
Mediterranean Ports in Ancient Times

by

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1. Introduction

This article looks into different historical periods in a summarized fashion which covers nearly 3,500 years in order to see the evolution of ports in ancient times. Our point of departure in this analysis is based on the following two concepts:

- * In an attempt to resolve a particular problem people always arrive at a solution which uses the techniques available at each historical moment.
- * In past times, as well as at present, the different cultures have always been interrelated.

2. Types of ports in Antiquity

The history of ports can be divided generally speaking in two periods: the first runs from 3000 B.C. to 500 A.D. and the second includes the period from the 18th century to present times.

The first period is characterized by the appearance and development of sea techniques (the building of ships, a knowledge of navigation and of the dominant winds in the different areas of the Mediterranean and the Red Sea, the opening and maintaining of commercial-maritime routes, experience in most common waves, currents, the local sea climate, etc.) and by the beginning of the construction of ports.

Between the first and second period, there was a period of technical stagnation which extended from the fall of the Roman Empire till the XVIth century. From this century on, the techniques which were employed were the same ones that were applied during the first period. Even the technical manuals which were written plagiarize the classics of the first period. The

book by the XVIth century Engineer **Juanelo Torriani** "**Los Veinte y Un Libros de los Ingenios y Máquinas...**"¹ collects, to a great extent, the knowledge that existed concerning construction fifteen centuries before and that was already compiled in the writings of the Roman architect **Vitruvius**.

In order to classify the ports of the first period (3000 B.C. to 500 A.D.), technical and cultural criteria have been followed, as well as the concepts mentioned in the introduction. This classification would be as follows:

1. Egyptian
2. Minoan
3. Phoenician and Carthaginian
4. Greek
5. Roman.

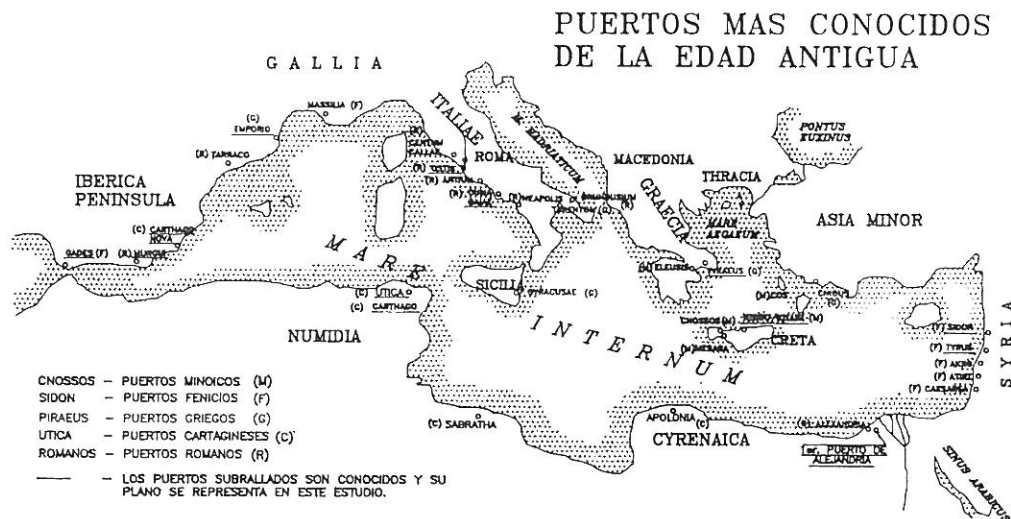
Figure 1 shows the location of the better known ports of these cultures in the Mediterranean.

3. Egyptian

The Egyptian culture begins with the First Dynasty (2920 to 2770 B.C.) of the Early Dynastic Period with the first known Pharaoh Hor-Aha (Menes) and ends with the defeat at Actium (31 B.C.) and the death of the last Pharaoh of the Lagid or Ptolemaic Dynasty, Cleopatra VII Filopator. Thirty centuries are encompassed by these two dates (thirty five if the late Naqada II period is included).

The Egyptian society developed an important river transport system in the Nile. This represented one of the fundamental elements in the social and economic development of the country and maintained the communication between the cities settled on the banks of the Nile.

1. The Twenty-one Books of Devices and Machines.



Though not as important as river transport, maritime transport was deeply-rooted in the life and culture of ancient Egypt. However, the Egyptians did not maintain commercial maritime navigation in a continuous form during the three milleniums of their history.

There were no important Egyptian ports along the Mediterranean coast. The Nile and its different branches and lagoons, were used as ports. The most significant river ports were Memphis and Thebes.

Along the coast of the Red Sea, in a city situated in the mouth of Wadi Gasus, Filoteris, during the period of Roman domination, the remains of an Egyptian port built during the XIIth Dynasty (1991-1777 B.C.) were discovered. These remains represent the only vestige of a sea port construction undertaken by the Egyptians.

