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The NAVIS II project

see also NAVIS I

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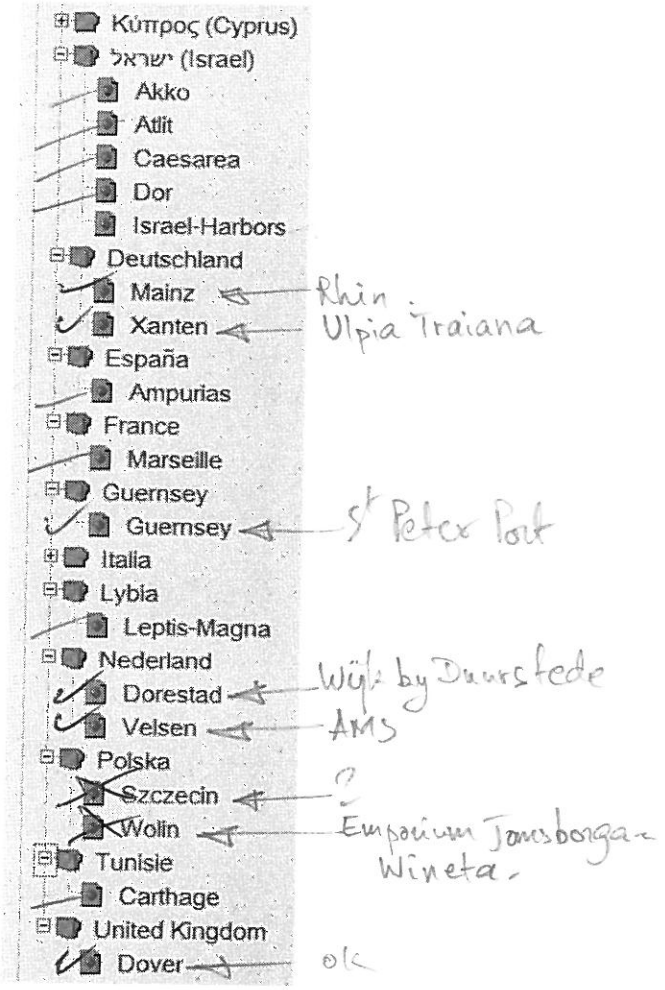

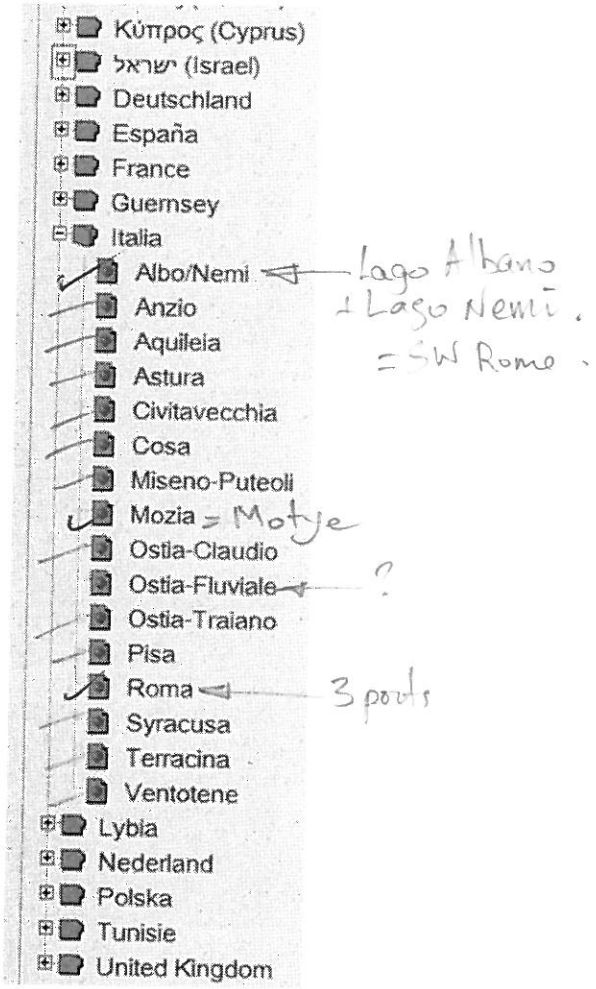

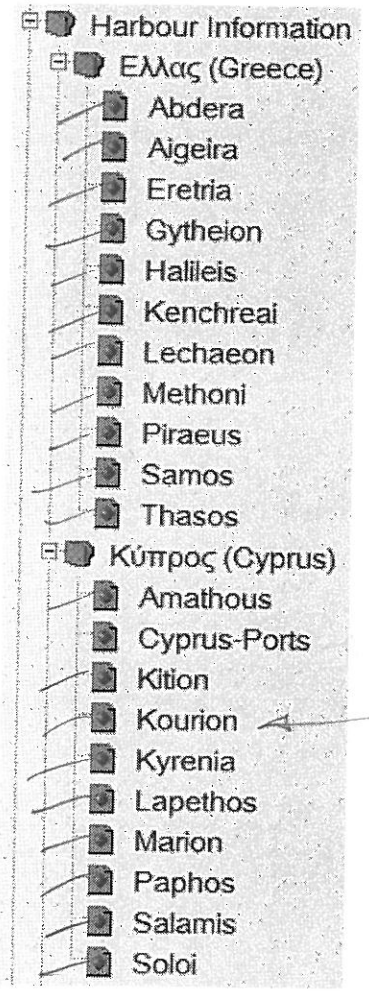

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Harbour informations about:

See this text in Abdera

Topography

Abdera is one of the most important cities of northern Thrace. The geomorphology of the area where the city is situated, a promontory with many bays, have allowed the use of the natural characteristics of the coast for the formation with minor interventions of harbours and anchorages. Today the ancient coastline has receded and is to be found on dry land, due to floods and alluvia from the river Nestos. The area of the ancient port is covered by an uncultivated marsh.

The foundation of the city goes back in myth. It is alluded that it was built to honor Abdera Abderos, who was devoured by the horses of Geriones. Ionians settled there round the 7th c BC. The city gained great renown and became a very important commercial and agricultural center. Its democratic regime and its important mint gave her impetus in the creation of a fleet to serve its commercial traffic. During the Persian Wars the city possesses a harbour capable of sheltering the fleet of the Thasians following the command of Dareios as is reported by Herodotus. Abdera among other things is the home country of Democretos.

Excavation work is being carried out in the area by the *Archaeologike Etaireia*. Abdera Moreover the Department of Underwater Antiquities carried out two consecutive underwater campaigns (1993-1994).

The installations of the archaic port and the ship shed are dated based on the ceramic Abdera evidence round the 6th or the early 5th c BC. Round the end of the 5th – beginning of the 4th c BC the harbour is silted probably because of some flood of the river Nestos. The traffic was then transferred to the port that lies in the area of the modern port of Abdera, a fact that is also observed in the area of the city as a transfer of activity from the north to the south. The installations of that port are dated round the 4th c BC and are still in use up to the Byzantine period. Last the mole in Agios Giannis area is dated in the classical period based on similarities in construction with the city wall.

The case of Abdera is rather characteristic for the Greek world. It a usual phenomenon for cities built on promontories to make full use of the natural morphology of the coast and thus with minor interventions have safe anchorages that

can protect their ships against several winds.

Θεοδουλου, Θ. /Theodoulou, Th. Abdera

Aigeira

See this text in

Topography

The ancient town of Aigeira is situated on the hill of Palaeokastro along the north coast of Peloponnesos. The harbour of the Roman town is situated in the cove of Mavra Litharia, at the foot of Palaeokastro and protected the ships against eastern and northeastern winds. The area is one of the few known that possesses the natural characteristics for the formation of a harbour (for the most part the coast is sandy and linear with few rocky areas that advance into the sea and belongs to a tectonically active area).

The harbour of ancient Aigeira is situated at the foot of the steep hill of Palaeokastro; its remains stretch for an area of approximately 100m along the coast and are better preserved in the eastern section. The installations, segments of breakwater and mole, are located today on land. The coastline of the time of the harbour's construction is now to be found at a height of round 4m above the present sea level

Homer refers to the town with the name Hypersie. It is mentioned along with other Aigeira Peloponnesian cities as forming part of Agamemnon's kingdom, under whom the town took part in the Trojan war. Later on the name of the town changed to Aigeira (Pausanias VII, 26: 2-4). Aigeira flourished during the Hellenistic period and is one of the cities that played an important role both in the old and new Achaean League (Papachatzis 1980, 160). Important architectural remains that are preserved on the hill attest to its prosperity in Roman times as well. Some time during the late 3rd century the town was destroyed most probably by an earthquake and was thus abandoned.

The ruins of the ancient town were identified by several travelers of the 19th century (Curtius, 1851). In the site of ancient Aigeira are preserved segments of the fortification wall, a Hellenistic theatre, which was restored in Roman times, remains of a temple dedicated probably to Zeus and Artemis, as well as numerous graves that date to the Hellenistic, Roman and Mycenaean periods.

Excavations in the town of ancient Aigeira have been carried out by the Austrian Archaeological Institute (1916, 1925 and 1971-1989). Leake was the first to identify the remains of the ancient harbour (1836: 396-387), but apart from isolated references it has never as yet formed object of systematic archaeological research. However due to the great interest that the area presents from a geological point of view, because of the great uplift of the coastline it has been studied by geologists and other scientists. Aigeira

The harbour of ancient Aigeira forms a typical example of a roman harbour as regards its construction technique and the extensive use of concrete. The port was dated with greater precision based on the results of the land excavations in the area of the ancient town. The construction of this rather expensive public work is dated round the period of the town's floruit namely in the period of the reign of emperor Maximus Thrax (236-238 AD). Moreover on the basis of the research made in the area of the ancient theatre it was deduced that this was abandoned round 250 AD, a time when the restoration works are interrupted, never to be resumed after that. The desertion of the city along with the abandonment of the harbour was attributed based on geological studies to a big and destructive earthquake round the end of the 3rd century AD, from which the city most probably never recovered. Aigeira

Any conclusion reached as yet for the topography and the construction of the ancient harbour is based on observations made on its visible remains. The fact that no excavation work has been carried out hinders significantly our understanding and any attempt to reconstruct the ancient site and the overall plan of the harbour. However, it still remains an important archaeological site, as it is one of the few roman harbours preserved in Greece and perhaps the only that is located in its entirety on dry land. Moreover it offers a very good case study for the impact that dramatic geological events can have on the topography and the history of an area.

Θεοδουλου, Θ. / Theodoulou. Th. Aigeira

Akko

Country Israel Akko

Locality Akko

Findspot 15 km north of Haifa

Coordinates (UTM; Longitude 35°04' Latitude 32°55'

Roads (on land); the northern coastal highway. Akko

The structures of Akko port above sea level (Tower of the Flies, the southern breakwater) have been mentioned in documents, were depicted in painting and on maps since the Middle Ages. In mid-19th century Mansel made a bathymetric survey of the harbor's bottom, for the British Royal Navy. He marked the submerged rampart between the Tower of the Flies and the northern shore. Akko

In the summer of 1964, the Israel Underwater Exploration Society (IUES), under the direction of Dr. E. Linder, made the first archaeological underwater survey of the port. In 1965, during the construction of the new breakwater, trial soundings were carried out by the divers in preparation of a detailed mapping of the submerged structure remains. Explorations of the harbor continued in 1966 with special attention on examining the foundations of the Tower of the Flies. From 1976 to 1978, several seasons of underwater excavations were conducted by the Center for Maritime Studies, University of Haifa and IUES. The foundations of the structure beneath the Tower of the Flies were partially exposed. Trial trenches were dug in the rampart beneath the Tower and the north shore. A trench was dug across the tip of the southern breakwater. During this period also remains of a shipwreck from the time of Napoleon's siege on Akko were revealed at the entrance of the harbor.

Persian and Phoenician Periods Akko

The Sidonians who launched out into the Mediterranean trades were called by the Greeks as Phoenicians. Akko was their most southern city. The physical feature of the Bay of Akko with its southwest rocky promontory was the kind of site that the Phoenicians always chose as a harbor for their coastal trade. With the Persian conquest in the middle of the 6th century BCE, Akko appears under its Phoenician name Aké (Ace), as the base of the Persian operations against Egypt. The Persian period was a critical one in the history of the city. The town moved closer to the bay with its transformation into an administrative and commercial center, mainly at the time of Cambyses (6th century BCE). Akko became an important naval center both to Egypt and Persia. Greek objects appeared in the new city of Akko through the sea trade. By the end of the Persian period, in the middle of the 4th century BCE, there was a colony of Greek merchants at Akko.

The buildings within the bay were constructed by the Phoenician method (header built) combined with altering sections of ashlar and fieldstones. The archaeological investigations revealed that in Phoenician and the Greek cultures existed side by side in Akko. In

the Hellenistic period the center of the Akko (later Ptolemais) completely moved to the bay, although the inland Tel (Mound), retained buildings with administrative functions.

Hellenistic Period

Phoenicia fell to Alexander the Great in 333 BCE, when the Persians were defeated. During this period coins were minted at Akko for the first time. Alexander set up a mint, which issued gold and silver *staters* and silver *tetradrachmas* of Greek type. This mint also issued silver coins of Tyrian type, probably for circulation in Phoenicia itself. From 261 BCE onwards there is a dated series of coins bearing the new name of *Ptolemais* along with the Phoenician name, which was indicated either by its first two Phoenician letters or written in Greek – AK.

Roman and Byzantine Periods

During the Roman period, Ptolemais (Akko) was specially favored by Julius Caesar, who visited the town in 48 BCE. Ptolemais became a regular landing-place and base of operations for the Roman forces and their allies. When king Herod built his unique artificial harbor at Caesarea Maritima (21-9 BCE), Akko suffered from this rivalry. Between 52 and 54 CE, the emperor Claudius settled a colony of veterans at Ptolemais and henceforward the city received the title *Colonia Claudia Felix Ptolemais*. It was the first city in Palestine to receive this distinction, probably because its port was used for military purposes. In the First Jewish Revolt (66-70 CE), Ptolemais was hostile to the Jew. In the later years of the war, Akko became Vespasian's headquarter in his operations against Galilee.

During the Christian period Saint Paul visited Ptolemais in his third missionary journey. In the Byzantine period, Akko was the seat of bishop and archdeacon of Tyre.

Arabic Period

Although Ptolemais had been the official name for very long periods, the Semitic name Accho (Akko) was still in general use among the population. After the Arab conquest in 636 CE, the old name had a slight modified form Akka, which became the official name. The caliphs ruled it for the next four centuries (1036 CE). Mu'awiya, the founder of the Umayyad dynasty in Damascus and the first of the Arab rulers who developed a sea power, made Akka one of his bases to conquest overseas. He strengthened both cities of Akko and Tyre by settling them with the Persian population he had brought from Syria. At Akko he established a shipbuilding industry, which made it a naval base only second to Alexandria. The naval importance of Akko returned during the 9th century, as the threat of the Byzantine re-conquest was renewed.

The harbor was much improved and strengthened by the Turk Ahmad ibn Tulun (a semi-independent governor of Egypt; 868-884), when he annexed Palestine and Syria to his province.

In 1073, the ruler of Egypt and Fatimid domain could not prevent the Turkish conquest. In 1089, he succeeded in recovering Akko and other leading ports south of

Tripoli (Syria).

Crusader Period

Marching down from Syria the army of the First Crusade arrived on the plains of Akko in 1099. They did not capture the city but only passed through on the way to capture Jerusalem. In 1104, the Crusader king Balwin I besieged Akko only after he had occupied the ports of Jaffa, Arsuf (Apollonia) and Caesarea. At once Akko became he chief port of the Latin Kingdom of Baldwn I, who had settled in Palestine and southern Lebanon.

In 1187, Akko fell to the sultan Saladin, but Richard the Lionheart retook it in 1191. Akko
From 1191 to 1291 Akko was the capital of the diminished Crusader Kingdom of Jerusalem and was under the king's direct rule. In April 1291, the Mameluk ruler Malik el-Ashraf laid siege to Akko. He could not conquer the city from the sea, but had complete control on the main land. The capture of Akko by the Mameluks was followed by the destruction of the town and its fortification. One of their leader Muhqmmad an-Nasir ibn Qalawun (later sultan of Egypt) had taken a Gothic doorway of one of the churches in Akko and transported to Egypt to adorn his tomb in Cairo, where it may still be seen. This piece is a solitary remain of the architecture of the numerous churches during the Crusader Akko.

Persian and Hellenistic Periods Akko

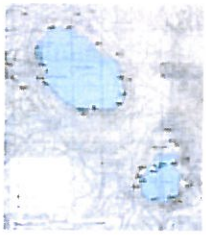
Remains of the earlier maritime constructions were found on the sea floor, in the area between the southwest shore and the southern breakwater. At a depth of 0.8 m, a double course of ashlar header (0.6 x 0.5 x 1.2 m) was exposed.

The pottery recovered included a fragment of a Phoenician bowl with a fragmentary Akko
inscription, dating to the second half of the 6th or the beginning of the 5th century BCE.

A very large quantity of pottery sherds from the 1st century CE retrieved during the Akko
deepening of the harbor basin in 1983, attests to intensive marine activities in the port during this period.

Zaraza Friedman Akko

Albo/Nemi



Albo/Nemi

Republik Italien, Rgion Latium, Provinz Rom
Koordinaten: ca. 41° 35' N – 12° 25' E (Lago di Nemi)
Koordinaten: ca. 41° 40' N – 12° 30' E (Lago Albano)

Es handelt sich hier um zwei Vulkankraterseen, ca. 18 und 26 km süd-westlich von Rom, entsprechend 293 (Albano) und 316 (Nemi) m ü.NN.

Albo/Nemi

Es liegen zahlreiche Fundnotizen aus älterer wie auch aus neuerer Zeit vor, ebenso einige Geländeaufnahmen, letztere hauptsächlich aus dem Beginn des 20.Jhs. Prospektionen mit modernen technischen Mitteln ergaben in und an beiden Seen diverse neolitische, bronzezeitliche sowie auch eisenzeitliche Fundplätze. Die Untersuchungen zu den bronzezeitlichen Fundorten im Lago Albano dauern teilweise noch an.

Der Lago di Nemi ist hauptsächlich wegen der zwischen 1929-31 geborgenen und durch Kriegseinwirkungen im II.Weltkrieg verbrannten Prunkschiffen aus der Zeit des Kaisers Caligula (37-41 v.Chr.) bekannt.

Albo/Nemi

Beide Seen waren gut über die Via Appia zu erreichen und waren Teil der römischen Villegiatur südlich der antiken Großstadt Rom. Seit der spätrepublkanischer Zeit entstanden an den Hängen rund um die Seen zahlreiche Villengebäude mit rekreativem Charakter. In domitianischer Zeit (81-96 v.Chr.) gehörte das Gebiet um dem Lago Albano zur Villa des Kaisers Domitian (Reste unter der heutigen Sommerresidenz des Papstes in Castel Gandolfo). Der Wasserspiegel des Lago Albano wurde künstlich konstant gehalten Dank eines 398-397 v.Chr. angelegten künstlichen "Überlaufs" ("Emissario" Livius V 15-19). Dieser besteht aus einem 1,8 km langen Tunneldurchbruchs (H 2.00 x B 1.00 m) zwischen Albano und Castel Gandolfo.

Marcus Heinrich Hermanns

Albo/Nemi

The port of the kingdom of Amathous

Amathous

See this text in

The French Archeological School of Athens investigated the port of the town from 1984 to 1986 and has conducted archeological research in the district of Amathous from 1975. Amathous

The research of the port indicated that the it was constructed at the end of the fourth century BC and abandoned almost immediately during the first years of the third century BC, probably before construction was completed. This is indicated by the quantity of native and imported pottery dating to the latter part of the 4th century BC found at the base of the lower level of the ashlars of the breakwaters. Amathous

The construction of the harbour may have been necessitated by the need of a naval base by Demetrius, and also Ptolemy, during their dispute for Cyprus. The most probable senario is the construction of the harbour by Demetrius who wished to utilize the port as the base for his naval fleet, whilst at the same time being able to consolidate and control Cyprus. Amathous

The fact that the port is mentioned as deserted could be explained in two ways. Firstly, Pseudo-Skyllax may have obtained the information from an earlier source, suggesting that the port was already deserted at the end of the Archaic or the early part of the Classical period. Alternatively he may have been refering to the existing state of the harbour in the mid 4rd Century BC, by which time it was already deserted or of limited use, something which would explain the neccessity at the end of the century for the construction of a monumental Hellenistic harbour, also bearing in mind the naval requirements of Demetrios and Ptolemy.

Θεοδούλου Θ. / Theodoulou, Th. Amathous

Topographie

Ampurias

Königreich Spanien, Region Katalonien, Provinz Girona
heutiger Ort: L' Escala, ca. 40 km nördlich von Girona
Koordinaten: ca. 42° 15' N - 03° 10' E

Die Stadt Ampurias (Emporion) findet schon in der Küstenbeschreibung (Periplus) des Pseudo-Skylax ebenso wie im Periplus des Skymnos (2.Jh.v.Chr.) Erwähnung. Seit der Renaissance war der Ort bekannt, und gab dem ganzen Gebiet den Namen: Ampurdan. Das bedeutende Hafendenkmal hat bisher immer im Schatten der archäologischen Untersuchungen innerhalb des Stadtsareals gestanden und kaum Beachtung gefunden. Zuletzt wurden verstärkt geoarchäologische Untersuchungen zur Rekonstruktion der antiken Küstenlinie durchgeführt. Von der Lage und des Umfeldes von Emporion gibt Strabon (III 4,8 f.) eine Beschreibung. Zwischenzeitlich hat sich die Küstensituation gänzlich geändert. So beschreibt Strabon den Hafen als eine direkt bei Emporion (an der Palaiopolis) gelegenen Flußmündung. Diese kann zwar nicht genau identifiziert werden, ist aber sicherlich die des Flusses Fluvia, der heute ca. 500 m nördlich in den Golf von Rosas mündet.

Ampurias

Griechische Kolonie von Phokäern aus Massilia (heute Marseille)im Jahre 575 v.Chr. gegründet. Die ursprüngliche Siedlung (Palaiapolis -Strabon III 4.8-) lag auf einer vorgelagerten Insel (Isla de San Martin) welche später nach dem Ausbau der Neustadt mit dem Festland (Neapolis)verbunden wurde. Die nahegelegene Flußmündung des Fluvia galt als Flußhafen. Im Jahre 49 v. Chr. gründet Cäsar neben der Neapolis eine römische Kolonie. Stadt und Kolonie verlieren in den folgenden Jahrhunderten u.a. durch die stetige Verlandung des Hafens an Bedeutung. Durch die Normanneninvasion 852 n.Chr. zerstört, wurde die Stadt gänzlich verlassen.

Ampurias

Es gibt keine genauen Belege für einen Hafen von Emporion und die bisher in der Fachliteratur geäußerten Vorschläge für seine Lokalisierung sind eher Arbeitshypothesen als genaue Erkenntnisse. Überwiegend wird der verlandete Bereich zwischen der Palaiapolis und der Neapolis als Hafenbucht betrachtet, jedoch blieben die in dieser Gegend durchgeführten geologischen Sondagen leider ergebnislos. Auch die Zuweisung der Mole, deren spärliche Indizien eine Datierung für das Ende des 2.Jhs. v.Chr nahelegen, zu einer regelrechten Hafenanlage stützt sich auf Vermutungen; stand diese "Hafenmauer" doch sicherlich nicht so isoliert da wie heute. Untersuchungen im Gelände haben ergeben, daß das Stadtgebietes sich weiter nach Osten erstreckt haben muß als bisher angenommen wird.

Ampurias

In der Forschung geht man von der Hypothese aus, es habe zu verschiedenen Zeiten der Stadtentwicklung verschiedene Hafenanlagen gegeben. So ist zumindest ab dem 2.Jh.n.Chr.eine mögliche Stelle ca. 10 km südlich von Emporion bei der Playa de Riells, La Clota petita und La clota grosa archäologisch nachgewiesen. Hier fanden sich neben nautischen Funden wie Anker und Schiffsfunden auch andere archäologische Reste an Land, welche auf eine intensive Nutzung dieser günstigen (Hafen-, Anker)-Bucht hinweisen.

Marcus Heinrich Hermanns

Ampurias

Repulik Italien, Region Latium, Provinz Rom
heutiger Ort: Anzio
Koordinaten: ca. 41° 25' N - 12°20' E

Anzio

Von eher war die volskische Stadt Anzio dem Meer sehr verbunden. Obwohl Anzio zu den "prisciae coloniae latinae" gehörte (497 v.Chr. als römische Kolonie gegründet) wurde der volskische Hafen ("Caenon" genannt) nach der vernichtenden Niederlage in der Schlacht am Flußе Astura in der Auflehnung gegen Rom im Jahre 338 v.Chr. besetzt und die Flotte, welche sich u.a. bis ins 3.Jh. v.Chr. als Seeräuber hervorgetan hatte, zerstört. Die Schiffsschnäbel wurden teilweise auf dem Forum Romanum in Rom als Trophäen zur Schau gestellt. Kurze Zeit darauf wurde die Stadt römisch neugegründet. Erst unter Kaiser Nero (54-68 n.Chr.) wurde der Hafen neu ausgebaut (Sueton, Nero IX 5). Unter Papst Innozenz (1691-1700) wurde östlich ein weiteres Hafenbecken angelegt ("porto Innocenziano"). Neben Civitavecchia war Anzio ein wichtiger Hafen des Kirchenstaates.

Anzio

Anzio

Marcus Heinrich Hermanns

Anzio

Republik Italien, Region Friuli-Venezia Giulia, Provinz Udine
heutiger Ort: nähe Udine
Koordinaten: ca. 45° 50' N - 13° 10' E

Aquileia

Es handelt sich um einen ca. 48 m breiten Flußhafen.(keyword: river port) deren beide Ufer in Stein befestigt waren. Schon in augusteischer Zeit schreibt Strabon (V 1.8) von einem großen Handelsplatz mit Seeanschluß von besonderer Bedeutung insbesonders für die alpinen Länder.
Die Bauten des jetzigen sichtbaren Hafen weisen Bauphasen einer späteren, vermutlich aus der Zeit Kaiser Claudius (41-54), auf. Später kamen die Verteidigungsmauern (298 n.Chr.) und Türme (361 n.Chr.) hinzu.

Aquileia

Grabungen G.Brusin 1926-1931. Laufende Untersuchungen der Ecole Francaise à Rome (s. Rechenschaftsberichte in der jährlichen Zeitschrift MEFRA).

Aquileia

Aquileia

Marcus Heinrich Hermanns

Aquileia

Topographie
Republik Italien, Region Latium, Provinz Rom
Koordinaten: ca. 41° 15' N - 12° 45' E

Astura

Südlich von Anzio an der Küste zwischen Anzio und Terracina. Heute militärische Sperrzone, daher schwer zugänglich.

Astura

Es handelt sich hier um den Privathafen einer (möglicherweise kaiserlichen) römischen Villa aus dem 1.-2.Jh.n.Chr. Sie lag in der Nähe des antiken Ortes Astura an der Mündung des gleichnamien Flusses (Livius VIII 13,5; XII). Der Hafen "Torre Astura" war durch seinen Ausbau gut geschützt vor Nord- und Westwinden. Im und um das Hafenbecken wurden diverse Schiffsfunde gemacht. Besonders zu erwähnen die Reste einer mit Amphoren beladenen nais oneraria.

Astura

Noch in der Reanaissacezeit war der Hafen bekannt. So wird er als Schutzort noch bei B.Crescenzio in seinem Werk "Nautica Mediteranea" (1602) erwähnt.

Astura

Marcus Heinrich Hermanns

Astura

Atlit

Country - Israel

Atlit

Locality - Atlit

Coordinates – Latitude: 32°48'46''

Longitude: 34°57'14''

Land excavations carried out by C. N. Johns, in the 1930's revealed a series of rock-cut shaft tombs and cremation burials along the SE part of the *kurkar* (sandstone) ridge. The burial and the settlement on the north coast were dated to the periods between the 9th and the 5th centuries BCE. While studying the Crusader's north walls, Johns found an older understructure beneath. It was at the ground level of the gate with a kurkar-paved passage and two flanking towers. The remains of the Phoenician harbor were first located in 1963, during underwater survey by a team from the Underwater Exploration Society of Israel (UESI). The mapping and trial excavations continued for two years (1963-1965), as part of the "Atlit Map Survey" carried out by the Archaeological Survey of Israel. In the following year (1966), surveys and trial excavations continued. A check was made on the relationship between the structures found along the shore and the gate discovered by Johns' excavations, near the northern *poterna*, east of the crusader fosse. Additionally, the remains of a settlement from the 10th to the 6th BCE centuries were found east of the Crusader cemetery. Atlit

Within the northern harbor and the area around it were revealed several wrecks. In 1976, Dr. E. Linder and A. Raban (University of Haifa) carried out underwater excavations to study the marine structures, digging down to their foundations. In 1981, within the North Bay and close to the shore was found a very large bronze, one piece cast, *battering ram* (476 kg) known as the *"Atlit Ram"*, dated to the Hellenistic period of the 4th - 2nd centuries BCE. Other finds were bronze objects from the Late Iron Age, Persian and Hellenistic periods, along with the ammunition from a Mameluk warship, including canons and copper helmets. In the early 1980', during the underwater surveys carried out by E. Galili from the Institute for Maritime Studies, University of Haifa was revealed the unique site of a Neolithic (7000 BCE) submerged village (7th-12th m). Excavations were carried out between 1984 and 1991.

Cultural context – MB II age settlement and burials Atlit

- Phoenican harbor and rock-cut shaft burials

- Crusader Citadel and Fortress

- Centuries – 16th century BCE

- 7th-5th centuries BCE

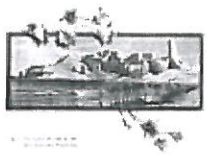
- end of 1291 Crusader rule was ended by the Mameluk Empire

There is not enough data to give a precise date for the ancient harbor at Atlit. The pottery vessels found during the underwater surveys and trial excavations was not earlier than the end of the 7th century BCE. The mole at Tabat el-Hammam, is dated

to the 9th century BCE. The parallels between Akko, Tyre and Sidon are not earlier than 6th-5th century BCE. The Atlit harbor being more sophisticated than that at Tabat el-Hammam, and the pottery finds within the harbor basin, permit an estimated date for its construction to the 7th century BCE or even later. The Hellenistic and Roman pottery finds are quite limited, thus one may assume that during these periods the harbor was not at its high pick and use.

The Templars established a fort or police station close to the rock-cut passage (1118), the ruins of which are still visible. In 1218, during the Fifth Crusade, the Castle known as *Castrum Perigrinorum*, was built by the Templars on the rocky promontory, on the ruins of the Phoenician settlement. It was named after the pilgrims (*peregrini*) who came and helped to build it along with a chapel, a palace, a stable and several dwellings. The site was chosen because it could have a better control on the coastal road and also the way to recovering Jerusalem, which had been taken 1187. The castle was completed while the main army of the Crusade was engaged into the Moslem siege at Damietta in Egypt (1218-1221). The main, east façade of the castle was doubled by the addition of a wall with three towers. A low wall along the outer edge of the fosse further strengthened it. Atlit

Through 1220, the Citadel was threatened by the Moslem conquerors. When in 1265, the Mameluk sultan Malik edh-Dhahir Baybars conquered the Atlit settlement he did not attack the Citadel. Only in 1291, when Akko fell under the Mameluk Sultan Al-Malek al-Ashraf, the Citadel at Atlit was deserted. For the fear that the of the Castle will be re-conquered by the Crusaders, the Mameluks destroyed the fortification walls on the eastern side of the promontory. During the Turkish government the stones from the masonry at the stones Atlit were shipped away to be used for building the sea walls at Akko, still surrounding the harbor . After the Mamekuk rule, Atlit fell in disrepair and the sever earthquake in 1837 caused its major damage afterwards. The ruins of Atlit and other sites as they appeared in the 19th century were illustrated in many pictures of the pilgrims and travelers to the Holy Land. One such print shows the ruined Atlit seen from the South Bay. In 1903, Edmund de-Rothschild, who owned the lands at the site, founded the Jewish village of Atlit, 1 km to the south of the Crusader settlement.



The best parallels to the piers at Atlit are found at the southern pier at Akko, Israel, the "Egyptian" harbor at Tyre and the ancient pier at Tabat el-Hammam, on the Syrian coast. The building system is much the same, although the width of the pier at Akko was 12 m (at Tyre and Sidon it was 15 m). Another close parallel to the piers is found at Amathos, in the southern Cyprus. The gap between the two islands at Atlit resembles the 20 m wide gap at the western side in the southern "Egyptian" harbor at Tyre. This opening most probably served for washing out silt from the closed basin of the harbor. Atlit

TH – two Phoenician letters incised on the vertical wall of the quarried kurkar ridge east of the Phoenician settlement; the letters are visible from the highway Atlit

Zaraza Friedman Atlit

Caesarea

Country: Israel

Locality: Caesarea

Coordinates (UTM; longitude/latitude): Long. 34° 53.5‘ E

Lat. 32° 30.5‘ N

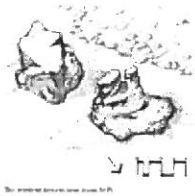
Caesarea is located on a straight sandy coast, stretching from Atlit (23 km N) to Givat Olga (6 km S), and south of Haifa (40 km). To the north of Caesarea is the Crocodile River (Crocodilus; c.2 km) and to the south is the Alexander River (c.3 km). The main sources of information about Caesarea and its harbor construction come from the writings of Josephus. He gives a general geographical description of the site where king Herod chose to built the harbor, on a straight shoreline without any natural protection : Caesarea

The earliest investigations of the ancient harbor of Sebastos were made in 1959 when Edwin Link and his wife Marion came to Israel Caesarea

to explore the port of Caesarea Maritima. The underwater remains of the submerged breakwaters may be seen from air in clear days and calm sea. At the terminus of one of the breakwaters, Link had discovered very large blocks that had been fastened together by iron clamps set in lead sockets. Link thought that these blocks might have been the remains of the colossal statues mentioned by Josephus, to adorn the harbor□s entrance.

In 1960, Link returned to Israel with a research vessel, *Sea Diver II*, a 28 m long steel craft suited with excavation, navigation and communication equipment. Working with aerial photos and the results of the divers□ surveys, Link was able to construct the basic plan of the submerged remains. The expedition also discovered a small medallion or token, identified by various scholars as depicting the harbor of Caesarea at its inauguration (10/9 BCE). The reverse of the medallion depicts a scene of a harbor□s entrance flanked by colossal statues, and the Greek letters KA in the upper field. However, this token may have been struck in Alexandria, perhaps in the reign of Antonius Pius (138-61) with no particular reference to Caesarea.

The Link Expedition to Caesarea was the starting point for years of underwater research carried out by the Israel Underwater Exploration Society (IUES), Caesarea Ancient Harbor Excavation Project (CAHEP) and Combined Ceasarea Explorations (CCE). In 1963, started the first international collaboration with Prof. Harold Edgerton from M.I.T. and his assistant Dr. Olivier Leenhardt, from the Oceanographic Museum at Monaco. The survey of the structures and wrecks buried under the sandy sea floor was made with Egerton□s invention "*Mud Penetrater*". This device was a low frequency echo sounder (12 kHz), which could plot submerged features. The "*Mud Penetrater*" was operated in the area of the sunken Herodian breakwater that had been surveyed previously by the Link Expedition. The results of the survey may be concluded as:



The coastline of the Roman era was at least 150-200 m further west of the present one. The divers have found two protruding high rocky blocks almost covered by sand, which might be the entrance□s towers.

2. The entrance to the ancient harbor is 350-400 m west to the northern Crusader□s Wall tip, which is cut by the sea. The farthest part of the semi-circular breakwaters is more than 450 m from the present shore. One may recall that this was not a harbor dug on land such as Ostia, but an artificially built port in open waters.

3. Some stone blocks on the sea floor along the north and northwest lines of the sunken breakwaters are remains of artificial structures. Josephus tells about stone blocks that were thrown into water in large quantities and to a great depth.

In 1975-76, Avner Raban of Center for Maritime Studies (CMS), University of Haifa carried out an underwater survey in the outer Herodian breakwaters, for the Israel Electric Company. In 1979-89, the collaboration between A. Raban (CMS, University of Haifa) and Robert Hohlfelder of the University of Colorado, USA, founded the Caesarea Ancient Harbor Excavation Project (CAHEP). Other co-directors to joint the expedition were Peter Oleson from University of British Colombia, Canada, and Lindley Vann from the University of Maryland, USA and

Raphael Stieglitz form the Rutgers University, USA. The project not only established that Josephus had described the breakwaters accurately but also recovered details on their design and construction.

The Joint Expeditions (JECM) and CAHEP had collaborated in the preparation of the Smithsonian Institution□s exhibition "*King Herod□s Dream*", which was shown in Washington and than around USA from 1988-90. With this occasion was founded the Combined Caesarea Expeditions (CCE) under the direction of Avner Raban of the Leon Recanati Institute for Maritime Studies (RIMS) and Kenneth Holum of the University of Maryland, USA, that started work from 1989 since present. CCE extended the research of the northern sections of the western breakwater, known limits of the Hellenistic and Herodian Inner Harbor, the octagonal plan of an Early Christian church on the temple platform and the Early Islamic and Crusader dwellings within the Old City, the administration complex outside the Crusader Wall, and the Decumanus and also the northern part of the hippodrome (stadium).

The long history of Sebastos (Caesarea Maritima) stretches from Straton's Tower dated to the 4th century BC, the harbor constructed by King Herod (22-10/9 BC) and to the Late Byzantine period. Caesarea

The information on the history of Caesarea and its harbor are found in the writings of Josephus Flavius: the *Antiquities of Jews* 15.331-39 and the *Jewish Wars* 1.408-15. Josephus had spent some time at Caesarea making detailed notes on the city and its harbor that was still functioning in the 1st century AD as much as it had in the last decade of the previous century (1st century BC). Caesarea

Named by its founder Herod the Great in honor of Caesar Augustus (Herod's patron), the city was the capital of the Roman province of Judea for about 600 years. To distinguish it from other cities with the same name and founded in the same period, it was also called Caesarea Maritima, Caesarea Palestina, etc. The port of Caesarea was named Limen Sebastos by Herod, Sebastos being the Greek equivalent of Augustus (in Latin).

In the 3rd century BC, during the Hellenistic period, the sandy hills along the eastern Mediterranean were given by the Persians to the Phoenicians who built a small fortified anchorage which they named Straton's Tower. There is a common assumption that the name Straton is the Greek form of the Phoenician name Abdashtart (the name of two or three Sidonian kings). Another assumption is that the town was named after its founder, translated literally into Latin as Stratonis Turris and into Hebrew, Migdal Śar. More likely it seems that a Ptolemaic king founded the city with an anchorage and named it after one of his generals (a general named Straton served Ptolemy II, but he is not the founder of Straton's Tower. Straton can also be a military title. In the Hellenistic citadel of Jerusalem, there was a tower named Straton, but it did not have any relation with the coastal settlement).

At the end of the 2nd century BC, Zoilos the tyrant of Dor, conquered Caesarea but it

soon fell to the Hashmonean Alexander Jannaeus (100 BC). It seems that the first Jewish community was founded there during this time, but the rabbis excluded it from the borders of Palestine. To weaken the Hashmonean kingdom, Pompey annexed Straton's Tower and other coastal town to the Roman Syria in 63 BC. The town was in a state of decay when Octavian, the future Caesar Augustus restored it to the Jewish state in 31 BC.

Between 22 and 10/9 BC, Herod built Caesarea on the site of Straton's Tower. Above the main harbor and just to the east, Herod built a spacious platform upon which he erected a temple dedicated to the goddess Roma and the deified Emperor Augustus. Herod resettled the city with Jewish population as well as Greek speaking pagans. Caesarea became a typical city-state (polis) of the Hellenistic age, ruled by a city council and magistrates under a royal resident general.

When the Romans annexed Judea to the empire in AD 6, they made Caesarea the headquarter of the provincial governor and his administrative center. A Latin inscription found in the theatre records that Pontius Pilatus, prefect of Judea, dedicated a temple at Caesarea to the Emperor Tiberius. The city remained the capital of Judea, later called Palestina, until the end of the Byzantine period. In AD 66, in the eve of the First Jewish Revolt, Vespasian stayed at Caesarea and used it as his main base. After he became emperor, and in gratitude for his loyalty, Vespasian refunded the city as a Roman colony. In the 2nd and 3rd centuries, the city continued to profit from its links with the Roman emperors. Hadrian, who paid an imperial visit at Caesarea in AD 130, expanded the city's aqueduct system and probably he also built the city's stone circus. In response, the citizens dedicated a temple to Hadrian, and coins from the local mint depicted him as the colony's founder. Other imperial visits were made by Septimius Severus in 199 or 201, and perhaps Severus Alexander in 231-232.

Christianity was founded at Caesarea within a few years after Jesus' Crucifixion, when Saint Paul converted the Roman Centurion Cornelius (*Acts* 10). From the late 2nd century there is a renewed record of a Christian church with its own bishop. In the same period Jews resettled at Caesarea, being attracted by economic advantages. By AD 250, the city had a celebrated rabbinical academy and the Christian school of Origen, the outstanding scholar and theologist who assembled the famous library and compiled the *hexapla* text of the Bible. Within the Christian Empire (AD 4th-7th centuries), Caesarea's population and economy expanded, as well as in the rest of Palestine.

In the Byzantine period, a new fortification wall enclosed a much larger urban space. The authorities built an additional aqueduct system (low-leveled covered aqueduct) and they continued to replace the city's street pavements, following Herod's original grid plan. When Christianity became the dominant religion, a church replaced Herod's temple to Roma and Augustus on the temple platform.

In AD 530, the Roman emperor Justinian, promoted the governor stationed at Caesarea to proconsul. The city's bishop also ranked as metropolitan of Palestina and Caesarea kept this prerogative even after AD 451, when the archbishop of Jerusalem obtained the rank of patriarch. The most famous bishop of Caesarea was the ecclesiastical historian and apologist Eusebius (bishop, AD 315 – 339), who recorded martyrdoms in the city's amphitheatre under the last Roman emperor.

Eusebius' contemporary was Rabbi Abbahu, who taught his daughters Greek, visited the city's baths and maintained excellent relations with pagan authorities. Another famous personality and result of city's learned culture was Procopius of Caesarea (6th century).

By AD 500, tectonic actions and coastal surge had reduced parts of the Herodian breakwaters that became submerged reefs, being a hazard to navigation. The Emperor Anastasius (AD 492-517) undertook a major campaign to restore Sebastos, helping Caesarea to reach its high prosperity in the 6th century. During the 5th and the beginning of the 6th century, the relationship between the Christian majority and the Samarian and Jewish minorities deteriorated, and several conflicts took over by burning down the Church of Saint Procopius. These troubles presaged the invasion of the non-Christians in the 7th century. In AD 614, Persian army attacked Caesarea, but the city capitulated without serious resistance. The Roman army returned for a brief period in AD 628, but in 642 Caesarea fell to the Arab army after a seven months siege. Between the 7th and the 9th centuries, Caesarea suffered of heavily depopulation, buildings collapsed, the stone robbing took over and the harbor fell in disuse. By the 10th century, Caesarea re-emerged a prosperous town but on a much smaller scale. The Arab and Persian geographers el-Muqaddas and Nasir i-Khusrau, mention flourishing gardens and orchards, a fortification wall and a great mosque, apparently situated on what had been the Herodian temple platform.

In 1101, the Frankish king Baldwin I of Jerusalem and the Genoese fleet conquered Caesarea after a brief siege, and established a Crusader principality that lasted until 1265 (despite periods of reconquest). A Christian church replaced the Great Mosque on the temple platform. In 1251-1252, the French king Louis IX (Saint Louis) built the city's fortification walls by "his own hands". In 1266, the Egyptian sultan Baybaras stormed Caesarea and in 1291, his successor leveled the city and other Crusader castles along the Levantine Coast of the Mediterranean. From time to time a squatter settlement existed among the ruins, but after 1291, Caesarea mostly remained desolated.

The Herodian harbor at Caesarea is one of the first kind in which Vitruvius□ descriptions (V.12. 4,5) for the use of hydraulic concrete in harbor construction were applied. The harbor was composed of three basins, one inside the other: Caesarea

1. The inner most was built on the basin made by the Phoenician inhabitants of the Straton□s Tower, in the southwestern part of the city.
2. The middle basin was in a natural bay protected from the N and S by rocky promontories.
3. The outer basin is the largest of three, was artificially created by constructing breakwaters to enclose a vast area of open sea.

The underwater archaeological research carried out for the last 22 years by CAHEP (Caesarea Ancient Harbor Excavation Project) and CCE (Caesarea Combined Expedition) confirmed most of what Josephus had written on the construction of the Sebastos Harbor. The width and overall outline of the Herodian quays are quite accurate, but his claim about the water depth is very exaggerated. Caesarea

Caesarea

The towers on both sides of the harbor entrance had been settled on sandy bottom. It seems that the western towers also served as sand catchers to prevent the silting of the harbor□s entrance. Also flushing currents kept the harbor channel silt -free and limited the accumulating sand bars on both sides in the open water. Caesarea

Caesarea

A staircase led from the harbor to the temple platform. The foundation of this staircase built into ground water level, was revealed beneath the Byzantine stairs. Its method of construction is similar to that of the Herodian breakwater. Caesarea

Middle Byzantine period (500-550 AD): The repairs and reconstruction of the vaults that were made during this period are attributed to Anastasius. The building project on the east side of the harbor basin included a garden, drainage channels, paved areas and a "reflective pool" fed by ground water found at the foot of the Herodian quay. The east quay was raised and widened. A column inserted in the quay was used as a mooring stone, presumably in the period when the water basin was deep enough to allow small vessels to anchor near the quay. The podium was raised and widened, serving as the setting ground for the octagonal church. Caesarea

Later Byzantine period (550-640 AD): As a result of marine transgressions, the inhabitants were forced to elevate the surface of structures built in the harbor basin. The "reflection pool" and the garden were covered by massive amounts of fill. Buildings and storerooms were built on top of this fill. By this time the inner harbor was totally sand-locked. Caesarea

The underwater excavations carried out on the breakwaters revealed a very complex technology of building and the most, the use of hydraulic concrete called *pozzolana* [actually the volcanic ash was called pozzolana; lime mixed with volcanic ash Caesarea

(pozzolana), being in contact with water or sea water, made the hydraulic concrete, that enabled the Romans to built bridges and harbor jetties]. Herod imported all the construction materials (wood, marble, glass, lead, etc.) and especially pozzolana, to build his unique harbor. Constructing the harbor, Herod wanted to create a safe shelter for large fleets "*to lie anchor close to the shore*" as well as quays for activities of loading and unloading the cargo from the anchored merchantmen. It seems that the outer basin was designed to accommodate passing fleets; probably the great grain fleets sailing from Alexandria to Rome.

Pozzolana

The Roman hydraulic concrete that hardens underwater is described in *Book II.vi.1* (a ten volumes work; *De Architectura*), written by Vitruvius, in 25 BC. In this book he describes the origin of pozzolana and its use to make the concrete for structures and piers:

> "There is a powder which, by nature produces wonderful results. It is found in the neighborhood of Baiae and in the lands of municipalities round Mount Vesuvius. This (pozzolana) being mixed with lime and rubble, not only furnishes strength to other buildings, but also, when piers are built in sea, they set under water□ And there would not be unless deep down they had huge blazing fires of sulphur, alum or pitch. Therefore the fire and vapors of flame within, flowing through the cracks, make that earthlight. And the tufa, which is found to come up there, is free from moisture. Therefore, when three substances formed in like manner by the violence of fire come into one mixture, they suddenly take up water and cohere together. They are quickly hardened by the moisture and made solid, and can be dissolved neither by the waves nor the power of the water."

Caesarea

The underwater archaeological researches carried out at Caesarea Maritima have revealed much of what Josephus did not see. The great breakwater had subsided through the centuries and what was originally at the water level is nowadays over 5-6 m bellow the sea level.

During the 1990-91 seasons, the divers discovered a series of wooden forms in which aggregate of pozzolana had been packed. One such form which had survived almost intact in its lower part was 14 x 17 m, and with its original height of 4 m, probably the depth of the sea floor at that site at the time of the construction. The discovery of more such concrete blocks poured in wooden caissons and the results of the previous investigations in the construction of the Herodian harbor, made possible to sum-up a general assumption on the construction phases:

Phase I

The first feature to built in the open sea was probably an artificial island, where eventually the main breakwater would be, some 500 m N-NW of the southern promontory (100 m long, 20 m wide) and about 350 m west of the stem of the northern breakwater. The island was built by a series of wooden formworks (caissons) packed with hydraulic cement

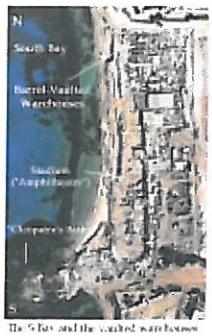
(pozzolana, lime and rubble). The forms had been constructed on the shore in the traditional shell-first shipbuilding technique of that period. Than, each form was towed into position in the open sea and moored by iron chains in all four corners. The caissons were set as close as possible, thus to create a large platform. When the process of setting the caissons was finished, additional loads of pozzolana, lime and rubble were added into the caisson from barges, so as to cause a gradual even subsidence till it rested on a rubble cushion that was previously prepared on the sandy sea floor. The sides of the forms were retained with piles of rubble and the gaps between the caissons were filled with pozzolana packed in sacks. The combined platform, probably 30 x 60 m, was covered with paving slab stones, on which a large tower was built, probably the "Drusion" mentioned by Josephus and the assumed lighthouse. Another artificial island of a similar type of construction was placed half away long the perimeter of the main breakwater, at the turn of its course from west to north.

