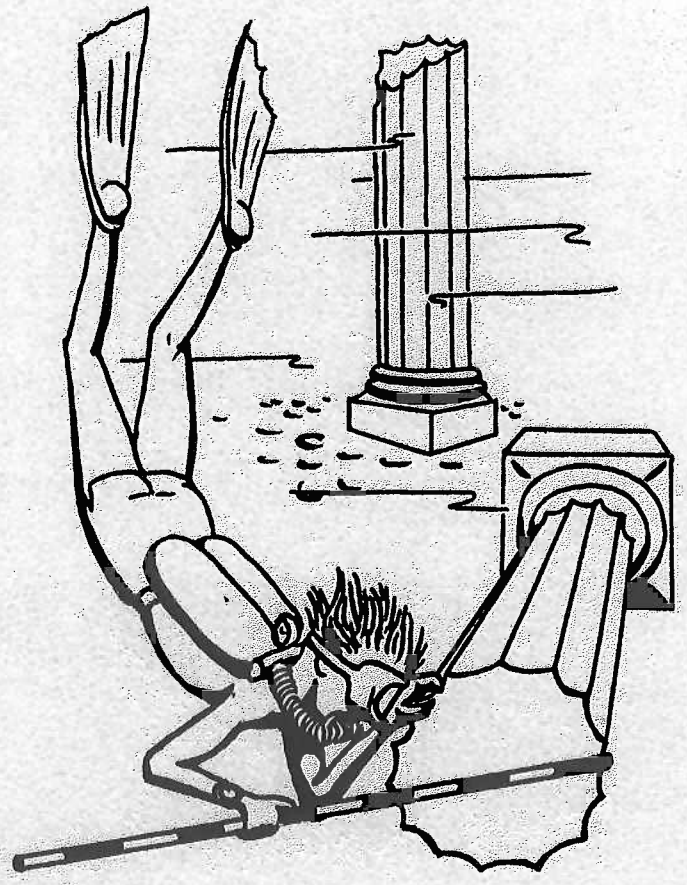
CAMBRIDGE ILLYRICUM EXPEDITION 1967 REPORT



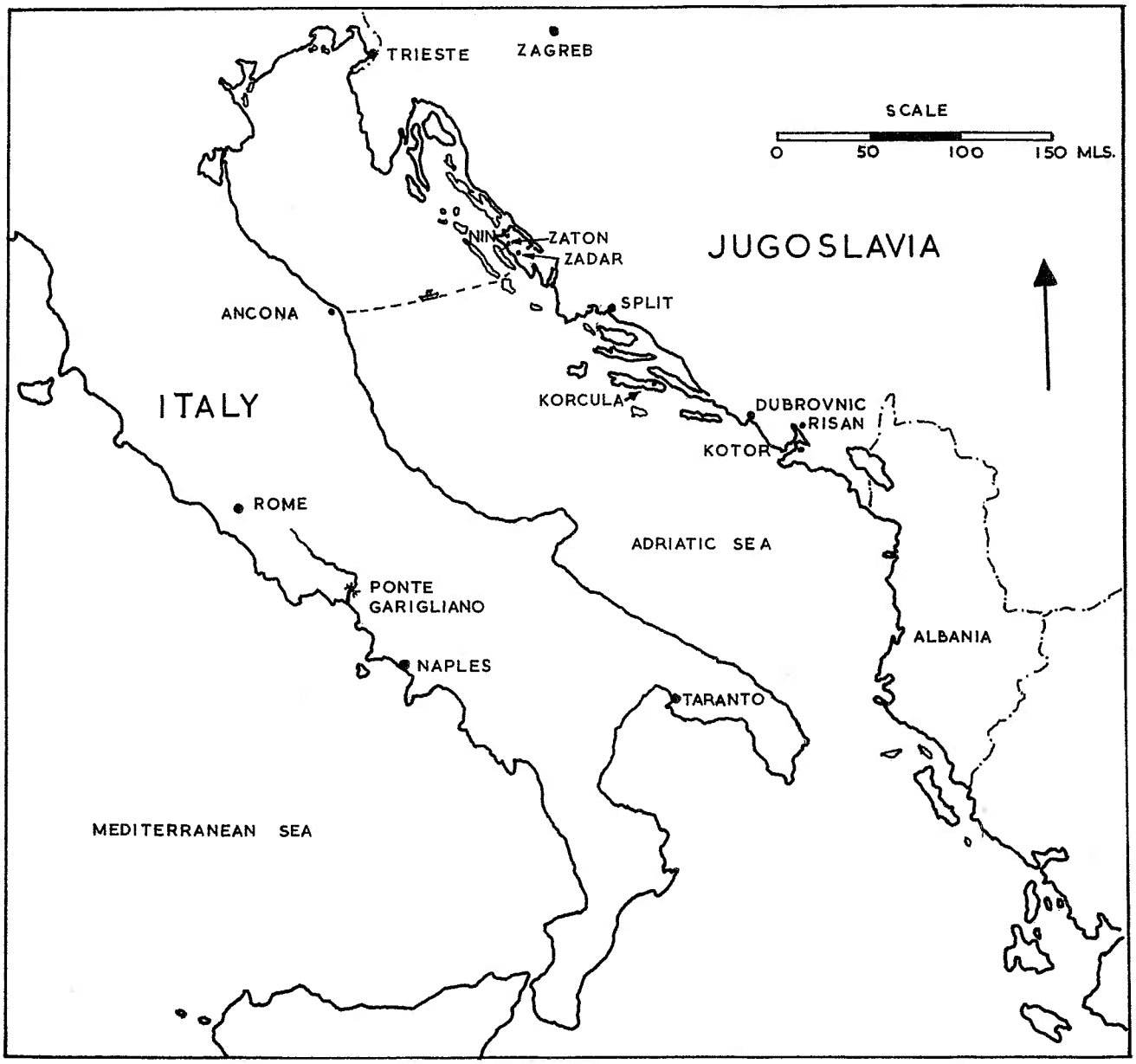
Patrons:

Lady Brogan, M.A., F.S.A.

J.B.Ward Perkins Esq., Director of the British School at Rome.

CAMBRIDGE ILLYRICUM EXPEDITION 1967

(Formerly Cambridge Maghreb Expedition)



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J.B. Ward Perkins, Esq., Director of the British School at Rome

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MEMBERS

M.F. Dallas, (Sherborne and Queens'), leader of expedition, surveyor and member of The Cambridge Expedition to Sabratha, 1966. Now working for Howard Humphreys and Sons.

D.P. Davidson, (Oundle and Sidney Sussex), electronics and cook; member of The Cambridge Expedition to Sabratha, 1966. Now working for Rolls Royce Ltd.

J.W. Ward, (Haileybury and Pembroke), mechanic and diving officer; member of The Cambridge Expedition to Sabratha, 1966. Now working for Matthew Hall Engineering Ltd.

R.A. Yorke, (Marlborough and Clare), photographer and surveyor; Leader of Cambridge Expedition to Sabratha, 1966. Now working for Laycock Engineering Ltd. Joined the expedition for four weeks.

N. Chitty, (Bryanston and Magdalene), photographer. Now working for National Opinion Polls.

A.J. Parker, (Portsmouth Grammar, Corpus Christi College and Institute of Archaeology, Oxford), Archaeologist. Now reading for Doctorate in Roman History.

R.A. Dartington, (Highgate and Kings College), surveyor and draughtsman. Now working with Arup Associates.

D.M. Livingston, (Dulwich and St. John's College), surveyor and chief draughtsman.

A.G. Whitelaw, (King's College), Medical Officer. Now in his fourth year at Cambridge doing research in psychology.

W.I. Buxton (Welbeck, Sandhurst and St. John's) diver. Now in his third year at Cambridge reading engineering.

All members of the expedition were experienced divers.

CAMBRIDGE ILLYRICUM EXPEDITION

REPORT

(formerly Cambridge Maghreb Expedition)

1967

INTRODUCTION

The Cambridge Maghreb Expedition was originally formed by members of The Cambridge University Underwater Exploration Group in late 1966 to survey the many classical submerged ports in the Maghreb (the coastal regions of western North Africa) between Cherchel (Algeria) and Tunis. This was to be an extension of the 1966 Survey of Classical ports carried out by C.U.U.E.G.'s "Cambridge Expedition to Sabratha" between Leptis Magna (Libya) and Tunis.

Regrettably, at a stage when almost all necessary preparations had been made, the outbreak of the Middle East War forced the group to abandon these plans. Alternative arrangements were made, in the short time left before the scheduled departure, to carry out a similar project on the Adriatic Coast of Jugoslavia.

The revised plan was to work northwards from Kotor, in Montenegro, to cover the many submerged remains which are believed to exist on the Dalmatian and Croatian coasts. Survey of the Istrian Coast was not contemplated.

The sponsors of the Maghreb project were informed of these plans and very kindly agreed to continue to support the expedition.

The Jugoslav authorities were advised of expedition's plans and, after a careful study of the available literature and discussion with persons knowledgeable on this area of the Mediterranean, the expedition was ready to leave England on June 27th.

JUGOSLAVIA

The expedition travelled in two vehicles, a Land-Rover (with trailer) and a Volkswagen Minibus. After crossing from Dover to Ostend, the group travelled through Germany and Austria to Jugoslavia, arriving in Kotor on July 1st.

Contact was made with Prof. Martinovic of the Maritime Museum, Kotor, and the work of making a preliminary survey of the ancient site of Risinium (Risan) was begun.

RISINIUM (Risan) See Plate 4.

The ancient site of Risinium is now occupied by the small town of Risan situated at the foot of the steep mountains which surround the eastern end of the Gulf of Kotor.

Observations by Sir Arthur Evans in the latter half of the 19th Century, and the size and nature of the remains which lie behind the centre of Risan, suggest that the town was of some size in Roman times. The coastal strip however appears to be too narrow to accommodate such a town and, since the region lies in an earthquake zone, it is possible that remains could have slipped beneath the sea. Local report and Sir Arthur Evans's observation of walls beneath the water tend to support this theory.

The following procedures were adopted for the preliminary search of the bay. Firstly five divers swam in line abreast following the shore line as indicated in the map of the site. (Plate 4). The depth of the water varied between 3–5 m and with a bottom consisting of thick mud. No signs of submerged structures were noted. Secondly a systematic search was made within the rectangular area directly off the quay, and thirdly divers swam compass courses across the bay as indicated on the plan. Lastly several traverses were made with a Ferrograph Offshore Echo Sounder carried in the dinghy. No positive observations were made during any of these searches.

Despite this the possibility of there being submerged Roman remains at Risan cannot be ruled out without making a more detailed search. For this an air-lift or similar equipment should be used to find out what lies beneath the mud. In a similar situation at Epidaurum (Cavtat) a large sector of the Roman town was surveyed by Falcon Barker in 1958 beneath the mud.

After this preliminary search it was learnt that no further work could proceed without the sanction of the naval authorities in Titograd, as the whole of the Gulf of Kotor is a military area. Since such permission was likely to take several weeks to come through, the expedition travelled to Dubrovnic and thence to Split.

At Split the Regional Institute of Protection of Monuments of Culture was consulted and it was learnt that the original application from England for an archaeological diving permit had been refused by the Central Committee in Zagreb.

Discussions with the authorities in the Institute, however, revealed that work might be possible in conjunction with a Jugoslav archaeologist from Zadar Museum.

Accordingly the expedition made its way to Zadar and, after calling at the Archaeological Museum, made camp near the village of Zaton on the western side of the Zadar peninsula.