The most important characteristics of Egyptian ports can be summarized by the following points:

1. The docking facilities of river ports presented different types of docks: wood pile docks, stone pile docks and solid stone docks. Double pile wood piers were placed perpendicular to these docks.
2. The facilities for loading large blocks of stone (obelisks, statues, etc.) near quarries, as well as unloading near construction sites, had a special importance. Numerous river transport canals were built with quarries and construction sites as their destinations. The Egyptians tried to limit the costs of land transport of construction materials and merchandise to the smallest possible stretches.

3. When there were no docks, loading and unloading was done directly through the use of a ramp which joined the boat with land.
4. The main problems of river ports were the shoaling and the flooding of the Nile. These problems obliged the Egyptians to build dikes to reduce these effects.

Without a doubt one of the master works of Egyptian hydraulic engineering was the construction of a navigation channel between the Red Sea and the Nile. Construction was begun with the Pharaoh Seti I (1306-1290 B.C.) and was finished by his son Ramses II in 1250 B.C. The channel started out from the eastern arm of the Nile delta in Bubastis and joined Bubastis with Lake Tima, the Bitter Lakes, and reached its mouth in the city of Patamus on the Gulf of Suez. It has a width of 45 m and a depth of 5 m. The banks were sloped with rocks which made steps. With Figure 2 in mind, it can be said that the design of the channel took advantage of the old right hand branch of the river which was 85 km long. The channel was later reconstructed by Pharaoh Neco II (610-595 B.C.) and by Darius I (521-486 B.C.). Later day accumulations of sand in the channel forced its restoration in the times of Ptolemy II (285-246 B.C.) and the Roman Emperors Trajan and Adrian.

4. Minoans

During the Third Millennium B.C., the Cretan society was more advanced than the societies of continental Greece and of the islands of the Aegean

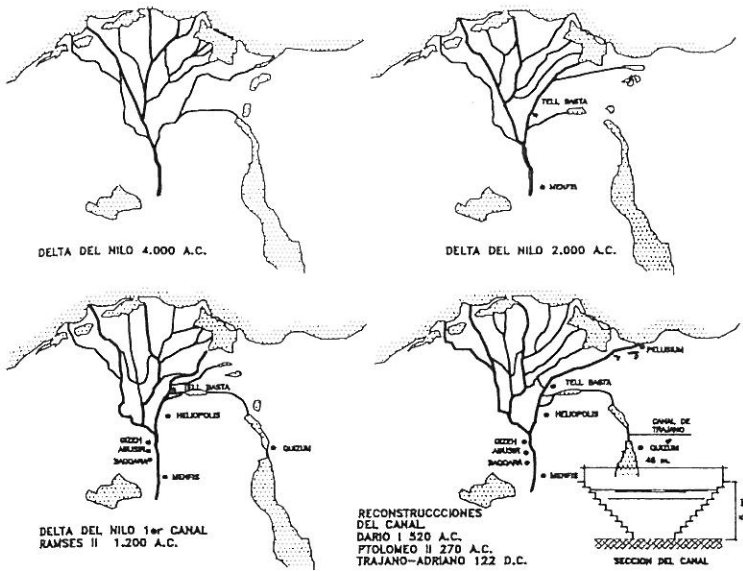


Figure 2
Delta and channel of Nil and Egyptian ports

Sea. That was due, among other things, to the geographical position of the island which permitted the Cretes to use the sea not only as a fishing resource, but also as an area for their trade relations with other Mediterranean countries (the Cyclades Islands, Greece, Egypt and the Asia Minor coast, Marseilles and the Balearic Islands).

The most important Minoan ports in Crete were: **Aminosos**, in the north of Crete, which was the port of Knossos (in the second half of the XVIII century B.C.. Knossos must have been the biggest city in Europe). Unfortunately, the present day port of Heraklion was built on the ancient port. **Mesara**, in the south, was joined to Aminosos by a road with heavy commercial traffic and some remains of the port have been preserved.

The general characteristics of the Minoan ports were:

1. The use of rocky bottoms as the foundations of the breakwaters.
2. The construction of detached breakwaters with a square bracket shape and sloped.
3. The basins were long taking advantage of the existing bottom in the shallow water.
4. The docks were made up of blocks on a rocky bottom, forming "fingers" sometimes.
5. The docks had several mouths which were not very wide and which allowed the current to go in and out.
6. When the bottom permitted piers, the Minoans used primarily wood pile piers with crisscross beams.

Today the best preserved ports of the Minoan culture are: the **ancient port of Alexandria**, the **Egyptian port or South of Tyre** and the **port of Nirou-Khani**.

The ancient port of Alexandria was located to the west of the island of Pharos, where there were some rocky reefs. It was discovered in 1910 by M. Gaston Joudet and was studied by Sir Arthur Evans, who made the original map of the port.

The port was built by taking advantage of a submarine valley 6 to 10 m deep located between the islets of Abu Bakar and Ras-el-tin to the west of the island of Pharos. As can be seen in Figure 3, the port was built in successive phases, a conclusion drawn from a study of the continuous rubble mound breakwaters, from the vertical breakwaters, and their layout in the planform. In the interior of the port, the docks were 14 m wide and made of blocks of rock 5 m long. The main basin had a length of 2,340 m, a width of 300 m and an estimated capacity of 400 Minoan ships with a length of 35 m.

