

Ancient harbors in Anatolia

Z. Kurtuluş¹ and Y. Arisoy²

¹*The General Directorate of Railways, Ports and Airports Const.,
İzmir.*

²*Dokuz Eylül University, Faculty of Engineering, Bornova 35100,
İzmir.*

Abstract

Anatolia Peninsula is situated as a bridge connecting Europe and Asia. Many people and civilizations had preferred this region because of its significant geographic location, climate, water and soil resources. Several outstanding cities have been founded especially in Ionian and Roman periods, and left remarkable remains. These cities with many exceptional harbors are very interesting with respect to archaeology, tourism and also history of coastal engineering. The authors have recently carried out a study covering the antique harbors in Anatolia. This paper presents and explains some features of the most interesting ancient harbors with respect to their reconstructions.

Introduction

Anatolia is considered to be one of the most exceptional settlement place of the world. The Anatolian peninsula had been preferred during the last ten thousand years because of its significant geographic location, climate, water and soil resources. The Hittites (2000-700 BC), Urartians (900-600 BC) and Ionians (1000 BC-395 AD) are the earliest civilizations which had lived in central, eastern and western Anatolia, respectively. Especially in Ionian and Roman periods, several renowned cities have been founded, of which remarkable remains still exist. These cities with many exceptional temples, amphitheatres, gymnasiums, water supply systems, aqueducts and harbors are very interesting with respect to archaeology, tourism and also history of coastal engineering.

KURTULUŞ/ARISOY

In the present day, numerous marinas, fishing shelters and harbors are planned in Turkey by The General Directorate of Railways, Ports and Airports Construction (DLH). Not only their constructions, but also their managements have some problems. There are more than one hundred ancient harbors and cities along the Anatolian coast. Certainly, the historical background of maritime works, relying on the past of three thousand years, will add new insight to coastal engineering of the present day. In addition, they will contribute to us through their experiences and background.

On the other hand, the increase in life standard versus the decrease in working hours, the developments in transportation and telecommunication facilities have caused that much more people are getting fun in travelling to a new place or country. In this matter, called tourism, particularly yachting is one of the popular branches in developed countries. Success in the tourism rely to a great extent on lodging and auxiliary facilities. Thus, for instance, there are more than two hundred marinas in southern France. The importance of the matter has also been perceived in our country. So, some ministries intend to develop the coastal zone and to restore antique harbors.

Nature, sea and historical sites are combined in Anatolia. In this aspect, the authors have recently carried out a study covering the subject in a much wider scope as the MSc thesis of the first author under the supervision of the second author (Kurtulus, 1993). In this study, short histories, locations, physical characteristics in the past and now, and reconstruction possibilities of antique harbors have been investigated from available maps, archaeological literature and other documents. Additionally, some of them are investigated in their places. This paper, mainly based on the study mentioned above, presents some features of the most interesting ancient harbors in Anatolia with respect to its reconstructions possibilities.

History of Shipping

From the earliest times, man has used waterways as a convenient and economical means of transport, not only for people but also for cargo. In addition, maritime lines had been preferred to travel on land, which was dangerous. In the beginning, small sandalwood, boat and caiques had been used for shipping; estuaries and natural inlets chosen for maritime activities. Then, the increase of requirements and port activities resulted in the construction of new ships and places having safer area. Vessels had been developed, their draft had been enlarged and they were seaworthy. Thus, some problems had taken place in their mooring, maintaining and repairing. This led to establish new places called harbor and shipyard.

It is estimated that the draft of sailing ships is approximately one meter. Although commercial and military ships have the same construction technique, their shapes are different. Military ships are thin and long, in addition, they have high moving capability. The commercial ships have wide hull. First, their weight was 70-80 tons; after 1500 BC, this capacity exceeded 150 tons. At third century BC, huge ships with lengths over 50 m, width 14 m, height 13 m and load capacity 1300 tons had been made. These ships had been used for the transportation of cereal between Egypt and Rome (Özdağ, 1991). An illustrated picture concerning antique ships and mooring at quay is given below (Figure 1).

