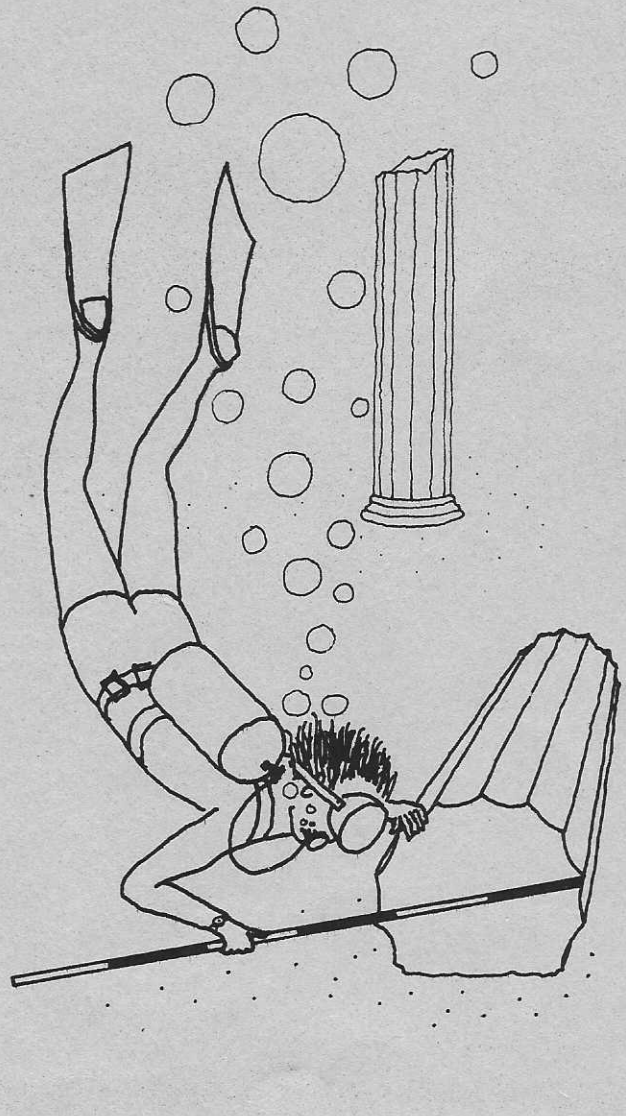
CAMBRIDGE UNIVERSITY UNDERWATER EXPLORATION GROUP

EXPEDITION TO ELAPHONISOS 1968



Patrons · J G D Clark Disney Professor of Archaeology and Dr Glyn Daniel

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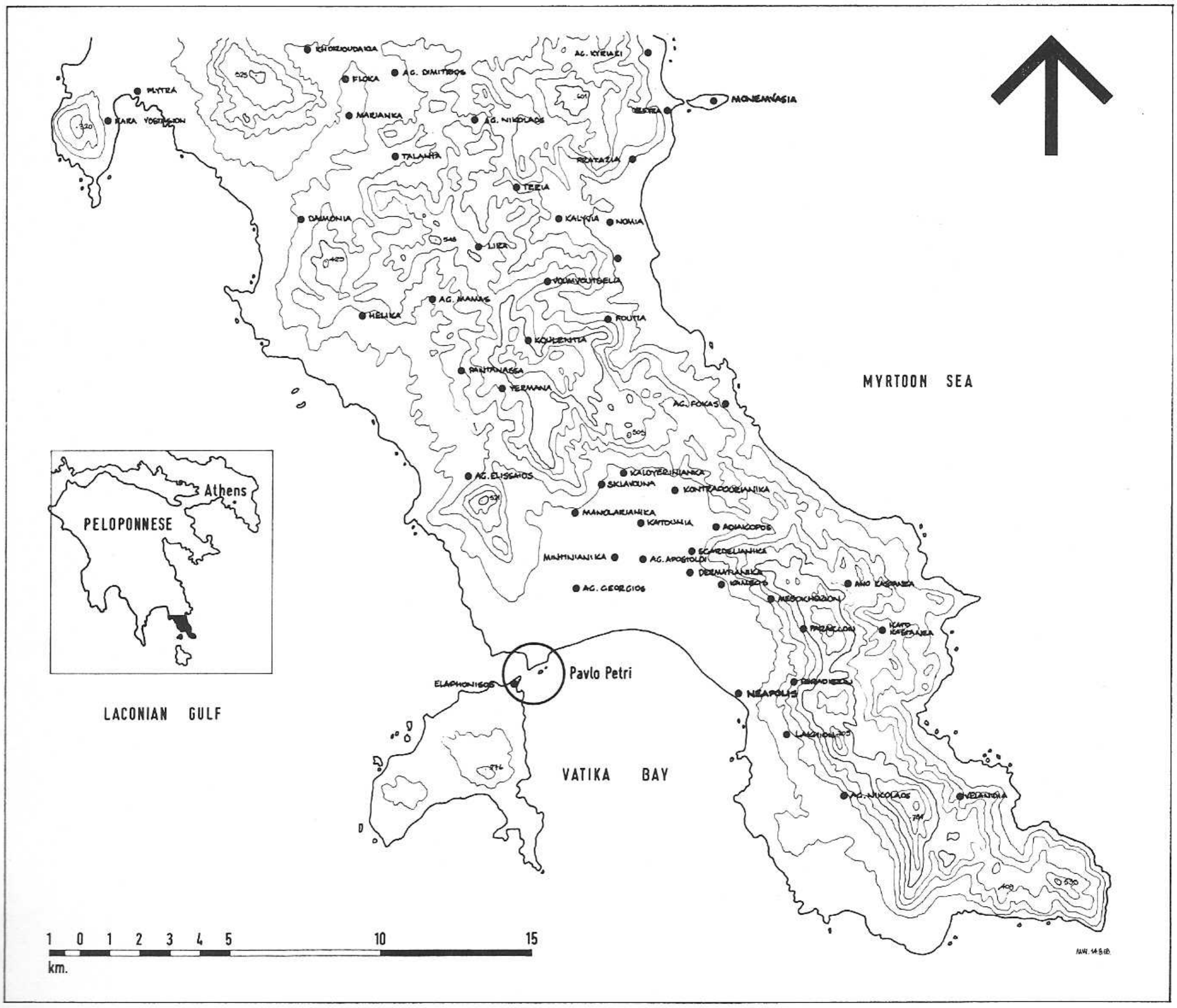


Patrons · J G D Clark Disney Professor of Archaeology and Dr Glyn Daniel

CONTENTS

LIST OF ILLUSTRATIONS

ABBREVIATIONS

CU	Cambridge University
CUUEG	Cambridge University Underwater Exploration Group
CUOTC	Cambridge University Officers Training Corps

I. MEMBERS OF THE EXPEDITION

R.C. Jones	(Brentwood and Clare). Expedition leader, surveyor, medical officer. Now a master at Rickmansworth Grammar School.
D. Gubbins	(King Edward VI, Southampton and Trinity). Diving Officer, photographer. Now in his fourth year at Cambridge, reading for mathematics Part III.
N.A. Mace	(Christs Hospital and Sidney Sussex). Mechanic and electronics engineer. Now in his fourth year at Cambridge reading Chemical Engineering.
R.E.A. Dartington	(Highgate and Kings). Chief surveyor and draughtsman; member of the Cambridge Illyricum Expedition, 1967. Now working with Arup Associates.
N.C. McNaughton	(Hymers College and Pembroke). Interpreter. Now in his second year at Cambridge, reading Natural Sciences.
M.G. Walton	(Repton and Christs). Architect. Member of the Garigliano Expedition, 1967, with John Huston. Now working with David Roberts and Geoffrey Clarke, Cambridge.
W.L. Jack	(Shrewsbury and Emmanuel). Diver. Now reading for an M.Sc. in Hydrology at Imperial College, London.
A.F. Harding	(Tonbridge and Corpus Christi). Archaeologist. Now in his fourth year at Cambridge reading for Part II Archaeology.
G. Cadogan	(Merton College, Oxford). Archaeologist. Currently engaged on research in Minoan archaeology.
R. Howell	(British School of Archaeology at Athens). Archaeologist. Currently doing research into regional variations of Middle Helladic pottery.

CAMBRIDGE EXPEDITION TO ELAPHONISOS 1968

REPORT

II. AIM OF THE EXPEDITION

The Cambridge Expedition to Elaphonisos was formed in the autumn of 1967 by members of the Cambridge University Underwater Exploration Group. Its purpose was to study, survey and photograph the underwater remains of a settlement site near the island of Elaphonisos, which lies off the Peninsula of Elos, in the south eastern part of the Peloponnese. This site was first discovered in the summer of 1967 by Dr. N.C. Flemming of the National Institute of Oceanography, whilst he was engaged on the study of sea level changes in the eastern Mediterranean.

The remains at this stage were believed to date from the Early Helladic Period (2000 - 1500 B.C.), and the area of preservation seemed to be considerable, thus indicating that this would be an important site, eminently worthy of further investigation.

It was originally intended that the expedition should also work on a large Classical submerged site at Plitra, some 30km. along the coast from Elaphonisos, but conditions imposed by the Greek archaeological authorities limited the expedition to a single location and this plan had to be abandoned, however, it is hoped that an expedition this year will be able to explore this site.

III. INTRODUCTION

The Expedition's plan of work comprised: land surveying, underwater surveying and photography, using aqualungs if necessary, and in addition, an attempt was to be made at aerial photography from a captive hydrogen balloon. Such work necessitated the aquisition of a permit from the Archaeological Council of the Greek Government, and an approach for this was made in late 1967 through Mr. Megaw, of the British School of Archaeology at Athens.

Fortunately, the required permission was granted two weeks before departure date, and the work was to be carried out under the direction of Mr. A. Delivoria, Ephor of Lakonia and Arcadia.

The Expedition left Dover on the midnight ferry for Ostende on 23rd June, with four members and all equipment in a single Land Rover with trailer. The party travelled overland through Belgium, Germany, Austria and Yugoslavia, arriving at Athens on 27th June.

A day was spent at Athens, visiting the British School, and arranging for the delivery of hydrogen gas to fill balloons. The group is grateful for the hospitality of Peter Throckmorton and a much-needed night's sleep at his home in Pireefs.

The group then travelled on down towards Lakonia, calling at Sparta to visit the Ephor and discuss arrangements, and finally arrived at Neapolis on 29th June.