Zaton (See Plate 5)

The site is situated near the point just north of the village of Zaton on the opposite side of the Zadar Peninsula from Nin (Aenona in ancient times).

A hook shaped artificial mole 120 m long was found to run out westwards from the point, curving toward the south at the seaward end in about 5 m of water.

A shoreward end of the mole was indistinct but the seaward end was more clearly defined; it consisted of smooth boulders (of a crystalline granite-like material) some 30 cm in diameter. In several places these boulders were piled 1 – 1.5 m off the bottom and were cemented together with what appeared to be marine concretions.

Many roof tiles and fragments of amphoras and pottery (See Plate 11) lay on the flat sandy bottom protected by the mole and, close to the seaward end of the mole, two marble columns (1.9 m x .25 m dia. and 2.3 m x .50 m dia.) of pink and grey marble were found. These columns had been cut to a cylindrical shape throughout and thus appeared to have been finished. As it is unlikely that they formed part of a structure standing on the mole, it is possible that they formed part of a seaborne cargo.

Several large white marble blocks (average dimensions 1 m x 0.4 m x 0.7 m) were found near the inshore end of the mole.

Other scattered finds included several cooking pots, a bronze coin (unfortunately unreadable), a glass dish, a lamp, bearing the stamp of the manufacturer Fortis, and the stamped neck of an amphora. These finds all appear to date between AD 0 - 150.

Beneath about 20 cm of sand close to the inshore end of the mole several walnuts and seeds were found fanning away the sand. Nearby several wood planks (about 30 cm x 3 cm thick of undetermined length) were partially uncovered. A small Italian vase of Roman date lay on top of the wood. Unfortunately, it was impossible to investigate further without the use of an airlift.

From the evidence above it seems that the port was in use during the first two centuries A.D. It is thought that the port served the ancient town of Aenona (Nin) at times when the frequent northerly wind, the Bora, rendered its own port unusable. The location of the port at Zaton would also have shortened the journey from the South by some 40 km. Support for this theory is given by the existence of a Roman road, visible in aerial photographs, leading from Aenona to the site.

Thanks are due to Mr. Brusic of the Zadar Museum, with whom the expedition worked at Zaton, and who was responsible for the discovery of the site.

After several days work at Zaton it became apparent that, without a full permit from Zagreb, archaeological work could not be continued in Jugoslavia. For reasons given in the Appendix, this could not be obtained, and the expedition returned to Split to consult The British Consul, Cdr. S. de M. Longsdon, whose help and hospitality deserves special mention.

Mr. J.B. Ward Perkins (Director of the British School at Rome) was contacted and the group was invited to work in southern Italy with Mr. John Huston (President of The Council of Underwater Archaeology, San Francisco).

ITALY

The expedition took the ferry to Ancona, Italy, and on July 26th joined the formal expedition of the Council of Underwater Archaeology which had been working since 1966, in the Garigliano River, about 27 km. from Sessa Aurunca.

From this time the expedition was under the direction of the Council with Brother Dominic Ruegg of St. Mary's College, California, as archaeological director, John Huston, the president of the Council, as general director, and Professor of Archaeology J.K. Anderson of the University of California, Berkeley.

In 1966, a group from the Council including Dr. Hartley Hoskins of the University of Chicago and John Huston, along with Gerhard Kipitan and Fred Harris, a diver, visited the Garigliano with the seismographic sub-bottom profiler, nicknamed "the mud pinger." This instrument developed by Dr. Harold Edgerton of Massachusetts of Technology consists of a sophisticated sonar device which makes profiles to ten meters deep similar to those made by seismographic oil exploration devices. The objective of 1967 was to explore the more than half dozen anomalies seen in the charts and to excavate the most promising.

Note from the Council of Underwater Archeology

The Council of Underwater Archaeology wishes to thank members of the Cambridge University Underwater Exploration Group for their co-operation and participation in the excavations on the Garigliano River in 1967. They worked under difficult circumstances to help complete the program of the Council. Not only did the group add divers who were badly needed, but also their special skills of exploration and surveying techniques which they had developed over a period of years. Exploratory systems such as the pendulum swing were welcome innovations of the University Group. The Cambridge divers were asked to contribute their special skills at the appropriate places and supplemented the Council team at F.G.1., whereas occasionally members of the Council team joined the Cambridge Group at the upper sites which were the heaviest responsibility of the latter. The work at F.G.1. was more in the line of an excavation, whereas the work in the upper river was exploratory.
The report here is that of the Cambridge Group itself. The Council will publish a preliminary, as well as a finished, report of the explorations and excavations.

FIUME GARIGLIANO

The area under investigation consisted of about 250 metres either side of the Ponte Garigliano immediately adjacent to the ancient town of Minturnae (Minturno). It was evident that the river had considerably undermined its banks in places (particularly above the Ponte Garigliano) and it seemed likely that substantial remains lay beneath the water. This idea was supported by many local reports and the existance of these remains was confirmed by a team from the Council using the sub bottom sounder in the summer of 1966.

The aim of the Cambridge Team was, first, to systematically search and survey the riverbed between the campsite (marked on the plan, see Plate 6) and the grid F.G.1. and, second, to assist in the detailed search of F.G.1.

Minturnae was a Roman colony founded in 295 B.C. on the site of a destroyed central Italic city. It lay in the southern part of Latinium, about one mile from the sea on the northern bank of the river Linis (modern Garigliano). It enjoyed its period of greatest prosperity from about 200 B.C. to A.D. 200, and towards the middle of the fifth century A.D. the town was abandoned in favour of the present hilltop site of Minturno.

After preliminary dives to establish the nature of the riverbed and the most likely whereabouts of remains (based on the presence of several walls protruding from the river bank) a grid (F.G.2.) was laid. While this was being examined, the river was systematically searched down to F.G.1. by means of the "pendulum" technique (see later). This search, combined with confirmatory dives, led to the establishment of three more grids F.G.3., F.G.4., and F.G.5.

The nature of the river bed above the bridge was generally as follows. On the inside of the bend (hereafter called the south bank), alluvial deposit had built up to a depth of about 2.5 m and any remains which might have been present were buried from view.

From the middle of the river to within about 2 m of the outer bank (the north bank) the bottom was approximately level at a depth of 7 –8 m, and then rose steeply in a series of hard mud steps (which appeared to be the uneroded bank) to the water's edge.

Several walls protruded from this bank and the tumbled remains of undermined structures were found on the level bottom.

F.G.2. See Plate 7.

The upstream end of the grid covered an area of many large squared blocks of local hard sandstone approximately 80 cm x 40 cm x 30 cm with a very large number of flat bricks, of average dimensions 25 cm x 25 cm x 5 cm, in piles between them. It was supposed that these bricks had once laid in courses, and not as paving, since several were found still adhering together. No similar bricks were found in the walls protruding from the bank, so it may be assumed that these remains came from another building.

The scattered blocks, but not the bricks, continued some distance above the grid and terminated with a line of rubble and concrete (composed of rough stones, approximately 20 cm across, and pot sherds set in a matrix of mortar) leading towards a wall in the bank about 20 m above the upstream end of the grid.

In squares 0, 32–36 to S, 32–36, below a submerged tree (which constituted a typical underwater hazard in the river), several almost complete amphoras, the necks and handles missing, were found; see Plate 12, 1 and 3. Their presence may be explained by local reports that some farmers had come across a number of amphoras while ploughing and had dumped them in the river, fearing interference from the authorities.

The lower half of the grid included several large lumps of ancient concrete (similar to that described above) and much rubble of small blocks and sherds. It was assumed that this rubble was disintegrated concrete. Several fragments of marble moulding were found in and around square I.43 but later a further piece was found embedded in concrete in I.53 suggesting that the walls were composed of rubble from earlier buildings.

F.G.3. See Plate 8.

A large number of boulders of average size (70 cm x 30 cm x 30 cm) all of which were flat on one side were found in this grid. The boulders appeared to stretch in a line across the river, vanishing into the alluvial deposit on the south side.

Closer examination of these stones revealed clear indication of track wear similar to that visible in the road stones of the Via Appia where it passes through the centre of ancient Minturnae.

This observation fitted in very well with the fact that a roadway protruded from the river bank in the same line and the stones were clearly an extension of this roadway across the river.

Several large pieces of concrete were found upstream of the roadway but comparison with the Roman bridge, which still stands near Sessa Aurunca, and the low level at which the roadway protruded from the bank (about 40 cm above river level) suggested that there had been no bridge at this point, but that erosion had simply undermined the roadway.

F.G.4. See Plate 8

The grid, 10 m by 14 m was laid over an area of gravel under 3 – 4 m of water in which numerous items of pottery were found. One amphora was reconstructed almost completely and appears to belong to a type produced in Central Italy in Roman times. It is possible that this was an example of local ware. (Plate 12. 4).

A small red glaze cup, with the stamp CN . . . may be Arretine and date from the first century A.D.

One of the most spectacular finds was a very large, roughly spherical Dolium (storage vessel) about 145 cm in diameter, some 5 cm thick, with a neck 65 cm in diameter. The pot was complete and nearby several fragments of similar vessels and lids were found. It was, unfortunately, impossible to raise it since it was embedded in mud and probably weighed around half a ton.

F.G.5. See Plate 9.

The "Pendulum" search of the river bed had to be broken off due to the presence of several huge masses of concrete rising some 4½ m from the bottom, fouling the search line.

Since this area lay close to the natural bridging point of the river (near the modern bridge) it was felt that these masses of concrete could be in the remains of the bridge by which the Via Appia crossed the river in ancient times.

A tape was laid along the river bed and the location of the concrete blocks measured off at right angles to it.

The detailed search of the area revealed that the masses extended parallel to the river bank, not across it. Likewise no evidence of road stones similar to those in F.G.3. was found.

It was concluded that these concrete remains were of artificial embankments and not a bridge.

Further masses of concrete (but not so large) and cut stone blocks were found downstream of the modern bridge on the south bank of the river, but again, these gave no appearance being the remains of an ancient bridge.

F.G.1.

Search of this area, directly adjacent to the ancient town of Minturnae, was already under way on the arrival of the expedition.

The grid, described in a later section, covered a 12 metre wide strip along the north bank of the river and was continually increased in length on the discovery of more and more finds until it covered a total length of 224 metres.

The rock strewn bottom sloped away from the bank to a flat gravel bottom near the centre of the river in about 5 metres of water. Sloping away from the water's edge to the centre of the river many large lumps of "concretion" were found. These concretions occurred in ledges throughout the site and contained innumerable ancient artefacts. Amongst the finds were the relics of the intense military activity to which this site was subjected during the last war, including helmets, rifles, pontoons and even unexploded bombs and shells.

Over 2000 coins were found lying among the rocks or embedded in the concretions, almost all of which dated from c.280 B.C. to c.A.D. 440. The majority were bronze, some silver, but none gold; the vast majority were official issues of the Roman mint, and made up a representative sample of the currency which was in use in the ancient town.

How the coins found their way into the river in such numbers was not at all clear, but many thousands of coins have been recovered from the river Tiber in Rome. The coins may have been thrown in as an offering or in fulfilment of a vow.

A large number of lead scale weights and net sinkers were found, along with the fragments of lead sheeting similar to that which might have been used for lining containers or sheathing ships' hulls. Since almost all of the other objects found nearby were ancient it was assumed these lead objects were also of ancient origin.

A diversity of bronze objects was recovered ranging from a magnificent one-handled ornamental dish (possibly from the first century B.C.) to numerous surgical instruments, household objects, and fragments of mortice locks (see plate 3).

A number of bronze ornaments, such as brooches and pins, were found, together with some gold jewellery, which included a gold necklace.

