NEAR EASTERN ARCHAEOLOGY

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Sussita-Hippos of the Decapolis: Town Planning and Architecture of a Roman-Byzantine City

FORUM: An Epigraphical Reminiscence

From the Editor

Together with my co-editors, Jeff Blakely and Andy Vaughn, our focus for *Near Eastern Archaeology* volume 70 (2007) is recent archaeological fieldwork spanning the Bronze through Islamic periods. In keeping with the precedent established by *NEA*'s former editor, Sandra A. Scham, volume 70/2 includes articles dealing with a variety of regions, periods, and approaches to the past. Two of the articles in this issue feature "hot off the press" news from projects currently in the field. One reports on the recent underwater archaeological excavations at Atlit and the second highlights the latest discoveries from the Decapolis city of Hippos. Both, to my delight, are co-authored by colleagues or students of mine during the 1990s when I was a faculty member at the University of Haifa. The Forum section in this issue presents an autobiographical reflection by Aaron Demsky of how the field of epigraphy has changed in his lifetime. This essay is instructive and allows readers to become better acquainted with one of our senior colleagues. The Arti-Facts section includes an update on the controversies surrounding the inexplicable "gap" in occupation observed in the archaeological record in Sistan Basin, Iran, beginning at the end of the third millennium BCE. "Crossing Jordan," an international conference on the archaeology of Jordan held in March 2007 in Washington DC, cosponsored by the American Center of Oriental Research, is also reported on in the Arti-Facts section. The book-review section covers new publications on the ancient Near East, Egypt, and Israel.

Although political uncertainties and conflict unfortunately continue, both ongoing and new archaeological work is flourishing in many regions covered in *Near Eastern Archaeology*.

Publication of recent excavations results, one of the most important contributions we can make to our profession as field archaeologists, will also be featured in issues 3 and 4, along with timely debates on controversial issues among leading scholars. With its reputation for high standards and richly illustrated format, it is our goal that *NEA* will serve as the leading semi-popular journal presenting the results of archaeological work to professionals, students, and the interested broader public. With a healthy backlog of manuscripts waiting in the wings and following a successful fund-raising campaign to bring *NEA* "up-to-date," we are confident that all 4 issues of volume 71 (2008) will be published by the end of 2008.

Ann E. Killebrew
Co-Editor, *NEA*

NEAR EASTERN ARCHAEOLOGY

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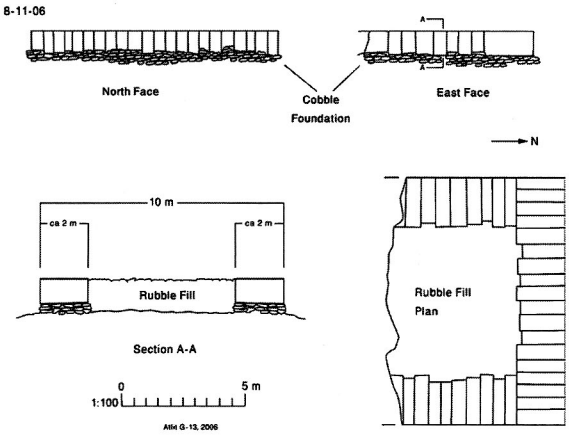
THE HARBOR OF ATLIT IN NORTHERN CANAANITE/PHOENICIAN CONTEXT

Arad Haggi and Michal Artzy

The Phoenician builders who located the Iron Age harbor at Atlit did so with foresight and knowledge. The Late Bronze–Iron Age city of Atlit is situated about twenty kilometers south of Haifa, on a kurkar sandstone ridge adjacent to two natural bays, the bay to the north being the best-sheltered, and the one to the south the second-largest on the coast of Israel. The city itself, built on the ridge, or promontory, is buried beneath the crusader town and fortress known as Pilgrim's Castle. Located to the northeast of the promontory, the harbor spans approximately eight hundred meters along the northern bay. Atlit harbor is a single-period construction with no superstructures of the later Hellenistic and Roman periods, meaning that it has the potential to provide ample data for a better understanding of Phoenician construction principles in the Iron Age. Recent underwater surveys and excavations in the harbor, sponsored by the Institute of Maritime Studies of the University of Haifa, have realized the harbor's potential in this respect and further suggest an origin for these techniques along the Canaanite coast in the Late Bronze Age rather than in Greece, as has been argued.

The city of Atlit is buried beneath the crusader town and fortress known as Pilgrim's Castle. *Photo by M. Artzy.*

The harbor of Atlit is a single-period construction with no superstructures of the later Hellenistic and Roman periods, meaning that it has the potential to provide ample data for a better understanding of Phoenician marine construction principles in the Iron Age. *Photo by M. Artzy.*

