"PYRAMIDAL" STONE ANCHORS; AN INQUIRY

As with Trade Fairs, the success of Symposia is measured by the volume of goods or information exchanged. The information I gained at Piraeus, particularly through Capt. Anastassios Tzamtzis has modified my original title: "Ancient Warship Anchors; an Inquiry" by focusing the same ideas on a distinctive form of anchor which relates particularly to Athens, ancient and modern*; I would —if he will permit me— like to associate Capt. Tzamtzis with this inquest on a new *phylum.*

It is now archaeologically axiomatic that each lost anchor marks the passage of a ship, consequently if the periods and "nationalities" of anchors can be established and their find-places marked on marine charts, this would give a picture of the sea lanes of antiquity and —even more interestingly— the nature, or the kinds of the ships that plied them. It is, for instance obvious that Bronze Age stone anchors weighing in the order of half a ton (one example weight well over a ton!) must denote giant craft, because: a, even one such anchor would sink a small boat; b, pierced-stones being very inefficient as anchors, it was impossible to use them singly: square-sailed ships had to carry complements of several anchors. Consequently in addition to the correlation between anchor-**weight** and ship size, the huge amount of **space** occupied by six large, flat slabs of stone is easily visualized.

The same does not apply to ships propelled by oars: a, because oars (and on occasion lowered mast) occupied most of the available space; b, being capable of rowing to shelter in an emergency oared ships were not forced to drop anchor in dangerous places as soon as wind turned against them (as were "round" ships with square sails); c, what deck-space there was often had to be kept clear, because again, unlike "round" sailing ships "long" oared ships were, potentially, fighting ships.

Various designs of ancient anchor would have been suitable for use on oared ships eg: the Byzantine iron anchors that could be used like grappling irons, space-saving lead and wood anchors with removable stocks (which lay flat when dismantled) and the identical "twin" stone anchors which are such a striking feature on certain Bronze Age sites on land (fig. 1) where it is evident that they were deliberately placed in architecturally symmetrical positions. What did this pairing represent? The answer is suggested by a 5th century BC simile in Pindar's *6th Olympic Ode,* when he likens the athlete Aegesias of Syracuse to a ship: "Two anchors are good for a swift ship to rely on in a stormy night". The absence of identical pairs of stone anchors undersea on the many "anchor graveyards" (those ancient forced mooring places known to Mediteranean divers) is, of course, already explained by the fact that storms would not force swift oared ships, but only square-sailed "round" ones to moor on the nearest shallows. The Israeli coast being shelterless is, however, one long "graveyard" for every kind of wreck, which explains the single exception to date: the discovery there of a pair of

anchors, respectively inscribed with a port and a starboard stearing oar (fig. 2). Within this general context, it was almost as a side issue that I drew attention to a neglected *phylum* of anchor: the pyramidal stone. These were anchors whose shape well qualified them for use on oared "long" ships. The design is reminiscent of the broad based Port-wine decanters introduced into the British Navy in the 18th century: unlike ordinary bottles they cannot topple over in heavy seas. Similarly, pyramidal anchors could stand upright on a moving vessel where unlike the archaic, bed-shaped *eunae* (εὐναί), they occupied —weight for weight— far less space.

Archaeological evidence relating to pyramidal anchors is —as yet— scarce, despite the fact that many of them "stared us in the face" even before the advent of archaeological diving. The 6 "pyramidal" stones standing outside the entrance of the Hellenic Maritime Museum's first home: the charming villa on Akti Moutsopolou, were among the first stone anchors I noticed in 1959 (fig. 3). An elderly, retired sailor (by then a Museum guard) told me they were "trireme anchors" which had been dredged from Zea Liman. Probably he was repeating tradition.

I can still find no reason to dispute his words, although until now I have failed to trace any contemporary, written record which specifically mentions the discovery of these stones. The marine growths they bear certainly prove a long sojurn undersea and since they are both heavy and lacking in commercial value they were unlikely to have been brought from afar (their registration cards give no provenance beyond "the Ministry of Education"). Many trireme sheds existed at Piraeus in the 5th century BC, only those at Zea Liman have been archaeologically investigated. The sheds themselves were destroyed in 404 BC, so only their rock-cut foundations could be excavated in 1885 by Dragatsis and Dörpfeld[1] and then only partially, since the lower ends of the slipways are underwater consequently knowledge of their dimensions is incomplete; conscious of this Dragatsis and Dörpfeld intended to continue their investigations. But for some reason published information ends at this point. Nevertheless everyone on the spot had been made aware of the slipways, so when routine dredging took place in front of them and anchors were found, these would have been recognised and set aside, then when an Archaeological Museum finally materialized at Piraeus, they were probably moved into it.

Thereafter, lack of comparisons contributed to the indifference to pyramidal stone anchors. Circumstances have changed even since I first saw them: votive Bronze Age anchor stones excavated in temples have been steadily accumulating during the past 25 years, while even larger numbers of anchors have been raised from the sea. A mass of evidence now shows the Piraeus anchors to be both exceptional and restricted in their diffusion. No pyramidal stones have been reported in countries such as Bulgaria and Israel, where coastal museums are so filled with stone anchors as to give the impression of a neo-cultic revival!

