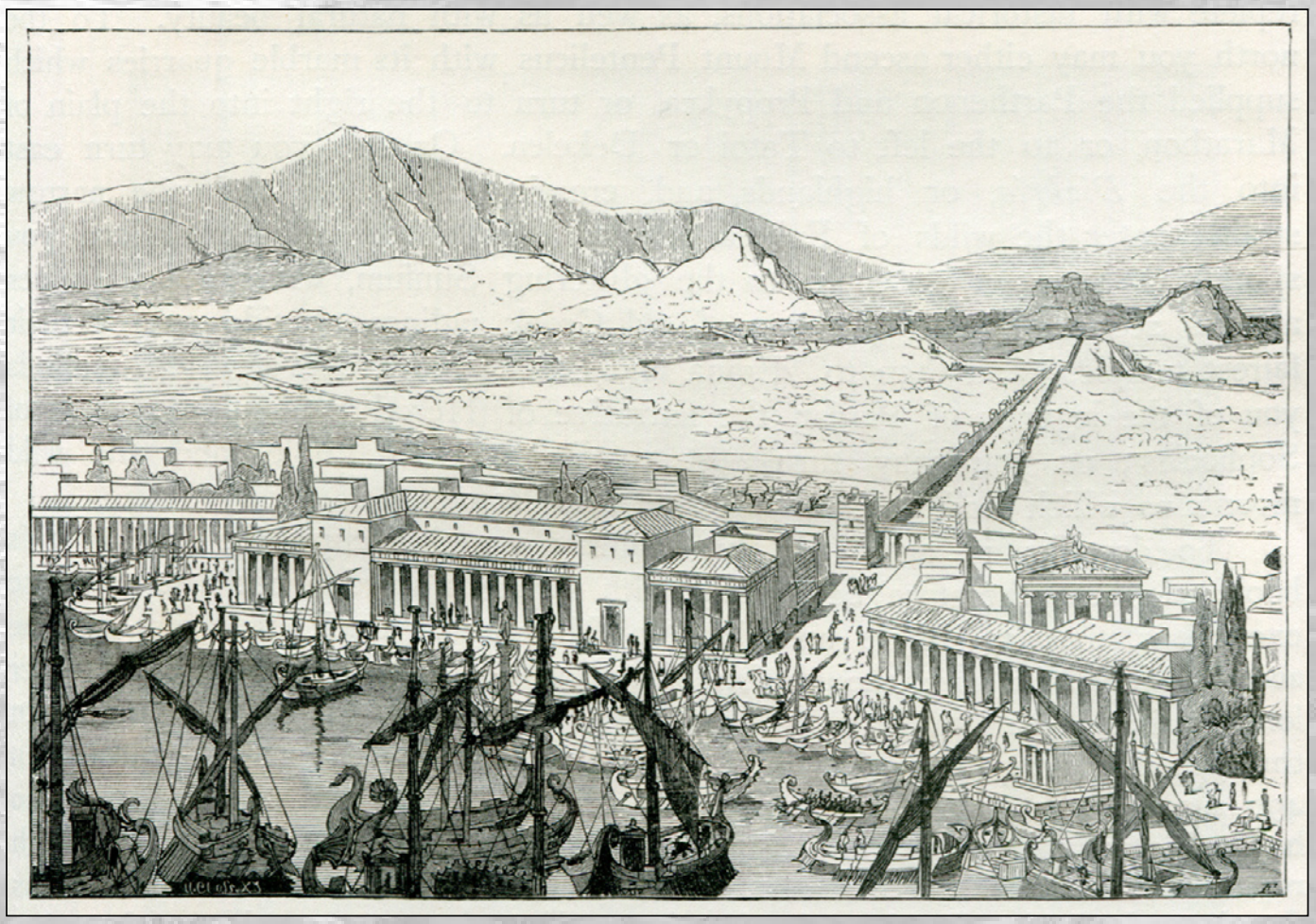
Archaic and Classical Harbours of the Greek World

The Aegean and Eastern Ionian contexts



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Introduction

This volume arises from a willingness to cast light on the archaeology and history of ancient harbours, with particular focus on the Greek world during the Archaic and Classical eras. It is spurred by three main concerns: to assign a historical and archaeological value to harbours, to fill the lack of information on this fundamental chronological arc within the development of harbour history, and to compensate for the dearth of specific works by providing readers with a bibliographic and scientific basis on this topic. In particular, since the state of the art on this topic reveals numerous gaps, the main aim of this book is to identify the primary characteristics of harbour areas in the Greek world. Therefore, even if other elements relating to the study of harbours could have resulted in equally interesting and relevant works, they have been deliberately left aside for the time being. The objective of this book is thus to establish a consensus on three fundamental research questions: what locations were the most propitious for the installation of harbours? What kinds of harbour-works were built and for what purpose? What harbour forms were documented?

In this book, I have sought to address these topics by evaluating the available evidence (archaeological, textual and geological) to consider what harbours looked like during the Archaic and Classical periods. In order to have an overview of this theme and to analyse it extensively, I have chosen to adopt a broad focus, with the choice falling on the Aegean and eastern Ionian contexts.[1] The selected scale, which could be defined as a mesoscale,[2] offered a number of advantages, as for example the possibility to work through assorted records and to gather general considerations from the available data. Furthermore, the results exposed within this volume could easily be transferred and applied to other areas influenced by the 'Greek expansion'. On the other hand, the choice of a wide geographical context entailed some disadvantages, including the fact that local harbours, anchorages, shelters and natural havens can be misrepresented.[3] Therefore, to have a clear idea of the various 'coastscapes' and 'maritime small worlds'[4] that were involved in the wider system of connectivity, it would be necessary to resort to micro-scale studies.

Chronologically, this volume is focused on the period between the 8th and the 4th century BC, this choice being dictated by two main concerns. Firstly, despite the major advances made in harbour archaeology during the last decades, these centuries have not received a thorough treatise so far. Whilst Phoenician and Near Eastern harbours have been studied by Poidebard, Lauffray and Frost,[5] Roman ports by the *Portus Project*,[6] and prime examples of excavations in Hellenistic harbours are known from Alexandria and Amathus,[7] the chronological arc between the Middle-Geometric period and the end of the Classical era is nearly unknown and not systematically examined, apart from Blackman's contributions.[8] Secondly, this chronological selection was motivated by the importance of the Archaic and Classical periods within the growth and development of harbour architecture. Indeed, this is the moment when, in the areas considered, the transition from natural proto-harbours, whose protection was mainly assured

[1] A complete list of the harbours examined can be found in the Appendix within and it will also be available online at <www.ancientgreekharbours.com>, viewed 18 September 2018 (see also Mauro 2016). The Appendix and the online database (which will be regularly updated) are indebted to the catalogues collected by Graauw, de 2017; Lehmann-Hartleben 1923; the Navis II project and Theodoulou 2015. Each harbour/anchorage included in the database has been assigned a number; thus, in this volume, numbers found following the toponyms of the harbour should be considered as references to the entries in Appendix 1.

[2] As it is between a micro-scale (which would have implied studying a single *polis* or a single historical region) and a macro-scale (which would have also affected the so-called 'areas of expansion').

[3] In particular, the selection of the harbours and anchorages examined here has been based on the consideration of two main factors: the presence of harbour-works and their mention as harbours in contemporary written sources. Therefore, the list in the Appendix should not be considered comprehensive, since many other harbours could have been active during these periods, the existence of which can be inferred only from the presence of imported objects (however, where the presence of imported objects was significant to the point that these places are labelled as 'harbours' in archaeological scholarship, it has been decided to include them within the Catalogue).

[4] On the concept of 'seascape' see Westerdahl 1994. Tartaron (2013: 185-203) suggested interpreting Late Bronze Age Aegean maritime connections using four different 'spheres of interactions': coastscapes, maritime small worlds, regional/intracultural spheres and interregional/intercultural spheres. These concepts could be diachronically transferred to other periods and used as a framework for analysing the seascape. 'Coastscapes' and 'maritime small worlds' are referred, respectively, to the spheres of interaction based on visible distances and seafaring in inland waters, and to the coastal landscapes connected to each other by routes of no more than two days (considering a round-trip).

[5] Frost, H. 1973, and 1995; Poidebard and Lauffray 1951. See also Carayon 2008; Higueras-Milena Castellano and Sáez Romero 2018; Morhange, Carayon and Marriner 2011.

[6] <http://www.portusproject.org>, viewed 19 September 2018. See also Keay 2012. On the Roman port of Tarraco, see also the recent PhD dissertation by Terrado Ortuño 2018.

[7] Alexandria: Robinson and Wilson 2010. Amathus: Empereur and Verlinden 1987.

[8] Blackman 1982a and 1982b. After the issuing of these papers, Blackman's research moved on to an analysis of Mediterranean shipsheds. His studies, together with other scholars' contributions, culminated in a monographic volume: Blackman and Rankov 2013. On the Greek military harbours, see Salzano 2014. Recently, on the Greek harbour of Empúries, on the Spanish coast of Catalonia, see Castanyer I Masoliver *et al.* 2016.

by the configuration of the coast, to purpose-built harbours occurred. However, as it will be underlined, despite the increasing number of infrastructures, this process was not homogeneous, nor did it involved all the harbour basins at the same time, since many of them endured as rudimentary and simple landing or mooring areas.[9]

With regard to the structure, this volume is composed of two main parts: the first one (consisting of Chapters 1 and 2) presents a general discussion of the state of the art (Chapter 1) and of the development of harbours until approximately 800 BC (Chapter 2); the second one (composed of Chapters 3, 4 and 5) is entirely centred on the Archaic and Classical harbours of the Greek world, and it contains a broad selection of the current evidence, each chapter dealing with a specific research question. In the conclusion, I have outlined the developments in Archaic and Classical harbours in the Aegean and eastern Ionian seas in light of the evidence and considerations presented earlier.[10]

If compared to previous studies, this work differs for its attempt to integrate historical and archaeological evidence with geographical and geological data. As stated above, the coexistence of natural and modified-natural harbours made it necessary to adopt a different approach. Thus, all the data presented should be read by considering that, even when not affected by the construction of infrastructures, harbour areas are in any case anthropogenic landscapes, where the interaction between men and nature can have left readable traces. Obviously, these material traces are not always easily recognisable (in other words, they not always correspond to the construction of permanent harbour-works). However, the comparison between different kinds of data (e.g., literary sources, *in-situ* pottery remnants, religious buildings strategically located along the shores) provides interesting starting points from which it is possible to assume that a particular area was exploited for harbour purposes. Starting from these indicators, I have sought to decode harbour areas, sometime regardless of (or, at least, not strictly depending on) the presence of harbour-works. In this way, I hope to have built a bridge in understanding Archaic and Classical harbours of the Greek world as the consequence of the system of relationships established in the Eastern Mediterranean following the 'collapse' of Bronze Age civilizations, and as the antecedents of the monumental infrastructures found in Hellenistic harbours.

[9] Blackman 2008: 639-645.

[10] The question addressed allowed one to deal with harbours and anchorages as a whole, regardless of their size, importance or role within the trade processes. For this reason, this volume considers a wide range of maritime places, whether they were major ports (e.g., Piraeus, Lechaion) or simple anchorages along significant sea-routes (e.g., Artemisium). Furthermore, it is necessary to underline that in this book the expression 'Greek harbours', whenever it will appear, should be read generically in the sense of 'harbours of the Greek world'.

Chapter 1

Account of Previous Research

1.1. Greek harbours in ancient literary sources

The earliest available information on Greek harbours comes directly from ancient literary sources: although this may suggest that it could be relatively easy to deal with this topic, it is rather difficult to reconstruct harbour development from the available evidence. We know that the third book of 'Μηχανική Σύνταξις' by Philo of Byzantium (late 3rd century BC) was entitled 'Λιμενοποικά' (*On harbour building*) and that Timosthenes of Rhodos, admiral of Ptolemy II's fleet, wrote an essay entitled *Harbours*,[1] but no technical text about harbours has been preserved in its entirety. The only surviving direct testimony is the fifth chapter of *De Architectura* by Vitruvius, but even this source is not very useful for reconstructing the development of harbours in the Greek world between the Archaic period and the Classical Age, because it belongs to a later period and is based on technical advances achieved in Hellenistic and Roman times.

In addition to these technical works on harbour construction, there is another source that could cast light on Archaic and Classical Greek harbours, the so-called *Periplus of Pseudo-Skylax*, but this is a controversial text of still uncertain provenance. The *Periplus of Pseudo-Skylax* survives as part of a compilation of minor geographical works gathered together by Markianos of Herakleia in the 4th or 5th century AD.[2] Its authorship has traditionally been ascribed to Skylax, a navigator from Karyanda who lived in the 6th century BC and explored the coast of the Indian Ocean on behalf of Darius I.[3] However, recent scholarship rejects Markianos' claim that the author of the *Periplus* should be identified as the Skylax of Karyanda recorded by Herodotus.[4] Instead, it proposes that this *Periplus* should be considered as the result of successive re-adaptations of an original text from the 6th century BC, the majority of which should be ascribed to the 4th century BC,[5] or as a text produced in the late 4th century BC, and with a close connection to the city of Athens.[6] None of the other surviving *Periploi* and Coastal Itineraries, including the *Stadiasmus Maris Magni* and the *Itinerarium Antonini*, concerns the periods or the geographical areas dealt with by this book. Therefore, the only useful information that they could provide relates to the continue use (or abandonment) of specific harbours.[7]

Despite being the only surviving 'technical' manuscript that specifically mentions harbours of the Greek world, the *Periplus of Pseudo-Skylax* should be considered as a unique type of text, since it does not exhibit the principal characteristics of a nautical technical work. It merely records the existence of various harbours, anchorages and landmarks, without providing any further details about them.[8] Because of its particular focus, the information provided by the *Periplus* would have little significance if it were not supported by archaeological, historical and geological data.

1.2. The study of ancient harbours in the 19th century and the first half of the 20th century

Modern scholarship concerning Greek harbours is far from exhaustive. Whilst quite a few publications exist which deal with the Roman and Phoenician worlds, there is only a small amount of works focused on individual Greek harbours. All the extant studies are wide-ranging ones that subordinate individual cases to a general pattern which can be applied to the entire pre-Hellenistic era. This might be attributed

[1] Strab. 9.3.10

[2] Counillon 2004: 24; Shipley 2011: 1.

[3] The work is conserved in the *Paris suppl. gr.* 443 (D), dated to the 13th century AD, and it is titled 'Περίπλους τῆς θαλάττης τῆς οἰκουμένης Εὐρώπης καὶ Ἀσίας καὶ Λιβύης', rendered in Latin as *Periplus maris interni*. On Skylax of Karyanda see also Hdt. 4.44.

[4] For a broader view on the later, differing hypothesis about the original text and the conserved edition, see Cordano 1992; Counillon 2004; Marcotte 1986; Shipley 2011.