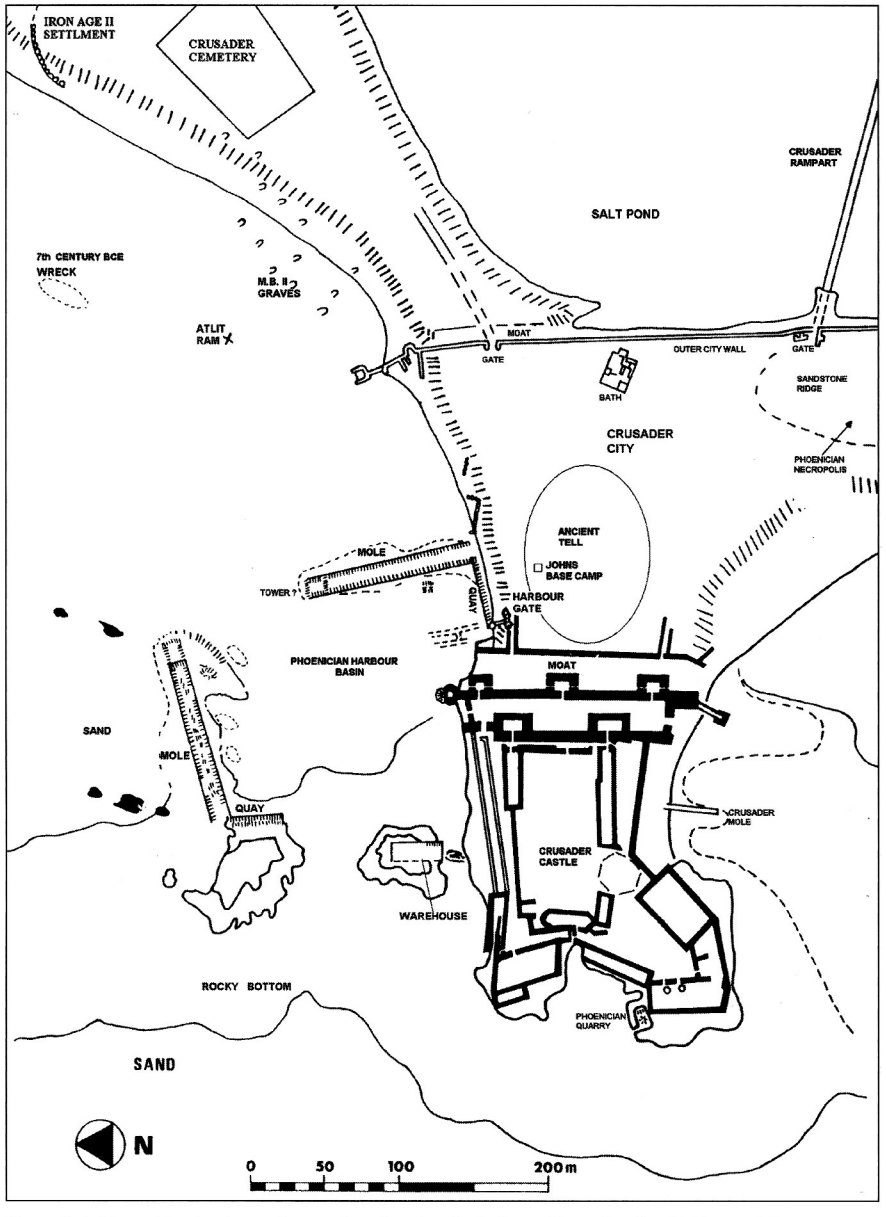


Drawings of sections and parts of southeastern quay. *Prepared by J. Tresman.*

C. N. Johns of Palestine's Department of Antiquities, whose main interest was the magnificent Crusader period remains, excavated Atlit in the 1930s. During his excavation, Johns noted second-millennium remains as well as a first-millennium necropolis; he assumed that the Phoenician harbor was situated within the large bay to the south of the promontory (Johns 1934:136), surprisingly missing the artificial harbor, which was noted for the first time only in the 1960s by the Underwater Exploration Society of Israel. During the 1970s, a team from the then Center for Maritime Studies of the University of Haifa, headed by E. Linder and A. Raban, surveyed they harbor. Since 2002, Arad Haggi and Avner Raban, and, following Raban's untimely death, Michal Artzy, have conducted underwater surveys and excavations in the harbor of Atlit on behalf of the Institute of Maritime Studies of the University of Haifa.

The Harbor of Atlit

Despite the size and the sandy shores of the southern bay, the builders selected the northern bay to serve as the city's main harbor. This side is well protected from the dominant west and southwest winds by the promontory on its southwest and the two islets on its west that belong to the coastal sandstone ridge. The natural location of the bay exposed it only to the northern and eastern winds. (We may assume that the southern bay was used as an anchorage for small seacraft when the weather permitted it.) The gap between the promontory and the estuary of Nahal Oren, which runs into the northern bay of Atlit, provides a maximum wave fetch of only a few hundred meters, hence there are no risks of storm waves from that side. This is the reason for the choice of this position as the main entrance to the harbor.



Plan of Atlit and its harbor after a drawing by A. Raban. *Drawing by S. Zagorski.*

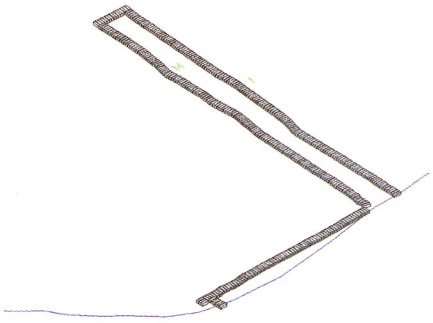
The harbor was divided into two symmetrical sectors, each consisting of a mole (protruding jetty) running perpendicular to a quay (Raban 1997a:16), which together created a closed rectangular area of low water energy. An opening between the ends of the two moles served as the harbor entrance. The northern mole protected the harbor basin from the northern swell. Anchored to one of the sandstone islets, it was accessible only by sea. At a depth of one and a half to six meters below sea level, it would have allowed anchorage of bigger seacraft. The eastern side of the harbor is better sheltered. The southeastern quay abutts the coast at the foot of the ancient tell, slightly east of the crusader moat. This area may have served as the town's mercantile port.