A most interesting category of finds included several fragments of crude terra cotta statuary, some representing heads, torsos and other limbs; others appeared to depict human internal organs.

This sculpture was probably of a votive character, for dedication in a sanctuary to secure the wellbeing of the supplicant or person prayed for.

A wide variety of marbles included several statues and statuettes representing deities, decorated architectural pieces, and the figure of a dolphin which may have stood on a quay. One piece, the headless life size statue of a Roman magistrate wearing the Toga, posed an interesting problem in "Heath Robinson" salving techniques.

Much household pottery was recovered, ranging from the glossy black ware of Republican times to the local coarse pots of the Empire.

The final analysis of the finds in this sector of the river will be undertaken by Brother Dominic Ruegg and Professor J. Anderson for the Council of Underwater Archaeology.

A report on the coins is being prepared by A.J. Parker and B.W. Frier for publication in a numismatic journal.

It remains to mention that, although only the areas described above were studied in great detail, the "pendulum" search revealed in addition, the presence of many isolated objects which included dolium fragments, sections of ancient concrete (in no readily recognisable shape), several sandstone column drums and marble capitals and a huge arsenal of equipment from the last war.

CONCLUSIONS FROM FIUME GARIGLIANO

Despite the abundance of finds described above, it was extremely difficult to make any sensible suggestions as to the nature of the remains (except possibly in F.G.4. and F.G.1.) since all had been hopelessly distorted by erosion from the riverbank.

The votive nature of the finds in F.G.1. suggest that the site may have been occupied by a sanctuary to a river deity in ancient times, although no coherent building remains were found.

F.G.4. clearly covered the extension of the roadway projecting from the river bank but, as explained above, was unlikely to have been the site of a bridge.

The via Appia passes through the centre of Minturnae and is visible again at the site of the Roman bridges in Sessa Aurunca. Its exact course is not known, but it appears that, at some point, there must have been a bridge (and, from comparison with that near Sessa Aurunca, a fairly substantial one) across the River Garigliano.

There is no doubt, however, that many of the finds were of great archaeological importance, and the members of the expedition gained much valuable experience in underwater work under difficult conditions.

METHODS OF SEARCH AND SURVEY EMPLOYED AT FIUME GARIGLIANO

Surveying Instruments

2 Telescopic Alidades
2 Planetables
1 Sextant
1 Range finder
5 x 30 m. and 2 x 50 m. Fibreglass tapes
2 Prismatic Compasses
1 Surveying Compass
Several Ranging poles
Formica underwater writing boards

The general method of surveying both in Jugoslavia and Italy was to lay out a shore base line from which alidade sights were taken on the object to be surveyed. If, as was the case at Fiume Garigliano, it was not possible to measure a base line directly, simple triangulation was used.

The range finder was found to be of use in conjunction with an alidade for establishing maps of shorelines and as a check on Alidade sightings. However its minimum range was 250 yeards which limited its usefulness.

The compasses and sextant proved very useful in preliminary work and in checking sightings.

Tapes, ranging poles and underwater writing boards were, of course, essential in all detailed underwater measurements.

Each diver's observations were recorded on a master plan as soon as he returned from a dive. This served the dual purpose of avoiding misinterpretation of the diver's sometimes garbled notes (it is often extremely difficult to make coherent notes underwater, especially when cold) and informing the next diver of the stage which the search had reached.

Owing to the poor visibility (at no time greater than 1 metre) and the speed of the current, it was necessary at all times to work with reference to some guide system underwater.

For the preliminary reconnaissance of the river bed compass courses were sufficient, but to locate objects accurately a much more rigid system had to be adopted.

The grids F.G.2, F.G.3.and F.G.4 were constructed from Rabone-Chesterman fibre-glass tapes or ranging poles laid as accurately as possible (using compass directions) in rectangles. Further tapes were then stretched parallel to the stream one or two metres apart. The diver would swim upstream between these tapes noting the position of each object on a formica board (from which the information was later transferred to a master plan back at camp). The tapes were then moved one or two metres across the stream and the operation repeated.

The grid F.G.1 consisted of two sets of two 6 metre galvanised iron pipes, laid parallel to each other on the bottom and held 2 m. apart by lengths of nylon cord at 2 m. intervals. The resulting 2 m. squares were thoroughly searched and the grid was then advanced up the river by carrying the downstream pipe 4 m. upstream. Using the two sets side by side a strip of the river 12 m. wide and some 250 m. long was searched.

To cover the vast area between F.G.2 and F.G.1 a quicker and thus less accurate, but very thorough, method was developed known as the "pendulum" technique.

An inflated rubber tyre was anchored to a stone in midstream by about 15 m. of nylon rope. A thin nylon cord, the search line, was led downstream from the tyre, and a guide rope 150 m. long stretched along the bottom downstream of the anchor stone.

The diver would hold the thin cord and, keeping it taught, would swim in circular arcs from bank to bank, recording objects in their estimated position as he found them Each time he came to a bank he would wind in two metres of the search line and swim back towards the other bank. In this way the whole river bed was covered in concentric circular arcs two metres apart. Objects of interest were marked with buoys and the positions of these fixed accurately from the shore.

On approaching the tyre the diver would find that he was unable to reach a bank at the end of a sweep; then the tyre would be moved downstream to a position about 30 m. upstream from the point at which the search had started (marked with a buoy) and the operation repeated.

The corners of each grid were surveyed by taking sights on a diver simultaneously from two alidade positions on opposite sides of the river. The diver would maintain his position above the corner of the grid by keeping a buoyline to the corner vertical below him.

Survey work was severely hampered by the presence of trees and bushes which grew right down to the water's edge. Unfortunately, although these considerably enhanced the beauty of the river, they prevented sightings being taken over a large section of the river from any one point on the bank.

Short wave radios and a loud hailer, the latter generously loaned to the expedition by Pye Telecommunications Ltd., Cambridge, were invaluable for maintaining contact between the two alidade positions and the diver.

A sounding sextant, a surveying compass and two prismatic compasses provided extremely useful methods of checking results or surveying objects which could not be sighted from the bank. Compass readings were subject to grave error anywhere near the modern steel bridge.

On leaving the river Garigliano on August 19th, several members of the expedition visited the excavation of a wrecked Roman ship which had foundered while carrying marble sarcophagi south of Taranto. The excavation was sponsored by the University Museum, Pennsylvania, U.S.A., under the direction of Mr. Peter Throckmorton.

It was a most valuable and exciting experience for the team to participate in the excavation, and observe the techniques and precautions used in this type of work.

PHOTOGRAPHY

Equipment:-

Land Cameras:	Nikon F with Normal Lens, 105 mm Lens. Pentax S.1. 55 mm Takumar lens. Yashicamat Twin Lens Reflex. 100 mm Trioplan lens x 2 Teleconverter.
Underwater:	Nikonos and Calypsophot both with 35 mm lenses. Westonmeter in Underwater Case. Sekonic Marine Underwater lightmeter.
Film:–	Kodak film was used throughout.

Of the 1,290 colour slides taken, 269 make up a lecture set. 50 black and white photographs have been selected from the 700 taken, for use as a display set of expedition activities.

Films were kept cool in a box lined with expanded polystyrene. One frame on each film was used to record the taker, location and date for later reference. Frosted perspex was found to be an extremely useful background for recording archaeological finds in the field.

An abundance of film was found to be vital; a change of plan or conditions can increase the usage of high or low speed film. A particular instance of this was the increase in the use of slow colour surface films when underwater visibility was permanently too restricted for photography beneath the surface.

On the spot development of black and white films was a great asset for checking that cameras were functioning correctly and for checking underwater exposure in differing conditions. The equipment and facilities needed were cheap and simple and so long as temperature and cleanliness were controlled the results were acceptable.

A 16 mm Kodachrome II cine film was shot of the group's acrivities at Minturno for the Council of Underwater Archaeology (to be edited to approximately 20 mins.). An 8 mm cine film was taken of the lighter side of expedition life. (Cameras respectively Bolex and Bell & Howell).

Most colour shots were taken on land in bright sunshine with Kodachrome II or Ektachrome X. A polaroid filter was used on a few occasions for water penetration when taking shots from the land. At Zaton, Plus-X Pan Black-and-White film was used underwater. An attempt was made at all times to use a shutter speed on less than $^1/_{125}$sec., except where the photographer was able to grasp a rock or support himself. This avoided camera shake which would often occur at a $^1/_{60}$sec. or longer when the photographer was free diving. Some action shots of divers, using hammers and chisels, were taken at $^1/_{60}$sec. to illustrate movement. Here the photographer was braced on the sea bed.

In Korcula most underwater pictures were in colour. All these were on High Speed Ektachrome film. For reasonable colour results flash had to be used below thirty feet. The flash cable on the Calypso and Nikonos flash guns was found to be inadequately short since it did not allow side lit photographs. Consequently large snowflaky particles dominated a good many underwater flash photographs. A 4 to 6 foot cable would give much more scope for effective flash photography.

Visibility was excellent in Korcula—100-180 feet. Light penetration was very good until 2 p.m. when invariably onshore winds would whip up the surface. Until around 2.p.m., assuming full sunshine, exposure for 160 A.S.A. film was $^1/_{125}$ sec. at f4 at 60 feet.

Underwater photography in the Fiume Garigliano was impossible due to the turbid conditions.

EQUIPMENT

Experience gained during the Expedition to Sabratha in 1966 gave a very useful guide to the sort of equipment which would be vital to an expedition of this size and nature. In addition it was realised that some measure of comfort paid great dividends in terms of increased efficiency of the working team.

CAMPING EQUIPMENT

Adequate tent capacity for all ten members (albeit a somewhat varied assortment) was taken, and this precaution proved itself justified, especially in Jugoslavia, where it rained frequently. In addition several large sheets were used to provide shade. Collapsing campbeds of the Safari type were used but regrettably these lived up to their name and collapsed all too frequently.

Cooking was done on two twin burner gas stoves, supplemented by two Primus Stoves. Messrs. Waterford Iron Founders Ltd., very generously supplied several Colourcast Cooking vessels which considerably eased the usually irksome task of preparing meals while camping.

Three Tilley lamps provided adequate light for night-time drawing.

DIVING EQUIPMENT

A total of seven diving sets were taken and Messrs. Beaufort (Air-Sea Equipment) Ltd. generously lent six inflateable life-jackets to the expedition. The value of these life-jackets cannot be over estimated on a trip of this kind, where divers may frequently be carrying a lot of equipment and be relatively unmanoeuverable on the surface, while some distance from the dinghy or the shore.

In anticipation of work below 30 ft. the expedition bought three cheap diving watches to prevent divers running into decompression times. Two failed within two weeks but the third was a valuable asset!

A 12 ft. Avon dinghy (purchased at a very generous discount) with a 4½ H.P. Seagull Outboard Motor (loaned by The Cambridge University Officers Training Corps) proved excellent as a diving tender.

The most valuable item of equipment, however, was a Dunlop 5 c.f.m. air compressor, without which it would not have been possible to operate as a fully independant diving team.

It was proposed, as far as possible, to complete drawings in the field and to this end two large drawing boards were taken. These were used to the full and still more drawing space would have been useful.

SCIENTIFIC EQUIPMENT

Equipment falling under the scope of this section:

2 Citizen band transceivers
transistorised loudhailer
echo sounder
proton magnetic gradiometer

The short wave radios & loudhailer were used while surveying; their ranges were comparable, in the order of hundreds of yards, depending on conditions. They proved invaluable, were reliable and required little or no servicing.

