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Early Harbour Structures in the Eastern Mediterranean from the Fifteenth to the Sixth centuries BCE

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Abstract: This contribution explores the developments in terms of harbour facilities between the fifteenth and the sixth centuries BCE in the Eastern part of the Mediterranean basin (i.e., Egypt, the Levant, Cyprus, Anatolia, and the Aegean). In particular, it seeks to analyse how coastal communities responded to the following harbour needs: improving the protection of the basin from the meteo-maritime dynamics, offering space and device for ships to moor, facilitating hauling manoeuvres, and increasing the visibility of the harbour. For each of these needs this article will evaluate how harbour facilities evolved during the period under consideration, eventually tracing an overview of the status of harbour areas in the second and first millennium BCE Eastern Mediterranean.

Keywords: harbour technology, Eastern Mediterranean, harbour works, coastal environment

Introduction

Harbours can be defined as places located at the crossroads between land and water used by ships to find a protection from dangerous seas, as well as for loading or unloading goods and people. Subsequently, the term itself does not necessarily imply the presence of particular structures, since −as long as routine activities can be performed− harbour areas could range from completely natural locations to fully artificial environments (Tartaron 2013, 4–5).

There is no doubt that the earliest harbours were located in places which were particularly favoured by nature or geomorphological conditions; however, our understanding of when and how human communities began to adapt the coastline to their own needs is still under construction and has to be tailored according to the space we are referring to. As far as the Mediterranean is concerned, for example, the transition from completely natural harbours to the emergence of the first, permanent harbour structures seems to have occurred between the second millennium BCE and the first millennium BCE. At this point in history, the long-distance trade network demanded improvements in both harbour facilities and capacity,[1] thus resulting in a progressively-increasing human action on the shoreline.[2]

The aim of this contribution is to assess the earlier phases of human adaptation of the coast to harbour needs in relation to the Eastern Mediterranean (i.e., Egypt, the Levant, Cyprus, Anatolia and the Aegean), which is where the first harbour structures have been recorded within the Mediterranean context (Figure 7.1). As for the chronology, it will focus on the period between the fifteenth and the sixth centuries BCE as it offers fertile ground to better understand when and how specific harbour structures began to be documented. In particular, the initial date −i.e., the fifteenth century BCE −has been selected because it provides a very likely context for the first attempts to improve the Mediterranean shoreline with either permanent or temporary structures;[3] on the other hand, the sixth century BCE represents the moment starting from which the number of permanent (and large-scale) harbour structures significantly grows and, with it, the archaeological and literary information which is available to us.[4] From a theoretical point of view, the selection of such a wide chronological arch allows to consider this phenomenon from a *longue durée* perspective, thus appreciating possible changes or parallelisms. Furthermore, it also encompasses the so-called 'Dark Age' (*c.* twelfth – ninth centuries BCE), a

[1] The roots of this large-scale trade network can be traced back to the third millennium BCE when commercial relations were established across western Asia and the eastern Mediterranean (Broodbank 2010, 250; and 2013, 355).

[2] As early as the fourteenth and thirteenth centuries BCE, the weight of the cargo and the dimensions of the ships in circulation likely made it difficult to load and unload them without mooring near the shoreline. Examples of LBA ships are the Uluburun (Kaş, southern Turkey) and the Cape Gelydonia (Besadalar, southern Turkey) wrecks. The Uluburun wreck (*c.* 15–16 m long) dates to the fourteenth cent. BCE (Pulak 2005), while the wreck of Cape Gelydonia wreck (*c.* 10 m long) dates back to the thirteenth cent. BCE (Bass 1991).

[3] As early emphasized, the construction of such structures may relate to the increase experimented in the dimension of the vessels (see previous note).

[4] Mauro 2019a, 78.

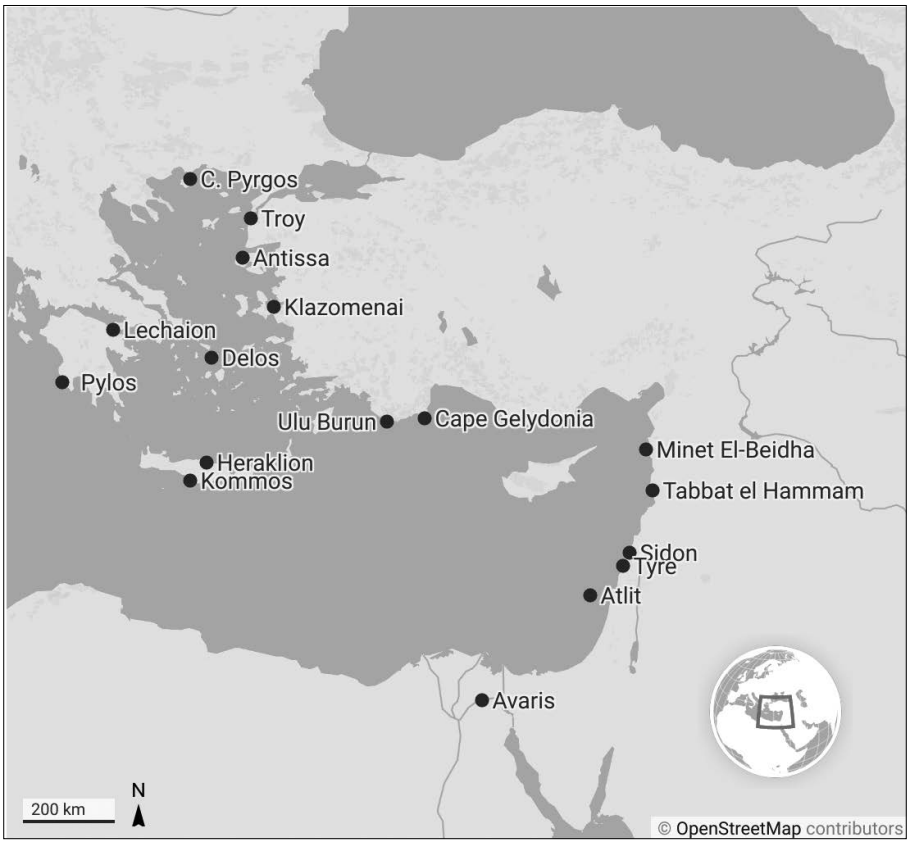

Figure 7.1. Map showing the main places mentioned within the text. Source: Mauro.

