KENCHREAI

EASTERN PORT OF CORINTH

are now linked together—probably by early robbers—by passages cut from the end of an inhumation chamber to the nearest tomb. The effect is that of a labyrinthine catacomb, though surely this was not the original design. Three of four such tombs were entered.

On the sea-cliff, seen from below, there appear marks of other closed entry-ways to tombs, like the one that was cleared.

In general, the impression given is that this area was given over to burials at least as early as the second century after Christ, perhaps facing on a road coming along the edge of the seaward spur, now fallen away into the sea. At least one other similar tomb has long been visible near grid point E 2500 / N 15300, possibly marking the continuation of this road or another.[5]

[5] Lampakes, *op. cit.*, p. 77 and map p. 73. Pallas, *op cit.*, p. 3, fig. 1, described and illustrates a tomb which seems to have been almost exactly similar to the one described here—and may even have been the identical tomb, though Pallas refers to it as being in the "south cemetery", which is difficult to reconcile with the location of our tomb as we see it on a map of the area as recently developed.

CHAPTER THREE

THE HARBORAGE

By Joseph Shaw

Along the modern road bordering the alluvial plain on the north, and from this northward to the foot of the ledge defining the Inland Spur, there may be seen traces of ancient walls, though not many, but these have not been investigated by excavation.

Around a point about E 2100 / N 14700 tests were made with a sonic seismic reflector[1] on three lines some 60 m. long, beginning slightly north of the road and continuing down into the alluvial plain. These revealed a resistance to the sound impulse about 3.00 m. below the surface throughout most of the area of the alluvial plain tested, suggesting only, perhaps, that the water table lies uniformly about 3.00 m. below the surface, but with no other variant resistances to suggest other stratification. (The device employed was incapable of distinguishing variant resistances below the water table.) Northward from a point about 12 m. south of the road there was material of distinctive density and reflectivity lying a meter and a half above the water table, and a meter below the surface. This investigation was too limited to be used as evidence in itself, and was not tested by excavation, but the readings are not inconsistent with the hypothesis that in antiquity there was an ancient quay wall running on a line about 12 m. north of the road, and beyond that, to the south, an open harbor.

But the principal area for the investigation represented by this publication was the harbor whose remains are visible in the sea—the basin itself, and the structures around it. This study was developed extensively, to the point at which information adequate to the understanding of the problems had been secured, or at which technical or certain other limitations imposed obstacles that could not be overcome under existing circumstances (Plan B, Figs. 3, 4).

The largest question posed and left unanswered in this situation is the extent of Greek development of the area. Traces of remains of the Greek period were discovered in a number of places along the shore (pp. 50, 51, 79, 80) but they proved to be slight in all instances, save, perhaps, in the Sanctuary of Aphrodite at the northeast promontory; and in no case was it possible to explore them extensively. The chief reason for this is that almost all such remains lie at or below the ground water table, and it was found impracticable to work below this depth on land. It may be taken as definite that there was some use of this shoreline in Hellenistic and probably earlier times, but the remains which have been discovered are few.

To understand the history of the structures associated with the harbor, it is necessary

[1] By Mr. Hartley Hoskins.

to understand that throughout its history the land around and including Kenchreai has subsided with relation to sea level on several occasions throughout the periods with which we are concerned (Appendix E). Beyond this, in understanding the significance of the depth of submerged structures on the moles, it should be realized that in addition to geologic isostatic movement of the area as a whole, the moles themselves have consolidated and spread in direct proportion to their height and the bulk of loose rock and earth of which they were made. Thus the seaward end of a mole will have subsided appreciably more than the landward end, where there was less fill.

A. The Anchorage

From the point of view of the sea-faring merchant, the harbor offered anchorage relatively well sheltered from the prevailing northeast wind. Two points of land, to the northeast and southwest, were extended out by artificial filling, leaving a gap of *ca.* 150 m. through which vessels would pass when entering or leaving port. Occasionally, one supposes, some of the larger merchant vessels may have anchored in the deep water offshore to the east while awaiting berths that were already full within the harbor. No doubt this same deep, open water also offered a haven when the wind blew so strongly that anchors would drag within the harbor itself. If ships did not leave the harbor with a wind that was rising threateningly, there was danger that they might be blown against each other and their rigging tangled, or dashed by the ensuing waves against the harbor quays. Smaller vessels may have pulled up on the shore south of the south pier, since this created an area of calm water to the south when the northwest wind was blowing; other small ships could have tied up alongside the southern or outer side of the pier.

The interior of this roughly oval harbor was, perhaps, about 30,000 square meters[2] (Plan B, Fig. 5) with a maximum extent of 450 m. along the shore and inner sides of the pier and the moles where ships could be pulled up on shore or moored. (Because of the subsidence of the shore, there are about 45,000 square meters within the harbor area now.)

[2] In comparison with other Greek and Roman harbors, the basin at Kenchreai is rather small. Listed below are some approximate sizes for other harbors:

1) Pireaus (Kantharos)	ca. 750,000 square meters
2) Portus (Ostia)*	ca. 322,000 square meters
3) Piraeus (Zea)*	ca. 225,000 square meters
4) Hadrumetrum*	ca. 200,000 square meters
5) Carthage	ca. 140,000 square meters
6) Lechaeum (inner)	ca. 100,000 square meters
(outer)	ca. 10,000 square meters
7) Leptis Magna*	ca. 102,000 square meters
8) Forum Julii (Frejus)*	ca. 100,000 square meters
9) Centumcellae (Civitavecchia)*	ca. 100,000 square meters
10) Kenchreai (hypothetical original harbor)	ca. 87,500 square meters
11) Piraeus (Munychia)	ca. 70,000 square meters
12) Kenchreai (Roman harbor)	ca. 30,000 square meters
13) Anzio*	ca. 30,000 square meters
14) Terracina*	ca. 16,000 square meters
14) Anthedon (inner)	ca. 11,000 square meters
(outer)	ca. 5,000 square meters

* cf. R. Bartoccini, "Il porto romano di Leptis Magna" in *Bolletino del centro di studi per la storia dell' architectura*, No. 13 suppl., 1958 (Roma, 1960), pp. 12 f.

Perhaps fifty percent of the total harbor space, that in the deepest water in the middle and that between the moles, would have been left vacant so that the ships could maneuver. The majority of the ships within the harbor were probably quite small, perhaps 5 to 20 meters long. The larger ships that used the harbor might have ranged from 15 to 40 meters long.[3]

Probably the larger ships did not pull up directly to the quay themselves. No doubt quay space was at a premium, and it is doubtful whether more than two of the larger ships would have fitted, bow to stern, along the edge of the south pier. Moreover, since the land has settled since the time the port was actually in use, it is uncertain if the water along the pier, now two to three meters deep at certain points, was then deep enough for a large ship with a draft of over 0.50 m. Instead, it is more likely that the ships docked at right angles to the quay (Frontispiece). They dropped their bow anchors in the deeper waters, at the center of the harbor, 50 to 100 meters offshore, and then were towed in, letting out anchor rope behind them, until their sterns were near the quay. (The anchor and rope might also have been carried out into deep water by a smaller boat.) Another line was thrown out from the stern, to be attached to the quay wall, and all ropes were then pulled taut. Thus the ship still had its bow to the prevailing wind and, if a high wind came up, it would be ready to go to sea at any time. If it were to dock parallel to the quay, it would have to take the force of the gale and ensuing waves broadside, and would probably not be able to make headway in order to escape out to sea. A similar practice is followed in many Greek harbors today.

Once the boat had been moored in this fashion, a gangplank could be lowered down onto the quay wall (Pl. X A). It was up and down this gangplank that much of the cargo would be carried. Some ships, however, were equipped with special "artemon" masts. From these masts, which would be set so that they projected out beyond the side of the ship, would be suspended block-and-tackle equipment for lowering and raising some of the heavier items. Special cranes for transferring cargo are also known, for they are mentioned in some literary sources.[4]

At Kenchreai there is no trace of bollards or mooring posts such as those known from other Roman ports, especially those outside of Greece.[5] Aside from a large wooden pulley block found within the Fountain Court,[6] and a single fragmentary wooden pulley-sheave discovered in a Roman deposit north of the South pier, there is little evidence for the lifting mechanisms that must have been in everyday use.

Once the ships entered the harbor, they were still in deep water. Between the moles the

[3] Most measurements are those recovered through excavations under water of sunken ships. Cf. L. Casson, *Ships and Seamanship in the Ancient World*, (Princeton, 1971), pp. 189-199.

[4] J. Rougé, *Recherches sur l'organisation du commerce maritime en Mediterranée sous l'Empire Romain*, (Paris, 1966), pp. 161-165.

[5] They are most common in Italy, for instance along the Tiber (M. Wheeler, *Roman Art and Architecture*, (New York, 1964), fig. 21 opposite p. 43) and at Terracina (M. R. de la Blanchère, *Terracine*, Paris, 1884, pl. VI). This type consists of a pierced stone ring that is actually the end of a block built into the quay wall. Although mooring rings have been reported in Greece (at Lechaeum, for instance (A. Georgiades, *Les Ports de la Grèce dans l'Antiquité*, (Athens, 1907), p. 4)) none are visible on the sites now nor were they ever illustrated by the authors who reported them. There are primitive bollards visible at Delos, however, which were reported and illustrated by J. Paris (BCH, XL, (1916), fig. 11, p. 39).

[6] See J. Shaw, "A Double-Sheaved Pulley Block from Kenchreai", *Hesperia*, XXXVI, (1967), pp. 389-401.

water was about 25 m. deep, and about two thirds of that depth where the lower slopes of the two moles meet the sediment layers that now characterize the bottom. A series of bottom soundings made by sonar (pp. 141f.) suggests that the sediment accumulated over the base of the mole is at some points up to two and one half meters thick, and extends outward from the south pier at least 30 meters. In one trench excavated on the north side of the south mole, about half-way along its length, some 1.5 m. were pierced before the rubble of the artificial mole structure was reached. Here was a natural place for the north-east-to-southwest scouring current to deposit its burden. Still, the amount of silt now deposited is limited; over a period of three years (1968-1971), the trenches excavated underwater remained open, even though their sides collapsed.

Immediately to the south of the south pier, the water is now quite shallow, and the bottom is characterized by scattered roof tiles, rubble, sherds and a few loose blocks of stone. There is no visible sign of walls, but the amount of rubble present in the area suggests that there may have been a number of buildings here, the walls and foundations of which were covered by debris when they were deserted or collapsed.

Today, the effect of the current on visibility is slight: the water is usually clear in the deepest part of the harbor, especially in the area of the north mole where there is a minimum of mud and sand deposit. But when the prevailing wind has been blowing for some time, and the waves have stirred up the sand and mud in the shallows, the water becomes cloudy, especially along the north side of the south pier where the mass of seawater, pushed by the accelerated current, the waves, and the wind, brushes up against the side of the pier as it attempts to escape to the south. Under such conditions, it requires a few days of moderate weather for the silt to settle.

As one approaches the moles and pier, the water becomes shallower, with the bottom climbing up spectacularly along the south side of the north mole and the north side of the south mole in great, stony masses (Plan B; Figs. 12, 13). These were created by cartloads of stone brought from convenient spots on land and then dumped into the water until they had created artificial hills with sloping sides.

