ANCIENT CAESAREA

CONSERVATION AND DEVELOPMENT OF A HERITAGE SITE

YAEL FUHRMANN-NAAMAN AND YOSEF PORATH

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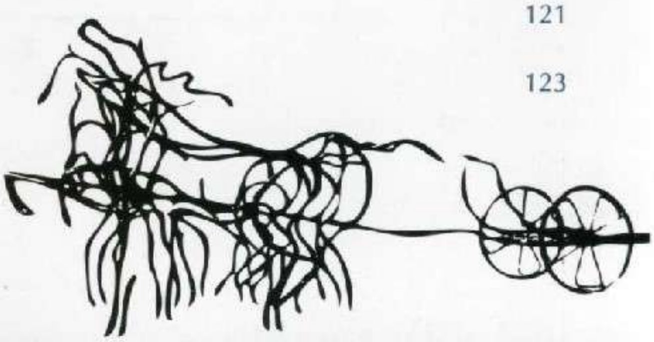
Contents



[8] Remains of the Caesarea harbor, aerial view (photography: courtesy of the Survey of Israel)

Ancient Harbors and Anchorages in Caesarea

Ehud Galili

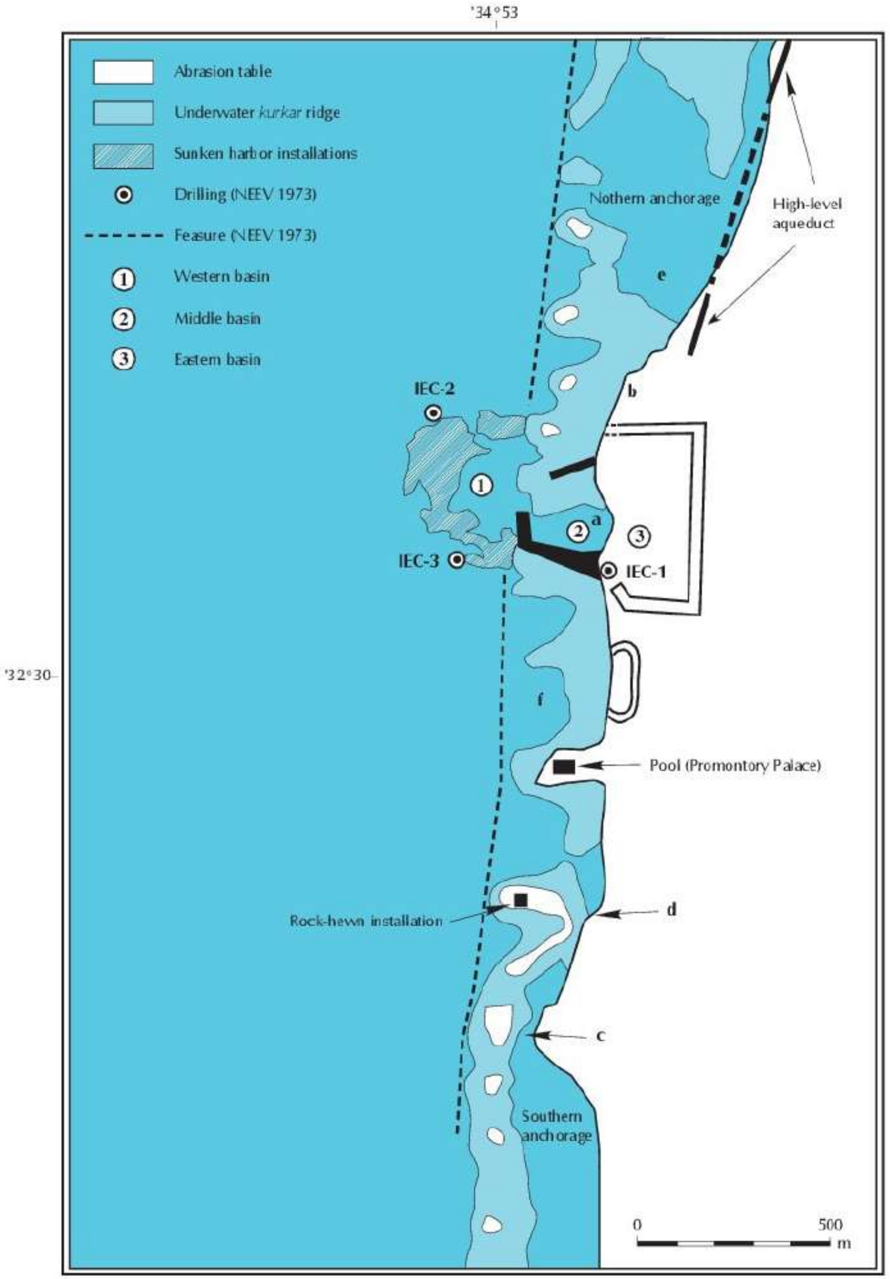
> However, by dint of expenditure and enterprise, the king triumphed over nature and constructed a harbor larger than the Piraeus, including other deep roadsteads within its recesses (Josephus Flavius, *The Jewish War* I, 408)

Underwater and coastal archaeological research has been ongoing at Caesarea since the mid-20th century. The excavations and surveys have revealed numerous findings, including remains of harbors, anchorages, sailing vessels, cargoes and coastal installations. The findings add an important dimension to our understanding of Caesarea's history and reveal characteristics of ancient shipping, vessels and harbors, as well as trade and fishing activities that took place there.

