עירית חיפה

המוזיאון הימי הלאומי חיפה

ספונים

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מוקדש לזכרו של אריה בן־אלי

תשמ״א

הוצאת קרן המוזיאון הימי הלאומי
בסיוע משפחת הנרי גלסברג, פריס

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SOME ARCHAEOLOGICAL EVIDENCE FOR ANCIENT MARITIME ACTIVITIES AT DOR

(Pls. I—II)

The city of Dor and its harbour are among the richest historical centers of continuing maritime activity. It appears that this was the most important harbour on the Carmel Coast from the latter half of the second millenium B C. (the Late Bronze Age) and up to the modern Arabic period [1]. Despite the intrinsic importance of the site, archaeological investigations have been minimal, and relatively little has been published on the artifacts that were uncovered [2]. Even from the little that has been published, the remains provide no evidence as to the duration and intensity of the site's maritime aspects. Only in the last decade have surveys (on land and sea), measurements, small test excavations underwater, gathering and recording of information by divers of the Undersea Exploration Society and students of the Department for the History of Maritime Civilizations of Haifa University, began to clarify elements of what may be the most interesting and important harbour on our Mediterranean coast line [3].

The opening of the exhibition of sea-storage jars in the Maritime Museum, which includes examples from the harbour and coastal area of Dor [4], and considering the exhibition of other important finds from this site and its area, seems an opportune time to introduce readers to some of the wealth of information and discoveries which have been studied in the last few years. These shed light on the focal position held by the site as a central base for maritime activity in the various periods.

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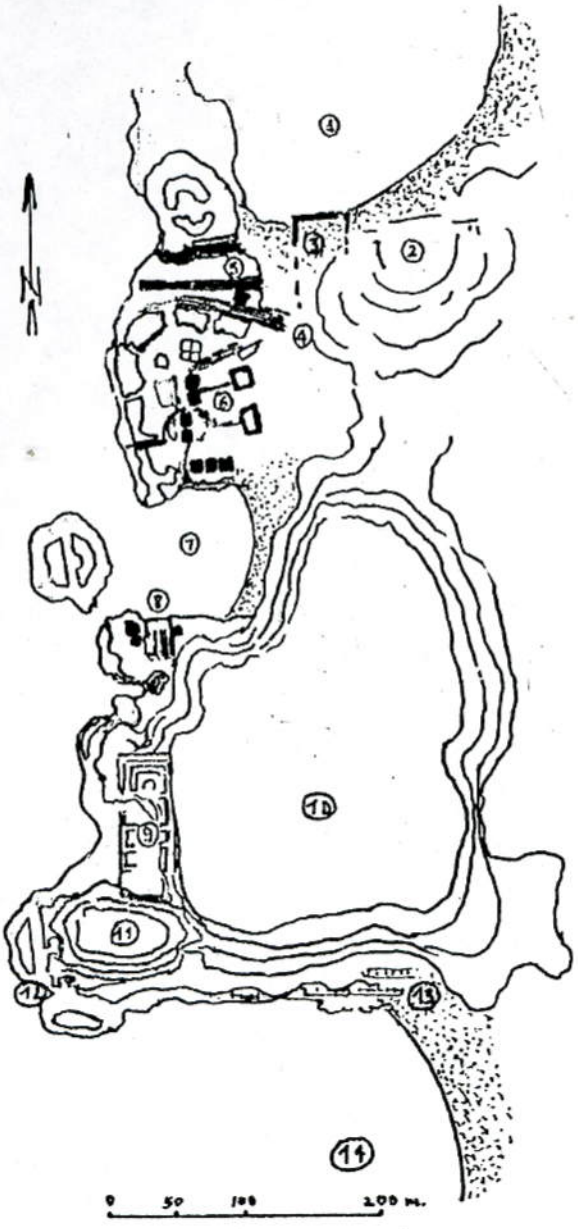
1. For history of Dor and its harbour see G. Foerster, *Encylopaedia of Archaeological Excavations in the Holy Land*, 1970 (Hebrew), vol. I, and additional bibliography. For sources for the history of Dor in the Hellenistic, Roman and Byzantine periods, see: M. Avi Yona, *Gazeteer of Roman Palestine*, Kedem V, Jerusalem, 1976, p. 52.
2. On the excavations: J. Leibovitz, *Alon*, 3, 1951, (Hebrew), pp. 38-9, J. Garstang, BBSJ, 4, (1924), pp. 34—5; 6 (1924), pp. 65—75.
3. A. Raban, *Notes for Guides*, (Hebrew), September-October 1977, pp. 17—30. A. Raban and E. Linder, in "Notes and News" section of JNA *(International Journal for Nautical Archaeology)*, 7:1 (February, 1978); N.C. Flemming, A. Raban and C. Goetschel, "Tectonic and Eustatic changes on the Mediterranean coast of Israel in the last 9000 Years", *Quarternarian Journal* (in Press) sites 26—7.
4. A. Zemer, *Storage Jars in Ancient Sea Trade*, the National Maritime Museum Haifa, 1977, No. 9 (p. 14) of the Iron Age; No. 19 (p. 25) and No. 25 (p. 31) of the Persian period.