Johns exposed an older structure beneath crusader layers on the shoreline, north of the tell. The structure consisted of a stone-paved surface and two flanking towers. He named it the "Northern Gate" (Johns 1934:fig.4).

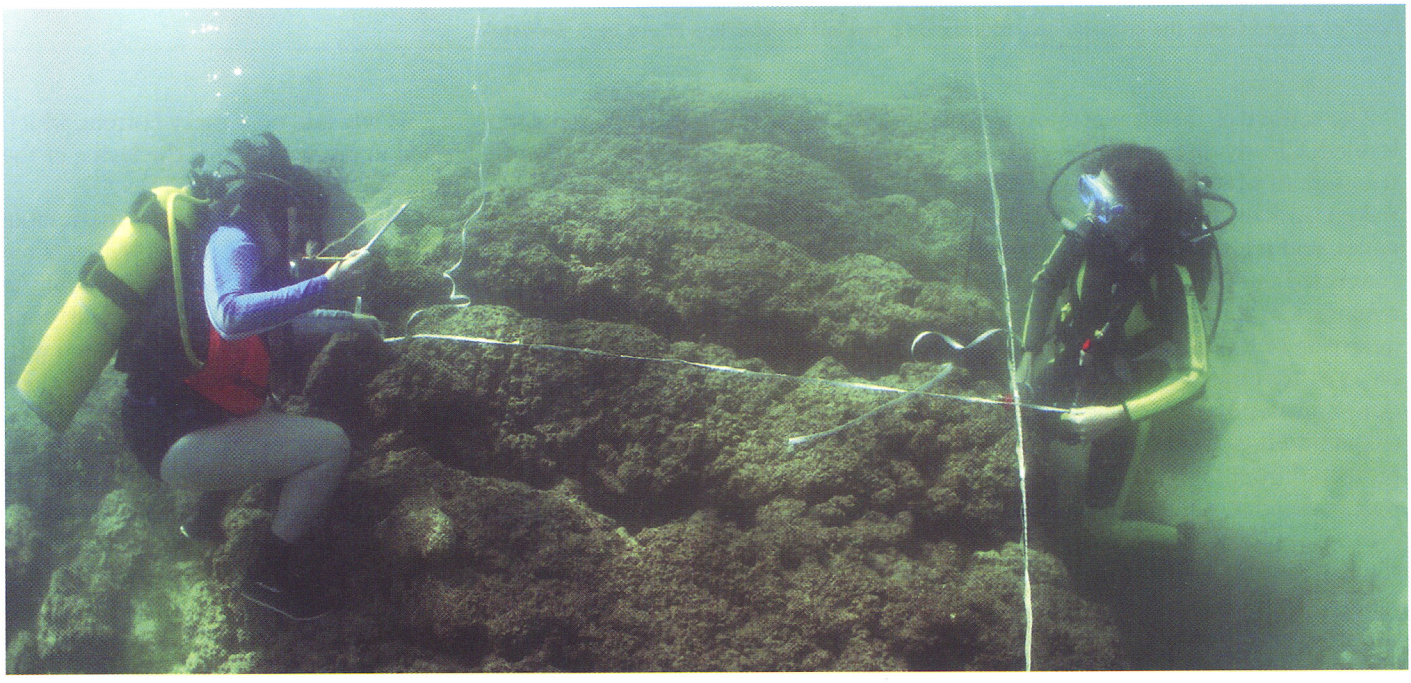
During the 1960s, Raban and his team exposed a paved road that led to the southeastern quay. Raban linked the "Northern Gate" to the harbor, and viewed it as the remains of a wall separating the city from the harbor (1997b:499). Unfortunately, we could not locate it, due to some human intervention in the area.

Both sections of the harbor exhibit the same construction methods. The thirty-eight-meter-long southeastern quay was constructed of headers whose narrow side (1.2 × 0.4–0.5 m on average) faced the sea (Raban 1985:31). The base of the mole extends from the quay's eastern end about one hundred meters into the sea. The mole is about ten meters wide and is constructed of two parallel ashlar headers of two to three meters in width. Between the walls, the builders placed a fill of rubble and medium-sized field stones. This form of construction added stability so that the mole could withstand the high energy of the waves. The northern part of the mole ends with north-facing ashlar headers. Raban's team also noted an additional construction at the northern tip of the mole, the function of which is not yet clear.

Unfortunately, during the 2006 excavation season, it became clear that most of the mole above the foundation course had not survived. The upper courses of stones were probably robbed for the construction of the crusader fortress. We found that the mole was placed on a foundation of flat and round river pebbles of various sizes. This foundation was located in turn on a clay/muddy sea bottom. As the underwater excavation revealed, the layer of pebbles extended to more than five meters from the outer side of each mole wall, a total width of over twenty meters.



The southeastern quay abutts the shore at the foot of the ancient tell, slightly east of the crusader moat. This area may have served as the town's mercantile port. *Photo by S. Breitstein; plan prepared by H. Cohen.*



Divers draw ashlar headers belonging to the eastern mole. *Photo by A. Yurman.*

Pebbles placed under the eastern mole foundation provided for stability. *Photo by S. Breitstein.*

The surface of the smaller southern islet was quarried and leveled. Clearly discernable on this islet are the remains of a structure of which only the southeast corner has survived. It was constructed from ashlar blocks similar to those used in the moles, and probably served as a warehouse. An artificial ramp connected this islet to land, now covered with Crusader period remains. On the larger northern islet there is no evidence of quarrying or leveling, except for the construction of the quay on its eastern side, which is about forty-three meters long. This quay consists of ashlar headers, three courses of which are still *in situ*. It is about four meters wide on average and is well protected from the westerly winds and waves by the natural rock of the islet, which forms a seawall (Haggi 2006:49–51).