At the south western tip of the peninsula of Lakonia, between the island of Elaphonisos and Cape Malea, lies the Bay of Vatika (Frontispiece). The coastal area is flat and fertile, and under intensive cultivation. This is the Plain of Kambos, bounded by the sea on one side, and the rugged mountains of the Peloponnese on the other. The Island of Kythera can be clearly seen to the south, filling most of the seaward horizon.

The only sizeable town in the area is Neapolis, at the south eastern end of the plain. This can be reached from Athens by road, the last 70km. of which is merely a dirt track, or, more comfortably, by means of the coastal ferry service. The Expedition set up camp in the village of Agios Georgios (Saint George), and rented the upper storey of a farmhouse. This was about 3km. from the site, at the north western end of the plain.

INTRODUCTION (continued)

On the beach at the site, a further camp was established with two tents and a tarpaulin lent by the Cambridge University O.T.C. Here, much of the equipment was stored, and also, some shade was provided from the sun during the hottest part of the day.

There are several instances of previous archaeological finds in the area. The much-eroded remains of a Mycenean site can be seen on the shore just north of Neapolis. Ten years ago, Dr. R. Hope Simpson reported many prehistoric finds on the island of Elaphonisos, and at scattered localities on the mainland. Last century, a thollos tomb was excavated near Kambos, but records of this have since been lost, and its position seems now to be unknown.

A preliminary reconnaissance of the area immediately shewed that the remains seen beneath the sea by Flemming the previous summer were still there, and had not been covered by sand. There were visible the traces of many walls, and the floor of the sea was littered with potsherds. The sandy beach also abounded in fragments of pottery, and at the southern end, a rocky hillock shewed evidence of having been an extensive cemetery, with some sixty graves clearly distinguishable. The tiny island of Pavlopetri, which formed part of the reef limiting the site at its seaward side, contained walls, rock cuttings and sherds.

IV. EQUIPMENT

Thanks to Dr. N.C. Flemming, advance knowledge of the local conditions on and around site, e.g. on site - wind strength and typical depths of the archaeologia; nearby - the nature of the countryside, state of the roads etc., gave great help in selecting suitable equipment for the expedition.

The vehicle was a long wheelbase petrol-driven Land Rover, and certainly the roads encountered demanded a very rugged transport. 'Dirt roads' would be a flattering name to some of the highways found in the south east Peloponnese. The Land Rover proved itself capable of carrying about 1 ton of luggage and 4 men, while also towing a trailer weighing some $\frac{1}{2}$ ton. Major repairs extended to replacing a sheared rear half-shaft, and a fractured front spring main leaf. The entire exhaust system was abondoned soon after arrival at Neapolis.

Large items of equipment included the CUUEG boat (an Avon Redshank) and a 'Seagull' outboard motor, kindly lent by the CUOTC. These were essential in enabling the project to proceed as fast as possible during the 2 months run of our permit. The CUUEG compressor was also taken with the expedition, and made the group self-sufficient as a diving team. In fact, after some days work on site, underwater techniques and confidence improved to the extent where aqualungs were no longer found necessary, and the compressor had little work to do from then on.

Dr. Flemming loaned the expedition a Ferrograph 'Offshore' echo-sounder, to help study of the sea-bed profile beyond the actual site. Two 12 volt car batteries were purchased to power the echo-sounder. An automobile dynamo and complete charging system (voltage regulator, fuses, ammeter) was fixed to the compressor so that the batteries could be properly recharged while aqualungs were being refilled.

All water equipment (boat, motor, aqualung and diving gear) and some survey equipment was kept on site, the more delicate and expensive items being stored in a tent.

Other equipment (Photographic, draughting and the balloon apparatus) was kept at the house. The batteries which were used to power the echo-sounder were also used in the 'darkroom' to power the enlarger and safe-light.

Domestic equipment was run entirely on kerosene - 3 primus stoves for cooking, and 3 Tilley lamps for lighting. The cheaper type of kerosene contained much foreign matter and failure of these items was frequent as a result. It would have been a better policy decision to use gas (for greater convenience) since bottled Butane and Propane gases were available locally - though we were unaware of this before reaching Neapolis. Another shortcoming in the domestic equipment was a lack of torches. Again, since batteries were available locally, small pocket torches would have been very useful.

Between $\frac{1}{4}$ and $\frac{1}{2}$ a ton of food was taken on the outward journey, and we are very grateful to the many manufacturers who assisted the expedition by offering goods free or at a reduced price.

As a form of shelter on site, a large tarpaulin (kindly lent by the CUOTC) was erected between 2 thorn trees. Unfortunately this failed to withstand the onslaught of the 'Meltemi' and eventually became ripped. However, it served well while it was needed, in the first week or two of acclimatisation. Two tents, belonging to members of the expedition, were also erected on site, for the storage of equipment. Again, one of these succumbed to the 'Meltemi' during the first week on site, but the other survived to provide a valuable shelter from sun, wind and sand for various fragile items of equipment.

V. MEDICAL

The Expedition was well equipped with medical supplies, for which the members are most grateful to Dr. Hawtrey May, but happily, and despite the considerable heat, none too careful preparation of food, and drinking of untreated well-water, almost none of the drugs were needed. There was only one case of intestinal infection, whom once having been persuaded to undergo treatment quickly recovered!

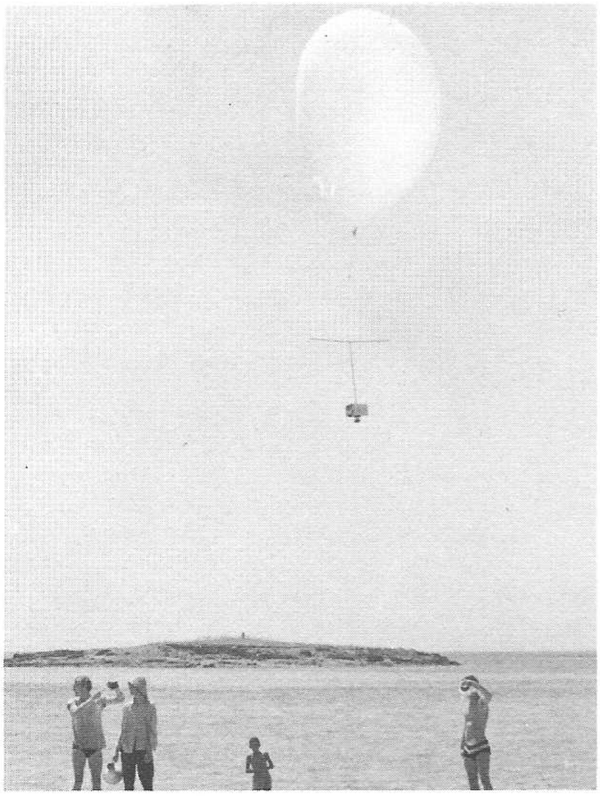
Probably the most troublesome aspect, medically, were the small cuts and abrasions which stubbornly refuse to heal when subjected to repeated immersion in sea water. Also, there were frequent minor cases of sea-urchins' spines in the skin which were often very difficult to remove.

VI. LAND SURVEYING

Most of the land-based surveying was carried out using a pair of plane tables with telescopic alidades. Using two stations on the shore base line, the water line and check points in the underwater grid were surveyed, together with known points on the island of Pavlopetri, and further plane table stations. To aid this work, two two-way radio sets were used; and also, a loudhailer kindly lent by Messrs. Pye of Cambridge proved invaluable for directing the person holding the ranging pole.

Pavlopetri Island was surveyed by plane table and chain offset methods, and the rock channel at the south eastern end of the beach was surveyed by chain offset.

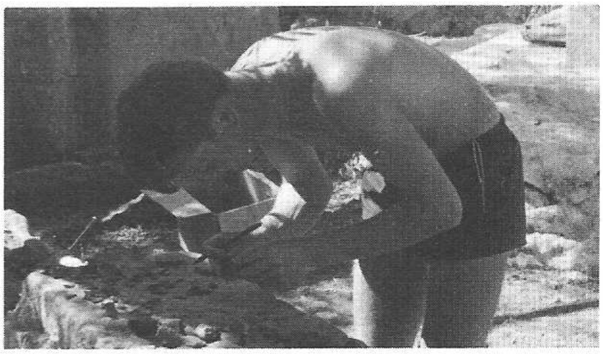
METHODS OF SURVEYING AND RECORDING FINDS