The echo sounder, which was loaned to the expedition, provided a means of drawing detailed contour maps of areas searched. An isobathic map of the river Garigliano has been drawn in some detail, and is available to interested parties but its publication falls outside the scope of this report.

Although the instrument was of fairly dated design, and was intended for use up to 300 ft. in 3 ranges, giving a maximum sensitivity of 1 inch per 30 ft., it proved adequate for most of the jobs for which it was required. The main drawbacks were in weight, size and power requirements. Transistorised equipment would have been better.

The technique followed in the echo-counder surveying was necessarily simple. Two assumptions were made: that the over distances of up to 50 m. the boat moved with constant speed in a straight line. The validity of these assumptions was checked by traversing in two mutually perpendicular directions and was within the resolution of the sounder. In addition to this, compass courses and back-bearings were taken.

The magnetometer was originally intended for use in North Africa, where features are frequently buried under silt or sand in shallow water, and where modern magnetic degris is relatively scarce. The sensitivity of the instrument, of the order of 1 gamma per foot, could have been sufficient to provide valuable information under these conditions. In the event, however, the expedition encountered in Jugoslavia deeper waters than originally anticipated. Greater sensitivity, and/or the use of submerged sensors would have been necessary to obtain satisfactory resolution. In Italy, the bed of the river Garigliano proved to be so littered with metallic debris from the last war, that search would have been futile.

MEDICAL

Living as they did from the contents of two vehicles in a hot climate, and being much of the time on the move, the members of the expedition were exposed to all the risks of stomach complaints, fatigue, and local infection.

Considering the conditions, however, health was remarkably good. The minor cuts and abrasions which are inevitably encountered while diving were healed by prompt treatment with mild antiseptics. Fatigue due to the heat was largely alleviated by the use of salt tablets. These almost invariably revitalised the taker although one suspects that this effect was often psychological as the diet was not deficient in salts and vitamins.

Careful washing of all foods, especially local produce, in Milton or some similar disinfectant almost eliminated cases of Mediterranean Diahorrea. When such cases did occur Enterovioform effected a quick cure except in one case of acute gastroenteritis in Italy, which required the attention of the local doctor.

The most disabling condition was experienced in the River Garigliano, where inflammation of the outer ear gave rise to periods of intense pain. Only one member of the expedition escaped this and it is probable that it resulted from long periods (up to 4 hours a day) spent in the dirty river water. The antibacterial substances normally present would be washed out, leaving the ear vulnerable to the normally non-pathogenic organisms such as protozoa, fungi and bacteria. It was found that keeping the ears out of river water, together with the local application of antibiotics and steriods, provided some improvement. The pain could be releaved with codeine. This persistent condition seriously affected the expedition's working capacity.

The members of the expedition are extremely grateful to the drug manufacturers who gave medical supplies, and to Dr. Hawtrey May for organising a most comprehensive Medical Kit.

DIVING

JUGOSLAVIA

Conditions in Jugoslavia varied greatly from place to place. In the Gulf of Kotor visibility was poor (about 10 m. maximum) and the depth no more than 8 m. The mud bottom was devoid of features.

At Zaton the maximum depth was 7 metres but visibility was excellent and marine life abundant.

At Korcula, where the expedition waited for replies from Italy, the best diving conditions were found. The bottom sloped steeply to 180 ft. and was teeming with marine life. Visibility also was excellent.

Altogether about 60 man dives were made in Jugoslavia.

ITALY

The conditions experienced in the River Garigliano have been described previously. The water was cold (full suits were almost always worn) and murky. The presence of submerged obstacles, such as branches, and the difficulties of orientation, necessitated careful diving.

A total of 104½ man hours (some 100 dives) were recorded.

APPENDIX 1

It was thought that it would be useful to include in this report a summary of the structure of Archaeological Authorities and the method of obtaining working premission in Jugoslavia.

Most towns of any size on the Dalmation and Croatian coasts contain an archaeological museum which is responsible for all work done in its own area. The programme of work in these museums in co-ordinated by The Regional Institutes for the Protection of Monuments of Culture (notably at Split and Rijeka) who in turn are responsible to the Republican Institute for the Protection of Monuments of Culture at Zagreb.

For a permit to work in any area application must be made either through the Regional Institute, or direct to the Republican Institute, in winter or early spring. A committee sits in early spring to decide on the projects for which a permit will be given. Applications arriving at a later date stand a very slim chance of being accepted.

In Montenegro the central authorities are at Titograd, and permission must also be sought from The Naval authorities, since most of the Montenegran cost is a military area.

APPENDIX 2: FUTURE WORK

The last two years work in underwater archaeology by CUUEG has inspired the Group to continue in this field. Several opportunities have been opened up and it is hoped that these will be exploited in due course.

Two members of this expedition and the Expedition to Sabratha, 1966, have won a Churchill Memorial Fellowship to carry out a preliminary investigation of the 30 sites in the Maghreb which this expedition originally intended to cover.

A team from CUUEG is planning to investigate and survey the sunken Mycenaean city of Elaphonisos, which was discovered on the south-eastern coast of Greece in the summer of 1967.

A team from Oxford University, under this expedition's archaeologist, intends to complete the work which was begun in Jugoslavia.

It is hoped that contact with Mr. Peter Throckmorton will be continued, and that also some thirteen unsurveyed sites on the southern coast of Italy (to which he drew our attention) will, in time, be investigated.

FINANCIAL STATEMENT

DEBIT

	£	s	d
Fares: Channel	90.	3.	0.
Adriatic	58.	10.	2.
Train (Rome to England)	30.	16.	4.
Train (Jugoslavia to England)	30.	0.	0.
Camping dues, Tolls	28.	3.	2.
Insurance: Vehicles	51.	15.	0.
Equipment and Health	73.	1.	6.
Fuel	203.	16.	8.
Vehicle maintenance, Spares and Trailer	152.	10.	4.
Maps, Charts, Stationery	21.	12.	6.
Travel documents	17.	4.	6.
Equipment: Compressor	255.	0.	0.
Dinghy	70.	19.	0.
Diving	78.	15.	5.
Camping and Misc.	65.	10.	8.
Surveying (Hire)	27.	7.	6.
Photographic: Film	75.	0.	0.
Processing	50.	0.	0.
Equipment	56.	8.	9.
Food	245.	10.	7.
Printing (prospectus etc.)	13.	10.	9.
Medical expenses	21.	13.	0.
Administration, postage, sundries	135.	5.	2.
Telegrams, phone calls in Jugoslavia	20.	0.	0.
Purchase of Land Rover	330.	0.	0.
Purchase of Volkswagen	100.	0.	0.
Report (estimated)	100.	0.	0.
Total	2402.	14.	0.

CREDIT

	£	s	d
Sir William Halcrow and Partners	25.	0.	0.
Queens College Cambridge	5.	0.	0.
The Gilchrist Educational Trust	50.	0.	0.
The Drapers Company	100.	0.	0.
The Albert Reckitt Charitable Trust	100.	0.	0.
The American Museum of Natural History Explorers Club ($ 500)	178.	4.	6.
The Faculty of Classics, Cambridge	350.	0.	0.
The Pilgrim Trust	250.	0.	0.
The Russell Trust	150.	0.	0.
The Society of Antiquaries	25.	0.	0.
North Sea Diving Services	10.	10.	0.
Divcon (International) U.K. Ltd.	50.	0.	0.
The Royal Geographical Society	150.	0.	0.
Personal Contributions	540.	0.	0.
Sale of Land Rover	250.	0.	0.
Sale of Volkswagen	20.	0.	0.
C.U.U.E.G. (toward Compressor)	100.	0.	0.
Sale of Assets (estimated)	50.	0.	0.
A.A. Travel rebate on Train fares	23.	2.	0.
Total	2426.	16.	6.

ACKNOWLEDGEMENTS

The Members of the expedition would like to thank all those many people who, be way of advice and hospitality, assisted the expedition in all stages of preparation and in the field. In particular special thanks are due to:

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J.B. Ward Perkins Esq., Director of the British School at Rome.
Miss J. du Plat Taylor, Secretary to the Committee for Nautical Archaeology.
Prof. C. Hawkes, Professor of European Archaeology, Oxford.
Prof. P. Salama, Algiers.
Prof. R.M. Cook, Professor of Classical Archaeology, Cambridge.
Monsieur P.A. Fevrier, Directeur des Antiquites, Algiers.
Dr. N.C. Flemming, National Institute of Oceanography.
L.P. Kirwan Esq., Director of the Royal Geographical Society.
Dr. G. Bass, University Museum, Pennsylvania, U.S.A.
Prof. G. Bean, Istanbul.
Albert Fried, New York.
Peter Throckmorton, University Museum Pennsylvania.

Surveying using alidade

Discussing amphora stamp

Chipping marble samples

Plate 2

FIUME GARIGLIANO, ITALY.

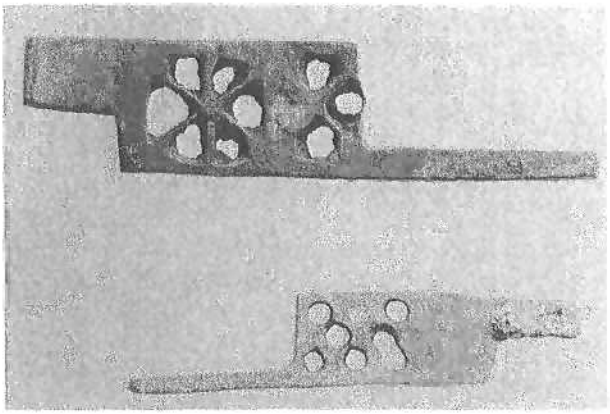
Transcribing diver's measurements

Reconstructing amphora

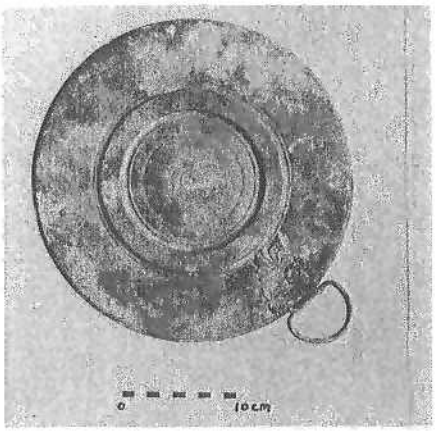
Echo sounding

SOME ZATON FINDS

SOME FINDS FROM FIUME GARIGLIANO



Fragments of mortice locks



Bronze dish

Terracotta head

Bronze coin (Nero)

Prof. B. Grbic, Belgrade University.
Prof. J. Luetic, Maritime Museum, Dubrovnic.
Prof. Suic, The Archaeological Museum, Zadar.
Prof. Z. Raknic, Archaeological Museum, Zadar.
Prof. M. Ivanisevic, Split.
J. Cvetjanov, Split.
Zdenko Brisic, Zadar.
Dr. M. Ballance.
Dr. J. Alexander.
Miss J.M. Reynolds, Faculty of Classics, Cambridge.
C. Vita Finzi Esq., University College, London,
S.Y. Dawbarn, Algiers.
P. Sparrow Esq., The British Embassy Tunis.
R. Baker Esq., The Foreign Office.
Dr. Chris Roads.
Dr. L. Hawtrey May, C.U. Health Service.
Mrs. Stojana Burton
Emil Tedesko, Korcula.
Cdr. S. deM. Longsdon, The British Consul, Split.
The misses Saniter, Ward and Mackey

The expedition especially wishes to thank John Huston of the Council of Underwater Archaeology, for enabling the expedition to continue, when further work in Jugoslavia proved impossible.

The many trusts and other organisations, listed with the financial statement, whose generous support made the expedition possible.

