SEBASTOS, THE ROYAL HARBOUR OF HEROD AT CAESAREA MARITIMA:
20 YEARS OF UNDERWATER RESEARCH

FOREWORD
The name of Caesarea and its whereabouts never got lost amongst Christians, Jews and Muslims all through the ages. The texts of ancient scripts, such as Josephus' books, the New Testament, the Talmud, Arab and Crusader documents, include a wealth to that city, its monuments and its history. Yet, between the 18th and 19th centuries only a few Europeans would visit its ruins and none would depict the remains of its lost Royal harbour, the Sebastos. The fact is that all through the 19th century modern surveyors and misreckoned it, as even more recent scholars did till 1960.

In fact, there was one exception: on April 10th, 1918, an airborne reconnaissance officer of the 303 flying squadron of the German air force wrote a report following his reconnaissance mission along the coast of Palestine, annotating an aerial photograph taken by his sergeant. In his report this officer pointed out the two parallel darker lines under the water as matching the description of Herod's harbour as he just received from home a few weeks earlier.

In 1960, one of the true pioneers of UW research, the American engineer, Edwin Link, came to Caesarea with his research vesel, the "Sea Diver" and spent almost half a year at the site, of which his navy divers only managed to dive 12 days, producing a very sketchy plan of the submerged remains and some data concerning their probe at the harbour channel. Yet, among their chance finds there was a tessel made of clay, silver and lead, depicting a harbour entrance with arched vaults and towers crowned by statues, much like Josephines' description of Sebastos. This tessel, dated to the 2nd century AD, carries the letices KA that might be a regnal year (021), or the initials of the Greek form.

In 1975, the writer was asked by the Israeli Electric Company to carry out a thorough survey at the site in order to collect ample data for attestating the site and character of subsidence of the harbour's main moles, in order to decide whether or not the Israel coastline is tectonically safe for locating a nuclear power plant. Since that year we have been studying the archaeological remains that harbour and those that were at its site before and after, both on land and underwater. Every year, for about two months, the professional staff of the Center for Maritime Studies at the University of Haifa would use dozens of diving volunteers from allover the world in order to advance the research.

The international collaboration enhance in 1979 when a group of American and Canadian scholars joined this project, creating CAHEP (Caesarea Ancient Harbours Excavation Project), Prof. R.L. Hohlfelder of the University of Colorado, Prof. J.P. Olson, of the University of Victoria, Prof. R.L. Van of the School of Architecture at the University of Maryland, and later on, Prof. R.R. Siegelitz of Rutgers University of New Jersey, joined S. Breitstein, Y. Tur-Kaspa, D. Yona, and other local experts for ten years of amphibious research.

In 1989 a new entity, the Caesarea Combined Expedition (CCE), replaced CAHEP. This time the aims were extended to include some additional terrestrial issues concerning the city of Caesarea in the Byzantine era. CCE is co-directed by the CMS and the History Department at the University of Maryland, led by Prof. K.G. Holm, with a consortium of Ifadd a dozen other institutes in the U.S.A.

Since 1992 the Israeli government has sponsored a 5-year program for year-round field work, aiming to extend and modernize the tourist park at Caesarea, including the ambitious plan of reopening its land-locked inner harbour. The following presentation is an attempt to summarize the more important results of the study carried out by both CAHEP and CCE, including earlier ones by the Israel Underwater Exploration Society (1975, 1976).

MAIN AIMS OF THE RESEARCH
Five preliminary facts dictated the study of Sebastos and other ancient maritime installations at Caesarea.

1. The detailed text of Josephus describing how Herod built his harbour and how it looked, in two versions, in each of his two major compositions (see the text in frame), should be used as a guide for a study which would verify or prove every incorrect entry in it. Taking into consideration that Josephus lived and visited Caesarea three generations after Herod's time, one might take his testimony as a first-hand one only for those components of the harbour that were visible for the writer. One might question Josephus sources for the building process and techniques and his own understanding in marine engineering and proper Greek technical terms.

2. About the time Herod built Sebastos, a Roman engineer wrote the "textbook on engineering, including one chapter on harbour technology. Chapter 12 of the fifth book in Vitruvius' 10 books "DE ARCHITECTURA", is another type of guideline for field study: To what extent did the builders of Sebastos use the same techniques Vitruvius advocated? What did Josephus mean when he wrote that the harbour was built by materials that were brought from afar, imported at great expense? What other local techniques were implemented in building Sebastos and of which tradition? Will it be possible to use the new data from the field study for better understanding Vitruvius' text (see in the frame).