The harbour facilities of Dor throughout the various periods are still problematic in the extreme. The site's coast line bears witness to many changes during its history, which occasionally necessitated alternative installations (see the general plan of the site in Fig. 1). A wide range of dock constructions, *piscinae*, industrial installations and rock cuttings have been found. In quantity and variety these are unique among the city harbours of our coast.



For example, this is the only site in which deep channels were cut on the western side of its cliffs facing the sea, to serve as "traps" for the excess water which is thrown landward by large waves. Parts of these channels were roofed, and served as dry docks for the repair of boats which were slung in the air on beams (Fig. 1 : 12, Pl. I., 1). This paper will deal in detail with only three aspects of the site.

1. THE SLIPWAY AND DOCKYARDS

In a small bay nestled against the ancient tell (see Fig. 1:7) one notes clear evidence of quarrying and expansion southward, apparently to create a large, well-protected anchorage. This seems to have been the inner and most important harbour of the city of Dor — at least from its days as a Phoenician maritime base and in the Hellenistic Period [5]. The main evidence for the importance of this baylet serving as a harbour is a unique installation cut into the rock and constructed near the south-west corner of the bay. This is a sophisticated complex for removing large vessels from the sea and for their storage during repair and construction. This is a true "drydock", and is the only one known from the eastern coast of the Mediterranean (see Fig. 1.8 ; and the air photo in Pl. I, 2).

The drydock is quarried into the kurkar bedrock in an area which had been levelled previously to a height more than 2.5 m above sea level. The rock cuttings consist of three parallel elongated areas which rise from sea level in the north, souhtward at an angle of 5°. The width of the areas varies ; in the east 3.4 m ; in the center 4.3 m ; and in the west 4.8 m. To these widths should be added stone partition 1.2 m wide which separates the three areas. The partitions have holes cut into them which seem to have served for placing wooden beams for roofing. It is difficult today to establish accurately the length of each of the areas in as much as it is not certain that they relate to the present day sea level. Despite this, it seems that the eastern and central areas were able to take ships up to 25 m in length. The western area was never completed, but from the remains of the quarrying it appears as to have been intended for slightly larger vessels. To the east of the installation and next to the central area a square pool was quarried (4.1 x 2.3 x 1.0 m). A narrow stone wall separated the pool and the area. Two larger pools were hewn to the west of the installation. (These have been partially destroyed by sea erosion). These pools were probably originally plastered, and intended for soaking the wooden bolts used in the construction of frames or stakes. This soaking procedure was necessary to insure the proper elasticity of the wood while it was being bent to the desired profile. In the upper, rear part of the eastern area, it is still possible to identify the foundation for a

5. A. Avi Yona, *Encyclopaedia Biblica*, II, pp. 579—81.

square room which constitutes a southern extension of the area under discussion. This is possibly the base for a capstan which aided in beaching the ships. The ropes from the capstan may have been connected to a sled constructed of wood and metal which was lowered from the quarried surface to below sea level to enable the vessel to be towed.

In this manner it was possible to bring the ship ashore with relatively little difficulty. As has been pointed out above, no similar installation has been studied in any of the other coastal sites on the eastern shores of the Mediterranean ; and before trying to establish the date of the installation and the classes of ships which it served, it seems worthwhile to review the information of other drydocks known to us from Turkey, Greece, and North Africa[6].