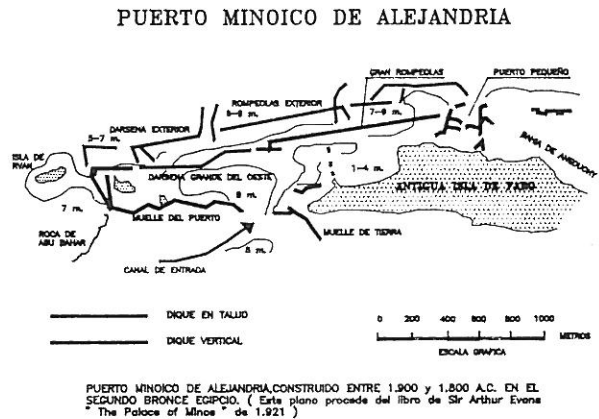


Figure 3
Minoan port of Alexandria

Twelve miles to the east of the present day port of Heraklion, the remains of the Minoan settlement Nirou-Khani (or Jani) were uncovered during excavations led by S. Marinatos in 1926. The structure of the port (Figure 4) came to light at that moment. The port was made up of a rectangular basin that was excavated in rock and was 43 m long and almost 12 m wide. It was divided into two docking channels of 6 and 5 m respectively by a vertical wall 0.8 m wide. There were some platforms on each side of the channels which served as docks.

PUERTO MINOICO DE NIRUO-KHANI, CONSTRUIDO SOBRE
1.500 A.C. FUE DESCUBIERTO POR SPYRIDON MARINATOS
EN 1.929

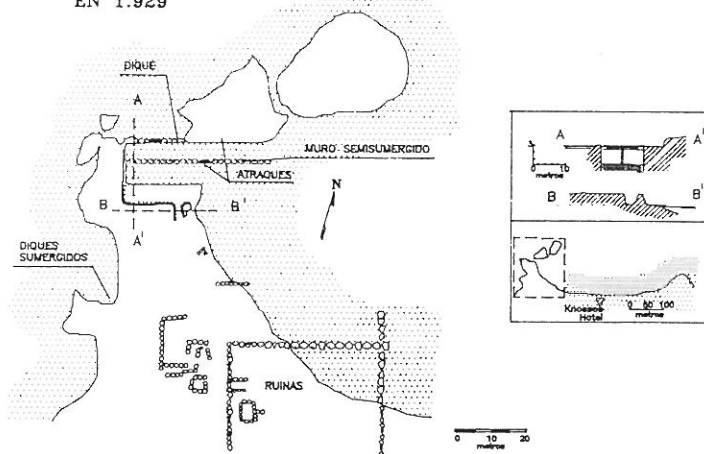


Figure 4

Minoan port of Nirou-Khani (Crete)

The port was built in the rocky zone of an open bay, thus diminishing substantially the risk of being closed by the littoral solid transport. In addition, it was protected from the dominant winds in the north of Crete due to its leeward location.

5. Phoenicians

The first information to be had about the cities of the Syrian-Palestine coast and their inhabitants comes from the Egyptians of the IIIrd Millennium B.C., from the Hebrews and later from the Greeks who use the name *phoenikes* to refer to the inhabitants of that coast.

Till the appearance of the Greeks in the Mediterranean, the Phoenicians developed a true monopoly of the existing knowledge and commercial use of sea routes.

The most important Phoenician ports on the Syria-Palestine coast were to be found in the cities of: **Ugarit**, located to the north of the Phoenician coast near the mouth of the River Nahr el-Kerib; **Biblos**, a few kilometers to the north of the present city of Beirut; **Sidon**, present day Saida, situated at a short distance from Beirut towards the south, its port is well known archaeologically speaking; **Tyre**, 20 km to the south of Sidon, its port is also well-known; **Akko**, present day Acre, located to the south of Tyre.

The independent city-states that made up the Phoenician nation all had a series of characteristics in common: a port, a well sheltered beach, a spring for drinking water and a rocky area or a hillock or a nearby island.

The most important characteristics of the Phoenician ports can be summarized by the following points:

1. Ports were situated in zones of sheltered waters, especially islands (Tyre, Gades) and peninsulas (Biblos, Sidon, Carthage), in search of the isolation of the coast so as to be able to defend themselves more easily.
2. They constructed various ports, two in general, connected by a channel. This separation could have two quite different objectives: the physical separation of the war and commercial fleets; or the distinguishing between the commercial routes which they operated in, north and south. Another reason for this two port design could be to guarantee the use of the facilities even during storms, since the fleet was always under cover in one basin or the other.

Without a doubt, the ports which are better known at present are the ports of Sidon and Tyre.

On the island of Tyre there were two known ports, one was called the **North or Syrian port** and the other the **South or Egyptian port**. The oldest one is the South or Egyptian port which was built around 2750 B.C. by the Minoans and/or the Egyptians, as the settlement for a colony there. The North or Sidon port is more modern and was better known in antiquity since it appeared in various Greek and Roman texts.

The archaeological remains of the city and its port facilities are the most complete and best preserved remains of the Phoenician culture. The port was discovered by Père A. Poidebard between 1934 and 1936.