From the north end of the quay, a mole was laid along the sea bottom. It extends eastward and is about 130 meters long. In width and construction it is similar to the mole on the southeast, but its foundations are in some places under almost five meters of water. The surviving mole reaches to just above the present surface of the sea in two places. According to Raban, its western part was laid on a rocky bottom, which divers apparently leveled in preparation for the laying of the ashlar headers of the foundation course (1985:31).

Our team excavated the inner wall of the northern mole about fifty meters east of the northern islet. The elevation of the remains of the upper course of the southernmost wall of the northern mole is 2.2 meters below sea level, and it was built using the header method. The surrounding seabed was covered with ashlar stones that had fallen from the upper courses of the mole, and fieldstones, which served as fill material for the core between the two mole walls. We found ashlar stones of various sizes (0.5 × 0.5 × 0.7 to 0.5 × 0.5 × 1.0 m) and even smaller ones (0.2 × 0.3 m), which may have been used in paving the mole.

Wooden wedges were found between the ashlars and blocks that had collapsed from its upper courses. The archaeobotanical examination carried out by N. Lifshitz showed that the wooden wedges were of two species of trees, *Olea europaea* (European olive), which grows throughout the Mediterranean area and *Cidrus libani* (Lebanese cedar), which grows only

Divers drawing remains of a possible storage area on the southern island. *Photo by A. Yurman.*

in Lebanon and Cyprus. The Lebanese cedar wedges were smaller and not as well preserved. It is likely that the wedges were used to level the stone courses and straighten the stones. The location of the wedges within the inner wall, deep between the ashlars, enabled us to date the construction of the mole and the harbor. Radiocarbon analysis carried out by E. Boaretto on three samples dates them to the late-ninth or early-eighth century BCE (Haggi 2006:57), which suggests that the harbor was constructed at least one hundred years earlier than Raban had envisioned (Raban 1985:38; 1997b:507).

The foundation course of the harbor, as revealed in the latest excavation, is situated at 4.2 meters below mean sea level. We assume that the remains of the wall today rise to four courses and reach the same height as that of the islets. In contrast, there were eight courses during the time when the harbor was active. The wall remains rest, as does the southeastern mole, on flat, round river pebbles and broken pieces of sandstone that were deposited on the sandy seabed. Geological analysis of the pebbles shows that they were composed of basalt, ophiolite, and gabbro, none of which is local to Israel, at least not in the coastal regions. These stones were used as ballast on board ships, and probably arrived in Atlit from northern Syria and Cyprus, attesting to the maritime network of the harbor (Haggi 2006:51). Sandstones found alongside the pebbles were likely waste material from the nearby quarry.

The entrance was about 140 to 150 meters wide, and thus likely too wide to have been secured by a chain. It is unlikely that the entrance was from the west, between the two islets, since the width of 35 to 40 meters is too narrow and the area too shallow for seacraft to pass through. This opening was never blocked, probably to ensure that the surge kept the harbor basin properly flushed and silt free (Raban 1995b:156). Thus, the water flowed into the harbor basin via this gap and exited from the harbor entrance to the east. Today, even though the harbor is not in use, one can still see the current coming into the harbor from the western gap and cleaning the ancient basin. No sand is piled in the areas exposed to that current. The only place that sand has accumulated is adjacent to the southeastern quay, where this current is not effective.

Phoenician Harbors

In this section, we survey Levantine harbors that are acknowledged to belong the Phoenician cultural milieu and that were constructed in the Iron Age, or in the case of the harbor of Akko, in the Persian period. The harbors are presented from north to south. The dearth of ancient harbors for comparison purposes to that of Atlit is the result not only of the exorbitant cost of their construction, but also of the fact that because of their favorable positions they were reused and rebuilt over a long period of time, some to the present day.

