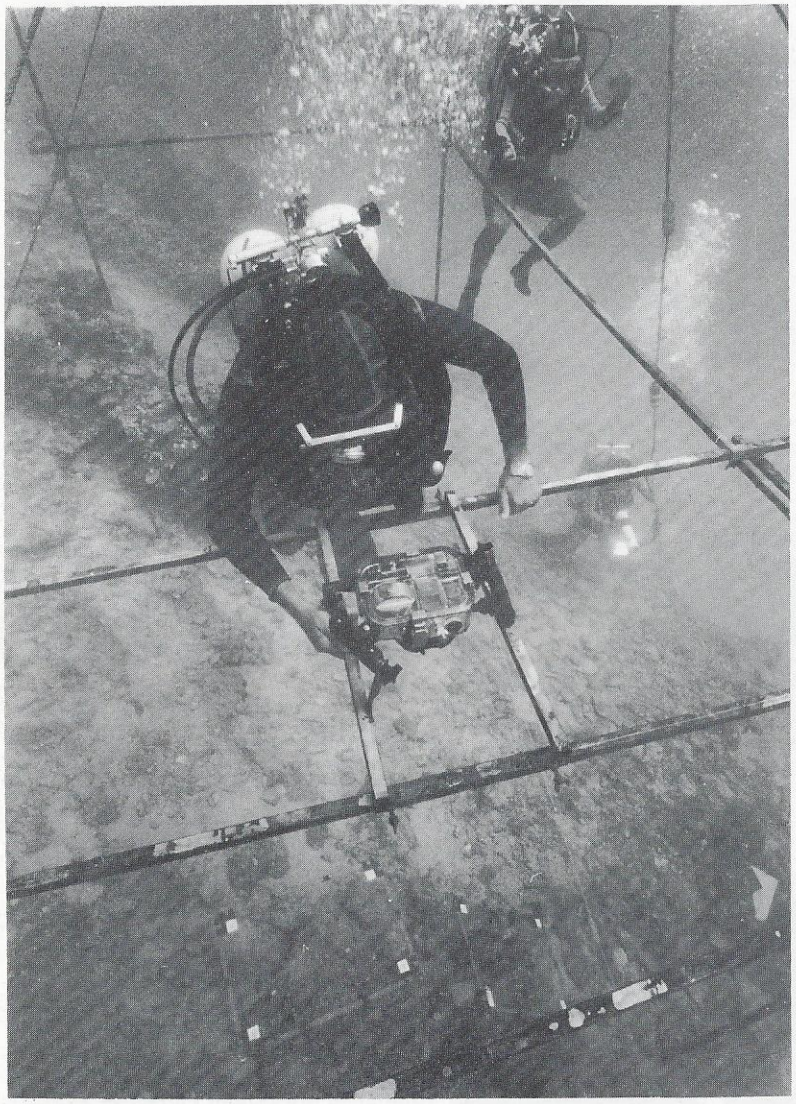


Fig. 5.

Fig. 6

Fig. 5. Taking stereophotograsphs with the frame. On the bottom under the frame can be seen the photographic scales used for the photogrammetry. *Photo: Kyle Jachney*

Fig. 6. Raising the finds in the metal basket. The lifting balloon is visible at the top. *Photo: Kyle Jachney.*

DOKOS 1989: METHODOLOGICAL RESULTS

- by Yannis Vichos -

The reconnaissance of the underwater archaeological site at Dokos resulted in the delimitation of a zone of 690 m that began at a depth of 15 m and went down to 32 m. Nearly all the visible finds on the seabed that had been located during the reconnaissance phase were within this zone. Some isolated finds were outside it at a depth greater than 32 m, but the main bulk of them was concentrated in the middle of the delimited zone.

This was divided into nine sectors of irregular shape, due to the anomalies and steep slope of the seabed. The irregular shape of the sectors did not hamper the plotting of the positions of the finds, because the operation of the SHARPS is unaffected by the shape of any grid; it is based solely on a theoretical horizontal plane bounded by the lines between the three fixed transmitter-receivers.

The nine sectors into which the delimited zone was divided serve only for carrying out the tasks of marking, recording and collecting the finds.
The latter were marked in clusters, beause generally there were many small sherds concentrated in a small area. Individual objects were marked only when they were relatively distant from concentrations of other finds.
We found that the labels had to be attached to the finds with wire, because otherwise there was a danger that they would be swept away by the currents.

Much time was spent in relocating marked finds when plotting their positions and photographing them in situ due to the fact that most of the finds were very small in size. In the next season, therefore, the nine sectors of the zone will be subdivided into smaller units to make it easier to locate the finds.

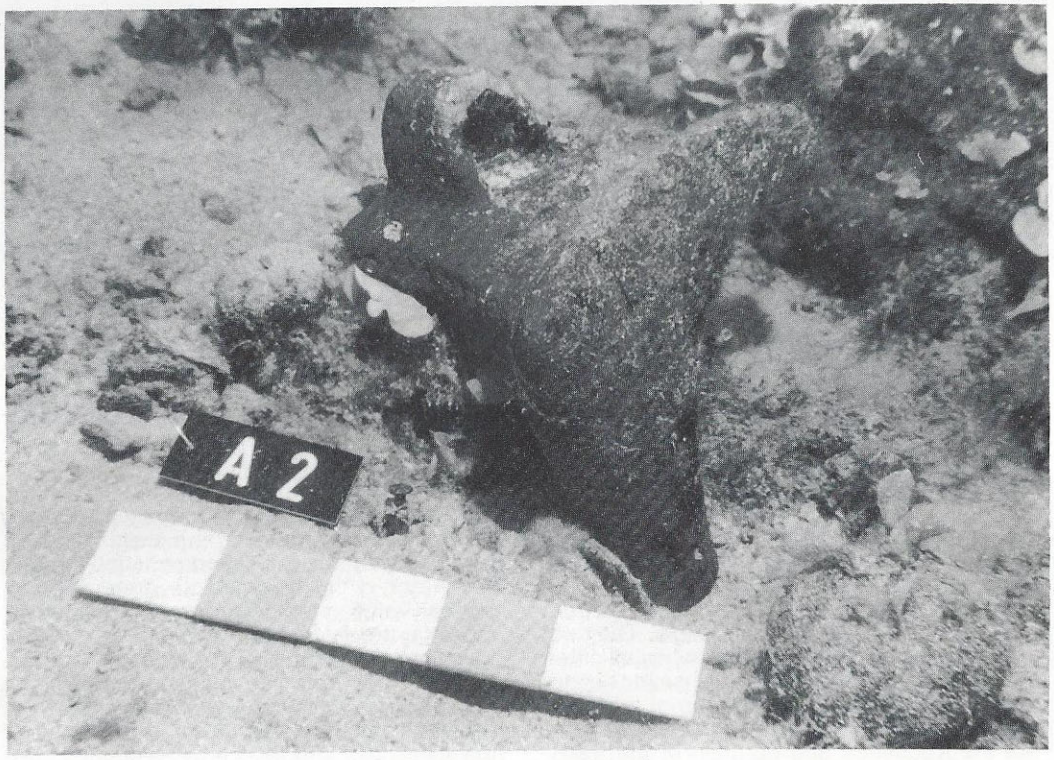
The 1989 season yielded the anticipated results as regards mapping the zone and recording the positions of the surface finds. Our choice of methods for this task proved entirely successful, and they were carried out in general in the usual approved fashion. Certain omissions and errors occurred due either to technical reasons (power cuts, false signals caused by reflections, etc.) or our inexperience, but these did not affect the final results. The employment of two different plotting systems proved to be especially useful when for various reasons one of the two systems did not produce the correct figures.
In the case of the iron frame for the stereophotography, we found that the material used for the frames was not rigid enough.
The use of a bottom-to-surface intercom proved indispensable for the operation of the SHARPS.
Although we are still at the stage of processing all the evidence, we already have, thanks to the Autocad graphics programme, a complete plan of the archaeological area with the positions of all the finds and rocks marked on it. We are also able to make drawn sections of any part of the zone and we know the relative heights (depths) of all the finds.

The positions of the main bulk of the finds on the plan made by entering and processing the data from the SHARPS with the Autocad, and shown on p. 28, will be checked one by one on the photomosaic assembled from the photographs taken with the stereophotographic frame. These photographs will also be processed with a stereoscope with a vew to making a photogrammetric plan of the site. For this purpose the Institute is already in contact with the Polytechnic (E.M.P.).

At the end of the excavation season at Dokos nearly all the visible finds on the bottom that had been marked were raised, except for a number of them that had become concreted to the rocks. Some finds that were found outside the working zone, whose positions are plotted on the SHARPS plan, were also raised.

Recording the finds as soon as they were brought to the surface proved particularly useful and this will be continued more methodically in the coming season.

Photo: Y. Vichos



The spit support no. A2 in situ.

UNDERWATER SURVEYING WITH THE SHARPS IN THE 1989 EXCAVATION SEASON AT DOKOS: PRELIMINARY COMMENTS

- by Vaso Kyriakopoulou -

The SHARPS (Sonic High Accuracy Ranging and Positioning System) is an echo system for fixing the three-dimensional position of a point. The system consists basically of four transmitter-receivers, a control unit and a computer with at least 640K of RAM, a hard disk, the 8087 mathematics processor and a graphics screen.
The transmitter-receivers are connected to the control unit and then to the computer by cables of up to 300 m in length. Three of the transmitter-receivers are set solidly on the seabed at a maximum distance of 100 m. from each other so as to form a triangle. They act as receivers for the sound pulses transmitted at a fixed rate by the fourth transmitter either automatically or by the operation of a trigger; the latter permits the diver to decide and control the frequency and duration of the transmission. This transmitter is moved by the diver to the different points to be measured. All the transmitter-receivers are of the same type of piezoelectric ceramic hemispherical transducer.
The frequency of the sound signal is 300 KHz (10%) and the measured accuracy of the distance is in the order of 2 cm in 100 m.
The triangular grid employed is defined by measuring the distances between the three receivers A, B and C on the inclined plane bounded by the lines joining each pair of vertexes, namely AB, BC, CA, and the depths hA, hB, hC. The accuracy of these measurements, which are made with a tape measure, affects the final accuracy of the measurements of the coordinates made with the SHARPS *(Fig. 1)*. The position of the transmitter in relation to the three receivers is determined in the same way both horizontally and vertically: the receivers receive the transmitted signals and send them to the control unit, and the distance of the transmitter from each receiver is calculated from the time taken for the signal to be received. The three distances and three depths are used to calculate the coordinates of the transmitter in the three dimensions x, y and z in an arbitrary system of reference defined by the receivers.
The calculations are based on the mathematical relationships resulting from the triangular grid and on the speed of the sound pulse through the water.
The speed of sound through water depends on the density, temperature, salinity and clarity of the water, factors that are continuously changing both locally and over a wider area.
This problem is met by calibrating the instrument and calculating an average value for the speed of sound through the water in the immediate area. A provisionsal value for the speed of the sound is fed into the instrument and this is used to calculate the lengths of the sides of the grid. If they differ from the measured sides, the first value is corrected, and this process is repeated until the values for the lengths of the measured and the calculated sides coincide.
This process may be repeated before each group of measurements is made, in order to take account of changes over a period of time in the average value for the speed of sound in the water along the sides of the triangle formed by the three receivers. It is not, however, possible in this way to locate anomalies that are confined to small or larger patches of water inside or outside the perimeter of the excavation zone and which are due to local changes in the factors affecting the speed of sound through the water.
The result of such patches is to cause the refraction of the signal or a change in its speed, leading to a random error of uncertain magnitude in the calculation of the distances.
Initially the installation of the system at Dokos presented considerable difficulties, but these were finally overcome and it functioned satisfactorily.
The peculiar morphology of the seabed due to the steep gradient and local outcrops was one of the main causes of these difficulties and it seriously restricted the positioning of the three receivers, for these have to be in visual contact with the transmitter at each point of measurement and to be located as nearly as possible at the corners of an isoceles triangle. These two conditions are necessary in order firstly to measure the points

Photo: Kyle Jachney

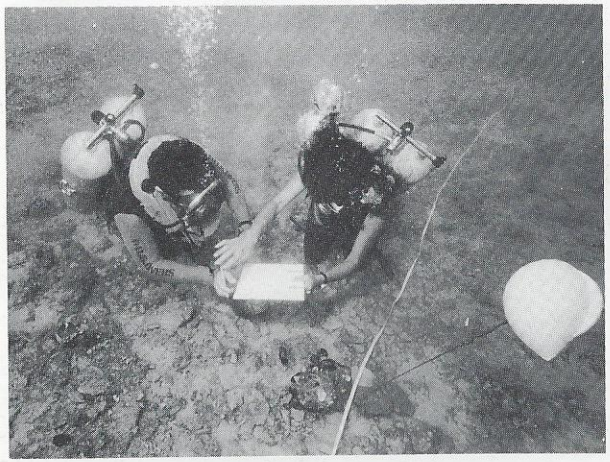


Fig. 1. Measuring with a tape.