The drydocks and slipways which have been discovered up to the present may be divided into two main groups : A) Installations which are placed outside of the harbour area (and occasionally outside the area of settlement) which serve primarily as drydocks. This technique is an improvement on the custom that was common in early periods in the Aegean ; light vessels were drawn ashore rather than being left to ride at anchor. This was possible due to the long and narrow proportions of the Aegean rowing craft and their large crew (at least a few tens of rowers) who were capable of beaching the craft in sandy bays on wooden rollers[7]. This technique is the only one attested to by Homer in both the Iliad and the Odyssey[8]. From the works of Herodotus and Thucidydes we learn that it was also prevalent in classical times. The ever-increasing role of military craft (patrolling, seige, etc.) necessitated the speedy lowering of galleys into the water. For this purpose special slip installations were constructed. These also served as "garages" during periods when the crews remained at their bases[9]. An installation of this type, for the use of two light warships is known from Cape Sunian (see Photo on Pl. I, 3). The slope is extremely steep, being more than 15°. The width of each area is about five meters and over 21 meters long. Both the deep channel down the center of the sloping area (approx. 1 m deep and almost 2 m wide) and the steep angle of inclination suggest that they were used for lowering military craft into the sea quickly[10]. The central channel

6. For general conclusion on shipyard buildings, see : D. J. Blackman, *Marine Archaeology*, Colston Papers, XXIII, 1973, pp. 126—131.
7. L. Casson, *Ships and Seamanships in the Ancient World*, Princeton, 1971, pp. 33-5 ; 49-53.
8. Ibid. pp. 41—48 ; A.J.B. Wace and F.H. Stubbings, *A companion to Homer*, London 1962, pp. 541-3.
9. D. J. Blackman, in J. S. Morrison and R. T. Williams, *Greek Oared Ships : 900—332 B.C.*, Cambridge, 1968, pp. 186—188.
10. Blackman, 1973 (see note 6, above), p. 131.

served to take the deep sitia keel which is so typical of war galleys of the classical periods. A similar installation has been recently identified near Sitiya in North-East Crete [11]. (Incline of 15° 30'; length — 30 m; width 5.5 m). In both cases the installations are situated outside the harbour, near strategic capes.

B) Installations which form part of larger harbour works. These usually consist of large numbers of slips with shallow inclinations. The best known complex of this type was discovered in the Port of Piraeus in the nineteenth century. It is undoubtedly part of the dockyard/arsenal belonging to the Athenian maritime power. Here the bases of stone pillars supporting the roofs of the sheds were found. The length of these slips reaches 38-40 m, the width is almost 6 m and the angle of inclination is about 6°. At the base of the slip was a raised area, along the center of which is a narrow shallow channel for the keel [12]. Almost identical to this complex is one found among the sunken remains of the Hellenistic harbour of Apollonia in North Africa. Due to their being underwater at present it is difficult to determine the exact length of these ships and estimates range between 28-40 m. The width here is also 6 meters. The angle of inclination is a moderate 4°. The bases of the slips are identical to those of the Piraeus complex [13].

Finally, it is desirable to quote the instructions given by the "father of architecture", Vitruvius, who lived in the first century and who summarized the main points of theoretical knowledge on this subject in the classical and Hellenistic world. In his description of how to build a proper dockyard (Book V : 12:7) : From the above comparisons it is possible to include the installations at Dor in the second group, for the inclination agrees with Vitruvius' suggestions. The small dimensions (although with the same width/length ratio) when compared with those of Piraeus and Apollonia (in Lybia), and the absence of a raised area with keel-channel in the base indicate simplification. The date of the installations at Apollonia and Piraeus is not definite, but cannot be earlier than the third-second centuries B.C. In that period the 'ship of the line' was the standard trireme which measured about 38 m in length and 5.5-6.0 m in width. This indicates that the docks at Dor were not adequate for berthing triremes [14]. It is perhaps possible to conclude from this that the installations at Dor predate the period in which this class of craft was the standard military vessel. In general, it should be noted that the moderate inclination and flat base are more suitable for merchant ships rather than military vessels. From this it would seem that

11. K. Davaras, "Eis Neosoikos paraten Seteian", *Arch. Epham.*, 1967, pp. 84—90 (in Greek).
12. W. Dörfeld, "Die Skeothek des Philon", *Athen. Mittel.*, VIII, 1883, pp. 147-164.
13. J. du Plat-Taylor, *Marine Archaeology*, London, 1965, pp. 170—173.
14. See Note 6 above.

a date in the sixth-fifth centuries B.C. (during the period of Phoenician expansion) is more probable.