It is in the sides of these masses that the majority of the fish, especially the smaller groupers, now take shelter, and in ancient times many fishermen must have cast out their lines from these moles. In the center of the harbor, even in the deepest water, there are few fish to be seen. Occasionally a seine is used in the harbor, but the catch is usually unimpressive, although sometimes a school of free-swimming silver fish, the mullet, will be unfortunate enough to be trapped. The situation may have been quite similar in ancient times, although there is no direct evidence; but it does seem reasonable to suppose that many more fishing boats than are now in the harbor at any one time could be seen departing from it then in the early morning and returning at night. Some of the catch would no doubt be sold to the managers of the fishtanks or *piscinae* (pp. 25ff.), the more choice fish probably bringing a good price. Later, the same fish might be sold to customers who came to dine at Kenchreai or, perhaps, to the inhabitants of Corinth who might ride out to inspect and order on the spot. Some probably put in their orders days in advance so that the *piscina* managers would not be caught short.

Today, as one swims west from where the moles converge toward the inner shore, the harbor first maintains its depth, then gradually begins to become shallow. At the same time, there is a significant increase in the amount of undersea vegetation. The muddy bottom of 25 meters deep, enlivened only by an occasional stone covered with black sea

sponges, and the seemingly aimless tracks of the traveling scallop and snail, yields to occasional green patches of long, slender eel grass, which becomes thicker as the depth of water between it and the sun decreases. Even at 20 meters depth, near the center of the harbor basin, this seaweed forms a thick, sometimes undulating carpet. Here there are few contrasting shapes or colors, but occasionally one can see the fringed, open shell of the large pina clam, its valves open so that it can filter the small sea animals that make up its diet. There are also some large snails like the Triton trumpet, which feed on the eel grass. There are few traces of human activity at this depth except for the tracks left by anchors dragged along the bottom: long swaths in the grass which are soon erased. And there are occasionally large fragments of amphorae in which octopuses may live. The remainder—lost anchor stocks, abandoned and sunken ships, refuse from anchored boats—has been covered by silt and vegetation.[7] Little seems changed here since ancient times, when the harbor bottom probably had similar contours, although the population that lived along the shores, and the ships anchored within the harbor, must have littered it considerably.

B. The North Mole

The north mole was to a large extent an embellishment of natural features already present. It is probably less of an artificial structure than the south pier. First, consideration of the general geological character of the area might be helpful. In the ancient harbor area, the tops of the hills overlooking from the north the slopes upon which most of the ancient town was set were capped with a thick, sloping layer of conglomerate stone (minimum thickness, 5 meters). The edge of this shelf has been gradually eroding away with the rain, wind, and in some areas, by men tunneling below it. Eventually the projecting layer of rock fractures along the edges and great masses of it fall down upon the already eroded hillside. Thus the Seaward Spur is formed by the undermining of the rock stratum along the coast, by wave action, and on the west by surface-water erosion and human agency.

On the Seaward Spur, moreover, the rock stratum is dipping eastward and southward. North of the Sanctuary of Aphrodite (Pls. IV B, XXIX), a conglomerate shelf forms the top of the Seaward Spur, but within the area of the sanctuary it is now gone, either quarried away for the purpose of the sanctuary or worn away by natural erosion. The layer is particularly thick and once, no doubt, extended to the east. In this regard it is important to point out that due east of the Sanctuary of Aphrodite, eastward from a point some 40 meters from the shore, there is a number of large conglomerate slabs lying at depths ranging from 3 to 15 meters below sea level. Undoubtedly these are from a similar shelf of rock that once existed in this area, and which now forms part of the sea bottom. For this reason, the water over the rock is quite shallow when compared with the depth of the harbor to the southwest.

Observation under water reveals that while the west side and tip of the north mole descend quite abruptly to the harbor bottom, all along the seaward (eastern) side of the mole the slope is an extremely gradual one, sloping downward gently southeastward some

[7] The only anchor discovered during the excavations at Kenchreai is a small one of limestone, pierced by three holes. Into two would have been fitted pointed wooden members; through the third the anchor rope would have passed. The anchor would have been used for very small boats. It was found in Area C, built into a Roman wall.

200 meters until slope and sea bottom merge at a depth of 34-40 meters. There is no doubt that this slope, which is a continuation of the bed-rock shelf extending out from the shore to the north, is completely natural. Only in shallow water, where there are a few superficial walls and some pavement surface, is there any sign of man's activity. These walls, once set on dry land, are eastward extensions of shoreside buildings (pp. 20 ff.). A pavement, formed of large limestone blocks with the interstices filled with rubble and mortar, apparently represents attempts to extend the then usable shore area out to the east. The tops of the blocks are now MSL −2.00 m. In deep water, along the southern edge of the natural platform, what appears to be the side of the main shelf of bedrock is visible. It also is being undermined by erosion, but this time by sea rather than air currents. Occasional slabs of bedrock, broken from this shelf, now lie canted on the underwater slopes below.

There is a good deal of circumstantial evidence, therefore, to suggest that in section the north mole consists of a rubble mass built upon the southwestern edge of a shelf of natural bedrock. The actual edge of the shelf is obscured at this point by the rocky fill of the ancient mole construction. It might have surprised the enterprising engineers who constructed the mole to know that although their plan to rest the mole on the bedrock shelf was sound, the entire shelf of bedrock was to subside along with the rest of the shoreline at least two meters in future years. Moreover, there is reason to believe that the end of the north mole has sunk at least two meters more than other parts of the harbor. The reason for this proportionately greater submergence is not known, but it is possible that the edge of the shelf on which the mole was built subsided independently of the other harbor areas, perhaps because of the weight of the stone heaped upon it, perhaps because of undermining along the edge by the water, or a combination of the two. Another possibility is that the mass of loose rock forming the mole was gradually consolidated and settled under its own weight, erosion and dispersal by the waves being additional factors.

At the south end of the north mole is a huge eroded block of poros limestone 4.30 by 1.30 m., the largest found in the harbor area. This (Fig. 7, Pl. X B) lies at the top of the mole, at grid point N 14586 / E 2441, and constitutes the most prominent architectural feature of this part of the mole. One of its corners has been taken as a permanent point in the topographic survey of the harbor. Located at MSL −3.77 m., the block lies on the brink of the precipitous side of the mole, which drops down sharply to MSL −20 m., where it joins the muddy bottom sloping off gently to the east and south. The slope itself is a confused jumble of rubble and a number of large squared blocks that have tumbled down from above. There are also some large amphora fragments such as those found along the side of the south mole. All of this is overgrown and encrusted with weed, sponges, and sea anemones.

The block is part of a mass of masonry which was cleared in part in the campaign of 1968. The immediate aim was to determine what structures, if any, may have been at this point. It was hoped, for instance, that remains of the base for the statue reported by Pausanias as being in the harbor area, perhaps at the end of a mole, might be discovered here. An area of about 20 m. square was cleared (Fig. 7, Pl. XI A) with the aid of the special dredge introduced at Kenchreai.[8] The pavement was solid and roughly level, but the blocks were irregularly laid, the interstices between them being packed not by mortar but by smaller blocks, sand and, sometimes, by large fragments of Roman pottery. As far as excavated, there was no indication that any taller structure had been erected at the end of the mole,

[8] J. Shaw, "Shallow-Water Excavation at Kenchreai, II", *AJA*, LXXIV, (1970), pp. 179-180.

although certain blocks such as the large one mentioned above seem to have been set in relationship to a few neighboring blocks and probably projected up above pavement level.

A retaining wall was apparently built around the edge of the mole at this point. This wall was at least three courses high, and the blocks were laid in an overlapping, step-like fashion. The bottom of the lowest "step" of this retaining wall, which might have been awash when originally set in place, is about MSL −4.80 m., which gives some indication of the magnitude of the total subsidence of this part of the north mole, assuming that the blocks were not set in place under water. Although it is known that the Romans built pier and bridge supports under water by means of cofferdams, and occasionally even built structures on land that were then tilted into the water (Vitruvius, *De Arch.*, V, xii, 4), there is no indication that such methods were followed at Kenchreai. During the building of the harbor at Caesarea, the moles were partly constructed of large blocks lowered down from above (Josephus, *Jewish War*, I, 408-14 [Loeb]) and some of these are still visible. But the wall and pavement blocks at Kenchreai have been set so evenly and carefully that one is inclined to believe that they could only have been put in place when on dry land. This is further shown by the fact that the blocks of the retaining wall were set in place with mortar. Pozzuolana, a hydraulic lime mortar made up of a lime mixture with an addition of crushed volcanic stone, was known by the Romans and used for a good many of their harbor works. But in order to be set under water it would usually have been used in conjunction with wooden cofferdams, for which there is no evidence at Kenchreai.

Although some of the largest blocks in this pavement have probably been quarried especially for use on the mole, especially some with a peculiar humped or loaf-like upper surface, many blocks were originally used in another structure. This is demonstrated by those with clamp cuttings of the swallow-tail variety (Pl. XI B), as well as by pryholes, setting marks, "lewis" cuttings, and what may be beam sockets. None of these could have performed a function in the relative position in which one sees them now. The clamp holes, for instance, do not match on adjoining blocks. The clamps themselves were of the swallow-tail and "I" types, as one can tell by the shape of the holes, and in the fill excavated were found a number of lead clamps, some of which had iron cores around which the molten lead had originally been poured (Pl. XI C). Since in size and general shape these clamps correspond to those used in the blocks, they have probably been pried loose from the blocks when they were removed from the original structure of which they formed a part before they were set in place in the pavement. It is perhaps risky to hazard a guess as to the origin of these blocks which, clearly, come from a once impressive structure. One possibility is that they are derived from Building D, described below (p. 20), at the base of the north mole, for the quality of its construction is equally fine. It is tempting, however, to associate the blocks with an early Roman structure contemporary with D and built in the area where they were discovered. At a later date, perhaps to strengthen the mole which had already been eroded by the waves, the monument was broken up for reuse. Confirmative evidence is perhaps provided by the presence of the clamps discovered near the blocks, for it seems doubtful that they would have been carried along with the blocks from which they had been pried loose, for any distance.[9] It is possible that the foundations of this earlier monument still lie undiscovered below the level of the pavement.

About other structures on the mole so little is known that they can be treated briefly

[9] It does seem curious, on the other hand, that the clamps were not salvaged for reuse by the workmen constructing the pavement.

and in a relatively arbitrary order, beginning at the base of the mole (see also Appendix E). The first, A, consists of a series of blocks of which only the tops are exposed in the water at the base of the mole (Plan F, Pl. XII A), some 110 meters to the north of the pavement just discussed. As for the date, the fact that the wall which they make up is at right angles to a Greek or Hellenistic structure (Fig. 35) to the north suggests that the two are contemporary. The second, B, is a curious structure, 1.10 m. by 1.25 m., formed of four closely-fitting blocks, with a central gap (0.35 m. by 0.47 m.) left open, at N 14686 / E 2452 (Pl. XII). Its purpose can only be guessed at. Perhaps it served as a base. It is more likely, however, that it is a socket for a wooden pole (a mast or a support for a crane) set into it.

Southwest of here we excavated on either side of wall C (Pl. XII) and found that the wall consists of at least three courses, the central one being a series of slab-like blocks set on edge in the manner of orthostates. The top block is set so that its edges jut out beyond the edges of the block below it. This suggests a coping stone, so that the wall was never carried up further than we see it now, but it might be that this course is the footing of a reconstruction of the wall at a higher level. The wall also probably belongs to a complex of which more is preserved to the north (Fig. 36).

On either side of wall C, especially on the west, the fill is very compact, being rough stones concreted (cemented) together in such a manner that they could only be pried loose by means of iron bars. On the western side of the wall, the hard fill stopped at the top of the lowest course excavated, to be replaced below by soft, fine blond sand at approximately MSL —1.30 m. This may be the level upon which the wall was originally built.

