CHAPTER NINE

DOR-YAM: MARITIME AND COASTAL INSTALLATIONS AT DOR IN THEIR GEOMORPHOLOGICAL AND STRATIGRAPHIC CONTEXT

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A. THE HISTORY OF THE STUDY

Dor, as a significant coastal site with a unique wealth of visible evidence for its long maritime history, has attracted the attention of marine archaeologists since the early 1960's. The intriguing fact is that at present the best natural haven along the Mediterranean coast of Israel lies, not next to the ancient mound, but within the lagoon of Tantura, half a kilometer south of it (Fig. 1). Here was located up to 1948 the only real coastal Arab village along the entire stretch of coastline between Haifa and Jaffa. This calls for an answer to the question of why did the ancient population not settle next to this natural harbor.

During 1962–1967, the volunteer divers of the Underwater Exploration Society of Israel (UESI) spent hundreds of hours combing the seabed of the lagoon, and around the tel and to its north, in an attempt to trace archaeological evidence of Dor's ancient harbors and remnants of the nautical activities which took place in and near them. From 1973 on, faculty members and students of the newly established Department of Graduate Studies of the History of Maritime Civilizations at the University of Haifa have carried out an annual field season at Dor, registering, surveying, and collecting archaeological data on the paleotopography of Dor's coastline and the changes in relative sea level along this coast throughout its history. This project culminated in 1975, when the geologist Prof. N.C. Flemming spent a semester as a visiting professor in the Department.[1] In the following year this topic was chosen as the subject of the M.A. dissertation of one of the graduate students of the Department, Mrs. Yael Sneh. In 1977 the Israel Department of Antiquities and Museums (now the Israel Antiquities Authority) established its base for the inspection of underwater antiquities at nearby Kibbutz Nahsholim; the small team led by S. Wachsmann and K. Raveh began carrying out occasional underwater surveys in Tantura Lagoon and next to Tel Dor, continuing the earlier work of UESI. Among other finds, they salvaged more items from the Napoleonic wreck off Hofami Island, a Byzantine wreck within the lagoon, and a score of stone anchors, jars, amphoras, and other small finds.[2]

From 1979 to 1984 the Center for Maritime Studies, in collaboration with the Dor Excavation Project, carried out a series of probes, limited trial excavations, and a multidisciplinary survey, in an attempt to study most of the known maritime installations at Dor in their geomorphological and archaeologically stratified context. In the first year, Dr. Michal Artzy joined the expedition with a group of students from Haifa and the University of Copenhagen and led the trial excavations at the slipways on the southern side of 'Love Bay'.[3] The underwater survey south and west of the tel was directed in 1980 by Dr. McCaslin of the University of California at Santa Barbara, with a team of volunteers from Canada and the U.S.A. Later that year, two weeks of excavations were carried out by the students of the Department for History of Maritime Civilization at the waterline along the eastern side of the southern slope of the tel, aided by a mechanical backhoe which cleared some of the larger fallen blocks along the shore and excavated trial trenches in shallow water. The same group carried out short seasons during two weeks in April 1981,[4] and a week in January and another two weeks in April 1982. In December of that year, during two additional weeks of field work, more mechanical trenching was carried out in various sites on the northwestern side of the tel near the waterline, and manual excavations were carried out at the foot of the tel next to the slipways. In both sites, attempts were made to expose and study the earliest occupation levels on the natural bedrock.[5] This session was supported by Oranim Teachers' Training College; its students assisted in the field work and processed the finds as a field study. Another group of students from Oranim College also took part in the next two-week session in December 1983, when the technical staff of the marine workshop of the Center for Maritime Studies carried out an experimental clearing of the 'Purple Dye Industry' site, using water at high pressure from fire hoses.

The April 1984 session was the last one to be carried out by this cooperative team from the University of Haifa and Oranim College, and the latest field work to be reported in this publication.[6] K. Raveh of the Center for Nautical and Regional Archaeology at Nahsholim, Dor (CONRAD), directed some additional clearing work at the 'Purple Dye Industry' complex and on the coast of the North Bay during 1987–1988.[7]

The various projects on behalf of UESI and the University of Haifa were directed through the years by the author, with Y. Tur-Caspa as chief assistant. Other professional participants in the project were: D. Sion-Friedman, R. Gertwagen, Y. Sneh, E. Adler, E. Galili, N. Raz, and D. Sivan. R. Polak and Z. Friedman were the registrar and draftswoman. The work was sponsored by the Center for Maritime Studies (CMS) at the University of Haifa.

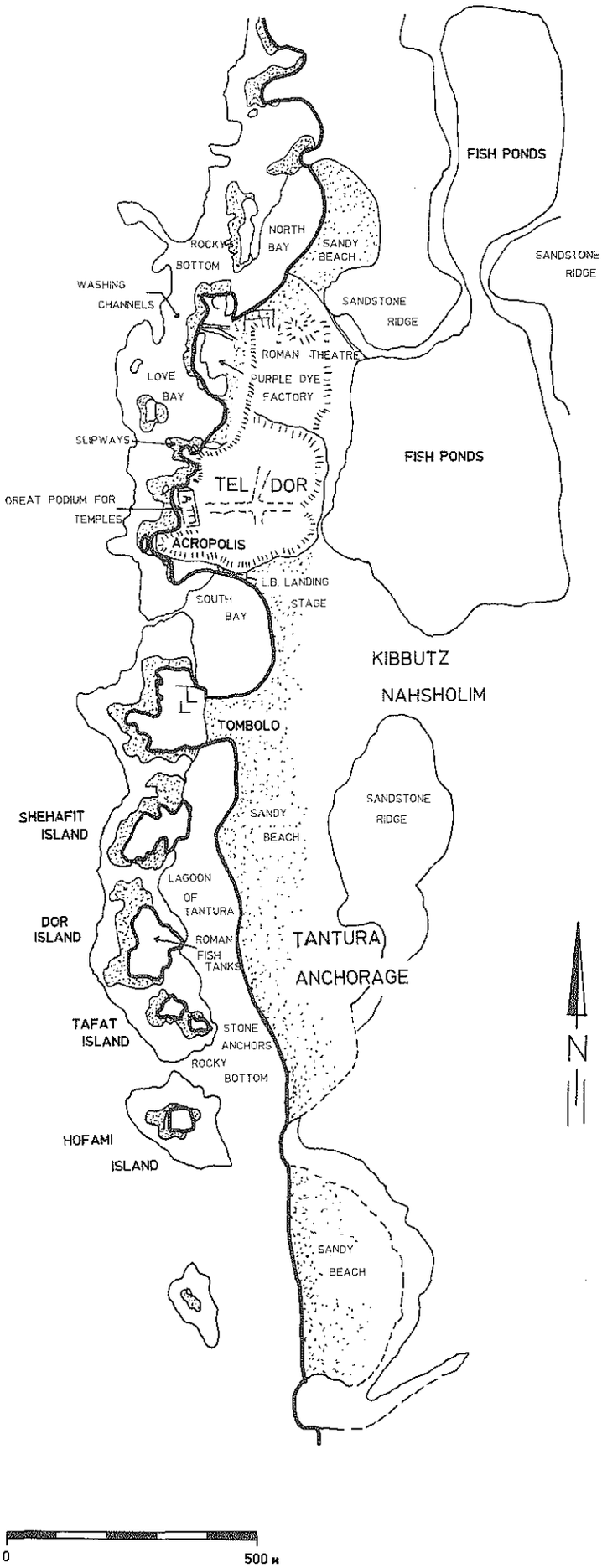

Fig. 9.1. General map of the coastal area of Dor and Tantura Lagoon, indicating the main marine archaeological sites.

B. GEOMORPHOLOGY AND PALEOTOPOGRAPHY

The site of Dor is located on the lee side of the westernmost of the three parallel ridges of Eolianite sandstone (*kurkar*) that run on a meridional axis along the entire length of the narrow coastal plain which separates the Carmel range from the present seashore.[8] This western ridge dictates the configuration of the shoreline from the River Me'arot gap and its currently silted-up estuary some four kilometers north of Tel Dor to the southernmost islet off the lagoon of Tantura (Hofami Island), about one kilometer south of it. Further to the south, this ridge and the next one to the east wedge down and disappear below the sea and the inundated coastal area on both sides of the River Dalia's outlet. Considering the probability that during the first stage after the last Postglacial (Flandrian?) transgression the lower River Dalia valley was flooded by sea water, it seems that the general area of Dor and Tantura Lagoon to its south was in the northwestern corner of such a triangular estuary (Photo 9.1). The western ridge is rather wide and high to the north of the tel, though in some places the sea has abraded it across almost its entire width (as is the case in the North Bay).

Photo 9.1. Aerial photograph of the lower River Dalia with Tantura Lagoon below, looking south.

It seems that the original width of the ridge prior to the last transgression was 150–200 m., with some hills 10–15 m. high. There are several topographic indications for some kind of tectonic uplift of this segment of the ridge, such as elevated alluvial basins east of the North Bay and next to Habonim Beach.[9] On the western side of this ridge there are at least three small 'bays' which are presently high above the sea level; the abraded marks of the original water line around their perimeter can easily be traced at 6–8 m. above the modern sea level (MSL) (see Photo 9.2).

It is clear that this uptilted movement postdates the last transgression and is relatively recent, young enough for most of the microtopographical features of what was once a regular rocky bay to remain intact, though now they are dry and exposed to erosion by the elements. The absence of

Photo 9.2. Aerial photograph of the coastal ridge south of Habonim Beach, clearly showing elevated alluvial basins and uplifted bays.

beachrock and the clearly discernible abrasive ledge on the lee side of these bays might indicate that there was a very limited supply of wave-carried sand at that time. There is some circumstantial evidence to suggest that such conditions characterized this part of the coast during the third millennium BCE.[10]

Another topographical feature that serves as a clear indication for a sub-recent tectonic uplifting during the third millennium BCE is the even surface of the bedrock along the western side of the tel (Photo 9.3). This raised platform is undoubtedly an ancient abrasive terrace. Its elevation is about 4.50 m. above MSL west of the acropolis on the southwestern tip of the tel and only 3.50 m. at the platform that was the base of the MB IIA occupation and the rock-cut slipways, some 200 m. to the north-northwest.

This tilting is even more prominent on the west–east axis. At the base of the MB II structures which were exposed on the eastern side of Love Bay about 100 m. east of the slipways, the bedrock is at only 1.60 m. above MSL; and at the rectangular well on the lee side of the *kurkar* ridge along the southern edge of the tel, some 150 m. east of the tip of the acropolis, this platform is only 0.40 m. above MSL.[11]

The same eastward and downward tilt typifies the topography of the western side of the North Bay and the lee side of the platform that was cut by flushing channels just south of it.[12] At every site where these platforms are exposed, it is clear that their tilting predates the human occupation, quarrying, and other activities that have affected the topography of the bedrock. All floors, building courses, and quarried channels seem to be at their original gradient.

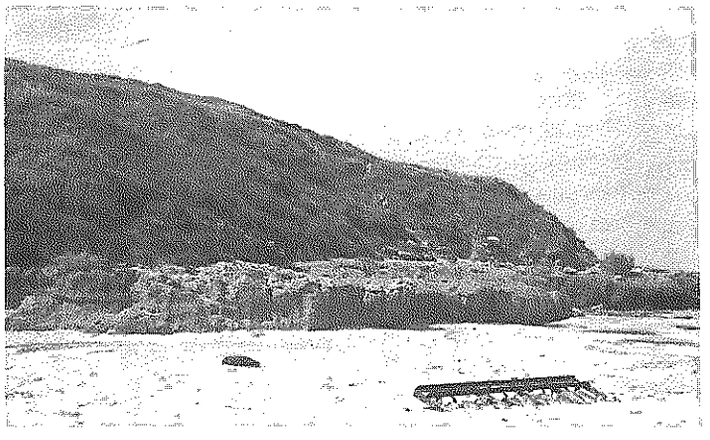

Photo 9.3. The elevated abrasive platform below the occupation levels of the tel along the southern side of Love Bay, looking southwest.

The field studies of Flemming and Raban,[13] Sneh and most recently Raban and Tur-Caspa[14] have classified a series of geomorphological and topographical components as indicators of changing land/sea relations during the later Holocene:

1. The Eolianite ridge, the western *kurkar* ridge, was rather more coherent than in its present state; when the first urban settlers came to Dor, at around or soon after 2000 BCE, it was almost intact all the way from Habonim Beach at map ref. 1433.2284 to Hofami Islet, map ref. 1424.2235. However, the assumed tectonic upheaval of the previous millennium, followed by eustatic rise of the sea level (transgression), enabled marine inundation of the lee basin along the eastern side of that ridge, all the way from the northern reaches of the River Dalia's estuary to the back of the present tel and into the topographical hollow of the North Bay. This left the southern 2 km. of that ridge as a long and narrow (200 m.) island, with a narrow strip of rock possibly connecting it to the mainland at the southeastern end of the North Bay, map ref. 1427.2252.

2. This inundated basin had previously been deposited by successive layers of alluvial mud, representing the accumulation of about 6000 years during which this basin became marshier, with the soil depositions varying from red loam to dark brown hydromorphic clay, rich in organic residues. The earlier depositions have been dated by the C14 method to approximately 11,000 years BP, and the later ones to around 9,000 years BP. These samples were taken from the area south of the tel from depths of 4.40 and 3.80 m. below MSL, respectively.[15] The upper and later samples contained faunal remains of species typical of brackish water; thus it seems that the present area of Tantura Lagoon was already partially affected by sea water from the gradually flooded estuary south of it at this early stage. The top of the hydromorphic mud was detected at 2.40 m. below MSL with a C14 date of *ca.* 4500 BCE. However, there was apparently some kind of

oscillation process in land/sea relations: the basin which had turned brackish around 7000 BCE became dry, or seasonally inundated with fresh water, during the 6th and 5th millennia BCE, indicating relative regression of the sea level.[16]

The top of the hydromorphic clay depositions in the hollow of the North Bay was traced at just above MSL, about 1.50 m. higher than in the area to the south of the tel, though dated to about the same period. In both sites this top mud had been flooded by sea water; it therefore seems that they were originally at the same elevation and that the present-day discrepancy was caused during the tectonic paroxysm of the 3rd millennium BCE.

3. Sand is to be found as the surface layer in every bay and lagoon around Dor, both on the beaches and on the seafloor. In the less disturbed areas, such as the floors of the North Bay, Tantura Lagoon, the tombolo that separates the lagoon from the South Bay, the wide beach of the South Bay, Love Bay, and the North Bay, these sandy depositions are characterized by three distinct types of sediments:

a. A fine-grained, uniform, yellowish type of sediment (quartzite particles).

b. Coarser, less uniform sand of grayish color with over 20% carbonated compounds of calcium, either from the primary source of wave-eroded seashells, or originating secondarily from the abraded material of the *kurkar* ridge.

c. Mixed sediments of seashells, small pebbles, shingle, and sand.

The difference between the three types of sediments is mainly based on the carrying energy of the sea waves in each area in any given period since it was inundated by sea water.

The field study that was carried out by the CMS and others[17] included a score of core drills, water-jet probes (Photo 9.4), and mechanical backhoe trial trenches. The data have been processed for granulometry, paleobotany, and faunal remains, and for archaeologically calibrated dating of the various sedimental strata.[18]

On the basis of the results of these studies it is safe to assume that the North Bay was always on the lee of the surge. The marine depositions on its floor are almost exclusively of the first type of fine sand, except for some recent deposition of coarser material on its beaches.

Photo 9.4. Probes with a water jet carried out at the beach of the South Bay to study sedimentological stratigraphy.

Love Bay, on the other hand, seems to have been always open to wave energy; seashells and shingle characterize the composition of both its floor and the beach to the east. The land excavations exposed such depositions interbedded with occupation levels of the MB II and post-LB periods (see also below). The relatively low area on the eastern side of the 'Purple Dye Industry' site which lies between Love Bay and the North Bay seems to have been inundated by the sea at some time in the past, prior to the Roman era, when a water channel with a depth of about one meter connected the two bays.[19]

The South Bay had a different and more complicated history. An even, hard surface was detected on the northeastern side of the bay at 2.00 m. below MSL. This platform is about 30 m. wide on the north–south axis and does not continue to the east, below the present sandy beach. It may be a submerged abrasive shelf that subsided to its present elevation during the tectonic paroxysm of the 3rd millennium BCE. On the other hand, it may be some kind of artificial installation, such as a landing stage or a quay that was in use when the relative sea level was eustatically lower by over two meters. There is another feature, about half the way across the lee side of the bay, where there are depositions of fine clay and red loam at an elevation higher than the surroundings by more than one meter. It is possible that some artificial structure, the wreck of a marine vessel, or its cargo triggered such an exceptional accumulation.[20] The lower layer of sand on the northern side of the bay and below the early Iron Age structures along its northeastern side is of the fine-grained, yellow type, indicating minimum wave energy at the area during and before the 13th century BCE. This type of sand characterizes the sedimentation on top of the hydromorphic clay under the tombolo, and on the floor of the lagoon south of it. There are two layers, consisting almost entirely of seashells and shingle; one covers the LB structures on the northern side of the bay and the other covers the segment of Hellenistic wall exposed above sea level on the southeastern side of the tel, 10–25 m. inland, to the northeast of the present waterline (see below, area F). These 'pulses' of wave energy may represent an era when the sea level was higher than that at present.

Finally, the topography of the coastline around Tel Dor prior to the initial phase of sand deposition can be divided into two main protected bodies of sea water:

1. *The northern unit* consists of the North Bay and Love Bay. The former was about 400 m. long on a southwest–northeast axis, with a maximum width of 150 m. There was an entrance from the open sea in the northwest quarter of the bay, some 30 m. wide and with up to 1.80 m. of water above the bedrock. The bedrock slopes to the southeast at a considerable gradient, but the hollow was filled with hydromorphic clay up to 1–1.50 m. below MSL. At the southeastern tip of the bay there was a channel or a water passage about one meter deep, 120 m. long, and at least 15–20 m. wide, leading to the northeast corner of Love Bay. This second bay was about 150 m. wide east–west and just over 100 m. long north–south. A navigable passage led to its western side from the north, partially protected from the surge by a series of rocky islets, including the large one due west of Love Bay. This passage was about 200 m. long and less than 70 m. wide. Its depth exceeds 4.50 m. below the waves. Another entrance to the bay, between the island and

the uplifted abrasive platform southeast of it, was much narrower at that time, probably no more than 30 m., with a shallow bedrock floor no more than 1.20 m. in depth.

2. *The southern lagoon* consists of Tantura Lagoon, which was much better protected along its western side, and the South Bay. There were two entrances from the south, on the northern and eastern sides of Hofami Island, 30 and 100 m. wide respectively. Both entrances had a water depth of well over 4 m. The maximum width of the lagoon may have been no less than 300 m. which is the distance from the lee side of Dor Island to the *kurkar* exposure east of it, near the 'Glass House' at Kibbutz Nahsholim. The entire length of the lagoon was almost 900 m., from Hofami Island to the south side of the tel. There was no tombolo at that time and the western entrance to the South Bay was still blocked almost to the water level, keeping the surge away. There is a narrow rock-cut passage across this blocking ridge, 4–5 m. wide and over 70 m. long, with a water depth of about 4 m.; however, this feature may be considered an artificial one, made by the inhabitants of Dor for the purpose of initiating a flushing circulation of water within the lagoon. At that initial stage it seems that the southern lagoon was connected with the low basins on the lee side of the tel, probably including some of the later built-up area along the eastern edge of the settlement. These eastern basins, which are now fish ponds, may originally have been an inner mooring and berthing area for small water craft. While the water depth in the lagoon was as much as 2–3 m., these eastern basins were nowhere deeper than 1–1.50 m., as attested by the elevation of the sand layer which tops the hydromorphic mud in this area. These water basins extended over a rather large area, the limits of which have not yet been fully studied.

C. THE ARCHITECTURAL REMAINS AT THE NORTH BAY

There is no doubt that the urban extent of Dor included the North Bay, or at least the area around its southern half. Early surveys during the 1960's and 1970's which were carried out by UESI divers yielded quantities of pottery vessels and stone anchors from the floor of this bay. Most of these finds were of the Persian and Hellenistic periods, including some 'basket-handle' jars, crude mortaria, bowls, and Rhodian amphoras (Photo 9.5). However, there were also broken parts of jars and amphoras of the Roman and Byzantine eras, suggesting maritime use of this bay during these periods. During and following winter storms the beach along the southeastern side of the bay is cleared of some of the sand, exposing various walls and displaced components of quays, storage buildings, and/or paved landing stages and mooring facilities.

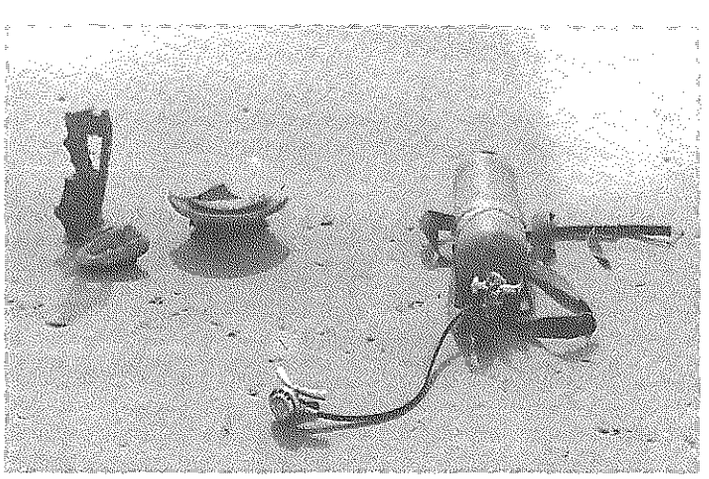

Photo 9.5. Some of the pottery from the floor of the North Bay, from the UESI survey of 1964.

During the winter of 1987 some of these architectural remains were preliminarily surveyed by K. Raveh and his assistants on behalf of the Israel Department of Antiquities. The surveyors traced some kind of a quay, or a sea wall, running northwards from the eastern side of the rectangular structure on the southern shore of the bay for about 50 m. (Photo 9.6). Much of this wall is displaced, at least along its exposed part, but it seems to have incorporated some kind of stylobate on which a colonnade was based. Some of these columns, made of marble and of local *kurkar*, were traced lying along this line. Two perforated rectangular blocks have been located, protruding from this presumed quay. They are spaced 25 m. apart, are over 1 m. high, and are pierced by a square hole measuring 0.20 x 0.20 m. At the northern end of this structural line is an adjacent one leading west, towards the center of the bay. There, about a dozen marble columns were located piled in close proximity in shallow water, remnants of some kind of pergola[21] or perhaps one of the medieval jetties built of reused Roman columns that are so characteristic of other coastal sites, such as Caesarea and Ashkelon.[22] Plates of the Crusader period that were found in the water nearby may support such an interpretation.

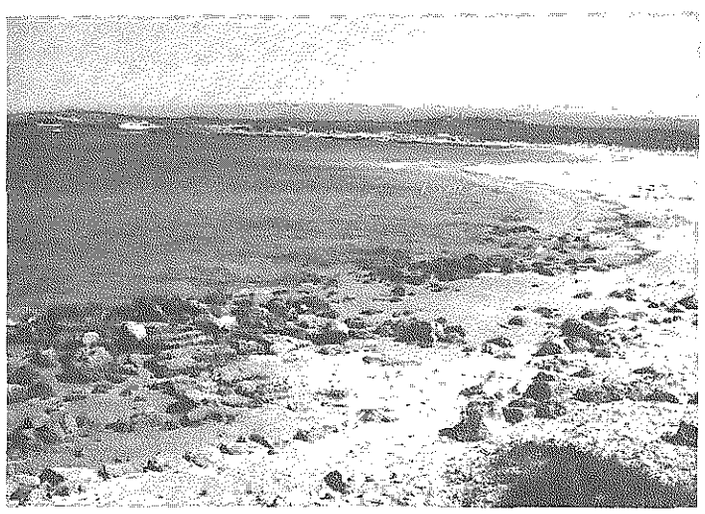

Photo 9.6. The displaced quay (?) or stylobate along the southeastern shore of the North Bay, looking north.

The main structure along the shores of the North Bay is a rectangular complex on its southern side. It is located on the present sandy beach covering the area between the northern edge of a small mound (most probably a sand-covered structure) and the water line, some 40 m. west of the Roman theater (see Fig. 9.1; Photo 9.7).

The external dimensions of this structure are 37 m. on the east–west axis and at least 35 m. along its western side. The uppermost course, which has been preserved throughout the northern half of the structure, consists of ashlar headers of local *kurkar* blocks measuring 1.20 x 0.60 x 0.50 m. on the average. In its final phase the inner faces of these external

Photo 9.7. General view of the rectangular structure on the southern side of the North Bay, looking northeast.

walls were broadened by an additional single course of smaller slabs, 0.40 m. wide. This ledge was used as a base for a floor made of flattened rubble cemented over by a limeish substance (Fig. 9.2; Photo 9.8). The entire structure is tilted to the northwest by an average of 4°, probably due to an extended process of undertrenching and fluidization by the sea water.

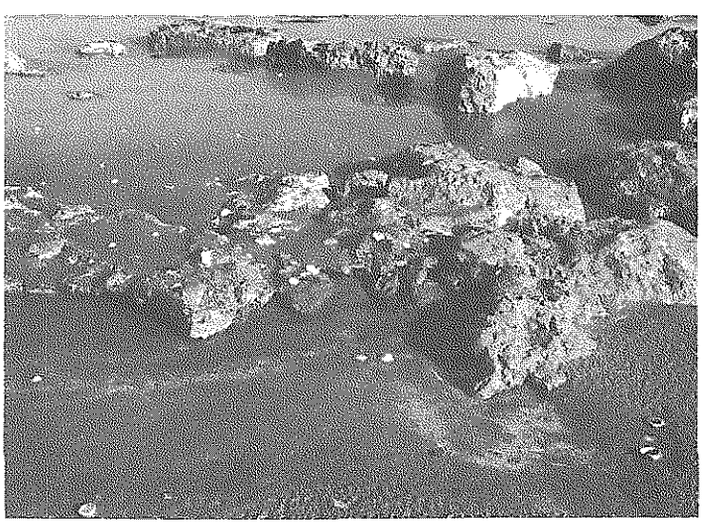

Photo 9.8. Remains of the rubble floor of the latest surviving phase of the rectangular structure at the North Bay.

In the final phase the inner space was subdivided into four large rooms: the northwest measured 23 x 9 m.; the northeast, 9 x 9.50 m.; the southeast, 9.50 x 12.50 m.; and the southwest, 23 x 12.50 m. The floor of the southern part of the structure overlies a series of narrower partition walls of the earlier phase. It is quite obvious that better-preserved parts of this structure are still hidden below the mound to the south.

Pottery collected below the rubble pavement of the last phase consisted almost exclusively of sherds of large containers — Roman amphoras of the 1st and 2nd centuries CE. Some later types were found scattered on the surface and at the northern edge of the mound, suggesting that the later phase was in use at least until the beginning of the Byzantine period.

In April 1983, a probe was made by mechanical backhoe and manual excavation along both sides of the western wall (Photo 9.9). The trench was 2 m. wide and 5 m. long at the outside, extending southwards from a point 14 m. south of the northwestern corner of the structure. On the inside the probe was excavated by hand and was only 1.20 m. wide.

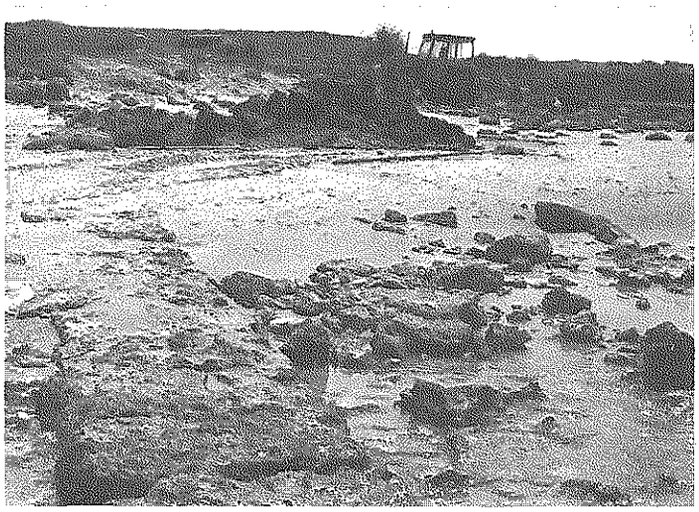

Photo 9.9. The western wall of the rectangular structure and the trench dug along it, looking southwest.

The base of the wall was found to be laid in a foundation trench that had been dug into a compact dark clay, the bottom of which is now at 1.02 m. below MSL. There are four courses of small roughly squared rubble stones in the foundation, topped by three courses of ashlar slabs. The base of the lower one is at -0.60 m. and bears a clearly distinguishable horizontal abrasive notch half way through its 0.30 m. height (i.e. at elevations of -0.48 to -0.43 m.). This is clear evidence for a sea level and a consistent body of still water next to the wall, though it may have subsided since due to fluidization and should not be considered a secure indication for the absolute elevation of sea level at the time. Above this line the mud is much softer and less compact; in it was a large quantity of sherds of the Roman period, most of it from the 2nd century CE. Another abrasive notch, less well defined, is to be found along the western, external face of the uppermost course of ashlars, at 0.40 m. above MSL (Photo 9.10). This notch is 0.30 m. below the top of the wall and indicates a sea level higher than the present one by almost half a meter, probably during the final phase in which this structure was in use. At that time the area west of the structure was flooded by at least 0.80 m. of water, with a greater depth farther to the west.[23] To the south this wall continues with some later additions in a less well-defined building style, partially displaced and partially covered by the western slope of the small mound.

To the west there is a geomorphological hollow, some 35 m. wide and presently filled with scattered, wave-carried building stones, seasonally covered by sand (Photo 9.11). This hollow has *kurkar* bedrock at its base, at 2.50–3 m. below MSL. The bedrock rises steeply along the western side of the hollow, on the lee edge of a low *kurkar* ridge about 100

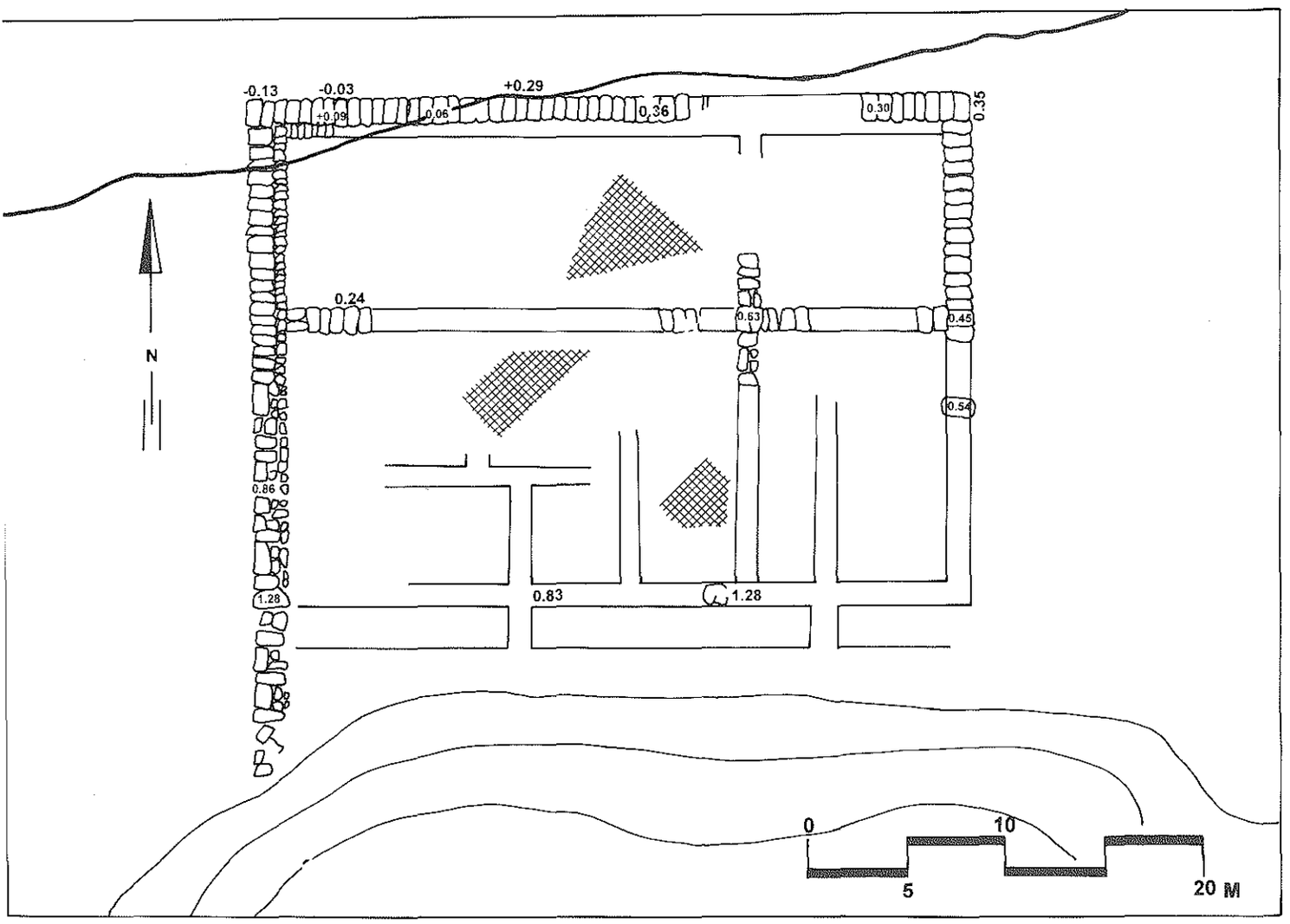

Fig. 9.2. Plan of the rectangular structure on the southern shore of the North Bay.

m. wide. A passage almost 30 m. wide has been quarried across this ridge, all the way to the abrasive ledge on its seaward side. Elsewhere at Dor, the low coastal *kurkar* ridge was quarried extensively in antiquity down to just above sea level, leaving unquarried only a protecting rocky rim towards the waves. This through passage is an exception to this procedure and seems to have been quarried for a purpose: to enable the controlled flow of wave-generated sea water across the ridge and into the hollow. This controlled flow was channeled into an artificial rock-cut narrow channel. Three channels of this type were identified at the site, each of a different period and corresponding to a different sea level (Figs. 9.3, 9.4; Photo 9.12).

Channel 1 is 83 m. long and on an almost exact east–west orientation. At its eastern outlet into the hollow the width of the channel is 3.60 m. and its bedrock floor is at 1.70 m. below MSL. At 3.50 m. west of the outlet there is a cross wall left in the bedrock; another one is 4.60 m. behind it. The tops of these barriers are at 0.18 m. below MSL, and it seems that when this channel was made they were just above sea level, forming a settling basin for silt. A presently submerged abrasive notch at -0.20 m. supports this notion (Photo 9.13).[24]

At present the water level in the channel is higher than it was when the flushing was functioning, as attested by a higher abrasive notch along the rock-cut sides of the channel on the lee of its mid-section. This mid-section was deliberately filled and blocked by spilled and piled building stones across the entire width of the quarried passage. One may argue that such blocking was necessary in order to maintain a controlled flow of wave-generated water when the sea level rose and flooded the top of the channel and the entire passage (Photos 9.14, 15). Within the western segment of the channel there was another quarried and cross-screened settling basin, 10 m. long and almost 4 m. wide. Within it, on the bedrock floor and under 1.60 m. of water, some Hellenistic sherds and a dozen lead net-weights were found below the silt.

When the blocking spill was laid over the quarried passage, two rectangular basins remained with their floors at elevations of 0.21 and 0.24 m. above MSL (Photo 9.15). Considering the probability that the basins were used as either fish tanks or settling hollows, they document a sea level at least half a meter higher than the present one.

When they blocked Channel 1 with reused building stones, the inhabitants of Dor built a second flushing channel at a higher elevation and along the southern edge of the blocked passage. This time the channel continued farther to the east and across the geomorphological hollow, to its southeastern corner (Figs. 9.3, 9.4). This channel has a length of over 90 m. and an almost even width of 3.60 m.

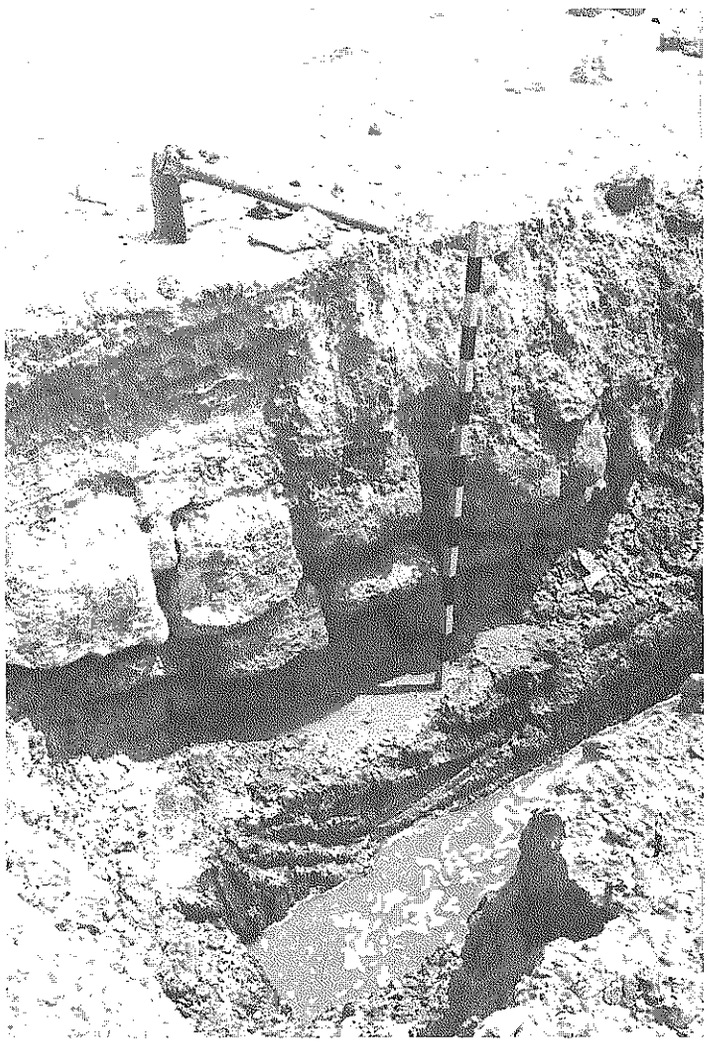

Photo 9.10. The external side of the western wall of the rectangular structure, looking southeast. Note the compact mud and the two recessed abrasive notches.

Photo 9.11. The hollow in the lee of the *kurkar* ridge on the southwestern side of the North Bay (taken in the summer with sand cover), looking west.

The walls on both sides were built of ashlar blocks bound by mortar, and only the western 30 m. of the southern wall were quarried in the *kurkar*, as was the western threshold which is even today, after generations of erosion and abrasion, as much as 0.92 m. above MSL.

The course of the channel curves slightly towards the southeast and an attempt was made to reinforce its lee part

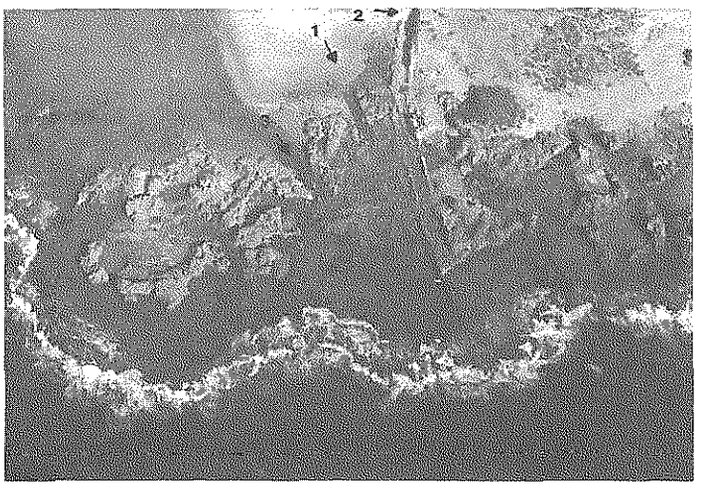

Photo 9.12. Aerial photograph of the quarried *kurkar* and the three flushing channels.

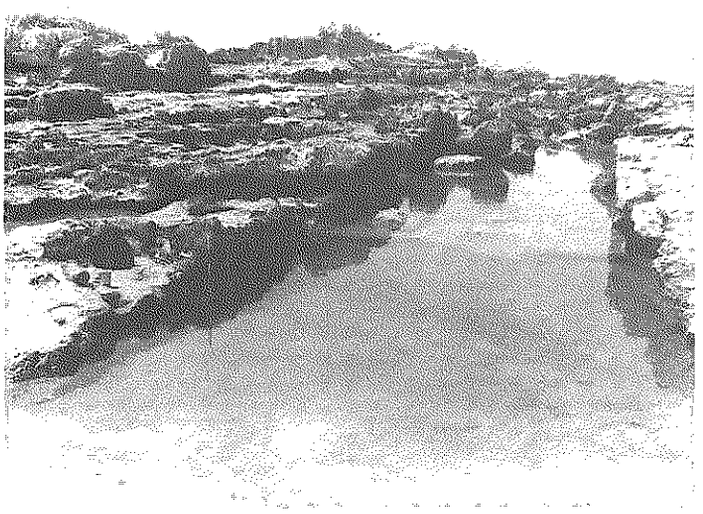

Photo 9.13. The eastern outlet of flushing channel 1, looking west. Note the cross wall and behind it the deliberate fill of stones blocking the channel. The ancient abrasive notch can be seen under the water in the lower left corner.

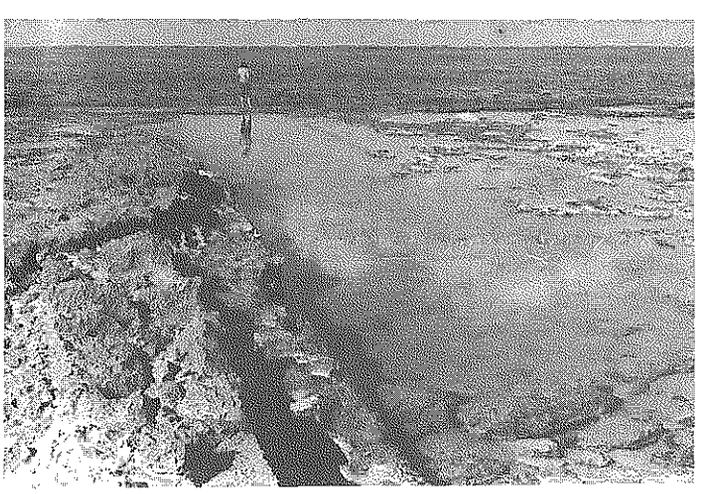

Photo 9.14. Looking west over the flooded western part of flushing channel 1. The fisherman is standing on the threshold, or unquarried edge, separating the western end of the channel from the open sea.

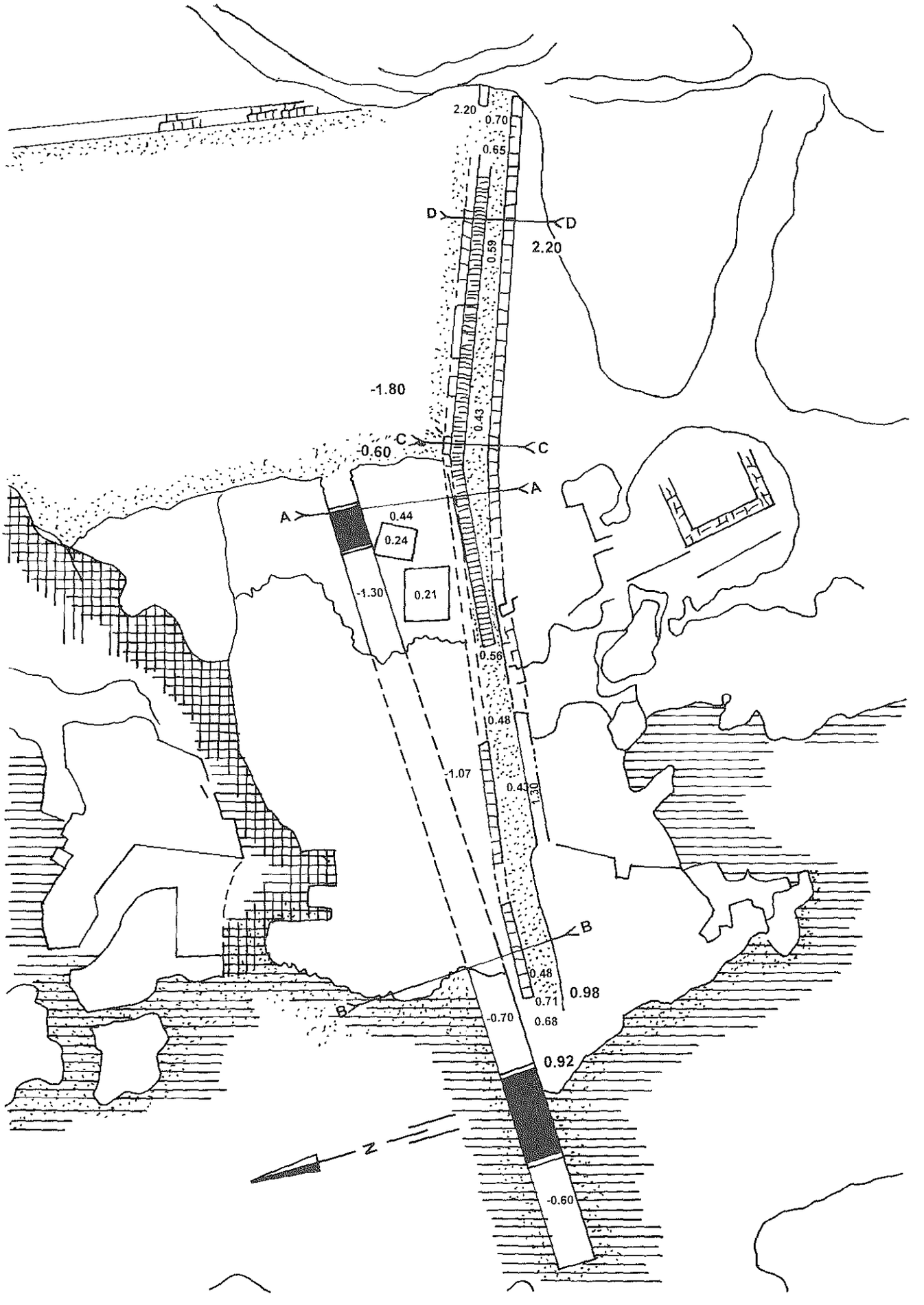

Fig. 9.3. Plan of the flushing channels in the southwestern corner of the North Bay.