It is significant that the ancient remains of the nearby buildings are clearly related to the installation (the courses of the walls parallel those of the latter). These buildings have not been excavated. However, a study of the pottery suggests that this part of the site was inhabited at least from the seventh-sixth centuries B.C. until the Byzantine Period.

2. THE PURPLE-DYE INDUSTRY

To the north of the harbour bay and the dockyard a flat strip of bedrock separates the anchorage from a big, shallow bay to the north (Fig. 1:1). This strip is part of a kurkar ridge which was quarried and used for local building stones. As was the Phoenician customs in other coastal settlements, the rock was not quarried in its entire width. On the western side, facing the sea, the original stone face was left to serve as a natural breaker. After the central part of the ridge had been levelled almost to high-tide mark, the area was used for a series of interesting and complicated installations (see Fig. 1:6). In the center and the southern part two series of shallow pools were cut. Benches were left along their sides. Channels permitted water from the waves which broke against the abrasive shelf to flow in. These channels were domed by wooden sluices, of which only the recessions cut for them remain. Other channels drained the excess water from the pools and returned it to the sea. The entire complex suggests series of fish ponds (*piscinae*) found along the coasts of Israel, Cyprus, Crete and Italy [15]. However, the pools found at Dor are shallower and smaller than usual. The main difference, though, is in the series of channels, hewn and built (with plaster) which lead to these pools from the east. Here one finds two buildings at a higher level which have a series of areas contained by walls and with thickly plastered floors. There can be no doubt that these buildings served to hold liquids. Their high situation precludes the possibility that they were fed by sea water and it seems probable that they contained fresh water. The fresh water was brought to the site by an aqueduct which may be traced from Ein Faradies at the base of the Carmel Range to the theatre (Fig. 1:2). I believe that this type of installation has never been described before : i.e. a series of pools which receive both fresh and salt water (see the air photo on Pl. I, 4) Research into the possible use for such an installation continues; it is hoped that the grey mullet can be grown in artificial conditions. This fish is capable of growing in fresh and salt water. The spawning is done, however, only at the mouths of rivers during the winter months; up to the present biologists have been unsuccessful in reconstructing conditions

15. Blackman, 1973, pp. 173—175 ; G. Schiedt, *Il livello Anticodel Mar Tirreno*, Rome. 1972 ; A. Flinder, *JNA*, 5:2 (1976), pp. 136—143.

which will permit the development of these fish in the laboratory. If we assume that the installation at Dor served this complicated purpose, then we must admit the possibility of technological knowledge which modern scientists have been incapable of duplicating. Apart from this the only advantage in growing this fish artificially is in the use of large fresh water pools. There is absolutely no evidence that this type of "crop" was used in ancient times.

Another possibility is that the pools were used as swimming pools by inhabitants of the city. However, all the other examples of fresh or salt water pools include roofed buildings and have pools which are much larger and deeper. A third possibility which would require the use of salt and fresh water is the purple dye industry. Salt is still used today as a necessary element for colouring material and for holding the pigment to the thread. The material must then be rinsed in fresh water after the dyeing process has been completed. It is known that the Phoenicians were experts in producing purple and in dyeing fabrics. The blue, red and purple dyes which were produced from the murex were of far higher quality than the faded red of ochre or the purple of Indian indigo. Hence purple materials produced by the Phoenicians were in great demand and were very expensive, becoming a symbol of the aristocracy and monarchy. In the Bible "The blue and the purple" are connected with the majesty of monarchy.