Phase II

The final phase

During this stage of building Sebastos, the southwestern and northern breakwaters were completed and the upper structures were built on top. Some of them were observed and described by Josephus. Towers and the vaulted stores were built on the spinal (main) quay. Subsidiary jetties were added dividing the harbor into three mooring basins, one within the other. Remains of a quay and jetty are found beneath the modern quay built atop about forty years ago.

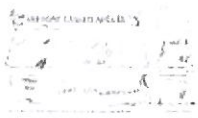
At the tip of both breakwaters of the main basin there are huge masses of tumbling blocks, remains of the elaborated superstructures that crowned the harbor□s entrance. Some of these large blocks are over seven meters long. Other stones were carved with a hemispheric socket for wooden shafts for capstans on which, probably chains were rolled up across the entrance. In order to withstand the drag of the pulled chains the blocks were fastened to each other with iron clamps fixed in molten lead that was poured into cut grooves in the stone. Solidified flows of molten lead, which were found at the foot of the tumbling mass, 10 m bellow the sea level, indicate that the lead had been poured after the blocks were laid in place in the water. For such work, divers were needed to work underwater probably using snorkels for breathing. Such professional divers were known in the Roman world as *urinatores*.



Caesarea

The subsiding of the Herodian breakwaters created an underwater obstacle that prevented the use of the basin to its east even as an open anchorage. On top of the main breakwater were found several concentrations of broken amphorae and ballast stones, evidence that ships were wrecked while trying to sail over this sunken reef (breakwater), on their way to the shore. The 4th century remains, provide the latest date of the final submergence of the Herodian harbor. During this period, the bay to the south was apparently used as a semi-protected anchorage area, where ships loaded and unloaded merchants in small boats (lighters) that, carried them to be

stored in the vaulted barrel warehouses on the coast. These structures also formed the raised area of hanging gardens of the Byzantine and Arabic periods.



On top of the northern part of the main breakwater (Area K 5), was found a group of five lead ingots that were cast in the same form (each ingot weighted from 60 to 70 kg). They have a trapeze cross-section and on top are found an elongated Latin inscription "IMP.DOMIT.CAESAR.AVG.GER.". The inscription is related to the Emperor Domitianus (81-96 AD); he earned this title after his victory in Germany, in 84 AD. These ingots probably were cast in the late 80□s or the beginning of the 90□s of the first century AD. The other inscriptions found on the sides of the ingots relate to the weight of 200 Roman Libra. The inscription "MET.DART." (Metalia Dardanica), is found on all five ingots. It attests the origin of the lead and silver mines within the Roman Empire; such a place was Dardania, within the Cosovo area, near Bosnia. The date of the ingots indicates the exact period when the ship wrecked and also the date of the ruined Sebastos, in the late 1st century AD, about one hundred years after its building and inauguration. Caesarea

Zaraza Friedman Caesarea

Topographie Carthage

Republik Tunesien
heutiger Ort: Tunis, Stadtteil Byrsa
Koordinaten: ca. 36° 55' N - 10° 10' E

Zwar haben schon 1908-13 Grabungen im Gebiet der Häfen stattgefunden, so waren es aber hauptsächlich die Grabungen im Rahmen der internationalen UNESCO-Rettungsaktion seit 1973, welche im Vorfeld der sich ständig ausbreitenden Villengebiete am Stadrand des modernen Tunis an den Lagunen durchgeführt wurden, welche größtenteils zur Erforschung der Hafenanlagen beigetragen haben. Die Grabungen des runden Hafens standen unter englischer Leitung, die des rechteckigen Hafens unter amerikanischer Leitung. Carthage

Von der im Zuge der städtebaulichen Maßnahmen zur Neustadt errichteten imposanten Hafenanlage, welche uns Appian schildert, sind aus grabungstechnischen Gründen nur kleine Ausschnitte bekannt. So wurde nur auf der Insel sowie nördlich derselben gegraben, ebenso westlich des Tophet am rechteckigen Hafen Carthage

(Handelshafen). Die stratigraphische Abfolge auf der Insel ergibt eine Abfolge von sechs Kulturperioden, von ca. 400 bis zur byzantinischen Epoche am Ende des siebten nachchristlichen Jahrhunderts (s. Übersichtstabelle aus Hurts 1979).
Erst im archäologisch nachweisbaren Höhepunkt der Stadtentwicklung, welche den politischen Ereignissen zu widersprechen scheint, nämlich in den 50 Jahren, welche der schweren Niederlage des zweiten punischen Krieges 202 v.Chr folgten, erfolgte der Ausbau der Häfen in ihrer von Appian (einer Textstelle von Polybios zitierend) uns überlieferten monumetalen Weise: Kriegs-, Werft- und Handelshäfen.
Hafenanlagen vor dem 4.Jh. sind gänzlich unbekannt. Zur genauen Lage der Hafenanlagen früherer Zeit liegen bisher nur Vermutungen vor. Vermutlich lag der archaische Hafen Karthagos in der Bucht du Kram südlich des heutigen Lagunengebietes, im jenem Gebiet wo in späterer Zeit die Hafeneinfahrt vermutet wird ("Quadrilatere du Falbe").

Der Hafen bis um die Mitte des 4.Jhs.v.Chr.
(keyword channel) Im Bereich der späteren Häfen fanden sich Spuren eines mindestens 350 m langen, 2 m tiefen von Menschenhand geschaffenen 15-20 m breiten Kanals (F 469). Er schneidet mittig die spätere "Admiralitäts-Insel" und verläuft schräg zwischen dem späteren rechteckigen Hafen und dem Tophet vorbei südwestlich wo er auch in den amerikanischen Grabungen erfaßt wurde. Er diente als breiter Drainagekanal vermutlich zur Sanierung des sumpfigen Lagunengeländes und stand (anhand von Muschelresten nachweisbar) mit dem offenen Meer in Verbindung. Aus diesem Grunde und wegen seiner Breite diente er vermutlich auch gleichzeitig als Kanalhafen. Er wurde im Laufe des 4.Jhs. zugefüllt, wobei das Datum seiner Aushebung nicht genau festgelegt werden kann. Er mag aber, wie anhand der Stratigraphie der Sedimente erkennbar, nicht lange in Benutzung gewesen sein. Zeitgleich zu dieser Anlage mögen die im Gebiet der "Admiralitäts-Insel" festgestellten länglichen Holzstrukturen (Hellinge ?) im Bereich der späteren Schiffshäuser sowie die im westlichen Gebiet ergrabenen Handwerkerbetriebe gehören (Metallverarbeitung, Töpfereibetriebe).

Die punischen Häfen Ende des 3.- Anfang des 2. Jhs.v.Chr.
(keyword basin) Die Hafenanlagen dieser Zeit sind nur spurenhaft erhalten. Es sind dies die Anlagen aus der Endzeit des punischen Karthagos, wie sie uns Appian auf eine Quelle zur Zeit der römischen Eroberung 146 v.Chr. zurückgehend beschreibt (Appian VIII 96). Der kreisrunde Militärhafen und der mit ihm in Verbindung stehende rechteckige Handelshafen, wurden unter erheblichem Aufwand gebaut. Große Erdreichmassen mußten hierzu ausgehoben und aufgeschüttet werden. So umschließt allein der Handelshafen ein Gebiet von ca. 123.000 Kubikmeter Erde (ca. 150 x 400 m, T. 2.00 m), während der Kriegshafen mit geschätzten 115.000 Kubikmeter etwas kleiner war. Allein ca. 10.000 Kubikmeter mußten aufgechüttet werden, um auf der Insel die nötige schräg-konische Oberfläche zu gestalten für die Hellinge. Hinzu kämen die weiteren Schiffshäuser rund um den Rundkanal, welche die Insel umgibt.

Marcus Heinrich Hermanns Carthage

Republik Italien, Region Toskana, Provinz Rom Civitavecchia

heutiger Ort: Civitavecchia
Koordinaten: 42° 05' N - 11° 50' E

Civitavecchia liegt nördlich von Rom, an der Küste Südetruriens ca. 4 Meilen nördlich von Kap Linaro, des einzigen natürlichen Vorsprungs an der tyrrhenischen Küste nördlich der Tibermündung. Heutiger Industrie- und Fährhafen (Überfahrten nach Sardinien). Civitavecchia

Ursprünglich als künstlicher Hafen einer (kaiserlichen) Villa wurde dieser Hafen unter Kaiser Trajan (98-117 n.Chr.) angelegt (Plinius d.J., epist.VI 31,1: 106 n.Chr.) an einer relativ flach und geraden Küste. Die halbkreisförmigen Molen mit der mittig angelegten Insel sind heute noch Bestandteile des modernen Hafens. Nach dem Niedergang von Ostia übernahm dieser über die Via Aurelia gut erreichbare Hafen die Rolle des Seehafens von Rom. Noch 416 n.Chr. findet dieser Hafen im "Itinerarium Antonini" Erwähnung. In der Renaisance wurde nach den in dem Werke "Nautica mediterranea" von B.Crescenzio (1602) dargelegten Plänen und Hinweisen zum wichtigsten Hafen des Kirchenstaates ausgebaut. Die ovale, zangenartige Anordnung der Molen des Hafens von Civitavechia, als dem typischen Renaissancehafen und als einer der wichtigsten Häfen des Kirchenstaates, findet in den Kolonnaden des Architekten Giovanni Lorenzo Bernini vor dem Petersdom in Rom (erbaut 1657-1667) einen architektonischen Anklang (der Hafen als symbolischem Schutzort der Pilger). Civitavecchia

Civitavecchia

Marcus Heinrich Hermanns Civitavecchia

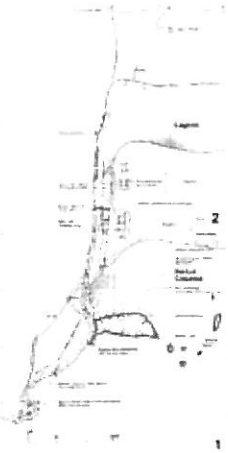
Topographie
Republik Italien, Region Toskana, Provinz Groseto
nächstliegende heutige Ortschaft: Ansedonia
Koordinaten: ca. 42° 20' N - 11° 05' E Cosa

Kleines Vorgebirge südöstlich des Monte Argentario, ca. 46 km von Grosseto, 139 km nördlich von Rom gelegen. Höchster Punkt 113 m üNN.

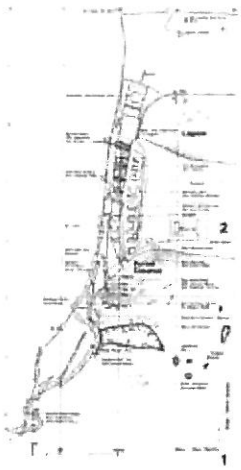
Cosa

Die Stadt Cosa lag in einer in der antike reichsten Regionen Italiens auf einen Hügel über dem Meer gelegen. Am Fuß der 273 v.Chr. nach dem Sieg über Vulci und Volsinii gegründeten latinischen Kolonie□(Plinius NH III 51) wurde der Portus Cosanus, der Hafen, gebaut und das ganze Hinterland wurde mit weitausholenden Infrastruktureinrichtungen versehen (Villa delle Colonne, Villa Settefinestre). Im Verlauf von etwa hundert Jahren wurde die hinter dem Hafen liegende Binnenlagune (heutiger Rest: Buraner See unterhalb von Capalbio) durch eine tiefe Felsenkluft im Vorgebirge von Ansedonia, den □Spacco della Regina□ mit dem Meer verbunden und entwässert, wobei zugleich bestimmte Strömungen erzeugt wurden, die das Hafenbecken spülten und dafür sorgten, dass es nicht versandete. Der Hafen erreichte den Höhepunkt seiner Entwicklung im 1. Jh.v.Chr., als die Molen aus der früheren Periode verlängert und ausgebaut wurden und die Kluft, die möglicherweise durch Geröll /Erdmaßen versperrt war, durch einen künstlichen Einschnitt, der sog. □tagliatta□ ersetzt wurde. In der Lagune wurde Fischzucht betrieben und zu diesem Zweck war die □tagliatta□ mit Schotten versehen. Vielleicht hatte die Stadt noch einen zweiten Hafen auf der anderen Seite des Vorgebirges, am Ausgangspunkt des Tombolo di Feniglia. Ein Portus Fenilie ist in spätantiken und mittelalterlichen Urkunden □ dokumentiert und könnte auch schon in spätrepublikanischer Zeit bestanden haben, wie die Anhäufungen von Amphoren, die man in der Flur Pineta gefunden hat, vermuten lassen. Reste einer Fischkonservierungsanlage sowie einer Villa maritima runden den Gesamtblick ab. Die Entwicklung vom Stadthafen zu einem werkseigenen Hafen eines an einer Villa angeschlossenen Fischverarbeitungsbetriebes mit Amphorenproduktion ist eine einzigartige Kombination (Fabrik der Sestii). Hier werden nur die zum Hafen gehörigen Bauten besprochen.

Cosa



Innerhalb des Hafenbeckens wurde ein ca. 13.50 m langes und 3.40 m breites Rumpffragment eines Schiffes gefunden. Die rekonstruierte Länge beträgt ca.15 m. □Erhalten ist der Kiel und 29 Spanten mit Beplankung. Das Schiff stammt aus dem spätem 16.Jh.; seine Ladung bestand aus Eisenerz.



Cosa

Der Hafen lag an der Küstenroute nach Gallien und Spanien, als Sprungbrett nach Sardinien und Korsica. Zusammen mit Portus Herculis (heute Port San Ercole) eine der wenigen natürlich geschützten Ankermöglichkeiten von Portus Lunae (La Spezia) im Norden und Portus Caietae (Gaeta) im Süden, sieht man einmal von der Tibermündung ab. Zudem lag die Stadt an der später angelegten Via Aurelia antica.

Das Stadtgebiet war seit 1948 eine amerikanische Grabung unter der Leitung der American Academy in Rome. Erste Untersuchungen zum Hafenareal 1965. Weitere Kampagnen zu Lande und zu Wasser 1968, 1969 und 1972. Untersuchungen zur Lagunenentwicklung durch die Fondazione Lerici (Rom) 1970, 1971, 1972. Diverse Nachuntersuchungen in den 90er Jahren. Cosa

Die direkt zur Hafenanlage gehörig anzusehenen Strukturen bestehen aus diversen Molenwerken, darunter eine breite, heute gänzlich überspülte Aufschüttung, mehrere Blöcke im Wasser, welche in knieartigen Bogen von der Spitze der Aufschüttung die Bucht abschließen sowie fünf schräg-parallel zur Küste liegende massive Blöcke in römischem Betongußmauerwerk. Cosa

Der Hafen wurde seit der Koloniegründung 273 v.Chr. verwendet und war bis Mitte 3.Jhs.n.Chr. in Verwendung (villa maritima). Die kleinzonenartig durchgeführten Caisson-Sondagen unterwasser (trenches C1-3, D 2-3) konnten die stratigraphische Abfolge anhand vom archäologischem Material einengen. Eine Benutzung in etruskischer Zeit läßt sich anhand des archäologischen Materials nicht feststellen. Der ursprüngliche Hafenboden konnte in einer Tiefe von 1.00-2.10 m Tiefe unter der heutigen Sedimentoberfläche oder 5.10-6.20 unter der heutigen Wasserkante festgestellt werden. Dies entspräche ca. 4.10-5.20 unter dem geschätzten antiken Meeresniveau. Der antike Untergrund stellte sich als brackische Sandschicht mit römischen Scherben und Kleinschotter vermischt dar.
Neben Tuff aus dem Gebiet des Lago Bolsena sowie Puzzolanerde aus dem Gebiet von Puteoli wurde als drittes Baumaterial Amphorenfragmente verwendet. Die im Pier 1 vermauerten Fragmente geben einen terminus post quem für das Ende des 2.Jhs.v.Chr. Die Bearbeiter gehen davon aus, daß der oben erwähnte Unterschied in den Baumaterialien zwischen dem unteren und dem oberen Bereich auf verschiedene Bauphasen zurückzuführen sei. Es wären somit drei Phasen in der Entwicklung des Hafens festzustellen:
- Molenaufschüttung und deren Verlängerung durch Blöcke (3.-Anfang 2.Jhs.v.Chr)
- Betonblöcke, zweiphasig (4.Viertel 2.Jh.-Ende 1.Jh.v.Chr)
Cosa

Handelsaktivitäten sind im Hafen von Cosa seit dem 3.Jh.v.Chr. anhand von Funden greco-italischer Amphoren nachweisbar. Zahlreich bekannt sind die in römischer Zeit errichteten Hafenschutzanlagen in Betonmauerwerk, insbesonders entlang der Küste des Tyrrhenischen Meeres, sind doch hier die geschützten natürlichen Buchten eine Seltenheit (z.B.Golf von Baia). Die von Vitruv (V 12) geschilderte Mauertechnik des Betongußwerkes wurde häufig für den Bau von Molen und Wellenbrechern verwendet. Hauptbestandteil war die Pozzuolanerde, einem Baumaterial, ähnlich dem heutigem Portland-Zement, dessen besondere Eigenschaft ist selbst unter Wasser abzubinden. Die bekanntesten Molenbauwerke sind: Centumcellae-Civitavecchia, Antium-Anzio, Anxur-Terracina, ... Von all diesen Cosa

Anlagen ist Cosa vermutlich das älteste bisher angenommene römische Molenwerk. Die Datierung in Cosa beruht auf im Beton verarbeitete gestempelte Amphorenfragmente, welche den Stempel SES(tius) aufweisen (terminus post quem: Ende 2.Jh.v.Chr.). Der früheste Großbau an Land in der "opus caementitium" genannten Bautechnik wäre in Rom am Tiberhafen (Marmorata) gelegene Porticus Aemilia, erbaut 193 v.Chr.

Die Reste von hauptsächlich in den Felsen gehauenen Kanalsielen sowie die Frischwasserbecken dienten vermutlich weniger zur Verproviantierung, sondern sind vielmehr in Verbindung mit dem Industrieviertel zu sehen. Neben der Fischzucht in der Binnenlagune ist sowohl die Fischverarbeitung wie auch die Verschiffung des Endproduktes belegt. Amphorenherstellung und Speicherbauten runden das Bild einer Fischverarbeitungsfabrik ab. Neben der Fischzucht ist auch der (Thunfisch-)Fischfang literarisch überliefert. Strabo (V 2,8) berichtet über einen auf dem Vorgebirge gelegenen Ausguck. Vergleiche aus römischer Zeit solcher Fischverarbeitungbetriebe sind aus Südspanien und Nordafrika bekannt. Solche Anlagen waren bis in die Mitte des 20.Jhs. auf Sizilien in Funktion ("tonnare"). Höhepunkt des Fischereibetriebes war die Zeit des letzten Viertels des 2. bis Ende des 1.Jhs. v.Chr. In diesem Zusammenhang sei auf den Wrackfund von Grande Congloue an der südfranzösischen Küste hingewiesen (110-80 v.Chr,), deren Hauptladung aus Amphoren der Sestier bestand. Amphoren dieses Typs fanden sich bis ins Rheinland.

Marcus Heinrich Hermanns

Cosa

Cyprus-Ports

Cyprus-Ports

Cyprus's geographical position at the eastern end of the Mediterranean, allowing it to act as a crossroad of civilizations, was the factor that determined the role of the island throughout history. Although isolated, Cyprus is visible and easily accessible from surrounding mainland. In contrast to most Mediterranean islands offers large areas of cultivatable land. Thick forests cover its mountains providing timber for shipbuilding and sufficient fuel to extract precious copper from ore that originated within the extensive mountain ranges. At the same time, predominant winds and currents in Eastern Mediterranean made Cyprus an inevitable stop-over on the sea routes that joined the Aegean with the Syro-palestinian and African coasts, and vice-versa. For this reason Cyprus's fortune has tended to rely on the strategic position that it holds along these sea routes. Considering that up to and including part of the 20th Century all contact with island was undertaken by sea, it is natural to assume that a network of carefully placed harbours would exist that could shelter, supply and repair the plethora of ships and boats that existed.

Results of archaeological research have revealed human presence on Cyprus as early

as 9000 BC. There is evidence that by the Early Bronze Age contact with the nearby mainland was occurring, although no facilities that would indicate a level of port organization have been uncovered. By the Middle Bronze Age new cultural elements coupled with dynamic economic development bears witness to an increased level of contact with the Anatolian and Syro-palestinian cultures. The exploitation of copper soon became a significant resource with which Cyprus, called Alasia(?) in ancient texts of that time, was often mentioned as being a copper-producing island. Concurrently, the first imported Minoan artifacts are found at sites in Cyprus, as well as the first clay model of boats. Probable areas that received and channeled this increased contact are the Bay of Morphou, the Lapithos's area in the north, and (in the 16th Century BC) the area of Kalopsida in the south without, however, identifying specific sites or marine-orientated structures.

The beginning of the Late Bronze Age reveals the first cities on Cyprus, with influences predominantly from the Syro-palestinian area, which had at their disposal some form of harbour facility. Specifically, the site of Egomi, which served as the port for the inland site of Kalopsida in the Middle Bronze Age, and the site of Hala Sultan Tekke near the saltpans of Larnaca, which was succeeded by the city of Kition. At the same time Mycenaean presence becomes evident on Cyprus, first through trade ventures and later through colonies, in which the cities of Egomi and Kition reached an advanced state of organisation and development. The latter part of the Late Bronze Age is characterized by turmoil of the "sea people", and the second influx of Mycenaens who introduce the Aegean culture on the island. Thus, at the beginning of the 1st millennium, within the Mycenean social and political framework, kingdoms were established who traced their origins to the heroes of the Trojan War.

The earliest references of the Geometric period from Cyprus indicate established cities and kingdoms (Stele of Sargon, Prism or Esarhaddon) where certain Homeric traditions and customs were maintained well into the Classical period. However, settlements at Amathous and the Kition area proved an exception since Phoenicians and the "eteocypriot" population settled these areas. By the end of the 4th Century BC the Cypriot kingdoms became part of the Hellenistic world, first under Alexander and then the Ptolemaic successors, eventually falling under Roman and latter under Byzantine control.

Cities, kingdoms, and harbours examined here clockwise from the northwest promontory of Akamas are as follows: Marion, Soloi, Lapithos, Kyrenia, Salamis, Kition, Amathus, Kourion, and Paphos. There also witnessed inland the kingdoms of Tamassos, Idalion and possibly Ledrae and Chytroi. As individual city states and kingdoms based on the Greek prototype, the cities of Cyprus that had access to the sea constructed and maintained harbour facilities for their own use. Strabo for example when referring to Praxandros and Laconians who established Lapithos, states that they formed the shoreline to accept vessels. Throughout history, however, the importance of each individual city or "state" with its respective harbour fluctuated according to external as much as internal social, political, economic, and strategic influences. Thus, a general image of the larger harbours is revealed, such as Salamis on the eastern coast, which took precedence over all other cities until the end of the Classical period, and Paphos on the west coast that inherited the role of Salamis during the Hellenistic and Roman period due to its access to sea routes that connected the Aegean with the Levant, and Alexandria. Competition between Salamis and the Phoenician colony of Kition, located further south, was constant, due to Kition's dynamic economy and swift access to the Syro-palestinian coast. The harbours of Soloi and Marion provided a platform for the export of copper from the

Skouriotissa and Limni mines respectively as well as the products of their fertile inland. These harbours, located on the two western bays of the northern coastline, were the closest to the Aegean and were orientated and influenced in that direction. The eastern and the central sections of the north coast were divided between the cities of Lapithos, and further east Kyrenia, whose orientation was expectedly towards the nearby Anatolian coast. The harbours of Amathous and Kourion on the southern coast were on the route between Rhodes and Egypt, and the Syro-palestinian coast via Paphos. Kourio, being further west orientated its efforts towards the Aegean, whilst Amathous, which consolidated the "eteocypriots" and was located near to the Phoenician city of Kition, was closely tied to the Levant. Aside from the main economic orientation of the harbours there also existed a plethora of trade networks that is evident in the archaeological record.

The harbours also functioned as naval bases for individual cities to protect terrestrial and marine interests, and through the naval assets to express the power and prestige of each. The main harbours that divided the coastal region co-existed with many havens, anchorages, and smaller harbours that are attested to from surviving texts. Early research concerning the ancient harbours of Cyprus by K. Nikolaou indicated nineteen harbours. This figure includes the sites of Arsinoe (Famagusta) and Leukolla (Protaras) in the Salamis area; Palaepahos, Zephyrion and Arsinoe (unidentified city) to the south of Paphos; Limenia (Limnitis), Melabron (Agia Irini) in the kingdom of Soloi area; and the sites of Makaria (Cape Moulos), Karpasia (Rizokarpaso), and Ourania (known as Aphendrica, east of Karpasia) on the eastern most area of the north coast (Map). He also states, "The reported cities and villages were the most important trade centers. There still remain a number of villages and settlements where there were not ports, although maritime activity was taking place especially during the summer season. There are many such sites, which cannot be enumerated here. Furthermore, remains of quays can be traced in many of these sites, and many natural bays were also used for the same purpose". Consideration must also be taken for regions where some form of survey has been undertaken, such as the sites of Kioni, Maniki, Thalassines Spilies, and Keratidhi along the coast between the Akamas peninsula and Paphos, and similarly the sites of Cape Elia (ancient Knidhos(?) near Agios Theodoros, and Vocolida on the north coast.

Underwater surveys have been undertaken at the harbour of Amathus by the French Archaeological School at Athens, and the naval harbour of Kition, which is a terrestrial site, whilst the University of Colorado has researched the harbour of Paphos. Finally, Flemming conducted surveys at Salamis in 1973. For the remaining sites archaeology relies on ancient sources and surface surveys (including underwater) to determine maritime activity. However, careful research and survey could certainly reveal many more sites that offered a harbour, an anchorage, or a safe haven to ancient mariners.

Dor

Country - Israel

Dor

Locality - Dor Farm/Tantura and Nachsholim Kibbutz

Hellenistic name – Dora (Δώρα)

Findspot – c.27 km south of Haifa, c.13 km north of Caesarea

Coordinates - Longitude 34°54'40''

Latitude 32°36'50''

Dor is a significant coastal site with a long and varied maritime history. Archaeological surveys and excavations on the Tel were carried out since the early 1920's. Underwater surveys were made during 1962-67 by the volunteer divers of the Underwater Exploration Society of Israel (UESI). They spent hundreds of hours searching the seabed of the Tantura Lagoon and around Tel Dor to trace archaeological evidence of the ancient harbors and the nautical activities. From 1973 on, faculty members and students of the Department of Graduate Studies of the History of Maritime Civilizations, at the University of Haifa, have carried out annual field seasons at Dor. From 1979 to 1984, the Center for Maritime Studies in collaboration with the Dor Excavations Project held a series of probes, limited trial excavations and the study of most of the known maritime installations in their geomorphological and archaeological stratified context. The Center made underwater surveys and onshore observations, tracing archaeologically dated evidence for the ancient sea-levels. They also plotted man-made structures and installations that may refer to the changes in land-sea relation over the centuries. Trial excavations were carried out along the shoreline of the Tel in 1981, '82, '83 and '85. These excavations, far from being complete, revealed a multitude of installations dated between the Middle Bronze Age to the Byzantine period. The discoveries included harbor features such as quays, a landing stage, slipways, wave-catchers, that testify to the richness and complexity of maritime activities throughout the history of Dor. Other installations were fish-ponds, washing-channels, wave-catchers and purple-dye facilities. Dor

Sometime, during the 13th and the end of the 12th century BCE (dated by the pottery sherds), the sea level rose and the kurkar reef at the entrance of the bay was flooded, thus the bay was exposed to more wave energy. This change was observed from the character of the sediments along the quay. The rising sea forced the people at Dor to raise their quays accordingly along with other waterfront structures. On the south slop of the Tel were traced two higher quays, also built of slim kurkar headers in area A and a retaining wall or quay Q. Towards the middle of the 11th century BCE, the eustatic trend reversed from transgression to regression. The harbor facilities at the south of the Tel came out of function and the area was incorporated into the built terrestrial settlement. The growing power of the Israelites in the hinterland and that of the Tyrian and Sidonians on the high seas weakened the domain of the Sikuli (Sea Peoples). When the Israelites came to Dor in the 10th century BCE, most of the structures were in ruins and probably covered by sliding soil fill and debris from the southern side of the Tel. It seems that the maritime activities at Dor diminished through the Persian and the Hellenistic period. Dor

Dor

The western side of Tel Dor is protected by a series of partly submerged islands. They are part of the western aeolianite sandstone (*kurkar* - carbonate cemented quartz sandstone) ridge that runs on the north-south axis, parallel to the narrow shore and the Carmel Range to the east. To the north of the Tel is a bay, partially protected by an island and is still used as a natural anchorage for fishing boats. To the south of the Tel was the main anchorage, today separated by a *tombolo* (sandbar), and now is comprised by the South Bay and the Tantutura Lagoon. In earlier periods, this bay was the northern edge of the lagoon. The series of several islands (part of the western *kurkar* ridge) that form the lagoon provide a protected body of water. This lagoon is a natural anchorage still used for anchoring fishing boats.

Dor may have been among the Levantine coastal cities used by Thutmose III, that served as stations for his troops moved by ships during the Syrian campaigns. The Canaanite harbors served as a line of forward bases to shelter the ships of Thutmose carrying his troops via sea, sparing time consuming march by land. The harbor installations found at Dor are the first to be attributed to one of the Sea Peoples (the Sikuli, attested in a historical records).

A unique structure found at Dor is the rock-cut slipways to the north of the Tel and on the southern edge of the North Bay. In the South Bay there is a sandstone (kurkar) slabs platform built in the "headers" technique, that became the trademark of the Phoenician harbor installations. This structure is assumed to be a paved quay or a landing stage for the ships on loading or unloading the merchants close to the shore.

Parallels

Some of the maritime installations at Dor may be compared to site in the Mediterranean and also to a closeness to their date of construction. The only Bronze Age harbor that has stone quays is found at Mallia, Crete, being dated to the Minoan period. There, the quays are accessible via a rock-cut navigational channel leading from the open sea to an inner lagoon. A quay platform paved with stone slabs, similar to the one found at Dor and also contemporary with it is found at Kition, Cyprus. Both sites (Dor and Kition) were settled by maritime people during the late 13th century BCE. Excavations made at Maa-Palaeokastro, on the west coast of Cyprus and Ras Ibn-Hanni, in Syria, revealed some ashlar "headers" structures were related to the new comers from the sea with a material culture similar to that of the Sea Peoples.

Dorestad

Dorestad

The most extensive excavations of Dorestad took place from 1967-1977, during which approximately 30 ha were exposed. The area of the Early-Medieval settlement begins approximately 1 km north of the Late-Medieval town centre of Wijk bij Duurstede and disappears almost 2 km south under the Lek dike. The settlement may have extended at least 1 km further south, representing a total length of about 3 km.
Dorestad must have been made up of three parts: the northern harbour district, a central part and a castellum-quarter to the south (the remnants of the former Roman castellum Levefanum).
The northern harbour district was divided in three parts: the actual harbour in the Carolingian Rhine bed, adjoining on the left bank the trading settlement - the vicus in the strict sense of the word - and behind it an area of agricultural character with scattered farmbuildings (see fig.1). The analysis of the data has so far concentrated on the harbour, the main subject of this homepage.

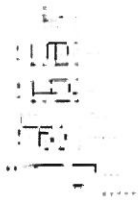
Dorestad

fig.1: after fig.2 in: W.A.van ES, `Dorestad centred', in: J.C.Besteman, J.M.Bos & H.A.Heidinga, Medieval Archaeology in the Netherlands, Assen/Maastricht 1990.
fig.2: after fig. on page 171 in: W.A.,van ES, H.Sarfaty & P.J.Woltering, Archeologie in Nederland, Amsterdam 1988.
fig.3: fig.8 in: W.A.van Es & W.J.H.Verwers, Excavations at Dorestad 1. The Harbour: Hoogstraat I. Nederlandse Oudheden 9, Amersfoort 1980.
fig.4: after fig.21 in: W.A.van Es & W.J.H.Verwers, Excavations at Dorestad 1. The Harbour: Hoogstraat I. Nederlandse Oudheden 9, Amersfoort 1980.
fig. 5: fig.11c in: W.A.van Es & W.J.H.Verwers, Excavations at Dorestad 1. The Harbour: Hoogstraat I. Nederlandse Oudheden 9, Amersfoort 1980.
fig. 6: fig.10c in: W.A.van Es & W.J.H.Verwers, Excavations at Dorestad 1. The Harbour: Hoogstraat I. Nederlandse Oudheden 9, Amersfoort 1980.
fig.7: after fig.21 in: W.A.van Es & W.J.H.Verwers, Excavations at Dorestad 1. The Harbour: Hoogstraat I. Nederlandse Oudheden 9, Amersfoort 1980.
fig.8: after fig.21 in: W.A.van Es & W.J.H.Verwers, Excavations at Dorestad 1. The Harbour: Hoogstraat I. Nederlandse Oudheden 9, Amersfoort 1980.
fig.9: fig.15c in: W.A.van Es & W.J.H.Verwers, Excavations at Dorestad 1. The Harbour: Hoogstraat I. Nederlandse Oudheden 9, Amersfoort 1980.
fig.10: fig.16c in: W.A.van Es & W.J.H.Verwers, Excavations at Dorestad 1. The Harbour: Hoogstraat I. Nederlandse Oudheden 9, Amersfoort 1980.
fig.11: after fig.21 in: W.A.van Es & W.J.H.Verwers, Excavations at Dorestad 1. The Harbour: Hoogstraat I. Nederlandse Oudheden 9, Amersfoort 1980.
fig.12: after fig.21 in: W.A.van Es & W.J.H.Verwers, Excavations at Dorestad 1. The Harbour: Hoogstraat I. Nederlandse Oudheden 9, Amersfoort 1980.

Dover

Dover as a town was created in Roman times, in the first century AD. Before that there was occupation of the area in prehistoric times, and particularly in the Bronze Age, about 1600-1000 BC, when there was a maritime use of the river valley and the coast. A well-preserved Bronze Age plank-built boat was found in the river valley associated with a fresh-water environment, and in the sea was a large concentration of bronze artefacts suggesting the site of a wreck, though it is possible that it was a hoard of weapons and tools that had once been on land and had fallen into the sea due to erosion. Dover

Very limited archaeological research in Dover has occurred in the distant past, and these alone do not give a clear picture of the topography of the Roman port. From 1970 onwards a major programme of excavation, particularly by Brian Philp but also by the Canterbury Archaeological Trust, has transformed our understanding of the port. The Classis Britannica forts with its barracks, the Saxon Shore fort and the medieval defences have all been found. Little new work has occurred on the waterfront structures, however, so the harbour works remain largely unknown. Dover



The shape of the Roman harbour is not known. Remains of Roman timber structures have been found in the bottom of the valley suggesting that there was a harbour at the mouth of the River Dour, with a quayside on the river bank. Structures include a possible harbour arm, found in 1855, which may have been about 4m wide, built from squared timbers in a box-like construction. Dover

The possible quay with an embankment wall of chalk blocks was found elsewhere, and on yet another site was a possible jetty also of chalk blocks. All possibly date from the late 1st - 2nd centuries AD.

P. Marsden Dover

See this text in Eretria

The site of Eretria, ancient city of Euboea, has been identified from the point of view of archaeological excavations with the modern town situated 20 km southeast of Chalkis in Cental Euboea. Eretria

Eretria stretches along the west end of a narrow coastal plain. Surrounded by the mountain chain of Euboean Olympus to the

north and west, it is dominated to the east by Mount Servouni, a southern offshoot of the mountain range of Dirfis. Its southern side is washed by the Gulf of Euboea that divides Eretria from the coasts of Eastern Attica.

The coastal plain is overlooked by the calcareous hill of Kasteli. On that site, as revealed by archaeological finds, stood the acropolis of Eretria in classical times. The hill, inaccessible from the north, together with three gulfs to the south, and a number of rocky islets provided a unique fortification that commanded the sea route to the southern part of the Gulf of Euboea, as well as the road axis that stretched from Central Euboea to the southeast.

Eretria

Human presence in the area of Eretria dates to the proto-Neolithic Period. On the site of present-day Eretia and in the vicinity of the Temple of Apollo Daphnephoros were found traces of a settlement dating to the Early Helladic I; said settlement expanded in Early Helladic II to the north and south, occupying the hill of classical acropolis and the Pezonisi islet.

In ancient Greek texts, mention of Eretria was first made in the Homeric works (Iliad B, 537), as one of the cities of Euboea that took part in the Trojan War.

In the 9th and 8th century BC the town flourished greatly due to extensive maritime commerce. Its maritime wealth is evidenced by the close relations it developed with areas of the Eastern Mediterranean, mainly Syria, Palestine and Cyprus. Eretria also experienced prosperity in the 8th century, it participated in the second phase of the Greek colonization together with Chalkis and established in the Gulf of Neapoli the colony of Pithikouses (modern Iskia). In northern Aegean, the most important colony of Eretria was Mendi in Chalkidiki.

The Eretrian supremacy at sea, resonant of the events that took place in the geometric and early archaic period, enjoys particular mention in the ancient Greek texts.

The name of the town itself is derived from the noun "Eretmon" (*in Greek oarsman*) and according to archaeologist Nikolaos KONDOLEON it aims to show the "town whose inhabitants never cease to row".

The pure maritime character of the city is attested on the one hand by the cult of Eretrian hero Nafstolos in the area of the closed port, and by the principle of "Aynafton" (*in Greek eternal sailors*) on the other. This epigraphically substantiated principle has been intertwined with Eretrian navigation since the 6th century BC. According to the relevant inscription which was discovered on a modern wall in the area of the present-day port, the Eretrian fleet dominated during the first half of the 6th century BC the northern and southern passage of the Euboean Gulf to the open sea.

In the course of the Ionian revolt against the Persians, Eretria offered its support to the Ionian population by contributing five triremes, something which accounted for the town's subsequent destruction by the Persians in 480 BC. In the Battle of Artemisium Eretria participated with seven triremes. It further joined the First Athenian Alliance which it later deserted in 411 BC, a time at which the Spartans

destroyed the Athenian fleet in the Eretrian port. In the wake of 411 BC the first Euboean league was set up, with Eretria as its capital. Between 377 and 357 BC, Eretria [was brought into] remained a member of the Second Athenian Alliance, while in the time-period 341-338 BC the Euboean League was reconstituted.

Conflict over the control of Eretria's strategic position arose among the Macedonian kingdoms during the era of successors, and the town was thus rendered a bone of contention.

Of equal importance in the history of Eretria was the dominance of cynical philosopher Menedemus in the early 3rd century BC, who was later forced into exile (274 BC).

In 198 BC the town was taken and destroyed y Lucius, brother of the Roman hero in the Battle of Pydna Titus Quinctius Flamininus. The latter accorded Eretria a certain degree of independence and set up again the Euboean League with which the town of Eretria allied itself.

Although Eretria did not manage to sustain itself to the same level of prosperity and power, it continued to occupy the same geographical site until the 7th century BC; at that time-period fear for pirate raids drove its inhabitants to move farther inland and seek shelter on the forested slopes of Eretrian Olympus.

The studies on the ancient port coincide with the beginning of the topographic study in Eretria. The first scientist who studied the visible port installations and made mention of a closed port was the American archaeologist john Pickard in 1890. Eretria

A number of other studies followed, notably those conducted in the early 20th century by county engineer Athanasios GEORGIADIS who linked his name with the port's study. His research on the chronology of Eretria's port installations (he pointed out that the western jetty was a project of the 5th century BC) was widely used and constituted the basis for every later text that dealt with the town's port. As regards the chronology of the port facilities in classical times, as well as the chronology of the waterside alterations that were carried out in the course of the last 5000 years, the studies of Clemens Crause are of equal significance. According to the latter's estimations, the eastern and coastal wall dates between the late 5th and early 4th century BC.

Yet, the most pivotal study, notwithstanding certain chronological inaccuracies, was conducted by Evangelos KAMBOUROGLOU, who offered a final image of the geological changes that the Eretrian land underwent and provided information on the coastal geomorphology of the area in antiquity.

Ινιωτάκης Πολυχρόνη / Iniotakis Polychronis Eretria

Topography:

Guernsey

Country

Guernsey is one of a group of islands collectively known as the Channel Islands, which lie in the English Channel, 25 miles off the western coast of the Cotentin peninsula of Normandy, and 60 miles from mainland Britain. Guernsey was defined as an island around ten thousand years ago, by rising sea levels after the Pleistocene glaciations. Jersey, now the largest of the Channel Islands, remained attached to the French mainland by a spur of land until some 2000 years later.

Locality

The Roman harbour was situated in what is now the town and parish of St. Peter Port on the east coast of Guernsey. Boats could be beached between the natural reefs in an area near to a freshwater stream. The island's position provided an ideal stopping off point for vessels en route from France and Iberia to Britain. The harbour was (and still is) a natural haven in the

dangerous waters around the Channel Islands. Among the natural hazards for sailors there are strong and variable currents, caused by a huge tidal range flowing between the many rocks and islands. The St Peter Port anchorage is sheltered from the prevailing westerly winds and the approach was defined by prominent landmarks and sheltered by other smaller islands opposite the harbour.

Findspot and co-ordinates

A Gallo-Roman trading vessel *Guernsey 1* was located within St. Peter Port harbour, about 60m south of the modern northern harbour arm known as 'The White Rock' (coordinates of the site are 49□ 27.41' N, 2□ 31.46' W and UTM 345 784).

Oro-hydrography

The area of the harbour is bounded on the north and south by fresh water streams and a sandy area formed a long strand below a cliff which rose quite steeply behind. Further to the north, areas of marsh land were probably navigable some way inland to small craft. The Channel Islands currently has one of the highest tidal ranges in the British Isles, with tides up to 3 metres giving substantial drying areas at low water but a good depth at high water. There is no reason to suppose that the situation was substantially different in Roman times although there is evidence in the St Malo area at St Servan (Alet) that sea levels were lower in the Early Iron Age period.

Several Roman Wreck sites have been located around Guernsey but local diver, Richard Keen, discovered the trading vessel

Guernsey

Guernsey 1 in 1982. It was located between the pier-heads of St Peter Port harbour and suffering badly from the scouring action caused by the overhead passage of harbour traffic. The Guernsey Maritime Trust was formed to rescue the wreck from destruction and excavation work began in 1984, under the direction of Dr. Margaret Rule. The final timbers were raised in 1985 and, together comprise a substantial part of the aft bottom of a Roman cargo ship. The surviving length amounts to about 18 metres with at least 4 metres of the bow missing. Dr Jason Monaghan, a Guernsey

based archaeologist co-ordinated much of the post-excavation research on the wreck and its contents, on behalf of the Guernsey Maritime Trust. He also co-authored the excavation report (with Dr Margaret Rule) which was published by Guernsey Museums & Galleries as a monograph. The Guernsey Museum Service now has the archive and artefacts from the ship in it's care.The wreck timbers themselves are now undergoing conservation at The Mary Rose Trust in Portsmouth. The programme will take approximately four years and includes immersion in PEG (polyethyleneglycol) and freeze drying. However, many of the small finds from the wreck site have already been conserved and some are on display in the Maritime Museum at Castle Cornet which is located only a hundred metres from the wreck site. The Guernsey Museum Service is hoping to display the wreck when it is conserved in a new museum telling the story of the development of St Peter Port harbour. The next phase of research on the wreck is underway consisting of:

- dendrochronology which will help with the dating of the ship and its provenance
- re-examination of the conserved timbers
- re-assembly of the conserved timbers
- scale models of the timbers
- comparison of other vessels
- research on a possible reconstruction model which would help to estimate the performance of the ship

Guernsey

There are some structures surviving, which can help to throw light on the ancient harbour. Excavations at La Plaiderie, St. Peter Port, have revealed Roman harbour-side structures, which appear to have been in use throughout the second and third centuries AD. Two buildings interpreted as quayside warehouses stood on the foreshore on the edge of the Roman town. The whole complex would have been close to the water's edge during its lifetime, most certainly being a large trading establishment on the route between north western Gaul and southern Britain. More recent finds from the Bonded Stores, in the heart of St. Peter Port, suggest that the Romans were established in Guernsey from the first to the fourth centuries AD, and traded goods are ever present – amphorae from France, Italy and Spain, pottery from France, Germany, Spain and Britain. These recent archaeological discoveries confirm the importance of St. Peter Port as a port of call throughout the Roman era. The Gallo-Roman vessel *Guernsey I* has been dated to the 3rd Century AD on the evidence from coins and pottery. Dendrochronological sampling will help to confirm the date of the ship and its provenance. Remains of other Roman shipping

have also been found, most notably the 'Little Russel Amphora Wreck A', which still lies just outside the harbour, and produced material from the late 1st/early 2nd centuries AD.
Several almost-complete amphorae of Beltran type II, together

with a number of amphora fragments and other pottery sherds, were recovered from the wreck.

Half a mile north of the present St Peter Port harbour a heavily corroded anchor was found with a late Roman mortarium sherd attached. Guernsey

Even though we have no tangible evidence for structures on the harbour front in Roman times, it is relatively certain that the area of the inner modern harbour was used then, and possibly even well before Roman times. Boats, before the 10th and 11th Centuries (when they increased in size and complexity), could easily have used the beach to be run aground and unloaded. It is only later, that ships would have needed structures and a stabilised waterfront. Guernsey

As a landing place, St. Peter Port harbour possesses the natural advantages such a port would need to accommodate Roman ships. It offers natural shelter from prevailing westerly winds, boats could have been beached, and it provides sailors with a number of easily recognised landmarks. There is, for example, the large rocky islet on which Castle Cornet is now situated, protruding out of the sea, which could easily have been seen when approaching the eastern coast of Guernsey. There would also have been access to fresh water, with a stream running into St. Peter Port harbour in Roman times - and the proximity of a Roman settlement would have meant that there were materials and manpower close by, to service and possibly repair ships and load/unload cargo. The fact that prehistoric and Roman settlement took place so close to the waterfront leads us to assume that St. Peter Port harbour was as relatively busy in prehistoric and Roman times as it is today, even though there are no visible structures surviving from that time.

See this text in Gytheion

Topography

Ancient Gytheion is located on the southern corner of the Peloponnese and the northwestern coast of the Laconian Gulf.

The first evidence of trade in the area date to the Bronze Age, when Lapis Lacaedemonius, which was quarried locally at the nearby cities Krokeai and Psephi, was exported at Crete and Mycenae. Later the natural harbour of Gytheion became the center of the Phoenician trade in purple dye. Gytheion

During the second half of the 8th century BC, the area around Sparta including Kythera, eastern Peloponnese and the land west of Cape Malea, were ruled by Argos. Sparta that needed a southern outlet to the sea conquered Helos, at the mouth of Eurotas River, and Las. In the beginning of the 6th century BC, the flourishing trade in Laconian pottery, and its increasing needs, suggest an active harbour at Gytheion.

Xenophon reports that the Spartan fleet was based at Gytheion. There is archaeological and historical evidence to support that Gytheion was active during the Peloponnesian War, the Hellenistic and Roman times. There is evidence for the existence of the commercial and military harbour until 374-5AD, when an earthquake destroys it, and a considerable part of the city is covered by the sea.

The Greek archaeologist A. Skias was the first one to locate and publish part of the submerged walls of ancient Gytheion in 1891-2. In 1969, N.C. Flemming of the British National Institute of Oceanography examined the changes at the sea level during the last 2000 years in Greece. In his study he used archaeological evidence to reconstruct the ancient coastline of the Peloponnese. The preliminary research and the first systematic attempt to map the area of Gytheion using sonar and divers took place in 1971 (Skoufopoulos & Edgerton 1972). The next year the survey was continued in an attempt to examine the ancient harbour (Skoufopoulos & McKernan 1975). Gytheion

There is disagreement between archaeological and historical evidence, concerning the harbour at Gytheion. Although ancient writers consider it a Spartan military harbour, no positive archaeological evidence has been found as yet. This disagreement is probably caused by the partial survey of the area and the lack of excavation. Gytheion

Θεοδουλου, Θ. / Theodoulou. Th. Gytheion

See this text in Halileis

Topography

The city of Halieis is located in the southern end of the Argolic peninsula, southeast of the Argolic bay, opposite Porto Cheli, at the closed bay that forms a natural harbour. It is 84km southeast of Nauplio, and 7km south of Kranidi.