The shape is also unknown in other much-dived parts of the Mediterranean

including France and Spain; indeed on present evidence, the distribution of the pyramidal form seems to be Hellenic with some diffusion in Magna Graecia. In period these anchors apparently coincide with the peak of Greek naval power: the 5th to 4th centuries BC. Such a late date is surprising since lead stocks had already been current for over 200 years and so great were their advantages over stone, that sailing ships carrying valuable cargoes over long distances could not have afforded to be without the former. In any case, pyramidal anchors contain a filling of lead, which in a *stone* anchor is very anachronistic... why was a small quantity of the metal used in this way? There is no clear economic answer: the poverty of small-boatmen is no argument, since the weight of pyramidal anchors shows they came from larger boats... the very merchantmen that were using lead-stocks! already current. The evidence needs to be mustered and reviewed.

The design which I call for convenience "pyramidal", is in fact a foursided stone tapering upwards from a quasi square base, but with the apex cut off leaving a flat top with (in the larger sizes) a central, vertical piercing running down into the anchor's horizontal "rope hole". The latter is larger than most "normal rope-holes". The design is in fact exceptionally complex, although at first glance this may escape notice, because unfortunately all pierced-stones tend to look alike in photographs and drawings (since the strict conventions used for drawing and photographing pottery are not yet applied to the documentation of stone anchors).

Careful examination of pyramidal anchors makes it seem unlikely that cables passed through the so called "rope hole" (as I myself once thought[2]), instead a stout bar of wood was probably lodged in it, and it is this bar which explains the connection between the apical and the horizontal piercings. Further, in some such anchors the lead that fills the apical piercing contains traces of corroded iron bars, nails, or pins. The function of this lead (and when present the iron embedded in it) must have been to prevent the wooden bar from moving. The bar's projecting ends probably served as handles for lifting the anchor and casting it overboard. As to the anchor's cable: instead of passing through the "rope hole", it would have been looped, externally, round the bar (fig. 4).

Providing the projecting "handles" were secure, well-drilled sailors could cast quite heavy anchors, although mechanical means would have had to be used for those weighing hundreds of kilos. As early as the Bronze Age giant anchors were lifted mechanically by a kind of boom, as shown on the well-known Cypriot vase painting.[3] On an oared ship with its mast down, some alternative such as a windlass could have done the job, especially as this exceptional design of stone anchor might have been hung externaly, over the bows, its wooden "handles" resting on cross-beams protruding at either side of the prow.

At Volos, a large pyramidal anchor, inscribed on one face with a swastica (fig. 5a and b), can be seen in the garden of the Archaeological Museum. Capt Tzamtzis was kind enough to draw it to my attention. The stone is grey and seemingly volcanic, with faint orange-brown overtones; according to the Museum

personnel it is local to Thessaly and possibly Macedonia and elsewhere in the north. It does not, however, appear to me to belong to the region around Athens. I hope lithological determinations, by microscopic examination of thin-sections of samples of the Piraeus anchors, can soon be compared with relevant quarry stones. If the Volos anchor does match the grey stone anchors from Zea Liman now in the Piraeus Archaeological Museum (fig. 6), this would raise a specific historical question (see below), while in general, thin-sections of stone from any anchor with a reasonably secure provenance, would help to identify similar anchors found undersea and out of context.

The Volos anchor bears no registration number, but again traces of marine growths, combined with its great weight and lack of commercial value, give credence to the local tradition that it was raised from the town's harbour.

I will not dwell on the limestone anchors in the Hellenic Maritime Museum (fig. 3), because the similar group in the lapidary collection in the grounds of the nearby Archaeological Museum of Piraeus (fig. 6), is more varied and completer in regard to lead fillings etc. I had forgotten that I had mentioned this group in 1962[2] so I am grateful to Professor Michael Katzev (again at the Symposium) for reminding me of them, then even more beholden to the Museum's Director, Dr. G. Steinhauer and his staff for their generous help. I am particularly indebted to Dr Steinhauer for checking the Museum's first Inventory made in 1912, wherein the objects are not only admirably described, but also accurately named (which is rare with anchors). The inventory was made some time after the neucleus of the new Museum's collections had been formed; the provenance of the anchors is not mentioned, perhaps because the writer did not know it, or more probably because he regarded it as too obvious to state, for the anchors bear marine growths, again proving a long sojurn on the seabed; Zea Liman is periodically dredged, while the *neosoikoi,* or "trireme sheds", are a stone's throw from the Museum.

Nine of the Archaeological Museum's anchors are of that grey stone similar to the Volos anchor, but foreign to the Athenian countryside.

Excluding the 2 smallest anchors in this group (which because of their size have no secondary piercing) half the remaining anchors have lead fillings still *in situ;* of the remainder, four are broken in such a way as to suggest the lead had been deliberately removed from their apical holes. In the fifth anchor the apical hole is intact but empty. As so often in archaeology, the breaks are informative, for without them the possibly diagnostic shapes of the apical piercings would not have been noticable.

Evidence from the Sea already corroborates —to a limited extent— the origin and surprisingly late period of this *phylum:* pyramidal anchors having been found within the areas of two dispersed cargoes of mid-4th century Attic pottery. Both sites are near the coast and in shallow water: the first off Syracuse (Ognina) was investigated by various divers including Gerhard Kapitän[4] (fig. 7). The second, off Taranto, was excavated by Peter Throckmorton and published by Dr. A.M. Mc Cann[5] (fig. 8). In both cases the anchors may be intrusive, the connection between

the Syracusan anchor and the Attic potsherds being the more tenuous, given the number of other dispersed cargoes in that area. Nevertheless the contexts in Magna Graecia,[6] the *neosoikoi* of Zea Liman and the port of Volos are striking in their similarities.