[5] Peretti 1979, and 1990.

[6] Shipley 2011.

[7] On the *Stadiasmus*, see the PhD thesis by Medas, published as a supplement to the journal *Gerión* (Medas 2008). The text of the *Itinerarium Antonini* can be found in the *Imperatoris Antonini Augusti Itineraria Provinciarium et Maritimum*, vol.1, edited by Otto Cuntz (1990), Stutgardiae in aedibus B.G. Teubneri MCMXC, Stuttgart. There are four more documents that could be useful in decoding harbour contexts: the *Periplus of the Erythraean Sea* (1st century AD); the *Periplus of Nearchus* (a navarch who described his voyage from the Indus River to the Persian Gulf following the Indian campaign of Alexander the Great in 326–324 BC); the *Periplus of Hanno* (a Carthaginian explorer of the 6th or 5th century BC known for his naval exploration of the western coast of Africa); and Arrian's *Periplus of the Black Sea* (2nd century AD).

[8] On the unique nature of the *Periplus of Skylax*, Medas (2008: 26) wrote: 'All of the essential information which qualifies a text as one written for practical purposes is missing: there is no information on landmarks, warnings of danger (shallow waters, submerged rocks, sea and wind conditions, which can be dangerous in specific anchorages), location of watering points, advice on landing and docking; precautions to be taken in certain places and circumstances, favourable and unfavourable winds for particular sea-routes, suggestions on the use of harbours based on winds, seasons and the types of ships that could be used, suggested routes' (Translation by the author). Prontera (1992: 38) suggested that the information about meteorology could have been lost with the absorption of the *Periplus* into the literary tradition.

to the general trend in that era to avoid large-scale harbour-works and to make minor changes only in specific locations, where the morphological characteristics of the area would naturally favour harbour operations and functions, guaranteeing strong natural protection. This has contributed to a dearth of significant archaeological evidence for these centuries. Furthermore, many modern ports are located in the same area as ancient harbours, a phenomenon referred to in the scientific literature as 'buried harbours'.[9] The small amount of available evidence can also be partly attributed to changes in sea level (due in large measure to the rise of global temperatures), to the evolution of geomorphological conditions (caused by phenomena such eustasy, subsidence, erosion, silting due to the advancing of the coastline around river mouths, bradyseism and other volcanic activity in general) and to the destruction of many facilities due to unfavourable weather conditions or strong tides. Lastly, human interventions have often contributed to changes in the configuration of the coast, as the inhabitants seek to adapt it to the needs of the tourist and fishing industries.[10] For the aforementioned reasons, the study of Archaic and Classical Greek harbours can still be considered as a nascent research area. Relevant evidence uncovered during excavations along the Mediterranean coast often receives little attention from archaeologists, and bibliography on them is rather scarce.[11]

Although modern 'harbour archaeology' started in the middle of the last century, in the 19th century some scholars and travellers included in their works basic details about the appearance of Greek harbours as they encountered them.[12] Leake's work is particularly important because of the wide area he examined. After completing his studies at the Royal Military Academy in Woolwich and spending four years in the West Indies as a Lieutenant of the Marine Artillery, Leake was sent by the English government to Constantinople. His journey across Asia Minor, to join up with the British Navy fleet at Cyprus, spurred a profound interest in antiquarian topography. His explorations were specifically aimed at creating a map of the coasts of Albania and the Morea, with the purpose of assisting the Turks against the attacks from the French and the Italians; in addition, they enabled the first-hand observations on which he based his written works *Travels in the Morea*, *Travels in Northern Greece* and *Topography of Athens and the Dem*i.[13]

Fortunately, Leake's meticulous work did not remain an isolated attempt but was rather a pioneering endeavour within a fairly extensive topographic output that included the works of Ross, Curtius, Spratt and Lebégue.[14] Nineteenth-century travellers' remarks, albeit not strictly scientific (for example, they often included incomplete or incorrect data), still represent an essential basis for those interested in the study of ancient harbours, and in some cases, they report on the existence of no more visible ancient structures.[15]

In 1904, a study conducted by the Greek engineer Negris on historic variations in sea-level rise spurred renewed interest in the remains of ancient harbours and submerged coastal sites. While working for a French company involved in drainage works, harbour dredging and canal excavation in Greece, Negris noticed a number of submerged harbour installations on which he reported in a paper submitted to the Athenian Section of the German Archaeological Institute.[16] Three years later, another Greek engineer – Georgiades – published the first study that focused on a specific group of ancient harbours.[17] In 1915-1916, Paris wrote two papers on two of the most important Greek harbours: the western Corinthian harbour of Lechaion and the harbour of Delos.[18] Both papers were published in *Bulletin de Correspondance Hellénique,* shortly before Paris' studies were interrupted by the First World War.

The first – and so far the only – large-scale account of ancient harbours was published by Lehmann-Hartleben in 1923.[19] Although it consists of a catalogue of the harbours based on literary evidence rather than personal observations, it remains an invaluable reference work as it summarised the state of knowledge on this topic at that time. In addition to literary evidence, Lehmann-Hartleben's catalogue was supported by nineteenth-century travellers' reports. The result of such scrupulous work was the identification of 303 ancient harbours thought to have been active across the Mediterranean in Antiquity. However, even though Lehmann-Hartleben's work is undoubtedly important, archaeological research carried out during the 20th and 21st centuries allows us to expand his list of ancient harbours considerably.

[9] Marriner and Morhange 2007.

[10] Chryssoulaki 2005: 77.

[11] It is necessary to remark that with the expression 'bibliography relative to harbours', we refer in this case only to works that have a harbour or a collection of harbours as the main object of study, not those works that merely mention them. As reported by Blackman (2008: 639), apart from the most important studies of harbours, like Ostia, Syracuse and Piraeus, 'few harbour sites were published'.

[12] These accounts are particularly interesting because they refer to a period prior to the great urbanisation of the 20th century. On *Grand Tour* travellers and early scholars' expeditions, see Morhange and Mariner 2007: 137-139.

[13] Leake 1830, 1835, and 1941.

[14] Curtius 1851; Lebègue 1875; Ross 1841; and Spratt 1865.

[15] These records often refer generically to the presence of 'ancient structures in the harbour area', without specifying their appearance or trying to determine a date.

[16] Negris 1904.

[17] Georgiades 1907.

[18] Paris 1915, and 1916.

[19] Lehmann-Hartleben 1923.

Although it is still considered a cornerstone of harbour archaeology, Lehmann-Hartleben's catalogue did not generate much interest at the time of its publication and little research was done for a decade, until further works were carried out by Father Podeibard in Tyre in 1934-36 and in Sidon in 1946-50.[20] Poidebard's studies not only paved the way for archaeological studies of harbour zones, but they also stood out because of their far-sighted use of aerial photography, aimed at identifying submerged structures lying at shallow depths.[21]

1.3. The study of ancient harbours from the mid-20th century to the present day

After a brief hiatus due to the Second World War, archaeological excavations were resumed and new harbour areas examined, including those of Miletus, Ephesus, Pheia and Knidos.[22] The growing number of harbour excavations could be explained with the diffusion of a new awareness arising from the ideological and scientific context of the mid-20th century. Indeed, the excavations of the Albenga and Cape Gelidonya shipwrecks highlighted the need to integrate findings from underwater contexts into historical and archaeological studies. Within this scenario, underwater archaeology developed as a new application of archaeology aimed at responding to these burgeoning scientific inquiries.[23]

In 1963, Honor Frost, who contributed to the first season of Cape Gelidonya excavations, wrote a seminal volume entitled *Under the Mediterranean*;[24] thanks to this publication, underwater archaeology gained a new level of maturity. In the 1960s and 1970s, new excavations were added to those previously mentioned, for example at Phaselis, Kyme, Side, Gytheion, Kenchreai, Halieis, Anthedon, and Larymna.[25] Furthermore, looking at the western part of the Mediterranean, we must certainly mention the excavations carried out in the site of *La Bourse* (Marseilles). Here, during the construction of the *Centre Directionel* that began in 1967, important remains related to the settlement of the Archaic period and its harbour area were identified. These findings stimulated further research, which was initially conceived of as a rescue excavation, but turned into the first large-scale urban excavation in France.[26]

1.3.1. The birth of underwater archaeology and its implications for the study of ancient harbours

The development and diffusion of underwater archaeology as a scientific discipline can be traced back to the 1970s, alongside the enormous expansion of the Social Sciences. Starting from the mid-1900s, this process began to promote both the emergence of new research themes and the possibility of applying new analytical approaches to historical and archaeological studies. From then onwards, various innovative projects were begun, some of them having as their main subject the study of topics related to the underwater environment. We must also place in this context the birth of harbour archaeology, which is often considered as one of the specialised fields of study within maritime archaeology.[27]

In truth, the intellectual framework for port and harbour archaeology is far more complex, because this particular field of study encompasses two worlds:

[20] Tyre: Poidebard 1939. Sidon: Poidebard and Lauffray 1951.

[21] In Italy, his legacy was carried on by Schmiedt, who studied Phoenician and Greek harbours through the aerial photography of the Military Air Force (Schmiedt 1975).

[22] Blackman 1982a: 88. Underwater surveys at Pheia were conducted by the archaeologist Yalouria Nikolaus (Baika 2009).

[23] Excavations at Albenga began in 1952 and were led by Lamboglia; the scientific direction of the Cape Gelidonya excavations was entrusted to Bass starting from 1963. The birth of underwater archaeology as an archaeological application *tout-court* could be dated to 1952, when Lamboglia founded the *Experimental Centre of Underwater Archaeology* in Liguria. However, it was in the 1970s that it was internationally recognised, after the foundation of the *Institute of Nautical Archaeology* (see below).

[24] Frost, H. 1963.

[25] In 1963 Karl Polanyi published a contribution entitled *Ports of Trade in Early Societies*; it dealt with the topic of harbours, but from a different perspective since he sought to confirm the global presence of the economic institution known as 'port of trade', applying economic models to ancient society. On the excavation at Phaselis, see Blackman 1973; at Kenchreai: Scranton, Shaw and Ibrahim 1978; at Porto Cheli: Jameson 1969.

[26] The excavations continued until the mid-1990s with the opening of new archaeological sites in Jules Verne and Villeneuve-Bargemon Squares. For an overview of the excavation at *La Bourse*, see Hesnard *et al.* 1999.

[27] Maritime (also called marine) archaeology constitutes, together with the archaeology of inland waterways (rivers, canal and lakes), the main field of interest of underwater archaeology. On scientific terminology, see a recent paper by Radic Rossi (2012: 207-230). On the same topic, see also *The Oxford Handbook of Maritime Archaeology* and, in particular, the chapters by Ford (2011: 763-785) and Domingues (2011: 907-916). Conventionally, maritime archaeology studies every kind of seafaring (recreational, exploratory, commercial, military), the people involved in maritime activities (e.g., seamen, merchants, explorers, port workers), buildings, objects and contexts related to seafaring (harbours, ports, ships, dockyards, as well as the areas frequented by the workers of the port). As previously pointed out, maritime archaeology is part of the wider field of interest of underwater archaeology, which also includes the archaeology of inland waterways. The boundary between these fields is rather loose, however, and it is not always easy to speak of maritime archaeology in the strictest sense of the term. For example, as highlighted by Ford in the aforementioned chapter, when does a boat, coming from the sea and entering a river, cease to be subject of the study of maritime archaeology and fall within the interests of riverine archaeology? The division between the different fields of interest is blurred and presents many more nuances than the use of the corresponding terminology would seem to suggest.

the sea[28] and the land.[29] In this sense, it would be more appropriate, from a conceptual point of view, not to restrict harbour archaeology to one or other sector (that is, terrestrial or underwater archaeology), but simply to recognise its *extra*-ordinary characteristics, and consider it as the point of conjunction between two separate areas of archaeology. This particular aspect of harbour archaeology, which could be described as liminal, affects both the archaeological methodology of excavations (which varies according to the current situation of the harbour) and the interpretation of the sites. Furthermore, since the coast is on the threshold of two distinct worlds, it is also necessary to take into account that architecture in harbour areas has developed its own characteristics. On the basis of these premises, but also taking into consideration the extent to which harbour studies have developed simultaneously with maritime archaeology, we shall now review the fundamental stages of their evolution, without separating their achievements from advancements in the broader field of underwater archaeology.

As previously stated, interest in the maritime world can be traced back to the 1950s. However, the foundation of the *Institute of Nautical Archaeology* in Philadelphia, Pennsylvania, in 1972 marked a very important event within the scientific world, which gave this discipline international recognition.[30] Moreover, with the publication of its first issue in the same year, the *International Journal of Nautical Archaeology and Underwater Exploration* soon became the main reference journal in this field of studies.[31] Following much media and scientific attention at the beginning of the 1970s, underwater archaeology soon gained a place in the academic world with the founding of the *Institute for Maritime Studies Leon Recanati* (University of Haifa, 1972) and of the *St. Andrews Institute of Maritime Archaeology* (1973).[32]

From the beginning, it was clear that in dealing with underwater studies, and especially those related to harbours, a multi-disciplinary approach was needed. Since coastal environments are dynamic spaces, it was necessary to embed geological observations into archaeological studies in order to properly reconstruct processes that affected the coastline and the sea-level. In 1981, a special issue of *Dossier d'Archéologie* was entirely dedicated to the interaction between geological and archaeological studies. In the introduction to that volume, Le Gall hoped for an approach encompassing the two branches of knowledge. Even if until that time geologists and archaeologists were not used to working together, in his opinion collaboration between the two professions was essential for them so that they would mutually benefit from the enterprise.[33] Inserting an editorial of this kind into a journal of disclosure implied not only a declaration of intent aimed at a specialized audience (who was thus called upon to take note of the new possibilities of archaeological science), it also represented an attempt to raise the awareness of a vast public (thereby informing it of a field of study that constitutes a key factor in reconstructing the past).

In 1982, Blackman published two papers titled *Ancient Harbours in the Mediterranean* in two consecutive volumes of the *International Journal of Nautical Archaeology*.[34] Due to their scientific importance and wide geographical area and time span examined in such a limited number of pages, these essays are considered, along with Lehmann-Hartleben's, the standard works in the field of harbour studies.[35]

In 1985, a symposium series was launched in Greece (significantly, the first conference was held in Piraeus), which soon became a meeting point for maritime archaeologists working mainly in the Mediterranean area. This symposium was entitled *Tropis* and, despite being subtitled 'International Symposium on Ship Construction in Antiquity', it always hosted different research panels, including shipbuilding, ships and

[28] Taking into account both structures connected to the harbour (e.g., shipsheds, warehouses), originally located on the mainland but now submerged, and structures situated underwater from the moment of their construction (e.g., piers, breakwaters).