The city of Halieis was founded short after the Persian Wars by Tirynthian refugees, after the submission of their city at Argos. Halieis join the Spartan League, when their city is captured by the Spartan Aneristos with one ship. After the 4th century BC the city declines and according to Pausanias it is abandoned at his time. However, there is some archaeological evidence that there is a small occupation during the Hellenistic and Roman and early Christian Times. Halileis

The first excavations at the area took place in 1958-9 under the supervision of N. Verdelis, the head of the Department of Antiquities of Argolid and Corinthia. Since 1967, the universities of Indiana and Pennsylvania took responsibility for the archaeological research at Halieis, at Porto Cheli. Halileis

Although the theory that the above mentioned two towers formed the entrance of a small, shallow, enclosed harbour, is widely accepted, Frank Frost (1985) has challenged it in the First International Workshop of Ancient Mediterranean Harbours at Ceasaria Maritima. According to him, the archaeological evidence does not support the existence of a harbour and the vicinity of the two towers could possibly be the market place. Halileis

Θεοδουλου, Θ. /Theodoulou, Th. Halileis

Introduction Israel-Harbors

The Mediterranean coastal region of Israel has an extended maritime history of about 4000 years. Trading, fishing and shipping activities have left an abundance of wrecked vessels, cargoes, anchorages and port installations that are threatened by

marine erosion, treasure hunters and intensive coastal development. Underwater surveys and excavations revealed numerous archeological sites and artifacts that shade light on the history of seafaring, ancient navigation, technology and material culture of the coastal inhabitants. The archeological material is concentrated within a narrow strip of c.180 km long and 200 m wide close to the shoreline.

The Israeli coast is straight and gently graded with the exception of the Haifa Bay, which is open and does not provide shelter. Along the coast there are no islands or bays to provide natural shelter for watercrafts during heavy storms. Israel-Harbors

In the coastal plain there are several *kurkar* (sandstone) ridges running parallel to the shore. Some of these ridges are partly submerged forming small islets and discontinuous reefs at 150 to 600 m offshore. Some of these ridges may provide partial protection to anchoring vessels.

Several rivers are running east west across the coastal plain. Most of them are generally dried, except during the winter rainy seasons when they are occasionally flooded by heavy rains and their outlets tend to clog with sea born and alluvial sediments.

Underwater and coastal research carried out during recent decades enabled us to classify the ports and anchorages into five main categories (Galili & Sharvit, 1991): Israel-Harbors

1. Man-Made Built Harbors: quays, breakers, jetties, etc. These facilities were constructed most probably by the ruling authorities starting at the Persian period. Three such harbors were found at Akko, Atlit and Caesarea (see map).
2. Proto - Harbor (3-7 m water depth): Usually the lee side of a *kurkar* ridge partly submerged at some distance offshore, with some man-made improvements provided a good shelter and mooring. Such anchorages were used since the Middle Bronze Age for night mooring by sea-going vessels or crafts waiting for proper sailing winds. Remains of related features were found at Caesarea, Apollonia, Yavneh Yam and Tel Ridan (see map).
3. Deep Water Natural Anchorage (4-10 m water depth): Usually the lee side of *kurkar* ridges partly submerged forming small islands offshore provide a protected anchorage. This type of mooring was used as early as the Middle Bronze period. Its function was similar to Type B. Remains were found at Achziv, Atlit, Neve Yam, Dor, Ma' agan Michael, Caesarea, Michmoret and Jaffa (see map).
4. Shallow Water Natural Anchorage (1-4 m water depth): Suchlike anchorages are created by utilizing minor natural features found close to the coastline

(bays, abrasion platforms, etc.). Associated features were common along the Israeli coast (see map), and have been used in ancient times by fishermen and lighters unloading cargoes from offshore-anchored large watercrafts. Traditional fishermen currently use such features.

5. Open Sea Anchorage: submerged *kurkar* ridge, 200-600 m offshore, with its peak at least 4-12 m beneath the sea level. Feature like this provides an optimal holding ground for ancient stone anchors. Ancient watercrafts especially chose such places for anchorage in areas where no shelters or port facilities were available and the sea bottom was silty or sandy. Anchorages of this type were found in the southern coast of Israel (see map).

Discussion

Some scholars suggested that rivers beyond their outlet served as inland harbors during the Bronze Age (Raban, 1985). There are other researchers who reject this assumption for reasons outlined bellow (Galili, 1986):

1. Thus far no evidence for the existence of such river-harbor was ever detected.
2. Hundreds of stone anchors recovered from proto-harbors and anchorages of types C, D and E suggest that these mooring basins were used during the Middle Bronze Age.
3. Underwater and coastal investigations indicate that in general the coastal riverbeds were shallow and could not serve as inland harbors for substantial watercrafts.
4. As mentioned previously sandbars obstruct most outlets of the coastal rivers most of the year. Unclogging those obstacles is a complex and expansive task even today and more so in antiquity.

The coast of southern Levant had been a busy sea route at least for the past five four thousand years. The shortage of natural shelters along coast and the strong winter storms were an everlasting problem. Therefore various solutions were demonstrated by ports and anchorage typology enumerated above.

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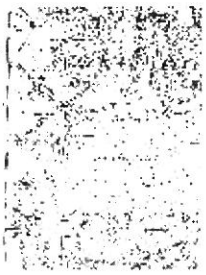
Israel-Harbors

See this text in

Kenchreai

Topography

Kenchreai are located at the northeastern end of the Peloponnese, southeast of Corinth, at the bay of Kenchreai, in the Saronic Gulf.



According to Pausanias, both the harbours of Corinth, Lechaion and Kenchreai, took their name from Leches and Kenchias, the children of Poseidon and Peirene, the daughter of Acheloos (or Oibalos). The first small settlements in the area from Isthmia and Kenchreai until Corinth appear as early as the Bronze Age. These settlements however, have not been studied, surveyed and excavated systematically as yet. Kenchreai share the history of Corinth. The major harbour of Kenchreai has not been surveyed as it has silted up. After 44/3 BC, a new harbour developed North of the aforementioned natural port, which continued to function. The second harbour has been studied in detail. Kenchreai

The eastern port of Corinth has been surveyed and excavated by the University of Chicago and Indiana University for the American School of Classical Studies at Athens, in the years from 1963 to 1966 and 1968. Kenchreai

There is only limited evidence of absolute chronology. Examination of architectural and ceramic evidence suggests that the south and north moles were Roman and were built at the same time. Kenchreai

The study of the literary sources offers only limited evidence regarding the history of Kenchreai, as the city independently from its function as Corinth's harbour, is only mentioned briefly.

Θεοδουλου, Θ. /Theodoulou, Th. Kenchreai

Kition

See this page in

The French Archeological School of Athens began excavations at the site of Kition

Pampoula in 1976.

Θεοδούλου Θ. / Theodoulou, Th. Kition

Kourion

See this page in

The only underwater survey for the harbour remains was undertaken by J. Leonard (Leonard 1995, 137-138). Kourion

Of course this hypothesis can only be proved after further detailed investigation. It is quite possible that the harbour was abandoned when Episkopi succeeded Kourion, during the Byzantine Period. Mediaeval travellers often mention the anchorage of the new town on their way to Limassol. Kourion

Θεοδούλου Θ. / Theodoulou, Th. Kourion

Kyrenia

See this text in

The only research that was done at the harbour was a brief survey made by the team of Linder and Raban in 1971 (Raban 1995, 166). It is alas reffered to Nicolaou's Kyrenia

catalogue of Cypriot Harbour.

In conclusion it may be seen that Kyrenia existed as an unimportant Classical city that as a consequense, was overshadowed by the neighbouring kingdom of Lapethos. By the end of the Classical period Kyrenia began to compete with Lapethos, and by 315 BC the city was under the rule of an independent king. This would confirm Pseudo-Skyllax's comments, providing that he was referring to the mid 4th century. Under the influence of a new independence new harbour works and reconstruction was undertaken, as the pottery evidence suggests. Similarly, the evidence provided by the Kyrenia wreck, that travelled and eventually sunk at the end of the 4th century, also indicates a new maritime capability most likely provided by the Kyrenia harbour (Katzev 1972). The cargo of the wreck revealed a quantity of almonds, that gave a C14 date of 288 +/- 62, whereas coins were also found of Antigonos Monophthalmos and Demetrius the Besieger. It is most likely that these same installations and harbour facilities, with Roman additions, were the ones referred to by *Stadiasmos*, noting that Kyrenia was a city with a "ὑφορμο" (harbour?). Kyrenia

Θεοδούλου Θ. / Theodoulou, Th. Kyrenia

Lapethos

John Myers and Menelaos Markidis made excavations in the area at the beginning of the century. Between 1957-1959 Nicolaou made surveys in the region and found traces on the coast of buildings which he believe to be fishtanks. The publication of these fishtanks also included a report that sections of the ancient harbour were still visible. In 1971 Raban and Linder also undertook surveys in the area. Lapethos

Θεοδούλου Θ. / Theodoulou, Th. Lapethos

See this text in Lechaeon

Topography

The area of Corinth was already populated from the Prehistoric period. The ancient settlement, much as the modern city, developed on the 'bridge' that connects the Peloponnese with continental Greece. The harbour of Lechaeon is situated to the west of the modern village of Old Corinth, and to the south of the old national road Corinth-Patrae. To the east of the harbour lies the well known prehistoric settlement of Korakou (Blegen, 1921). West of the prehistoric settlement, and south of the road, is situated the necropolis of ancient Lechaeon (7^{th} - 4^{th} century BC). The Roman necropolis is further west, and a Mycenaean tomb is reported to the area west of the harbour, next to the sea.

The excavations of Skias revealed two roads that reached from the city to the harbour. The first is the "Lechaeon Road' that is commented on by Pausanius, (II, 3, 4), and a second road between the main and western wall. The Lechaeon Road reaches roughly the center of the harbour complex to the south. A modern road still follows the same path as the Lechaeon Road. The second road follows the line of the western wall whereby as section of the road intersects the Lechaeon Road just before the harbour, nowadays in the area to the south of the old national road.

An important factor of the area was the ability to access both the Gulf of Corinth to the west, and the Saronic Gulf and the Aegean to the east. The rapid growth of the area is already noticeable during the Geometric Period when the ports of Kenchraie and Lechaeon are formed, each taking the name of one of the two sons of Poseidon and Perini (Pausanius II, 2). As Strabo indicates, it was due to these two strategic harbours that Corinth played the important historical role in the affairs of the ancient world (Strabo VIII, C378, 20). The variety of technical possibilities that the Corinthians developed in relation to the sea can be witnessed by the discovering of trereme (Thucididies History I.XIII.2), the construction of the "diolcos", and the artificial construction of an internal harbour at the marshy site of Lechaeon. The vitality and importance of Corinth may also be understood through her extensive colonies that spread throughout the Mediterranean, her role as the leader of the Achaean League, and the development that was undertaken during the Roman Period.

Lechaeon

Primarily the American School of Classical Studies and the Hellenic Archaeological Service have undertaken surveys and excavations in the area of ancient Corinth. The site of the harbour of Lechaeon, although a protected archaeological zone, has yet to be surveyed by any official organization. A mapping of the area was undertaken by Georgiadis in 1907, and several archaeological observations were made by Pallas concerning the harbour during the excavations of the Basilica of the Martyr Leonides (Pallas, 1963). A comprehensive bibliographical survey was published in the *Enalia* (Theodoulou 2002).

The marsh that existed in the area seems to have been transformed into a closed internal harbour during the Archaic period. During the Roman period a second phase of construction took place, whose remains are visible today. The construction of other features, as well as maintenance construction of the harbour took place throughout the history of the port. From the inscription on the plinth of a statue, for instance, it is clear that during the 4th century AD the Corinthians honoured, "Φλάβιον Ἑρμογένην τὸν λαμπρότατον ἀνθύπατον... τὸν εὐεργέτην καὶ κτίστην τοῦ λιμένος..."(Kent J.H. 1966, 164, pl. 42). This refers to a Roman officer who undertook a series of constructions at the harbour. Lechaeon

Of the two harbours that Corinth had at her disposal, Lechaeon must have been of prime importance since it offered access to the Gulf of Corinth. The distance from the harbour to the city was small (Strabo IV, C380, 21), and offered access to the colonies founded by Corinth to the west, without the interference of Corinth's rival, Athens, and her navy. This vast harbour complex is unique in Greece, and offers an example of the similar technical achievements displayed at the harbours of Ostia, Caesarea, and Carthage. A survey and research of the installations built during the Archaic period would certainly shed light on the technical and constructive abilities concerning harbour works of this period. The harbour of Lechaeon was utilised until the Frankish occupation when, due to new trade routes that circled the Peloponnese and the more advanced ships that were used, the harbour began to decline. The decline of the port is further indicated by the construction during the Venetian period of a fort to the west of the harbour. This area was known as "karavostasi" (a place where ships stop), and reveals that the vessels of the period, either due to size or the dilapidated state of the harbour, anchored outside the fort, although the use of the harbour by small fishing vessels would have continued unabated.

Θεοδουλου, Θ. /Theodoulou, Th. Lechaeon

Topographie Leptis-Magna
Volksrepublik Lybien
heutiger Ort: Râs el-Hammâm (Homs)
Koordinaten: ca. 12° 35' N - 30° 25' E

Von den Ruinen in Leptis Magna sind seit dem 17.Jh. diverse französische (C.Lemaire), später im 19.Jh. auch englische (H.W.Smyth) und deutsche (H.Bath, Roths) Reisebeschreibungen überliefert (hierzu s. P.Romanelli). Archäologische Tätigkeiten, insbesonders im Gebiet des Hafens, wurden verstärkt unter italienischer Leitung durchgeführt 1922-1923, 1949-1953 (tachymetrisches Aufmaß 1952). Leptis-Magna

Leptis-Magna

Das Hafenbecken wurde dadurch angelegt, in dem die rechte Uferseite im Laufe der Benutzungszeit (vermutlich schon ab der phönizischen Epoche) künstlich nach Osten erweitert wurde. Ursprünglich eine trichterförmige Flussmündung mit davorgelagerten breiten Riffen, begann der Ausbau zum Hafen in der früheren Kaiserzeit und fand seine endgültige Form mit der im wesentlichen wohl severischen Neuregulierung des Stadtplanes. Die leichten Geländeanhöhen im Süden und Osten könnten somit durch den anfallenden Aushub entstanden sein.

Leptis-Magna

Genaue Datierungspunkte liegen nicht vor. Während die Nordseite mit der inschriftlich unter Nero (54-68 n.Chr.) errichteten Porticus vermutlich aus neronischer Zeit stammt (zu anderen neronischen Häfen vgl. Ostia, Anzio), so entspricht die heute noch sichtbare polygonale Ausgestaltung größtenteils vermutlich dem römisch-kaiserzeitlich (d.h.severischen) Ausbau. Hierfür spricht die städtebauliche Konzeption und die Anlage der heute noch sichtbaren Hafenanlage am Ende der Säulenstraße mit dem Leuchtturm auf der Westmole als optischem Endpunkt. Welche Bedeutung dem Leuchtturm zugesprochen wurde, kann man an dem sog. Triumphator-Relief erkennen. In der spätantik-frühbyzantinischen Periode treten in Leptis Magna die Befestigungsmauern als ein zusätzliches Element innerhalb des Hafens hinzu (vgl . Aquileia).

Leptis-Magna

Der Hafen bestand aus vorgelagerten Molen (Wellenbrecher) und von einem ausgebauten Hafenbecken mit verschiedenen Kaimauertypen und den daran anschließenden Nutzbauten. Der Hafen wurde unter Benutzung der vorgelagerten Riffe zu einem geschlossenen Becken ausgestaltet (ca.102.000 qm), dessen vieleckige, von gemauerten Kaimauern umschlossene Form ein wenig an den trajanischen Hafen von Portus (Ostia) erinnert.

Leptis-Magna

Südseite: Nach ca. 80 m von Westen nach Osten werden aus den acht Stufen für weitere 44 m zwölf Stufen und bilden somit eine festlich anmutende Freitreppe. Im Anschluß führt eine 20 stufige Freitreppe zu einer Plattform ca. 4.80 m üNN, auf welcher der Tempel des Jupiter Dolichenus stand. Architekturfragmente und Inschriften weisen auf eine Existenz schon vor dem sev. Umbau hin. Dies erklärt teilweise die unterschiedliche Ausrichtung der Kaianlagen und der anschließenden Gebäude.
Nördlich der Ladenzeile auf der Ostseite steht ca. 13.50 m ein Podiumstempel in antis mit vorgelagertem Altar in hellenistisch-dorischer Bauordnung.

Marcus Heinrich Hermanns Leptis-Magna

Topographie Mainz
Bundesrepublick Deutschland, Land Rheinland-Pfalz, Stadt Mainz
Koordinaten: ca. 50° 00' N - 08° 15' E

Diverse Funde bei städtebaulichen Unternehmungen (1962 Schlosserstraße, 1970 "am Brand", 1982 "am Kappelhof") Mainz

(keyword shipyard)
1962 wurde aus dem Gebiet der Schlossertraße ein Befund gemeldet, in dem von "Hölzern in der Art eines Knüppeldammes" die Rede ist. Noch im Mittelalter wurde dieses heute abseits des jetzigen Uferlinie gelegene Areal als Hafen oder Werft genutzt. Eine dendrochronologische Datierung dieser vermutlich als Slipway genutzten Hölzer (vgl. den antiken Befund in Marseille) liegt nicht vor.

Marcus Heinrich Hermanns Mainz

Marion

Excavations of the area have been undertaken by the Swedish Cyprus Expedition (Gerstad 1937, 287-288), the Department of Antiquities of Cyprus (Νικολάου 1964,131-187), and since 1983 the Princeton Cyprus Expedition (Childs 1988, 121-130, Childs 1999, 223-237). E. Linder and A. Raban carried out the only investigation of the remains of the harbour in 1971 (Raban 1995, 165). Marion

The remains of the ancient harbour can be detected 3km west of the settlement, at Lachi, which is the modern fishing shelter. Marion

Several questions are raised from the comparison of the results of the investigation and the references to ancient written sources. Firstly, it is not known whether Pseudo-Skyllax's information is of the mid forth century BC, or rewritten from earlier writers. However, the kingdom's wealthy presence during the Classical Period, along with its port facilities, is a fact that could not have been easily Marion

overlooked. Furthermore, according to the researcher, the harbour at Latsi was abandoned early in the Hellenistic period, when the "Dovetail" clamps resemble those used in the Amathous harbour, thus enabling the dating of the Amathous harbour to the early Hellenistic period.

Several proposals could be undertaken such as the inclusion of the port in the "Amathus Project" or "Paphos Project", or perhaps to search somewhere else on the Marion coast for the Classical port. These proposals could answer basic questions concerning the marine oriented Kingdoms, however nothing can be sure without further investigation. It is certain, however, that Marion – Arsinoe had a port or harbour until the end of Ancient Times witnessed by *Stadiasmos*. From then on, although the town existed, there is no reference to its harbour. Marion

Topographie

Marseille

Republik Frankreich, Departement Bouches-du-Rhone
heutiger Ort: Marseille.
Koordinaten: ca. 43° 15' N - 05° 15' E

Die griechische Kolonie, später unter römischer Herrschaft Massilia genannt, wurde um 600 v.Chr. östlich des Rhone-Deltas, an der durch einen kleinen gebirgigen Vorsprung geschützen Bucht (Lacydon) gegründet. Diese weist eine langgezogene, nord-südlich orientierte Form auf mit einem hinteren westlich abbiegenden Ende (das sog. corne du port). Es handelte sich somit um einen Küstenhafen (keyword sea port) mit sehr günstig ausgesuchter Lage an den Handelsrouten entlang der Südküste Frankreichs (Kontakte mit Iberern, Etruskern und Phöniziern), sowie nach Mitteleuropa über die Rhone entlang der "Zinnstraße" (Kontakte mit den Kelten und Angel-Sachsen).

Marseille

Die zeitlich unterschiedlichen Hafenanlagen traten durch diverse städtebauliche Eingriffe innerhalb der heutigen Großstadt zu Tage: Grabungen La Bourse, Place Jules Verne, Place Villeneuve-Bargemon. über dem römischen Lagerhaus mit den in situ belassenen Dolia befindet sich heute das Musée du docks romains. Marseille

Keramikfunde in den Schichten, welche an die Befunde anstoßen (hauptsächlich Verlandungsschichten, Sedimentierungen) Marseille

Bekannt sind Hafenanlagen aus archaischer, klassischer und hellenistischer Zeit. Marseille

Marcus Heinrich Hermanns Marseille

See this text in Methoni

Topography

Methoni lies on the southwestern end of the Peloponnese, on the peninsula of Messenia, and an embayment of the Ionian Sea. The human presence at the area dates to the Middle Bronze Age (around 1700BC). There is archaeological evidence supporting the city's existence from the Prehistoric Ages to the present. The Messenian Methoni will develop to a famous port during the Classical, the Late Antiquity and the Middle Ages. Methoni takes part at the Peloponnesian War, during the Hellenistic times joins the Achaean League, and the Romans grant her autonomy. Later, Byzantium grants Venice free trade at Methoni. From the 12th century AD, Methoni comes under Venetian rule and until 1828, is conquered twice by the Turks and twice by the Venetians. In 1828, Methoni is freed and shares the history of the rest modern Greek cities.

Methoni's harbour has not been systematically surveyed. In 1969, N.C. Flemming published his study 'Archaeological Evidence for Eustatic Change of Sea-level and earth movements'. In the abovementioned study, he examined the ways that archaeological evidence can be used to calculate sea level changes and reconstruct ancient coastlines, drawing examples from the wider area of the Peloponnese. Few years later, J.C. Kraft and S.E. Aschenbrenner examined the harbour of Methoni in an attempt to reconstruct Methoni's ancient coastline. N. Lianos (1987, 129-135) studied the harbour constructions of the Castle in relation to sea fortifications, such as Bourtzi and the Southern Gate. Finally, the Ephorate of Underwater Antiquities undertook survey at Methoni. Methoni

The dating of the ancient mole has troubled archaeologists. According to Kraft & Aschenbrenner (1977, 30) most researchers agree that both the archaeological and Methoni

historical evidence suggest a Roman date for the construction of the mole, somewhere between the 2nd and the 3rd centuries AD.

Despite the fact that this is an area of significant archaeological interest, research so far has had limited success, since archaeology has not been able to provide a stratigraphic sequence for successive periods and there is a lack of historical evidence in sequence for the most recent periods (Kraft & Aschenbrenner 1977, 24). Long term occupation of the area and continuous structural alterations have disturbed the archaeological record. This, in conjunction with limited research, has led to the partiality of the evidence.

Αργύρη Ξανθή / Argyri Xanthi

Methoni

Republik Italien, Region Kampanien, Provinz Neapel
heutige Orte: Miseno, Baia, Pozzuoli und nördliche Vorstädte von Neapel
Koordinaten: ca. 40° 55' N – 14° 05' E

Miseno-Puteoli

Der Küstenstreifen der Phlegräischen Felder umfaßt den gesamten Golf von Pozzuoli nördlich von Neapel. Die gesamte Küstenstrecke von Cumae bis Neapel hat im Laufe der Jahrhunderte tiefgreifende Veränderungen durch geologische Ursachen erfahren. Neben dem Vulkanismus ist dies der Bradysismus, die langsame Bodenbewegung. Letzterer hat intensiv gewirkt und das Versinken und die überflutung eines breiten Geländestreifens zwischen Pozzuoli und Miseno vor allem in der Bucht von Baia geführt (ca. 2 cm jährlich, insgesamt bis ca 8 m in der Bucht von Baia). Für den Vulkanismus sei hier□ u.a. die Entstehung des 140 m hohen Monte Nuovo zu nennen, der 1538 an der Stelle des antiken Lukriner Sees entstand und somit die Küste gänzlich neu gestaltete.

Miseno-Puteoli

Eine gebirgige Halbinsel bildet den nördwestlichen Abschluß der Bucht von Neapel, südlich der Bucht von Formia und Gaeta. Die weitgezogene Sichel des Golf von Pozzuoli bildet verschiedene kleinere Buchten , das Hinterland wird durch Berge vulkanischen Ursprungs abgegrenzt. Wegen der schwefelhaltigen Umgebung, der heißen Quellen und anderer vulkanischer Phänomene wurde die Region auch □campi phlegraei□ genannt. Bekannt war der langgestreckte, in diverse kleine Buchten untergliederte Golf zur römischen Zeit als mondäner Aufenthaltsort, archäologisch durch die Villenlandschaft wie Unterhaltungsinfrastruktur (Thermen,...) bestätigt ebenso wie literarisch überliefert. Heute ist dies eine eher triste Landschaft mit Vorstadtcharakter. Hinzu kommt die seit dem Mittelalter betriebene Schiffsausbesserung im Golf von Pozzuoli, deren Auswirkung in der Neuzeit zum modernen Schiffsfriedhof im (unterwasser-)archäologischen Park von Baia geführt hat.

□

Auf diesen Küstenabschnitt beziehen sich verschiedene Landschaftsdarstellungen in der Wandmalerei des zweiten pompejanischen Stils (vgl. Vitruv VII 5,2: □...pinguntur enim portus...□) aus Stabia, aus Pompeji und aus einer Villa vom Esquilin in Rom□ sowie die berühmte Serie von Glasgefäßen aus dem 3. bis 4. Jh.n.Chr., welche mit Souvenircharakter panoramaartig diverse örtlichkeiten dieser in der Antike mondänen Gegend wiedergeben (Pozzuoli, Baia, Miseno). Die Gläser wurden in Ampurias, Köln, Odemira, Ostia und Populonia gefunden und befinden sich jetzt in verschiedenen Museen der Welt. Das zahlreiche Auftauchen spricht für einen besonderen Bekanntheitsgrad.□

Hier zu besprechende Hafenanlagen: Militärhäfen von Misenum und "Portus Iulius" / Zivilhäfen von Pozzuoli (Puteoli) und Isola di Nisida□

Zur Versorgung eines großen Flottenverbandes gehört auch die Bereitstellung von Trinkwasser. Hierzu dienten die im Umfeld von Miseno angelegten großen Wasserreservoirs wie die sog. Piscina Mirabilis (Endpunkt des Serino-Aquädukts), die sog. Cento Camerelle" sowie die Grotta Dragonara.

Miseno-Puteoli

Marcus Heinrich Hermanns

Miseno-Puteoli

Topographie

Mozia

Republik Italien, Region Sizilien, Provinz Trapani
Koordinaten: ca. 12° 15' N - 36° 50' E

Insel San Pantaleo, vor der Westküste Siziliens. Privatbesitz der Stiftung Whitacker (Palermo, Italien)

Die flache Insel San Pantaleo (ca. 45 ha) liegt ca. 1 km vor der Westküste in einer weiten Bucht als Bestandteil des kleinen Archipels der Isole delle Stagnone ca. 8 km nördlich von Marsala (Kap Boeo), dem antiken Lilybäum und ca. 10 km südlich von Trapani. Zum offenen Meer durch die längliche Isola Grande geschützt bildet sich hinter dieser eine kleine, seichte lagunenartige Bucht (Stagnone di Marsala) in der die Inseln San Pantaleo, Santa Maria und La Scuola liegen. Die Insel San Pantaleo ist nach der Isola Grande die zweitgrößte, der zu besprechende Hafen liegt an der Südwestseite der Insel westlich des Südtores des Befestigungsmauerringes, der sich rund um

Mozia = Motye

diesselbe erstreckt.

Eine geomorphologische und /oder geophysische Untersuchung der Bucht steht noch aus, somit auch die Erkenntnis über die Zugänglichkeit der Insel von See. Die Bucht besitzt heute zwei Ausgänge, je einem in Norden zwischen der nördlichen Spitze der Isola Grande (Punta di Tramontana) und der Torre di San Teodoro, sowie einen im Süden an der südlichen Spitze der Insel (Punta dello Stagnone) und der Punta di Palermo /Punta d'Alga. Sowohl die Isola Grande wie auch die Isola Santa Maria erscheinen auf topograhischen Karten des 18.Jhs. (Baron Samuel von Schmettau 1719-21) und 19.Jhs. (Officio topografico di Palermo 1810, Officio topografico di Napoli 1818, William H.Smyth 1824, Julius Schubring 1866) verschiedentlich aufgeteilt. Ebenso auf nautischen Karten (F.Arancio 1845). Erst später werden diese Inseln als von einzelnen anthropomorph eingezogenen Salinenbauten verbunden dargestellt. Der antike Schriftsteller Diodorus (XIV 50) schildert den Angriff der Syrakusaner auf Mozia, bei dem die Hafeneinfahrt von feindlichen Schiffen versperrt wurde. Die Maßnahme, welche daraufhin die Verteidiger ergriffen um der Blockade zu entkommen, nämlich die Schiffe über Land ans offene Meer zu ziehen (vermutlich über die Isola Grande), läßt vermuten, daß die Bucht in der Antike nur einen Zugang von Süden her besaß und somit wie durch eine Halbinsel geschützt war. Mozia

Älteste phönizische Kolonie auf Sizilien. Der Küstenhafen besaß eine Mittlerposition zwischen der West-Ost-Verbindung (Südspanien-Levante), sowie an der Nord-Süd-Richtung (Karthago-Sardinien). Einschneidendes Ereignis war die Zerstörung 398 v.Chr. durch Dionys von Syrakus. Danach gab es nur noch eine spärliche Bebauung. Mozia

Das bis in die frühe Neuzeit als Saline (daher die Flurbezeichnung "salinella") genutzte Becken wurde 1906-07 schon unter der Leitung von J.Whitacker freigelegt (NSc 1915, 439f.). F elduntersuchungen mit archäologischen Fragestellungen fanden zwischen 1968 und 1971 statt (englisch-amerikanische Zusammenarbeit). Forschungsschwerpunkt waren Erkenntnisse zur Funktion, Datierung und Bauabfolge dieses Bauwerks. Mozia

Vermutet werden insgesamt drei Hafenanlagen: Mozia

- künstliches Becken in der Nähe des Südtores der Stadtmauer (51 x Mozia

35) aus regelmäßig behauenen Steinblöcken auf geglättetem Felsboden. Ein ebenso künstlicher Kanal verband es mit dem Meer. Ein künstlich angelegtes Hafenbecken wurden in der Antike "Kothon" genannt (Servius, Kommentar zur Aeneis I 427: "Cothona sunt portus in mari non naturales sed arte et manu facti", s. Karthago).

- ein durch Molen gesichertes Becken im Norden der Insel

- Ein weiterer Hafen wird im östlichen Bereich der Insel vermutet. Hier befindet sich eine im Gelände auffällige Senke (noch nicht untersucht).

Mozia

Die Interpretation der Keramikfunde aus stratigraphisch angelegten Grabungen an den Kaimauern weisen auf eine Erbauuung im späten 6.Jh. oder im frühen 5.Jh. hin (obere Schichten). Keramikfunde aus dem ca. 40cm mächtigen Schlick im ursprünglichen Kanal weisen in das späte 5.Jh. und frühe 4.Jh. (alles vor 397v, dem

überlieferten Datum der Zerstörung Mozias -Diodor XIV 50-). Zu dieser Zeit scheint diese Anlage nicht mehr in Betrieb gewesen zu sein, wurde doch der Kanal durch eine Mauer in der Flucht der Beckenbegrenzungsmauer verschlossen. Diese wurde unfundamentiert auf den Schlick aufgesetzt, welcher den ehemaligen sich bis weit in das Becken erstreckenden in den Felsen gehauenen Kanal füllte. Zwei aufrecht im Bereich des mittleren Kanals eingebrachte Steinsäulen trugen vermutlich seinerzeits eine Stegkonstruktion und ermöglichten somit den Übergang hinter der Befestigungsmauer. Ebenso lassen sich in der Mauerart zwei Bauphasen erkennen. Der jüngeren von beiden entsprechen die obengenannten Arbeiten. Das Mauerwerk ist hier überwiegend im Läuferverband verlegt.
Obwohl die chronologische Abfolge der Gebäude und ihre Zusammengehörigkeit (insbesonders das Verhältnis zur Stadtmauer) fraglich ist, scheint doch, daß die Anlage ca. zweite Hälfte - Ende des 6.Jhs. angelegt wurde. In einer ersten Phase war das Becken durch einen Kanal mit dem Meer verbunden (Mauerwerk im Binderverband). In einer weiteren Phase wurde das Becken vom Kanal durch eine Mauer getrennt (Schlickfunde 2.H.5.Jh.). Der Kanal wurde in der jetzigen Form ausgebaut.

Mozia

Der sogennante Kothon von Mozia war vermutlich eine Werft bzw. ein Trockendock (vgl. Thurioi -Sybaris-). Hierfür spräche der Sockel längst der Beckenwand, wo eventuell die Stützen darauf ruhten, um die Schiffe aufrecht zu halten. Jedoch weist auch die Kaiwand des Hafenbeckens in Karthago im unteren Bereich einen profilierten Sockel auf. In Zusammenhang mit den umliegenden kommerziell und handwerklich geprägten Vierteln wird dieses Bauwerk daher aber weiterhin häufig noch als Hafenbecken interpretiert (zu gemauerten, künstlichen Hafenbecken vgl. Karthago). Wie dieses Bauwerk auch interpretiert werden mag,

die beengten Maße ließen nur Schiffe mit max. Länge 19 m und max. B. von 4.50 m sowie einem geringen Tiefgang (2,30 m Tiefe insgesamt im Becken, 1,75 m im Kanal) in geringer Anzahl zu. So müßte im Falle eines Hafens von einer Umladetätigkeit auf kleinere und wendige Lastkähne auf Reede ausgegangen werden, welche den engen Durchgang durch den Kanal schneller und leichter bewältigen konnten. Eine weitere Interpretation -vorausgesetzt werden hier Vorrichtungen wie Schieberventile und dergleichen- ist die eines heiligen Sees mit rituell-religiöser Funktion. Fische und Wasser spielten in den syro-phönizischen Kulten eine besondere Rolle. Ebenso die rituelle Waschung eines Kultbildes. Nur gezielte, weitere Grabungen im näheren Umfeld dieses Bauwerkes könnten hier vermutlich eine Lösung erbringen, steht doch dieses Bauwerk bisher auch in der Urbanistik Mozias ziemlich isoliert.

Marcus Heinrich Hermanns

Mozia

Ostia-Claudio

Ostia-Claudio

Lo scalo fluviale di Ostia e il porto di Pozzuoli erano stati i due poli del sistema portuale della città di Roma per tutta l'età repubblicana. Mentre il secondo era troppo lontano e difficilmente raggiungibile, Ostia era inadatta e insufficiente alla gestione di un largo traffico di merci, perché attrezzata con una sola banchina. Le imbarcazioni di grande tonnellaggio erano costrette a trasbordare le loro merci su natanti più piccoli, che venivano tirati da coppie di buoi fino a Roma (sistema dell'alaggio).

Ostia-Claudio

Il porto di Claudio non è mai stato scavato sistematicamente e la storia delle ricerche di quest'area non può essere separata da quella che ha interessato il porto di Traiano.

Nel rendiconto della visita del Papa Pio II nel 1461 figura la più antica descrizione del sito. Vengono, infatti, menzionate le rovine del faro che si sarebbero trovate non lontane dal mare a causa dell'ancor limitato avanzamento della spiaggia. La stessa situazione venne rilevata da A. Danti nel 1582 in un famoso affresco nella Galleria delle Carte Geografiche del Museo Vaticano.
È infatti a partire dall'epoca rinascimentale che si susseguono una serie di carte e di ricostruzioni ad opera di famosi cartografi ed architetti (Mannucci 1987). Esse rappresentano importanti documenti per la conoscenza del sito.

Nel 1907, Carcopino eseguì una serie di saggi nel porto di Claudio ma essi furono troppo limitati per risolverne i problemi topografici.
Nuovi dati sulla topografia del porto di Claudio sono venuti dagli scavi del 1957, in occasione della costruzione dell'aeroporto « Leonardo da Vinci » di Fiumicino

(Lugli 1961; Scrinari 1960, 1971, 1979; Testaguzza 1970). In base a questi lavori, venne proposta una ricostruzione del bacino portuale con un solo ingresso situato a nord.
Castagnoli (1963) e Giuliani (1992), a partire dall'interpretazione delle fotografie aeree e dalla riconsiderazione della cartografia rinascimentale, hanno infine proposto una nuova ricostruzione, oggi generalmente accettata, che vede un ingresso principale a ovest e uno secondario a sud.

Ostia-Claudio

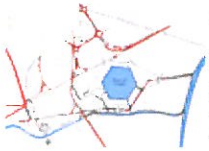
Ostia-Fluviale

Una grande cisterna, lunga 36 metri e larga 26, si conserva al di sotto dei Bagni di Nettuno sul lato settentrionale del Decumano, a metà strada tra Porta Romana e il Foro. Quando i bagni furono costruiti sotto Adriano questa cisterna non venne più utilizzata. Sebbene sia stata chiamata repubblicana essa data all'inizio dell'Impero. Non c'è traccia di altre cisterne simili a Ostia e questa grande riserva d'acqua doveva risolvere un problema specifico. Una tubatura in piombo corre dall'angolo nord-ovest in direzione nord-est verso il fiume. Gismondi ha suggerito che la cisterna venne costruita per rifornire di acqua potabile le navi che erano ormeggiate lungo la sponda del Tevere.

Giulia Boetto

Ostia-Fluviale

Ostia-Traiano



Ostia-Traiano

Oggigiorno, il porto di Traiano può essere raggiunto dalla capitale attraverso l'autostrada Roma-Fiumicino e la via Portuense, da Ostia e Fiumicino attraverso la via dell'Aeroporto.
In epoca antica, il porto di Traiano, costruito quale bacino interno rispetto al porto di Claudio, utilizzava quest'ultimo quale riparo in rada. Un canale navigabile, tenuto sgombro dai depositi portuali, collegava l'ingresso al bacino traianeo.

Ostia-Traiano

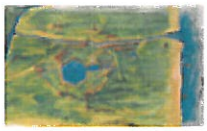
Il fallimento dell'impianto portuale di Claudio impose sotto il regno di Traiano, quindi dopo neppure cinquant'anni, una nuova progettazione dell'intero sistema così da renderlo consono alle esigenze sempre più pressanti di Roma e all'importanza raggiunta dai traffici marittimi internazionali.
Vennero considerate tutte le componenti negative caratteristiche dell'area, ossia l'incidenza delle correnti litoranee, i regimi del Tevere e la connotazione del suo delta, la natura alluvionale del terreno. Si decise quindi di costruire un bacino interno rispetto al porto di Claudio e collegato a quest'ultimo da un percorso articolato in modo da tenerlo sgombro dai depositi.
Al vecchio bacino venne sicuramente lasciata la funzione di rada, potendosi in parte

contenere i suoi problemi di insabbiamento con dragaggi periodici. Oltre al faro, che era divenuto ormai il simbolo stesso di Ostia-Porto, non si è in grado di individuare altre parti dell'impianto precedente reimpiegate nel nuovo assetto, anche a causa dei molti restauri resi necessari nel corso del tempo.
Per scongiurare l'impaludamento in caso d'alluvione e insieme per alleggerire il Tevere, al tempo di Claudio erano stati praticati due o più canali (fossae) con andamento dall'ansa del fiume a mare : non si può escludere, come suggerito da Testaguzza (1970) e Verduchi (1999) che nella ristrutturazione traianea almeno due di essi venissero riutilizzati diversamente, uno trasformato nell'attuale darsena e l'altro nel canale di collegamento con il Tevere, la Fossa Traiana (odierno canale di Fiumicino), per agevolare la risalita delle navi verso Roma.
Il nuovo complesso venne inaugurato nel 112, dopo almeno dodici anni di lavori, certamente non completato ma definito nelle linee principali. Il fulcro era rappresentato dal bacino esagonale interno, scavato per intero nella terraferma a breve distanza dal fiume.
Al di là dell'indiscutibile grandiosità e dell'elevato valore ingegneristico del complesso di Traiano, un dato di particolare interesse è costituito dalla razionalità dell'organizzazione dei percorsi, sia di quelli per via d'acqua, sia di quelli all'interno degli edifici di stoccaggio. Le navi da carico (onerariae) attraccavano alle banchine sui due lati del canale d'ingresso o a quelle del bacino interno, e le merci venivano immediatamente smistate ai magazzini, da cui ripartivano alla volta di Roma, dopo permanenze di varia durata legate al tipo e alla deperibilità del prodotto, su battelli di stazza minore (caudicariae), più adatti a risalire la Fossa Traiana e quindi il Tevere.
E' ormai accertato che il progetto traianeo comprendeva il molo traverso con un piccolo faro terminale, il canale d'ingresso al porto interno con le banchine adeguatamente attrezzate, la cosiddetta darsena, il bacino esagonale, il canale di collegamento con la Fossa Traiana e con ogni evidenza la maggior parte delle infrastrutture di SE e SO.
A partire dal 314, anno del Concilio di Arles, la città portuale fu resa autonoma da Ostia e diventò, per decreto di Costantino, a tutti gli effetti "Portus Romae".
In questo periodo venne posta la massima cura nel mantenere l'efficienza e garantire la sicurezza dell'impianto, che rappresentava la sopravvivenza stessa della capitale: per questa ragione venne costruito il primo circuito di mura difensive che dapprima comprese tutta l'area ma che progressivamente, di pari passo con l'incremento delle scorrerie barbariche e la conseguente necessità di trasferire immediatamente le merci a Roma senza soste nei magazzini, si ridusse al solo settore sud-orientale, costituendo il "castello di Porto" legato alle vicende delle guerre gotiche (VI secolo).

Infatti è accertato che dal V secolo tutte le operazioni portuali venivano svolte sugli unici due lati dell'esagono (quelli meridionali) che si erano potuti mantenere in efficienza. Le modifiche nella morfologia del territorio, l'avanzamento della costa e la mancanza di manutenzione conseguente al tracollo economico e politico di Roma portarono abbastanza rapidamente all'impaludamento dell'area e alla ricolmata quasi completa del bacino esagonale, che in epoca medioevale fu parzialmente adibito dalla diocesi di Porto all'allevamento dei pesci per osservare il precetto del venerdì.

Ostia-Traiano

Il porto di Traiano e il circostante insediamento di Portus non sono stati mai scavati sistematicamente. D'altra parte, la loro grandezza e l'importanza dei resti affioranti hanno costituito un forte motivo di attrazione per un gran numero di studiosi, almeno a partire dal XV secolo.




La più antica descrizione del sito riguarda la visita del Papa Pio II nel 1461 ; la prima pianta è quella di Giuliano da Sangallo eseguita tra il 1485 e il 1514 mentre la più antica ricostruzione è dovuta a Pirro Ligorio (1554). In seguito, le rovine furono sfruttate per il materiale da costruzione o per il recupero di opere d'arte.

Gli scavi del tardo XVIII e XIX secolo non ci hanno lasciato una documentazione completa. Tutto ciò che sappiamo lo dobbiamo al Fea e alla sua pubblicazione del 1824, mentre il Nibbi, nel 1837, incluse nella sua storia e descrizione delle rovine delle informazioni importanti su ciò che era venuto in luce fino ai sui tempi. Le ricerche di Lanciani, nel 1867, segnarono un gran passo avanti nella conoscenza della storia e della topografia del sito. Il suo resoconto, pubblicato nel 1868 insieme ad una pianta dettagliata del porto di Traiano, per lungo tempo è rimasto la fonte di referenza.
Nel 1856, la famiglia Torlonia acquisì il territorio e il sito di Portus. Durante i lavori agricoli allora promossi con il fine di bonificare l'area, furono messi in luce una parte degli edifici senza che nessun resoconto venisse pubblicato.
Quando il bacino del porto di Traiano, che nel frattempo si era trasformato in una palude, fu pulito e restaurato nella sua forma originale nel 1923, il Calza riuscì a studiare la struttura del molo prima che il bacino fosse nuovamente riempito.
Nel 1935 Lugli raccolse in un volume le notizie disponibili sulla storia del sito e descrisse le rovine.
Il passaggio di parte della proprietà Torlonia allo stato ha permesso la costituzione dell'Area Archeologica di Portus e moltiplicato le attività della Soprintendenza archeologica di Ostia al suo interno.

Ostia-Traiano

Giulia Boetto

Ostia-Traiano

See this text in

Paphos

Paphos

An amateur diving team of the British Army between 1959 and 1961 first surveyed the ruins of the ancient harbour of Paphos. Unfortunately the results of the survey were never published. A second survey was undertaken by the Polish professor Daszewski in 1965, however detailed plans and photographs of the site were never published (Daszewski 1981, 327-336). Even so, the survey provided valuable information of the ancient facilities before the construction of the modern harbour at the same site buried and destroyed most of it. Finally, the American University of Colorado, directed by Hohlfelder and Leonard, undertook underwater surveys of the site between 1991 and 1992. In 1996 the same programme made a geological survey of the harbour area with enlightening results (Leonard 1998, 141-157).

These two breakwaters were most likely constructed during the Hellenistic period, whereas the additions, such as the extension of the western breakwater, and the second mole to the south of the eastern breakwater, may be Roman works most probably constructed after the earthquakes of 15 and 77 AD. Paphos

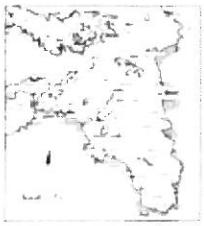
The history of the harbour of Paphos may be summarised as follows: The site contains a natural anchorage however it is uncertain as to when it first began to be used. The area, however, certainly had a Classical settlement, as Mlynarczyk has proven. It is probable that this settlement utilised the anchorage and a natural basin slightly to the south of the Hellenistic harbour, at the site where Nicolaou in1966 and Raban in1971 noted a marsh area. At the end of the 4th century the old capital was transferred to this site and the two breakwaters enclosed the harbour. It is possible that the breakwaters did not extent to the length that we see today if the funds available came only from the kingdom. However, the harbour was extended and completed with the funds provided either by Ptolemy or Demetrius who vied for control of Cyprus. The conditions that were formed due to the constructions had a detrimental effect on the harbour. An interrupted sea current deposited large quantities of silt, as did the stream that fed into the harbour basin, and the silting of the harbour was intensified after the earthquakes of the 1st century BC. As the provincial capital during the Roman Period, the harbour of Paphos underwent renewed construction to combat the problem of silting. The earthquakes of the 3rd century, and the geopolitical change of Roman Empire into the Byzantine Empire had as a result the overal neglegt of the harbour and its facilities. The harbour was still in use during the Arab raids of the 7th-10th centuries AD. The continued neglect of the harbour eventually led to the complete silting and dereliction of the port. Construction during the 20th century resulted in the demolition and covering of large sections of the ancient harbour. Similarly, the modern changes to the morphology of the coast, and the pace of constructions in and around the harbour area have as a result hindered the possibility of further analytical surveys. The task of the surveyors now is to undertake underwater excavations of the harbour area to discover the exact morphology of the ancient port, and to date the various phases of construction that were undertaken. Paphos

Θεοδούλου Θ. / Theodoulou, Th. Paphos

See this text in  Piraeus

Piraeus is situated in the northern part of the west coastline of Attica peninsula, surrounded by the Saronic gulf. Written evidence by ancient geographers and Piraeus

historians such as Srabo, Suidas and Arpokration, confirm the region's geological history, according to which, Pireaus was an island before the tetartogeni geological period. During that period, the alluvial sedimentation of Kifisos river and of other Attica's torrents led to the formation of the seashore that unified Piraeus with the mainland of Attica and to the creation of Halipedon (a marshy area that covered a great part of the region and resulted in its inaccessibility).



During the classical period, the geomorphology of Attica's coastlines, 24 miles long, was suitable for the docking of ships of that day at many points along the coastline, resulting in the operation of several small ports.

The selection of Piraeus for the development of Athens' main port was made in ancient times, as it happened in modern years (1834), mainly due to the protection that is provided by its location and the geomorphology of its three natural ports as well as its proximity to Athens.

Cantharus, the main harbor of Piraeus, is situated in the western part of the peninsula and it is a totally protected and secure natural harbour. The other two ports of Zea and Munychia are situated in the eastern part of the Peiraïke peninsula and on either side of Munychia hill. Further to the east, the gulf of Phaleron played the role of the main port of the Athenians before the establishment of Piraeus.

Piraeus

The only area of Piraeus from which there is evidence of inhabitance since the early prehistory of Attica (the first finds are neolithic potsherds), is the temple of Artemis Munychia, on the western part of Munychia harbour. (Steinhauer G.A. 2000, p.10-13).

Inhabitance of Piraeus was mainly initiated in 479B.C. with the instigation of the Athenian Deme by Themistocles to fortify and develop the most significant port of Athens. He was the first to turn the Athenian's attention to the sea when he became Archon in 493/92B.C. and the one who pointed out the ideal location of Piraeus, navigated a powerful commercial and military fleet and, in a very small period of time, fortified the town and its natural ports. Fortification works for the direct and secure connection of the harbor with Athens were carried on by Kimon who wanted to complete Themistocles' plan and constructed the two Long Walls, the Phaliron Wall and the Northern Wall (fig.5), and later (445B.C.) by Pericles who constructed the Southern (or middle) wall, between Phaliron and the Northern Wall.

Pericles was the one who assigned the design of a plan for the city of Piraeus to the famous architect of that period, Hippodamus from Militos. With the harbour installations already planned and constructed earlier, the town planning took place on a totally unbuilt but well protected area that was destined to become the mercantile marine center of Mediterranean as well as the naval headquarters of Athens. It was designed in direct connection to "asti" and with generative elements of its structure, the geomorphology of its three natural ports, and the diagonal tracing of the Long Walls, which materialized in the attican lanscape the two pole formation of "City-Port" during the thriving period of the Athenian Democracy.

During the 3rd century BC, the Macedonian garrison was established at Munychia and Piraeus became one of the most powerful forts that supported Macedonian conquers of Greece.