The possible intrusiveness of the anchors on the two wreck-sites is surprising from another point of view besides date. The presence of stone anchors on cargo-carrying sailing ships, which would normally have been equipped with lead-stocked anchors, remains to be explained. It would be easier to justify the presence of anchor stones on the Greek oared ships of the period (less dependent on anchors than sailing vessels and lacking the space for a full complement). Two space-saving "pyramids" would have sufficed for an oared ship, while occupying less cubic space than a single long-shafted wooden anchor with a lead-stock firmly fixed at right angles to its arms. The removable lead-stocks (which allowed a dismounted anchor to lie flat) appear a century later, and in Phenico-Punic rather than Attic contexts.

As to the presence of pyramidal anchors amidst merchant-cargoes of Attic pottery close to beaches in Magna Graecia: it is possible —even probable— that while the cargo-carriers were foundering, oared vessels came alongside in some capacity. Whether they did so before, during, or after the crisis, and whether as escorts, as pirates, or as salvors... the difficulty of manoeuvering beside, or over, an inshore wreck could have lost them their anchors. Stone anchors were by nature dispencable.

Two minor characterists, seemingly common to the four Magna Graecia anchors, are hitherto unknown in Greece. The tentativeness of this statement is due to lacunae in their recording, which now needs to be rechecked. In 1965 I made hasty notes on the Syracuse anchor, while Gerhard Kapitän published it in 1982, but not in every detail. I never saw the Taranto anchors; in Dr. McCann's short, general article on the site, pottery datings etc. the anchors do not feature in great detail. I am therefore drawing on memory from conversations (with Peter Throckmorton and members of his expedition) which took place shortly after the event; I would be most grateful now for further information.

I recall no description of the rock, or rocks from which the Taranto anchors were hewn. When I examined the grey stone of the Syracuse anchor, 20 years ago, I assumed it to be the local volcanic rock of the region, but microscopic examination of thin-sections might now show it to match, not the Etna rock, but the grey stone of the Volos and/or the nine grey Piraeus anchors. A wrecked ship's ports of call can be devined from its cargo, but only a build-up of information about anchors could eventually indicate where the ships originated, thus giving "nationality" to the various shapes of ancient craft and filling a serious gap in marine archaeological knowledge.

Reverting to the special characteristics of the Magna Graecia anchors: the first (judging from the photograph in Dr. McCann's article, also Lionel Casson's fig. 187 in *Ships and Seamanship*) is a seemingly functionless cupule. A similar

cupule, about 2 cm deep, is cut into a "frontal" face of the Syracuse anchor, below the horizontal piercing, it matches two Taranto anchors (on one the position is the same, on the other the cupule is cut into an un-pierced face of the pyramidon). A cupule may exist on the third Taranto anchor, but if so, it does not show in the photograph.

All four Magna Graecia anchors have lead in their apical piercings. If my memory serves, their second common feature is the traces of iron bars, rods, or nails embedded in this lead. I recall a suggestion that the iron represents the remains of apical rings, presumably for lifting the anchors. Technically, this seems unlikely, but interpretation must wait on both verification and more evidence. To this end it is useful to list the queries.

In conclusion, the pyramidal anchors of Zea Liman raise an interesting and specific historical question. I am grateful to M. Lucien Basch for illuminating it for me. Assuming that the period of these anchors is the 5th to 4th centuries BC, and that the grey stone of 9 of them is Northern, not Athenian, what could this signify? Athens having no wood for building triremes, imported it from the forests of the North, through the port of Olynthos (which Philip of Macedon annexed in 349 BC, forcing Athens to treat with him). Given that the Athenians imported their wood, where were their shipyards? The military slipways of Zea Liman were not designed for building triremes. Assuming the anchors are of northern stone, did they arrive at Zea Liman on cargo ships bringing timber? or on oared vessels built in a foreign shipyard and subsequently delivered to the military dockyard? This will remain idle speculation until more archaeological evidence is collected; a promising step in this direction would be better documentation of more anchors, and above all of obtaining lithological determinations of those pyramidal anchors that are already well known.

Honor Frost
31 Welbeck Street
London W1M 7PG

Notes

* My thanks go to the President Rear Admiral E. Markis and the staff of the Hellenic Maritime Museum for their great helpfulness, and to Mr Harry Tzalas whose kindness and organization made possible extra research.

1. Dragatsis I. Ch. & Dörpfeld W., *"Ekthesis peri ton en Piraiei anaskaphon"*, **Praktika,** 1885 (-1886), 63-71, Athens.

D.J. Blackman, *"The Ship Sheds"*, **Greek Oared Ships** J.S. Morrison & R.T. Williams, 181-182, Cambridge 1968.

2. Honor Frost, *Under the Mediterranean,* 48, London 1962.

3. *"Bichrome IV"* jug in the British Museum (1926, 6-28, 9), V. Karageorghis, **La Céramique Chypriote de Style Figuré,** Rome 1974, XI, 1.

4. I am indebted to Miss Yael Sneh of the centre for Maritime Studies, Haifa University, for a photograph of another pyramidal anchor, probably around 60cm. high, in the Museum on the Island of Linosa (south of Sicily) and for the information that it too is a grey volcanic stone which she naturally assumed was local (the Island itself being volcanic).