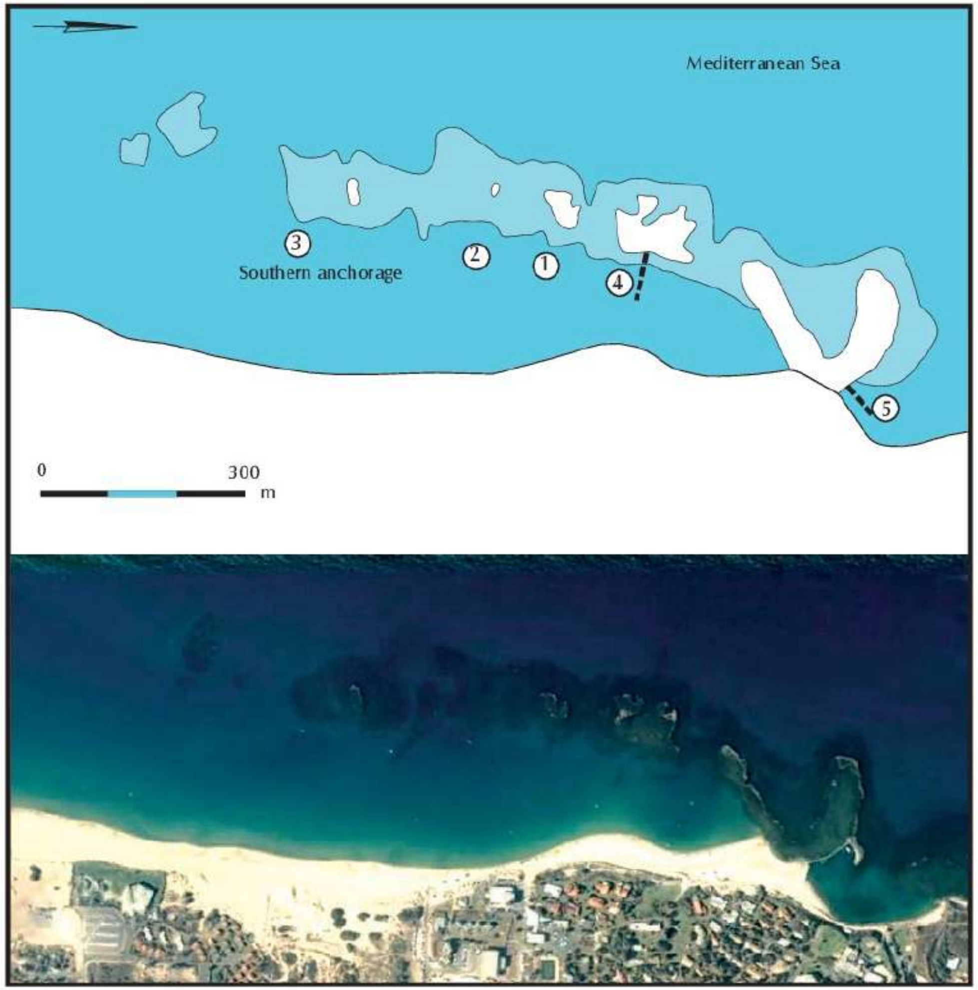
The coastal waters of the Land of Israel have been an active shipping lane for more than 5000 years. The physical marine conditions near the shore made shipping difficult, and sailing along the southern coast of the Levant was often dangerous. Sudden storms created waves sometimes more than 10 m high, sinking many vessels at sea or sweeping them to be wrecked near the shoreline.

There are no natural safe havens for watercraft along the coast of the Land of Israel (about 200 km long), except for a few natural anchorages that cannot provide proper protection from winter storms. Along the coast stretch, a few *kurkar* (calcareous sandstone) ridges, sometimes flooded by sea water, created tiny islets and rocky reefs 100–600 m offshore. These *kurkar* reefs served as natural anchorages, from the dawn of shipping in the Early Bronze Age. However, these natural formations could have provided only temporary havens for ships anchoring overnight as they waited for a good wind or to unload or take on cargo, passengers and supply. These special fundamental conditions dictated the nature of ancient maritime activities and shipping along the Levantine coast in general, and that of the Land of Israel in particular. With the establishment of the ancient coastal cities, population growth and increasingly complex economic activities and trade along the coast and at sea, the natural anchorages no longer sufficed, and artificial harbors began to be built. During the Iron Age, the first artificial harbor in the Land of Israel was built at 'Atlit, and during the Hellenistic period, a harbor was erected at 'Akko.