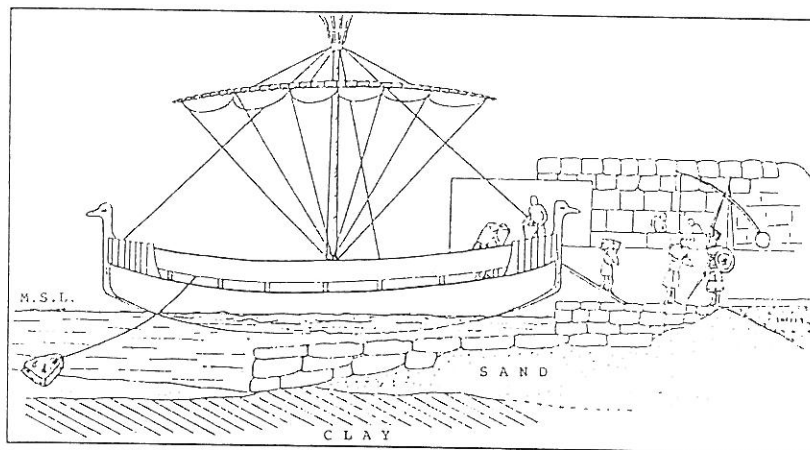


Figure 1. An illustration of an antique harbor (Raban, 1988).

In this period, there were port activities like loading, unloading, inspecting and storing similar to the present day practice but certainly, more elementary and uncomplicated. Items are carried by hand and used a simple block and tackle system with pulley and rope in loading. Liquids, like wine or oliveoil, were conveyed and conserved by using potteries. The pottery found in old Cnidos was probably storing oliveoil (see Figure 2). In this period, usually quays have been built from regular rocks. In many wharfs, rocks had been joined by metal bars (Figure 3). Ancient vessels have stone anchors. Numerous stone anchors have been found at excavations made in Mediterranean. Some of them are shown in Figure 4.

From the tenth century BC onwards, harbor construction took place in Anatolia. Thanks to underwater construction techniques, developed in seventh century BC, jetties laid into the sea could have been established. Thus, it was

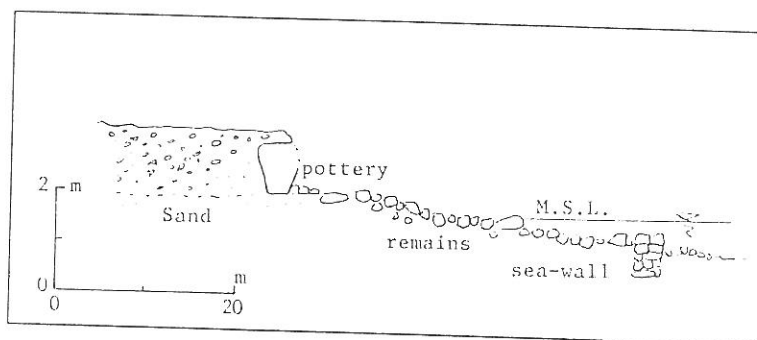


Figure 2. The oliveoil pottery in Old Cnidus (Kayan, 1988).

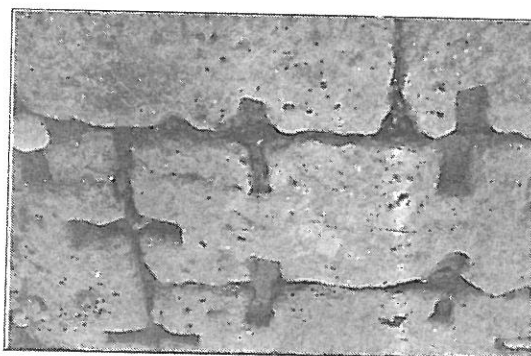


Figure 3. Connection tracks on the quay rocks in Soloi-Pompeipolis (Mersin-Viransehir).