3. Josephus, Strabo and others mentioned a former port city at the site of Caesarea, that had an harbour, at least since the mid-third century BCE. Where was the harbour of this town, Strato's Tower? What technology did it have? To what extent were its features incorporated, or renovated in Sebastos if at all?

4. Having the main part of Sebastos...
vertically displaced by at least 5 metres since antiquity, makes it obligatory to study the cause and nature of that subsidence, as well as its limits. This issue becomes more crucial when reading the Etology written by one of the early Christian writers, Procopius Gaza (of Gaza) around 500 AD, praising the Byzantine Emperor, Anastasius I, for his generous attempt to renovate the harbour of Caesarea that was already in a state that would cause mercantilment to be wrecked over its sunken moles (and see the text frame).

Since the port of the city named after Caesarea had fallen into bad condition in the course of time and was open to very threat of the sea and no longer in fact deserved to be classed as a port, but retained from its former fortune merely the name—you did not overlook her need and her constant laments over the ships which frequently, escaping the sea, were wrecked in the harbour. Those who awaited the cargoes suffered greatly, seeing the destruction of those things of which they were in need, and seeing it without being able to help. But, thanks to your good will, the city is rejuvenated and receives ships with good courage, and is full of the necessities.

THE SUBSIDENCE OF SEBASTOS
As mentioned above, the first issue in our study was to find out whether the harbour works, or part of it, had been subsided and at what scope. Careful examination of good aerial photographs have suggested the existence of at least one fault line, which runs parallel to the shore, not far to the west. This alleged line is clearly marked by the seawards visible edges of the rocky reefs and sea floor. Along the stem of the presently submerged moles; this alleged line is indicated by the transition from bedrock to tumbling mass of buildings stones. Series of geomorphological drills carried out for the Israeli Geological Survey, indicated offset nature geological strata and proved that there are two relatively "young" fault-lines at Caesarea, of vertical displacement of 5-6 m for the one closer to the shore, and an additional 2-3 m for the second, western one, which might be a little older.
The underwater surveys have verified these data in various sites. The easternmost one is the sunken "Floor", or a pavement of ashlar slabs, found at -5.2 m, in rather horizontal and intact state. Similar pavements were traced along the inner side of the western mole at similar depth, which suggest an even subsidence for most of the main harbour basin. Such a disposition can hardly be triggered by fluctuation, or understandings, as has been suggested by some scholars. It is more likely that some type of tectonic displacement was the cause. The fact that the sunken floor at area F, which is only a few meters away from the active fault line, subsided as an intact, even unit, may indicate that its subsidence was gradual, rather than a sudden event. Yet a recent discovery might indicate that the subsidence of the outer, main harbour basin occurred rather early in history and probably quite suddenly. When studying the huge hummocking at the northern end of the main, western mole, we were surprised when the probe excavated below the tilted foundations of an artificial island that had been installed as a base for the "limnion", or the lighthouse (see below), we came upon typical remains of the wreckage site of a merchantman. The vessel ran aground over the already-interrupted, tumbling structure, as a piece of coiled lead sheathing stripped off its keel and the torn-off bolts clearly attest. Having only metal objects at the wreckage is typical for foundering in shallow, turbulent waters over a hard substrate.

The surprising items are a group of lead ingots, all of the same model and undoubtedly from that wrecked vessel. Two of these ingots still retain their original form and all the imprinted markings, including the imperial imprint on their crest, which can easily be read as IMP. DOMIT. CAESARIS AUG. GER. This would date these ingots sometime between 83 (the year the Roman Emperor Domitianus was entitled "Germanicus", following his victory in Germany, and 96, his last year. Other moulded letters on the sides of the ingots, MET.DARD. might indicate that the mines where they were cast were located at Contra, Dacia of the Roman era. The occurrence of wreckages over the lee side of the lighthouse already in the first century and about the time Josephus wrote his composition referring to Sebastos as an intact, properly operating complex, is the earliest datable evidence for the harbour's subsidence, and too early to be considered as gradual. There are other indications of that sort, such as a composite, lead and wool anchor found in the harbour basin, laid over very coarse sand, mixed with shells and shingles, about one metre thick, which has been deposited by the surge, over the original harbour's floor. The C dating of the anchor is mid-first century AD and the fact that it was dumped over sediments deposited by considerable waves might suggest that prior to that the harbour was non more than an intact basin of still waters. Other supporting dates of that sort involve our studies at the inner parts of the harbour, where wave-carried sediments were traced underneath 3rd century structures and in the inner harbour.

The suggested early date for the destruction of Sebastos has caused arguments between scholars of CAH63 and other historians as well. Yet, it is quite clear that the people of Caesarea preferred to use the open anchorage at the south bay already in the early 2nd century AD.