The following are to be thanked for their material assistance by way of loans of equipment and gifts or generous discounts on goods.

The Royal Geographical Society.
Corpus Christi College, Oxford.
Rabone Chesterman Ltd.
Chesterfield Tube Co. Ltd.
Pye Telecommunications Ltd.
Lilleywhites.
Dunlop Co. Ltd.
Avon Rubber Co. Ltd.
Cambridge University Officers Training Corps.
British Ropes Ltd.
Firestone Tyre & Rubber Co. Ltd.
William Sindall Ltd.
Messrs. Kodak Ltd.
Cyril Ridgeon & Son, Ltd.
Joseph Lucas Ltd.
Collins & Chambers Ltd.
D.W. Page, Esq.
The Ferrograph Co. Ltd.
Cambridge Outdoor Centre.
Scurfields Ltd.
Waterford Ironfounders Ltd.
Beaufort (Air-Sea) Equipment Ltd.
Dr. N.C. Flemming.
A.F. Davenport, Esq.

And for their most obliging and efficient service:

Wallis & Son Ltd.
Stanley Thomas, Esq.
Galbraith, Pembroke & Co.

For gifts of food and provisions

L. Rose & Co. Ltd.
H.J. Heinz Co. Ltd.
Alfred Bird & Sons Ltd.
British Egg Marketing Board.
Unilever Ltd.
Fray Bentos.
Welch & Sons Ltd.
Kavli Ltd.
Liebig's Extract of Meat Co. Ltd.
British Match Corpn. Ltd.
Velvet Crepe Paper Co.
McDougalls Ltd.
Ryvita Co. Ltd.
Ovaltine.
Quaker Oats Ltd.
Condima (England) Ltd.
Allied Produce Co. Ltd.
Vesta Products Ltd.
Whitworths Holdings Ltd.
Tate & Lyle Refineries Ltd.
Weetabix Ltd.
Pierce Duff Ltd
Proctor & Gamble Ltd.
Peak Frean Ltd.
C. Shippam Ltd.
Batchelors Foods Ltd.
Lever Bros. & Assoc. Ltd.

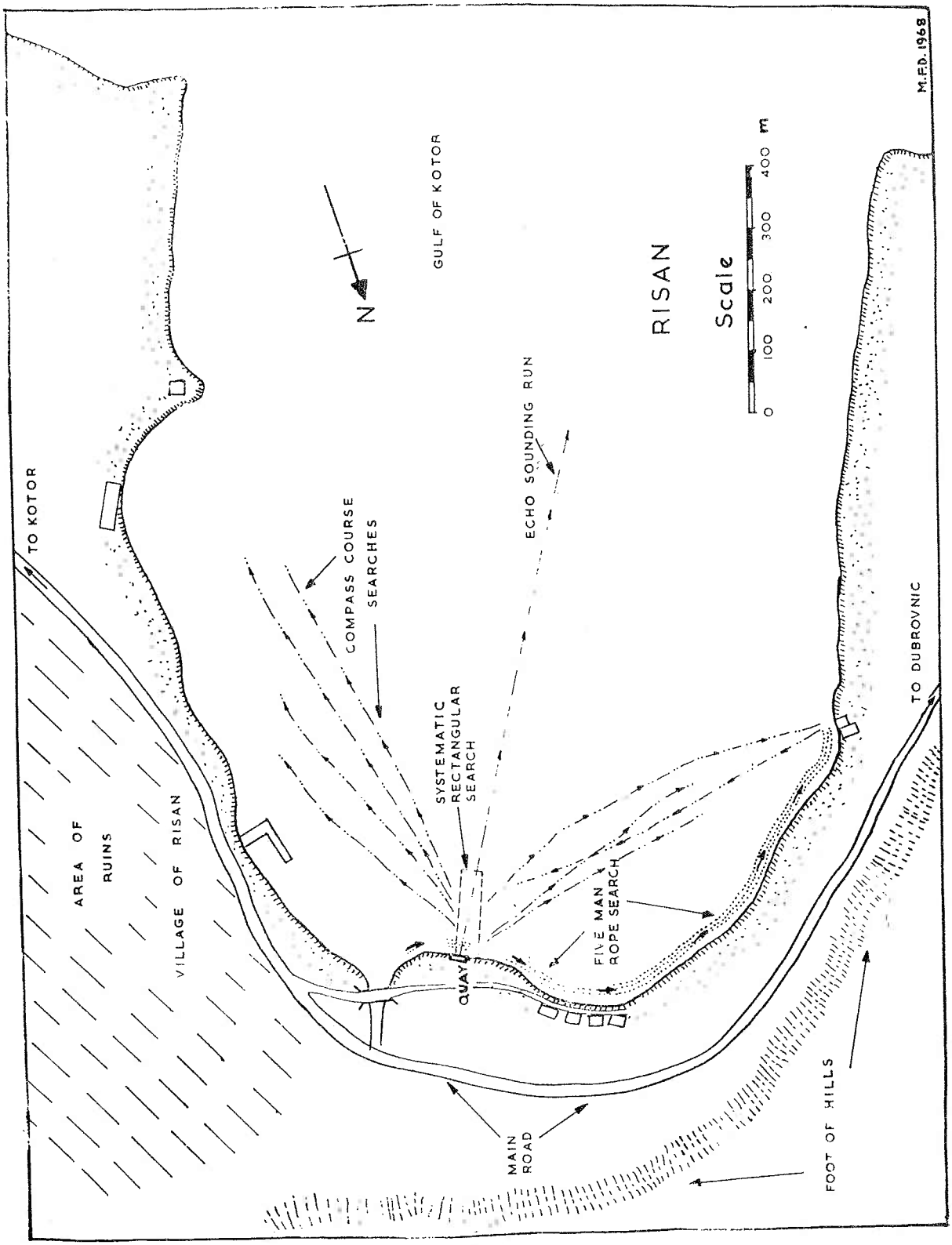
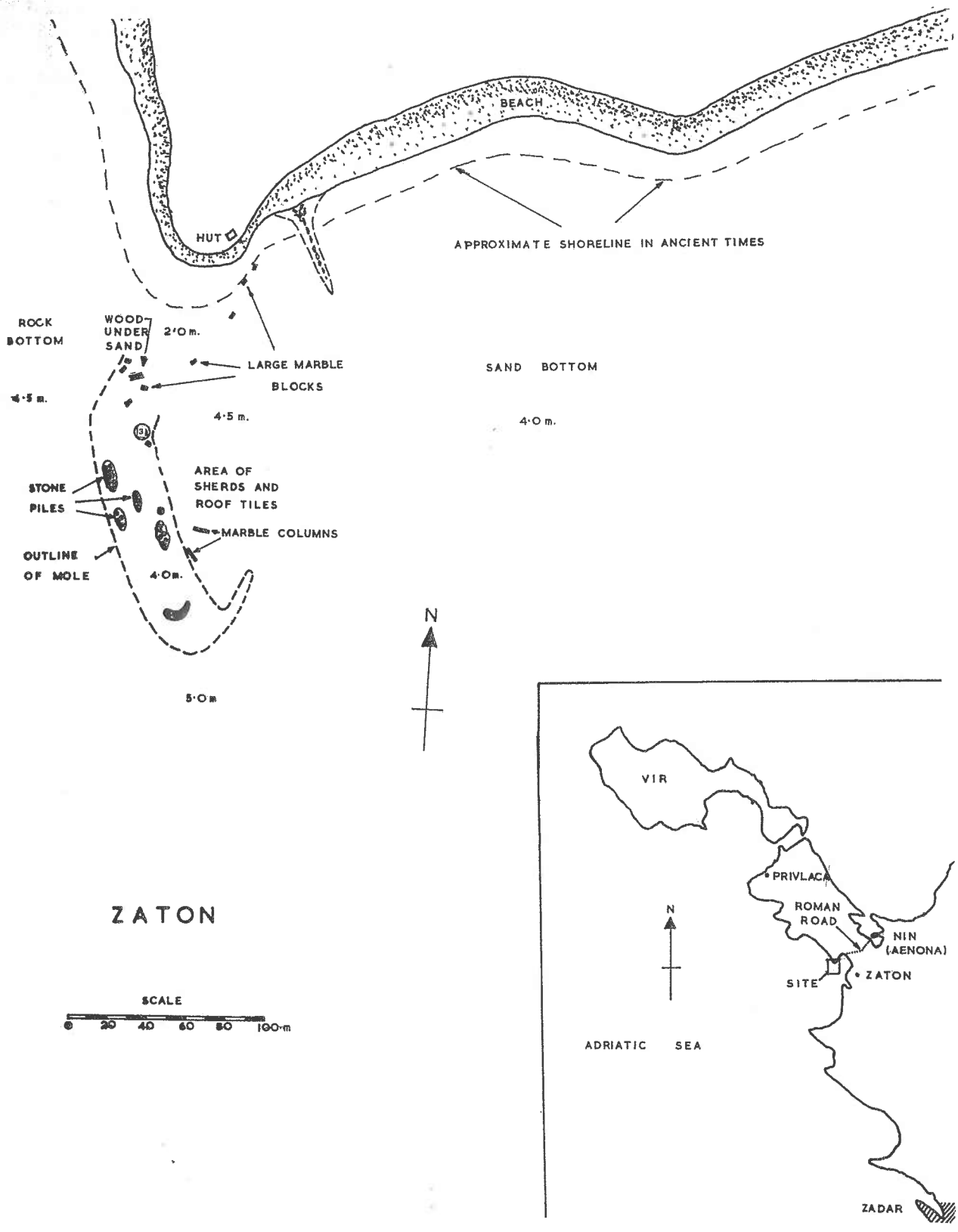

M.F.D. 1968
RISAN
Scale
0 100 200 300 400 m
N
GULF OF KOTOR
TO KOTOR
TO DUBROVNIC
AREA OF RUINS
VILLAGE OF RISAN
COMPASS COURSE SEARCHES
ECHO SOUNDING RUN
SYSTEMATIC RECTANGULAR SEARCH
FIVE MAN ROPE SEARCH
QUAY
MAIN ROAD
FOOT OF HILLS

Plate 5


BEACH
HUT
APPROXIMATE SHORELINE IN ANCIENT TIMES
ROCK BOTTOM
WOOD UNDER SAND
2·0m.
LARGE MARBLE BLOCKS
SAND BOTTOM
4·5 m.
4·5 m.
4·0 m.
AREA OF SHERDS AND ROOF TILES
STONE PILES
MARBLE COLUMNS
OUTLINE OF MOLE
4·0m.
5·0m
N
ZATON
SCALE
0 20 40 60 80 100m
VIR
PRIVLACA
ROMAN ROAD
NIN (AENONA)
SITE
ZATON
N
ADRIATIC SEA
ZADAR