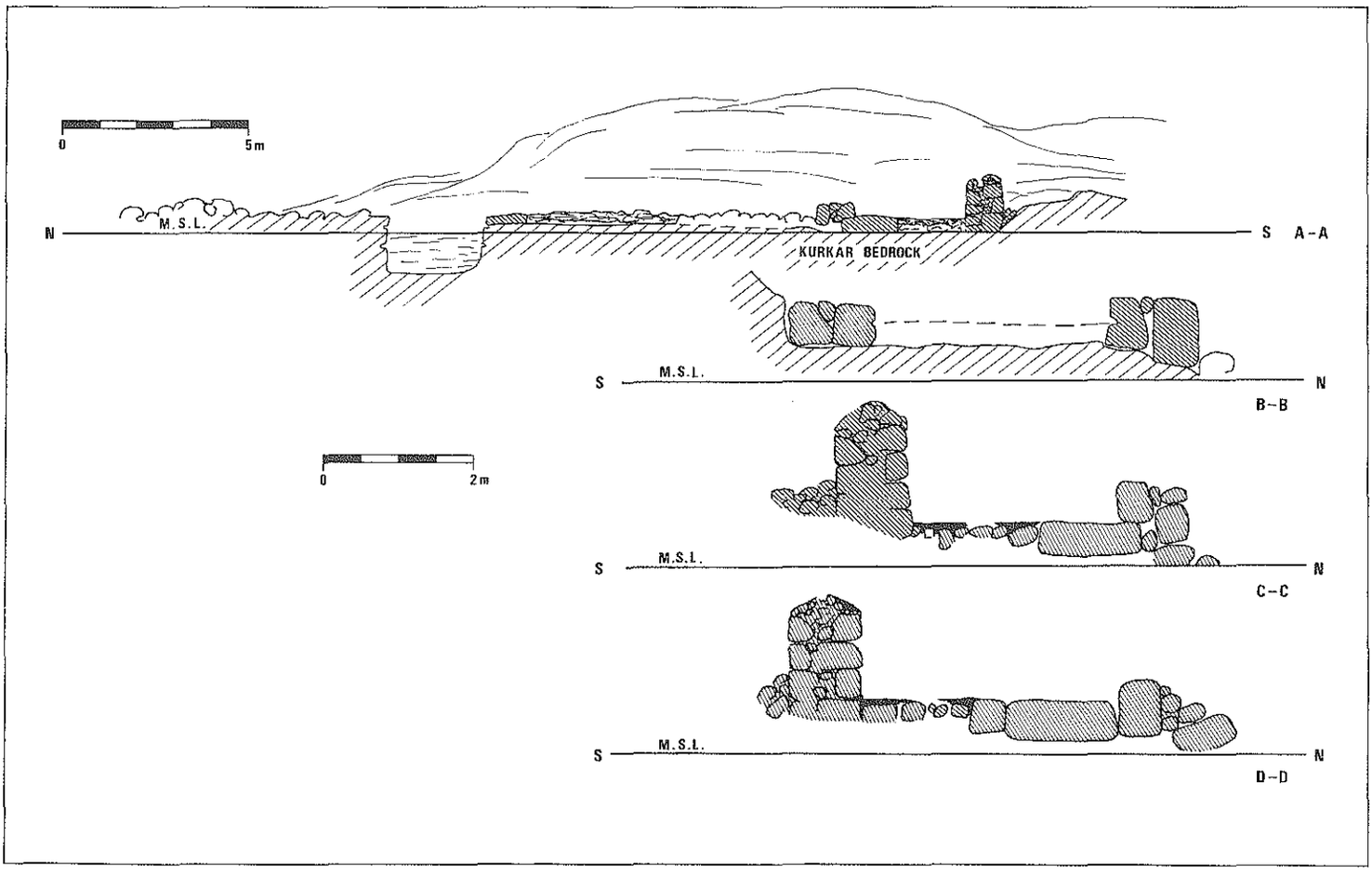

Fig. 9.4. Sections across channels 1 and 2.

with an existing quay of ashlar headers that ran across the southern side of the hollow. The southern wall of the channel was made of double-faced ashlars of medium size with an inner fill of small rubble, all bound with limish cement. This wall has survived up to its original plastered top with a rounded crest shape (see Fig. 9.5 C-C, D-D; Photo 9.16). The original height of the wall was 1.50–1.70 m. The floor was evenly laid with a fill and paving of small rubble, cemented in lime mixed with sand. Much of this floor is now missing in the western part of the channel, though there is enough left to reconstruct its gently sloping elevation towards the lee, from 0.70 m. next to the threshold on the west to 0.38 m. above MSL at its eastern end.

Along the inner face of the first course of ashlars of the northern wall of the channel one can clearly see a solution (abrasive) notch documenting the elevation of the water in it: 0.78 m. above MSL (Photo 9.17). Some early Byzantine sherds incorporated in the fill and the plaster of the southern side wall date this structure to the late 5th century CE or somewhat later.

The earlier ashlar quay (Photo 9.18) is preserved to a total length of almost 50 m. The western 19 m. are oriented almost due east–west, while the part to the east turns to the south by as much as 20°. The quay was built of blocks of much the same size as those of the rectangular structure on the north-eastern side of the hollow; they seem to have been part of a

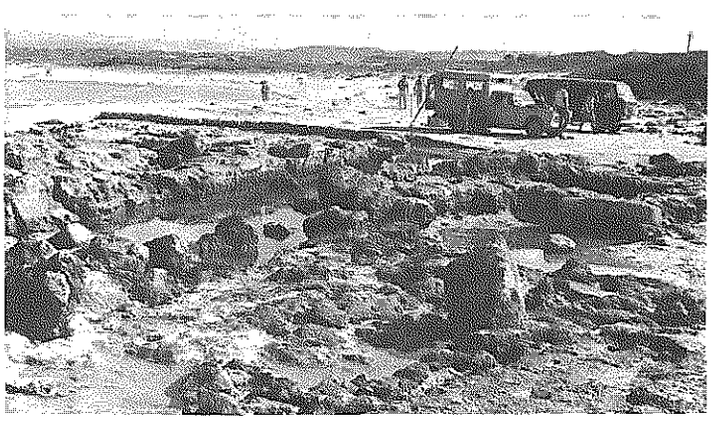

Photo 9.15. The encrusted spill over the rock-cut passage with one of the rectangular basins on the right, looking northeast.

Photo 9.16. Flushing channel 2, looking west. The surveyor on the right stands on the pre-existing quay, facing another who stands on top of the southern side wall.

Photo 9.17. The western section of the northern wall of flushing channel 2 with the abrasive notch clearly visible.

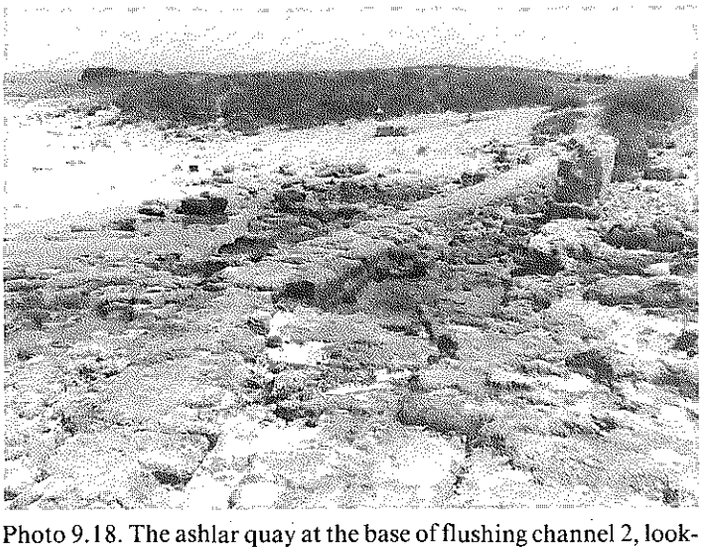

Photo 9.18. The ashlar quay at the base of flushing channel 2, looking east.

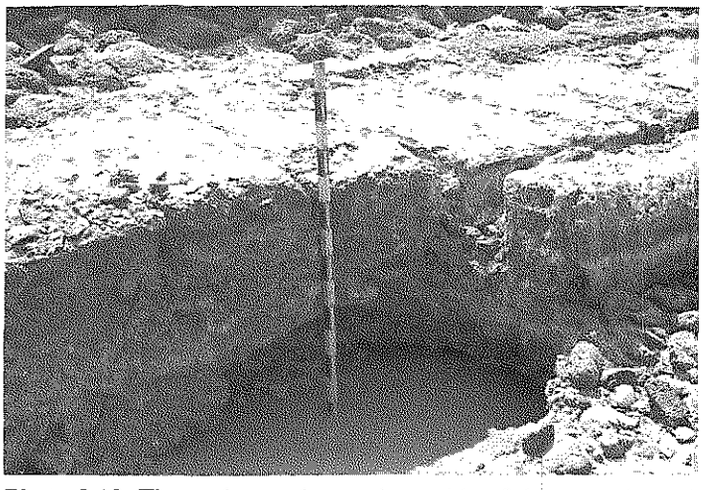

Photo 9.19. The probe on the northern side of the quay through the side wall of channel 2, looking southwest.

complex which bordered a shallow trapezoid water basin 35 x 50 m. in size. This basin was probably large and deep enough for small freighters and fishing boats, as long as the flushing channels were functioning properly to keep it silt-free.

In 1983, a probe was made at two places along the northern face of the quay and below it (Photo 9.19). The lowest course of the flushing channel's southern wall was removed, revealing a foundation trench cut into a natural fill of shingle, shells, and wave-worn sherds. The latest datable pottery fragment is of the early Byzantine period.

The quay itself comprises two courses of headers laid into a compact dark mud, the top of which is at 0.20 m. below MSL. Sherds of the 1st and 2nd centuries CE found in the upper part of the mud may date the quay.

Summary

It seems that there were three periods of massive construction in this southwestern corner of the North Bay:

1. The first period of construction comprised the original quarrying of the passage across the kurkar ridge and the forming of flushing channel 1. This channel was functioning well into the Hellenistic period, but may have been built earlier. The ceramic evidence, though it lacks a secure stratigraphical context, may indicate a date in the 5th century BCE.

2. At some time during the early part of the Roman period, and no later than the beginning of the 2nd century CE, the large rectangular structure was built on the northeastern side of the hollow, with its western wall running along the eastern side of the water basin towards the eastern end of the quay laid along its southern side. This basin may have been flushed from the south rather than from the west. Two probes with a mechanical backhoe which were made at two locations due south of the quay, one 12 m. south of its eastern end and the other 47 m. south of the same point, revealed that there was a topographical hollow which was open to the sea water and which probably connected the North Bay to Love Bay. The stratigraphic column in both probes was much the same: a base layer of compact clay up to 0.30 m. below MSL covered by a thin deposition of shingle, broken shells, and potsherds of the 1st to 3rd centuries CE (Photo 9.20). Over these deposits and up to 0.50 m. above MSL there are extensive depositions of beach sand mixed with shells and only a few eroded sherds. Above this layer there are tumbled building stones in Eolian sand, up to 1.30 m. above MSL, covered by half a meter of alternating layers of sand and soil. These probes may support the suggestion that during the Roman period there was a constant flow of sea water from Love Bay to the basin north of it, probably with a controlled passage between the eastern end of the quay and the southern end of the western wall of the rectangular structure. This flow would be sufficient to keep the hollow silt-free at a time when sea level was slowly but steadily rising. The blocking of the rock-cut passage to the west and that of the earlier flushing channel are probably products of this phase.

3. At some time at the beginning of the 6th century CE the second flushing channel was built on top of the quay, putting it out of use. The sea level was higher then by at least 0.80 m. than MSL and the quay was certainly flooded. At that time the rectangular structure was renovated, probably as a storage place. It is tempting to attribute the building activities of either this phase or the earlier one to the time of

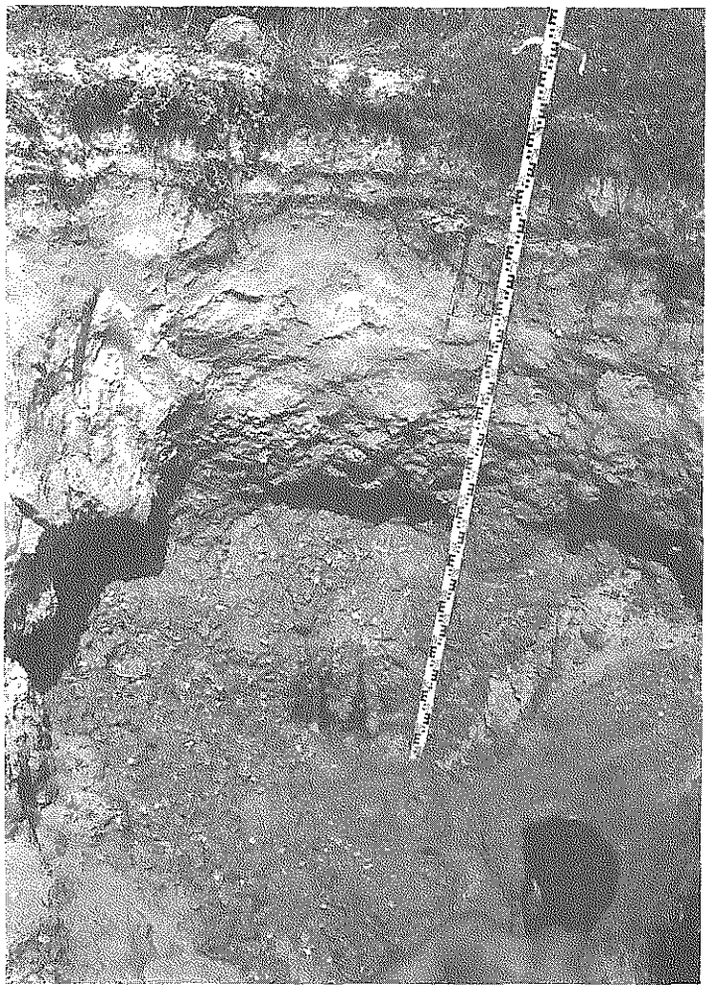

Photo 9.20. The southern side of probe 2 in the lee of the industrial area north of Love Bay, with the dark clay exposed at its base.

Stephanus of Byzantium, who writes (quoting the earlier Roman writer Claudius Iuleas): '...Dor, a very small town, inhabited by Phoenicians. These settled here because of the somewhat rocky nature of the shores and the abundance of the purple fish. At first they built themselves cabins, about which they placed stakes. When their business prospered, however, they split the rocks and with the stones thus set free they built city walls and made a harbour with good and safe anchorage.'[25]

There are no indications for continuing activity at this site after the end of the Byzantine period. However, much later a third flushing channel was quarried along the northern side of the passage and through what was left of the blocking. This channel is only 45 m. in length and of uneven width. Its outflow is too far north to be functional in maintaining the entire hollow silt-free, but the constant inflow of water still keeps the depth of the southeastern corner of the North Bay greater than in its central part.

D. THE INDUSTRIAL AREA

The title 'industrial area' was given by us to the more intact segment of the coastal *kurkar* ridge that separates the North Bay to its northeast from Love Bay to its south (Photo 9.21). This segment of the ridge is about one hundred meters long from flushing channel 2 in the north to Love Bay in the south, and about 50 m. wide from the open sea on the west to the sandy tombolo on its lee side on the east.

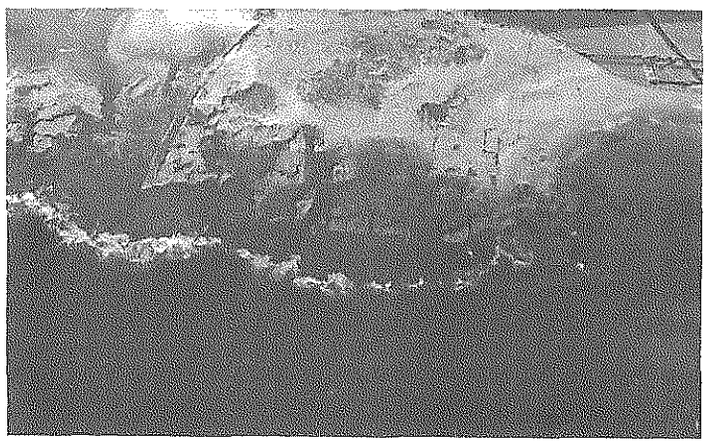

Photo 9.21. Aerial photograph of the industrial area.

The original topography of the rocky ridge was altered in antiquity by an extensive process of quarrying for building stones. Stone were quarried in such a way that the seaward edge of the ridge remained intact, with the bedrock left there to a height of almost two meters above MSL. Only a few rock-cut channels dissected it, enabling a controlled flow of wave-generated sea water to reach the lower area on its lee (Fig. 9.5). On the northern side of this quarry there are some groups of huge blocks *in situ*, still undetached (Photo 9.22).

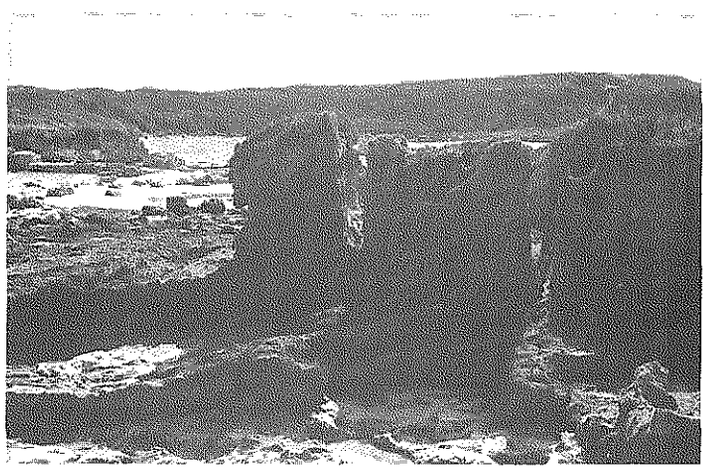

Photo 9.22. Half-quarried blocks of *kurkar* on the northern side of the industrial area, looking south.

A channel 3 m. wide and about 30 m. long (Photo 9.23) was cut in the sunken base of the quarried area, separating the unfinished northern section from the industrial complex to the south. The base of the channel is half a meter above MSL on its western side and about 20 cm. higher on its eastern end, at the point where it disappears below an unexcavated stone-built structure covered with sand. A second channel, only two meters wide, leads to the same unexcavated area from the southwest, where it originates in a lower quarried base below the northwestern corner of the industrial complex (Fig. 9.5). The entire area west of it is full of rock-cut shallow basins and narrow channels, but at present this complex is either too badly eroded by wave action or encrusted with naturally cemented rubble fill for one to

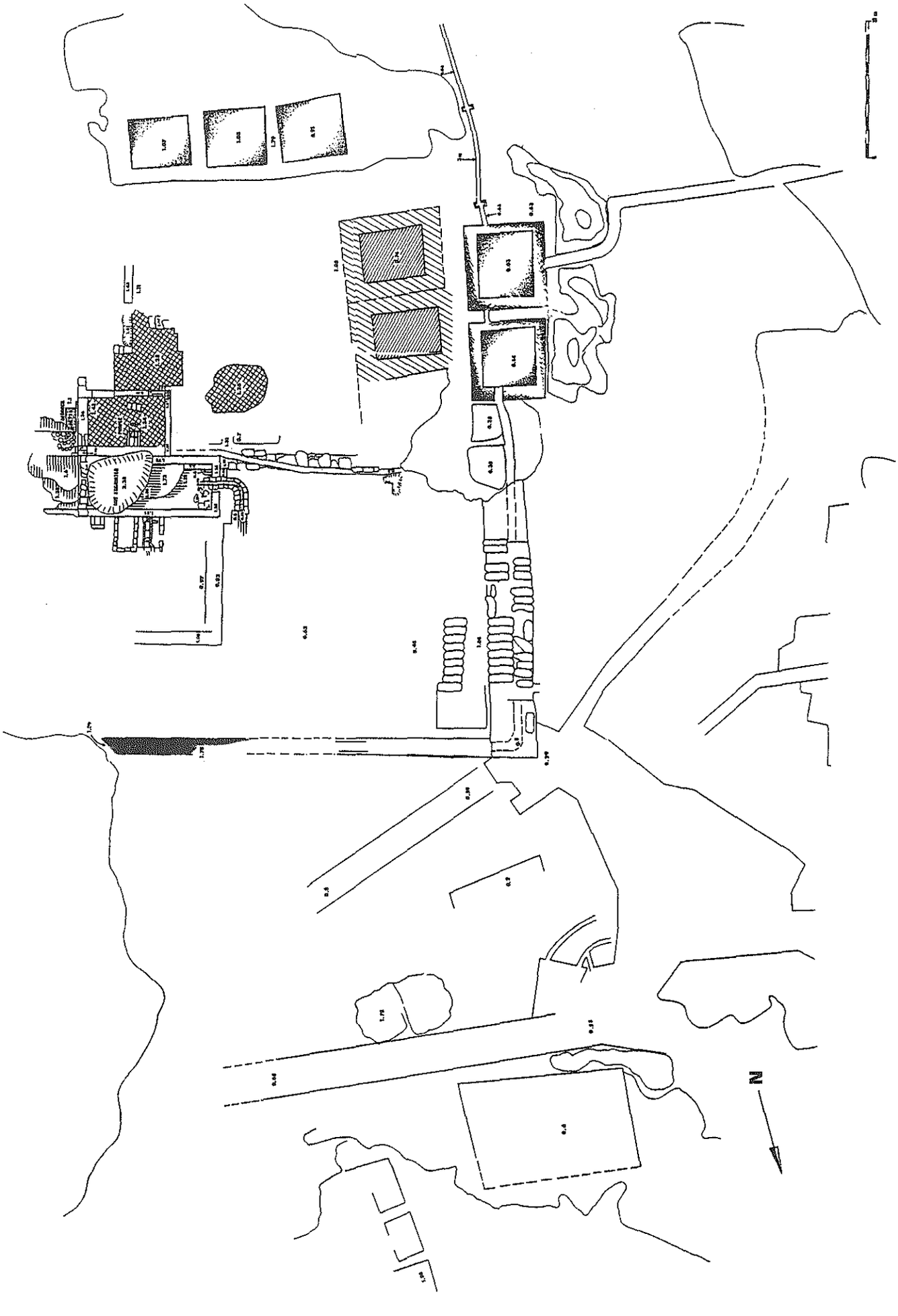

Fig. 9.5. General plan of the southwestern side of the industrial area.

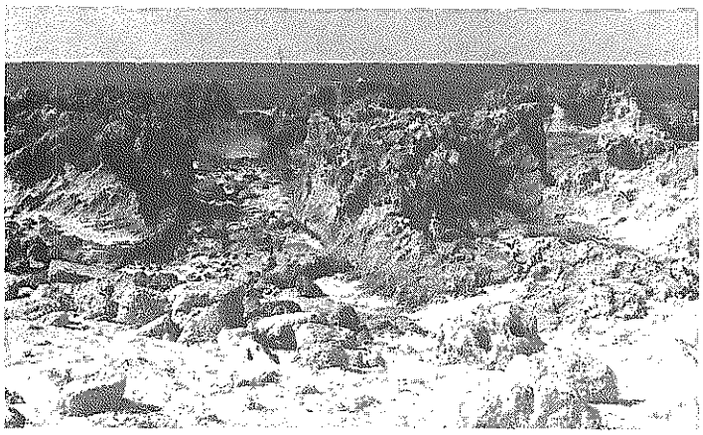

Photo 9.23. The wide through channel on the northern side of the industrial complex, looking west.

guess at its original overall plan or function. However, it does seem that there was some kind of silt-free supply of sea water to the northeastern area, whether for filling presently sand-covered plastered basins, or for flushing the opening that connected the two adjacent bays in the Roman period (see above).

The better-studied part of the industrial area is what seems to have been a single complex of water channels, shallow basins, and open courtyards. There are at least four phases of this complex, each corresponding to a different sea level. However, the general plan remains the same:

Phase 1

Of the first phase only rock-cut installations can be detected. On the northern side there is a rock-cut channel leading due west for over 35 m. and then turning at a right angle to the south for another 26 m. This channel was covered and built on in a later phase by another one at a higher elevation; at present only the last 10 m. of the earlier channel, on the southwest, are visible. The base of this 0.80 m. wide channel is at 1.30 m. above MSL at its northeastern end and only 0.20 m. at the other end, where it enters a basin. This is one of two rectangular basins measuring 6 x 6 m. each, connected by a short and narrow water passage (Photo 9.24). The rocky floor of these basins is only 0.05 m. above MSL; there is a wide ledge or bench along all four sides, at about 0.35 m. above MSL. One feeding channel reaches these twin basins from the northeast, bringing in fresh water from a branch of

Photo 9.24. The northern of the two connected rock-cut basins on the southwestern side of the industrial complex, looking north.

the aqueduct that originates at the River Dalia.[26] Another feeding channel leads from the west, through a narrow gap in the unquarried edge of the *kurkar* ridge, into the western side of the southernmost of the twin basins (Photo 9.25). There are pairs of vertical grooves for sluices on both sides of the rock-cut channels which enabled fine control of the water flow in them. A third channel was cut through the southern bank of the southern basin, leading farther south to the lee of the ridge at Love Bay, and probably used as a drain (Photo 9.26). This channel too has twin sluices across its opening.

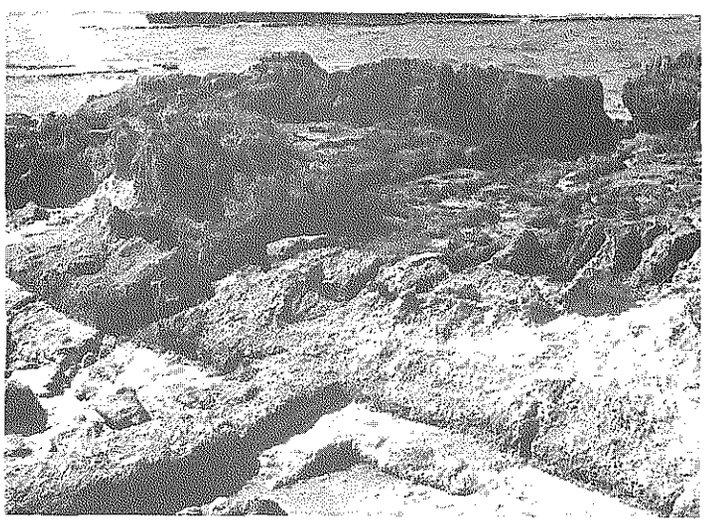

Photo 9.25. The western feeding channel leading from the sea to the twin basins, looking southwest.

Photo 9.26. The drainage channel of the twin rock-cut basins, looking north.

The system feeding sea water to these basins would function adequately only at a sea level much the same as the present one, suggesting a date based on comparative data of either the late 1st century BCE or the early 1st century CE.[27] This is the date of the earlier sherds found in the sand fill of two oblong rock-cut basins on the southeastern side of the central structure of the industrial complex (Photos 9.21, 9.27), which was partly excavated during our 1983 and 1984 seasons. These basins were cut into the bedrock from 1.10 m. above MSL down to 0.72 m. Their overall plan is unknown, since they are covered by later structures. There

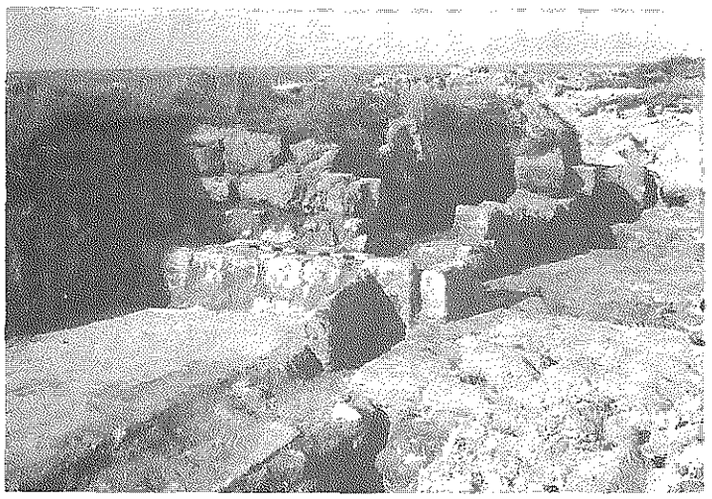

Photo 9.27. The southeastern side of the central structure of the industrial complex, with the earlier rock-cut basin (pre-Herodian) at the bottom, looking north.

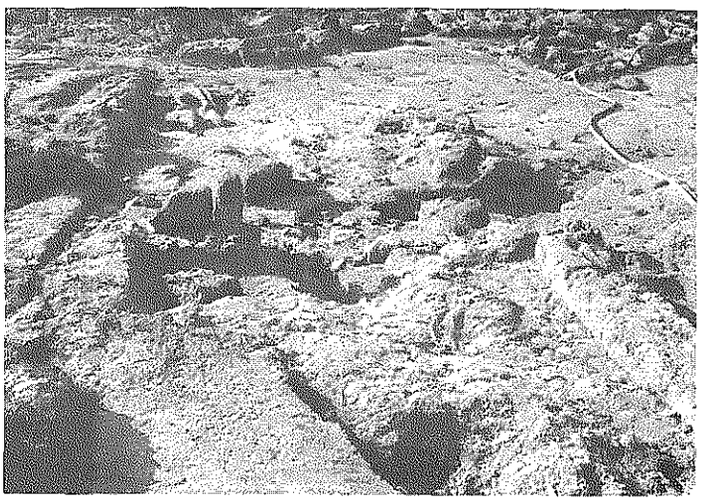

Photo 9.29. View to the east, from the northwestern part of the central structure towards the partition ledge and the northern side of the industrial complex.

are indications that there was another part of the complex, of the same early phase, 25 m. farther to the north, just behind the easternmost part of the fresh-water channel in the northeastern corner of the area. K. Raveh cleared this area in 1986 with a group of youngsters from Kibbutz Nahsholim, and uncovered what seems to be the southwestern flank of a complex of plastered rectangular rooms with oval plastered basins in them. According to his oral report, there are two sub-phases in the structure: in the earlier the bottom of the plastered basins is at 0.50 m. above MSL, and in the second it is some 0.30 m. higher. Between these two floors were sherds of late Hellenistic date.

Phase 2

In the second phase of the complex the northwestern side was protected from the rising sea level by an ashlar wall which topped the former channel (Photo 9.28). A rock-cut ledge, probably of the earlier phase, was used as an embankment, dividing the area between the central structure and the twin basins into two spaces. The northern one, of leveled bedrock, was at 0.52–0.46 m. above MSL, and the southern one, an ashlar-paved courtyard measuring 19 x 15 m., at 1.10 m. above MSL (Photo 9.29).

Photo 9.28. Ashlar sea wall on top of earlier rock-cut channel on the northwestern side of the industrial complex, looking north.

In the southern space, two neighboring basins were built of plastered rubble walls to the lee of the twin rock-cut ones. They measured 3.40 x 4.70 m. and 30 cm. deep, with their floors at 0.73 m. above MSL. A conduit for fresh water, built as a U-shaped plastered channel on top of the rock-cut partition ledge, led to these pools from the central structure. There was possibly a third basin to the north of these two, but it did not survive. Probably belonging to the same complex was a rectangular plastered basin with ashlar walls around it. To the north of the central structure only the western side of this structure is preserved, but it seems to have been subdivided into smaller basins. Its external dimensions are 13.40 x 11–12 m. (the east–west dimension is conjectural). The lowest plastered floor. exposed on the northeastern side of the central structure and running under its northern wall, seems to be of the same phase. The sherds associated with it date from the 2nd and early 3rd centuries CE.

Phase 3

In the third phase the central structure was built of rather large and carefully laid ashlars. There was a central room measuring 6.10 x 3.60 m. and facing south, with a door on the western side of its southern long wall leading to the main open courtyard through a wide passage (Photo 9.30). This passage, with a paved floor at 1.25 m. above MSL, is 2.80 m. wide on its eastern side and 2.60 m. on the west, at the opening to the courtyard. It continues to the south as far as 4.80 m. from the entrance to the central room, and there is another opening 1.20 m. wide on the western side of what may have been another water conduit, built on top of a stone wall with its U-shaped channel at 1.56 m. above MSL. This conduit fed three rock-cut basins, leading to the northeastern corner of the easternmost one some 12 m. to the south. These basins, which flank the southern side of the complex, measure (from east to west respectively) 3.5 x 4.3 m., with a floor at 1.07 m. above MSL; 4.20 x 4.30 m. with a floor at 1.03 m.; and 4.20 x 4.70 m. with a floor at 0.91 m. The central

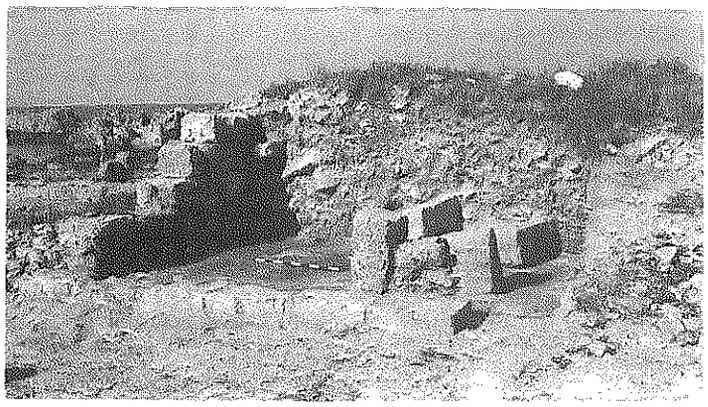

Photo 9.30. The central room and the structures in it, of the third phase of the central structure, looking northwest.

room of the building has a rectangular structure in its center, built of ashlar blocks around a raised podium of ashlar slabs measuring 1.10 x 1.60 m. In front of it, 1.70 m. from the southern wall of the room, there were three upright slabs (Photo 9.30). On the plaster floor of this room between the two structures was a large spot of bright purple color. Laboratory tests at the Weizmann Institute failed to detect chemical residues of *murex* purple, or any other organic components.[28] However, this purple spot is thus far the only clue we have as to the possible purpose of this multiphased industrial complex.

Behind the central room to the east, on the other side of a 0.70 m. wide ashlar wall, there were at least two more rooms, with a similar type of plaster floor covering a fill of small pebbles at the same elevation of 1.30–1.35 m. above MSL. Only the western part of the partition wall between the two rooms and of the one on the northern side of the structure were preserved. Their length (north–south) was 5 m. each. Both these walls and the eastern one of the central room were rebuilt in Phase 4 (see below).

The second major component of the central structure is a large rectangular space with a floor consisting of rubble fill covered with heavy plaster which continues over the side walls. This space, apparently a water tank, was 9.20 m. long (east–west) and 3.40 m. wide, with ashlar walls 0.55 m. wide. The floor is at 1.22 m. above MSL. This basin was drained through a curbed ashlar-built U-shaped plastered channel, 0.30 m. wide on its western side, around the rock-cut ledge and the western wall of the earlier structure, to the northern side of the leveled bedrock (Photo 9.31). Over the northern wall of the basin and adjacent to it from the outside, there was a series of ashlar-built basins and dividing slab-covered channels that brought fresh water for use in some kind of sieving process (Photo 9.32). There were some stone-cut grilles and pierced architectural members that demand further study in order to establish their exact function.

A large number of broken amphoras, cooking pots, and various other pottery vessels were recovered, including two intact jugs and a few oil lamps. All date to the 4th century CE and were found on the floors of the eastern rooms of this phase, in what seems to have been an almost total destruction of the central structure. Half a dozen identifiable coins from the same context are all imperial bronze coins of Constantine, Constans I, Julian, and Valens (364–378 CE, the latest of the coins).

Photo 9.31. The ashlar-built dividing channels on the northern side of the main structure, looking north.

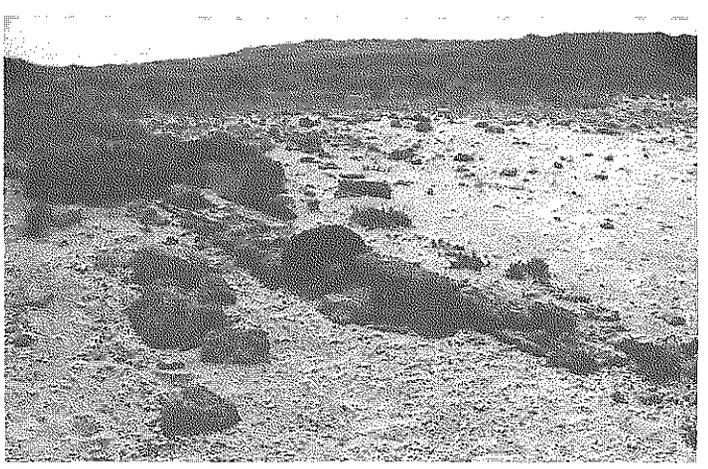

Photo 9.32. The fresh-water U-shaped conduit on the northeastern side of the industrial complex of its latest phase, looking southeast.

Phase 4

The last phase of the industrial complex was built at least two centuries after the previous one, probably following a period when it was not in use.

New rooms were laid on top of the tumbled mass of the eastern and central walls of the main structure; only the western wall and the large water tank were reused according to their previous layout. The tank was filled and its plaster floor

covered by building debris of the third phase, and a new plastered basin was established with its floor at 1.73 m. above MSL. To the east of the back wall of the basin was built a new room that was later turned into another plastered water basin, with its floor at 1.65 m. There are no indications as to where the water from the main basin would have drained, or the source of the water. The only other visible surviving element of this final phase is the uppermost water conduit in the northeastern corner of the complex, topping the older rock-cut one of the first phase. This is a rather wide V-shaped, open channel which was installed over a well-built wall. It survives to a length of about 9 m. at an elevation (at the bottom of the channel) of 1.89 m. above MSL at its eastern end and 1.78 m. at its western preserved end. The small finds in the fill on top of the main water basin of this phase include typical Byzantine pottery fragments of such vessels as cigar-shaped jars (the Gaza type), 29 African Red Slip bowls and plates, and typical 6th-century oil lamps. There were also a couple of bronze coins of the 'M' type, one of the mint of Constantinople from the reign of Anastasius and the other of the mint of Cyzicus from the reign of Justinian.[30]

Discussion

The so-called industrial complex on the northwestern side of Dor has several characteristics.

1. It was established in an area of quarrying that predated its earliest phase. This can be deduced from the fact that the rock-cut channel had to be cut diagonally through the corner of a group of partly hewn blocks, a leftover from the last use of the quarry.

2. It was located in the northwestern part of the city, apparently to keep off unpleasant smells deriving from whatever was processed there. This type of relative location for industries is common in the Hellenistic and Roman eras in the coastal cities of Palestine.[31]

3. There was at least one central building with some indoor installations, perhaps for cooking or heating some substances. However, the main features are shallow water basins, some with benches around their sides just inundated when these basins were full of water, and a rather elaborate network of feeding and draining channels.

4. It appears that the rinsing basins could be fed by both fresh water from the hinterland and salt water from the sea nearby. The former water supply would flow in by gravitation, while the latter would be generated by the waves. Such a combination would demand careful calculation of the elevations of the feeding inlets and the location of the basins in relation to the local topography of the seashore, in order to ensure full control of the inflow of water from the sea.

5. The complex was in use for what seems to be the same purpose and with the same general layout from the Late Hellenistic to the Byzantine periods, and at least three of its four phases seem to correspond with phases of the inner basin and the flushing channels next to it on the north.

Conclusions

The study of this area has not yet been completed, and much remains to be exposed and investigated. Nevertheless, one is tempted to relate this industrial unit to the nearby haven for small craft and deduce that whatever was processed in this basin was based on raw materials that came by boats.

One possible use could have been as hatching pools for the larvae of the gray mullet (*Mugil cephalus* and *Mugil capito*). This fish, very popular in the eastern Mediterranean (locally known as *buri*), is adapted to life both in salt and in fresh water, and females of the species give birth to their young in the brackish environment of river outlets in rainy spells during the winter. Consequently, an appropriate mixture of fresh and sea water may have been used by the inhabitants of ancient Dor in order to create artificially controlled hatching pools for the gray mullet. The problem is that even the present-day fishery research center at Dor has not been able to achieve optimum conditions for this, though this has been attempted for the last 40 years. The same experiment has been tried all over the world with no greater success. Among the rather detailed descriptions of the sophisticated Roman agriculture there is no reference to such a process, or to any other procedure using mixed salt and fresh water for fish ponds. In any case, the shallow basins and the barely inundated benches would be unsuitable for marine creatures.

Another alternative may have been the harvesting of *murex* shells for the manufacture of purple dye, known to have taken place at Dor.[32] These shells and probable residues of the pigment were found elsewhere at the site, in Area D1 by A. Gilboa.[33] However, what we know of the technique of purple dye manufacture in antiquity does not fit with this type of large open basins, implying a complicated operation of alternate rinsing of either wool fibers or cloth with fresh and sea water.[34] The ancient sources do mention the need for ponds for keeping the harvested *murex* alive and perhaps their hatching and raising in captivity. The accounts of Aristoteles, Strabo, and Columella attest to their intimate knowledge of the complete ethology of these mollusks and the fact that they were kept alive in ponds otherwise used for salting, pickling, or even hatching fish. Yet none of these sources refers to fresh water. Fresh water may have been used in this context, in ample quantities, for washing the natural grease from wool fibers before the dying process.[35]

All in all we prefer the interpretation that the function of the industrial complex was connected with purple dyeing rather than other alternatives such as the tanning of hides or processing of salted fish.

E. LOVE BAY

The excavated area at the back of the sandy beach of Love Bay runs along the lower part of the slope of the tel in a northeast–southwest direction for about 25 m. The width of the trench reached 7 m.; its southwestern edge was within the wave-disturbed area of the beach.

This location was selected for several reasons:

1. Love Bay is the best-protected body of water in the immediate vicinity of the mound, and the only one encompassed by its accumulated strata. On the assumption that the ancient inhabitants of Dor would have preferred to settle around their haven and to include it within the city's fortification line, Love Bay is the best existing candidate for the original harbor of Dor.

2. There are geomorphological indications to suggest that a local tectonic upheaval may have taken place along the coast of Dor in the third millennium BCE.[36] This tectonic

fracturing tilted and displaced the bedrock, leaving a rather deep hollow on its lee at the point where the tilted abrasive shelf was lowest. This newly formed natural feature was then protected by the higher rocky platform on the western side of the hollow and the coastal ridge, with the rising sea level flooding it through the opening to the north. Such a topographic setting would be almost optimal as a naturally well-protected year-round shelter for marine vessels.

3. Since it was a new topographic feature, this hollow would have had much less sand deposited on its lee, and assuming that in this initial phase the rocky islet and its adjacent shallow kurkar reef were much less abraded than they are now, sand would be carried and deposited in the bay at a much slower pace. The inhabitants of Dor would thus have had ample opportunity to manipulate this topographic formation to create a deep haven accessible both from the open sea and from the built-up area on land.

4. Preliminary survey of the edge of the mound, along the back of the eastern part of the bay's sandy beach, indicated that there are some intriguing man-made structures partly exposed by storm waves. Among these features was a very massive wall, made of huge roughly squared blocks laid in the lowest course with their narrow side facing the sea. This arrangement, typical of a sea wall, suggests that this may be the residue of a quay or a retaining structure that protected the land site from the sea waves. On top of this wall was a visible corner of a massive ashlar structure lying diagonally to the beach and the present topography, indicating a period when the waterline was different from today's.

During the season of December 1982 the sand and some offsettled slabs of beachrock were removed mechanically from the area to the west of these structures and a manual excavation was carried out, cleaning and exposing the long sea wall (K) and the area behind it all the way to the western face of the ashlar structure (W) (Photo 9.33). The manual excavation was carried down to the bedrock behind wall K in a trench 2.50 m. wide and 10 m. long (Figs. 9.6, 9.7).

The southern end of the trench was defined by a tumbled mass of building stones with a few huge ones from wall K at the base, directly on the bedrock at 2.43 m. above MSL. Two meters north of it was another tumbled mass overlaid by a cross wall of rubble, continuing into the mound. The base of this wall (N) was at 2.65 m. above MSL, and no floor or any other undisturbed level of occupation could be traced in relation to it. L. 71 is the fill between these two masses of debris, on the lee of the best-preserved segment of wall K. The wall consists at this spot of a base course of headers each measuring 0.60 x 1.10 m., topped by two larger stretchers, the southern one 2.90 m. long and the other only 1.40 m. The top of this second course is at 3.30 m. above MSL and the base of the wall at 1.90 m. above MSL. A detached segment of similar types of block to the west, if *in situ*, would extend the original width of wall K to 2.70 m. Such a width would give it the character of a quay rather than a retaining sea wall.

L. 71 proved to be a mixed fill displaced from the slope of the mound in various periods. The pottery included two pieces of Hellenistic braziers,[37] some Persian mortaria, broken pieces of the holemouth jars with twisted handles very common in Phoenician coastal sites of the Persian period, and other types dating from the 5th to 2nd centuries BCE. In the lower part of the fill were some sherds of LB I and MB IIB types of pottery (Fig. 9.8).

Photo 9.33. Sea wall K and ashlar wall W in Love Bay, looking northeast.

L. 72 is the area next to wall N to the south. It too is a mixed fill, extending almost down to 2.40 m. The content of this fill is much the same as that on the other side of wall N, including some MB II sherds that were in the more compact clay and loam just above the bedrock. The bedrock itself was found to slope inwards as typical beachrock ledges. The lowest point is at the eastern corner of the locus at 1.90 m. above MSL; there a cupmark was found with its base at 1.67 m.

The central area of the trench proved to be the least disturbed. A floor of compacted lime topped by red loam at 2.95 m. above MSL was found on the northeastern side of the area, with a rubble screening wall (X) on its west and the foundation trench of wall W cutting through it on the northeast. On the floor (L. 74) there were some sherds of the MB IIC and possibly the LB I. The limited ceramic assemblage suggests a 17th–16th century BCE date for this floor. Above the floor level there were at least two thin layers of shells and beach deposits with some wave-worn sherds, one at 3.12 m. and the other at 3.83 m. above MSL; they are indications of either a couple of short-term flooding events (such as tsunamis) or a longer-term transgression. Below the floor, at 2.54 m. above MSL, there is another layer of shells and beach deposits, and above it (L. 75) some sherds of the MB IIB, including decorated pieces of Cypriot White Painted V and VI vessels (Fig. 9.9; see section in Fig. 9.7). Below the marine

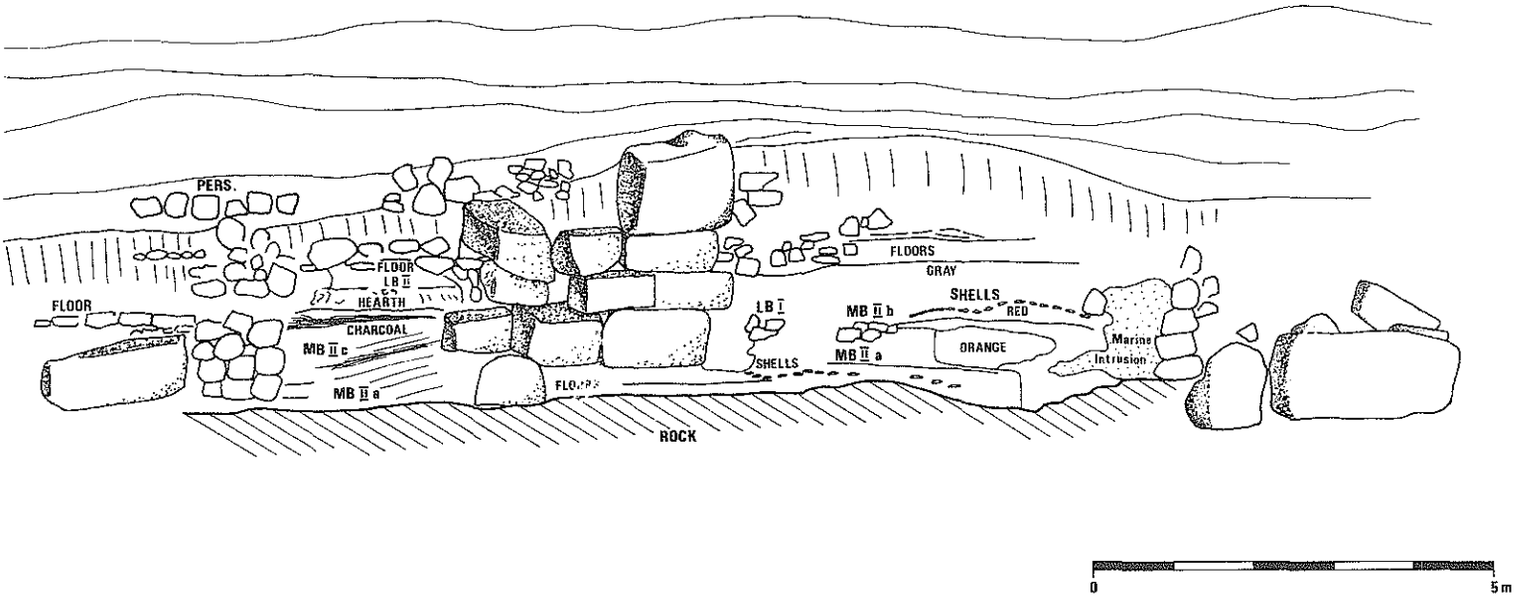

Fig. 9.6. Plan of the excavated area in Love Bay.