As Figure 5 shows, the city of Tyre was located in the northern part of the island. The North or Sidon and South or Egyptian ports were connected by a navigation channel. The North port was sheltered from the waves by a chain of rocky islets. The external structures of the port were made up of a vertical breakwater in the shape of an open L with an initial alignment in an almost W-E direction which then turned approximately 80° to a second alignment which has a N-S direction. The breakwater then ended in a small perpendicular breakwater which acted as the roundhead. Next to the first alignment, there was another parallel breakwater at a distance of 30 m. This was the primitive sheltering structure which had

to be discarded due to foundation problems which forced the construction of the L-shaped breakwater. In order to shelter the port on the other side, a straight vertical breakwater was built. The mouth of the port measured 43 m.

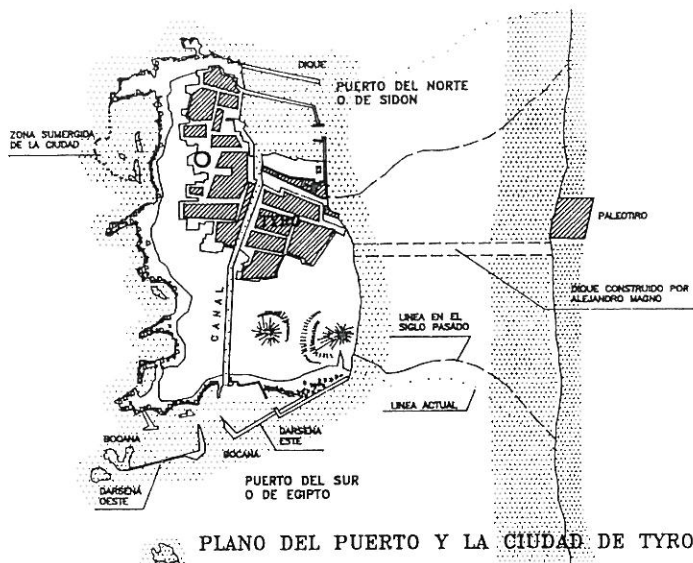


Figure 5
Tyre ports

Both breakwaters were reconstructed during the Roman period. This fact can be proven by the use of masonry rock of a greater size than was normally used by the Phoenicians and by the joining of the rock with iron clamps and cement, a technique usually used by Roman engineers. The basin had an area of six hectares and its docks were also built with masonry rock.

The South or Egyptian port is much older than the first one. The external structures were made up of three breakwaters more than 300 m long that were laid on rocky reefs built with quarry stones of nearly 15 tons. The first breakwater started out from the furthest southeast point. Two-thirds of its length served as a contention wall for a landfill and the continuation joined with a new breakwater which stretched out for a total length of 750 m for both structures. Another breakwater was built from the southwest end. This breakwater started off from some rocks near the coast, in front of a little island, and headed towards the western end of the eastern breakwater. Both breakwaters ended with a small perpendicular breakwater, like a roundhead, in the direction of the interior of the port.

The port has two mouths. The main one was located between the breakwaters described in the previous paragraph, while a second one was between the rocks and the coast. With this layout, the interior of the port was divided into two basins (east and west). The east port has a greater depth and more docks and the navigation channel which joined both ports set out from there.

6. Carthaginians

The Phoenician decline, which was caused by the different invasions of the city-states on the Syrian-Palestine coast, forced the colonies of the other end of the Mediterranean to take over the use of the western trade routes.

Among all the colonies, Carthage assumed the commercial preeminence, the naval power and saw to Phoenician interests in the West.

The most important Carthaginian ports were located in the following cities: **Utica**, situated a few kilometers to the north of Carthage; **Motia** in Sicily near cape Lilibeo; **Apolonia**, on the Lebaresse coasts. (Its port was extremely important in the grain trade not only for Carthage, but also later for Rome).

The most important characteristics of the Carthaginian ports can be summarized by the following points:

1. They were situated at the foot of easily defensible promontories, on islands, or peninsulas
2. The ports consisted of two basins: a big one for merchant and civil ships, a commercial port; and a smaller military basin, a military port or *cothon*. The Carthaginians sometimes took advantage of a small nearby lagoon for the commercial port, while it was usually necessary to excavate the military port in land. It was usually located in the city. There normally was a well protected channel which joined the military port to the commercial port.
3. They avoided the construction of external structures whenever possible, looking for natural harbours which fulfilled the prerequisites described in the first point (New Carthage), or they excavated the port in the ground (Carthage)
4. When the conditions that were mentioned did not exist, the problem was resolved by only excavating the *cothon* and taking advantage of a naturally sheltered harbour for the commercial port and constructing a breakwater (Motia). Another solution was found by sheltering a rock of the coast with a breakwater and afterwards they dredged towards land (Utica).

5. The works in the interior included docks made of blocks, where wood piers were built perpendicular to the dock. As part of the mooring facilities, they built columns which also acted as bollards, in addition to simple mooring methods (rings, etc.).
6. The *cothon* usually has a rectangular or round shape. An island with a central tower was constructed in the center and housed the admiralty.
7. Both the military and the commercial port were closed by means of chains; consequently the mouths were very narrow.