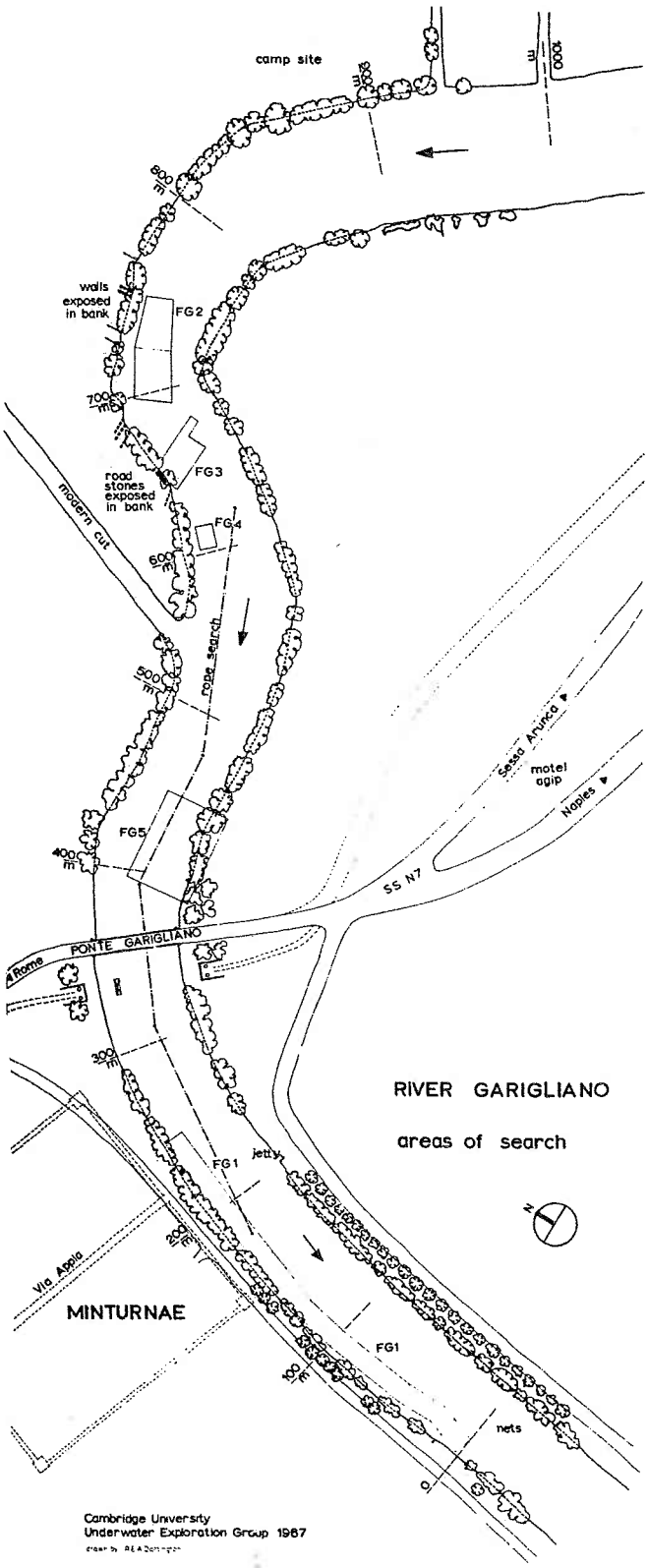
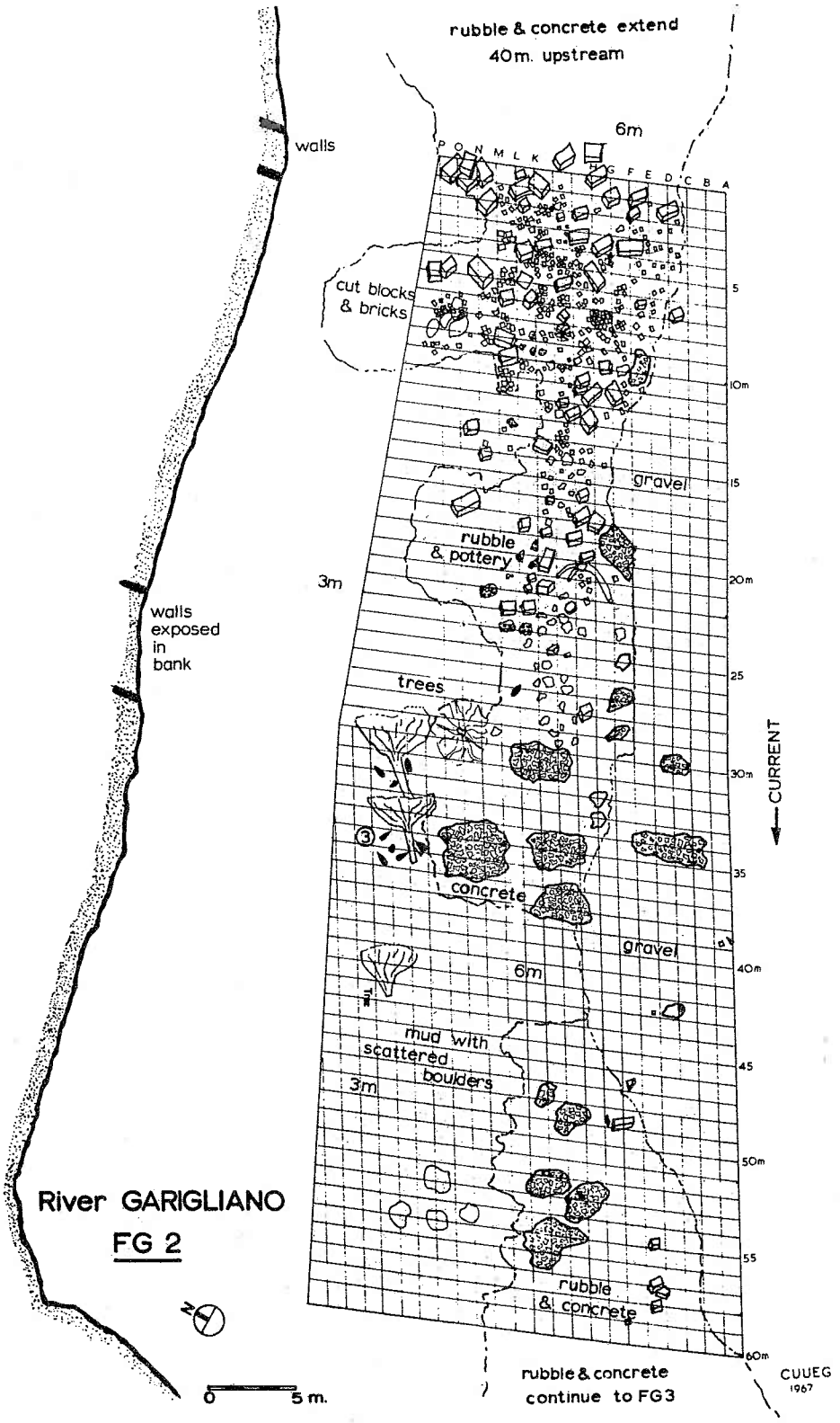
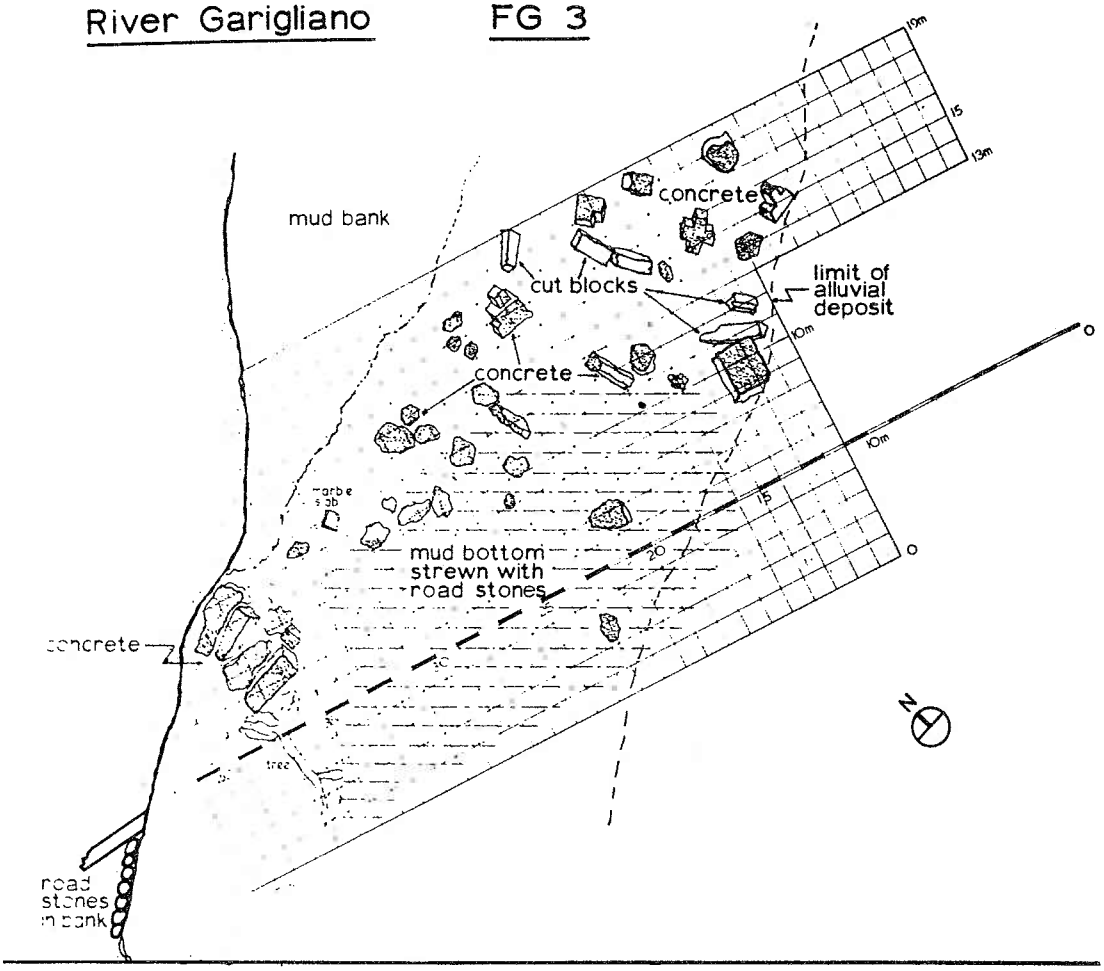

camp site
1000 ft
800 ft
walls exposed in bank
FG2
700 ft
FG3
road stones exposed in bank
FG4
modern cut
600 ft
rope search
500 ft
Sessa Aurunca
motel agip
Naples
FG5
400 ft
SS N7
PONTE GARIGLIANO
A Rome
300 ft
RIVER GARIGLIANO
areas of search
FG1
jetty
N
200 ft
Via Appia
MINTURNAE
FG1
100 ft
nets
Cambridge University
Underwater Exploration Group 1967

Plate 7


rubble & concrete extend
40m. upstream
6m
P O N M L K J H G F E D C B A
walls
cut blocks
& bricks
gravel
rubble
& pottery
3m
walls
exposed
in
bank
trees
CURRENT
concrete
gravel
6m
mud with
scattered
boulders
3m
River GARIGLIANO
FG 2
rubble
& concrete
0
5 m.
rubble & concrete
continue to FG3
CUUEG
1967