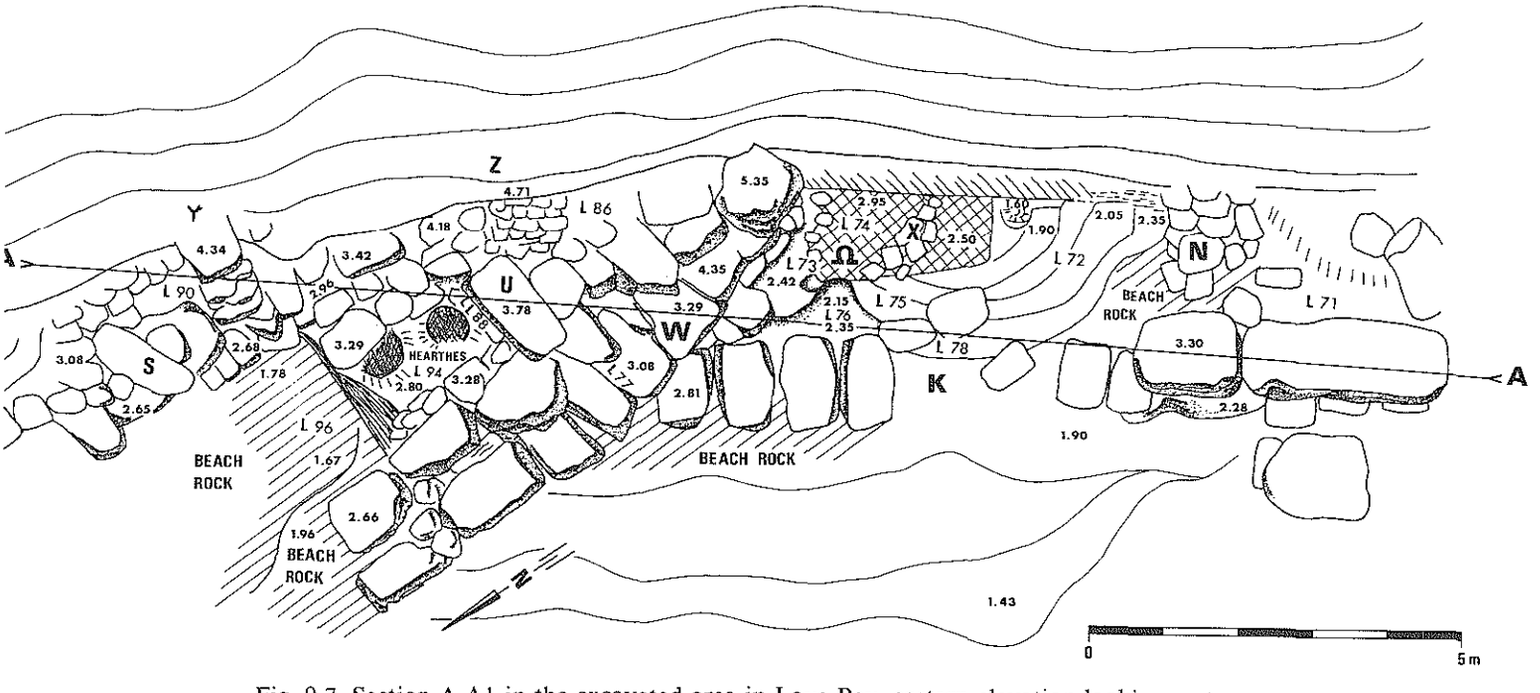

Fig. 9.7. Section A-A1 in the excavated area in Love Bay, eastern elevation looking east.

intrusion was a segment of a wall of sun-dried red mudbricks. On a lime floor next to it (L. 28) there were some fragmentary sherds of red-slipped and burnished carinated bowls and juglets of the MB IIA. Similar types of sherds were found below the lowest layer of marine intrusion (at 2.15 m. above MSL), down to the bedrock at 2.05 m. above MSL. The lowest level on top of the bedrock was aligned with the lee side of the sea wall K, thus dating it to the earliest urban phase at Dor in the MB IIA.

North of the floor and next to the western side of the ashlar wall W there were two distinct levels. L. 73 seems to be the fill of the foundation trench of the ashlar structure, with its base at 3.42 m. above MSL at the same elevation as the base of the lower course of the wall. Among the few fragmentary sherds in this fill there were two of the Bichrome type of the 16th century BCE (Fig. 9.9). Below that level there was a gray fill (L. 76) with some sherds of the middle phase of the MB IIA.[38]

The field seasons of 1983 and 1984 were devoted to excavating and clearing the stratigraphy of the area to the northeast of wall W and its continuation to the north.

Wall W was exposed to the north to a total length of 8.40 m.; its general orientation is 350°. It consisted of a base course of a double line of stretchers overlaid by a course of headers. The third course was also of headers, most of which were offset to the east. The original size of each block was

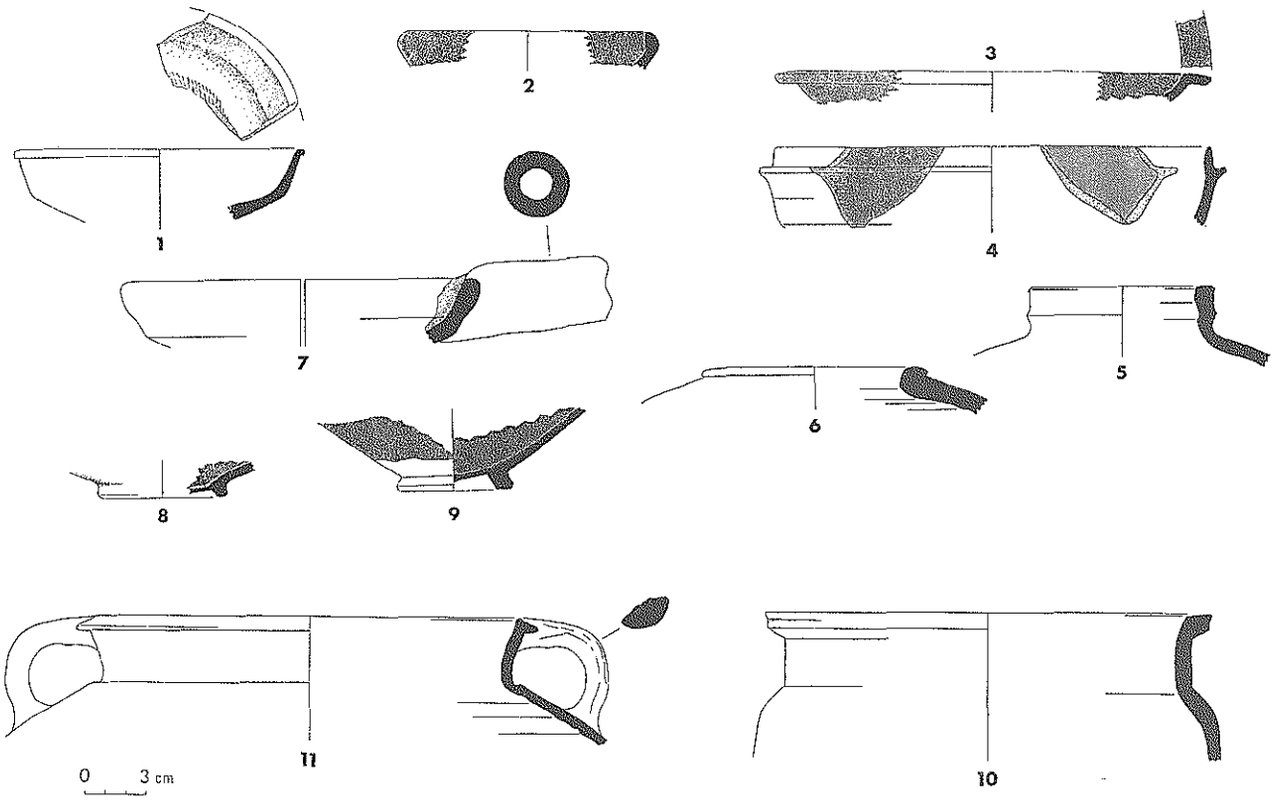

Fig. 9.8. Pottery from the fill of L. 71 in Love Bay.

No.	*Type*	*Reg. No.*	*Color*	*Remarks*
1.	Bowl	82-71-10	10R6/6	Black slip, rouletted decoration inside
2.	Bowl	82-71-22	7.5YR7/4	Dark brown burnished slip inside and out
3.	Bowl	82-71-21	5YR4/2	Dark brown-red slip
4.	Bowl	82-71-12	5YR6/6	Yellow-red slip inside, dark red outside
5.	Jar	82-71-6	7.5YR6/2	
6.	Jar	82-71-15	5YR6/6	Hole mouth
7.	Frying pan	82-71-1	25YR4/6	Blackened inside
8.	Bowl	82-71-19	2.5YR6/4	Brown slip inside
9.	Bowl	82-71-2	2.5YR6/6	Dark brown slip inside and out
10.	Krater	82-71-3+5	10YR6/3	Some white grits
11.	Cooking pot	82-71-8	2.5YR4/6	Various grits

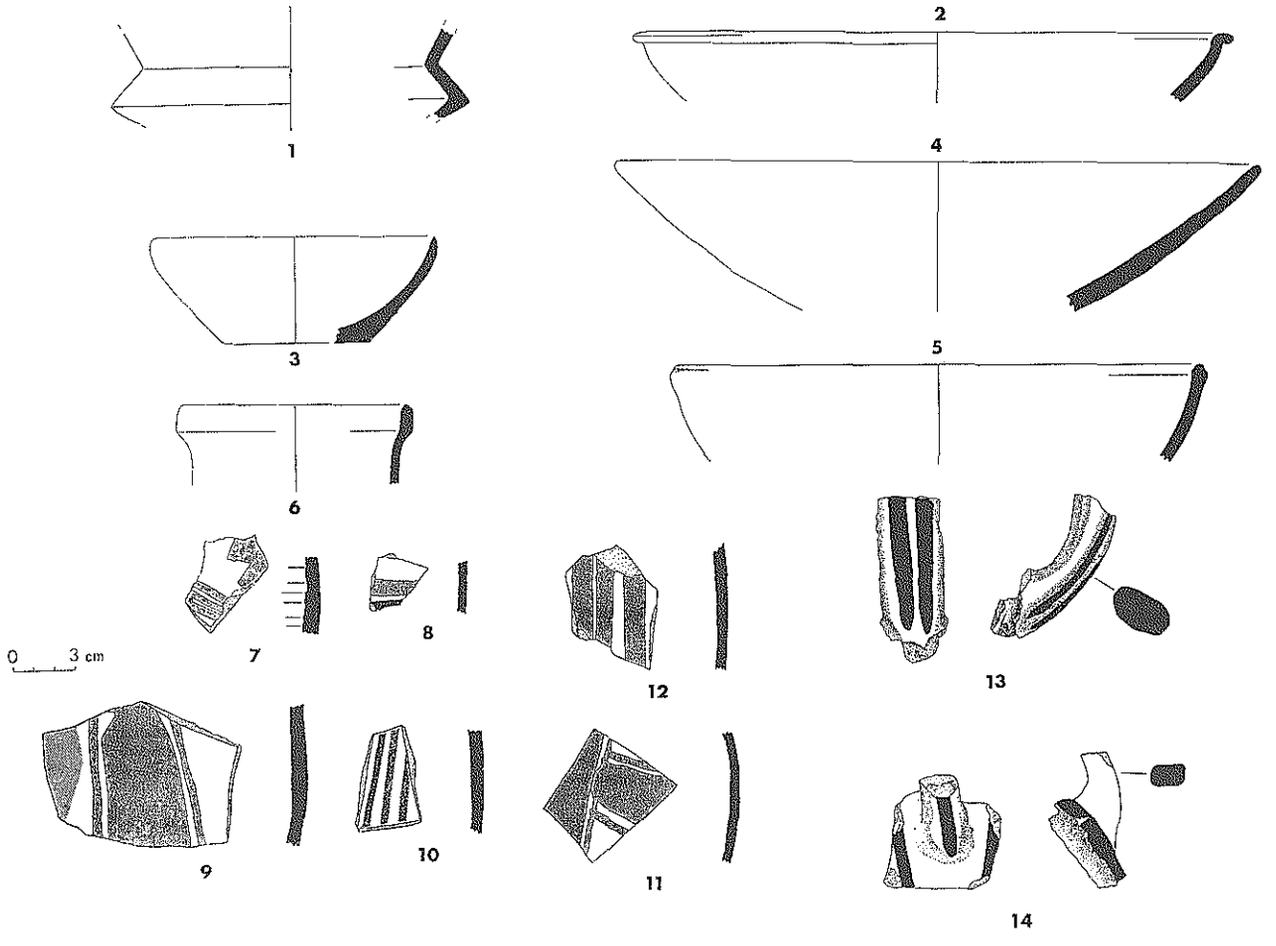

Fig 9.9. Pottery from the 1982 trench in Love Bay, L. 72–76.

No.	*Type*	*Reg. No.*	*Loc.*	*Color*	*Remarks*
1.	Carinated bowl	82-74-4	74	7.5YR,7/2	MB IIC
2.	Bowl	82-75-8+3	75	2.5Y7/2	Large white grits
3.	Small bowl	82-72-7/1	72	10YR6/2	String-cut base
4.	Large bowl	82-74-3	74	2.5YR4/0	Remains of burnished slip
5.	Deep bowl	82-76-3	76	5YR4/1	Fine clay
6.	Jug	82-76-2	76	2.5Y5/2	Gray and white grits
7.	Jug	82-73-2	73	5YR6/4	Light brown paint on buff slip
8.	Jug (?)	82-75-2	75	2.5Y6/2	Black and brown decoration, burnished (MB IIC-LB I Bichrome)
9.	Jug	82-75-6	75	2.5Y7/4	Dark brown and yellow-red patinated stripes on buff slip, Cyp. WP
10.	Jug	82-75-3	75	2.5Y576/4	Dark red stripes, Cyp. WP
11.	Jug	82-75-4	75	10YR6/4	Dark brown stripes on white slip, Cyp. WP
12.	Jug handle	82-75-7	75	10YR6/4	Black stripes on white slip, Cyp. WP
13.	Jug handle	82-75-5	75	5YR6/4	Dark brown stripes on white slip, Cyp. WP

0.70 x 0.70 x 1.40 m. The width of the wall was about 1.80 m. at its foundation course, and at least 0.50 m. wider above the floor level. This broadening was achieved by an additional fill of small rubble in the eastern side of the foundation trench. This trench went down to the bedrock which slopes gently towards the sea, at a gradient of 8–10%. To the east the beachrock overlaid an almost horizontal surface of *kurkar*, at 1.67 m. above MSL. From the east a floor of flat slabs of *kurkar* and beachrock (L. 88) reaches the wall over the rubble fill of the foundation trench (Photo 9.34). On the slab floor, at 3.30 m. above MSL, there was a bronze blade and pottery of the 12th century BCE. Behind the floor there is a segment of a cross wall (U) preserved to a maximal height of almost four meters above MSL, also built of ashlars, though of somewhat smaller size. Directly on top of this wall there was a later one built of much smaller squared blocks. This later wall (Z) was covered by a fill containing large quantities of sherds of the Persian period.

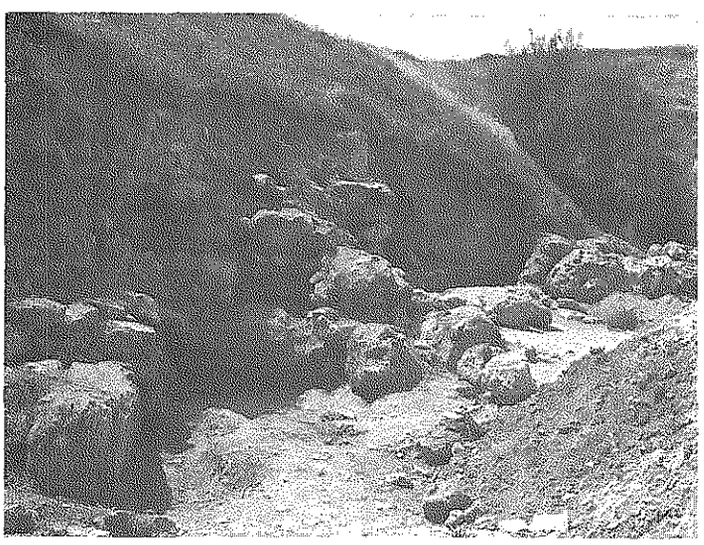

Photo 9.34. The excavated area in Love Bay after the 1984 season, looking south.

Below the slab floor of L. 88, at 2.95 m. above MSL, was a lime floor (L. 92) with some sherds of the transition between LB II and Iron Age I. When this floor was laid it cut the upper part of two adjacent hearths, made of compact dark mud and lined from within with large sherds of LB II jars. The fill below L. 92 was characterized by layers of ash and carbonized pieces of wood. C14 analysis was carried out at the Weizmann Institute in Rehovot on two samples, giving calibrated dates of 1420 ± 30 and 1680 ± 60 BCE.[39] A floor of beaten earth associated with the hearths (L. 94) was exposed at an elevation of 2.78 m.; it was renewed several times, with layers of ash between the floors, of which the first was at 2.52 m. above MSL (Photo 9.35). Below L. 94 is a compact fill of loam, with some shells and pottery. The sherds in the fill were mostly of MB IIC types, but just above the bedrock there were some MB IIA red-burnished sherds. The base of wall S on the eastern side of this fill is on the bedrock at 1.78 m. above MSL and the base of wall W to the west is on the bedrock at 1.67 m. The foundation trenches of both walls cut both the fill and the two floors (L. 94, L. 92) below the stone slab floor (L. 88). This last floor runs up to

Photo 9.35. The beachrock at the base of L. 96 with L. 94 on top, looking south.

the side wall half way up the second course, giving wall W a foundation over 1.60 m. deep.

About two meters east of wall W and parallel to it there is another ashlar wall (S), 1.40 m. wide, cut by a later wall (Y) whose foundation trench was dug through it. Behind the ashlar wall are some collapsed structures of a later date. The pottery found associated with them (L. 90) proved to be mainly of the Hellenistic period, with some Persian period sherds.

The survey of the various architectural features on the lee side of Love Bay, the associated floors, and the ceramic evidence enable us to suggest some conclusions about the occupational history of this limited site on the northwestern side of the mound (Photo 9.36).

1. This site was first occupied during Dor's earliest urban phase, probably during the 20th century BCE. In this stage the huge longshore sea wall K was built, either as a retaining line for the built-up area on its lee or as a quay (though the bedrock to its west is at present well above sea level and would not permit the approach of marine vessels of any size). The suggestion that the tectonic tilting occurred later and that prior to that event the bedrock was at a much lower level relative to the sea nearby finds no supporting evidence in the data so far collected at the site.

2. The sea wall ceased to function at some time towards the end of the MB IIA, though the area continued to be occupied during the later 17th and 16th centuries BCE (the MB IIB–LB I). The frequent flooding of occupation levels during that time suggests that Love Bay was no longer an important maritime feature for the people of Dor, and we should probably look for the main harbor of the city during these centuries in some other location. However, this suggestion is only a tentative one based on very limited excavation; future extension of the archaeological investigation along the eastern shore of the bay may disprove it.

3. Major building activity took place at the site at some time in the late 13th century BCE and in the following generation. Massive ashlar structures were laid in an orientation that cannot be understood in terms of the present configuration of the shore. The inhabitants of Dor at that period were well aware of the substrata of bedrock and related their buildings to its hidden topography. This fact, and the magni-

Photo 9.36. General view of the excavated area of Love Bay after 1984 season.

tude of the structures, might suggest a maritime orientation, though its exact character and the function of the ashlar structures have yet to be determined.

4. It is clear that this area was abandoned during most of the Iron Age; it was resettled only during the Persian period.

The reason for this is not clear, though a rise in sea level might be suggested. However, in that case one would expect to find heavier beach deposits in the section, accumulated during this time lapse. Again, only further excavations over a much larger area may provide the answer.

F. THE SLIPWAYS

The rock-cut slipways at Dor have apparently always been fully exposed to the eyes of visitors and to the devastating erosion of the elements. However, this unique installation has remained unnoticed until recently.

The slipways were quarried into the northern part of the uptilted abrasive platform which characterizes the segment of the coastal Eolianite ridge on which the tel is based (see above). The platform at that point is currently about three meters above the sea and rather eroded. Three hollows, sloping towards the sea, were cut there to the north, within the lee of Love Bay (Photos 9.37, 9.38). The uncut partition walls are at present worn away closer to the sea, and the lower sections of the sloping hollows are partly covered by more recent beachrock. Consequently, only the southeastern part of the original complex has been fully preserved. The length of the rectangular hollows was originally almost 30 m. and the width of each, from east to west, was 3.80, 4.10, and 4.50 m. respectively (Fig. 9.10). The partition walls are 0.60–0.80 m. high and 1.50 m. wide. There are small round holes in their tops at intervals of 1.80–2.40 m.; these probably served for the insertion of wooden poles supporting an awning. The overall plan recalls the instructions of Vitruvius (V.12.7):

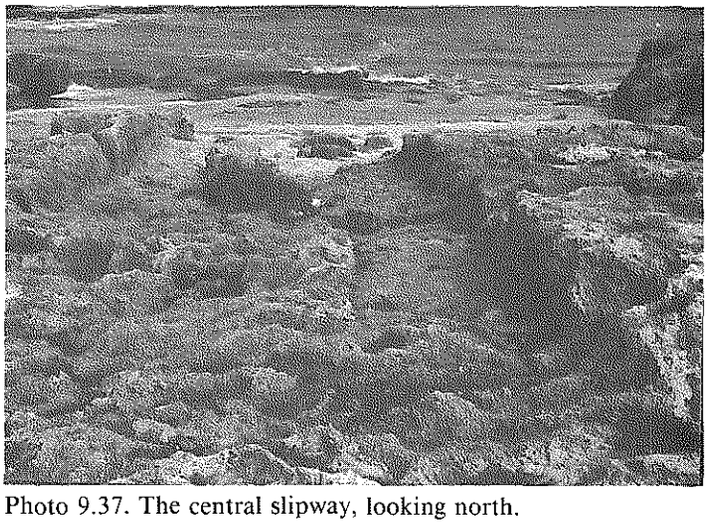

Photo 9.37. The central slipway, looking north.

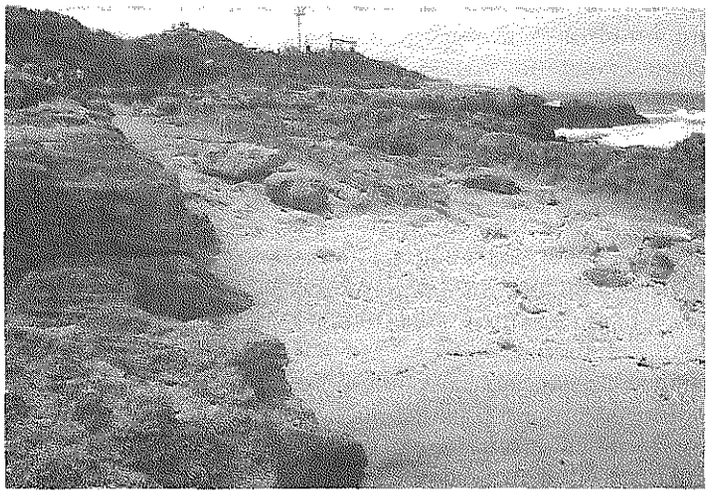

Photo 9.38. The eastern and central slipways, looking southwest.

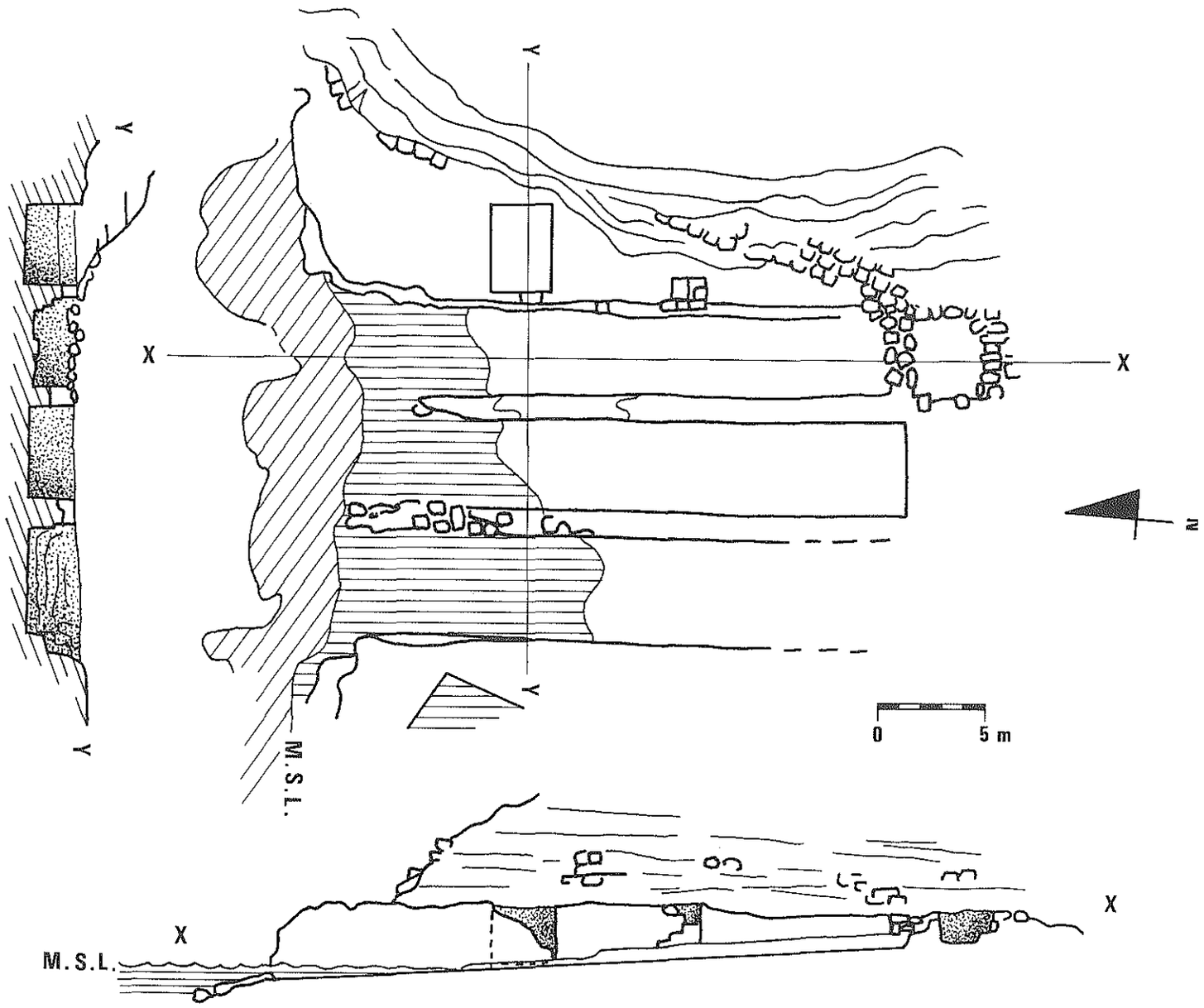

Fig. 9.10. Plan and sections across the rock-cut slipways at Tel Dor.

'The general rule for shipyards will be to build them facing the north. Southern exposures from their heat produce rot, the woodworm, shipworms and all sorts of other destructive creatures, and strengthen and keep them alive. And these buildings must by no means be constructed of wood, for fear of fire. As for their size, no definite limit need be set, but they must be built to suit the largest type of ship, so that if even larger ships are hauled up, they may find plenty of room there.'

Along the upper 13 m. of the eastern side of the eastern hollow is a bench 0.80 m. wide. Three meters before its end a rock-cut staircase leads down from the nearby higher platform on the east (Photo 9.39). Farther to the north along the eastern platform, 16 m. away from the back of the sloping hollow, there is a rock-cut basin measuring 2.40 x 4.10 m. and 2.70 m. deep. There were two larger basins on the northwestern side of the complex, behind the western slipway, but they are now too badly eroded for their exact original size and shape to be determined. These basins were probably used for soaking timbers in water so that they could be bent to the desired curvature without breakage. The back of the eastern slipway was found blocked by a cross wall, with some later ones running eastwards and making a corner towards the north over the upper part of the slipway hollow, making it unusable for its original purpose (Photo 9.40). During the 1981 season, a limited excavation was carried out in this area by Michal Artzy and a group of Danish students. These later walls were found to relate to a plaster floor on which some early Hellenistic sherds were found *in situ*.

Behind the crosswall, to the south and aligned with the eastern slipway, there was a room measuring 4 x 4 m., partly cut in the rock and partly ashlar built. It is possible that this space was originally used for a capstan or a similar pulling device to haul ship cradles up on the slope. Artzy's excavations over the eastern edge of the slipways have cleared a series of ashlar walls and several plaster floors, all dated to the Persian period. However, it is not clear in what way these structures were related to the shipyard and whether they are

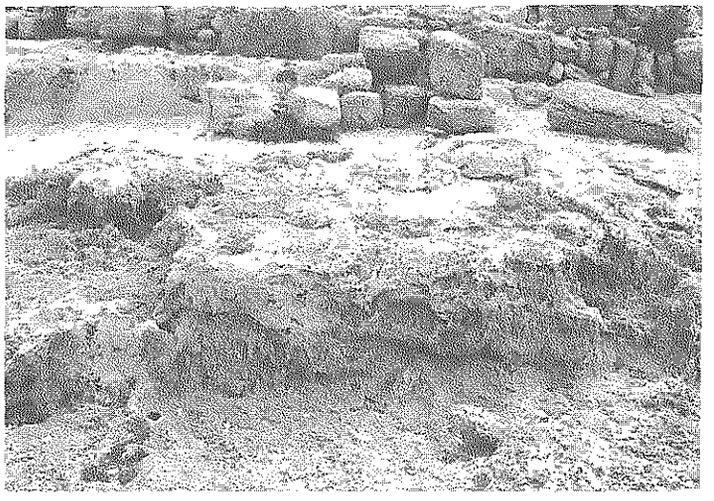

Photo 9.39. The southern side of the eastern slipway, looking east.

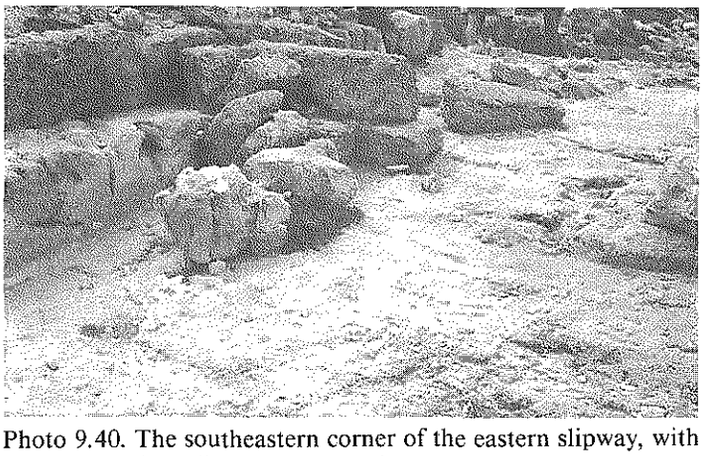

Photo 9.40. The southeastern corner of the eastern slipway, with the Hellenistic wall that postdates its use.

of the same date. The only significant fact is that these walls are accurately aligned with the rock-cut structure, and thus it is unlikely that they predate it.

There are no good parallels to Dor's slipways in other sites from the Levantine coast; the known repertory of such installations comes only from Greek settlements. There are two major types of slipways:

1. Trireme shipsheds at strategic outposts, outside harbors and away from other port installations, such as the double slipways at Cape Sunion.[40] These are rather steep (15°), just over 21 m. long and 5.50 m. wide. There is a deep (1 m.) and wide (2 m.) channel in the center of each of the slipways at Sunion, probably for the heavy keel of a military craft. The size of these slipways does not fit a full-scale trireme, which are known to have been almost 6 m. wide and up to 38 m. long. Thus, somewhat smaller patrol craft may have been stationed there, guarding the entrance to the Saronic Gulf.[41] A somewhat larger slipway was found near Siteia in Crete, also a rock-cut installation remote from any known settlement. It is almost 30 m. long and just over 5.50 m. wide, with a gradient of 16°.[42] Both installations face north, as at Dor.

2. The major group of slipways are those known as shipshades, or *neos oikoi* — the regular hangars of the classical Greek triremes.[43] The largest known series of such shipsheds, and the best known, is the 374 units along the shores of the twin military harbors of Piraeus in the mid-4th century BCE. The larger naval base, the Zea, had 196 berths, some of which were excavated in 1885,[44] and the other one, the Munychia, had 82. The remaining units occupied the southern end of the commercial harbor, the Cantharus. The standard size of each berth was 37 x 6 m., with a gradient of 4.5° (the same as at Dor). There was no central slot for the keel, but rather a raised leveled rock-cut platform with lower recesses where the wooden poles for the gabled roof were placed. There are smaller groups of similar rock-cut shipsheds at Matala and Rhethymnon (three slipways) in Crete,[45] and at Syracuse (not fully studied and at present covered by modern buildings).

Less similar to Dor's slipways are those found under water at the presently submerged harbor of the Hellenistic city of Apollonia in Cyrenaica. Ten such slipways were found grouped together, facing south towards the harbor basin, each one of somewhat different width and length (up to 40 m. long and 6 m. wide). Their average slope is just over 3° and most have a central keel slot.[46]

From the published data on this type of slipways or shipsheds it is hard to build a typology with any sound dating, cultural, or functional significance. However, there are enough comparative data and circumstantial documentation concerning ship sizes and length/breadth ratio for us to propose that the slipways of Dor were not mere shipsheds, but rather shipyards where ship maintenance and replacement of rotten planking and frames took place.[47] Considering that the maximum beam of vessels treated here could have been somewhat more than the width of the hollows' floors, because of the relatively low elevation of the sloping rock-cut partition walls, one can calculate that the eastern slipway could have accommodated a vessel measuring up to 4 x 24 m., the central one 4.50 x 26 m., and the western one, 5 x 20 m. The latter ratio, 1:4, is characteristic of merchantmen, while the other two would be appropriate for some type of oared naval vessel.[48] As for the suggested date for the slipways, though we have historical references to such installations in Egypt around 600 BCE during the reign of Pharaoh Necho[49] and from the time of Polycrates, the tyrant of Samos[50], a date in the 5th century BCE seems to be more likely, considering the archaeological evidence for what may have been an Athenian presence at Dor from that time.[51]

Earlier occupations with undisturbed stratigraphy were detected only in the southeastern corner of the slipways. Under the back wall of the square chamber to the south of the eastern slipway there is a rubble wall (L. 126), based directly on the bedrock at 3.17 m. above MSL. Two fragmentary walls (124, 125) meet to form the northwestern corner of a structure that has not survived. A floor made of a compact red loam reaches this corner at 3.26 m. above MSL. The sherds found on the floor can be dated to the mid MB IIA and include some pieces of imported White Painted IV Cypriot pottery decorated with thin red and brown lines on a light buff burnished surface, with thicker lines overlapping. The red loam floor is covered by a thin white floor of a limeish substance (L. 123). This later floor continues to the east, under a rubble wall (122) that protrudes from the base of the steep slope of the tel. A small probe was made to the northeast of wall 122 down to another lime floor (L. 121), on a higher level (3.68 m.), that seems to be contemporary with it. The sherds that were retrieved from that floor date

from the MB IIB. These very scanty remains of MB II occupation were the only remains of earlier strata within the immediate context of the slipways on top of the raised abrasive platform. The proximity of that platform to the open sea and its present exposure to wave erosion may explain the absence of later strata that have been washed off through the ages. Yet, the very existence of domestic occupation at that site during the MB II may indicate that at that period the area was better sheltered from the surge — either because the sea was farther away, or because there were additional massive structures to the west which were later washed away.

G. THE SOUTHEASTERN SIDE OF THE TEL

The area studied at the waterline along the eastern part of the southern side of Tel Dor was observed by us to contain architectural remains, both below and above the water level. The location is on the northeastern side of a large bay, the South Bay, which separates the ancient settlement from Tantura Lagoon. There, on the lee of the coastal Eolianite ridge, the southern side of the tel slopes steeply and some massive walls protrude from it. From the foot of the slope to the water line there is a strip 10–15 m. wide covered by a heavy mass of fallen building stones and large blocks (Photo 9.41). Under this mass one could observe remains of some ashlar courses and paving. Looking down from the top of the tel towards the waterline, three lines of large rectangular paving slabs were visible just below the water (Photo 9.42). This paved area, some 30 m. long east–west and about 6 m. wide, was bounded at both ends by a course of huge headers. On the east these headers continued for over 20 m. before disappearing under the beach sand. To the west, they reached the lee edge of the tilted rocky platform, some 12 m. from the western corner of the pavement. The eastern edge of the coastal ridge was bounded by a retaining wall running in a curved line northward, into the tel (Photo 9.43).

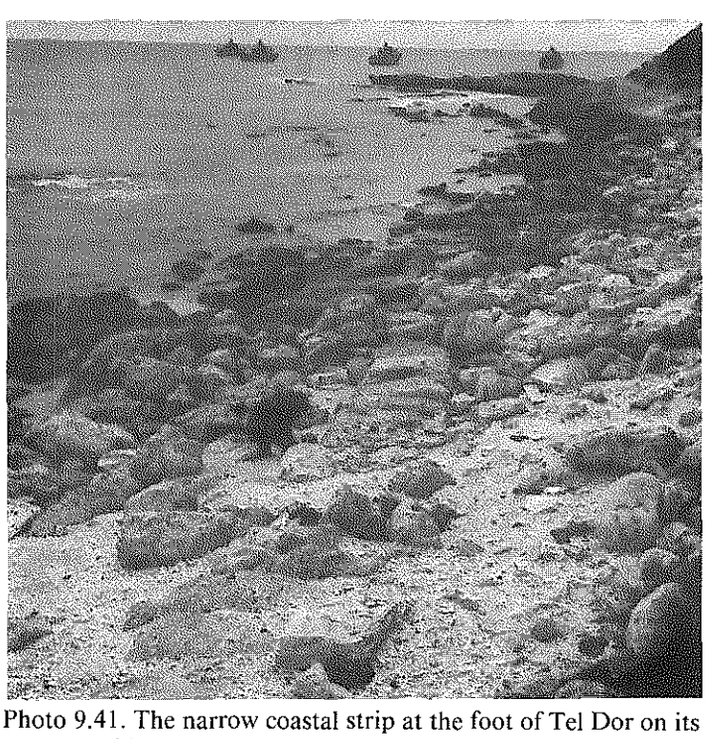

Photo 9.41. The narrow coastal strip at the foot of Tel Dor on its southern side, looking west.

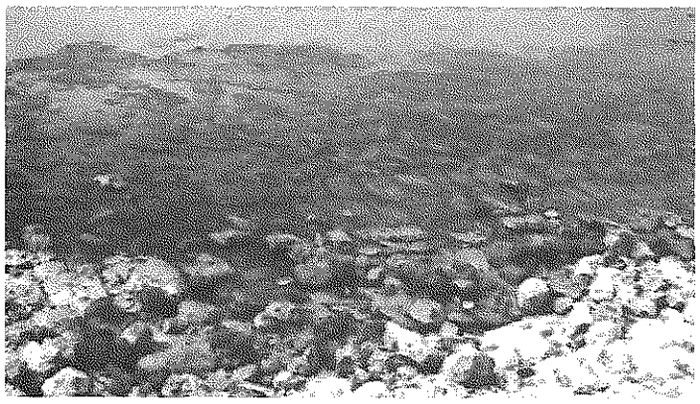

Photo 9.42. Some of the submerged paving slabs on the southern side of the tel.

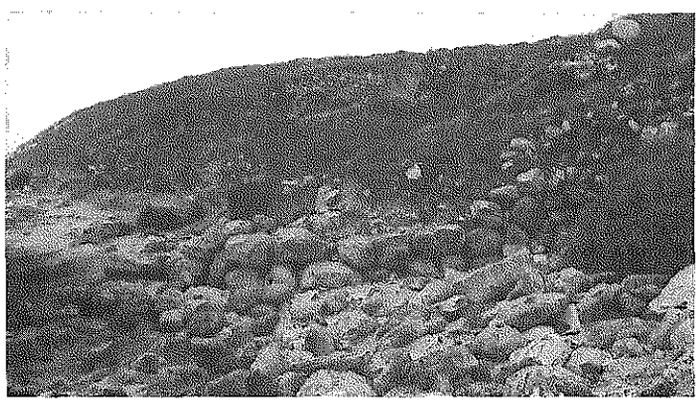

Photo 9.43. The retaining wall at the southern side of Tel Dor, looking northwest.

In 1923, a group of students from the British School of Archaeology in Jerusalem, led by J. Garstang, dug a section on the western side of the retaining wall. Their 5 m. wide trench extended down to the bedrock through six strata designated A–F.[52] The four lowest strata (C–F) comprised 3.50 m. of accumulation above the bedrock (Fig. 9.11). Four floors were found to be related to the retaining wall. The fill on top of the highest floor (stratum C, a gray pavement) contained mostly Hellenistic sherds, but also some that were described as Early Iron Age types. Below there were three floors at 2.25, 2.05, and 1.52 m. above the bedrock. The fill between the floors was of gray to brown soil with some sand enclaves. The sherds collected at these elevations (stratum D) were found to be rather homogeneous and of Early Iron Age types. The most dominant type of vessel was a holemouth jar with conical body and very sharply defined shoulders. A single piece of a decorated jug with a black pattern of cross-hatched lozenges between parallel strips of red and black, and another piece of a strainer jug, were considered by the excavators to represent the occupation of the Sikil tribe of the Sea Peoples at around 1100 BCE.[53] Stratum E was found to comprise a layer of ash or dark clay at 1.30 m. above the bedrock, which runs just below the foundation course of the wall. This layer was the lowest that contains Early Iron Age sherds, while in the sandy fill below it only Late Bronze Age types were found. The latter included Cypriot 'Milk Bowls', Base Ring, and Red-on-Black pieces. These types, which may even be dated to the end of the MB II, were also found in the lowest stratum (F), which was

Fig. 9.11. Garstang's section 1 (Garstang 1924: Fig. 1).

found to be bisected by a thin petrified layer of sand at 0.25 m. above bedrock.

From 1980 to 1984 we studied the coastal strip to the east of this retaining wall and between the submerged paving up to the slope of the tel, an area of about 65 x 20 m. (Fig. 9.12).[54] The study included a general survey of all visible structures and detailed recording of all the architectural features on land and in the water; repeated underwater survey of the floor of the southern bay; removal of selected parts of the fallen blocks by mechanical backhoe; and manual probes in seven areas designated A–G. The following text describes these probes, with summaries of their pottery; a stratigraphical discussion concludes this section.

Area F

This is the easternmost area. It contains three unrelated structures (F-1, F-2, and F-3), none of which has a clear plan.

Wall 4 (F-1) is a single course of ashlar slabs laid directly on top of a wave-affected deposition of shingle and small rubble (Photo 9.44). The surviving segment is 12.10 m. long and 1.20 m. wide. It comprises standard slabs measuring 0.60 x 1.20 m. and 0.30 m. high. Its surface is 1.05 m. above MSL at its western end and 1.41 m. at its eastern end, which terminates with a double row of stretchers (Photo 9.45). Its orientation is 264° from the north. In its mid-section the ashlars are missing for a stretch of 3.65 m. and only rubble fill, probably of the foundation, marks the line of the wall. A trial probe under this foundation fill and under the eastern end of the ashlar slabs (L. 02) exposed beach depositions made by high-energy waves with quantities of wave-worn sherds. The latest datable sherds are of Early Hellenistic types.

Wall 5 (F-2) seems to be either a defensive or a retaining wall. It is visible for over 15 m. on an orientation of 273°

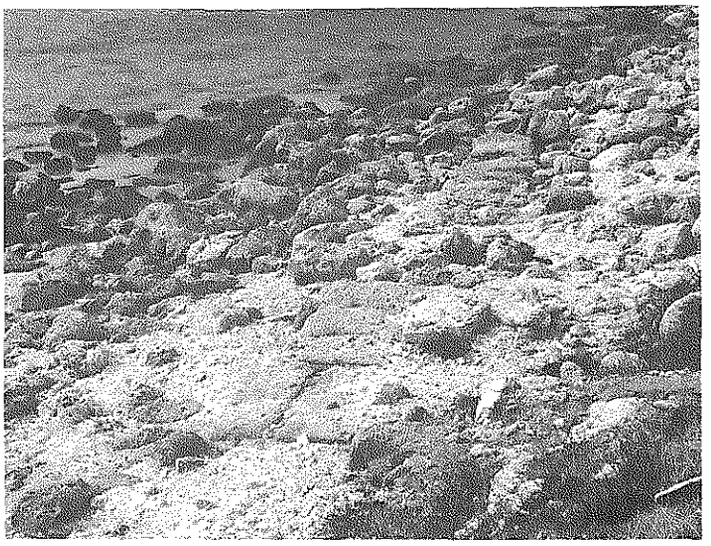

Photo 9.44. Slabs course F-1, looking west.

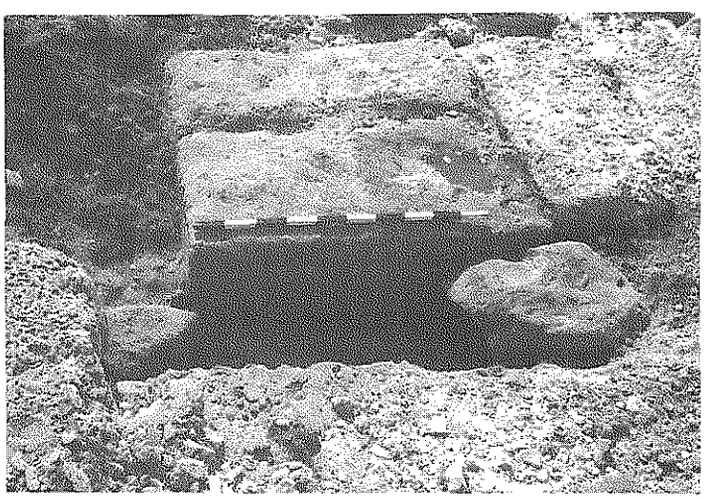

Photo 9.45. The eastern end of F-1, looking south. Note the westernmost block of F-2 on the lower left.

from the north. It backs onto the lower part of the tel's slope. A trial probe was made to expose the entire southern face of the wall along a two-meter stretch 10–12 m. east of its western visible end, which is less than half a meter south of the eastern termination of F-1. The probe (L. 01) revealed three courses of ashlars built of standard blocks, laid in headers only, each measuring 1.20 x 0.60 x 0.30 m. The first and third courses were built of blocks laid on their wide side, while the second was built with the blocks laid on their narrow side (Photo 9.46). The wall was based on what seems to be the debris of an earlier retaining wall (H; see below). The top of the wall is at 3.17 m. above MSL.