Directly west of A, B and C are two superimposed masses of masonry, E and D (Fig. 8, Pl. XII B) N 14689 / E 2435-50. The upper, E, its surface now just at sea level, presents the shape of a reversed "L" when viewed in plan. It is about 3.20 m. wide, and is composed of much-eroded blocks of poros limestone. There is a row set as headers along each side of the wall, with the interior space filled up with small blocks laid somewhat irregularly. The wall extends to the northwest about 12 meters, then turns at right angles to the north; no continuation to north or west was found. This wall does not seem related in its orientation to any other nearby structures. Moreover, it is composed of only one course of blocks, probably reused, set at about MSL —0.50 m. on a bed of cement about 0.35 m. thick. This may be late Roman, because a combed-ware sherd was found in the cement bedding.[10] Its function has not been satisfactorily explained.

A sounding made by means of the dredge between the easternmost end of E and wall C (Fig. 8) exposed an earlier structure, here called "D", its top surface at MSL —0.78 m. Upon this was set the cement bedding of pavement E. D is apparently a foundation built from a level of about MSL —1.80 m., of well cut poros blocks, at least four courses high, joined at one time by metal dowels and clamps, the latter of the I and [types. While the fill alongside it is probably Greek,[11] the position of the foundation and its construction type allow the possibility that it is of early Roman date, perhaps of the first century A.D. It, too, may originally have been built of reused blocks, for in the second course from the bottom there are unaligned clamp cuttings of the swallow-tail-⧖-type on adjacent blocks, while the blocks themselves show no signs of having shifted. The metal clamps and dowels on all the blocks excavated were all removed at some time in the past. Unfortunately, although an approximate date for the structure can be ventured, we do not know its

[10] UA 411 in Excavation Inventory.

[11] No Roman ware was found in it, while there was a base fragment of a Hellenistic bowl (UA 412).

function, or its overall plan. It is so carefully built, however, that it must be associated with something substantial, the superstructure of which has now disappeared.

To the south, and laid at an angle that points toward the end of the mole, is a stretch of wall about 28 meters long, from N 14678 / E 2455 to N 14650 / E 2460 (Plan F). This wall, apparently built entirely of reused blocks, can be divided structurally into three sections, F, G, and H. In plan, F appears as a fairly large, rectangular platform or foundation, *ca.* 2.70 m. by 1.60 m. G is a continuation of F to the south, but is only one course wide. A shallow sounding here determined that the wall, as preserved, is at least two courses high, and that the surface on the western side of the wall was sufficiently compact to suggest that it was a pavement.

The southernmost section of this wall (H), is composed of thirteen reused poros limestone column drums set in an open curve, adjoining drums set quite close to one another, their tops being at about MSL —1.66 m. We excavated around the northernmost of these and discovered, to our surprise, that the drum was never finished by the masons. It is not fluted, its surface is not worked, and it has four lifting bosses set at equal distances along the outside of the drum (Fig. 9, Pl. XII C). There is a cutting for an empolion in its upper surface, but none in its lower surface, suggesting that the drum was to be the lower one in a column of the Doric order.[12] The diameter of the drum is 1.00 m., excluding the lifting bosses. As to the date when it was placed in its present position, a first century A.D. sherd packed between drums and below the surface concretion gives us the earliest possible date for their positioning.

On either side of this wall, and shortly before the end of the mole, for about 50 meters, there is little evidence for any building. On the mole surface one can see only a rough, unpaved surface, although there are a few extremely large blocks at intervals along the center of the mole, approximately in line with the walls just described. It may have served, in the later days of the subsiding mole, as a slight barrier against waves washing over the top of the mole.

At the base of the mole, at the shore edge of the Seaward Spur, there is a rectangular tower *ca.* 6.50 m. by 7.50 m., and preserved 3.50 m. high (maximum) (Pls. XXXIV, XXXIII). It is set right on the modern shoreline, and rests on earlier walls. Its walls are 1.50 m. thick, and on the west there is a roughly made entrance-way. While its construction of heavy blocks below and mortar above is very solid, it is still somewhat shabby in technique, and it clearly dates from late or post-Roman times. In earlier publications this structure has been referred to as a "tower", which usually connotes a military function. However, since there is no fortification wall or other towers in the vicinity to be associated with it, at best one could call it a watch or signal tower. The hollow space within the interior, (*ca.* 3.00 m. by 4.40 m.) could have accommodated a flight of steps winding up within its interior to a platform, perhaps covered, on top. The foundation, most likely, represents the lower part of the base of a signal tower or lighthouse of Late Roman times, upon which was lit a beacon to guide sailors into the harbor. Lighthouses set at the entrance of Roman harbors were not uncommon at a harbor of this importance.

The fact that the lighthouse (or watch tower) was placed at the base of one of the moles rather than at its seaward end suggests that the building may have been constructed after

[12] Ionic drums were joined to each other and to their bases with *empolia*.

a subsidence of land had already taken place, leaving much or all of the mole submerged or awash.

In the shallows along the shore, north of the base of the mole and east of the Seaward Spur, and about 28 meters offshore (around N 14710 / E 2509) there is an interrupted stretch of worn poros limestone blocks, the tops of which are at MSL −1.60 m. The line which they form does not correspond in orientation to any of the walls now visible on shore. Its finished face is on the east. It may be a retaining wall for a roadway, now destroyed, that passed along the shore at this point, or even a quay wall. If the latter, it would probably date to the first or second century A.D. An extensive pavement borders this wall on the east. Large sections of this eastern pavement seem to have been destroyed by wave action, but as preserved it is at least 40 m. long and 10 m. wide at one point. It is composed of large blocks of poros limestone laid roughly parallel to each other but separated by large gaps filled in with rubble and mortar. Its position to the east of the "quay" wall just described makes its relation to that wall a problem. It may belong to an earlier quay pavement, or be a later device to reduce erosion in front of the quay. The tops of the easternmost blocks are now at *ca.* MSL −2.00 m.

In review, evidence for absolute chronology is limited, especially when we deal with the submerged parts of the north mole. However, three major periods seem discernible in their development (see also p. 87). The earliest is probably Greek, to which wall A, socket B, and perhaps wall C (the "orthostate" wall), can be attributed.

Sometime after the refounding of Corinth in 44 B.C., probably in the first century A.D., Monument D was built, the missing structure once resting on the foundations discovered being at a higher level than the earlier wall C but with the foundations themselves penetrating into early, sandy levels which probably represent the Greek beach. At about the same time construction of the mole was begun and completed; perhaps there was even an earlier, smaller mole over which the later mole was laid. Perhaps a monument was built near the end of the visible mole. Unlike the south pier, however, this mole was probably barren of buildings and served chiefly as a breakwater to make the interior harbor safe for anchorage and unloading. At a later date, the pavement which we discovered on the tip of the mole was constructed, most of the pavement blocks having been taken from an earlier structure.

At a still later period there was a general subsidence around the harbor area. No major attempts were made to rebuild the submerged structures. While most of the south pier was completely abandoned as a landing place, the tip of the northern prominence may have been improved with a quay wall (wall E) and a rough breakwater composed of walls F, G and H.[13] Thus the lines of E and C-F-G-H form an open triangle of a small but protected harbor in which a few small ships could be beached on shore and unload their goods on the quay (E). Finally, the lighthouse or signal tower was added as an extra garnishing, perhaps in the sixth century after Christ. At some later point in time, the area west of the breakwater was partially filled in with cement and rubble. Eventually the area was abandoned and, with subsequent land subsidence, submerged even further.

[13] The evidence for F and G remains unsure. It is possible that they were tall, earlier walls of which we now see only the tops which were covered during the course of later Roman construction. This does not basically affect the interpretation proposed, however.

C. The South Mole and Pier

The south pier (Fig. 23) is in effect a long, sloping platform, broader at its base than at its end, with the south mole joining it at an angle. To some extent the prominence is probably natural—perhaps there was a small spit of land here during ancient times, although bedrock was never found in the immediate area during excavation and must be some distance below the ground-water level on land.

Visible from the air (Pls. III, XV) today is the mole, once a kind of breakwater extending into deep water, and the pier itself, the end of which was converted in a later period into use as fishtanks or *piscinae* by the Romans (Figs. 10, 11). Westward stretch the extensive foundations of the great warehouse buildings; south of these and over parts of them, were built a sanctuary and, later, a church. (Figs. 23, 25, 30).

1. *The Mole*

The south mole, the top of which is now submerged from about 1.90 m. to 4.00 m. below water level, is a great mass of rock fill dumped into the harbor in order to close, at least partially, the gap between the north mole and the south pier. Presumably, both north and south moles are contemporary, built and used exclusively during the Roman period. The south mole, along its northern side, is about 85 m. long[14] and descends precipitiously from 4 to 18 m., whereupon the sides join the muddy sea bottom that slopes away gently to the north and east. The sides are extremely rough, being composed of large chunks of limestone tumbled together without order, and covered with various types of sea growth, sponges predominating. The end of the mole is rounded and without traces of any structures that might once have been placed there. Nor is there a pavement preserved such as that discovered on the north mole.[15]

To the south, along the side of the mole, the water shallows quite quickly. This area is probably the southern edge of the harbor basin onto which the Roman mole was built. Further south, the water is even shallower (1.50 to 2.00 m. deep) and slopes gently up to the sandy beaches which stretch southward some 500 yards, all the way from near the south pier to the rocky point of land on which the Baths of Helen are now situated.

About halfway along the north side of the mole there is a large, rounded boulder, about 3 × 3 × 1 m. It is tilted toward the north, and is just north of the line of the edge of the mole. While it is conceivable that it could have been placed there by man (e.g. floated out on a raft by the Romans and then sunk in place where we see it now), it is perhaps more likely that it is simply a boulder that rested on the edge of an underwater slope forming the southern edge of the partly natural, partly artificial harbor.[16]

The edge of the mole for at least half its length was reinforced by converging retaining walls of cut poros limestone. Along its southern edge there is a stretch of wall *ca.* 20 m. long,

[14] The distance given is somewhat arbitrary, for although the point of departure on the west—where the mole and pier join on the north—is sure, there is no specific point to which to measure on the end of the mole, for the slope at the end is gradual and otherwise undefined by permanent architectural features.

[15] A sounding, however, was never made here.

[16] The top of the boulder is at MSL-3.15 m. No other large boulders are visible in the rest of the harbor. However, similar boulders can be seen in the water seaward of the point of land east of the Baths of Helen, south of Kenchreai, Here they continue under water up to a depth of at least 30 meters.

the tops of the blocks being at MSL −2.00 to −2.64 m. Most of these were laid as headers (Fig. 10). A second course, of which five blocks are preserved on the west, suggests that the wall was once somewhat higher than we see it now. North of here, when one has passed over the great mounds of concrete rubble that once formed the upper covering of the mole, there is another, even heavier wall, composed of headers, which begins on the west where the mole joins the north side of the pier, and ends on the east some 37 m. away, where two courses of headers are fairly well preserved. At this point they are in close association with a rubble and cement mass, the top of which may be a pavement.[17]

Between the two walls on either side of the mole is another wall, *ca.* 14.50 m. long. Its western end rests upon a north-south wall at least two courses high. The latter wall continues to the south, ending at a point where its southern end rests upon the *krepidoma* of the southern retaining wall of the mole. The style of building of these two walls is so similar that it is likely that they are contemporary. However, the function of the former is not clear.[18]

2. *The Pier*

The facade of the long stretch of warehouse buildings was paralleled on the north by two wide retaining walls (Figs. 4, 10, 12, 23). The first from the north, henceforth called "A" here, is about 9 meters from the front wall of the warehouses. In places, two courses have been preserved. The bottoms of the lowest blocks still *in situ* are at MSL −2.60 m. On the north there is no sign of construction and the wall is bordered by the sea bottom. On the south there are substantial remains of a very solid pavement composed of blocks with their interstices filled with mortar. On the east, the wall begins at a point where pier and mole construction join. It continues to the west for about 54 meters, where it ends at a point just north of the center of the second block of warehouses.[19] Here also is plainly visible an extensive pavement of limestone blocks that begins where the wall ends and continues off to the north and west until it disappears below the sand. This pavement slopes down to the east. The top of the lowest exposed block of this pavement is at MSL −1.95 m., which shows subsidence at this point since Roman times, as it is likely that the pavement was exposed above water level.