Photo: Kyle Jachney

Fig. 2. Placing the SHARPS transmitter-receiver C in position.

and secondly to improve the accuracy of the coordinates due to the better sector angles.
The receivers were mounted on iron poles set in cans of cement and placed on the bottom *(Fig. 2)*. Their stability proved unsatisfactory as they were even affected by the movement of the divers around them.
The receiver nearest to the shore repeatedly fell down during the first trials due to the steepness of the slope, until finally the pole with its base was placed parallel to the bottom with the receiver projecting above a bump that existed in this particular spot on the seabed. The calibration for the speed of the sound transmission through the water was made as soon as the initial measurements had been made with the tape measure and it was repeated regularly, at least during the first days, without showing any significant variation.

Photo: Kyle Jachney

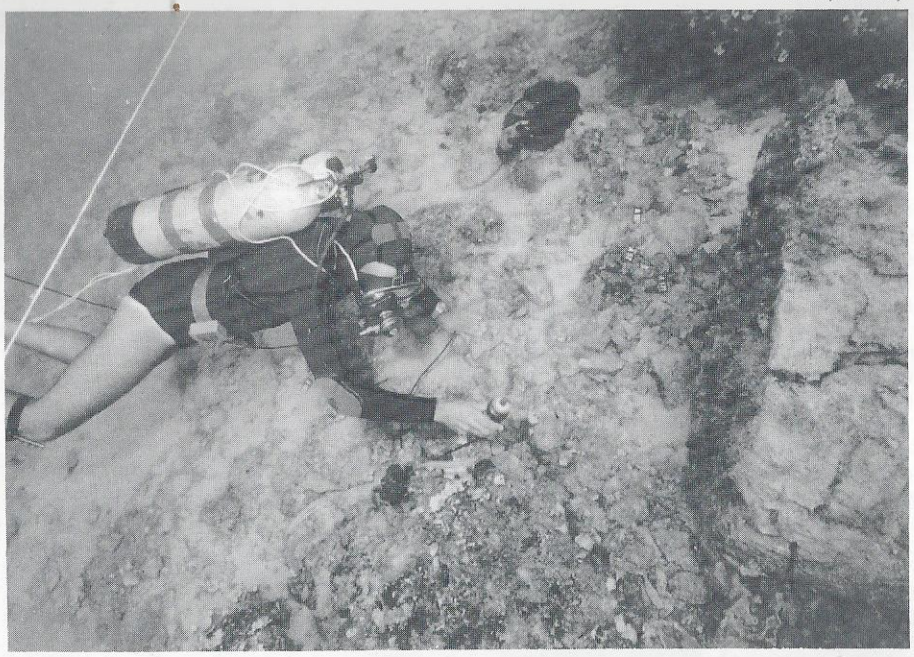


Fig. 3. Recording the position of a group of finds with the SHARPS.

The geomorphology of the bay of Skindos at Dokos (narrow, shallow inside) and the period in which the measurements were made (large diurnal temperature changes) created currents and different thermal layers, causing the refraction of the signals in some places.

There was also the possibility that the very steep gradient of the seabed would cause some reflection of the signals against physical obstructions.

Before starting to measure the positions of the finds, two points in roughly the centre of the excavation area were selected and securely marked with solidly embedded iron stakes, and their coordinates were calculated. These markers served as fixed reference points against any movement of the receivers during the course of the measurements in 1989 and will serve the same function in the next season, enabling the new reference system to be aligned with the old one.
The transmitter was fitted with a trigger, which however broke down in the first days of the trials and was not used at all for the measuring of the main area, and it was therefore not possible to check its transmission.
The method of continuous transmission to which we resorted requires the diver to be in communication with the computer operator for a longer time, because in addition to recording the description of the object (the number of the label), which is necessary with both methods, the operator also has to activate the beginning and end of the measurements by means of the computer keyboard.

Contact between the diver and the operator was by cable, using a full-face mask, which required experience and familiarity on the part of the diver. Locating the points to be measured was carried out by three divers with differing degrees of experience and specialized knowledge, and who therefore had different ways of choosing the exact point on the object from which to make the measurement, since the object was not always marked in a precise and identifiable spot.

On the other hand the positive side of this was that it gave more than one diver familiarity and experience in the technique of operating the transmitter.
The method of aiming the transmitter recommended by the makers was to rest its head on the point to be measured or to direct it at the point from some distance away.

It was soon discovered, however, that the reliability and accuracy of the system were improved when the back of the transmitter was rested on the point to be measured and the head (transducer) was pointed vertically at the surface *(Fig. 3)*. In this way the transmitter is steadier and at a constant distance from the object; thus errors due to reflections from the seabed, or to movements of the transmitter caused by the unsteadiness of the diver, or to an interruption in the signal if the diver's body comes between the transmitter and the receiver, are reduced to a minimum. The purpose of the transmitter's hemispherical head is to cover a wide area and not to allow the reception of the signals it transmits to be affected by the body of the diver carrying it. Nevertheless both the diver carrying the transmitter and the other divers moving around between the receivers while the measuring is going on can affect the reception by interfering with the path of the signals.

An increase in the frequency of the sound signal would improve the clarity of the reception and reduce the interference, but it would also reduce the distances that can be measured.

Both methods of aiming the transmitter were employed, that is with the head pointing down and with it pointing at the surface; furthermore, where the points were in hollows among the rocks, the transmitter had to be held at some distance above the object being measured in order to maintain visual contact with the receivers. Thus the measured depths can be considered reasonably but not absolutely accurate.

Mounting the transmitter on a pole from which its distance to the bottom can be measured might overcome this problem, but this would also increase the measuring time. The same method would also improve the angles of reception where the bottom shelves steeply, as it does at Dokos.

The lack of a printer connected to the computer for checking the measurements on the spot was a disadvantage. It was also felt to be a drawback that the files created by the programme are rather inadequate in terms of the amount of information they can hold, compared with the amount of information that an experienced diver can gather in a single dive at a moderate depth.

The area to be measured was laid out on the bottom with nails and cord, and the perimeter was first measured with a tape, before the SHARPS was used, in order to compare the two methods and to have a preliminary picture of the area until the SHARPS was in operation. To measure longer distances on the steep slopes with a tape it was necessary to condense the straight lines, and this was carried out rather hastily because of the shortage of personel at that particular time, with the result that there are considerable deviations between the results of the two methods.
For the lengths of the sides, which were measured twice (the lengths of the diagonals were measured only once), the results correspond. In respect of the time required on the bottom, which is an important consideration in underwater work, the SHARPS was significantly faster in measuring than the classical methods. It did, however, take a lot of time to install the SHARPS at Dokos initially, chiefly because of the nature of the bottom and the absence of previous experience in working with the system. The training of one or more regular teams would considerably shorten both the installation time and the speed of measuring, and would make it possible to make survey plans and perhaps large scale plans in many places easily and quickly.
The application of the SHARPS during this first excavation season at Dokos may be considered successful in spite of some failings. Nevertheless the system and its operation need more research, there should be more comparisons with conventional surveying methods, and more study of different methodologies and possibilities for its application that may contribute to its development and improvement.

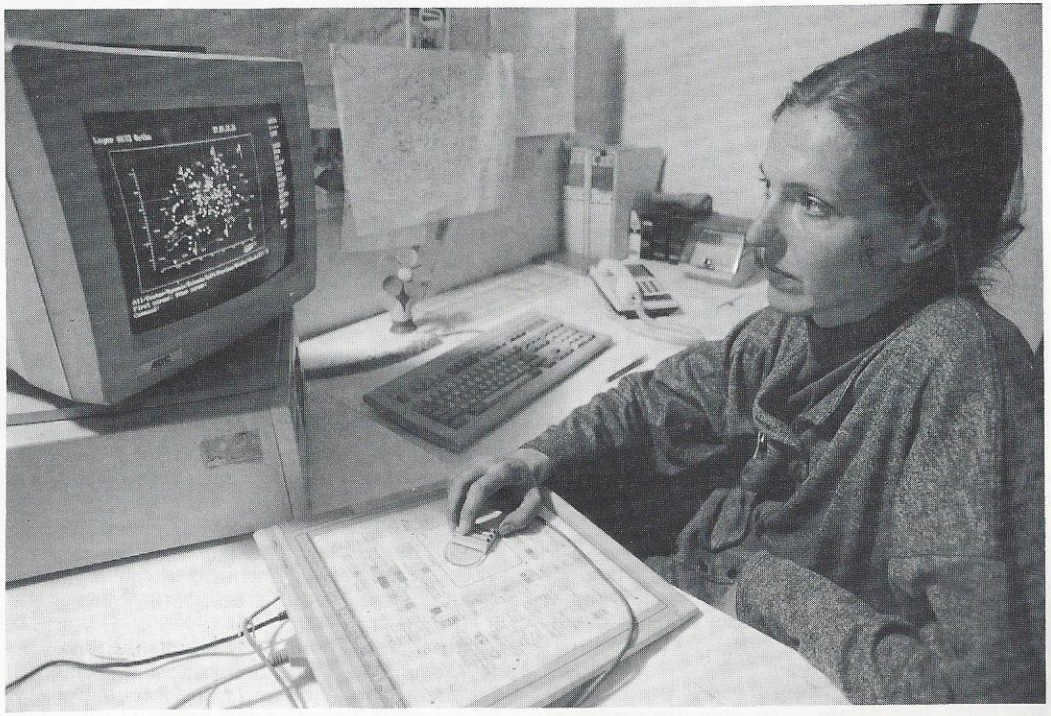
PROCESSING AND GRAPHIC PRESENTATION OF THE SHARPS DATA FROM THE 1989 DOKOS EXCAVATION

- by Marianna Teske -

Processing the SHARPS data from the Dokos excavation proved more difficult to carry out on the spot than we had anticipated. This was largely due to the fact that the guidelines given by the firm of Marine Telepresence for classifying data with the computer were insufficient, and we were thus obliged to perform this task afterwards on our return to Athens. In the end, however, our efforts to classify and process the data after the event proved useful since they gave us a better understanding of the programme, and this will help us to improve the organization of the system in the 1990 excavation season.

Here I shall briefly outline the basic problems we encountered and the ways in which we solved them.
The SHARPS transmitter transmits ten sound pulses a second, and its position is calculated from the time taken for the signals to arrive at the three receivers. When we want to fix the position of a find, the diver places the transmitter on the object and activates the

Photo: N. Danielidis



Marianna Teske processing the SHARPS data with AUTOCAD.

transmission of the sound signal by pressing a trigger. At the same time through his mask intercom the diver gives the operator of the system the reference number of the find, which the latter records in a log.

Because of the break-down of the trigger mechanism early on we had to resort to another method: as the diver-operator placed the transmitter on each find he informed the operator ashore and the latter activated the transmitter through the computer keyboard. The transmitter sends out a fixed number of impulses per second, and the position of a find is recorded in the computer each time the impulses are transmitted.