Wall 6 (F-3) is a rubble wall that runs diagonally from within the slope of the tel on an orientation of 255° from the north and over the retaining wall H for about seven meters, terminating 1.10 m. south of the central part of F-1 at a much higher level. However, it seems to be of an earlier date and to have been cut when F-1 was laid. It has survived to a height of 0.80 m., with its base at 2.90 m. above MSL.

Wall H is probably the most significant architectural feature along the eastern part of the southern side of Tel Dor. It continues for over 50 m., from next to the eastern end of F-1 to at least as far west as wall M, on an orientation of 278° from the north.

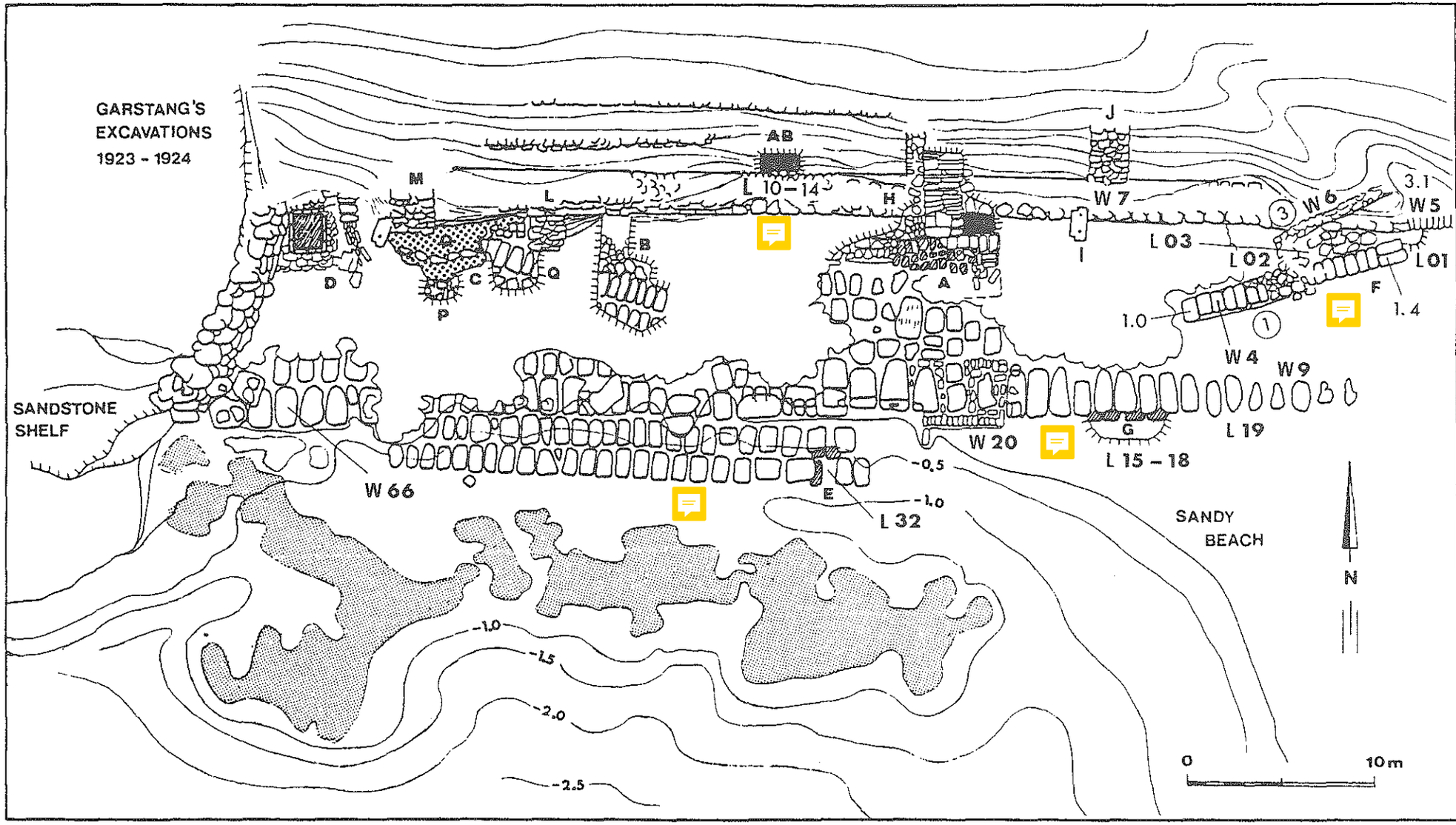

Fig. 9.12. General plan of the studied area on the southern coast of Tel Dor.

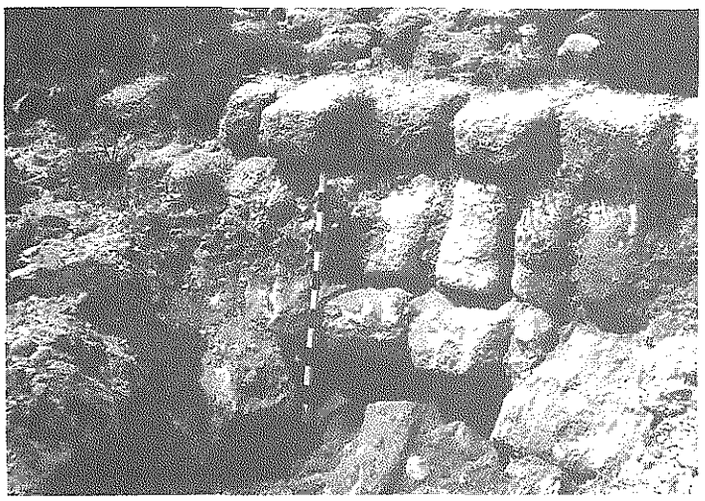

Photo 9.46. Wall F-2 in the probed area, looking north.

At one point (AB on Fig. 9.12), 33 m. west of the eastern end of wall H, a 2 x 1 m. probe (L. 10) was made manually on its northern side (Photo 9.47). The wall here is just over 2 m. wide and 1.20 m. high. It comprises a base course of large square blocks of different sizes, 0.42–0.61 m. high. Where these blocks are shorter, an underlying course of roughly squared slabs had been added. This foundation was laid on top of and into a layer of compact dark mud (L. 11) at 1.30 m. above MSL and a marine intrusion (L. 12) of shells, coarse sand, and shingle some 0.05–0.15 m. thick, at about one meter above MSL. Below the wall's base and the marine intrusion there is another layer of compact dark mud (L. 13) down to 0.84 m. above MSL, and below that a deep fill (L. 14) of fine, light sand without shells or sherds. The top of the ashlar course is 1.48 to 1.67 m. above MSL for the entire length of wall H. Over the western half of it there is an additional construction of small to medium-sized rubble which has survived to a height of 2.30 m. above MSL at AB and 4.45 m. above MSL next to wall M on the west. It seems, for both structural and stratigraphic reasons, that the rubble addition is a later one, probably from the 11th century BCE.

The pottery found in the probe at AB, which is in the lee of wall H and thus undisturbed by the waves, was of rather homogeneous character, of the transitional period from Iron Age I to Iron Age IIA, quite probably representing the first Israelite phase at Tel Dor. Stratigraphically, it is either contemporary with or postdates the wall.

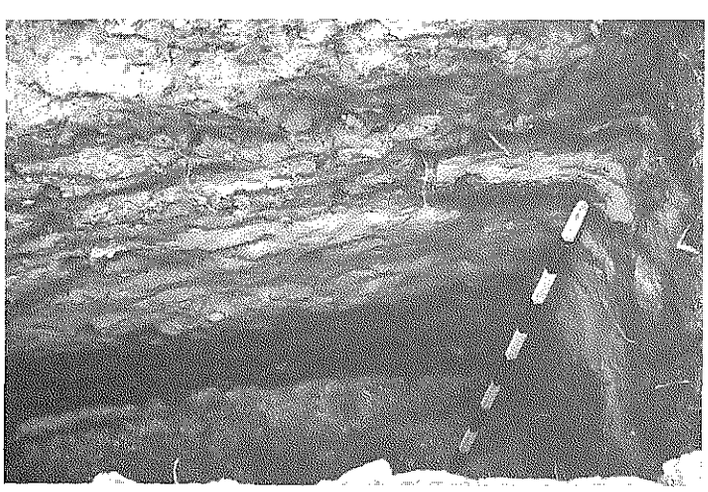

Photo 9.47. The probe at AB on the northern side of wall H, looking north.

However, below the layers of sand and gray soil at the upper level of compact mud (L. 11), the sherds represent types spanning some two hundred years: rope-smoothed, hemispherical bowls with flattened bases, early types of bar-handled bowls, and some fragments of Late Cypriot II and III 'Milk Bowls' and Base Ring II cups of inferior quality. The mud layer below the marine intrusion (L. 13) contained only sherds of the LB II, probably of the later part of that period.

Though the contexts of wall 4 and wall 5 are disturbed, the best estimate of their date is in the Hellenistic period, perhaps the 3rd century BCE. Both structures were constructed of the same blocks, and though their architectural correlation is somewhat ambiguous, they seem to have functioned contemporaneously.

Wall J protrudes from the slope of the tel, with its visible base at over 3.40 m. above MSL. It was built of large rubble blocks, most of which are limestone. It is about 1.80 m. wide and closely resembles walls L and M in Area C (see below). Next to wall J, on top of the ashlar course of wall H, was an unusual type of slab which seems to have been incorporated as paving over the base ashlar course of wall H, probably in secondary use (marked I in Fig. 9.12). It is 1.80 m. long, 0.80 m. across, and less than 0.30 m. thick. The two corners of one of its long sides were cut off, leaving a rectangular recess, probably to be fitted with a similar neighboring slab in a paved platform. On the surface of the slab there are two pierced holes, most likely made for the insertion of a hoisting rope. Broken parts of similar slabs are scattered among the debris on the shore nearby and farther to the west, and in Area D. It is intriguing to recall that such distinctively shaped slabs, with the same dimensions and pairs of vertical holes, were found comprising the pavement on top of the so-called 'bastions' of the Cyclopean wall in Area II of the excavations at Kition in eastern Cyprus (the area known as Kathari), on low ground next to the temenos of the temples.[55]

Area G

This area comprises a single architectural feature, a massive line of huge adjacent headers, running east–west for about 30 m. It may be divided into two segments.

The western part comprises 10 blocks each 3.80 m. long and over 1.50 m. wide. The upper parts of these blocks have been abraded by surge to various extents over time; the best-preserved block has its top at 0.71 m. above MSL and its base 0.40 m. below sea level. Abrasion has also affected the vertical sides of the headers which face the sea, and it is quite likely that their original length was as much as 4.50 m.; in other words, each block originally weighed over 20 tons. These blocks were laid on pure fine sand containing no shells and only a few sherds (L. 16); among these there were a complete vessel, a crude deep bowl or krater (Fig. 9.13:1), the upper part of a pithos of the collared-rim 'Galilean' type (Fig. 9.13:2), part of an oil lamp (Fig. 9.13:3), and part of a strainer jug decorated with brown-red painted stripes (Fig. 9.13:4). These sherds were found next to the blocks in undisturbed sand and their stratigraphic context suggests that they were deposited not long after the course had been laid.

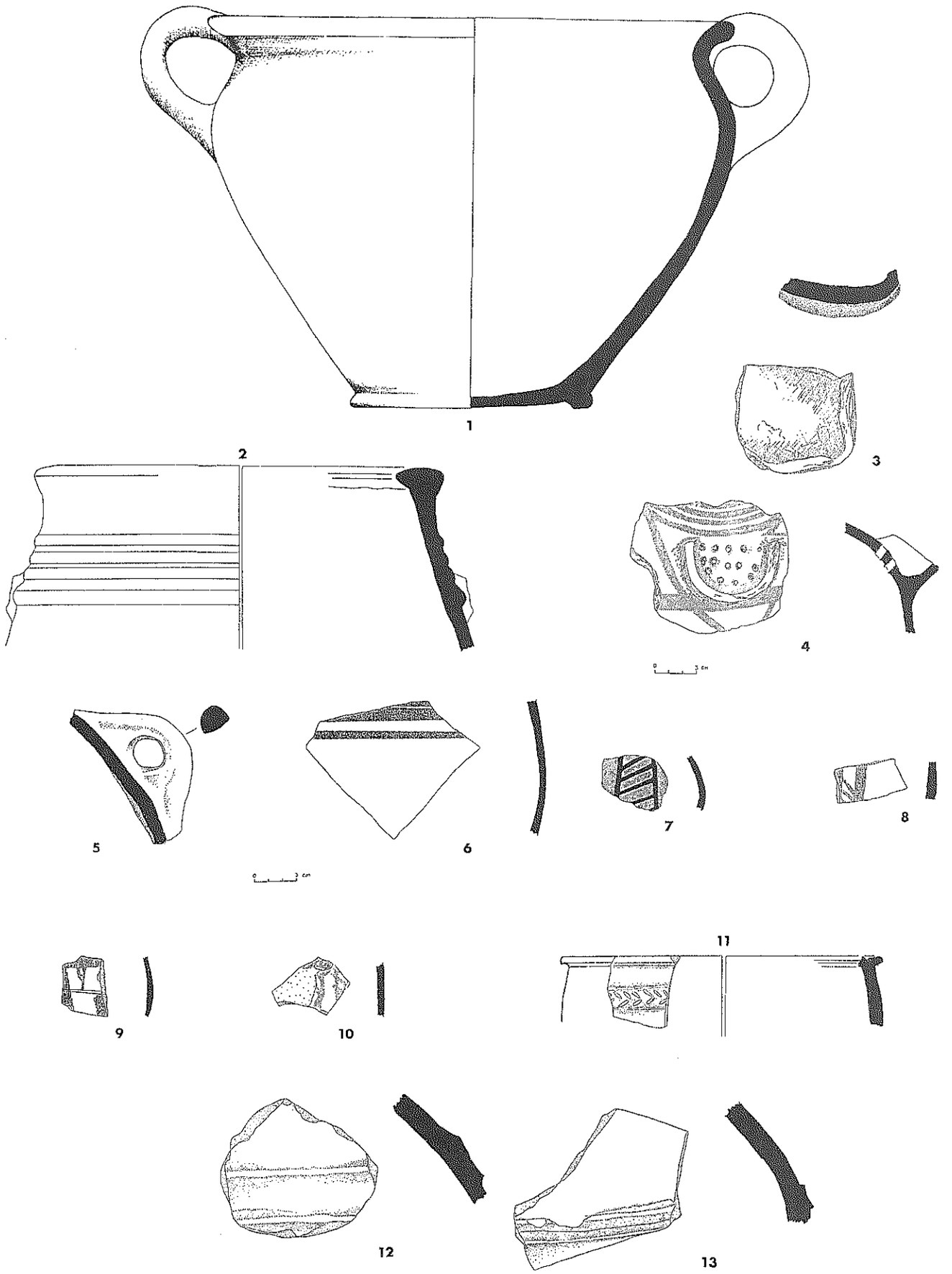

Fig. 9.13. Pottery from the probes in Areas G and A.

Fig. 9.13.

No.	*Type*	*Reg. No.*	*Loc.*	*Color*	*Remarks*
1.	Krater	G/T-XIV,64	16	5YR6/4	Crude, wave-worn
2.	Pithos	12-82,63	16	10YR4/1	Large white grits
3.	Oil lamp	10-82,10	16	10YR5/2	Wave-worn
4.	Strainer jug	12-82,43	16	5YR5/1	Dark red stripes
5.	Pierced jar handle	16-83,1	18	75YR6/4	Large quartzite grits
6.	Jar	9-81,21	25	10YR6/3	Dark brown stripes
7.	Pilgrim flask	2-80,9	25	5YR5/4	Reddish-yellow burnish, black painted stripes
8.	Cyp. Milk Bowl	2-80,3	25	10YR4/2	Dark brown burnish, dark brown paint
9.	Cyp. BR II	IV-80,8	25	10YR6/1	Burnished
10.	Jug	9-81,11	30	7.5YR6/4	Brown-red painted decoration
11.	Small krater	B-81,9,8	30	5YR6/4	Burnished, incised decoration
12.	Pithos	B-83,13	30	5YR5/5	Yellowish slip, Tyrian type
13.	Pithos	B-83,17	3	5YR5/3	Yellow slip, Tyrian type

In most cases the fill along the southern face of the course (L. 15) was found to be wave-disturbed, with recent redeposition of wave-worn sherds of all periods and even some plastic bags (Photo 9.48). Some offset flat slabs similar to those which comprise the quay in Area E were found in the water, next to the huge blocks. Thus, it may be assumed that the quay originally continued as far east as this part of structure G. The fine sand continues below the structure and at 0.60 m. below MSL there is a thin and well-defined layer (L. 17: 0.20 m. thick) of shells, wave-worn sherds, and small rounded fieldstones. The sherds are of the late 13th and early 12th centuries BCE. Below this level there is sterile fine sand without shells or sherds (L. 18). At 1.45 m. below MSL is a surface of very hard, compact mud, from which a few sherds of Chalcolithic and EB I date were collected (Fig. 9.13:5).

Photo 9.48. The sand fill below the blocks of structure G.

The eastern segment is built of somewhat smaller headers in two courses; there are no remains of paving slabs to its south. The lower course was made of headers 1.10 m. wide, 0.90 m. high, and 2.20 m. long. Of this course only the westernmost block has survived *in situ*. East of it, the probe established that the fill behind consisted of rubble and roughly flattened slabs (Photo 9.49). On top of that course was another one, probably of the same type, though its blocks have been almost completely worn away by the waves. Thirteen blocks of this course have survived to a recognizable extent. This eastern part was probably added to the western one in a period when the wave energy inside the bay was similar to the present, resulting in the deposition of much less sand and more coarse material, such as rubble, shells and wave-worn sherds (L. 13, just west of L. 15). These sherds are all of Early Iron Age types, probably dating from the 11th century BCE.

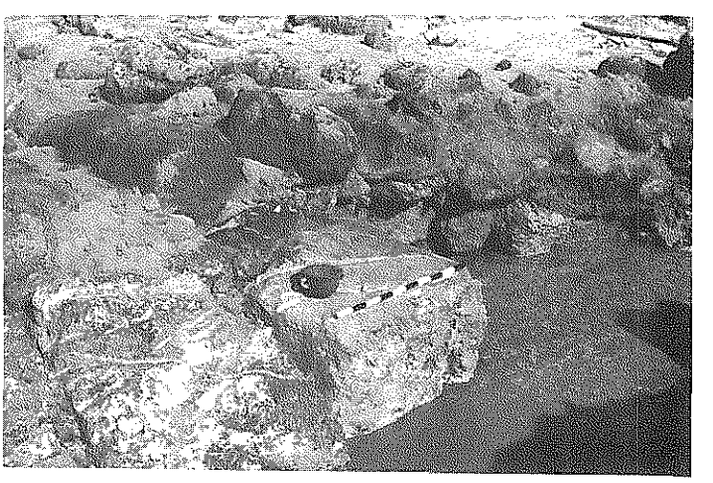

Photo 9.49. The central part of structure G, showing the blocks of both segments and the fill behind the eastern one, looking northeast.

The western six blocks of structure G were leveled in some later period to serve as a floor for a rectangular structure of unknown date (wall 20). Its date is probably considerably later than structure G; this may be deduced from the fact that there was a need to add smaller ashlar slabs in order to fill in those parts that were already abraded to below the desired floor level (+0.20 m.). This floor was originally 10.40 m. long along its waterfront and 4.80 m. wide, and very likely served as a quay (Photo 9.50). In order to achieve an adequate water depth next to it, the eastern part of the earlier quay E had to be removed. The extra depth entailed additional exposure to the surge, and the smaller blocks of the western side of the new quay have been carried away, leaving the grooved edges of the earlier blocks as evidence for their existence (Fig. 9.14).

Photo 9.50. The later quay in Area G, looking east.

The third block from the west in structure G has a vertically pierced hole near its seaward side on the part that was later trimmed for the slabs of the new quay. Consequently, the original surface of the hole, which might have given an indication of its function, has not been preserved. It may have been a mooring pierce (though in this case one would expect to find traces of rope cuttings around its rim), or perhaps a socket for a mooring post.

Area A

This is the part of the coastal strip to the north and adjacent to Area G, extending to the base of the tel behind wall H (Fig. 9.14; Photo 9.51). This area had an extensive cover of fallen blocks that had to be removed mechanically; subsequently a trench 5 m. wide was dug manually.

The area to the lee of structure G, on its north, was found to be disturbed and filled with a wave-deposited mixture of rubble, shells, and rounded sherds of many periods. Some 4 m. north of the back of structure G there is a single block of much the same type, with its southern end at 0.32 m. above MSL; the rest had been leveled to 0.23 m. above MSL. This slanted edge is in line with what seems to be a sub-surface fill of rubble for a rectangular pavement (L. 22). This pavement was found to have two phases. The first (L. 23) is about half a meter above the sea and comprises flattened, rectangular ashlar slabs around the edges and of irregular shape inside

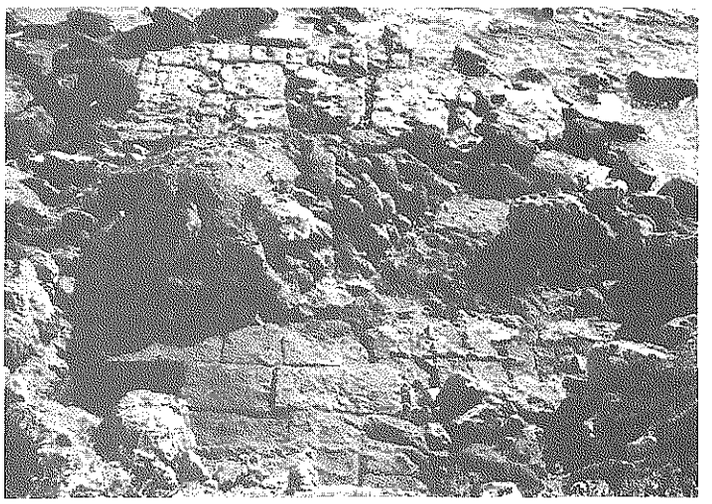

Photo 9.51. General view of Area A, looking south.

the perimeter (see the darkened structure in Fig. 9.14). This structure was laid on fine sand containing no shells or sherds. A probe along its eastern edge (L. 25) exposed a heavy intrusive layer of dark compact mud that extends to the north and is wedged off towards the base ashlars at the southern face of the structure (see Fig. 9.15A). In the mud were sherds of the LB II, including decorated pieces of Cypriot 'Milk Bowls' and other painted sherds (Fig. 9.13:6–9). It is clear that the mud was dumped after the paving slabs had been laid and thus that the structure must be dated to the LB II, probably to the late 13th century BCE.

The state of preservation of the floor did not permit us to establish its southern and western boundaries. There are stratigraphic reasons to suggest a continuation, or at least some correlation with structure G.

In a somewhat later phase, and after the deposition of the black mud, a new pavement was laid on top of the flat slabs (L. 24). This new pavement was built of carefully squared slabs of various sizes. Around the edges were rather regular slabs of two lengths, 0.80–0.90 m. and 1.05–1.15 m.; both were 0.55–0.60 m. wide. The thickness of the slabs varies from 0.22 to 0.60 m. in order to achieve a level surface over the uneven base. The slabs were tightly laid, creating a surface 0.81–0.82 m. above MSL (Photo 9.52). Though only the

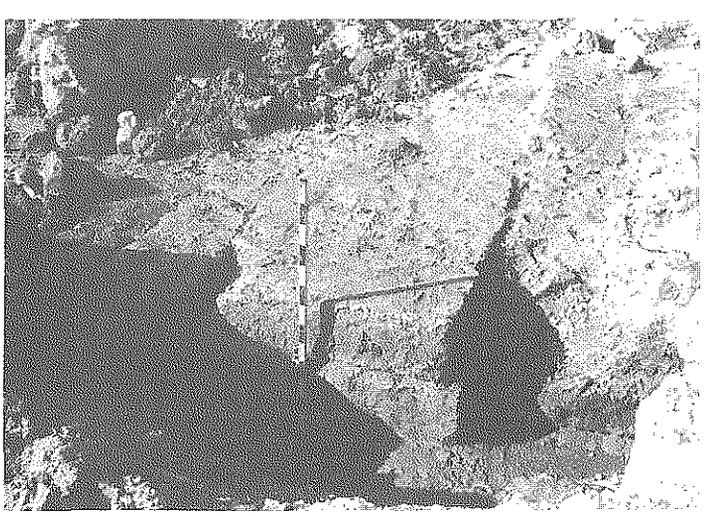

Photo 9.52. The northeastern corner of the rectangular quay (L. 24), looking west.

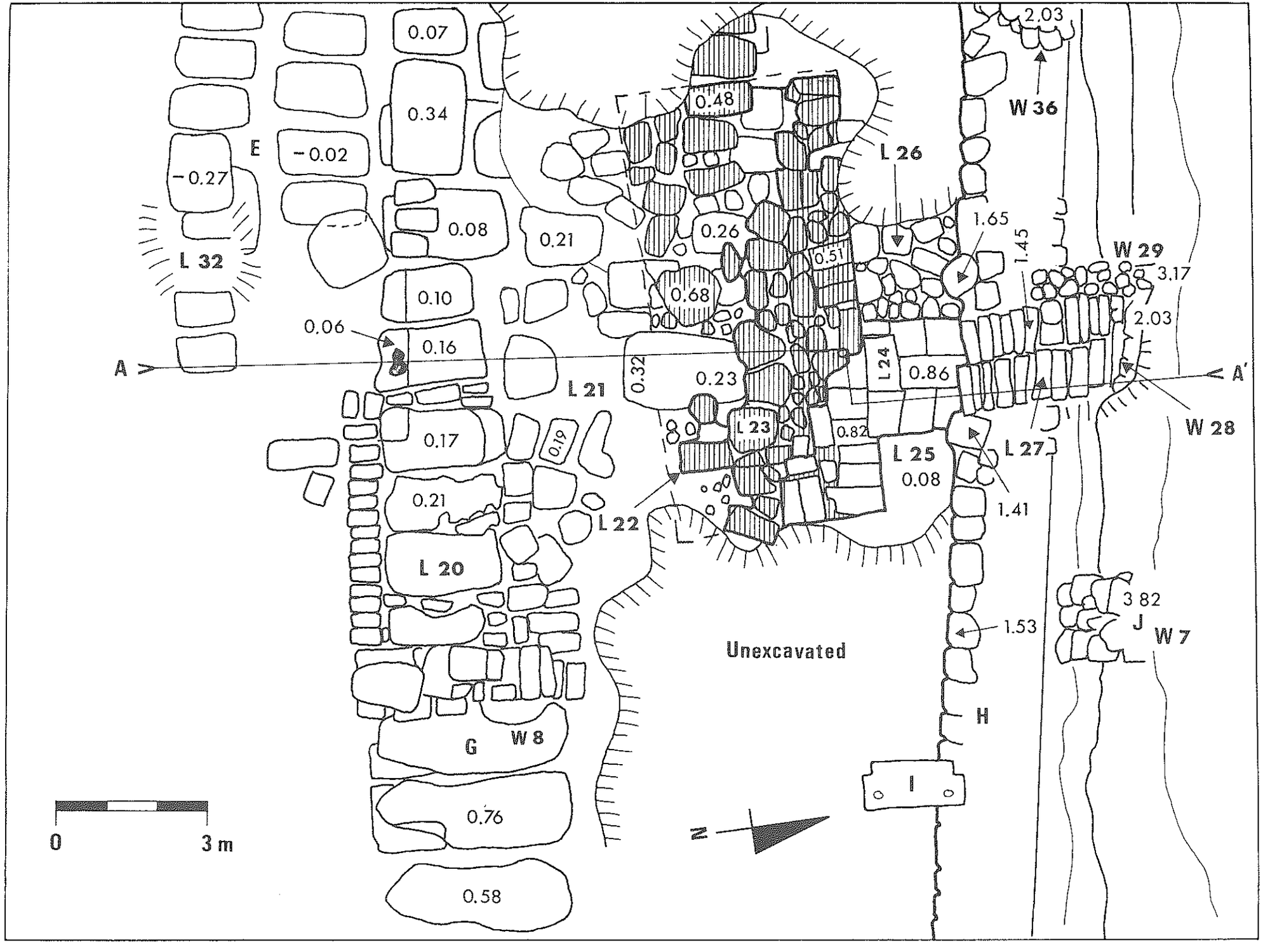

Fig. 9.14. General plan of Area A′ and the western side of Areas F and G.

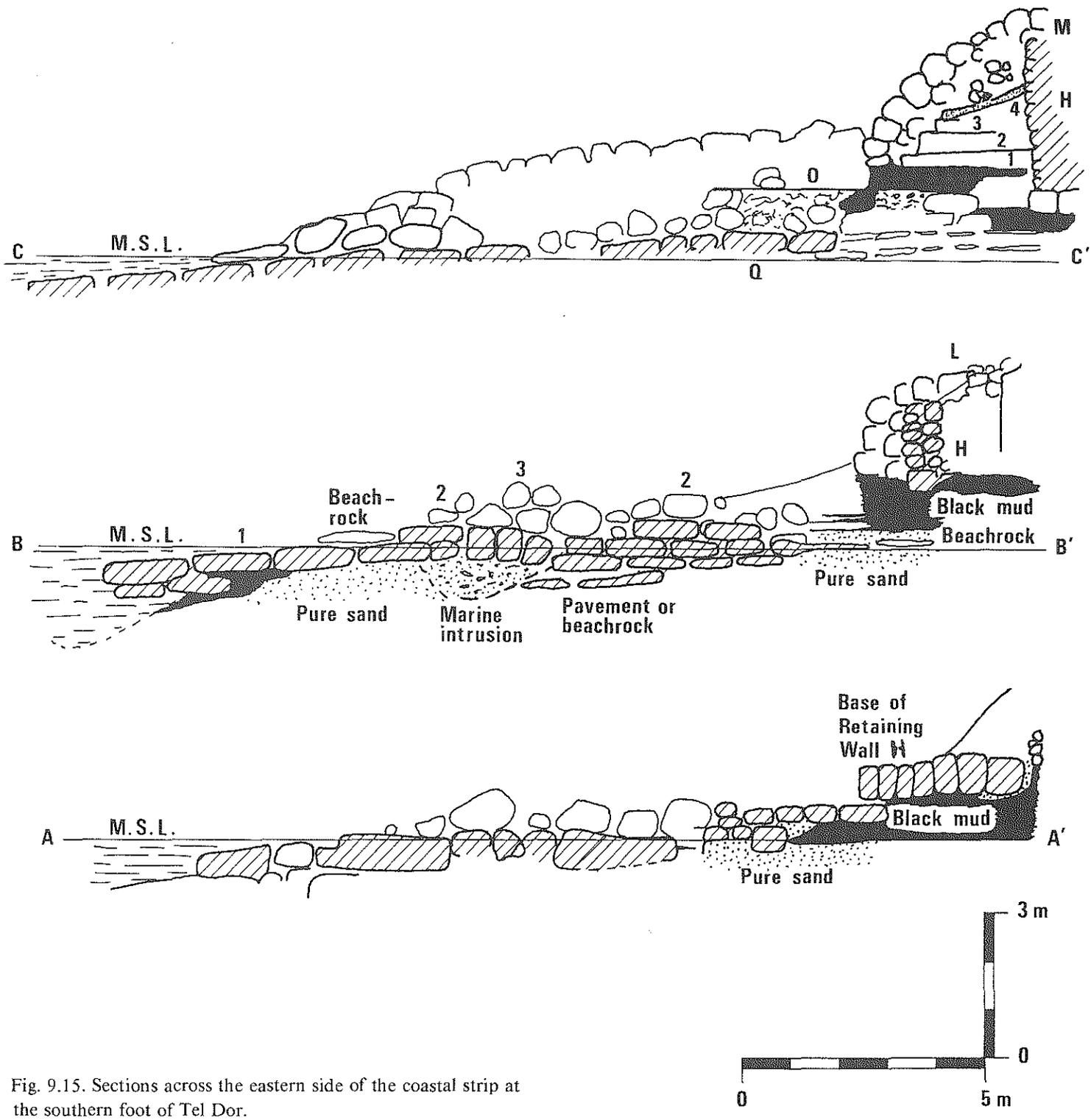

Fig. 9.15. Sections across the eastern side of the coastal strip at the southern foot of Tel Dor.

northeastern corner and most of the northern and eastern sides of this structure have survived intact, one can reconstruct an elevated, free-standing rectangle measuring 4.30 x 9.10 m. These dimensions, and the concept of a free-standing rectangular quay, are most closely paralleled by the two 'bastions' of Kathari in Kition (Photo 9.53). There, the dimensions of the better-preserved one are 13.40 x 4.60 m. and the paving slabs are similar to ours.[56]

This rectangular quay was connected to the built-up area of the settlement by a 2.50 m. wide pavement at its surface level. This paved passage was found intact. It is presently exposed for a distance of no more than 1.80 m., and farther to the north it disappears under wall H. This pavement was laid on the mud, with shells and wave-carried sand (L. 26) over it indicating some marine flooding prior to the establishment of this structure. At a later date many of the slabs from the rectangular quay were removed and reused, laid on their narrow sides in two adjacent courses — the eastern one comprising longer slabs (1.10–1.15 m.) and the western consisting of slabs 0.75–0.90 m. long. The new structure (L. 27) has the appearance of a roughly laid raised pavement, leading northwards towards the tel (Photo 9.54). It is about 1.90

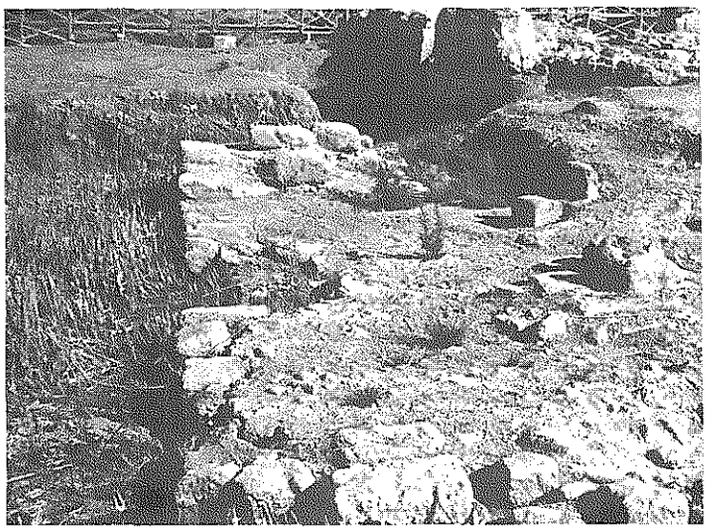

Photo 9.53. 'Bastion' No. II at the Kathari excavations in Kition, looking southeast.

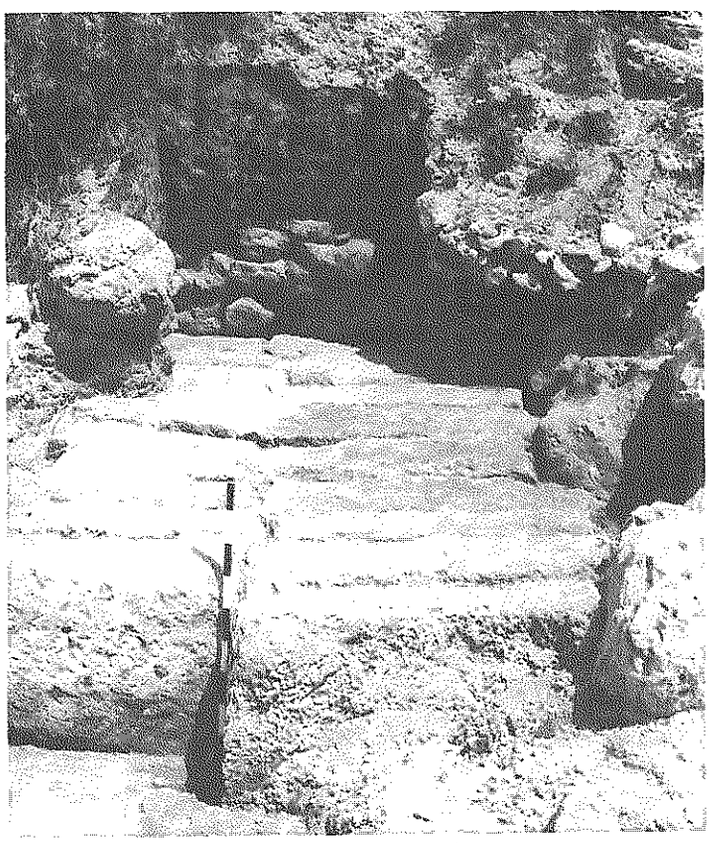

Photo 9.54. The higher pavement leading from the seashore to the settlement in Area A, looking north.

m. wide (though the width is not even) and was exposed for a distance of 3.40 m. up to the point where it was overlaid by a cross wall (wall 28) made of courses of medium-sized field stones (Photo 9.55). The surface of this paved passage is 1.45 m. above MSL; because of its rough construction and uneven surface it was probably plastered over.

Heavy depositions of seashells below and around the sides of this raised structure indicate that at the time the surge had reached that area. This may have been the reason for building the raised pavement in what seems to be a rather hasty manner (Photo 9.56).

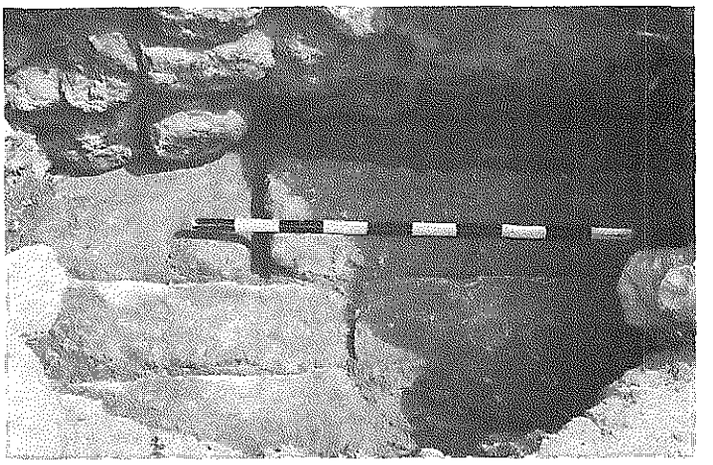

Photo 9.55. Close-up of the northern end of the higher pavement in Area A and the rubble cross wall above it, looking northwest.

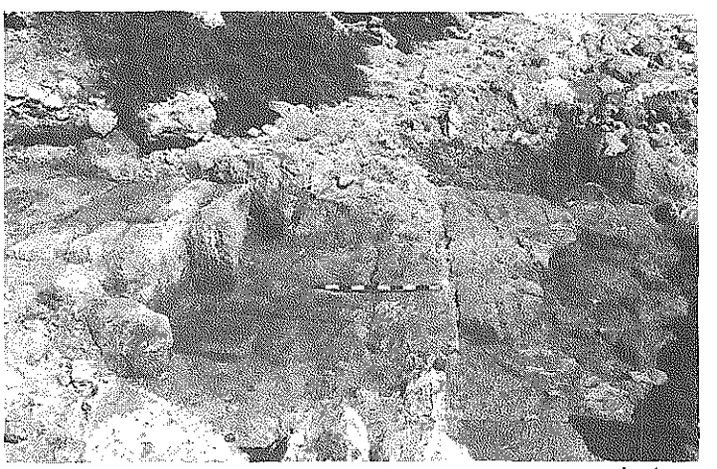

Photo 9.56. The remaining paving of the rectangular quay in Area A and the two pavements, looking east.

Area E

This area is actually a single architectural unit: the partly submerged quay. It is a rather even pavement of regular flat slabs measuring 1 x 1.70 x 0.25–0.35 m., laid in rows with their shorter sides facing the sea front (Fig. 9.12). The two rows to the south are clearly visible in the water for a distance of 26 m. on the east–west axis, with their southern edge some 14 m. to the south of and roughly parallel to wall H (Photo 9.57). Probes made in Areas A, B, and C exposed at least two more rows to the lee of the inundated ones, suggesting that the original width of the pavement was about 6.80 m. The study of Area G suggests that this pavement continued for an additional 10 m. to the east, consisting of only the two southern rows of slabs. On the west the quay is lined with a course of larger headers, much like those on the eastern flank of structure G. This western course (wall 66) is about 10 m. long, retaining the well area (D) on its lee. It consists of 6–7 units, of which the four western ones were laid on the bedrock, on the lee of the coastal ridge (see also below).

Attempts were made to date this quay and to study its base. Unfortunately, from all the probes along its southern side it became clear that undertrenching and fluidation by sea water had disturbed the original stratigraphy. This disturbance and intrusive replacement of material below the pavement was observed as far as the third row from the

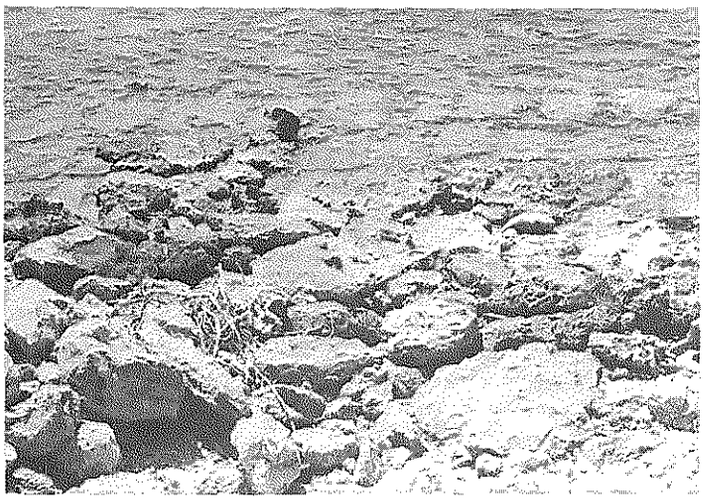

Photo 9.57. The submerged central part of quay E, looking south.

south, in trenches made adjacent to Areas A and C. Another probe on the southwestern side of Area G (L. 32) yielded the same kind of data: a mixed fill of coarse sand, shells, and wave-worn sherds of all periods was found below the structure, to about 0.60 m. below MSL. Underneath there is sterile, fine sand, and at -1.40 to -1.50 m. appears the top of the compact clay (see above). In all three probes an underlaid paving slab was noted (see Fig. 9.15).

In an attempt to study the issue, a mechanical trench and a manual probe were made next to and to the south of Area B (L. 30). The slabs of the third and fourth rows were removed along a two-meter wide trench (on a north–south axis) and the levels underneath were studied. It became apparent that these slabs were laid directly on fine sand, with only a few shells. Some fragmentary sherds were collected at that level, all of which are of LB II types, including a piece of a Cypriot White Slip II 'Milk Bowl,' a Canaanite krater bearing molded decoration with an incised herringbone pattern, and two sherds from large pithoi of the Tyrian type with a broad molded stripe (Fig. 9.13:10–13).

Behind this undisturbed point, to the north, the original layout had been altered in antiquity either by man or by the elements. On top of a fill consisting of a heavy marine intrusion, which includes some rounded sherds of both LB II and early Iron Age I types, a new course of ashlar blocks was added (wall 31), with their surface level at 0.40 m. above MSL. This intrusive hollow cuts through a thin layer of flat slabs at 0.70 m. below MSL (wall 32), either an earlier paving or (more likely) plates of natural beachrock that slopes down gently from the north towards the sea (Fig. 9.15B).

Area B

This is a probe measuring 5 x 5 m. adjacent and to the south of wall H and next to the eastern side of wall L. On its southern side this manual probe was continued by mechanical backhoe towards Area E (see also above).

The area for the probe was selected at a spot with minimal cover of fallen blocks next to the segment of wall H where there is the additional rubble wall on top of it, and extended to the west as far as the corner of wall H with wall L. To the south the dig extended as far as the marine intrusion behind wall Q (see Figs. 9.15B, 9.16).

The trench next to wall H exposed its base and the stratified sediment under it, down to the sea level (Photo 9.58). The foundation trench for wall H was dug into a gray soil containing some LB II sherds to about 0.80 m. above MSL (L. 35). An uneven base course of ashlar blocks, packed rubble, and flat slabs was laid in the trench up to 1.15 m. above MSL; on top of it were a carefully laid course of ashlars 0.32–0.46 m. high and a paving of large flat slabs of the same type as the unusual slab in Area F. On top of the paving slabs was added in a later phase a broad retaining wall, built of ashlars and roughly squared rubble of various sizes (wall 36). This wall is clearly tilted southward, probably due to the weight of the tel's slope which it retains. To the west, this wall passes behind wall L, which is later (at least constructionally) and is a 2.10 m. wide structure of huge limestone blocks, with some packed *kurkar* rubble in between. It was laid into dark, compact mud (L. 47), a matrix which had been used to fill in the foundation trench of wall H (Photo 9.59), at 1.75 m. above MSL.

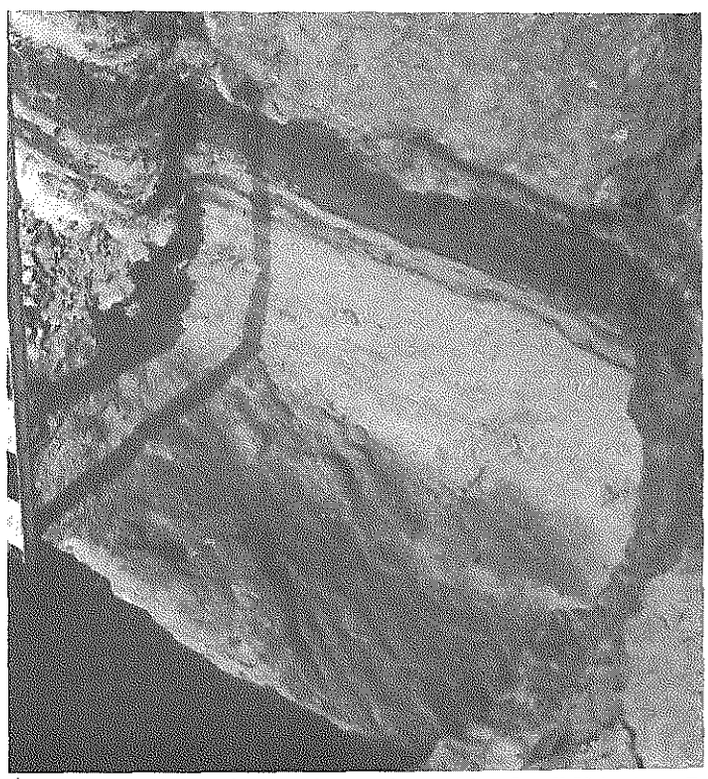

Photo 9.58. The section on the southern side of wall H in Area B, looking north. The meter rod stands at 0.30 m. above MSL.

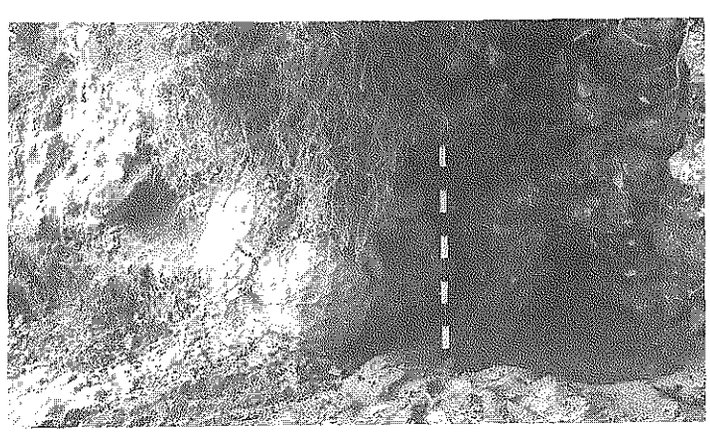

Photo 9.59. The corner of wall L (on the left) and wall H, at the beginning of the excavations, looking northwest.