phase that is traditionally believed to contain profound cultural and economic transformations. The 'Dark Age' is frequently seen as a chronological boundary by Bronze Age and Iron Age specialists, who use it as a reference that marks the end and the beginning of their respective areas of expertise.[5] Subsequently, covering the millennium between the fifteenth and the sixth centuries BCE, this study also encompasses two periods that are usually considered separately, thus offering a view on possible continuity or discontinuity phenomena in terms of harbour technology.[6]

If, on the one hand, the wide chronological timeframe offers a sense of perspective, allowing us to detect how harbour structures changed during the period under consideration, on the other, it inevitably flattens the details. To this backdrop, we should add that the page limits – together with the selection of the Eastern Mediterranean as geographical mark – impose us to do not enter into the idiosyncrasies of the different communities who were responsible for the building of those structures.

With regard to the harbour structures analysed, the focus is on those facilities that were built to improve the experience of ships approaching, anchoring or mooring into the harbour basin, i.e., breakwaters, moles, quays, wharves, mooring and signalling devices. In particular, the text will be divided into different sections, each one dealing with a specific harbour need and analysing how it was possibly fulfilled during the period under examination. The expectation is that this discussion will provide an overview on how humans responded to different harbour needs and what kinds of development could be detected during the timeframe and the geographical area under consideration. However, it is first necessary to disclose major biases connected to this study and clarify how they will be possibly mitigated.

Biases Connected to the Study of Harbour Facilities and how to Mitigate them

Focusing on harbour structures and their development does not mean carrying out an exhaustive study of ancient harbours: this is certainly the first thing that must be clarified. Over the last 50 years, scholarship has already successfully demonstrated that harbours are not just the facilities they are equipped with; rather, they are complex systems composed of elements that are both material (e.g., shipwrecks, land remains) and immaterial (e.g., place names, traditions of usage) (Parker 2001; Westerdahl 1992). In light of the foregoing, an analysis of harbours that is exclusively focused on structures could be misleading, as we know that many places were used for a long time

[5] In this sense, see for example the recent contribution by Knapp (2018), who sets the chronological limit of his book at the end of the Bronze Age.
[6] In the last 15 years, two PhD theses have dealt with both Bronze Age and Iron Age harbours, i.e., Carayon (2008) and Noureddine (2016); both of them, however, focused exclusively on Levantine harbour areas.

as nautical shelters without having ever been provided with permanent or monumental structures.[7] Subsequently, the analysis of harbour works that will be performed here represents just one of the possible approaches through which archaeologists can gain access to ancient harbours and it does not pretend to offer an exhaustive view on harbours during Antiquity.

The second factor that need to be assessed is that the data on ancient harbour works that will be presented is inevitably incomplete, due to different phenomena. First, issues of coastal dynamism should be considered (Ford 2011, 3): coastal zones themselves are dramatically active settings in which processes like subsidence, erosion, deposition, bradyseism and other general volcanic activities take place; these events alter both the landscape and its components in a substantial way.[8] Second, one should take into account the archaeology's own biases: over time the majority of ancient harbour facilities may have been lost because of the perishable materials used in their construction or because they have been exploited.[9] Moreover, there have been cases where ancient harbour facilities have been incorporated into later buildings to save time, effort and materials; or where later interventions conducted within port areas have completely destroyed the previous assets of a specific harbour.[10] All these interventions mean that the archaeological evidence in harbour areas is extremely fragmentary and complex (Ford 2011, 3).

Lastly, to make the picture even more harsh but certainly more realistic, it is necessary to outline that even when ancient harbour works have been preserved their dating is often difficult to determine: harbour architecture had, in fact, largely relied on techniques that had a continuous use over time (e.g., rubble mounds or rock cutting). Additionally, innovations introduced in harbour technology have not been adopted everywhere at the same time or in the same way; rather, conservative elements – derived from the local worker traditions – have frequently continued to persist.[11]

Whilst there is no conclusive solution for exhaustively reconstructing the scene of harbour works during the second and first millenniums BCE, it is still possible to reduce, at least partially, the previously discussed biases by applying a holistic approach. In this paper, the scattered archaeological evidence will therefore be counterbalanced with (the very limited) data originating from iconography and literature. Furthermore, to bring some unpreserved remnants into the conversation, we will discuss certain structures that – because they were made of perishable materials – have been lost and did not leave any trace. Such an inclusive approach has been already used by Basch (1987) and Wachsmann (1998) to study seagoing ships, or by Blackman (1982a; and 1982b) in his pivotal twofold paper on ancient harbours. Within this contribution, we will rely once again on this approach as it is in line with the goal of providing an overview on this particular period and area that is representative rather than exhaustive.