**HOW WAS THE HARBOUR BUILT?**

At the present stage of our field work, we can attempt to reconstruct the techniques and succession of working phases in the construction of Sebastos. Though our study proved Josephus figures to be accurate as far as the width and the overall outlines of the Herodian moles, his claim for the water depth was exaggerated by far. In order to fully appreciate the uniqueness of Herod's moles, one has to consider that they were a daring engineers feat, being laid in the open water, off the shore, with no topographic lee from the full might of the surge. Taking into account what Josephus tells us about the mol-nature of the place and what we know about the local coastal process, we can estimate the scope of the problems that were to have proper engineering answers to the planning of the mole:

1. Establishing a rather massive and voluminous structure on a non-consolidated sea bed, over what was known to be ever shifting sand.

2. Building structures that were to be strong enough to endure the constant pounding of the winter, with its components well-ties and of overall coherence to avoid the familiar destructive of segmentation and hollowing at such structures, built in our times, due to the excessive suction of the retreating surge.

3. Solving the inevitable phenomena of overtopping of sea water on the lee of the sea wall, in order to facilitate proper storage and shifting of goods on the inner part of the mole, as Josephus described it.

4. To maintain a proper water depth within the harbour basin and to keep it silt-free, in a place known notoriously for the constant shifting of wave carried sand toward the shore, as Josephus indicated and as it is well known anywhere in protected basins along our Mediterranean. While today this ineluctable problem is dealt with repeated dredging, the ancients did not have the heavy duty machines for such an operation, and for that reason preventive measures should have been applied as imperative features in the overall planning of the harbour.

Sebastos was planned to be built at the site of the former town of Straton's Tower, which had two small harbourer: one at the northside of that town, at the lee of a series off-shore reefs. There we have studied the Hellenistic quay, built in a typical Phoenician style of slim, long headers at the southern, protected side of the cove. Excavations next to that quay, in the water and on land, have revealed a score of 2nd century BC pottery, at stratigraphical context with the quay, and an early Roman vessel, of the Herodian Period - at a later context, when this relatively small basin might have been used as a fisherman's anchorage for the Jewish suburb of Sebastos.

The other basin was originally a sandy bay, protected on its south side by a rocky promontory. That bay had been widened and deepened by the polder of Straton's Tower, probably during the latter part of the 2nd century BC and was not compassed by the city wall on its south and western sides. Of that "sea wall" only the round tower that crowned its tip, guarding the entrance, has survived to our day. This ashlar structure with a diameter of 13 m, which was laid in 2.5 m of water is an exact replica of the twin towers at the north city wall that also protected the other basin. Herod's engineers incorporated this southern harbour as the inner basin of Sebastos and the city walls of Straton's Tower as the dividing line between the Royal Harbour and the adjacent city of Caesarea, which was a semi-autonomous municipal entity.

The first feature to be built in the sea was probably an artificial island, at the place where eventually the top of the main mole would be, some 500 m N-NW of the top of the southern promontory and about 350 m due west of the stem of the northern one.

During the 1990-1991 seasons of field work we have discovered a series of wooden forms in which aggregated pumicoids had been packed, that served as the basis of that island. One of this forms, the lower part of which has survived almost intact, was about 17 x 7 m, with its original height just over 4 m, probably the depth of the sea floor at that site at that time of construction. The wooden form had been constructed on the shore in the regular shipbuilding technique of that period. That is to say a shell-first system,
in which side beams were laid, with composed boards of planks fastened by mortises and tenons attached to them as floor and side walls.

After completing that rectangular shell, upright trimmed round and square section timbers were added over the floor and along the inner face of the side walls. Cross beams and diagonal ones enforced the structures that had in it inner compartments. A mixture of volcanic ash, filled it up to about one third of its height and was left to be dried and consolidated. Then the form was shoved in the water to the site in the open sea and moored by iron chains at all four corners. Additional loads of rubble and pozzolana was then added into the caisson, from barges, in measured quantities, so as to cause its gradual, even subsidence, till it rested on a rubble cushion that was made for it on the sandy sea floor. The neighboring form would have submerged next to the first one, as close as possible. The sides of the caissons were retained with piles of rubble and the gap between the forms were filled with pozzolana packed in sacks. The combined platform probably 21 x 42 m in size was covered with pavings slabs, on which the largest tower was built, probably the "Druzan", mentioned by Josephus, quite likely with a function of a lighthouse. Initial lab analysis suggests that both the wooden timbers for the caisson and the volcanic components of the pozzolana had been imported from Italy.