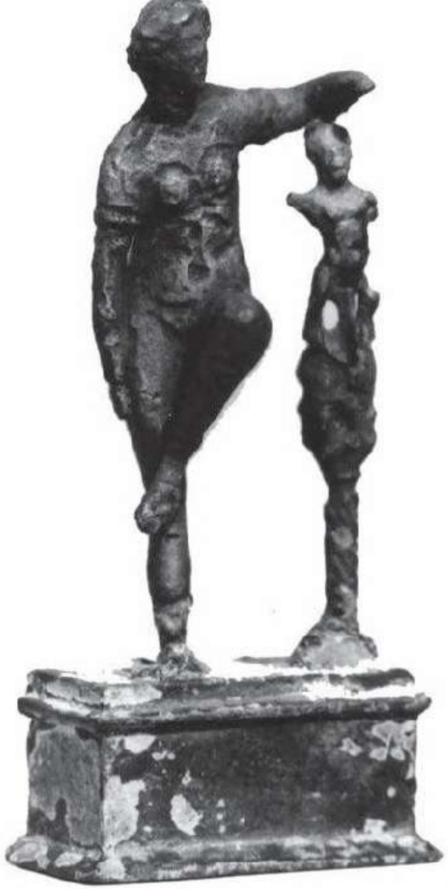
Evidence for maritime activity in the area of Caesarea dates back as early as the Late Bronze Age. The partly flooded *kurkar* reefs at Caesarea served as natural anchorages for vessels beginning in the second millennium BCE. During the Hellenistic period (the fourth–first centuries BCE), a small city named Straton's Tower was built in the center of the coastal strip of the Land of Israel. It became a commercial hub connecting the agricultural hinterland with the shipping lanes to Phoenicia and Egypt. During the Roman period, King Herod ordered the construction of the port of Sebastos next to the city of Caesarea. It was to become one of the largest and most magnificent harbors in the Mediterranean at that time.



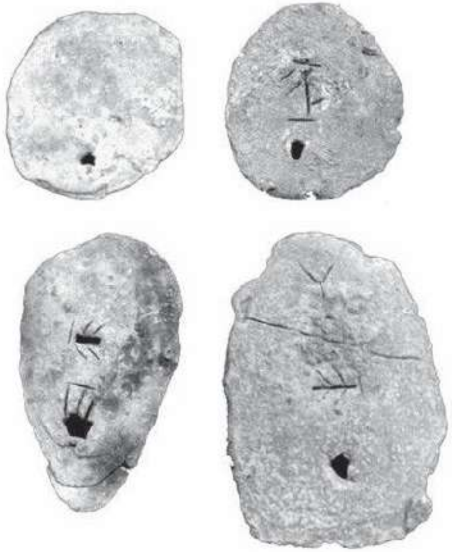
[9] Map of the Caesarea harbor and its surroundings (drawing: Ehud Galili and Sharon Ben-Yehuda).



[10] The southern anchorage and location of the archaeological assemblages:
drawing (top; Ehud Galili) and aerial view (bottom; photography: courtesy of the Survey of Israel).



[11] Bronze figurine of Aphrodite removing her sandal, southern anchorage, Roman period (photography: courtesy of Dan Toren/Turnovsky).



[12] Group of lead ingots bearing script, southern anchorage, Late Bronze Age (photography: Ehud Galili).

The Importance and Unique Nature of the Caesarea Harbor

The Caesarea harbor was built during the reign of King Herod and was inaugurated in 10 BCE. The historian Josephus Flavius describes its construction in detail (*The Jewish War* 1, 401–408). Underwater archaeological excavations have shown that the harbor's construction was based on the most advanced knowledge in the Roman world at the time. The Caesarea harbor is one of the Roman harbors that has been the subject of comprehensive, long-term and thorough research. An international expedition led by A. Raban from the University of Haifa studied the harbor for three decades (1975–2004). That project placed Israel at the forefront of worldwide research on ancient harbors. The state of preservation of the Caesarea harbor is rare, because most of it subsided during the centuries after its construction to a depth of up to 7.5 m, and the site was never modernized like many other Mediterranean harbors. In 1992, an initiative was launched to build an underwater archaeological park in the Caesarea harbor, and in 2006, the park's diving route was inaugurated.

The harbors and anchorages of the Land of Israel serve as open-air museums and archives of global shipping. They document economic activity, trade connections and wars from the dawn of recorded history to the present age. Some of these ancient harbors were modernized. Marinas were built, damaging their historical setting beyond repair ('Akko, for example). It must be ensured that a similar fate does not befall the Caesarea harbor, the jewel in the crown, and an important link in the chain of ancient harbors and anchorages in the eastern Mediterranean basin.

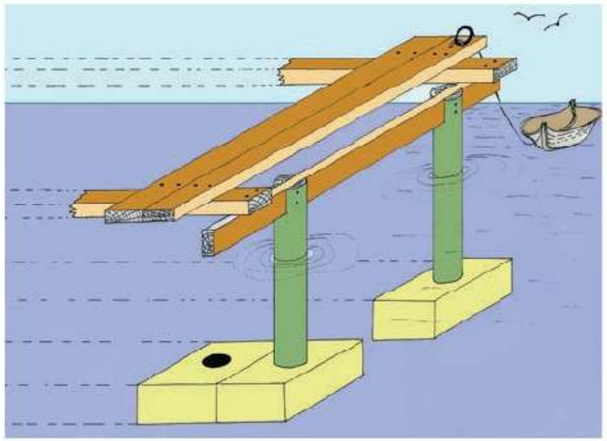
The Anchorages Predating the Harbor of Sebastos

Underwater surveys carried out in the 1980s revealed remains of sailing vessels, cargoes and anchorages in the area of the *kurkar* reefs north and south of the Caesarea harbor (Fig. 9).

The Southern Anchorage. West of Kibbutz Sedot Yam, about 100–150 m from the shoreline, are remnants of a submerged *kurkar* ridge forming a strip of islets and reefs (Figs. 9, 10). The area on the lee side of the submerged *kurkar* ridge is fairly well-protected and served as a

[13] Cargo of marble slabs, southern anchorage, Byzantine period; the divers are floating the marble slabs by using a parachute float (photography: Ehud Galili).