Harbour Structures

As stated at the very start of this contribution, harbour structures were not a *conditio sine qua non* in the ancient Mediterranean: here, the wind and wave ecosystem – together with the jagged nature of the coastline – has in fact allowed various natural locations to be used as harbours with little or no modifications to serve their purpose.[12] Harbour structures were therefore chiefly intended as an enhancement to an already extant natural protection, or as a way to create a safe shelter in an unprotected area that, due to its continental conditions, demanded the presence of a nautical hub (Karmon 1986).[13]

Essentially, a harbour area needed to fulfil four needs:

- protecting the basin from the waves, currents and winds;
- providing space and devices to moor;
- facilitating the beaching of the ships;
- making the harbour more visible and easily identifiable from afar.

As we will see, particular characteristics of the coast could have already favoured these operations without the need to build any artificial structure: as an example, the presence of a headland projecting into the sea in a parallel or transversal direction in relation to the shoreline could have acted as a natural breakwater. However, in cases where the geomorphology of the coast did not itself suffice, facilities were built to artificially recreate these favourable conditions.[14] In the Eastern Mediterranean, such a process possibly began during the second millennium BCE.

[7] This is the case of the Phaleron that, despite having been the main harbour area of Athens before the fifth century BCE, was never provided with specific devices: Garland 1987; Mauro 2019a, 75.

[8] See, as an example, the case of the harbour of Tyre (Lebanon) that during the period analysed by this contribution was an island; however, this island was later connected to the mainland through a semi-artificial tombolo as soon as in the second half of the fourth century BCE. For more details on the geomorphology of Tyre, see Marriner, Goiran and Morhange 2008.

[9] Wooden mooring devices have been identified on the upper part of the external mole at the Lechaion harbour, Corinth (Mauro 2019a, 55).

[10] Between 1880 and 1920, for example, the Piraeus underwent considerable interventions with the construction of a new urban plant (Dragatsis 1885; and 1900).

[11] Contrary to Lehmann-Hartleben (1923, 45–65) – whose monograph is organized so as to suggest the idea that the development of harbour works was a consistent process – Blackman (2008, 638–40) correctly called the attention to the fact that heterogeneous situations can be found in harbour areas.

[12] The advantages and disadvantages of different natural situations have been analysed by Blue 1997, 31–4; Flemming 1980; Mauro 2019a, 25–43; and 2019b; Vann 1994, 302–20.

[13] E.g., inland routes connecting a particular coastal area with other centres of economic activity, the nature of the hinterland or the traffic demand of the territory.

[14] It is necessary to state that facilities were not built in all cases in which the natural protection was only partial: their construction also depended on other factors, e.g., ambition, economic resources, political agenda, etc. (Shaw, J.W. 2018).

Protecting the Basin from Waves, Currents and Winds

The protection of a basin from waves and winds was certainly a primary concern. Some places were already capable of providing ships with shelter as they could count on offshore sandstone or reef formations dissipating the incoming waves. One example is the 600-m long offshore quaternary ridge that protected the northern harbour of Sidon (Lebanon) (Marriner et al. 2006, 2). However, not all harbour basins were naturally provided with a barrier against winds and waves; in such cases, it was necessary to enhance the level of protection either by building one or more specific structures (i.e., breakwaters and moles) or by creating an inner basin artificially connected to the sea. While outside the Mediterranean both kinds of interventions have been documented from at least from the third millennium BCE,[15] in the Eastern Mediterranean – according to the current state of the knowledge – similar works made their first appearance during the first half of the second millennium BCE. What apparently seems a 'delay' can be actually justified in light of the different, and more favourable, environmental conditions extant in this particular geographical context.

In particular, the first attempt to create an inner harbour connected to a wider sailable area has been documented in the ancient site of Avaris, modern day Tell-ed-Dab'a (Egypt). Here, an inner basin measuring 450 x 400m was connected by canals to the Pelusiac branch of the Nile as early as in the Middle Kingdom (Bietak 2008; and 2010, 18; Forstner-Müller 2009). Slightly later, but equally attributable to the second millennium BCE, are two artificial interventions identified at Pylos (Navarino, Greece) and Troy (Hisarlik, Turkey) that Zangger and his team interpreted as possible inner harbours linked to the sea (Zangger et al. 1997; and 1999). Such artificially excavated basins could be considered as the predecessors of a long tradition, eventually culminated in the Phoenician *kothon*.[16]

As for breakwaters and moles, they were probably born as an attempt to artificially replicate a phenomenon that already existed in nature, i.e., the restraint of the action of meteo-maritime dynamics operated by natural barriers. However, the chronology of their introduction in the Mediterranean is more difficult to establish with certainty since they were built with continuous techniques that impede an accurate contextualisation unless external dating elements can be found to compensate for this limitation (Mauro 2019a, 49). Apparently, the first examples of manmade structures that can be more accurately dated are attributed to the ninth or eighth century BCE, as this seems to have been the case for the facilities found at Tabbat el Hammam (Syria), Atlit (Israel) and Tyre (Lebanon); however, previous attempts to reinforce already extant natural barriers were likely realised earlier. In the case of Tabbat el Hammam, a breakwater was built on the northern bay, starting from the *tell* on the top of which the settlement was located; this L-shaped breakwater was built on the sandy bottom using dressed blocks and it measured approximately 130m, having a width of *c.* 8m (Braidwood 1940, 207–8).[17] In Atlit two straight breakwaters (NW and SE) have been detected, associated with two perpendicular quays. The C^{14} analysis carried out on the wooden wedges of the NW quay suggested the late ninth or the early eight centuries BCE as the possible construction date;[18] therefore, if all these structures pertain to a same harbour amelioration, the two breakwaters should also be ascribed to the beginning of the first millennium BCE (Haggai 2006, 52; Carayon 2008, 324–8). Lastly, Noureddine's recent archaeological campaigns in the northern harbour of Tyre have proposed a similar dating (ninth – eighth cent. BCE) for a structure located 57m north of the modern jetty (Noureddine 2010; and 2019). Indeed, this chronology has been supported due to the close parallels between the Tyrian breakwater and the Tabbat el Hammam and Atlit structures (Noureddine 2020, 144). All these interventions realised on the Levantine shores can be justified in light of the fact that, at the beginning of the first millennium BCE, these settlements (i.e., Tabbat el Hammam, Tyre and Atlit) were at the center of a massive Mediterranean-wide network (Manning 2018, 44). Therefore, the increasing number of ships arriving at their harbours must have required the construction of structures capable of assuring them greater protection from waves and currents. In addition, the archaeological evidence found at these places shows that, as early as in the first centuries of the first millennium BCE, breakwaters could be built on different kinds of sea bottoms[19] and with different layouts;[20] and that their construction could have laid on extant ridges or have been established *ex-novo*.[21]