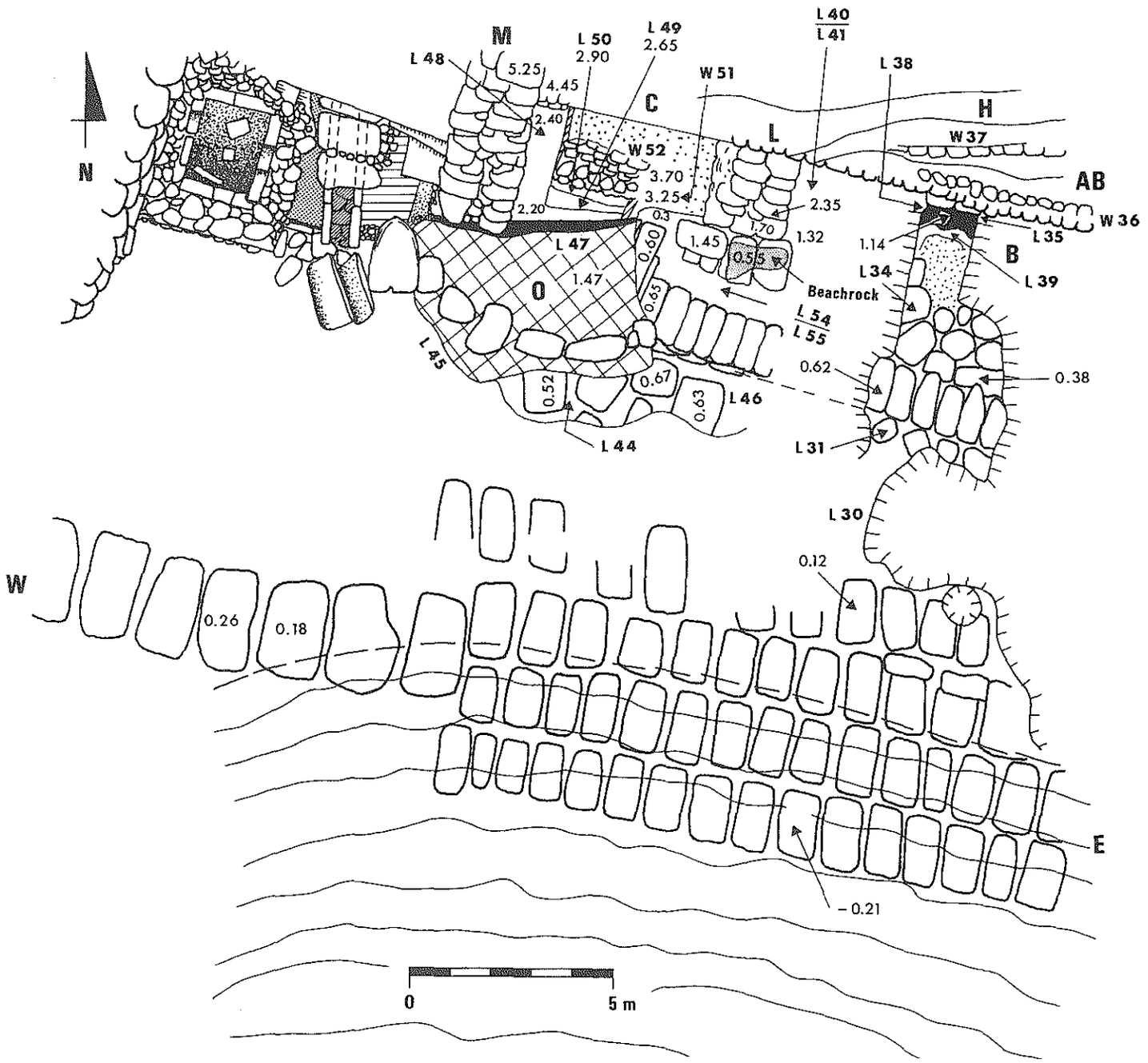

Fig. 9.16. General plan of Areas B and C.

Next to the corner between these two walls there was a talus of fallen debris from later structures, including a crumbled mudbrick structure buried in white sand, and below that piled material of gray matrix. The upper part of the talus (L. 40) included many sherds of 10th-century BCE types, mainly of medium-sized and small bowls with short, vertical rims and flat bases. Among the sherds retrieved from the sandy context of the crumbled, mudbrick structure (L. 41), which predates wall L and is stratigraphically below it, there are some sherds of the collared-rim type of pithoi (Fig. 9.17:1–3) and other Iron Age I vessels (Fig. 9.17:4–5).

In the eastern side of trench B the compact, dark, plastic mud that had been used to fill in the foundation trench of wall H reaches the base of the ashlar course at 1.24 m. above MSL (L. 38). Below the wall and the bottom of trench are alternating varves of sand and brown clay. At 0.80 m. above MSL there is only white sand, with no shells or sherds (L. 39). At 0.45 m. and 0.28 m. above MSL are two rock-hard calcified layers of either kurkarized (carbonized) sand or beachrock, indicating beach processes with minimum wave energy.

A short distance south of the foundation trench of wall H the stratigraphy was found to be disturbed by a marine intrusion of considerable wave force (L. 34). Tumbled blocks mixed with seashells and rounded sherds fill the hollowed gaps of almost two meters, to the lee of and above a course of slim, long ashlar headers, the top of which is at 0.62 m. above MSL (Photo 9.60). Seven blocks of this course (Q) have been exposed, oriented at 287° from the north; they are not oriented with either wall H or quay E. The blocks are 0.90–1.20 m. long, 0.60–0.70 m. wide, and 0.35–0.40 m. high. The course has a straight, even edge towards the south, but on its lee, to the north, it seems to have been incorporated with additional paving slabs, most of which were found tilted and shifted from their original site by the above-mentioned marine intrusion of high wave energy.

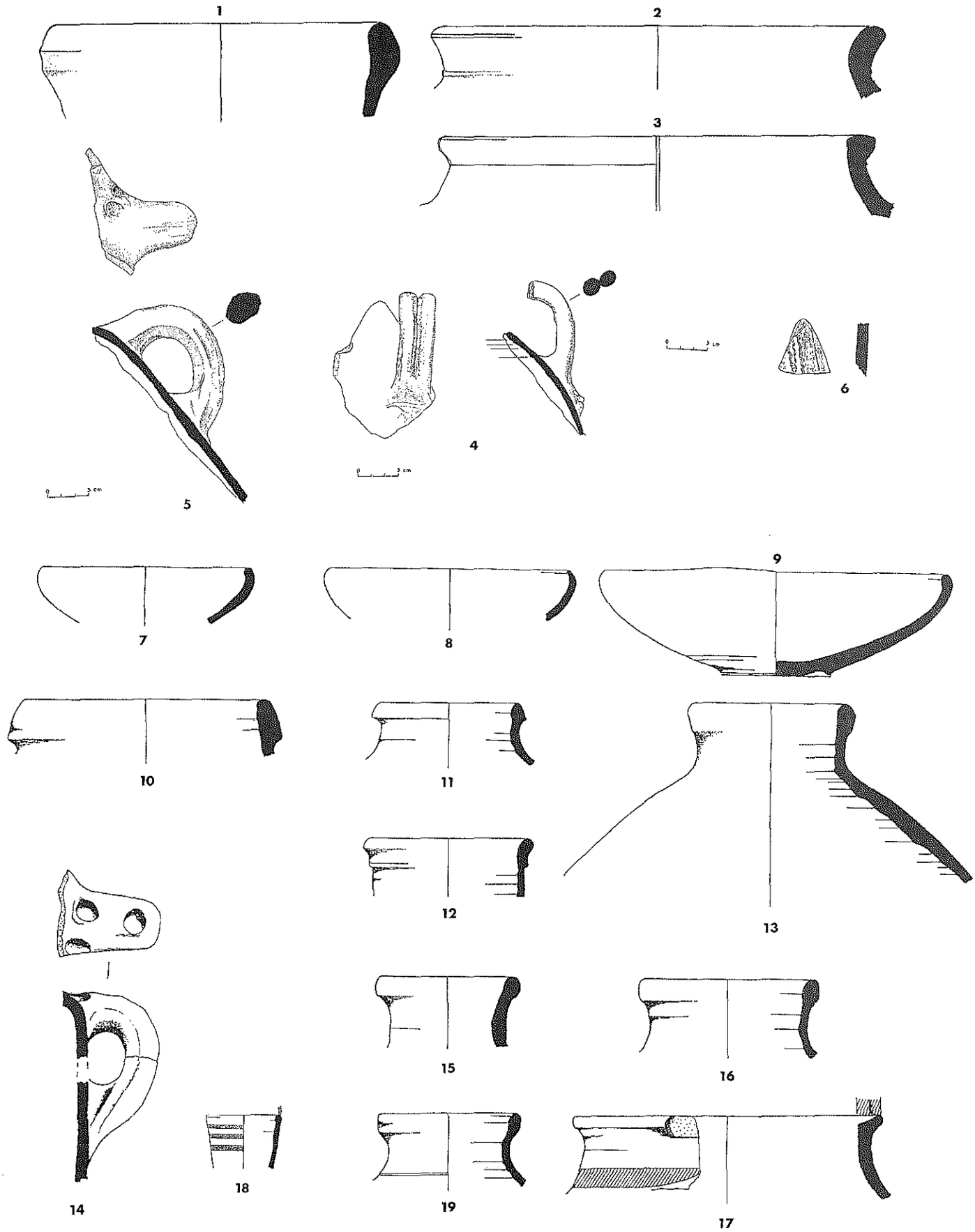

Fig. 9.17. Pottery from L. 41 in Area B and the 'Red Floor' in Area C.

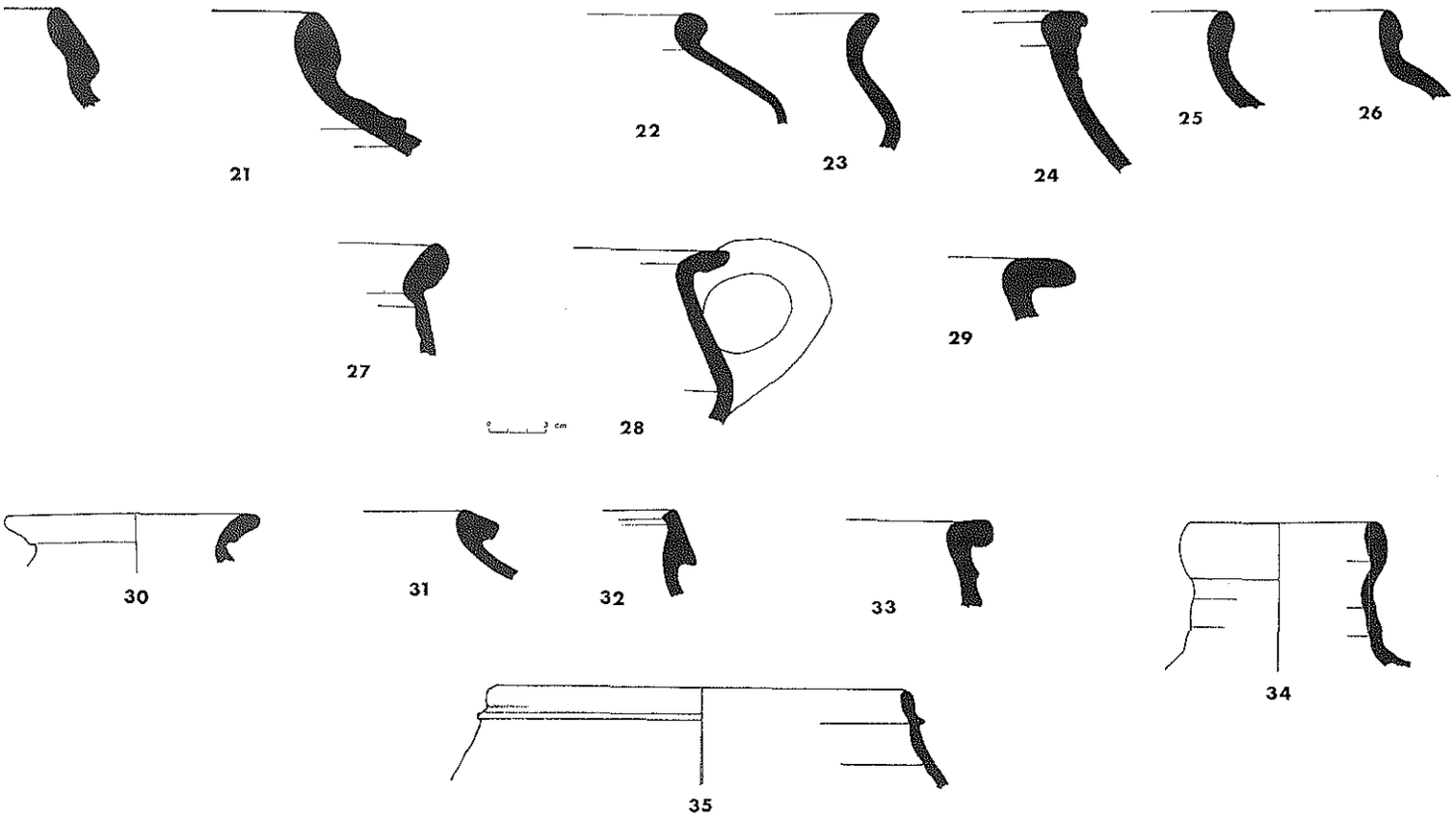

Fig. 9.17.

No.	*Type*	*Reg. No.*	*Loc.*	*Color*	*Remarks*
1.	Jar	1, 81-B,2	41	10YR6/4	Few mixed grits
2.	Pithos	2, 83-B,7	41	10YR6/3	Collared rim
3.	Pithos	2, 83-B,8	41	7.5YR6/2	Collared rim
4.	Jug	4, 82-B,3	41	10YR4/1	Cyp. WP II-III
5.	Jar	3, 82-B,3	41	5YR5/1	Double pinched handle
6.	Juglet	2, 82-D,13	55	7.5YR7/3	Dark and light brown painted decoration
7.	Bowl	II, 81-5/1	45	5YR5/2	
8.	Bowl	II, 81-5/2	45	7.5YR5/1	Brownish slip
9.	Bowl	II, 81-5/4	45	7.5YR4/1	Rope smoothed
10.	Pithos	II, 81-5/7	45	7.5YR5/4	Collared rim
11.	Jar	II, 81-5/6	45	5YR5/1	Yellowish coating
12.	Jar	II, 81-5/10	45	10YR6/1	Limeish coating
13.	Jar	II, 81-5/5	45	10YR6/3	
14.	Jar	II, 81-5/8	45	10YR4/1	Three finger-pinched handles
15.	Jar	II, 81-4/1	45	5YR5/1	Yellowish coating
16.	Jar	II, 81-4/2	45	7.5YR5/3	Limeish coating
17.	Krater	II, 81-4/3	45	7.5YR6/2	Brown-red painted stripes
18.	Jug	II, 81-4/4	45	7.5YR4/2	White slip, dark red painted stripes
19.	Jar	II, 81-4/5	45	10YR6/1	
20.	Pithos	4, 82-40/1	45	10YR6/3	Collared rim
21.	Pithos	4, 82-40/2	45	7.5YR6/2	Collared rim
22.	Krater	4, 82-40/3	45	5YR5/1	Buff coating
23.	Krater	4, 82-40/4	45	10YR6/2	Gray coating
24.	Krater	4, 82-40/5	45	7.5YR4/2	Whitish coating
25.	Krater	4, 82-40/6	45	7.5YR5/3	
26.	Krater	4, 82-40/7	45	5YR5/3	Yellowish coating
27.	Krater	5, 82-40/8	45	5YR4/3	Remains of brown slip
28.	Krater	5, 82-40/9	45	7.5YR4/1	Yellowish coating
29.	Krater	5, 82-40/10	45	5YR5/3	Whitish coating
30.	Jar	5, 82-40/11	45	10YR6/1	Dark gray coating
31.	Cooking pot	5, 82-40/12	45	10YR3/2	Large grits
32.	Cooking pot	5, 82-40/13	45	7.5YR3/3	Quartz grits
33.	Krater	5, 82-40/14	45	7.5YR4/2	Buff coating
34.	Jar	5, 82-40/15	45	10YR5/1	Yellow-gray coating
35.	Cooking pot	6, 82-40/19	45	10YR3/2	Small grits

Photo 9.60. The ashlar blocks of Q in Area B, looking northwest.

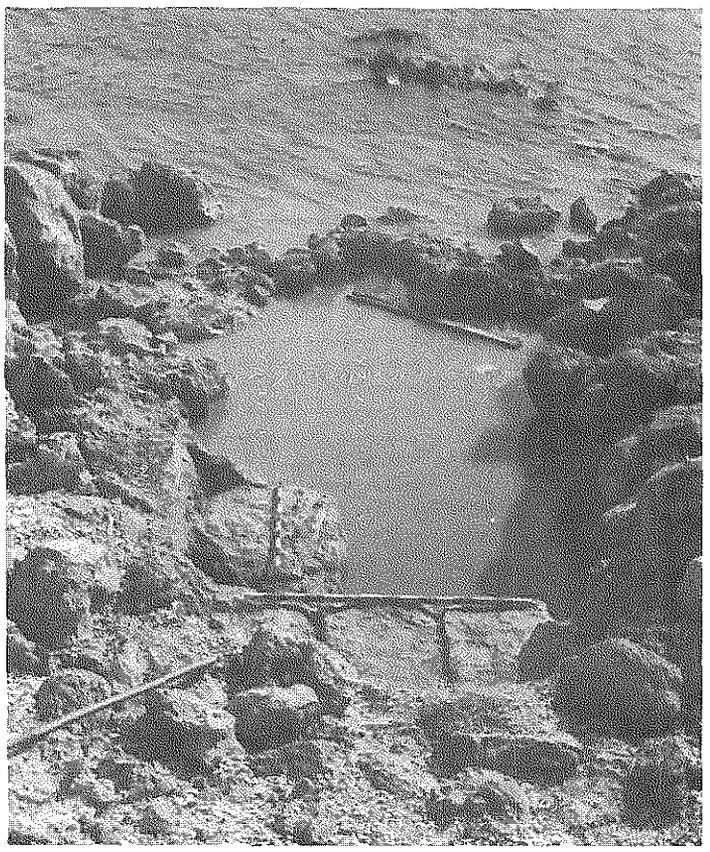

Photo 9.61. The quays in Area B, the flooded mechanical probe, and quay E behind, looking south.

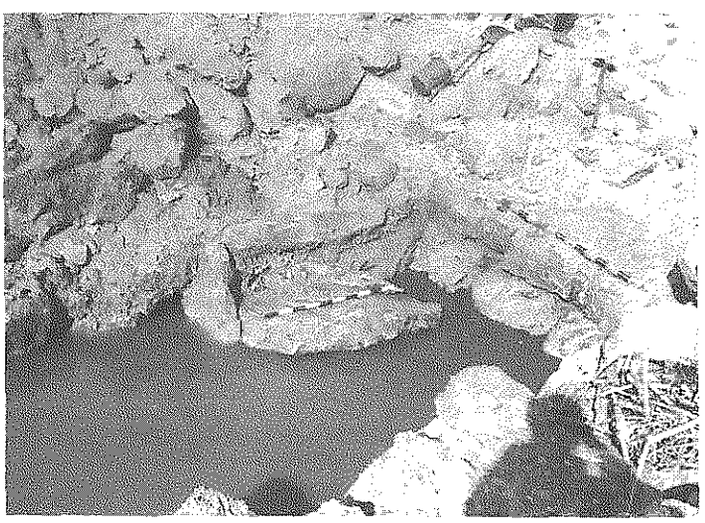

Photo 9.62. The walls 31 (below) and Q on the southern side of Area B, looking northwest. Note the marine-intrusive shells (L. 33) between the two platforms, above the meter rod.

During the combined mechanical and manual probe on the southern side of course Q a lower course was exposed, of somewhat larger slabs, with its base at 0.12 m. below MSL, on sterile sand. Next to it to the south, and at the same level, there are some flat rectangular slabs and square blocks of a later structure (wall 31) postdating the marine intrusion mentioned above (Photos 9.61, 9.62). The sherds retrieved from below this later platform (L. 33) are mostly wave-rounded and of Early Iron Age types (see also above, Area E).

Area C

This is a stratigraphically complicated and multiphased series of walls, floors, and depositions just west of Area B. The three architectural features spanning the two areas are the limestone wall L, the retaining wall above wall H (wall 36), and the ashlar header quay Q (see Fig. 9.18). The other two main features in the area are the 'Red Floor' (O) and wall M.

Floor O covers a large part of the studied area, and 4.50 x 3.50 m. of it have been exposed (Photo 9.63). The main importance of this floor, made of compact brownish-red loam on a thin fill of small rubble and chunks of *kurkar* (L. 45), is that it seals all ancient marine intrusions and maritime components, and serves as a base for a succession of terrestrial walls and floors. This fact enables us to trace an undisturbed stratigraphic sequence of at least half a millennium. A large repertoire of crushed pottery vessels was retrieved from the surface of this floor, comprising a rather homogeneous corpus of late 12th-century BCE types (Fig. 9.17).

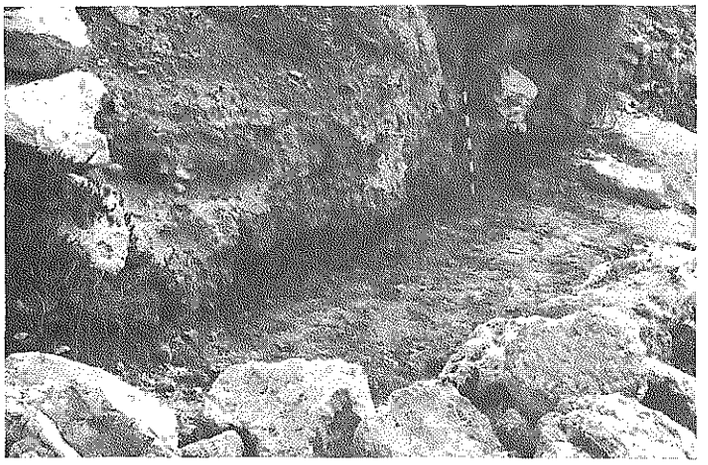

Photo 9.63. Floor O in Area C, looking east.

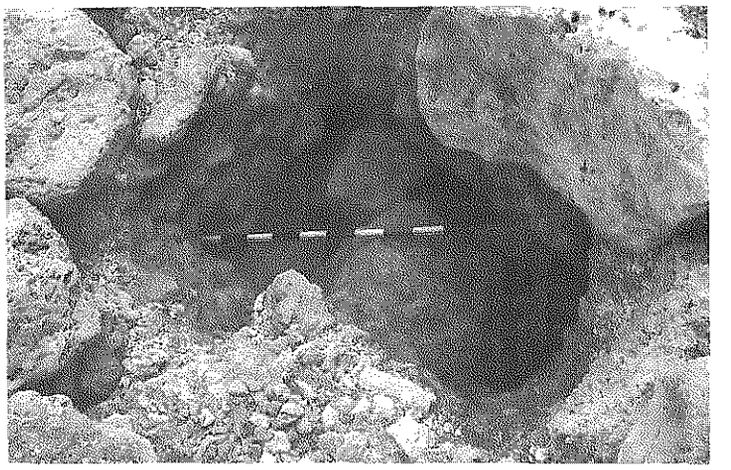

Photo 9.65. The probe north of and below the 'Red Floor' (L. 44) in Area C, looking northwest.

Wall M is a structure 1.90 m. wide, 4.80 m. to the west of the parallel wall L and built of a similar type of large blocks of limestones (Photo 9.64). Its base was inserted into a foundation trench dug into a layer of the compact dark clay that covers floor O, and a higher fill of small chunks of *kurkar* mixed with gray soil. The bottom of the trench is at 1.76 m. above MSL; it was filled in on both sides of the wall with small rubble, up to the adjacent floors. The floor on the western side of the wall is at 2.80 m. above MSL (see also Area D, below), while the lowest one on the east is at 2.60 m. above MSL. Over 3.50 m. of the length of the wall are exposed, but it is not clear whether the wall terminates at the corner with wall 36 or continues to the north. The highest visible point of wall M is 5.25 m. above MSL. This wall is probably the earlier Israelite structure in the area.

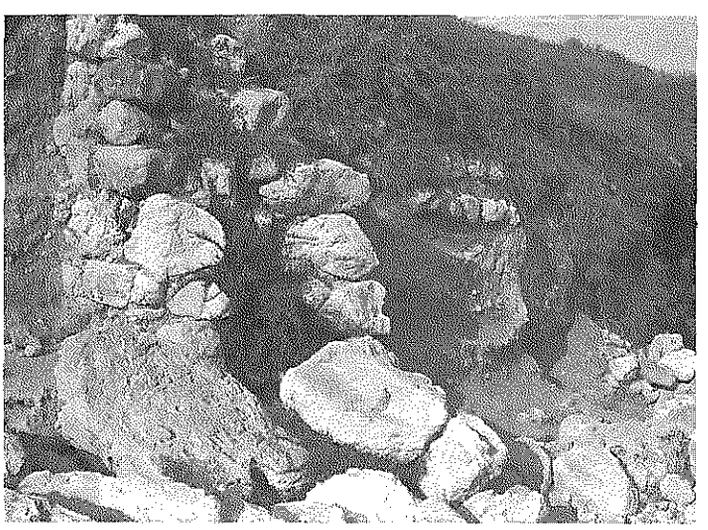

Photo 9.64. Wall M in Area C, looking northeast.

The deepest probe in Area C was made just south of floor O, into a wave-disturbed and calcified conglomerate of rubble down to sea level (L. 44). At the bottom of this probe there are some ashlars with no apparent architectural context (Photo 9.65).

Floor O ends on the east somewhat short of wall L, being replaced by a pile of fallen blocks. Below this debris the western continuation of course Q was exposed at 0.60 m. above MSL. When more of the eastern part of the floor was removed, it became clear that the quay continues below it and is covered by heavy depositions of tumbled ashlars, rubble of all sizes, and a score of shells and rounded sherds (Photos 9.66–68). The additionally exposed blocks of Q below

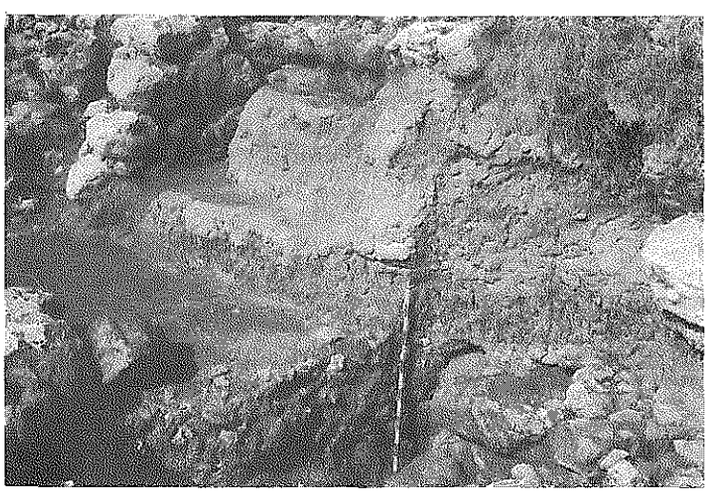

Photo 9.66. General view of Area C looking northwest, with the meter rod standing on the beach cemented topping of Q.

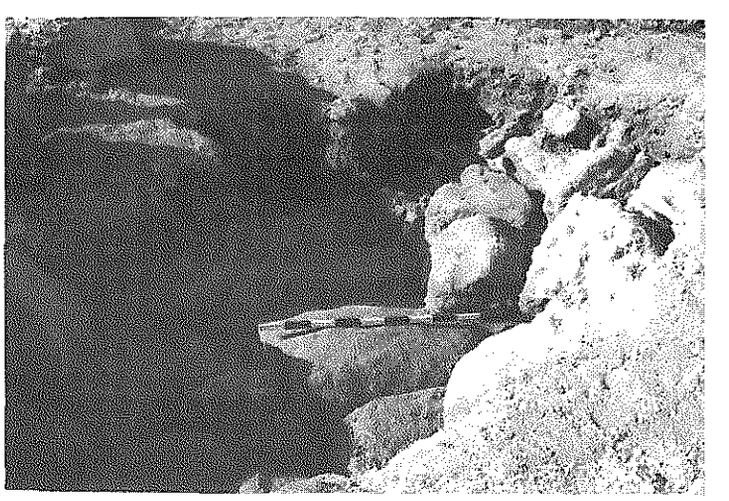

Photo 9.67. The quay in Area C (Q) overlaid by the 'Red Floor' (O), looking west.

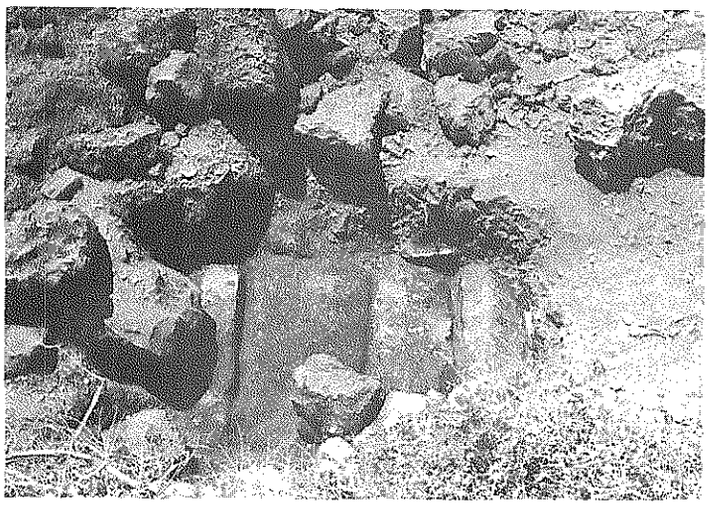

Photo 9.68. The quay on the eastern side of Area C, looking south.

floor O were found to be covered by calcified marine encrustation of beachrock type. North of that course there are several ashlar blocks (L. 55), partly topped by the crumbled mudbrick structure under wall L (Photo 9.69), which may have been a base for a pavement adjacent to the quay. These blocks were laid on a bed of fine, clean sand. Above the blocks, and covered by the mudbricks, was a human skeleton in a crumbled state, with a bronze toggle pin next to its shoulder (L. 54). The few indicative sherds in this context were all of the final stage of the LB II.

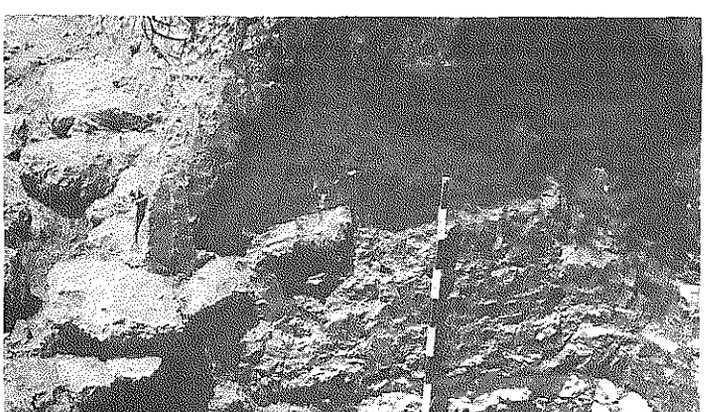

Photo 9.69. The bottom of wall L and the crumbled mudbrick structure under it, looking west.

The northern part of floor O was covered by a massive layer of compact dark clay (L. 47) that had buried the pottery-bearing surface in a deposition over half a meter thick. Above the mud there is a fill of crushed *kurkar* topped by a floor of beaten earth (L. 48) that was cut by both wall M on the west at 2.20 m. above MSL and wall L on the east at 2.25 m. The floor was exposed in a narrow trench about one meter wide, to the point in the north where it meets wall H (wall 36) at 2.37 m. above MSL, along the eastern face of wall M (Photo 9.70). It is clear that this floor predates both

Photo 9.70. The trench along the eastern side of wall M in Area C and the adjacent floors and rubble walls, looking north.

limestone walls, as their foundation trenches cut through it. A large assemblage of household vessels was found on this floor and in the gray fill above it, mostly kraters and cooking pots. All the types are characteristic of the later phase of Iron Age I, probably the mid to second half of the 11th century BCE (see Figs. 9.18, 9.19).

Over this floor (L. 48) is another one (L. 49), of a distinctive beaten brown clay with a limeish coating, at 2.65 m. above MSL. This floor reaches walls M and L and is most probably contemporary with both. The few sherds from the gray fill directly above the floor are typical of the 10th century BCE. Above the gray fill there is a sloping layer of crushed kurkar chips (L. 50), about 0.10 m. thick, at 2.90 m. above MSL next to wall L on the southeast and at 3.45 m. next to the corner of wall M and 36, on the northern wall. There are two adjacent narrow walls of medium-sized rubble above that layer, one with its base at 3.25 m. above MSL (wall 51), and the second, behind it to the north, at 3.70 m. above MSL (wall 52). The poor state of preservation of both walls does not permit us to determine whether they have an architectural relationship with walls M and L. No floors were detected adjacent to these two rubble walls, that seem to represent the latest visible feature in the sequence of Area C.

Area D

This area is adjacent to Area C to the west, bounded by wall M on the east, the retaining wall (wall 69) on the west, the paving blocks (wall 66) on the lee of the cyclopean headers in the water to the south, and the rubble wall (wall 67) at the back of the rectangular well to the north (Figs. 9.20, 9.21).

The excavations in this area began in the spring of 1981 and continued through three seasons during the following year and a half. The first architectural feature to be cleared was a corner of ashlar orthostats that was visible under a large bush, next to the northeastern side of the retaining wall that had been exposed by Garstang and his team in 1923 (see above). Within this structure clearance of the surface exposed a neatly carved rectangular gutter with a projecting spout made of a single slab measuring 1.20 x 0.70 m. (Photo 9.71). Though this architectural member seemed not to be *in situ*, the quality and characteristics of the orthostat and the gutter at first seemed to be reminiscent of components of a fountain house, probably of the Hellenistic or the Roman period.

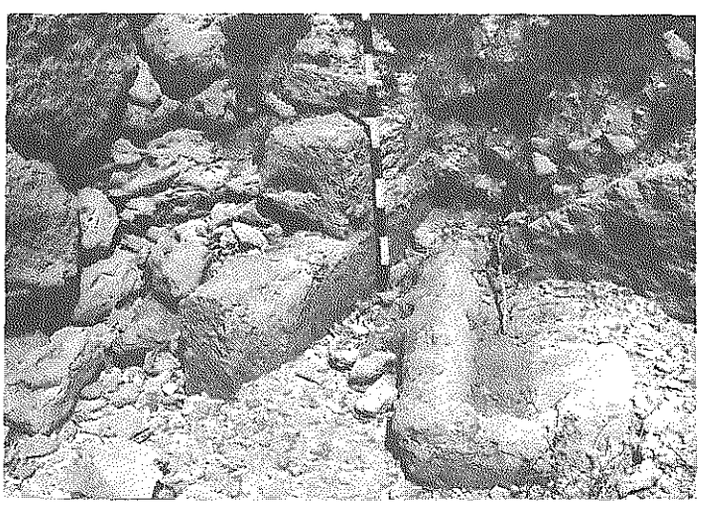

Photo 9.71. The top of the rectangular well at the beginning of the excavations in Area D. To the left is the retaining wall (wall 69); to the left of the meter rod are the base of rubble wall 67 and the rectangular molded block of the gutter and the spout. Looking north.

The rectangular orthostat structure was found to be overlapped on its northern side by a later wall (wall 67) 0.60 m. wide, built of medium-sized rubble and oriented east–west. Behind this wall the extension of the excavation exposed a floor of beaten red loam (L. 59) over a fill of crushed *kurkar* chips, at 3.06 m. above MSL. This floor is the lowest and earliest that relates to wall 67 on its northern side. In the balk of the trench, two higher floors were traced, at 3.81 and 4.17 m. above MSL, continuing to the east and reaching wall M at 3.91 and 3.88 m. above MSL respectively. High above these floors there is another rubble wall, parallel to the eroded slope of the tel, with its base at 4.47 m. above MSL (Photo 9.72). A red floor (L. 59) was found throughout the northern half of Area D, reaching wall M in the east and aligned with it at 2.80 m. above MSL. This floor is the lowest one that reaches the wall on its west and it seals the foundation trench filled with small rubble (see above). The lower

Photo 9.72. The eastern part of the northern balk of Area D, looking northeast.

floor (L. 59) is important for dating both wall M and wall 67, which postdate the rectangular well (see below).

The rectangular well (L. 62), as the structure of the orthostat slabs proved to be, is a beautiful architectural unit of first-class quality (Photo 9.73). Its inner dimensions are 1.61 x 1.94 m., and its sides are paved with ashlar slabs 0.30 m. thick. Its overall depth, from the top of the highest surviving slab below the base of wall 67 down to the quarried bedrock at 0.42 m. below MSL, is 3.14 m. Though carefully laid and tightly fitted, the paving slabs seem to represent three successive phases of construction:

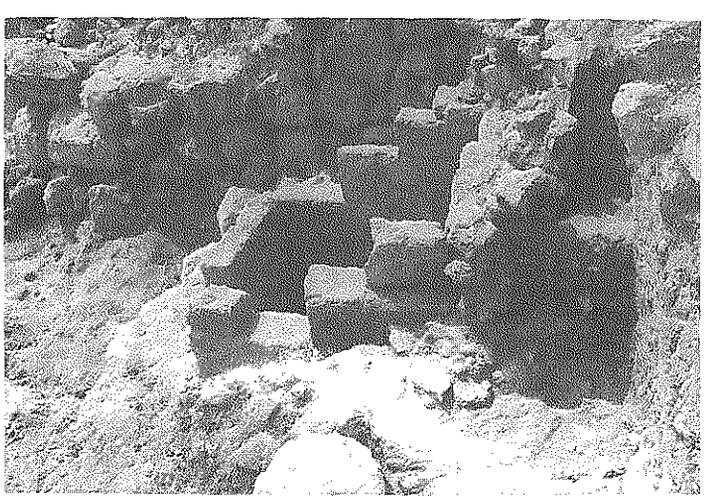

Photo 9.73. The northwestern side of Area D, looking west. Note retaining wall 69 at the back and rectangular well 62 in the center, with rubble wall 67 over its northern side and floor 59 on its right.

In the first phase a rectangular basin was quarried in the bedrock, from its surface at 0.53 m. above MSL to a depth of almost one meter (0.42 m. below MSL on the northern, deeper side and only 0.23 m. below MSL on the southern side). A shallow foundation trench was then cut in the rock around the basin and into it long ashlar slabs were laid, each just short of two meters in length (Photo 9.74). The top of the second course, at 1.04 m. above MSL, is at the same elevation as the lime plastered floor that surrounds the well (L. 70). If there was an additional parapet construction around

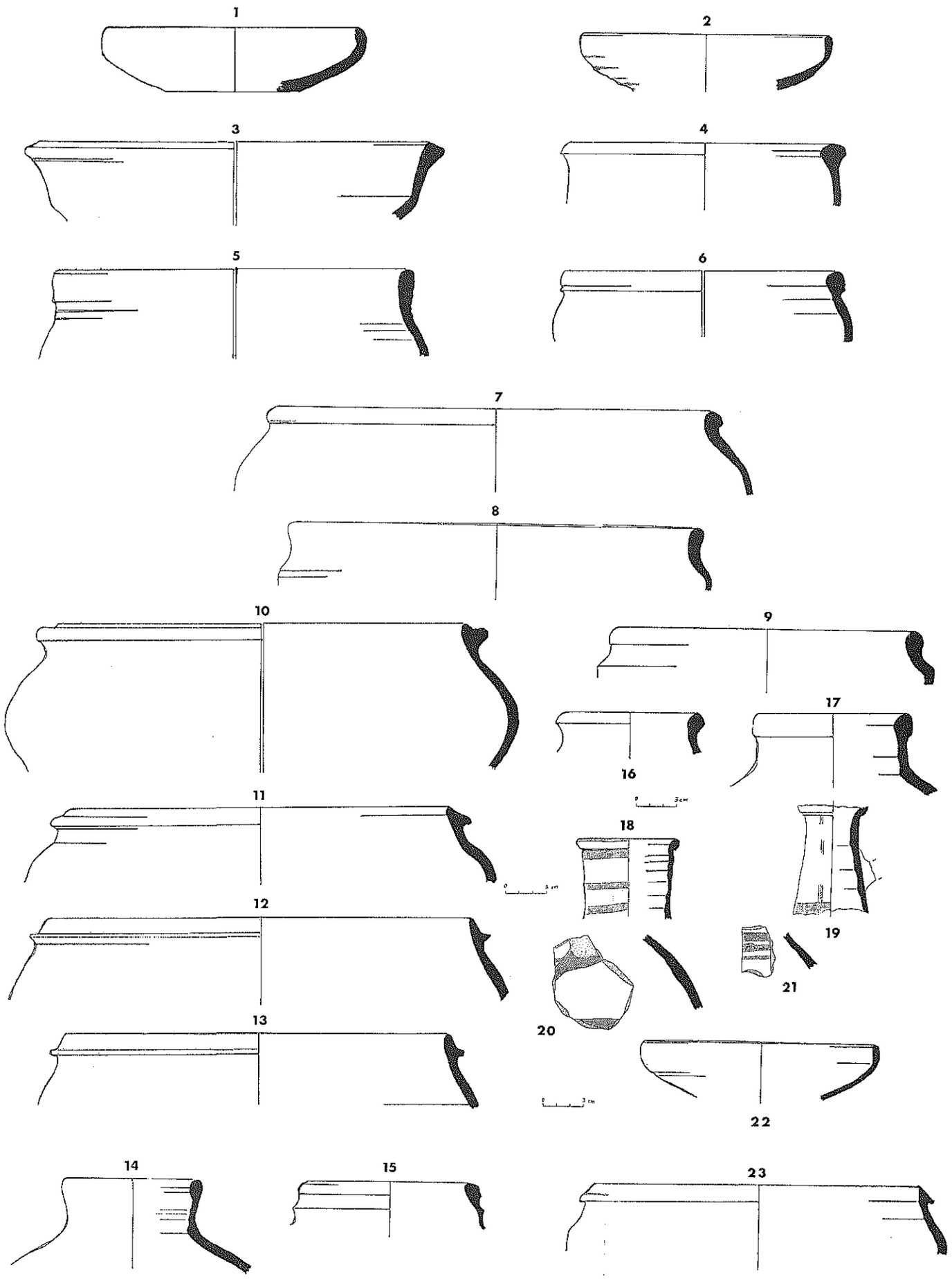

Fig. 9.18. Pottery from floor 1 in Area C (L. 48, 49).

Fig. 9.18.

No.	*Type*	*Reg. No.*	*Loc.*	*Color*	*Remarks*
1.	Bowl	C, 82-59/4	48	10YR6/3	String-cut base
2.	Bowl	C, 82-59/52	48	7.5YR5/2	Smoothed surface
3.	Large bowl	C, 82-59/45	48	5YR6/6	Few white grits
4.	Krater	C, 82-59/41+32	48	10YR4/6	Buff slip
5.	Krater	C, 82-59/38	48	5YR5/1	White grits
6.	Small krater	C, 82-68/24	48	5YR5/1	Gray grits
7.	Large krater	C, 82-68/10	48	2.5YR4/0	Yellowish coating
8.	Krater	C, 82-59/12	48	10YR5/1	Brown slip
9.	Krater	C, 82-68/7	48	2.5YR3/0	Buff coating
10.	Cooking pot	C, 82-59/15+34	48	10YR5/3	Quartzite grits
11.	Cooking pot	C, 82-68/33	48	5YR4/1	Small quartzite grits
12.	Cooking pot	C, 82-59/14	48	7.5YR5/4	Medium quartzite grits
13.	Cooking pot	C, 63-3,111/7	48	5YR3/1	Medium quartzite grits
14.	Jar	C, 82-68/3	48	10YR5/1	Remains of red paint
15.	Jar	C, 82-68/14	48	2.5YR3/0	
16.	Jug	C, 82-68/37	48	5YR6/4	Buff slip
17.	Jar	C, 82-51/6	48	7.5YR6/2	
18.	Jar	C, 82-51/5	49	5YR6/6	Red painted stripes
19.	Jar	C, 82-51/4	49	5YR6/6	Red painted stripes
20.	Jug	C, 82-51/18	49	5YR6/1	Dark red painted stripes
21.	Jar	C, 82-51/43	49	5YR6/2	Dark red painted stripes
22.	Bowl	C, 82-51/13	49	10YR4/1	Brown slip
23.	Cooking pot	C, 82-58/2	49	2.5YR3/0	Quartzite grits

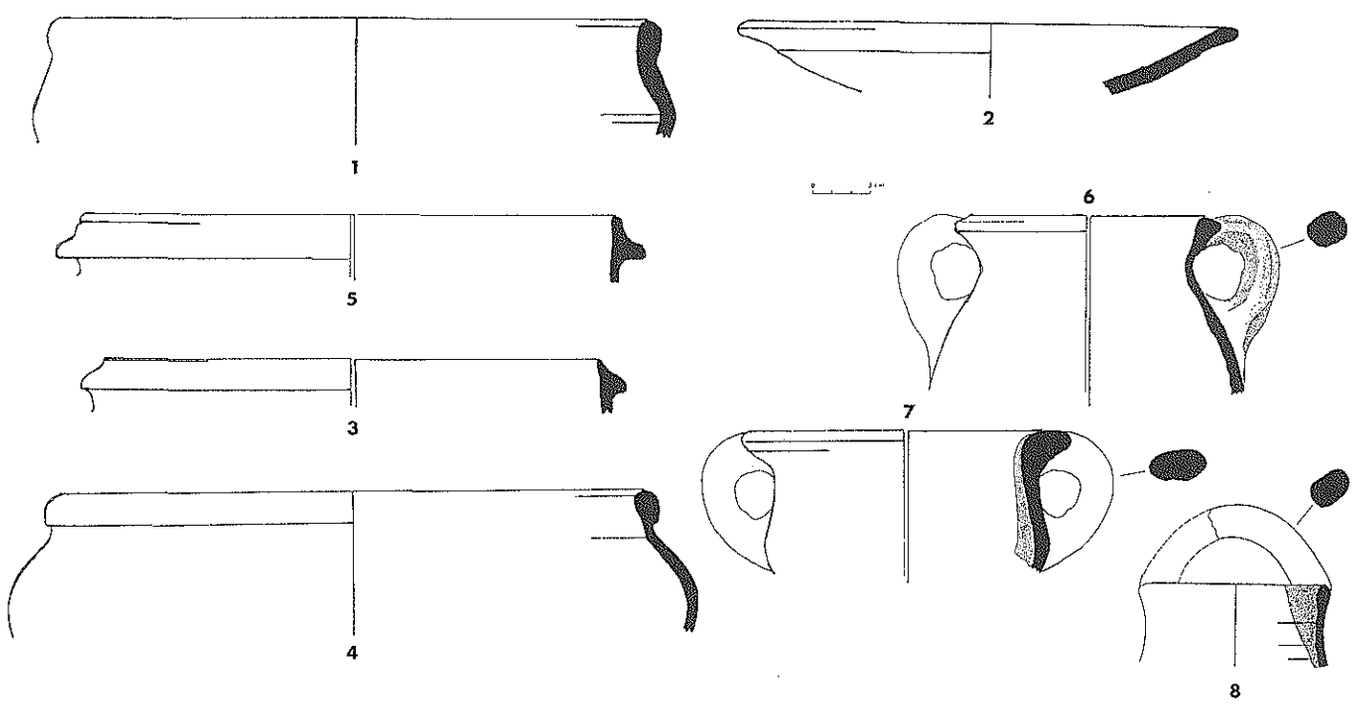

Fig. 9.19. Pottery from later floors in Area C (L. 50, 54, 55).