[14] Perforated ashlars, which served as a base for a quay in the southern anchorage (photography: Ehud Galili).



[15] Graphic reconstruction of the wooden poles (drawing: Ehud Galili).

[16] Ashlars set as headers in a jetty on the southern bank of the bay, west of Kibbutz Sedot Yam (photography: Ehud Galili).

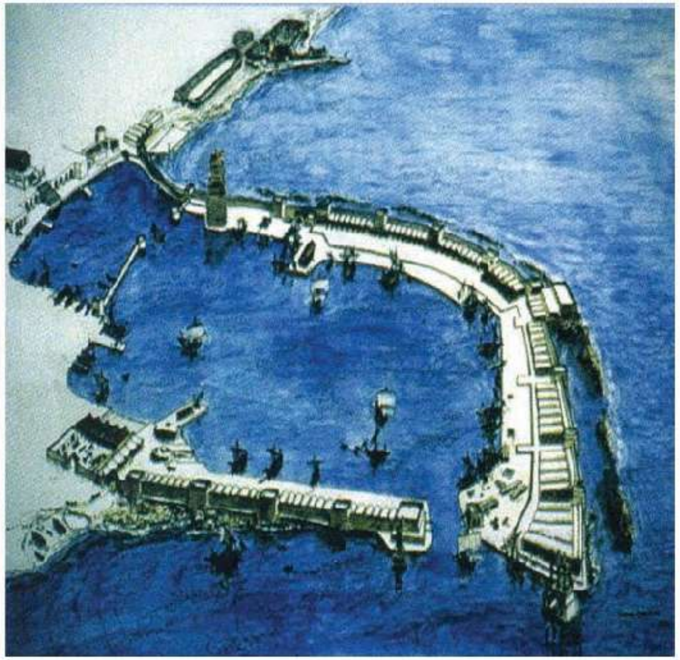
temporary haven for sailing vessels. Findings from a few different periods were discovered in this anchorage, including a Late Bronze Age cargo of inscribed lead ingots (Figs. 10:1; 12), and stone anchors with one perforation. From the Hellenistic period, bronze coins were found, as well as pottery vessels and the handle of a bronze krater, decorated with duck heads and leaves. Among remains of ship cargoes from the Roman period, a bronze figurine was discovered, depicting Aphrodite removing her sandal (Figs. 10:2; 11) and a protome of a woman wearing a toga. In a ship's cargo from the Late Roman period, remains were discovered of 20 lead sheets (12 x 90 cm; 5 mm thick), which had apparently been dismantled from the roof of a public structure for secondary use or to be melted down (Fig. 10:4). The sheets, which had a total weight of 750 kg, had been rolled up to ease their transport. The site also yielded bronze coins of Emperor Constantine II (337–340 CE), along with fragments of jars, bronze nails and two iron anchors. In another Late Roman shipwreck assemblage from the time of Emperor Constantine II, a hoard of hundreds of bronze coins, most of them worn, were found, accompanied by bronze nails. In the remains of ships from the Byzantine period a cargo of raw glass chunks was found; it probably originated in the glass manufacturing centers discovered in Caesarea and in the nearby Bet Eli'ezer neighborhood in Ḥadera. In the southern corner of the anchorage, a cargo of 35 roughly worked marble slabs was found, along with a few column drums and bowls (Figs. 10:3; 13). Crosses incised on the handles of the bowls and a bronze coin date the cargo to the Byzantine period. In the area of the anchorage many isolated findings associated with marine activity, trading and fishing were discovered, including bronze nails, lead sinkers for fishing nets, bronze needles for repairing fishing nets, pithos handles, clay amphorae and lead sounding weights.

A marine structure, apparently a pier where vessels could handle cargo, was discovered on the seabed west of the central part of Kibbutz Sedot Yam (Figs. 10:4; 14; 15). The structure is built of two parallel rows of ashlars (1.5 x 0.6 x 0.5 m) with round holes in their center. It is about 75 m long and 5 m wide, and extends from the eastern edge of the *kurkar* reef eastward, at a depth of 1.5–3.0 m below see level. The holes probably held wooden poles that bore a bridge, connecting the reef to the shore, or a pier to which small crafts could tie up while at anchor in the southern anchorage.

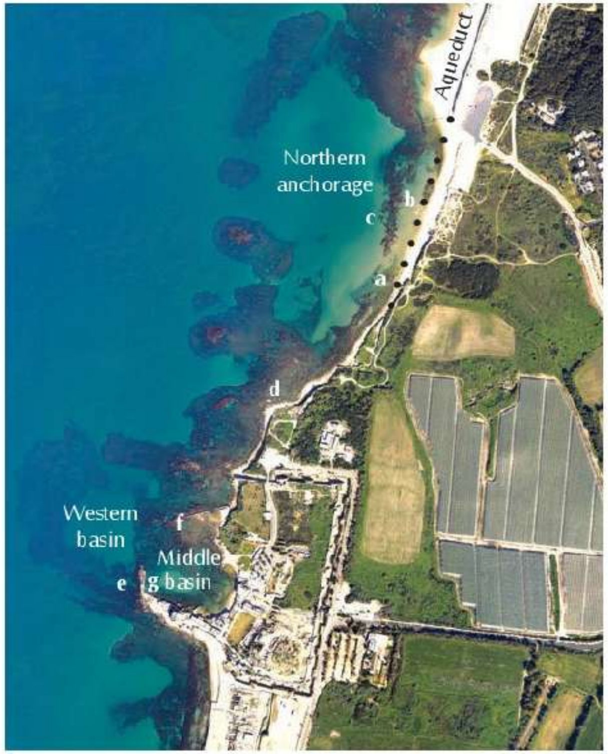
The findings show that the anchorage was in use since the Late Bronze Age. Most of the stone anchors found there weighed no more than 50–60 kg, and thus, it seems that the anchorage served small- and medium-sized crafts as an overnight haven or while waiting for favorable winds in