There is little question that the Roman shoreline on the southwestern side of the harbor began here, some 35 meters from the present shoreline. That the wall, and the pavement related to it, are Roman is suggested by the fact that when a section was made in front of

[17] The top is at MSL −1.85. The bottom of the lowest block is at about −2.60 m., which suggests the amount of subsidence possible at this point (p. 146). The "pavement" may once have projected out of the water; the blocks were probably laid with their lower surfaces just below water level. This would suggest that at this part of the mole, the mole was at least 0.75 m. above water level when complete, and that the total amount of change in relative water level since early Roman times is about 2.50 m. (minimum). (Appendix E.)

[18] The relationship between the central wall and the southern retaining wall is somewhat similar to that between the northern and southern retaining walls: they both converge toward one another on the east. There also seems to have been a pavement between them. There is a possibility, therefore, that the former pair may represent an earlier phase of the mole which was later extended by building on the north and east (see p. 34).

[19] This observation was first made in the summer of 1971 when J. W. Shaw, financed by a grant from the Canada Council, found that the currents created by the winter storms had swept a good deal of the sand from the area and had exposed the end of the wall as well as a pavement. Up to this time it had been assumed that the wall continued further to the west.

Wall A[20] (Fig. 13), the wall was associated with Roman fill and did not have deep footings that penetrated to earlier levels. Moreover, the wall is parallel to the warehouse buildings which were probably built in the early first century A.D. (p. 43), and there is no known predecessor to these buildings with the same orientation.

Between Wall A and the front wall of the warehouses is a heavy wall, henceforth called Wall B, bordered by pavements on either side. At its eastern end, it makes a right angle turn, the extension turning to the south. At one time this north-south wall continued further to the south, but the later construction of the *piscinae* (p. 34) interrupted its original course (Fig. 11 B).[21] At this eastern corner the wall is quite sturdily built, consisting of headers and stretchers set alternately one next to the other. No mortar seems to have been used, and the large, well-cut blocks were set on a *krepidoma* composed of headers. The top of the wall is somewhat higher than the top of Wall A to the north. If one follows Wall B to the west, it continues without interruption for some 60 meters until it disappears below the sand, at a point about 8 meters west of the end of Wall A, and some 25 meters from the modern shore line (Fig. 23).

As to the date of Wall B, although the fill upon which it was built was not sampled, it is reasonable to expect that it is contemporary with the warehouse buildings because of their close relationship in plan. As to its function, it may have served as a retaining wall for a platform on which the warehouses were erected. Another problem is whether Walls A and B are contemporary, although there is little doubt that they are not far apart in time. Thus the northernmost wall (A) would serve as a quay wall, and that to the south (B) form a raised platform upon which the easternmost warehouse building was constructed.

3. *The Fish Tanks* (*Piscinae*)

Southeast of the warehouses is a series of six large rectangular basins linked by channels[22] with each other and with the sea (Figs. 10, 11, Pl. XV). Their construction clearly post-dates that of the warehouses, for the westernmost basin is built upon the southeastern rooms of one warehouse building, and also cuts across the southwestern extension of warehouse retaining wall B, described above.

This curious structure consists of large, paved surfaces in which intentional gaps are left open. Each gap is surrounded by masonry, and there is no indication that the masonry on either side of the gaps was ever carried up above present pavement level, unless by one course. The gaps, which we came to call "basins" when it seemed clear that they were intended to be filled with water, are carefully arranged on either side of an axis about thirty degrees south of east by 30 degrees north of west, that divides the basins symmetrically. The axis bisects basins A and B, and also the long channel east of B. Thus basins A and B are divided in half by the axis line, with basins C and E on the north corresponding to basins D and F on the south. Contributing to this orderly arrangement are the channels on the east sides of basins E and F that once linked them with the sea. The channel east of E has been destroyed by the sea; that east of F was filled in during ancient times, when the basin had gone out of use.

[20] Trench IVA—1965.

[21] Thus it is not known whether the visible course is set directly on fill or whether it continues further below.

[22] This area was originally described as the "Channel Complex" in *AJA*, LXXI, (1967) p. 225f.

D. The Inner Quay

Along the shore between the moles there were a number of commercial buildings between streets. These seem to have been *tabernae* or harbor-front shops (pp. 46 f.; Plan D; Fig. 5). Some of the buildings faced the center of the harbor and, as in many a harbor town today, there was a road or promenade supported by a wall that ran along the shoreline. On the northwest quay was a convenient well (Pl. XX B) which even today has an abundance of fresh water, even though it is closer to the sea now than during the most active days of the harbor.

A trench 3 by 5 meters was excavated with the dredge on the sea side of the quay wall, along the northwest side, the top of which had long been visible in the shallow water (Figs. 21, 22; Pl. XIV). Here it was hoped to discern strata that would help us date the wall and elucidate at the same time the various phases of the shoreline. In trenches west of the wall, penetration into the earlier, lower levels had proved to be extremely difficult because of the high level of the ground water which, as was pointed out in the preliminary reports, was impossible to control when one excavated below it. From a strictly technical point of view, this was also an area in which to experiment with the new dredge designed for archaeological work in shallow water. Both aims were to a large extent achieved.

In the process of excavation, which reached MSL −2.20 m. at one point, five definite strata were identified below present water level (Fig. 22). These strata sloped gently down to the east, which suggested that they followed the natural slope of the earlier seashore. These layers were consistent throughout the exposed width (north-to-south) of the trench, and were not interrupted by intrusions from above, so in the explanatory section they are shown with their respective finds throughout the trench.

If we begin our description (see also Appendix E) at the top, the first layer (1) lay just below the water line, parts of it being awash when the wind came up. The layer itself was only ten to twenty centimeters thick, and consisted of the wave-worn Roman pottery and tiles characteristic of most of the modern harbor shoreline today. The material was loose and was, clearly, the upper layer of beachside fill that is shifted about by the waves throughout the year. The second layer consisted of wave-worn beach pebbles, coarse late Roman pottery fragments, and a few bits of Roman lamps. It was quite thick (average, 0.90 m.) and homogeneous in nature, although at the bottom there were discovered fragments of gold and silver jewellery and also a few coins. The transition between this layer (2) and the one below (3) was quite distinct. The latter was much sandier in color and texture, and contained a number of large stones. Moreover, there were lamp fragments of the first century A.D., and some 34 coins were found at various levels. The wall appears to have been set into layer 3, or to have been built while Layer 3 was accumulating. Layer 3, then, rested upon an extremely hard-packed cobble surface (4) in which few finds were made and the top of which was covered with a curious mottled green and black discoloration. No satisfactory explanation for this discoloration has been proposed. This layer, no doubt man-made, continued below the wall on the west, and so is certainly earlier than the wall. It also effectively seals the layer (5) below it, the latter consisting of yellow sand, a few small stones, and fragments of Hellenistic roof tiles and pottery. This earlier layer is at least 0.40 m. thick; we did not follow it down any further because of the difficulty of excavating carefully in a trench with sides that, as one digs deeper, contract toward the center of the trench. The color, texture, and content of this

layer appear to be milar to deposits found elsewhere in the deeper soundings below water.[50]

A second possible quay wall in this area of the harbor is represented by a number of limestone blocks in the water some 30 to 45 meters east of the wall just described. The tops of these blocks are now in 1.30 to 2.10 m. of water. Some of them were cleared by us in hopes of finding an early shoreside structure, but although they did not seem to be part of a specific building, they seem to be too regularly placed to have accumulated at random like the piles of small stones visible at intervals in the same area. The latter can probably be interpreted as ballast stones dumped from ships when they were filling up with cargo, during a later period of the harbor's use and after the submergence of the earlier shoreline.

It is important to note that the seaward side of the main upper quay wall has been eroded on its base and second course. Under the circumstances, this erosion could have been caused only by the sea, and thus before layer (2) was deposited.

If we begin our interpretation with the earliest of these layers or strata, number 5, and work up, it would seem that this must represent beach or shallow sea bottom close to shore. Since all around the harbor there is evidence for a substantial amount of land settlement (Appendix E), we might assume that the top of this stratum once stood as much as two meters—perhaps more—higher than it is now. On this basis, the top of the early layer (5), now at MSL −1.70 m. would have been elevated above water level by as much as 0.30 m. or more. Thus we would be dealing with the upper part of the beach, while the actual shoreline, whether natural, where sea and land separate, or a sea wall, was some distance to the east of the trench. This suggests, of course, that the harbor area was smaller then than it is now.

Then level (4) must be part of an extensive pavement along the water front, which paralleled the Roman shoreline. As to its date, although it could be Late Hellenistic on the basis of the pottery found below it, it is more likely Early Roman in date, and was probably constructed shortly after the refounding of Corinth in 44 B.C. by Julius Caesar. A worn coin of a B.C. type (Coin 1305) was found imbedded in the pavement. Indeed, the blackened material raises the question as to whether it might be debris from destruction in the time of Mummius, or at least an accumulation of decay from the century before Caesar.

But this pavement was surely above water, and shows that at this time the land lay at least two meters—perhaps 2.30—higher than now.

Resting on this roadbed is layer (3), hard-packed, coin-strewn, with every mark of its being an accumulation created from Augustan times to the latter half of the First Century A.D. The date is based mainly on coins, of which some 34 were found, and 14 were identifiable. As to their range of date, the earliest is Late Hellenistic (Coin 1295), with the latest possible date for one (Coin 1288) being the Third Century A.D., although it is probably much earlier and may be intrusive. The majority of the coins fall in the late First Century B.C.—late First Century A.D. time span.[51]

Sometime at the end of this period, the well-constructed wall shown in Pl. XIV A, B; Figs. 21, 22, was built. The lower, broader foundation footing, consisting of headers, was at least partially set into layer (3) from above. The bottom of its lowest course is now at

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[50] In the South Pier area, in the lower part of Trench IV B-C (p. 137), and in the area of the North Pier, in the sounding next to structure D (p. 20).

[51] One coin is of the 30's B.C. (Coin 1307), 7 are of Imperial Corinth (Coins 1290-1294, 1299, 1303), and there is one of Domitian (Coin 1300), Trajan (Coin 1312), one of the First Century A.D. (Coin 1273), and one of an Imperial Greek state (Coin 1287) (Cf. Excavation Inventories).

MSL −1.40 m. Below one of the blocks was a lamp of the mid First Century A.D.[52] It is to be noted here that the material in layer (3) was not sea-worn: the edges of the pottery fragments were sharp and the stones were not rounded, which suggests that at the time the layer was accumulating, the sea did not reach this high up on the shore.

In this arrangement, the new wall would have stood as a terrace wall or upper quay wall separating the unloading area extending to the quay wall to the east, and the space in front of the *tabernae* to the west.