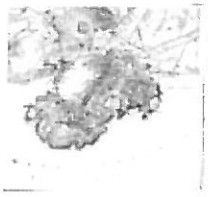
During the Macedonian occupation of Piraeus, only the dockyards were in use, while the city is driven to decline. After the harbor's liberation in 229B.C., the connection between the city and its harbor was never again restored, until the modern times.

Prior to Roman times, the harbor was used for a while, cut off from Athens, while in the early Roman times it was destroyed by Syllas in 86B.C. after a long term seize. The complete demolition of the fortifications and the marine installations of the harbor resulted in the lack of safety for seafarers and merchants and lead to the final devastation of the port.

From the remnants of the fortifications, marine installations and buildings, very few have been preserved to this day. It is also known (Angelopoulos H. 1898, p. 43) that for a number of years Piraeus was the commercial center for lime, which was produced in furnaces using architectural parts from the destroyed harbour.

A great part of the ancient harbor installations as well as the post-Roman docks that were still visible under the surface of the water during the early 19th century had already been covered since the end of ancient era due to the rise of sea level.

The planning of the modern city and the harbour of Piraeus was done by Kleanthis and Schaubert after the proclamation of Athens as the capital of the newly formed Greek state in 1834, using the Hippodamian system of town planning once again. The evolution of Piraeus as the main passenger and mercantile harbour of the country, the installation of major industrial units and the construction of modern marine installations along the contemporary coastline, the bombing of the harbour during W.W. II, and the new uncontrolled erection of the city, led to almost total vanishing the most developed marine and urban center of Classical Greece.



Piraeus

Research on the city-harbor of Piraeus began during the early 19th century by foreign travelers, cartographers (E. Dodwell 1801-1806, W. M. Leake 1821), researchers like E. Curtius (1841), H.N. Ulrichs (1843) and topographers like C. von Strantz (1861), while a systematic recording of the visible ancient relics and a very significant representation of the ancient town was conducted by E. Curtius - A. Kaupert in collaboration with topographer G.V. Alten, which lead to the production of the maps of Attica (fig.3) and the attached text by A. Milchofer.

Most of the evidence that was recorded in the early 19th century, does not exist any more since most of the remnants disappeared during the construction work that was done for the new embankment of the modern Piraeus harbor, under grate time pressure that did not permit the recording of monuments.

Archaeological research in the harbour of Piraeus began during the first period of the rapid construction of the modern city and had the character of rescue excavations, which even today are the main option for research in the densely inhabited city, and

the harsh interventions that the ancient harbour has undergone, due to the industrialization of its use.

The excavations that were done by Dragatsis, during the first period of construction for the modern city (1880-1920), revealed in the port's area a group of Shipsheds, "neosoikoi", Zea's theatre, the southern portico of the "Emporion" called Serangeion and the residence of the Dionysiasts. The most significant excavation was that of a row of 20 neosoikoi at the eastern part of Zea by Dragatsis. Their recording by Doerpfeld constitutes the main source of our knowledge about the form and dimensions of neosoikoi and about the size of triremes and their launching method. From that group the only part that remains intact today is situated in the basement of a block of flats. (Fig.4)

The results of this period of archaeological research were collected in a volume by W. Judeich, (Topographie von Athen, 1905, 1931).

The most recent discoveries and excavations, that were done by the Service of Antiquities, between 1960 and 1990 regard the Arsenal of Philon in the military port of Zea, the "Makra Stoa" and the Neosoikoi of Munychia, as well as a large number of houses, cisterns and quarries, are collected in V.K v. Eickstedt's dissertation (Beitrage zur Topographie des antiken Piraeus, 1991).

Piraeus

Zea was the second largest port of Piraeus and was wholly covered by the installations of the dockyard of the attican fleet. Its development most probably preceded the other two ports, since it granted the best natural protection for the mooring of vessels. (fig.11) Piraeus

The drawing of the port preceded its construction in order to cover the increased need for the immediate building of ships that would form the powerful fleet of the Athenians (493 – 492).

The port of Munychia is the smallest of the three main harbours of Piraeus, protected from NW by the hill of Munychia and was used as naval dockyard. Piraeus

Βλαχάκη Φωτεινή / Vlachaki Foteini Piraeus

Topographie Pisa

Republik Italien, Region Toskana, Provinz Pisa
heutiger Ort: Pisa
Koordinaten: ca. 43° 35' N - 10° 20' E

Pisa liegt im nördlichen Abschnitt der toskanischen Küste am Arno, ca. 10 km vom Tyrrhenischem Meer entfernt. Pisa war Knotenpunkt verschiedener Land- und Seewege. Weitere Häfen- bzw. Anlegemöglichkeiten entlang der Küste sind literarisch belegt und teilweise archäologisch nachgewiesen. Pisa

Ursprünglich ein etruskischer Handelsplatz und seit 180 v.Chr. römische Kolonie.Im Mittelalter besondere Blüte seit dem 11. Jh. Hauptsächlich handelt es sich hier vermutlich um einen Handelshafen, wenngleich er zeitweilig auch militärische Bedeutung hatte. Letztere besonders bis zur endgültigen Unterwerfung der Ligurer durch die Römer.. Pisa

An der Westküste der Apennin-Halbinsel, nördlich des westlichsten Armes des Arno-Deltas (Strabo V 222, Plinius NH III 50) lag mitten in einem Binnenlagunensystem, ehemals wenig mehr als 3,5 km von der Küste entfernt die antike Stadt Pisa (Strabon V 5,2). Nach der Beschreibung desselben Autors□ besa□ der Arno, in dem der heute verlandete Auser mündete, drei Mündungsarme; an dessen nördlichem, welcher besonders durch dessen Windungen geprägt wurde, am Zusammenfluß□des Arno und des Auser die Stadt lag. Dabei war, immer der Beschreibung desselben Autors folgend, die Auser leichter befahbar als der Arno.Das sumpfige Gebiet war von kleineren Wasserläufen durchzogen. Kleinere Seitenarme und künstliche Kanäle charakterisierten das umliegende Siedlungsgebiet.

Gleichzeitigt zur Verlagerung der Küstenlinie sowie zum Anstieg des Meeresspiegels ging eine fortschreitende Versumpfung des Geländes einher, welche in der Antike wie im Mittelalter durch verschiedene Maßnahmen eingedämmt wurde. Durch die allmähliche Verlandung des Mündungsgebietes sowie die Verlagerung der Küstenlinie besaß Pisa ein System von mehreren Häfen und Landeplätzen (Itinerarium Maritimum Antonini Imperatoris, CIL XI 6665: portus pisanus).

Insgesamt lag die Küstenlinie weiter landeinwärts. Die ehemalige, von den beiden Flüssen gespeiste küstennahe Lagune ist heute verschwunden. Durch alluviale Sedimente des Arno ist der heutige Küstenverlauf stark vom antiken abweichend. Die ehemalige Mündung müßte sich auf der Höhe von San Pietro in Grado befunden haben. Hier ist archäologisch unter der Basilika eine seit archaischer Zeit existierende (Hafen-)Siedlung nachgewiesen.

Der Waldbestand der Toskana hat schon früh dem Schiffshandwerk der Region den Rohstoff geliefert. Schiffsbautätigkeit ist aus römischer Zeit inschriftlich überliefert

(CIL XI 1436: "... fabri navales").

Die Untersuchungen zu den Häfen von Pisa konzentrierten sich bisher um die Frage des Hafensystems innerhalb des verzweigten sich im Laufe der Zeit mehrmals veränderten Flußdeltas des Arno, wie etwa durch die Grabungen an der Kirche San Pietro a Grado (1919-1925, 1950-1960, 1965-1967, 1995). Weitere Hafenstrukturen wurden bei Bauarbeiten an der Via Vecchia in Barbaricina 1969 gefunden. Der bedeutenste Befund zu den Häfen im Stadtgebiet stammt aus den neueren Arbeiten auf der Rückseite des Bahnhofes Pisa-San Rossone (1998-...), ca. 500 m westlich von der Piazza del Duomo entfernt. Pisa

Die Arbeiten in Pisa-San Rossone brachten Spuren von Hafenbauten diverser Zeitstellung ans Licht. Diese Anlegestelle lag auf dem Westarm des Auser und somit in direkter Verbindung zur städtischen Ansiedlung. Die Hafenbecken und Landestellen waren ständig der Gefahr des Versandens durch zwei Flüsse ausgesetzt: dem des Arno und des heute ganz aus dem Stadtbild verschwundenen Auser. Mehrere feststellbare Veränderungen des Hafengebietes verdeutlichen dies. Sie sind nur bis zu einem gewissen Grade datierbar. Sie gehören der etruskischen Stadt und der römischen Colonia an. Pisa

Zu den Hafenstrukturen kommen noch die Reste von zahlreichen zerstörten Wasserfahrzeugen und die Wracks von 16 Schiffen und schließlich eine ungeheure Anzahl von Materialien aus den Ladungen und Schiffsausrüstungen, welche sich im ergrabenen Bereich des ehemaligen Hafenbeckens fanden.

Marcus Heinrich Hermanns Pisa

Roma

La localizzazione dei Navalia è oggetto di disputa tra i topografi. Lo Hülsen (1896) parla di "Navalia superiora" nel Campo Marzio" e di "Navalia inferiora" nel Foro Boario. Il Cressedi (1949-51) si rifà a questa ipotesi e colloca i Navalia superiora in corrispondenza di un molo, scoperto nel 1890 nella zona dell'ex teatro Apollo a valle di Ponte Elio (Marchetti 1891). Le Gall (1953) ritiene, invece, che non esistessero due Navalia ma uno solo la cui localizzazione, sulla base del calcolo dell'area occupata delle imbarcazioni (340 m. di lunghezza per 50 quinqueremi), andrebbe ricercata presso lungotevere dei Vallati, tra Ponte Garibaldi e Ponte Sisto. Il Coarelli (1968: 37) li posiziona . immediatamente a monte dell'estremità dell'isola Tiberina, nel Campo Marzio meridionale, su un'area lunga non meno di 500 m. Roma

alla fine del II secolo a.C. Esso era posto in posizione leggermente obliqua rispetto alla corrente del fiume, era lungo m. 50, largo 13,30, alto 6,50 ed era costruito in opera quadrata di tufo di Grottaoscura e dell'Aniene. La testata era, invece, in lastre di travertino. Roma

A sud del foro Olitorio si trovava il più antico porto commerciale della città, il portus Tiberinus, che doveva essere delimitato a valle dal Ponte Emilio e a monte dal Ponte Fabricio, occupando quindi uno spazio di circa 8000 mq. Roma

Il porto tiberino si sviluppò presso il Foro Boario laddove la corrente del Tevere è resa più tranquilla dalla interposizione dell'Isola Tiberina.

Questi caratteri geomorfologici favorirono prima la formazione di un traghetto e poi di un ponte (Pons Sublicius). Il luogo, inoltre, doveva essere particolarmente favorevole al ricovero delle imbarcazioni e doveva sfruttare un'ampia ansa del fiume, oggi scomparsa.

Si tratta probabilmente del più antico porto fluviale di Roma. Qui si trovava un emporio regolarmente frequentato almeno dall'VIII secolo a.C. da commercianti del bacino mediterraneo, provenienti soprattutto dalla Grecia e dalle sue colonie, in particolare dagli Euboici della vicina isola di Ischia, come testimoniato dagli scavi del tempio arcaico della Mater Matuta, scoperto sotto la cosiddetta "Area Sacra di S. Omobono" che si trova a livello della sponda del ramo sinistro del fiume.
Il porto tiberino venne rinnovato e sistemato insieme con il vicino ponte Emilio dai censori del 179 a.C. mentre Traiano intervenne con un nuovo restauro. Roma

Collegato al porto è l'edificio rettangolare noto come Tempio della Fortuna Virile, ma nel quale si può identificare con certezza il tempio di Portunus che nella sua forma attuale risale al I secolo a.C.

Un altro tempio collegato all'area portuale è quello a pianta circolare di Hercules Victor, detto Olivarius. Esso fu fondato da un mercante romano, arricchitosi probabilmente con il commercio dell'olio, Marcus Octavius Herrenus. Ercole era infatti il patrono della corporazione degli oleari, i mercanti d'olio.

Poco più a sud, si trovava l'antico porto del Vicus Alexandri dove approdavano le navi di grande portata le quali risalendo il Tevere non potevano raggiungere gli scali urbani. Qui fu sbarcato nel 357 l'obelisco fatto trasportare dall'imperatore Costanzo da Tebe e collocato nella spina del Circo Massimo (ora al Laterano). Roma

See this text in

Salamis

Salamis

During Hellenistic Period, in 274 BC, a new city named Arsinoe was founded southward of Salamis by Ptolemy Philadhelphos, showing the attention that the Ptolemies were giving to the area opposite the Syrian littoral of the Seleukid state. Salamis and its harbour continued to function but without the importance they had enjoyed in the past. For geopolitical reasons Paphos was from then on, until the end of Roman period the capital of the island. The catastrophic earthquakes of 432 AC more likely fully devastated the city. Similarly, Arsinoe was also destroyed by the earthquake and succeeded by Constantia, which in turn was succeeded by Ammochostos.

Salamis

Excavations at the site of ancient Salamis by the Department of Antiquities of Cyprus and the French Mission of the University of Lyon were in progress until 1974, when the Turkish Invasion interrupted them. Several publications concerning the history and archaeology of the area has been published, the main one being *Salamis in Cyprus. Homeric, Hellenistic and Roman* (Karageorghis 1969). Linder and Raban also investigated the port area in 1971 (Raban 1995, 162-163), as did Flemming in 1973 (Flemming 1974, 163-174).

Salamis

From the above it could be stated that the harbour of Engomi and Geometric Salamis were on the estuary of Pedieos. Sequentially, the city moves northwards due to the gradual silting of the southern harbour, and to utilize the northern harbour. This is perhaps the meaning of Isocrates report concerning the absence of port facilities up to the years of King Evagoras. Evagoras either repaired or reconstructed the south harbour and included it in the fortification of the city. Whether the north basin was included in this program or not is yet unknown. It could be used by the time of Evagoras, but in 306 during the naval battle between Demetrios and Ptolemy, Polyaenos states that the fleet of Demetrious was hidden at the north under a cliff without any reference to the north harbour. If it were the naval harbour o Salamis Demetrius's fleet would not go to this area to be hidden. Furthermore Ploutarchus and Diodorus Siculus mention that ten ships where enough to blockade the entrance of the harbour. A 200m entrance to the southern harbour would comfortably allow ten ships to form a blockading "wall", and therefore concur with these references.

Finally, the lagoon between the two basins was certainly different than today. More likely a part of it or maybe the whole area north of the reef was terrestial, evident from the structures. Different port structures can also be assumed to exist in the

south and maybe north basins. All of these of course need further investigation, which is unfortunately not possible for the moment.

Θεοδούλου Θ. / Theodoulou, Th. Salamis

Samos

See this text in 

Topography

The island of Samos is situated in the north Aegean at a short distance (~2.35 km) from the coast of Asia Minor.

The ancient city was built where now the modern village of Pythagorion (Tegani) stands, on the SE side of the island. The Hellenistic city is situated near the port, and on the slope of the hill the remnants of a theater can be seen. The roman city is located SW. At a small distance, 6klm, west of the city lays the great Sanctuary of Hera, where the wooden uniconic statue of the goddess was kept and the her marriage to Zeus was celebrated.

The port of the city lies in a well-protected bay at the foot of mount Ambelos. It is situated at the eastern end of the ancient city and belongs to the type of the closed harbour, which is formed by the extension of the city walls to the sea.

Samos

The first inhabitants settled on the island as early as the 4th millennium BC, most probably people from Anatolia, while round the beginning of the 1st millennium it was colonized by Ionians. Samos has been one of the first Greek cities which, taking advantage of its privileged geographical position – near the Cyclades and on the maritime route of the ships to and fro Ionia, have developed a wide network of communication not only in the Mediterranean, but also with important eastern centers such as Cyprus, Egypt, Syria etc. From the beginning of the 6th c BC Samos becomes a very important artistic and cultural center of the Greek world.

The island prospered greatly under the rule of Polycrates during the second half of the 6th c BC. During that period an extensive building program is adopted, which comprised public, defense as well as technical woks that are amongst the greatest technical achievements of the ancient world, the tunnel of Eupalinos from Megara and the breakwater of the harbour. Through the building of a strong fleet, mainly of penteconters and triremes, Samos rises into a great nautical power, which would also conduct piratical attacks against her neighbors.

During the classical period the island looses part of its renown and becomes an Athenian colony in 365 BC (after its being involved in the Persian Wars and the

Peloponnesian War). In the Hellenistic times the island prospers anew, the city is fortified in a wider area with a wall that stands to the present day modified by later additions, with a circumference of approximately 6.220 km. Between the years 190-129 BC it falls under the rule of Pergamon and in the Roman times is incorporated in the Roman Province of Asia. Moreover there is archaeological evidence attesting to its being a rather remarkable city at the Early Christian Times.

Excavation work in Pythagorion at Samos has been carried out at a small scale by the Greek Department of Underwater Antiquities instigated by the need for preservation works of the modern port in 1988and continued further for two consecutive campaigns in 1993-1994. Samos

The ancient remains have been located mainly outside the modern port basin. However, at its southern part it is estimated that isolated traces of the ancient fortification are preserved underneath the remains of the Byzantine installations. Samos

The remains that have been located were at first dated from isolated finds and ceramics at a time span from the beginning of the Hellenistic period until the Late Antiquity. Under the light of new research it has been supported (Ageliki Simossi, *Le port de guerre de Thasos* D.E.A., Aix-En Provence, 1993) that this is the mole of Polycrates of the 6th c BC. The stone structure and the remains of the wall foundations on the SE side have not yielded evidence that could date these structures with certainty. Samos

Aim of this research, which has not as yet been completed, is to locate the archaic port installations, the port of Polycrates, one of the most important ancient harbours. Due to excessive modern interventions the topography has been considerably altered. The reconstructions suggested at times by scholars (Kienast, J.H., 1978, Toelle, R., 1976) are based mainly on ancient sources and the plan of later fortifications, provided that they follow the plan of ancient ones. The continuation of modern research is expected to help in the understanding of the extant remains and to bring new evidence to light that would complement the topography of the port.

Μίχα Παρασκευή / Micha Paraskevi Samos

Die Anlagen Schiffshaeuser

See this text in Soloi

Excavations at Soloi and Vouni (Aipeia?) had been undertaken by the Swedish Cyprus Expedition between 1927 and 1930. From 1965 until the Invasion of 1974 the Canadian University of Laval, Quebec, was excavating the area of Soloi and meanwhile the Department of Antiquities of Cyprus excavated several tombs around the area (Christou 1973, 91-102). A.Westholm (of the SCE) gives a description of the surviving part of the port. E. Linder and A. Raban visited the area in 1971 to investigate the remains of the ancient harbour, but modern facilities for copper ores (Hellenic Mines Company) and structures of late Antiquity made the task almost impossible. According to K. Nicolaou, in 1966 "The modern bridges of the Hellenic Mines Company for ore loading is build exactly on the position of the ancient port" (Nicolaou 1966, 98). Soloi

Conclusively, the kingdom of Soloi seems to have had its own important closed harbour during the Historical times, which must have been in use until the 1st c. BC. This harbour is evidently out of use by the end of the Roman Period. Soloi

Θεοδούλου Θ. / Theodoulou, Th. Soloi

Topographie Syracusa

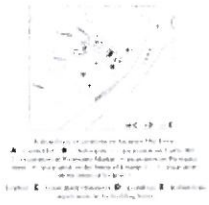
Republik Italien, Region Sizilien, Provinz Syrakus
heutiger Ort: Siracusa
Koordinaten: ca. 37° 00' N - 15° 15' E

p>Die heutige Stadt Syrakus an der Südostküste Siziliens nimmt das Gebiet der antiken korinthischen Kolonie ein. Den östlichsten Vorsprung des jungtertiären Kalkhügelrandes bildet die Insel Ortygia, die durch einen sehr schmalen, von einer Brücke überspannten Meeresarm von der Küste getrennt ist. Die griechische Kolonie auf der Insel Ortygia wurde von zwei natürlich geschützten Buchten flankiert: eine westliche größere Bucht und eine östliche kleinere Bucht. Syracusa
Während der athenischen Expedition im letzten Viertel des 5.Jh.v.Chr. (416-413) spielte der große Hafen von Syrakus eine entscheidende Rolle: in ihm wurde das athenische Expeditionskorp nach mehreren mit wechselndem Kriegsglück geführten Gefechten vernichtend geschlagen.

Die Häfen von Syrakus fanden hauptsächlich aus historischer Betrachtung Interesse. Eine archäologische Übersicht fehlt bisher gänzlich. Neben topographischen Arbeiten (Cristoforo Cavallari / Adolfo Holm) sind hier insbesonders gelegentliche Unterwasserfunde nach Baggerarbeiten zu nennen (NSc 1885: Architekturteile gefunden bei Drainagearbeiten im "porto grande"). 1887 wurden östlich des "foro siracusano" an der Via dell'Arsenale Reste einiger Schiffshäuser ausgegraben. In den 80er Jahren wurden einige Funde aus dem Kleinen Hafen während eines Unterwassersurveys gemeldet. Beim Parkplatzbau Ende der 90er Jahre wurden weitere Beobachtungen zu möglichen Hafeninstallationen am Forte San Giovanello gemacht. Syracusa

Marcus Heinrich Hermanns Syracusa

Szczecin



See this text in

Country: Poland Szczecin

Location: voivodeship – zachodniopomorskie, administrative district – Szczecin, town – Szczecin

Geographical coordinates: 14 34 E , 53 26 N

The location of Szczecin harbour has been a subject of controvery and during the last couple of years a number of hypotheses have been proposed.

Topographie Terracina

Republik Italien, Region Campania, Provinz Latina
heutiger Ort: Terracina
Koordinaten: ca. 41° 10' N - 13° 05' E

Die Stadt liegt südlich der pontinischen Sümpfe an der Grenze zwischen den Regionen Latium und Kampanien, auf halbem Weg zwischen Neapel und Rom. Nördlich der Bucht von Gaeta und südlich des Kap Circeo gelegen, wurde Terracina 329 v.Chr. als "colonia maritima civium romanorum" als Machtpunkt gegen die Volsker gegründet. Hauptsächlich bekannt war die Stadt wegen ihres Heiligtums auf dem Monte San Angelo, der sich als hoher Felsen bis direkt ans Meer erstreckte. Die 324-312 v.Chr. angelegte Via Appia hatte hier eine Engstelle zwischen Meer und Berg zu überwinden und verlief daher über den Berg. Erst mit den städtebaulichen Erneuerungen in trajaneischer Zeit wurde diese Situation geändert: Die Straße verlief nun dank einer künstlichen Felsabarbeitung (Einschnitt Pisco Montano) am Wasser vorbei, unweit des zeitgleich neuen Hafens (vergleiche Ausbau der Häfen Ancona, Brindisi, Portus und Civitavecchia in trajanischer Zeit). Terracina

Die Topographie hat sich geändert. Das große Becken in dem der Fluß mündete ist heute gänzlich verlandet und wird von der modernen Stadt eingenommen. An seiner Stelle ist noch ein kleiner Flußhafen in Betrieb. Seine Funktion ist hauptsächlich Fischereibetrieb sowie Fährdienst zu den Pontinischen Inseln.

Die Bautechnik war opus reticulatum in der äußeren Hülle, opus mixtum im inneren Kern. Große Teile der Mole, welche heute nicht mehr erhalten sind, wurden von G.Lugli dokumentiert (Bild bei Felici 1998). Terracina

Die Zeit des ersten Molenbaus im Jahre 179 v.Chr. durch den Censor M. Aemilius Lepidus ist literarisch überliefert (Livius 40,51,2). Umbauten sind unter Trajan (98-117 n.Chr.) und unter Antonius Pius (138-161 n.Chr.) durchgeführt worden (Historia Augusta, Antonius Pius VIII,3). Terracina

Topography Thasos

The island of Thasos is situated in the north Aegean, near the Thracian coast, on the maritime routes leading to the Black Sea and the Thracian mainland.

The first colony of the island that was made by Parian settlers under Telesikles, is located on the north coast and is dated round 680 B.C. After founding the colony and with the assistance of other Greeks, the settlers expanded on the Thracian coast from Strymona River to Nestos and Stryme creating the Peraia. Thasos

The potential that the island offered for various cultivations (e.g. vines, timber), for fishing but mainly the goldmines and silver mines not only on the island but also in Thrace (Paggeo, Skapti Yle), played a primordial part in its evolution into a great commercial and nautical power.

The archaeological evidence for the commercial relations of the island is abundant. Silver coins of Thasos are traced as far as Egypt and Syria, while products of areas such as Corinth and Ionia can be found as early as the last quarter of the 7th c B.C.

The city of Thasos, big and populous, is enclosed since the beginning of the 5th c B.C. within a fortification wall made of marble. Because of its strategic position as a bridging point towards Thrace and Asia Minor, along with Imbros and Temedos, it attracted the interest of local and foreign powers. During the Persian Wars Mardonios sieged it in 492 B.C., while after the victory of the Greeks Thasos entered the Athenian League with the obligation to provide 33 triremes. It was its position on the grain trade route, that made her confront the Athenians, when she attempted to leave the League, and endure the dissolution of her fortification walls and her navy as well as the detachment of her possessions in the mainland. The island prospers anew after the reacquisition of part of its territorial possessions and the rise of the wine exports (ranging from the African coast to the Black Sea). After a period of civil combats the city is restored with the construction of big edifices and the reinforcement of the fortification wall, as a result of the progress made at that time in the besiege techniques. During the Hellenistic period it is incorporated in the Macedonian Kingdom and in the following Roman times declines. It prospers again during the Early Christian times.

Within this geographical and historical framework ancient Thasos formed as early as the 7th c B.C. on the north-eastern end of the island port installations to serve the naval force both of the city and of her allies, as a forward base of the Athenian League in the north Aegean, as well as the increased import and export commercial traffic. The ports of the island are among the most characteristic and best-preserved ancient ports of Greece.

The ports were already known to the travelers of the 19th century (G. Perrot, 1864, Conze, 1860). Modern research that has been undertaken in the area is directly connected to dredging works in the port basin for the facilitation of current mooring needs. At the beginning, 1980-1984, small-scale excavation work was carried out by the Greek Department of Underwater Antiquities. Further to this a joint mission of the Greek Department of Underwater Antiquities and the French School at Athens carried out the excavation of the closed military port and of part of the commercial port in eight campaigns. Thasos

Based on the archaeological evidence, mainly ceramics and isolated finds, along with certain constructional characteristics the excavators discern three main phases in the history of the military port. The fortification of the port is dated round the end of the 6th –beginning of 5th c BC based on the ceramic evidence and similarities to Thasos

the land fortification. The ship sheds are dated round the middle of the 5th c. At the end of the 4th c BC the wall was reinforced with circular towers, just as the land wall is reinforced with square ones. At that time the artificial beach at the western end outside the port is also dated. During the Early Christian Times (4th – 7th c AD) a new segment of mole is constructed and the entrance of the port is shifted. The port from that time onwards serves the increased commercial activity of the area. The port is abandoned after the destruction of the city at the late 6th – early 7th c AD and starts functioning again from the 10th c.

The mole of the commercial harbour dates at the end of the 6th – beginning of the 5th c BC (its foundations), is rebuilt round the 4th c BC and continues in use until the 7th c AD.

The ports of Thasos are very important for the study of ancient port installations. The military port of Thasos is one of the most characteristic examples of a closed harbour with some of the most ancient extant ship sheds. Their history is interwoven with the economic life of the city and their forms is dictated by the technical progress made both in architecture and besiege techniques.

As regards especially the military harbour, it is walled during the classical times and is provided with ship sheds, capable of sheltering a great number of warships. Later on their fortification is enhanced through the construction of circular towers and in the Early Christian Times its plan is altered and the entrance is shifted to where it stands today. Based on the results of the research this is one of the best-preserved examples of the closed military harbour type, which evolved in Greece in order to serve the sea defense of the city along with the protection and mooring of its ships, in places where, by position, juncture or tradition relied on the navy as their main weapon.

Μίχα Παρασκευή / Micha Paraskevi — Thasos

That the feelings between Romans and natives were not always of the friendliest, is indicated by the above-mentioned Friesian revolt of AD 28 and the temporary abandonment of the Velsen area by the Romans, probably connected with it. — Velsen

The first Roman finds were discovered in 1945, in the spoil of a World War II German anti-tank trench. They belonged to what was later called Velsen 2 (since the discovery in 1972 of Velsen 1 by members of the Velsen section of the Netherlands Association of Amateur Archaeologists [AWN]). A date of AD 40-50 was indicated by these finds and also by finds from later activities. The sparse features of Velsen 2 - rows of rammed posts and deposits of the former Oer-IJ - appear to indicate, in conjunction with the nature of the finds and a comparison with Velsen 1, the presence of *quays* and/or *jetties*, probably connected with a *fortified base*. — Velsen

From 1973 to 1991, extensive excavations have taken place every year, with the

exception of 1983-1984. As a result of the close teamwork between the AWN-amateurs and the Instituut voor Prae- en Protohistorie (IPP) of the University of Amsterdam (UvA), an area of over 6 ha in size has been totally laid bare.

The major difficulty encountered during the excavations, was the severe erosion, which has removed over 2 m from the original Roman surface, leaving only the deepest features. A slight consolation was the fact that the site remained undeveloped following the Roman occupation.

Topographie

Ventotene

Republik Italien, Region Latium, Provinz Latina
Koordinaten: ca. 40° 45' N - 13° 25' E

Gleichnamige, südlichste Insel des Archipels der Pontinischen Inseln

Ventotene

(keyword sea harbour) Die Ponza-Inseln (arcipelago Pontino) sind vulkanischen Ursprungs und liegen vor der Küste des südlichen Latiums. Sie begrenzen den Golf von Gaeta gegen das Tyrrhenische Meer. Zu der südöstlichsten Gruppe dieser Inseln gehören die Inseln Ventotene und Santo Stefano. Die Insel Ventotene, mit gleichnamiger Ortschaft, besteht nur aus einem Kraterrest von 3 km Länge und 1 km Breite.

Marcus Heinrich Hermanns

Ventotene

Mediaeval port in Wolin

Wolin

Province Zachodniopomorskie, administrative district kamieński, commune Wolin, Polska

Wolin

14 □° 31' E, 53 □° 50' N

Wolin

In the second half of XIX century one acceded to first archaeological work

Wolin

connected with research legendary emporium Jomsborgâ€ Wineta (well-known from written sources), which in result of works archaeologists and historians one identified as Wolin.

Author: I. Pomian

Wolin

Topographie

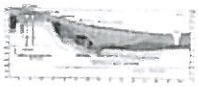
Xanten

Bundesrepublik Deutschland, Nordrhein-Westfalen, Kreis Wesel
heutiger Ort: Xanten
Koordinaten: ca. 51° 45' N - 06° 55' E

Die ca. 73 ha große römische Colonia Ulpia Traiana (CUT) wurde nördlich des um 12 v.Chr. über dem Rhein (heute Alt-Rhein) gelegenen Doppellegionslager Vetera I und II gegründet. Die um 100 n.Chr. gegründete Stadtanlage, deren östliche Stadtfront an einen natürlichen Rheinarm stieß, lag auf einer hochwasserfreien Terrasse, der sog. Niederterrasse, ca. 12-17 m üNN.

Xanten

Zu römischer Zeit müssen westlich und östlich dieser Niederterrasse, einer eiszeitlichen Moräne, bruchartige Gelände gelegen haben. Heute liegen die Ruinen der antiken Stadt ca.2 km vom heutigen Verlauf des Rheins entfernt. Die Situation, daß der Alt-Rhein-Arm als Unterstrom mit dem Hauptstrom in Verbindung stand, sowie der asymmetrische Profilverlauf der Rinne mit einem stadtwärts gelegenen Prallhang bot die Gelegenheit zum Ausbau von Kaianlagen und somit für das sichere Festmachen der Schiffe zum Be- und Entladen. Als Arbeitsfläche dieses Flußhafens diente der Bereich vor den Stadtmauern, wie die Schicht IIIk der Altgrabungen vermuten läßt, welche hauptsächlich aus Schiefersplitter und Grauwackebrocken besteht. Als ausgleichende Schicht zwischen Stadtmauer und Kai wird sie als Reste vorübergehend gelagerten Materials interpretiert. Diverse Abfallschichten aus den neueren Grabungen lassen ebenso eine rege Handwerkstätigkeit in Hafennähe vermuten.



Xanten

An der weitläufigen Uferzone vor der Stadtmauer werden Werften und Schiffsländen vermutet. Durch die feuchten Erhaltungsbedingungen haben sich nicht nur die hölzernen Kaianlagen erhalten. Da schon in römischer Zeit das Hafenbecken teilweise als Müllkippe benutzt wurde, gelangten nicht nur Gegenstände des alltäglichen Gebrauchs hinein sondern auch Spuren der damaligen Umwelt, deren Untersuchung heute die Möglichkeit zur Rekonstruktion der gleichzeitigen Flora und Fauna bieten. Doch nicht nur Müllablagerungen und eingeschwemmte Materialien haben das Aussehen der Hafenrinne bestimmt. Auch überschwemmungen haben dauerhafte Spuren hinterlassen. So lassen sich in den

Ablagerungen drei größere überschwemmungshorizonte innerhalb des 1.Jhs.n.Chr. ablesen und somit den Schluß zu, daß bereits sehr früh der Hafen zu verlanden drohte. Schon in der zweiten Hälfte des 2.Jhs. n.Chr. war der Hafen verlandet und konnte nicht mehr als solcher genutzt werden. Er diente fortan weiterhin nur noch als Müllkippe. Hauptsächlich Funde aus der "Müllkippe", wie div. Holzfunde, Korbwaren, Leder und Textilien, Seile, Speise- und Pflanzenreste.

Die Datierung dieser Bauwerke beruht auf der archäologischen Interpretation der geologischen (alluvialen) Stratigraphie und deren beinhaltende Funde. Aus der Stadtgeschichte ist bekannt, daß 105/106 mit der Stadtmauerbau begonnen wurde. Erst 134/135 wurde der Hafenkai ausgebessert, womöglich auch nach Norden verlängert, da die Verlandung des Rheinarms von Süden her erfolgte. Auf dem verlandeten Teil entsteht außerhalb der Stadtmauer eine kleine Vorstadt aus Bootsschuppen (sic?) und Gewerbebetrieben (Chr.B.Rüger).

Erste Grabungen 1934 bis 1937 (H.Stoll, P.Wieland, H.von Petrikovits): ca. 27 m der Kaianlage
Weitere Grabungen 1974 bis 1977 (M.Gechter): Kaianlage (Erweiterung nach Nordosten) und Mole

Xanten

Wegen der beobachteten Grundwasserabsenkung und wegen der somit drohenden Austrocknung der Naßbefunde eingeleitete Rettungsmaßnahmen 1993. Erstellung eines geologischen Gutachtens zur Rekonstruktion der Rheinrinne zur Römerzeit sowie zur Rekonstruktion der Verlandungs- und Verlagerungsprozesse des Rheinarmes.

Die Errichtung der Kaianlage wird zu Beginn des 2.Jhs.n.Chr. angesetzt ("in seiner letzten erkennbaren Form bald nach 98 n.Chr", "zwischen 80 n.Chr. und der Erbauung der CUT um 100 n.Chr.": H.v.Petrikovits). Die Kaianlage würde somit aus der Erbauungszeit der Stadt stammen. Da aber die geologische Stratigraphie noch nicht ganz geklärt ist, sind diese Ergebnisse der Grabungen aus den 30er Jahren mit der Einteilung in diverse Bauphasen nicht ganz schlüssig und bedürfen einer überprüfung. Die Erstellung des letzten Bauzustandes der Bohlbrücke (Bauperiode III) wird wegen der Verlandung des Rheinarmes ungefähr zwischen 120 und spätetens 150 n.Chr. anzusetzen sein (Keramikdatierung: H.v.Petrikovits). Die Tatsache, daß nach der Aufgabe des Siedlungsgeländes im 3.Jh.n.Chr. die Zone an der Terrassenkante abgespült wurde, lassen eine Bestimmung früher Laufhorizonte nicht eindeutig zu (S.Leih).

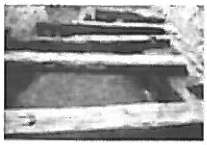
Xanten

Bei der Hafeninstallation der CUT handelt es sich um uferparallele hölzerne Kaianlagen.Sie befestigten und schützten die Uferkante und ermöglichten somit das Anlegen von Schiffen zum Löschen und Aufnehmen der Ladung. Rückwärtig schloß sich eine Balkendecke an. Letztere diente zur Stabilisierung und ermöglichte die Begehbarkeit der üferböschung. Für beide finden sich Parallelen im steinernen

Xanten

römischen Hafenbau.

Die älteste Ufersicherung □wurde innerhalb der neueren Grabungen erkannt und war ein Fangdamm, der aus kleinen Pfosten mit Astgeflecht bestand. Er stammt aus dem frühen 1. Jahrhundert und war nur in seinem unteren Bereich noch erhalten. Massiver waren die Uferbefestigungen der späteren Zeit. Drei Reihen sorgfältig bearbeiteter angespitzter Pfähle, die einen maximalen Durchmesser von 40cm besitzen, gehörten zu einer vermutlich in zwei Bauphasen erbauten stabilen Kaiwand. Hierüber wird die dendrochronologische Untersuchung der Hölzer nähere Aufschlüsse ergeben.□



Die "Holzbrückenkonstruktion": In die oberste und zweitoberste Balkenlage waren verlegte Ankerbalken mit Schwalbenschwänzen in Winkel eingebunden. Diese Ankerbalken waren auf teils gerammte, teils eingegrabene Pfosten aufgezapft und waren gegen den Rheinarm hin um 5-7,5° geneigt. Während die unteren Ankerbalken an ihrem landseitigen Ende blind ausliefen, führten die oberen Anker zu einem weiteren Balkensystem. Dies war ein aus Tragbalken, Auflagebalken und Belag gebildeter Boden, der auf Tragpfosten aufgezapft war. Die Bohlbrücke schloß mit der Kaiwand in einem Winkel von etwa 11,5° an. Gleichzeitig ist auch in den Profilen ein ansteigen der Bohlbrücke gegen Westen zu bemerken. Den Brückenbelag bildeten etwa 3 cm starke Bretter von mindestens 3 m Länge. Sie waren□ mit Fugen von 5-10 cm verlegt. Wie der eigentliche Belag darüber ausgesehen haben mag ist unklar. Wie man sich auch den Kaibelag vorstellen mag, immer ergibt sich durch diese Winkel- und Niveauunterschiede eine Stufe vom Kai zur Bohlbrücke hinunter. Xanten

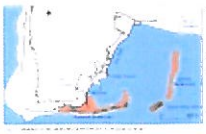
Ein Vergleich bietet die uferparallele Kaimauer in Aquileia. Es handelt sich hier um ein steinernes Bauwerk bestehend aus einer Reihe hochkant verbauter Orthostaten. Darüber liegt eine Lage flachverlegter, leicht vorspringender Platten mit in regelmäßigen Abständen vorkragenden Steinen mit senkrechtem Loch zur Vertäuung von Booten. Zu einer Holzkaiwand vgl.die Befunde aus London,□Classe (Ravenna) und Pisa, San Rossone. Aus Pisa sind auch Befunde bekannt, welche auf einen ins Wasser führenden Steg deuten lassen. Ebenso aus Marseille. Die hier ebenfalls gefundene Holzkaiwand läßt sich nicht direkt mit der Balkenwand in Xanten vergleichen. Während sie in Xanten Bestandteil einer selbsttragenden Holzkonstruktion ist, so besitzt sie im Befund von Marseille lediglich die Funktion der Verschalung der rückwärtig eingebrachten Schüttung hydraulischen Betons (vgl. Homepage zum Hafen von Cosa). Eine Balkenwand-Uferbefestigung, deren Balken mittels Schwalbenschwanzverbindung verbunden sind, ist aus den Altgrabungen im und am□ Lago di Nemi südlich von Rom bekannt. Eine Uferbefestigung aus einer Pfostenreihe bestehend ist auch aus Mainz bekannt. Xanten

Marcus Heinrich Hermanns Xanten

Back to the homepage of NAVIS II

Harbour informations about: Basin

Three port basins have been traced, which offer protection against several winds. Two of them are made by the extension of the city wall and the third was formed by an artificial breakwater. Abdera



When the harbor basin was deepened in 1983, for the new yachts port, remains of two vessels cargos of were revealed, one from the 5^{th}-4^{th} century BCE and the second from the 1^{st} century CE. Akko

The additional construction of the breakwaters created a port with two anchorages, the inner (western) harbor and the outer harbor that comprised the northeastern basin. The new port of Akko resembled the plan of the Tyre port. Akko

The southern breakwater was 250 m long and the eastern pier (on a southwest-northeast axis) was 325 m long. These breakwaters and the western pier divided the harbor in two anchorages: the inner harbor or *Darsane* and the outer harbor or *Portus*. Akko

Südseite Lago Albano, località I Quadri: Von den zur sogenannten Villa des Clodius gehörigen Uferanlagen, welche noch G.Lugli gesehen und beschrieben hat, sind durch moderne Überbauung kaum Reste erhalten (s. Plan). Zu den noch sichtbaren Strukturen zählt eine Kaimauer wie auch die vorgelagerte Mole aus opus quadratum (Peperin-Blöcke). Beide bilden ein rechteckiges Hafenbecken mit einer absidialen Ausbuchtung sowie der Einfahrt auf der Längsseite.Vom Unterbau des "Leuchtturms" ist nur die äußere Blockreihe aus Peperin erhalten, der Rest ist mit Zement verbaut. Albo/Nemi

Ostseite Lago Albano, località Cantone: Zeitgleich zu den Resten in Località I quadri sind die Spuren anderer Uferbauten auf der Ostseite. Es handelt sich hier um ein kleines, aus Blöcken gemauertes rechteckiges Hafenbecken (opus quadratum). Das Baumaterial Peperin spricht für einen Bau in republikanischer Zeit. Es war aber sicherlich noch in domitianischer Zeit in Verwendung Albo/Nemi

A second entrance at the northwest may have led to an existing earlier port that, during the Hellenistic construction, was included in the overall plan. Arial photographs and electromagnetic readings at the base of the hill have revealed a silted circular harbour. This harbour most likely served the city of Amathous when it was founded until Classical times, which Pseudo-Skyllax refers to as deserted, and Aupert suggests was used in the summer season. This interior basin was probably natural, suggestive of the western Phoenecian harbours of the Classical Period, which indicate similarities with the geographical position of the kingdom and town of Amathous. Amathous

The projecting rocky island forms two separate bays: the North Bay and the South Bay. The northern and southern islands found within the North Bay provide a good shelter for water vessels, thus the bay was more suited for a harbor built. The South Bay is the second largest among the Mediterranean coast of Israel, is only partially protected by submerged reefs and not suitable to built harbor installations. The approach to this bay from the west was not difficult but quite dangerous, due to the strip of the reefs at its entrance and their orientation to the storm waves. Atlit

The Middle Basin (200 x 200 m) is located east of the Outer Basin. To the north and south it is enclosed by rocky promontory and to the east by the round tower and the wall of Straton's Tower. On the northern side of the basin are found ashlars structures that during the Hellenistic period may have been used as shipyards or *nauscenae*. At the sea level are the remains of a "finger" quay that continues to he west. The quay made of narrow elongated ashlars (2 x 0.4 x 0.5 m) is a little more than 4.5 m wide and the surviving length is more than 10 m. On the southern side of the basin, the inner face of the Herodian quay survived to the sea level. Soundings at the base of this quay demonstrated that it is partly founded on natural rock and partly on an artificially poured conglomerate. Caesarea

To the west, the inner basin was separated from other parts of the harbor by a wall running from the northern part of the natural bay up to 40 m, where it ended with a circular tower, 13 m in diameter. Remains of the tower were found during previous seasons of excavations. Caesarea

Hellenistic (pre-Hellenistic, 2nd century BC): A partially rock-cut basin forms the inner basin. A quay built of stones east, appears as a wall. Caesarea

Late Roman-Early Byzantine period (3rd-5th centuries AD): The excavations did not reveal any structures dating to these periods and connected with the activity of the inner harbor. It seems that large parts of the inner basin were sand-locked. Drillings and excavations carried out in the areas I/9 and I/14 revealed a thick layer of organic material. The top of the layer lies 0.6 m below the sea level, while its base laid on bedrock and a thin layer of sand (2.3 m below the sea level). Pottery shards found in this context date to the late 3rd - early 5th centuries AD. It seems that during the Late Roman period and probably till the mid 5th century, the inner harbor continued to decay by the accumulation of urban residue and waves carried sediments. Caesarea

The main and the interior port Eretria

Today one can discern two basins: the first one occupied the central gulf of Eretria and was protected by the large jetty to the west and by Pezonisi to the east. It lied exactly at the site where the basin of the today's port is situated. The monumental structures date to the middle of the 4th century BC, and probably are associated with the attempt of the Macedonians to fortify those Greek ports whose geographical position was of strategic importance.

It is worth pointing out that the port's entrance measured 400 m. To the northeast, a second entrance led to the interior port that at present is silted up. It formed part of the town's fortification during the late 4th century BC, thus constituting an extension of the eastern wall. In the classical period this silted up basin served as a port, and was also used as such in the early Hellenistic times until the last quarter of the 4th century BC, when it turned into a shallow marsh. The latter necessitated its drainage, as indicated by extant epigraphic evidence. The state of the port basin in classical times is somehow vague, as the only evidence that has survived into the present is the jetty that extends as a continuation of the town's western walls.

Equally unknown remains today the port's state in geometric times, that is, the era in which Eretria experienced prosperity on a large scale, particularly in the 8th century BC when it played a fundamental role in Euboean colonization. In addition, there is scanty knowledge today for the Eretrian port in the Archaic period, a time at which, as indicated by various inscriptions, Eretria had established its maritime supremacy, thus becoming the leading city of Euboea. Today we can only assume that during those time-periods the Eretrians made use of the interior port of the Classical period.

The inner basin of the harbour was probably extended inland on the low sandy shore, to the south of the cliff, on top of which there are the ruins of the city. According to the researcher, rough sea conditions in the bay often covered and uncovered parts of the remains. Kourion

One more reason in making this place convenient for a harbour was the potential

water supply, since even today brackish water can be found in this area of the shore. Another factor re-enforcing the use of this area as a harbour is the presence of at least three steps (1m. wide by 0.5m. high) on the side of the cliff, possibly representing the remains of a path leading to the town on the top.

Lapethos

Raban also suggests the existance of a second harbour basin next to the east wall of the city, and to the north of the Troullin hill, where there now exists a marshy site (1971). To the north of this site the surveyors recovered encrusted sherds of Cyprio-Phoenecian amphoras.

Lechaeon

According to archaeological indications, the harbour area consisted of two marshy 'basins' before any construction was undertaken (Pallas 1963, 75 - 76). Separated from the sea by a narrow stretch of sandy earth, the two basins were further protected in antiquity by the placement of large stone blocks on this narrow earth bank (Pallas 1965, 139-140, Pallas 1963, 75-76). These first constructions took place during the Archaic Period, along with a channel to the west that connected the basins to the sea. A flourishing new period under the Emperors saw the undertaking of large-scale constructions of which the remains are still visible today.

The material excavated to create the harbour was placed either side of the entrance to the port, forming two hills that today survive to a height of 16.5m to the west, and 17.5m to the east. At the peak of the eastern mound are reported to be the remains of a tower, probably dating from the medieval period. The two mounds were most likely raised so as to protect the harbour from the north winds, but also to reduce the visibility from the sea into the harbour.

The fully formed harbour seems to have consisted of two large basins, the eastern (A in plan) most at the point of entry from the channel, and the western basin (B in plan) that was connected to the sea by a second channel. The two basins were connected via a channel of the same proportions with the entrance channel (10 – 12m), which was constructed for the ease of manoeuvrability of vessels that were passing through, with the addition of mooring spaces its length that allowed a clear path in between for inter-basin movement. The eastern harbour was connected to two smaller basins (A1 and A2 in plan) whose function is still unclear. The western harbour seems to have extended even further towards the southwest, an area that is now cultivated (B1 in plan), and where the waters of the area flow into the harbours via a stream.

To the north of the western harbour, along the coastline, there are the remnants of a protective entrance harbour with a double scheme as is evident from the existence of three external moles (Georgiades, 1907, 4-5, Paris 1915, Fig. 1).

Leptis-Magna

Das Hafenbecken ist ringsherum von gemauerten Kaimauern umschlossen. Vor der

severischen Zeit bestand der Hafen sicherlich nur aus geringen Kaianlagen und Magazinen entlang der nord-westlichen Seite des Wadi. Bei dem Ausbau entstand ein polygonales Becken, ca 21 ha groß mit einer kleinen Einfahrt zwischen zwei gerade im Winkel aufeinander zulaufenden Molen. Der Hafen wurde unter Benutzung der vorgelagerten Riffe zu einem geschlossenen Becken ausgestaltet (ca.102.000 qm), dessen vieleckige, von gemauerten Kaimauern umschlossene Form ein wenig an den trajanischen Hafen von Portus (Ostia) erinnert. Eine breite Säulenstrasse, an die das neue Forum unmittelbar angrenzt, mündet in geradliniger Führung in den Westkai des Hafens. Die Verlängerung ihrer Achse über das Hafenbecken trifft genau auf den Leuchtturm, der die Hafeneinfahrt flankiert und von der Seeseite her den markantesten Punkt der Stadt bildete. Diese Beziehungen lassen sich nicht nur am Plan ablesen, war doch der Hafen in funktionell und ästhetisch überzeugender Weise in das Stadtgebiet integriert.