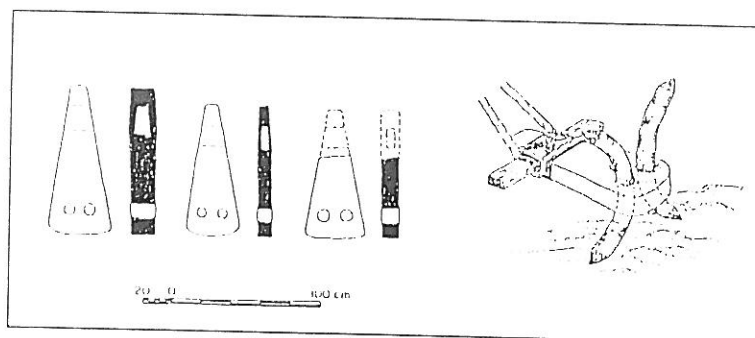


Figure 4. Stone anchors (Nibbi, 1991).

possible to make artificial harbors. Underwater excavation researches, made during the last three decades in ancient seaside cities, have shown us that the building techniques of conventional breakwater were also well-known in ancient times. Even, breakwaters with various types had been realized under different circumstances of soil and water. Two major types of them are the filling of rough rubble between two sea walls built on bottom, and the submerged caissons prefabricated on land, floated and then sunk with heavy sinkers just to their place. In addition, some remains found in recent studies show that ancient sea people were able to solve urgent problems like erosion of sand, sediment transportation, scouring and silting. Some examples are: diversion channel or dredging to prevent silting, retaining walls against wave forces, rough rubble or quarry debris pillow and foundation improvement for weak subsoil (Raban, 1988). A typical antique breakwater cross-section is given in Figure 5.

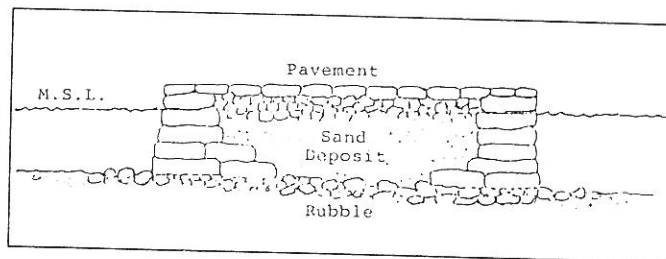


Figure 5. Tentative cross section of an ancient breakwater

Antique Harbors

a) The Blacksea Coasts

Although the earliest remains of water works in Anatolia date back to the Hittite period - the 2nd millennium BC - (Öziş, 1987), the first notable ancient harbors date from the Ionian period. Strabon, the famous geographer who lived in Nysa, had pointed out that there were numerous harbors in Anatolia, in his book "The Geography". The famous Turkish mariner and geographer Piri Reis had travelled all over the Mediterranean in fifteenth century. He combined his explorations in the work entitled "Kitab-ı Bahriye" in 1520. In this book, all cities on the sea, harbors, bays and mooring areas have been indicated by Piri Reis. A similar work has been performed by Captain Beaufort. Especially during the last three decades, ancient cities on the sea gained intensive interest with regard to archeology, geology and coastal engineering. Hartleben, Fleming, Blackman, Knoblauch, Ruge, Wilhelm, Heberdey, Mansel and Serdaroğlu are the earliest researchers on this matter.

There are more than one hundred ancient harbors in Anatolia. Most of them are set up along Aegean and Mediterranean coasts. Trapezus (Trabzon), Amisos (Samsun), Sinope (Sinop), Armene (İnceburun) and Hieracia (Zonguldak Ereğlisi), located in the Blacksea region, were destroyed to a great extent and lost their original forms.

The Bosphorus with special locations has been of great importance since the earliest time. Especially, Golden Horn is a natural port. For that reason, this area is keeping on importance, today. Byzantium (İstanbul) was colonized by Byzas who was the Magerian commander in 657 BC. Roman Emperor Constantine-I conquered the city in 330 AD, and renamed it as Konstantinapolis. The city has then became the capital of Roman, Byzantine and Ottoman empires, respectively. İstanbul is also today the greatest metropolis of Turkey. The remains of the ancient harbor of İstanbul are destroyed and covered completely by modern constructions. There is another ancient port city in Bosphorus in the Asian side: Khalcedon (Kadıköy). Although this city had two harbors, even in ancient time, it has been expressed that they are unsuitable due to strong Bosphorus currents and excessive silting (Hartleben, 1963).