In the Aegean world, the eighth and seventh centuries BCE provide a very likely context for the very first large-scale attempts to improve the protection of the harbour basin (Blackman 2008). Indeed, even if written sources suggest that the first intervention of this kind was realised in the third quarter of the sixth century BCE (Hdt. 3.60.3)[22], the archaeological remains found at Delos (Cyclades, Greece) indicate that a breakwater could have been possibly

[15] I.e., the third millennium BCE Harappan site of Lothal (India), where a huge backed and brick-lined basin was identified in the late 1950s by Rao (1979, 125–34), and the third millennium L-shaped jetty excavated at Wadi al-Jarf (Egypt), composed of limestone blocks and large pebbles (Tallet 2013; Tallet and Marouard 2014).

[16] With regard to the first millennium BCE, the connection to the sea of Lechaion (Corinth, Greece) seems to be attributable to the seventh cent. BCE (Rothaus 1995, 296; Salmon 1984, 464). On the concept of *kothon* see Carayon et al. 2017.

[17] The breakwater has been dated on the basis of the pottery finds associated with the structure (Braidwood 1940, 206–8).

[18] These wedges were made of *Cedrus Libani* and *Olea Europaea* (Haggai 2006, 52).

[19] The sea bottom of Tabbat el Hammam is sandy (Carayon 2008, 249), while at Atlit the breakwaters are built on the rocky bottom (Haggai 2006).

[20] E.g., there are both straight breakwaters, like at Atlit, and L-shaped breakwaters, as seen at Tabbat el Hammam.

[21] At Sidon, the quaternary ridge was artificially reinforced to improve its action against meteo-maritime dynamics; at Tabbat el Hammam, the ninth cent. BCE breakwater is an example of a free-standing structure.

[22] Herodotus claims that the breakwater built in 530 BCE at Samos by the tyrant Polycrates was the first harbour work of the Greek world.

established in this area as soon as in the eighth or seventh centuries BCE (Duchêne and Fraisse 2001, 93; Lehmann-Hartleben 1923, 50).[23] Moreover, from the seventh century BCE onwards, the recurrence of these interventions significantly improved as both reinforcements of pre-existing natural reefs (as seen in Sidon) and free-standing structures (as previously in Tabbat el Hammam) were documented: an example of the first kind comes from the northern harbour of Antissa, on the island of Lesbos (Greece) (Koldewey 1890, tab. 6), whereas *ex-novo* structures are demonstrated by the two moles found at Klazomenai, modern day Liman Tepe (Turkey) (Artzy 2009, 14).

With regard to the construction techniques used for slowing down the impact of waves, currents and winds inside the harbour basin, two different methods of proceeding were already in use from the early centuries of the first millennium BCE. The first consisted of jettisoning piles of stones according to their unit weight: the inner core was composed of smaller pieces, whilst the external part was sometimes provided with larger stones capable of protecting the core against the waves. The second employed roughly faced and paved blocks, superimposed without any mortar. Understandably, both these techniques pose complex chronological problems as they were used continuously over time; structures of these kinds are therefore datable only in cases where external elements are found in connection with them.

Providing Space and Devices to Moor

Another basic need for a harbour basin was to provide ships with space (and possibly devices) to facilitate mooring operations. Mooring operations could be performed on unequipped shorelines; however, the mooring space at ships' disposal could also be artificially increased by equipping the inner side of the moles; as well as by building structures inside the harbour basin, i.e., along its perimeter (quay) or in correspondence with platforms perpendicular to the shoreline (wharves).

Artificial mooring structures were in use at least from the third millennium BCE, as documented in the case of Ur, in present day Iraq. Here, a small dock in mudbrick and bitumen has been identified (Blackman 1982a, 92; Shaw 1990, 429) and various written sources mention a word probably meaning 'quay' (e.g., R17.133 and R20.008, according to Sauvage 2012, 75). Within the second and first millenniums BCE Mediterranean, the presence of quays – and mooring structures in general – is extremely reduced, thus suggesting that loading and unloading manoeuvres were predominantly carried out on the shoreline or on flat planking levels. In this sense, second millennium BCE iconographic evidence, even if not directly coming from the Mediterranean shore, strengthens this idea, showing scenes of harbour life where people and goods are loaded and unloaded via ramps and gangways. For example, the scene represented in Kenamun's tomb at Thebes – dated around the 1386–1350 BCE – represent Syrian ships disembarking at an Egyptian harbour (Davies and Faulkner 1947); ships are moored by stern and their cargo is been disembarked by means of ramps on a straight level, probably the same shoreline or a platform (Basch 1987, 64, figure 114). Another relief, found in Queen Hatshepsut's funerary temple at Deir el-Bahri, depicts a similar scene, probably set at Punt (Oleson and Hohlfelder 2011, 606–37); however, in this case the cargo seems to be unloaded through gangways without steps. As for Mediterranean sites, we do not have any archaeological or iconographic evidence for the construction of quays or for the use of ramps during the second millennium BCE. Indeed, the chronology and interpretation of the thirteenth-eleventh century BCE 'quay' at Dor (Israel) has recently been questioned (Lazar et al. 2018). Subsequently, we can only guess that something similar to what Egyptian iconographic sources show was also taking place on the Mediterranean shores.