[17] Ruined portion of the high-level aqueduct on the shoreline of the northern anchorage, and foundations of the aqueduct, now submerged (photography: Ehud Galili).

[18] Jetty built of headers in the middle basin, remains of the Herodian port (photography: Ehud Galili).



[19] Aerial photograph of the submerged western anchorage (on left; photography: courtesy of the Survey of Israel), and a graphic reconstruction of the harbor (on right; courtesy of the Caesarea Development Corporation).



[20] Caesarea harbor, aerial view to the north: the submerged western basin; the northern basin; and the northern anchorage, where a portion of the aqueduct was apparently destroyed by the construction of the harbor (marked with black dots) (photography: courtesy of the Survey of Israel).

the summer, spring and fall. It could not, however, have served as a safe haven during winter storms. Some of the finds discovered in the anchorage probably came from ships that were wrecked in storms while at anchor.

In 1990, in a small bay north of the anchorage, a ten-meter-long pier was discovered (Figs. 10:5; 16). It was built of ashlars set as headers (each stone c. 1.5 m long). This installation was destroyed during the construction of a modern anchorage built by Kibbutz Sedot Yam.

The Northern Anchorage. North of the remains of the Herodian harbor is a partly submerged *kurkar* ridge, forming reefs and small islets 200–300 m from the shore (Figs. 9:e; 20). A fairly well-protected area, 3–5 m deep, was created on the lee side of the islets where ships could anchor.

In underwater surveys conducted at the site, nine stone anchors from the Bronze Age having one perforation were discovered (0.6–1.0 m long, weighing 50–120 kg), one of them incised with a cross-like design. Marble bowls were also discovered, as well as deep conical marble vessels, lead and bronze objects and numerous clay vessels from the Hellenistic, Roman and Byzantine periods. Part of the wooden hull of a large merchant ship from the first century BCE was discovered (Fig. 20:a). This ship may have carried construction materials intended for the Herodian harbor. About 30 m south of the ship, a rectangular lead basin was discovered, to which two lead pipes were attached. This, apparently, was the collecting box of a bilge pump, an apparatus intended for pumping bilge water from a ship.

Findings from the northern anchorage show that ships had anchored there from the Late Bronze Age until the construction of the Herodian harbor, and most probably thereafter. On the southern coast of the northern anchorage, an elongated structure, oriented east–west and built of ashlars set as headers, was documented (Fig. 20:d) and attributed by Raban to the harbor of Straton's Tower.

Near the shoreline, in the central part of the northern anchorage, at a depth of up to one meter below the surface and at a distance of 10–15 m from the shore, the remains of the foundations of the high-level aqueduct were found (Figs. 17; 20:b). This portion of the aqueduct was destroyed by the sea. Parts of the aqueduct foundation were preserved on the seabed, standing on friable *kurkar* bedrock, the stones still in the order in which they had been built. It is unclear whether the foundations were originally built above the water's surface (like the foundations of the aqueduct uncovered on Aqueduct Beach to the north), and sank intact after the sand beneath them was swept away by the sea, or whether they were built on *kurkar* rock at the level where they are at today. A long, narrow strip of *in situ* beach rock deposits, c. 2 m thick, was found 0.2–3.0 m below the present sea level. It is oriented north–south and is c. 60 m west of today's shoreline and parallel to the remains of the aqueduct (Fig. 20:c). This beach rock marks the location of the ancient shoreline before the construction of the harbor and the aqueduct, and shows that the shoreline has retreated some 60 m eastward. Apparently, this retreat has occurred as a result of downstream erosion due to the construction of the Herodian harbor to the south. Another indication that the coast has retreated in this area is attested by the remains of a Byzantine sewer inlet, located in this area (see Fig. 20:a). Our observations show that the ruins of this stone-built convey system are presently scattered on the sea bottom off the coast. The inlet of the sewer, which must have ended on the coastline when it operated some 1500 years ago, is now c. 50 m offshore, suggesting that the coastline has significantly advanced to the east since the Byzantine period.