Kios (Gemlik), Daskylion (Eşkel Limanı), Kyzikos (Erdek), Priapos (Karabiga) and Parium (between Karabiga and Lapseki) are in the shore of the Marmara Sea. At the western coastline of Çanakkale Strait (Dardanelles), there were ancient harbors of Lampsakos (Lapseki), Gallipolis (Gelibolu), Abydos (Nara), Sestos (Eceabat), Dardanos (Çanakkale) and Eleussa (Seddülbahır).

b) The Aegean Coasts

The Aegean coastline is quite winding. This geographic formation create many natural harbors. Aenus (Enez), Lysimachia (Bakla Limanı), Kardía (Güneyli Limanı), Alepe Conessus (Ece) are in Saros Bay; Troia (Hisarlık), Sigeion (Yenişehir), Tenedos (Bozcaada), Alexandria Troas (Eskiistanbuluk) and Assos (Behramkale) in Biga peninsula. Two of them, A.Troas and Assos, have remarkable harbors. There are two breakwater in A.Troas. The main breakwater, with a length of 260 m and width of 10 m, in A.Troas, is completely submerged. The basin of the harbor has been transformed to the lagoon at present. Assos is the most important city of this area and its settlement dates back to sixth century BC. Archaeologists are actually carrying on excavations and reconstructions works. The breakwater and the quay of the harbor have been repaired by Ü.Serdaroğlu, and began to be used by local fishing boats.

There are a dozen natural and artificial harbors between Edremit and Izmir bays. Some of them are: Adramytion (Burhaniye), Aterneus (Dikili), Karene (Bademli), Pitane (Çandarlı), Elaëa (Reşadiye), Grynion (Yenişakran), Myrina (Aliğa-Yenişakran), Kyme (Aliğa-Nemrut), Phokaa (Eskifoğa) and Leucaea (Çamaltı tuzlası). Myrina has been severely damaged by an earthquake in 30 AD; but, the breakwater with a length of 50 m is partly in good condition. Its stone blocks are scattered and awash. The upper surface of the breakwater is 40-50 cm above sea level (Figure 6).



Figure 6. The Myrina Breakwater.

Symrna (Izmir) dates back to 3000 BC, and is the most outstanding city of western Anatolia. During the ancient time, it has been resettled on several occasions. The first settlement place is Bayraklı. Then, in 300 BC, a new city was founded in Kadifekale owing to increasing population. Archaeological excavations and findings indicate that old Symrna had two harbors and the sea level was lower than the present position. The harbors were wholly covered by sand brought by the Meles river. The excavation works have been continued in Symrna. It is considered that the fountain recently found is the oldest one of İonia and was probably built to feed the harbor.

Klazomena (Urla-İskele), Erythrai (İldır) and Teos (Seferisar-Sığaek) are other seaside cities in this area. They were especially active in the Roman period. In addition, between Çeşme and Efes, there are a lot of natural harbors and mooring places: Çiftlikköy, Kaystes (Kokar), Geerhaiddai (Doğanbey), Lebedus (Kısık), Notium (Ahmetbeyli).

Ephesus (Efes), situated 7 km far from seaside now, was one of the most important cities in western Anatolia. The city was first established 1.2 km to the west of Artemis Temple in tenth century BC. In third century BC, the city was

rebuilt in its present location. Ephesus is in rather good condition compared to other antique cities. It has striking temples, theater, library, gymnasium, bazaar (agora), water supply systems and wide streets. But, its harbors had been fairly affected by the silting originated from the Küçükmenderes River. Although the number of harbors and its places are still discussed, it is pointed out that Ephesus had a dockyard and two harbors, Koressos and Panormos, except the one next to the famous Harbor Street. The harbor located at the end of the Harbor Street is swampy and covered with rushes. DLH intend to restore this harbor and to connect to the sea by way of a channel. Thus, this harbor will be used by tour boats and tourist yachts. In addition, a modern marina is planned at the end of this channel. Priene (Güllübahçe), Miletus (Milet) and Didyma (Didim) are three of the twelve important cities of the Ionian Union. Büyük Menderes river carries a large amount of sediments, so that, Priene and Miletus became located far from the sea. The shorelines, in ancient period and present, are given in Figure 7.