Die Befunde an der Brand-Löhrstraße,ca. 500 m stromab vom Kapellhof lassen seit dem 2.Jh. n.Chr. hier ein Hafenbecken vermuten. Hier fand sich die Bohlenverkleidung eines hölzernen Piers (Anlegers), der vermuten läßt, das Hafenbecken sei hier in den Rhein gebaut worden. Mainz

(keyword quay) Im Gegensatz zu den ansonsten üblichen Anlagen mit ausgebauten Uferanlagen (Kaianlagen) und vorgelagerten Molen, eine einzigartige Bauart.

Für die Bildung des Hafenbeckens wurden zwei Küstenseen, der Lukriner und der Averner See, ausgenutzt indem beide miteinander verbunden wurden. Der Averner See ist ein Kratersee, etwa 2 km von der Küste entfernt. Schon seit altersher von melancholischen und geheimnisvollen Legenden umwoben steht er angeblich mit dem Fluß der Unterwelt, dem Styx, in Verbindung. Durch den Damm der Via Herculanea wurde die Bucht künstlich zu einem Binnensee, dem Lacus Lucrinus. Agrippa ließ den Averner See mit dem vorgelagerten Lucriner See (der seinerseits Verbindung mit dem Golfvon Pozzuoli hat) durch einen breiten Kanal verbinden und verfügte damit über einen geschützten Hafen. Durch die plötzliche Hebung des Monte Nuovo 1538 wurde die Bucht größtenteils verschüttet.

Miseno-Puteoli

Das innere der beiden Hafenbecken (heute Mare Morto genannt) diente als Werft, während das äußere durch die Punta Sarpanella zweigeteilt, die Reede war. Ein Kanal, über dem eine inschriftlich überlieferte hölzerne Brücke führte (pontus ligneus) ermöglichte die Durchfahrt. Rund um diesen inneren Hafen müssen die Werften und Arsenale gelegen haben, von denen heute leider nichts mehr überliefert ist. Miseno-Puteoli

Mozia

Im Südwesten der Insel, innerhalb der Befestigungsanlagen liegt ein in phönikischer Tradition gemauertes Becken. Es handelt sich hier um ein schräg zur Küstenlinie liegendes, aus Blöcken gesetztes Rechteck von 51.00 x 35.50 m und ca.2.30m Tiefe u.N.N. Die Wände sind aus Blöcken gemauert, der Boden bildet das anstehende geglättete Gestein, teilweise durch Steine ausgebessert. Eine Steinkante an der Nordseite wird als Einstiegerleichterung bei Niedrigwasser interpretiert.

Ostia-Claudio

Nonostante le considerevoli sopravvivenze di strutture antiche, la ricostruzione del porto di Claudio, soprattutto nella zona meridionale, si basa su indizi desunti dalla lettura di fotografie aeree e dalla cartografia portuense di età rinascimentale.
Il bacino portuale è orientato a sud ovest con un grande molo a protezione dei venti di maestrale, ponente e libeccio, similmente a quanto avviene per la maggioranza dei porti della fascia medio tirrenica. L'imboccatura principale si trovava a ovest mentre l'ingresso meridionale va ricercato all'altezza della moderna via di Fiumicino.
L'invaso ha dimensioni ragguardevoli perché l'area si aggira su misure di oltre m 1200x1300 per una superficie di almeno 150 ettari.

Ostia-Traiano

Il bacino del porto di Traiano ha una forma esagonale di 358 m di lato. La superficie totale misura all'incirca 33 ettari. La forma esagonale fu ritenuta dai progettisti la più sicura dal punto di vista strutturale e la più idonea allo svolgimento contemporaneo delle molteplici operazioni di attracco delle navi, carico scarico e trasporto delle merci.
L'assetto attuale dell'invaso è il risultato della bonifica completata negli anni 30, quando i lati dell'esagono vennero messi allo scoperto, restaurati e foderati con nuove murature prima dell'immissione dell'acqua pompata direttamente dal Tevere.
Il Lanciani, che nel 1868 assisté ai lavori di bonifica, scrive che il fondo del bacino si trovava a cinque metri di profondità media, era inclinato verso il mare ad era lastricato con grandi pietre.

Ostia-Traiano

La darsena è un bacino di forma rettangolare con ingresso a nord-est . Essa misura 227 x 48 metri ed è contornata sugli altri tre lati dai magazzini traianei.
Le sponde sono sagomate a scarpa per smorzare il moto ondoso. Si ignorano le caratteristiche del fondo e la profondità. e di collegamento con la Fossa Traiana potrebbe essere definita una "darsena di evoluzione" per il carico e lo smistamento verso Roma di imbarcazioni di medio e piccolo tonnellaggio, adatte a risalire il fiume (Verduchi 1999).

The harbour can be classified as the Hellenistic "closed harbour". Two breakwaters enclose the external basin, the western having an NE-SE orientation, and an eastern breakwater with an orientation of NE-SW. Paphos

Geomorphological surveys in 1996 revealed that the basin of the harbour was far larger than it seems today. It was believed that this was due to tectonic movements from the seismic activity of the 1st and 4th centuries AD. The survey, however, revealed that the tectonic movement in the basin was relatively small, and that the actual construction of the port hindered the free flow of a silt laden current from the east. This factor caused the silting of the harbour to occur and thus encouraged the corrective works that are visible today. Paphos

Finally, the shape of the triple harbour that *Stadiasmos* relates has been interpreted in different ways. For instance, it has been suggested that there was a tripple internal division with the main basin formed inside the breakwaters, and at the same time the use of the bays to the north and south. The geophisical surveys revealed that the bedrock of the basin is divided into two uneven parts upon which remains of construction can be identified, in effect creative two basins. The placement of a warf in the western part of the basin could in theory create a harbour with three sections. The plans of the surveyors reveal remains of building material at two points at right angles to the beach in the west harbour. A tripple sheme could also be envisioned using the natural separation in the eastern harbour from the stream that exited into this section of the harbour. Similarly, the tripple harbour may have consisted of the division of the eastern and western sections of the port, and also utilised the natural bay that exists to the south, which was also used in medieval times when the main harbour became too silted.

The basin of the main harbor was called Cantharus due to its shape, which resembled the corresponding vase. The Basin of Cantharus as it was recorded in the maps of the first researchers, had the shape of an irregular rectangle, smaller than the modern harbour, with dimensions approximately 1000x750m. Starting from the west and moving clockwise around the basin, the Athenian shipyards were located inside the walls and along Eetioneia coast. To the north a marshy region formed outside the walls, was used a cemetery, (as the great number of grave stelae and sarcophagi which were unearthed during its dredging for the construction of the modern entrance port) and was until recently mistakenly identified as the Kofos Limen (Steinhauer, G.A., 2000,p.79). The commercial port of Piraeus "Emporion" situated on the northeastern side of the basin, while one part of the military dockyard of the Athenians extended in the southern point of Cantharus, on Alkimos coast. The Kofos Limen was on the west coast of Eetioneian peninsula in today's Krommydarous' bay, while outside the port, beyond the north beacon that was found in Lipasmata area, was the Foron Limen or " Thieves' Harbor" where there was no control of any kind by the port's authority (Steinhauer, G.A., 2000,p.79). Piraeus

The basin of the port of Zea had a circular shape in antiquity, as it has today, with a diameter of 450m and an entrance port on its south side 180m wide and 200m in length (Traulos 1972, p.442-456). Piraeus

B. Jetties

As in the port of Cantharus, the entrance was formed by two jetties (moles), over which extended the walls that run along the coastline of the peninsula. At the end of each mole the walls were reinforced with a large rectangular tower from which a chain was hang across the entrance of the port.

Both the hill and the harbour of Munychia were enclosed by the city walls, which in the same way as Cantharus and Zea, extended over two jetties and were reinforced at their end, at the mouth of the harbour, with two large rectangular towers, leaving an opening of 37m. (Fig.13). The basin of Munychia had an elliptical shape in antiquity and dimensions, 360m in length and 220m wide. (Traulos, 1972,p.450). Piraeus

Furthermore, Raban believes that the lagoon at the north of the city was functioning as the city's "neorion", the place with facilities for ship construction and repair, storage, and shipment. At the same time he places as only candidate for the "secret" naval harbour, the second basin north of the lagoon. Salamis

Flemming, however, in the area of the lagoon that Raban considers as the «neorion», discovered during his investigation two streets, one going parallel to the modern shore and a second one meeting it. Along the length of the streets, and in general the southern half of the lagoon, he also discovered several architectural remains. This apparently means that the area was not submerged by the time of the constructions. His investigation was limited especially in the northern half of the lagoon. On the other hand, he concurs with the location and function of the north and south harbours and makes observations about the silting and the posibility that more features may be buried there.

The harbour possibly had a closed inner basin well protected from winter east winds, as it is evident from the geomorphology of the area. The circular shape of the basin can even today (1929) be recognized on the shore as "a low depression in the garden belonging to Imbranim" as Westholm lively describes. Soloi

Terracina

Der Hafen geht sicherlich auf die Zeit der Volsker zurück. Zwei Molen schließen das Hafenbecken ein: eine in ost-west Richtung verlaufend, die andere in nord-süd Richtung, zur ersteren im Winkel von 104 Grad gelegen (zangenartige Anlage). Der halbrunde Abschluß auf dem Ende der letztgenannten Mole trug vermutlich den Leuchtturm.

Thasos

The remains of the closed harbour are situated in the middle of the eastern part of the ancient city, under the modern port installations, in a rather good state of preservation. The ancient military harbour was enclosed within a marine wall, which is nothing but the continuation of the land fortification towards the sea. The part of the wall separating the harbour from the city area is now extinct; therefore it is hard to say whether there was direct communication between these areas, apart from two gates on the city wall outside the harbour area. During the Hellenistic period the wall is reinforced with circular towers and its western side is being expanded outside the wall through the construction of an artificial beach, made of marble and schist slabs in two rows, which hold together the filling of rubble. In this area is also placed the sanctuary of Soteira (Artemis?). The present state of the port was formed during the Early Christian Times and was preserved by the Genoans, while its overall dimensions have remained constant since the time of its construction. To the North –East lays the commercial port basin, which is protected against the northern winds by a fortified mole.

The basin of the military port is quadrilateral in shape and up to 3m deep today. It is defined by two moles and is protected by a marine wall, a continuation of the land fortification. To the north NE the basin of the commercial port is to be found, open to the south, which served the great commercial activity of the island. It is protected through a fortified mole against the northern winds and communicates with the agora of the city through two gates on the city wall.

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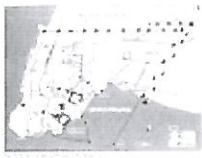
Harbour informations about: Breakwater

The topography of the ancient harbour of Aigeira has unfortunately been to a large extent altered due to geological factors, namely uplift and corrosion of the coastline, but mainly because of the extensive construction works along the coast. Because of the great uplift of the coastline it became possible to study and interpret the stratification of the harbour and to make some observations regarding its construction. Remnants of two breakwaters, or of a breakwater and a mole, are preserved on site, which stretch towards the north. Based on the prevailing winds of the area (NE and mainly NW) it is surmised that the mole-breakwaters were constructed running a. NW and b. NE. The entrance to the harbour should be placed in the area between the breakwater that runs NE and the rock that delineates and protects the harbour from the West. Aigeira

The constructions are founded on the natural sandy seabed. The underwater part of the harbour was formed by a mixture of hydraulic concrete with rubble and stones from the area held in place by wooden containers after the well-known technique of the *caissons*. Above the sea surface level it consisted of large hewn blocks placed along the outer side as well as transversally at intervals. The interior part was filled with concrete (*opus cimentitium*).



The first building phase of the southern breakwater, which originally was more than 330 m long and 12 m wide probably was constructed at the end of the 6th or the beginning of the 5th century BCE. The breakwater was constructed against the southeastern end of the *kurkar* ridge, with a shallow eastern curve. The breakwater protected an area of 25 acres of water within its north face and the northern shore . It was built at a depth of 3 m, on a pebble base laid on the sea floor. The courses of ashlar headers were laid on the pebble cushion without any bonding material. Each course was 0.55 – 0.6 m high. The size of the stones and their method of construction are nearly identical to those in the ports of Atlit, Tyre and Sidon, predating the Hellenistic period. Akko

Both faces of the breakwater were vertical. On the seaward face, the wall was made of header blocks, 2 m long each and 0.6 m wide. The wall facing the northern shore was made of header blocks of 1.5 m long each and 1.2 m wide.

Port of Ibn Tulun Akko

From the archaeological investigations, two of the deposits of debris in the port of Akko are attributed to the 9th century CE. At the end of this century Ahmad Ibn Tulun, the ruler of Egypt, enlarged the port. The eastern breakwater built from the Tower of the Flies joint the line of the eastern city wall. This breakwater and another rampart that extended northward from the eastern end of the southern breakwater for a length of 100 m, both were built during the 9th century. Each structure, more than 30 m wide, was made of small ashlar and rubble, and fragments of columns in

secondary use. The columns are preserved to a height of 3 m above the sea floor.

The outer harbor was comprised of a wide curving breakwater that enclosed the basin from S and W, encompassing a water area of approximately 25 acres. The eastern end of the southern breakwater rests on a rocky promontory that was the southern boundary of the middle basin. The remains of this breakwater (c. 40 m wide), continued westward for approximately a length of 200 m before turning northward for an additional length of 300 m. The width of the fallen remains differ in the western fall, from 60-70 m at the beginning of the arc to 150-180 m near the head of the breakwater, at the northwestern edge of the harbor. In the southern part of the breakwater only a few ashlars of the quay survived. Approximately 30 m west of the base of the breakwater, and 80 m north of its inner side, a floor made of ashlars slabs, of which only a survived section of 4 x 12 m, was found at a depth of 4.9 m bellow the sea level. Presumably the floor was the northern edge of the quay separating the middle and the outer basins.

Caesarea

The body of the southern breakwater was built of conglomerate blocks that were poured in wooden frameworks (caissons). The average of the blocks are 1.8 x 3.9 x 3.9 m. They were placed on a bed of stone rubble. Underneath this bed appear to be a foundation structure also made of concrete blocks. The outer edge of the breakwater rests on long ashlars blocks, some of which reach a length of 5 m, arranged in header courses.

During the excavations seasons of 1990 □ 1991, was found a huge tumbled mass of blocks, in area K (comprised of the northern tip of the main breakwater and the twin towers north of it). The blocks are scattered on an area of 25 x 35 m, at a depth varying from 1.5 m to 8 m bellow the sea level. The tumbled blocks were found on a platform of hydraulic concrete mixed with rubble that had been poured in wooden frameworks (caissons), Some of the wooden caissons survived to a height of 2 m. The caissons had external and internal walls.

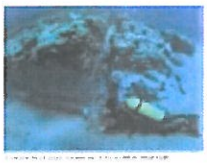
Prokomia or Prokomatia (Subsidiary Breakwater)

A well defined wall built of ashlars blocks and rubble, and incorporating few large masses of concrete blocks, branches off the southern face of the southern breakwater, close to its east end. This feature extends for c.130 m in a straight line to the NW. The upper surface of this structure is found at a depth of 6 m bellow the sea level. The width varies from 4 to 8 m and usually it rises 1 to 2 m above the sandy bottom. This wall is not an accidental structure created by the destruction of other features related to the main breakwater. This wall of a segmented line, being placed about 20-30 m outside the spinal wall of the southwestern breakwater, would cause the breaking of the surge and also absorb the waves energy. In his writings *(JW 1*.411-13; *AntJ* 15.334-38), Josephus mentions of an outer breakwater that he called *prokomia* or *prokomatia* (a subsidiary breakwater). The main role of this breaker was to prevent the splash of the seawater over the spinal quay wetting the vaulted stores. This feature also would ease the destructive impact of under-trenching

currents at the base of the main breakwater. Being a segmented line with openings for rip currents, it would prevent the pilling up of seawater on the lee side and also keep it silt free. It seems that this unique structure was only added to the main breakwater, which faces the open sea and the full impact of the surge from the W and SW. This extra breakwater still remained almost intact, though it subsided 5-6 m.

The Northern Breakwater

The northern breakwater was a long rectangular structure projecting almost 240 m from bedrock shoreline towards the entrance channel. Its eastern base is rested on natural rock. Its width varies from 60 to 70 m, being covered (almost entirely) with small pieces of rubble. In the attempt to remove the rubble from the entrance area, large quantities of pottery and coins of the 5^{th}-6^{th} centuries were found. In addition, it was revealed that among the rubble large ashlars blocks were sunken at the entrance. Underneath the rubble wooden beams were discovered, probably to control the descent of the stone blocks on the sea floor. Carbon 14 tests indicate that the wooden beams age range from 1550 to 1700 years ago. Based on this information, the researchers assumed that the beams might be the remains of an attempt to rebuild the sunken harbor by the Byzantine emperor Anastasius (491 □ 518). Near the head of the breakwater, protruding above the rubble of the Byzantine repairs are the remains of an enormous structure built of ashlars blocks 7 m long or more. Iron clamps were implanted in some of the blocks, to set them in place. They were implanted in lead cast in niches carved into the edges of the blocks. Remains of lead flows on the sea bottom (at a depth of mare than 9 m bellow the sea level) indicate that the casting was made after the stone blocks were placed under the water.



On the outer side, near the tip of the northern breakwater was found a rectangular concrete block. This block was poured into a double-wall wooden form (caisson). The dimensions of each formwork were 15 x 21 m. It seems that the original height of the block was as much as 3 m. A pavement of rectangular stone slabs was placed on top of the concrete block.

Cosa

(keyword breakwater)älteste Anlage zum Schutz der Bucht vor dem durch südsüdwest-Winden bedingten Wellengang ist eine vom Steilhang des Vorgebirges in östlicher Richtung verlaufende, ca. 110 m lange Aufschüttung aus lokalen Bruchsteinen ("breakwater") □ An ihrer mächtigsten Stelle betrifft ihre Breite bis ca. 70 m.

Gytheion

During sonar surveying a target of possible archaeological interest was located. The researchers (Skoufopoulos 1985) believe that the target may be a structure of the ancient harbour of Gytheion or a Pleistocene rock, or a quay, while they are not able to determine its precise nature without further excavation. The area is located southwest of the modern stadium and almost parallel to the coast. It is located 5m

beneath the sea sub-bottom and it is around 220m long and 70m wide.

During Leonard's investigation a silted breakwater was identified, with a number of fallen square blocks, which were recorded on the shore. The breakwater consists of two parts, the main one is about 68 m. long, narrowing toward its seaward end with maximum width of about 12m; the second one consists of square stones and rough rocks extending 30m. further. Kourion

Kyrenia

He states in 1966 that, " The breakwater behind the castle of Kyrenia, which is today utilised for the same purpose, the new harbour of the city, was built with large blocks similar to those used at other ancient harbours. It must therefore be an ancient breakwater and not medieval mole for the protection of the castle as many would believe". Under the construction works of the new port the ancient breakwater still survives, as the research of 1971 has proven. Although the modern harbour entrance is located to the east, the ancient entrance must have been placed to the north-west as it was up until the reorientation of the entrance in the 1950's. On a map of .... the remains that Nicolaou refers to are marked as being ancient sea-walls. The plan from the 1971 survey simply refers to the breakwaters as archaeological remains with a questionmark added to indicate the uncertanty of the statement. On the western breakwater, which is now covered by the modern facility, the upper remains of the Roman and medieval moles can be discerned, whose size (0.6x1x2.3m) act as the base for the modern western breakwater. This is now joined to the eastern breakwater and thus has closed of the ancient entrance to the harbour.

The ancient western breakwater, visible along its entire length, is orientated in a NE direction. It reaches a distance of 40m from its origin, and end a few meters further from the modern lighthouse. For approximately 19m after this point the breakwater curves slightly to the northwest. Past this point the breakwater continues for a further 20m, at a depth of 6m, and turns further northwest towards the open sea where Hellenistic pottery was discovered.

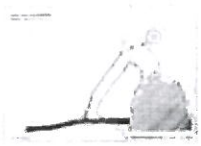
Lapethos

The harbour consists of two breakwaters, which form an enteance to the facility approximately 100m to the west, and have survived to a great extent. The northernmost mole (and hence the winward) survives to length of 155m with a width of 10m, with a SW-NE orientation. The two ends of the mole are curved, with the result that the westernmost curve effectively 'covers' the second mole, and thus protects the interior of the harbour from westerly winds. It is possible that the mole was placed on a natural ridge that projected from the beach into the sea. According to Raban two phases of construction are evident on the mole. The first phase compromises well constucted stonework in the Phoenecian style, whilst the second phase of stone blocks up to 1.5m large which most likely placed by Roman

engineers.

The second mole projects perpendicularly from the shore in relation to the first, and is orientated NW-SE. The mole has a length of 40m. According to Nicolaou both moles were re-enforced between 1957-1959 to create a modern fishing haven.

Methoni

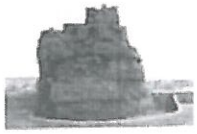


There are two jetties in the area. The remains of the earlier mole are of semicircular shape. The ancient mole starts at the Southern Gate of the Castle, from where it spreads towards the south for 100m, and then curves southeast for 80m, to curve again north for the rest 220m and run almost parallel to the walls. The Venetians and Turks undertook a number of harbour works in order protect the Castle and fortify the port. However, these alterations caused the harbour to silt up in the following years.

The second mole was built around 1880 on top of the north mouth of the ancient harbour and vertically to the Castle and it consists of large boulders. This newer mole passes over the north end of the ancient one and extends on at the same direction for 100m. The second mole was an effort to replace the silted harbour mouth north, however, with no result.

Paphos

The western breakwater is today covered by the constructions of the modern harbour. According to Daszewski the breakwater has a width of 10-15m and a length of 270-280m, with a submerged section measuring 50-70m and a southerly orientation, which is still visable today. This extention was probably constructed in order to protect the entrance to the harbour from the west winds.



The eastern breakwater had a length of 600m with a width of 10-15, whereas Hohlfelder comments that the width had a length of 20-25m. A section of the western breakwater was destroyed during the dredging of the modern harbour entrance. The ancient entrance to the harbour had an opening of 52-55m. A purposly constructed opening on the eastern breakwater, and possibly others that have not yet been discovered, may have been used to combat the effects of silting due to sea currents at the harbour entrance. A second mole to the south of the opening, which extends for 199m parallel with the breakwater and has a width of 5m, may have functioned for the same reason.

Pisa

Etruskischer Wellenbrecher (ca.400 v.Chr. als terminus ante quem)
römisch 1, hellenistisch (Anfang 2.Jh.v.Chr.)
römisch 2, kaiserzeitlich (claudisch?/ tiberisch)

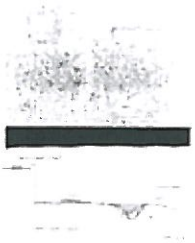
In südlichen Areal der Grabung (ampliamento sud) wurden unterhalb der Niveaus der kaiserzeitlichen Centuriation einige Anlagen gefunden, die zum Hafen der etruskischen Stadt gehören.

In der Ostecke wurde ein Teil einer Buhne /Palisade (Wellenbrecher) ausgemacht, die sich noch in situ befand und aus einer Reihe gerader Baumstämme geringen Durchmessers (ca. 18-20 cm) bestand, die senkrecht in das sandige Sediment getrieben wurden.

Salamis

According to Raban the south harbour is the commercial one. It is formed from a breakwater, running southwest - northeast. The south end curves southwest to leave an entrance of approximately 200m. The lower part of it is a rampart built of large blocks down to 6m depth. Over the lower part of large blocks an upper layer consisting of ashlar blocks was placed. This technique of spilled rampart, or breakwater, was not used in Phoenician harbours, but was quite common in Greek harbours, such as the Archaic harbour at Samos, the Classical harbour of Aegina and the commercial port of Cnidos. The construction of the breakwater using this particular technique reflects the orientation Evagoras had towards the Aegean, which hypothesis can be supported by the dense harbour network on the north coast enumerated by Pseudo-Skyllax (Karpasia, Kyrenia, Lapethos, Soloi, Marion). The ashlars are submerged at a depth of 2m, whilst in the basin the depth of the water does not exceed 2.5m. Taking into account the rising sea level from antiquity, estimated to be approximately 1.8-2m, the depth of the harbour would have been only 0.7m. This factor demonstrates the level of silting that occurred in the basin of the harbour, since 0.7m of water is far to shallow for a facility of this size. Under this thick stratum of sediments might possibly lie more architectural features of the harbour, if they exist. To prove this hypothesis excavation would be necessary, since the limited survey of 1971 and 1973 did not locate any further features.

Samos



The breakwater was located outside the modern port basin and the city wall, south, on the outer side of the modern mole following a parallel direction. It is a stone structure made of rubble and architectural material in second use, 480m long. Its width has not been identified as it is covered by sediments and material fallen from the modern mole. The construction lies now submerged at a depth of 2.75-3.20m near the shore, 4.43m at the external side of its central part and up to 14m at its south end. At that point it turns slightly and is lost under the modern mole. This construction has been identified with the Polykrateian 'choma', which was constructed lasting the reign of Polycrates in 530 BC.

Another stone structure, with estimated dimensions 170-190m length and 20m width, was discovered at a depth of 2m underneath the northern modern mole. It is suggested that it could form part of the foundations of the marine wall/ mole, a continuation of the land fortification from N to S, which must have closed from the east the military port. This hypothesis has been strengthened by the presence of ancient blocks incorporated in the mole of the 19th

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Harbour informations about: Caissons

To understand how these caissons were constructed and used for building the breakwater, we have to relay on the paragraph where Vitruvius (5.12.4) describes the method how to set up formworks in rough seas. He also proposed a method of preparing and curing concrete blocks on land for the breakwater that would be transported to site by the natural forces of beach-movement. This method is not relevant because there is no control to where the blocks would have been taken by the surge. In the following paragraph he describes how to built a double walled cofferdam (5.12.5) to construct a pier: Caesarea

> "Let double-walled formwork to be set up in the designated spot, held together by close set planks and tie beams, and between the anchoring supports have clay packed down baskets made of swamp reeds. When it has been well tamped down in this manner, and is as compact as possible, then have the area bounded by the cofferdam emptied and dried out by means of water-screw installations and water wheels with compartmented rims and bodies. The foundations are to be dug there, within the cofferdam."

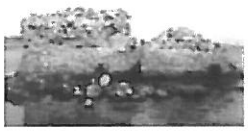
The cofferdam described by Vitruvius, may by applied in shallow water and in close vicinity of the shore. The wooden forms used for the eastern Tower and the western tip of the northern breakwater is a combined result of Vitruvuis□ description and the physical conditions at Caesarea. The bottomless double-walled formworks were built on the shore. A liquid hydraulic mortar was poured between the walls of the caisson, about 1/3 or half height and let to dry. The density of the dried concrete was 0.6, thus it allowed the caisson to float. When dried, the caisson was floated to its final position. Once the form was anchored by heavy chains by the divers, mortar was poured into the sections of the hollow walls with careful attention to balance, until the buoyancy of the wood was overcome, and the form settled into position on the prepared surface. While the inundated compartments of the form were filled with mortar and aggregate, rubble was also dumped around the periphery of the form to prevent it□s shifting prior to curing of the concrete, or undermining of the final block. The use of caissons system would allow a rapid and flexible schedule of harbor construction.

This process of building caissons on the shore and installing them as compartments for an artificial island seems to correspond with the eye witness testimony of Pliny the Young, in one of his letters (1st century CE), written from the Roman coastal town of Centumcellae. Caesarea

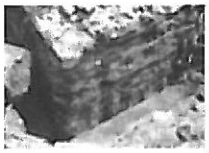
Sechs Blöcke aus römischen Gußbeton (A-F) verlängern diese in einem Bogen nach Osten und schließen die Bucht somit gänzlich ab. Das so umschlossene Areal beträgt ca. 25.000 qm. Eine Verbindung zwischen den Pfeilern und der breiten Mole konnten nicht gefunden werden. Zwischen den Blöcken D und F befand sich die Hafeneinfahrt in einer Breite von 33 m und einer jetzigen Tiefe von 6□ m. Die Bearbeiter bleiben jedoch Cosa

die Erklärung schuldig, wie ein so gestaltetes offenes Bauwerk auch gänzlichen sicheren Schutz vor den vorherrschenden nordwestlichen Strömungen bieten kann. Die Ursache, daß diese mächtige Aufschüttung heute unter NN liegt führen die Bearbeiter auf die Tatsache zurück, das diese ehemals eine Sandschüttung abdeckte, welche durch den Wellengang im Laufe der Zeit erodierte und die Steine zum absacken brachte.

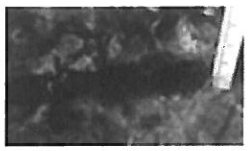
Ein weiteres Molenwerk bilden die fünf □Blöcke ("Pier 1-5") sowie eine in deren Verlängerung verlaufende Mauer an Land ("wall M") aus römischen Gußmauerwerk, welches einst ein kleines Areal von ca. 30 qm im Westen der Bucht am Fuße des Steilhanges abtrennte. Diese Blöcke, welche eine Reihe über ca. 150 m bilden, waren in der von Vitruv V, 12 beschriebenen Bauart mittels der unter Wasser abbindenden Pozzuolanerde errichtet (Vitruv II, 6,1). Die Freiräume zwischen den Blöcken waren unregelmäßig. Vergleiche lassen sich in vielen römischen Hafenanlagen feststellen. Cosa



Während der untere massive Teil dieser Blöcke mit Pozzuolan-Erde und Füllmaterial (Tuffbrocken) errichtet war, so wies der oberhalb der Wasserlinie befindliche Teil aus Materialersparnis nur normalen Mörtel mit Füllmaterial auf. Solch eine Materialwahl zwischen dem Bauteil unter und ober der Wasserlinie findet man z.B. auch am neronischen Hafenbau in Anzio und ist mit der Tatsache zu erklären, daß diese besondere Puzzolanerde aus dem Gebiet um Puteoli importiert werden mußte. Cosa



Um zwei dieser Blöcke wurden Sondagen bis zu einer Tiefe von -2.50 m durchgeführt ohne die Fundamente zu erreichen. An Pier 1 konnten noch die Verschalungsabdrücke von 6 Bohlen festgestellt werden. Ebenso solche Holzabdrücke der Verschalung lassen sich häufig finden: Anzio, Fiumicino (Portus), Pyrgi, Side, Caesarea,...



Die Bauart in Pilae-Konstruktion, d.h. vereinzelte Blöcke mit Freiräumen zwischen denselben,□ findet sich häufig an Molenwerken in stillen, geschützten Buchten. Bekanntestes Beispiel ist Puteoli im Golf von Baiae. Wird allgemein behauptet die Mole sei durch Kanäle unterbrochen um eine Versandung zu vermeiden, so konnten bei Nachuntersuchungen in Cosa ein bisher nicht erwähntes Detail den Nachweis erbringen, daß diese Freiräume mit anderem Material gefüllt wurden.□ In der Außenwandung von Pier 1 fanden sich Amphoren in der Wand eingelassen, die als Halteloch für Stangen zur Schließung der Freiräume gedient haben mögen (Felici 1998). Cosa

Some conglomerate formations east and west of the entrance interpreted as caissons Lechaeon by a searcher of the area.

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Harbour informations about: Channel

Atlit

Within the North Bay there are two rocky islands that provide protection to the bay and also were used as components of the Phoenician harbor. They are separated by a gap of about 20 m and 2-3 m deep. The seafloor of this gap revealed no evidence of any stones construction to indicate that it had been closed or a bridge had connected these islands at any time. Nevertheless, when the harbor was constructed and functioning, presumably the gap was narrower and no sailing craft could pass through. In ancient times this gap probably provided a good washing channel to scour out the accumulated sediments from the harbor basin. This channel being under the constant waves energy widened during the centuries (2500 years passed), by the erosion of the *kurkar* bedrock. Nowadays, the gap is wide enough to cause trouble waters within the harbor basin in stormy periods.

Caesarea

With the completion of the quays, the harbor basin was enclosed and well sheltered from the surge. Within this enclosed basin was a setting body of still water, a terminal for the shifting sand and also a reason for gradual silting. In order to prevent or minimize such a natural process flushing currents were created, flowing out through the harbor mouth. Such a flush current was created by an inflow through a series of shallow channels transversely crossing over the southern mole. Each channel had its opening facing the surge with a base above the income waves to create a constant inflow of water. Such channels would feed the harbor basin with additional water. Vertical grooves for insertion of sluice gates would enable proper control over the rate of the inflow in various sea conditions. The additional quantity of water would find a way out through the harbor channel, flushing it properly. Confirmation for the successful flushing of the harbor basin was found on the sea floor. Within the main basin, under layers of wave carried deposits there was a thin layer of fine mud with some 1st century pottery shards on it. Such sediment is typical of still waters and represents the time when Sebastos was fully operational. The absence of sandy particles in the mud indicates that there was no silting of the harbor from the open sea. Probes carried outside the harbor mouth revealed a deposit of over two meters thick of mud, dirt and all sorts of garbage from the harbor, some kind of dumping site for whatever was carried away by that overflowing flushing currents.

Caesarea

On the southwestern edge of the rocky promontory a channel was carved in the rock, leveled at 20 to 30 cm above the sea level. The sides of the channel have vertical grooves in which wooden gates could be placed to control the water flow into the channel. From plans drawn by researchers of the Palestine Exploration Fund in the 19th century, it seems that there were other channels east to this one. Their function was to force a surplus of water into the harbor and thus, create a constant flow from the entrance channel onward. This flow would ensure the removal of sediments from the bottom of the harbor, to prevent sand and silt from penetrating through the entrance. Proof that such a flow existed was found in a layer

more than 1 m thick at the mouth of the harbor. The layer contained muddy clay and an abundance of pottery, metal parts of ships and gravel that drifted there from the bottom of then-active harbor.

Other remains of the Herodian construction on the southern side of the Middle Basin are today covered by structures of the Crusader harbor fortress and the concrete of the modern wharf.

Mozia

Mit dem Meer ist dieses Bauwerk durch einen geknickten, ca.23.50m langen Kanal verbunden. Dieser trifft die eine Breitseite des Beckens nicht mittig und verjüngt sich kurz vor dem Erreichen der Beckenwand. Die unterste Blockreihe aus Sandstein springt vor und bildet hier somit auch einen Absatz. Der Kanalboden, nicht so tief wie das Becken (ca. 1.75 m), ist mit Blöcken ausgelegt. Mittig verläuft eine vertieft angelegte Rinne mit konkavem Querschnitt (B 0.54m x T 0,13m), zu der sich die beiden flankierenden Bodenhälften hin leicht neigen. Zwei Dreiecksteine im SO und SW Winkel engen den Durchgang weiterhin ein.

0 Die gesamte Anlage scheint zwei Bauphasen aufzuweisen (s.u.). Der Kanal weist an der engsten Stelle eine konische Verjüngung auf durch zwei strebepfeilerähnliche Konstruktionen. Auch das getreppte Mauerprofil erinnert an heutige Trockendocks, dennoch konnte eine Verschlussvorrichtung des Kanals nicht nachgewiesen werden.

Ostia-Claudio

Grazie all'aerofotografia è possibile individuare una lunga e sinuosa traccia scura che, partendo dalla testata del molo destro e connettendosi al bacino esagonale traianeo, aveva funzione di canale d'ingresso a quest'ultimo bacino.

Ostia-Traiano

Un sistema di canali (tra cui la Fossa Traiana, l'odierno canale di Fiumicino), collegavano il porto con il Tevere e quindi con la capitale. La via Portuense, inoltre, assicurava il collegamento via terra.
Un'altra strada, chiamata più tardi via Flavia-Severiana, collegava il porto di Traiano ad Ostia. Essa attraversava l'Isola Sacra, ovvero il territorio compreso tra il braccio naturale del Tevere, a sud, e la Fossa Traiana, a nord.

Ostia-Traiano

Il canale d'ingresso al bacino esagonale è largo in media 60 metri ed è lungo oltre 500 metri. Esso era fiancheggiato a sinistra da un grande molo e dalle

banchine antistanti ai magazzini cd. severiani e a destra dalle banchine dei magazzini traianei.

Ostia-Traiano

Un canale si distaccava dal lato meridionale del canale d'ingresso al bacino esagonale collegando il porto di Traiano con la Fossa Traianea. Questo canale, oggi totalmente interrato, è lungo 330 metri ed è largo 25 metri.

Ostia-Traiano

La Fossa Traiana è un canale artificiale, largo 50 metri, che fiancheggiava a sud il porto di Traiano collegandolo direttamente al Tevere. Oggigiorno essa è nota quale canale di Fiumicino.

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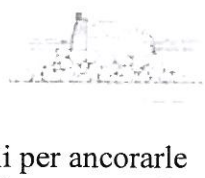
Harbour informations about: Coffer dam



Ostia-Claudio

Le casseforme lignee hanno lasciato tracce evidenti nelle gettate di calcestruzzo: è possibile osservare i montanti piantati lungo il perimetro esterno delle casse, utili per ancorarle al fondale, e il loro collegamento alle traverse - i cui fori erano già stati interpretati quali tracce, in negativo, dei bagli della nave di Caligola - e alle paratie di contenimento della gettata di calcestruzzo. Un sistema di costruzione dei moli foranei descritto da Vitruvio (Vitr., 5, XII) e ben documentato lungo la costa tirrenica (Felici 1993; Felici 1998: 280-283; 324).

Inoltre, la base del molo era costituita da una gettata di blocchi in selce.

Ostia-Fluviale

Il muro è spesso oltre 2 metri, costruito in cementizio con larghi blocchi in tufo. Rimangono le tracce in negativo delle traverse lignee che costituivano i cassoni lignei di fondazione.

Ostia-Traiano

Il molo, lungo 150 metri e largo all'incirca 8 metri, è costituito da gettate di calcestruzzo.

Velsen

The moles consisted of coffer dams with revetments of closely spaced rows of posts, separated by transverse partitioning. The coffer dams once contained a fill (see fig.8) of layers of willow twigs (fig.10), separated by thick layers of clay, enclosed between layers of straw (fig.9), to prevent the clay from being washed away. Only some of the fill was preserved at the end of the western mole (see fig.11).

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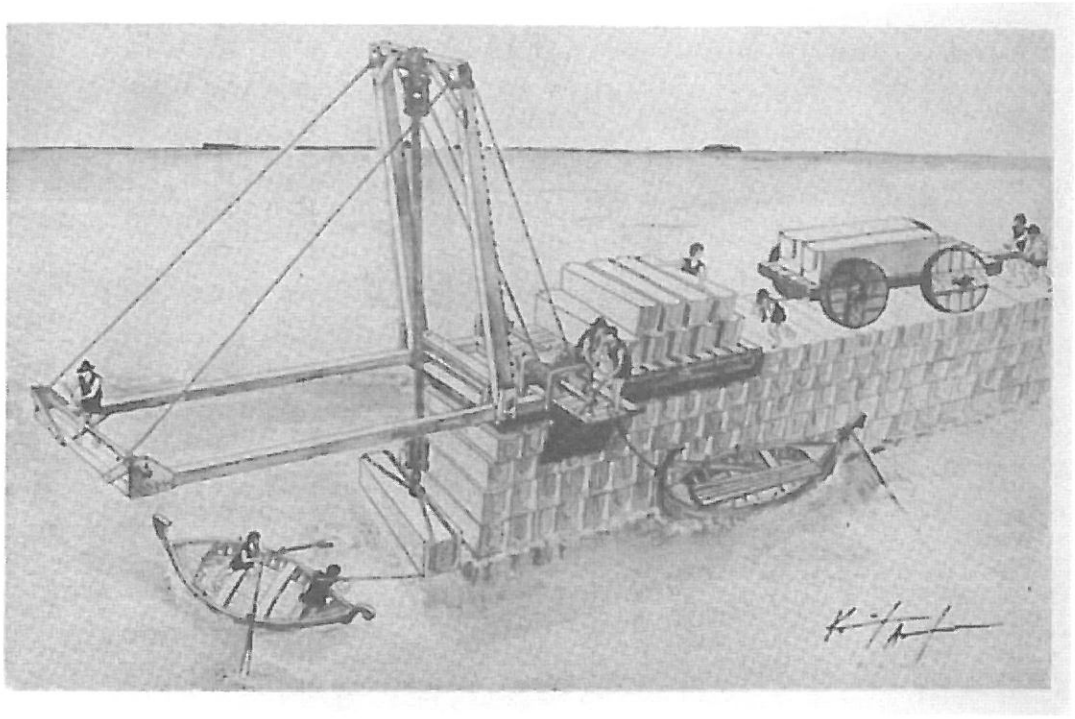

Αναπαράσταση του ανυψωτικού μηχανισμού για την κατασκευή του εξωτερικού – ελληνιστικού λιμανιού

Representation of the crane mechanism for the construction of the external Hellenistic harbour

(Aupert P. (ed), *Οδηγός Αμαθούντας*, Πολιτιστικό Ίδρυμα Τράπεζας Κύπρου, Λευκωσία, 1999, 95, εικ. 36)

Harbour informations about: Defences

The archaic mole was formed by the extension of the city wall, which runs from E to W and protects the port from the north. This part of the wall ends at the sea, which is today traced by a layer of sand with shells and pebbles in the area where the sea basin stood. The foundation of the wall made of rubble that was found was probably built at the level of the sea surface. At the western end, where it meets the sea, it widens either to offer greater protection or to serve as a basis for a tower. Abdera

Crusader Port Akko

During the Crusader period no important work was carried out on the breakwaters or the sea walls. During the Turkish government the stones from the masonry at Atlit were shipped away to be used for building the sea walls at Akko, still surrounding the harbor.

Another tower was built at the northern tip of the western jetty, connecting to the southern breakwater. In the writings of the Persian traveler Nasr Kursau (1047), is mentioned that a chain as a blockage was closing the entrance of the inner harbor during the night and against enemy attacks. Akko

Dover was a very important Roman government crossing point to the European mainland and it was heavily defended by the Roman navy, the Classis Britannica, who had built forts there in the late 1st and 2nd centuries. Dover

These were superseded in the late 3rd century by a Saxon Shore fort, one of a number of later Roman coastal forts around south-eastern England, suggesting that it was the base of a naval fleet that operated during the 4th century until the end of the Roman period in the early 5th century.

The defences of Dover fall into two types: Roman and medieval fortresses, and a medieval town wall recently excavated near the seafront. The Roman forts lay at the bottom of the river valley close to the sea, and the medieval fortress, Dover Castle, lies on top of the high eastern hill. Dover

There are two phases of Classis Britannica fort, each surrounded by a defensive

stone wall rectangular in plan with rounded corners like a normal Roman military fort. The first fort was unfinished and was probably built not earlier than the late 1st century AD.

The second phase of Classis Britannica fort was built on the same site about AD 130-140, and was finally abandoned about AD 210. Inside its defenses were rows of buildings beside a grid of streets.

The forts include many bricks and tiles stamped CL.BR in their construction.

The Saxon Shore fort also had a stone defensive wall, but was built in the late 3rd century. The complete shape of that fort has not yet been revealed.

Gytheion

According to the ancient sources, the Spartans probably fortified Gytheion, as in 370BC, when the Spartan Epameinondas laid siege to the city was not able to destroy the Spartan ship-sheds. However, there is no archaeological evidence to support the existence of harbour fortifications.

Halileis

According to the researchers Halieis is a small, man-made harbour, with the surface area of 4km². Two circular castles are located in the center between the Eastern and Western side of the city. There is a gap of 20m between them, one is located North than the other, and they both form the mouth of the harbour. From the Southern castle, almost vertical to the modern coast and direction towards the North, there is a mole that leaves between its northern end and the second castle a gap of about 9m. The opening bares cutting marks and probably closed with a boom.

Lechaeon

The harbour of Lechaeon was, according to Strabo (VIII, 6, 22) and Xenophon (Hellenica, IV, 4, 5), well fortified and connected to the city of Corinth via 'long walls'.

The eastern portion of the long walls was discovered during the excavations of the American School of Classical Studies (Parsons 1932, 84-125). According to the excavation results, the wall reached the eastern side of the eastern harbour mound (Parsons 1932, Fig. 55). Segments of the west wall were discovered in 1906 by A. Skias, which terminated to the west of the harbour (Skias 1907, 145-166).

The harbour was also fortified to the south, as mentioned by Diodorus Siculus (XIV, 86, 4). These walls would have formed a protective 'H' shaped fortification on the three sides of the harbour of Lechaeon. It is also possible that the harbour was further fortified by a secondary wall facing the sea, and possibly north of the two mounds. There are still visible remains above the level of the eastern reinforcement

wall, at the entrance to the harbour, that may well indicate this sea wall (*Fig 11, 3*).

On the retaining wall of the western's entrance channel may be seen, according to Pallas (Pallas 1969, 201), a cutting that resembles the niches for a bridge, or possibly a system for the blockage of the harbour. Today, only the grooves that once held the metal clamps, for the connection of the stone blocks, are visible, and can be dated to the first construction phase in the Archaic period.

Die heute verlandete Hafeneinfahrt war ca. 100 m breit. Sie war durch eine Kette absperrbar (vgl. Vitruv XII 1), wie eine an der äußßeren Spitze der Ostmole erhaltene 2 m hohe Säule (Durchmesser 70 cm) zeigt. Leptis-Magna

Although the city of Methoni was already fortified during the 5th century BC (Thucydides II.25) there is no positive evidence for the fortification of its harbour until the 15th century BC, when P. Bembo mentions that the Venetians undertook large-scale repairs at the fort and the moat. According to him the Venetians constructed a note-worthy fort at the harbour and created in the sea a dam, which did not let the hostile ships to sail near the city walls. However, they left a small gap that enabled the entrance of a single ship at a time, because for them it was easier to fight a single ship at a time, rather than a lot together (Lianos 1987, 132) Methoni

According to Lianos (1987, 134), during the underwater survey a gap around 20m wide was located, cut on small lime-stone reefs, on the southern end of the ancient mole, while the fort mentioned in the literature, can probably be identified with an earlier construction phase of the fort, now called Bourtzi.

I pochi resti delle mura sono visibili da terra solo in alcuni punti: il tracciato in generale è invece ben leggibile nelle planimetrie o nelle foto aeree. Ostia-Traiano

Il porto non ebbe bisogno di essere difeso fino a quando le trasformazioni avviate in tutto l'impero all'inizio del IV secolo incominciarono a ripercuotersi su Roma con una serie di problemi, fra cui quello sostanziale del rifornimento dei generi di prima necessità. Proprio per questa ragione Costantino concesse a Porto, per la sua funzione di deposito annonario, il titolo di civitas e l'autonomia amministrativa da Ostia.

Con il doppio obbiettivo di salvaguardare i magazzini e controllare più strettamente gli accessi alla capitale minacciata dalle continue incursioni barbariche, tra la fine del IV e gli inizi del V secolo fu eretta una cinta difensiva delle strutture portuali.
Il tracciato delle mura era irregolare perché seguiva una linea spezzata imposta dalla funzionalità: ne rimasero fuori le strutture del porto di Claudio e alcuni edifici di

diversa natura.
Secondo il sistema tardoantico, per la costruzione si sfruttarono in tutto o in parte alcune preesistenze, che in qualche caso sembravano avere conservato la funzione originaria (per esempio i magazzini cd. severiani).
Successivamente, l'aggravarsi della situazione di Roma, con il conseguente calo demografico, e l'intensificazione delle scorrerie resero più prudente il trasporto immediato delle derrate in città, evitando il più possibile gli immagazzinamenti, sempre più difficili da difendere. In quest'ultima fase all'interno del primo circuito di mura se ne eresse un secondo (settore sudorientale), di fatto un vero e proprio castello fortificato a difesa della Fossa Traiana, unico accesso a Roma per via fluviale dopo l'intasamento del Tevere, e secondariamente di quanto rimaneva ancora in funzione dei vecchi impianti.

Di nuovo vennero utilizzate le strutture precedenti, stravolgendone l'assetto e la funzione originari (in particolare, i magazzini traianei, il cui lato occidentale ancora conserva le tracce delle reiterate operazioni difensive).
Le attività residue si concentrarono in questo settore, che sarebbe rimasto fino al medioevo inoltrato il solo nucleo operativo, mentre gli edifici esterni alle mura furono progressivamente abbandonati. Scavi recenti vi hanno infatti evidenziato numerose sepolture non facilmente databili, ma certo successive al V secolo.

Piraeus

The semicircular arrangement of the porticoes on either side of the "Diazeugma" and the adaptation of such an arrangement to the city's Hippodameian plan points to the formation of an enclosure around the area of the "Emporion" (Steinhauer, G.A., 2000,p.91).
The existence of the enclosure is noted on Judeich's map (fig.10) with a length of 80m and foundations of such walls have been discovered near one of the porticoes (Dragatsis portico) and further north.