The Hellenistic Period: The Harbor of Straton's Tower

In the fourth century BCE, a small coastal town, called Straton's Tower or Sharshan's Tower, was built in the area of Caesarea. The city and its harbor were built in the center of the coastal strip of the Land of Israel, near water sources, and served as a haven and trading hub. Josephus Flavius (*The Jewish War* 1, 409–410) notes that there was no active harbor between Dor and Jaffa before Herod built Caesarea, and that Straton's Tower had no proper harbor services. According to Raban, there were two harbors at Straton's Tower: a northern one, in the place where remains from the Hellenistic period were discovered (see Fig. 20:d), and a southern one, within the area of the middle basin of Herod's harbor. The extensive construction of Caesarea and the Sebastos Harbor covered up much of the remains of Straton's Tower. In the excavations in the eastern part of the middle basin of Herod's harbor, near the entrance to the eastern basin, a round tower was discovered submerged in the sea, built of ashlars set as headers (Fig. 9:a). It was dated by the excavators to the Hellenistic period and attributed to the harbor of Straton's Tower; however, according to Porath, it cannot be ruled out that this tower was built at the time of Herod, because round towers were also in use in Herodian Caesarea.

The Roman Period: Sebastos Harbor at the Time of Herod

Sebastos Harbor was built next to the city of Caesarea between 22 and 10 BCE, on orders of King Herod. This was one of the largest and most magnificent harbors in the

Mediterranean at that time. The harbor was named after Augustus Caesar, Herod's patron, who received the title Augustus (Sebastos in Greek) in 27 BCE. Josephus Flavius lived a few generations after the harbor was built and described its construction (*The Jewish War* 1, 408–414).

The first underwater excavations at the Caesarea harbor were carried out in 1960 by E.D. Link. They exposed the outlines of the submerged Roman harbor, which until then could only be seen in aerial photographs. Previous mappings of Caesarea and its harbor by Pococke in 1745, Mansel in 1863 and Conder and Kitchner in 1882, failed to identify the layout of the submerged harbor. Between 1963 and 1972, excavations took place within the Roman harbor, sponsored by the Underwater Exploration Society of Israel and headed by E. Linder. From 1975 to 2004, the harbor has been excavated and investigated on behalf of the University of Haifa's Institute for Maritime Studies, headed by A. Raban, in collaboration with several institutes from abroad. Ongoing research at the site has revealed that the Herodian harbor comprised three basins (Figs. 9; 20).

The Western Basin is located in the open sea. The main breakwaters of the western basin were built of large blocks of hydraulic concrete, made of volcanic ash (*pozzolana*), crushed limestone and gravel, which was poured into floating wooden frames that were sunk in the water. The main, wide breakwater was built in an L-shape facing north. At the same time, on the outer side, a narrow breakwater was built to reduce wave energy. In the northwestern part of the western basin two towers flanking the entrance channel to the harbor were uncovered, precisely where Josephus described them. The northern breakwater was shorter than the main one and was built perpendicular to the shoreline.

The Middle Basin is located on the coastal *kurkar* ridge, utilizing a gap or inlet in the ridge. In the northeastern part of the middle basin a wharf was found, probably Herodian, built of headers that had survived *in situ* up to the water's surface, near the southern jetty of the modern-day fishing port (Figs. 18; 20:g). Another portion of construction, built of ashlars set in headers (a wharf?), was discovered in the northeastern part of this basin. Flushing channels were also uncovered, the purpose of which was to bring the tops of the high waves that struck the southern part of the harbor into the harbor basins to create a current to flow outward from the harbor. This flow was intended to reduce the amount of sand penetrating the entry to the harbor and remove sand trapped in it, thereby preventing the silting of the harbor.

The Eastern Basin is situated east of the coastal *kurkar* ridge and was dug on land to be used in maritime activity. Comprehensive excavations of this basin exposed portions of the anchoring pool and the wharfs that enclosed it. Fixed in the eastern wharf of this basin, a perforated mooring stone that was used to anchor ships was discovered.

The Reasons for the Construction of the Herodian Harbor at Caesarea

The physical maritime conditions near Caesarea do not provide any advantages to this site as a harbor when compared with other anchorages in Herod's kingdom, such as Yavne-Yam, Jaffa, Apollonia and Mikhmoret, or anchorages on the northern coast of the country outside his kingdom, such as 'Akko, the Qishon estuary, Haifa Bay or the 'Atlit and Dor anchorages. The coast of Herod's kingdom was straight, mostly rocky, and exposed to winds,

[21] Jetty of columns in the middle basin, 2005 (photography: Itamar Grinberg, courtesy of the Caesarea Development Corporation).

[22] Surface built of ashlars on the seabed, 2005 (photography: Itamar Grinberg, courtesy of the Caesarea Development Corporation).