5. A.M. McCann, *"A 4th Century Shipwreck Near Taranto"*, **Archaeology** (U.S.) 25, 3, (1972),

181-187.

6. G. Kapitän & F. Naglschmid, *"A 4th century BC Dispersed Amphora Cargo..."*, **Proceedings of the Diving Sciences 16th Annual Symposium,** 1980 Edinburgh, Ed. National Environment Research Council 1982, 229-239.

Captions

Fig. 1. Twin anchors symmetrically placed, *in situ* in "Temple 2", Kition, Cyprus, Late Bronze Age.

Fig. 2. Twin anchors incised with a ship's port and starboard stearing-oars, probably Late Bronze Age, found undersea off Tell Megiddo, now in the Maritime Museum, Haifa.

Fig. 3. Limestone (Athens region?) anchors, probably dredged from Zea Liman (all bear traces of marine growths), Maritime Museum Piraeus. In every case the lead has been remmoved. Note the variations in the apical piercings, the slot-shaped variant in no. 5, exceptionally, runs parallel with the horizontal piercing. For Museum numbers see the italics: 1/70, 2/73, 3/71, 4/27, 5/26, 6/54.

Fig. 4. The proposed rigging of a pyramidal anchor.

Fig. 5 a & b. The Volos Anchor (by the sea wall of the Volos Museum garden). Volcanic stone, charcoal grey tinges with orangy-brown patches, pock-marked with holes; said to be local to Thessaly. Marine growths. Lead still present in the apical piercing; no trace of iron pins. The front of this anchor is well preserved and bears an incised swastica. The back is worn, especially at the top and inside the lower part of the horizontal piercing.

Fig. 6. Anchors of various stone; probably from Zea Liman (marine growths); garden of Archaeological Museum, Piraeus. Museum numbers are expressed in italics and when there are none, the numbers in inverted comas refer to my note book.

Anchors 1-4 (313, «5», «9», 312) are of coarse, dark grey, volcanic stone similar to the Volos anchor Fig. 4. The Syracuse anchor Fig. 7, which is described in my own 20 year old notes as "grey volcanic stone" may fall into either this group, or the lighter grey less coarse stone of nos. 5-9 (315, «2», 317, 311, 310). Nos. 10-12 (319, «11», «10») are light coloured stones: —"white limestone", light buff, layered limestone and a light grey stone, more compact than the rest, but possibly volcanic. In general, the grey stones do not seem to be from the region of Athens.

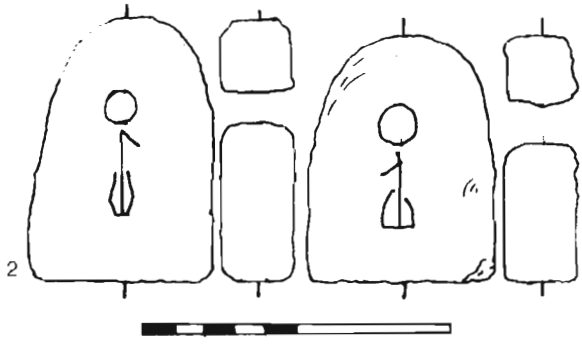
Five of the anchors still contain lead in the apical piercings, but without trace of iron inclusions. Lead may have been removed after salvage from some anchors, such as no. 6, to judge by the recent break. There is only one example of a round apical hole (no. 10) this, like the smallest anchors without apical piercings, is of possibly Athenian stone.

Fig. 7. La Madonnina, Taranto. Schematic reconstruction from the published photographs and measurements (stone is not mentioned) of the 3 anchors from a dispersed cargo of mid 4th century BC Attic and Corinthian pottery.[6] Lead is present in all three anchors and (from recollection of a verbal communication) iron bars, or

pins were embedded therein. Compare the cupule on the central anchor with Fig. 7.
Fig. 8. Ognina, (in deposit: Syracuse Museum), Sicily. As with the Taranto anchors Fig. 6, the context is a dispersed cargo of Greek 4th century BC pottery. My notes on this anchor, made some 20 years ago, specify that the stone is coarse, grey and volcanic. I recollect traces of iron in the lead. As with the Taranto anchor, there is a large cupule some 2 cm. deep, in this case under the horizontal hole.
Fig. 9. Thin-section of 6 stone anchors from the Hellenic Maritime Museum, Piraeus, Greece.