The most famous port was the port of Carthage (Figure 6), which was located within the primitive city. Access to the port was provided through Lake Tunis which was connected to the sea by an opening of 90 m along the southern coast line called "La Goleta". The port itself was divided into two basins. The first was dedicated to commercial maritime traffic and entry was through a small 21 m wide channel which could be closed by chains. The second basin was the **military basin (*cothon*)**. Access to this basin proceeded through another channel of a width similar to that of the mouth of the port from the commercial port. It had a **400 by 300 m circular shape** and in the center there was a **150 m wide island** where the admiralty was located with its nautical and military observation tower. The island and the basin were both surrounded by continuous dock walls where wood pile piers were constructed perpendicularly. Up to **220 ships** could be moored between each pair of piers. Two Ionic mooring columns were set up on the stretch of the dock between the two piers. The port facilities with their archways were located in front of the docks. Finally, the *cothon* was surrounded by walls so that it was impossible to see the military basin either from the commercial basin or from the coast.

During the Third Punic War, Carthage made two exits directly to the sea from the *cothon* and the commercial port since Scipio had cut the natural access through Lake Tunis during his siege of the city. When Augustus ordered the reconstruction of the city of Carthage, the new port, called **Mandracium**, was built by using the advantages of the old *cothon* and a part of the commercial basin since the access by means of Lake Tunis was closed by sand.

7. Greeks

A description of the Greek world and culture should begin with a study of the first culture known in the Aegean, the Minoan. However, we have intentionally separated it since there was no continu-

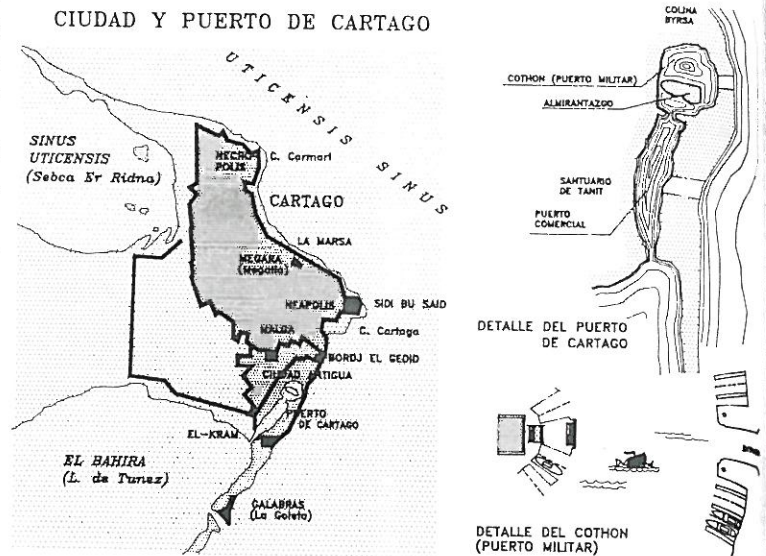


Figure 6
Carthage port

ity between this culture and the successive cultures of the different people who invaded continental Greece. This succession of invasions with the passage of centuries brought about the Hellenic Civilization.

Due to the nature of the littoral geography of Greece, many natural harbours existed which only needed small civil works to improve their efficiency and operativeness. The **most important Greek ports** were: **Piraeus**, the port of Athens, and the port of **Alexandria**.

The **most important characteristics of the Greek ports** can be analyzed by the following points:

1. The Greeks sought natural shelter for their locations: bays, the mouths of rivers, firths, etc.
2. Where these were not sufficiently sheltered, they undertook maritime works which improved the sheltering.
3. The sheltering works consisted of rubble mound breakwaters when there was no natural defense. When there were natural structures (shallow water, reefs, islands, etc.) they built vertical breakwaters, although these required skilled workers and more sophisticated machinery.
4. Like the Phoenicians, they usually had more than one port with mouths oriented in different directions. However, the joining of the two basins by means of a channel was not common.
5. The interior maritime works included a **longitudinal dock made of masonry rock, wood pile piers, docks with stone walls and wood pile or stone pillared wood platforms.**

The city and the port of **Alexandria** (Figure 7) were founded by Alexander the Great in 332 B.C. and he chose its location, since he had information that the place had been occupied many centuries before by a pre-Hellenic settlement. He commissioned the architect Dinocrates of Rhodes to do the construction.



Figure 7
Alexandria port

The construction of the port took advantage of the sheltering from the island of Pharos. A vertical breakwater was erected, like a solid bridge, which joined the island with land, a distance of seven stadia (1,243 m) and was consequently known as **Heptastadio**. It had a width of nearly 30 m. It had two pontoons which facilitated the passage of small boats. This breakwater practically divided the port of Alexandria into two ports: the **port of Alexandria** itself to the east, and the **port of Happy Arrival**, also called **Eunostos** to the west. There was a network of channels which joined both ports with Mareotis Lake and the Nile.