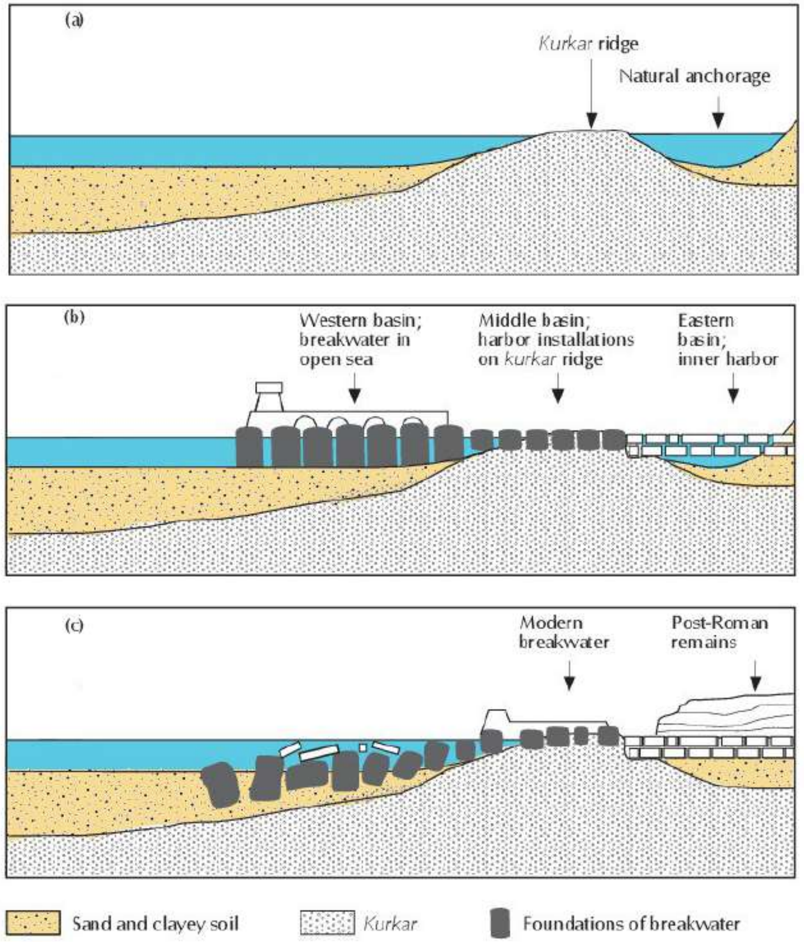
waves and currents. Except for small *kurkar* reefs, which could provide partial haven to small vessels when the sea was calm, this area has no natural bay or protected area that could serve as a base for a large maritime harbor. Thus, it seems that the reasons for constructing the harbor had to do with political and economic factors, not necessarily associated with the maritime environment. The continuous supply of wheat from Egypt was a strategic need of the Roman Empire, and the Caesarea Harbor was built, among other reasons, to ensure this supply.

As far as maritime elements go, it seems that in the central part of the country's coastline, where natural havens for sea-going ships were lacking, harbor services had to be provided, along with a place for the ships to anchor and be protected.

Caesarea's connections with the agricultural hinterland of the northern Sharon plain, Ramat Menashe and northwestern Samaria, were an important factor in the choice of Caesarea for the construction of the harbor. The Ḥadera swamps extending south of Caesarea and the Kebara swamps to its north were hostile environments, where farming was impossible and traffic restricted. However, in the immediate hinterland of Caesarea there were extensive, fairly well-drained farmlands. Caesarea was built in the northern Sharon, which was the northernmost portion of coastline in Herod's kingdom. The Sharon coastal cliff stretches to its south, with extensive height differences between the coast and the hinterland, which created a barrier between land and sea, impeding passage between the two. Caesarea's location on a junction of the longitudinal, cross-country coastal road, with the transversal road leading inland, led to the construction of the harbor. It was one of the most important harbors in the Land of Israel, and it also served as the harbor of Samaria.

The Reasons for the Destruction of the Harbor and the Cessation of Its Activity

Archaeological research, both on land and underwater, exposed many remains of the Caesarea harbor and shed light on the past grandeur of this important facility. The reasons for its destruction and the cessation of activity has preoccupied scholars, giving rise to several theories. The time when the Roman harbor ceased to function can be deduced from the shipwreck remains discovered on



[23] Graphic reconstruction of the submersion process of the Herodian harbor's western basin (drawing: Ehud Galili and Sharon Ben-Yehuda).

the main breakwater of the middle basin. In one of the shipwrecks, a cargo of lead ingots from the end of the first century CE was found atop the breakwater. The ingots were dated based on inscriptions to 83–96 CE. They show that the main breakwater was underwater and went out of use about 100 years after it was built.

According to some scholars, excavations in the Caesarea harbor show evidence of young tectonic subsidence of the western basin of the Herodian harbor, now about 3–7 m below sea level. In this basin, an area built of dressed stones, believed to have originally been above sea level, was found (Figs. 20:e; 22) at a depth of 6 m below sea level. On the other hand, the installations of the middle basin of the harbor, which were built on the *kurkar* ridge (like the wharf built of headers from the Roman period), maintained their original level (Fig. 23). Further detailed geotechnical surveys along the coastline of Israel showed no active fault along the Caesarea shoreline. Moreover, hewn installations at Caesarea, like the pool in the Promontory Palace, located south of the harbor, indicate tectonic stability of the coastline over the past 2000 years.

Other studies show that while the Caesarea harbor was active, and even thereafter, several earthquakes damaged the city (Shalem 1956:264; Guidoboni, Comatri and Traina 1994:234). A re-evaluation of the historical sources that reported earthquakes in the area of Caesarea when the harbor was active, show that these sources are not unequivocal. Eusebius reports that Caesarea and Nikopolis were destroyed in an earthquake that occurred between 127 and 130 CE; however, interpretations differ over whether the reference was to Caesarea and Nikopolis in Asia Minor, or Caesarea and Nikopolis (Emmaus) in Judea. The sources do not give details as to what structures were damaged, and do not note destruction of the harbor. Thus, it seems that the archaeological findings and the historical sources do not indicate any destruction of the Herodian harbor or the city as a result of earthquakes. Reliable reports of earthquake damage in Caesarea can be found from later periods, in the years 363, 551, 1759 and 1837, after the Roman harbor went out of use.