No.	*Type*	*Reg. No.*	*Loc.*	*Color*	*Remarks*
1.	Krater	C, 82-50/17	50	10YR6/3	
2.	Chalice	C, 82-50/18	50	10YR3/1	Smoothed inside
3.	Cooking pot	C, 82-58/6	50	2.5YR4/0	Quartzite grits
4.	Krater	C, 82-54/1	54	5YR6/6	Gray coating
5.	Cooking pot	C, 82-52/29	55	10YR5/2	Large grits
6.	Krater	C, 82-50/12	50	2.5YR5/8	
7.	Krater	C, 82-54/0	54	5YR6/6	
8.	Jug	C, 82-54/4	54	10YR5/2	

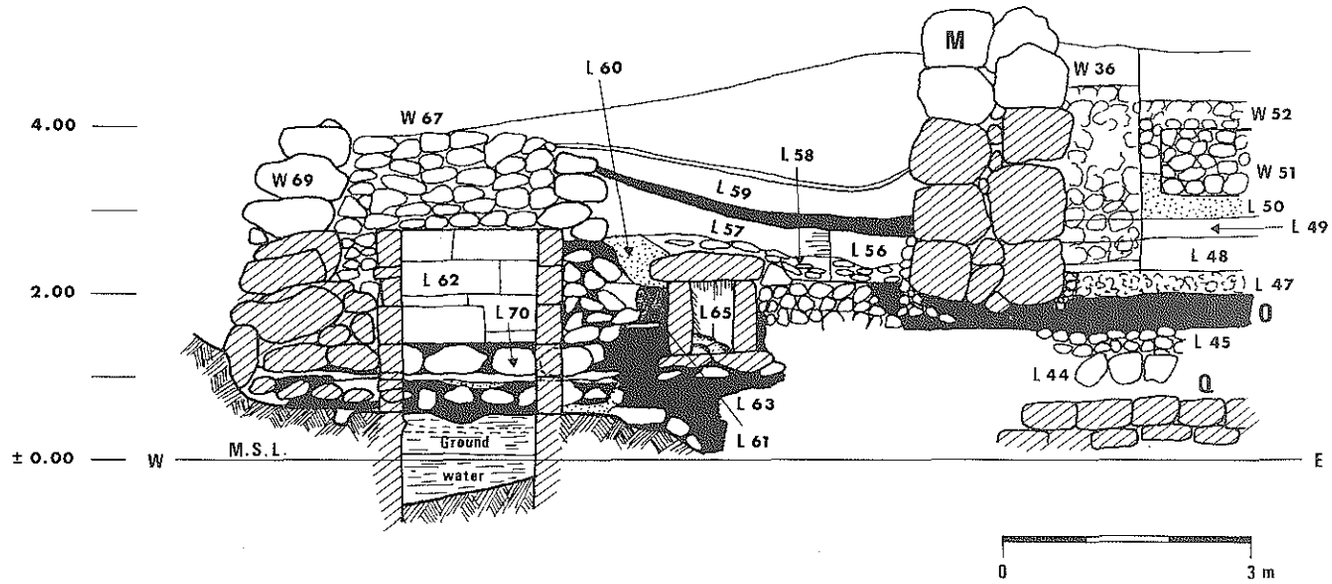

Fig. 9.20. General elevation of Areas D and C, looking north.

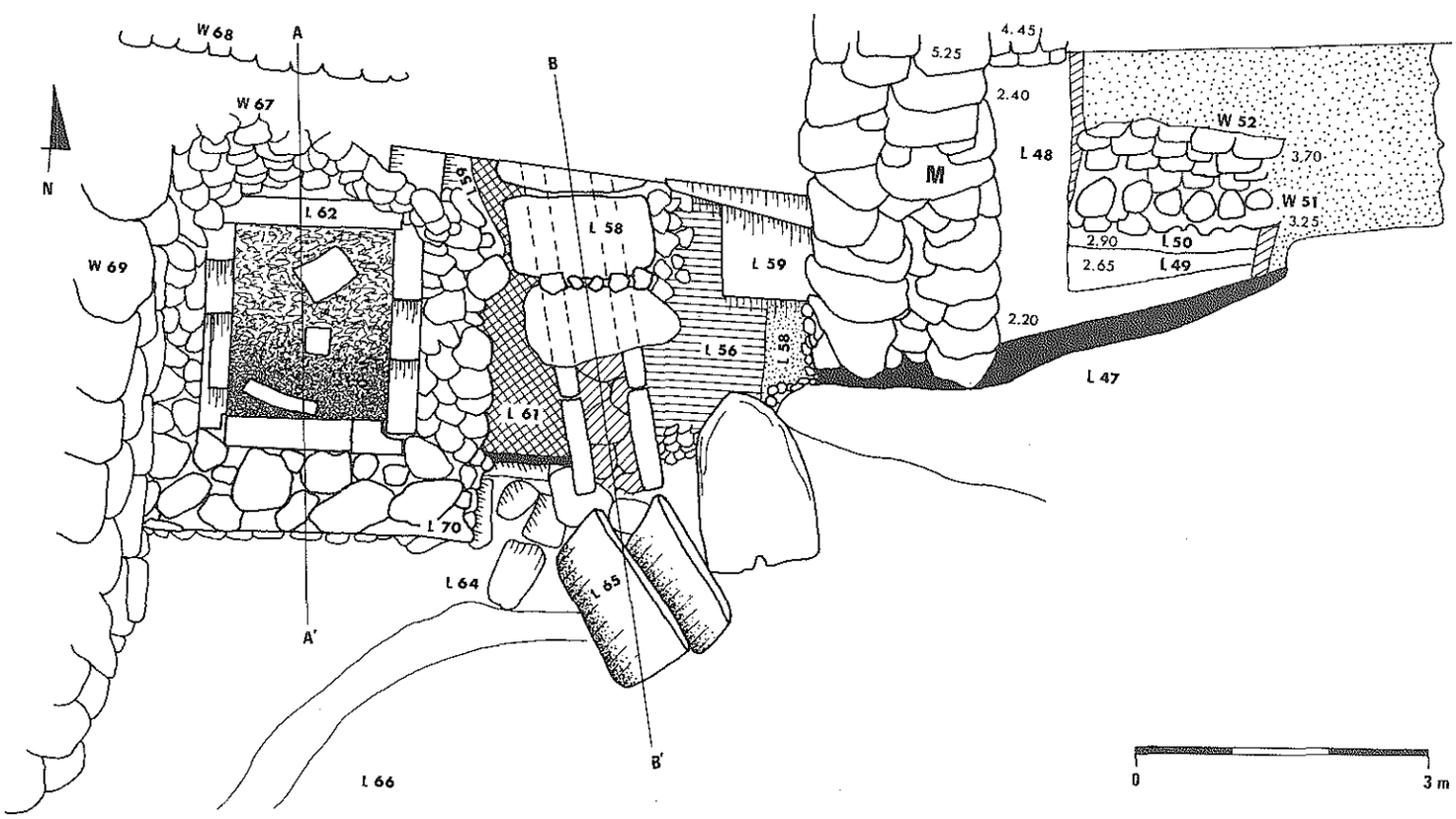

Fig. 9.21. Combined plan of Areas C and D.

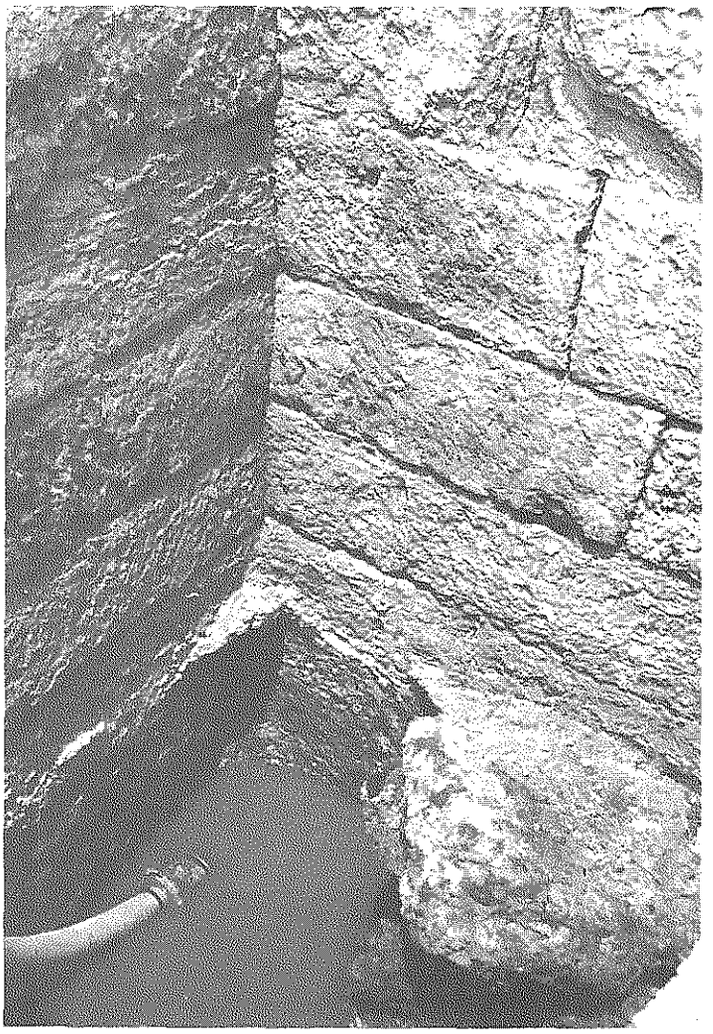

Photo 9.74. The northwestern side of the rectangular well; note the encrusted layer, representing the recent elevation of the ground water.

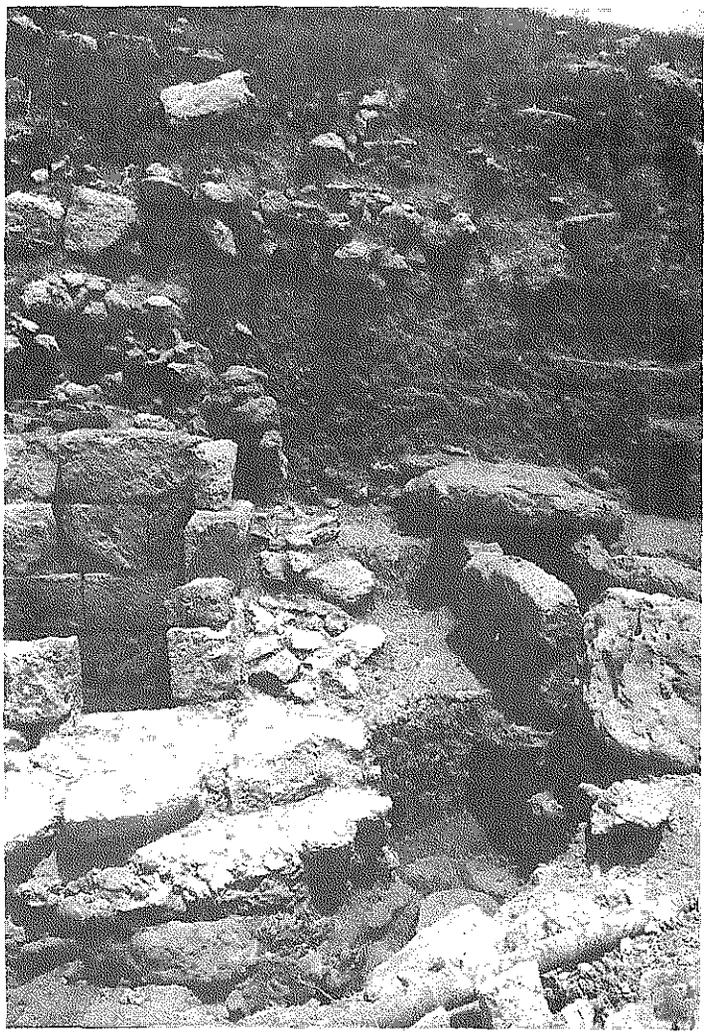

Photo 9.75. The eastern side of well 62 and sewer channel 65, looking north. Note the various floor levels adjacent to the well.

the well and above the floor level of that phase, it has not survived. This floor (L. 70) was laid on a fill of rubble and dark clay; it continues to the west, below retaining wall 69 to the rocky slope 2 m. away. To the east the floor was cut by the later foundation trench (L. 65) of the drainage channel.

In the second phase the parapet seems to have been removed and the sides of the well were raised by two additional courses, each 0.38 m. high. The sides of the well were in this stage at 1.78 m. above MSL (Photo 9.75). A new floor was laid around the wall at 1.57 m. above MSL, of which only limited segments have survived (L. 61) on the south and east. To the west it seems to have been dismantled when the retaining wall was built some time later.

In the third phase the sides of the well were raised again by at least two more courses of ashlar slabs, 0.47 and 0.45 m. high. The new floor (L. 58) around the well of this third phase also covered the neighboring drainage channel, though on the northeastern side of the well it buried an earlier fill of layers of *kurkar* fill (L. 60). The level of the floor next to the well is 2.43 m. above MSL, about 0.30 m. lower than the parapet.

The well of the first phase seems to have been protected from the sea on its southern side by the line of huge headers that flanked the main quay E on the west. The area in between, some 7 m. wide north–south, seems to have been paved by flat ashlar slabs (wall 66), some of which were found buried in the fill of the floor adjacent to the rocky platform of an older and raised abrasive platform (see Fig. 9.20 and section A in Fig. 9.22). There are indications for some earlier structure on the lee of that paving and below the fill of the floor of the well (L. 64), judging from the pottery fragments of the LB period (Fig. 9.23:1). The few sherds that were found on the floor of the first phase (L. 70) are to be dated to the late 13th century BCE (Fig. 9.23:2,3). The sherds from L. 61 (the second floor of the well) were found in a mixed context, with the mud fill of the foundation trench of the drainage channel. The pottery from the *kurkar* chip fill below the floor of the third phase, the rubble wall (wall 67), and Floor 57 (L. 60) is a rich assemblage of 12th-century types, rather similar to that of the floor itself (L. 58). This corpus includes some collared-rim pithoi, holemouth conical jars, hemispherical bowls, and one fragment of a Late Cypriot III decorated jug of the White Painted class (Figs. 9.24, 9.25).

The clearance of the fill from the well proved to be a disappointment. The waterlogged debris, including some fallen blocks from the well's sides, was found to be rather recent, with worn sherds of many periods mixed together. At 0.40 m. above MSL there was an encrusted and well-cemented

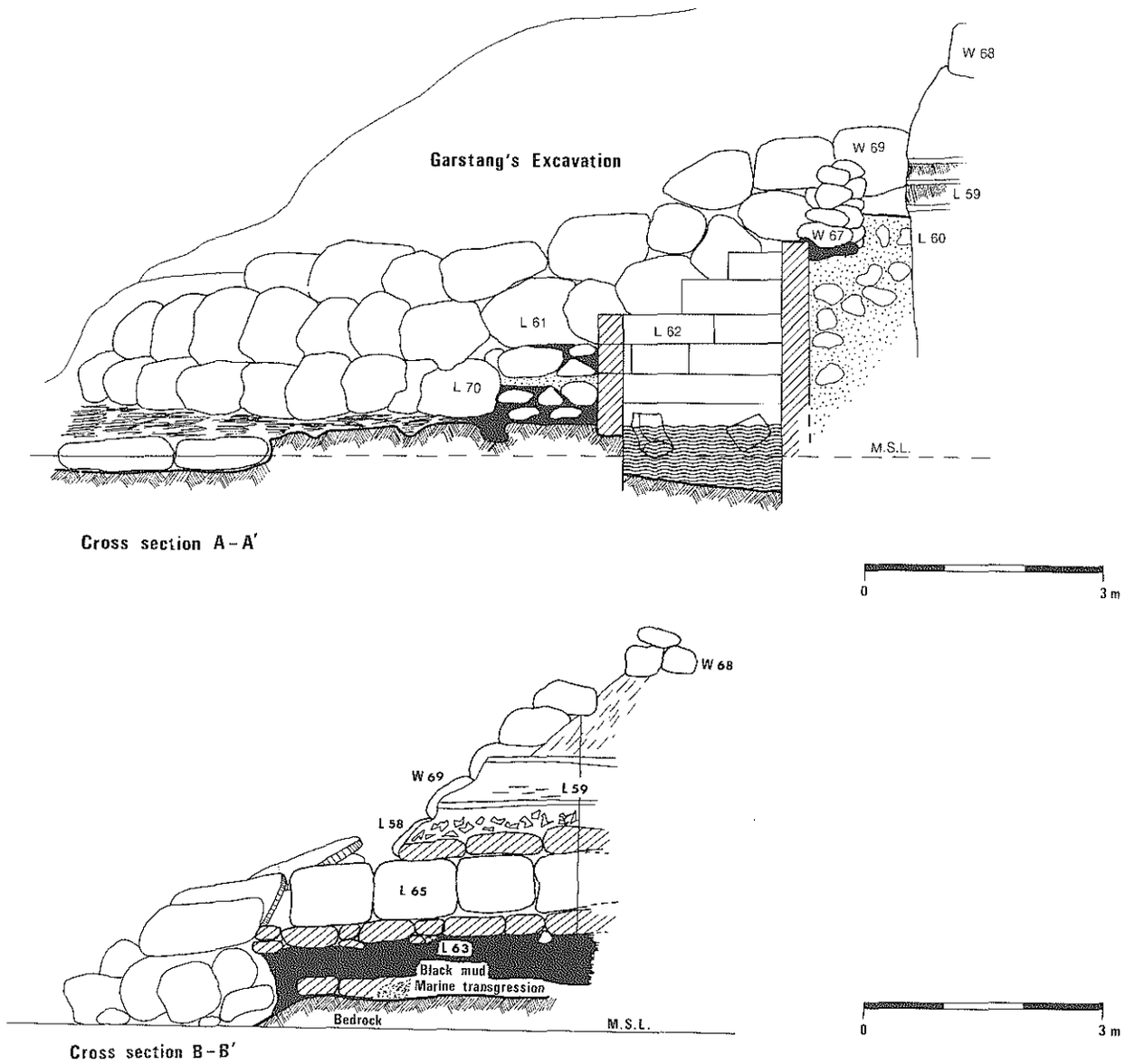

Fig. 9.22. North-south sections in Area D, A across the western part of the area and B across the central part.

layer, over 0.15 m. thick. Breaking through it and into fresh ground water we found near the base of the well some broken vessels of a late period, probably the Mamluk or Ottoman (Fig. 9.23:4–7). The inhabitants of the nearby Arab village of Tantura apparently discovered this well at some time in the past, cleared it, and restored it to its original function. The massive cemented layer over these finds indicate that some generations have passed since the well went out of use for the last time. The fact that the large broken pieces of water jars were found close to the original rock-cut bottom of the well, below the present sea level, indicates that at that time the sea level was lower, probably by as much as 0.40–0.50 m.

The repeated renovation of the well during the later 13th and the 12th centuries BCE must have been dictated by the rising sea level (or gradual subsidence of the coastal strip) during that time. Assuming that the inhabitants of Dor dug their well only as deep as the interface of the fresh ground water with the heavier sea water underneath, it is quite safe to draw the line for that interface at about 0.40 m. below MSL. Such an elevation would indicate a relative sea level at least half a meter lower than the present one for the second half of the 13th century BCE, the suggested date for the first phase of the well.[57]

The additional parapet raising the well by about half a meter half a century later (the second phase) may indicate a similar rise in sea level. In order to keep the well free of sea water, its lower shaft was filled with sand, up to just above the interface which was probably a few inches lower than the present one. The continuing rise of the sea level through the 12th and early 11th centuries BCE necessitated a third renewal of the well's side walls, this time by almost one meter. However, this last phase and the extensive vertical addition may not be due only to the rate of the transgression; the addition of the drainage channel next to the well on the east and the overall reconstruction of the surrounding area may have been additional factors. One may make a correlation between this third phase and the establishment of the high paved passage in Area A (L. 27; see above).

As for parallels to the rectangular well with ashlar-paved

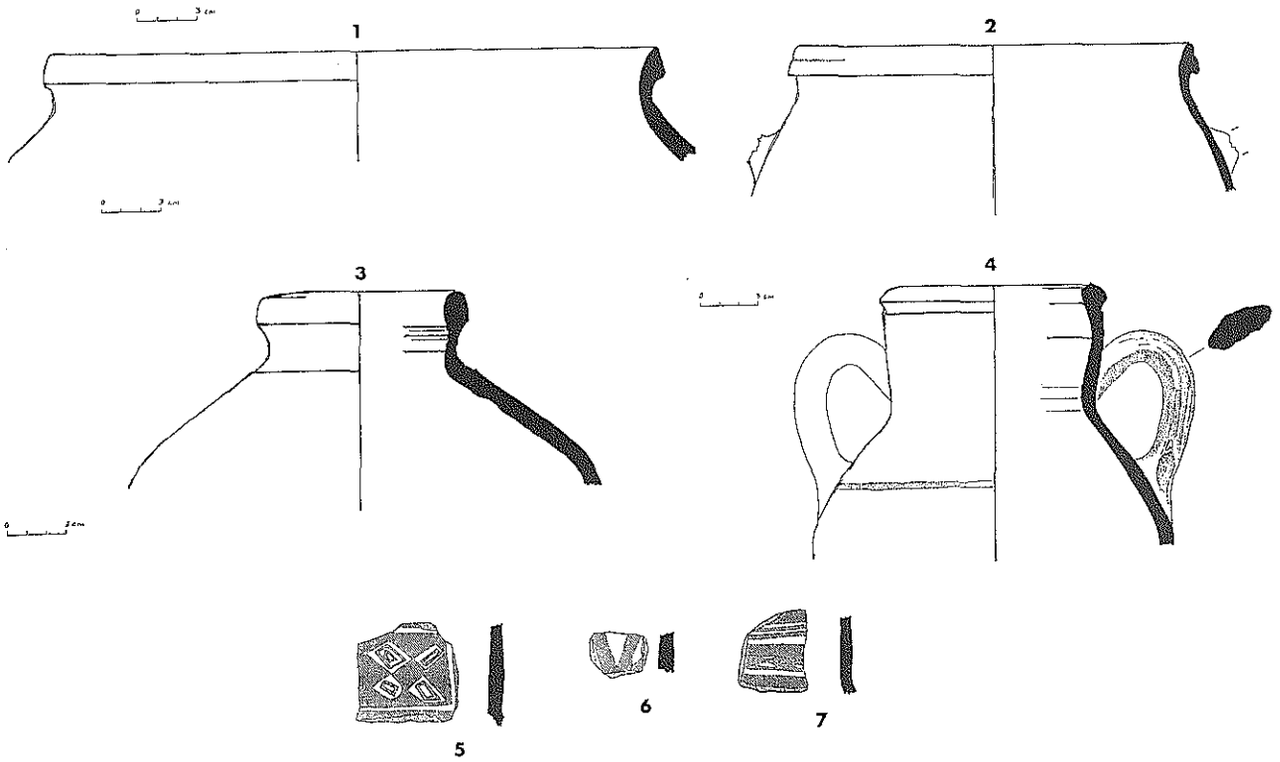

Fig. 9.23. Pottery from the vicinity of the well in Area D (L. 62, 64, 70).

No.	*Type*	*Reg. No.*	*Loc.*	*Color*	*Remarks*
1.	Cooking pot	E, 82-42/3	64	10R4/1	Quartzite grits
2.	Cooking pot	D, 82-41/12	70	7.5Y4/2	Quartzite grits
3.	Jar	D, 82-41/2	70	7.54YR6/4	Collared rim
4.	Jar	D, 82-49/26	62	2.5YR3/6	Mamluk
5.	Jar	D, 82-43/	62	5YR5/1	Red paint on white slip
6.	Jar	D, 82-43/	62	5YR6/1	Red paint on white slip
7.	Jar	D, 82-43/	62	10YR4/1	Red paint on white slip

walls, the closest is probably from Kato Zakro in eastern Crete: the so-called 'fountain house' within the southern sector of the Late Minoan palace is also a rectangular structure with ashlar-lined walls, fed by the ground water table from above the coastal interface.[58] Similar in concept is the rectangular 'basin' (F 1070) at Hala Sultan Tekke in eastern Cyprus, which is dated to around 1200 BCE or somewhat earlier by the excavators.[59]

A drainage channel (L. 65) was built about one meter to the east of the rectangular well (Photo 9.76). The channel was constructed of a floor of flattened slabs of irregular shape that were laid into a foundation trench dug down to the bedrock and then partly filled with compact black clay, topped by some rubble (L. 63). The width of this floor is about 1.60 m. and it slopes gently towards the sea at a gradient of 6°. It is about 1 m. above MSL at its southernmost preserved end, and 1.50 m. next to the northern balk of the excavation in Area D, 6.50 m. away (see section in Fig. 9.22B). The side walls of the channel are built of rectangular slabs 0.30 m. thick, 0.75–0.85 m. high, and 0.95–1.20 m. long, laid on their narrow sides. The internal width was 0.60 m. and the channel was roofed by large slabs. The black clay fill reaches almost the top of the western side wall, while the eastern wall was laid next to the rubble fill of an earlier floor, on the eastern side of the foundation trench. The top of the black mud fill on the western side of the channel was covered by a layer of crushed *kurkar* chips 0.40 m. thick, mixed with broken pottery vessels, mainly of conical holemouth jars (Fig. 9.24).

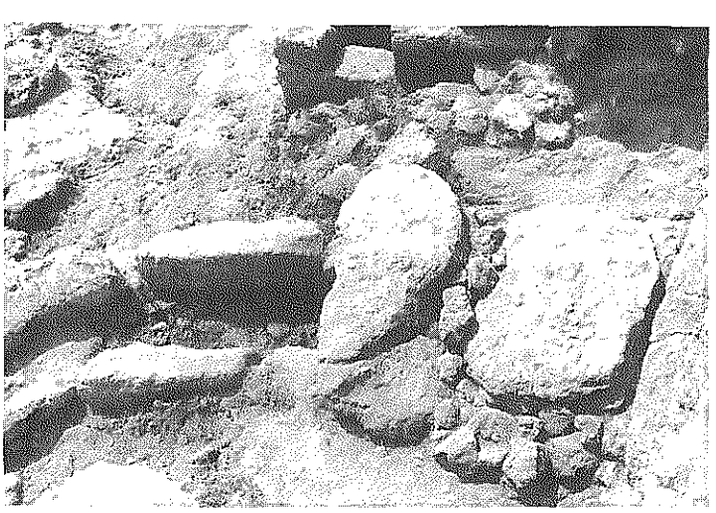

Photo 9.76. Drainage channel L. 65 in Area D from above, looking west.

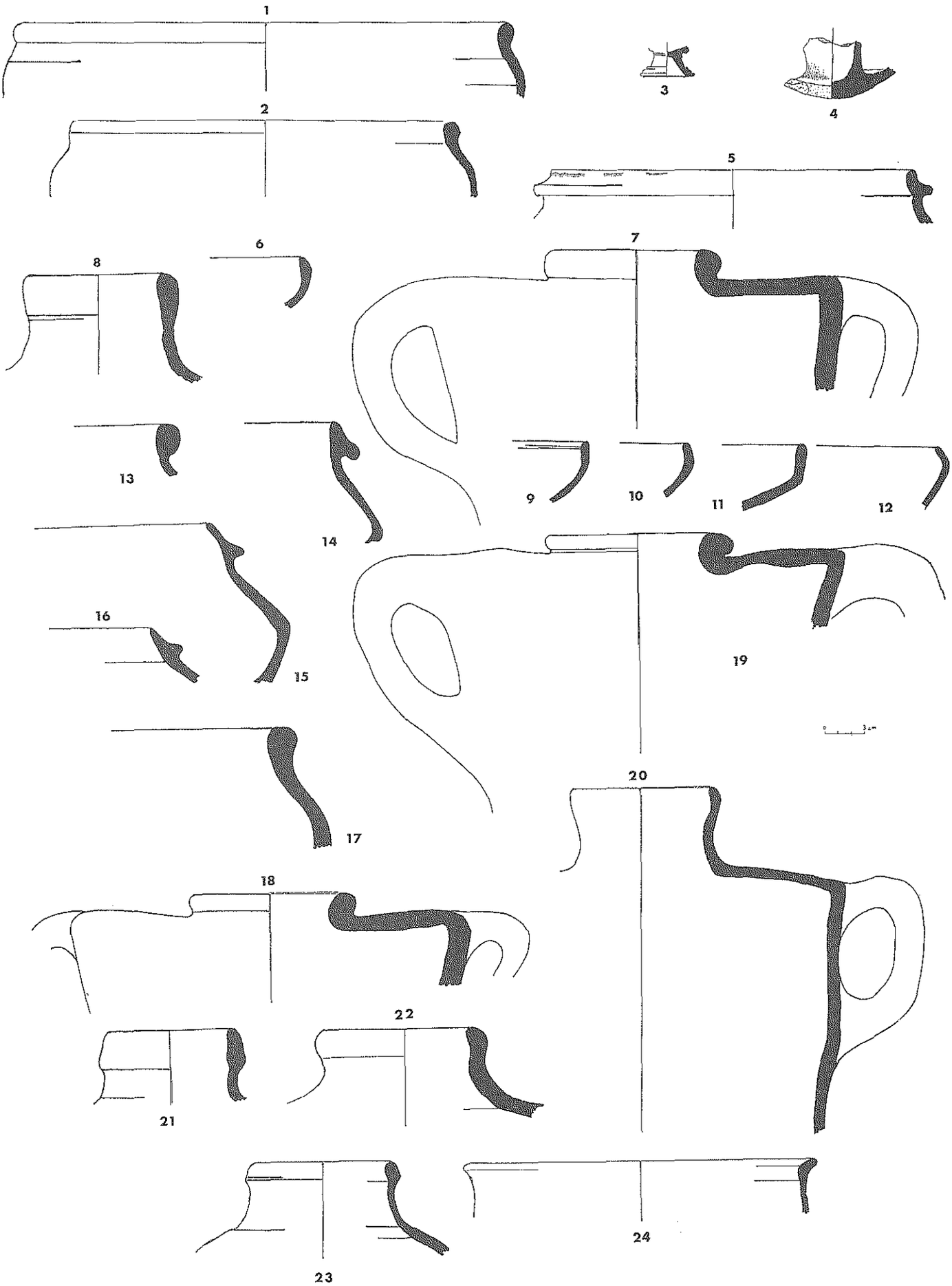

Fig. 9.24. Pottery from the floors adjacent to the last phase of the rectangular well in Area D (L. 56, 57, 58).

Fig. 9.24.

No.	*Type*	*Reg. No.*	*Loc.*	*Color*	*Remarks*
1.	Krater	D, 82-56/25	56	5YR6/4	Few large grits, coated
2.	Krater	D, 82-56/11	56	10YR5/2	Lime grits and coating
3.	Goblet	D, 82-56/6	56	5YR7/6	
4.	Cup and saucer	D, 82-57/19	57	10YR6/4	
5.	Cooking pot	D, 82-66/22	57	10YR5/2	
6.	Bowl	D, 82-34/3	57	10YR6/1	
7.	Jar	D, 82-34/1	57	7.5YR6/4	Hole mouth
8.	Jar	D, 82-34/2	57	5YR5/1	Large grits, white coating
9.	Bowl	D, 82-37/3	58	10YR5/3	Brown-gray slip
10.	Bowl	D, 82-37/4	58	7.5YR4/0	Smoothed inside
11.	Bowl	D, 82-36/12	58	10YR6/3	Thin slip walls
12.	Bowl	D, 82-36/19	58	7.5YR5/2	Smoothed surface
13.	Krater	D, 82-36/7	58	5Y4/3	Buff coating
14.	Cooking pot	D, 82-36/4	58	5YR4/1	Quartzite grits
15.	Cooking pot	D, 82-36/3	58	5YR6/3	White grits
16.	Cooking pot	D, 82-37/5	58	7.5YR6/1	Variegated grits
17.	Krater	D, 82-36/9	58	5YR4/1	
18.	Jar	D, 82-36/1	58	10YR6/3	Hole mouth, angular
19.	Jar	D, 82-37/1	58	7.5YR6/2	Hole mouth, angular
20.	Jar	D, 82-37/2	58	10YR5/3	Angular
21.	Jar	D, 82-36/5	58	7.5YR5/2	
22.	Jar	D, 82-36/2	58	10YR6/1	Collared rim (?)
23.	Jar	D, 82-65/7	58	10YR6/3	Collared rim (?)
24.	Krater	D, 82-58/10	58	10YR5/2	

A coarser fill was added over the channel's roof and on the lower surface to the east (L. 58). This sloping surface was then leveled by an additional fill of crushed jars, topped by a beaten surface of red loam. On top of this floor there was a deposit or fill of gray soil, mixed with sherds and some small rubble (L. 56, 57). Over it ran the red loam floor (L. 59) described above (see sections in Figs. 9.20, 9.22). The rich repertoire of pottery from above this floor is characteristic of the 10th century BCE (Fig. 9.26). Stratigraphically the floor is contemporary with wall 67 that postdates the well, walls M and L on the east, and the floor L. 49 in Area C (Photo 9.77).

Photo 9.77. General view of Area D at the end of the excavations, looking northeast.

Discussion

The study of the architectural sequence of what seem to be marine installations is not yet complete. It would take a considerable effort to achieve total removal of the mass of fallen blocks along the entire length of the narrow coastal strip, in order to study every ashlar of the partly-surveyed structures described above. Moreover, such a procedure would expose the southern side of the tel to the eroding energy of storm waves. We have learned that the limited exposure carried out so far has already caused extensive damage. Consequently, any further excavations in that area must include some preventive measures and protective coverage of the ancient features revealed is to be considered essential.

Of the architectural features that have been studied, the majority are understood as quays or landing stages. The reason for such an interpretation is not that they are presently near the water line, but because of their architectural characteristics and the kind of natural deposits in their contexts. The most coherent unit of this type is the paved platform (E) with the flanking ashlar header structures on its east (F) and west (wall 66). There are two phases in this unit, with part of the eastern flank (wall 9) being added somewhat later. This is attested by the fact that it was laid over beach deposits of high wave energy, a deposition that postdates the other components of the unit. The original structural phase was established on a beach with very little wave energy, probably deep at the back of a cul-de-sac type of lagoon. Considering the present elevation of the submerged rocky ridge at the western side of the South Bay, one may argue for a sea level about half a meter below MSL, or even more, in a reconstructed paleotopography that would fit both the type of natural deposition and the original level of the well (L. 62) in its first phase. Later structures and destructions caused by

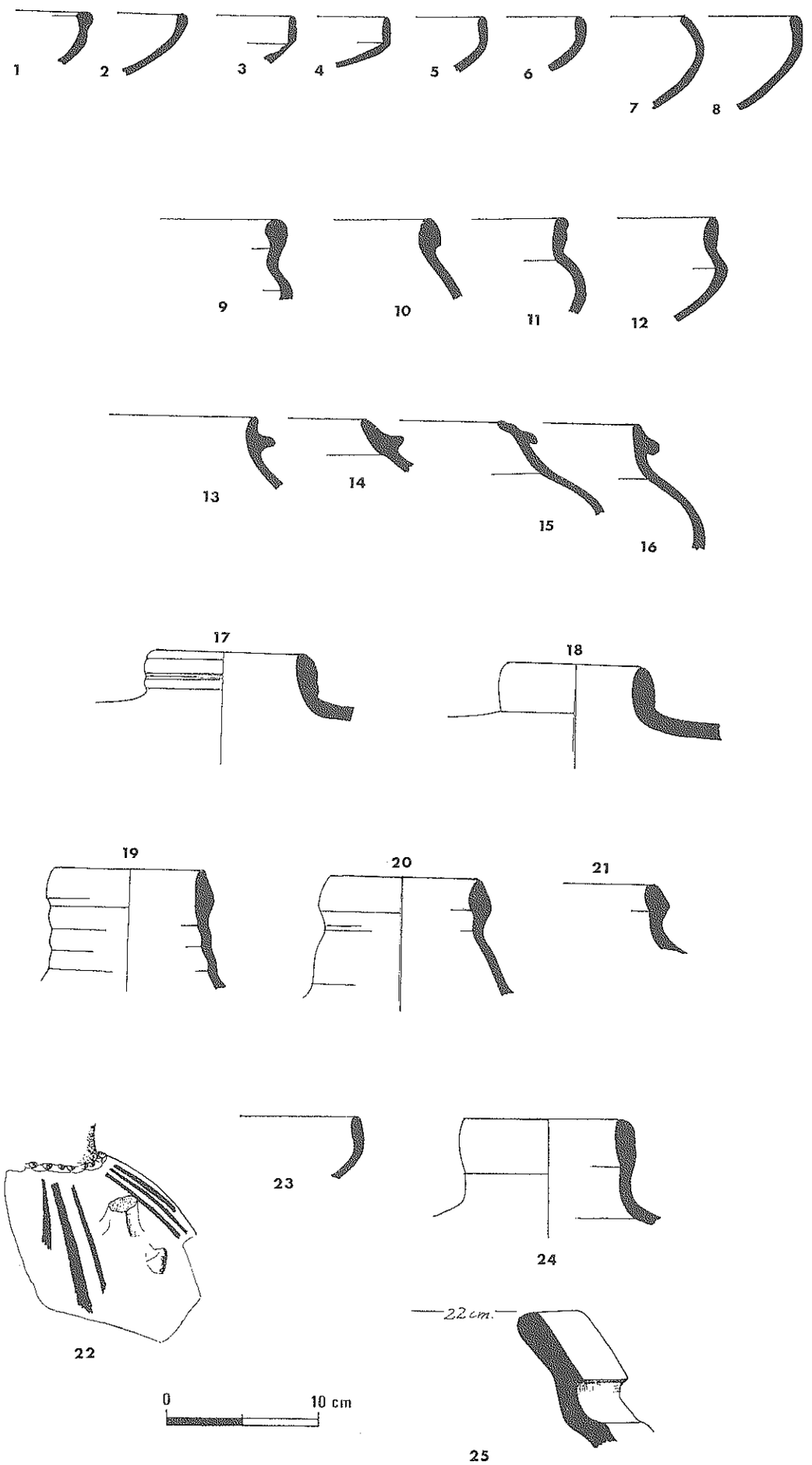

Fig. 9.25. Pottery from Area D, L. 60.

Fig. 9.25.

No.	*Type*	*Reg. No.*	*Color*	*Remarks*
1.	Bowl	D, 82-38/10	7.5YR5/1	Partly burnished
2.	Bowl	D, 82-38/11	5YR4/3	Slipped
3.	Bowl	D, 82-38/12	10YR6/2	Carinated, slipped
4.	Bowl	D, 82-38/13	10YR5/4	Carinated, slipped
5.	Bowl	D, 82-38/14	5YR4/3	Partly burnished
6.	Bowl	D, 82-38/15	7.5YR6/1	Partly burnished
7.	Bowl	D, 82-38/16	5YR5/3	
8.	Bowl	D, 82-38/17	10YR6/2	
9.	Krater	D, 82-38/1	7.5YR5/3	Yellow coating
10.	Krater	D, 82-38/2	5Y4/0	Limeish coating
11.	Krater	D, 82-38/3	2.5Y5/1	Buff slip
12.	Krater	D, 82-38/4	5Y5/7	
13.	Cooking pot	D, 82-38/5	10YR6/1	
14.	Cooking pot	D, 82-38/6	10YR5/2	
15.	Cooking pot	D, 82-38/7	7.6YR6/3	
16.	Cooking pot	D, 82-38/8	5YR4/2	
17.	Jar	D, 82-38/21	10YR7/2	
18.	Jar	D, 82-38/22	5YR6/2	
19.	Jar	D, 82-38/18	5YR4/3	
20.	Jar	D, 82-38/19	7.5YR6/7	
21.	Jar	D, 82-38/20	10YR6/2	
22.	Jug	D, 82-38/9	5YR5/7	Cyp. WP, black painted and molded decoration
23.	Bowl	D, 82-35/1	5R4/0	Smoothed inside, burnished (?)
24.	Jar	D, 82-35/3	7.5YR6/2	
25.	Pithos	D, 82-35/2	5YR5/3	Collared rim

the surge have left no clear architectural connection between that unit and others further inland to the north.

This gap, at least in the areas that have been studied, makes it impossible to define whether platform E is contemporary with, earlier than, or later than the beachrock plates that were exposed below Q and H in Area B, or whether E and Q are of the same phase. Only the slight difference in the orientation of these two elements can be used as an argument against the latter interpretation.

Another indication for the identification of contemporary structures along the southeastern shore of the tel may be the elevation of the surface of their paving. In that case the platform behind wall 7 might be considered as contemporary with L. 31 in Area B, and probably also L. 66 in Area D. All three postdate the first marine intrusion and may have been built soon after it.

The same correlation can be made for the first rectangular quay in Area A (L. 23) and Q in Areas B and C. These features may have been functioning when the well in Area D was raised in its second phase, with its surrounding floor (L. 70).

Somewhat later during this period, the rectangular quay in Area A was raised by 0.30–0.40 m., probably due to a rise in sea level. This was probably when the retaining wall (wall 69) at the western end of the coastal segment was built and the well was elevated once again (floor L. 61). Chronologically, as is attested by the pottery finds, this stage is to be dated to the mid-12th century BCE or somewhat earlier, when the sea level was higher by 0.20–0.30 m. than the present one.

The following period in this general area is characterized by a sudden and radical change of wave energy, reaching and flooding the coastal structures. Coarse beach deposits, shells, wave-worn sherds, and fallen building stones have accumulated over the quays and the floors, and a rather hasty attempt had to be made in order to protect the settlement from the eroding surge. It was apparently during this stage, probably around or soon after 1100 BCE, that the rectangular quay in Area A was partly dismantled and its slabs were used for establishing the higher pavement (L. 27). In Areas C and D the waterfront was retained by a sea wall that facilitated the use of the area on its lee for terrestrial structures. Such were floor O in Area C, the final phase of the well (L. 62), and the drainage unit in Area D (L. 65). This entire sequence predates the long retaining wall H that seems to be the latest architectural feature along the shore prior to the Israelites. During a period of about 250 years the sea continued to rise relative to the coast, from well below MSL to almost one meter above it. Though the presumed retaining wall along the waterline has left no structural remains, its existence in the past may be concluded from the characteristically terrestrial type of deposition on and above floor O and the red floor over the drainage channel in Area D (L. 58). It is clear that both floors were sheltered from marine elements, not because the sea had subsided, but due to some higher separating structure against which the later depositions of dark fine clay (L. 47 in Area C) and broken jars (L. 56, 57) were dumped. These terrestrial depositions are absent farther to the east, in Areas B and A. Thus, it may be suggested that the protecting structure did not continue far in that direction, or was dismantled soon after its construction and was replaced by the long retaining wall H.

The sudden breakthrough of high-energy waves into the back beach of the South Bay around 1100 BCE may have been the result of an earthquake that caused additional subsidence of the rocky bar (or barely flooded ridge) across the western entrance to the bay, or may have been due to the artificial flushing channel that bisected it. This channel, 70 m. long and 3–5 m. wide, is clearly visible, even from the air. The present elevation of the bedrock on both sides of the

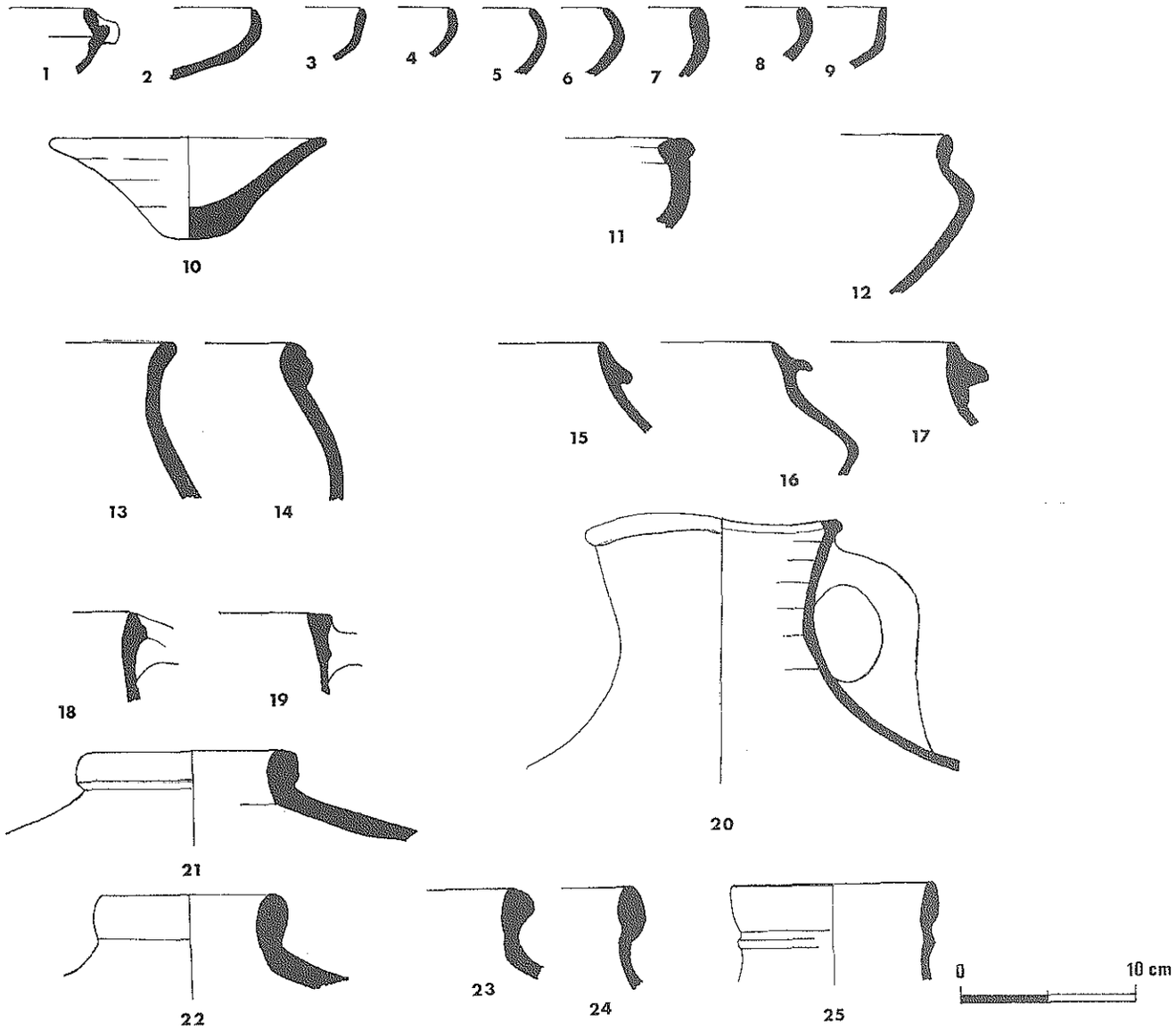

Fig. 9.26. Pottery from the 'post-well' floor in Area D (L. 59).