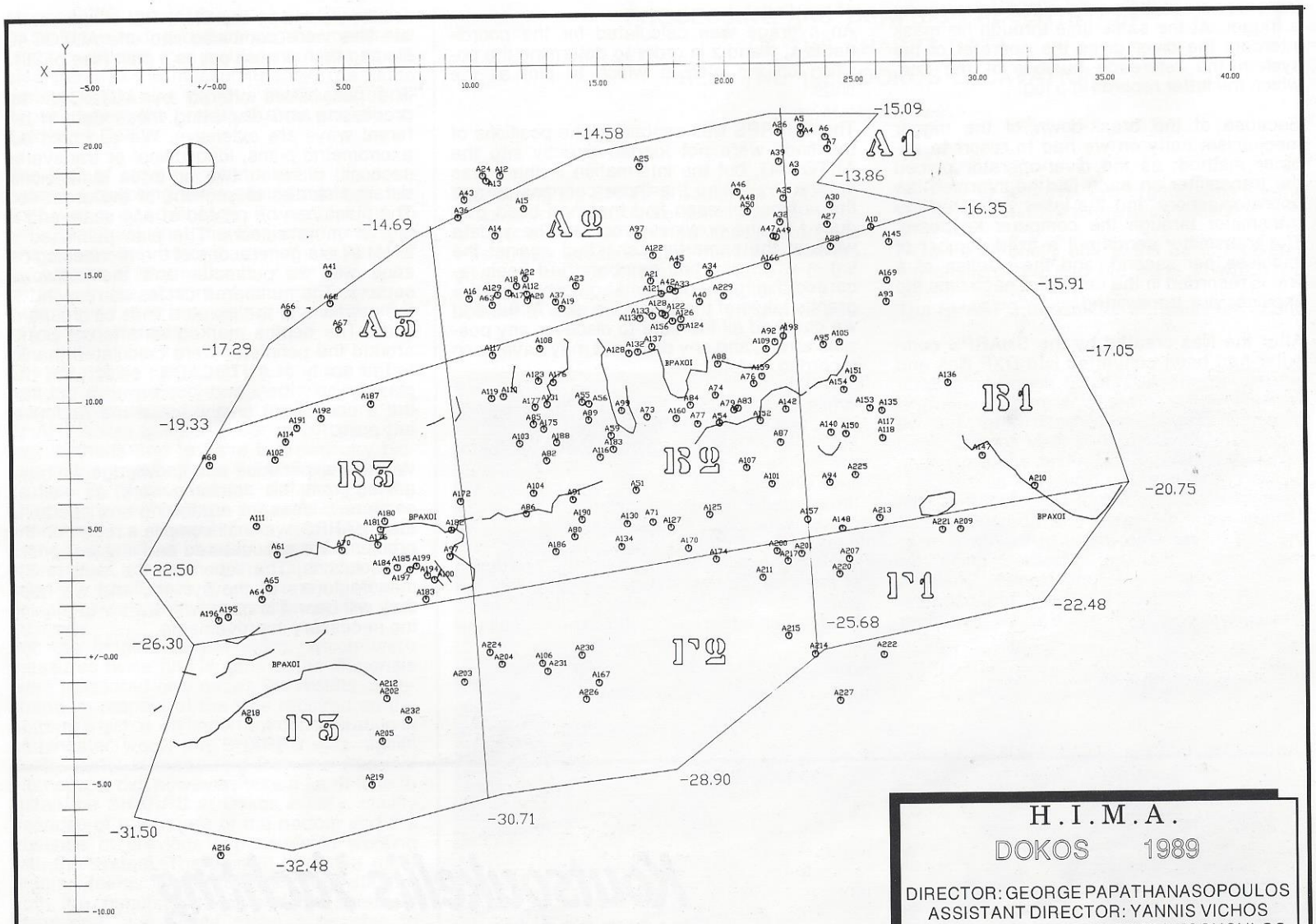
After the files created by the SHARPS computer had been converted into DXF files and loaded into the AUTOCAD programme, what we saw on the screen was an agglomeration of points, very close to each other, but we could not tell which finds they corresponded to. We then loaded these files into a common wordprocessor, which displayed all the coordinates of each group of finds together with its number. Fortunately the archives are of the ASCII type and thus the task was relatively easy, although time-consuming for Christos Doukas, who undertook it. The files had this form: TIME, x, y and z (coordinates) and, after a few lines, a line with the number of the find.
An average was calculated for the coordinates x, y and z in order to determine the position on the plan in which to plot all the finds.

The SHARPS files containing the positions of the finds were not loaded directly into the AUTOCAD, but the information in them was entered by typing the three coordinates and the number of each find that had been produced by the previous process. These data were at the same time checked against the log in which the find numbers had been recorded during the dive and against the photographs taken of the objects in situ. At the end we checked all the data to discover any possible errors, and any data that may have been recorded in duplicate.

While inserting the data from the SHARPS into the AUTOCAD through the DXF files we also entered the data relating to the perimeter line of the excavation zone and the straight lines dividing this area into nine sectors. On the computer screen the perimeter and sector cords were displayed as lines composed of many dots of the same type as those representing the finds. To improve the projection of the lines they were redefined, and only the dots forming straight lines were joined up.To produce an integrated picture showing all the results yielded by the SHARPS, all the separate files were combined into one AUTOCAD file and then printed out as a plan (see p. 28).

The possibilities offered by AUTOCAD for processing and displaying these data in different ways are extensive. We can print out axonometric plans, longitudinal or transverse sections, plans in two or three dimensions, detailed studies of sections of the area, etc. The plans can be printed at any scale and in one or more colours. The plan published in ENALIA is a general one of the archaeological zone with its perimeter and the individual sectors. The numbered circles correspond to the positions of the isolated finds or groups of finds. The depths marked at different points around the perimeter were calculated thanks to the ability of AUTOCAD to select and display not only the x and y coordinates but also the z coordinate (in this case the depth) of any point.

With the experience and knowledge we have gained from this season's work, as well as some new ideas for organizing and operating the SHARPS, we shall compile a report on the problems we encountered and suggest possible solutions. The report will be sent to the manufacturers of the system, and we hope they will bear it in mind with a view to making the necessary improvements.



H.I.M.A.

DOKOS 1989

DIRECTOR: GEORGE PAPATHANASOPOULOS
ASSISTANT DIRECTOR: YANNIS VICHOS
TECHNICAL DIRECTOR: NIKOS TSOUCHLOS

TOPOGRAPHIC PLAN OF THE
SURVEYED LIMITS OF THE SITE
AND THE POSITIONS OF THE FINDS

AUGUST/SEPTEMBER 1989

TOPOGRAPHER: VASOKYRIAKOPOULOU
SHARPS: KYLE JACHNEY
CAD: MARIANNA TESKE

THE PHOTOGRAPHY OF THE 1989 EXPEDITION AT DOKOS

- by Nikos Tsouchlos-

Photo: Kyle Jachney

Fig. 1. *Photographing an isolated find in situ.*

Photography plays a very important role at Dokos as on every excavation. Together with the other systems of recording and plotting it is another valuable tool that helps us to form a complete picture of the condition of the finds and the archaeological area before they have been disturbed. It also helps us in a vivid fashion to map the site and to make a photographic record of the installations, as well as of the progress of the work and the way in which the various tasks are carried out.

Thus at Dokos the photography had four principal aims:

1. To make a plan of the area and a record of the installations on land and in the sea.

2. To record the work on the bottom.

3. To make a photographic plan of the site and the main bulk of the finds on the bottom with the aid of a stereophotographic frame.

4. To photograph the marked feature finds while still in place, after being raised, and before and after conservation work.

The value of photographs in the first two instances is obvious: they constitute archival material for reference and viewing, as well as for instruction and education.

In the case of third aim, the use of a stereophotographic frame enables us, after the photographs have been correctly joined, to construct a simple photomosaic of the underwater site, and using the same photographs for photogrammetry, to make an accurate scale plan of the site.

In the fourth instance, photographing the individual objects enables us to know exactly where and how each object was found on the bottom after it has been raised, and to compare the object before and after conservation *(Fig. 1).*

The last two uses of photography, insofar as they overlap with the other methods of topographical surveying, are an aid in verifying data and correcting any errors, omissions and inconsistencies occurring in the other two systems.
The photographic work was undertaken by the three photographers on the excavation team: the surface photography was carried out by Nikos Danielidis, who also photographed a large number of individual finds in situ on the bottom. Kyle Jachney photographed the underwater work and some of the finds in situ, and also helped with the stereophotography, which was chiefly performed by the writer *(Fig. 2).* Yannis Vichos and the architect Nikos Lianos helped with photographing the finds.

STEREOPHOTOGRAPHIC FRAME-EQUIPMENT-MATERIAL

The frame was specially designed to be used in the particular conditions prevailing at Dokos *(Fig. 3).* As its construction was delayed we decided to build one out of cheap material in order to test it out during the first season of the excavation and afterwards, with the experience gained, to make the necessary improvements and modifications to the design and to build a new version for the future expeditions out of tough, resistant material (aluminium, plastic and stainless steel).

This first frame was made from simple iron tubing 25x25 and 30x30mm square in section. It consists of a basic frame (A) of variable dimensions with 4 adjustable legs, and it can be set up on an uneven and steeply sloping bottom while remaining parallel to the surface of the sea. The size chosen for the frame was 2x5 m, which covers an area of about 10 m.

A second variable frame (B) rested on top of frame A and moved along the 5 m axis, and a third frame (C), which supported the camera) was mounted on frame B and moved sideways along the 2 m axis. Three photographs were taken along the 2 m axis and five along the 5 m axis. Each of the photographs overlapped by about 60% as the camera moved sideways on the 2 m axis, and about 25% as it moved along the 5 m axis.

Photo: Kyle Jachney

Fig. 2. *Taking stereophotographs with the frame.*

H.I.M.A.
Stereophotographic frame

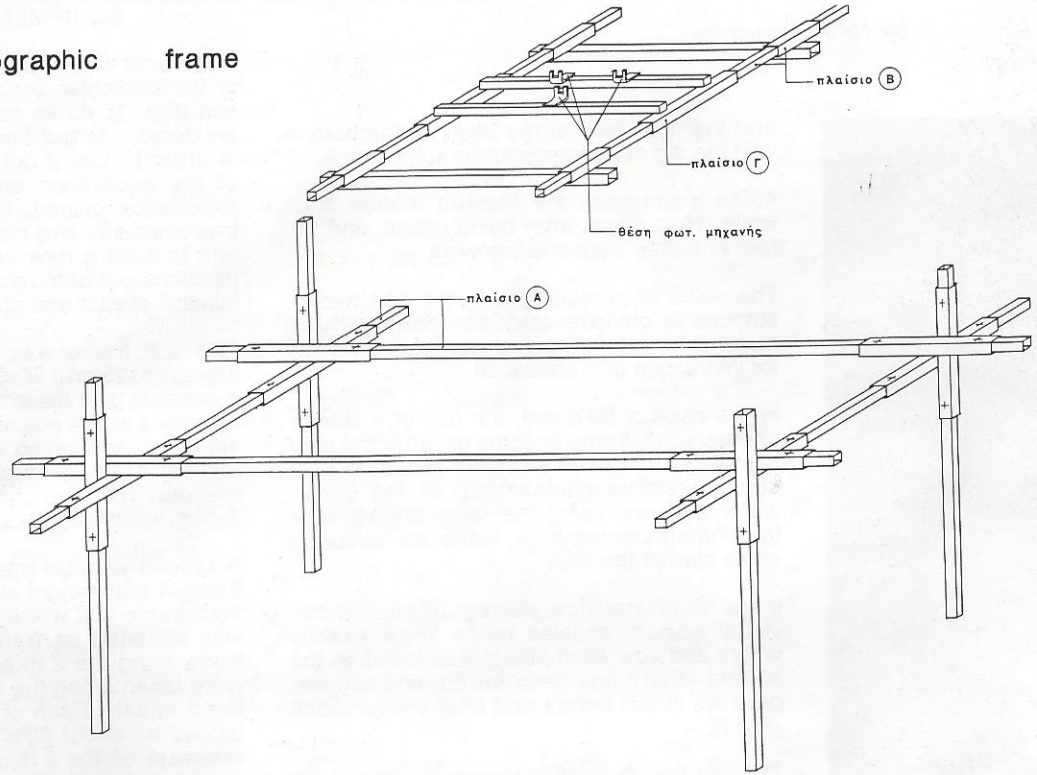


Fig. 3.

At all depths the exposures were made with the natural lighting at an average camera-to-seabed distance of 2 metres.

On the bottom below the camera were placed three rightangle scales (0.40x0.60 m), which are necessary for the photogrammetric processing of the photographs. The frame was moved 19 times, covering about 190 m with 285 exposures *(Fig. 4)*.

In order to be know exactly what area was being photographed in each new position of the frame, we recorded the position with the SHARPS.