[29] Including structures connected to the harbour and located on the mainland since their construction (e.g., slipways, porticoes for commercial purposes), and those originally located at sea (e.g., breakwaters), but today situated on land due to the progradation of the coastline.

[30] It was founded as a non-profit institution; in 1976, INA moved to Texas A&M University.

[31] Once again, Honor Frost played a fundamental role in the creation of the journal. She entered the world of maritime archaeology at the end of the 1950s. She was involved mainly with the Levantine context and in particular with the study of the harbours of Tyre, Sidon and Arwad (Frost, H. 1973, and 1995).

[32] The Institute for Maritime Studies Leon Recanati preserves its long-standing interest in harbour studies, thanks to the activities carried out by the Department of Maritime Civilizations (see lastly Yasur-Landau *et al.* 2018).

[33] In the introduction to that issue, Le Gall (1981: 7) wrote: 'Les archéologues qui travaillent sur le bords de la Méditerranée sont pout la plupart de formation littérarie ou purament archéologiques, ils ne sont donc pas particulèrmient sensibilisés aux phénomenes de la géographiques et géologiques; de leur cote, les géographes spécialistes de la géographie psysique et le géologues le sont assez peu aux conséquences qu'ont pu avoir pour la vie humaine les phénomènes qu'ils étudient'. The main contributors to this special issue were Flemming and Pirazzoli who, from that moment, dedicated their entire career to geo-archaeology.

[34] Blackman 1982a, and 1982b.

[35] Blackman had already dealt with harbour archaeology in 1968, when he wrote a chapter for the book *Greek Oared Ships 900-322 BC* (Morrison and Williams 1968). Between 1966 and 1967, he also studied and published research papers on the harbours of Perachora (Blackman 1966) and Anthedon (Blackman, Schafer and Schlager 1967).

boats, navigation and seafaring, and – obviously – ports and harbours.[36]

1.3.2. The study of ancient harbours since the advent of underwater archaeology

The 1980s truly marked a turning point in harbour archaeology. This field of study suddenly grew to such an extent that some scholars began to affix the name 'port studies' even to research projects or papers that had nothing to do with harbours *per se*, as noted by Ben Ford in a chapter dedicated to coastal archaeology.[37]

In recent years, harbour archaeology has advanced thanks to the benefits of a multi-disciplinary research approach,[38] as the excavations of the ancient harbour of Abdera (in the northern part of the Aegean Sea) and Caesarea Maritima (Israel) have shown.[39] Furthermore, in 1994-1995, during the excavations in Marseille (France), harbour facilities from the Classical era were identified.[40] Beginning in the 2000s, Lovén, from the University of Copenhagen, has been leading the *Zea Harbour Project*, which explores and studies the eponymous harbour, one of the three basins of Piraeus; moreover, since 2005 this project has been extended to Mounychia.[41]

Nowadays, the archaeological community is increasingly aware of the importance of the environment in understanding ancient societies. This interest has been translated into the organisation of numerous specific courses, the publication of a long-awaited book by Blackman and Rankov on ancient Mediterranean shipsheds, and the funding of an ambitious project on the study of Portus led by the University of Southampton.[42] Following in the footsteps of the *Portus Project*, a new collaborative research project has recently begun, funded by the *European Research Council* (ERC) and led by the University of Southampton: the RoMp, or *Rome's Mediterranean Ports Project*. Its aim is to examine 30 Roman ports in order to understand better their interconnections and their role within the Roman Imperial harbour network.[43] Lastly, in October 2017, a new forum for maritime archaeologists working in the Mediterranean was born, with the purpose of regrouping and re-engaging the principles of the early *Tropis* symposium. Significantly, the name chosen for this new series of conferences has been inspired by the title of a Frost's publication (*Under the Mediterranean*), and it has been decided to inaugurate its first edition in Nicosia to celebrate at the same time the centenary of Frost's birth in Cyprus.

Although today the scientific scene is certainly more vibrant than it was just fifty years ago, the main subjects of study remain the greatest harbours and those ameliorated with appropriate facilities. However, the other harbours – often simply natural anchorages – are not given their due recognition; in this sense, Mediterranean maritime archaeology lags behind compared to Northern Europe and, in particular, to the Baltic area.[44] As far as the Eastern Mediterranean is concerned, research is almost exclusively focused on the area of Asia Minor as the *Eforia Enalion Archeotiton* (the Greek Archaeological Superintendence for Maritime Antiquities) imposes tight restrictions on excavation teams, especially on foreign ones.[45] From 2000 onwards, however, even the Greek authorities seem to be partially open to collaboration with foreign teams, thus positively influencing advancements in research.[46]

1.4. The study of the environmental factors in relation to ancient seafaring and harbours

Simultaneously to the development of underwater archaeology, a new branch of research evolved; even if it is not altogether distinguishable from underwater

[36] The proceedings of this symposium were published in a series with the same title (*Tropis*). The last *Tropis* conference took place on Hydra (Greece) in 2008.

[37] Ford 2011: 763-385. One can think of Milne 1985; and Rudolph 1988. At the end of the 1980s, Simossi excavated and studied the harbours of Samos (1991) and Thasos (excavations began in 1984 with the collaboration of Empereur and Simossi 1990, 1991, 1992 and 1994-1995). In the same years, Joseph and Maria Shaw, who had already participated in the excavation of Kenchreai in the 1960s, discovered six shipsheds dated to the TMIIIA2 in Kommos, in the southern part of the island of Crete. In addition to this, we must mention excavations in the harbour areas of Kition on Cyprus (beginning in 1985, led by Yon), Apollonia (directed by Laronde), Corcyra on the island of Kos (directed by Kantzia) and Oiniadai (directed by Kolonas).

[38] In addition to the previously mentioned works by Flemming and Pirazzoli, it is necessary to mention the studies of the Aix en Marseille team led by Morhange and Marriner.

[39] Abdera: Koukouli-Chrysanthaki 1991; Caesarea Maritima: Raban 1989.

[40] Hesnard 1994, and 1995.

[41] More information is available on the official website <http://www.zeaharbourproject.dk/>, viewed 19 September 2018. See also Lovén 2011.

[42] Blackman and Rankov 2013. One year after its publication, the catalogue by Blackman and Rankov has already become the most authoritative and complete source available on the subject. The developments of the Portus Project, led by Keay, can be followed on the official blog <http://www.portusproject.org/>, viewed 19 September 2018. The research group is very active and has recently organised a free online course on the *FuturLearn* platform (*Archaeology of Portus: Exploring the Lost Harbour of Ancient Rome*).

[43] More information on this ongoing 5-years project can be found on the website <http://portuslimen.eu>, viewed 19 September 2018. Within this project, numerous courses, workshops and seminars have been promoted (such as a course entitled *Ports in Antiquity* held by the University of Cadiz in June 2015, or the international conference that took place at the British School of Rome in January 2015). See also Keay 2012.

[44] Chapman, H.P. and Chapman, P.R. 2005; Ilves 2009.

[45] Tartaron 2013: 142.

[46] An example is offered by the previously cited research conducted by Lovén in the zone of Piraeus, which began precisely in 2000.

archaeology, the study of the environmental factors is more strictly related to ancient seafaring. It arose within the field of Economic History and its primary aim was initially to calculate the duration of sea journeys from a specific starting point to different destinations, and consequently to deduce how advantageous some routes proved to be.[47] Over the years, the economic aspect lost importance, while the study of factors that could limit or facilitate maritime travel began to spur growing academic interest. In particular, it has been demonstrated that this kind of contextualization can be extremely important in interpreting underwater and harbour sites.

It was the famous work by Braudel, from the French school of *Les Annales* (*La Méditerranée et le Monde Méditerranéen a l'époque de Philippe II*), to open the door to the inclusion of meteorological factors in the study of historical contexts.[48] The publication of this monograph in 1949 marked an extremely important date in international historiography, and contributed in substantially modifying historical studies of the Mediterranean world. The reasons that made this work revolutionary, compared to traditional studies present at the time, was that Braudel sought to explain the history of the Mediterranean as a story made up not of individuals, but of a community of people in relation to one another and connected through geographical links. In other words, Braudel was the first to introduce the concept of a 'Mediterranean landscape', which was possible to study from a historical point of view. In particular, in the aforementioned work it was asserted that history should be understood not only through the succession of events, but also through ordinary events, such as the arrival of winter and its necessary repercussions on maritime traffic. To this end, the first part of the book was entirely dedicated to the Mediterranean environment and some paragraphs were focused on specific 'geographical' factors that the French historian had every right to claim to have had a fundamental role in ancient and medieval seafaring.[49]

At the end of the 1960s, scholars became aware that it was not possible to deal with a complete study of a maritime cultural landscape (composed of shipwrecks, coastal and harbour contexts)[50] without first establishing how seafaring operated in Antiquity. In 1968, Schüle presented an interesting paper at the *XI Congreso Nacional de Arqueología de Mérida*, where he sought to calculate the areas of visibility within the Mediterranean Sea.[51] The experiment was remarkable, above all because it showed that there are only a few points in the Mediterranean from which it is not possible to catch sight of the coast.[52] In this way, Schüle added a third factor to the meteorological ones introduced by Braudel: visibility (which could be defined as multi-factorial since it depends on meteorology, orography and curvature of the earth). [53]

In the last fifty years, studies concerning nautical conditions are growing, even if the number of scholars involved in them is still minimal. Among the reference studies, it is fundamental to signal the seminal monographs by Rougé and Casson, although nowadays they are somewhat outdated;[54] more recent publications are the works by Arnaud, Beresford, Medas and Morton.[55] In particular, the latter contributions have succeeded in demonstrating that the concept of *mare clausum* (meaning a complete winter closure of the sea) could no longer be accepted, and that it is necessary to look further into the nuances of this seasonality.[56] Indeed, Casson argued that 'all normal activity was packed into summer and [...] at other times the sea lanes were nearly deserted and ports went into hibernation to await the coming of spring'[57] and Rougé that 'in winter sailing on the open seas was not possible'.[58] However, recent scholarships established that sailing along the Mediterranean during the winter

[47] Cerezo Andreo 2014: 345-356.

[48] Braudel 1949.

[49] Braudel 1949. *The environment* is the title of the first part of the volume. Among these factors, Braudel mentions winds and currents. Braudel went on to consider the environmental factors that affected seafaring: in 1968-1969 he started to work on a new study, which was published posthumously. This work, titled *Les Memoirs de la Mediterranée*, came to light in 1998, thirteen years after Braudel's death. For a recent reading of Braudel's work see Abulafia 2013.

[50] Definition by Westerdahl 2011: 733-763.

[51] Schüle 1970: 449-462.

[52] However, it is necessary to remember that the paper was based on a geometrical method that allows one to calculate the maximum visibility of a promontory in excellent meteorological conditions (d= 3.57 x sqrt [h x 1000]) and was therefore purely theoretical. In any case, visibility may vary due to different factors that cannot be considered at the same time (e.g., navigational experience, the height of the navigator in respect to the waterline, the presence of mist, accidental factors, meteorology).

[53] Cerezo Andreo 2014: 351-353.

[54] Casson 1967, 1971, and 1984; Rougé 1975, and 1981.

[55] Arnaud 2005: 7-33; Beresford 2013; Medas 2000, and 2004: 34-82; Morton 2001. In Spain, this field of study is particularly vibrant: in particular, Guerrero Ayuso's works have made a significant contribution to the knowledge of ancient seafaring, with particular attention to the context of the western Mediterranean and the Balearic Island. See Guerrero Ayuso 1998, 2005, and 2006. Díes Cusí (2005) presented an intervention aimed at understanding how physical factors influenced the creation of the Phoenician routes along the eastern Mediterranean. Lastly, Izquierdo i Tugas (2009) also dealt with the theme of seafaring, analysing how physical factors affected the choice of harbour location in *Hispania Citerior*.

[56] According to Beresford (2013: 9-52), the concept of a closure of the sea during the winter months is justified in three sources: Hesiod, *Op.* 663–669; Vegetius, *Mil.* 4.39, and an edict passed by Emperor Gratian in 380 AD (*Theodosian Code*, 13.9.3). However, textual evidence, together with the lack of a Mediterranean meteorological unity, suggests that there was not a forced closure of the Mediterranean sea-lanes during wintertime. See also Arnaud 2005.

[57] Casson 1971: 270-271.

[58] Rougé 1981: 15-16.

months was a fairly common practice:[59] consequently, the Mediterranean in winter time was frequented and its harbours were active all-year-round.

In order to gain a better understanding of ancient Mediterranean seafaring, all the aforementioned scholars have primarily sought to outline a geographical framework. Braudel (who was the first to consider geography as part of historical studies) was later repeatedly accused of a strong inclination towards environmental determinism, but it is undeniable that physical factors play an important role within the nautical context.[60] In a period when sails and oars were the means behind any sea travel, the maritime environment influenced not only the choice of sea-routes and their duration but also the selection of strategic locations that could be adapted to function as harbours or landing areas. Of course, this should not lead us believe that the geographical context had an all-encompassing importance, since it did not prevent seafarers (at least in the Mediterranean area) from reaching different points of the coast, nor did it freeze – as we have previously seen – sea circulation at any time of the year. Indeed, as Abulafia argued in a recent critical review of Braudel's book, 'the forces of nature could be challenged with skill and ingenuity'.[61]

Studies of physical factors in relation to seafaring are mostly based on the assumption that the conditions of the ancient Mediterranean maritime environment were broadly similar to those of today: that is, a generalised wind regime with prevailing north-westerly winds for much of the year and an anticlockwise circulation of currents.[62] However, it is necessary to point out that the reconstructive process of the meteorological conditions in Antiquity, which of itself implies a high level of uncertainty and approximation, has to deal with the reduction in temperatures that took place between 800 and 200 BC, and that is well documented both by archaeological and climatological studies. This reduction inevitably involved considerable changes in the conditions of winds and currents throughout the Mediterranean, due to a greater persistence of the polar front.[63]

Despite this necessary precondition, looking further into the geographical areas examined here, it is still possible to hypothesise a sailing season that was not limited to the summer months. In this respect, some general observations can be made: one concerns the meteorological local framework, while the other is connected with the particular topographical nature of Aegean and eastern Ionian coastlines. With regard to meteorological conditions, both eastern Ionian and Aegean coasts are affected by prevailing northerly winds, which blow at different times throughout the year. While the Ionian coasts are partially affected by Gregale and Bora, occurring chiefly during the cold seasons, the Aegean coasts experience Etesians throughout the summer months.[64] Etesians are dangerous to sailors because they occur in clear weather without warning and can reach 8th-9th level on the Beaufort scale. Furthermore, they are particularly aggressive in narrow spaces, such as the Doro Channel, the strait between Euboia and Andros and the maritime area between Kythera, Crete, Karpathos and Rhodos.[65] Considering this, it could have been difficult for ancient mariners to sail vessels northwards through the Aegean during the summertime, since sea-currents in this area also flow southwards. Then, it was definitively more suitable to undertake voyages northwards in early spring, autumn, or during wintertime, when winds blowing from other directions were considerably more frequent.[66]

[59] Coastal hops could be realised all-year-round, even if they could take more time in case of unfavourable conditions.