No.	*Type*	*Reg. No.*	*Color*	*Remarks*
1.	Bowl	4, 82-30/11	10YR4/2	Ledge handle, burnished
2.	Bowl	4, 82-30/17	7.5YR5/2	Slip, partly burnished
3.	Bowl	4, 82-30/18	10YR4/1	Slip, partly burnished
4.	Bowl	4, 82-30/19	5YR6/2	Slip, partly burnished
5.	Bowl	4, 82-30/20	7.5YR6/1	
6.	Bowl	4, 82-30/21	5YR5/2	Purple-brown slip
7.	Bowl	4, 82-30/22	2.5YR6/3	
8.	Bowl	4, 82-30/23	10YR4/3	Slip, partly burnished (?)
9.	Bowl	4, 82-30/24	10YR6/0	Dark brown slip
10.	Cup	4, 82-30/8	7.5YR6/2	Perhaps a jar lid
11.	Deep bowl	4, 82-30/18	10YR6/2	Brown slip, partly burnished
12.	Krater	4, 82-30/13	2.5YR5/1	
13.	Krater	4, 82-30/9	7.5YR6/2	
14.	Krater	4, 82-30/10	5Y4/0	
15.	Cooking pot	4, 82-30/14	10YR3/2	Large quartz grits
16.	Cooking pot	4, 82-30/15	10YR4/0	Large quartz grits
17.	Cooking pot	4, 82-30/16	5YR5/1	Large quartz grits
18.	Jug	4, 82-30/6	5YR6/1	
19.	Jug	4, 82-30/7	5YR4/3	Yellow coating
20.	Jug	4, 82-30/5	7.5YR5/2	Buff slip
21.	Jug	4, 82-30/25	10YR4/6	
22.	Jug	4, 82-30/1	10YR6/2	Limeish coating
23.	Jug	4, 82-30/2	7.5YR5/3	Yellow coating
24.	Jug	4, 82-30/3	5YR4/5	
25.	Jug	4, 82-30/4	10YR6/3	Limeish coating

channel is less than 2 m. below MSL, while its base is 2–3 m. deeper. One may argue, though, that this channel was quarried earlier, perhaps during the first structural phase on the shore on the southeastern side of the tel, probably in order to facilitate better circulation and more effective flushing of the mooring basin next to platform E.

The stratigraphy in Area C indicates that there was a later occupational phase in the 11th century BCE, of which no marine or coastal structures have survived, though one floor (L. 47) over the dark depositions of fine mud, and probably also the rubble wall over the ashlar retaining wall H (wall 36), date to this phase.

The next structural phase may be dated to the 10th century BCE, and is assumed to be the first one built by the Israelites, probably during the latter part of the reign of David, or that of Solomon (I Kings 4:11). This new phase is characterized by the extensive use of large limestone blocks in construction of massive walls, such as J, L, and M. One may wonder why these new settlers hauled such huge blocks all the way from Mount Carmel, across marshy basins and rocky ridges, when there were almost unlimited quantities of building stones at the site and ample source of Eolianite beds in its immediate proximity. The only logical explanation for such an attitude would be a reluctance to use unfamiliar types of building stone. This would be an understandable attitude on the part of immigrants from the hill country of the hinterland, and might indicate that they came to an uninhabited site. The same lack of awareness of the existing qualities of the site may have been the reason that the freshwater well was ignored and wall 67 was built over it. However, if we accept the opinion of some scholars that Dor of Solomon was predominantly settled by gentile descendants of the previous population and by Phoenicians, this phenomenon remains an enigma.[60]

Summary

Direct and circumstantial evidence, in combination with the geomorphological and historical data, enable us to sum up the following sequence for the southeastern coastal strip of Tel Dor (Figs. 9.27, 9.28).

1. This area was originally low ground, on the lee of the coastal ridge, a sandy beach facing the long sheltered bay to the south and its inner extension to the east. The sea, which had stabilized at more or less its present level some 4000 years ago, subsequently carried growing quantities of sand and deposited it on the southeastern shores of that body of backwater. Some of the sand was carried farther by the wind.

2. Apparently at some time in the 13th century BCE, new harbor facilities were built at Dor, the first to be located at that particular site on the southeastern side of the settlement. One might argue for the location of earlier facilities at Love Bay to the northwest, or at the lagoon on the northeastern side of the settlement. The latter location may have been abandoned by then because of extensive silting. One may postulate a new group of settlers who brought with them marine engineering and architectural technologies as the instigators of this new harbor.[61] In this first phase the harbor facilities consisted of a wide ashlar paved quay (E), with a massive retaining wall of huge headers on its western side closing the gap towards the rocky ridge, and a similar one on the east, perhaps underlying the southeastern corner of the settlement. The relative sea level at that time was at least half a meter below the present one, and the harbor engineers may have quarried the flushing channel across the low ridge blocking the bay to the west, in order to instigate a flushing current through the mooring basin and to keep the silt from the quay. Soon after the completion of these harbor facilities there was a short-term flooding event during which the mooring and berthing facilities were exposed to considerable wave energy. This catastrophic phase did not last long, and when it was over some structures were added to the earlier ones. Such were the additional ashlar header wall (wall 9) on the eastern flank of the slipway, the ashlar paving behind the platform wall on the west (L. 66), and the well behind it (L. 62). The material culture from the stratigraphic contexts of these structures dates them to the last phase of the Late Bronze Age.

3. The continuous rise in relative sea level necessitated renovations and readjustments of the quays and other waterfront structures. Such renovations were carried out at least twice during the 12th century BCE. The first comprised the platform in Area A (L. 23) and the quay or retaining wall of ashlar headers (Q). The second comprised the rectangular ashlar paved platform on the east (L. 24) and the second raising of the well. At that stage the western retaining wall (wall 69) was added.

4. A radical change in the local topography occurred during the first half of the 11th century BCE, probably soon after Wenamon's visit to the harbor.[62] This upheaval exposed the structures on the southern waterfront of Dor to the surge, much as they are today. Subsequently the western part of the area was detached from the sea by extension of the western retaining wall (wall 69) towards the east; the area on its lee was renovated with a newly elevated wall, a well-built drainage channel (L. 65), and a series of floors (L. 58, Floor O). On the eastern side (Area A) the rectangular platform was removed and the raised pavement (L. 27) was laid. Somewhat later, but still in the 11th century, most of the coastal strip was abandoned to the surge and wall H was established as the southern retaining wall of the settlement. South of that wall no maritime structures survive to indicate that the southern harbor was still functioning.

5. When the Israelites came to Dor early in the 10th century BCE, most of the earlier structures were already in ruins and probably covered by a sloping fill of soil and debris. Their buildings on the southern side of the settlement were rather massive, but are quite high above the sea level and, judging from what has survived, cannot be ascribed to any maritime function. The lack of sand between the floors of this and the following occupational periods would suggest that this particular site was well sheltered from the sea, either because there was some kind of longshore sea wall, south of and parallel to wall 36, or due to subsidence of the sea level to considerably below the present one.[63] It is interesting to note that in Love Bay too coastal structures with maritime functions are absent in this period. In fact, no architectural or other remains have been discovered so far to document maritime activity at Dor during the first half of the first millennium BCE (see also below).

6. The latest datable architectural features at the site are of the Late Persian or Early Hellenistic periods (4th–3rd centuries BCE). These units are the fortification wall in Area F (wall 5) and the nearby course of ashlars over the eastern part

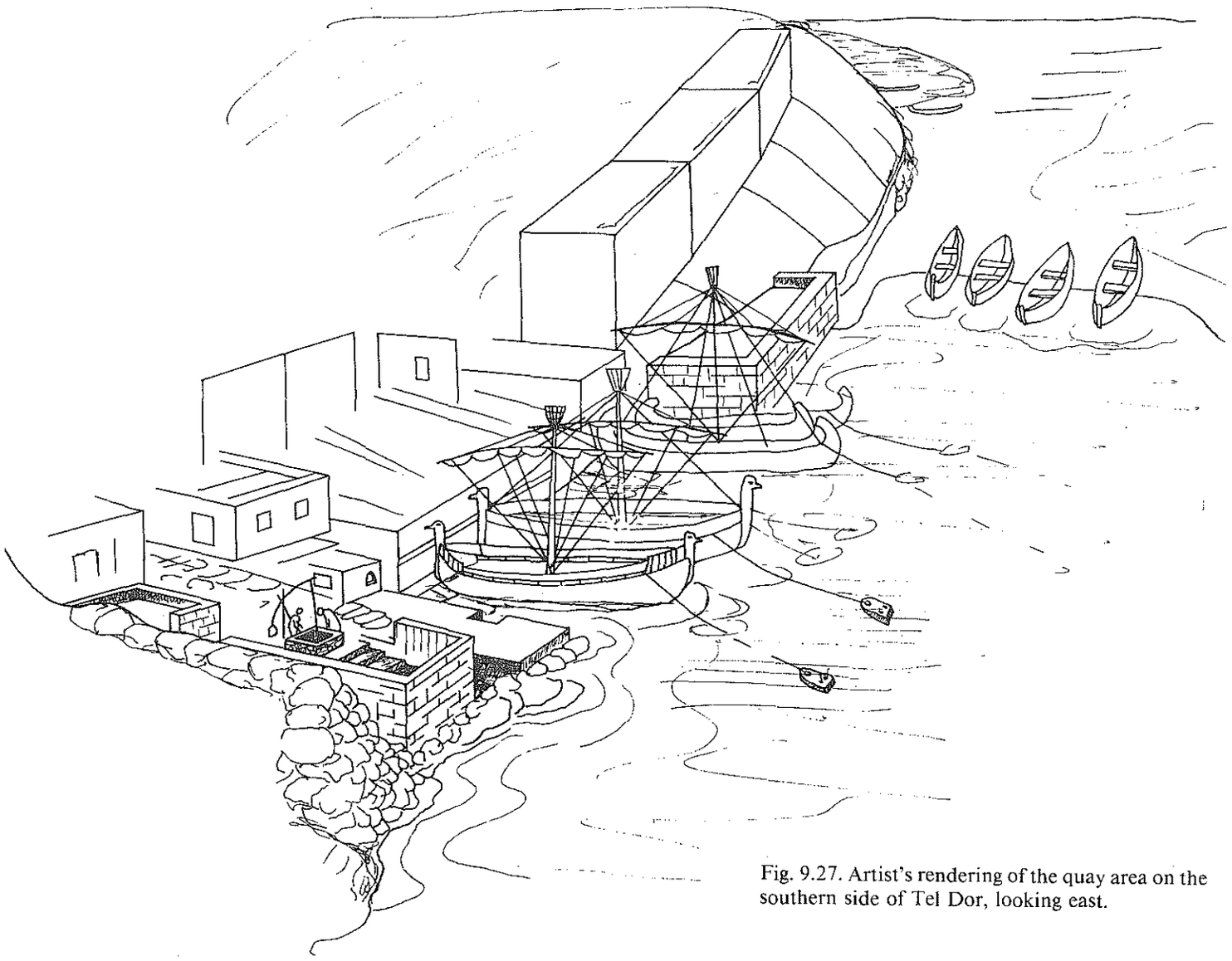

Fig. 9.27. Artist's rendering of the quay area on the southern side of Tel Dor, looking east.

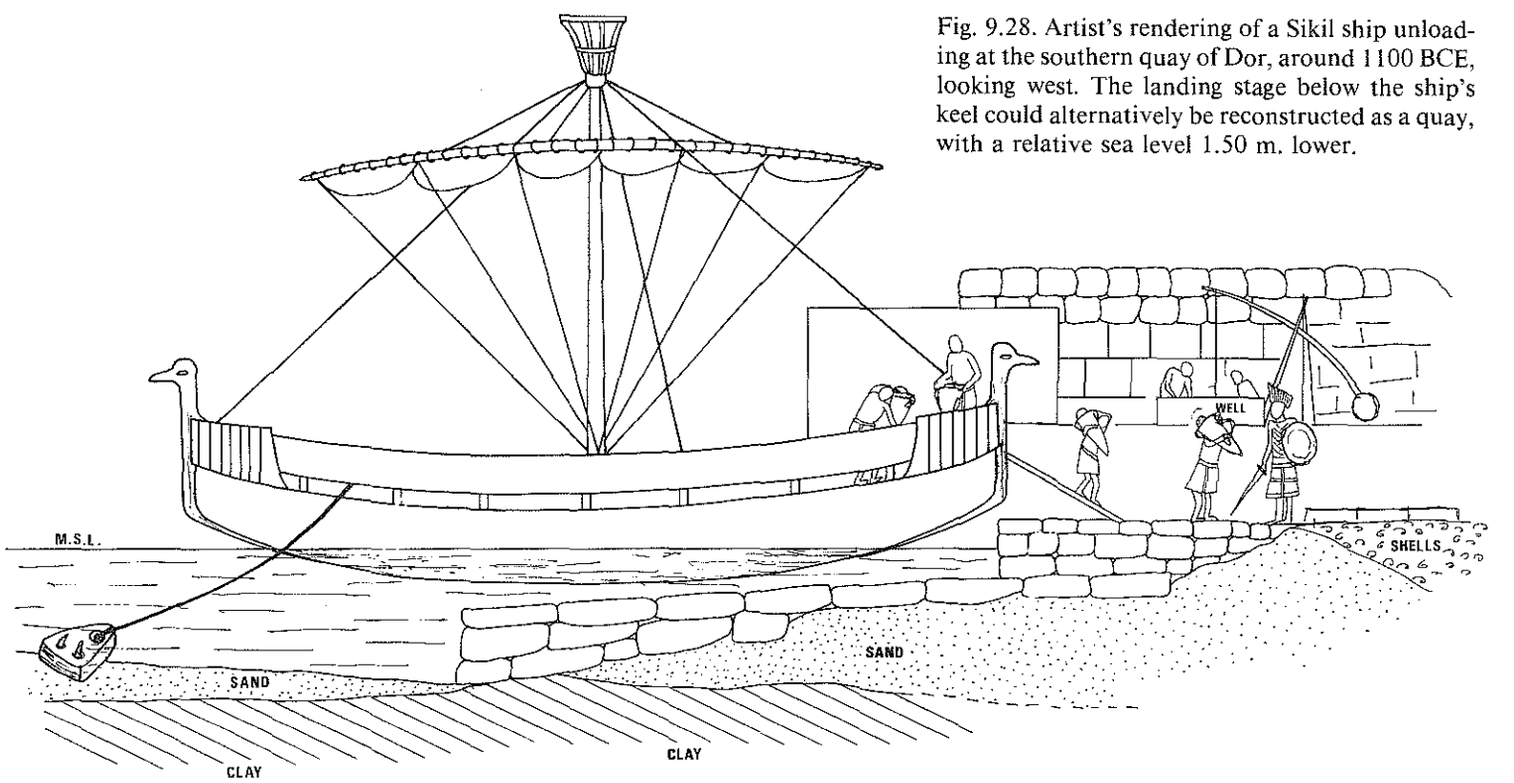

Fig. 9.28. Artist's rendering of a Sikil ship unloading at the southern quay of Dor, around 1100 BCE, looking west. The landing stage below the ship's keel could alternatively be reconstructed as a quay, with a relative sea level 1.50 m. lower.

of the coastal strip (wall 4). It is intriguing to note the absence of additional structures from these periods farther to the west. However, the ashlar base for a rectangular structure (a quay platform?) on the southern side of Area A (wall 29) may be ascribed to this general era. The quantities of surface finds of these periods all over the coastal strip indicate that the nearby part of the settlement was extensively occupied in those days, as were at least the eastern and southern sides of Love Bay.

H. OTHER MARINE INSTALLATIONS

During the years of study of Dor's archaeological features in relation to the sea, several rock-cut installations have been surveyed.[64] None of these units can be dated by stratified sherds or contemporary structures in their immediate vicinity. However, some of these installations have good datable parallels in other coastal sites, and for most of them the land/sea relations at the time of their use are known. Consequently, comparative typology and correlated sea levels may be of assistance in determining an estimated date for the period of their functioning. There follows a brief description of the more important installations.

1. Wave Catchers

This is a term we gave to cross-cut hollows on the weather side of rocky promontories. Three such man-made hollows have been surveyed in the general area of Dor (Figs. 9.1, 9.29).

a. The largest of the three is that which bisects the western tip of the acropolis of the ancient city, on the southwestern side of the tel (Photo 9.78). Its location is at the spot where the tilted uplifted *kurkar* ridge is at its highest elevation (over four meters above MSL). The bedrock has been hewn away, leaving vertical scarps on both western and eastern sides, for a width of over seven meters and down to just below the water level (-0.20 m.). The hollow, almost fifty meters long, is open towards the abrasive shelf and the sea at both its northern and southern ends. In much later periods additional quarrying widened its eastern side by a large rectangular hollow which cut through the midsection of a large rock-cut cistern dating from late antiquity. This additional quarried hollow lacks the characteristic series of horizontal abrasive notches which are so clearly visible along the lower part of the original western one. At the base of the original passage there is a series of quarried shallow rectangular basins down to about 0.80 m. below MSL. These basins were cut when the sea level was at least half a meter lower than at present; they postdate the original hollow and predate the additional one to the east. Along the edges of these rectangular basins there is another solution notch, at 0.40 m. below MSL. This notch may represent a period of stable land/sea relations that have followed the quarrying of these basins, at 0.50–0.80 m. below MSL.[65] A similar solution notch is being established at present at an elevation of just above MSL all around the edges of the combined hollow. The higher horizontal notches along the western scarp represent two phases of stable sea level higher than the present one, at about 0.40 and 0.70 m. above MSL. Comparison of these data with the raised elevations of the flushing channels and water basins on the northwestern side of the site suggests dates for these notches in the 4th and 6th centuries CE respectively. With these dates in mind, the lower basins should be attributed to the medieval period, when the sea level was 0.70–0.80 m. below MSL. Such a low sea level in the 13th century CE has been suggested on the basis of archaeological data from other sites along the coast, such as Caesarea and 'Akko.[66] As for the function of this hollow, we believe it was fashioned in its original outline in relation to the local topographic features of the time, in order to reduce the mass and energy of the incoming surge, and thus preserve the structures on the lee from saltwater spray. Such wave-absorbing rock-cut channels or quarries are known from Phoenician harbors such as Sidon,[67] and as an artificial component of the Herodian harbor in Caesarea.[68]

b. The second 'wave catcher' is a narrower and shorter curved channel or through hollow at the northwestern tip (the weather side) of the large temple platform (Fig. 9.29; Photo 9.79). The topography of this site when the great podium was built apparently consisted of a wide, short promontory, with a level surface at about 3.60 m. above MSL and a moderate slope towards the sea. There is no doubt that storm waves would reach the top of this promon-

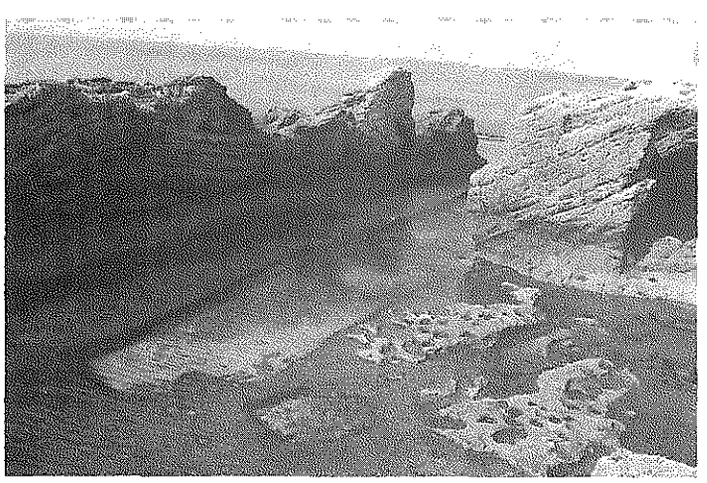

Photo 9.78. The southwestern wave catcher, looking north. Note the series of horizontal abrasive notches above and below the water level.

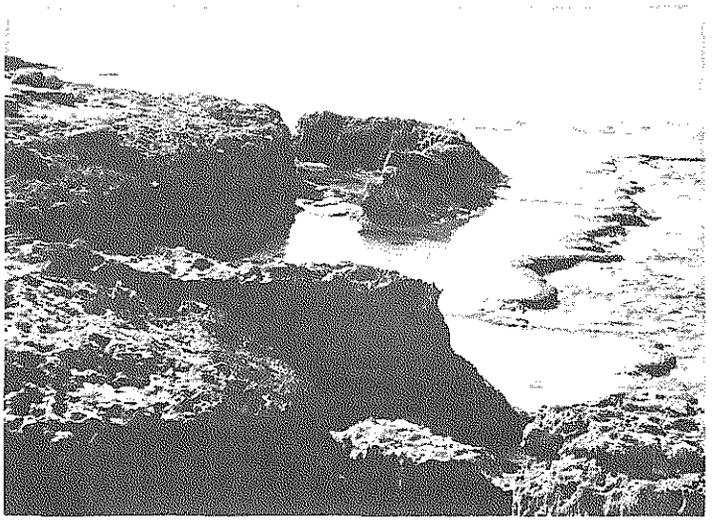

Photo 9.79. The northwestern wave catcher, looking west.

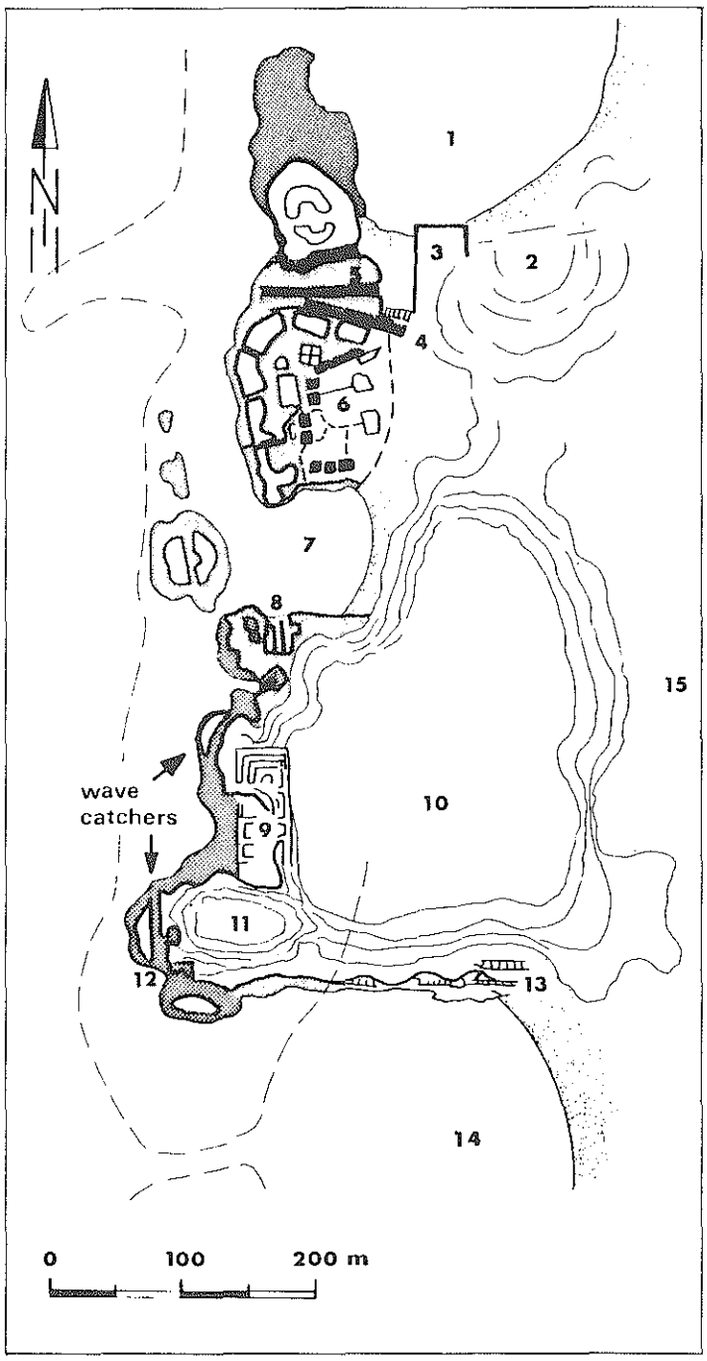

Fig. 9.29. General location map of the marine installations on the western side of Tel Dor.

tory every winter. The wave catcher was presumably hollowed out when the area on its lee was prepared for the building of the north temple, in order to keep the sacred precinct spray-free.[69] The hollow is just short of 20 m. in length and about 4 m. wide. There is no later quarrying next to it or at its base, which seems to indicate that the land/sea relationship remained stable. The only additional feature is a series of rectangular recessed notches along the sea wall of the hollow, at 1.40 to 2.10 m. above MSL (Photo 9.80). These recessed notches were made for fixing wooden beams across the hollow. Such cross beams may have been used as hanging devices for lighters or fishing boats, for maintenance, or for seasonal storage, though such a use would not be practical during stormy weather or in the winter.

c. The third 'wave catcher' is more enigmatic than the former two. It was cut across the western, weather side of the southernmost islet of Tantura Lagoon (Hofami Island). It is a narrow (less than 2 m. wide), deep quarried channel almost 34 m. long (Photo 9.81). The cutting was never finished and the channel terminates some 3–4 m. short of the northwestern edge of the rocky islet. There is also a narrow unquarried rocky screen or partition wall 1.40 m. high across the channel about 5 m. from its southern end. The bottom of the quarried passage is 0.60 m. above MSL, but this elevation is not even throughout its length. There are no visible remnants of any structures or other quarrying on the islet; thus the function of the installation is hard to comprehend. One possible explanation might be that there were plans to exploit the islet for some unknown purpose (a quarry, shrine, storage facilities?), but that for some reason these plans were never executed. Hofami Island is located between the two navigable entrances to the moorings in the lagoon, which became favorable during the Late Roman and Byzantine periods.[70] The islet may have been used during these periods as a base for a navigational beacon or a lighthouse, with the unfinished wave catcher protecting it from storm waves.

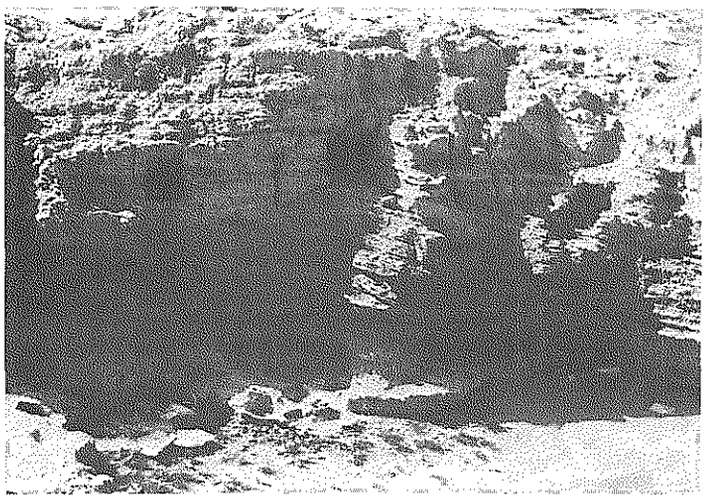

Photo 9.80. The western wall of the northwestern wave catcher. Note the square notches for wooden cross beams.

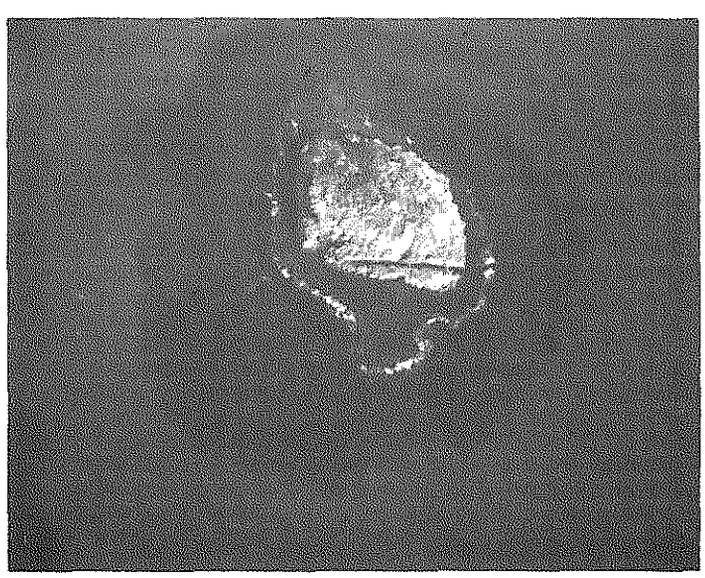

Photo 9.81. Aerial photograph of Hofami Island; note the unfinished cross-cut along its weather side.

2. Piscinae

These are rock-cut and/or stone-built basins with some flushing facilities, with their floors below sea level and their edges well above it, which were used to store fishermen's catch alive until sale to fish merchants or other local customers. This type of installation is well known from classical sources and is common in coastal sites of the period all over the Mediterranean.[71] In the area of Dor several such installations have been surveyed. Of these three are described below.

a. Twin rock-cut basins are located on the southern side of the southwestern promontory of the tel (No. 12 on Fig. 9.29; Photo 9.82). A rectangular hollow measuring 6 x 8 m. was quarried at the southern edge of the promontory, leveled at 0.80 m. above MSL, and separated from the low, exposed area to the south by a narrow segment of the *kurkar* ridge. At the base of the hollow two rectangular basins were quarried, with a partition wall 0.37 m. wide along their longer side. Each of the basins measures about 3 x 2 m. The eastern one had a maximum depth of 0.83 m., while the western one is much shallower, no more than 0.40 m. deep. A narrow through channel was opened in the rocky segment and towards the abrasive platform behind it, enabling the access of a wave-initiated flow of sea water into the basins. An overlapping plate of beachrock currently covers the place where that feeding channel enters the basin, and thus it is not possible to determine whether there are sluices across it for controlling the flow in and out. This beachrock attests to a period during which there was a considerable sand deposition over these basins, with somewhat lower sea level and wave energy. This period postdates a phase during which the rock-cut edges of the basin were inundated and had to be raised by additional stone block walls around their rectangular perimeter (Photo 9.83). This additional ashlar construction may be another indication for a relative rise in sea level during the later classical era and subsequently, as is attested by other structures described above.

b. Two pairs of almost identical units were surveyed on the western side of the peninsula at the other side of the South Bay, by the team of the Israel Archaeological Survey led by the late Y. Olami; they are presently covered again by wind-blown sand.[72] Basins of the same type were apparently

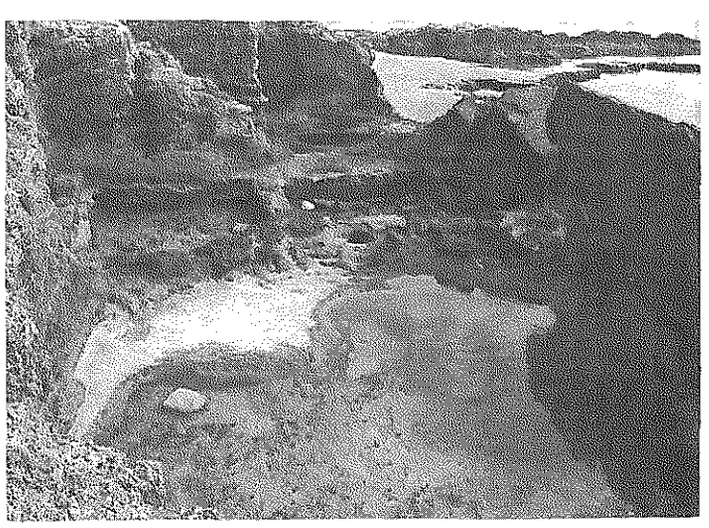

Photo 9.82. The twin fish tanks on the south side of the southwestern promontory, looking southwest.

Photo 9.83. Close-up of the twin fish tanks.

cut near the shoreline elsewhere in the Dor area and on the weather side of the islets of Tantura Lagoon. One such basin was quarried into one of the foundation trenches of the walls of the great podium on the tel, most probably at a time of maximum sea level and long after the sacred complex had gone out of use. One may propose a Byzantine date for its quarrying.

c. The *piscina* on Dor Island is a rock-cut installation on the western side of the rocky islet. Unlike the other, rather simple fish tanks at Dor, this is more sophisticated and larger, fashioned for the storage of large quantities of fish and for more than a few days. It consisted of two main rock-cut basins, one behind the other, level with the incoming surge on the weather side (Fig. 9.30; Photo 9.84).[73] The forward chamber is separated from the abrasive platform on the west by a ledge two meters wide and sloping outwards, presently 1.30 m. above MSL but originally about half a meter higher. This chamber measures 5.90 x 2.80 m., with its floor at about 0.60 m. above MSL. A narrow rock-cut ledge runs along its southern side, and behind it is the second chamber, measuring 2.10 x 3.60 m. with its floor at 1.90 m. above MSL. The forward chamber has a rectangular extension of the chamber on its northeastern side with the floor at the same elevation as that of the main space. Next to it there is a rock-cut passage 3.30 m. long with a width varying from 1.37 m. in the western part of the passage to only 1.08 m. in its eastern inner part. A rock-cut threshold 0.20 m. high separates the two segments of the passage, and there is another one at each end. The passage leads to a large rectangular chamber, measuring 9.60 x 4.10 m., which was quarried from the rock to about 2.50 m. below its original elevation. The bottom of this basin is partly covered by encrusted rubble fill, mostly on its inner part and along its southern wall. The original rock-cut floor seems to have been about 0.40 m. above MSL, with a well-developed solution notch about 0.80 m. above it along the side walls and the lower part of the rock-cut staircase leading into the basin along its northern wall, from the northwestern corner (Photo 9.85). There is no doubt that when the *piscina* was in use the water level in it was about half a meter higher than the present one. One might argue that such a water level could be

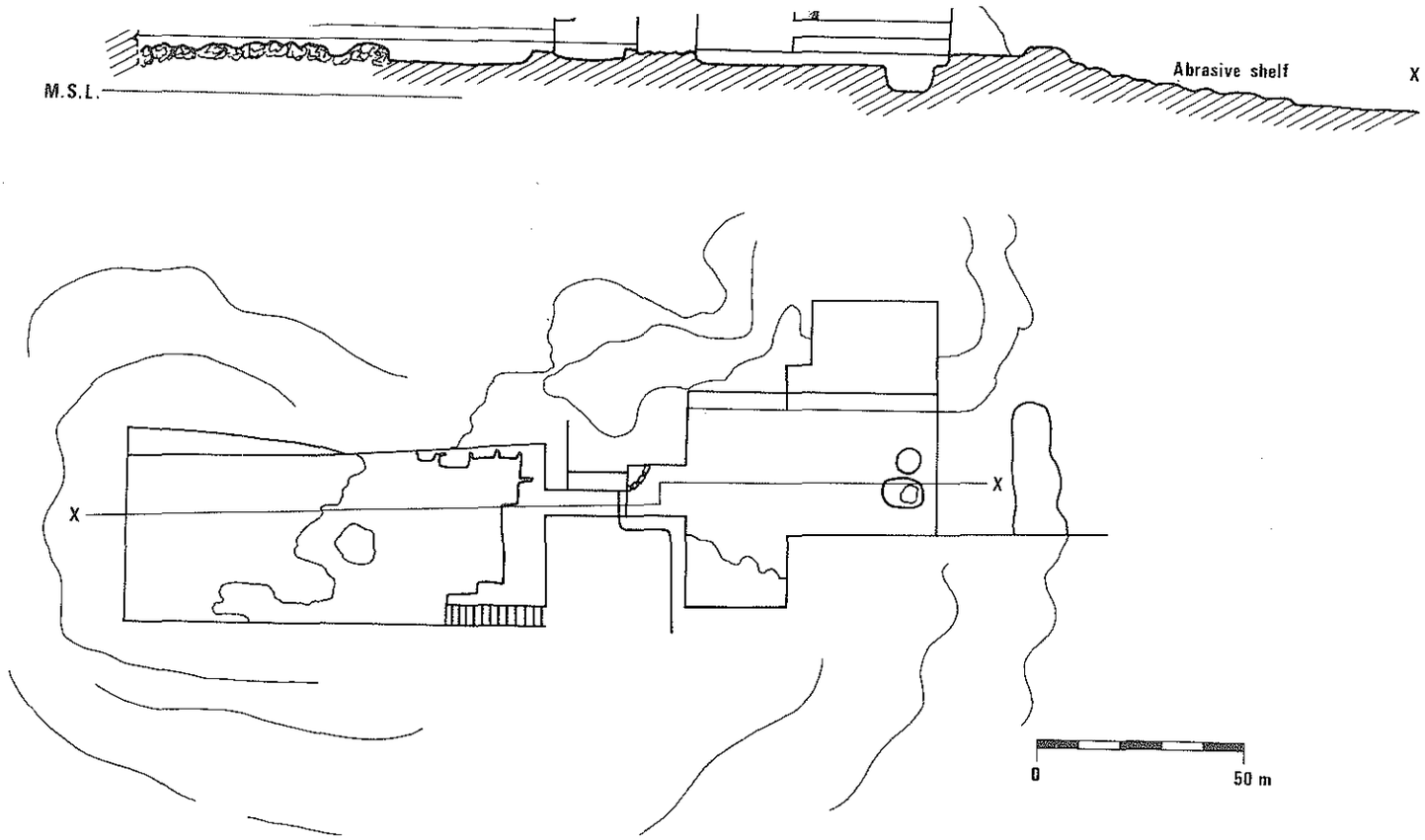

Fig. 9.30. Plan and section of the *piscina* on Dor Island.

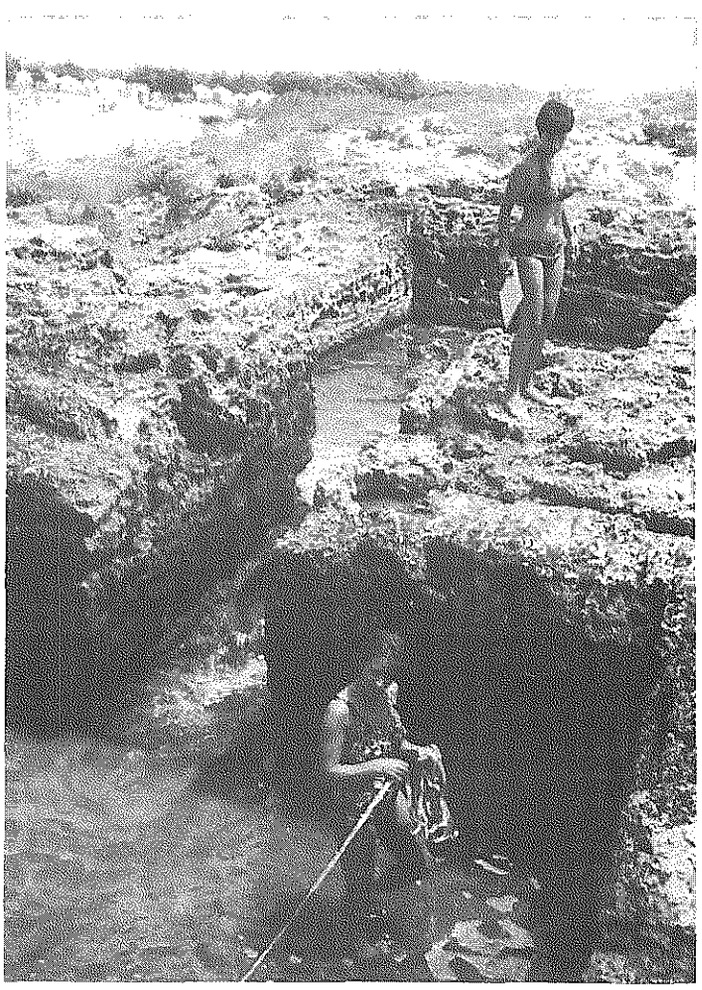

Photo 9.84. The *piscina* on Dor Island, looking northeast.

maintained if the threshold at the entrance was originally higher, and thus that the sea level was not necessarily high at the time. However, if the threshold were higher, a high sea level would be required for an ample, continuous supply of water to the *piscina*; the present sea level is too low and too far away for this. Taking into account other archaeological data for maritime activities in the nearby lagoon, a Late Roman date would be the best estimate for the use of the *piscina*. In a much later period the basins dried up and were used for other purposes, as attested by the remains of rubble walls and fireplaces that were installed in the passage between the two chambers and on the floor of the basins. Considering data derived from elsewhere for a lower sea level in the medieval period and the fact that a large rectangular rock-cut basin at the center of this islet was used about

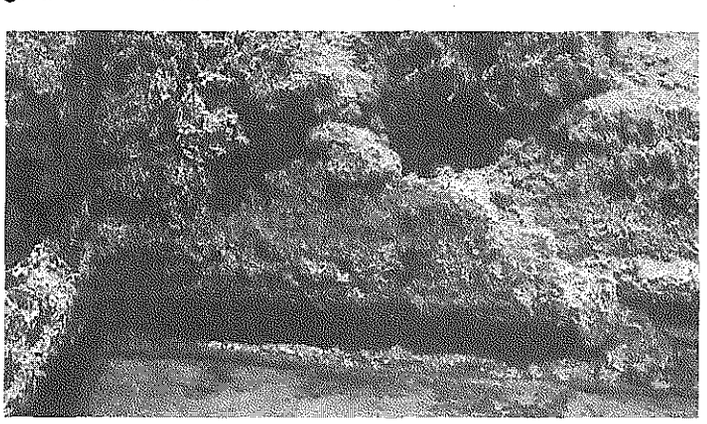

Photo 9.85. The staircase at the northeastern corner of the main chamber of the *piscina* on Dor Island, looking north. Note the solution notch, which indicates the water level in the basin when it was in use.

then as the site of a small mosque or *wali*, one may date these later secondary uses to the Mamluk period, probably when the Arab village of Tantura was settled.

3. Quarries

On the peninsula on the southern side of the South Bay are numerous quarries, of various sizes and shapes, and presently half covered by wind-blown sand. A large part of the rocky area on the peninsula was apparently quarried, leveled, and shaped to fit fish tanks and some rectangular buildings. The area has not been thoroughly studied, but the preliminary surveys carried out by the late Y. Olami and ourselves indicate continuous activities and occupation at the site from the Roman period onwards. Some 12th–10th century BCE sherds collected there indicate human presence in even earlier periods. The location of this site between the South Bay and the lagoon may suggest that these activities were connected with fishing, processing of the catch (brining, salting, and preserving), etc. The two units of double fish tanks may be indicative of such functions.

4. The Sea Well at Tantura

This sea well is a good example of the local Arab population's understanding and sophisticated exploitation of the shallow coastal fresh water table, just above the interface with the sea water. This type of well is attested as early as the Pre-pottery Neolithic period at the neighboring Atlit, and is also represented by the rectangular Late Bronze Age well in Area D along the southern side of Tel Dor (see above). The round well at the northern end of Tantura Lagoon was still functioning in the present century and even now yields fresh water when there is a calm sea and extremely low tide (Photos 9.86–87).[74] The principle is simple: wherever the beach and the inshore shallows next to it are underlaid by an impregnable layer of fine clay, the fresh water table is sealed underneath it. An artificial well dug through this clay provides an outlet for the hydraulically pressurized fresh water to rise within it, providing that the shaft is kept intact and waterproof in order to avoid salination by the surrounding

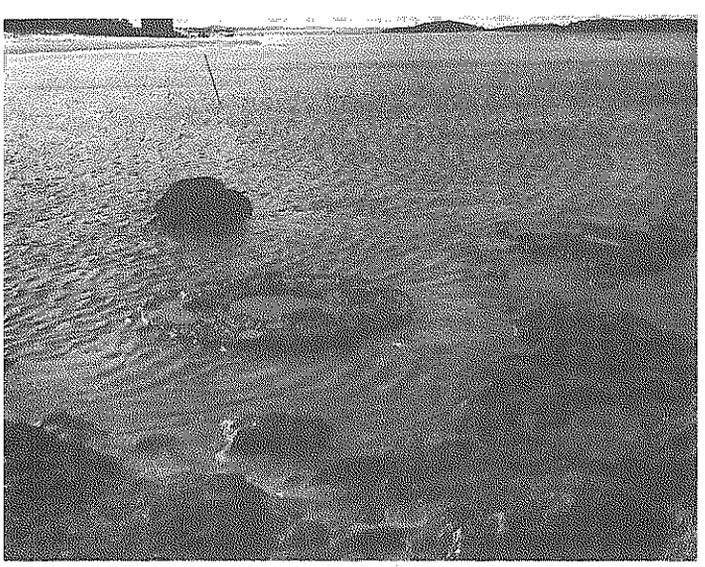

Photo 9.86. The Arab well at Tantura Lagoon in a calm sea, looking southwest.

Photo 9.87. The Arab well at low tide, looking south.

body of sea water. This particular well at Tantura is known to have been in use since at least the mid-17th century CE, and may have replaced the Late Bronze Age rectangular well at the tel, some distance from the Arab village.[75]

I. UNDERWATER FINDS

Though this report summarizes the archaeological data concerning the maritime aspects of the occupational history of Dor, it contains little relevant information from under the water. The seafloor around Tel Dor has been repeatedly surveyed by divers for over 25 years and hundreds of archaeological finds have been recorded, but there is no single data bank and no research group has been established to undertake the necessary process of studying these casual finds within their overall context.

Since the mid-1970's most of the underwater work has been carried out by S. Wachsmann and K. Raveh on behalf of the Israel Department of Antiquities and Museums (now the Israel Antiquities Authority) and the Regional and Nautical Archaeological Research Center of the area of Dor, housed in the 'Glass House' Museum at Kibbutz Nahsholim.[76] It is to be hoped that these finds will be studied systematically and published in their context in the near future. Most of the data and the underwater finds from surveys which were carried out by the IUES and the CMS have been handed to the above-mentioned team and are stored in the files and archives of the Israel Antiquities Authority. It is appropriate here to give a list of the major sites and the more important artifacts that have been recorded, or published in preliminary form, so far.