Piraeus

The naval zone was separated from the rest of the city –in the same way it did in Cantharus' port – with an enclosure that run across its whole length at a distance of 50m from the coastline, serving in the same time, as the closed wall of the ship sheds' narrow side.

Piraeus

The fortification of the city and the harbour, was established by Themistocles in 493 B.C., before the building of the city, with the two large city gates of entrance to Piraeus from Athens. "At this point, which bore the main weight of the city's defense, was the thickest (5m) part of the wall, the strongest, most solid construction and the protection by a dense array of enormous circular towers 10m. in diameter" (Steinhauer, G.A., 2000,p.45).(Fig.18)

The gates are the most ancient feature of the Piraeus fortifications while different phases of construction can be identified in the surviving towers. In the remains of the towers that form the western gate, the round towers are attributed to the

Themistoclean phase and the reconstruction by rectangular ones to that of Conon. From the walls that surrounded the city from the north, continued on the coastline and extended over the harbour entrances (as it has been described for each pot separately) the westward line of the northern wall, towards the Eetioneian coast, has been confirmed by a series of excavations retaining its solid construction and its width.

The third surviving gate that has been discovered, is the Eetionian gate, situated on the hill of Kastraki on the northwest side of the Main Harbour (Cantharus), overlooking the entrance to Piraeus from the sea." This is a simple type of gate (fig.21, 22), without a recess internal courtyard. It consists of an entrance (3.70m wide) with a two- paneled gate, flanked by two towers which were initially rectangular but which, very likely in the Hellinistic era, were enclosed in circular ones with a diameter of about 10m.The towers have been preserved today to a height of 3.00 and 5.00 meters respectively." (Steinhauer, G.A., 2000,p.48-49)

The walls that extend over the Eetionian coast (fig.19, 20) as well as the Eetionian gate have preserved at least three different construction phases.

The coastal walls that surrounded the peninsula of Piraeus are preserved today in quite good condition and to a length of approximately 2.5 kilometers from the entrance of the port of Zea to the entrance of Cantharus. The walls constructed by Themistocles (493-404 B.C.) were shorter in length than the surviving Cononian walls that were extended in order to cover the entire, perimeter of the peninsula, and avoid any possibility of landing. The cononian walls were constructed at a distance of 20-40m from the sea and was a lot narrower (3.10-3.40m) than that of the northern fortification of the city and the solid construction of the former was replaced by the "emplecton" method according to which, the two sides of the wall are constructed with blocks of carved stone and the inner part is filled with mud and rocks.

Remnants of the fortification of the harbour and the city are preserved on the peninsula of Piraeus, on the whole length of the Eetioneian coast, northeast of the city as well as behind the area of today's Kastella. (Fig.23) At some points the wall is preserved up to the height of eight courses of stone and along a total of 2 kilometers (at intervals of 45 to 100m, according to the morphology of coastline), 22 rectangular towers (4x6 m) have been preserved. (Steinhauer, G.A., 2000,p.52). From the towers that formed the entrances to the ports one is still standing on the eastern side of Zea, as well as those of the port of Mounychia.

The military port was enclosed in ancient times within a marine wall, which formed Samos part of the land wall. During the excavation a segment of the Byzantine wall was located 0.50m under the sea surface at the SE cove of the port. It was established that the foundation lies on top of the foundation fill of the ancient wall. Two

segments were revealed, the first is made of three layers of transversal and horizontal limestone blocks, 4m wide, the second segment 1m underneath the foundation of the Byzantine wall is made of 17 transversal limestone blocks in two layers, 13m long. The second segment is thought to be the outer face of the marine wall that closed from the south the ancient military port.

The moles of the closed harbour are formed by the extension of the Thasos land fortification wall towards the sea and are partially covered by the modern quays. In the northern part of the port the marine wall starts off from the land wall, near the gate of the Goddess with the chariot, follows for 148.6m a SE-SW direction and then turns SW at a length of 45m (points A-B). The wall is 3m wide, and is made of a double row of schist slabs with rubble fill in-between, mounted with marble blocks, on rubble foundations. A part of it is preserved at a height of 2m. In the SW part the wall (points G-H) starts off from the marine gate and turns NE (points F-G) for 31m. During the excavation only its inner face was revealed. It is made of marble blocks in even layers and rubble fill; a part of it is also preserved at a height of 2.13m. The way blocks placed vertically are spaced every 2.40 to 2.50m in the segment F-G of the mole is very characteristic.

In the area between the points D-F the excavators estimate that the continuation of the marine wall is to be found and as a result they place the entrance of the port in the area between the points C-D. The restricted opening of the entrance at this point, namely 20m, would also account for the use of the term *'kleistos'*, translated enclosed or closable, in the ancient sources. It is very usual at this period to place the entrance of the military ports at an angle.

On the side of the ancient agora the excavators place another stress of the wall that separated it from the harbour area and through gates communicated with it.

During the Early Christian Times the plan of the port changes and the entrance is shifted to the point where it stands today. During this period a new part of the mole is constructed (points C-D and D-E) from architectural members in second use and roughly made columns. Its one end (point E), underneath the modern red light, is made of *spolia* joint with hydraulic concrete and is founded on an ancient construction, which consists of transversal and horizontal stone blocks joint with axe tenons (two have preserved the lead fill).

Lasting the excavation the already known mole of the commercial port, situated outside the fortification wall, was partially explored. It follows an E-W direction, is 115m long and 18-30m wide. At its W end it forms a semicircular area with a diameter of 20m. It is built with two rows of worked stone blocks, of greater size on the windward side, with central fill of marble and schist splinters. The superstructure is made of marble blocks, which were found misplaced or fallen on top of or round the mole. It is estimated that the mole was also fortified and that on the southern part there must have been a quay at the base of the fortification wall. The semicircular end is supposed to be a tower.

During the Hellenistic period the fortification wall of the closed military harbour was reinforced with circular towers at its angles. The existence of three of these towers is archaeologically attested. They form part of the general reinforcement

program of the city instigated by the progress made during this time in the besiege techniques.

The tower at point G, with a diameter of 8m at its base, is preserved at the height of 6 layers made of marble blocks (height of layer from bottom to top: 0.40, 0.25, 0.15, 0.35 and 0.50m). Its interior has been filled with small stones and the excavators believe that there was no arrangement for interior free space. The tower was a donation of *proxenos* Heracleodoros, as is stated on an inscription associated with the building material of the tower (*Et Thas* V, 376).

The tower at point B, 10m in diameter, is today submerged. It is preserved at a height of three layers made of trapezoidal schist blocks (average length 2m/0.50-0.80m and average height 0.30-0.45m) and is founded on small stones. The excavators have traced an entrance at the point of its joint with the wall of the 5th c BC, where a differentiation in the masonry is observed.

The tower at point C, 9.60m in diameter, is preserved at a height of two layers in shallow water. It is built with schist blocks of similar dimensions to those of the tower at point B, the lower of which, 0.35m high, projects 010m. Its position was associated to the existence of the entrance of the harbour at that point. It is also suggested that towers B and C had interior arrangements for war machines, i.e. catapults etc.

The existence of a tower at point F, which is mentioned in the preliminary reports of the excavation, is considered, according to new evidence yielded through additional research, to be uncertain.

Zwei ebenfalls aus dem Felsen gehauene Steinsäulen, jeweils an den Molenenden gelegen, dienten zum Verschließen der Hafeneinfahrt mittels einer Kette (vgl. Leptis Magna).

Ventotene

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Harbour informations about: Defences

The entrance of the port, located at the southeast corner, was 20m wide, with a wall that was constructed on the moles provided protection. Amathous

Fortifications are visible at the eastern edge between the shore and the rocky promontory Atlit

The Phoenician harbor in the North Bay of Atlit is the only one along the Israeli coast with sufficient remains that permitted an investigation of the building techniques and harbor engineering prior to the Hellenistic period. This harbor was connected to the southern settlement (which lay between the water and the Phoenician cemetery excavated by Johns), by kurkar slabs pavement that led from the shore to the gate exposed at the foot of the Crusader *poterna*. Only the passageway and two square towers remained of the gate, which were built of ashlar headers. Johns assumed that they were much older than the Crusader structures.

Caesarea

The Crusader harbor occupied part of the Middle Basin of the Herodin harbor. It seems that during this period the sea level was one meter lower than today, and the Inner Basin was filled up with rubble and silt accumulation west of the round tower. On the sea floor, 30 m west of the tower, another rectangular one was discovered, which was similar in dimensions to those of the Crusader fortress. A wall (N-S orientation), meets this tower from the north; its width at the base is 4-6 m. The western face of the wall is preserved for a height of five or six courses, being built in the similar technique as the outer walls of the Crusader City.

The principal component of the Crusader harbor was the harbor fortress, built on the base of the southern Herodian breakwater. The fortress was separated from land by a wide moat that cut the base of the breakwater on both sides (perhaps at the point where flushing channels had previously existed. Between the base of the southern breakwater, east of the moat, and the submerged tower was an entrance (40 m wide), connecting the city to the harbor.

Archaeologist Petros KALLIGAS agrees on the existence of a fortress that stood on the site where the large western jetty turned, the purpose of which was to protect the port's entrance. Eretria

The interior port was protected by the extension of the eastern wall and its entrance was sheltered by at least one fortifying tower. Today only a very small portion of the

fortification is conspicuous due to earth fills that were carried out in the area, as well as to unchecked building.

A modern sea-wall, which existed until 1980, and was located behind the medieval castle at the point where the western breakwater begins, reached a height of 4.5m. This wall, which did not afford complete protection from the elements allows the estimation of the minimum height of the fortified protective wall that would have extended the length of the breakwaters. A small section of masonry located at the middle of the modern mole it is the so-called Frankish Fort. Witnessing also the medieval fortifications is the Castle at the west end of the mole. Also discovered at the ends of the ancient breakwaters were architectural remains possibly belonging to fortified towers at the entrance to the harbour, or even remains of a facility, which regulated the port and the tarrifs that were paid. On the eastern breakwater ruins are also visible which belong to part of the breakwater fortifications. Paphos

Raban also considers that the city wall extended along the breakwaters of the two harbours, and possibly the natural ridge, which separated the lagoon from the sea forming the usual "closed harbour" type. On the northeast end of the breakwater of the southern harbour he also recorded a section of fortification wall, outside the main city wall, for further protection. Salamis

Flemming, believes the wall to be a reef that acted as a natural wall between the city and the sea during the 4th century BC. He also interprets several opening on this natural wall as streets that led from the city to the sea.

According again to Westholm the city wall was continued over the eastern mole, which was visible under the waters surface, clearly forming the known Classical type of closed harbour (Limen Kleistos). Soloi

Interesting information was also revealed by the excavations conducted between 1975 and 1978 at a site in Pływacka Street. A string of edge-to-edge connected boxes was found there; the faces of the boxes at the water side were strengthened by vertical logs. As a result of further research the boxes have been interpreted as the construction of a defensive embankment. Szczecin

The fort Velsen

Period 1

In *Period 1a*, the first or initial fort - in fact a kind of temporary *`construction camp'* - was built on the sluggish southern shore of the Oer-IJ river. In this period, the shape was more or less triangular (see fig. 2). The defences mainly consisted of an earthen wall, with a simple external ditch in front of them (fig. 2: *wal* and *spitsgracht*). A simple timber palisade defended the eastern part of the enclosed river shore, with a centrally placed, simple wooden gate (fig. 2: *poort*). This `fort' did not initially have any harbour works, although ships could have been beached on the undefended western, gently sloping riverbank.
Shortly afterwards though, in a *transitional period* between Periods 1a and 1b (*Period 1a/1b*), the simple wooden fence was provided with an extra, more substantial gate. This harbour gate (fig. 2: in *red*) gave access to a short open jetty (fig. 2: *kleine steiger*), at which bigger ships could unload, for instance, building material for the next period. Thus ships no longer needed to be beached.

Period 1a is dated to AD 16.

In *Period 1b*, a more permanent fort, similar in shape, replaced the `construction camp' (see fig.3). The new defences followed almost exactly the course of the previous one (: *verloop verdediging per. 1a*, in *red*). The earthen defensive walls now were replaced by a box-rampart, a so-called *Holz-Erdemauer*, which consisted of two parallel wooden revetment walls, set into a foundation trench, with vertical posts at approximately 1.3 m intervals set slightly deeper (fig.3: *houtaarde muur)*. The 3 m wide space between the timber revetments, was filled with spoil from the single ditch in front of it. The *Holz-Erdemauer* was provided with simple wooden towers (fig.3: *toren*) and probably one (or more) simple gates, of which the ground plan was not distinguishable from that of the towers. The eastern riverside section was also provided with a, somewhat narrower, *Holz-Erdemauer*. In this period, extensive harbour works were constructed, consisting of three moles (fig.3: *westpier*, *noordpier* and *oostpier*) and a single shipshed (fig.3: *scheepshuis*).

Period 1b is dated to AD 16-22

After only a couple of years, erosion caused by the river running alongside the fort (see fig.12 below), necessitated modifications to the harbour works in *Period 1c* (see fig.4). The partially washed away shipshed also had to be replaced by a similar construction of almost exactly the same dimensions. It seems that the fort itself remained unchanged, possibly with the exception of some repairs or minor modifications, for instance, at the north-western end of the defences. There a part of the former ditch from period 1b was `widened' by the above-mentioned erosion and provided with a protective revetment, thus forming a substantial harbour basin (fig.4: *insteekhaven*).
To the west of the fort, the slight remains of a single ditch, running parallel to the rivershore seems to indicate a defended working area outside the fort itself.
An interesting feature, is a small, defended `camp' opposite the main fort, provided with a small basin. Here ships could moor relatively safe in `hostile' Friesian territory. Such small *`Bruckenköpfe'*, but from a later period, are known from Roman forts along The Rhine and Donau, permitting the romans to unload military personel

in the german territories. The possibility remains, that this *Bruckenköpf* dates from, or was still in use in period 2

Period 1c is dated to approximately AD 22-25.

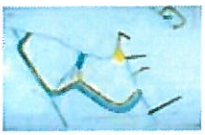
Period 2

The fort from period 1b/c was possibly abandoned for a (short) period of time. In Period 2, a `construction camp' was again the first to be built (here named *Period 2a*, see fig.5). The defences, this time oval in shape, consisted again of an earthen wall with a single ditch in front of it, only encircling the harbour works from the previous period, with the exception of the shipshed. This defence probably still incorporated the *Holz-Erdemauer* along the (eastern) riverside section (fig.5: *oevermuur per.1b*).

Period 2a is dated to approximately AD 25.

In *Period 2b*, the fort got its final trapezoidal shape (see fig.6). To the east, the defences followed directly those from Period 2a, but westward they were extended up to the line of the period 1b/c western *Holz-Erdemauer*. The new defences consisted of an earthen wall with wooden towers and (at least) one double wooden gate in the west (fig.6: *poort*). The defences were now encircled by three ditches, which stopped shortly before the so-called *insteekhaven* from period 1c.
The total river shore within the defences now remained undefended. In the harbour, open jetties replaced most of the massive moles from period 1, with an extra jetty outside the eastern defences (fig.6: *vierde steiger*). This new jetty, outside the defences, was controlled by a sturdy platform, added to the eastern end of the defensive wall (fig.6*verdedigings-platform*).
To the west (and possibly also to the south and east) of the fort, a new defensive single ditch was dug, thus providing a bigger defended working area, for instance, for ship repair, `dirty' activities and so on. It also incorporated the so-called *vierde steiger* and a new, this time double, shipshed, since the shipshed from period 1c, if still usable, obstructed the new double gate.
A most interesting feature, was a huge well, 3 x 3 m in plan. From this well, a wooden aqueduct transported fresh, clean water to ships in the western *insteekhaven*. This might seem illogical, but the activities of the Romans must have polluted the harbour area. Water from the river itself (possibly also somewhat brackish) could not be used any more as drinking water.

Period 2b is dated to approximately AD 25-28.



At the end of period 2b, in AD 28, the fort was attacked by the Friesians, as mentioned by Tacitus (see above *General dating of Velsen 1)*. It is probable that the attackers did not take the fort itself, but that the defended working area outside the fort was overwhelmed, as is shown by the distribution of lead shots. Even if the fort itself remained undamaged, the `loss' of the working area represented a problem. It was there that the double shipshed and the most important well were situated.
It is clear, that the Romans did not immediately abandon Velsen 1, but they had to find a solution to encounter the problems with the weak defences of the working

area. This was done by replacing them by a defence, comparable to those of the main fort (see fig.7) and connected with it. This consisted of an earthen wall, but now only encircled by two, quite deep, ditches. The wall was provided with the `normal' towers (set wider apart than those of the defences from period 2b) and two narrow gates, one to the east - close to the fort defences - and one to the west. Dendrochronological dating of posts from one of the `new' towers suggests a building date slightly later than AD 28.
How long the occupation of Velsen 1 lasted is unclear. Velsen seems to have been abandoned for at least some time. Velsen 2 (mentioned above), situated 1 km to the west, was build around AD 40, It is possible that the Romans first (re)occupied Velsen 1 as a temporary base, from which Velsen 2 was build.

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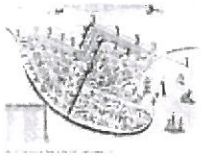
Harbour informations about: Function commercial

Later Periods

Akko



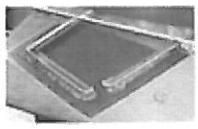
After the Crusaders were expelled from Akko in 1291 and the Mameluks destroyed the city, the port fell into disuse. Lannoy, a traveler from Flanders who visited Palestine in the 15th century, described the ruins of Akko as uninhabited, aside from two or three clerks who were responsible for reporting all shipping movement to the Mameluk government, and a Venetian trader who looked after the cotton belonging to Italian merchants and stored in some buildings in the port. Lannoy referred to the remains of the Crusader port, which according to his report could still accommodate small ships. A map made at the beginning of the Ottoman rule (1525-26), shows that the port was still in use.

Reports from 1650, noted that the port of Akko was so clogged with sand that it was necessary to anchor out at the sea and load all the cargo on small boat to bring them to the city. Towards the end of the 17th century, despite Akko's growing trade (particularly in the cotton trade by the French merchants) the port's condition deteriorated. The English traveler Pococke, who visited Akko in 1738, wrote that the port being congested with debris and remnants of the ancient harbor permitted only small ships to anchor and load during the summer. After Dahir al-Umar took control of Akko in the mid-18th century and made his capital in the city, he built safe warehouses and made plans to repair the port. However, he found that the conditions of the harbor are not reparable, and considering the hazardous winds, decided instead to built the port in Haifa.

Al-JazzarPasha, Dahir al-Umar's successor, built a mole to the port's entrance and installed special safety measures to guaranty safe entrance to the port in the winter. In 1807-1808, Sulayman Pasha renovated the mole, which reached the Tower of the Flies and built a wooden bridge to connect the gate of the port to the anchorage, to enable passengers disembark. Passengers also were able to walk from the port's gate to the boats and cargoes were loaded from the gate. Akko ceased to serve as a port during the end of the Turkish rule, in the 19th century. Ships were not able to anchor at Akko and preferred the port of Haifa.

Amathous

The site was developed as the capital of the kingdom, in which the native "eteocypriot" population centralized after the colonising Mycenaean-Greek element on the island ascended as the dominant culture. From archaeological evidence it is clear that the Amathous Kingdom developed, and conceeded to the fate of all the Cypriot Kingdoms, with the advent and obeisance of Cyprus to Alexander and afterwards the Ptolemeys. The city existenced until the seventh century AC when, after the second Arab raid (653-654 AD), it was completely destroyed and failed afterwards to recover. During the Historical period the city's administrative center, sanctuaries, and some residences, were located on a hill that was both naturally and artificialy fortified, and that overlooked the territory and the sea to the south. The city was concentrated to the southeast of the hill where a small natural bay formed a natural anchorage, and was most likely used as the city's harbour from its founding.


Wie der Name "Emporion" vermuten läßt, hatte der Hafen hauptsächlich eine Handelsfunktion. — Ampurias

Anzio liegt 58 Km südwestlich von Rom entfernt. Als Ausflugs- und Erholungsort der Metropole Rom findet der Hafen heute als Fischerrei- wie auch als Yachthafen Verwendung. Vereinzelt auch Fährverkehr zu den Pontinischen Inseln (s. auch Terracina). In der Antike diente er sicherlich als Ausweich- oder Reedehafen für Ostia (vgl. der römische Hafen Torre Astura). — Anzio

Die Tatsache daß der Hafen mit dem Festland nur durch ein schmales Viadukt verbunden ist wie auch die Tatsache der fehlenden Magazine spricht für keinen Handelshafen. Es könnte sich hier um einen Schutzhafen, zwischen dem Capo Circeo und Ostia gelegen, gehandelt haben (Strabo V 3,5, vgl. Anzio). — Astura

The separation of the harbor into two mooring areas enabled a distinction between the "*home quay*", for the Sidonian or other Phoenician ships to anchor and the "*free quay*" or *emporium* for foreign ships, transshipping the cargo in lighters to harbors such as Akko and Sidon. — Atlit

Der Handelshafen war mit dem Meer durch eine 70 Fuß breite Zufahrt verbunden. Da der Kriegshafen als militärisches Sperrgebiet durch eine zweifache Mauer geschützt war (Oros, hist IV 22,6) konnte man vom Handelshafen durch bestimmte Tore direkt in die Stadt gelangen. Während die Anlage des Handelshafens mit als "limen" bezeichnet wurde, so trug der Rundhafen den Namen Kothon (Strabo XVII, 3.14, vgl. die Schilderung der Stadterstürmung durch die Römer bei Appian, VIII, 123-124, 127). Grabungen erbrachten Erkenntnisse zu der Kaianlage des rechteckigen Handelshafen und zur sog. "Admiralitäts-Insel" des Kriegshafens. Eine zeitliche Abfolge innerhalb des Hafensbaus erscheint möglich, wobei der Handelshafen etwas älter wäre. — Carthage

Handelshafen, Etappenhafen und "Industriehafen": Fischfang und Fischzucht, — Cosa

Fischverabeitung, Fischverpackung und Verschiffung innerhalb eines Großbetriebes.

Due to its situation at this `fork', the settlement was included in the network of Northwest-European shipping routes: the Lower Rhine formed a direct link with the German Rhine area, the Kromme Rijn with (sea)routes to England, the North of France, the Northern Netherlands, North Germany and Scandinavia (fig.2). The Lek possibly gave access to the lower reaches of the Meuse and the Scheldt. Dorestad

The Roman wrecks found in the St. Peter Port harbour area are evidence for a commercial function for the harbour,and also show Guernsey being well established on the major trade route from Gaul to Britain at that time. Amphorae were found, which would have been used to transport commodities such as wine, garum and oil throughout the Roman world. A large amount of pitch was also transported on one of the Roman ships. The pitch has recently been traced to the Les Landes area of south-western France. Guernsey

According to the ancient sources ancient Gytheion was used both as a commercial (Strabo, Geography, 8.5.2) and military harbour (Xenophon, Hellenica VI 5.30) Gytheion

The harbour of Kenchreai was mainly commercial. Kenchreai

The district around the town of ancient Kition was inhabited from the Neolithic and Chalcolithic period (Άρπερα, Κίτι, Κλαυδιά), and during the Late Bronze Age the important settlement of Hala Sultan Tekke flourished. This city used as its harbour the present day salt-pan lake, which during this period had an exit to the sea thus ensuring a safe port (Engvig-Åström 1975). Evidence of the harbour and its use is indicated by the stone anchors that have been recovered in the area, and by the excavated materials that highlight the connection with the Near East, Egypt, and the Aegean. □'y the end of Late Bronze Age (13th century BC) the lake-port was abandoned, most probably due to the silting of its entrance (Nicolaou 1976, p. 9-52). For this reason the city was moved towards the north, having as a centre the district of Pamboula, were there was a small bay which could be used as the new harbour. Kition

Kition was organised as a Mycenaean city comprising cyclopian walls, sanctuaries, an administrative centre, and workshops for the exploitation of copper, however the city declined in the 11th century BC during the period of unrest and turmoil that characterises this period. In the 9th Century BC Phoenecian traders who may have origionated from Tyre settled in the city, and by the middle of the century political power of the city and the surrounding area was firmly under their control, thus establishing the first colony west of Phonecia. Kition remained under a Phoenecian King until the Hellenistic period, and throughout its history it mostly supported other powers that were adverse to the surrounding Greek Kingdoms.

As skilful seamen and traders the Phoenicians of Kition advanced the city's interests, and in the Classical period, to incorporate the kingdom of Idalion and buy the kingdom of Tamassos for the exploitation of their copper. They also exploited the Kingdoms natural resourses through the export of products such as the oil, indicated by the olive mill of the 3rd century BC at Mari-Kopetra, timber from the forests that existed in the area of Larnaka, and of course the salt from the nearby salt lakes (Yon 1994, 15 and Yon 1995, 121). The imports of products are attested to by the stamps on amphoras from Thasos, Chios, Rhodes, Knidos, and pottery from Athens, Phoenicia, Rhodes, and salted fish from Egypt. The commercial nature of the town is mentioned by various ancient sources, such as Dimosthenes and Lisias, and inscriptions, which mention Kition as the place of commercial activity, and Kitians as traders settled in various parts, such as Delos, Dimitrias, and Pireaus (Yon 1995, 120-121).

Kourion

Concerning the chronology, Leonard places the site among the Roman harbour network of Cyprus. In addition Strabo was the only one who mentioned the anchorage(?). Due to the unique position of this point on the sea-route on the south coast of the island, the geomorphology of the area, and the short distance between the shore and the city, its possible that the bay was in use for maritime activity from earlier on than the Roman times.

Lapethos

In conclusion it may be seen that during the 5th century BC, in which the first coins are minted, the Phoenecian kings constructed the harbour of Lapethos, which was intricately tied to the power and prestige that it afforded the kingdom. With the advantage the harbour had of not being located near a river, it remained unaffected by the problems of silting, evident in so many other harbours. This advantage allowed it to be utilised even today. Supplementary construction was undertaken during the Roman period, and in 1957, however the origional plan of the harbour has not been altered since it also affords protection from all wind directions.

Lechaeon

The harbour complex was used for merchant oriented activities, either supplying the city with goods or loading exports for sale elsewhere, but also as an important naval base for part, if not the largest portion of the Corinthian navy.

Die Funktion war hauptsächlich die eines Handelshafens. Ein getrennter Kriegshafen ist nicht bekannt (keyword function commercial). Leptis Magna war mit dem geschützten Hafen vor/nach der überquerung der großen und kleinen Syrte eine wichtige Etappe entlang der nordafrikanischen Küste (Route ägypten-Karthago). Leptis-Magna

This geopolitical tension can be easily explained by taking into account the position of the city, which is the nearest Cypriot harbour to the sea-route from Rhodes. With the construction of the larger harbour at (Nea) Paphos during the Hellenistic period, the importance of Marion as the primary harbour on the Rhodes-Cyprus sea route was dramatically lessened. In the following years the sea route that connected Rhodes with the Near East was undertaken using the harbours of Paphos, Limassol, and Kition. Marion

Handelshafen, kein getrennter Kriegshafen bekannt. Marseille

The position of Paphos on the protected north-west and south-west region of Cyprus had as a result the geographical benefit whereby ships would pause on their journeys from the beginning of maritime contact between Cyprus and the outside world (Hohlfelder 1995, 194). During the Hellenistic period the city of Paphos became the capital of Cyprus, replacing Salamis, and a large port was constructed whose remains may still be seen at the site of the modern harbour. According to Strabo the Hellenistic city of Paphos ascended to become the first city on Cyprus due to the port that offered three harbours which were protected from all wind directions, with easy access to the timber forests ideal for shipbuilding, and with the ports of Alexandria and Rhodes within easy reach, and during which time the harbour of Salamis had become so silted as to render it useless. Paphos

Nell'area urbana di Roma, documentazioni epigrafiche e testimonianze storiche ci tramandano i nomi di numerosi porti. Gli studiosi sono giustamente propensi a riferire questi nomi non a strutture portuali distinte ma a denominazioni date a determinati tratti di banchine specializzate nella ricezione e nello smistamento di particolari mercanzie o in rapporto topografico con aree di magazzini di specifici prodotti.
In linea generale, possiamo dire che i porti di Ripa Grande (a Sud) e Ripetta (a Nord) esistenti fino alla metà dell'800 trovano una certa corrispondenza nella situazione antica. Roma

Il grande porto commerciale della capitale va ricercato dunque nel Foro Boario (il Portus Tiberinus) e nella zona di Marmorata e Testaccio (Emporium) dove, a partire dal II secolo a.C., Portus Tiberinus si è andato ampliando.
Isolato e di modesta rilevanza è lo scalo, di cui rimangono resti di scarichi e di argini, nella parte Nord. Quest'ultimo, forse, rispondeva principalmente alle esigenze di un commercio interno, quale, per esempio, quello relativo al tufo dell'Aniene.

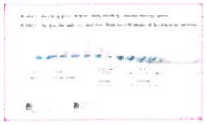
Il porto era principalmente costituito da banchine con piani inclinati, scale, anelli per ormeggio. Si tratta di "ripae" costruite lungo gli argini del fiume. In stretta connessione con quest'ultime si trovavano i magazzini ("horrea", "cellae") per lo stoccaggio delle merci.

A valle della zona individuata come centro del traffico portuale, ovvero a valle del porto urbano, si ha la testimonianza di una fascia attrezzata, su ambedue le rive, per lo sviluppo di almeno 2 km. Anche in questo caso si tratta di "ripae" costruite in opera cementizia o quadrata, parzialmente provviste di piani inclinati e anelli di ormeggio.
Questi apprestamenti si possono considerare come un'appendice del porto urbano, potendo servire come scali sussidiari o banchine di attesa. In particolare è da notare una connessione con le vie Ostiense e Campana, attraverso le quali le merci potevano essere introdotte in città.

Another reason of this orientation is the neighboring copper mines of Phoucasa and Scouriotissa, where the first evidence of copper production can be traced dating from Early Bronze Age (Ambelikou). This product, and concurrently the fertile valley with the abundant forests of the Troodos foothills, could not have escaped the attention of the Mycenean colonists and traders, and also the Greeks of the Historical Times. Soloi

At the beginning of the Slavic settlement in Szczecin the river western bank ran adjacent to the site of discovery, under the hill Zamkowe Wzgórze. It is also were probably the trading port was. Szczecin

Heute als Fischerei- und Yachthafen verwendet; ehemalige Funktion unbekannt. Ventotene



1. From second half VI century to second half VII century: settlement about fishing - agricultural character with building half dugout. Wolin

From halves VII of age existed in Wolin settlement handicraft-trade engaged with sea – trade. In IX century evolved into fully developed sea-trade centre of municipal type, basing oneself on trade with cereal, of production craftsman's and to far-reaching exchange (Filipowiak 1985). Wolin

Diese Kaianlage war Bestandteil des Handelshafen der CUT: Warenstapel und Umschlagplatz am Ende wichtiger römischer Landverkehrswege mit Kontakten ins□ rechtsrheinische Gebiet. Es bot sich hier die Gelegenheit eines sicheren Be- und Entladens sowie des Treidelns. überliefert ist auf einer Weihinschrift zum Wohle des Kaisers Antonius Pius (160n, heute im Rheinischen Landesmuseum, Bonn) der Baumaterialtransport mittels Lastschiffe der "classis germanica" zum Wiederaufbau des Forums der CUT. Xanten

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Harbour informations about: Function Commercial / Military

Akko

During all periods, the harbour was used for commercial purposes. Only during the Roman period, under the Emperor Vespasian, the harbour had also a military function. Today it os only a port for fishing boats and yachts

Carthage

Getrennter Militär- und Handelshafen (ca. 14 Ha). Künstlicher Hafen (Kothon) aus der Frühzeit Karthagos, davon äußerer Teil (500x300m) als Handelshafen, innerer runder Teil (Durchmesser ca. 300m) als Kriegshafen für ca.186 Kriegsschiffe (literarisch überliefert wird die Aufnahmekapazität von 220 Schiffen).

Piraeus

The important element in the socioeconomic structure of this powerful (during the classical period) city – harbour was the simultaneous presence of the Dockyard and the Naval base of Athens with the Mercantile Marine center of eastern Mediterranean. During the drawing of the plans for the city of Piraeus, the dominating functional factors were the three ports and the essential installations to support their use, while the rest of the city (public buildings, temples, houses) was built around them.

The central harbour, Cantharus, served as the commercial port as well as the as the second largest dockyard Athenians. The ports of Zea and Munychia were fully occupied by the use of the Dockyards.

Roma

Il porto militare di Roma è noto unicamente grazie alle scarse notizie pervenuteci dalle fonti scritte mentre non è stato ancora localizzato con precisione sul terreno.

Salamis

A reef can be discerned today that goes parallel to the shore at distance of almost 100m, forming a "lagoon" at the south of it. The two ancient harbours of Salamis were at the north and south ends of this "lagoon". The commercial harbour was more likely at the south and the military harbour to the north.

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Salamis

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Harbour informations about: Jetty

Abdera

At the port that lies south in the area of the modern port of Abdera a mole was traced that protects the port from east and south. It is 170-180m long, runs from E-W with a slight turn to the north. Its width is from 5.5 to 8m. It is made of granite blocks and rough stone boulders. The excavators traced two building phases. To the second one belongs a gradient that was interpreted as a new foundation base.

At the point where the mole turns north, at its southern side, stand two adjacent horseshoe shaped towers.

The port that lies at the eastern part of the city, in Agios Giannis area, is formed by the extension of the eastern part of the city wall; it is 30m long and ends at a semicircular tower, 6m in diameter. Its masonry is rather refined and it is founded on an older square structure. It was probably destroyed by an earthquake, as can be surmised by the fallen blocks on its eastern side.

Akko

Traces of this additional structure may be seen by the huge ashlars laid astride the breakwater; 12 m long and in cross-section, a width of 1.5 x 1.5 m. The stones were set at intervals of one meter, forming a series of openings at sea level. These openings that were bridged by a pier above, allowed the waves to circulate through the openings and create a water surplus within the harbor basin. As the water circulated back to the open sea, it flushed the accumulated silt on the harbor's floor.

No building remains have been found so far in the port of Akko that may be attributed to the Late Roman and Byzantine periods.

Caesarea

From the northern end of the north wall on the shore, a quay built of Roman granite columns in secondary use, was laid to the west. The columns were placed next each other on top of a rocky abrasion shelf and the gaps between were filled with stone construction and mortar. The jetty extends to the west for 100 m and than turns to S-SW. Most of the southern part of the jetty is submerged beneath the sea level (0.20 □ 0.30 m in calm sea), as a result of the collapse of its stone foundation. Additional remains of this jetty have been found for another 40 m along its original line.

Late-Classical Eastern Jetty

Eretria

Today the surviving part of this jetty lies in an eastward-westward direction, measures 19 m in length and is made of stone (the type of construction is similar to the one of the Eastern jetty that dates to the same period). Prior to its destruction by

earth fills that were carried out at the end of the 1960's, the jetty extended from the southern tip of Pezonisi and run southwards along 60 meters, then wound to the west closing the ancient port on the northeast.

Classical-period jetty and 2nd-century spur dike

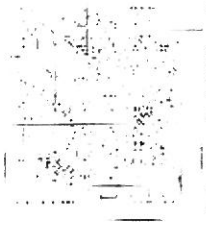
At the southern end of the town's western wall a rectangular stone construction runs almost parallel to the western jetty. It is half a meter wide, and its direction remains steady along 48 meters, while it slightly winds to the south-east and stretches along another five meters. During the last five years, this construction lies beneath the seafloor at about 60-80 cm. At the point of curvature there is a rip-rap running parallel to the present-day coast; the ceramics that were incorporated in it revealed that it dates to the 2nd century BC when it served as a protective spur dike of the coastal wall which survives today.

The spur dike is 110 m long and 4 m wide. Its upper surface displays a camber. This structure was apparently built in haste and in all probability is associated with the siege of Eretria by the Romans in 198 BC (Liv. 32, 16, 6-17). Au contraire, the jetty is a continuation of the western wall and, on the basis of this, its construction is traced somewhere between the late 5th and early 4th century BC.

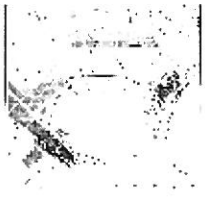
Western jetty of the late Classical Period

This jetty demarcates the western end of the Eretrian port. It is a monumental crude-stone structure extending along 600 m approximately, with a direction from NNW to SSE. Its south-southwestern tip on which the modern port's lighthouse is sited winds to the east for about 55 m, thus protecting the port's entrance from the south. The first 300 m of this construction are covered by a modern jetty, which, after said 300 m, runs in parallel to the ancient structure.

The northern end of the harbour consists of a part of the wall that was founded on Halileis the jetty for a considerable length east of the northern castle.



The harbour offered protection from the prevailing in the area northwestern winds. Two points of land have been extended artificially to create two moles. The moles' ends left a gap of about 150m that formed the entrance to the harbour. The internal part of the harbour was about 30 square km.



Kenchreai

Both moles were built almost vertically to the coast and extended from the North to the South for about 100m. There is some evidence to support that the north mole partly consisted of rubble mass and was based upon the southwestern end of a shelf of natural bedrock.

On the coast are visible two of the three jetties of the presumed 'entrance harbour' with a length of 10 –15m, although the jetties continue under the beach to the south (*Fig. 3*). The jetties are constructed of large stones upon which may be seen grooves at different points. These grooves and other similar features may have been used for the connection of the stones with the upper layers of the mole, for the placement of the large blocks, or even for the niches from which wooden scaffolds and wharfs would have projected from the moles. The third (eastern) jetty is only visible underwater and is composed of heaped rubble, perhaps indicating a different period of construction and possible function. This mole may have functioned as a protective barrier for the western entrance to the inner harbour from the undercurrents prevalent in the area. At the end of the western jetty a construction, such as a fortified tower or lighthouse, was probably constructed. Lechaeon

Das äußere östliche Hafenbecken wurde durch zwei brückenartige Molen von 100 und 180 m Länge geschützt, die nur eine enge Durchfahrtsöffnung frei ließen. Bei der Punta Terrone wie auch an der Punta Pennata, an der äußersten Spitze der Hafeneinfahrt, sind Reste einer mächtigen Mole aus Gußmauerwerk aufgenommen worden (Pilae-Konstruktion). Letztere diente hauptsächlich dazu die Einfahrt gegen den Westwind "Scirocco" zu schützen. Die beiden Pfeilerreihen der längeren westlichen Mole waren zusätzlich gegeneinander versetzt, um das Durchlaufen der Wellen zu unterbinden. Der Nachteil der Molen war, daß auch die Strömungen unterbunden wurden, die bis dahin die Versandung verhindert hatten. So durchstieß man die Punta Sarparella und die Punta Pennata mit je zwei Tunneln, welche -ohne daß Wellen eindringen konnten - bis heute erfolgreich für den nötigen Wasseraustausch sorgen.
Dieser äußere Hafen diente vermutlich als Reede und Bereitstellung der Flotte, event. auch für übungen. Miseno-Puteoli

The two natural jetties projected into the sea with the extension of the walls that run along the eastern and western coastline of the harbour, in order to form a narrow entrance. The moles were constructed, in their upper part, with the use of rectangular large stones of local porous limestone (aktetis) with a length of more than 3.30m which were held in position with the help of clamps sheathed with lead (Shaw, J.W., 1972, p.90-91). The moles had a length of 130m each leaving an entrance of 50 m. The coastal walls of the harbour extended over those two moles to form, at each extreme, a large rectangular tower (Spon, 1676, p.234) from which a chain was hang across the entrance, to protect the harbour in case of a sudden attack. Piraeus

The jetties of the basins coincide with projections of the city walls in the sea. Thasos

A short, open jetty replaced the curving head of the central mole (fig.12: rendered in Velsen *red*). This open construction was considered to improve the water flow to some extent, in an attempt to prevent further silting.

In *Period 2b*, the appearance of the harbour was changed, since the alterations of the harbour constructions in period 1c must have appeared unsatisfactory (see fig.6). Open jetties, consisting of three rows of heavy posts (see fig.13 and fig.14), replaced most of the moles. A jetty was added to the western mole, at an angle to it and running parallel to the river shore, thus enclosing the `inner harbour'-basin. The central mole, together with the added short jetty, was entirely replaced by a long open jetty, while the eastern jetty was extended into the river. Since the river shore within the defences now was totally open, the fort became dangerously exposed to an eventual attack from the riverside. To counter this weakness somewhat, a new jetty was build outside of, and to the east of, the defences of the fort for use by non-Roman ships, as was the case with the eastern (defended) mole from period 1.

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Harbour informations about: Lighthouse

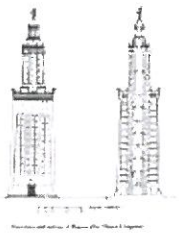
Auch von den auf dem Plan von G.Lugli am "Leuchtturm" anschließenden Räumen ist ebenso nur noch die seeseitige Mauer erhalten.Während das Mauerwerk in Peperin-Blöcke die Baustrukturen aus republikanischer Zeit charakterisiert, so stammt der "Leuchturm" wie vermutlich auch die sich an diesem anschließenden Annexbauten aus domitianischer Zeit. Albo/Nemi

At the tip of the pier there is a very wide rampart cause by a collapsed structure. At the eastern tip of the pier there is a rectangular tower (12 x 30 m), identical to the structure on the N-S mole, on the southern shore. Possibly also a lighthouse Atlit

Josephus described the general harbor□s outline in both his works *Jewish Wars* (I. 408-418) and *Jewish Antiquities* (XV. 335-341). He also mentions about towers to be built on the main quay and the tallest and most fabulous was called Drusion: Caesarea

> "At intervals along it (the quay), were great towers (pyrgoi), the tallest and most magnificent of which was named Drusion, after the stepson of Caesar (*JW* I. 411)"
>
> "The rest comprised a stone wall (teichos) set at intervals with towers (pyrgoi), the tallest quite a beautiful thing, was called Drusion, taking its name from Drusus, the stepson of Caesar who died young (*AntJ* XV. 335)."

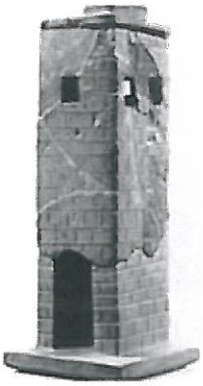
In none of his writings, Josephus does not mention of a lighthouse at Caesarea. He is also less precise about Drusion, the only monument in the port facilities, other than the Great Temple that was dedicated to the goddess Roma and the deified Emperor Augustus.



If we try to reconstruct the lighthouse at Caesarea, than we must relay on other known Hellenistic and Roman similar structures. The famous neighbor Pharos at Alexandria may have been used as a model: three-tired structure with a square base, octagonal superstructure and a cylindrical turret. The reconstructed lighthouse at Caesarea would have been also based on other Herodian towers and known Roman lighthouses.

An der gerade verlaufenden Küste wurde das Hafenbecken durch zwei zangenartig angelegte Molen mit vorgelagerter "Hafeninsel" vor der Hafeneinfahrt angelegt. Der im Kern noch römische Hafenturm an der Einfahrt stand noch bis 1943-44. Heute, wenn auch durch Bombeneinwirkung während des Civitavecchia

zweiten Weltkrieges stark in Mitleidenschaft gezogen, nur noch im Kern römisch erkennbar .



Auf der Spitze der Aufschüttung wird von den Bearbeitern ein Leuchturm rekonstruiert, deren rechteckiger Unterbau Pier 5 ist. Archäologisch zwar nicht nachgewiesen, wird ein Tonmodell aus Vulci als Rekonstruktionshilfe herangezogen. Ebenso wird die Möglichkeit, daß ein Amphorenstempel der Sestier dieses Bauwerk abbilden könnte in Erwägung gezogen. Es handelt sich dabei um einen einfachen schmalen, eingeschossigen Turm auf dessen Plattform das Feuer entfacht werden konnte. Cosa

On top of each of the east and west hills overlooking the valley was a Roman lighthouse (pharos), the eastern one mostly having survived inside the medieval Dover Castle where its upper works were rebuilt in medieval times. Both lighthouses, when alight at night, may have been visible from the French coast and certainly could guide ships crossing the English Channel at night. Dover

The eastern lighthouse is an octagonal tower 11m wide whose surviving Roman structure is 13.1m high. It is built of stone with courses of Roman bonding tiles. It rises in four stages, each originally with a timber floor with a window facing the sea. Its original height is unknown.

The western lighthouse was destroyed long ago, and its site has not been archaeologically investigated in recent times.

These lighthouses matched a tall Roman lighthouse that once stood in Boulogne where the Classis Britannica seem to have had their headquarters.

At the base of the north mole there is a rectangular building. Its base is about 6.5m x 7.5m and its surviving height about 3.5m. It is located directly upon the modern coast and has been built on top of earlier wall foundations. Its construction seems late Roman and according to the excavators it must be part of the structure of the ancient lighthouse. Kenchreai

In the southern section of the western basin survive the remains of a four-sided island measuring 8 X 8m. This feature has been interpreted as the base for a bronze statue of Poseidon as mentioned by Pausanius (Pausanius, II, 2, 3). The feature may be dated to the Lechaeon

3rd century BC. The interpretation of the island as a plinth for the statue of Poseidon, holding a flame to act as a lighthouse, is only feasible since the island is situated in a straight line with the entrance to the harbour. The island is constructed from large ashlars (2 X 0.8 X 0.8m).

At the end of the western external jetty a construction, such as a fortified tower or lighthouse, is also evident.

Der dritte Abschnitt der Nordseite besteht aus der unteren und einer weiteren oberen Ebene. Endpunkt bildet der Leuchturm. Dieser steht auf einem rechteckigen Unterbau (21.20 x 21.20) von dem man zur oberen Kaiebene durch zwei eingewölbte Treppenaufgänge zu 20 Stufen gelangte. Der eigentliche Turm besteht aus drei übereinander angeordneten, sich nach oben verjüngenden Kuben. Die beiden ersten Absätze haben ihren architektonischen Schmuck teilweise erhalten, vom dritten sind wenige Reste aufzufinden. Der Zementkern hat noch eine Höhe von bis 9 m. Die ursprüngliche Höhe mag ca. 30 m gewesen sein. über das Aussehen der Laterne können keine Aussagen gemacht werden (s. Sturzlage).

Leptis-Magna

Ein weiterer Leuchtturm stand auf der Ostseite ca. 23 m vor dem Tempel, leicht östlich aus der Flucht der anderen Bauten auf der oberen □Ebene verschoben.□ Der in pseudo-isodomischen Mauerwerk errichtete Turm weist einen fast quadratischen Grundriß von 9.90 m auf. Die erhaltene Höhe beträgt 6.50 m. Die Türöffnung geht nach Süden (vgl. römische Leuchturmbauten in La Coruna und in Dover).

Leptis-Magna

Tra l'ingresso maggiore e la probabile entrata meridionale, la fotografia aerea delinea un'area ovoidale allungata molto più ampia della linea dei moli, che potrebbe essere il luogo del faro.

Manca però il riscontro archeologico.

Ostia-Claudio

Ostia-Fluviale

Un faro doveva guidare le imbarcazioni verso il porto fluviale. Tor Boacciana risale all'epoca medievale, ma conserva un nucleo romano, della fine del II o degli inizi del III secolo d. C. Non ci sono tracce di resti romani all'intorno; ma sia la forma che la posizione suggeriscono che doveva trattarsi, in epoca romana, di un faro o di una torre d'avvistamento (Meiggs 1973: 279).

Alla sua testata, ove oggi si trova una casa colonica, doveva trovarsi un piccolo faro.

Ostia-Traiano

Ostia-Traiano

La testata del molo si allargava in una base il cui lato lungo misura 21,8 metri. Qui doveva trovarsi un faro, ancora in parte visibile agli inizi del secolo.

The existence of lighthouses (columns with fire at their highest point) for the signification of the entrance is confirmed by the remnants that have been restored in two positions along the coast (Steinhauer, G.A., 2000,p.79). (Fig.6, 7). The first one on the northwest, inside the area of today's fertilizer factory and the other to the south, in the area of the Maritime Administration of the Aegean, beside the precinct that has been identified as the tomb of Themistocles.

Piraeus

Waterways played an important role in the trade contacts of the Odra delta, especially the three passes of the Gulf of Szczecin: The Piana, Dziwna, andĠZwina. The numerous coins and silver ornaments hoards found on their banks that come from various distant centres prove the great range of the contacts. The founding of trade settlements (e.g. Menzlin), and crafts, trade city centres (Szczecin, Wolin) developed early in this area. Written documents confirm the existence of regular sail links, especially with Wolin but also with Kamień, Szczecin, Uznam in the 11th century. These waterways criss-crossed the Gulf of Szczecin, which because of shallowness, shifting winds, low banks, and low waves did not favour sailing. Facilities promoting sailing must have existed as Adam of Bremen noted 1074 in his description of Wolin: Ibi est Olla Vulcani, quod incole Graecam ignem vocant. R. Kiersnowski (1951) attempted to locate the Volcano Pot on Chrząszczewska Island, inspiring further research and study. In light of these studies and analysis of the maritime conditions in the Gulf of Szczecin, we are inclined to place the oldest lighthouse on the southern peninsula of Hangman's Hill (Wzgórze Wisielców). Archaeological finds such as large fire site and „pirates" grave with a head on a pole also indirectly support this view. The beacon from the point would have covered the entire so-called Large Gulf. Adam of Bremen, mentions Greeks twice {Graecis et Barbaris) in addition to a "Greek light". The universal view in the literature is, they were old Russ named after their religion, but this does not precluded that they were actually Greeks. Wolin's contacts with Byzantium and with Kiev Russ in the 9th and 10th centuries have been confirmed by archaeological finds of brocades. Knowledge of the construction of a lighthouse from Byzantium where they were known in the 10th century, most probably reached Wolin through Kiev, which had very lively contacts with Byzantium. The signal tower discovered at the fortifications in Witiczew on the Dniepr forty kilometres from Kiev can serve as an example of the intermediary role. It is constructed like a lighthouse with firelight on a tower in a large vessel. We conclude from the above that the "Volcano Pot" that the inhabitants call a "Greek light" is a lighthouse of Greek-Russ origin. This applies especially to the phrase "Greek light" which is not connected to the name of the weapon used effectively from the 7th century A.D. on in the Byzantine fleet. The phrase.Volcano Pot" probably originated with Adam of Bremen who could have known volcanoes from Italy and Sicily(Filipowiak 1985).