In this way we can easily locate each of the 19 positions on the general plan of the bottom.
The camera we used on the frame was a SLR Nikon F3 with a 35 m lense, an Action Finder DA2 viewfinder, housed in a watertight Ikelite case with a domeport so that wideangle lenses could be used.

The film was black-and-white negative with a speed of 400 ASA developed at 800 ASA and gave very satisfactory results in terms of sharpness, grain and contrast.

The rest of the equipment included a SLR Canon 35 m in a Sea Eye case with various lenses and lense ports, and three underwater cameras: a Nikonos II, III and IV with a 35, 28 and 15 mm lense and an electronic Nikonos and Ikelite flash.

The film used was Kodak T Max 400 ASA black-and-white negative and colour positive Kodachrome 64, Ektachrome Prof. 64 and Ektachrome Plus Prof. 100 ASA. These also gave entirely satisfactory results in terms of sharpness amd colour rendering and balance.

To end this short note, we should like to stress that the photographic work achieved all its aims very satisfactorily and produced photographs of excallent quality.

It was also a help in elucidating some of the data relating to the exact positions of the finds during their preliminary classification and inspection.

Εικ. 4. *Photo: N. Tsouchlos*

DOKOS WRECK: PHOTOMOSAIC NUMBER 1.

The photomosaic is made up of photographs taken with a succession of exposures from the frame's first position. The shoreline is at the bottom of the photomosaic. Because of the different distances of the camera from the bottom, owing to the steep gradient of the seabed, the objects under the frame appear in different scales. As a result, to assemble the photomosaic, the photographs converge at the top to make the positions of the objects coincide. Hence the fan-shape of the photomosaic.

In each of the photographs the rectangular frames with scales can be seen; these are used in conjunction with a stereoscope to construct the photogrammetric plans.

Group of Early Helladic finds on the bottom.
Part of a spouted bowl can be seen (photo: Kyle Jachney).

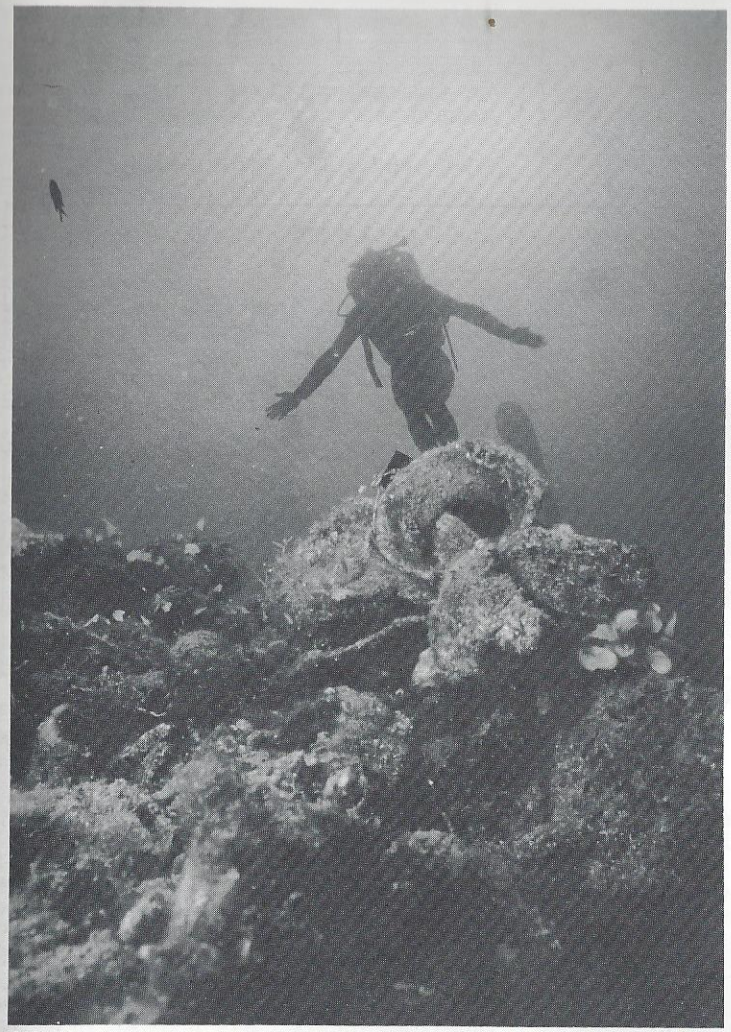


Photo: Kyle Jachney

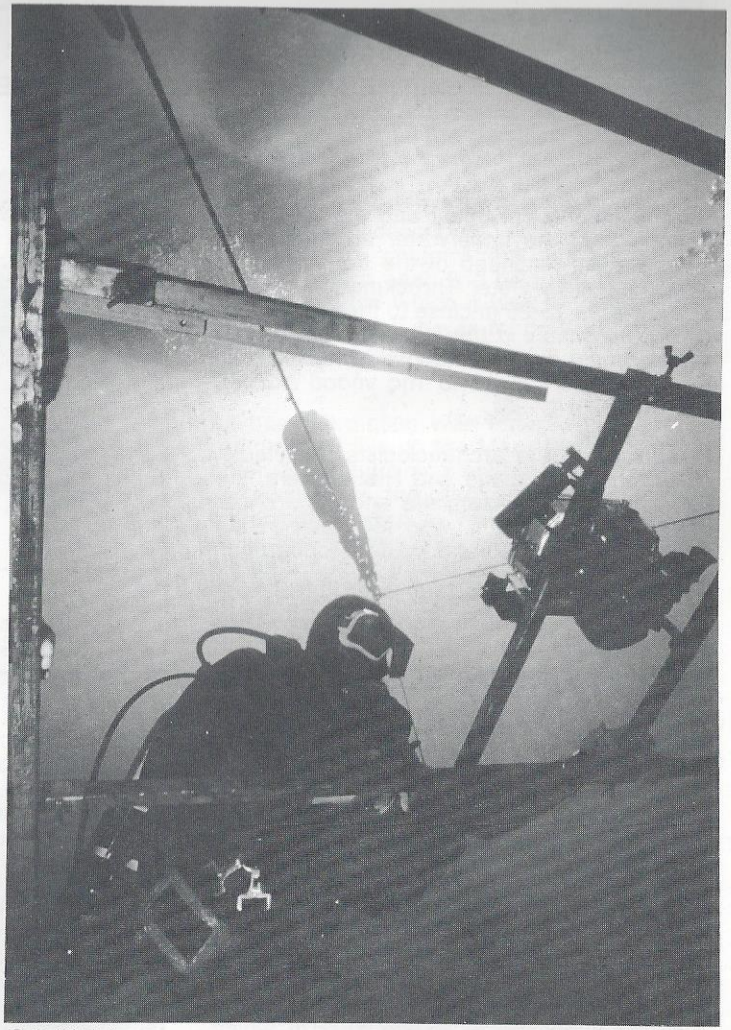


Photo: Kyle Jachney

Shots of the Dokos expedition in the summer of 1989.
Left, a diver of the HIMA team appears behind the neck of an Early Helladic amphora concreted to the rocks.
Right, Nikos Tsouchlos prepares to take a photograph from the frame.

DOKOS EXCAVATION '89
• THE EARLY HELLADIC WRECK AT DOKOS
• THE PREHISTORIC SETTLEMENT

- by George Papathanasopoulos -
Honorary Ephor of Antiquities

Between the 20th August and the 20th September 1989 the underwater archaeological investigation continued of the Early Helladic wreck found by Peter Throckmorton in 1975 at a depth of 15-25 m close to the promontory of Myti Kommeni in the little northern bay of Skindos (see Γ. Α. Παπαθανασόπουλος, "Το Πρωτοελλαδικό Ναυάγιο της νήσου Δοκού", ΑΑΑ 9 (1976) 17-23).

In addition to the archaeologists, architects, surveyors, technicians and HIMA divers, the surveyor Kostas Kazamiakis and the archaeologist Yianna Galani, who took part in the expedition, surveyed and made a topographical map of the area.

The first map had been made in August 1975 by E. Yialouris and V. Jensen, and a second one, showing the limits of the prehistoric settlement and the site of the wreck, was produced in November of that year by two topographical students, Lefteris Tsavliris and Vasilis Vitalis.

Using the new SHARPS plotting system (see the article above by V. Kyriakopoulou) a total of 1381 finds were located, plotted, raised and taken to the Spetses Museum for conservation and keeping.

As can be seen on the plan (p. 28), the main body of the finds was in area B of the delimited zone, and more particularly in sector B2, at a depth of between 16.35 and 20.75 m, which is probably the exact spot where the ship sank. On the plan the positions are marked of 205 separate pots and groups of pots or sherds that were visible on the surface of the seabed inside the delimited zone.

To facilitate the work of plotting, this area was divided into nine sectors (A1, A2, A3, B1, B2, B3, C1, C2 and C3), whose irregular shapes were dictated by the morphology of the bottom and its steep gradient.

The first conclusions from a preliminary scrutiny of the evidence from the excavation are limited and put forward with due reservations, because the finds in the Spetses Museum have not yet been studied and the excavation is not yet over.

Photo: N. Tsouchlos

Fig. 1. Dokos. Early Helladic sauceboats.

Our original opinion after the 1975 investigation has been fully confirmed, namely that the find represents the cargo of an Early Helladic ship and is therefore the earliest concrete evidence for the existence of maritime trade in the Early Helladic II-III period. The wreck, dating to around 2,200 BC is consequently the oldest shipwreck hitherto known in the Aegean and possibly in the world. An important aspect of the wreck is that the finds so far recovered constitute the largest closed body of material from the EH period. The clay vases are estimated to number more than 500; they include many of the curious deep spouted vessels known as sauceboats in a variety of different shapes and sizes, as well as cutaway jugs, shallow and deep bowls, also in a variety of different shapes and sizes, amphorae, plates, cups, jars, askoi and pithoi, and household utensils, querns and grinders *(Figs. 1, 2)*.

Of interest are the clay spit supports and the brazier *(Figs. 3, 4)* that were found at the site of the wreck, utensils for everyday household use. The existence of such a large number of finds, and especially the pottery, all together at the moment when the ship sank, has great archaeological importance and can make a significant contribution to the study of EH pottery and of the EH culture in general.

A preliminary examination of the pottery and an inspection of the many sauceboats, from the smallest to the largest examples, with their distinctive projecting spouts, suggest that typologically they belong to the same type of sauceboats as those from Askitario (A.E. 1953-1954, 69, figs. 8-10, pl. 1), which are among the finest examples of Attic pottery in this period (for the shape, compare the sauceboats from Lerna in the Argolid, Lithares in Boeotia and those from the Cyclades). It is to be hoped that after all this closed material has been studied we may be able to identify the provenance of this elegant vessel, whose function may have been cultic.

If my view is confirmed that the Dokos sauceboats originated in Attica, then the position of the wreck can be seen to lie directly on the maritime trade route from South Euboea to the Saronic and Argolid gulfs, at the end of which was the great Early Helladic centre of Lerna.

The importance of the wreck, however, is enhanced by other finds: two fragments of the same lead bar, found among pottery sherds, might also point to an Attic provenance for the pottery, if an analysis of the lead showed that it came from Lavrion, because we know that ore was already being mined there in the EH period.

Two primitive stone anchors were also found, at a distance of forty metres from the wreck and in deeper water, precisely on the line the ship would have taken after entering the bay. This suggests that the anchors may have belonged to the EH ship and been dropped just before she sank, in which case they would also be Early Helladic in date.

When we have finished the excavation, which we hope will uncover at least some part of the ship itself, we are confident that many of the fragmentary pots that we have raised can be mended and that it will be possible to restore their complete profiles.

What we already know, however, is that the pottery from the wreck includes most known EH pottery types.

Perhaps we may imagine a wealthy Early Helladic shipmaster taking on board a cargo of pottery and querns from Attica or Euboea and sailing south to sell or barter them to the folk who lived in the EH settlements on the shores of the mainland (Ermioni, Franchthi, Lerna, etc.) and on the islands (Dokos, Spetses) in the Gulf of Argolid.

If the thousands of obsidian blades, chiefly from Milos, that have been found at every Neolithic and Early Helladic site in Greece, on the mainland and the islands, are clear evidence of seafaring in this distant past (7000-2000 BC), then the cargo of the EH ship that was wrecked by the entrance to the small inlet on the island of Dokos may be considered tangible proof of sea trade in Greece and the oldest seafaring document so far to emerge from the floor of the Aegean sea.