during the 1992-1993 seasons more forms were exposed and studied at area K. Some, after tedious efforts to float off some of the overlaid huge chunks of hydraulic cement, and others - due to the fact that the fill of the rectangular barges contained a lesser quality component -- the mass that was added when the form was due to be sunk at the building site. It seems that part of the building process was the most delicate one. Having a floating barge being moored at an accurate position in the open sea and deliberately and evenly sunk to rest on the sea floor in a proper position, necessitated accurate, well-coordinated work of a large team, pouring components for hydraulic cement and rubble in a tight space. The ratio of the components and the coherence of the final product were trivial in that context. No wonder form K/3, tilted a bit when it was sunk, with its NE corner being damaged and one of the vessels dragged down with it. Other forms lost that lesser quality matrix by centuries of wave erosion, leaving hollows "tunnels" for us to clear off the sand fill to reach the barge's floor. The overall setting of the wooden forms in area K is still under and will continue in coming seasons, but it is already obvious that this sophisticated technique of single mission barges of best ship right quality is far from what Vitruvius ang much more advanced than the secondary use of Caligula's barge as the base for the Lighthouse of Portus.

Another artificial island of a similar type of construction was installed half way along curved line of the main mole at the turn of its course from west to a northerly direction. When this skeletal composition had reached the stage of blocking off the surge, another artificial island was established at the designated tip of the northern mole. There, the wooden forms were made of somewhat "lighter" mode of construction. One such form we have studied in area G. The caisson with no planked floor had been composed of rectangular form of heavy square beams, on top of which double walls of mortised planks were inserted, fastened to a series of uprights, which were installed on top of the slipper 1.5 m apart. The hollow in between the uprights and within the double walls was filled, on land with fluid mixture of volcanic ash, fine grain tuffe and lime. When dried that concrete had a specific gravity of 0.6 only. Then, the enforced form was towed to the site at the tip of the northern breakwater, moored in place with iron chains on shakers and
eventually subsided all the way to its nestle over the rubble cushioned sea bed, due to the additional burden of water soaked in the cement. At that stage the inner hollow within the frame was filled by aggregates of rubble, volcanic ash and lime, pozzolana, up to its rim, at water level. When hardened by absorbing the sea water the form was used as a platform on which the superstructures were laid. This process of building caissons on the shore and installing them as components for artificial islands seems to correspond with the eyewitness testimony of Pliny the Younger in one of his letters, written a half century later from his vacation place at the Roman coastal town of Centumcellae.

During the second phase, after the line of caissons cement forms was laid at the designated course of the spinal wall, a second parallel was laid, within the first one along the designated line of the quay (or promenade, as Josephus named it).

This innermost wall was built of ashlars cut stones that were laid in tight courses of headers in a typical Phoenician tradition of sea walls. When that had reached the height above the sea level, three confined hollow spaces were created: two parallel ones along the curved line of the main mole, and one within the confinement of the northern mole.

The work would have stopped at that stage, allowing the elements time to contribute their constructive share in the project. The incoming waves overrunning the Prokomia and the spinal line would break and deposit their load of sand within these hollows, which would eventually fill up.

Probes we made into these deposits were exposed the accumulated layers of well-sorted grain sizes sediments, demonstrating the alterable wave energies over the time span of deposition. Five to seven layers of coarse sand, shingles and shells representing deposition during severe winter storms were counted in theseprobes, suggesting a duration of 2-3 years for the natural process of silt up of these hollows. When filled in with wave-carried sand the hollows were covered by a layer of rubble, sealing the captured sediments and used as a base for the paving slabs of the promenade and floors of the storage vaults.

The ashlars of the quay can be traced along the lee side of the western mole for over 200 m. The courses were built of a standard side header 0.6 x 0.6 x 2.1-2.5 m, of the large dimension is the one retaining to the neighboring blocks in tight fitness, so as to have maximum drag between them. Such a structural mode would secure the endurance and integrity of the quay for long periods of repeated impact.

In the third phase the Prokomia, or Prokomatia was confined as a segmented line of subsidiary breakwater, relative narrow and not much above the sea level, being some 20-30 m outside the spinal wall of the mole it would cause breakage of the surge, leaving an ample settling area on its lee, in which the wave energy would be absorbed. The main role of that structure would have been to prevent the splashing of sea water over the spinal wall, wetting the storage vaults that were on its lee. Breaking and settling the waves' energy away from the main mole would also ease the destructive impact of undertrenching current at the base of the main mole. Being a segmented line, with openings for rip currents, would keep the settling area on the lee of the Prokomia from the piling up of the sea water and from being silted up in the course of time. It seems as if this unique subsidiary structure was added only to the main mole, which faces the open sea and the full impact of the surge. We did not find any remnants of it along the northern mole, which faces the wind of the fairest weather, as Josephus attested.