Subsequently, however, there was a change in sea level, so that the base of this upper wall was eroded by waves washing shallowly over the top of Layer 3. And, still later, a further change in sea level, or several of them, brought the entire wall to its present level (see Appendix E).

[52] U.A. 215, KE 1961, L 517 (Excavation Inventories).

CHAPTER FOUR

THE HARBOR-SIDE COMMERCIAL FACILITIES

By Robert Scranton

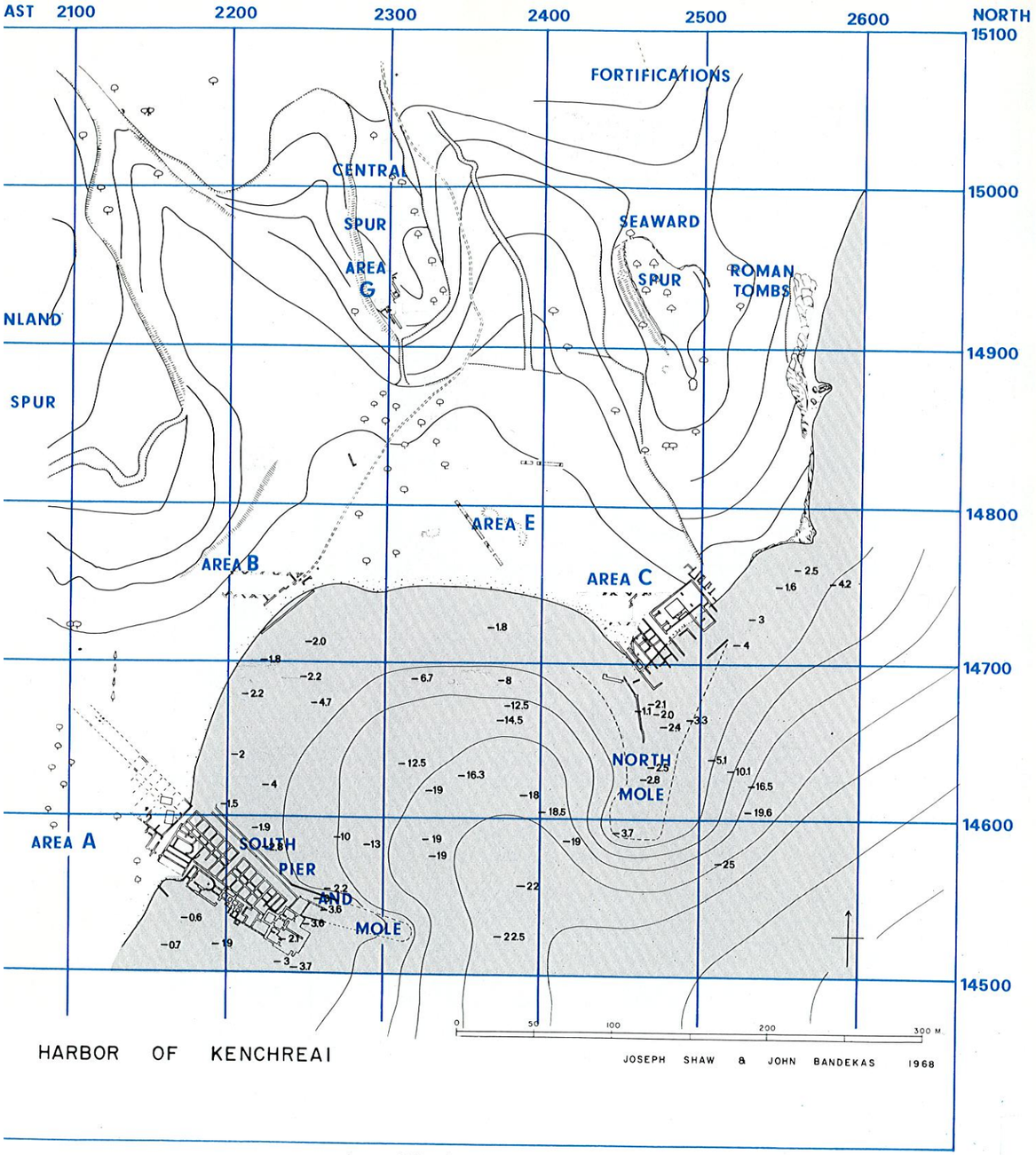
Facing on the quay aprons surrounding the harbor was a solid array of structures of which most, if not all, were of unpretentious functional design and construction presumably built and used for the purposes of commerce (Fig. 5). On the south pier and extending inland from that was a phalanx of *horrea,* or warehouses, of conspicuously homogeneous pattern; along the northwest side, as we infer from limited evidence, was a row of less formal structures; and on the north, a quay-side plateia on which probably faced a simple stoa and within which were some structures of unidentified character. We shall begin the survey with the southwest side, as offering the clearest picture and the basis for many subsequent hypothetical inferences.

A. The Southwest Side of Roman Harbor

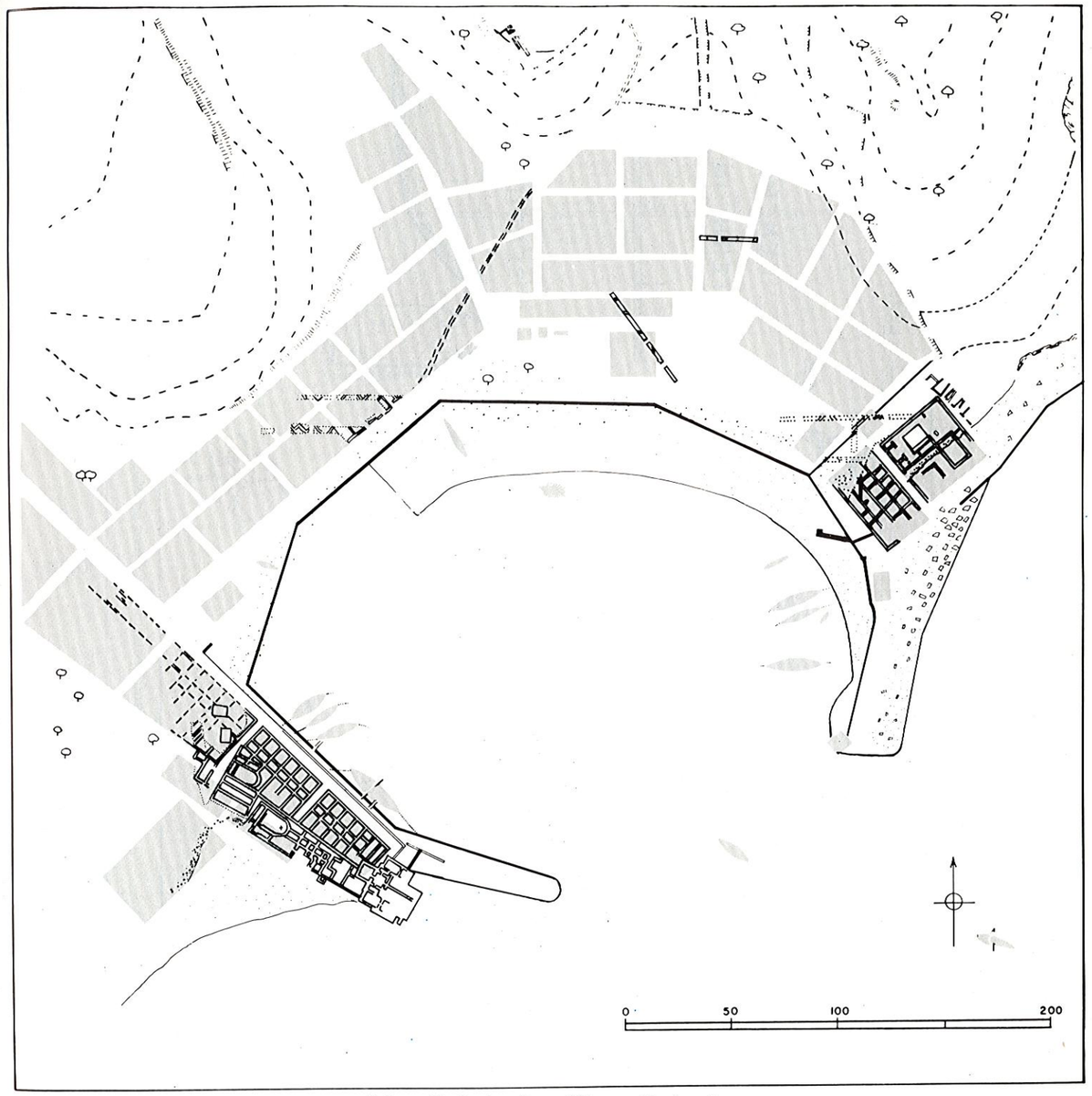
Evidence for the arrangements along the southwest side of the harbor has been accumulated along a front about 175 meters long. The evidence varies in kind and amount, according to the circumstances of the several areas involved, and it will be helpful to indicate the general areas from which it comes, for convenience in reference and exposition (Fig. 23).

1. The Pier Area. East of grid-line E 2180, on the pier itself (cf. Fig. 10).
2. The Central Area. Within grid-coordinates E 2145-90 / N 14560-14700, extensively explored by excavation (Plan C, Fig. 23, 25).
3. The Inland Area. West of grid-line E 2140 explored sporadically in three trenches:
   A. The North-South Trench, at E 2145 / N 14605-14645. Fig. 23.
   B. The East-West Trench, at E 2095-2135 / N 14610. Fig. 23.
   C. The West Trench, at E 2100-20 / N 14650-60. Figs. 23, 24.

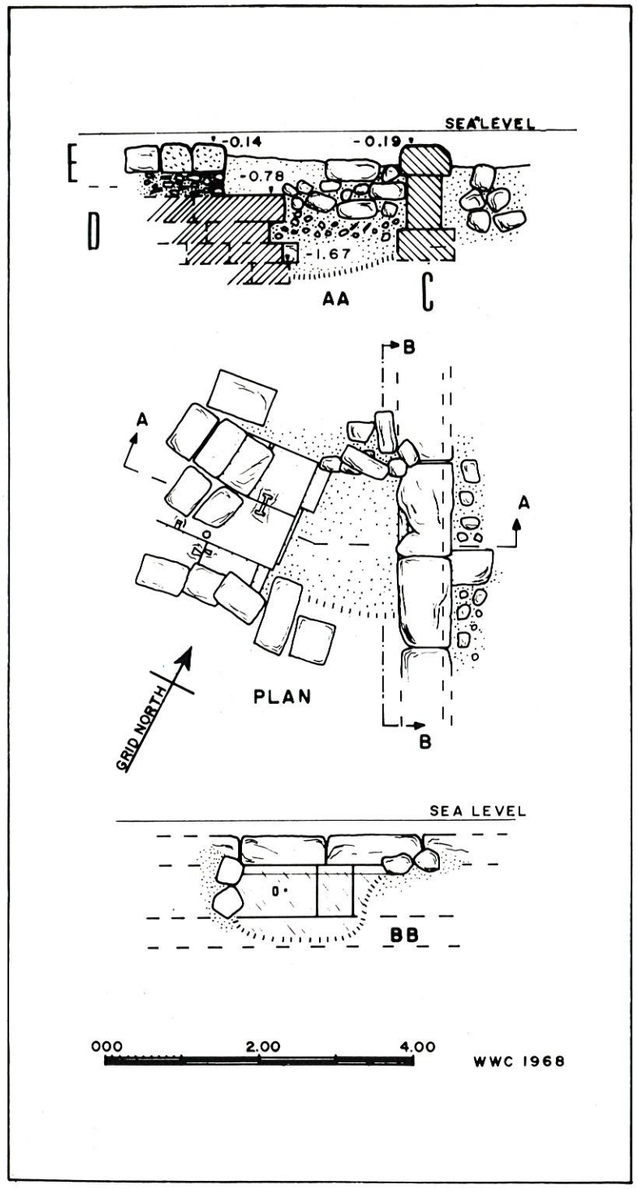
The Pier area provides the basis for the conception of the general scheme of the system. The foundations in this area have long been visible in the sea, and show clearly in an aerial photograph although they present some difficulties in any attempt to trace them closely in the water itself (Pls. III, XIV). A discussion of them, in so far as they bear on questions of the structure of the pier itself, has already been presented (p. 24). At this stage several points need to be recalled to clarify the value of the remains for the understanding of the warehouse system. In the first place, it must be remembered that they are only foundations;