Tabbat el-Hammam

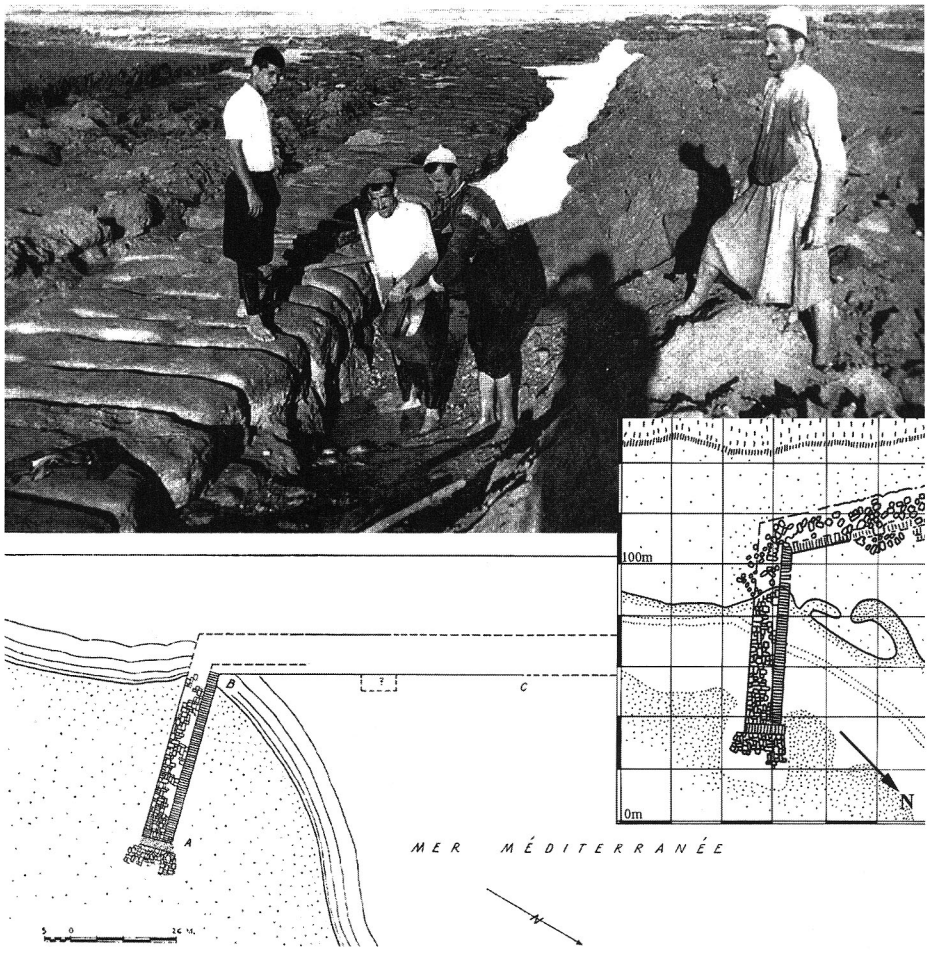
The site of Tabbat el-Hammam was excavated by Robert Braidwood (University of Chicago) in the 1930s. The excavations discovered an L-shaped breakwater or mole with its longer leg projecting out into the sea to the west of the tell. The mole creates a small harbor, protected from the southwesterly winds (Braidwood 1940:204).

Although the mole was never properly excavated, Frost feels that the inner portion of the sea leg was built with a course of headers facing seaward (Frost 1972:106, fig. 59). This element is obviously similar to the mole in Atlit. During Braidwood's excavations, the land leg was very well preserved. On the lee side runs a wall of ashlars averaging 1.90 by 0.43 m in size. Like the sea-leg wall, the lee wall of the land leg was built with a course of headers facing the inner side of the harbor. It is likely that this side of the land leg was once at sea, and sand piled up along the inner wall due to a silting process (between points A and B, on the plan below. The L-shaped mole allowed larger seacraft to be loaded and unloaded without being beached.

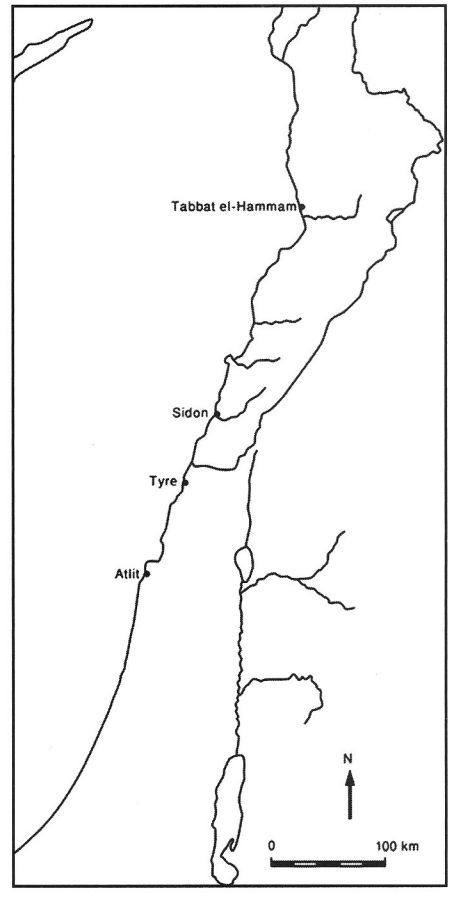
Braidwood dated the harbor at Tabbat el-Hammam to the ninth century BCE (1940:207–8). The port was probably associated with Tell Kazel, the ancient city of Sumur located a few kilometers east of Tabbat el-Hammam.

Sidon

The ancient city of Sidon is situated on a rocky promontory that belongs to a partially submerged sandstone ridge running along the coast. Sidon's coastal physiography makes it an ideal location for the establishment of three natural anchorages (Marriner *et al.* 2006:1516). Two natural bays are situated at the northern and southern sides of the promontory. The third is located at the island of Zire, which is located some six hundred meters north of the northern harbor.