With the completion of the third phase of construction, the harbour basin was closed and well sheltered from the surge. This would make it a settling body of still water-a terminal for the shifting sand and for that reason - due to be gradually silted. In order to nullify such an inevitable natural process, a flushing current was initiated, flowing out through the harbour. Such a flushing current was conceived by letting extra water to be added to the harbour basin by inflow through a series of shallow channels diagonally aligned on the main mole along its southern side. Each channel had its own draining facing the surge with a base somewhat above the sea level, so as to take only the incoming waves, with constant inflow of water. Incorporating with a wider settling basin along its course, such a channel would feed the harbour basin with additional quantities of silt-free water. Vertical grooves for insertion of sluice gates would allow proper control over the rate of the inflow in various sea conditions. The additional quantities of water would find the way out through the harbour mouth, flushing it properly. Confirmations for the successful flushing of the harbour basin were found by us on the sea floor. Within the main basin, under layers of wave-carried deposits there is a distinguished thin layer of fine sand with some first century sherds on it. Such a sediment is typical for still waters and represents the time Sebastos was intact and operating. The absence of sandy particles in the mud indicates that there was no siltation of the harbour from the open sea. Yet, when we started probing the sea bed just outside the harbour mouth (area D), we have exposed a deposit over two metres thick of mud, dirt and all kinds of garbage from the harbour - a dumping site for whatever was being carried away by that outflowing flushing current. Actually a full scale exhibition of artifacts which were found mostly at that site, including a score of clay vessels of fine Italian ware, wooden instruments, metal figurines, etc.

The final stage in the building of Sebastos included the upper structures, some of which Josephus saw and described. Among these features there was the spinal wall along the mole, the towers in it and the vaulted chambers within its confinement. Square slabs of cut stones were laid for the promenade. Subsidiary jetties were settled, dividing the harbour to three mooring basins, one within the other. One such jetty was settled at the south side of the harbour cutting off the southern mole, to the north, dividing between the main (outer) and the intermediate harbour basins, this pier was constructed by parallel side walls of ashlars headers and was topped with pavers of cut stones, carefully laid over a sand fill (Area F). Last of that pier, at the part of the harbour that did not subside (on the lee of the fault line) one can see the edge of the quay along the inner face of the south mole, near its stem, retained to the rocky promontory. On the other side of the present day haven, under some later Roman buildings, at the water level, there is a quay and a pier, both subsidiary features within the intermediate basin of Sebastos. These structures were built in a typical Phoenician tradition of tightly laid long slim headers, as was recommended by Vitruvius in his last paragraph quoted above.

The inner basin that had been dug out artificially over a century earlier was incorporated as the innermost harbour basin of Sebastos, with a series of large vaults along its eastern edge and the large temple which was dedicated to Augustus and Rome on top of the, overlooking the entire harbour.

Along the vertical face of this eastern edge of the inner basin we have exposed a line of marine fauna, vermetidies and ostraca, marking the sea level at that time, much at its present elevation. About half a meter above that line there is a pierced mooring stone jetting from the easy.

At the tip of both moles of the main basins there are huge masses of tumbling block, from the elaborated superstructures that crowned the harbour.
mouth. We already mentioned above one of them, the "Drusian", which was on the north-west side. This lighthouse which is an essential navigation aid, marking the way to the harbour for ships sailing in toward a rather low coastline, is reconstructed on the model and drawings not according to our archaeological data form the site, but based on the Roman lighthouse of Leptis Magna in Libya.

On the tip of the north mole, next to the eastern side of the harbour channel, there was a structure not much smaller than the "Drusian". Its tumbling mass comprises huge rectangular cut stones, some of which are over seven metres long. Some of this blocks were fashioned at one end with a recessed scarf and hemispheric sockets for the woodshafts for capstans on which were rolled up across the entrance. In order to withstand the drag of pulled chains the blocks had been fastened to each other with iron clamps fixed to their place in the cut grooves by molten lead. Frozen flows of lead were found at the foot of that tumbling mass under 10 m of water. This delicate work, as the accurate displacement of the blocks, would demand use of free divers, working under the water and probably using snorkels for breathing, such professional divers were known in the Roman world as members of the guild of "unotaros".

As Josephus tells us there were statues, crowning columns, which had been set on top of upright rocks. Two bound together on the right side of those sailing into the harbour are clearly visible on aerial photographs and have been studied by us for several working seasons. They have been to be made of artificial conglomerate, and their position made them excellent navigational aids for defining the western edge of the sailing course into the harbour. The matching "Tower" on the eastern side was found by us, buried in the sand, just north of the tip of the northern mole, where it should have been according to Josephus (Area G). It is a cement block of 15 x 15 m, and some remnants of its wooden form survived along its sides. The towers on both sides of the entrance had been settled on sandy bars, shallower than the sea floor nearby. It seems as if the curved line of the main mole had altered the way the wave-carried sand was traveling along the nearshore and the combining factors of the breakwater of Sebastos with the local wave climate deposited some of it just outside the entrance. The functioning flushing current kept the harbor channel sill-free and defined the accumulating sand bars on its both sides, in the open sea. The tower marked these bars, defining the navigational channel toward the entrance.