At the beginning of the first millennium BCE, the evidence for mooring structures slightly increases. The inner side of the above-mentioned mole at Tabbat el Hammam (Syria) could have been used for mooring purposes. Moreover, at Atlit (Israel) two quays (NW and SE) have been found in connection with two breakwaters: the SE quay was 38m long, while the NW measured 43m (Haggai 2006, 49–51). Following radiocarbon analyses conducted on the wooden wedges found on the NW quay,[24] this structure (and probably the entire harbour building programme) has been dated to the end of the ninth century or the beginning of the eighth century BCE (Carayon 2008, 324–8). Nonetheless, even if there is evidence of the construction of quays, iconographic sources coming from the Levantine area suggest that in several sites, unloading and loading manoeuvres possibly continued to be performed on the shoreline.

The Assyrian bronze relief from the gate of Balawat (ninth century BCE) and a bas-relief from the palace of Sennacherib in Ninive (eighth or seventh century BCE), for example, both depict scenes set at Tyre and do not include representations of mooring structures; rather, the departure scene and King Luli's escape illustrate a rocky shoreline not equipped with any facility (Figure 7.2). In general, therefore, despite the incrementation of testimonies during the first millennium BCE, we can imagine that the operations aimed at embarking and disembarking people and goods probably continued to be performed mainly on areas of coastline which were not specifically equipped. However, it should be stressed that, whenever present, the installation of quays and moles in harbours can be read as an indicator of the community's will to facilitate the arrival of ships, and this assertion can probably be justified

[23] The eighth century BCE chronology was first proposed by Lehmann-Hartleben (1923, 50) and later repeated by several scholars (e.g., Duchêne and Fraisse 2001, 93), but an archaeological reassessment has not been conducted, so that this structure is still waiting to be accurately studied and dated.

[24] See note 18.

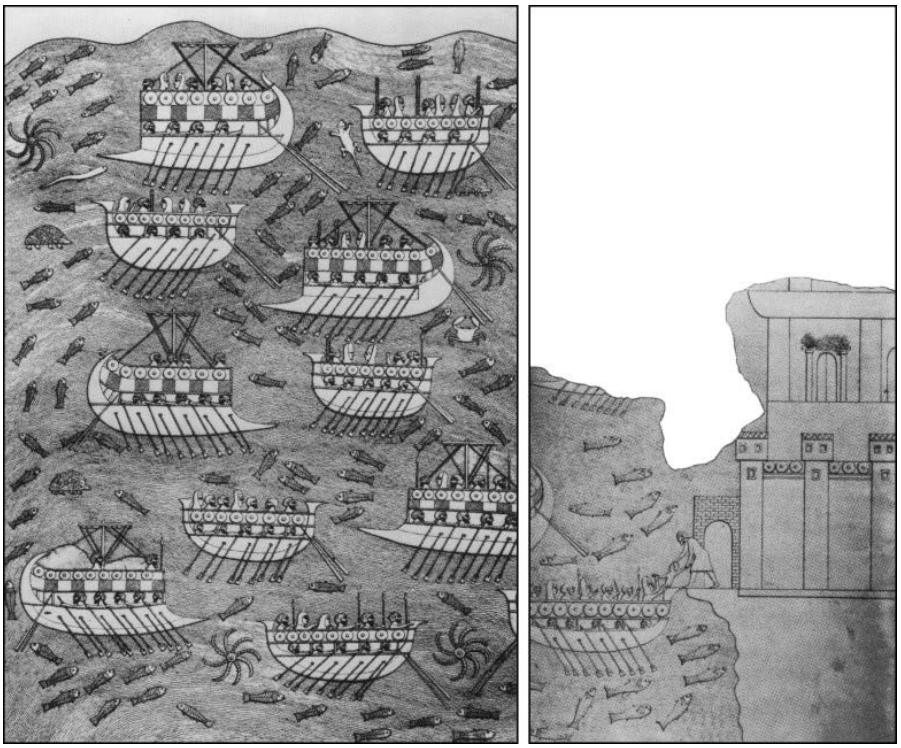

Figure 7.2. Representation of King Luli's escape from Tyre found in the Palace of Sennacherib at Niniveh (Iraq). Source: The New York Public Library Digital Collection.

by the frequent visits of large and medium cargo ships to the harbour basin.[25]

As for the techniques employed for the construction of quays, the scarce extant evidence shows that most structures were made using ashlars; this allowed workers to create a fairly level upper surface that could facilitate the transferral of people and merchandise. The headers of the ashlar blocks were usually placed towards the sea, whilst the stretchers were placed side by side. In the period under examination, no mortar, clamps or tenons were used to fasten together the blocks. The exact height that mooring devices (i.e., quays and wharves) reached above the water cannot be established with accuracy given the lack of substantial available evidence; however, it can be argued that it approximately coincided with the level of the deck of the mooring ships to comply with the necessity mentioned above, i.e., to ease the passage from the planking level to the ship and vice versa. In case a gap between the two existed, this was certainly smoothed out thanks to the use of ramps and gangways as the iconographic documents illustrate (Mauro 2019a, Figs. 2.2 and 2.3).