The external works of the port were made up of **two vertical breakwaters** which were supported by the numerous existing rocky promontories. One of these started off from the extreme eastern part of the city, formed by the Loquia peninsula, and consisted of three straight alignments. The other set off from the extreme eastern part of the island of Pharos and was supported by the islet which 50 years later would be the home of the famous **Lighthouse of Alexandria**, a work by Sostratus of Cnidus. It had two straight alignments.

8. Romans

Traditionally the Romans were neither a seafaring nor trading people. The development of their navy was imposed upon them in order to survive. Thus, the knowledge about the sea which the Romans acquired was the compendium of the sciences and maritime techniques of all the cultures which had preceded them and which they enriched with their own contributions.

As Polibius and Strabo indicated, there were very few ports on the western Italian coast. Those that were of interest were located in the bay of Naples: **Cuma**, **Miseno**, **Baia** and **Puteoli**. After those there were the ports of **Ostia** and **Aquilea**. Both of these were initially river ports with no sheltering construction.

The most important characteristics of Roman ports can be summarized as follows:

1. When it was possible, the Romans took advantage of river ports using the course of the river as a way for navigation.
2. In those cases where they built outer harbours, they built quarry stone breakwaters, as well as vertical breakwaters and arched breakwaters.
3. Their great knowledge concerning the sea made them design the layout of the breakwaters adapted to the sea climate of the zone, except in certain cases like that of the port of Ostia.
4. Two types of vertical breakwaters were constructed. One with **large stone slabs joined with puzzolanic cement** and the other with **masonry rocks of large dimensions joined with metal clamps**.
5. Both the river and port docks were built of masonry rock with a double height in the Atlantic for high and low tide.
6. The arched breakwaters appeared at a later date. There were two lines of arches, asymmetrically placed, which allowed the currents to pass and provided a relative dampening of the waves.
7. They applied quite amply all the techniques described for the different types of ports.

Among all the ports of the western Italian coast, the most important commercial ports were **Puteoli** and **Ostia**. The first is well known thanks to its representation in a fresco found in good condition in Sabia, presently at the National Museum of Naples.

The primitive port of Ostia was constructed around 634 B.C. and was essentially a river port located in the mouth of the River Tiber. When Julius Cesar was consul, it was improved and expanded. Under the

Empire, Agrippa began the studies to build a large outer harbour near the existing port. The construction of the new port began under Claudius, though not without great debate, and was finished under his successor Nero.

The new port (Figure 8) was located to the north of the mouth of the Tiber and two-thirds of it was external and the rest excavated in rock. The outer construction consisted of two converging breakwaters, 600 m long and 54 m wide, with an initial straight alignment followed by a curve. The distance between the roundheads was 335 m. A central island of 230 by 120 m was constructed between the two heads and a lighthouse and two towers for the chains which closed the port were built. Later on a statue of Claudius was erected inside the island.



Figure 8
Ostia port

The central and southern breakwaters were constructed of solid blocks while the northern breakwater had arches. The main basin had a maximum depth of 5 to 6 m and minimums of 2.5 to 3 m.

Behind the main basin (or the port of Claudius) of 56 hectares, there was a small trapezoidal shaped basin of 3 hectares separated from the first by a detached 200-m-long breakwater. A navigation channel went from this point to the Tiber and to the sea. A second channel, parallel to the first, also served to pass directly to the river from the sea without entering the port.

Fifty years later, Trajan expanded the port. He added a hexagonal basin (the port of Trajan) with sides totalling 404 m and an area of 42 hectares. The two previously mentioned channels disappeared. The first served as the access to the new basin. The second was closed and a new channel (the Trajan channel) was opened.

This port did not last long, as Roman engineers had predicted, since the solid littoral transport of the zone was such that the shoreline next to the port had an average annual growth of 2 m in spite of the constant dredging. Finally, the port was abandoned and a new port was built in Centum Cellae (Civita Vecchia) 40 km to the north. This port is represented in the "Tabula Peutingeriana".

9. Ancient ports in Spain

The first references to the Iberian peninsula came to us from the intrepid Phoenician navigators who arrived on our coasts and founded the colony of Gades (Cadiz), a settlement for trade with Tartessos.

The most important and complete ancient geographical information about the Iberian peninsula comes to us from the hands of Strabo, Pliny, Polibius and Mela. Based on these and on different archaeological and paleological studies, a synthesis of the most important ancient ports of the Iberian peninsula can be presented.

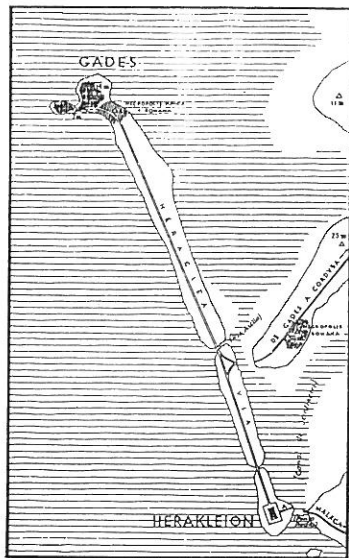
The three most important ports of the peninsula were: Gades, New Carthage and Emporion, to which Murgi, a Roman port, can be added.