River Garigliano FG 3



FG 4

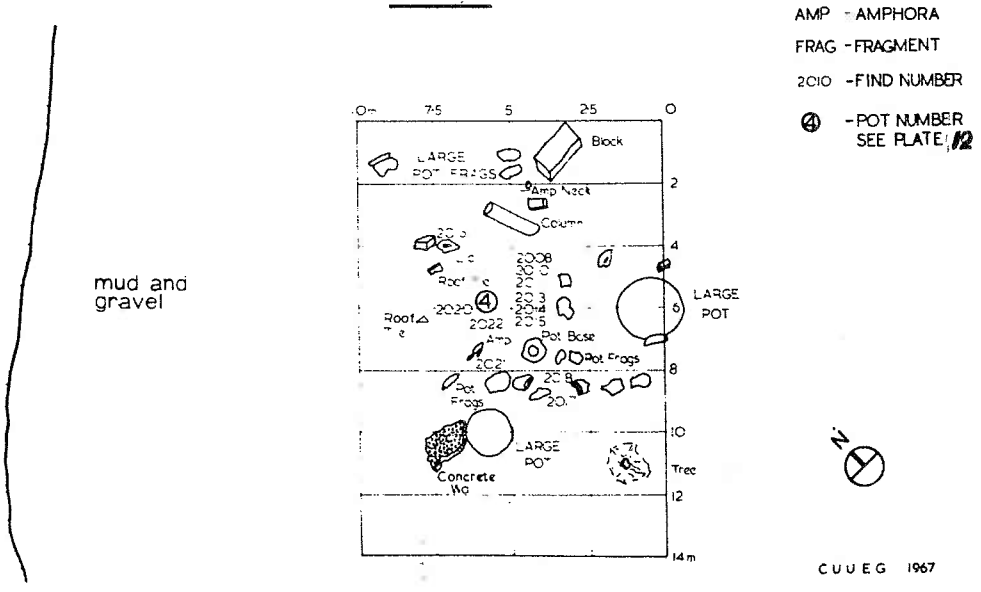
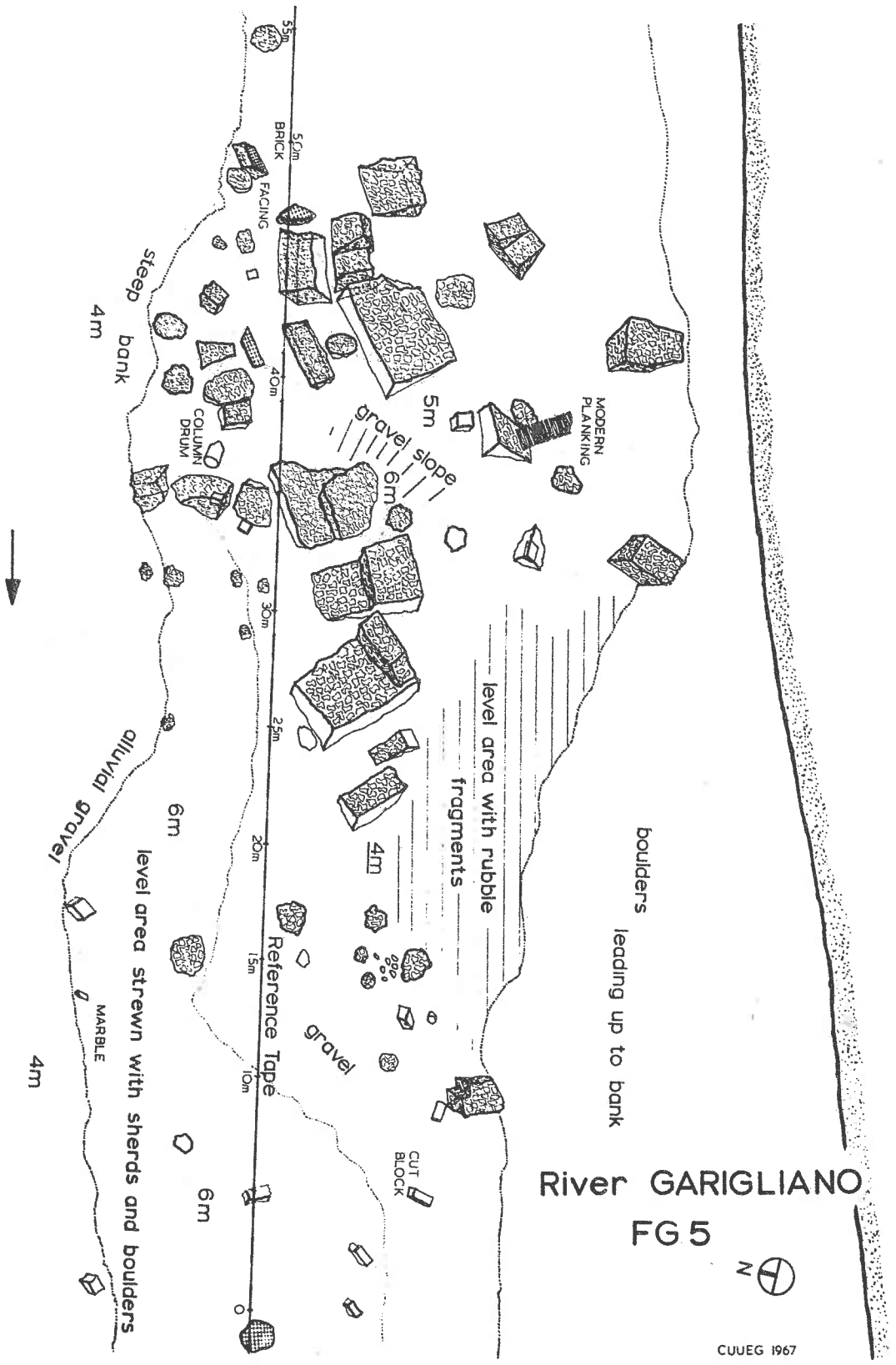
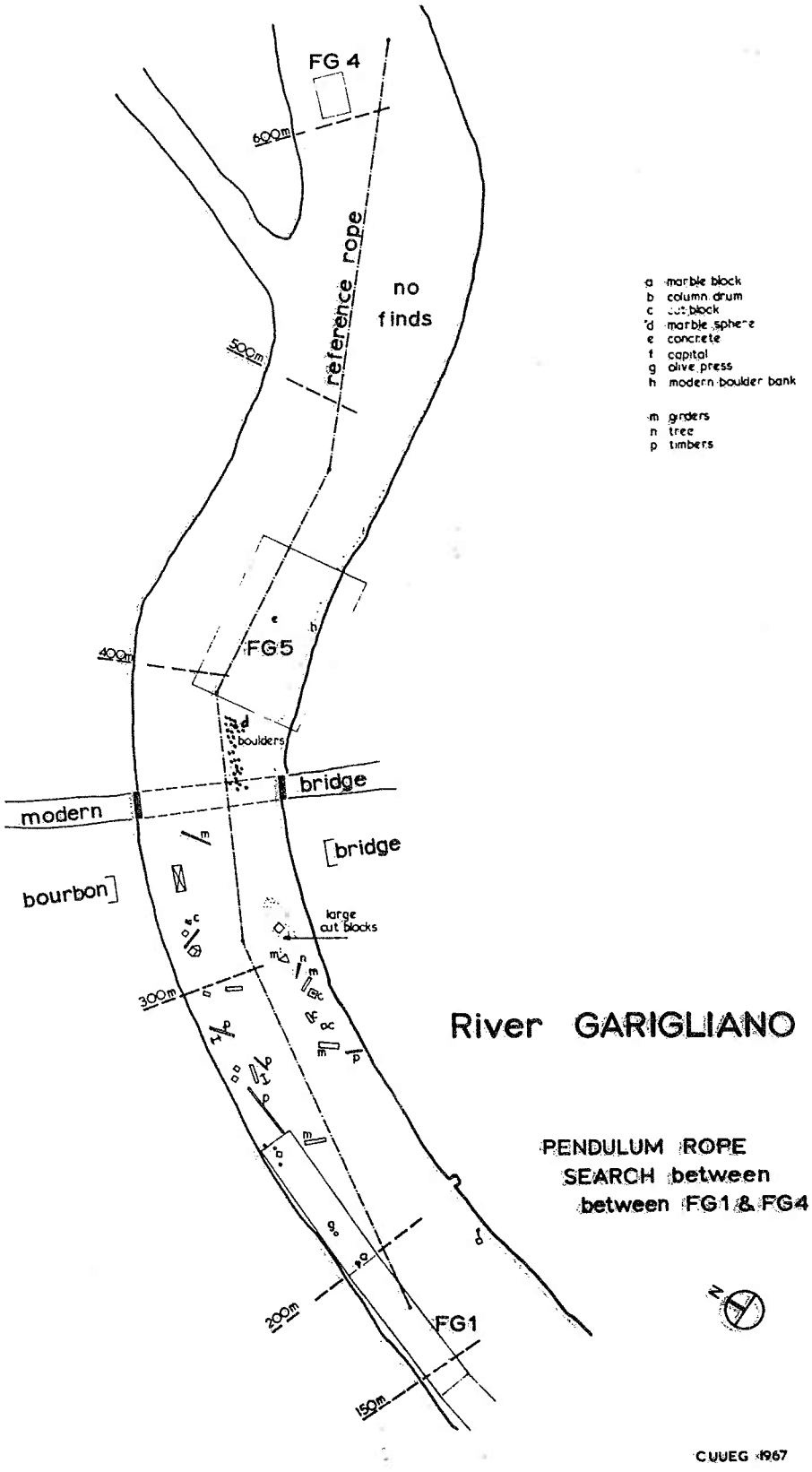


Plate 9


55m
50m
BRICK FACING
steep bank
4m
40m
COLUMN DRUM
gravel slope
5m
6m
MODERN PLANKING
30m
level area with rubble fragments
4m
25m
alluvial gravel
6m
20m
level area strewn with sherds and boulders
15m
Reference Tape
gravel
MARBLE
4m
10m
CUT BLOCK
6m
0
boulders leading up to bank
River GARIGLIANO
FG 5
N
CUUEG 1967


FG 4
600m
reference rope
no finds
500m
FG5
400m
boulders
bridge
modern
bridge
bourbon
large cut blocks
300m
300m
FG1
150m
a marble block
b column drum
c cut block
d marble sphere
e concrete
f capital
g olive press
h modern boulder bank
m girders
n tree
p timbers
River GARIGLIANO
PENDULUM ROPE SEARCH between between FG1 & FG4
N
CUUEG 1967

POTTERY FROM ZATON, YUGOSLAVIA. Plate 11

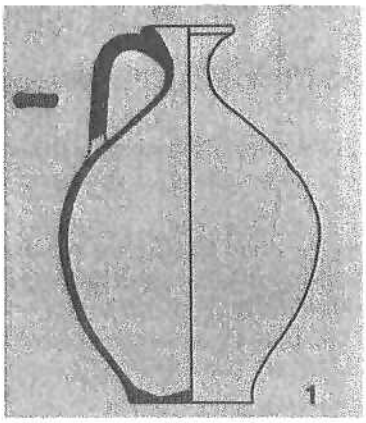
1. One-handled jug. Grey-brown, fairly fine fabric, possibly with orange external slip. Internal rilling; strap handle with one reed. *cf. Agora* M 228.
2. Small flanged pot. Thin brown-orange fabric with fine white grits; external grey colouring may be original.
3. Belly-bottom pot. Fine, orange-buff fabric, darker outside; some dark grits and mica. External and internal rilling; flimsy handles, poorly attached. Perhaps rather earlier than *Agora* J 56 (*Circa* A.D. 150–225).
4. Small jar. Thick, yellow-buff fabric, discoloured grey. Evidently wheel-thrown, but of irregular shape. Of Italian origin? Found lying on timbers.
5. Cooking-pot. Soft, brown fabric. *cf. Agora* K 94 (before *c.* A.D. 250).
6. Handled pot. Part of a wide cooking pot in rich red-brown fabric with yellow grits; flat, hammer-head rim, with double-reed handle. *cf. Agora* G 193 & 194 (early second century A.D.) and K 92 (before *c.* A.D. 25).
7. Small amphora. Fine, hard fabric, red to pinkish buff; brownish external deposit may represent slip. Probably of Greek origin; *cf. Amphoras* fig 66.
8. Amphora. Buff to orange-buff fabric. Found by buoy 1 (see Plate 5).
9. Amphora. Neck and part of handles of a large amphora. Dark grey when found; this may be recent discolouration. Stamp on neck: ✠ CL.S. Form and origin uncertain; may be of local manufacture.
10. Amphora neck with one handle preserved. Buff fabric; flat handle with double reed. Graffito (on neck, incised after firing): Z; probably a merchant's mark. Of Greek type; possibly Chian or Knidian. Found by buoy 3 (see Plate 5).