The in-sailing ships that were guided to Sebastos from afar, by the smoke and the fire at the top of the Drusian, and into it by the two water, were held at the tip of the northern mole, next to the control building of the harbour master for inspection of their credentials, cargo, bill of lading and taxation. Then they would be humped into their designated berth next to one of the harbour quays, for unloading, loading and even wintering when needed.

THE INNER HARBOUR

As mentioned above, the main part of present field work in Caesarea is the year-round excavations in the "Inner Harbour". This party dug-out and artificially expanded bay was originally (or at least since Herod refurbished it) enclosed by a mounded vertical wall, made of a mixture of porolana, and mumble, on top of which ashlars were laid in places, for a quay. This basin was about 240 x 120 metres in size, with an even water depth of over two metres over most of it (except for its northeastern part). At present, the majority of the area is landlocked and capped by later, terrestrial structure that represent ten successive occupational phases, dating from about 500 AD to the Crusader period. The average elevation of the surface when we started our excavations was about four metres above sea level, with about 2.5 metres of architectural remains before reaching the water table (of the fresh ground water) at 0.5-0.8 m above MSL. Only 1/7 of the former basin is still floded by sea water with a sandy beach within it.

The field research incorporates several issues:
1. A careful study of each building phase of the terrestrial structures, taking into consideration that those are due to be removed eventually. We were surprised by the high standard of the residential and commercial complexes found at the site, which illustrate the quality of urban life in Caesarea during the Early Islamic Era (750-1101). The complexity, quality and sophistication of the water supply and drainage systems and the reach corpus of impaled body parts are exceptional and in some contradiction to the scenarios for Caesarea as a flourishing urban center during that period. In contrast to the character of the Arab levels, the Crusaders seem to have used the relatively low area within their fortified city only as a burial ground.
2. An interdisciplinary study is mandatory for tracing the various sifting processes that had caused the inner harbour basin to go out of use. Layers of coltan sand, beach deposits, human deposits of garbage, deep pits that were dug for cisterns and wells, wave-eroded artifacts and marine encrusted building stones and sherds are all to be carefully documented, collected and studied in geomorphological, sedimentological, botanical and zoological labs, before one can reconstruct the complicated mutual response of man versus nature.

3. Of particular importance for our study is the alleged repetitive attempts made through the Roman and Byzantine eras (between 100-500 AD) to fight the intensive process and to remove the maritime function of that inner basin. This study has just begun, but we are already baffled by all kinds of additional post-Herodian marine structure that were laid well below water level, manually, with extensive use of non-moulded "terrestrial" curvets that were found covered by marine encrustation. It is obvious that these structures had been installed the sea and ground water had to be pumped off constantly and intensively at a pace which would exceed that of ours, working with heavy duty, modern pumps.

4. As we work, in this "archaeological hostile" environment of overbuilt, inundated and very non-consolidated area, we are still far comprehending the various building techniques of the ancients and still wonder which structures had been installed by the people of Saratow’s Tower, Herod’s engineers, or the later Roman inhabitants of Caesarea. An overall study of the texture, chemical components and mechanical characteristics of various types of cement and concrete might help us to solve these perplex issues.

5. The top elevation of marine fauna on structures, the level of well bottoms installed in various time periods, foundations and floors of buildings, etc. give us a uniquely reach corpus of well-dated evidence for reconstituting quite accurately the ever-changing sea level, or land-sea relations, both on vertical and horizontal scales. These mostly elastic changes are good indicators for minor climatic changes and wider trends of historical and economic significance not only for the ancient people of Caesarea, but for the entire Near East.