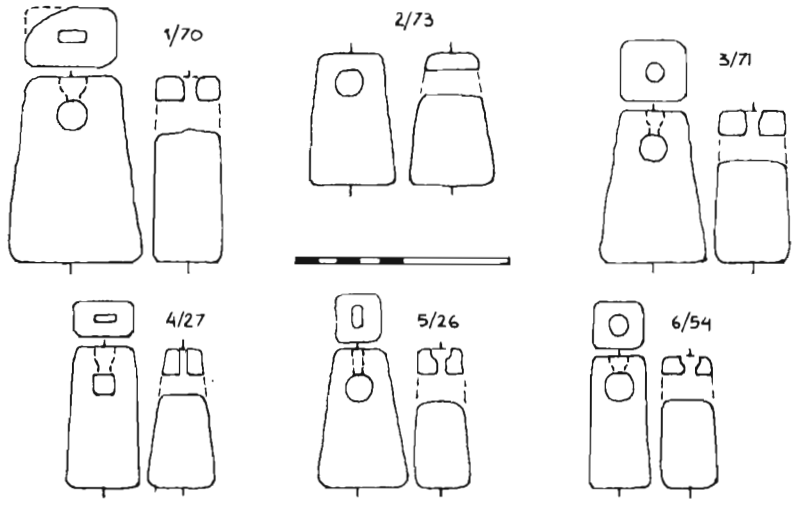
PHOTO-GRAPH	ANCHOR No.	
e	26.	A pale, coarse grained cellular biomicrite packstone. With areas of wackestone. The stone is composed largely of micrite casts of small gastropods and the cavities left by the solution of? bivalve shell fragments. Terrigenous material is represented by rare silt grade angular quartz grains. A sparse microspar cement leaves numerous cavities.
g	27.	Pale grey cellular biosparite packstone. Worn shell fragments and foraminiferal remains are common. Terrigenous material, possibly of volcanic origin is fairly abundant, and includes angular quartz grains, fragments of? chert or argillised volcanic ash, and noticable grains of angular colourless pyroxene.
d	54.	A pale oo-intrasparite, packstone. Composed of poorly sorted limestone fragments commonly with an oolitic coating and moderately well sorted ooliths. The limestone fragments are themselves oolitic. The fragments are bound by a cellular sparry cement. Terrigenous material was not noted.
f	70.	Poorly sorted, porous sandy limestone, composed of angular fragments of fine-grained? volcanic ash or chert, common grains of neutral coloured augite and minor quantities of quartz set in a generally micritic cement.
a	71.	A medium grained porous oopelsparite packstone. Ovoid pellets and ooliths, commonly with large rounded shell fragments cores. Some pellets appear to be compound. Rounded grains of quartz are very rare. The cement is of sparry calcite thinly coating the grains.
b	73.	Coarse fraction. A coarse grained, poorly sorted oosparite packstone. This rock contains large abraded grains of pelmicrite and fragments of argillised micaceous volcanic ash.
c	73.	Finer fraction. This material appears to be identical with that of anchor No. 71 Identifications by R.W.Sanderson, Geological Museum (BRITISH MUSEUM NATURAL HISTORY). (1.7.1987).