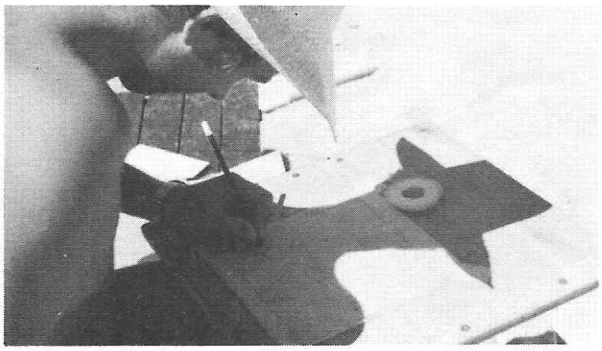
1 Aerial photography apparatus

2 Diver with equipment

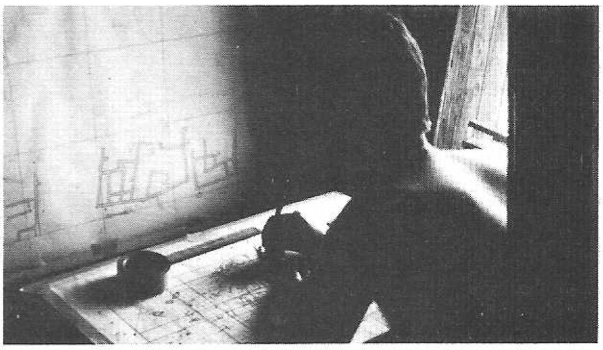
3 Surveying with alidade



4 Marking sherds

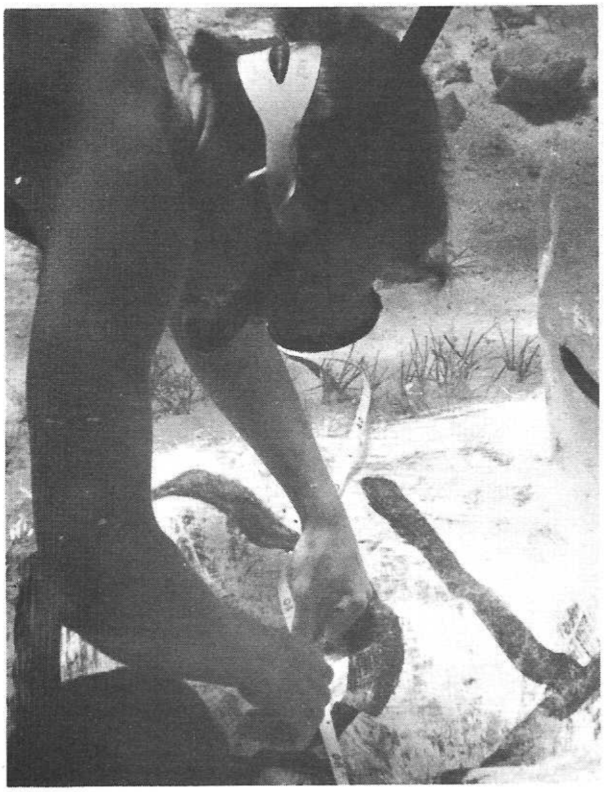


5 Recording measurements

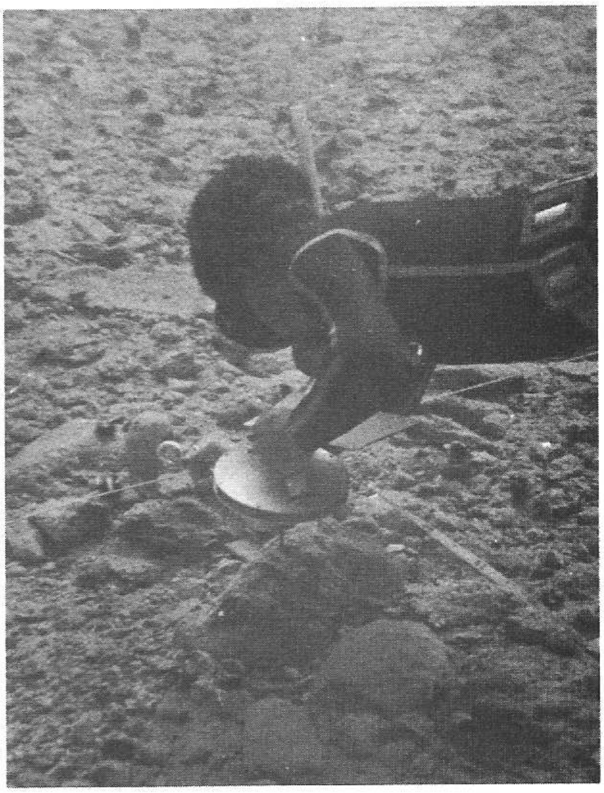


6 Drawing up plans

7 Laying out grid markers at 20 metre intervals



8 Measuring to grid point



9 Measuring wall marker

VII. UNDERWATER SURVEYING

The detailed survey of an area of seabed of rough extent 300 by 200 metres required a grid of semi-permanent markers, to form a grid of reference points. The basis of the grid was a line of points, 20 metres apart, labelled E to T, laid along the beach from north east to south west, approximately parallel to the water's edge. This provided a base line 300 metres long. The extension of the grid outwards to the seabed was completed, in the main, by the following method. Two ranging poles were set up on the beach at each lettered point, aligned at right angles to the base line by means of a sextant. Then the dinghy was taken out from the shore, keeping the poles in line, and paying out nylon cord knotted at 20 metre intervals. At each knot, a marker was thrown overboard, and secured on the seabed by divers. Each row was numbered, the shore line being 1, and the line 20 metres from the shore base line being 2, and so on.

The markers themselves consisted of one metre squares of polythene sheet, painted white with emulsion paint, and with the grid number painted with an improvised concoction of tar and petrol. This would enable each point to be clearly seen and identified by divers, even from some distance in poor visibility conditions. It was also hoped that these would be identifiable in any aerial photographs. The polythene sheets were secured by placing a substantial rock at each corner, and also one at the centre. A six inch nail, driven into the seabed, and held in place under the centre rock, provided an accurate point for taping measurements.

Thus was established a grid of approximate 20 metre x 20 metre squares. Due to the method of laying, these squares were not accurately 20 metres, and although the average deviation was 1 to 2 metres, some sides were as much as 4 metres out. In some cases, where a marker would have been laid over a wall or cist grave, it was deliberately moved to one side. But this inaccuracy did not detract from the value of the grid, since each marker was accurately mapped by measuring the four sides and both diagonals of every square.

All but a few of the 114 markers put down stayed in position despite occasional high winds and strong currents, although after a few weeks, most of them had lost much of their paint. In the subsequent surveying, each square of the grid was known by the lowest of its four co-ordinates.

The survey of detail within the grid squares had to establish accurately the positions of walls, cist graves, and important finds, relative to the grid. Many of the squares contained much archaeological detail, and it was found by experience that this was difficult to take in all at once. Moreover, a wall which might be distinguishable to a swimmer on the surface would often prove unobservable to a diver on the bottom, due to the fact that only the bottom course of many walls remained, and with scattered stones all around, it was very difficult for the eye to detect alignments. Therefore, the following procedure was adopted:

Firstly, a square would be sketched, and the positions of walls, their corners and intersections marked by small buoys. These buoys consisted of a disc of expanded polystyrene two inches across and $\frac{1}{4}$" thick, anchored to a small lead fishing weight by three or four inches of nylon cord. The white buoys would remain suspended a few inches above the walls, and could easily be seen from some distance. Each was numbered in black with a "Gem Permanent Marker".

The buoys were then surveyed into the square. Initially this was done by measuring a distance along one side, and a distance perpendicular to that side, the right angle being judged by eye. But this method proved to be inaccurate, and so a modified form of triangulation was adopted. The perpendicular distance of each buoy from the two nearest non-parallel sides was measured with Rabone-Chesterman fibreglass tapes. Periodic checks to the other pair of sides shewed that this was accurate to 10cms over 20 metres, the limiting effect on accuracy being the bowing of tapes in the current.

The recording of results was efficiently carried out using a pencil on "Perma-Trace". One foot squares of this were secured to stainless steel boards, and were easily manageable underwater. After the initial sketching of a square on a formica board, and the laying of the buoys, the sketch was transferred to the Perma-Trace sheet, and the numbers of the buoys written down. On the actual survey, the two distances necessary for each buoy were recorded in an appropriate column.

There were 120 small marker buoys in use at one time, and with two divers required for the survey of a square, this meant that generally two squares were being worked at one time. On surfacing, the pair of divers would transcribe their results onto a masterplan, also of Perma-Trace. This could later be taken underwater for checking, and the addition of further detail, such as wall thicknesses.

VIII. PHOTOGRAPHY

The equipment used was as follows:-

Land:	Pentax SV	55mm Takumar lens, with 28mm, 85mm, 135mm lenses and X2 Teleconverter.
	Canon	50mm Serenar lens 35mm Leitz Elmar lens.
	Practika	with 35mm and 50mm lenses.
Underwater:	Lewis Photomarine II housing for Canon. Nikonos with 35mm lens. Lightmeter in perspex case.	
Aerial:	Robot Royal Automatic, f2.8, 40mm lens (36 x 36mm format). Practi Automatic Camera	

Kodak black and white film was taken in 50ft. tins and loaded into casettes on the site using a changing bag. Weather conditions in Greece made this a lengthy process, since only a few rolls could be loaded before humidity in the bag rose to a dangerous level. Loaded casettes were stored in a tin lined with polystyrene to exclude rapid changes in temperature. Colour film was brought out from England loaded in 20 exposure casettes. This short film length meant that any one camera could be used for a variety of purposes without the need to re-wind a partly used film before changing to a faster or slower film.

Facilities were taken to enable development of films to be carried out at the house in Aghios Georgios. Water came from the well, (which fortunately had not been treated with lime) at 65^{o}F, which made the temperature control very easy. Dust in this very arid part of Greece presented the worst problem, as it settled on the film during drying. With the film sealed in a large cardboard tube for drying, satisfactory results were obtained. Immediate development of films proved an invaluable check on exposure for underwater photography and the aerial photography.

An enlarger was modified to work from a 12 volt car battery using a headlamp bulb made opaque by roughening the glass. This enabled 8" x 8" prints to be made of the aerial photographs as an aid to the surveying using Kodak Grade 3 Waterproof Paper, which does not stretch excessively during development and drying.

Kodachrome II film was used for land colour photography, and a supply of High Speed Ektachrome was very useful as an all-purpose film, suitable both on the surface and underwater.

PHOTOGRAPHY (continued)

Conditions for underwater photography on the site were good, with visibility 40 - 70ft. and only occasionally going down to 10ft, when a southerly wind blew in from the open sea, making photography impossible. Tri-X developed in Acutol-S and rated at 800 ASA was used for black and white photography. A X2 yellow filter helped eliminate blue scatter from the water and improve contrast. Under-exposure and forced development was also employed, rating Tri-X at 1600 ASA with an increase of 50% in development time, but this did not give a great improvement in contrast. Plus-X film was also fast enough for use underwater.

Exposure for Tri-X (800 ASA) using a yellow filter was constant at 1/100, f11, between 10.00 a.m. and 3.00 p.m.

The General Aniline Film Corporation generously donated some Anscochrome 500 colour film, which was ideal for use underwater. The colour correcting filter required for this film was found to be considerably stronger than that suitable for slower films. Wratten CCR 40 and 50 filters were found to give correct colour balance for light paths up to 10 feet. With longer light paths, colours deteriorated rapidly.

Aerial photography was carried out shortly after dawn when the light intensity was low. An exposure reading taken of the sea with the meter pointing vertically down was correct for these photographs. Plus-X developed in Acutol (160 ASA) enabled a shutter speed of 1/500th second to be used, (f2.8-4). A yellow filter was employed to reduce blue scatter from the water, but results shewed that use of a Polaroid filter to cut down reflection from the sea surface was unnecessary.

IX. BALLOON PHOTOGRAPHY APPARATUS

The most important point in the design of the apparatus was its minimal cost. The choice of each item was influenced by this overriding control.

'Beritex' meteorological sounding balloons (kindly donated by Dr.H.T. Bull of the Meteorological Physics section of the Cavendish Laboratory) filled with hydrogen supplied lift for the camera and its operating mechanism. These balloons, made of thin latex, definitely only serve their purpose once, and so about £2. 10. 0. is expended on a balloon per flight. A superior but more expensive alternative, a nylon reinforced kite balloon (costing about £50), would have been preferable since this type may be used many times. The balloon was inflated to about 7' vertical diameter and 5½' horozontal diameter (bursting diameter is rated as 16') with hydrogen which was purchased in cylinders in Athens. The gas proved fairly expensive by U.K. standards and each 'fill' cost between £8 and £10. Besides being able to lift the camera and its control, the balloon had to have sufficient buoyance to provide a good tension in the tether lines. Depending on wind conditions, this extra lift amounted to between 5 and 10lbs.