[60] Braudel 1949. Braudel was eventually accused of environmental determinism by Horden and Purcell 2010.

[61] Abulafia 2013: XVII.

[62] McCaslin 1980: 88; Murray 1987, and 1995.

[63] Between 800 and 200 BC (a period partially corresponding to the time span of this book), there seems to have been a change towards a cooler and wetter European climate, otherwise known as 'Iron Age Cold Epoch' (also known as 'Iron Age climate pessimum' or 'Iron Age neoglaciation') (Geel *et al.* 1996). During this cooler Holocene climatic phase, Alpine and Anatolian glaciers enlarged, determining a decrease in temperatures. As a consequence, it is possible to think that between the Archaic and Classical eras there was a greater amount of precipitation and that the regional winds (e.g., the Etesians) could have blown with more force (Neumann and Metaxas 1979: 186). See also: Geel and Ziegler 2013; Harvey 1980; O'Brien *et al.* 1995. Guerrero Ayuso (2006) also examined this topic, focusing his analysis on the changes that occurred in the Balearic area. However, some scholars assumed that the modern climate must not have changed significantly in the last 2400 years, including Meigs 1961: 374; Morton 2001; Rougé 1966: 39; and Semple 1931: 100. I would like to personally thank Stefano Medas for his valuable advice and for suggesting a relevant bibliography on 'Iron Age Cold Epoch'.

[64] Holland Rose 1969: 163. The word 'Etesian' derives from the expression 'ἐτησίαι ἄνεμοι', which means 'yearly winds'. Etesians usually blow from either the north or the northeast in the central and northern regions of summertime Aegean, while, further to the south, they typically blow from the northwest. These winds are known as *meltemi* by the Turks.

[65] Ancient literary sources were aware of the existence of Etesians, i.e. Ap. Rhod. *Argon.* 2.498, who described them as winds commanded by Zeus: 'ἦρι δ' ἐτήσιαι αὖραι ἐπέχραον, αἵ τ' ἀνὰ πᾶσαν γαῖαν ὁμῶς τοιῇδε Διὸς πνείουσιν ἀρωγῇ' ('At the morn the steady summer winds began to blow, which breath o'er the whole earth equally, for such is the command of Zeus' [Translation by Coleridge]). Etesians are reigning winds, that is, winds which appear with a high frequency (> 50%). Reigning winds differ from dominant ones: the latter are winds that, within the same area, blow with a stronger intensity, prevailing for their strength and speed (faster than 20m/s). On the Etesians, see also Armstrong 1967: 41-57. The ideal sailing condition was to undertake a sea-travel with winds blowing at 3th-4th level of the Beaufort scale (gentle/moderate breeze); when a wind reaches the 5th Bft level, sailing could be difficult (depending on the type of boat in use). Starting from the 7th Bft level, sailing becomes critical (Arnaud 2005: 19).

[66] Severin 1985: 132. On the winter sea travels in the Aegean Sea, see also Morton 2001: 89. Beresford (2013: 80) noted that Timomachus,

The following consideration which could make the idea of an all-year-round seafaring (at least within these areas) sustainable is based on the particular topographical nature of Aegean and Eastern Ionian coastlines. Firstly, due to the presence of different islands and islets, local winds within these areas are very difficult to predict. The deviation of the flow of the winds caused by the presence of many islands translates into the creation of various specific depression systems. This means that, when not affected by periodic winds, these areas are characterized by the existence of micro-systems of complex winds. As a result, finding favourable conditions for seafaring even outside the so-called *mare apertum* season is more likely. Secondly, whereas, on the one hand, islands made the system of winds rather unpredictable, on the other hand, their widespread presence allowed seafarers to eventually divide the journey into several daily coastal hops. In this way, the risk of running into unfavourable weather conditions was drastically reduced, as long as seafarers could decide on a daily basis if it was safe to undertake a specific sea-travel. Because of this, while it is still reasonable to admit a partial ceasing of Mediterranean long trade sea-routes during winter-times, caution needs to be exercised in making this assumption in the case of the geographical context examined within this book.

Such meteorological conditions had a clear implication even in the choice of the places to be used as harbours. Obviously, the geo-morphological requirements for a landing area varied greatly depending on micro-local environmental factors, so it is actually not possible to trace a unique framework that is valid for the whole Ionian and Aegean coastlines. However, we can still say that the majority of their harbours share a common feature, which is a certain level of natural protection on the northern side.[67] This could be easily explained by thinking of the direction of the prevailing winds both in the Ionian and in the Aegean Seas, and the resulting necessity for the sailing ships to find shelter from them.[68]

the Athenian commander, used triremes to tow grain ships returning from the Crimea southwards through the Hellespont in 361 BC (Dem. 50.14): then, in his opinion, it could be supposed that warships would also be used to tow such vessels north-eastwards against the current.

[67] Even on the Thermaic Gulf and on the northeastern part of the Aegean Sea, where Etesians do not make seafaring difficult (in these areas Etesians are perceived as northeastern winds which blow with a soft intensity), the most challenging winds for seafarers rush from a northern direction. In particular, the Thermaic Gulf is affected in winter, spring and autumn by a cold local wind called *vardaris*, which can reach the 8th Bft level. When it stands opposite the currents proceeding from the Bosphorus channel, it creates dangerous whirlpools along the Chalcidice Peninsula's coasts (*Greek Water Pilot* 1982: 232).

[68] Among the many harbours naturally protected on the northern side, we could mention Alkinoos (n° 34) and Hyllaikos (n° 35) on the island of Corcyra, Oiniadai (n° 126) and Halieis (n° 59).

Chapter 2

A History of Ancient Harbours up to 800 BC

Archaeological research in harbour areas is still in its early stages. Indeed, as Breen and Lane noted in 2003, maritime archaeology initially experienced a marked 'ship-centrism' – scholars focusing on problems connected with ships and their structural components – to the detriment of studies aimed at analysing harbours and their infrastructures.[1] Thus, although the discipline has experienced a real breakthrough in the past thirty years, the current situation of harbour archaeology could still be described as Avner Raban did in a paper in 1991.[2] Specifically, Raban decried the lack of surveys aimed at an understanding of ancient harbours, arguing that this neglect was often justified by the difficulty in identifying harbour-works.[3] In the same contribution, he coined the expression 'proto-harbours' to indicate those kinds of situations which, lacking in significant artificial infrastructures, needed a comprehensive analysis to be fully understood.[4] These harbours will be the subject of this chapter, which proposes a reconstruction of their development up to 800 BC.[5]

2.1. Harbours in the Near East, Egypt and adjacent regions

The earliest evidence of harbour installations dates from the 3rd millennium BC and can be found in the Indian and Mesopotamian regions. Structures assigned to the late 3rd millennium include the trapezoidal basin with kiln-fired mud-brick walls and the dock identified on the Harappan site of Lothal, in the vicinity of the Gulf of Cambay, on the eastern bank of the Indus River estuary.[6] Within the Third Dynasty, in the Mesopotamian city of Ur, awareness of the fundamental role played by a harbour inside the urban environment spurred a new organisation of the settlement. It is in this context that we can explain both the incorporation of the two docking basins (northern and western) within the city-walls and the construction of small docks from mud-bricks and bitumen.[7] In addition to the archaeological findings, written sources can expand our knowledge of Near Eastern harbours. Hence we know that Enmetena, king of Lagash, ordered the construction of a wall for the harbour of Girsu (*c.* 2100 BC), and that Ishbi-Erra of Isin, in a letter addressed to his king, Ibbi-Suene of Ur, declared his commitment to personally take responsibility for a mooring where more than 600 boats loaded with barley were to dock (*c.* 2005 BC).[8]

However, the most significant testimonies for this period and for the 2nd millennium BC derive from the Egyptian area, most of them being iconographic sources.[9]

Recently, over the course of two archaeological campaigns (2011-2012), an L-shaped jetty with associated stone anchors has been excavated at Wadi al-Jarf (Egypt). It can be dated to the Fourth Dynasty (2613-2494 BC) and was strategically situated at the mouth of the River Wadi Araba.[10] The mole was composed of limestone blocks and large pebbles from adjacent *wadis* and was built as an elbow jetty: it started from the beach, extended underwater in an easterly direction for over 160 m and finally turned SE for approximately 120 m with a more irregular layout (Figure 2.1). This orientation allowed it to act as a breakwater, protecting an anchorage zone of more than 3 ha from the constant winds and the coastal currents flowing N-S.[11] Interestingly, at 200 m from this harbour basin, an artificial mound made of limestone blocks was identified: it formed a visual landmark, allowing us to assume that Wadi Al-Jarf coastal installations acted as a harbour system.[12] Furthermore, archaeological and geological studies in the Egyptian area demonstrated that the appearance of excavated basins along Mediterranean coasts could be backdated to the Late Bronze Age: at this stage, the fortified citadel and

[1] Breen and Lane 2003: 469. See also Marriner and Morhange 2007: 137-142.

[2] Raban (1991: 129-146) was referring in particular to Minoan and Canaanite harbours, but his analysis could easily be extended to other periods of harbour history.

[3] *Ibidem*

[4] *Ibidem.* This expression was later used by Frost, H. 1995: 1-22. In a book edited by Keith Muckelroy in 1980, Flemming (1980b: 166-167) identified in the 9th century BC the period from which it is possible to talk of 'the first true harbours'. This definition appears outdated, since it implied an underestimation of the role of harbours prior to that period.

[5] Recently, Knapp (2018) published a monograph on Bronze Age seafaring in the Eastern Mediterranean, dealing also with the topic of harbours.

[6] In 1970 BC, when the course of the river changed, a new channel connecting the basin with the nearby river was cut. See also: Bass 1972: 89; Blackman 1982a: 90-92.

[7] Blackman 1982a: 90-92; Shaw, J. W. 1990: 429.

[8] Michalowski 2011: 416-418.

[9] For an overview on Egyptian harbours and seafaring see Fabre 2004.

[10] Probably the main corridor of communication between the Nile Valley and the Red Sea.

[11] Tallet 2013; Tallet and Marouard 2014.

[12] In particular, as a simple harbour system. See Chapter 5 for a clarification of the meaning of this phrase.

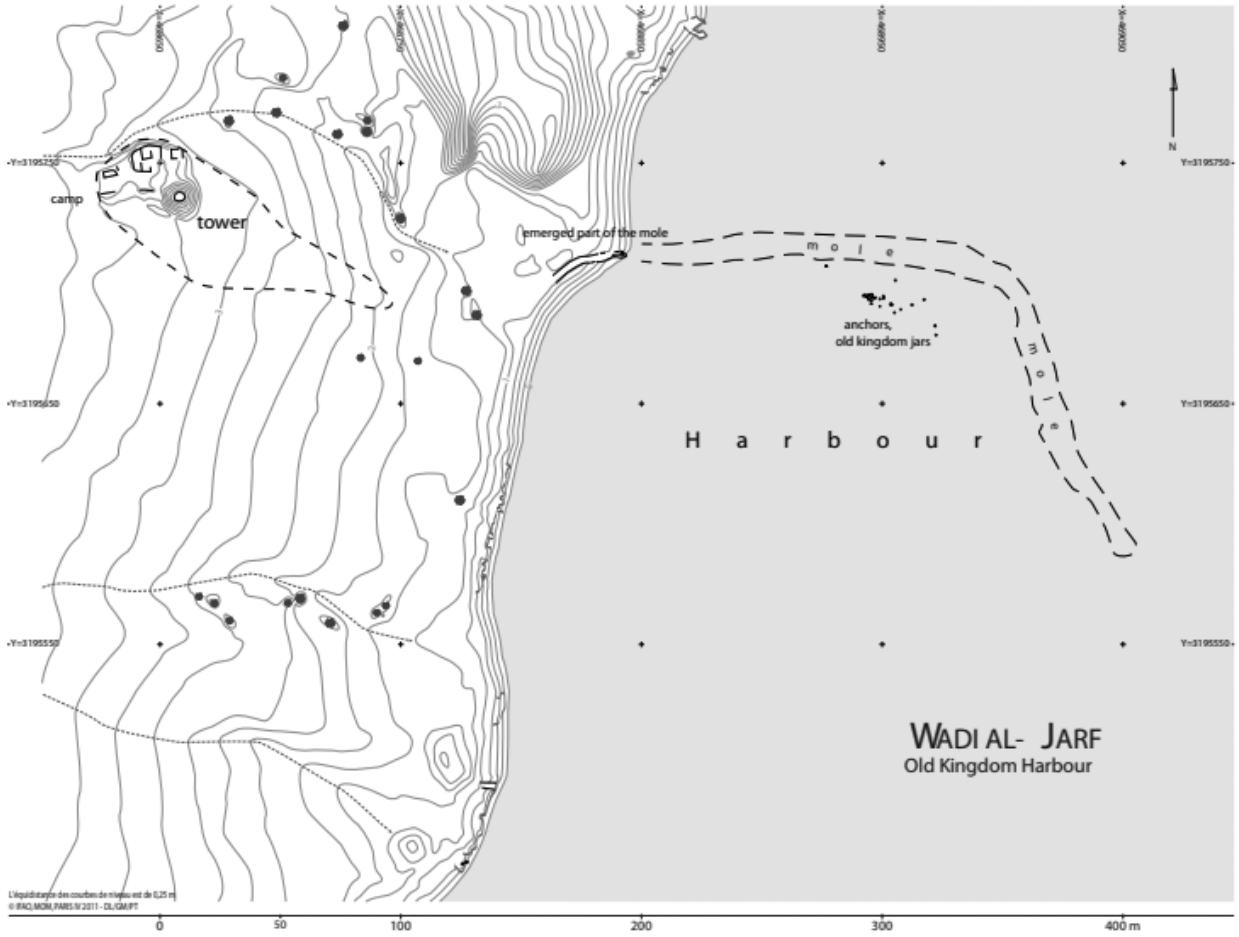

Figure 2.1. Map of the harbour facilities at Wadi Al- Jarf. Tallet and Marouard 2014: 7, figure 8. © Wadi al-Jarf archaeological mission.

palaces at Tell el-Dab'a (a site corresponding to the ancient Avaris) were fronted by an artificial harbour basin (450 x 400 m) linked by two canals to the main river channel.[13]

By considering iconographic sources, it is possible to analyse three interesting representations from Egypt set in harbour contexts. The first one, dated to the 14th century BC, pertains to a funerary context, being one of the scenes found inside the tomb of Kenamun (TT162) at Thebes: it depicts some Syrian ships disembarking at an Egyptian harbour.[14] While no harbour structures are apparently visible,[15] the presence of a platform (or, more generically, of a planking level) is noticeable, to which the prow of a ship seems to be moored: wares are then unloaded on shore by means of ramps (Figure 2.2). Similar to these ramps, but without steps, are the gangways represented in a relief located in Queen Hatshepsut's mortuary temple at Dier el-Bahri (Figure 2.3).[16] To these two testimonies a third picture must be added, which has been found in Amarna: it also derives from a funerary context (tomb of May, n.14) and represents moored ships, connected to bollards with ropes (Figure 2.4).[17]

The installations found at Tel Dor, Israel, seem to be more recent: here, a structure was built parallel to the coastline, within a protected lagoon south of the city. This harbour-work has traditionally been interpreted as a quay or a platform from which to disembark, it is orientated in an E-W direction and its dimensions are

[13] Forstner-Müller 2014; Tronchère *et al.* 2011. Other Late Bronze Age artificial basins have been documented at Birken Habu (Kemp and O' Connor 1974) and along the Palestinian coast (for an overview, see Sauvage 2012: 75). At the same time, the construction of artificial harbour basins seems to have appeared in the Aegean area, where it is documented in Pylos and, probably, in Troy (Zangger *et al.* 1997, and 1999). More information on Aegean artificial basins can be found in the next paragraph.