Without doubt the most important port and city of the entire peninsula was Gades (Figure 9). It is not in fact known where the port was located, although it can be supposed that given its Phoenician precedent, it had two ports: the military and the commercial.

The city of New Carthage (Cartagena) (Figure 10) was founded by the Carthaginian admiral Asdrubal. The choice of the place was not accidental because of the natural sheltering conditions for the locating of a port and its strategic situation for the control of the silver mines. The port, a natural harbour, was composed of two basins, the military (cothon) and the commercial, separated by a peninsula where the city was located. The commercial basin was located in the zone now occupied by the present day port of Cartagena, and the military or interior basin existed till the XVIIth century.

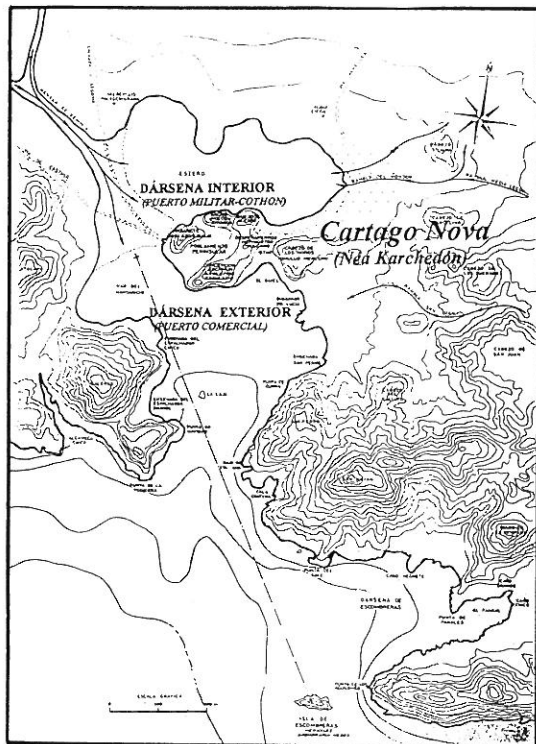
The city of Murgi (Roquetas de Mar-Almeria) was the limit of Betica and Tarraconense. The outer works of the port (Figure 11) consisted of a straight vertical breakwater, 800 m long and 6 m wide, built with large stone slabs joined with mortar. It is the first case that we know of a roundhead breakwater. Next to where the breakwater begins, there was a slipway made of stone slabs of the same type used in the

6 sides of 360 m
area of 33 ha
(Franco, 1996)



Reconstrucción paleográfica de la isla de Cadiz
(según Antonio Garcia Bellido)

Figure 9
Gades (Cadiz)



Reconstrucción paleográfica de Cartagena
(según Julio Mas Garcia)

Figure 10
New Carthage

construction of the breakwater. According to the on-site inspections we have made, the breaking of the breakwater was due to the undermining of a great part of the breakwater, particularly in its central zone.

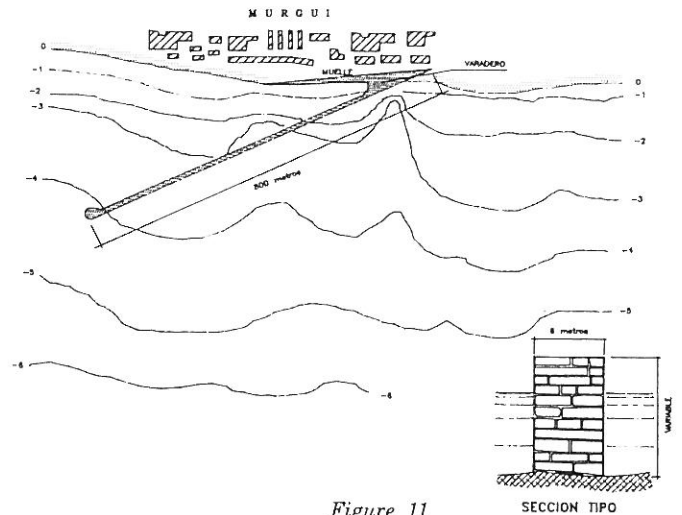


Figure 11
Murgi port

Lastly, we will deal with the city and port of Emporion. It was founded by the Foceos around 600 B.C. in an island situated in the estuary of the river Fluviá (Palaiá Pólis). In 510 B.C. they moved from the island and founded Néa Pólis. In 100 B.C. a new Roman city was founded in that same place. Only a section of the vertical breakwater remains in its port, a port which was very active in the Greek and Roman period. The section has the same characteristics as that of Murgi and it was 82 m long, 6.6 m high and 5 m wide. It was constructed with stone slabs and mortar during the first half of the 1st century B.C., which indicates that its origin and the techniques employed were Roman and not Greek. Initially the port was situated within the estuary of the river with two breakwaters for shelter. When the population moved to the mainland, a new breakwater must have been built in the southern end of the estuary. During the Roman era, the port was expanded and the vertical breakwater described was built. This breakwater formed a channel which joined the new and old ports.