Another controversial issue that should be addressed when considering the mooring operations concerns the way in which the ships were moored to the quay or to the wharves. When the ships were approaching the shoreline, on-board hawsers were cast ashore to be attached to specific devices. Unfortunately, there is little evidence which can help to understand what these devices looked like during the second and first millenniums BCE. As a matter of fact, only a few examples of mooring devices dating to this period survive, probably because most of them were made of timber or metal. A funerary scene from the fourteenth century BCE found at Amarna could shed some light on this question, since it represents moored ships fastened with ropes to bollards, which appear to be vertically fixed to a platform (Figure 7.3). To this testimony, we should add the extremely varied ethnographical documentation that suggests that different techniques and devices could have been in use to fasten the ships. To provide just an example, in the Mediterranean context it is still common to observe ships moored to the shoreline through a long rope: once the ship anchors close to the coast, the crew can proceed to secure one or more cables from the stern to a fixed point ashore (e.g., a well-places tree or a rock of a suitable shape). In addition to bollards or stones positioned on the mooring area, the possibility of mooring bitts pierced into the rock through which ropes could be passed should also be highlighted.[26]

Facilitating the Beaching

Ships sometimes had to be extracted from the water when they were out of use or demanded maintenance. In case

[25] An example of this willingness could be seen in the harbour of the Lechaion (Greece): here, on the upper part of the external moles, flutes have been identified and interpreted as cavities for wooden wharves to be built (Pallas 1995).

[26] The existence of mooring bitts pierced into the rock can also be deduced from Hom. *Od.* 13.77, who mentions a 'pierced stone' permanently fixed in the harbour of the Phaeacians.

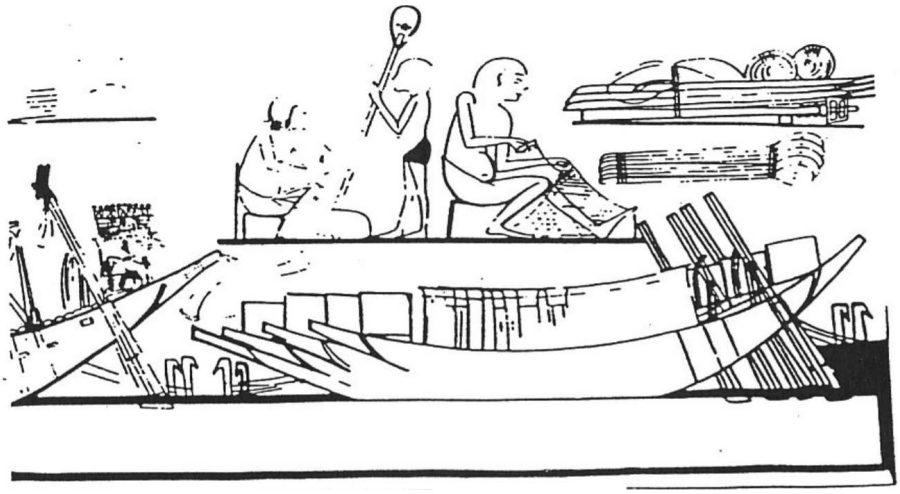

Figure 7.3. Reproduction of the funerary picture found at Amarna, *c.* 1365 BCE. Source: Garies, de (1908, plate 5).

of smaller vessels used for cabotage or fishing activities, they were probably pulled out from the water with the aid of trenches, wooden sleepers and rollers.[27] As for military ships, they probably went through long dormant periods, especially during the winter season; therefore, they needed to be hosted within permanent installations provided with a roof – i.e., shipsheds – where they could be dried out, maintained and repaired.[28]

The first examples of shipsheds come from the Aegean context and are dated to the middle second millennium BCE. The fresco cycle discovered in the Western House at Thera (Greece) represents a peculiar coastal building: in the scene known as 'The Battle', a structure with a flat roof and four parallels galleries appears located on the shoreline. Initially interpreted as a dairy (Marinatos 1974, 41), in the mid-1980s M. Shaw proposed that this building was in fact a shipshed based on the atypical opening of the galleries towards the sea and on the proximity of the building to the coastline. Such a suggestion was initially viewed with suspicion as at that time few other contemporary parallels were known;[29] however, it is now more widely accepted, since additional buildings of this kind have been found along the Aegean shores, e.g., the structure identified by Vasilakis (2010) at Katsambas, an area north of Heraklion (Crete, Greece).[30]

After these second millennium BCE examples, however, there is no further evidence of shipsheds in the Mediterranean until the sixth century BCE. During the centuries separating the Minoan cases from the sixth century BCE shipsheds, we should therefore imagine that the more common practice was to use slipways or to simply haul ships onto the beach with the aid of timber or metal devices.[31] In the sixth century BCE, probably in response to the intensification of maritime traffic, purpose-built installations were increased in dimension and constructed from durable material. The (re)appearance of shipsheds is, in fact, documented by both literary sources[32] and archaeological evidence.[33] However, substantial differences exist between the second millennium and the sixth century BCE structures: whilst the second millennium BCE shipsheds had a flat roof made up of earth and clay, the archaic buildings found in Greece were sloped and tiled (Gerding 2013, 175–81). Furthermore, whereas the second millennium BCE structures were located at some distance from the shore, the later Greek shipsheds were located more precisely inside the harbour areas, not far from the coast and the other harbour facilities. Therefore, it has been proposed that Minoan structures were probably meant to host ships drawn up on shore once a year (during the wintertime) and that, on the other hand, the sixth century BCE Greek shoreline shipsheds were more frequently used during the year (Shaw, J.W. and Blackman 2020).