Ideally the camera itself should be supported on mutually perpendicular knife edges, with a short pendulum period of swing. This would help to prevent gusts of wind and general movement of the balloon and lines having any serious (resonant) effect on the attitude of the camera. However, with the time and funds at our disposal, a long, jointed pendulum assembly was developed (Fig.1). Although this tended to swing violently at times, the camera operator could see the position of the camera and so wait until the pendulum's oscillations had died down before taking a photograph.

Early trials in Cambridge showed that a single-tethered spherical balloon spins in wind; to prevent our camera spinning with the balloon, a double-tether system was decided upon, which conferred much greater control over the attitude of the camera. Provided it was not full of sand, the 'frictionless' swivel joint permitted the balloon to gyrate at its own convenience, while the camera remained stationary. Rubber band stabilising tethers fitted between the free end of the pendulum and the two main tether lines served to damp out large oscillations of the pendulum.

The main tether lines - single strand nylon fishing line of 50 lbs breaking strain - were marked at 20 metre intervals, and wound on plastic reels.

BALLOON PHOTOGRAPHY APPARATUS (continued)

The camera and its operating mechanism were housed in an adjustable sheet Aluminium chassis, rigidly mounted on the end of the long pendulum. Radio control was decided on to operate the camera, and the complete RC unit, together with its batteries and servo motor, was mounted directly onto the camera.

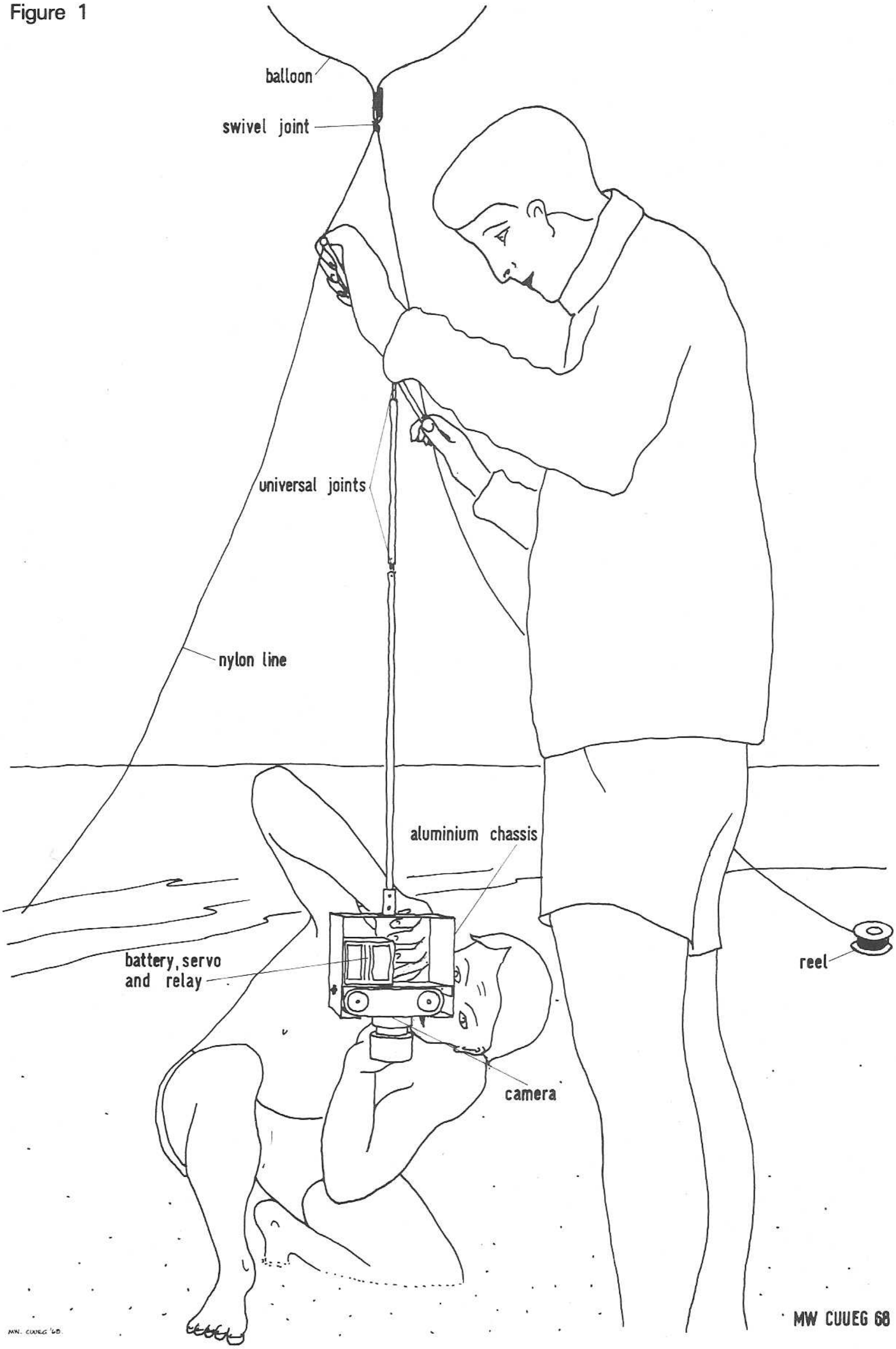
The RC unit was a single channel tone control system, as used for model aircraft. The transistorised receiver, using 4.5 volts supply, operated a miniature relay, which in turn set the servo mechanism in motion. The servo, using another power pack of 1.5 plus 3 volts, was connected to the camera trigger button by a simple pushrod.

The greatest problems encountered in using this equipment were the servo motor. Its current consumption proved to be so great that the driving power pack became exhausted after one or two films-worth of exposures. When the batteries became too weak to drive the motor round its cycle of operation, the mechanism would stick halfway and the batteries be rendered useless within a minute by short circuiting of their power. A simpler servo, more suited to this particular task, would have prevented much frustration and saved time and expense. Several times, both in England and on site, a balloon run was foiled at the last minute by the exhausted batteries. The eventual success of the balloon photographic equipment was achieved using much larger batteries than had been planned originally, consequently raising the payload of the balloon considerably.

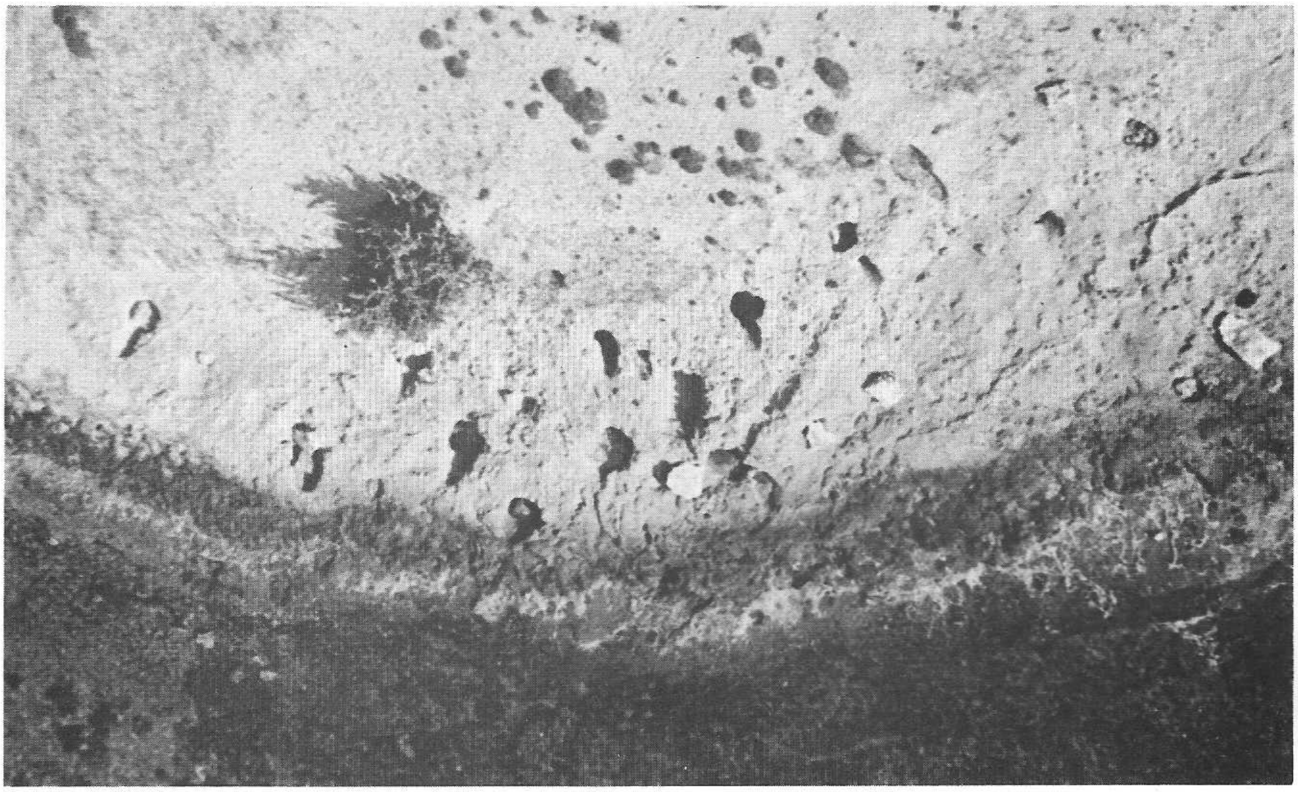
Again, although the radio control unit itself functioned well, a simpler type would have been adequate, and more suitable for our purpose. The tone-control type of transmitter and receiver tends to be 'jumpy' and touching the receiver aerial, for instance, would cause the camera to fire. A carrier wave model would not have suffered this disadvantage, and would still easily have provided the 100 and 300 yards range required for our purposes.