Wolin

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Harbour informations about: Mooring equipment

Akko

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Das östliche Ufer besteht aus einer ca. 300 m langen steinernen Kaimauer. Auf einer mächtigen Orthostatenreihe ruht eine Lage aus sorgfältig verlegten und teilweise verklammerten Steinen unregelmäßiger Größe. Baumaterial ist ein Gestein aus Istria, welches dem Salzwasser besser widersteht als das anstehende Gestein. In der oberen Steinreihe sind in regelmäßigen Abständen vorkragende Steine mit jeweils einem senkrechten Loch zur Vertäuung der Fahrzeuge eingelassen. Ankersteine: 4 Steine "a foro verticale" (18-21 m Abstand zueinander); 6 "a foro orizzontale" (14-24 m Abstand).

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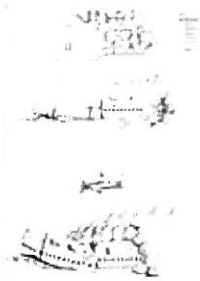
Miseno-Puteoli



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Ostia-Traiano



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Roma

Nel tratto a monte dell'odierno Ponte Marconi è testimoniata una notevole variazione del corso del fiume, che ha insabbiato la riva destra erodendo e sorpassando le opere di difesa della riva sinistra.
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Roma

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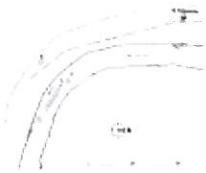

Roma

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Szczecin

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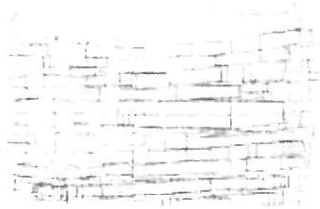
Harbour informations about: Platform

Akko

About 70 m east of the tip of the southern breakwater stands a structure known as the Tower of the Flies. The tower is laid on an artificial island, atop a platform of 60 m long and 17-18 m wide, that extends on a northeast and southwest axis. The northeastern part of the island is preserved almost up to the present sea level. The surviving upper course is built of ashlar header blocks similar to those in the outer face of the southern breakwater. Such building stones also may be seen in the foundation of the structure exposed on the southern edge, at a depth of 6 m bellow the sea level. During the underwater investigations of this artificial island, was observed a combined construction of headers and stretchers of irregular heights and widths.

Parallel and Date of the Tower of the Flies: The construction resembles the ancient quay of the port at Sidon, which is dated to the Hellenistic period (5^{th}-4^{th} century BCE). The earliest potsherds recovered from the excavations at Akko near the bottom of the island were dated to the Hellenistic period. The structure beneath the Tower of the Flies probably served as a pier.

Dorestad



During the excavations in the harbour, remains were found of an extensive complex of wooden constructions, interpreted as platforms (see fig.3). These were about 6 to 8 m wide, situated at right angles to the river bank and firmly anchored in the subsoil with long vertical piles. The construction of the platforms is connected with the development of the Rhine meander here: they bridged the in-creasing distance - caused by the gradual retreat of the river towards the east - between the bank and the stream. It seems that the platforms had a more or less closed front in the various phases and that the ships were drawn to the beach in front of the platforms in order to be unloaded. This would imply that the platforms formed a sort of link between the relatively high bank and the river beach, on which the ships were drawn. The ships then had to be unloaded on the beach and the cargo afterwards had to be hoisted on the platforms. This seems rather impractical, unloading directly on the platforms - in fact long platforms or jetties - seems more reasonable. The ships then had to come alongside, or against the platforms, which possibility is also stated by the excavators.

The harbour parcels adjoined a road, approximately 3 m wide, which ran along the edge of the em-bankment from north to south, with the vicus situated behind it. Since little of the vicus has been excavated, the following outline cannot be more than a hypothesis.

The harbour parcels were continued into the vicus, which means that it was also divided into plots, running from east to west. These were approximately 20 m wide and corresponded each with a couple of platforms in the riverbed. Houses on these plots stood with their longitudinal axes towards the river. These were rectangular, 6 m-wide wooden buildings, of which no further details are known. Lengthwise, there was room for at least three houses, one behind the other, with an average length of 20-25 m each. It is possible that the houses had enclosed yards. The vicus might then

have consisted of three rows of houses parallel to the river, situated behind each ther.

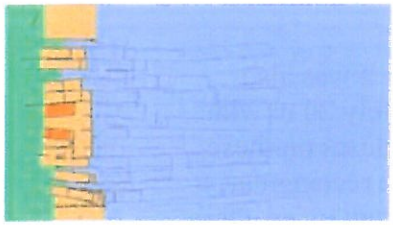
Dorestad

The plan (see fig. 3) shows a bewildering and apparently inextricable tangle of posts and postholes.
However, long and straight rows of closely set posts and postholes stand out. The posts vary in size, the bigger ones having a diameter of roughly 20 cm. The post rows include a great number of coupled posts, at right angles to the axis of the rows. Where posts do not stand exactly opposite each other, they are placed in a more or less regular zigzag line. The post must have held a wooden revetment, probably of planks, but a revetment of wickerwork occurred as well, but more rarely. These revetments were used to strengthen the edges of narrow strips of land, between 6 and 8 m wide. The strips are divided in a number of segments of varying length by transverse connections. The total length of the strips is about 200 m.
Construction of the platforms took place in several phases, the sections representing the individual construction periods. The growth of the platforms was mainly in length, but the occurrence of multiple side revetments, show that the strips of land could also be slightly widened.

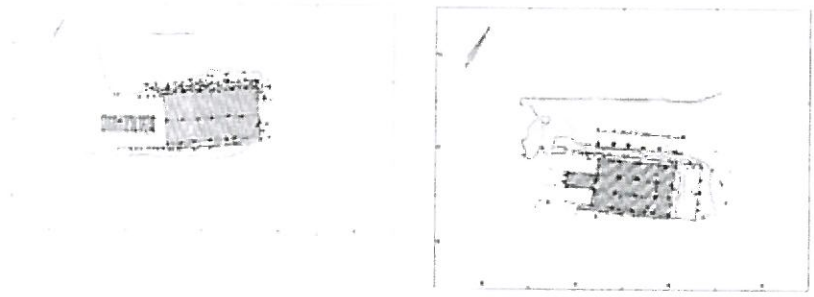
Sections of platforms completely free of internal features are rare. In most cases, the inner space is marked by the presence of rows of vertical posts - with roughly a diameter of 15 cm - parallel to the long axis of the platforms. They might have been connected by planks or beams, fastened to the top, which probably served as foundations for the road pavement. The construction of the pavements itself remains obscure.

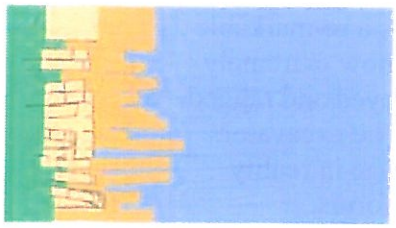
The complex of the platforms is the result of a long building process. The development started on the west bank of the river in approximately AD 675/700, from which the building activities spread to-wards the east, gradually penetrating into the river bed. The total complex of the harbour is made up of two parts: a western (Part 1) and an eastern (Part 2), characterised by a significant change in building-style. The division runs across the whole complex from north to south, at about the transition from squares A/K-8 to A/K-9 (see fig.3 and fig.4). To the west of this division, the sections are relatively narrow and often rather vaguely outlined, with mostly short compartments; well-defined rows of inner posts are rare. To the east, the platforms tend to be slightly wider, with clear outlines, many long compart-ments and well-defined inner post rows.

Part 1 is subdivided into two zones, the Sectors 1A and 1B, of which the transition corresponds roughly with the squares A/K 5.



Sector 1A is characterised by by several isolated, short but remarkably regular ground plans (see fig.4). These substantially built platforms (see the reconstructed platforms in fig.5 and fig.6) - some 10 or 12 m long and 6 to 7 m wide - represent the starting points in the development of the whole complex. Most of them were extended afterwards by the addition of new compartments.

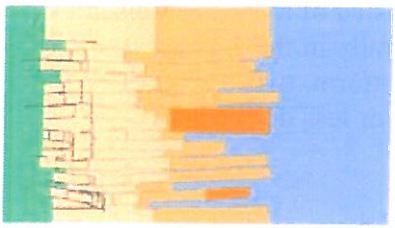




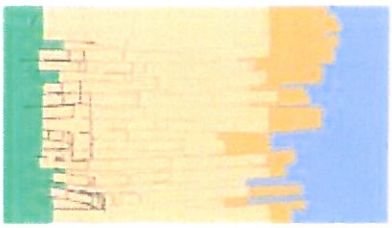
Sector 1B is characterised by its `vagueness' (fig.7). The not easily definable platform sections probably represent comparatively light constructions.
The Sectors 1A and 1B are dated to approximately AD 675-700/725.

In Part 2 the complex acquires its definite form, with a relatively regular system of well defined, substantially built platforms. The length of the compartments and the regularity of the general layout suggest a more rapid growth than in Part 1.

Part 2 also shows a subdivision into successive zones, but of minor importance, as the difference between the individual sectors is far less pronounced than in Part 1. Three zones are distinguishable: Sector 2A (division line with 2B mainly through squares A/K-16), Sector 2B (division line with 2C mainly through squares A/L-18/19) and Sector 2C.



Sector 2A (see fig.8) shows unusually long compartments (see the reconstructed cause-ways on fig.9 and fig.10), extending nearly as far as square 17, with their eastern ends forming an almost straight line, from north to south. Sector 2A is dated to approximately AD 700/725-750/775.



Sector 2B (see fig.11) has compartments rather shorter than those in Sector 2A, but the difference is not great. This sector is dated to approximately AD 750-775.

Sector 2C (see fig.12) represents the end of the development of the harbour. It shows a re-markable change, since the compartments are now extremely short. The eastern edge presents a frayed and ragged line, caused by substantial erosion. The excavators presume however, that the eastern edge in reality represent the original end of the platforms.

Period 2C is to be subdivided in:
a. completion of harbour works: circa AD 775-800/825;
b. continued occupation with minor additions and repairs in a time of growing economical stagna-tion: circa
AD 825-850/875;
c. end of function as international trading site: circa AD 850/875.

In *Period 1b*, the extensive port installations consisted of a platform, projecting into the river and placed centrally in the encircled river shore (see also fig.3). From this platform, two moles extended further into the river, which more or less defined an `outer' harbour. Velsen

It is possible that along the easternmost mole, defended by the eastern riverside defences, *non-Roman* (Friesian?) ships could unload. The central platform with its moles and the undefended western riverside section that gave access to the shipshed, were undoubtedly only accessible for use by Roman ships. Velsen

In *Period 1c*, the harbour was modified. This was necessary, due to scouring at the west side of the platform (see fig.12: rendered in blue) and silting in between the platform-moles and at the east

side of the platform (fig.12: rendered in yellow). It is obvious, that the moles will have contributed to a partial stagnation of the Oer-IJ current. The scouring also weakened the revetments of the moles.
A wooden revetment was constructed along the western river shore, to counter further scouring. The quays of the platform were extended outwards, because of accretion of silt deposits, and additional reinforcements were built along the westernmost mole.

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Harbour informations about: Mooring equipment

Akko

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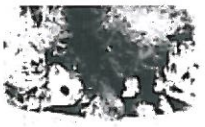

Roma

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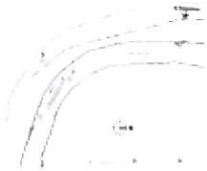

Roma

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Szczecin

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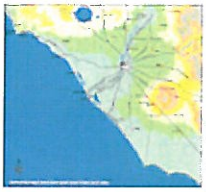
Harbour informations about: Sea / River Harbour

Leptis-Magna

Ursprüngliche Form des Hafens bildete der ästuar des Wadi Lebda. Er bildete hier eine von Osten durch einen umbiegenden Vorsprung (Kap Lebda) nach Westen geöffnete Bucht. Die rechte Uferseite wurde im Laufe der Benutzungszeit künstlich erweitert. Somit bildete sich die für die nordafrikanische Küste übliche Hafensituation (vgl. Sabratha, Oea), welche besonders in den Sommermonaten Schutz bieten mußte vor den Ostwinden.

Mehrfach freigespült und wieder eingesandet bildet das breite Hafenbecken heute eine teilweise feucht-sumpfige Niederung (vgl. hierzu die Situation in den Karten von P.Romanelli in ersten Viertel des 20.Jahrhunderts).

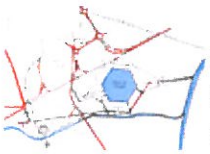
Ostia-Claudio



Il porto di Claudio è situato a circa 35 km a sud di Roma, verso la costa tirrenica, e a circa 3 km a nord della foce del Tevere e dell'area archeologica di Ostia Antica. Il mare dista all'incirca 3 km verso est.

L'aeroporto internazionale di Roma, ovvero l'aeroporto "Leonardo Da Vinci" di Fiumicino, confina a nord e ingloba ad ovest parte dell'area archeologica. Quest'ultima copre un'estensione di circa 150 ettari.
Il sito fa parte del territorio del comune di Fiumicino mentre l'area archeologica è controllata dalla Soprintendenza archeologica di Ostia.

L'avanzamento della costa (all'incirca 3 km) a partire dall'epoca romana è segnalato sul terreno e sulle foto aeree da una serie di dune parallele. La linea di costa, inoltre, aveva un andamento meno regolare ed erano presenti numerose lagune (Segre 1986; Bellotti 1998).



Oggigiorno, il porto di Claudio può essere raggiunto dalla capitale attraverso l'autostrada Roma-Fiumicino e la via Portuense, da Ostia e Fiumicino attraverso la via dell'Aeroporto.

In epoca romana, il porto era collegato a Roma per via terrestre, attraverso l'antica via Portuense, e per via fluviale, attraverso il Tevere. Uno o più canali collegavano direttamente il Tevere con il porto. Secondo il Testaguzza (1970: 179) uno di questi sarebbe da identificarsi con la più tarda Fossa Traiana (odierno canale di Fiumicino).
Un'altra strada, chiamata più tardi via Flavia-Severiana, collegava il porto di Claudio ad Ostia. Essa attraversava l'Isola Sacra, ovvero il territorio compreso tra il braccio naturale del Tevere, a sud, e la Fossa Traiana, a nord.




Ostia-Fluviale

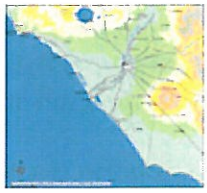
Ostia fu costruita in riva al mare e lungo il Tevere; oggi il mare si trova a più di due miglia di distanza a causa dei sedimenti depositati alla bocca del fiume e la sabbia trasportata dalla correnti litoranee.

Il fiume, inoltre, ha cambiato il suo corso. Nelle mappe degli inizi del XVI secolo, il Tevere segue un andamento parallelo al Decumano, a partire da Tor Boacciana. Poco a est di Porta Romana curva vistosamente e ritorna davanti al castello che venne costruito per il suo controllo. Invece, dopo un'inondazione particolarmente forte nel 1557, il fiume abbandonò il suo letto. Il meandro si spostò verso ovest e l'antico letto divenne una depressione paludosa detta "fiume morto", finché non venne colmata con terra e macerie nel XIX secolo. Il suo tracciato può essere seguito grazie alle fotografie aeree e parzialmente sul terreno.


Ostia-Fluviale

Ostia era collegata a Roma dalla Via Ostiense, che da Porta Romana, raggiungeva Roma passando attraverso le mura Aureliane dalla porta oggi nota quale Porta San Paolo e attraverso le mura repubblicane attraverso la Porta Trigemina. Il Tevere assicurava il collegamento via acqua.

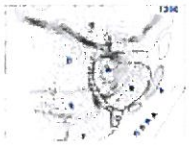
(Keyword: river harbour)
Il porto fluviale fu fondato lungo il Tevere ed entrambe le rive destra e sinistra furono equipaggiate per sostenere un traffico d'imbarcazioni su larga scala. L. Bertacchi (1960) ha avanzato l"ipotesi che il Tevere non seguisse il corso generalmente accettato durante il periodo imperiale, e che il porto repubblicano debba essere ricercato nella laguna a sud-est dell'insediamento moderno, zona che dall'epoca medievale al XIX secolo è nota come "Stagno di Ostia". Probabilmente un braccio del Tevere o un canale si collegava a questa laguna che doveva avere poi uno sbocco a mare presso Tor Paterno. La laguna, ovvero il "lacus Ostiae", era anche sfruttata per la produzione del sale.

Ostia-Traiano

Il porto di Traiano è situato a circa 35 km a sud di Roma, verso la costa tirrenica, e a circa 3 km a nord della foce del Tevere e dell'area archeologica di Ostia Antica. Il mare dista all'incirca 3 km verso est.

Il sito fa parte del territorio del comune di Fiumicino mentre l'area archeologica, nota come Area archeologica di Portus, è controllata dalla Soprintendenza archeologica di Ostia.
Essa è compresa tra il porto di Claudio e il canale di Fiumicino (in antico la Fossa Traiana) che connette il Tevere al mare, ed ha una superficie di circa 65 ettari.

Szczecin

Archaeological research conducted between 1954 and 1963 in the area of the Vegetable Market, adjacent to the Odra River, delivered some

substantial information concerning the location of the Szczecin harbour. A wreck of a Slavonic vessel was found at a depth of 1.80 □ 1.87m below sea level, occupying the upper part of the slime layer. The discovery together with the conditions in which the wreck was found led to the determination of the original western bank of the Odra River.

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Harbour informations about: River Harbour

The Early-Medieval site of Dorestad was situated to the north of the Late-Medieval town of Wijk bij Duurstede, in the province of Utrecht (the Netherlands). At Wijk bij Duurstede, the northernmost branch of the Rhine (the Lower Rhine) splits into the Lek and the Kromme Rijn (see fig.1). Dorestad

Ostia-Fluviale

Abbiamo due descrizioni del porto alla foce del fiume.
Dionigi di Alicarnasso, (Dion. Hal. III, 44), che scrive nel I secolo secolo a.C., offre la descrizione più positiva:
"Dato che il Tevere si presta a far arrivare navi di grande tonnellaggio fino a Roma favorendo rapporti con mercanti stranieri, Anco Marcio fondò un porto comodo e adatto anche al naviglio più grande. Questo si poté fare con facilità grazie alla posizione del fiume nell'area della foce che, con le sponde molto aggettanti in mare, dà luogo ad ampie rive. Il fiume poi non è mai ostruito dall'insabbiamento marino e alla foce non si dissolve in aree paludose, ma, restando sempre in un unico alveo porta le navi fino al mare dove sbocca all'altezza del faro. Così il naviglio grande fino a 3000 anfore entra agevolmente nella foce e raggiunge Roma per mezzo dei remi o del traino. Quando vi sono bastimenti di tonnellaggio superiore, vengono messi alla fonda davanti alla foce e scaricati per mezzo di battelli fluviali. Il fiume si allarga notevolmente alla sua foce e forma una larga insenatura, come per i migliori porti marittimi".

Il suo contemporaneo Strabone (231, 2) enfatizza invece gli svantaggi:
"Ostia è senza porto a causa dell'insabbiamento prodotto dal Tevere, poiché esso è arricchito da numerosi affluenti. Benché l'ancoraggio alla foce significhi un grande pericolo per le imbarcazioni commerciali, la prospettiva del guadagno prevale; e infatti il traffico continuo di battelli che ricevono i carichi e ne portano altri in cambio permette alle imbarcazioni di ripartire senza indugio prima di raggiungere il fiume, o ancora, dopo essere state parzialmente scaricate, risalgono il Tevere fino a raggiungere Roma".

Non esiste una vera e propria contraddizione tra i due racconti. La bocca del fiume era navigabile per le imbarcazioni di piccolo tonnellaggio, mentre le grandi imbarcazioni, soprattutto quelle utilizzate per il trasporto del grano dovevano ancorare al largo. Il Tevere trasportava grandi quantità di detriti che si depositavano lungo la costa rendendo difficile l'accesso per le imbarcazioni con un grande pescaggio.

L'insabbiamento non rappresentava il solo problema. Il fiume era largo soltanto 100 metri. Le imbarcazioni di piccolo tonnellaggio avevano spazio per manovrare, mentre soprattutto a causa dell'aumento dei traffici nella tarda Repubblica, diventava sempre più difficile gestire imbarcazioni di dimensioni maggiori, specialmente quando il grano arrivava da lontano. Il porto fluviale era troppo limitato per i bisogni della Roma imperiale.

I resti archeologici

Sfortunatamente, sono scarsi i resti archeologici che possano essere messi in relazione con il porto fluviale di Ostia. Le diverse evidenze sono state raccolte qui di seguito.

Cippi di confine lungo la riva del fiume
Cinque cippi di confine erano allineati lungo il lato settentrionale del Decumano. Tutti recavano la stessa iscrizione:
"C. Caninius C. f. pr(aetor) urb(anus) de sen(atus sent(entia) poplic(um Ioudic (avit)".
Essi coprono una larghezza di circa 600 metri. Immediatamente accanto il cippo più occidentale ne fu aggiunto più tardi un altro che segnalava la fine della zona pubblica:
"privatum ad Tiberim usque ad aquam".
Secondo Meiggs (1973) lungo questa stretta sponda fluviale i mercanti in epoca repubblicana scaricavano le loro merci.

La città di Roma, fin dalle epoche più antiche, era attrezzata con una serie di approdi lungo il fiume Tevere. Soprattutto a partire dall'età Repubblicana, tali approdi divennero vere e proprie installazioni fisse dotate di importanti infrastrutture. In particolare, tutta la zona meridionale a valle dell'isola Tiberina, su ambedue le rive, ma soprattutto sulla sinistra, può essere considerata come la grande area portuale della capitale.

Roma

Position

Velsen

The early Roman site of *Velsen 1* is situated about 2 km to the west of the Medieval centre of the village of Velsen, in the province of *Noord-Holland* (the Netherlands) (fig.1: A).

At *Vechten*, in the province of *Utrecht* - where the Roman *castellum Fectio* once was situated (fig.1: B) - the Rhine splits into the *Oude Rijn* and the *Vecht.* In the Roman period, the Vecht represented the northwesternmost branch of the Rhine, streaming northwards and having its outlet to the *North Sea* (fig.1:9) via the so-called *Oer-IJ* (fig.1: 10). Velsen 1 was situated at the southern shore of this Oer-IJ, surrounded by an area inhabited by the local population, the *Friesians* (fig.1: 11).

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Harbour informations about: Sea Harbour

Akko

Coastal situation: Akko is found in a natural bay, 15 km north of Haifa
River situation: 1.5 km to the south of the bay of Akko is the Na'aman River.

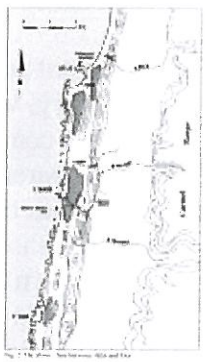
Amathous

The ancient town of Amathous was the capital of the ancient Cypriot Kingdom of Amathous, which was located on the south coast of Cyprus. It is found at the southeast part of the new city of Limassol, between the old and the new road that connects Limassol with Nikosia and Larnaca. Human presence in the area is attested to from the eighth millennium BC, and in Amathous specifically, human activity is evident from 1100 BC.

Ampurias

Der Ort liegt im südlichen Abschnitt des langgestreckten Golfo de Rosas im Küstenabschnitt der östlichen Pyrinäen, an der Costa Brava. Südlich des Kap de Creus bildet sich bei L'Escala eine weite, langgezogene geschützte Bucht die sich als schützender Etappenaufenthalt anbietet. Sehr gefürchtet sind in dieser Region die starken Nord und Ostwinde (Tramontana, Mistral), welche sich an der südfranzösischen Küste (Golfe du Lion) bilden und die Segelschiffahrt hier stark gefährden.

Atlit

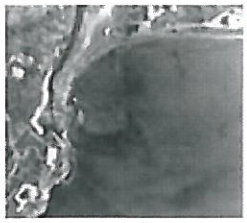


Atlit is located to the south of Haifa (20 km). It may be reached by the coastal highway or the ancient road to Haifa. The ancient site spreads on a rocky island, on an area of 700 acres. The boarders are: the sea to the west, to the east is the road cut through the *kurkar* ridge (parallel to the shore) and to the north is the Oren River outlet.

Carthage

Halbinsel nordöstlich des heutigen Tunis; ehemals schmale Halbinsel an der Binnenlagune. Zwischenzeitlich hat ein starker Verlandungsprozeß zu einschneidenden Veränderungen der topographischen Verhältnisse geführt, insbesondere im nördlichen Teil der ehemaligen Halbinsel. Drang einst das Meer zwischen dem Kap Sidi Ali el-Mekki und dem Kap Gamarth, (der nördlichen Spitze der karthagischen Halbinsel) tief in das Land hinein, so zieht sich heute die Küste in einer nur leicht nach innen gekrümmten Linie zwischen den

beiden Vorgebirgen hin. Der Wasserstand mag, anhand von archäologichen Beobachtungen (Hurst 1979) ungefähr gleich dem heutigen gewesen sein. Polybios beschreibt uns die Lage wie folgt (I 73): Karthago liegt an einem Meerbusen, in den es sich in Gestalt einer Halbinsel vorstreckt, so daß es fast überall von Wasser, auf der einen Seite von der See, auf der anderen von einer Lagune, umschlossen ist. Die Landenge, die es mit Libyen verbindet, ist etwa fünfundzwanzig Stadien breit. Nach der Seeseite hin liegt nicht weit entfernt die Stadt Ityke (Utica), auf der anderen Seite an der Lagune Tynes (Tunis)." Die Hafenanlagen sind heute noch sichtbar als Lagunenweiher (ringförmige Lagune von Douar-Chott).



Cosa

An einer westost verlaufenden Landzunge, in deren südlichem Bereich sich eine geschützte Bucht bildet. Im Hinterland bildet sich im sumpfigen Gebiet der Maremma eine barrierenartige, küstenparallele Lagune. In dieser Gegend, in der das hydrographische Gleichgewicht immer problematisch und Versumpfung eine dauernde Gefahr war, brachte die römische Landaufteilung auch eine Lösung des Drainageproblems mit sich: die ganze Küstenebene wurde mit einem dichten Netz rechtwinkliger zueinander verlaufender Kanäle überzogen. Es bildete sich somit ein komplexes System einer Lagune für Fischzucht, Be- und Entwässungsanlagen sowie ein geschützter Ankerplatz.

Dor

The bays at Dor are called in Arabic Tantura "peak of the cape" after the small cape which divides the bay in two. In the Talmudic literature, it is called "the tooth of Dor". It is one of the few natural anchorages on the coast of Israel. Dor is one of the largest ancient Tels (mound) in Israel.

The ancient settlement was built on a rocky promontory, which is part of an aeolinite (*kurkar* – carbonate cemented quartz sandstone) ridge that stretches parallel to the sea and the Carmel Range. To the south of the Tel is a sandy shore with several offshore islands that form the continuation of he western kurkar ridge. These islands form a lagoon that is a natural anchorage still used nowadays. To the north of the Tel is the North Bay, partially protected by an island that provides a natural anchorage. In ancient periods this body of water was used as a harbor attested by the marine installation found to the south of the bay, at the northern edge of the Tel. The main anchorage was to the south of the Tel, today separated by a *tombolo* (sandbar), thus comprising the South Bay and the Tantura Lagoon. Adjacent to the Tantura Lagoon are the Nahsholim Kibbutz and the Dor Farm. The site of Dor is found to the south of Haifa (30 km) and may be reached by the coastal highway or the old road to Haifa.

The Crusaders built a castle on the small cape on the coast of Dor and named it after the family of de Merle, which received the area from the lords of Caesarea as their domain. Merle was captured by Saladin in 1187. The Crusader fortress was abandoned just before the fall of Atlit in 1291. Sketches from the 19th century show a high tpwer, which was apparently part of a Norman keep. Today, there are no remains of this tower nor of its foundations.

The port of Dover lies on the coast of south-east England beside the English Channel, within sight of and at the nearest point to France. It is situated at the mouth of the River Dour in a deep narrow valley between high chalk hills. As the sea level has been rising relative to the land since the last Ice Age, thereby forming high cliffs, the exact position of the coastline in prehistoric and Roman times is not known.

Dover

Guernsey

Recent archaeological excavations have produced material which shows that people on Guernsey were trading from the early prehistoric period. At the Royal Hotel site in St Peter Port, flint tools and pottery similar to types from the Paris basin were found. The people who brought these items to the island probably brought farming skills and techniques with them in the early neolithic period. During the period of megalithic tomb building a ritual deposit of barbed and tanged arrowheads was made at Les Fouaillages in the low lying north of the island. A distance of more than 350 kilometres and a difficult sea crossing would have been necessary to transport these prestige objects to Guernsey. Polished jade axes from the French Alps also made their way to the island. Later in the Bronze Age, metalsmiths came to the island with new skills and their characteristic large decorated beakers, although there is little evidence of significant trade in the Later Bronze Age. By the Iron Age Guernsey was well established as a port of call between the northern coast of Brittany and the southern coast of Britain. Pottery imports from Armorica and other goods such as shale from Hengistbury Head on the south coast of Britain are found in Guernsey. By 50BC a trading network is evident with substantial cargoes of amphorae containing wine and garum (fish sauce) passing in and out of the island along with other fine imported pots from Armorica. During the years leading up to the Roman conquest of Britain evidence for trade continued. At the native farmstead at Les Tranquesous, terra nigra wares from Rennes were found alongside Gaulish pottery, indicating that cargoes were reaching the islands en route from France to Britain throughout the period. Amphorae from the early first century AD were found just outside the modern harbour of St Peter Port and recent land excavations have provided further evidence that the islands were under Roman influence from the time of their presence in neighbouring Gaul. Remains of cargoes from the Roman period litter a wide area of the east coast around the present harbour.

The Gallo-Roman ship *Guernsey 1* was

carrying a cargo of pitch. Recent research (Connan *et al,* 2001) has located the source of the pitch to the Les Landes region of France, suggesting that the ship was on its way from there to Guernsey and on to Britain. The pitch may have been used for sealing or lining amphorae or barrels. Barrel staves were also found on the ship. There was no evidence that it was used for caulking the ship itself.

The capital of the kingdom of Kition is located at the centre of the present town of Larnaca, in the area of Pamboula, where the ancient naval port was found. The rural area of the kingdom extended around the district of Larnaca between the areas of the kingdoms of Salamis, with which existed a continual rivalry, and of Amathous.

Kition

The kingdom of Kourion was found on the southwest shore of Cyprus. Its capital was at the cove of the bay west of Akrotiri peninsula. The first evidence of occupation in the area dates to Neolithic Period (at site of Sotira). Although a specific founder is not mentioned in ancient texts, Herodotus and Strabo attribute the establishment of the kingdom to colonists from Argos. The colonisation of the kingdom by Achaeans is further re-enforced by the presence of Mycenean tombs in the area. The city is well witnessed during Historical times through the archaeological remains and ancient written sources until the Arab raids, when the city was transferred to the area of Episkopi.

Kourion

The kingdom of Kyrenia occupied the east central region of the north coast of Cyprus. The historian Hill mentions that Kyrenia is referred to for the first time as a city under the independent king definitely after 315 b.C (Hill 1940, 113).

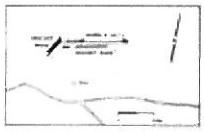
Kyrenia

The ruins of the town of Lapethos extend over the area of the beach, at the north side of the village Karavas, at the site of Lambousa, at the western part of the north coast of Cyprus. To a large extent the city walls are visible especially from the hill, named Troullin, which most likely compromised the acropolis. The surrounding territory consists of a fertile plain, which was until 1974 covered with citrous trees, and watered by the two springs of Lapethos and Karavas. This rich rural region,

Lapethos

combined with its proximity to the Anatolian coast, was the incentive for the foundation of a large kingdom with a harbour facility at this site, which, according to researchers, dominated the neighbouring kingdom of Kyrenia.

A coastal city was already established in the Late Bronze Age. In the surrounding region settlements dating from the Neolithic, and the Early and Late Bronze Age are evident, however settlelments of the Geometric period are concentrated further south towards the Pendadaktilos mountain, in the area of present day Lapethos and Karavas. This site on the coast (Lambousa) cannot be dated ealier than the Late Bronze Age. The city seems to flourish mainly from the Archaic until the Roman period. The coins minted in the city date back to as early as the 4th and 5th Century BC and include the names of the Kings. In the mid 4th Century coins depicting Athena and certain Phoenecian elements appear, indicating the transfer of power to Phoenecian Kings, and reflecting the attempts by the Persian Empire to consolidate a Phoenecian client state on Cyprus. In 312 BC Ptolemy suspected that King Praxippos of Lapethos was cooperating with Antigonos. During the Roman period the city compromised one of the four provincial centers of Cyprus, and during the early Byzantine period it was an Episcopal seat. The city was finally abandoned after the Arab raids and moved northward.



The kingdom of ancient Marion was at the valley of the modern Polis tis Chryxochous, at the northwest littoral of Cyprus. Both the ancient and the modern settlements are located on approximately the same point on the south of the shore, in the cove of Chrysochou bay. Extended cemeteries from the Early Geometric Period down to Roman and Byzantine Times have been well recorded occasionally or by systematic excavations. The first period of the city's life was truculently interrupted in 312 BC, when Ptolemy Soter totally devastated the town and moved the population to the newly established Nea Paphos. At about 270 BC the city was rebuild from Ptolemy Philadelphos and renamed Arsinoe in honour of Arsinoe Philadelphos (Childs 1988, 121).
Marion
It was once a rich kingdom with several resources located as it was in a fertile, well irrigated valley, abundant pastoral land, rich forests, and with control of the copper and perhaps gold mines of Limni area. The city played a significant historical role having mainly Aegean orientation, although occasionally "philopersian" kings took on or were deputed to the throne. The excavations, artifacts, and moreover the history of the kingdom clearly indicate this tension (Nicolaou 1964, 131-187 and Childs 1988, 121-130).

The Kingdom of Paphos occupied the west and north-west coast of Cyprus, having borders with the kingdom of Marion to the north, and the kingdom of Kourion to the south-east. The capital of the kingdom, called Παλαίπαφος, was located at the modern day site of Kouklia, at a distance of approximately one kilometer from the coast. In the 4th century BC the capital was transferred northwards, by King Nicocles, to an already existing town which boasted an anchorage. The new capital was named Nea Paphos
Paphos

and is located in the area known today as Kato Paphos. This grandiose plan to transfer the capital included the construction of a large harbour facility at the new site. It is possible that the two rivals who vied for supremacy on Cyprus at the end of the 4th century BC, Ptolemy Soter and Demetrius the Besieger, contributed to the harbour works in order to benefit from the safe harbour at the west coast that would latter be afforded to them (Daszewski 1987, 171-175, Hohlfelder 1995, 194).

Salamis

The kingdom of Salamis extended to the east littoral of Cyprus with its capital on the estuary of Pediaeos river. According to myth the establisher of the city was the Trojan hero Teukros, son of Telamon, the king of island of Salamina in Saronic Gulf (Greece). The city succeeded Prehistoric Engomi and flourish during Geometric period as the wealthy finds of the so-called 'king tombs' indicate. Professor Karageorghis states that the Archaic and Classical city extended seaward, north of the Geometric city, in a larger area around the port, and was the predominant city of Cyprus. This northward movement may have been due to the gradual silting of the port by the river's sediments and thus coaxing the inhabitants to the area of the northern anchorage (Karageorghis 1969, 167-169).

Soloi

The kingdom of Soloi was on the northwest coast of Cyprus with its capital on the cove of the Morphou bay. The ruins of the ancient city are located at the foothills of a low hill called even today "Palaia Hora" (Ancient Capital), east of the village of Potamos tou Kampou. The river of Kampos flows west of the hill and on the east side of the estuary the ancient port can be traced. According to myth the Athenian Trojan heroes Phaleros and Demofon established the city. A second interpretation given from Ploutarchos considers that king Philokypros established the city of Soloi, which succeeded the older city of Aipeia that had been established by Demophon. He mentions that the Athenian legislator Solon visited the city of Aipeia, where Philokypros was the king and encouraged him to relocate the city from the inaccessible place it was to the neighboring valley. The relocation was then performed and the new city got the name Soloi, thus honoring the Legislator. However, the excavations indicated that in the area of Vouni, which was considered as the position of Aipeia nothing earlier the Classical Period was found, and moreover in the area of Soloi some tombs go back to Geometric Times. Unfortunately, the question still exists since the excavations were interrupted by the Invasion of 1974. In its history, the kingdom of Soloi kept an Aegean orientation as the myth and archaeological record proves, and as the position of the city on the northwest shore suggests. It comprises the second nearest port after Marion, located further west, coming from the island of Rhodes and the Aegean via the Cilician Sea.

Syracusa

In den sog. großen Hafen, einer großen natürlichen Bucht, geschlossen auf der einen Seite durch die Insel Ortygia, auf der anderen durch die Halbinsel Plemmyrion (heute Peninsola della Maddalena) münden die Flüße Anapa und Ciane.

Dem sog. kleinen Hafen (oder Lakkios) östlich der Ortygia geschützt durch die Küstenfront der Achradina. Die Topografie hat sich seit der Antike stark verändert. Der antike Küstenverlauf anders als heutiger, entspricht ca. der heutigen –3.00 m Linie.

Im Gegensatz zu Cristoforo Cavallari, geht man heute aus urbanistischen Überlegungen von einer geraden Verlängerung der Mittelachse der Ortygia nach Norden aus. Der Istmus befand sich in der Antike weiter nord-östlich (heute ca. Piazza Santa Lucia), die Brücke, welche die Insel Ortygia mit dem Festland verband, würde somit im Bereich des jetzigen kleinen Hafens zu suchen sein. Dieser hätte weiter gelegen. Dies könnte somit auch eine Erklärung für die relative Fundleere im inneren Bereich des jetzigens Hafens sein, dessen Öffnung mit dem Kanal zwischen dem vorgelagerten Unterwasserriff Gerhard Kapitän untersucht hat.

Wolin

The Archaeological site in Wolin is situated in S – E part coastal island Wolin, over sandy bank of river Dziwna on one of three shoulders of the Oder (Odra) delta, about 25 km from present coast of the sea. Island is found between Pomorska Bay on north and Gulf of Szczecin on south. From island Uznam separate her river Świna and from land river Dziwna. Wolin situated is in place where waterway – Warta and Oder river basin crosses with land road along the coast Baltic (E – W). Track continental lead from Hamburg to Novgorod – writes about this Adam of Bremen. Track united island Wolin with land in place narrower troughs of river Dziwna, where are found silt isles. In point of passage on bank of island was post-glacial sandy bank surrounded with swamps. This region was flooded in period high state of water in river.

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Harbour informations about: Shipshed

During the land excavation the remains of a building came to light, 6m away to the south of the city wall running parallel to it, which was identified with the ship shed of the archaic port. Its northern side is formed by a segment of wall, which is interrupted by a row of column bases (only one column survives), made of local volcanic stone. The bases show a substantial gradient towards the west. The building was most probably roofed with red and black clay tiles judging from the ones located in the destruction-fill covering its floor. It is estimated that similar structures were to be found further to the south. At some point the ship shed is destroyed, most probably by flood, the port is silted up and a new part of the wall delimiting the new coastline is being built. Abdera

Parallel walls with direction towards the coast, were located east of the surveyed area F (Skoufopoulos & McKenna 1975: 111) in the gulf 'tis Mantilou'. The walls probably belong to the foundations of Roman shipsheds. Gytheion

Ship sheds are mentioned by Xenophon in his description of the battle between Corinth and Sparta in 392 BC, however the specific location is not given (Hellenica IV, 13). There is no evidence to indicate the site of the ship sheds, however it is natural that a harbour complex belonging to one of the strongest naval forces of the ancient world would include this feature. Lechaeon

The dockyard of the harbour was situated on the south of Cantharus, at Alkimos coast and consisted of 96 ship sheds in 331 (IG II² 1627-1629 & 1631) in a total of 372 in the whole of Piraeus. This area of the main harbor developed into a naval military zone after Munychia and Zea, when the need for military ships was increased. Piraeus

D. Ship sheds of Zea and Munychia. Piraeus

"The Shipsheds were the most ancient buildings of Piraeus. According to Plato, it was Themistocles who had the first permanent installations built" (Steinhauer, G.A., 2000,p.60). From the registers "diagrammata" of the overseers of the dockyards, we know that the total number of Shipsheds in all three ports was 378, from which 83 were in Munichia, 196 in Zea and the rest 94 in Cantharus.

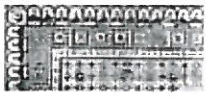
In Zea the Shipsheds, "neosoikoi" were divided into two groups, east and west , along the coastline

of the harbour. At the center of the bay the lack of slopes made it impossible for them to be located there. So 196 Shipsheds, 6.50m wide each, were situated on a coast a total of 1120m.This points to the fact that some of them were situated in two successive rows with one ship tied up behind the other. The existence of two rows of shed is also supported by the fact that traces of them were found in the 19th century and were noted on Kaupert's map (Curtius, E. -Kaupert, J.A., 1881). From the Shipshed of the western side of the harbour no traces have survived today, while from the eastern side a small section is preserved in the basement of an apartment building (on the corner of Akti Moutsopoulou and Sirangiou Street) (Fig.15) That is the only section that remains from the the group of 20 Shipsheds that were excavated in 1880 by Dragatsis and recorded by Doerpfeld. Every couple of "neosoikoi" formed an elongated Shipshed, which was covered by a roof and was closed at its rear end by a continuous wall. (Fig. 16) According to "the layout of the Zea sheds , they were organized in groups of ten , separated with partitions, and served by an entrance from an outside corridor, in the middle of the back wall(the entrance in Munychia has been confirmed)" (Steinhauer, G.A., 2000,p.64). One trireme was moored in each "neosoiko" –or two smaller vessels- on the slip that ships were launched or hauled, with an incline of less than 10% and a total length that extended for a few meters in the sea and exceeded the sheltered space of the shed." In Zea this consisted of two parallel walls 4m. Apart to which a wooden floor was attached, which would be greased along the axis over which the keel would slide, flanked by the side pieces. (Fig.17) In the Munychia sheds described by Von

Alten (Curtius, E. - Kaupert, J.A., 1881, p.14-15) which were excavated recently, the slip consisted of stone slabs with sockets in which to secure the wooden floor." (Steinhauer, G.A., 2000,p.63). The sheds were divided in two parallel compartments and from the adjacent shed, by colonnades of unfluted columns on individual cubical bases, which varied in height and number, corresponding to the highest or the lowest part of the roof. The first ones were higher and more sparsely placed, while the second, ones were lower and more densely placed with a buttress wall at the back. Between the slip and the colonnade, there was a corridor for the movement of the personnel and the necessary materials for the restoration of the ships. So the width of each Shipshed was 5.60m in Zea and 5.30m in Munychia, while its length reached the coastline at 42m.

There haven't been found as yet any traces of the ship sheds of the military port of Samos. Samos Samos. However, their existence is considered by scholars to be certain, as there is explicit mention of them in ancient sources and most importantly because they form an integral part of every military port, due to the need for the safekeeping of the vulnerable ancient warships.

Alle bis jetzt entdeckten Mediterranen Schiffshäuser stammen aus der griechisch/hellenistischen Periode. Römische Schiffshäuser aus dem Mittelmeergebiet, die ähnlich ausgesehen haben müssen, kennen wir hingegen nur von bildlichen Darstellungen und aus der literarischen Überlieferung. Schiffshaeuser



Die meisten Schiffshäuser aus dem Mittelmeergebiet sind ganz, oder zumindest teilweise, in den gewachsenen Felsboden gehauen. Das bedeutet, daß beim Bau von Schiffshäusern, die weiter vom Ufer entfernt lagen, vor allem bei einer Steilküste zusätzliche Arbeit nötig gewesen wäre, um die enormen Gesteinsmassen zu beseitigen. Darüberhinaus hätten die Schiffshallen zuviel Platz in den häufig dicht bewohnten Städten beansprucht. In Karthago wird der mögliche Platz durch die Größe der Ile de l'Amirauté bestimmt.

In 0eniadae bestand der erhaltene Teil der Helling aus 3,25 m breiten Gräben mit abgeschrägten Seitenwänden, in Piraeus-Zea aus 3,03-3,12 m breiten, erhöhten Plattformen, deren Breite mit den aus Querhölzern aufgebauten Hellingen von der Hofestatt (unten) übereinstimmt. Bei einigen Anlagen wurde in die Helling ein zentraler Graben eingetieft. in dem entweder ein Balken oder aber die Schiffskiele geruht haben.

Obwohl im Mittelmeerraum kaum Holzreste gefunden wurden, kann man vermuten, daß die steinernen Schlepphellingen auf die eine oder andere Weise mit Holz verkleidet waren. Wahrscheinlich wurden die Schiffe entweder von Menschenhand oder aber mechanisch hochgezogen. Dabei glitt nur der Kiel über die hölzernen Schwellbalken. Die Schiffe wurden von der Mannschaft oder mit Hilfe eines hölzernen Stützskeletts im Gleichgewicht gehalten, wodurch der empfindliche Schiffsboden geschont wurde. Sobald das Schiff an der gewünschten Stelle aufgestellt war, konnte es mit von den Seiten her untergeschobenen Holzkeilen oder schräg gegen den Gangbord gestellten Pfosten oder einer Kombination beider Methoden abgestützt werden.

HarbourChapterText " Schiffshaeuser

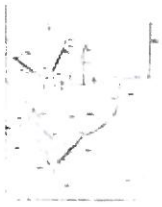
Die Anlagen

Die Anlagen auf der Hofestatt wurden zwischen 1901 und 1904 ergraben. Seitdem hat dort keine weitere Grabung stattgefunden; das Gelände ist heute nahezu völlig überbaut. Die römischen Befunde erstrecken sich über eine Fläche von 270x100 m entlang der Lippe.

Problematisch bei der Berechnung der Innenfläche der verschiedenen Phasen ist der nicht sicher bekannte Verlauf des Lippeufers in römischer Zeit. Die ursprüngliche

Innenfläche ist wahrscheinlich bis an eine 2 m hohe steile Uferterrasse erodiert. Südlich davon scheinen die meisten Spuren der Verteidigungsanlagen der Erosion zum Opfer gefallen zu sein.

Die Mehrzahl der hier gefundenen Pfostenreihen, die parallel mit der Terrassenkante und 10 m südlich davon verlaufen, bestanden aus quadratischen oder rechteckigen Pfählen-, dazwischen lagen u. a. einige Baumstümpfe. Auch im äußersten Westen der Grabungsfläche wurden Pfosten in einem Ost-West orientierten Graben unmittelbar südlich der Verteidigungsanlagen angetroffen.



Ebenso wie für Velsen 1 kann man auch für die Anlagen auf der Hofestatt unterstellen, daß die Pfostenreihen weiter oben einen regelmäßigen Eindruck erweckten. Die Baumstümpfe zwischen den Pfostenreihen, also den Uferbefestigungen, scheinen zu einer Auffüllung zu gehören, die zwischen die verschiedenen Perioden datiert, in denen die Pfosten eingeschlagen wurden. Die mittelalterlichen Funde zwischen den Pfosten werden auf jüngere Störungen zurückzuführen sein.

Bei diesen Pfahlreihen handelt es sich wohl um mehrperiodige römische Uferbefestigungen, deren Verlauf sich der auf dem Ufer befindlichen Anlagen anschließt und den südlichen Abschluß der mehrperiodigen Anlage der Hofestatt darstellen.

Die gesamte Anlage der Schiffshäuser von den vierten Periode von Haltern-Hofestatt bildet sich als rechteckigen Hof, der von einem Zaun umschlossen war, in dem sich sehr regelmäßig gebaute Baracken befanden. Der Befund des Zauns bestand aus einem 0,3-0,4 m breiten und flachen Streifen. An der Nordseite des Hofs ist dieser Streifen 55 m lang, an der Westseite 29,5 m. An der Ostseite verläuft der Zaun bis an die Grenze der Hofestatt, also bis an die durch Erosion entstandene steile Terrassenkante. Es gab auf der Nordseite des Zauns eine Unterbrechung von 1,5 m., die 23 m von der Ostecke und 30 m von der Westecke entfernt lag. Es handelt sich um eine Palisade, die die darin gelegene Schiffshäuser vom Rest des Lagers abtrennt. Der Haupteingang befindet sich im Westen, ein Seiteneingang im Norden. Von der Nordseite des Zauns zweigt ein kurzer Graben rechtwinklig nach Süden ab; (Planquadrat H-2), ein weiterer reicht bis an die Holz-Erde-Mauer im Norden (Planquadrat U-1).