[14] Davies and Faulkner 1947.

[15] Blackman 1982a: 90-92. The picture can be dated to between 1386 and 1350 BC.

[16] The bas-relief represents Egyptian cargo ships in shipment in Punt (probably identifiable with a current locality in Somalia); the wares are transported to the shore via the described footbridges at the moment of disembarking (Oleson and Hohlfelder 2011: 606-637).

[17] *Ibidem.*

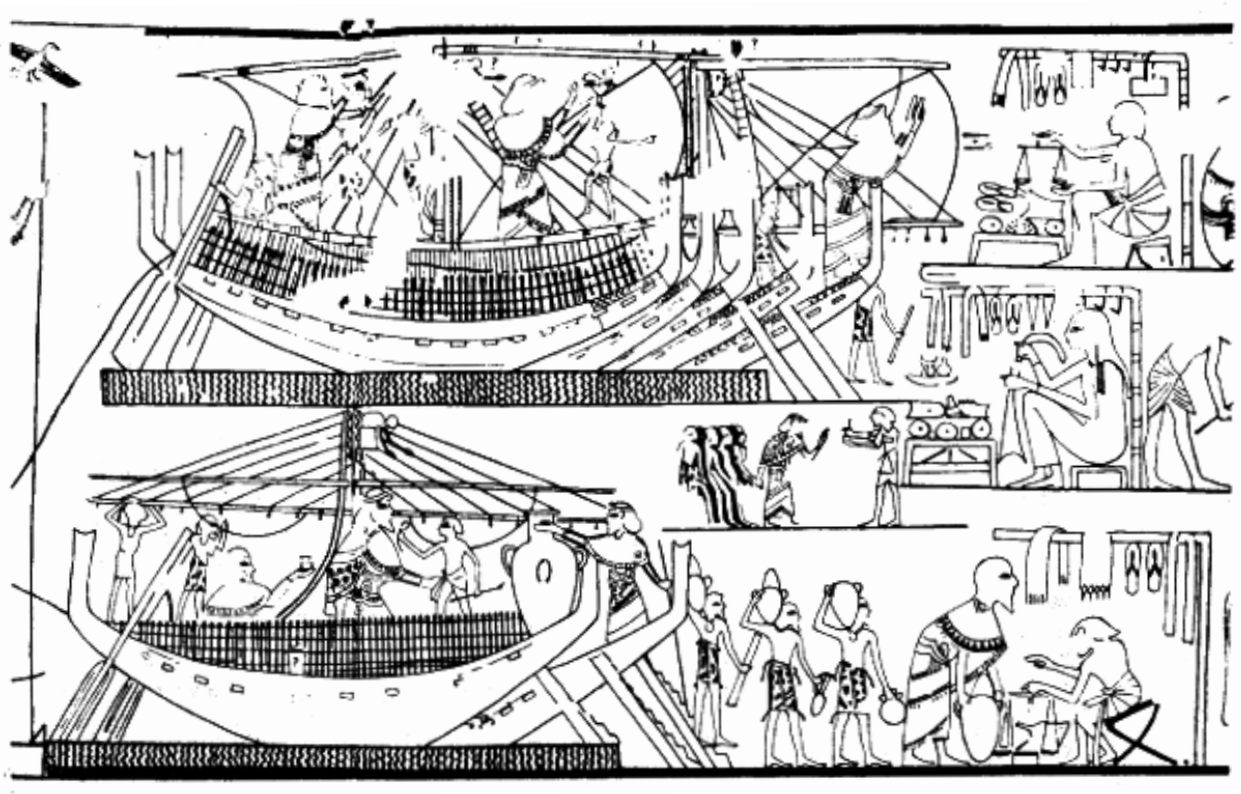

Figure 2.2. Reproduction of the harbour scene represented in Kenamun's tomb at Thebes, days of Amenhotep III (TT 162). Basch 1987: 64, figure 114.

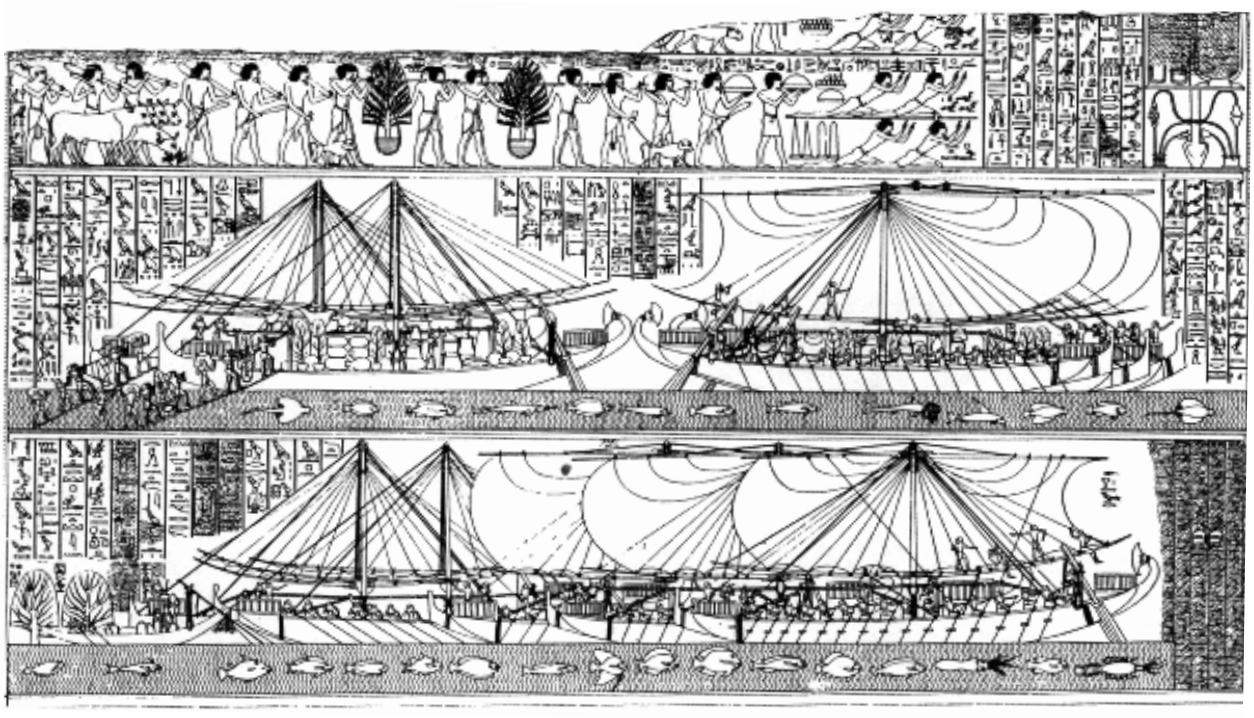

Figure 2.3. Reproduction of one of the reliefs found in Queen Hatshepsut's funerary temple of the at Dier el Bahri. On the left footbridges for loading and unloading can be clearly recognised, viewed 19 September 2018, <http://maritimehistorypdcast.com/ep-009-new-kingdom-maritime-war-maritime-peace/>

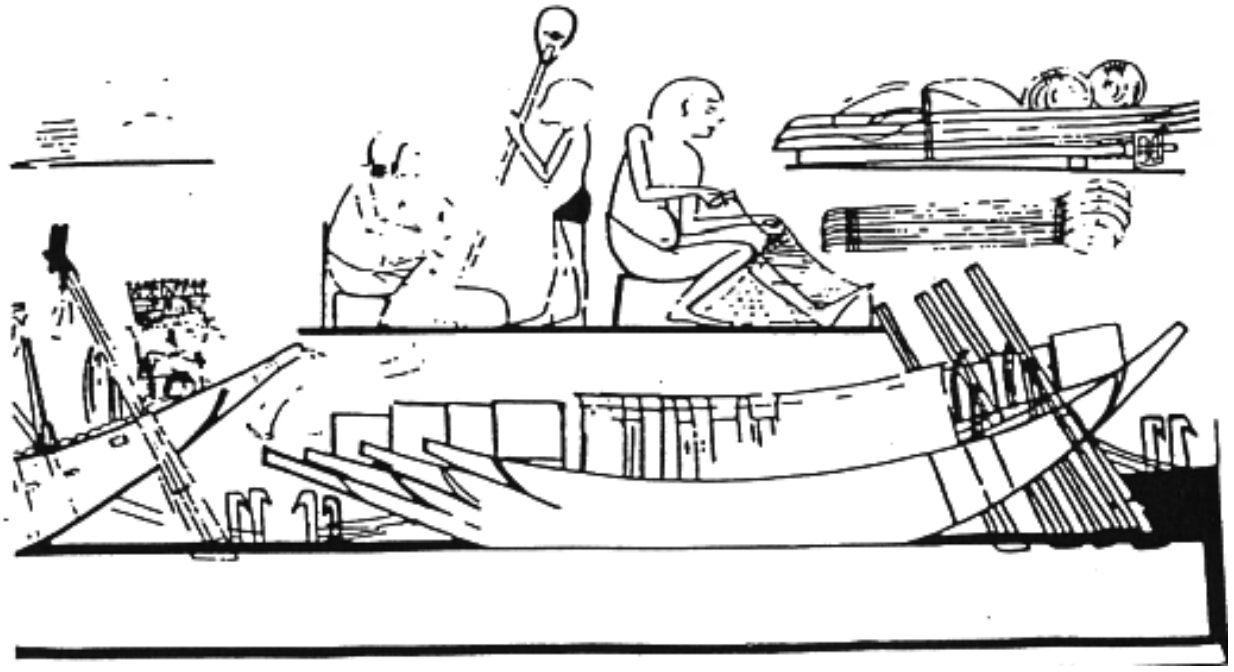

Figure 2.4. Reproduction of the funerary picture with moored ships found in Amarna, *c.* 1365 BC. Shaw, J. W. 1990.

approximately 40 x 10 m. Based on pottery remnants found on the same stratigraphical level, this structure has been dated to the 11th century BC;[18] however, some doubts have recently been cast about its identification as a quay.[19]

2.2. The Aegean Harbours

Greece represents a unique geographical context. Its continental part is characterised by a jagged coastline, full of marked promontories and small islands, whereas the Aegean Sea is crammed with a great number of rocky islands which facilitate sea connections towards the Anatolian Peninsula (to the east) and the island of Crete (to the south). Because of this distinctive coastal topography, the Aegean area has always attracted seafarers, for it offers numerous natural safe havens.[20]

At the beginning of the 2nd millennium BC, Crete acquired a decisive role on sea-routes and there is no reason to doubt that its geographical features made a key contribution to its function.[21] Starting from the MMIB, the emerging 'palaces' boosted a wide commercial network, which put the island into contact with Kythera, Lerna and Egypt.[22] The island maintained this close connection with the sea even in a later period (the so-called Neopalatial period), when intense maritime activities were documented both in southern and in northern Cretan settlements.[23]

The most tell-tale testimony which sheds some light on the Aegean harbours during the Bronze Age comes from the *Western House* of Thera, where a fresco cycle was discovered in 1972 by Marinatos. The scenes of this cycle originally occupied two rooms on the first floor of the house; they are dated to the LMIA (*c.* 1550-1500 BC).[24] Despite its incomplete state of conservation, this fresco is probably the most exhaustive and informative

[18] Fragments of LBAII pottery have been found here, including Cypriot White Slip Wares, a Canaanite crater decorated with herringbone engraving, and two fragments of pithoi of 'Tyrian' type (Artzy 2006: 75-77; Raban and Galili 1985: 321-356). The cladding of the quay is built of large blocks (2 x 0.80-0.60 m) and, according to Raban (1995b: 286-289), three building phases could be identified. At this stage, Tel Dor could not have been the only settlement whose harbour was equipped with infrastructures: at Tell Abou Hawam a wall made of stones has been interpreted as a quay. Furthermore, some texts from Ugarit (RS 17.133 and RS 20.008) mention the presence of moles, suggesting the idea that this kind of structure was rather widespread in the Eastern world (Sauvage 2012: 75).

[19] Lazar *et al.* 2018: 112.

[20] A further advantage for seafarers in the Aegean area was mutual visibility between the various points of the coast. Indeed, no point of the Greek coast is more than 100 km from the sea.

[21] Crete is a mountainous island, with over 700 km of coastline. Along its coasts, there are approximately 50 natural safe havens (Corvisier 2008: 14).

[22] Some of these palaces were located in places which presented a good natural protection, e.g. the palace at Zakro.

[23] To the south: Trypiti, Lebena, Kaloi Limenes, Matala and Kommos. On the northern coast: Roc Troué (near Poros), Skyros, Palaiokastro and Amnisos.

[24] The western house did not present, at the moment of its discovery, any distinguishing features which could indicate that it held a particular position within the urban topography. Its size, building technique and spatial organisation suggest that it was a private house (Benzi 1977: 3).

representation of Aegean maritime activities hitherto available.[25] From the moment of its discovery, it fuelled a heated debate on boat typology, on the possible relations between Thera and Libya in the Late Minoan Age, and on other features connected to the Bronze Age maritime environment.[26] Here, the discussion will be focused only on the three maritime centres which can be identified within the fresco in order to understand their configuration.[27] Particularly, these centres appear in two of the scenes of this cycle, known as *The Battle* and *The Return of the Fleet*.[28]

Figure 2.5. Room 5, Northern wall: 'The Battle', the building identified as a 'shipshed'. Marinatos 1974.