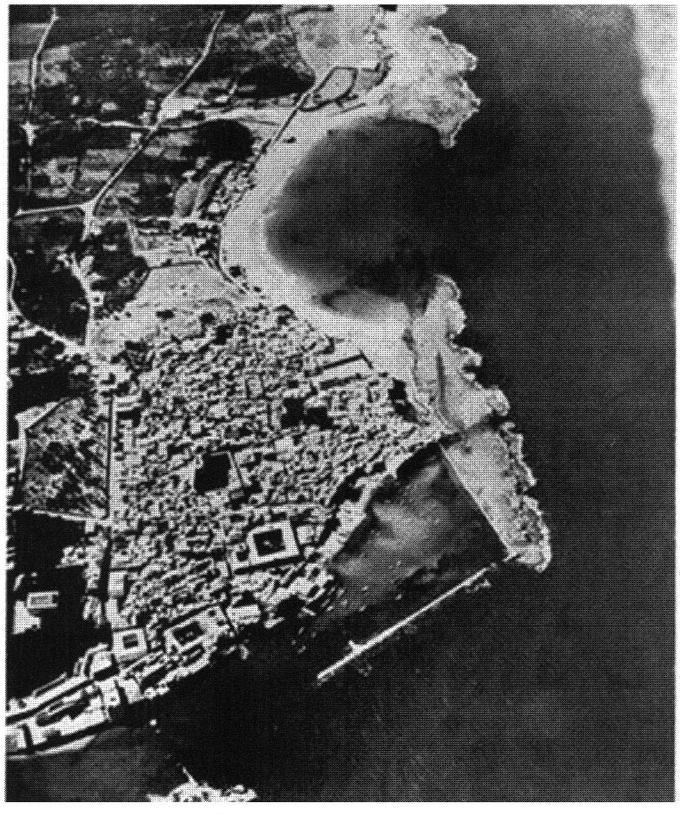


The harbor at Tabbat el-Hammam provides the closest parallel to the harbor of Atlit in terms of construction. *Based on Braidwood 1940 and Frost 1972; prepared by M. Artzy and S. Zagorski.*



Map of sites with acknowledged Phoenician harbors. *Drawing by S. Zagorski.*

Old aerial photograph of Tyre. http://almashriq.hiof.no/base/archaeology.html



Old aerial photograph of Sidon. http://almashriq.hiof.no/base/archaeology.html

The southern harbor, named the "Egyptian harbor" by Renan (1864) and "Crique Ronde" by Poidebard (1939), is presently a sandy bay. This bay is not well protected from the dominant southwesterly swell and storm waves. To the present, no artificial harbor works have been found at the southern bay. As at Atlit, it appears that the sandy southern bay was unsuitable to serve as an anchorage.

The northern harbor is situated in the northern bay, protected from the open sea by a prominent sandstone ridge. It currently serves as the main harbor of the modern city of Sidon. Much of Poidebard and Lauffray's (1951) studies were centered on this bay. They identified a series of harbor works along the sandstone reefs to its north and west.

The northern harbor was divided into two sectors, both of which rest on the northern reef. The northern reef was reinforced with ashlars to offer better protection from the open sea and to create a haven. A mole was built on its lee side, extending about 230 meters. Most of the western reef was quarried and leveled on the lee side, creating a quay. The western external side of the reef was left intact as a natural seawall. Probably later, during the Roman period, additional courses of large rectangular blocks were added to the wall, as in the cases of Akko, Tyre, and Arwad (Raban 1995b:161).

Three flushing channels were quarried along the western reef to prevent silting. The flushing channels created a circulation of water, preventing the sand from piling up on the harbor basin. The water was filtered over tanks cut into the reef with gates at the inner side. When the gates were open, silt-free water could be shot into the harbor basin to flush out the silt (Blackmann 1982:202).

The island of Zire was first described by Renan in the nineteenth century. When preliminary studies were carried out by Poidebard and Lauffray (1951), they drew a plan of the quarries and the harbor works of the 540-meter-long island. They described a double seawall at the western side of the island that protected a series of quarries and other facilities at the island (Carayon 2003:96–97). On the lee side of the island, the remains of two jetties have been dated to the Persian period (Frost 1999:70–71). Frost discovered numerous scattered masonry blocks on the seabed around the island (Frost 1973:79–80). Much as with Tyre, it is difficult to differentiate between the Iron Age II—the "classic Phoenician phase"—and later periods on the island of Zire. The use of an adjacent island as an outer harbor is a typical Phoenician method of deliberately separating the land sector and the outer harbor (Raban 1997a:18).

Tyre

The ancient city of Tyre was located on an island, connected to the mainland by Alexander the Great in 332 BCE The island is part of a sandstone reef that runs parallel to the southern Lebanese coast. The remnants of the city's historic harbors are the subject of ongoing controversies dating back to the early nineteenth-century traveler Renan (1864) and the twentieth-century pioneer archaeologist Poidebard (1939).

There are potentially two harbors at Tyre. In the north is the "Sidonian harbor." The modern-day northern harbor is a sheltered bay facing north and protected from the dominant southwesterly winds by a series of sandstone reefs. It appears to correspond to its ancient counterpart (Marriner *et al.* 2005:1302). Wave climatological data from the southeastern Mediterranean coast shows that only Tyre's northeastern corner is naturally protected from the dominant southwesterly swells and storm waves (Marriner *et al.* 2005:1303). According to Poidebard and Lauffray (1951:36), the Sidonian harbor includes two moles. The first extended from the northern edge of the island from the vicinity of the present-day lighthouse. The mole had a curved shape and its general direction was from west to east. Several gaps were left along the mole to enable water to get into the harbor basin to prevent silting. The second mole extended from

the east side of the bay northward. The main entrance to the Sidonian harbor was from the east between these two moles.

To the south is the "Egyptian harbor." The position of the supposed southern harbor is the subject of ongoing debate (Frost 1971:105–6). Poidebard, in his preliminary work at the southern reefs, claimed that there were traces of construction at a depth of nine to fifteen meters and at a distance of two kilometers from the land (Poidebard 1939:31–37). Later research asserted that Poidebard's divers mistook the natural layering of the rock for courses of masonry (Frost 1971:106).