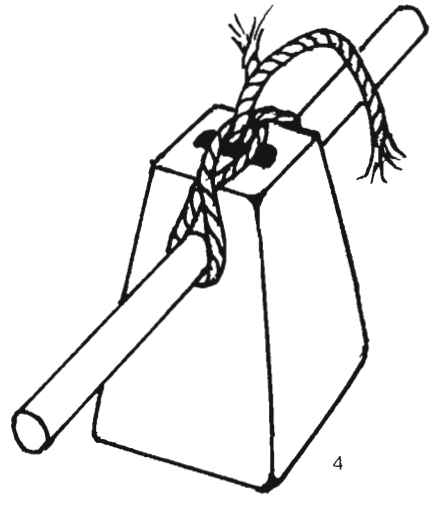
1



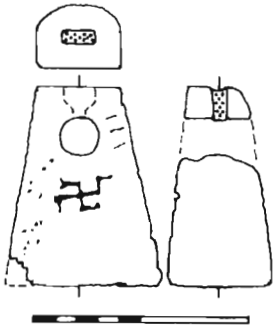
2

3



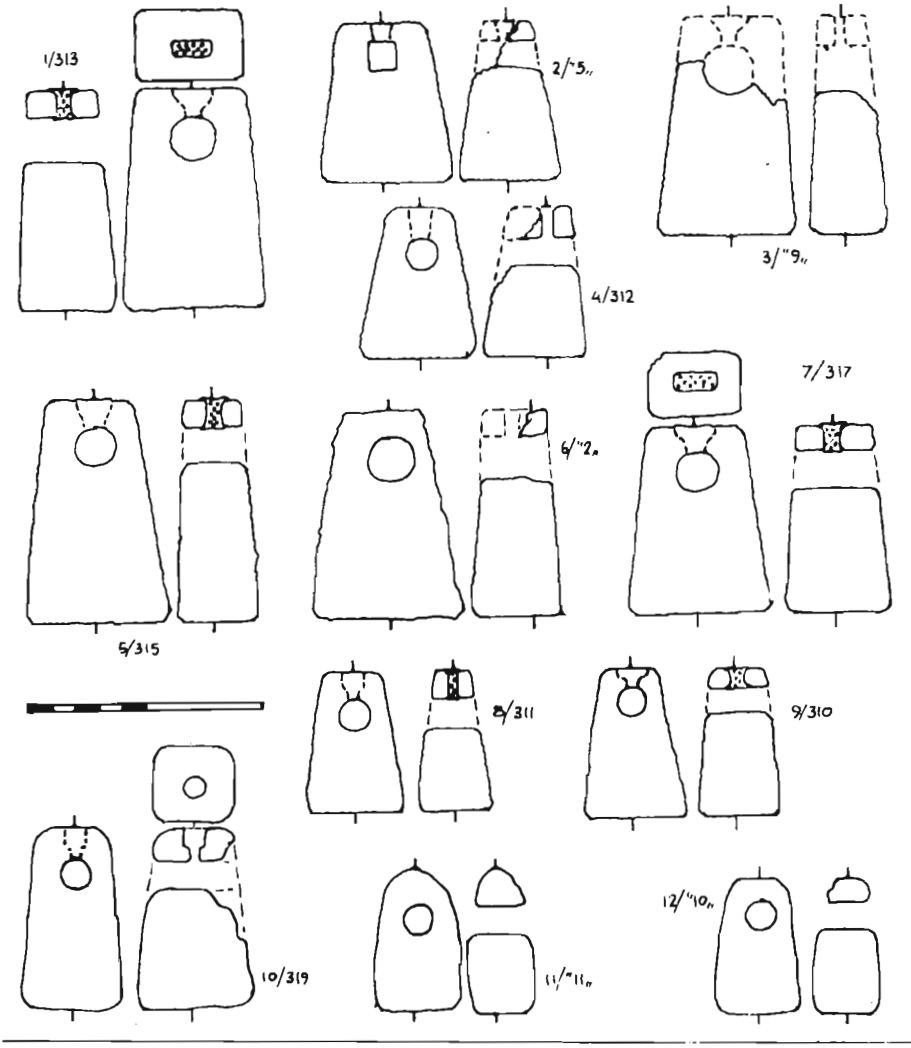


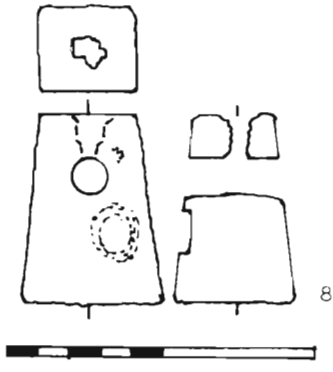
4

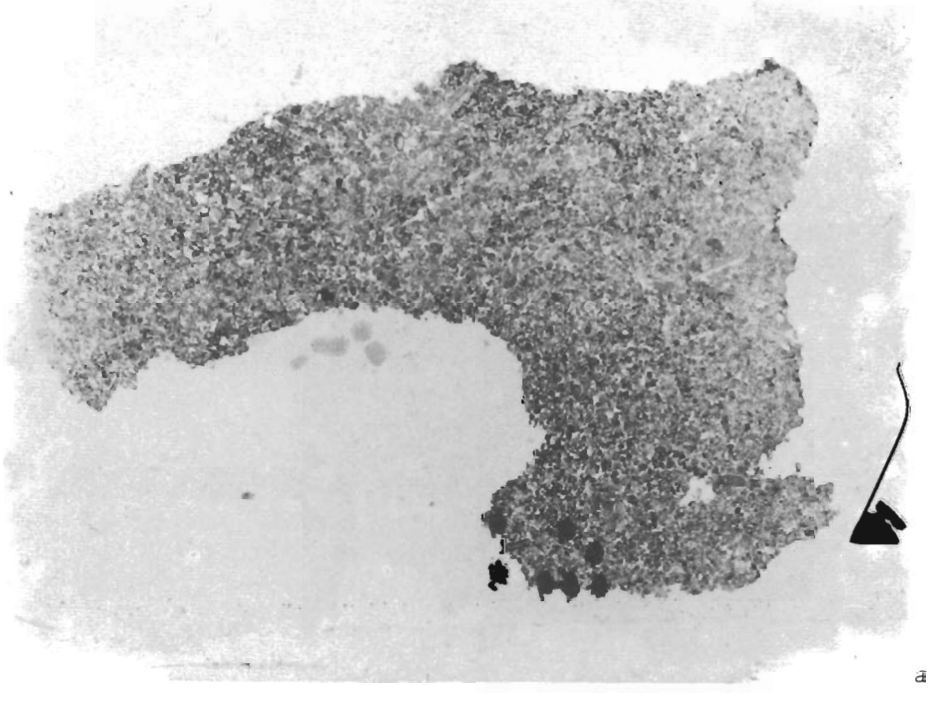


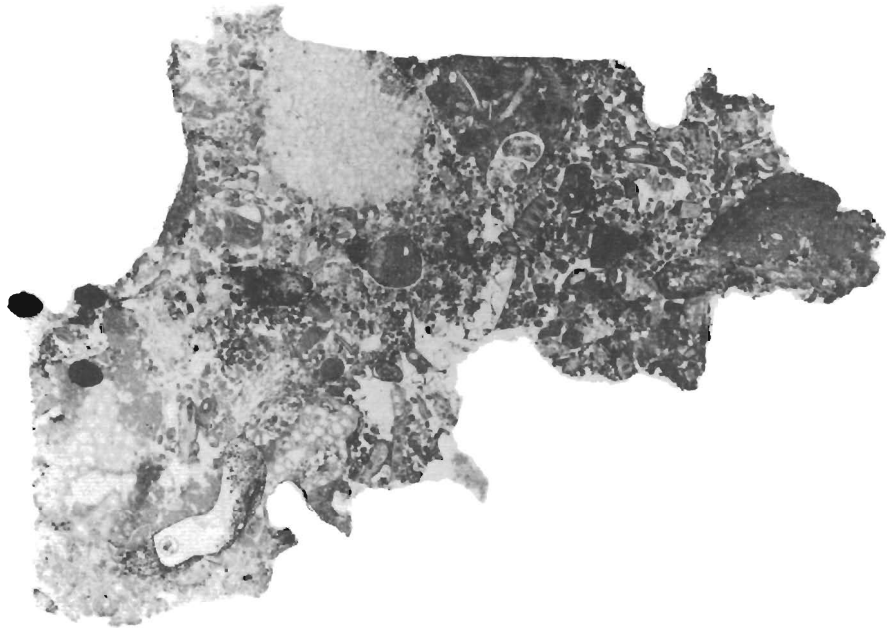
5a

5b


1/313
2/"5"
3/"9"
4/312
5/315
6/"2"
7/317
8/311
9/310
10/319
11/"11"
12/"10"