On the 21st September the finds brought up from the wreck were taken by the writer with the approval of the Central Service of the Ministry of Culture to the Spetses Museum, which was the nearest in the region.

They were stored in two rooms of the Museum under the care of the museum personnel and appropriate measures were taken for

Photo: N. Tsouchlos

Fig. 2.
Dokos. Handle and part of the neck and body of an EH jug.

Photo: Y. Vichos

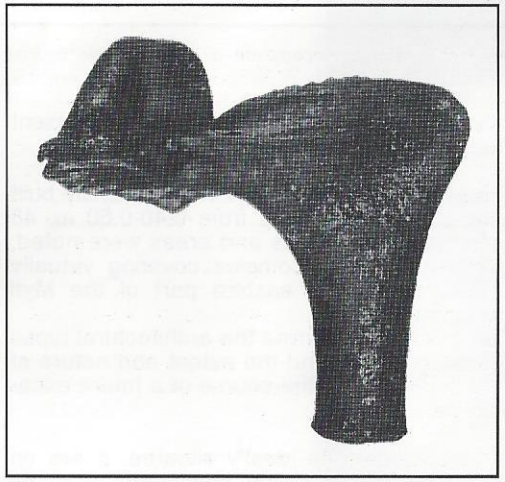


Fig. 3. *Dokos. Part of a clay spit support.*

their conservation until the systematic work of cleaning and restoring them can begin.
The first inventory of the finds was made on the spot with the help of the archaeologists Elpida Hadzidaki and Ioanna Vourexaki, and it was completed in the Spetses Museum by Yannis Vichos and Yannos Lolos.

In the end a total of 1381 finds were inventoried and briefly described.
The inventory contains the number of the group to which each find belongs, the sector of the site from which it was recovered, the date, the material it was made from, a provisional chronological attribution and a short description.

All this information was entered in the programme MS File on the Macintosh Plus computer. This programme enables the finds to be sorted in ascending order according to the archaeological stratum or sector where they were found, their chronology, the date they were raised and even according to the kind of each find. These data can be supplemented at any time during the study of the finds using the same programme or another one more suited to our needs.
For the conservation of the finds it was decided with the Directress of the 1st Ephoria of Byzantine and Postbyzantine Antiquities, Mrs Lela Manolesou, to set up a fully equipped conservation laboratory in a suitable location in the Spetses Museum.

For this purpose a grant of 900,000 drachmes to the 1st Ephoria was approved by the Administrative Committee of TAPA on the recommendation of the writer. Part of the cost of establishing and operating the laboratory had already been met by HIMA.

As the excavation continues and conservation work on the finds progresses, a detailed programme will begin for photographing and drawing them; this is indispensable in order to study the material properly.

THE PREHISTORIC SETTLEMENT

At the same time as the underwater excavation, a surface survey was carried out on the headland of Myti Kommeni on the north side of Skindos bay.

The extensive EH and Mycenaean settlements in the area behind the head of Skindos bay, which were discovered in 1975 and in-

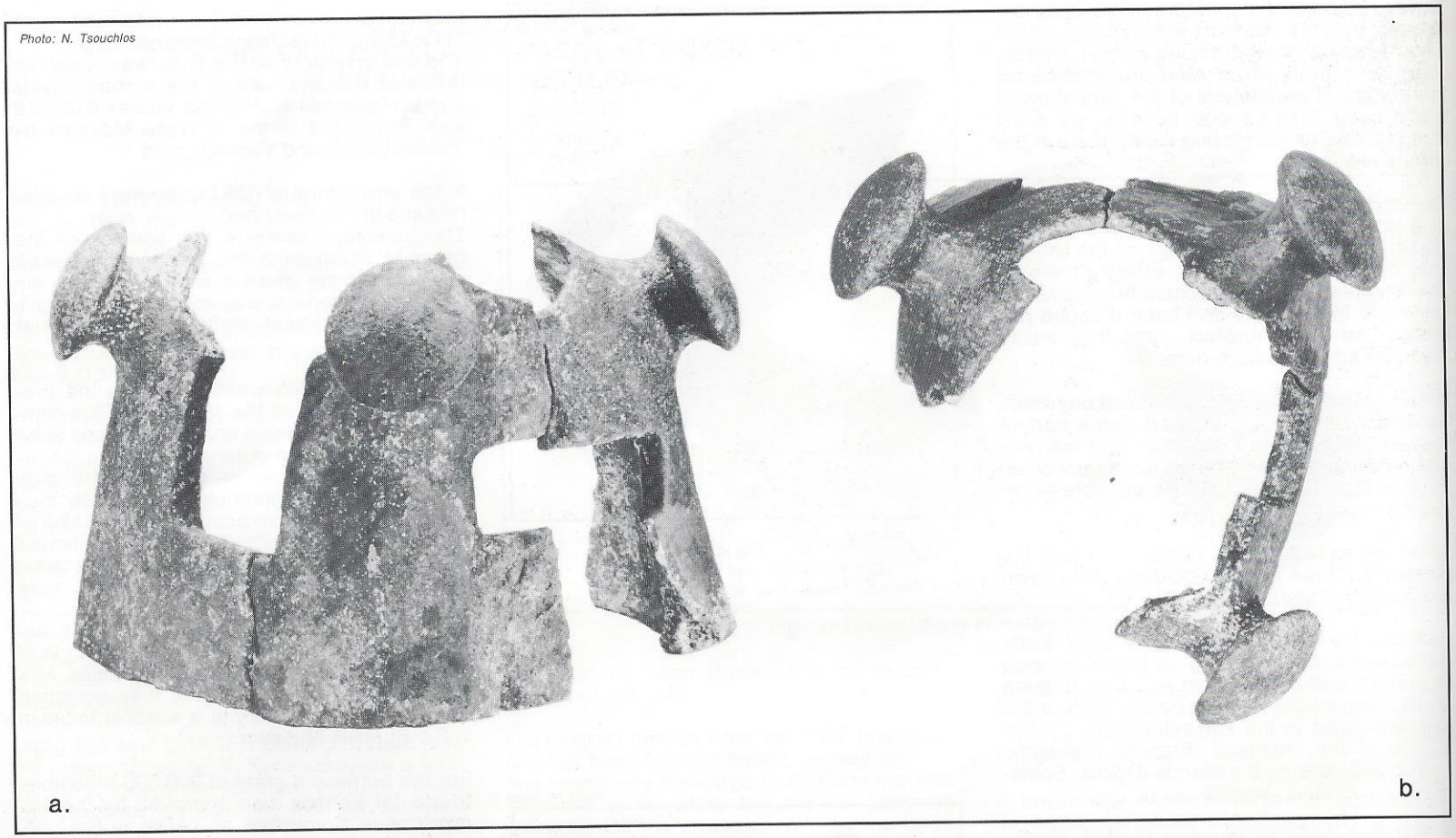


Fig. 4. Dokos. Clay brazier, incomplete. a: from the side, b: from above.

vestigated superficially in 1989, have been overshadowed by the more spectacular EH wreck.

The depth of soil on the headleand is minimal to nonexistent; the rockfalls and strong winds, chiefly from the north, have eroded the soil and destroyed the remains of the buildings on the neck of the long thin promontory, where the densest part of the prehistoric settlement was.

The building remains of the rectangular or square rooms and areas, whose lower parts, at least, were stone-built, rectilinear in plan and large in size, were visible and could be traced on the surface even before the removal of the quantities of small stone fragments that covered the ground between the ancient foundations and the rocks *(Fig. 5)*.

The walls of the buildings were carefully built and their width varies from 0.40-0.60 m. 48 small and larg rooms and areas were noted, forming a dense complex covering virtually the whole of the eastern part of the Myti Kommeni point.
We hope to determine the architectural types of the buildings and the extent and nature of the settlement in the course of a future excavation.

The settlement is ideally situated. It lies on the sea route already mentioned; from its center, and even better from the top of the steep hill that rises almost vertically southeast of the bay, there is a view of the Hydra strait to the northeast and the Dokos strait to the southweat leading to Spetses and the Gulf of Argolid.

The settlement is secure, protected naturally by the steep rocks on its northern side, along which a fortification wall was built in the Mycenaean period, and it has a harbour sheltered from the north. The south side of the settlement facing the harbour does not appear to have been fortified, although there is a wide stepped area, on the east side of which there may have been a tower-like structure.

The underwater excavation of the Early Helladic wreck at Dokos has proved very successful and has yielded important results.

Photo: K. Toutountzides

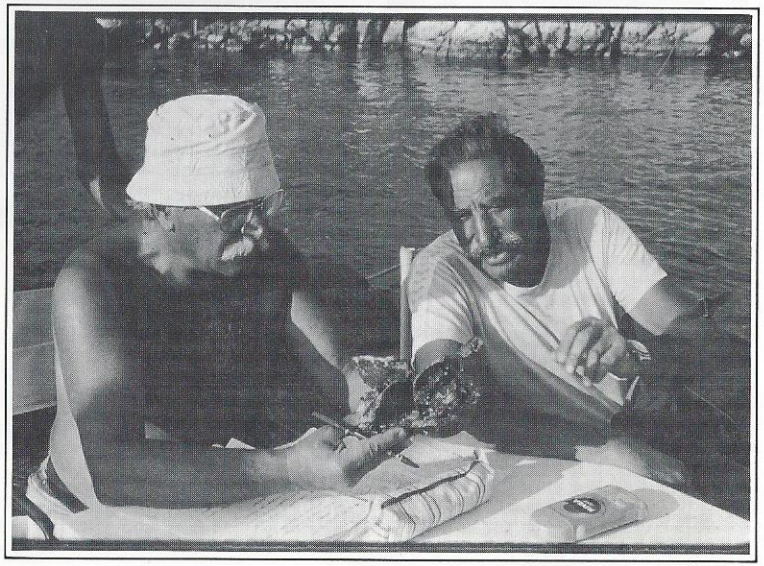
Fig. 5.
Dokos. Promontory of Myti Kommeni. Prehistoric building remains after cleaning.

This success is due to the people in charge of the different sections of the excavation and to all the members of HIMA who made up the team and who carried out the difficult job responsibly and seriously.

I would like to thank the general secretary of the Ministry of Culture, Makis Trikoukis, for his assistance in the enterprise, the head of the Nafplion Ephoria, Mrs Fani Pachiyanni, for permission to make the land survey on Dokos, and the head of the 1st Ephoria of Byzantine Antiquities, Mrs Lela Manolesou, for her collaboration over the conservation of the finds in the Spetses Museum, in which matter the contribution of the Museum personnel under Mrs Kanella Skantzou must be mentioned. Finally I should like to thank the journalist Mr Adonis Kyrou, who is deeply versed in the history and archaeology of the region, for his valuable archaeological information and for pointing out the antiquities on the island of Dokos.

The director of the excavation, George Papathanasopoulos, and Nikos Tsouchlos examining finds from the wreck just after they were raised.

Photo: Kyle Jachney



DOKOS 1989: DIVING ORGANIZATION

- by Phaedon Antonopoulos -

On the 21st of August we arrived at the site on Dokos above the wreck where we were to spend the next 30 unforgettable and for some of us exciting days.

The idea we had formed of the wreck from previous inspections proved somewhat different from reality, as we discovered in the course of the excavation. The size of the wreck site, for example, and the quantity of finds were greater than we had thought. The bottom at this point is a duplicate of the terrain above water, equally inhospitable and rugged.

The first dive was made on the 26th of August and its purpose was to delimit the visible archaeological zone. This has an area of 690 m with a least depth of 13 and a greatest of 30 m, and the gradient of the bottom is about 60%. This was the place in which 40 people had to dive and work underwater with complete safety and security.

Our primary concern was for the safety of the diving. A very strict programme was devised in conjunction with all the safety means at our disposal. For the whole of the thirty days the naval operations chamber, the decompression chamber at the naval base and a helicoper were in a state of operational readiness.

Φωτ. Kyle Jachney

Fig. 1. *The floating platform over the wreck from which the diving was supervised. In the background, the tank filling station.*

A floating platorm (Jet-Float), 36 m in area, was moored approximately over the centre of the wreck zone; it had two permanent decompression stops at depths of 3 and 6 m constantly equipped with full bottles *(Figs. 1 and 3)*. There was also a speedboat at the ready tied up to the platform. Every dive had an obligatory three minute decompression period, and as a matter of rule was programmed within a zero time limit. In very few cases and only when necessary were the limits exceeded, and then only by experienced divers.