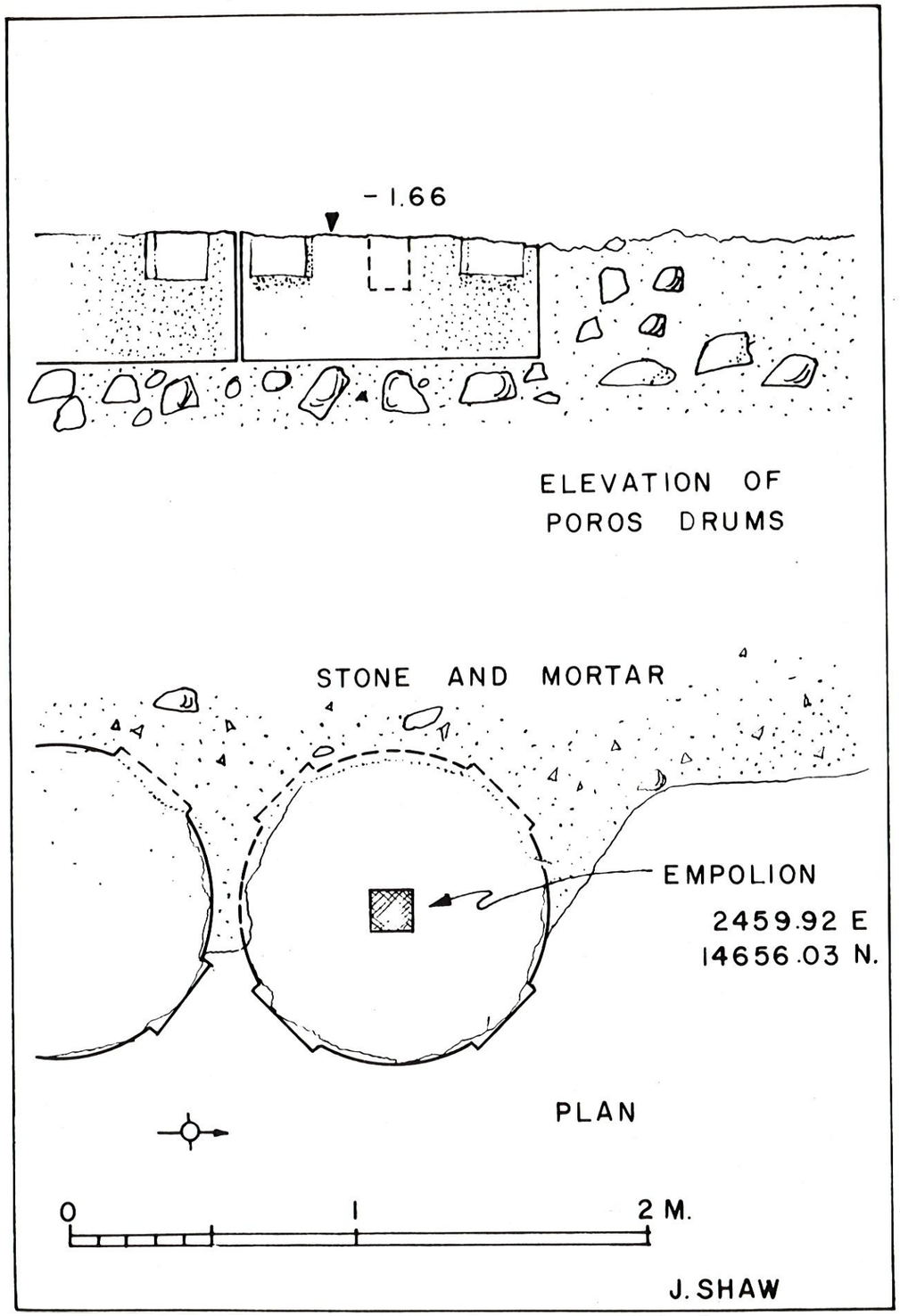
4. Area of Kenchreai Explored by Excavation.



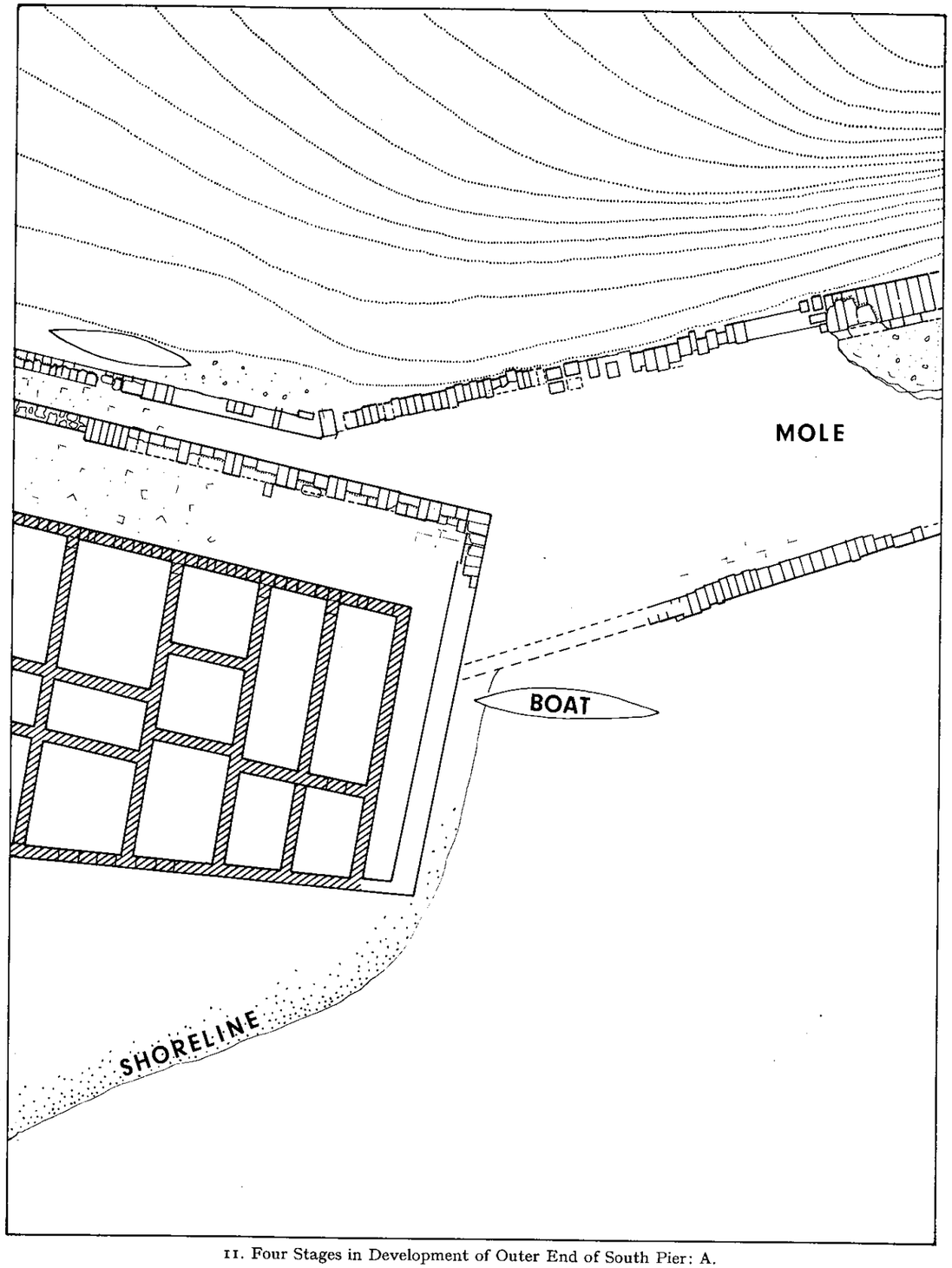
5. Schematic Restoration of Roman Harbor Area.



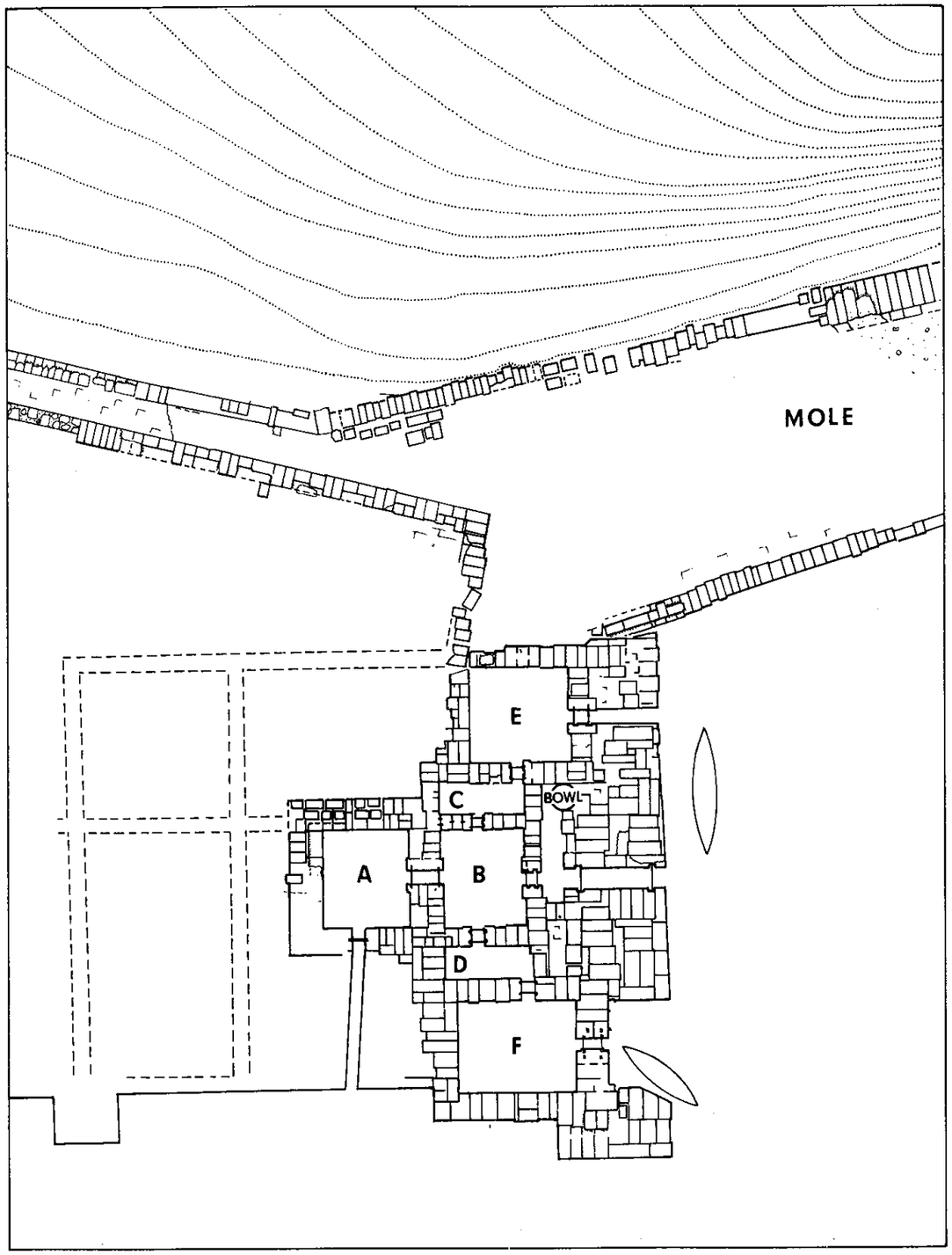
8. Plan and Section of Sounding near Walls C, D, E at Base of North Mole (W. W. Cummer).