Following the reading order of the fresco, the first harbour representation can be seen in the scene known as *The Battle*: here, a city with a natural harbour can be identified as being located between the mainland and an islet.[29] On the shoreline it is possible to distinguish a building with unique characteristics; this structure presents a typical Aegean flat roof, but it has a peculiar façade formed by at least four parallel compartments opening towards the sea (Figure 2.5).[30] Its four galleries are painted in different colours, two being black and two white. Since the fragments of this fresco have been recomposed, different hypotheses on the identification of this building have been put forward. The most reliable proposal was suggested in the mid-1980s by M. Shaw, who maintained that this structure was a shipshed. Her idea was mainly supported by the proximity of the building to the coastline and the atypical opening of the compartments towards the sea; according to the archaeologist, the dark colour utilised for two of the galleries would point to their depth.[31]

The following scene (Figure 2.6) illustrates *The Return of the Fleet* and was originally situated on the southern

[25] The fresco was originally on the first floor. Broken off from the walls or detached by collapse, its fragments have been found on the floor of the house. For more information on the exact location of the fragments, see Marinatos (1974: tabs. 5-7).

[26] Shaw, J. W. 1990: 429.

[27] For a general interpretation see the interesting, albeit dated, contribution by Benzi 1977.

[28] Both these scenes were in Room 5. *The Return of the Fleet* is also known as *Flotilla Fresco*.

[29] This particular harbour configuration documented by iconography has been found at Mochlos and Nirou Khani (Tartaron, Rothaus and Pullen 2001: 28).

[30] Shaw, M. C. 1985: 19-25.

[31] According to Maria Shaw (1985: 22-24), white could have been used fundamentally for aesthetic purposes, or to highlight the two stylised figures in the foreground. Marinatos (1974: 41) identified this same structure as a dairy. The interpretation of the building as a shipshed has opened an interesting debate, the focal point essentially being the chronology of this kind of structure in the Mediterranean world. Indeed, before Shaw's proposal, it was commonly accepted that this kind of building appeared for the first time in the 6th century BC (this idea was based on Hdt. 2.159.1). However, Shaw maintained that the diffusion of shipsheds could be backdated. Her idea finds support in her excavations at Kommos, where – in the 1980s – she identified a building with six deep galleries (Building P); this structure was built in the LMIIIA1-2 (14th century BC) and was used until the LMIIIB (13th century BC). At the moment of its discovery, this structure was approximately 80 m from the sea, but at the time of its use it should have been located at 130-150 m from the coastline (Blackman 2011: 4-11). Recently, a comparable structure has been identified at Poros/Katsambas (Vasilakis 2010), a Minoan harbour used by the city of Knossos between the LMII-IIIA and the LMIIIB; in LMIIIB, this structure was destroyed (the date of its destruction roughly corresponds to that of the Palace of Knossos, which occurred between 1320 and 1250 BC). Other possible shipsheds (the identification of which is far from certain) have been found at Nirou Khani (Marinatos 1926: 141-147), Mallia (Shaw, J. W. 1990: 427-428) and Gournia (Watrous 2012: 521-541). Additionally, it has been proposed to identify as 'νεώσοικοι' a structure represented on a fragmentary fresco from Ayia Irini, on the island of Keos (Shaw, J. W. 1990: 430). This fragment has been published by Abramovitz (1980: 62). Concerning other possible harbour-works found in the Aegean Sea and dated back to the Minoan era, many doubts remain: in some cases, their chronology is difficult to establish (as in the case of the basin excavated in the rock at Nirou Khani [Blackman 2011: 4-11]); on the other hand, the aim of these structures is often unclear (i.e., the structures found in Mallia [Guest-Papamanoli and Treuil 1979: 668-669; Raban 1991: 139] and Amnisos [Schäfer 1991: 111-119]).

Figure 2.6. Thera, Western house, room 5, wall South III, 'The Return of the Fleet'. Top: the second city, located at the mouth of a river. Bottom: the city of arrival. Marinatos 1974.

wall of Room 5. Here, the fleet (which constitutes the principal subject of the representation and is centrally placed), having left the first harbour (on the top left corner), heads towards a second port (on the bottom right corner). If the fresco has been correctly restored, the first city is set at the mouth of a river,[32] whereas the city of arrival is located on a promontory overlooking the sea; here, there is a bay on each side of the headland and both appear to be used for harbour purposes.[33] On the shore of the smaller bay, three boats are hauled: in the western bay it is possible to distinguish two merchant ships, probably moored. Since the two bays host two different types of ships, it has been proposed that the two harbour basins could have been used for different purposes (Figure 2.7).[34]

With regard to other kinds of harbour-works, i.e. breakwaters and quays, there is no archaeological, iconographic or textual evidence to support their use in the Aegean world of the 2nd millennium BC so far. Thus, the only certain, documented harbour structures are shipsheds, which – according to current research – would have first appeared at Poros/Katsambas (where a building used between LMII-IIIA and LMIIIB was found) and at Kommos (LMIIIA1-2/LMIIIB). [35]

As far as slipways are concerned, various archaeological reports from the island of Crete show that trenches in the rocks have been identified and that they were probably used to haul the ships.[36] However, we must consider that the facilities for hauling the ships could have been built from perishable materials. In this sense, ethno-archaeological comparisons can be useful for understanding how maritime societies dealt with the necessity of pulling ships onto the beach on different kinds of shorelines. For example, wooden 'ladders' for boats are currently used at Arwad, Syria (Figure 2.8),[37] and even on the coasts of southern Italy systems exist that jointly exploit wooden beams and traction exerted on ropes (Figures 2.9 and 2.10). Similar equipment has also been found in Spain: at Cabo de Gata, in the

[32] Many settlements with their respective harbours were located at the mouths of rivers, as is the case of Phaistos (at the mouth of the Geropotamos) and Mallia in Minoan Crete. Outside Crete, the settlements of Troy and Miletus (Asia Minor) and Ephyra (southwestern Corinthia) also utilised the delta of a river for harbour purposes (Shaw, J. W. 1990: 427; Tartaron, Rothaus and Pullen 2003: 27-36).

[33] Archaeological and geological studies have identified various settlements that in this period used both sides of a promontory for harbour purposes, i.e., Agia Irini (Crete), Manika (Euboia), Kolonna (Aigina), Vayia (Eastern Corinthia), Agios Kosmas and Askitario (Attica). See Shaw, J. W. 1990: 423; Tartaron, Rothaus and Pullen 2003 with related bibliography.

[34] Other than a different function of two basins, it is possible to suppose that they were used alternatively, according to the meteorological conditions of the day and/or season. On the shore of the east coast (small harbour) a large building is also visible, with five rows superimposed with triangular apertures. Stucchi (1976: 39) proposed to identify the structure as 'νεώσοικοι'; however, his hypothesis was rejected (Blackman 2011: 4-11; Shaw, J. W. 1990: 433).

[35] Poros/Katsambas: Vasilakis 2010. Kommos: Shaw, J. W., and Shaw, M. 2006. Other possible shipsheds, whose identification is yet to be verified, have been identified at Gournia, Nirou Khani and Mallia. On this topic, see also Raban 1991: 129-146. For additional bibliography, see note 31.

[36] For the MMIIB slipway belonging to the 'Building AA' found at Kommos, see Shaw, J. W. 2018.

[37] See Basch 1987: 223, n. 466. The traditional ladder for beaching usually consists of parallel and cross-beams. This system forms a kind of ladder, which is anchored to the ground by wooden posts. The importance of ethnographical comparison is fundamental, since to this day it is possible to encounter rudimentary harbours with similar characteristics to those of ancient times. For further ethnographical comparisons, see Frost, H. 1963: 106, who documented the existence of boats hanging from trees in Northern Crete, and Baika 2002.

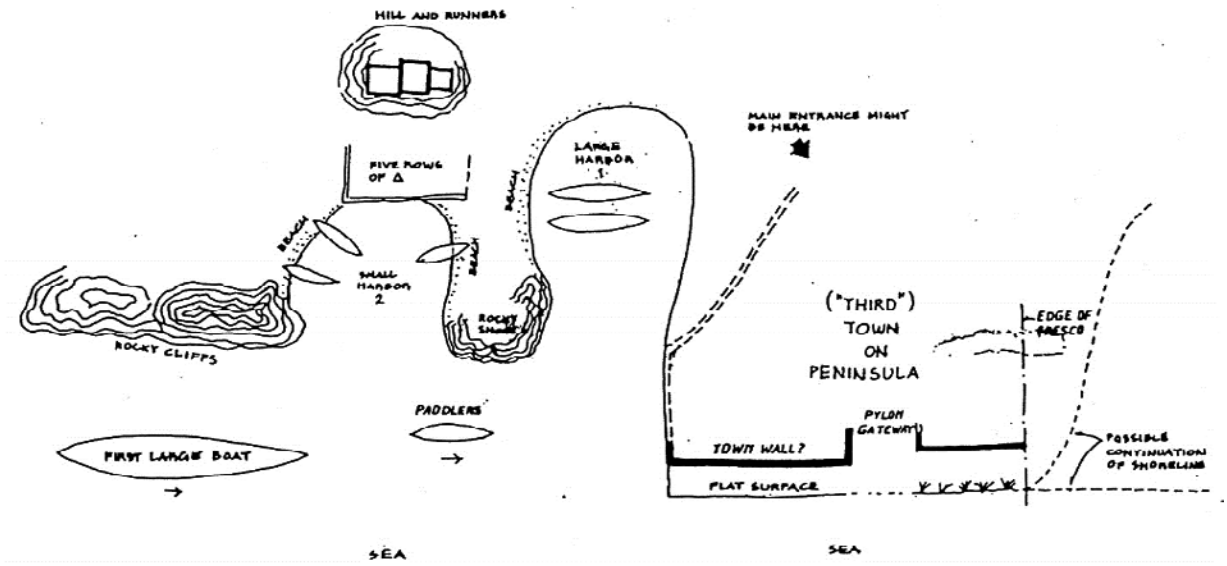

Figure 2.7. Schematic reconstruction of the harbour configuration of the so-called 'city of arrival' represented in the fresco of Thera. Shaw, J. W. 1990: 431, figure 19.

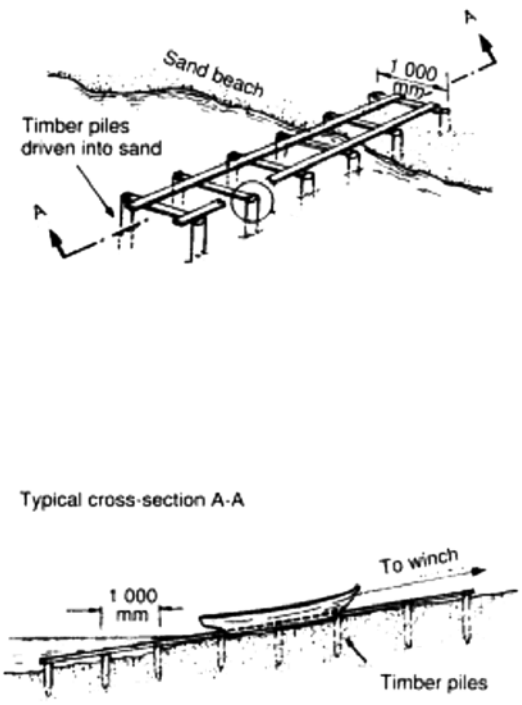

Figure 2.8. Traditional systems for hauling boats onto the shore: wooden 'ladders'. Sciortino 1995: 54, fig. 51.

province of Almeria, the traditional 'ladders' have been reproduced in metal to respond more effectively to stony grounds, and they have been provided with an upper spline for housing the keel (Figure 2.11).

To conclude the panorama of the Aegean world in the 2nd millennium BC it is necessary to point out the presence of artificially excavated basins, which are predecessors in a long tradition that will culminate in the Phoenician *kothon*. Recently, together with the case of Pylos (considered for a decade as unique), it has been hypothesised that the settlement of Troy had a similar system in the Late Bronze Age. The area of Navarino Bay, under investigation from the 1990s within the framework of the *Pylos Regional Archaeological Project*, revealed the existence of an artificial harbour, where archaeologists identified a 330 x 230 m basin, artificially excavated at 500 m from the coast. According to the analysis carried out by the archaeologists and geologists involved in the project, the basin was linked to the sea through a riverbed. The entire system was further improved thanks to a drainage implant capable of preventing sediments carried from coastal currents from entering and subsequently accumulating. The water required for this system to operate came from the Selas, the largest river in the region; this water was then redirected into a second artificial basin (acting as a settling basin), which measured 180000 m^2.[38] The existence of a similar system in Troy has been suggested by Zangger; in this case, the Kenic basin would have been connected – through two canals – to the Mediterranean and the Propontis (Figure 2.12).[39]

2.3. The harbours of Cyprus in the Post-Palatial period, meeting point between the East and the West

In contrast to a rather widespread idea in the past few decades, today it is correctly assumed that the Mediterranean during the 13th and the 12th centuries BC was not experiencing an era of stasis. In fact, it enjoyed a period of lively commercial contacts

[38] Zangger *et al.* 1997: 620. This complex system was in use at Pylos between 1400 and 1200 BC (Sauvage 2012: 60).
[39] Zangger *et al.* 1999: 101.

Figure 2.9. Traditional system used for hauling boats onto shore: ropes. Palizzi Marina (RC), Italy.

Figure 2.10. Traditional system used for hauling boats onto shore: wooden beams for hauling in the boats. Palizzi Marina (RC), Italy.

Figure 2.11. Traditional system for pulling in boats on stony ground. Arrecife de las Sirenas, Cabo de Gata. Almeria, Spain.

which resulted in an acceleration of technological development, probably due to the mutual exchanges of information between the East and the West. During the 'Dark Age', the Mediterranean was not a 'no man's land', nor was it a space unified under a single political or cultural dominion.[40] There were many people travelling, and relations between the different populations were intense and vibrant;[41] moreover, the organisation of the interactions between the various traders must have been complex.[42] This lively situation can also be observed in harbour areas: during the excavations at Kommos in Crete and at Hala Sultan Tekkè in Cyprus, the archaeologists found materials of heterogeneous provenance associated with the same stratigraphic units.[43]

In this epoch of intense relations between the East and the West, the island of Cyprus earned a leading position in commercial networks, taking over the role previously held by the Mycenaeans. Additionally, Cyprus presented a favourable geographical situation: its location between the Aegean and the Eastern Mediterranean coasts (the two major economic poles of the 2nd millennium BC)

[40] It should be underlined that in this volume the phrase 'Greek Dark Age' simply refers to the chronological arc between the Post-Palatial period and the Early Iron Age. Thus, this definition is free from any kind of judgement referring to the lack of archaeological information; moreover, the author is aware of the re-examination of this term after Mazarakis-Ainian, A. 2007.

[41] Studies published at the end of the 20th century (Graziadio 1997; Mederos Martín 1996; Ridgway 2000; Vagnetti 2000) demonstrated that, after the crisis that hit the Mycenaean world and its palatial economy, the Mediterranean continued to be criss-crossed, and that the sea-routes connecting the eastern coasts to the western ones were never totally abandoned. So, it is incorrect to look at this period as an epoch of freezing of sea communications. On the contrary, the expression 'Dark Age' belies a period of lively contacts.