1. The Napoleonic Weaponry Location

This is over the seafloor in the gap between Tafat and Hofami Islands, at the southwestern entrance to Tantura Lagoon (Fig. 9.1). The site was discovered by the divers of IUES in 1964 and studied in 1968 by a team led by Y. Galili, from whose unpublished files the following summary is derived.[77] A baseline 60 m. long was laid on the seafloor, on a north–south axis, and the remains of weaponry and other items were surveyed and plotted as far as 15 m. west of the baseline and about 10 m. to the east (Fig. 9.31). Of over 100

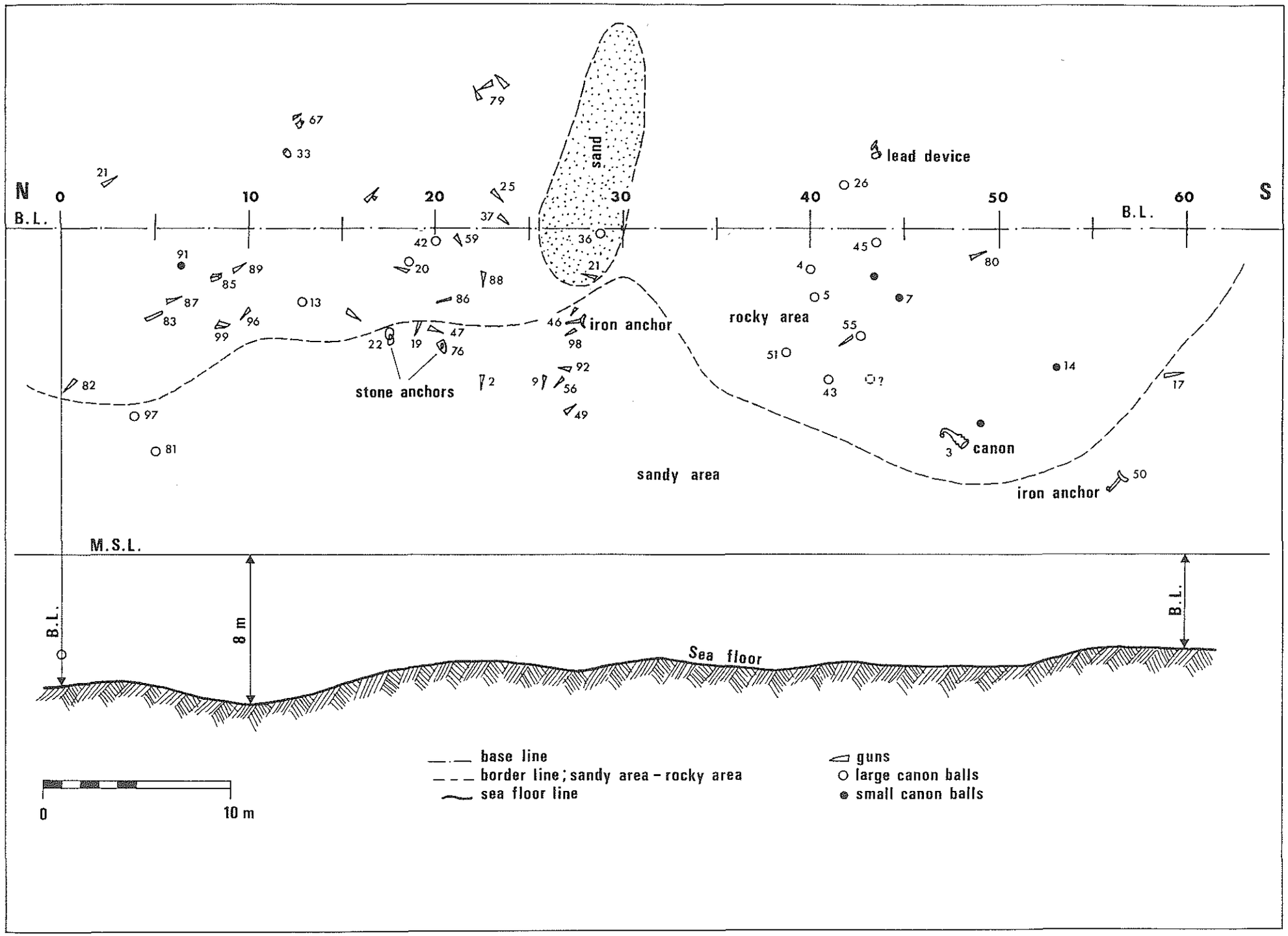

Fig. 9.31. Survey plan of the Napoleonic weaponry area, based on Y. Galili's data and plotting of May 4, 1968

Photo 9.88. Group of muskets from the Napoleonic weaponry site.

items plotted more than 30 were flintlock muskets, most of which were well preserved, especially their wooden parts, and covered by heavy marine encrustation (Photo 9.88). The water depth along the baseline was 6.50–8.10 m. The guns were found spread over an area of 70 sq. m. (more were found later, farther to the east, by Wachsmann and Raveh). The guns were studied by M. Gihon of Tel Aviv University and M. Kravi and were identified as the standard gun of the French infantry during the later 18th century. Though probably made at the Royal Armory in St. Etiennes, they were known by the generic name of 'Charleville guns.' Their steel buckles indicate that they were intended for the infantry rather than the navy (whose guns were furnished with bronze devices). On the basis of the manner in which the barrel was fastened to the wooden part of the gun by iron bands and rings, the manufacturing series of these guns may be dated to 1728. The diameter of the balls is 69 mm., and they were loaded through the muzzle. The wooden part (Fig. 9.32) was made of chestnut and was well oiled.

Three encrusted guns were taken to the metallurgic laboratory of the Technion in Haifa and were X-rayed. In two of the three, balls were found inside the barrel, either because they had become jammed there or because of circumstances which demanded the loading of the guns. Since the standard procedure in the French army during the Napoleonic campaigns was to load guns only in a combat situation, one may argue that this was the case when all of these guns and other weaponry were lost in the sea.

In addition to the guns one swivel cannon was found, on the southwestern side of the surveyed area (Photo 9.89). This

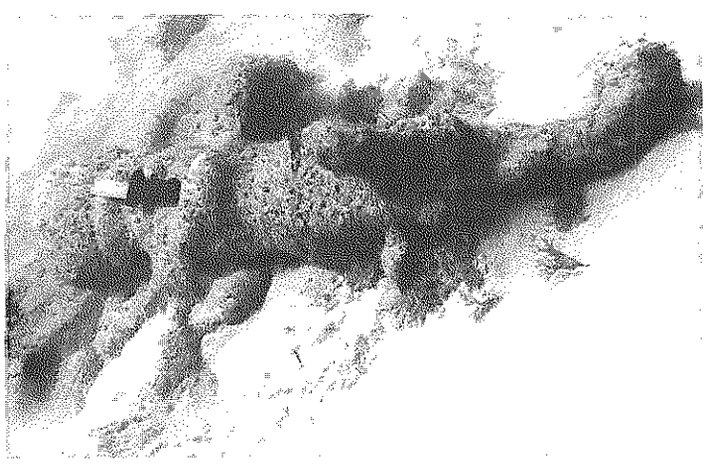

Photo 9.89. A swivel cannon on the seafloor south of Tafat Island under 7.20 m. of water, looking southwest.

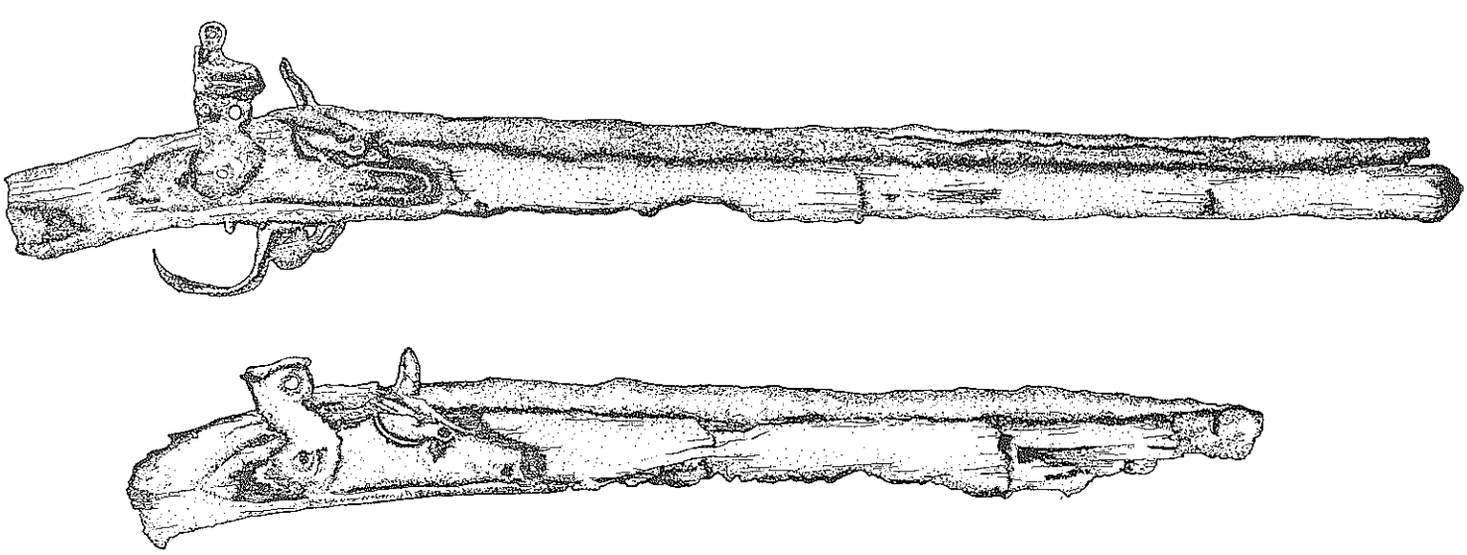

Fig. 9.32. The wooden parts of two muskets (*Qadmoniot* 15 (1982): 89).

type of naval weapon was in standard use since the early days of seaborne artillery in the 15th century. This particular cannon was not salvaged, and was left *in situ* together with most of the plotted weaponry. Since it is covered by marine encrustation, its source and date of manufacture have not been studied.

About a dozen cannon balls over 10 cm. in diameter and made of iron were plotted at the site, probably ammunition for the 24-pounder heavy siege cannons used by the French.[78] There were also several smaller cannon balls of 6-pounders and 12-pounders, the standard ordnance of the French artillery.

Of greater interest is a mortar bomb 0.37 m. in diameter and bearing two iron rings typical of 18th-century ordnance, though without any marks that would help to identify its source or date (Photo 9.90). It was obviously intended for a much heavier and wider mortar than the one found in 1983 to the east of this site by the divers of the Department of Antiquities and Museums (Fig. 9.33).[79]

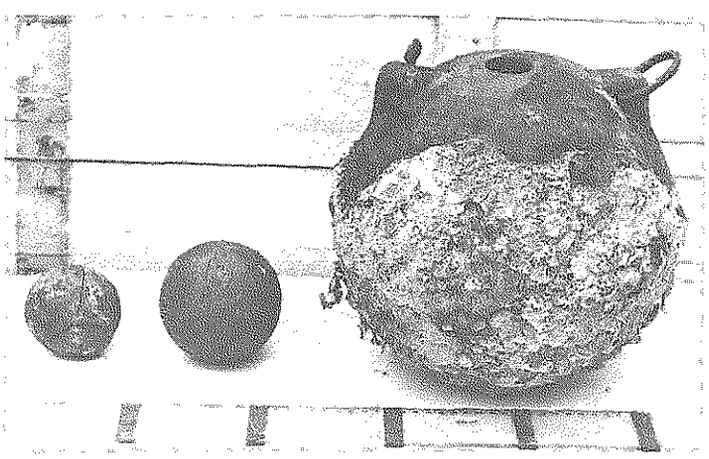

Photo 9.90. Cannon balls and mortar bomb from the Napoleonic weaponry site.

Within the surveyed area on the seafloor there were also several locations of broken amphoras dated to various periods; the earliest are basket-handle types dated to the Persian period, and the latest are the cigar-shaped Gaza types of the Byzantine period.

Two stone anchors of a single-hole type were found half buried in the sand next to the scattered guns (Photo 9.91),

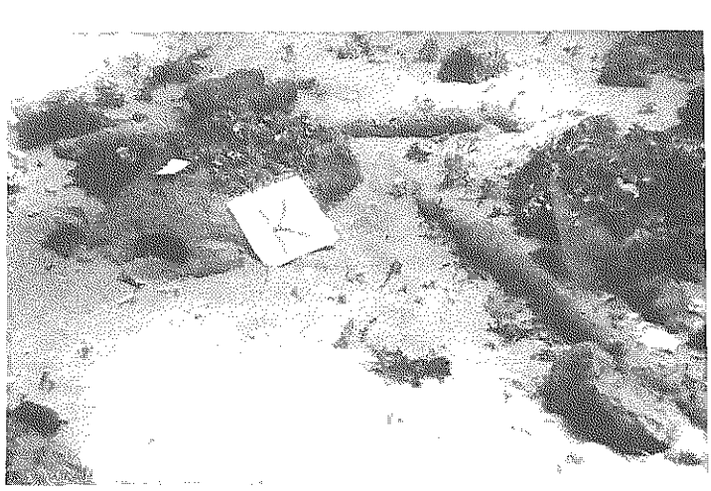

Photo 9.91. A stone weight anchor among muskets on the seabed, south of Tafat Island.

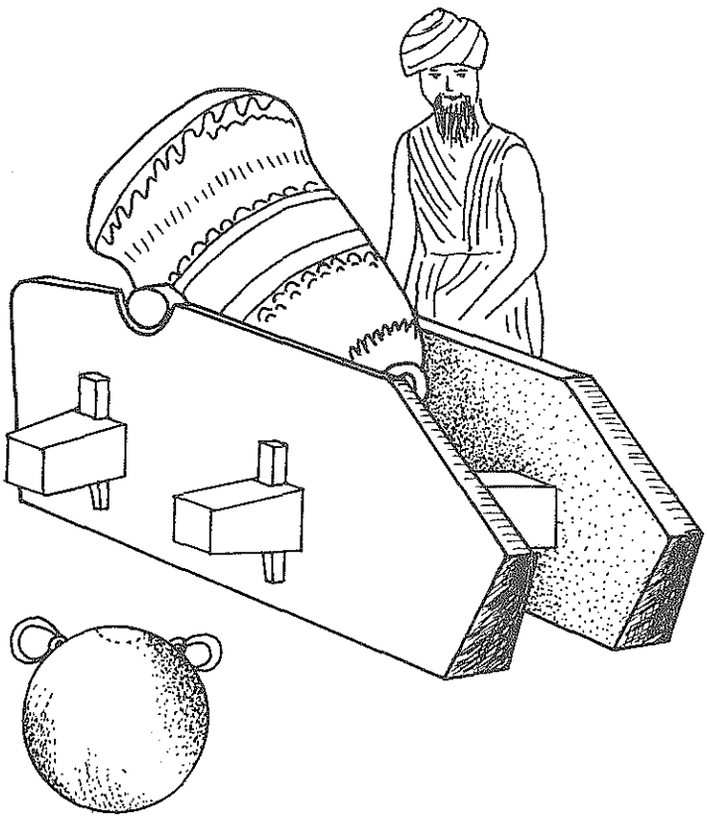

Fig. 9.33. Reconstructions of the mortar and its bomb (Y. Galili).

both rather small (weighing less than 30 kg. each) and of unknown date. Probably more closely connected with the weaponry are two large iron anchors with shanks over 2 m. long, both badly corroded.

The scattered weaponry almost certainly belonged to the French army of Napoleon. However, it is not clear whether they were deliberately dumped when the retreating units attempted to leave Tantura by land and sea on their way to Jaffa and Egypt, or whether there was a shipwreck while the French units were making their way to 'Akko, two months earlier. While the former possibility has been discussed by Wachsmann and Raveh at some length,[80] there is some literary evidence in support of the latter one.[81] The loaded guns and signs of fire on some planking boards and cannon balls may indicate a third alternative explanation of a naval engagement between French gun boats and the British navy during the siege of 'Akko, when the French maintained a secondary base at Tantura.

On the basis of the known evidence we would prefer to relate the finds of Napoleonic weaponry to the events of May 22nd 1799, when some French gun boats succeeded in reaching the defeated units encamped at Tantura; before their embarkation the cannons, mortars, and guns on board were burned and jettisoned in order to provide more room for wounded soldiers. It is of interest that dumping sites of similar weaponry have been found farther to the north, in shallow waters between Haifa and Atlit.

2. Shipwrecks in the South of Tantura Lagoon

These are rather numerous; so far a dozen wreckage sites and

remnants of wooden hulls have been traced within this confined area. However, only one of these sites has been partly excavated, while the others have been surveyed, documented, and plotted.[82] During 1982 and 1984 Wachsmann and Raveh, assisted by the CMS team, dug a small trench in the deep sand deposits in the shallow water on the lee of Tafat Island. Over a dozen intact and broken amphoras of the 6th century CE were exposed, stuck to one another against the inner side of wooden planked vessels. These amphoras are all dark brownish-gray in color and belong to the bag-shaped 'Bet Shean' type.[83] Though they were laid in dunnage, the surfaces of some of the amphoras were eroded and ground during their voyage in the ship's hold.

Somewhat farther to the southeast, similar types of jars were found, mostly broken and with residues of organic substances including what seem to be grape pips. In another location, in a context of scattered basalt stones (probably a ship's ballast), there are many broken amphoras of the basket-handle type, dated to the Persian period.

The earliest securely dated piece of pottery found so far on this side of the lagoon is from a White Painted V Cypriot jug of the 17th century BCE.

Among the score of stone anchors of various sizes and shapes that have been retrieved from the lagoon's floor, there is a group of over twenty from the area south of Tafat Island and just east of the Napoleonic weaponry site.[84] All in all, these finds illustrate a long and continuous maritime history during which the lagoon was used as an anchorage, much as it is today.

3. The Floor of the South Bay

During 1980, a group of volunteer divers from the USA and Canada led by D. McCaslin from the University of Santa Barbara carried out a systematic survey of the seafloor of the South Bay and the area west of the tel. During this survey many stone anchors and broken amphoras were plotted, and some were retrieved, recorded, and transferred to the Israel Antiquities Authority. Though these finds constitute an additional illustration of the maritime activity at Dor, no single site could be considered as that of a shipwreck or submerged structures.

This survey was continued by us in later years and some important data were collected in the South Bay. It was demonstrated that under the relatively thin deposit of sand, the floor of this bay consisted of a thick layer of compact clay of terrestrial origin. In some places along the northern side of the bay, ashlar blocks were found laid directly on the clay, in what may be a slightly tilted or settled submerged structure. In two places, just off Area D, these blocks overlie submerged plates of beachrock at over 2 m. below MSL, indicating the existence of a sandy beach at the site at some time in the past, when the relative sea level was at almost that elevation.

In the center of the bay there were many stone anchors, mostly of the single-hole weight type which is so characteristic of the Bronze Age.[85] Some of these anchors were found in close association with ashlar blocks which are laid on the seafloor in a formation which is not typical of jettisoned cargo or wave-carried debris. These slabs may have been submerged due to continuous undertrenching and might represent a consolidated artificial structure in the proximity of the present site in the past. If this were the case, some of the alleged weight anchors might be considered as mooring stones, originally from a quay.[86] Among these pierced blocks there is a flat slab of beachrock of uneven shape with a single round pierced hole, 0.10 m. in diameter, within a square groove measuring 0.17 x 0.17 m. and 0.02 m. deep (Photo 9.92). This unique pierced stone may have served not as a weight anchor but as a base for some kind of wooden post, either within a ship's hull or as a mooring device in a quay.

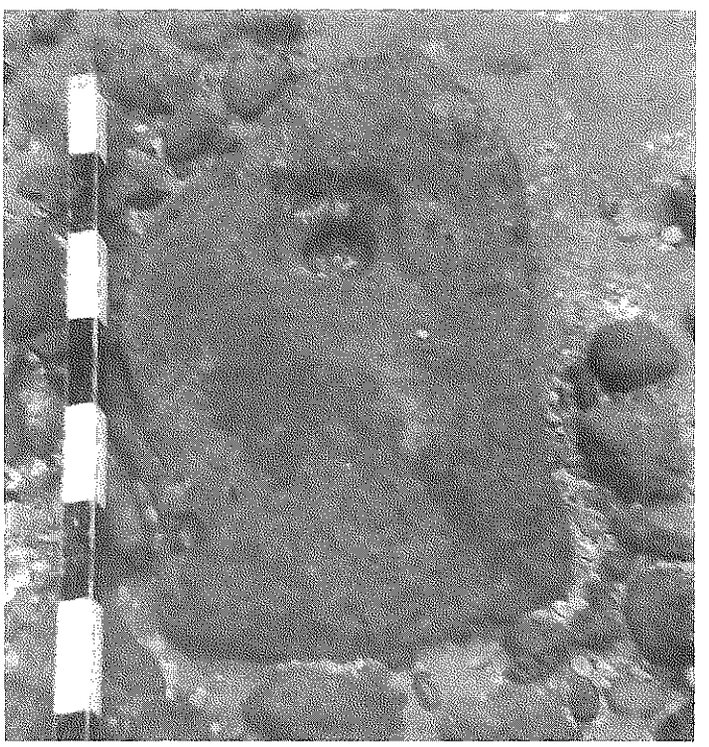

Photo 9.92. A pierced mooring block, or a unique type of weight anchor, *in situ* on the seabed in South Bay.

The most intriguing find on the seabed of the South Bay was what appears to be an intact segment of an ashlar course of headers located about 70 m. due south of L. 20, in almost 3 m. of water. These slim headers do not resemble in size or shape those in either of the structures on the northern shore of the bay. They average 0.40 x 0.30 x 0.80 m. in size, and though they are still in tight formation, there are no other structural remains in their vicinity. Consequently it seems that the packed formation represents a load of building stones that went down with the barge that carried it from one of the coastal quarries in the area.

A careful study of all the recorded data from the seafloor west of the tel, in the South Bay, and in Tantura Lagoon reveals the absence of items dated to the 10th–9th centuries BCE and the rarity of seaborne artifacts of the 8th–7th centuries BCE. This *argumentum ex silentio*, though not conclusive, is significant in view of the extensive corpus of data which has been collected during 25 years of continuous underwater surveys in the vicinity of Dor. Similarly, only a few potsherds from the seafloor are dated to the Early Roman period (the 1st–2nd centuries CE). The historical documents relating to the declining maritime importance of Dor in these periods may be of assistance in understanding these archaeological facts.

J. SUMMARY AND CONCLUSIONS

This report is basically a factual presentation of data collected by the writer and his colleagues up to 1985. The archaeological study of the maritime aspects of Dor is far from being complete. Within the present context the description of the data is the first step in a long and tedious process still ahead of us. Since it is only one part of a comprehensive amphibious field project, the maritime study of Dor may resume in the future, when more of the large body of data from the land excavations has been processed and published. Then, when controversial issues are better defined, the search for answers will be more sharply focused both on land and on the seabed.

In this initial phase, any attempt to build a reconstruction of the maritime history of Dor will be rather tentative and often only conjectural. However, much work has been carried out so far and should be summarized, with all due reservations. With this in mind, we shall offer the following propositions:

1. The early sedentary occupation of the Dor area took place in a landscape whose topographical features differed greatly from those of the present day. Although we cannot draw an exact paleotopographical map, we may still deduce that at that time, probably some 6000 years ago, the sea level was considerably lower and farther to the west, and that the presently segmented and partly submerged coastal ridge was still a continuous feature, at least as far south as Hofami Island. The low ground on its lee was gradually filled in by alluvial silt and clay. With the post-glacial rise of the sea level, this alluvial basin gradually lost its drainage gradient, turned into a brackish marsh, and later, probably towards the end of the fourth millennium BCE, became part of the Nahal Dalia estuary. The local population of that period lived in widely spaced settlements along the edge of the estuary. They were farmers with close contacts with the hinterland, but carried out some seaborne trade, as is attested by the abundance of imported obsidian among their stone tools.

2. The third millennium BCE is an enigmatic period at Dor, as in most of the other coastal sites of the country. The rural settlement was abandoned and radical topographic changes occurred in the area, some of which are due to an alleged series of tectonic upheavals. Though the sea level apparently kept rising, the uptilted coastal ridge protected the area behind it to the east from inundation by sea water and from seaborne sand. However, some airborne sand did cover the clay-filled basins and the remains of the earlier human occupation.

3. The first urban settlers of Dor probably arrived at around 2000 BCE, at a time when the relative sea level was only 1–2 m. below its present elevation. They probably found the southern part of the basin on the lee of the coastal ridge to be already flooded by the sea, perhaps due to a segmenting fault line that ran along the present northern side of the South Bay. The sea-covered area included the low ground to the east of the mound, the South Bay, its present sandy beach, and the area of Tantura Lagoon, as a continuous body of water that was open to the sea only south of Tafat Island. The water in the lagoon would have been too shallow to permit its use as a major haven for seagoing vessels. Only at its southernmost end, behind the partial shelter of Tafat and Hofami Islands, were there waters sufficiently deep and calm for safe seasonal anchorage. For that reason Love Bay was selected as the site for the MB II harbor, and measures had to be taken in order to maintain an adequate water depth by keeping it properly flushed and silt-free. The layout of the early city around Love Bay substantiates this reconstruction. However, it is possible that another, inner harbor basin existed at that time in the northeastern part of the lagoon on the eastern side of the city. The archaeological data suggest that the urban area spread during the Bronze Age from the coastal ridge to the low ground east of it, towards such an alleged inner harbor.

4. During the 18th–17th centuries BCE the sea level apparently continued to rise (eustatically?) and exceeded the present MSL. Shell deposits over occupation levels at Love Bay and on the southern side of the mound document this transgression. In this phase the main harbor of Dor was probably transferred to the southern lagoon and its northeastern extension on the eastern side of the mound. Love Bay may now have been too exposed to the weather, but the lagoon had an adequate water depth and flushing circulation. The quantities of imported Cypriot potsherds indicate that seaborne trade was still active and important for the economy of Dor in this phase, as during the previous one.

5. Towards the second half of the second millennium BCE the relative sea level subsided considerably, probably by over a meter, enough to prevent any further use of the eastern lagoon as a haven. It is possible that extensive deposition of seaborne sand detached it from the southern lagoon and its northern part, in the area of today's South Bay. This northern part of the lagoon, which was still on the lee of the low ridge to the west, became the site of a commercial harbor. Quays and landing stages were built along its northern shore, in architectural conjunction with the city behind the acropolis to the southeast. It is impossible to determine at what stage during the second part of the Late Bronze Age the first ashlar quays were constructed, and whether the structure in Area E was the first of its kind in the South Bay.

6. During the latter part of the 13th century BCE and for the next two centuries, the sea gradually continued to rise, from about one meter below the present MSL to about half a meter above it. This was a period of extensive maritime-related building activity on the southern side of the city, and the continuous efforts to readjust the harbor facilities to the ever-changing land/sea relationship are extensively documented by the stratified architectural remains. The repeated reconstruction of the rectangular well and the floors around represents a good indication of the architectural stratigraphy of the quays and of the various types of deposited sediments. Towards the second half of this period an attempt was made to protect the western flank of the area (Areas D, C) from the surge by a massive retaining wall of huge rubble blocks (wall 69). This effort may have coincided with the final breakthrough of the sea over the constantly abrading low ridge on the west and the exposure of the South Bay to the weather. Following that there was some decline in maritime activity, as can be judged from the poorer quality of the renovated quays. However, this later phase of the 11th century BCE was predated by an era of flourishing maritime activity around 1100 BCE, which is documented not only by the story of Wenamon, but also by the abandoned seaborne commercial jars that were found on the seafloor of Tantura

Lagoon and on the floors in Areas C (floor O, L. 45) and D (L. 58).[87] This heyday is also documented by the ashlar structure in the Love Bay area (W) and various types of imported pottery. Of additional importance are the various types of collared-rim pithoi and jars found in the stratigraphic contexts of this period; among them are all three known variants: the Israelite type from the hilly hinterland, the Galilean type, and the so-called Tyrian or Cypriot type. Further excavations on land and careful study of both the architectural remains and the material culture of this period at Dor will enrich our knowledge of the Sea People in general, and particularly the ethnic group of the Sikil and their role in establishing the Iron Age civilization of the coast.

7. The Israelite conquest of Dor and their first settlement on the site was followed by fluctuating sea levels[88] and complete renovation of the built-up area on the southern side of the city. No maritime structures, or even marine depositions, have been found from this period, or the following ones up to the Hellenistic era, in this part of Dor. The 10th-century structures, though massive, were built of limestone blocks of inferior quality and brought from rather distant sources, and are nowhere related to the waterfront in any functional manner.

8. There is some circumstantial evidence that Dor's harbor was transferred to the north during the Iron Age II, though no maritime structures can be dated to a time prior to the Persian period. In view of the lack of archaeological remains from this period on the seabed too, one wonders how important was the harbor of Dor during the first half of the first millennium BCE. The land excavations have revealed a flourishing walled city with what seems to be a Phoenician material culture, but the location of the harbor facilities of this presumed Phoenician colony remains an enigma.

9. Towards the Persian period the sea level started to rise again and gradually reached its present elevation, just before the beginning of our era (Fig. 9.34). In the Persian period, and probably not without some Attic influence, the slipways were established on the southwestern side of Love Bay. There are enough archaeological finds in the North Bay to suggest that at that time it too was used as a haven, perhaps as the anchorage for a local fleet of fishing boats and supply vessels that harvested *murex* shells for the local purple dye industry. The same functions continued during the Hellenistic era, when the first flushing channel was cut over the quarried platform at the southwestern corner of the North Bay. The well-organized industrial area adjacent to the channel to the south may have been established towards the end of the Hellenistic period. It is possible that at some time during that period a small ashlar quay was built over the ruins of the earlier quays in Areas F and E in the South Bay, attesting the renewed use of that body of water as a harbor, or at least a mooring place, for merchantmen. The finds in Tantura Lagoon may help to date this renewed maritime activity in the south as early as the Persian period.

10. There are no true harbor facilities in Dor that can be dated to either the Roman or the Byzantine periods. During these eras the sea level continued to rise and reached an elevation of almost one meter above the present one in the Umayyad period. The industrial area was in constant use and was readjusted to the rising sea level several times; similar renovations were carried out in the flushing channel north of it and the rectangular structure on the southern side of the North Bay. In the later Roman period, in the late 2nd or early 3rd century CE, a navigational channel was dug connecting Love Bay and North Bay, but it went out of use during the 4th century. Earlier in the Roman period were constructed the wave catchers (?), the fish tanks, and the *piscina* on Dor Island. The main maritime activities during the later history of Dor were apparently fishing and the marine industries of preserving, brining, tanning, and purple dyeing. In this period the North Bay was the main anchorage for local boats, and a longshore quay may have been added in the Byzantine era in the southeastern part of the North Bay. The South Bay, and particularly Tantura Lagoon, were used as mooring basins for the seasonal seaborne trade of foreign merchantmen.

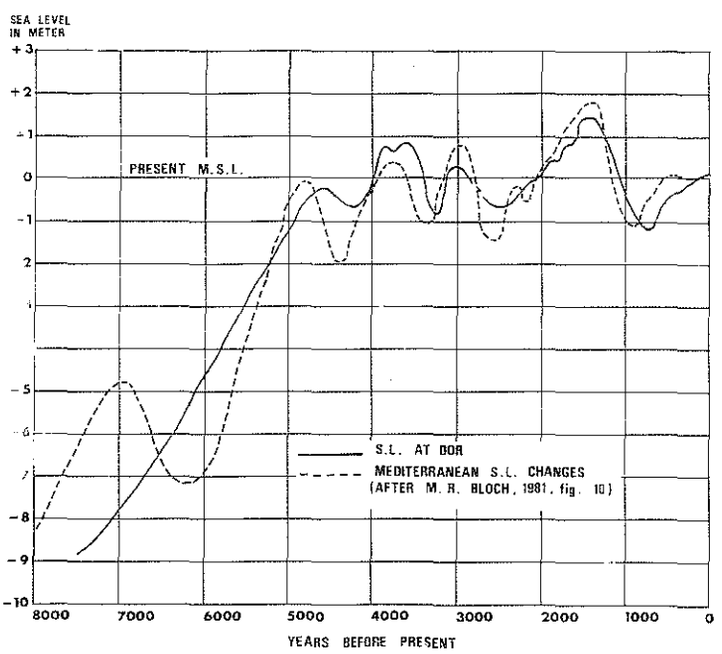

Fig. 9.34. Graph of the presumed sea level at Dor during the later Holocene.

BIBLIOGRAPHY

Blackman, D.J. 1982. Ancient Harbours in the Mediterranean. *International Journal of Nautical Archaeology* 11: 79–104 (Part 1); 185–211 (Part 2).

Dahl, G. 1915. The Materials for the History of Dor. *Transactions of the Connecticut Academy of Arts and Sciences* 20: 1–181.

Flemming, N.C., Raban, A., and Goetschel, C. 1978. Tectonic and Eustatic Changes on the Mediterranean Coast of Israel in the Last 9000 Years. Pp. 33–94 in: J.C. Gamble and R.A. Yorke (eds.). *Progress in Underwater Science*, Vol. 3 (new series). London.

Garstang, G. 1924. Tanturah (Dora). *Bulletin of the British School at Jerusalem* 4: 35–45; 6: 65–69; 7: 81–98.

Gvirtzman, G., Shachnai, E., Bakler, N. and Ilani, S. 1984. Stratigraphy of Kurkar Group (Quaternary) of the Coastal Plain of Israel, *Geological Survey of Israel Current Research* 83–84: 70–82.

Neev, D., Bakler, N. and Emery, K.O. 1987. *Mediterranean Coasts of Israel and Sinai: Holocene Tectonism from Geology, Geophysics and Archaeology*. New York.

Nir, Y. and Eldar-Nir, I. 1987. Ancient Wells and their Geoarchaeological Significance. *Geology* 15: 3–6.

Raban, A. 1981a. Some Archaeological Evidence for Ancient Maritime Activities at Dor. *Sefunim* 6: 15–26.

Raban, A. 1981b. Recent Maritime Archaeological Research in Israel. *International Journal of Nautical Archaeology* 10: 287–308.

Raban, A. 1982. Notes and News: Dor Yam. *Israel Exploration Journal* 32: 256–59.

Raban, A. 1983. Recent Maritime Archaeological Research in Israel. *International Journal of Nautical Archaeology* 12: 229–51.

Raban, A. 1985. The Ancient Harbours of Israel in Biblical Times. Pp. 11–44 in: A. Raban (ed.). *Harbour Archaeology* (B.A.R. International Series 257). Oxford.

Raban, A. 1987. The Harbour of the Sea Peoples at Dor. *Biblical Archeologist* 50: 118–26.

Raban, A. 1988a. The Constructive Maritime Role of the Sea Peoples in the Levant. Pp. 261–94 in: E. Lipiński and M. Heltzer (eds.). *Social and Economic Structure of the Eastern Mediterranean in the Second Half of the Second Millennium B.C.E.* Leuven.

Raban, A. 1988b. The Port of the Sea Peoples at Dor. *Qadmoniot* 20: 81–86. (Hebrew)

Raban, A. 1989. *The Harbours of Caesarea Maritima, Vol. 1: The Site and Excavations* (B.A.R. International Series 491). Oxford.

Raban, A. and Artzy, M. 1982. Notes and News: Dor Yam. *Israel Exploration Journal* 32: 145–47.

Raban, A. and Galili, E. 1985. Recent Maritime Archaeological Research in Israel. *International Journal of Nautical Archaeology* 14: 321–56.

Raban, A. and Linder, E. 1978. Notes and News: Israel. *International Journal of Nautical Archaeology* 7: 238–43.

Raveh, K. 1988/89. Dor — Maritime Archaeology, 1987/1988. *Excavations and Surveys in Israel* 7–8: 50.

Raveh, K. and Kingsley, A. 1991. The Status of Dor in Late Antiquity: A Maritime Perspective. *Biblical Archaeologist* 54: 198–207.

Riley, J.A. 1975. The Pottery from the First Session of Excavations in the Caesarea Hippodrome. *Bulletin of the American Schools of Oriental Research* 218: 25–63.

Roll, I. and Ayalon, E. 1989. *Apollonia and the Southern Sharon*. Tel Aviv (Hebrew).

Sharon, I. 1987. Phoenician and Greek Ashlar Techniques at Tel Dor, Israel. *Bulletin of the American Schools of Oriental Research* 267: 21–41.

Sneh, Y. 1981. *The Paleogeography and the History of the Coast of Dor in the Holocene Period*. M.A. Thesis, University of Haifa. (Hebrew).

Sneh, Y. and Klein, M. 1984. Holocene Sea Level Changes at the Coast of Dor, Southeast Mediterranean. *Science* 226: 831–32.

Stern, E. 1985. Five Seasons of Excavations at Tel Dor. Pp. 169–92 in: E. Lipiński (ed.). *The Land of Israel — Crossroads of Civilization*. Leuven.

Stern, E. and Sharon, I. 1987. Tel Dor, 1986: Preliminary Report. *Israel Exploration Journal* 37: 201–211.

Stern, E., Gilboa, A., and Sharon, I. 1989. Tel Dor, 1987: Preliminary Report. *Israel Exploration Journal* 39: 32–42.

Tamir, G. 1977. *The Morphology's Impact on the Defraction of Wave Energy and Sedimentation at the Bays of Hof Hakarmel*. M.A. Thesis, Tel Aviv University.

Vitruvius, *The Ten Books on Architecture*. Trans. by M.H. Morgan, Harvard University Press, 1914.

Wachsmann, S., and Raveh, K. 1978. Notes and News: Underwater Investigations by the Department of Antiquities and Museums. *Israel Exploration Journal* 28 (1978): 281–83.

Wachsmann, S., and Raveh, K. 1980. Notes and News: Israel. *International Journal of Nautical Archaeology* 9: 256–64.

Wachsmann, S., and Raveh, K. 1983–84. The Guns of Tantura: Napoleonic Weaponry from beneath the Sea. *Israel Land and Nature* 9: 6–60.

Wachsmann, S. and Raveh, K. 1984. A Concise Nautical History of Dor/Tantura. *International Journal of Nautical Archaeology* 13: 223–41.

NOTES

1. Flemming *et al.* 1978.
2. For a summary of this work and further bibliography, see Wachsmann and Raveh 1984; Raveh and Kingsley 1991.
3. Raban and Linder 1978; Raban and Artzy 1982.
4. Raban 1981a: 293–308; 1982: 256–59.
5. Raban 1983: 229–41.
6. For a preliminary report of the more recent sessions, see Raban and Galili 1985: 332–49.
7. *Excavations and Surveys in Israel* 7–8 (1988/89): 50.
8. For these ridges, see Gvirtzman *et al.* 1984.
9. For more detailed discussion of these young tectonic movements, see Neev *et al.* 1987: 58–60.
10. Neev *et al.* 1987: 127–29; see also Raban 1985: 12–18; Sneh 1981: 72, 75, 95.
11. Raban 1983: 232–36; Raban and Galili 1985: 332–34.
12. Sneh 1981: 52; Raban and Galili 1985: 339–43.
13. Flemming *et al.* 1978: 56–58.
14. Sneh 1981; Raban and Galili 1985: 332–49.
15. Sneh 1981: 70–72.
16. Sneh and Klein 1984.
17. Tamir 1977.
18. For more detailed descriptions of the various techniques of field and laboratory work, see Sneh 1981: 14–22.
19. Sneh 1981: 52–59.
20. Sneh 1981: 62–64.
21. Raveh 1988/89.
22. Raban 1989: 151–54, 231, Figs. 14–17.
23. Raban and Galili 1985: 339–41.

24. See also Raban and Galili 1985: Figs. 26, 28.
25. Dahl 1915: 94.
26. See I. Peleg and I. Porath, *Excavations and Surveys in Israel* 4 (1985): 24.
27. Raban and Galili 1985: 343–49, Fig. 26.
28. The samples were given to our colleague at CMS, Dr. E. Spanier; the results quoted here were communicated by him orally.
29. See Riley 1975: 29–31.
30. The coins were identified by Prof. R.L. Hohlfelder of the University of Colorado at Boulder; the author is most grateful to him for his contribution.
31. Roll and Ayalon 1989: 65.
32. Dahl 1915: 94.
33. *Excavations and Surveys in Israel* 6 (1987/8): 51–52; *Excavations and Surveys in Israel* 7–8 (1988/9): 47.
34. For further details, see N. Karmon and E. Spanier in E. Spanier (ed.), *The Royal Purple and the Biblical Blue*, Jerusalem 1987: 147–49.
35. For a full discussion of the ancient sources and the archaeological finds, including Dor, see N. Karmon, *The Purple Dye Industry in Antiquity in the Eastern Mediterranean Basin*, MA Thesis, University of Haifa 1986: 62–71 (Hebrew), and relevant bibliography there.
36. See above, section B, and Raban and Galili 1985: 332–39.
37. L.Y. Rahmani, Hellenistic Brazier Fragments from Israel, *Israel Exploration Journal* 34 (1984): 224–31, similar to type IIIa. As for the function of these braziers, it seems to me that they were used mainly for cooking on board sailing ships and were replaced in that function by lead braziers somewhat later, in the Roman period. This would explain why they are to be found only at sites that were active commercial harbors in the 2nd century BCE.
38. See P. Beck, The Pottery of the Middle Bronze Age IIA at Tel Aphek, *Tel Aviv* 2 (1975), Fig.6:10, the 'Palatial' phase at Aphek.
39. Weizmann Institute, Rehovot, Isotopes Laboratory, sample Nos. RT 685a and b.
40. Raban 1981a: 18, Pl. I:3.
41. Blackman 1982: 206.
42. K. Davaras, *Archaelogika Ephemeris* (1967): 84–90.
43. See D.J. Blackman (ed.), *Marine Archaeology* (Colston Papers No. 23), London 1973: 126–31.
44. I. Ch. Dragatsis and W. Dorpfeld, *Praktika* (1885): 63–68; J.W. Shaw in G.F. Bass (ed.), *History of Seafaring based on Underwater Archaeology*, London 1972: 90–93.
45. J.D. Blackman, *Proceedings of 3rd Cretological Congress, 1971*, Athens 1973: 14–21.
46. N.C. Flemming, *Cities in the Sea*, London 1972: 103–111.
47. See also L. Casson, *Ships and Seamanship in the Ancient World*, Princeton 1971: 364; Shaw, above, n. 44.
48. See D.J. Blackman in J.S. Morrison and R.T. Williams, *Greek Oared Ships*, Cambridge 1968: 181–86.
49. Herodotus, 2.159.1; A.B. Lloyd, Were Necho's Triremes Phoenician?, *Journal of Hellenic Studies* 95 (1975): 45–61.
50. Herodotus 3.45.4.
51. See E. Stern, Excavations at Tel Dor, A Canaanite-Phoenician Port-City on the Carmel Coast, *Qadmoniot* 20 (1987): 70–72 (Hebrew).
52. Garstang 1924: 40–45, Fig. 1.
53. Garstang 1924: 42, Fig. III:1, 6.
54. For preliminary reports of this study see Raban 1981b: 293–308; 1982: 145–47, 256–59; 1983: 229–41; 1985: 23–27; A. Raban, Chronique: Dor, installations maritimes, *Revue Biblique* 91 (1984): 252–56.
55. For discussion see Raban 1983: 239–40 and further below.
56. V. Karageorghis, Chronique des fouilles à Chypre, *Bulletin de Correspondance Hellénique* 92 (1968): 302–306, Figs. 82–85; V. Karageorghis, *Kition*, London 1976: 59–60.
57. For discussion of this, see also above, section B, and Flemming *et al.* 1978: 56–58; Sneh 1981: 90–91; Raban 1983: 232–34; Raban and Galili 1985: 343–48; Nir and Eldar-Nir 1987.
58. N.C. Flemming and P.A. Pirazzoli, Archéologie des côtes de la Crète, *Les dossiers de l'histoire de l'archéologie* 50 (1981): 78–79; N. Platon, *Zakros: The Discovery of a Lost Palace in Ancient Crete*, London 1971: 192–94; Y. Calvet, Les bassins du palais royal d'Ougarit, *Syria* 67 (1990): 31–42; Raban 1988a: 276–81.
59. G. Hult, *Hala Sultan Tekke* 4 (Studies in Mediterranean Archaeology XLV: 4), Goteborg 1978: 29, Figs. 6, 8, 14, 93.
60. Y. Aharoni, The Solomonic Districts, *Tel Aviv* 3 (1976): 10, 13, Fig. 1; Y. Aharoni, The Districts of Israel and Judah, in A. Malamat (ed.), *The Kingdoms of Israel and Judah*, Jerusalem 1961: 110–31 (Hebrew).
61. Raban 1987; 1988a: 272–84.
62. H. Goedicke, *The Report of Wenamon*, Baltimore 1975: 27–30.
63. For similar indications of relatively low sea levels during the Iron Age II, see A. Raban and I. Galanti, Notes and News: Tell Abu Hawam, *Israel Exploration Journal* 37 (1987): 179–81.
64. Raban 1981a; 1981b: 295–302; Raban and Galili 1985: 348–49.
65. One should recall that such basins would be filled by the surge and the tide and so must have a water level of at least 0.30–0.50 m. above MSL. See for this phenomenon and its significance P. A. Pirazzoli, Marine Notches, in O. van de Plassche, *Sea Level Research: A Manual for the Collection and Evaluation of Data*, Great Yarmouth 1986: 361–400.
66. For Caesarea, see Raban 1989: 293–97; for 'Akko, see A. Raban in M. Yadaya (ed.), *The Western Galilee Antiquities*, Tel Aviv 1986: 184–85 (Hebrew).
67. See H. Frost, The Offshore Island Harbour at Sidon and Other Phoenician Sites in the Light of New Dating Evidence, *International Journal of Nautical Archaeology* 2 (1973): 75–94.
68. Raban 1989: 120–24, 286–88.
69. For the original date of this precinct or temenos, see Garstang 1924: 65–67; Stern *et al.* 1989: 41–42.
70. Wachsmann and Raveh 1984: 240–41. Recently some additional wreckage sites, mostly of the Byzantine period, have been traced and surveyed by K. Raveh (personal communication). Raveh and Kingsley, 1991.
71. See, e.g., K. Nicolaou and A. Flinder, Ancient Fish-tanks at Lapithos, Cyprus, *International Journal of Nautical Archaeology* 5 (1976): 133–41; G. Schmidt, *Il livello antico del Mar Tirrheno*, Rome 1972; A. Flinder, A Piscina at Caesarea — A Preliminary Survey, *Israel Exploration Journal* 26 (1976): 77–80; Raban and Galili 1985: 349–51; Raban 1989: 160–67. For classical sources, see e.g. Columella, *De Re Rustica*, VIII, 16–17; Varro, *Rerum Rusticarum*, III, 3, 17.
72. The documentation of these twin basins is in the unpublished files of the Dor map (No. 20) in the archives of the Israel Antiquities Authority.
73. Raban 1981a: 21–23.
74. For coastal wells, see Nir and Eldar-Nir 1987; for the Neolithic well at Atlit see E. Galili and Y. Nir, Athlit-Yam — 1990, *Hadashot Arkheoloyiot* 97 (1991): 40 (Hebrew); Raban and Galili 1985: 323–25. Similar wells used by the Arabs from the Umayyad period onwards are known at Caesarea, Ashkelon, Akhziv, 'Akko, and Gaza.
75. Wachsmann and Raveh 1984: 232, Figs. 13, 14.
76. Some of these activities are recorded in Wachsmann and Raveh 1978: 281–83; 1980: 256–63; 1984: 239–41; Notes and News: An Underwater Salvage Excavation near Kibbutz

ha-Hotrim, Israel, *International Journal of Nautical Archaeology* 10 (1981): 160; and more recently by Raveh and Kingsley, 1991.

77. See recently Y. Galili, Top Secret, *Yam* 16 (1990): 26 (Hebrew).
78. For a plausible historical reconstruction of the circumstances surrounding the dumping of the French weaponry and two heavy 24-pounder cannons, see S. Wachsmann and K. Raveh, The Search of Napoleon's Lost Ordnance in the Sea off Tantura/Dor, *Qadmoniot* 15 (1982): 87–91 (Hebrew); S. Wachsmann and K. Raveh, In the Footsteps of Napoleon at Tantura, Israel, *Archaeology* 37 (Sept./Oct. 1984): 58–59, 76.
79. S. Wachsmann and K. Raveh, A Bronze Mortar of Napoleon's Army from the Tantura/Dor Coast, *Qadmoniot* 17 (1984): 33–34 (Hebrew).
80. Wachsmann and Raveh 1984: 232–35.
81. The full text and discussion will be published in the near future by Y. Galili. Here we will refer to a letter written by the British commander W.S. Smith to his superior, the Earl St. Vincent, on April 8th, 1799, indicating that the entire French flotilla of gun boats, except for one, succeeded in reaching 'Akko from Jaffa in a stormy sea. Comparison of the list of these boats with an earlier one given in a letter of March 23rd between the same correspondents indicates that a gun boat named *La Fondre* may be the one which foundered.
82. The summary of these finds is based on oral information from K. Raveh and the preliminary information published in Wachsmann and Raveh 1978: 281–82; 1980: 259–61; 1984: 239–41; and recently Raveh and Kingsley 1991.
83. For this type, see Riley 1975: 26–29.
84. For these anchors and the assumption of a 'proto-harbor' in this area, see Wachsmann and Raveh 1978: 282, Pl. 56: B, C; 1984: 239.
85. See, e.g., H. Frost, Anchors, the Potsherds of Marine Archaeology: On the Recording of Pierced Stones from the Mediterranean, in D.J. Blackman (ed.), *Marine Archaeology* (Colston Papers 23), London 1973: 397–410.
86. See above, section B, and Sneh 1981: 89; Wachsmann and Raveh 1980: 260.
87. Wachsmann and Raveh 1984: 228, Fig. 10.
88. For the low sea level in the Iron Age II, see A. Raban and I. Galanti, Notes and News: Tell Abu Hawam, *Israel Exploration Journal* 37 (1987): 181.