The dates of construction of the artificial moles at the northern harbor are still unknown. Geoarchaeological research carried out recently suggests that during the first millennium BCE, the Phoenicians built a "semi-artificial harbor." During that period, the northern harbor basin was bigger since part of it was under the modern city. As a result of silting, the inner part of the harbor was lost, compelling construction of the artificial harbor during the Roman and Byzantine periods (Marriner *et al.* 2005:1325). Unfortunately, the first-millennium BCE strata are missing from Marriner's research. Perhaps the reason for the absence is dredging that may have been carried out during the Roman and Byzantine periods (Marriner *et al.* 2005:1326).

Akko

According to Raban, the same concept in harbor planning and building used at Atlit appears later in the construction of the Phoenician harbor at Akko. The Akko harbor was built during the Persian period, in the sixth century BCE, as a naval base to accommodate Cambyses' campaign against Egypt (Raban 1995b:158). This harbor was built at the southeastern side of a headland, which was exposed to the southwesterly winter storms. Consequently, the location demanded a long and massive breakwater to create a properly protected haven. A mole of ashlar courses three hundred meters long and twelve meters wide was laid on a layer of pebbles in an area about twenty-five to thirty meters wide. As at Atlit, beside the main mole, a second section of the harbor unconnected to the land was built on an artificial island. This island, named the "Tower of Flies," was a rectangular quay thirteen by sixty meters in size, with its southern edge lying at a depth of six meters. The artificial island was built on courses of ashlars.

Origins of Phoenician Construction Techniques

Avner Raban felt that the origin of the Phoenician maritime building techniques should be sought in the legacy of the "Sea Peoples." He suggested that it was these enigmatic people who introduced the "headers" sea walls and quays to the northern Canaanites/Phoenicians (Raban 1995a:339; 1995b:148;1997b: 507;1998:429). According to Raban, a pre-Phoenician stage can be seen at Kition in Cyprus and at Dor (1983:229–41). Stone towers, refered to as "Bastions" by the excavators, were exposed at Kition along the outside of the earliest Cyclopean wall (Karageorghis and Demas 1985:88–89; Karageorghis 1967:315–24). Raban was under the impression that these two rectangular structures were originally free-standing quays established at the artificially scarped edge of the marine lagoon in the inner harbor of Kition. Raban's assertion that these structures closely resemble in shape, dimensions, and components the quay of the third phase at Dor is not universally accepted (1995a:348). He dates them to the twelfth century BCE and attributes them to the Sea Peoples (1998:42). Raban further placed the origin of this new maritime technology in the Aegean and Crete. The Sea Peoples, who settled in Cyprus and the northern coastal Levantine sites, including Dor, then introduced it to the Levant in the Late Bronze II period (Raban 1987:118–26;1998:430).

Raban dated the initial stages of the harbor construction at Dor to the later part of the fourteenth or early-thirteenth century BCE He also suggested that further construction, due to geomorphological changes, namely, a rise in sea level, involved the replacement of the original quay over the course of its nearly two hundred years of use (1998:429). Two sections of the quay remained, including the blocks on the western side, which Raban (1995a:313) estimated to have weighed twenty tons each. Raban proposed a dating to the late-thirteenth and early-twelfth centuries, a period that is, however, not yet attested on the tell itself or corroborated by finds presented by Raban himself. The dating is thus in need of a thorough reexamination (Artzy 2006:78–79).

The double ashlar walls with a filling of field stones used in the construction of the moles is a technique common to the Phoenicians known as the pier-and-rubble technique. This technique has been noted at Sarepta, Lebanon, in a layer dated to the eleventh century BCE (Markoe 2000:30). The pier-and-rubble technique is a common construction method along the Phoenician northern Israel coast, and in royal centers in Israel such as Samaria, during the Iron Age II (Sharon 1987:29). Van Beek and Van Beek (1981:72) argued that this technique is Phoenician in origin and that it spread from Late Bronze Age Phoenicia all over Israel, to the western Phoenician colonies, and then to Greece and Roman North Africa, where it can be found as late as the sixth century C.E. The pier-and-rubble technique was very common during the Persian period in Phoenicia and along the coast of Israel in defensive construction and domestic architecture (Markoe 2000: 83).

The use of headers also appeared in Phoenicia already in the eleventh century and were common in Phoenicia and Israel in the Iron Age II period, but are found in Greece only after the Iron Age II. If indeed contact is to be assumed, its direction would have to be from the Levant to Greece and not vice versa as Sharon has already argued (1987:39). The radiocarbon tests carried out on the wooden wedges from the northern mole at Atlit indicate clearly that the pier-and-rubble technique was transferred to its maritime usage at least by the ninth century BCE The use of similar techniques can be seen at the Persian-period harbor at Akko, the Hellenistic harbor at Amathus on Cyprus (Empereur and Verlinden 1987:18), and the Roman headers quay at Sarepta (Pritchard 1978:60, fig. 28).

The construction technique used in the harbor at Dor agrees well with that of the terrestrial Phoenician constructions noted above. Dating the harbor at Dor to an earlier period, which seems likely, places the site within the Canaanite/Phoenician sphere. Future work at the harbor at Dor, focused on its construction and the basin, should clarify its dating.