[42] The discovery of the Cape Gelidonya wreck, considered not unanimously as Syrian-Canaanite or Mycenaean, had already presented the problem of assigning a ship to a precise cultural context. The analysis of the Ulu Burun wreck, dated to the LHIIIB, (with its cargo composed of Mesopotamian, Syrian-Palestinian, Cypriot, African and Mycenaean items; see Pulak 2005) and Point Iria wreck (cargo consisting in Cypriot and Mycenean pottery; see Lolos 2003) confirmed this idea. The impossibility to precisely attribute a cargo to a specific cultural context has been seen as proof of the existence of mixed crews; these boats probably made frequent stops, loading and unloading different items at every stopover (Bernardini 2000). On early Iron Age shipwrecks with homogenous cargoes as opposed to Bronze Age ships with mixed cargoes, see Mauro 2014a.

[43] Åström 1989: 204; Vagnetti 1996: 134.

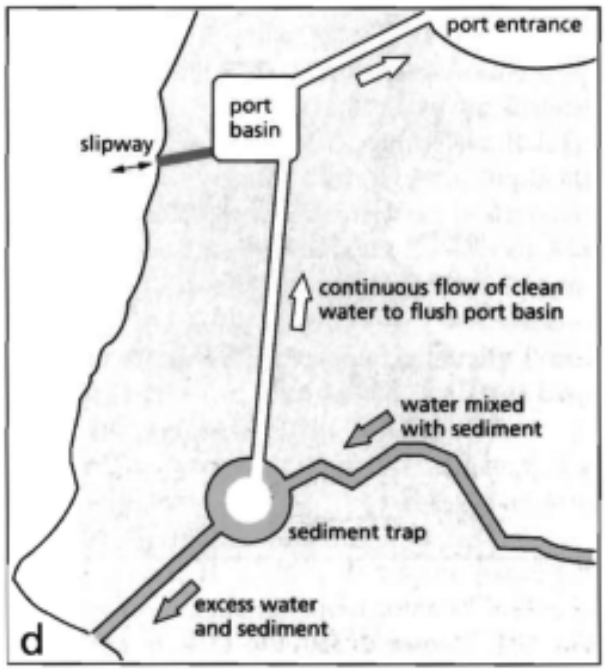

Figure 2.12. Troy (Anatolia), the hydraulic system of the harbour. Zangger *et al.* 1999: figure 10.5.

made it the natural intermediary of the international trades.[44] The availability of natural safe havens and the presence of economic and commercial resources complemented such a favourable geographical context. The harbours that played a fundamental role in this chronological phase, operating as meeting points between the Aegean and Eastern populations, included Maa-Paleokastro,[45] Agios Demetrios,[46] Kition, Hala Sultan Tekkè and Enkomi.[47]

2.4. Harbours of the Levant at the beginning of the 1st millennium BC

The Levantine harbours of the 10th–9th century BC could be regarded as previous direct models for the Archaic Greek harbours. On the Levantine shores, a new concept of harbour was developed, based on the implementation of favourable natural characteristics. In particular, the first breakwaters seem to have been born as artificial reinforcements of natural sandstone formations.[48] Indeed, as Flemming pointed out, the observation of the performance of waves in particular weather conditions could make Bronze Age sailors aware of the presence of offshore ridges and riffs located below the sea-level.[49]

In the Levant, breakwaters have been identified at various locations, primarily aimed at closing off the harbour basin from open-water environmental dynamics and designed as though they were actual sea-walls. Their appearance at sites such as Tabbat el Hammam (Syria), Sidon (Lebanon) and Athlit (Israel) could be backdated to the 9th century BC, whilst their construction and use in the Greek world seems to be slightly later.

The first freestanding sea breakwater in the Levant has been documented at Tabbat el Hammam, *c.* 20 miles south of the island of Arwad. The settlement was located on a small hill slightly projecting towards the sea. Despite this favourable location, the coastline on each side of the headland did not in itself guarantee sufficient protection to the ships. It was likely for this reason that the northern bay, which was not directly exposed to the prevailing winds, was equipped with a breakwater, which allowed for the use of this bay as the main harbour of the settlement from the 9th century BC (Figure 2.13).[50] Specifically, starting from the *tell*, an L-shaped breakwater was built using dressed blocks. It measured approximately 130 m, with a width of 8 m.[51]

The harbour layout of Athlit during the initial centuries of the 1st millennium was similar to Tabbat el Hammam. Even in this case, the settlement was placed on the top of a promontory, with two bays on its sides, one to the south and the other to the north. The northern bay might have been the main harbour and was used both as an anchorage (based on findings of stone anchors) and as a landing place.[52] Its natural configuration protected the northern basin from the prevailing SW winds and waves, as well as from the eastern offshore dynamics (due to the presence of small islets on this side). At the end of the 9th century BC, the northern harbour was the scene of substantial interventions aimed at improving its use. The construction of such harbour-works provided the harbour with additional

[44] On the role of Cyprus in this period see Robertson, Boardman and Kurtz 1994.

[45] On the SW of the island. Although there is no direct evidence for the use of Keratidhi Bay as a harbour, the identification of a settlement on the headland, together with the finding of Aegean material, would allow us to consider Maa-Paleokastro as one of the sites occupied by Aegeans escaping from the mainland. See Sauvage (2012: 34) with related bibliography.

[46] This settlement made use of Kalavassos Bay for harbour purposes.

[47] On the eastern part of the island. At the end of the Late Bronze Age, the settlement of Enkomi was abandoned and its role was taken over by Salamis, which was continuously occupied between the 9th and the 7th centuries BC (Sauvage 2012: 34). All these sites must be considered as natural harbours, since no evidence of harbour-works has been found so far.

[48] Breakwaters as reinforcement of sandstones ridges have been identified at Sidon, Tyre, Arwad and Athlit (Flemming 1980b: 166-167).

[49] *Ibidem*

[50] The breakwater has been dated through analysis of the pottery found *in situ*.

[51] It is possible that the southern bay was also used for harbour purposes (see again Figure 2.13), but exclusively at specific periods of the year. Indeed, it was dangerously exposed to the strong southwestern winds blowing in this area.

[52] Raban 1985: 30-38.

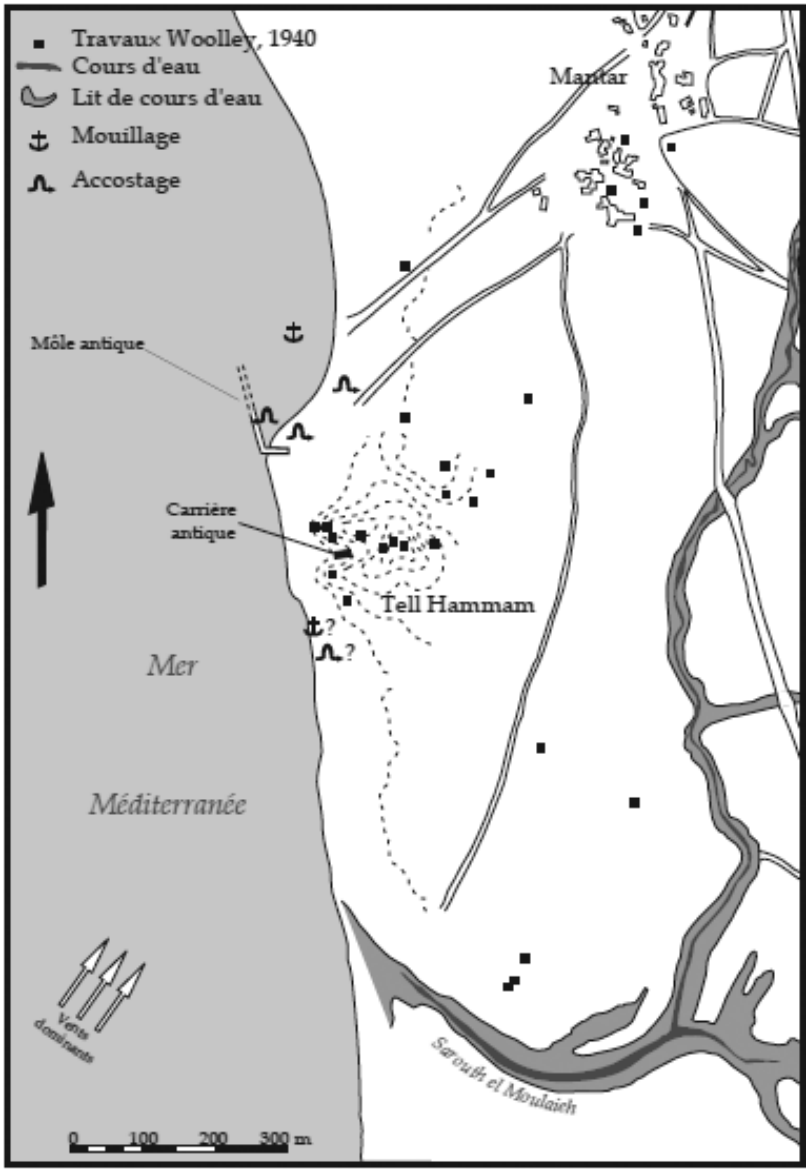

Figure 2.13. Tabbat el Hammam's harbour area with the location of the breakwater. Carayon 2008: 914, fig. 09.01.

protection both from the eastern winds and from the northern winds, which usually blow in this area during the winter months. It has been possible to date these infrastructures thanks to the finding of a small number of wooden bollards (*Cedrus Libani* and *Olea Europaea*) near the NW quay. Through C^{14} analysis, these remnants have been dated to the end of the 9th century or at the beginning of the 8th century BC.[53] Perpendicular to the quay and on its western side, a breakwater was constructed with a NW direction (130 x 10 m) from *kurkar* blocks (limestone) laid in a 'header shape'.[54] On the SE of the harbour basin, another structure composed of a breakwater (100 x 10 m) and a quay (perpendicular to the breakwater and measuring 38 m) has been found.[55] Since the two breakwaters and the two quays were built using the same technique, it has been proposed to attribute these interventions to the same building programme.[56]

The harbour-works in Sidon were presumably built in the 8th century BC. At that time, Sidon was one of the most important Mediterranean sites, the *akmé* of its harbour being currently dated between the 10th and the 8th centuries BC.[57] The settlement layout broadly corresponds to the cases examined earlier: a headland projecting directly towards the sea with two bays on its sides. In the case of Sidon, the northern bay was composed of different coves, whilst the southern one was quite pronounced (Figure 2.14; the southern bay is known as *crique ronde*). Core drillings have made it possible to see that the northern side suffered significant progradation, due to the accumulation of sediments. At the beginning of the 1st millennium BC, on the northern side there were two inlets, both naturally protected from the prevailing winds by the island of Zira which acted as a natural breakwater. In addition, projecting from the headland were a sandstone ridge and different islets oriented in a SW direction (see *Cordon Dunaire* and *Languette Rocheuse* in Figure 2.14). Evidence of artificial interventions referred to the Archaic period was first recognised by Poidebard and Lauffray (and later on by Frost) both on the west side of the headland and on the eastern side of the island of Zira.[58] These interventions were aimed at creating an inner harbour (defined on the western side by the islets and on the northern side by a mole; see *port intérieur* in the Figure 2.14), and an outer-one, where ships could

[53] The quay starts in correspondence to the northern islet (Haggi 2006: 49-51).

[54] Carayon 2008: 324-328.

[55] Carayon 2008: 324-328; Linder 1967; Raban 1985: 11-40, 1995a, and 1997; Raban and Linder 1993.

[56] Haggi 2006: 43-60. The southern bay had considerable dimension (600 m in width), so it could have been used for berthing the ships in good weather conditions.

[57] The maritime importance of Sidon is also recorded in Homer's poems and in the Voyage of Unamūn. Sidonian ships were active on the routes towards and for the Aegean Sea, as well as on those directed towards Egypt. Furthermore, its harbour basin must have had a considerable size, since in the Voyage of Unamūn it is stated that 50 ships were anchored there (Raban 1991: 138).

[58] Frost, H. 1973: 75-94; Poidebard and Lauffray 1951: 73-77.

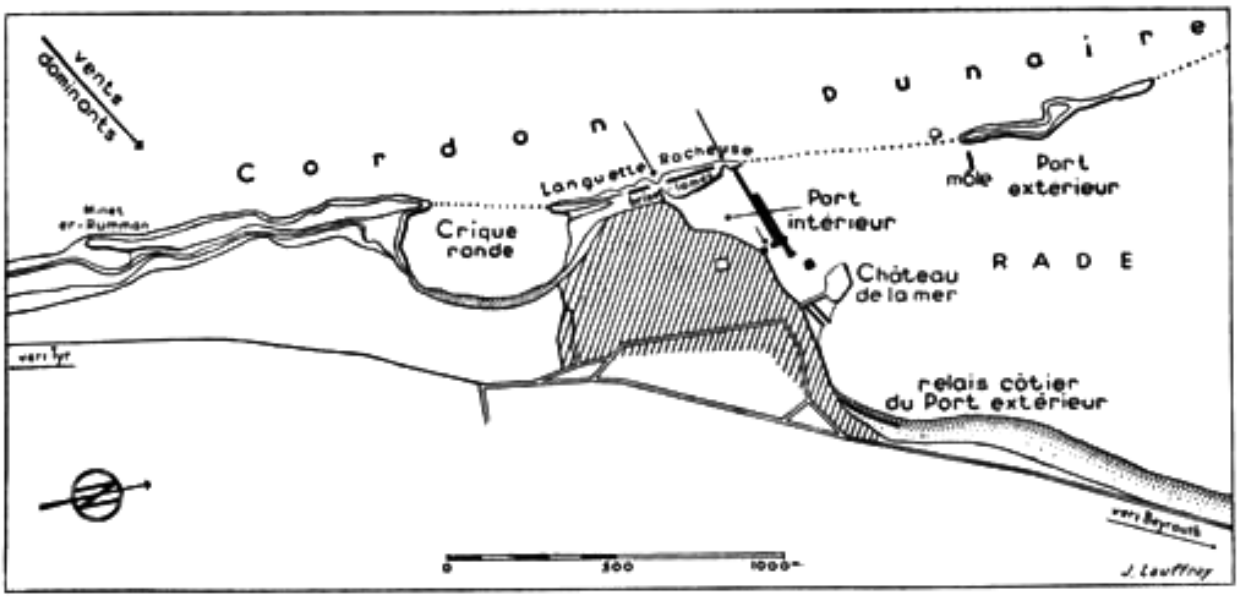

Figure 2.14. Reconstruction of the Archaic harbour system of Sidon. Poidebard and Lauffray 1951.