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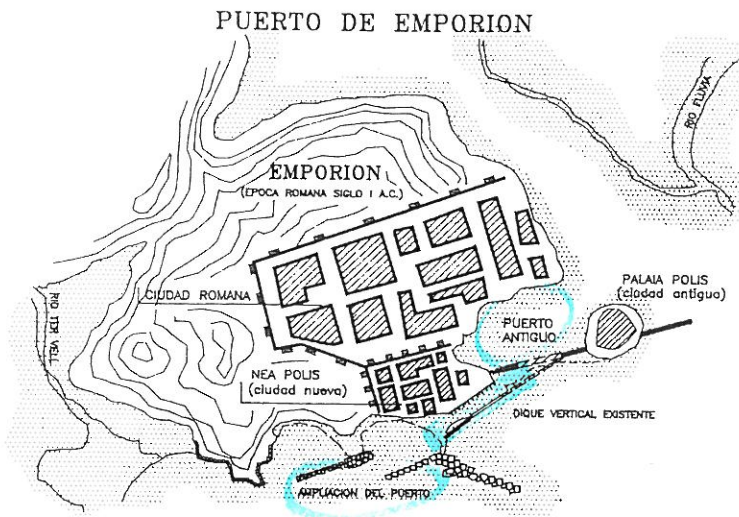


Figure 12
Emporion port

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RESUME

LES OUVRAGES PORTUAIRES DANS L'ANTIQUITE

L'histoire portuaire peut se diviser en deux périodes: la première allant de l'année 3000 av. J.C. à l'année 500 ap. J.C. et la seconde du XVIII^e siècle à nos jours.

Nous décrivons synthétiquement dans cet article les ports les plus représentatifs de l'Antiquité et les caractéristiques techniques les plus usuelles quant à leur situation et leur construction dans chacune des cultures de ces deux périodes. Ceci nous permet de faire une classification basée sur des critères technico-culturels: 1) Egyptiens (Figure 2); 2) Minois (Figures 3 et 4); 3) Puniqs, Phéniciens et Carthaginois (Figures 5 et 6); 4) Grecs (Figure 7); 5) Romains (Figure 8).

Enfin, nous décrivons brièvement les ports antiques les plus importants de la péninsule ibérique.

ZUSAMMENFASSUNG

HAFENANLAGEN IN DER ANTIKE

Die Geschichte des Hafenbaus läßt sich in zwei Perioden unterteilen: die erste von 3000 v.Ch. bis 500 n.Ch., die zweite vom 18.Jhd. bis heute.

Dieser Artikel beschreibt umfassend die repräsentativsten Häfen der Antike sowie die bezüglich Lage und Bau meistverwandten technischen Grundlagen jeder Kultur aus diesen beiden Perioden. Hieraus ergibt sich folgende Klassifizierung nach technisch-kulturellen Kriterien: 1. Ägypter (Skizze 2); 2. Minoer (Skizzen 3 und 4); 3. Punier, Phöniker und Karthager (Skizzen 5 und 6); 4. Griechen (Skizze 7); 5. Römer (Skizze 8).

Abschließend werden die wichtigsten antiken Häfen der iberischen Halbinsel kurz beschrieben.

RESUMEN

OBRAS PORTUARIAS EN LA ANTIGÜEDAD

La historia portuaria puede dividirse a grandes rasgos en dos períodos: el primero transcurre entre el 3000 a.C. y el 500 d.C.; y el segundo abarca desde el siglo XVIII hasta nuestros días.

En este artículo se describen, de forma muy resumida, alguno de los puertos más representativos de la antigüedad, así como las características técnicas más relevantes empleadas en la disposición en planta y construcción de los mismos por cada una de las culturas durante el período (3000 a.C. al 500 d.C.), lo que nos permite realizar una clasificación siguiendo criterios técnico-culturales, ésta clasificación es la siguiente: 1) Egipcios (Figura n° 2); 2) Minoicos (Figuras n° 3 y 4); 3) Púnicos, Fenicios y Cartaginenses (Figuras n° 5 y 6); 4) Griegos (Figura n° 7); 5) Romanos (Figura n° 8).

Para terminar se hace una breve descripción de los puertos antiguos más importantes de la península Ibérica.

SOMMARIO

OPERE PORTUALI NELL'ANTICHITÙD

La storia delle opere portuali si può dividere, in prima approssimazione, in due periodi: il primo è compreso tra il 3000 A.C. e il 500 D.C.; il secondo tra il secolo XVIII° fino ai nostri giorni.

In questo articolo si descrive, in forma molto sintetica, alcuni dei porti più rappresentativi nell'antichità unitamente alle caratteristiche tecniche più significative nella disposizione planimetrica e nella costruzione per ciascuna delle culture dominanti durante il primo periodo. Ciò permette di realizzare una classificazione tipologica seguendo criteri di natura tecnico-culturale: 1. Egiziani (Fig. n.2); 2. Minoici (Figg. n.3 e 4); 3. Punici, Fenici e Cartaginesi (figg. n.5 e 6); 4. Greci (Fig. n.7); 5. Romani (Fig. n.8).

Infine si propone una breve descrizione dei porto antichi più importanti della penisola Iberica.