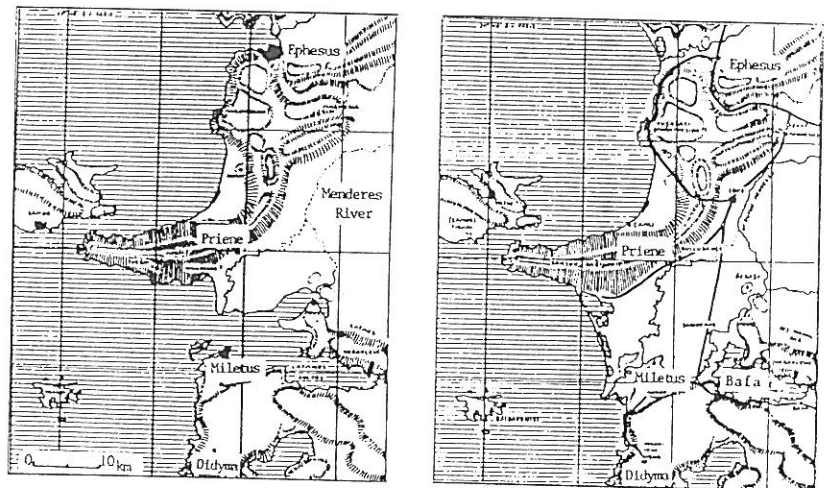


Figure 7. Shorelines of western Anatolia, in past and now
(after Archaeologist Doğu Gökse)l)

Miletus, the most important city of this region, is colonized probably by Mykenians in sixteenth century BC. It entered to Ionian Union and was the most powerful city of this area; destroyed by Persians in 494 BC; was then reconstructed with perpendicularly crossing roads principle by Hippodamos. The city had been prosperous in I. and II century AD. The harbor, located to the north of Miletus, is famous for The Temple of Harbor and sculptures of lions, guarding the harbor (see Figures 8 & 9).

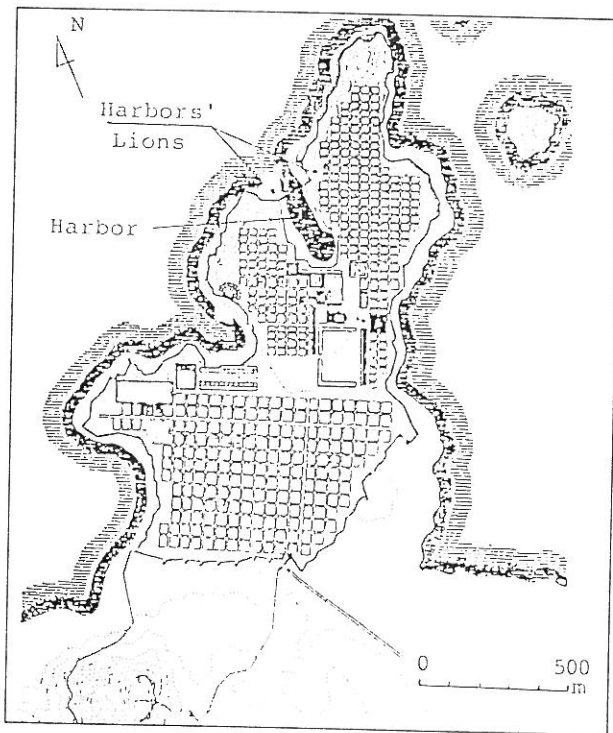


Figure 8. City plan of Miletus (after Akurgal, 1990)

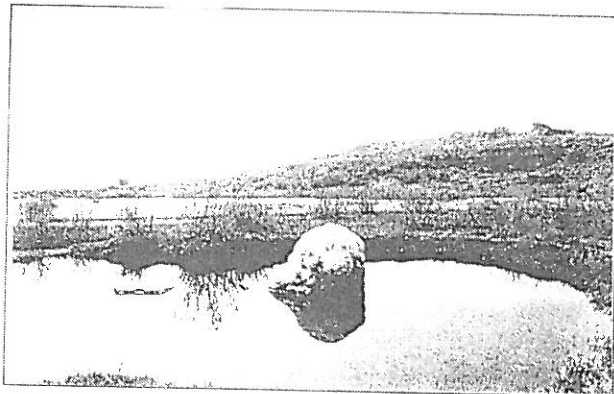


Figure 9. One of the Harbors' Lions of Miletus.