Another theory which attempts to explain the cessation of activity in the harbor is that a tsunami struck the coast of Caesarea in 115 CE and destroyed the harbor (Reinhard et al. 2006). This theory is based on Shalem (1956), who suggested that Talmudic sources state that the coast of Caesarea and Yavne was struck by a tidal wave. However, according to Karcz and Lom (1987), and later, David Amit (pers. comm., 2006), these sources say nothing specific about the location or the timing of such a wave, if there ever was one. The archaeological and sedimentological findings, as well as the historical evidence of a tsunami at Caesarea, are not unequivocal, and therefore, no conclusion can be drawn from them regarding the destruction of Caesarea's harbor. At present, it cannot be entirely ruled out that tsunami waves struck the country's coastline when the harbor was in use; however, it seems that if such a significant tsunami had occurred and destroyed the Caesarea harbor, it would have been mentioned in historical records. No such record is known thus far, suggesting that it never happened.

Other scholars, including the author, posit that the western part of the Herodian harbor subsided due to geotechnical reasons, rather than tectonic subsidence or a catastrophic tsunami. The foundations of the western basin's breakwater were built on an unconsolidated and unstable seabed consisting of sand and clay. Strong waves and currents, typical of winter storms, battered the breakwater and swept away the sand beneath its foundations. The wave poundings also caused sand liquefaction, and the breakwater subsided and ceased functioning some 90 years after its construction, as attested by the shipwrecks recovered above it.

The Harbor after the Roman Period

During the Byzantine period, attempts were made to rebuild the harbor, as attested by texts describing repairs to its installations. In the northern, shallow part of the middle basin, a quay can clearly be seen, made of hundreds of columns in secondary use, set alongside each other on the flat rock surface (Figs. 20:f; 21). The columns are mostly submerged; their upper parts can be seen at low tide. This quay leads from the northeastern shoreline of the middle basin westward, and then turns southwest, where the water is c. 3.5 m deep, enabling convenient access to sailing vessels for loading and unloading. It seems that it was built during the Middle Ages or later, and was used, among other uses, to bring architectural items from the ruins of Caesarea, for secondary use in the coastal cities of the Land of Israel.

Summary and Conclusions

The conquest of the city by Alexander Jannaeus and the massive construction during the time of Herod obscured the remains of the earlier settlement of Straton's Tower. The scanty Hellenistic remains, discovered on the southeastern coast of the northern anchorage (see Fig. 20:d), may belong to Straton's Tower. The installation built of headers, which has been identified as a wharf of the Straton's Tower harbor, is placed in a very shallow and rocky area that could not have accommodated sailing vessels, and thus, it may be reasonably posited, that these are the foundations of a large structure that stood on the shoreline and not of a wharf used to load and unload ships in Straton's Tower harbor.

The Herodian harbor of Caesarea, the largest Roman-period harbor to be built in the open sea, was constructed to serve as anchorage, safe haven, a place to await favorable winds, to re-supply and provide services to vessels sailing along the coastline of the Land of Israel, and those on their way to Egypt and southern Europe. These ships brought to Rome essential supplies of wheat from Egypt, as well as luxury items like silk and spices from the east. The harbor was also a strategic base for the Roman navy in the southern Levant, an export harbor for local agricultural produce, such as wine, oil and flax, and for commerce with Mediterranean countries.

The main reasons for the choice of this site for building a harbor did not necessarily involve the physical characteristics of the marine environment. Rather, geopolitical considerations; good access and convenient passage from the coast inland; proximity to extensive, fine agricultural areas in the harbor's hinterland; proximity to perennial water sources; and location in the center of the coast of the Land of Israel and on the northern coast of Herod's kingdom—all influenced the choice.

Despite thorough research, many basic questions regarding the functioning of the harbor and the reasons for its destruction are still debated. Archaeological and geological evidence do not support the theories suggesting that the western part of the Herodian harbor sank as a result of a catastrophic event, such as tectonic activity, an earthquake or a destructive tsunami. It is reasonable to assume that such a significant event, had it ruined such an important facility of the Roman Empire, would have been mentioned in many historical records; however, no such records are known thus far. It seems that the main reasons for the destruction of the western part of the Caesarea harbor was a geotechnical-engineering fault, and stemmed from the fact that the breakwaters in the western basin were built on a foundation of sand that was swept away due to powerful winter storms and underwent liquefaction due to wave poundings. The construction of Herod's harbor changed the natural sedimentological processes in the shallow area of the nearby coast. As a result, an erosion had occurred downstream, north of the harbor, and the coastline retreated eastward by some 60 m. This retreat contributed to the destruction of a 500 m long portion of the high aqueduct, whose foundations in this area are now submerged. The timespan over which this destruction took place is yet unclear.

The archaeological remains and written sources show that after the destruction of the Herodian port at the end of the first century CE, maritime activity declined at Caesarea, although during the Roman and Byzantine periods the city expanded and flourished. During the Early Islamic and Crusader periods, the ruins of ancient Caesarea became a source of building material and the construction of improvised anchorage installations, such as the quay made of columns. These installations, as well as the southern and northern anchorages, enabled access, albeit difficult, of ships to the shore for loading and unloading, and provided temporary haven for ships in summer, spring and fall. The archaeological and geological evidence in Caesarea suggest that there have not been significant sea-level changes (greater than 25 cm, the local tidal range) in the region in the last 2000 years, and that the area has been tectonically stable during this timespan.

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