The bottom teams always included at least one experienced diver *(Fig. 2)*.

Each dive was undertaken for a particular purpose in a particular spot and with a particular object, except for the inspection dives and those made to measure the perimeter.

All dives were measured to their maximum depth + one meter and the duration was the maximum + one minute. This had the effect of reducing the net working time, but the loss of time was unavoidable and imposed by the need for all the dives to have a large safety margin.

When there are twenty people diving each day in repeated dives totalling an average of seven hours a day, the statistical chances of an accident increase, and ways have to be found of reducing them. If we had a surface-diver-surface intercom system and a closed circuit television to watch the work underwater, and the support of a decompression chamber for 3-4 persons, the diving times could be appreciably increased, and this is in fact something we are working on for 1990.

In 25 days 386 dives were made, which translates into about 175 man-hours or 7.5 hours per day, without an accident. A few minor problems were caused by some of our members turning up who had not been included in the diving programme. Unfortunately in some cases we were unable to take advantage of their offers of help because of the strict programming. Any changes in this posed risks for the repeated dives.

We hope that in the 1990 excavation season at Dokos the programme will be more flexible. From the table it can be seen that the greatest percentage of the time was spent in the stereophotography, which took up about 25% of the total diving time. Next came the raising of the finds, with 12%, and the work with the SHARPS, with 11%. The SHARPS took up a considerable time because it was the first time we had worked with it and time was lost in learning and calibrating the system.

The 1990 season at Dokos will last for 45 days. The projected work will include trial

Photo: Kyle Jachney

Fig. 2. Ascent of a pair of divers to the decompression stop.

trenches and excavation of the bottom. Forty-five days will mean, on the basis of last year's data, an increase in diving time in the order of 60%-80%.

Therefore the safety measures and diving programming must be adjusted accordingly. We are already negotiating for the use of a closed circuit television and an intercom system supported by a computer, always having in mind that the safety of the divers comes first.

Fig. 3. Divers at the 3 m decompression stop.

Photo: Kyle Jachney

WORKING DIVING TIMES FOR THE FIRST SEASON AT DOKOS

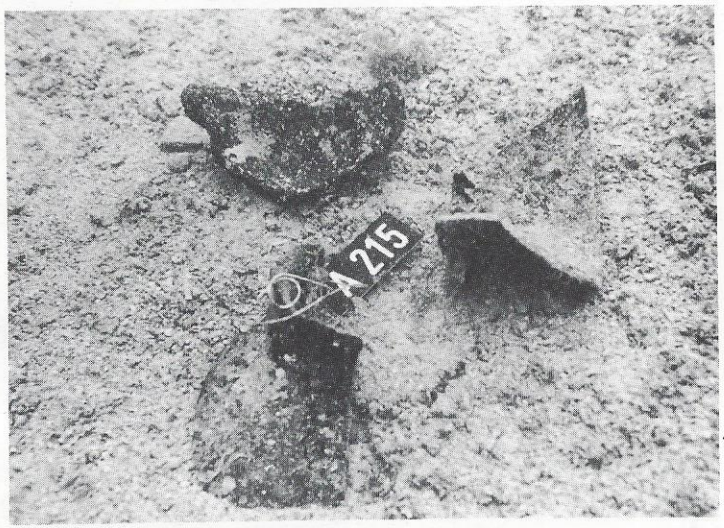
WORK	MIN.	MAN/MIN	%	HRS
RECONNAISSANCE	56.00	90.00	00.86	01.50
MARKERBUOYS	55.00	140.00	01.30	02.33
INSPECTION	50.00	125.00	01.20	02.08
PHOTOREPORTAGE	58.00	76.00	00.73	01.27
BOUNDARYMARKERS	30.00	60.00	00.57	01.00
PERIMETER	25.00	75.00	00.72	01.25
HORIZONTAL MEASUREMENTS	28.00	84.00	00.08	01.40
DIAGONAL MEASUREMENTS	140.00	360.00	03.40	06.00
INSTALLATION OF SHARPS	116.00	232.00	02.20	03.87
SHARPSDEPTHS	25.00	50.00	00.48	00.83
COLOURPHOTOGRAPHY	3.19	710.00	06.80	11.83
SITE CLEANING	30.00	270.00	02.60	04.50
PERIMETER WITH SHARPS (A)	62.00	124.00	01.20	02.07
SHARPSDISTANCE	60.00	120.00	01.20	02.00
BOUNDARYROPES	81.00	244.00	02.30	04.07
STAKES FOR THE ROPES	16.00	48.00	00.46	00.80
TESTING SHARPS	55.00	110.00	01.10	01.83
PERIMETER WITH SHARPS (B)	36.00	57.00	00.54	00.95
LABELS	350.50	761.00	07.30	12.86
SHARPS POINTS	516.50	1054.00	10.00	17.57
ANCHORS	126.00	252.00	02.40	04.20
PHOTO GRID NO. 1	37.00	148.00	01.40	02.47
MARKINGFINDS	132.00	287.00	02.70	04.78
GRIDMOVING	60.00	330.00	03.20	05.50
GRIDMOVING	281.00	843.00	08.10	14.05
PHOTO GRID NO. 2	281.00	562.00	05.40	09.37
PHOTO GRID NO. 3	289.00	867.00	08.30	14.45
CLEANING	254.00	486.00	04.60	08.10
B/W PHOTOGRAPHY	118.50	237.00	02.30	03.95
SHARPSPERMPOINT	35.00	70.00	00.67	01.17
GRIDEND	7.00	21.00	00.20	00.35
RAISING	532.00	1280.00	12.00	21.42
SHARPSEND	25.00	100.00	00.96	01.67
ROPESEND	34.00	68.00	00.65	01.13
MOORINGSEND	18.00	36.00	00.34	00.60
VIDEO	88.00	88.00	00.84	01.47
TOTAL	**4426.50**	**10470.00**	**100.00**	**174.50**

PLANNING THE 1990 EXCAVATION PERIOD

The 1990 season at Dokos is planned to start at the end of July and to last for six weeks. It is expected that the same means and methods will be used as in the last season.

The excavation budget amounts to approximately the same as last years's. The excavation team will consist of the same number of scientists, technicians and divers, but will be better organized in terms of time.

Last year's experience has shown how many members and what kinds of specialization the team needs for the different phases of the work.



The group of finds labelled A215 in situ

The main purpose of the 1990 season will be to ascertain the depth and full extent of the archaeological zone and then to excavate it. Two or more trial trenches will be made using an airlift inside and outside the 1989 excavation zone to discover how deep the finds go and how far they extend beneath the sand.

All the finds will be plotted with the SHARPS and photographed in situ.

The excavated area will then be stereophotographed with a camera from a stereophotographicframe.

The tubular iron frame used in 1989 will be replaced by one made from solider and more rigid material.

The nine sectors into which the area delimited in 1989 was divided will be subdivided into smaller sectors. The subsequent stratigraphic soundings with the airlift will be carried out sector by sector.

In the coming season video and cine films will be made of all the underwater work and the principal activities on land.

All finds will be inventoried on the spot and at the end of the excavation taken to the Spetses Museum.

Next season it is hoped to discover whether or not any part of the ship has survived.
Also in 1990 the work of conserving the finds will proceed and the work of mending, restoring, drawing and photographing all the feature finds will begin.

There will be a full graphic presentation of the plotting of the new finds in relation to the positions of the finds found on the seabed in 1989. The method of plotting with the SHARPS makes it possible to align the plans showing the positions of the finds at any depth below the sand, as long as the reference points used for the system are located in exactly the same positions for the whole excavation period.

In 1990 it is also proposed to organize and carry out an excavation of the prehistoric settlement on the land.

Lastly, the results of the 1990 season will be published in "ENALIA".

THE SPETSES MUSEUM WHERE THE DOKOS FINDS ARE KEPT

The island of Spetses is better known for its natural beauty and the part it played in the 1821 war of independence than for its history in antiquity. Nevertheless, apart from its picturesqueness and the monuments of more recent periods, there are archaeological remains on Spetses going back to the 3rd millennium BC.
At Ayia Marina an Early Helladic and Mycenaean site was discovered by the journalist and authority Adonis Kyrou, a small part of which was excavated by the archaeologist D. R. Theocharis (see the Archaeological Deltion for 1971). Another prehistoric site has been found on the island at Ayia Paraskevi.
The Spetses Museum, which is administered by the 1st Ephoria of Byzantine Antiquities, houses and exhibits important examples of the island's cultural history.
Under the authority of the directors of the Dokos excavation, rooms in the Museum were fitted out by HIMA with a modern laboratory to treat and conserve the finds from Dokos.
The interest of the Spetses Museum lies in the fact that in its rooms, which preserve their old style and furnishings, it houses representative examples of the island's history. The traditional building harmoniously unites the archaeological finds and the island's historical legacy, and its rooms and exhibits are displayed in a manner especially welcoming to the visitor.
The Ministry of Culture's department of publications has recently published a short guide to the Museum in Greek and English.
The text is by Haris Koilakou of the 1st Ephoria of Byzantine Antiquities; it was edited by Evangelia Kypraiou and translated by William Phelps. The facts given below are taken from the guide.
The Museum is housed in the mansion of Hadziyannis Mexis which was built between 1795 and 1798. It is a three-storeyed building built around three sides of a courtyard.
The arched porticos and two tall flights of steps in the front give it a lightness of appearance.
The private apartments of Mexis were on the ground floor. In the right-hand wing are three connecting rooms with the strongbox in the middle. It was probably here that Mexis paid the sailors who worked on his ships.
These 3 rooms house the finds from the Dokos wreck that were raised in the 1989 season, and the laboratory has been installed here.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DONORS AND SUPPORTERS OF THE DOKOS EXPEDITION IN 1989

The donors and supporters of the first underwater archaeological excavation at Dokos, which was carried out by the Hellenic Institute of Marine Archaeology between the 20th August and the 20th September 1989, came chiefly from the private sector, although help was also forthcoming from public authorities. The following is the list of their names:

I. F. Kostopoulos Foundation, through its president, Yannis Kostopoulos, donated 5,000,000 drch.
The Hellenic Navy and the Underwater Demolition Unit lent us personel and material from the UDU.
Andreas Potamianos of the "Epirotiki Lines" lent his yacht "Pnoe" as living quarters for the excavation team.
The loan is estimated to be worth more than 4,000,000 drch.
The companies "Shell Company (Hellas Ltd)" and "Shell Chemicals (Hellas Ltd)" each donated 500,000 drch.
Vasilis Konstantakopoulos of the "Costamare Shipping Co." donated the sum of 500,000 drch.
The Union of Greek Shipowners donated 500,000 drch.
The Greek Aspropyrgos Distillery donated 500,000 drch.
The National Bank of Greece donated 400,000 drch.
Konstantinos Nizamis of the "Greek Diving Centre" lent the expedition a boat, trained personel and mechanical equipment. The worth of his offer is estimated at 1,500,000 drch.
George Livanos's "Hydrofoil Joint Service" supplied tickets worth 600,000 drch.
The technical company of "Koutsourakis-Eleftheriadis EPE" lent technicians and material for the construction of the installations on Dokos. The offer is estimated to be worth 500,000 drch.
Aristotelis Papadakis of "Asso Divers" supplied us with a boat and diving equipment. His offer was worth 1,000,000 drch.
The company "BP Greece Ltd" donated 200,000 drch.
The insurance company "Nasco Hellas EPE" insured the members of the team and the equipment free of charge.
Ed Moore lent a speedboat for the period of the excavation.
"Kodak (Near East) Inc." offered photographic material and film worth 154,000 drch.
The company "A. Pallis A.E." supplied graphic and printing material free.
"Tag-Heuer Hellas" lent precision stopwatches and electronic equipment.
The cultural organisation "Panorama" lent and continues to lend the use of space on its premises for the HIMA offices.
The Harbour Authority put a patrol boat at our disposal for the reconaissance survey in May 1989.
The Ministry of Health, Welfare and Social Security lent us a tent.
The firm of "Elais" provided food.
Dimitrios Pavlatos provided fuel.
George Panagopoulos donated a professional refrigerator.
The company "Meli Inrteriors" organized free of charge a reception at the presentation of the first results of the excavation at the Acropolis Centre of Studies.