Although the Bafa Lake has been the Latmus Bay, as shown in Figure 7, Büyük Menderes River filled up the mouth of the bay with sand. In this shore, Heraklia and Grikairi were probably cities which had harbors (Fleming, 1972). The magnificent temple of Apollon in Didyma is located 20 km south of Miletus. Southward from Didyma, many cities and natural harbors are situated near the sea: Teichiussa (Kazıklı koyu), Iassus (Kıyıcakışlacık), Bargylia (Asarlık), Karyanda (Güvercinlik), Gölköy, Myndos (Gümüslük), Karatoprak, Halikarnassos (Bodrum) and Cedreae (Taşbükü). Especially, it is possible to see the remains of the harbors of Bargylia and Myndos (see Figure 10).

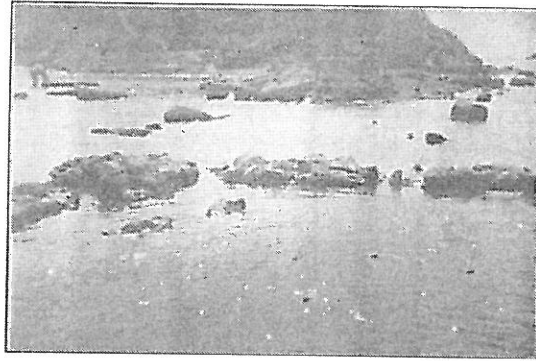


Figure 10. Wharf remains in Myndos.

The Halikarnassos Harbor was located at the site of the modern marina. Its breakwaters were repaired by DLH. In archaeological resources, it is pointed out that the city had also a secret military harbor, which can be closed in dangerous situation.

Datça Peninsula is considered to be a suitable place for settlements with respect to agriculture, animal and trade. The earliest colonization in this region dates back to the 2000 BC. The first settling place, called Old Cnidus, is chosen near the present Datça town. Then, in fourth century BC, it is relocated to The Cape of Tekir, in order to be nearer to the ocean. Old Cnidus had four harbors. The city and its harbors are today damaged to a great extent. But, new Cnidus (Reşadiye) is partially well-preserved. There are two harbors in Cnidus. One of them (north harbor), which has dockyard and closeable entering mouth, had been used for military services. The other (south harbor) was for trade. The breakwater of the south harbor is in quite good condition (Figure 11). The coupling ring made of stone on the quay is interesting (Figure 12). This harbor is actually used by tour boats and tourist yachts.

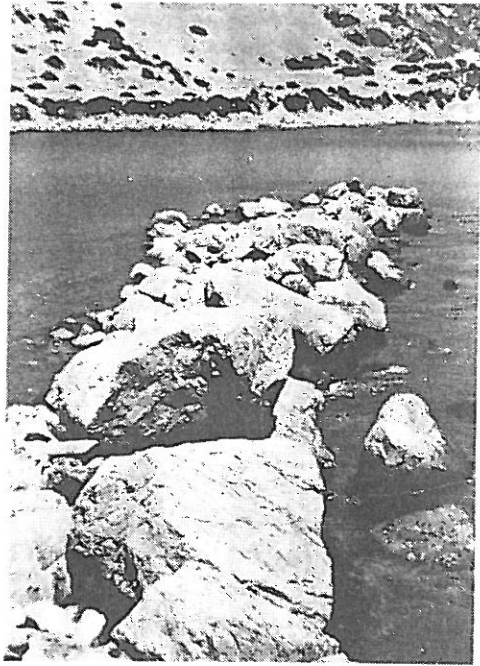


Figure 11. Breakwater of south harbor in Cnidus.