Atlit in the Context of Phoenician Harbors

Having surveyed the evidence from surviving Phoenician harbors and located the origin of the construction techniques used to build them in Late Bronze Age Canaan, we are now able to identify the features that characterize Phoenician harbor construction, namely, location chosen, construction techniques used, and approach taken to drainage and silting problems.

Location

At Sidon the main harbor lies at the northern bay, which is protected from the open sea by a prominent sandstone ridge. The northern reef was reinforced to afford better protection from the northern winds. A disconnected sector was built at the island of Zire, which is accessible only by sea. The southern bay, Crique Ronde, is not well protected from the dominant southwesterly swell and storm waves, and was thus unsuitable to serve as the city's main harbor.

The ancient city of Tyre was built on an island, which is part of a submerged sandstone reef. Two possible harbors are identifiable, namely, the Sidonian harbor in the north, and the Egyptian harbor in the south. The Sidonian harbor is well protected from the dominant southwesterly winds by a series of sandstone reefs. As at Atlit and Sidon, an artificial mole was built to the north to prevent the northern winds entering the harbor basin. The location and actual size of the so-called Egyptian harbor are not yet known. But the fact that the ancient northern harbor of Tyre is still in use today indicates that it was the preferred location for the main harbor of the city.

Despite the fact that the Akko harbor was built at the southern side of the headland, it still has the same characteristics and concept as Atlit. A massive curved breakwater was built from the end of a rocky promontory to create a protected harbor basin. A second section, which was disconnected from the land, was built on an artificial island, the Tower of Flies.

In sum, Phoenician harbors tended to be located adjacent to promontories and next to small islets that are part of the sandstone ridges along the Levantine coast. The main harbor was typically at the north side of the promontory, which is the better-protected side due to dominant southwesterly and westerly winds along this coast. The Phoenician harbors were divided into to two sectors, one within the city boundaries and the other disconnected from the land. As at Atlit and Akko, the second section consisted of moles situated in deeper water. This section was probably used to anchor large seacraft used for Phoenician international trade with Philistia and Egypt. It appears that the sandy bay to the south, as in the case of Atlit, was used as an anchorage in good weather, or for the beaching of small boats.

Construction

The quays at Atlit were built of ashlars with their narrow sides facing the sea (headers). The moles were built from two parallel header walls, and the gap between them was filled with field stones. The moles were placed over a layer of pebbles to prevent the waves from undermining the structure. The use of such a layer of pebbles can be seen at the fourth-century BCE harbor of Amathus in Cyprus (Empereur and Verlinden 1987:10). At the western part of the northern mole where the seabed is rocky, the harbor builders probably used divers to level the surface, according to Raban (1984:250–53).

Similar techniques characterize other Phoenician harbors, including the northern harbor of Sidon and at the island Zire, the Sidonian harbor at Tyre, and at the mole of Akko and the island Tower of Flies. The best parallel to the Atlit moles are those dated to the ninth century BCE at Tabbat el-Hammam, which was built using a similar technique (Frost 1972:106, fig. 59). Even though the harbor of Tabbat el-Hammam was never excavated, the use of headers in the outer wall of the mole, and a similar cross-wall enclosed between the side walls, which Braidwood called the "sea gate" (1940:206), can be seen.

The Phoenicians used a marine construction method developed from ashlar construction techniques used on land. Since the Atlit harbor is a single-period facility, it can be seen that the moles were built in a marine version of the pier-and-rubble technique that evolved along the north Canaanite/Phoenician coast. The moles were placed on a layer of pebbles to prevent wave action from undermining the structures.The use of this technique helped the Phoenicians build free-standing moles at the beginning of Iron Age II period (ninth century BCE).

Drainage and Silting

The main problem in the operation and maintenance of a harbor is the prevention of silting. At most Phoenician harbors, such as Tyre and Akko, several gaps were left along the moles to enable water to enter the harbor basin, thus preventing silting. At Sidon a system of three flushing channels and a special pool to collect the sediments was built along the western reef. This device helped to prevent silting. The efficiency of this system is clearly demonstrated in an aerial photograph taken during the 1940s (Raban 1995b:162, fig. 34). One can clearly see in the photograph that the southern channel is the only one that was never blocked in later antiquity. This channel continued to supply water and prevent the southern part of the inner harbor from silting. In Atlit the builders used the natural western currents flowing into the harbor from the gap between the two islets for this purpose. This gap was never blocked and the continuous flow cleared sediment from the harbor basin. Surveys and underwater excavation at Atlit indicate that there is no accumulation of sediment at the harbor sea bottom. The location of the harbor and the natural currents were sufficient to prevent silting.

Clearly, the Phoenicians invested great effort in planning and building circulation and flushing systems. At Atlit they used the natural settings of the northern bay to create a constant flow of water into the harbor. In other harbors, flushing channels were quarried at natural reefs and gaps were left in the moles to prevent silting.

Conclusion

The harbor of Atlit belongs to the Phoenician tradition of harbor construction. The early date of the harbor's construction, as indicated by radiocarbon dates, place the harbor of Atlit chronologically alongside that of Tabbat el-Hammam and possibly Sidon and Tyre, and before that of Akko.

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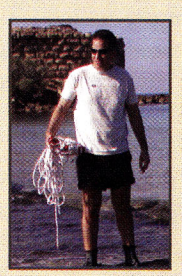

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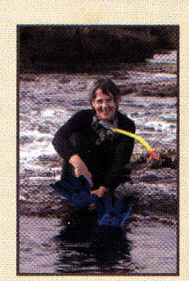

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