Without the warm interest and material support of all these donors it would have been impossible to carry out the excavation.

The team that took part in the expedition at Dokos in the summer of 1989 consisted of nine persons responsible for the different sections of the excavation and of another thirty-six participants who took turns. Of the forty-five in all who took part in the expedition, thirty-three were members of HIMA.

Those in charge of the separate sections were:

- Archaeological director of the excavation: Dr George Papathanasopoulos
- Archaeological assistant director of the excavation: Dr Yannis Vichos
- Deputy archaeological director of the excavation: Dr Elpida Hadzidaki
- Technical director of the excavation: Nikos Tsouchlos
- In charge of surveying: Vaso Kyriakopoulou
- In charge of diving: Phaedon Antonopoulos
- In charge of mechanical equipment and everything afloat: Dimitris Papadas
- In charge of photogaphy: Nikos Tsouchlos
- In charge of coordination and supplies (Ermioni): Achilleas Lagopatis
- In charge of the Athens office: Irini Antonopoulou

The other members of the team were:
- Haralambos Kritzas, Director of the Archaeological Ephoria at Heraklion
- Ioánna Vourexaki, archaeolgist
- Katerina Delouka, archaeologist
- Alexis Kourtezis, archaeologist
- Yanna Galani-Kazamaki, Min. of Culture archaeologist
- Dr Catherine Aubert, archaeologist
- Vasilis Koniodoros, Min. of Culture architect
- Nikos Lianos, Min. of Culture architect
- Aristotelis Papadakis, surveyor
- Yannis Baltsavias, architect
- Dimitris Farmakidis, architect
- Komninos Diamantaras, architect
- Marianna Teske, architect, responsible for the Autocad programme
- Kostas Kazamiakis, architect Min. of Culture, surveyor
- George Koutsouflakis, student of archaeology
- Thanos Aronis-Webb, student of archaeology
- George Valvis, student of archaeology
- Kyle Jachney, SHARPS trained, photographer
- Nikos Danielidis, photography instructor
- Edward Moore, computer specialist
- Christos Doukas, computer specialist
- Kostas Nizamis, technician, diver
- Yannis Karavas, diver
- Yannis Garras, diver
- Markos Garras, diver
- George Kastel, technician, diver
- George Masselos, diver
- George Antonopoulos, diver

The following eight officers, petty officers and divers of the Naval Underwater Demolition Unit took part:

- Vangelis Apostolakis, lieutenant, jumior commandant of NUDU
- Nikolaos Yeorgopoulos, sublieutenant
- Komninos Tsioros, petty officer
- Panayotis Tsatsos, petty oficer
- Spyros Konstantinidis, sailor

The video recording of the underwater work was made by Christos Pozidis, and Manolis Bantouvas was in charge of the tow boat for part of the time.

VISITORS IN THE 1989 SEASON

During the course of the excavation the site was twice visited by the Education Minister Anna Psarouda Benaki, and Linos Benakis, the General Secretary of the Ministry of Culture Makis Trikoukis, the Mayor of Hydra Mr Saitis and the journalist and authority Adonis Kyrou.

The site was also visited by the following foreign archaeologists, who also dived during the excavation: the Israeli professors Elisha Linder, Avner Raban and Yakoov Kahanov, the English pioneer of underwater archaeology Honor Frost, the English Archaeologist Mensun Bound and the archaeologist Lucy Blue.

Visits were also made by Michalis Perratikos together with Konstantinos and Anna Grammenos and also Manolis and Mika Kontelis.

We shoulkd like to thank warmly the head of the Hellenic Navy Leonidas Vasilikopoulos and the commodore of the fleet Timotheos Masouras for their support, as well as the officers Dimitris Lagarias and Spyros Kopitsas, who enthusiastically coordinated the arrangements for the participation of the Hellenic Navy in the Dokos excavation.

We should also like to give special thanks to our member Achilleas Lagopatis, who with great dedication managed the difficult and often thankless task of supplying the team on Dokos with all the necessities and ensured our communications with Ermioni and Athens.

We also thank for his support before, during and after the excavation the former Minister of Shipping Antonis Dentidakis, the directress of the Ephoria of the Acropolis, Evi Touloupa and the personel of the Acropolis Centre of Studies, the Π.Ο.Ι.Α.Θ and Mr and Mrs V. Chadzimikes.

Lastly, we thank the captain and crew of the yacht Pnoe and the technicians of "Koutsourakis-Eleftheriadis EPE" for their assistance.

THREE-DAY MEETING ON THE AEGEAN

A three-day meeting devoted to the History and Culture of the Aegean was held last year in Athens (21-23 December 1989) by the Literary Society "Parnassos".
There were 59 papers chiefly by Greek scholars on subjects relating to the prehistory, history, archaeology, folklore and literature of the Aegean.
The following HIMA members gave papers on nautical or underwater archaeological subjects:

N. Mourtzas and L. Mendoni: "The archaeological approach to coastal archaeological sites: the ancient harbour of Karthaia".

E. Vranopoulos: "Ancient shipwrecks in the Aegean".

Y. Lolos: "Piracy in the Prehistoric Aegean: evidence from South Salamis", a summary of which follows:
Piracy, a form of 'unoffical' warfare, appears to be as old as seafaring itself. This paper presents evidence for piracy (brigandage) in the prehistoric Aegean with special reference to South Salamis and the Saronic Gulf, and an evaluation is made of its diffusion and role in the conditions of life during the prehistoric period. References to piracy at that time in the Iliad, the Odyssey, the Homeric Hymn to Dionysos and in the works of Hesiod and Thucydides (preamble to Book I of the History) have been collected; and archaeological testimony and evidence whose interpretation can contribute to an investigation of the phenomenon of piratical raids and activities in the prehistoric Aegean. Reference is made to the fortifications of Mainland coastal settlements and island centres of the Early, Middle and Late Bronze Age; to the silver rhyton from Shaft Grave IV in Grave Circle A at Mycenae with the representation of a besieged coastal town; to the frescoes of the Late Cycladic I period from Room 5 in the West House at Akroteri on Thera; and to the representations of ships on two pithoi of the latest Middle Helladic period from the prehistoric settlement at Kolona on Aigina, which have recently been recognized by Lucien Basch as pirate vessels (see *The Mariner's Mirror,* Vol. 72, No. 4, November 1986, 415-437).
In particular there is a discussion of the evidence from recent archaeological discoveries of prehistoric sites and fortifications made by Professor D. I. Pallas in the southern part of Salamis (see his extensive report in the volume of Meletes of the *Αρχαιολογικόν Δελτίον* in the press) and from the on-going study of these sites made jointly with the undersigned. In considering the evidence for human presence and the forms of maritime activity in the Saronic Gulf and neighbouring regions in late Mycenaean times use is also made of literary sources that refer to aspects of the personality of Aias, the king of Salamis, who at Troy, according to tradition, distinguished himself as perhaps the most warlike of the Greek chieftains. The continuity is also pointed out of the phenomenon of piracy in the region during the historic period, and especially in Hellenistic times, and again later in the Middle Ages.

Yannos G. Lolos

CORRESPONDENCE

On the 7th September 1989 the Isreali professor Dr Avner Raban, who is a corresponding member of HIMA, sent a letter to the Ministry of Culture which they passed on to us, since a large part of it mentioned the impressions gained by the group of Israeli archaeologists on their visit to Dokos during the course of the excavation. We publish part of the letter here and thank him for his favourable comments:

"Yet, in addition we also had a chance to visit the expedition working underwater at the island of Dhokos, excavating the submerged Early Helladic site. As field archaeologists with over 30 years of experience in underwater excavations we were more than pleased to realize what a great poential this unique site has and that a capable and true professional team is doing the work there. We do believe that the present group which is responsible for the scientific field work, both on land and in the water, will be executing what might be the most important marine archaeological excavation ever carried out in the Aegean and maybe one of the most important ones for the entire ancient history of the Mediterranean.
We wish you, the Greek people and the most capable group of archaeologists at Dhokos, all the best and fruitful research, and shall be joining the international community with great expectations for the promising results.

Sincerely yours,

Dr Avner Raban Centre for Maritime Studies

PLATIYALI-ASTAKOS:
A SUBMERGED EARLY HELLADIC SITE IN AKARNANIA*

- by Aikaterini Delaporta, Elias Spondilis and Yannis Baxevanakis -

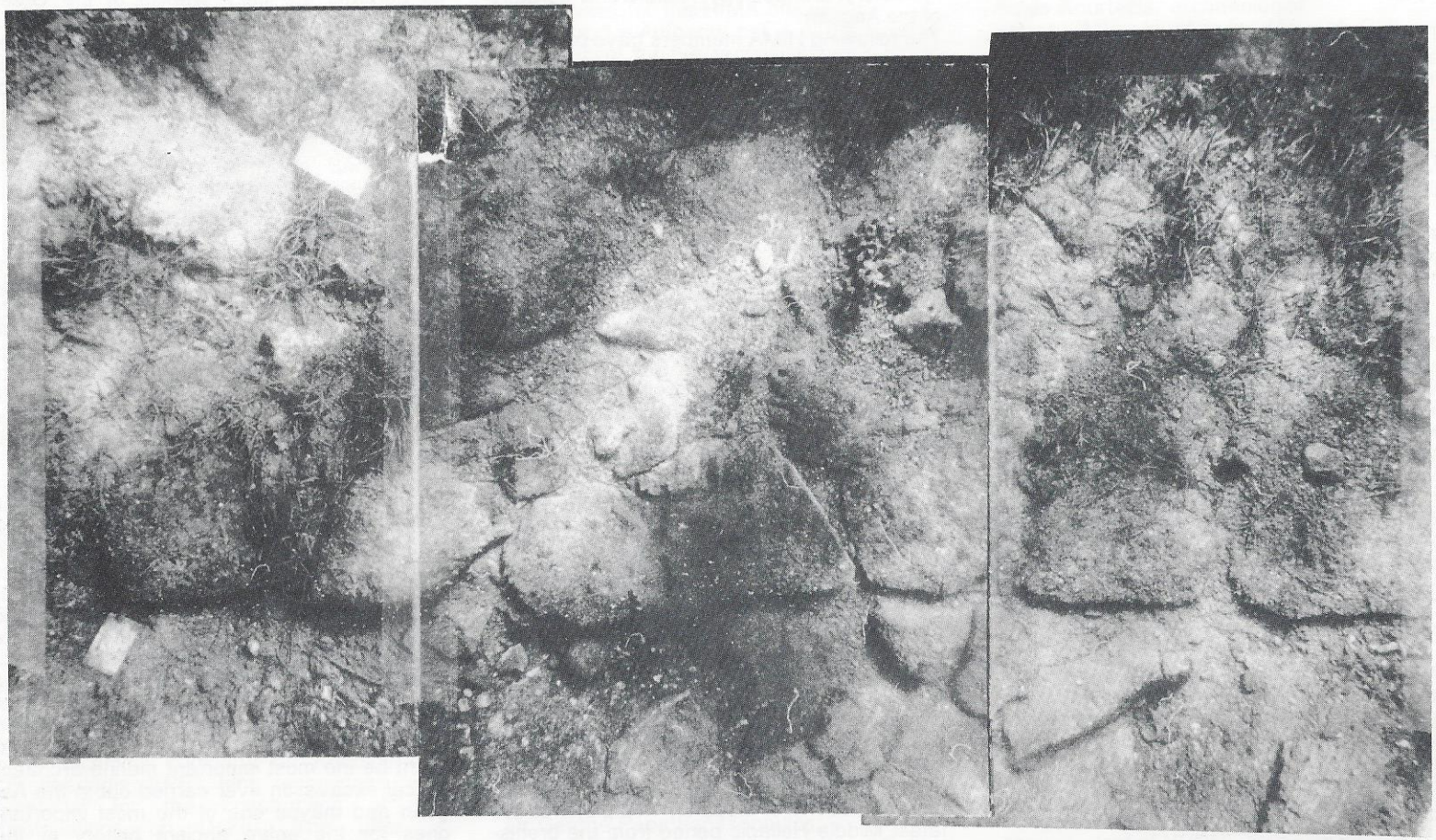

Fig. 1. The north wall of room IV of Building Complex 1 (KΣ 1).