Finally, the camera itself was required to be automatic as far as wind-on was concerned. The great advantages of radio control would have been partially lost had the balloon needed raising and lowering for each exposure. Although it would have been possible to build an external automatic wind-on mechanism, this would probably have been rather heavy, and so both the cameras we used were chosen because of their internal automatic wind-on mechanisms. The first (which was never actually used on the balloon) was a Prakti, with automatic exposure control, and automatic

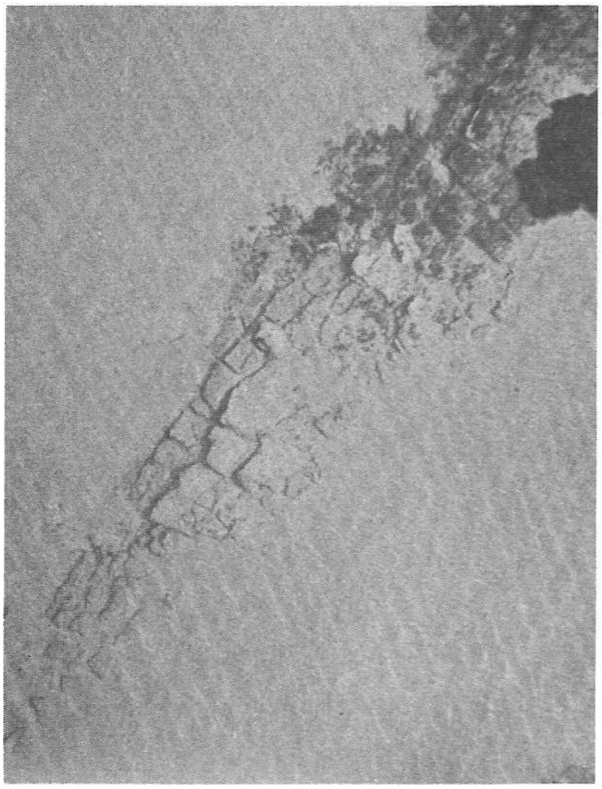
Figure 1



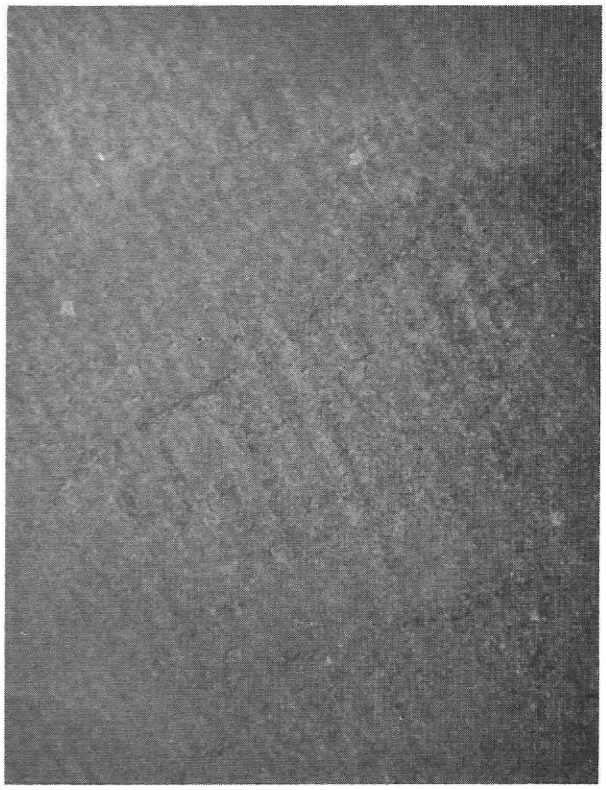
balloon
swivel joint
universal joints
nylon line
aluminium chassis
battery, servo and relay
camera
reel
MW CUUEG 68



10 Bronze Age rock cut tombs near the waters edge



11 Reef projecting above sand



12 Traces of walls with markers

wind-on driven by batteries mounted internally. The second camera, a Robot Royal, was heavier than the Prakti, probably due to its clockwork wind-on mechanism, but eventually gave good results. Its heavier weight probably contributed to the ending of its last flight, when it suffered the ultimate fate of any camera suspended over sea-water.

X. BALLOON PHOTOGRAPHY OPERATION

Photography took place shortly after dawn when the sea was calmest, the wind minimal and the sun's heat low enough not to endanger the balloon (distortion and explosion can occur). Preparation for an attempt commenced at about 5 a.m. - an hour before dawn - by filling the balloon with hydrogen from cylinders and loading the camera with film.

When the balloon was filled the camera assembly was attached to the neck and the equipment tested. Final adjustments then took place such as checking the shutter speed and aperture setting and ensuring the clockwork wind-on was fully wound.

Once aloft the balloons height and direction were controlled by the two nylon tether lines, either from the shore or from a boat in association with a swimmer, or by a combination of both, depending upon wind speed and direction.

The balloon was traversed over the site in such a way that a photographic mosaic could be made up and checked against the grid markers on the sea bed. Photographs were taken at heights varying between 25 and 80 metres above sea level.

Altogether six attempts were made, and in spite of either malfunctioning equipment or too strong a wind many successful shots were taken (Plates 10, 11, 12). The apparent lack of clarity in the photographs taken over water is due to the lack of contrast between the walls and the sea bed which was densely littered with similarly coloured stones: had the walls been against a background of sand for instance they would have shown up far more clearly.

XI. ARCHAEOLOGICAL REPORT

The site was named Pavlo Petri, after a small rocky island lying some 200m. off the shore. (Fig.2) There were a number of walls visible on this islet, of particular importance being those that projected from an eroded bank on the north side, for here alone on the site could stratigraphical observations be made. (Fig.3) There seemed to be Roman and Byzantine material in the upper strata, and Mycenean walls, with contemporary and earlier pottery, in the lower. It is quite clear that these walls were once an integral part of the main site (from which they are now separated by 100m. of sea) and that the old coast-line must have lain south of this island and the reefs that bound the site on the southern side. In the rock beside these reefs were cut two or more chamber tombs, (Fig.6) now submerged and caved in, and on the shore was a whole cemetry of small rock-out tombs, (Plate 10) some at least of Mycenean date: these two groups represent the northern and southern limits of the site.

The remains in the water seem to be mostly of Mycenean date, judging from both the style of architecture and the abundant scatter of pottery that lies on the sea-bed. As the plan shows, (Fig.4) the town was composed of a number of separate buildings which mostly seem to front on to a street on one side and a courtyard or open space on another. Ten rooms seems to have been the usual number in a house, and these varied in size from 10m. x 5m. to 4m. x 2m. Perhaps the usual complement was two long rooms at either side of the house, with a number of smaller ones between, their long axes at right-angles to those of the outer ones. This arrangement, if indeed it is typical, can be seen most clearly in building VI and VIII. (Fig.5) Another feature which merits attention is the presence, in about the centre of each house, of a larger, perhaps squarer, room, which, it is suggested, may have been an inner court.

Most of the walls are built of roughly squared limestone blocks, two to a wall thickness, and have an average width of 0.60m. Certain other walls are better built, with carefully dressed blocks laid 'long and short', and a number are much worse, simply being composed of rubble, and thus hard to distinguish from the litter of stones over the whole area.

The streets are a noticeable feature of the plan, and there seems to have been one main NE-SW street with others leading off it at right-angles. This is a simplification, however, for the process of getting from the main street to street 3 was extremely complicated, involving