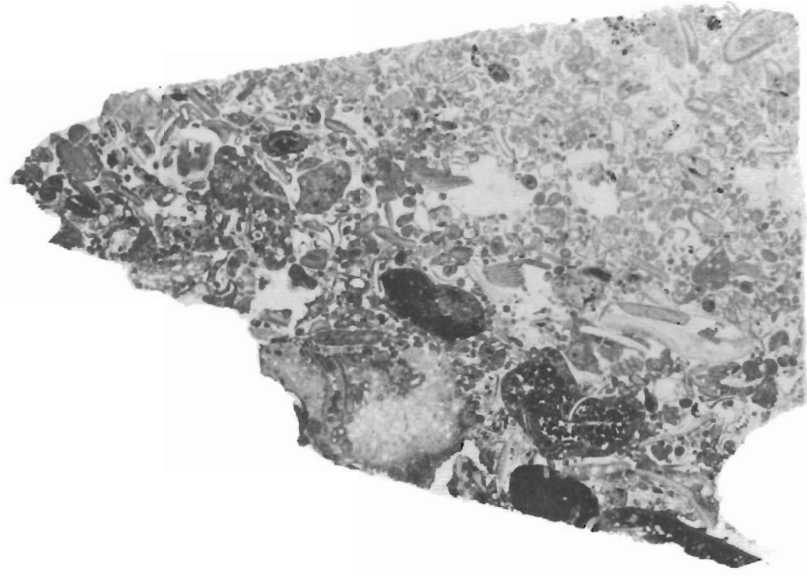

8



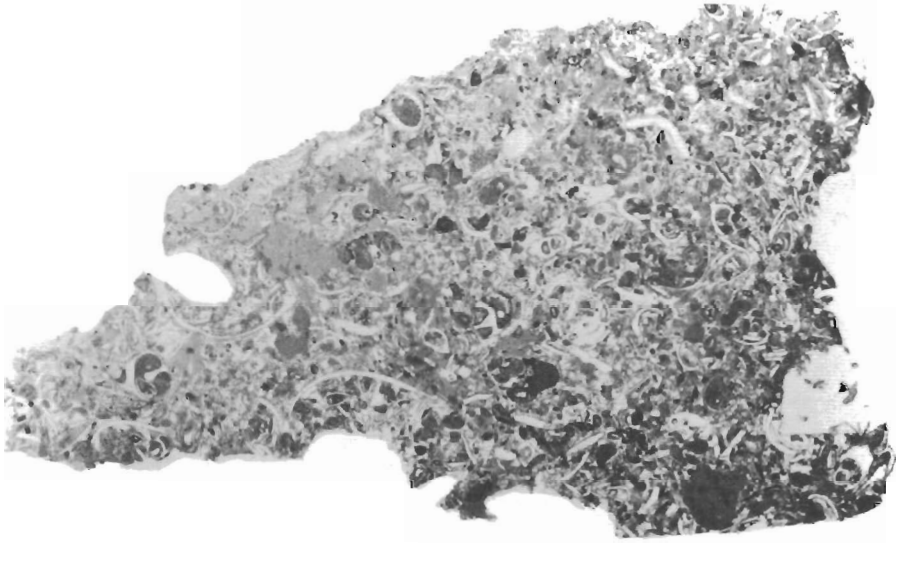


b

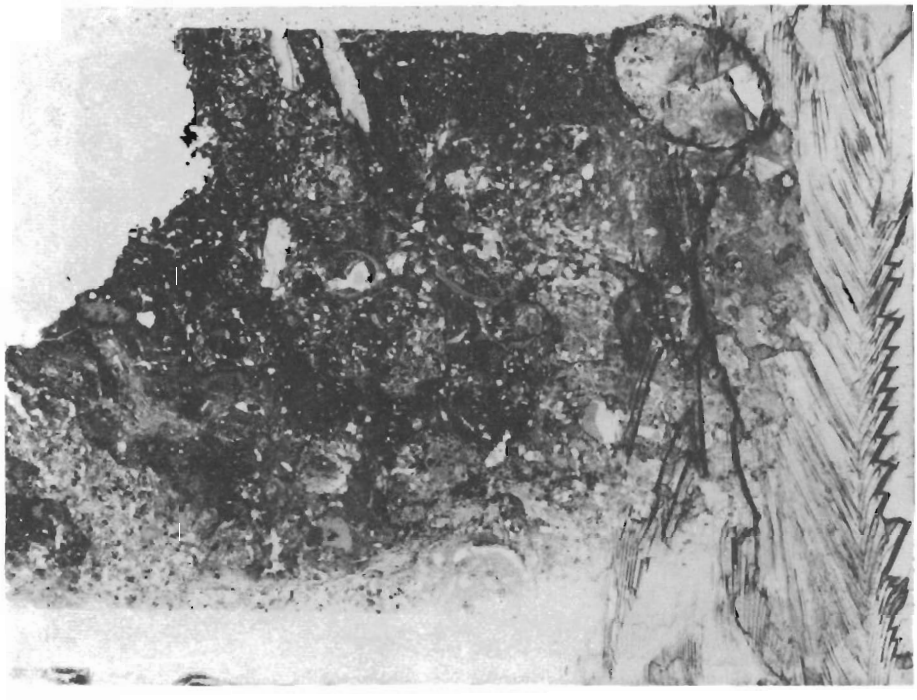
c

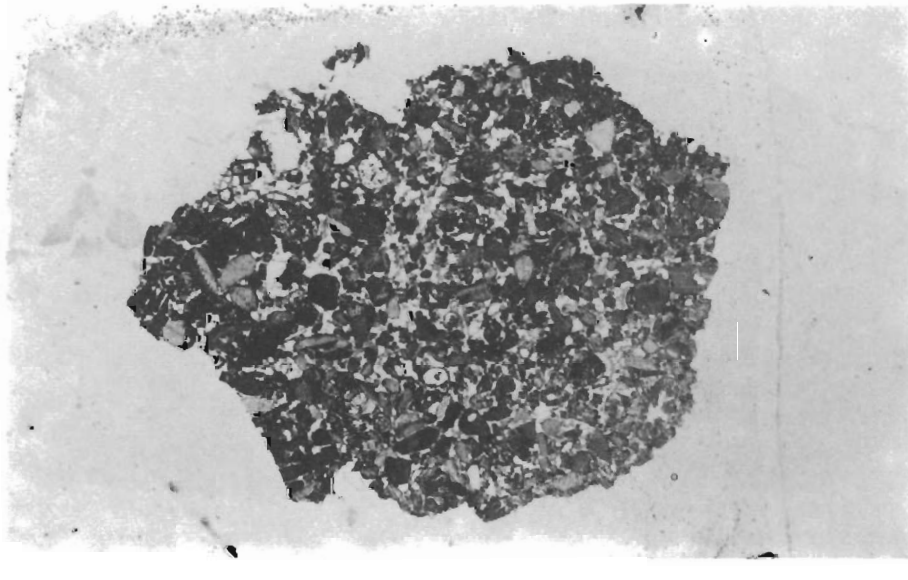


d

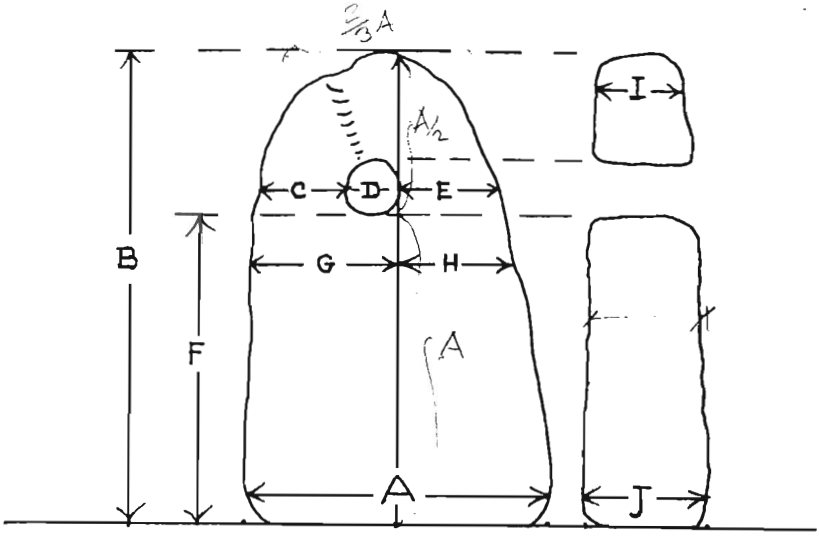


e





9



FIELD-RECORDING OF STONE ANCHORS

MEASURE: at appropriate points, as shown above (if underwater, sketch then transcribe measures later).

DRAW: Make a preliminary drawing (life-size or any convenient scale)

PHOTOGRAPH

a) always showing a centimetre scale;
b) whenever possible, take from back, front and side.
c) If found unexpectedly underwater use makeshift scale, eg. diving-knife

STONE: chip off a small sample for thin-sectioning (making sure it is not just surface concretion).
Write visual description (colour, inclusions etc.), stating whether examined wet or dry.

TOOL-MARKS? WEAR? describe distinguishing features.

WEIGHT

If a stone cannot be put on a weighing-machine, calculate its weight as follows, from its measurements (taken as shown above):

Multiply average breadth = 1/2 (A+C+D+E), by height = B,
subtract the round area of the piercing = 22/28xDxD,
multiply by average thickness = 1/2 (I+J),
then multiply the result: the anchor's volume in $(cm)^3$,
by the SPECIFIC GRAVITY of the stone in question, eg. limestone= 2.7
(the result will be in grammes).

N.B. The main objective being to find out the number of men needed to lift an anchor-stone this simple calculation is adequate. Should greater accuracy be needed,more complex calculations are possible.

CARD-INDEX

For convenient indexing on small, standard cards (12.8 x 8.2 cm.), reduce preliminary drawings to scale of 1:20 and paste onto top left corner. Index under geographical, or site name; give date of entry, adding information under the above headings, leaving space for eventual stone-analysis, bibliography etc.

1st INTERNATIONAL SYMPOSIUM

ON

SHIP CONSTRUCTION IN ANTIQUITY

PIRAEUS, 30 AUGUST — 1 SEPTEMBER 1985

PROCEEDIGNS

SPONSORED BY THE MINISTRY OF CULTURE

Published by the Organizing Committee of the Symposium, Athens 1989.
Editor: Harry E. Tzalas.
Cover design and layout: Yannis Pantzopoulos.