(not illus.) Base of lamp stamped FORTIS. Rich red-brown fabric. Probably of early–mid second century A.D.; *cf.* Ivanyi 'Die Pannonischen Lampen' taf. LXXXVII f. Many lamps of this type appear to have been made not in Italy (where the original potter Fortis worked) but in the provinces (Wheeler 'London in Roman Times' p. 64; Brusin 'Gli Scavi di Aquileia' p. 134).

Summary. Although only a few parallels for this pottery have been assembled, it is clear that it must belong to the first two centuries A.D. and have diverse origins.

Abbreviations: *Agora* H.S. Robinson 'The Athenian Agora: vol. V, Pottery of the Roman Period' (American School of Classical Studies at Athens, 1959).

Amphoras Virginia Grace 'Amphoras and the Ancient Wine Trade' (*ibidem,* 1961).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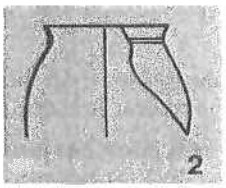
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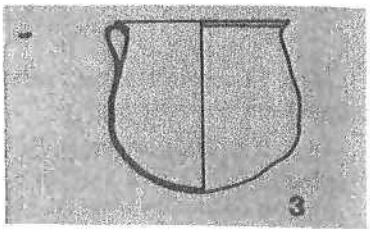
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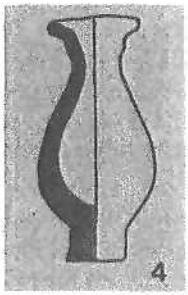
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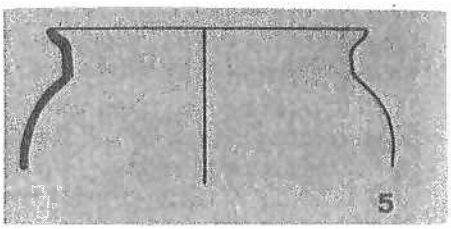
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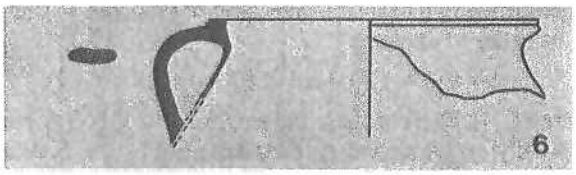
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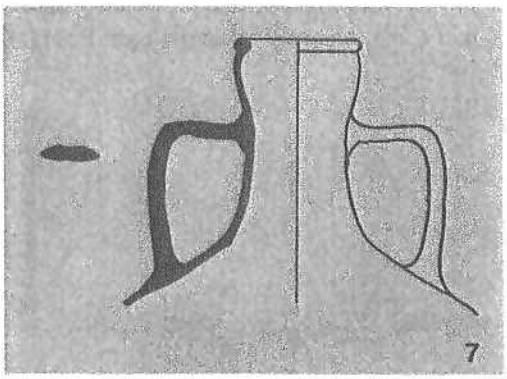
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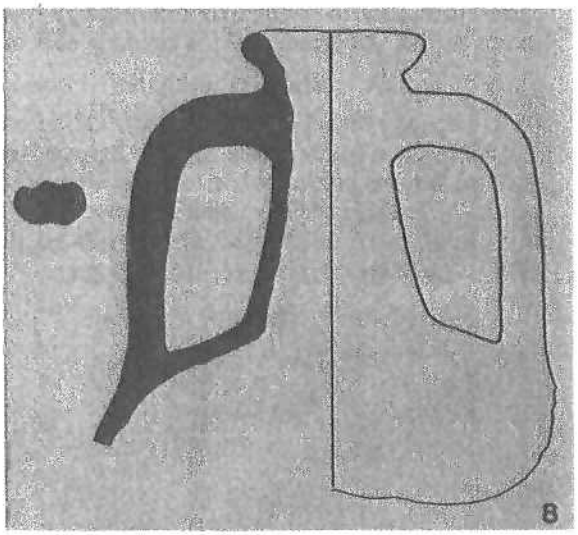
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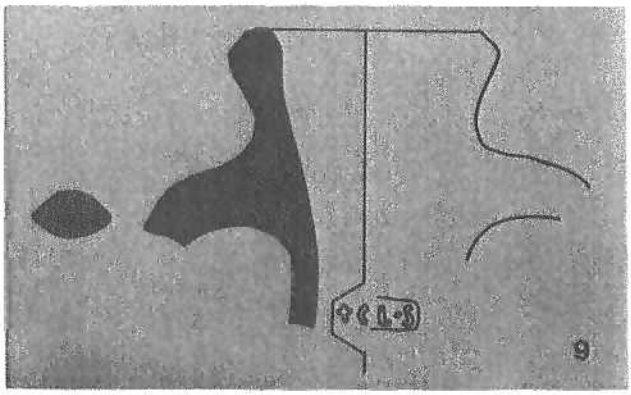
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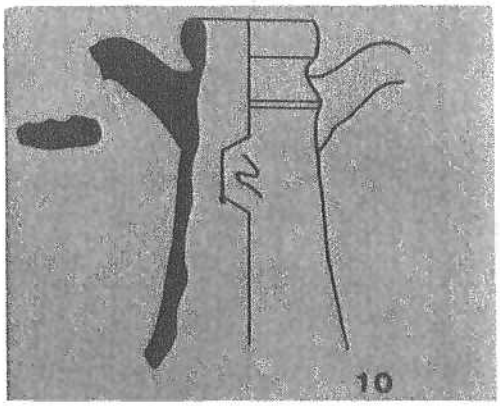

10

AMPHORAS FROM THE RIVER GARIGLIANO. Plate 12

These examples have been selected for their interest from the vast quantity of finds at Fiume Garigliano, and are described here by courtesy of the Council of Underwater Archaeology.

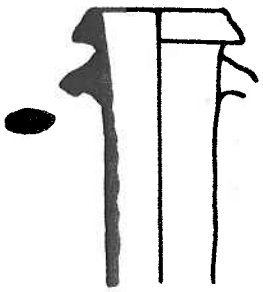
1. Neck of an Italic amphora, Dressel/Lamboglia Form 1A. (Find no. 175). For the lip, *cf.* Ventimiglia levels VI B 3-4, *circa* 150–120 B.C. Amphoras of this type were probably produced in the locality, chiefly for the export of wine, and were found in some quantity in the river (*cf.* no. 3).

2. Neck and handles of a Rhodian amphora. (Find no. 204). One handle bears the stamp IMA(S); for a similar stamp, *cf.* M. P Nilsson 'Timbres amphoriques de Lindos' no. 254, 4-5. The amphora-maker Imas is well known; at Delos there are 15 examples (Virginia Grace, *Bulletin de Correspondance Hellenique* 76 (1952) p. 527). Imas worked in the years before 150 B.C. (Grace, *Hesperia* 3 (1934) fig. 2 p. 219, *cf.* p. 225). The caduceus appears on several stamps of Imas cited by Nilsson, and is used by other potters as well (*cf. B.C.H. cit.* plate XXIII 25).

   Rhodian amphoras were widely exported at this time, especially to Provence and Catalonia (Grace, *Hesperia* Supplement 8 (1949) p. 183; F. Benoit 'L'Epave du Grand Congloue' pp. 30-1); but to find one in a wine-producing part of Italy is rather surprising, especially as there were limitations on the use of Greek wine at Rome at this period (Tenney Frank 'Economic Survey of Ancient Rome' vol. 1 pp. 193, 198-9). Rostovtzeff's suggestion that Rhodian amphoras might contain non-Rhodian wine is now unlikely ('Soc. and Econ. Hist. of the Hellenistic World' p. 1268); but Virginia Grace (*Amphoras*) notes that 'wine carried in Rhodian and Knidian jars was not choice (like Thasian or Chian) but of ordinary grade consumed in bulk, for instance by the troops'. If this applies to our period, the presence of the amphora here may be easier to explain.

3. Body of an Italic amphora, probably Dr/L Form 1A. See no. 1 above. (Find no. 2001; from site FG 2).

4. Italic amphora, Dr/L Form 3. (Find no. 2020; from site FG 4). Derived from the amphoras of Kos (*cf. Amphoras* figs 56-7), these amphoras are made in Italy perhaps as early as the second century B.C., and by the first century A.D. are being exported widely to the western Mediterranean and the imperial frontiers (Benoit, *Gallia* 14 (1956) pp. 26-7; Hawkes and Hull 'Camulodunum' Form 183 and comments). Our example is likely to date from the mid first century A.D., and may have been made locally; it is of a less markedly articulated sub-form (*cf.* Camulodunum 183C) which was imitated in southern Spain.



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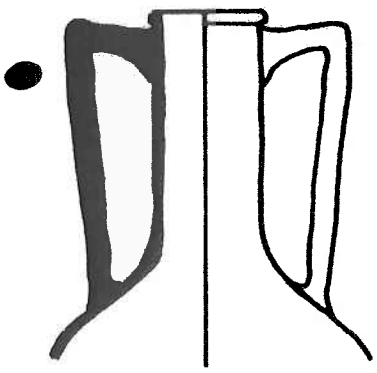

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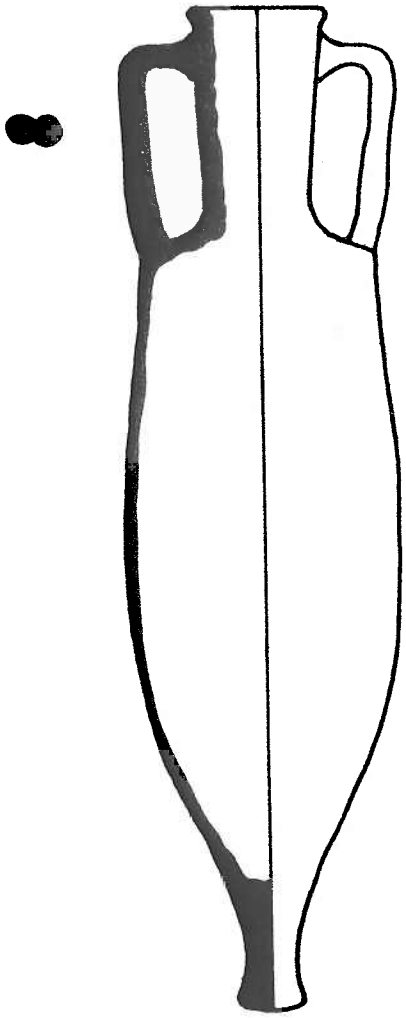

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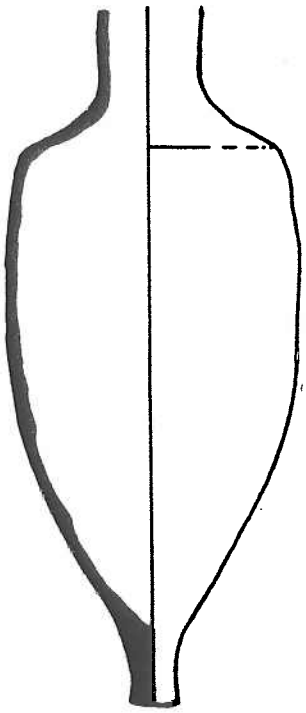

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