There were other solutions to pull ships out of the water that were likely more common than shipsheds. As underlined earlier, alternative forms for hauling the vessels were probably used during the initial centuries of the first millennium BCE and they were certainly already

[27] The existence of such devices is documented in Hom. *Il.* 2.151–154 and 557–558; and *Od.* 2.263–265.
[28] Especially dangerous for the hulls of military ships, which were not covered with lead to avoid compromising their speed and manoeuvrability, was the *Teredo navalis*, a shipworm that tunnels into wooden structures causing their damage and destruction.
[29] In the mid-1980s, M. Shaw also excavated a six-gallery building in use between the fourteenth and the thirteenth cent. BCE at Kommos.
[30] For an overview on Late Bronze Age harbours in the Aegean, see Loizou 2016.
[31] We will discuss these kinds of arrangements later in this section.
[32] Herodotus (2.159.1) states that in 593 BCE the Pharaoh Necho ordered the construction of a shipshed complex to shelter his fleet. He also mentions shipsheds in relation to Samos (3.45), when he claims that Polycrates imprisoned his troops' wives and children there as a precaution. Although he does not attribute the construction of the Samian shipsheds to Polycrates, he thus suggests that shipsheds were found at Samos during the sixth century BCE.
[33] Late sixth or early fifth cent. BCE shipsheds have been documented at Abdera and probably at Thasos, Corcyra and Aigina. On shipsheds, see Blackman and Rankov et al. 2013.

employed from the very dawn of harbour areas. Along the Mediterranean shores, several slipways have been recorded (for practical examples see the catalogue edited by Blackman and Rankov et al. 2013); they were often carved into the rock, exploiting the natural slope of the coast, and their exact chronology is therefore difficult to establish. Eventually, as suggested by ethnographical comparisons, they could have been covered by wooden roofs (Figure 7.4). An example of a slipway in use during the second millennium BCE (in particular, during the MMIIB) could come from Kommos, where an arrangement of this kind has been found belonging to 'Building AA' (Shaw, J.W. 2018).

Other than slipways, temporary arrangements such as sleepers or rollers could have been used; however, traces of their use disappear with time unless they were used with stone slabs.[34] In this sense, ethnological comparisons can once again provide us with devices that not leave any trace. Traditionally, various devices have been used to pull ships out of the water on different kinds of shorelines: in some cases, wooden ladders could have been used as documented at Arwad, in Syria (Basch 1987, 223), or along the southern Italian coasts (Mauro 2019a, 16); in others, ladders could have been built from metal in order to haul boats onto stony ground (as currently documented in Spain) (Mauro 2019a, 17). Lastly, in case of cliffs, boats could be hanged from trees (Figure 7.5) (Frost 1973, 87).

Figure 7.4. Slipways for local fishermen's boat covered with wooden roofs, Ibiza (Spain). Source: Mauro.

Figure 7.5. Boat hanging from trees implanted on a rocky shoreline, northern Crete (Greece). Source: Frost (1873, figure 10).

Making the Harbour more Visible from Afar

The final area for assessment is the efforts made to ensure the harbour more visible from the sea. Visibility has always played a fundamental role in seafaring (Mauro and Durastante 2022), with the identification of landmarks being the most ancient form of orientation. Several harbours and shelters were already located in correspondence to or nearby easily recognisable natural features; however, their radius of visibility could have been further improved by using signalling devices. This is likely to have occurred long before the construction of the well-known lighthouse of Alexandria.[35]

In the second millennium BCE, there were already structures located near the shoreline or on high spots to direct sea-routes, thus having a (voluntary or involuntary) role in seafaring. An illustrative example of a building used for signalling purposes is the tower-like 'Temple of Ba'al' at Ugarit (Syria) which – according to H. Frost (1991; and 2002) – was highlighting the presence of the ill-defined and low-lying port at Minet El-Beidha.[36] However, as it has been underlined in relation to the other examined harbour needs, the increase in a harbour's radius of visibility could have been achieved without building permanent structures as well. In Homer's poems, the reference to 'blazing fires burning on the mountain and appearing to seamen' (Hom. *Il.* 19.375–378) can be used as proof that the use of fire signals as a navigational aid was fairly widespread in the initial centuries of the first millennium BCE; moreover, it could also suggest that similar signalling systems were employed even earlier.[37] Fires were likely lit on high points along the coast; during the night, their flames were easily spottable, and during the day, seamen were guided by their smoke. Structures like temples, tombs and altars – usually found on the top of promontories or on other strategic sites along the coast – were equally useful in

[34] We find confirmation of the use of such devices in the Homeric corpus, e.g., Hom. *Il.* 2.557–558 and 3.445; Hom. *Od.* 4.438, 5.482 and 13.77. For a reassessment of the practice of beaching in Homer's epic, see Votruba 2017.

[35] The construction of the lighthouse of Alexandria, on the island of Pharos (Egypt), is dated to the first decades of the third century BCE.