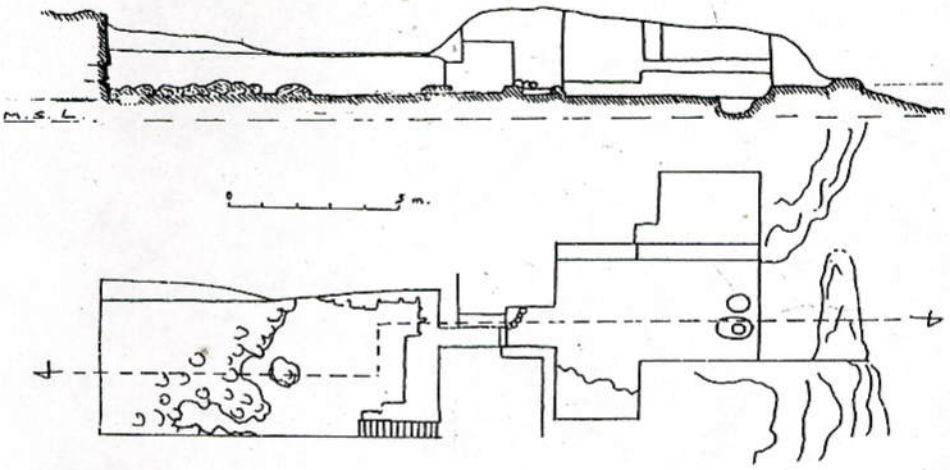
The murex was collected from the sea-bed and from the sandy shores in the area of Dor, and worked at the site. From the internal juices a colour was derived which served as a basis for the dyeing industry. The finished product was probably traded from the local harbour, to the entire Mediterranean basin. This seems to be a unique installation at the present time. In other excavations mounds of shells of the purple snail (murex) have been found [16], but it appears that Dor is the first site in which have been found installations for the conversion of the expensive snail into a well-known export.

3. THE PISCINA ON THE TANTURA COAST

Every coastal settlement in the ancient world enjoyed the possibility of a regular supply of fresh protein. This supply depended on the condition of the sea and on the seasons in which it was possible to fish with net and hook. The inability to freeze the catch required the fisherman to sell the fish on the same day as they were caught, or else to dry and salt them. A technique was soon

16. As for instance, at Shikmona, at the Iron Age level (courtesy Dr. Elgavish) and at Tel-Mor, of the Canaanite period, M. Dotan, *Yediot, Bulletin of the Israel Exploration Society*, 24, 1960, pp. 120—132 (Hebrew). According to Stephanos of Byzantium, the purple snail was the reason for the settlement of Phoenicians at Dor (see also M. Avi Yona, *Essays and Studies in the Lore of the Holy Land*, (Hebrew), p. 129, note 63.

developed by which it was possible to keep them fresh : the captured fish were brought while they were still alive to pools hewn into the stone. The salt water in these pools was changed at regular intervals. This enabled the fish to be kept alive for weeks on end and to offer the customers a variety of fish with no danger of poisoning [17]. Among dozens of fish ponds which are known along our coast none is as complicated as the one to be found on the western side of the northernmost of the islands in the island chain of Tantura (Fig. 2 ; Pl. I, 5).



On the rocky island, inward from the water shelf, two pools were excavated. The forward pool was separated from the sea by a wide stone railing which is inclined on its outer side. This permits the waves to climb and enter the pool. A channel leads from this pool to an inner primary pool. This is a rectangular basin 4.1 x 9.6 x 1.5 m. A staircase leads into the pool at the northwest corner. The channel is closed by a pile of stones which form a wall permitting the movement of water while preventing the fish from escaping. There are no remains which permit dating of the installation. Today, during storms, the bottom is covered to a maximum depth of 10-15 cm. It is self-evident that the pool is related to a sea level which is higher by at least 0.5 m than that of the present day.

17. On technique, see note 15 above.

A tide-mark 80 cm above the floor of the main chamber indicates that this was the original depth of water in the pool. Today, the lower level and the erosion of the forward barrier of the first pool prevent this happening. In addition, it appears that at one period in the past the pool dried up entirely and served as a habitation. Evidence for this may be discerned in the remains of a stone cooking installation in the east corner of the first pool. This phase could possibly be attributed to the Middle Ages or the Mameluke Period, since at that time a mosque was built on another quarry on the island. Much evidence of a general lowering of the sea-level at the beginning of the first millenium A.D. [18] permit us to assume that it was built in the late Hellenistic period or in the early part of the Roman Period (first century B.C. to the first century A.D.). The closest parallel to the complex (in rectangular shape and the existence of a staircase) is found at Paelaserna on the western tip of Crete. It is dated to the same period (although there the installation is more primitive) [19].