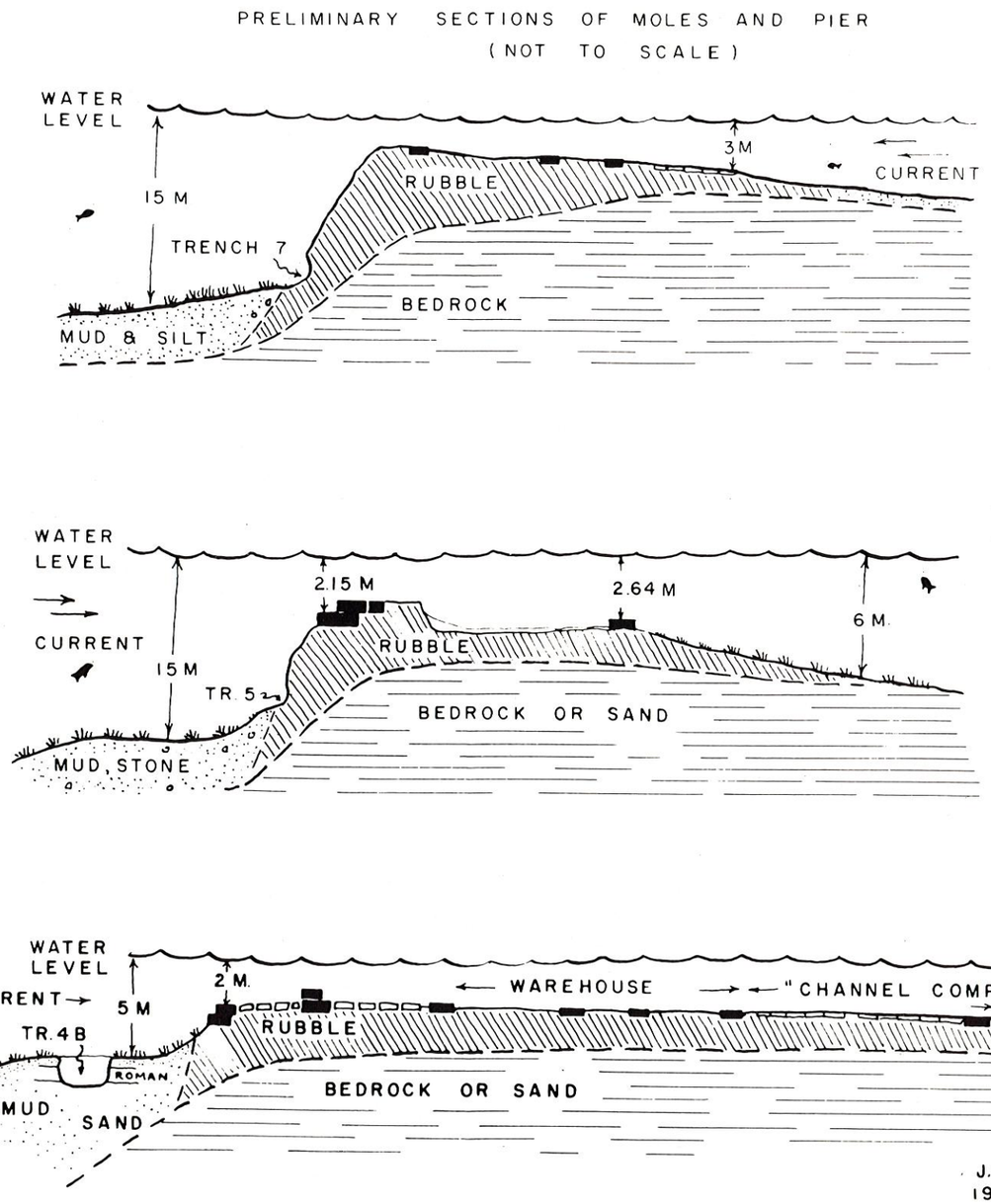
9. Plan and Elevation of Northernmost Drums in Wall H on North Mole.



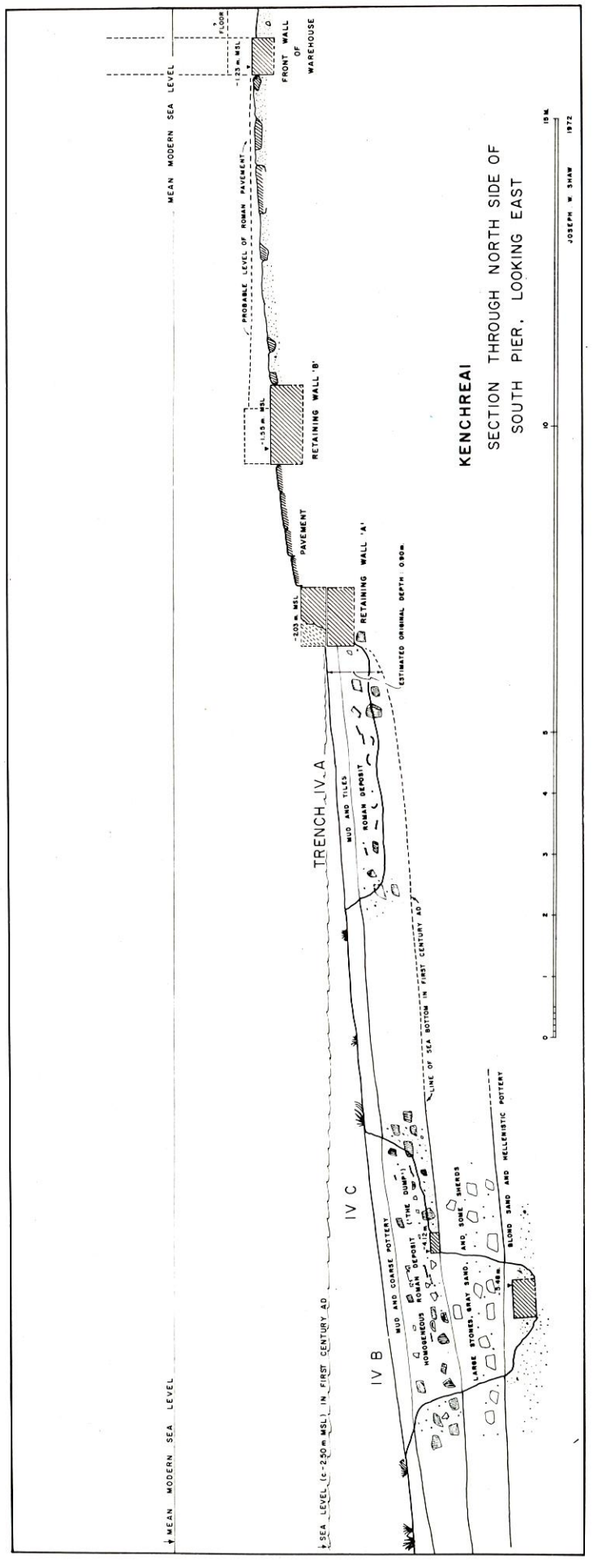
11. Four Stages in Development of Outer End of South Pier: A.



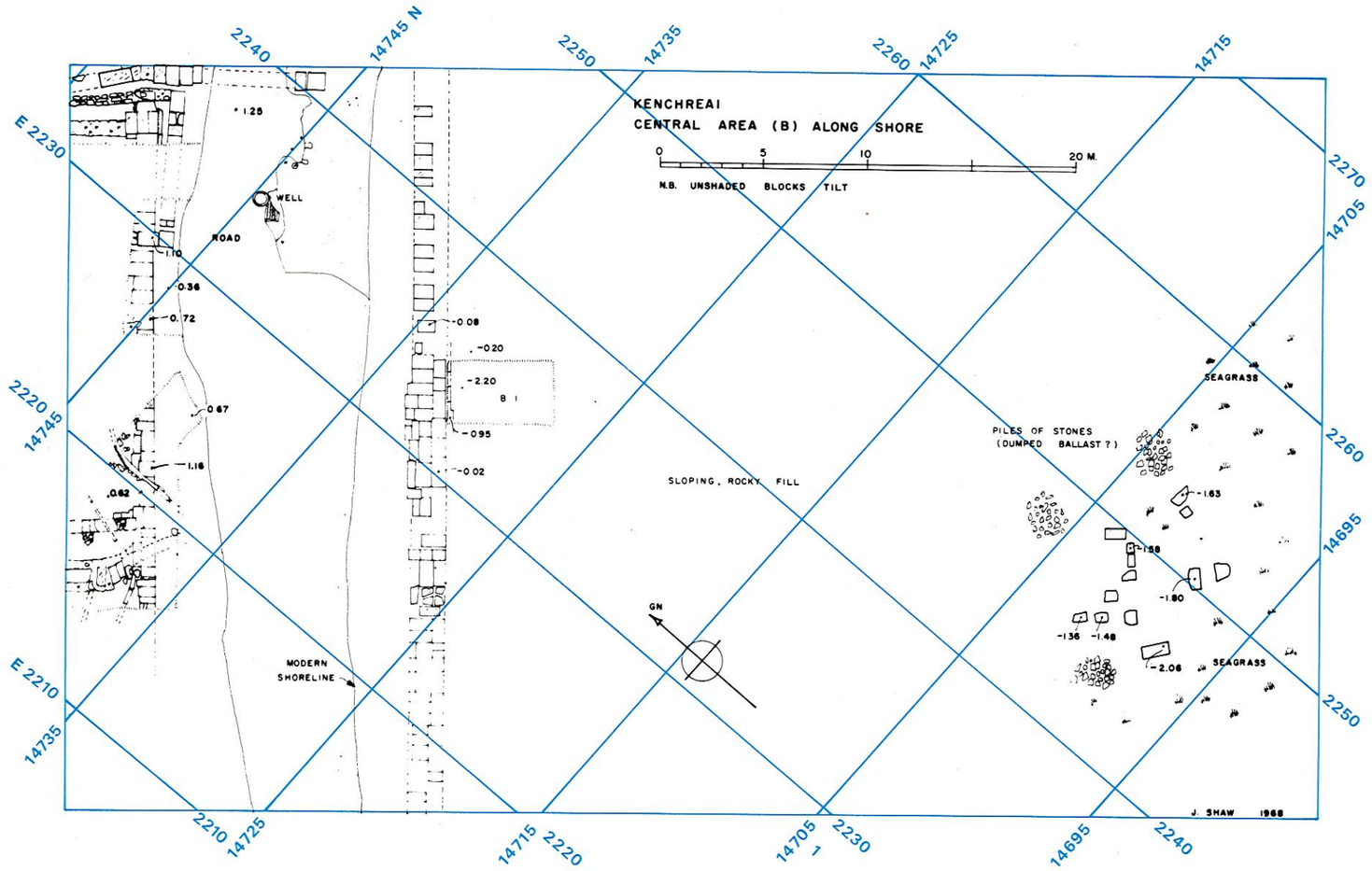
11. Four Stages in Development of Outer End of South Pier: B.