[36] Minet el-Beidha (*Mahd/Ma-a-ha-di*) was one of the two harbours controlled by Ugarit that are mentioned in Ugaritic documents (the other is *Rish*, tentatively identified with Ras Ibn Hani) (Astour 1970, 113–116). It was located in a natural cove, one km far from Ugarit (Knapp 2018, 116; Yon and Sauvage 2015, 81).

[37] Other references to fires on high spots can be found in Hom. *Il.* 18.207–214 and *Od.* 10.30.

terms of orienteering seamen and thus could have played a role as proto-lighthouses (Morton 2001, 210–4).

From the sixth century BCE, the task of directing seafarers and facilitating the identification of safe shelters was entrusted to specific structures, i.e., coastal towers. Beyond having surveillance functions, these buildings were likely employed as proto-lighthouses or – more generally – as navigational aids. As visibility is directly related to the height, coastal towers needed to stand out from the rest of the landscape. A clear example of a coastal tower meant to be an aid for seafarers is the late-archaic building found at Pyrgos Cape (figure 7.6), which is inscribed with an inscription that openly reflects its role: 'I am here, on the extremity of the harbour, as a protective signpost for ships and sailors' (Kozelj and Wurch-Kozelj 1989).

Conclusion

Until 50 years ago, scholarship traced back the introduction of artificial facilities in Mediterranean harbour areas only to the sixth century BCE, probably relying too strictly to the Herodotean passage mentioning the breakwater at Samos (Greece). However, advancements in the discipline – together with the widespread new interpretation of the concept of a 'harbour' – have shown that human intervention on the shoreline took place considerably earlier and that, in the Mediterranean, it could have occurred during the second millennium BCE. In particular, it was during the second half of this millennium that all the basic needs of a harbour basin found a practical response and were fulfilled thanks to the development of specific harbour works. To protect the harbour from meteo-maritime dynamics, inner basins were connected to the sea through excavated canals; similarly, barriers (that in this first phase were essentially reinforcements to existing natural features) could have been fortified to further protect the harbour basin. To create or increase the mooring space, quays were sometime constructed at the border of the basin and mooring devices were placed on different structures (i.e., platforms, quays, moles, wharves or directly on stony shorelines). To haul ships onto the shore, shipsheds were built to host vessels; other arrangements (slipways or hauling devices) could have been used to drag boats out of the water. Finally, to increase the visibility (and, subsequently, the recognisability of a harbour) high buildings were erected on the top of strategic nautical points.

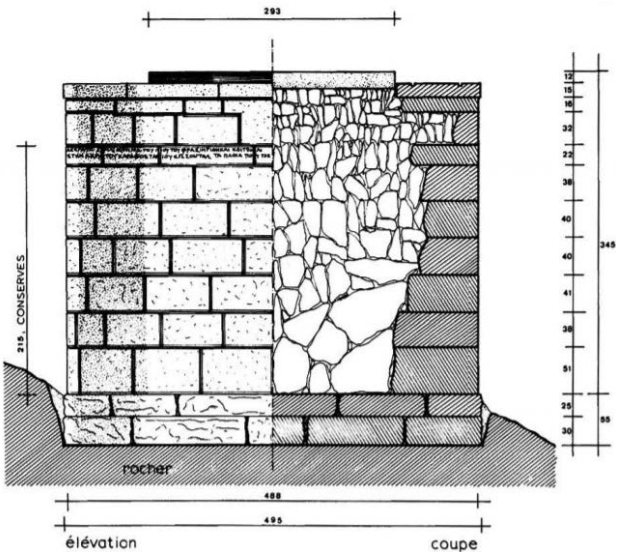

Figure 7.6. Perspective drawing and section of the preserved part of the coastal tower at Pyrgos Cape, Thasos (Greece). Source: Kozelj and Wurch-Kozelj (1989, figure 13).

All of the harbour requirements discussed above could also be fulfilled without the need for building specific structures, relying instead on natural characteristics or on perishable materials. In the previous pages, possible alternatives and non-permanent solutions have been presented to provide a sample of how certain operations could have been performed even in apparently not-equipped areas. Very likely, these solutions were used continuously during the examined period.

In the initial centuries of the first millennium BCE, there are clues pointing to a continuity in the employments of certain harbour practices (e.g., lightening fires on high spots). Moreover, with regard to permanent harbour facilities, we can broadly detect the same typologies of harbour works that were elaborated in the previous millennium. In this sense, it can be stated that there is a clear continuity between the Bronze Age and the Iron Age harbours, at least in terms of harbour work typologies. More difficult (and perhaps impossible) to ascertain is whether the use of these structures has a *real* continuity, i.e., if an uninterrupted chain of architectural knowledge can join the second millennium harbour interventions to the facilities found in the first millennium BCE harbours. In other words, is it possible that specific harbour engineering knowledge was transmitted from one area to another through the intense, transcultural network developed in the Eastern Mediterranean? In some cases, the existence of a direct continuity is more likely: for example, free-standing breakwaters have been found on the Levantine shore dating to the ninth century BCE and they could have appeared in the Aegean area as early as in the eighth century BCE. Furthermore, both literary and archaeological sources confirm a massive presence of Phoenician merchants in the Aegean during this period and vice versa (Mauro 2015). In other cases, the continuity is less clear and more difficult to sustain. This is the case for shipsheds complexes that were probably already in use in the Aegean area during the second half of the second millennium BCE; however, after the collapse of the Palatial system, there is no documentary evidence until the sixth century BCE (Shaw, J.W. 2019). Additionally, when they (re)appeared, they had different characteristics. In cases like this, we should therefore consider that it was the same nature of the ships – together with the harbour needs – that encouraged similar solutions in different chronological and/or geographical areas.

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