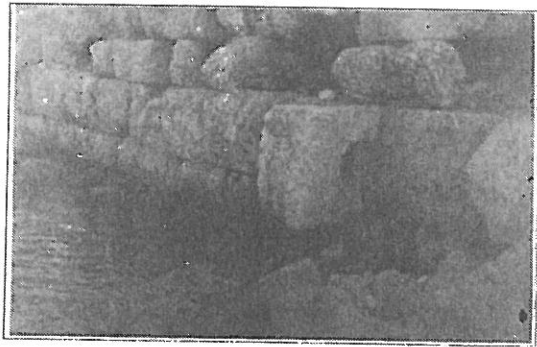


Figure 12. Coupling ring on the wharf in Cnidus.

c) The Mediterranean Coasts

Although the Mediterranean coastline is fairly straight to build harbors, numerous of ancient harbors were set up. They are: Saranto (Kızılyer), Physikos (Marmaris), Loryma (Aziziye), Kaunos (Köyceğiz-Dalyan), Telmesos (Fethiye), Patara (Gelemiş), Antiphellus (Kaş), Aperlae (Sıcak Yarımadası), Apollonia (Üçagöz), Andriake-Myra (Kale), Olimpos (Çıralı), Phaselis (Tekirova), Attaleia (Antalya), Aspendos (Belkis), Side (Manavgat-Selimiye), Ptolemais Augaia (Fığla Burnu), Hamaxia (Sinekkalesi-Elikesik), Koracesium (Alanya), Laertes (Mahmutlar), Selinus (Gazipaşa), Kharadrus (Kaladran Köyü), Anemuryum (Anamur), Nagidus (Eski Anamur), Arsinoe (Bozyazı), Kelenderis (Gilindre), Holmi (Taşucu), Seleukeia (Silifke), Korykos (Kızkalesi), Elaiussa Sebaste (Ayaş), Soloi Pompeipolis (Mersin-Viranşehir), Tarsos (Tarsus), Aigaii Amanide (Yumurtalık), Issos (Dört Yol) and Seleucie Pieria (Samandağ-Çevlik). Some of them are very interesting with respect to coastal engineering.

Phaselis, having three harbors, is one of the harbor cities of great interest in Mediterranean. Because its soil was improper to agriculture, the city had highly developed in trading, thanks to these harbors. Phaselis harbors have been investigated by many researchers. Even, in 1969, two researchers, Helmut Schlager and his assistant Udo Graf, drowned in a tragic accident. Their studies have been completed by the German researchers Jörg Schafer, Paul Knoblauch and D.J. Blackman. The plan of the city is given in Figure 13.

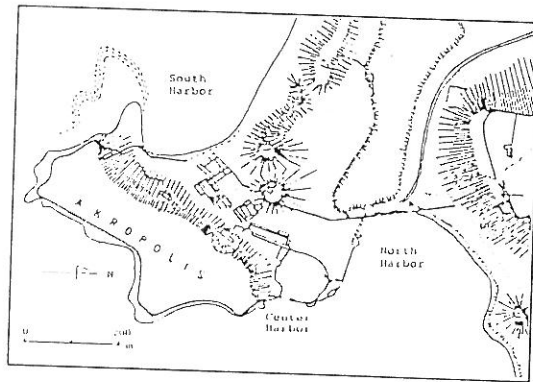


Figure 13. Plan of Phaselis after Blackman (1973).

The breakwater of the south harbor of Phaselis with a length of 100 m, stretched out underwater from land into sea. The head of the breakwater is at

a depth of about 5-6 m below M.S.L. The bottom is at a depth of 12 m. The remains of the breakwater are scattered in the harbor. Probably, it was more exposed to the waves.

The center-harbor of Phaselis is located at the end of the main street of the city. This harbor is small, but well-preserved. The mouth of the harbor has a width of about 10 m. The coupling structures are placed irregularly. Apparently, since this harbor was insufficient for the port activities, the others had been constructed. The north harbor's breakwater has a length of 235 m and width of 4 m. The rock-cut blocks at the seaside of this breakwater are damaged by wave action.

The other important city in this region having a harbor is Side, founded in seventh century BC, especially developed in the Roman period. Side harbor underwent several changes along the course of the time. Manavgat River influences intensively the harbor. So, in a short time, the harbor was filled by the sediments. P. Knoblauch has investigated the changing of the harbor. The plan of Side Harbor after Knoblauch is given in Figure 14.