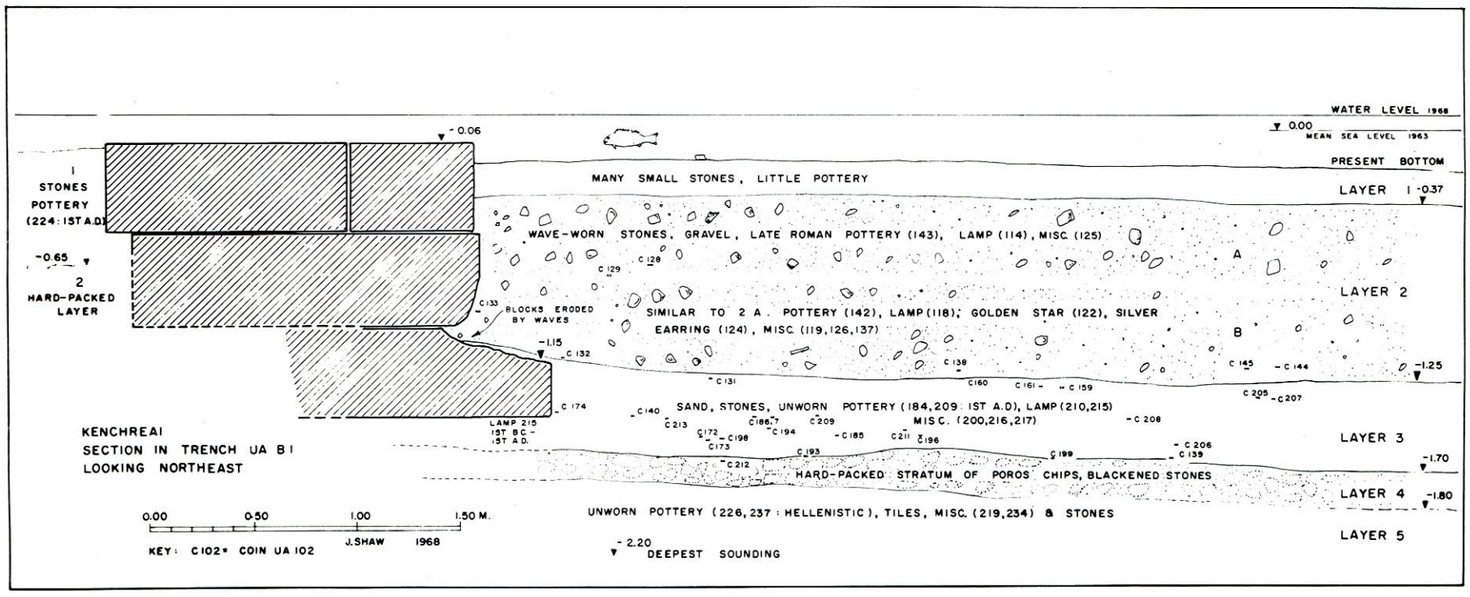
12. Schematic Sections through Moles and Pier.



13. Scale Section through North Side of South Pier.

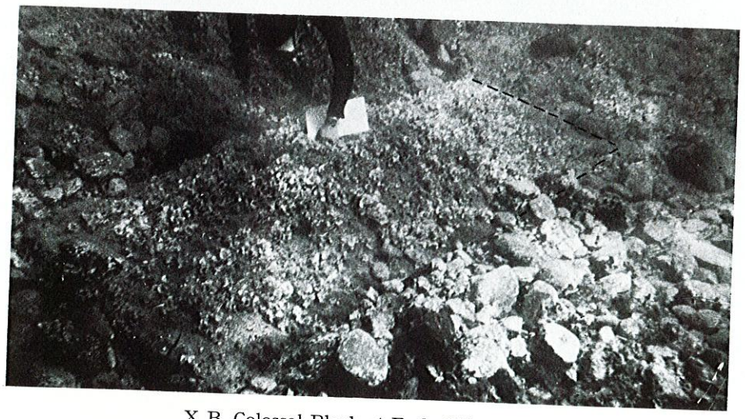


21. Plan of Remains at Northwest Side of Harbor Front.



22. Section through Quay Wall at Northwest Side of Harbor Front.

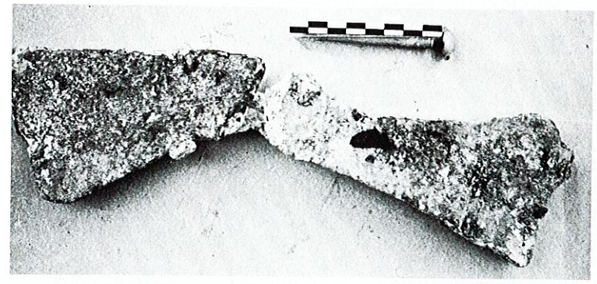
X A. Detail of Unloading Scene at Roman Ostia (Torlonia Relief, Museo Torlonia in Rome. Gabinetto Fotografico Nazionale).



X B. Colossal Block at End of North Mole.

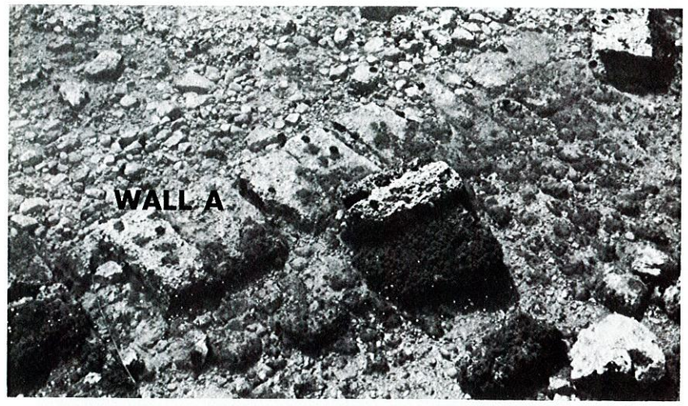
XI A. Pavement at End of North Mole.

XI B. Clamp Cutting in Block of Pavement at End of North Mole.

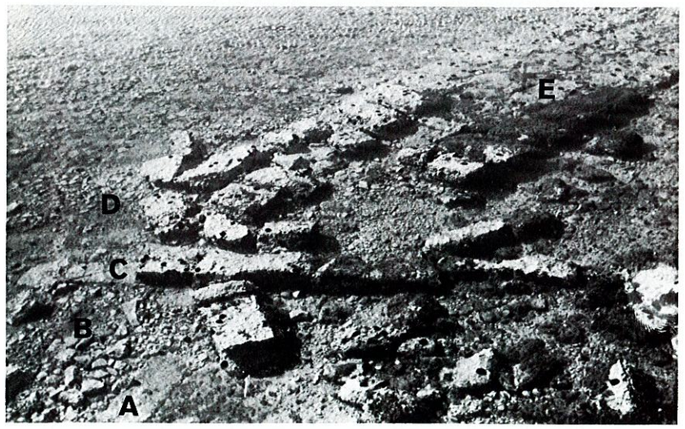


XI C. Lead Clamp from Fill around Blocks.

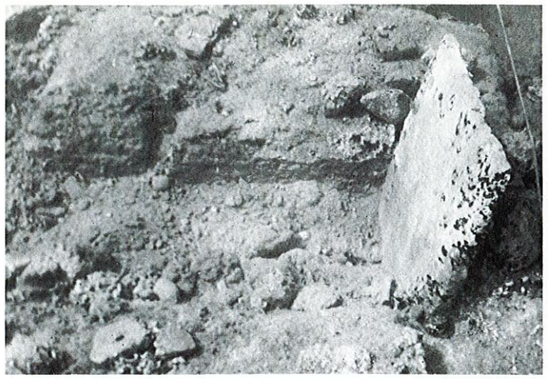
XI D. Sides of Two Column Drums in Wall H.



XII A. Submerged Walls just Offshore at Base of North Mole.

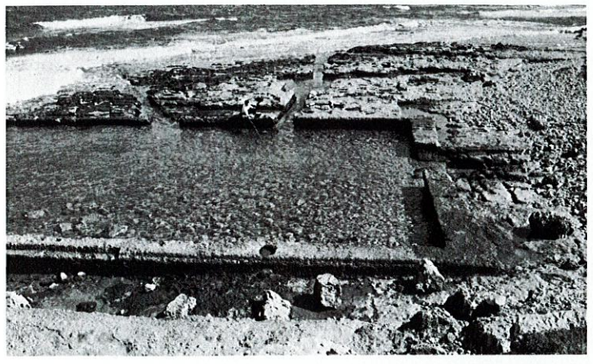


XII B. Submerged Walls just West of those in A.



XIII A. Channel and Slab in Basin E of Piscina on South Pier.

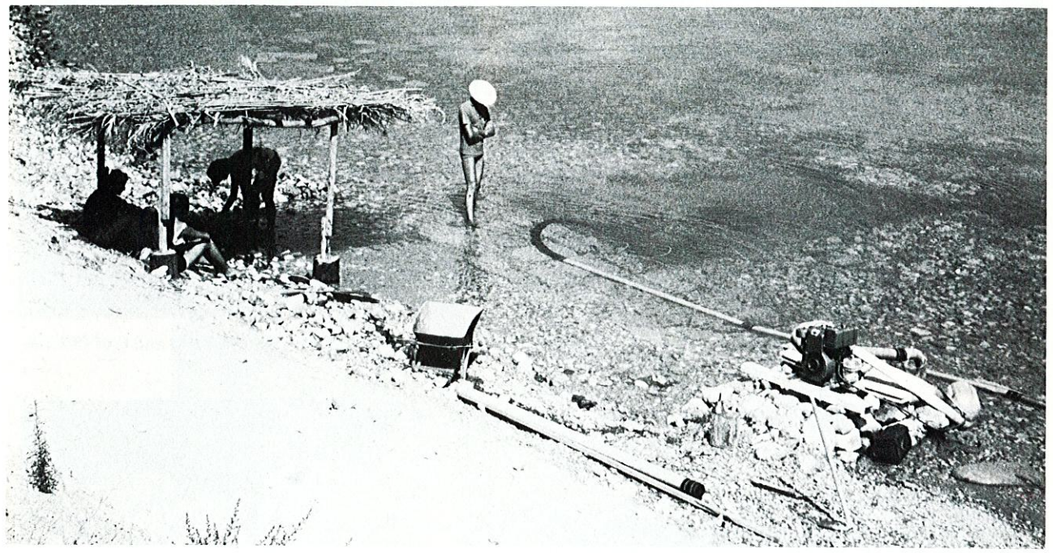
XIII B. Channel between Basins B and C of Piscina.



XIII C. Main Basin of Piscina near Lambousa in Cyprus (courtesy M. Katsev).

XIII D. Detail of Piscina at Lambousa.

XIII E. Fish Tanks at Sabratha (courtesy B. Yorke).



XIV A. Submerged Quay Wall near Middle of Harbor Front (Northwest Side).

XIV B. Eastern Face of Quay Wall.

XV. Air View of South Pier and Excavated Area on Shore (Fr. Raymond Schoder).