Die Spuren der Schiffshäuser bestehen aus acht Längsstreifen mit kurzen Querstreifen, von denen der westlichste vollständig, der zweite beinahe vollständig und der fünfte zu einem großen Teil ergraben wurde. Die übrigen sind nur aus Suchschnitten bekannt. Vor und zwischen den Längsstreifen liegen neun Reihen Pfostenlöcher, deren Abstand in der Längsrichtung 3 3/4 m (entsprechend 12 1/2 römische Fuß) und in der Breite 6,5 m beträgt. Der erste, 25 m lange, Streifen hat sorgfältig angelegte, etwas mehr als 0,5 m breite und tiefe senkrechte Wände. Die insgesamt 3,5 m langen Querstreifen sind etwas schmaler und ebenso breit wie tief. Sie standen 1,8 m auseinander und sprangen 1,5 m aus den Längsstreifen vor. Der Abstand der Pfostenreihen zum Mittelstreifen beträgt 3 m. Die Streifen verlaufen in einem Abstand von 6 m untereinander, die Mittelpunkte der Streifen liegen bei etwa 6,5 m.

Die zweite Halle war etwas unregelmäßiger gebaut, die Querstreifen sind hier etwas kürzer als bei der ersten. 0,5 m vom Mittelstreifen entfernt befindet sich ein 7 m

langer paralleler Streifen, der die Querstreifen verbindet. Alle Streifen sind hier 0,2 m tief. Im Südende des zweiten langen Mittelstreifens befinden sich zwei 0,15-0,4 m auseinanderliegende 0,07 m tiefe Eintiefungen mit einem Durchmesser von jeweils etwa 0,4 m.

Der fünfte Streifen ist sehr unregelmäßig. Hier befinden sich kleine, regellos verteilte Pfostenlöcher nahe dem Mittelstreifen. Der Rest der Streifen befindet sich nach den Suchschnitten in einem regelmäßigen Abstand von 6,5 m voneinander.

Die Anlage von Haltern-Hofestatt kann mit ziemlich großer Sicherheit keine Uferverteidigung besessen haben. Velsen 1 ist ein überzeugendes, wenn auch seltenes Beispiel eines Lagers mit einer offenen Hafenfront, das etwas später (16-28 n. Chr.) als die Befestigung auf der Hofestatt datiert wird. Fest steht jedenfalls, daß die mediterranen Schiffshallen direkt am Ufer lagen. Bei den Schiffshäusern von Haltern-Hofestatt - auch bei denen von Velsen 1 - besteht eine völlig andere Situation. Hier gibt es keinen schwer zu bearbeitenden Felsboden oder eine die Bootshallen umgebende städtische Bebauung. Die Hellingen konnten deshalb auf die bestmögliche Weise gebaut werden. Sie unterscheiden sich auch durch ihre Lage an einem ziemlich flachen Flußufer von den mediterranen Vorbildern. Ein steiles Gefälle wäre in diesen Fällen bautechnisch kaum realisierbar. Um die Schiffe auf den Hellingen trocken zu lagern, sie vor Hochwasser nach starken Regenfällen oder Tauwetter zu schützen, zog man die Schiffe weit auf das Ufer. Der Abstand zwischen dem Lippe-Ufer und den Schiffshäusern auf der Hofestatt betrug 30-32 m, In Velsen 1 betrug der Abstand zwischen dem südlichen Bootshaus und der Uferbefestigung 32 m. Bei Novae an der Donau (Bulgarien) wurden ebenfalls lange, römische Schlepphellingen gefunden. Eine davon bestand aus V-förmig aufgestellten hölzernen Querbalken, die am Ufer 3 m und am anderen Ende 1 m lang waren. Die Länge der Hellingen betrug hier sogar 80 m! Die zweite Helling, ebenfalls V-förmig, war in Stein gebaut und besaß die gleichen Breitenmaße wie die hölzerne, war jedoch nur 40 m lang.

Vermutlich bestand das Aufgehende aus Pfosten mit einer darüber errichteten Dachkonstruktion. Der am besten erhaltenen Pfostenreihe (Planquadrat B-3 bis A/B-16) zufolge belief sich der Abstand der Pfostenlöcher in der Längsrichtung durchschnittlich 3,67 m. Dieser mittlere Abstand gilt für die ganze Reihe. Individuell besitzt dieser Wert besondere Gültigkeit für die Abstände zwischen dem zweiten und neunten Pfostenloch von Norden (also Planquadrat B-4 und A/B-14). Der Abstand zwischen den beiden nördlichsten Pfostenlöchern liegt etwas unter dem Durchschnittswert, der zwischen den beiden südlichsten darüber. In der Breite kann der durchschnittliche Abstand zwischen dem Mittelpunkt der westlichsten Pfostenlochreihe und der (von Westen aus gesehen) fünften Pfostenreihe ermittelt werden.

In der Breite stimmt der Abstand zwischen den Pfostenlochreihen, durchschnittlich 6,47 m, gut mit den mediterranen Vorbildern überein, insbesondere Piraeus-Munichia, Appollonia, Piraeus-Zea, Aegina und der Holzbauphase von Karthago *(Siehe Tabelle)*. Auch in der Länge kommt der durchschnittliche Abstand von 3,67 m im großen und ganzen anderen Beispielen nahe: Thurii und Piraeus-Zea. Diese sind für die Bestimmungen der lichten Breite weniger interessant und können darum stärker variieren.

In der Mitte zwischen beiden Pfostenlochreihen lagen Längsgräben, von denen kurze Quergräbchen ausgingen. Die größte Länge der ersten Helling betrug 24,80 m. Diese ist zu gleich die am besten ergrabene. Im zweiten Schiffshaus ist der Graben

20,85 m lang, und ist sowohl am Süd- als auch am Nordende (Grabungsgrenze) etwas kürzer als der erste Graben. Im fünften Schiffshaus wurde der Graben nicht vollständig freigelegt, springt jedoch nach Süden etwas weiter vor als beim ersten Graben.

In mindestens zwei Schiffsbäusern, dem zweiten und dem fünften, wurden die Längsgräben von kürzeren Parallelgräben begleitet, möglicherweise auch der vierte (Befund in Planquadrat J-9). Der Parallelgraben in Schiffshaus 7 scheint, bei einer konsequent ausgeführten Rekonstruktion, zum zentralen Graben selbst zu gehören. Die Abstände zwischen den Mittelachsen der Gräben stimmen mit denen der Pfostenlochreihen überein.

Die Länge der kurzen Quergräben variiert ein wenig. Im ersten Schiffshaus sind sie am längsten, durchschnittlich 3,35 m, hier weisen sie außerdem eine sehr regelmäßige Form auf. Im zweiten Schiffshaus sind sie kürzer und unterschiedlich - zwischen 2,05 m und 3,85 m - lang. Außerdem fehlt der eigentlich zu erwartende nördlichste Quergraben. Auch im fünften Schiffshaus variiert die Länge der Quergräben beträchtlich, zwischen 2,65 m und 3,75 m. Im ersten Schiffshaus ist der Abstand der Ouergräben weitgehend regelmäßig, durchschnittlich 2,32 m. Im zweiten Schiffshaus erweckt deren Anordnung einen bedeutend unregelmäßigeren Eindruck.Dies wird durch einen vermutlich später eingefügten Querbalken (Planquadrat E/F-10) verursacht. Der durchschnittliche Abstand zwischen den übrigen Quergräben beträgt 2,06 m. Im fünften Schiffshaus wurden mehrere jüngere Veränderungen festgestellt, doch auch hier beträgt der durchschnittliche Abstand zwischen den Quergräben 2,05 m, was mit denen im zweiten Schiffshaus übereinstimmt. Sowohl die Längs- als auch die Quergräben enthielten wahrscheinlich hölzerne Schwellbalken. Mindestens einmal, und zwar am Südende des Grabens des zweiten Schiffshauses, wurden zusätzliche Pfostenlöcher entdeckt. Vermutlich dienten diese als Verankerung für einen Schwellbalken.

Man kann davon ausgehen, daß in den zentralen Gräben von der Hofestatt lange Balken lagen, die als *Schienen* dienten, auf denen die Schiffe gezogen wurden. In den Quergräben lagen kurze Balken, auf die die Stützkeile geschoben werden konnten, mit denen das Schiff im Gleichgewicht gehalten wurde, oder auf denen die Pfosten standen, die z. B. unter die *Galerie* geklemmt wurden. Ohne die *Querbalken* würden sie im weichen Untergrund einsinken. Das ist möglicherweise eine Erklärung für die "regellos" angelegten Pfostenlöcher neben dem Längsgraben des fünften Schiffshauses. Die kürzeren, parallelen Längsgräben in den Schiffshäusern 2, 5 und vermutlich auch 4 können später angebrachte, zusätzliche Verstärkungen enthalten haben.

Kurze *Querbalken* sind auch im Mittelmeerraum nicht ungebräuchlich. So gibt es Gräben für Querbalken in der zweiten Phase der Hellingen von Rhodos. Auch in Thurii gab es Gräben für Querbalken. Das beste Beispiel liefert jedoch die Steinbauphase von Karthago, wo mit Sicherheit in einer der Hellingen hölzerne Querbalken ruhten.

Ein zusätzliches Problem bei der Erörterung der Anlagen von der Hofestatt ist das Fehlen von Höhenmessungen. Der eventuelle Neigungswinkel der Schlepphellingen innerhalb der Schiffshäuser läßt sich deshalb nicht mehr ermitteln. Andererseits steht fest, daß der zentrale Graben im ersten Schiffshaus etwas tiefer war als die Quergräben, um wieviel läßt sich jedoch nicht sagen.

Es ist denkbar, daß die Querhölzer zum Zentralgraben hin V-förmig gelegt waren.

Das würde die kürzeren Quergräben im zweiten Schiffshaus erklären, bei dem der Längsgraben nur 0,2 m tief ist. Die Spitzgräbchen würden also langsam an die Oberfläche steigen. Beim Aufdecken der Fläche könnten die seitlichen Enden der Quergräben abgegraben worden sein, wodurch sie im Planum kürzer erscheinen, als sie wohl ursprünglich waren. Das gleiche könnte auch beim fünften Schiffshaus vorliegen. Wenn man unterstellt, daß der zentrale Graben des zweiten Schiffshauses ebenfalls nach Norden anstieg, dann würde er ebenfalls kürzer erscheinen als beim ersten Schiffshaus.

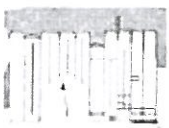
Die *lichte Breite* der Schiffshäuser in Haltern läßt sich nicht mehr mit Sicherheit bestimmen. Bei einem Abstand der Mittelpunkte der Pfostenlöcher von durchschnittlich 6,48 m und einem möglichen Umfang der Pfosten von 0,2-0,5 m ergibt sich eine lichte Breite von 5,98-6,28 m, entsprechend 20 *römischen Fuß* oder etwas mehr, Dies stimmt mit vielen anderen Beispielen, darunter Ve 1 s en 1 *(Siehe Tabelle),* überein. Die Länge von 28,63 m (ohne) oder 33,04 m (einschließlich des südlichsten Pfostenlochs) entspricht den Maßen der Schiffshäuser von Sitea oder Dor.

Die Schiffshäuser der Hofestatt liegen in der Nähe der westlichen und nördlichen Umwehrung. Besonders an der Ostflanke zum unbebauten Innenraum des Kastells kann der Zaun um die Schiffshäuser durchaus bis ans Ufer gereicht haben. Möglicherweise befand sich hier, unweit vom Ufer, ein Durchgang zum Ostteil des Kastells (so wie angegeben). Die Befundlage ist jedoch nicht eindeutig. Offenbar hielt man diese Abgrenzung für unzureichend, weshalb der Durchlaß zwischen dem nördlichen Zaun an der Rückseite der Schiffshäuser und der Verteidigungsmauer mit Hilfe einer kurzen Zwischenmauer blockiert wurde *(Planquadrat U-1).* Auf diese Weise wurde der Komplex vom übrigen Kastell abgetrennt. Die Schiffshäuser erhielten einen eigenen Eingang durch eine Toranlage in der westlichen Holz-Erde-Mauer. Dieser kann erst zu einem späteren Zeitpunkt gebaut worden sein, gleichzeitig (?) mit der Abtrennung zwischen Zaun und Nordmauer. Die Pfostenlöcher der Toranlage scheinen nämlich zwischen denen der Holz-Erde-Mauer zu stehen, wobei beim Abtragen der Erdaufschüttung Störungen entstanden sein können. Eine solchermaßen völlige Abgrenzung der Schiffshallen vom Rest der Siedlung ist, wie oben erwähnt, im Mittelmeergebiet gebräuchlich.

Auch die Hofestatt scheint keine Zutrittsmöglichkeiten zu den Schiffshäusern erhielten. Man scheint ausdrücklich dafür gesorgt zu haben, daß Unbefugte - in diesem Fall doch wohl Soldaten selbst - keine Zutrittsmöglichkeiten zu den Schiffshäusern erhielten.

Allgemeiner Aufbau antiker Schiffshäuser

Die griechisch/hellenistischen Schiffshäuser im Mittelmeergebiet und die römischen von der Hofestatt und Velsen 1 weisen einige deutliche Übereinstimmungen auf. Sie *liegen immer innerhalb* von Befestigungsanlagen. Manchmal sind sie darüberhinaus durch zusätzliche Abgrenzungen umgeben (wie Thurii, Piraeus-Zea, Haltern-Hofestatt).



Auf felsigem Grund standen die Schiffshäuser über steilwandigen Gräben (Sitea, Neda, Sounion, Appolonia und Dor); an flachen Uferlinien waren es offene, hallenähnliche Gebäude mit Stützpfeilern

oder Pfosten. Auch für die Hofestatt und Velsen 1 kann man vermuten, daß sich zwischen den Pfeilern der Hallenkonstruktion keine Wände befanden, sondern höchstens ein winddurchlässiges Plankengitter. Von einer einzigen unsicheren Ausnahme abgesehen (Sounion Nord, *siehe Tabelle, auch für die folgenden Vergleiche*), variiert die offene Breite der Schiffshäuser zwischen 4,3 m und 7,2 m.

84,5% aller Hellingen sind zwischen 5,4 m und 6,3 m breit, davon entfallen 63% auf eine Breite von 5,6 m und 6,1 m. Die lichte Breite von 6 m der Schiffshellingen von der Hofestatt fügt sich ausgezeichnet in dieses Bild ein.

Die Länge der Hellingen variiert wesentlich stärken Die Angaben müssen jedoch mit einiger Vorsicht betrachtet werden. Gerade das zum Ufer gerichtete Ende ist im mediterranen Gebiet häufig gestört oder unzugänglich. Daher gibt es häufig keine oder nur geschätzte Angaben. Aus den bekannten Befunden lassen sich drei Gruppen von Schiffshäusern bilden:

1. Hellingen mit einer Länge von gut 20 m (Sounion-Süd, Thurii und Velsen 1),
2. Hellingen mit einer Länge von etwa 30 m (Sitea und Dor),
3. Hellingen von 40 m (0eniadae, Appollonia und Piraeus-Zea) oder länger (die meisten Hellingen der Steinbauphase von Karthago).

Dabei muß bemerkt werden, daß die meisten kürzeren Hellingen im mediterranen Bereich in Steilufer eingearbeitet sind. Längere Hellingen hätten mehr Arbeitsaufwand erfordert.

Auf die kurzen Hellingen der ersten Gruppe konnten einzelne kleine Schiffe wie z. B. *Biremes* oder *Liburnae,* auf die der zweiten Gruppe einzelne kleine Schiffe oder eine *Trireme* gezogen werden. Auf den Hellingen der dritten Gruppe konnten eine *Trireme* oder zwei kleine Schiffe hintereinander untergebracht werden. Der offene Bau der meisten Schiffshäuser garantierte einen ausreichenden Arbeitsraum und ermöglichte das Trocknen der Schiffe. Der Steinbau im Mittelmeergebiet verringerte die Brandgefahr. In Haltern und Velsen 1 wurden die Schiffshäuser in Holzbauweise ausgeführt.

Bei einer ausreichenden Befundlage läßt sich erkennen, daß alle Schiffshellingen und Fundamente zum Ufer hin abfallen. Wenn auf der Hofestatt erneute Untersuchungen möglich wären, dann wäre das Gefälle der zentralen Längsgräben zum Lippeufer hin ein Beweis dafür, daß die Interpretation der Befunde als Schiffshäuser richtig ist. Denn auch in Velsen 1 fällt die Unterkante der Pfosten der Schiffshäuser ein wenig zum Ufer ab, vor allem bei dem *am* dichtesten unter dem Ufer gelegenen Schiffshaus. Hier ist das Gefälle mit 1:30 steiler als in Thurii. Beim anderen Schiffshaus, das viel weiter vom Ufer entfernt liegt, ist das Gefälle mit 1: 150 deutlich geringer *(siehe Tabelle).*

Durch die starke Erosion ist die Schiffshelling innerhalb der Schiffshäuser von Velsen 1, die sich vermutlich auf dem damaligen Laufhorizont befand, völlig verschwunden. Eine Konstruktion wie auf der Hofestatt mit Längsbalken und kurzen Querbalken darf man auch für Velsen 1 unterstellen. Eventuell vorhandene Schlepphellingen, die zu den Schiffshäusern von Velsen 1 und Haltern führten, sind erodiert.

Frühkaiserzeitliche Uferkastelle in Nordwest-Europa

Hofestatt und Velsen 1 sind deutliche Abbilder militärisch genutzter Häfen in der frühen, expansiven Phase im Nordwesten des Römischen Imperiums.

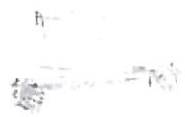
Die Anlagen auf der Hofestatt und Velsen 1 bilden also keine besonderen Lager, sondern es handelt sich um Befestigungen mit starken Übereinstimmungen sowie einer besonderen Funktion, die zu einer spezifischen, äußerst praktischen Gestaltung geführt hat.

Lager vom Typ Velsen 1 scheinen sich nach dem heutigen Stand der Forschung geographisch auf Nordwesteuropa und chronologisch auf die *augusteisch-tiberische Periode zu* beschränken. Weitere Grabungen werden nötig sein, um die Kenntnis der Strukturjüngerer Marinestützpunkte an Rhein und Donau, die von der *Classis* auch nach der Festlegung des Rheinlimes 47 n. Chr. unterhalten wurden, zu vertiefen.

"

Die Schiffshäuser an der Via dell'Arsenale, welche immer nach einer Textstelle von Thukydides mit dem Kleinen Hafen in Verbindung gebracht wurden, kämen nach dieser topographischen Rekonstruktion an das nördliche Ufer des großen Hafens zu liegen. Hierfür spräche auch deren südwestlich-nordöstliche Ausrichtung, welche nur noch in den Gräben der Trennwände erkennbar ist (Innenraumabstand ca. 5.50 m). Es sind parallele rechteckige Einarbeitungen im Fels, größtenteils ausgeraubt; nur noch wenige Quaderblöcke in situ.

Syracusa

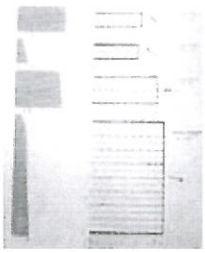


Being a military port, the port of Thasos ought to possess ship sheds for the safekeeping of its long ships. Their remains were located in the area between the points A-B-C in the NE part of the port. Part of the foundations was revealed made of schist slabs, on a double row in the part a-b, 40m long, and 1.10 wide, and on a single row in the part g-d, 14m long. The foundations form a Π shaped room, 44m long and 19m wide, which could shelter three triremes (length of trireme 36m and width 6m). Part of the foundation of a similar room is preserved next to it extending to the south. According to the preserved remains the excavators suggested a reconstruction of three groups of ship sheds on the three sides of the port basin, with a capacity of 50 triremes (this is an estimate based on information from ancient sources), with colonnades supporting the roof and separating the hauling gradients. Lasting the research part of wall foundations was revealed, 9m long, which is estimated to belong to a certain building of the early phase of the ship sheds, contemporary with the construction of the wall of the late 6^{th} – early 5^{th} c BC, which was later abandoned when the orientation of the ship sheds changed for the better arrangement of the space available.

Thasos




Remains from Velsen shipsheds were till recently only known from the Mediterranean and restricted to the Greek and Hellenistic periods. These shipsheds were carefully build constructions, consisting of sloping slipways, separated by stone pillars or columns and covered by stone vaults or a wooden roof with tiles. Although no Roman shipsheds are known in the Mediterranean, they must have existed there, as is shown by Roman-period depictions on coins (fig.15), frescoes (fig.16) and mosaics (fig.17). Click here for more information about shipsheds in the mediterranean.



Since the middle of the 1980s, shipsheds have been known from Haltern-Hofestatt and from Velsen 1, they constitute the only remains of roman shipsheds so far known. The most extensive is that of Haltern, with dimensions of 56 x 32 m, and consisting of eight slipways (fig.18, below). These slipways, approximately 6 m wide, could contain galleys over 30 m long.
In *Period 1b*, the first shipshed was built in the western part of the fort, at a short distance from the shore (see fig.18, above). The dimensions, 6.1 x 22.1 m, point towards a small galley. It lay so close to the river, that the above-mentioned scouring overwhelmed, or washed away, part of it.
In *Period 1c*, the shipshed was moved some 30 m southwards. Shape and dimensions, 6.4 x 20.5 m, where very similar to the first shipshed (fig.18, second from above).
In *Period 2b*, a completely new shipshed was built (fig.18, third from above), this time double and with dimensions of 29.7 x 12.2 m.

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Harbour informations about: Shipyard

There are no surviving harbour structures or installations from the Roman period. A little way from the waterfront at the Bonded Stores site (below the present, Victorian market buildings) slag and a smelting furnace were excavated, where ship repairs may have been carried out. Guernsey

- Klassischer Hafen (chantier navale 4.Jh.v.Chr.) Marseille

Im Bereich der Grabung La Bourse sind die griechischen Hafenanlagen durch die späteren römischen überbauungen stark in Mitleidenschaft gezogen worden. Bei den Befunden an der Place Jules Verne und Villeneuve-Bargemon handelt es sich um Werftanlagen, über eine Länge von ca. 150 m des Strandes. Die Uferausrichtung hat sich in diesem Bereich leicht in westöstlicher Ausrichtung geändert. Sie lässt sich aber bis zum 1.Jh.n.Chr. wegen der römischen Baggerarbeiten schwer rekonstruieren. Oberhalb des Strandes sind kleinere, mit dem Meer verbundene Wasserbecken angebracht. Die Anhäufung der Schiffsbauteile sowie Seilzeuges lassen auf ihre Funktion Rückschüsse zu: sie dienten zur Formung der Hölzer.□ Die aus Stein gearbeiteten Hellinge verlaufen in nordöstlicher Richtung, ca. 5.50 - 6.00 m breit, auf der Länge von ca. 40 m und gehören zu Schiffshäusern (Place Villeneuve-Bargemon)

- hellenistischer Hafen (3.-2.Jh.v.Chr.) (Keyword shipyard)

Ausbau der west-östlich verlaufenden Ausrichtung des Ufers. Bekannt durch die Grabungen im Bereich des Hotel de Ville und Place Jules Verne. Slipanlage. Parallel zum Ufer verlegte und ins Erdreich verankerte Rundhölzer dienten um die Schiffe an Land zu ziehen, wie dies heute noch in den Anrainerstaaten des Mittelmeeres üblich ist. Erhalten sind desweiteren Stützenreste mit Pfahlschuhen zum Abstützen der Schiffe, sowie häufig Kleinhölzer mit Seilspuren.

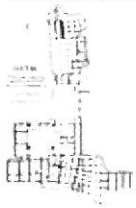
- römischer Hafen:
Die Befunde der Grabung La Bourse deuten auf eine Auflassung der Slipanlage hin. Aus der Grabung Place Jules Verne sind aus römischer Zeit Dämme, hölzerne Kaianlagen und Holzstege bekannt. Die hölzerne Kaianlage besteht aus zwei Pfostenreihen dazwischen, liegende Bohlen eingezogen; in Abständen drei Strebepfeiler gegen den Druck (vgl. London, Xanten). Muschelreste an den Hölzern wie auch an den Steinen der Stein-Kaimauer lassen □ Rückschlüsse auf die Meereshöhe zu sowie auf die Hafenbeckentiefe.

Miseno-Puteoli

Die Berghänge um den Averner See tragen reichen Baumbestand, so war eine wichtige Materialvoraussetzung für den Bau neuer Schiffe erfüllt. Reste der Werft und eines Trockendocks sind heute noch sichtbar.

Ostia-Fluviale

Accanto al cd. palazzo imperiale nella parte occidentale della città, vicino alla sponde fluviale, una serie di ambienti stretti e profondi coperti a volta erano stati interpretati quali banchine repubblicane.



Un'inscrizione del secondo secolo ricordava il restauro di un "navale a L. Coilo aedificatum"
Sembrò quindi normale associare questi ambienti con l'iscrizione: la forma arcaica del nome, infatti, suggeriva una datazione all'età repubblicana.
Secondo alcuni resoconti sembrava che questi ambienti voltati raggiungessero il fiume, e che potessero essere utilizzati per ricoverare le navi (Carcopino 1911; Paschetto 1912: 346).
Nel 1952 grazie ad un abbassamento del livello del fiume, che normalmente ricopriva le rovine, fu possibile un esame più approfondito. È stato così escluso il loro utilizzo come ricoveri per le navi (Meigss 1973: 126).

Wolin

On ground of main harbour, in excavation trench No 8, in layer from IX-X age one met on wooden pegs from cut off, during disassembly of thatch of boat, heads and endings (fig.7). In excavation trench No 4, in layer from IX age, one discovered base and bottom part of the winch to haul the vessels ashore and fragments three bound with pegs of planks from part near the steam, and also part of plank and benches (fig.8)(Filipowiak 1994). Elements of ships, former were used secondarily to builds of houses or the streets pavement strewing. Part originated from taken clothes off wrecks, but certain quantity most likely also from replaced party of thatch the ships □ overhauls (Filipowiak 1996).

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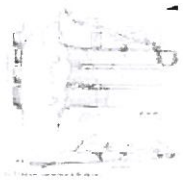
Harbour informations about: Slipway

The rock-cut slipways found at Dor make quite a unique marine installation. They were quarried into the northern part of the *kurkar* bedrock, in an area which have been leveled previously to a height of 2.5-3 m above the sea level. Three hollows are sloping towards the sea into the North Bay. The partition walls are at present, worn away close to the sea. The lower part of the slips, at the water line, are partly covered by more recent *beachrock* . Only the southeastern part of the original complex has been fully preserved . The original length of the cut rectangles was probably 30 m. The width of each slip varies from the east to the west: the eastern slip (*nr. 1*) is 3.8 m, the middle (*nr. 2*) is 4.1 m, and the western (*nr. 3*) is 4.5 m. The partition walls are between 0.6 to 0.8 m high and 1.5 m wide. There are small rounded holes on top of the walls, at intervals of 1.8 to 2.4 m, probably for the insertion of wooden poles supporting some kind of roof.



Dor

The overall plan of the structure seems to be fitted to the description given by Vitruvius (V.xii.7), on the construction of shipyards:

"*Subsequently the shipyards are to be built facing the north... And for their size, no definite limits need to be set, but they must be built to suit the largest type of ship, so that if even larger ships are hauled up, they may find plenty of room there.*"

Along the eastern face of the eastern slip (*nr. 1*) is a bench of 13 m long and 0.80 m wide. Further to the north, adjacent to the eastern edge of slip (*nr. 1*), there is a rock-cut pool: 2.4 m wide, 4.1 m long and 2.7 m deep. To the north-west side of the complex, next to the slip *nr. 3*, there were two larger pools, now too badly eroded and difficult to get their exact original size and shape. These pools were most probably used for soaking the wooden timbers and frames, thus they could be bent to the desired curvature without breaking. The south part of the eastern slip (*nr. 1*) was blocked by a cross wall running east-west. Behind this wall was built a room measuring 4 x 4 m, partly cut into the rock and partly built of kurkar blocks. It is possible that in this space was found a capstan or a similar pulling device to hauled the ship cradles up on the slope.

Questo edificio presenta a nord uno scivolo per l'alaggio delle imbarcazioni.

Ostia-Claudio

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Harbour informations about: Warehouse

During the Crusades, the participants who helped on capturing Akko, received parts of the city where they set their own quarters, street or piazza with its own courthouse, parish church, as well as warehouses (Genovese, Pisan, Venetian, Templar, Hospitallier, etc.). Each quarter was administrated by its own representative and their head exercised like a consular power. The customs taken by the city of Akko on the trade that passed through formed the principal revenue of the city. Akko

A massive wall found on the sea floor connected the breakwater with a round tower at the southern corner of Khan el-Umdan, interpretable as a warehouse. Akko

Von der Landseite des Hafens ist kaum etwas bekannt. In der Nähe der westlichen Mole sind hier wenige Reste möglicher Speicherbauten zu nennen. Die gewölbten Kammern (vermutlich Magazine, im Volksmund "le grotte") besaßen sicherlich wie auf Münzbildern überliefert seeseits eine Portikenfront (s. auch. Centumcellae, Aquileia, Terracina, Leptis Magna). Anzio

Hinter dem in zwei Ebenen angelegten Kai erstreckte sich parallel zu diesem ein langstrecktes Magazingebäude mit vorgelagerter Portikusfront (s.auch Centumcellae, Anzio, Leptis Magna). Der längliche Plan wird zweimal durch zwei Rampen unterbrochen, welche die tiefergelegene Kaiebene mit der Stadt verband. Das Gebäude wird anhand seiner Bautechnik in die claudische Zeit datiert (1.Jh. n.Chr.). Die Lagerräume öffneten sich zum Hafen. Die Front wird unterschiedlich rekonstruiert. Aquileia

The South Island was artificially connected to the fort promontory by a rampart or a bridge. Its face was quarried and leveled in order to get a large rectangular building of which only the S-E corner survived which is supposed to be a warehouse. Its base was quarried into the rock. In the southern part of the structure survived two or three ashlars header courses. Atlit

Josephus describes the inner harbor as "having deep anchorages in its innermost recesses for ships and goods". Caesarea

In the excavations carried out by A. Negev in 1962, a large arched vault was exposed, cleared and identified as a warehouse, belonging to the Inner Basin. The excavations carried out in 1976 revealed that the eastern quay of the inner basin runs for about 250 m, on the SSW-NNE axis. Major excavations carried out in the Inner Basin between 1991 and 1996, revealed its most part, but constant excavations still go no. Excavations made on three sides of the original quay made possible to identify the extent of the basin within the limits of the inner harbor. To the south, the course of the quay is very similar to that of the Crusader fortification, and it runs for about 150 m from the present diving club to the southeast (near the South Gate of the Crusader City).

Civitavecchia

Teilweise sind die den Kaianlagen parallel verlaufenden Magazinbauten im Kern der renaissancezeitlichen Umbauten erhalten Geringe Retikulatmauerwerke der Magazine

Guernsey

Although no structures of the ancient port have been found, there is indirect evidence of a landing station. There are, for example, the 'warehouses' at the La Plaiderie site, which consist of two large stone-buildings. Finds from the site confirm that wine, oil, garum (a fish sauce) and other Mediterranean produce were shipped here and then most likely stored in these buildings. The illustration shows an artist's impression of a harbour scene, unloading a cargo of amphorae. No tangible evidence for a pharos or light house survives but there must have been some form of navigation beacon to guide ships to the landing place.

Kenchreai

West of the southern breakwater there is architectural evidence of Roman buildings that probably formed part of the ancient warehouses.

Southeastern of the remains of the warehouses there is a series of six large, rectangular basins, that were linked to each other and to the sea with channels. According to the excavators, these constructions formed part of a fish tanks system.

Leptis-Magna

Die besterhaltene Ladenzeile ist auf der Ostseite zu sehen. Sie ist von einer Kolonnade begrenzt und weist 20 parallele Räume verscheidener Größe auf, welche sich zum Hafen hin öffnen (zu den Magazinen vgl. Ostia, Aquileia).

Miseno-Puteoli

Die Strukturen der bisher bekannten Bauten in nächster Nähe der ehemaligen Küstenlinie liegen heute ca. in 2.50 bis 5.00 m Tiefe und gehören vermutlich zu Speicherbauten (horrea).

Ostia-Claudio

Proseguendo lungo via A. Guidoni verso l'imbocco dell'autostrada Roma-Fiumicino, sulla destra, si incontra l'area archeologica di Monte Giulio, da cui si gode una bella visuale su buona parte dell'area più interna del bacino del porto di Claudio e dove sono state messe alla luce altre strutture che si affacciavano sul bacino: una cisterna, delle terme e alcuni magazzini. Tali edifici, le cui fondazioni sarebbero in fase con la costruzione del molo destro, sono databili al tardo II secolo con riprese più tarde.

Ostia-Fluviale

Sarebbe stato impossibile inviare a Roma in una sola volta tutti i carichi che arrivavano nel porto. La sola soluzione pratica era quella di immagazzinare il grano e inviarlo poco per volta nella capitale con delle imbarcazioni fluviali.
Quattro grandi horrea possono essere identificati quali magazzini per il grano a Ostia e l'emblema del modius sull'ingresso di un'altra costruzione che però è stata largamente distrutta dal fiume può costituire l'indicazione per un quinto granaio.

I cd. Horrea di Hortensius, a sud del Decumano di fronte a teatro, sono uno di questi granai. Gli altri si trovano vicino al fiume. Tre di essi presentano la stessa planimetria. Le stanze di immagazzinamento si aprono sui quattro lati di un colonnato o di un portico che circonda un ampio spazio aperto. La capacità di immagazzinamento è aumentata dall'aggiunta di un secondo piano che ripete la pianta del piano terra.
Gli Horrea Antonini (della fine del II secolo) si rifanno alla pianta dei magazzini traianei nel porto di Traiano: gli ambienti d'immagazzinamento si affrontano in una serie di blocchi, e l'area aperta tra i blocchi è ristretta.
Due dei magazzini per il grano vennero costruiti poco dopo il completamento del nuovo porto; i Grandi Horrea vennero ricostruiti nel tardo II secolo per raddoppiare la loro capacità e un quarto venne probabilmente aggiunto sotto Commodo.
Non tutti gli horrea di Ostia erano utilizzati per il grano, ma magazzini temporanei dovevano anche essere previsti per l'olio e il vino e per altre merci.

Ostia-Traiano

I magazzini traianei vennero progettati e iniziati con il nuovo porto, ma completati nell'arco di ottant'anni.
Il terreno poco coerente su cui vennero costruiti fu

consolidato da una fitta trama di cassoni in muratura, colmati con le terre dello scavo del bacino esagonale.
I magazzini furono costruiti a blocchi. Una serie di corridoi e cortili interni facilitavano la distribuzione, mentre un sistema di rampe permetteva il trasporto dei carichi ai piani superiori.

I vani di stoccaggio misurano 14 x 6 metri ed hanno una copertura a botte. A seguito di un innalzamento della falda nel II secolo si dovettero rialzare i pavimenti con "suspensurae" in muratura.


Ostia-Traiano

Il sistema di magazzini doveva fiancheggiare il bacino esagonale anche a sud e a est.

Nel settore nord-orientale del porto di Traiano, si trovano i magazzini cd. severiani che vennero in realtà costruiti in età adraineo-antonina (dal 114 a tutto il II secolo).

Ostia-Traiano

L'edificio, dalla inconsueta planimetria a L, fronteggiava il canale principale d'ingresso al bacino traianeo con il lato lungo mentre con il lato corto parte di un lato del bacino stesso.

Il magazzino era organizzato in modo che lo scarico, lo smistamento, lo stoccaggio e il carico delle mercanzie avvenissero contemporaneamente in ogni settore senza intralci, grazie alla distribuzione dei sistemi di rampe.
L'accesso ai vani sui vari livelli avveniva da un corridoio distributivo illuminato da finestre che garantivano anche la visibilità negli interni, aperti solo con feritoie per l'aerazione.



A differenza dei magazzini traianei qui manca la fondazione a cassoni e al posto delle volte a botte si trovano quasi esclusivamente coperture a crociera, o comunque composite. Le parti adibite a magazzino non hanno "suspensurae", perché per isolare dall'umidità si è preferito sfruttare gli interi pianterreni.
Le mura di IV-V secolo sfruttarono questo edificio sovrapponendosi a parte del lato lungo e riducendone gli spazi al pianoterra.

In the area of Emporion it is believed that there were five porticoes (Panagos Ch.Th., 1968, p. 224) that were used for mercantile exchange as well as for storage. Their position their form and their number has been a question among the researchers of Piraeus, while the latest excavation results form a more consistent image of their layout (Steinhauer, G.A., 2000,p.83-84). Among them was the famous "Makra Stoa"

Piraeus

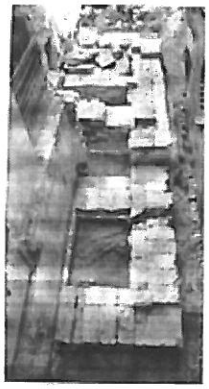
that was built during Periklis' time and served as the grain market, the "Deigma", the business center that was used for the exhibition of sample of the imported merchandise as well as the place that housed all the banks. The position of "Makra Stoa" is now believed to be at the northern end of "Emporion" (at the corner of Posidonos Coast and Gounary street) while that of "Deigma" is placed in the center of "Emporion" according to an inscription found in site (Judeich, 1931, p.448).

The discovery of parts of the foundations from three of the porticoes of "Emporion" (Notara st, Philonos st, Miaouli Coast and Bouboulinas st) allow in some degree the reconstitution of the ancient coastline (fig.9), according to which (Steinhauer, G.A., 1995,p.313) the layout of the porticoes does not follow the Hippodamian web of the ancient city that enclosures the harbour – as it was suggested by the maps of Kaupert-Milchhöfer (1889), Judeich (1930), Trauvlos (1969) and Hoepfner – Schwander (1986, 1994). The inclined axis of the of the three verified porticoes prove that the best reconstitution of the ancient coastline is given by the Venetian map of 1687 (Sofou, H., 1973, p246-258, fig.112-113).

Piraeus

During the time that passed in between the expeditions and during the winter months, the triremes' equipment was stored separately - the wooden parts (oars, masts, etc) in the ship sheds and the hanging parts (sails, ropes, cables etc) in special wooden buildings (arsenals, "skeuothekai") the existence of which is mentioned since the establishment of the dockyards (early 5th century B.C.).

In 347/346 Euvoulos introduced the idea for the revival of the Athenians' naval power and the construction of a new arsenal that was designed by the architect Philo and was completed at the time of Lycurgus (Steinhauer, G.A., 2000,p.64).



The discovery and partial excavation of the Arsenal of Philo took place during 1988-1989 (fig 12.1). However the fame of this important building preceded its discovery due to the praising comments about the arsenal by Demostenes, Ploutarch, Strabo, Pliny, Val.Maximus and Vitruvius (Steinhauer, G.A., 1996, p.71) as well as due to the discovery, onew hundred years earlier (1888), of a marble inscription (IG II²1668) with the detailed description of the construction and use of the building, written by Philo. The inscription was 98 lines long and allowed a detailed graphic representation of the building making it one of the better known buildings, construction wise. (Fig 12.)

The Arsenal was built between the Hippodameian Agora and the ship sheds, NE of the deepest recess of the gulf of Zea with its axis running from SW to NE (Fig.11), a direction that allows the proper ventilation of its internal space and is one of the important elements for the design of the building according to Philo. The building was 18m wide and 130m long with entrances on both its narrow sides and two colonnades of piers that divided its inner space into three aisles. The central aisle extended in the whole length and height of the building, while the side aisles were separated in 34 compartments each, they had lofts with wooden shelves that served as storage space.

Roma

Nel Campo Marzio nord-occidentale, tra ponte Elio e Ripetta, era la località detta "ad Ciconias nixas", dove avveniva lo sbarco del vino che veniva trasferito nei portici (forse criptoportici) del tempio del Sole di Aureliano. Rougé suppone che siano da cercare in questa zona il Portus Vinarius e il Forum Vinarium.

Qui erano anche dislocate le officine dei marmorari, testimoniate dal rinvenimento di marmi grezzi o in corso di lavorazione e i porti collegati alla produzione di laterizi, quali il Portus Corneli, il Portus Licini, il Portus Parrae e il Portus Neap (olitanus).

Roma

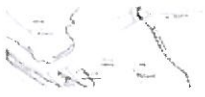
I lavori per la costruzione del Palazzo dell'Anagrafe negli anni 1936-1937, rivelarono un quartiere di magazzini di età traianea, costruiti interamente in laterizio e travertino. Resti simili sono stati scoperti sull'altro lato della strada (e sono ancora visibili nei cortili degli edifici moderni). Tutto questo complesso potrebbe identificarsi con un rifacimento imperiale degli (Horrea) Aemiliana, magazzino annonario costruito probabilmente da Scipione Emiliano nel 142 a.C., e che dovette servire soprattutto come deposito del grano destinato alle distribuzioni gratuite alla plebe romana.
Qui doveva trovarsi la Cella Lucceiana (seconda metà del II sec. d.C.) nota attraverso un'epigrafe.

Roma

Qui dovevano trovarsi, fin da età molto antica, i magazzini del sale ("Salinae") e, alle pendici del colle, sono avanzi di età imperiale che potrebbero forse appartenere a edifici di stoccaggio.

Emporium e Porticus Aemilia (carta n. 5)

L'antico porto di Roma, situato sulla riva sinistra del Tevere, nell'ansa che fronteggia il Velabro e il Foro Boario, non aveva alcuna possibilità di espansione, stretto com'era tra quartieri già intensamente edificati. Quando, dopo la seconda guerra Punica, ebbe inizio una fase di intenso incremento demografico e commerciale per la città, fu necessario cercare spazio per la realizzazione di un nuovo complesso portuale, che fosse all'altezza delle necessità che allora si presentavano.
Il punto più adatto era la pianura, interamente libera, a sud dell'Aventino: qui i censori del 193, Lucio Emilio Lepido e Lucio Emilio Paolo, costruirono il nuovo porto (Emporium) e la retrostante Porticus Aemilia. Successivamente, i censori del 174 lastricarono di pietra l'Emporio, lo suddivisero con barriere, creando scalinate di discesa al Tevere. Inoltre, completarono la Porticus Aemilia.



Roma

Ci sono rimasti importanti elementi della Porticus Aemilia nella zona a sud di via Marmorata, tra

questa e via Franklin. La pianta marmorea Severiana la rappresenta con notevole precisione.

Si trattava di un immenso edificio in opera incerta di tufo, lungo 487 m e largo 60, (1600 x 200 piedi), suddiviso da 294 pilastri in una serie di ambienti, disposti su sette file nel senso della profondità, che formavano 50 navate, larghe 8,30 m ciascuna, coperte da una serie di volticelle aggettanti le une sulle altre. La superficie utilizzabile, calcolata dal Le Gall, superava i 24.900 mq. dandoci una misura del volume di importazioni nei primi decenni del II secolo a.C.
Questo edificio, in stretta connessione con il porto, era evidentemente il magazzino di deposito delle merci in arrivo. Esso distava dal fiume circa 90 metri: questo spazio fu via via colmato, in seguito, e soprattutto in età traianea, da altre costruzioni.

Tutta la pianura del Testaccio, man mano che crescevano i bisogni della città, si andò colmando di edifici, in particolare di magazzini annonari. Quando a partire dai Gracchi, ebbero inizio le distribuzioni gratuite di grano e di altri generi alimentari alla popolazione della città, fu necessario costruire nuovi magazzini: sorsero così gli Horrea Sempronia, Galbana, Lolliana, Seiana, Aniciana. Roma
I meglio conosciuti sono gli Horrea Galbana (il nome repubblicano era Horrea Sulpicia), una parte dei quali è rappresentata negli stessi frammenti della pianta Severiana in cui appare la Porticus Aemilia, dietro di questa con orientamento diverso. L'edificio costruito interamente in reticolato di tufo era organizzato attorno a tre grandi cortili rettangolari porticati, sui quali si aprivano lunghi ambienti.

La collina artificiale detta Testaccio, cioè Mons Testaceus "monte dei cocci", è alta circa 54 metri sul livello del mare (30 al di sopra della zona circostante), con una circonferenza di 1 chilometro e una superficie di circa 20.000 mq. Essa è di forma grosso modo triangolare ed occupa parte dell'angolo compreso tra le Mura Aureliane e il fiume, all'estremo sud della città. La collina si andò formando con gli scarichi delle anfore, che contenevano i prodotti importati nel porto di Roma. Roma

A valle della villa della Farnesina sono venute alla luce le rovine delle "cellae vinariae Nova et Arruntiana Caesaris nostri", come indicato da un'iscrizione del 102 d.C. Roma

La zona di Trastevere a valle del Ponte Emilio nella Forma Severiana (lastre 27-28-33-34) appare in gran parte occupata da magazzini: possiamo collegare questa situazione allo sviluppo stesso del quartiere e al suo carattere artigiano.

Roma

In questa zona possiamo individuare la Cella Civiciana in via del Porto di Ripa Grande e la Cella Saeniana testimoniata da epigrafi trovate subito a monte della ferrovia.
Recentemente, scavi della Soprintendenza archeologica di Roma nel deposito dei

tram a Porta Portese hanno portato alla luce i resti di magazzini e abitazioni databili tra il II e il IV secolo d.C.

Nelle aree golenali sottostanti la chiesa di Santa Passera, si intuisce la presenza di murature pertinenti forse a magazzini. Tutte queste strutture erano in stretto collegamento con la via Campana. Roma

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Harbour informations about: Wharf

Dor

There is plenty of comparative data and documentation concerning the size of ships and their length/breadth ration, to assume that the slipways at Dor were not shipsheds but rather a shipwharf. Considering the width/length of the slipways at Dor, one may reconstruct the size of the vessels that could be hauled up on them:

- the eastern slip (*nr.1*) – vessels of 4x24 m
- the middle slip (*nr. 2*) – vessels of 4.5x26 m
- the western slip (*nr. 3*) – vessels of 5x20 m.

The ration of 1:4 is characteristic for merchant ships while the others of 1:6 and 1:5.7 would be appropriate to oared naval vessels.

Parallels

There are no good parallels for Dor's slipways to be found in other sites in the Levant coast. Such installations come only from the Greek world. Similar structures were found in the Port of Pireus, Greece and in North Africa. The installations at Pireus were part of the dockyard/arsenal belonging the Athenian maritime power. The length of these slips was 38-40 m, the width almost 6 m and the angle of inclination is about 6°. At the base of the slips was a raised area, and along its center a shallow channel was cut to fit the keel of the vessels. Almost identical to the Pireus complex is found in the sunken remains of the Hellenistic harbor of Apollonia, in North Africa (Libya). Due to their being underwater at present, it is difficult to establish the exact length of the slips. An estimated range for their length is between 28 to 40 m. The width is about 6 m and the angle of inclination is 4°. The base of the slips is identical to those found at Pireus complex.

The sites described above helped to conclude that the slipways at Dor were used for repairs and maintaining ships that anchored in the in the North Bay and in the Tantura Lagoon. The date of the Pireus and Apollonia (Libya) installations is not defined but cannot be earlier than 3rd - 2nd century BCE. During this period the standard vessels were the trireme which measured 38 m in length and 5.5 - 6 m in width. The dimensions of the docks at Dor indicate that they were not adequately fitted for triremes. It should be noted that the moderate inclination of 5° and the flat bottom of the slips are more suited for merchantmen rather than military vessels. The Dor docks could be dated to the 6th-5th century BCE, deduced from the Athenian sherds found on the eastern side of the installation complex.

Wolin

In the region of former Wolin were localized four ports and harbours– main port was found in region centre of present city (fig.4). Build wharf of main port begun in 880 year lasted to 896-900 year. One localize street passing in port footbridge, which was twice rebuilt in distances 50 of years among 900 and 995 with year. In archaeological material from port we can observe gradual pushing oneself of construction in direction deeper waters, every level of construction was added in result of settlement of construction on wet ground. In 1952 in caisson No 1 being found on bank present troughs of river, one met on pale constructions dated on X □ XII in. In 1985 in excavation trench No 3. □ 60 of metres from present bank, on depths 6 m one found wooden constructions

being with remainders of wharf port - in form oak - logs (halved of trunks) creating constructions of wall of wharf. From land wall strengthened and stiffened were beams fulfilling function pull-offs, which fixed former in ground at help oak □ pegs (fig.5). During researches in region of former port, in excavation trench No 8, on 2, 6 metre was found fragment of keel of boat, which used secondarily as fulfilment of side of wharf (fig.6). On base of dendrochronological analysis one fixed, that keel originates from boat built in years 860 □ 870. Disassembly of boat and secondary used of keel happened about 966 year.

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Harbour informations about: Winch

The single north wall and the ramps display distinctive traces indicating the use of a Kition wooden pully or crane system.

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