In 1986 a new Early Helladic site was discovered underwater at Platiyali in Akarnania, in the northwestern part of the Greek mainland. The remains were first observed during an investigation of the seabed conducted for a project by the Greek Bank for Industrial Development (ETVA), the purpose of which was the construction of a ship-breaking yard. The settlement was discovered and partially excavated by the Ephoria of Underwater Antiquities of the Ministry of Culture.

Platiyali is a large well-protected bay about 12 kilometres by road south of Astakos. Most of the EH site is today under the sea at a depth of up to 5 metres. The site covers an area of at least 50,000 m and lies in the middle of a barren landscape covered with scrub. In view of the limitations of time and money our first efforts were directed to making a topographical plan of the site in order at least to obtain a good idea of its focus and general character. The topographic study of the ruins was carried out with a tachymeter (EDM) and the data was processed with a portable computer *(Fig. 2)*. The plan was incorporated into

TOPOGRAPHICAL PLAN OF THE EH SETTLEMENT
AT PLATIYALI, ASTAKOS
SCALE PLAN: YANNIS BAXEVANAKIS, SURVEYOR

JUNE - DECEMBER 1986

the National Grid. The density of the selected points of measurements was proportional to the plotting scale and the importance of the survey. A grid system was established only in areas chosen for detailed archaeological investigation.

All the points had x and y coordinates and real depths based on mean sea level. Many reference points were thus available for plotting the archaeological finds and making the observations necessary for a scientific study of the site.

The second stage of our work was to open up trial trenches and collect any visible pottery remains from the seabed.

The excavation revealed three main building complexes roughly in line (see plan). The entire area between these complexes was covered with walls in various states of preservation, some in excellent condition.

Building Complex 3 (KΣ 3) was a large megaron-type of building, while Building complexes 1 (KΣ 1) and 2 (KΣ 2) consisted of large and small oblong rooms ranging in size from 5 x 4 to 5 x 8 m *(Fig. 1)*. Usually only the first stone courses of the walls were preserved, built in the typical EH manner. In most cases the walls were built on a stratum of (non-marine) pebbles and sand, which in turn rested on a layer of unworked stones. This layer had probably been used to level up the red earth stereo and it also provided effective drainage for the buildings. The preserved floors were either paved or covered with pebbles and sand.

The stratum of pebbles and sand everywhere yielded sherds along with flint and obsidian tools. Three infant pithos burials without offerings were found under the floors of rooms I and II of Complex KΣ1. The pithoi (two with closed shapes and one with an open shape) were approximately 0.60 m in height and lay almost horizontally within the stratum of pebbles and sand. The mouths of two of them were closed by large pottery fragments; the third was closed with (built?) stones. The children had been placed with their heads towards the rims and were primary burials. These appear to be rare instances of EH intramural burials.

The finds have not yet been studied in detail, but it seems that the greater part of the ceramic material can be assigned to the EH II period: it consists of fragments of saucers, pithoi, handles, rims of closed vases, red-burnished sherds, etc. Of special interest was a fragmentary vessel found on the seabed: it is shallow and oblong with rounded corners and two long cylindrical feet underneath. Querns, pounders and a variety of flint tools were found all over the area; obsidian blades were rarer and only one obsidian core was recovered.

The layout of the settlement, style of architecture, pottery and lithic industry all support the conclusion that Platiyali is a classic EH settlement. The site thus adds significantly to our knowledge of the settlements of this period, especially in western Greece, which until now has only been known from the important cemetery on Levkas, the partly excavated site of Pelikata on Ithaca and the small habitation at Graves near Astakos. The town of Platiyali may well have played an importat role in the spread of EH civilization in this area.

*The present article is a summary of the paper given at the Symposium of the Greek Anthropological Society (Athens, 28-30 November 1986) by Aikaterini Delaporta, Elias Spondylis and Yannis Baxevanakis and published in Ανθρωπολογικά Ανάλεκτα 49 (1988) 7-19 (q.v. for further details and bibliography).

The Gold Chalice from the Late Bronze Age Wreck at *Akroterion* (Ulu Burun) in Lycia.

ADDENDUM

(Continued from p. 9)

I should like to draw attention to the representation of a gold chalice, a version in gold of the well-known stone type current in MM III-LM I, on a fragment of the Camp-Stool Fresco from the N.W. Sanctuary at Knossos (see A. Evans, *PM* IV, pp. 390-391, Pl. XXXI:G, fig. 325; dated to early LM IB). As restored by Evans *(here Fig. 4)*, the Knossian example, although not identical in shape to the gold cup from the shipwreck at the Lycian *akroterion*, constitutes a valuable piece of evidence for the circulation of gold chalices in Palatial Crete.

(Y.G. Lolos, July 1990)

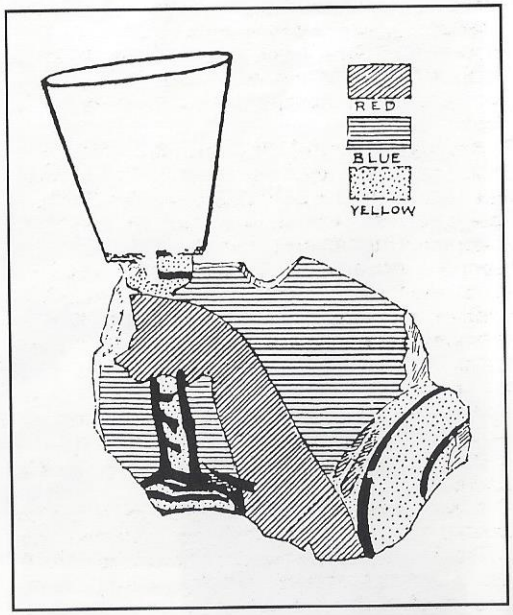

Fig. 4. Gold chalice on the Camp-Stool Fresco from Knossos; as restored by Evans (see PM IV, p. 390, fig. 325). Late Minoan IB.

PETER THROCKMORTON

The news reached us as we were going to press in June 1990 that Peter Throckmorton was dead. He died peacefully in his sleep in the old family house on the banks of the Damariscotta River, near Newcastle in Maine. He was cremated on Sunday the 10th of June and his ashes were scattered on the river, to be carried down to the sea that had always been his first love.

Diver, photo-reporter, archaeologist, writer and raconteur, he was born in New York City in 1928 and spent his youth in a variety of occupations, all connected with the sea. He learnt to helmet-dive in Honolulu at the age of seventeen and became proficient with the newly invented aqualung in 1950 while a student at the University of Hawaii in Honolulu.

In Paris in 1953 he became a photo-journalist, and in pursuit of colourful subjects drove around Europe in an ancient Morris Minor which took him to Spain, where he photographed gipsies and fighting bulls on the ranches of Andalucia, and finally across North Africa to Algers, where he covered the Algerian war of independence from the rebel side.

It was after a winter of documentary filming in India that Peter found his way to Constantinople and turned his attention to the Turkish sponge-divers, whose hard and hazardous occupation appealed to him both as a photo-reporter and a diver. Working with them he found many wrecks of all periods along the Turkish coast, and as a consequence of this experience he conceived a passion for underwater archaeology that was to dominate him for the rest of his life. Under the guidance of Virginia Grace of the American School of Classical Studies he acquired a good working knowledge of all the principal types of amphora.

The excavation of the Gelidonia Bronze Age wreck, which he organized, was a milestone in the history of underwater archaeology. It was the first time that a wreck of that period had been found and the first time that a serious attempt was made to apply modern excavation techniques to an underwater excavation.

He later settled in Greece, and from Tourkolimano, which remained his base until he returned to the States in 1977, aided by his wife Joan, he mounted expeditions in Italy, Sicily and the Southwest Peloponnese.

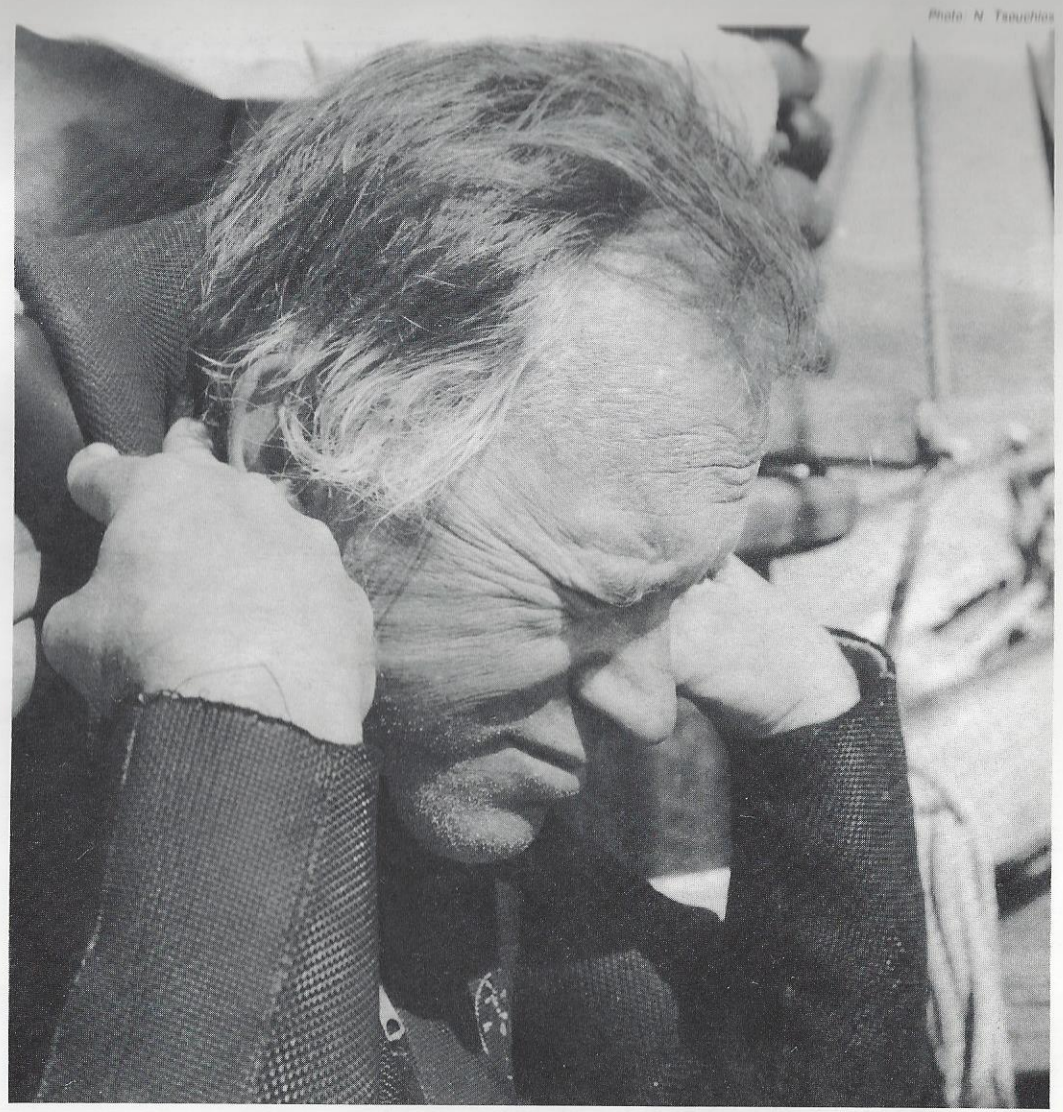

Photo: N. Tsoutchlos

Perhaps the best known of these were the wreck of a late 2nd c. AD Roman ship at Torre Sgaratta, south of Taranto, and a late Byzantine wreck at Pelagos, in the Sporades (NW Aegean); the first had a cargo of marble sarcophagi and facing slabs from Aphrodisias in Turkey, and the second a cargo of fine sgraffito ware.

His last, and some might say his most seminal contribution to underwater archaeology in the Mediterranean, was his discovery in 1975 of the Early Bronze wreck at Dokos. That his own programme for its excavation was frustrated by the bureaucracy which hounded him in every country where he worked, except perhaps Italy, and which he lacked the requisite patience and guile to circumvent, in no way diminishes the importance of his part in this unique enterprise. The great pity is that he did not live to witness the present execution of the project he had initiated, and the application of the new underwater techniques for mapping and plotting, which would have delighted him.

William Phelps

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