6. Digging up waterlogged sediments and depositions that were for centuries in a non-aerobic environment and out of reach from human hands is a unique opportunity for our part of the world to retrieve small finds in the best state of preservation. So far, we have only begun to clear off these strata, but elegant pieces of statuary, a unique Byzantine amulet, hundreds of cubic metres of dumped food remains and even a 4000 year-old cylinder seal from Cilicia, probably a property of some Byzantine collector of antiquities, are just a few examples for that potential richness.
LATER HARBOUR INSTALLATIONS

Sebasteion, though probably one of the highest achievements of Roman engineering and obviously the first and only truly modern harbour of ancient times, was also the one with the shortest life span. Around 70 AD, 80 years after its inauguration as a royal entity, serving the ambitious economical and financial schemes of a great king as the main exporting center for the goods of Arabia Felix of the Nabatean cross-country trade routes of the voluminous shipments of salt and bitumen from the Dead Sea, as a stopping point on the route of the Egyptian grain carriers (the “supertankers” of the time) on their course from Alexandria to Rome and a favourable wintering port, it had been transferred to the hands of the municipal authorities of Caesarea. Being far too big and its maintenance too costly for the needs of one city, the harbour soon fell to a state of disrepair. Laid over an active fault line, it started subsiding and soon gradually disappeared below the waves. Our studies have traced the only large-scale attempt to renovate that harbour, an effort financed and attempted around 500 AD by the Byzantine emperor Anastasius I. That attempt included a rampart made of the spilling of rubble over the submerged northern Herodian mole, mostly over its inner half. This spill was further west, behind the tip of the sunken mole, the original harbour’s channel and on to the site of the tumbrled light house at the tip of the western mole. From these, the rampart was spilled toward the south-east, for about 150 metres, completing an overall shape of figures 1. Our excavations at areas H, D and R have exposed not only that rubble spill, but also a score of earlier Byzantine amphoras and many coins of the period.

At that time the eastern quay of the inner harbour was renovated, expanded and repaved with ashlar slabs, not as a maritime features but as an elevated platform next to a series of fresh water pools installed over the already silted basin. Elsewhere along the shoreline of what was then a densely populated city, there were all kinds of raised sea walls, to protect the built-up area from the rising sea level and some alternative additional anchorages. One such anchorage, furnished with an ashlar landing stage was installed at the lee of the promontory at the south side of the bay south of Sebasteion (Area P). That bay was used as the municipal anchorage, during the time Sebasteion was operating as a Royal one and again - after its demise, when mooring within its submerged mole became too risky. That promontory was furnished with a large piscina, known by its later, Arab name: “Kleopatra’s Baths”, most probably - the municipal fish market. The landing stage next to it, to the south-east, may have served the local fishing boats.

Farther south along the new suburbs of the extended Byzantine city and at the lee of series of near shore reefs, we have studied additional fish tanks, and a line of pierced ashlar blocks, bridging the span between the shore and the lee of a rocky reef some 120 metres away (Area sc) - probably bases for wooden posts that once supported a jetty. So far we did not find any remnants of marine structures that can be dated to the Early Arab period. Yet, thousands of cubic metres of sandy depositions mixed with 6-8 centuries of sherds of mainly storage jars, covered by marine fauna had been dumped some time before 800 AD over the coastal area south of the Arab city after being dredged from the floor of the intermediate basin of Herod’s harbour, in what seems to be an attempt to refurnished Caesarea with relatively protected anchorage with an ample water depth for navigation.

During the Crusader Period, or maybe somewhat earlier, during the time of the Fatimid Dynasty of Egypt, Caesarea was made an important venue for exporting olive oil from the hills of Samaria, a long jetty was laid, over the northern edge of the intermediate basin, enabling transshipment of bulky cargos to be loaded into the hold of sizable merchantmen.
that would mean in water deep enough at its tip. A little further towards the east and closer to the present beach, at 1.5-2.0 metres of water, there are the submerged remains of the Crusader sea wall, with typical square tower at its tip. Next to that wall there was a quay, some 6 metres wide, which might have served boats of shallow draft and lighters that were sheltered within the fortifications.

SUMMING-UP THE STORY OF THE HARBOUR

The long, complicated history of Caesarea and its harbours is not fully told yet. After twenty years of a large-scale research we are still shy of knowing all the answers to the question, some of which were phrased at the beginning of this paper. Every field season adds much to our knowledge, answers some questions and eventually, as is so often in archaeology, creates a whole series of new ones. At the stage of the on-going research, which is already the largest and longest one to be attempted underwater, we might summarize the history of marine facilities in Caesarea as follows:

350-260 BCE - a coastal town of Phoenician type, furnished with an ample harbour settled and called "Straton's Tower," named after the Sidonian king "Abdahsthar, or an unknown Hellenistic commander of Polymy I Philadelphia. 258 BCE - the Egyptian official of Polymy II lands at the port of Straton's Tower, his mission to collect taxes from Palestine.

c.130-100 BCE - a local Seleucid governor, named Zoilus, conceived his own tyranny, or petty kingdom, with Straton's Tower as its capital. The town is fortified and withstands a siege by the Seleucids and Hasmonaean King Alexander Janneus. c.100 BCE - Polymy Lathyros helps Janneus in adding Straton's Tower to his Judean kingdom. 63 BCE - Pompey visits Palestinians,0 destroys coastal pagan cities from the Judean kingdom, including Straton's Tower. c.30 BCE - Strabo describes Straton's Tower as a small coastal settlement with a anchorage.