Figure 2

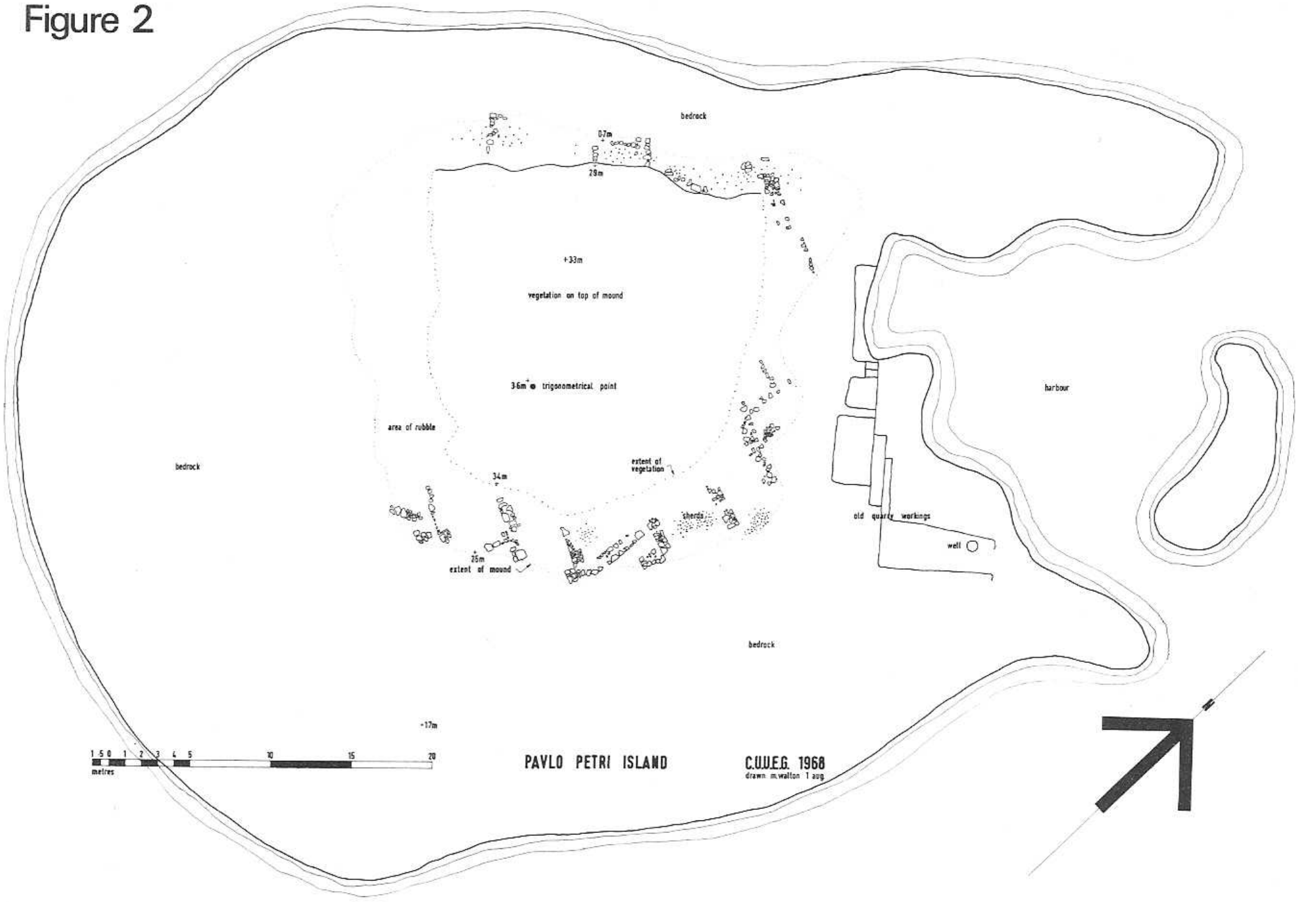


Figure 3

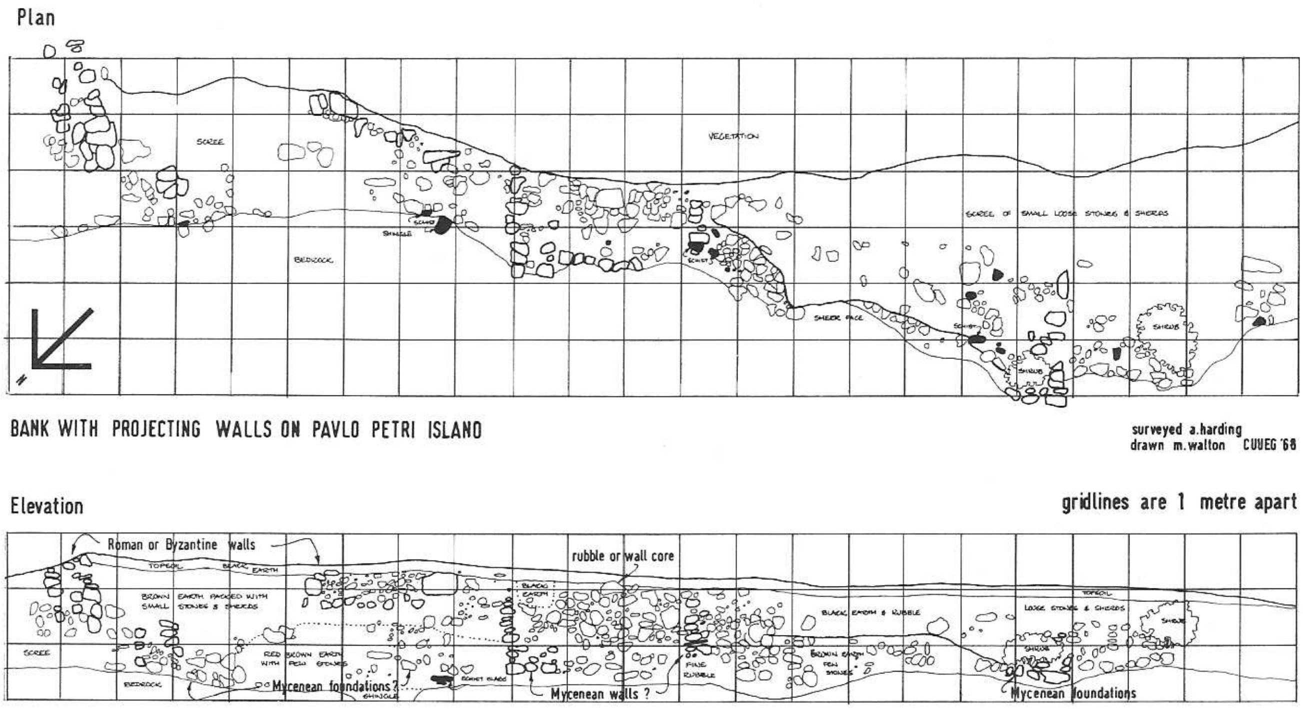


Figure 4

SURVEY OF PAVLO PETRI
CUUEG 1968
drawn m. walton.
Island
Cemetery
canal
edge of dune
dune
Shore
sandy bottom
sand line
waters edge
street 1
st. 2
st. 3
line of bedrock
bedrock
chamber tomb 1
chamber tomb 2
eroded bank
rock cuttings
+ 36m
Pavlo Petri Island
Vatika Bay
N
metres
distinct walls
indistinct walls
pithos
depth of sea in metres
cist grave
area
building number
height above sea in metres
paving stones
gridlines are 100 m. apart

turning through a narrow passage (caused by the sudden curving round of one side of street 1) and proceeding SE at an angle of 30^0 to street 1, with the walls of the two streets actually joining at that angle. Also worthy of note is the structure opposite the junction with street 2. A long rectangular boulder continues the line of the north wall, while a wing of masonry juts out south into the middle of the street. Slightly to the west a wall of some sort ran straight across the street. It seems likely that this all represents some sort of entrance area, and the blocking wall may be the foundation of a gate. To the east, the street widens as it approaches this area, and the walls are of the special 'long and short' construction, presenting a neat face on both sides of the roadway. Just south of the projecting wing lies another large boulder, irregular in shape, but such as would have been used in a Cyclopean type entrance-way. It is too large to have found its way there by chance.

There is one self-contained structure that merits special attention - building IX. (Fig 7) The walls of this are large slabs of stone placed on edge, forming a rectangle of single orthostats 8m. x 5m. In the middle of either end, several smaller stones form a small apse, radius 0.50m. To the west lies a wall of the Mycenean building that surrounds the area, but the two, though immediately adjacent, do not bond. On the stones of this building, and immediately outside it, were found three small hand-made bowls, of Early Helladic type. This is in fact the one building that is almost certainly anterior to the site proper. It can have supported very little in the way of superstructure, owing to the nature of its construction, and this being the case, the top of it is at the same level as the Mycenean foundations, which, as has been said, skirt the edge of it without actually intruding on it. As for its function, we may presume it was religious or ritual, perhaps to do with the burial of the dead, in the absence of any diagnostic material.

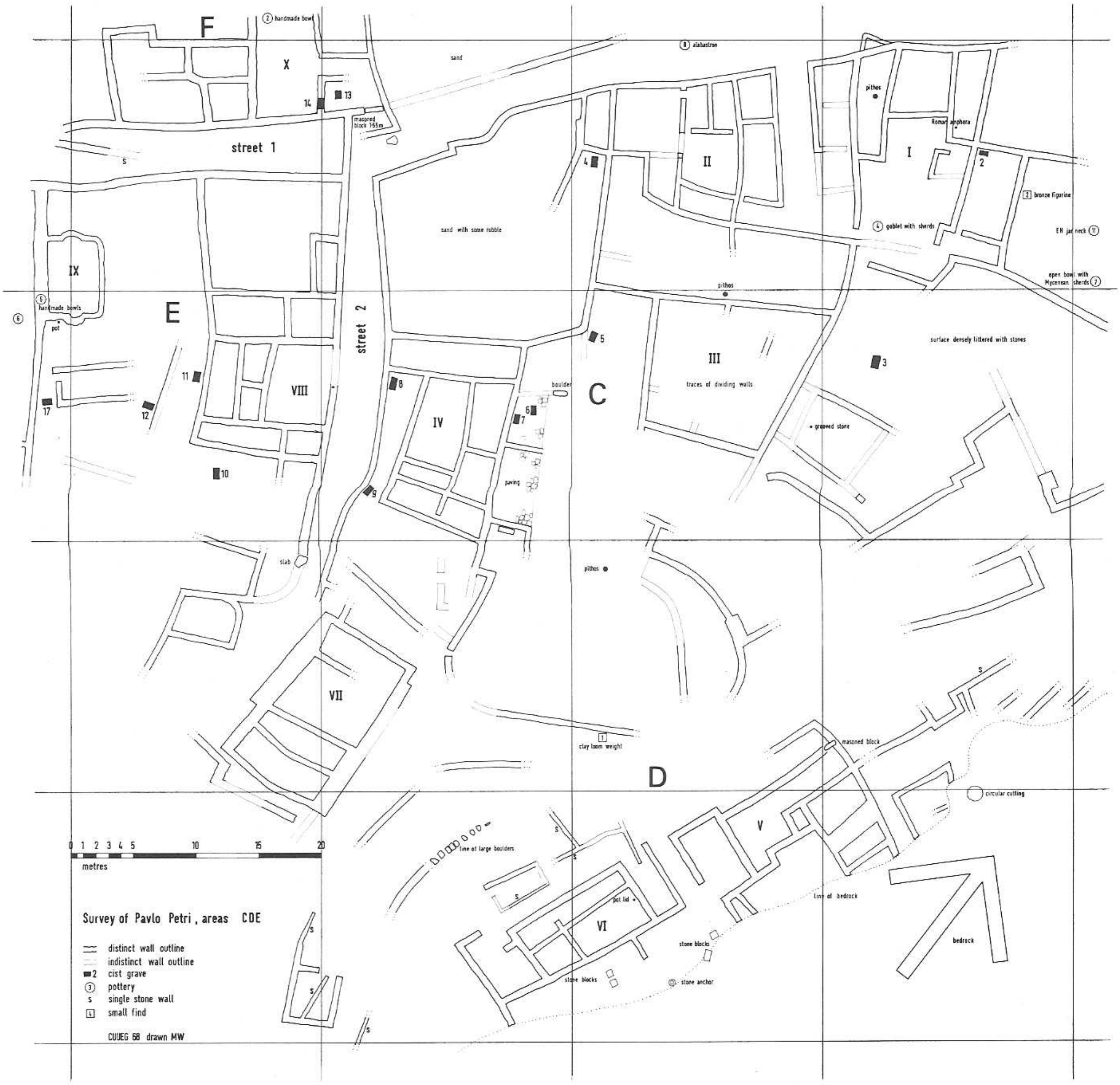
Perhaps the most important feature of the site was the presence of 37 intramural cist graves. (Fig.8, Plates 15, 16) These are in all observable cases composed of thin upright slabs of limestone, in the orthodox box-like manner. Usually there are four slabs only forming the sides, but in some cases there are more, producing a more polygonal cist, or a longer rectangle. Average dimensions are about 0.60m. x 0.35m. In a few cases the cover slab is present, lying either actually inside the cist or just outside (or even in position). Excavation of these few might prove fruitful.