4. SUNKEN SHIPS AND CARGOES

During the years 1961-64 the Undersea Exploration Society carried out the first of its studies on sunken ships. With a minimum of material, and totally lacking excavating equipment, dives were carried out during weekends. A most interesting site was mapped, measured, photographed and recorded. A few examples of artifacts were placed in the Haifa Museum. The work was carried out by Joseph Galili, aided by Haim Stav, Shuka Shapira, Giora Raz and Dr. Elisha Linder, and other divers from the Maagan Michael branch of the Society.

The site is located between the two southernmost islands of the Dor chain. Here, at a depth of 5-7 m, where the rock meets the sand, were found remains of a cargo of weapons which was sunk in the first half of the 18th century. The weapons found include short-range mortar, which was placed in the bows of a vessel, and was used to shoot an ordinance of 60-70 kg which was filled with gun powder. After much difficulty one of the balls has been restored and is now exhibited in the Israel Museum. The ball is large, heavy, and made of iron, with two ring handles for handling.

Among the artifacts found, mention may be made of two swivel guns which were left in the sea (see Pl. II, 6). These are later in date than the two which are at present exhibited in the National Maritime Museum, and are barrel-loaded. The main find, however, included dozens of flintlock muskets. Of these only one was removed. It was covered with concretion and was badly corroded, which precluded saving it. An X-ray photo made in the laboratories of the

18. M. R. Bloch, "Salt in Human History", *Interdisciplinary Science Review*, Vol. I., 4, 1976, p. 344.

19. N. C. Flemming, *Science Diving International*, London, 1973, p. 53, Plate 6.

Technion showed that when it sank the rifle was loaded (see Plate II, 8). The lead ball is clearly seen inside the barrel. The quantities of weapons found and the fact that the flintlock was loaded suggest that the ship was undertaking a military operation when it sank. Since most of the artifacts were left in the sea and were not scientifically studied it is difficult to date the ship wreck. The cannons are early 18th century, while the mortar may be dated to later in the same century (it is hard to date the rifles due to their corroded state). The two anchors (see Pl. II, 7) are of a type which was common in the 16th-17th centuries. On the assumption that the latest artifact dates the complex, the ship would appear to have sunk in the late 18th century, and may perhaps be connected with the struggle between Cahr El-Omar and the Ottoman fleet, or with Napoleon's campaign. As has been noted, the majority of the finds were left *in situ*, and additional research may provide more accurate data, and perhaps establish the nationality of the vessel and its crew.

In the past years divers belonging to the Nahsholim branch of the Society have found concentrations of Byzantine pottery of 5th-6th century on the sea floor in the channel between the southern island and the coast, and at the southern entrance to the Tantura Lagoon. One jar is on exhibition at the National Maritime Museum. At present the entire site is being studied by Shelley Wachsmann, Inspector of Underwater Antiquities, and Kurt Raveh of Kibbutz Nahsholim.

5. THE INGOT SITE

During the past six years rumours have abounded concerning copper and tin ingots which had been removed from the sea by fishermen/divers and sold for scrap. In 1972 Dr. Elgavish succeeded in purchasing two tin ingots without being able to discover their provenance. These ingots were studied and have received international renown. At the same time they have raised a considerable amount of curiosity among scholars[20]. Through a combined effort of the staff of the National Maritime Museum and the Society for Underwater Research, the source of the ingots was successfully identified and the story of their removal from the sea was partially clarified. The site is situated north of the harbour of Dor, approximately opposite Moshav Habonim, at a distance of several hundred meters from the coast. Here, on the sea-bed of mixed sand and rock, dozens of copper ingots, together with a smaller number of tin ingots were collected over the years. As has been noted, the majority of the ingots were sold as scrap and smelted. It appears that until now approximately 1½ tons of copper ingots have been removed (see Pl. II, 10). The ingots appear to weigh 3.7-3.8 kg, or multiples of this weight. The heaviest of the ingots seem to be 6 times this

20. R. Maddin, T. S. Wheeler and J. D. Muhly, "Tin in the Ancient Near East". *Expedition*, 19, 2, 1977, pp. 35—47.

weight, that is, a little over 21 kg. This information is based on reports by fishermen and scrap metal dealers, and its accuracy is open to question.