21-10 BCE - King Herod the Great built the harbour of Sebastos and the city of Caesarea next to it.

15 BCE - Herod hosts Marcus Vipsanius Agrippa and shows him his new harbour. 10 BCE - Herod inaugurates Sebastos and Caesarea, giving the harbour to the "Mariners" and the city "To its poole".

4 BCE - Herod dies, succeeded by his son, Archelaus.

6 AD - Archelaus deposed by the Romans, Judea rules as a Roman province, with Caesarea as its capital. 43 AD - St. Paul the Apostle sails from Sebastos to Tarsus and later (58-60) is imprisoned in Caesarea. 66 AD - Severe disputes between the gentle majority in Caesarea and its Jewish populace over the latter's right for citizenship of the city triggers the outbreak of the Great Jewish revolt. 70 AD - Using Caesarea as their headquarters, the Roman crush the revolt, caesarea "re-founded" as a Roman colony with the harbour as part of it.

c.200 AD - St. Peter sails from Caesarea to Italy. 253 AD - The largest coins minted in Caesarea still depict Tyche, the city goddess followed by a genius holding an anchor - symbolizing its harbour. c.500 AD - Anastasius I renovated the harbour of Caesarea.

614-628 AD - The Sasanians of Iran capture Caesarea and govern it for 15 years, maritime activity is documented. 640 AD - The Arabs conquer Caesarea after 7 years of years of intermittent siege. 844 AD - Ibn khuruddibih lists Caesarea as one of the ports of Palestine. 897-985 AD - Al-Ya'qubi, al-Muqaddasi and other Arab geographers mention and describe Caesarea as a flourishing, fortified coastal city.

1047 AD - The Persian traveler Nasir-i Khurraz visits Caesarea by the sea(?). 1151-1101 AD - Franks and Genoese capture Caesarea, slaughter most of its residents and sack the city. 1166 AD - Al Idrisi, describes Caesarea as a large, well fortified city with a small harbour that is capable of holding but one boat.

1177 AD - The byzantine John Phocas describes the "Truly wonderful harbour of Caesarea which was made by human skill.

157-1187 AD - Caesarea is easily taken and sacked by two of Saladin's officers. Dec. 1217 AD - After 30 years of desolation, Caesarea is rebuilt by the Hospitallers. 1235 AD - The geographer Yaqut describes Caesarea as a mere village 1228-1251 AD - Caesarea is rebuilt and fortified by the Germans and the Franks (St.Louis). 27.2.1265 AD - Baybars, the Mamlik rules, conquers Caesarea and destroys it. The thorough ruining and deliberate filling in of the harbour is carried out by the Sultan al-Ashraf Khalil in 1291.

Today, one can see some of the remains illustrating that long history of the harbour, either on land, by visiting the currently expanded tourist park, or by snorkeling over the shallow water of the present anchorage.

Since 1992 we have inaugurated an underwater archeological park for divers. Over 1500 metres of guiding cables were laid along four courses, around the perimeter of the submerged Herodian mole. These guiding lines are furnished with signs marked by numbers. Each indicates a special point of interest. Diving visitors may borrow from the local dive shops annotated palatice boards as underwater guides for their tour. There are over 30 marked signs along these underwater courses, each described in detail on the boards either in English or in Hebrew.

JOSEPHUS DESCRIPTION OF SEBASTOS

Introduction: The historian Josephus, who was born around AD 7/8, published a history of the Jewish War between 75 and 79 as a history of the Jewish people in 93/4. Both these works contain a detailed description of the city of Caesarea and its harbour, Sebastos. Despite certain inevitable inaccuracies, the data contained in these descriptions have been of the great value in assisting the reconstruction of the layout and appearance of the harbour in the Flavian period. The passages are quoted here in extenso to introduce the reader to the descriptions, and to avoid constant lengthy quotation of the passages in the text. The translation has been prepared by J.P. Oleson on the basis of the Greek text in the Loeb edition of Thackeray (1927-1929-96: for the Jewish War (or Bellum Judaeicum, as it is usually cited in scholarly literature; edd. BJ), and Marcus and Wiegand (1963:158-64) for the Jewish Antiquities (or Antiquitates Judaeae, abbr. AJ). Transliterations of some of the important Greek vocabulary have been left in for those sections that deal with the design and construction of the harbour proper. Josephus' Greek is very idiosyncratic, so it is not always possible to render the text literally into English. The Caesar mentioned in the text is the emperor Augustus.