The plan clearly shows that the graves are intramural: and even if it is argued that they belong to an earlier phase than the buildings, the area over which they are spread is too great to allow them to form a regular cemetary - they were an integral part of whatever settlement they accompanied. The question of their date is a difficult one. Intramural cist graves were a feature of Middle Helladic settlements, and this was in fact the commonest form of burial at this date. There is a little Middle Helladic pottery at Pavlo Petri, but even allowing for unrepresentative sherd-collection, not a great deal - there is much more Early Helladic. It seems that there are two possibilities. Either the graves belong to the Middle Bronze Age, and the Myceneans, in laying out their houses, carefully avoided these earlier burials (out of respect for the dead?) - actually one grave is in a wall, - or we must consider the idea that these are Mycenean cist-graves. This is not now the heresy that it used to be: 35 or 40 examples are known from the Greek mainland, including two at Mycenae (and two pithos burials), three at Malthi, five at Agios Kosmas (and the possibility of many more), and 10 in the Athenian agora. Furthermore a number of sites (Argos, Korakou, Perati and others) show that burial in a simple earth-cut trench was probably a standard way of disposing of the poorer dead. Multiple burial was by no means universal; and the tholos and chamber tombs are perhaps only a manifestation of the richer strata of Mycenean society. At any rate, the possibility must be recognised here, and only excavation can provide an answer either way.

Two of the graves contain pottery vessels of a coarse household nature, presumably containing the bones of infants. (Plate 15) These are of a reddish, metallic-looking fabric, undecorated and of open, neckless shape (so that they cannot strictly be termed 'pithos' burials, though this serves as a convenient generic term). Burial in pithoi was again characteristic of the Middle Helladic period, but a few examples of later date are known. We face here the same chronological problems as with the cist graves in general.

No clear evidence concerning the changes in relative land and sea-level was found. The entire area under survey was once, of course, on dry land, from Pavlo Petri island to the cemetary on the shore. The depression of the site has been not less than three metres, and this could be explained by a eustatic change of sea-level, a local tectonic subsidence of the land,

Figure 5

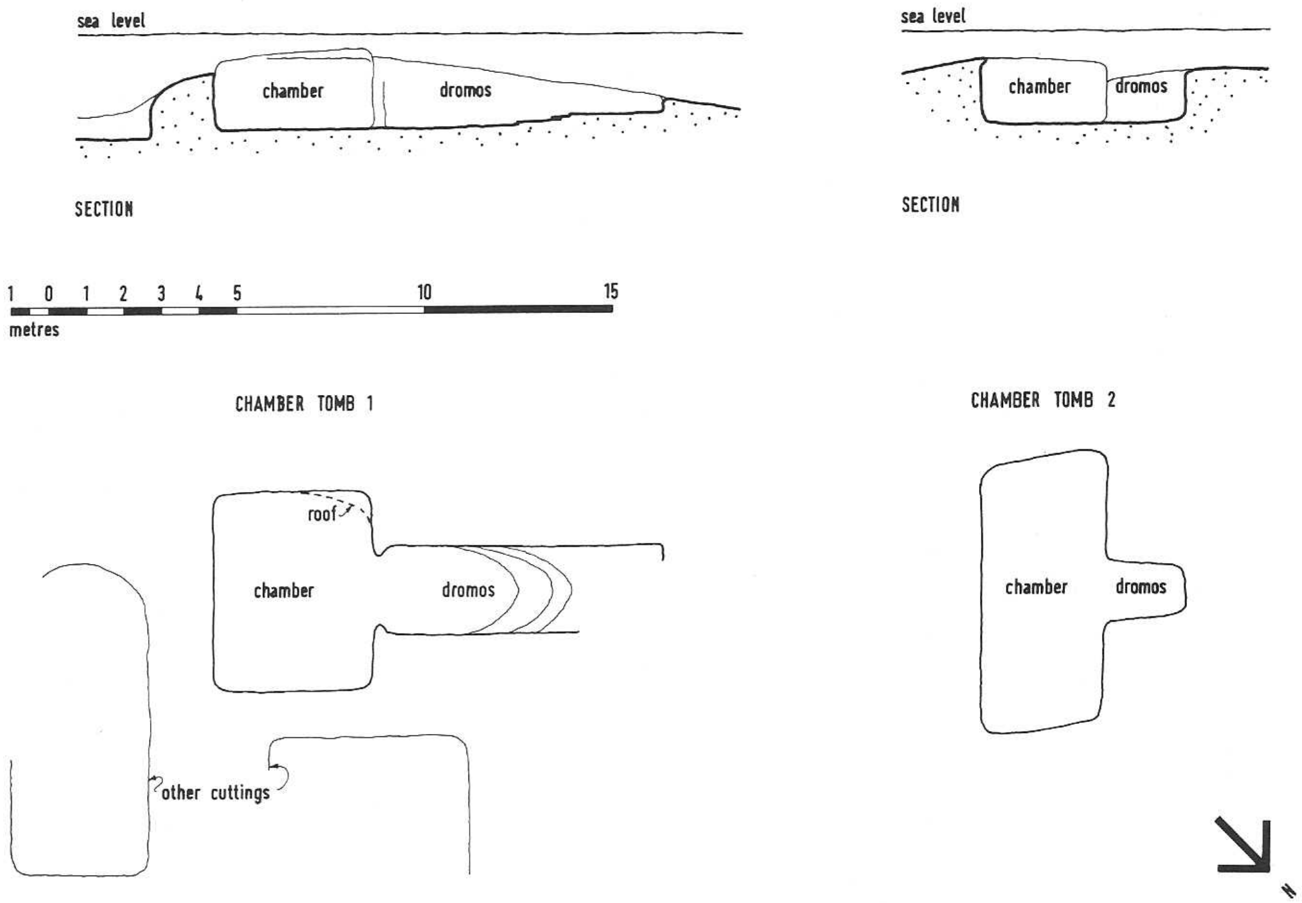


F
E
C
D
X
IX
VIII
VII
IV
II
I
III
V
VI
handmade bowl
alabastron
sand
masoned block 165m
street 1
street 2
sand with some rubble
pithos
Roman amphora
bronze figurine
goblet with sherds
EH jar neck
open bowl with Mycenaean sherds
surface densely littered with stones
traces of dividing walls
grooved stone
handmade bowls
pot
boulder
paving
slab
clay loom weight
masoned block
circular cutting
line of large boulders
pot lid
line of bedrock
bedrock
stone blocks
stone anchor
0 1 2 3 4 5 10 15 20
metres
Survey of Pavlo Petri, areas CDE
distinct wall outline
indistinct wall outline
cist grave
pottery
single stone wall
small find
CUUEG 68 drawn MW

Figure 6

CHAMBER TOMBS AT PAVLO PETRI

C.U.U.E.G. 1968
drawn m. walton

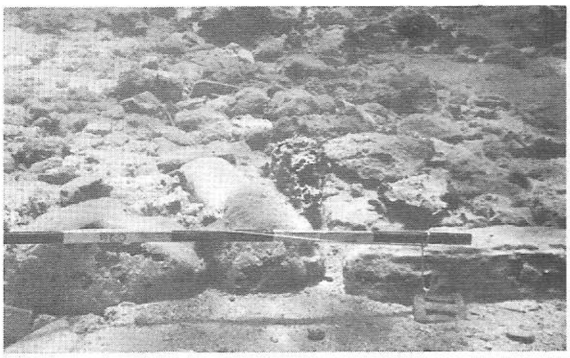


or, as seems most probable, a mixture of both. Theories accounting for the underwater sites of the Mediterranean are legion, and no agreement is possible at present. Dr. Flemming's own work suggests to him a eustatic change of around half a metre a millennium, the remainder being attributed to tectonic movement (see Nature, March 16th, 1968).

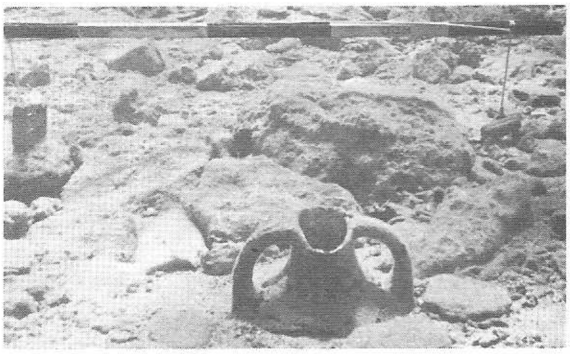
We may sum up the importance of the Elaphonisos expedition as follows: techniques for large-scale underwater survey and balloon photography of underwater sites were developed; this produced a plan of the largest Mycenean town yet known (excepting Mycenae), with streets, houses, possible ritual buildings and graves; and the possibility of important and fundamental changes in ideas of Mycenean burial practice were opened up.

A full report will appear in the Annual of the British School of Archaeology at Athens.

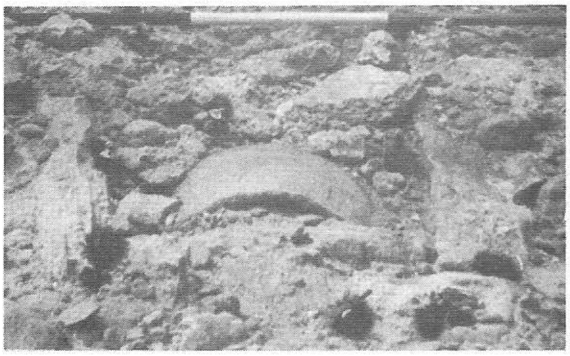
13 Intersection of two typical walls



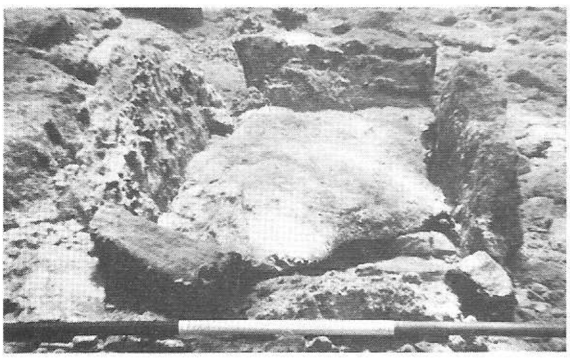
14 Area with walls and late Roman amphora neck



15 Cist grave with pithos burial

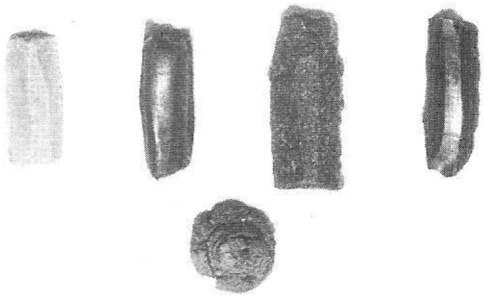


16 Cist grave with cover slab inside



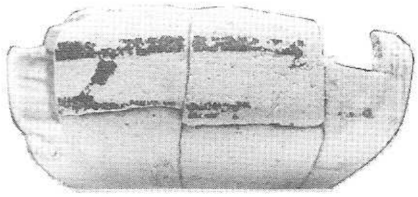
Scales in 13 and 14 are 20cm,in 15 and 16 30cm