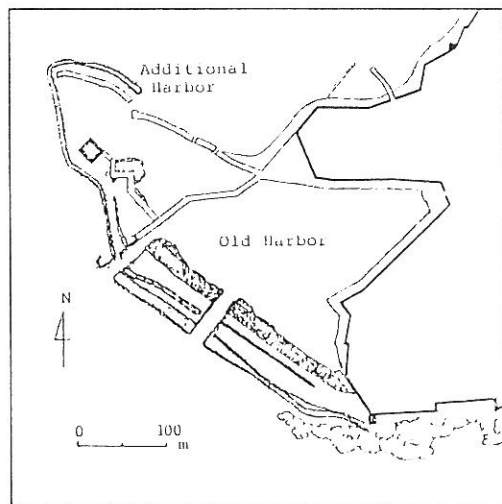


Figure 14. Plan of Side Harbor in the V. century AD, after Knoblauch (1977).

Soloi-Pompeipolis near Mersin, is set up in seventh century BC, by the seafarers coming from Rodos. The harbor of Soloi is at the end of the famous street with marble columns. The street and the breakwater of the harbor are shown in Figure 15.

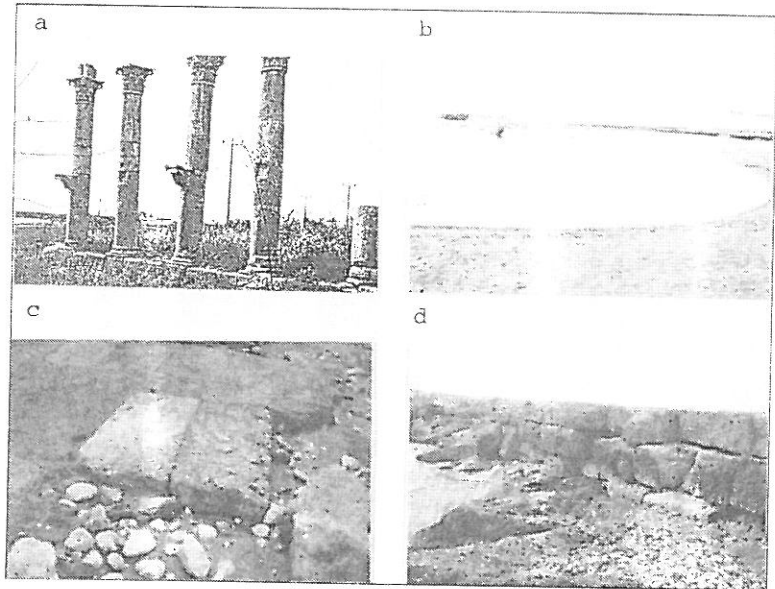


Figure 15. a) The harbor street b) The breakwater c) The rock-cut well blocks at the breakwater d) The wharf in Soloi-Pompeipolis

Seleucie Pieria, the earliest settling dates back to 4500 BC, is the end of the coast of Turkey in the eastern Mediterranean. The city flourished especially in the Roman period, when the harbor was set up. The most interesting feature of this harbor is that a river diversion system is constructed to protect the harbor from silting. The flood diversion system, having a total length of 875 m and a hydraulic capacity of $70 \text{ m}^3/\text{s}$, consists of a diversion dam, open channels and two tunnels, basically excavated in limestone (Alkan & Öziş, 1991).

Conclusion

Anatolia is to be considered as one of the exceptional places in the world with respect to ancient harbors. More than one hundred harbors were constructed in the ancient times. Although many of them were damaged by silting, waves, earthquakes, wars, still valuable knowledge can be gained from them for the design of modern structures. On the other hand, any attempt should be made to reconstructed and put to actual use; some of them are Assos, Ephesus, Kaunos, Cnidos and Phaselis.

The future of the human being will very likely depend upon the use of the seas for food, transportation, tourism and raw materials. At the present, the research on Coastal Engineering, especially in subject of port and harbor

planning is continuing. In spite of continuous advances in science and technology, the engineers run everyday into several problems regarding the construction and management of harbors. Obviously, studies on ancient harbors can give considerable insight into the design of offshore structures. This study showed that the vital destructions of the ancient harbors were due to silting by sediments of the rivers. This silting problem mostly originated from the preference of the settlement location close to a large fresh water body like rivers and creeks. Today's engineers will probably have to deal with the same problem in the design and maintenance of modern marine structures.

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