The tin ingots have a square or rectangular shape with a trapezoidal section. They measure approximately 32 x 20 x 3.6 cm. They carry marks in the Cypro-Minoan script [21]. This script was common mainly in Cyprus during the 16th-11th centuries B.C. The signs were impressed on the ingots after they were poured. Samples for tests were removed from the two ingots in the Haifa Municipal Museum. The tests indicate that their composition is of 95% tin and 5% magnesium, which does not include the outer surface of the ingots [22]. Since there are no tin deposits in Cyprus or any other area where the Cypro-Minoan script was in use, it is probable that the tin was brought to Cyprus after it had been refined. From there it was shipped to our area [23], together with a cargo of copper ingots. The combination of these two elements is logical since together they produce bronze. Cyprus became a major producer of copper in the second millenium B.C. It seems, however, that ingots were not imported to Canaan from Cyprus [24]. To date only one other ingot similar to the copper ingots from Cyprus has been found in this country. This is the miniature ingot, perhaps cultic in use, which was found in Tel Beit Mirsim. This "ox-hide" ingot is entirely different in shape from the ingots from the site at Dor. The ingots from Dor resemble more closely in shape of those from the Timna mines [26]. If this comparison is correct, the combination of 'local' copper ingots, and tin ingots from Cyprus carried as carge by a single vessel opens new vistas on the position of our country in the metal trade of the Canaanite period. A sample of the metal from a copper ingot has been sent to Nahel Sorek for tests, and we hope that their results will permit us to identify the source of the copper with greater certainty. Tests which were carried out in the Metallurgic Laboratory of the Technion on a small piece of a tin ingot indicated that 80% of it consisted of Sulfide salts. The sample was taken from the face of the ingot. This phenomenon is characteristic of metals which have remained on the sea bottom for a considerable period. While the process is not entirely understood, it is clear that it is due to the exchange of metal ions sulfate in sea water. This phenomenon is known to us from the ship near Na'ama Bay in Southern Sinai [27], and from silver coins which were removed from the seabed opposite the Carmel coast.

21. op. cit; E. Masson, "Cypromincica", *Studies in Mediterranean Archaeology*, Bl (2) Lund. 1974.
22. Naddin, Wheeler and Muhly, 1977, (see note 20 above), p. 45.
23. Ibid, p. 46.
24. op. cit.
25. W. F. Albright, "Tell Beit Mirsim II", *AASOR*, 17, 1936—7 (1938), p. 54, Pl. 41:13.
26. Ingots were also found at Cape Gelidonya, but smaller and more flat; see: B. Rothenberg, *Timna*, London 1972, pp. 72—5. G. F. Bass (at. all) *Cape Gelidonya a Bronze Age Shipwreck*, Trans. Amer. Philos. Soc., Vol. 57. Part 8, 1967, pp. 78—81.
27. A. Raban, Sefunim, 4, 1972—5, p. 41, fig. 7.

It is early yet to try to date the wreck and to guess its port of origin and its destination. We hope this will be clarified by future research. At present two additional tin ingots have been recovered (see Pl. 9) and efforts are being made to purchase them for the National Maritime Museum. The site has been defined as archaeological and the writer has received a permit to excavate. In the first stage of research Joshua Rimon (who is a member of the Society and a student in the Department for Maritime Civilizations) has been placed in charge of co-ordinating the existing information, and carrying out a survey, the purpose of which is to define the borders of the cargo. This survey is being carried out by means of an underwater metal detector (see Pl. 11) since the site is covered by a thick layer of sand. We hope to succeed in discovering additional details of the cargo and perhaps of the ship itself, which will enable us to complete the historical picture. It already seems possible that this site may be even more important than the famous wreck of similar date and cargo found off Cape Gelidonya in Southern Turkey [28].

28. See note 26, above, Bass, 1967.