17 Obsidian bronze and flint objects

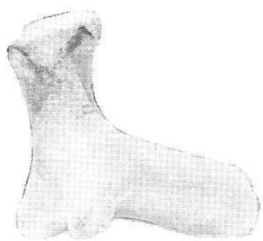


18 Early Helladic handmade bowl

19 Mycenean alabastron



20 Mycenean terracotta figure



21 Bronze figurine

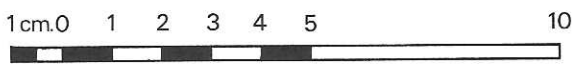


Figure 7

PAVLO PETRI BUILDING IX

m.w. CUUEG 68

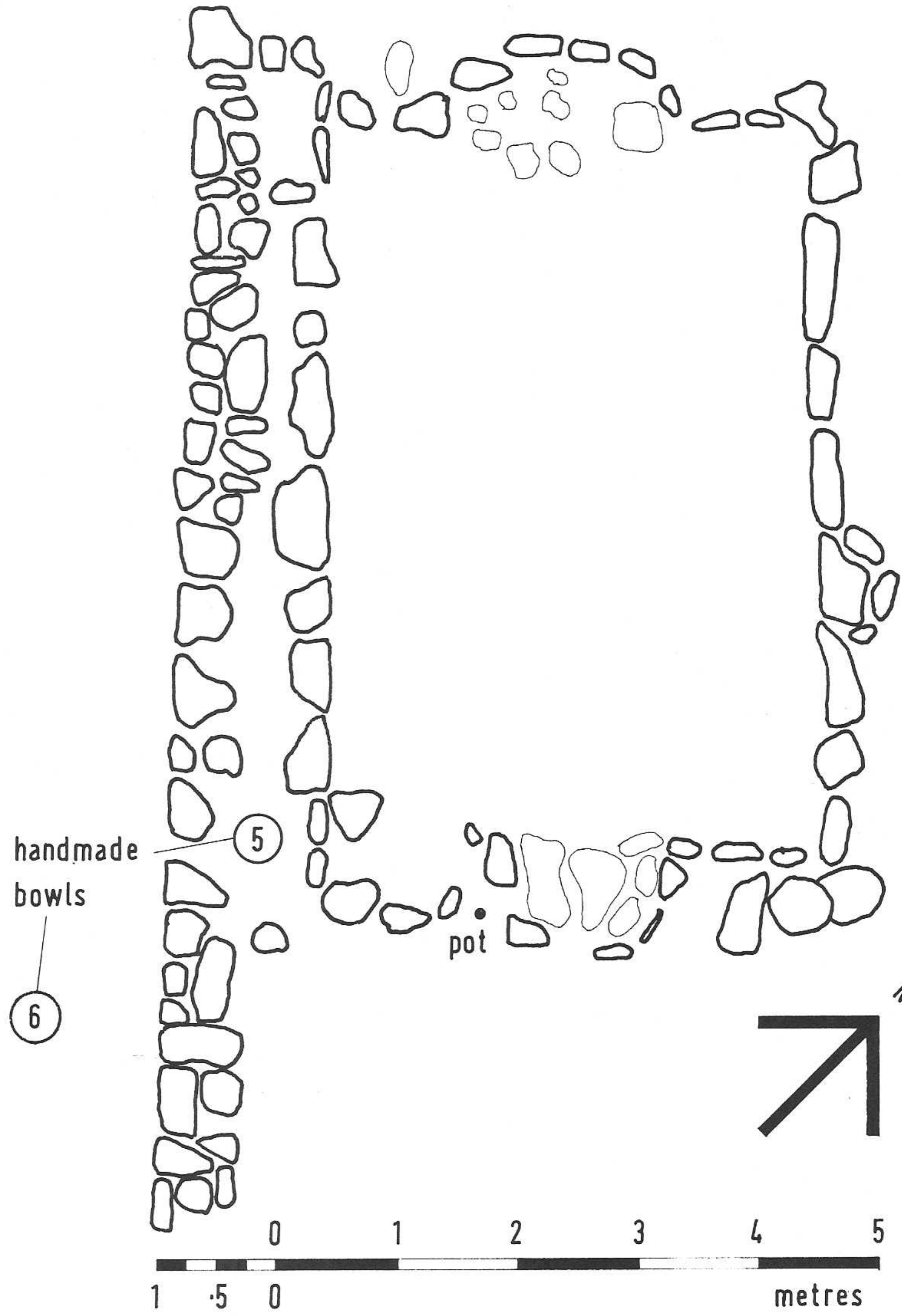
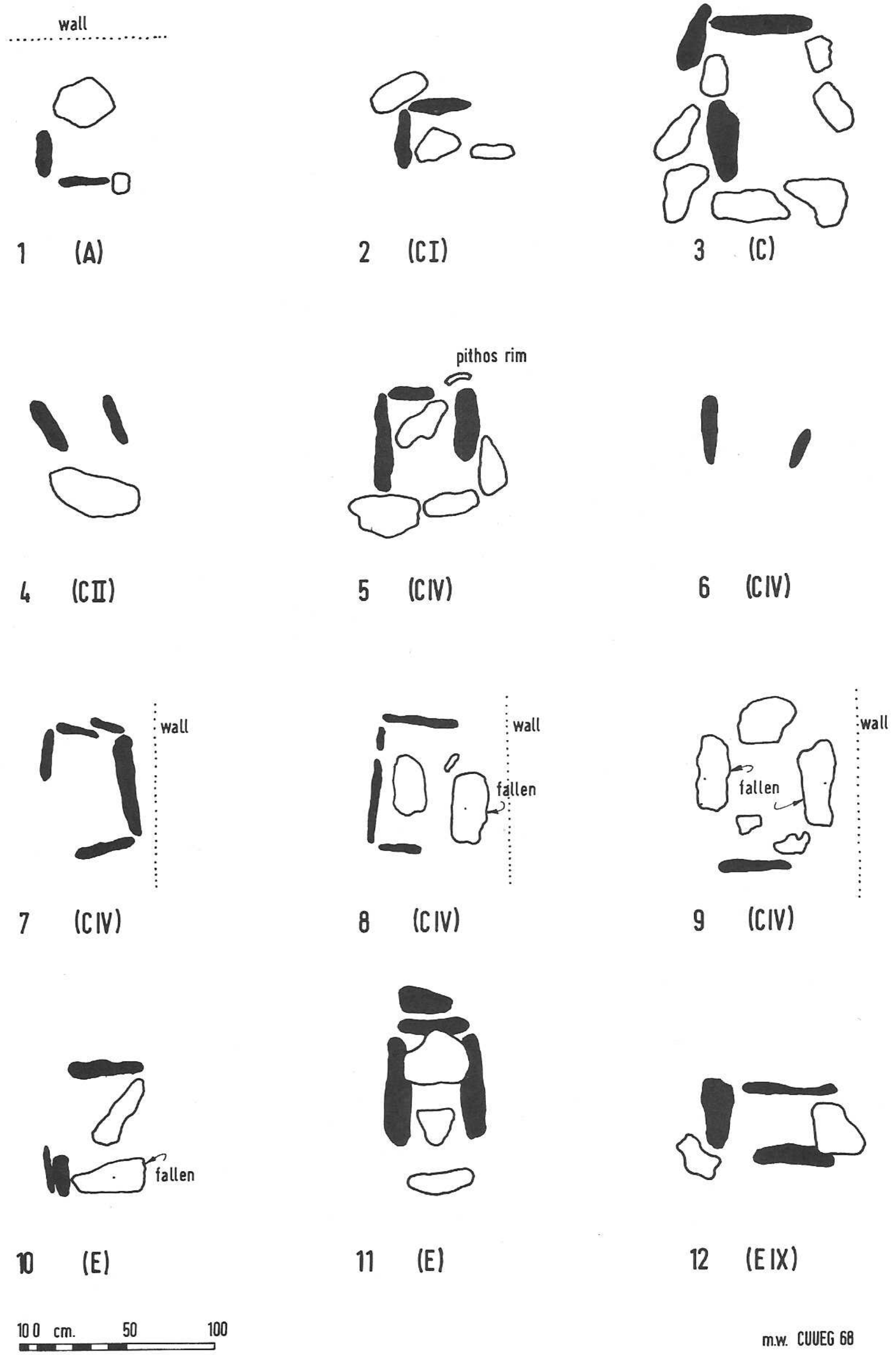


Figure 8


wall
1 (A)
2 (CI)
3 (C)
pithos rim
4 (CII)
5 (CIV)
6 (CIV)
wall
wall
fallen
wall
fallen
7 (CIV)
8 (CIV)
9 (CIV)
fallen
10 (E)
11 (E)
12 (EIX)
10 0 cm. 50 100
m.w. CUUEG 68

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XIII. FINANCIAL STATEMENT

DEBIT	£	s	d
Channel fares	43	5	0
Hire of house & furniture	42	7	2
L/Rover maintenance & spares	130	3	0
Vehicle tax	12	1	0
Vehicle insurance: England	56	18	0
Europe	10	5	0
Medical & Equipment insurance	50	17	0
Maps & stationery	38	7	6
Nikonos underwater camera	93	0	0
Aerial photography apparatus	32	10	4
Robot Royal automatic camera	49	0	0
Photographic equipment incl. films and processing	149	17	7
Purchase of Land Rover	250	0	0
Petrol	170	7	5
Food	210	0	0
Administration, miscellaneous	122	7	3
Publication of Report (est.)	50	0	0
TOTAL	1,511	6	3

CREDIT	£	s	d
North Sea Diving Services	20	0	0
The Royal Geographical Society	150	0	0
The Royal Society of St.George	50	0	0
The Faculty Board of Classics, Cambridge.	350	0	0
The Engineering Dept. Cambridge	20	0	0
CU Underwater Exploration Group	10	0	0
The Gilchrist Educational Trust	50	0	0
The Drapers Company	80	0	0
The Aerican Museum of Natural History, New York.	250	0	0
Personal contributions	300	0	0
Sale of Land Rover	200	0	0
Sale of equipment, some to 1969 Expedition at nominal charge	31	6	3
TOTAL	1,511	6	3