Figure 2.15. Fragment of a tribute scene, departure from Tyre. On the left, the city of Tyre with the two gates. Photography supplied courtesy of the © British Museum.

anchor or be hauled (between the dunary reefs and the mainland's shoreline, see *port extérieur* in Figure 2.14).[59]

Available archaeological information on Levantine harbours can only be partially integrated with data from iconographic sources. An Assyrian bronze relief from the gate of Balawat, for example, depicts King Shalmaneser III (859–824 BC) receiving tribute from the Tyrians and the Sidonians (Figure 2.15).[60] Here, Tyre is represented as an island surrounded by a bastion with two gates leading into the city, the loading area being placed outside the city-walls. Although the presence of two gates has been used to support the claim that two harbour basins were already active in the 9th century BC, no direct links between the gates and the sea could be found.[61]

Another Assyrian bas-relief, which adorned the palace of Sennacherib in Niniveh, shows the harbour of Tyre as it should have been at the end of the 8th century BC (or at the beginning of the 7th century BC). The scene depicts King Luli of Tyre fleeing his city to Cyprus in order to escape from Sennacherib's attack (Figure 2.16). Unfortunately, the original relief is now lost, but – thanks to an unpublished drawing by Layard and today conserved at the British Museum – in 1956 Barnett was able to identify and reconstruct the image.[62] The scene takes place in front of the city of Tyre, where a flotilla

[59] Poidebard and Lauffray 1951: 53-55. The *crique ronde* was probably also used for harbour purposes; it was a pronounced bay with a sandy shoreline, so it was easy to beach small boats (Morhange, Carayon and Marriner 2011: 60-69).

[60] The fragment of this relief depicting Tyre is currently preserved at the British Museum, while the other parts are at the Louvre.

[61] Barnett (1969) and Katzenstein (1997: 13) supported the idea that the two gates could imply the existence of two harbour basins already in the first half of the 9th century BC. *Contra* Bunnens 1983.

[62] Barnett 1956: 91.

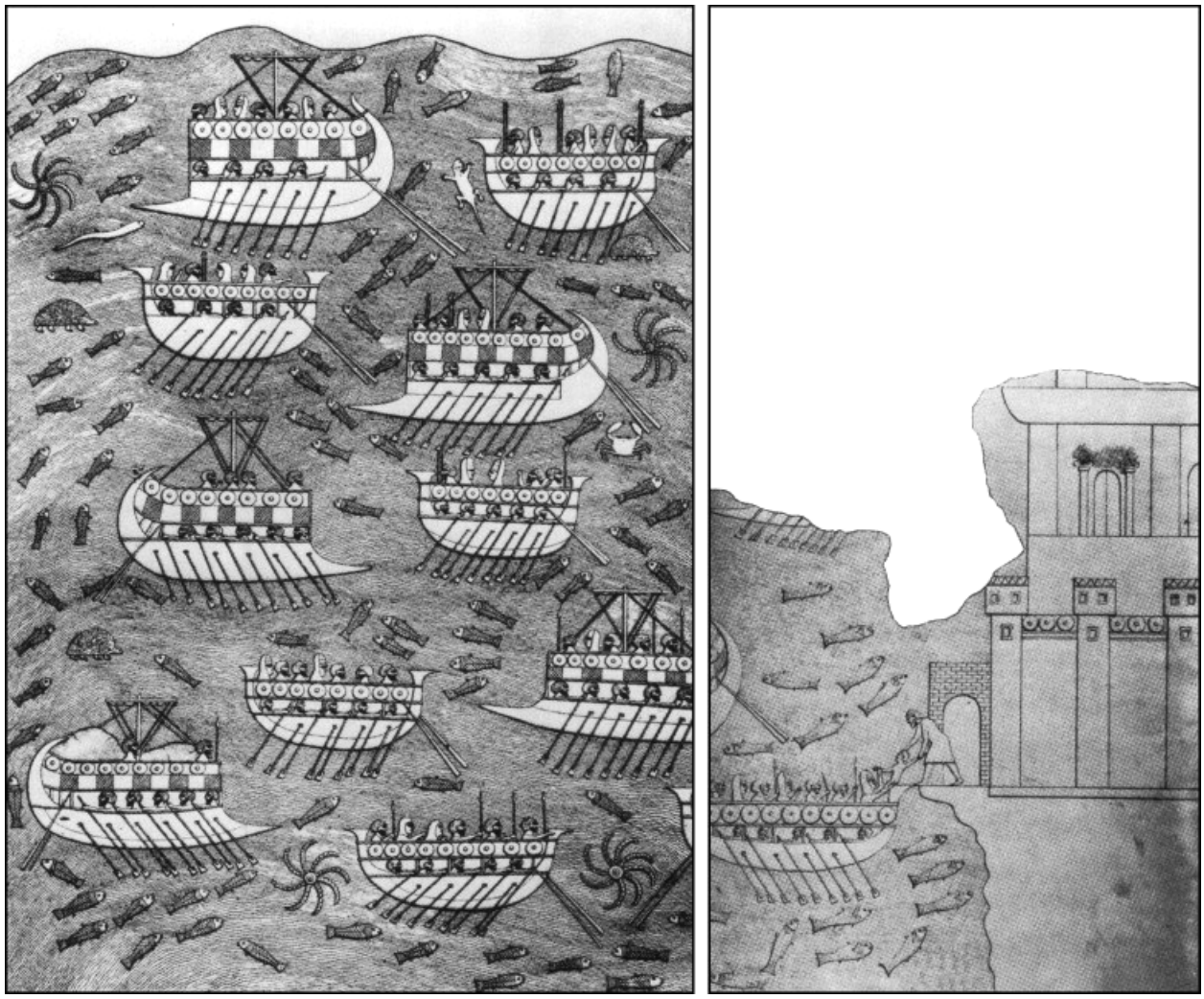

Figure 2.16. Luli, the king of Tyre, and his family escape from Tyre as Sennacherib advances on the city. Palace of Sennacherib at Niniveh. Barnett 1956: fig. 9.

– composed of round-ships (conventionally interpreted as *gauloi*) and long warships (*hippoi*) – awaits the king.[63] On the right, it is possible to identify the city of Tyre with various buildings behind the walls; outside the gate, a man is putting a child on a round-ship in a place that probably corresponds with one of the two harbour basins of the city.[64] This relief is interesting for the study of the ships, but the only information it suggests regards the location of this harbour basin outside the city-walls and its accessibility via a postern, but no trace of harbour-works could be found.[65]

2.5. Instilling knowledge: maritime contacts between Greeks and Phoenicians in the early 1st millennium BC and their consequences

The notable advances in Phoenician harbour engineering had a significant influence on the Greek world. Here, the breakthroughs of the Eastern Mediterranean had rapidly been absorbed and re-elaborated. However, this transmission of knowledge has to be inserted within a wider panorama of relations between Aegean and Eastern traders, which harks back to a period prior to the beginning of the corresponding 'western adventures'.[66] Already in the LMIIIC, their sea-routes overlapped and it is reasonable to believe that

[63] The traditional interpretation of the round-ships represented in this relief as *gauloi* has been criticised by Guerrero Ayuso (1998). The reasons for his scepticism lie in the number of the oars (a double row of oars should have substantially reduced the space for the cargo), the absence of sails and the size of the ships. However, the absence of sails could be explained by the presence of removable masts, and the similar dimensions of the two kinds of ships could be due to artistic requirements.

[64] According to Marriner, Morhange and Carayon (2008: 1296), this basin could be the southern harbour.

[65] Another maritime scene that does not offer more information on the appearance of Levantine harbours is represented in the bas-reliefs from the temple of Sargon II (721-705 BC), found in Khorsabad and today preserved in the Louvre Museum; here, two island cities (traditionally interpreted as Tyre and Arwad) are represented, surrounded by bastions.

[66] Phrase borrowed from Domínguez Monedero 2002: 19-59. On this topic see also Mauro 2015a.

the proximity of their homelands also played a key role in facilitating such cultural and material exchanges.[67]

Systematic contacts between the Aegean and the Levantine populations can be recognised in thirteenth/tenth-century-BC Cyprus. From the 'Island of Copper' there are numerous attestations to these mutual exchanges, so much so that, as Coldstream maintained, the situation of Cyprus in the Late Bronze Age could be described as 'largely a story of Greek Geometric drinking cups going east, and of small flasks of Eastern Mediterranean type travelling to the west'.[68] Such contacts appear to be confirmed also from the Levantine front (e.g., the discovery at Tyre of Greek material dated to the 10th century BC)[69] and the Greek area (e.g., funerary contexts from Lefkandi).[70] In particular, the case of Lefkandi is paradigmatic, since the materials found in the necropolis prove the establishment of trade contacts with various Eastern areas (Cyprus, Syria) beginning from the Proto-Geometric Era (1050 BC).

The mutual influences between the Greeks and the Phoenicians at the beginning of the 1st millennium BC has long been discussed by scholarship.[71] If, on the one hand, it seems impossible (with currently available data) to determine the existence (or the non-existence)[72] of Aegean settlements in the Levant and vice versa,[73] there are enough elements that allow us to assume that regular commercial exchanges existed. For example, a careful reading of Herodotus' work seems to enrich the previously outlined context with 'new' elements: the historian frequently mentions the presence of Phoenicians in Thasos,[74] Kythera,[75] Thebes,[76] and on the Cyclades.[77] Additionally, Homer often refers to Phoenician traders who are said to have regularly been present in major Greek harbours, such as Lemnos[78] and Syrie (probably one of the Cyclades).[79] Another Greek historian, Aergia, wrote that the Phoenicians, led by Phalanthus, were ousted by the Greeks from their fortified city within the territory of Ialysos.[80] Furthermore, we are aware of the existence in Greece of various localities called Phoenice, which could be a toponymical persistence indicating the presence of Phoenician places of exchange.[81] Another hint to these contacts between Greeks and Phoenicians could be inferred from the worship in Corinth of a god named Melikertes, whose name appears to be very similar to the Phoenician Melqart.[82]

It is probably in this context of mutual contacts, established after the collapse of the Palatial system and intensified at the beginning of the 1st millennium BC, that the scenario for the transmission of technical knowledge has to be set. This wealth of experience stands at the basis of the great movement towards monumentalisation experienced by the Greek harbours starting from the 8th century BC.

2.6. Ancient Greek harbours in the Archaic and Classical periods

The period between the 8th and the 4th centuries BC is significantly important for understanding Greek harbour history, as it marks a pivotal moment in the

[67] On Phoenician Archaic routes, see Mauro 2014b.

[68] Coldstream 1986: 231.

[69] Coldstream and Bikai 1988: 35-43.

[70] Coldstream 1998a: 355-256, and 1998b: 14-15; Lemos 2001: 215-226.

[71] For an overview, see Stampolidis 2003.

[72] With regard to this hypothesis, see Papadopoulos 1997.

[73] Niemeier (2001: 11-32) suggested the possible presence of Phoenician communities settled in prevalently Greek centres, such Knossos (Crete), Samos and, perhaps, Athens. On the presence of Greek traders in Levantine settlements, see: Boardman 2002: 1-16; Coldstream and Bikai 1988: 35-44; Domínguez Monedero 2001: 231-238; Kearsley 1999: 109-134; Luque 2003; Riis 1991: 203-311; Waldbaum 1994: 53-66.

[74] Hdt. 2.44.4: 'I went also to Thasos and here I found the sanctuary of Heracles founded by the Phoenicians, who, setting off to sea to discover Europe, made a settlement there' (Translation by the author); *cf.* Paus. 5.25.12.

[75] Hdt. 1.105: '...and the sanctuary of Kythera [the sanctuary of Aphrodite Urania] was founded by the Phoenicians who came precisely from this part of Syria' (Translation by the author).

[76] Hdt. 2.49: 'To me instead, it seems very probable that Melampus learned the worship of Dionysus from Cadmus of Tyre and from those who came with him from Phoenicia to the region now called Boeotia' (Translation by the author); 5.57-58: 'I saw that the Gephyreans were Phoenicians, those Phoenicians who came with Cadmus to the region now called Boeotia. The area of Tanagra, where they settled, was allotted to them. [...] These Phoenicians who came with Cadmus and of whom the Gephyreans were a part brought with them to Hellas, among many other kinds of learning, the alphabet' (Translation by Godley).

[77] Hdt. 4.147.4: '...because Cadmus, son of Agenor, during his search for Europa, landed on an island now called Thera [...] and left on this island Membliarius together with other Phoenicians' (Translation by the author).

[78] Hom. *Il.* 23.741-745: '... a mixing bowl of silver, richly wrought; six measures it held, and in beauty it was far the goodliest in all the earth, seeing that Sidonians, well skilled in deft handiwork, had wrought it cunningly, and men of the Phoenicians brought it over the murky deep, and landed it in harbour, and gave it as a gift to Thoas' (Translation by Murray).

[79] Hom. *Od.* 15.415-416: 'Thither came Phoenicians, men famed for their ships, greedy knaves, bringing countless trinkets in their black ship' (Translation by Murray). On the identification of Syrie, see Mele 1979: 87. From the Homeric poems, it emerges that the Phoenicians were active especially as merchants of metallic items; furthermore, they seemed to be perfectly settled within the Greek code of hospitality and the exchange of gifts.

[80] Jacoby, Ergias von Rhodos, FGrH 513F1 (Ath. 8.360d-361c).

[81] Starr 1961. Nevertheless, this toponym could be referred to the presence of numerous palm trees ('*φοινικών,* ῶνος, ὁ'), and not to Phoenician presence (Domínguez Monedero, personal comment).

[82] Gebhard and Hemans 1992: 23-25 and 76; Starr 1961. In Corinth, there was also a temple where Athena was worshipped with the epithet Phoinike (Lycoph. *Alex.* 5.658), even if traditionally this title has been associated with the possible existence of a statue painted in red colour. For a different interpretation, as well as for bibliographical references on this topic, see Romero Recio 2008: 77, and 85.

transition from entirely natural harbours (in which protection from winds and currents was guaranteed basically by the conformation of the coast itself) to semi-artificial ports. Obviously, it would be incorrect to seek a linear development in Greek harbour architecture, since the Greek world was composed mainly of small coastal settlements, which adopted forms of rudimentary and continuous building techniques.[83] This is primarily motivated by conceiving harbour-works exclusively as a response to the primary needs of harbour basins. As a consequence, very often simple breakwaters – built to restrain the action of the waves – were the only artificial structure of a harbour. However, it still seems possible to outline some common steps within the development of Greek harbours.

Scientific knowledge about this phenomenon is rather incomplete and no summary on this topic is currently available. As underlined in the first chapter, even if the number of excavations is constantly growing, the very nature of harbours at this stage is difficult to study from a historical and archaeological point of view. Indeed, if we consider an ancient harbour active only where there are visible signs of infrastructure, then we would miss many Archaic and Classical ones. Moreover, for the same reason, the number of local anchorages would be misrepresented. Lacking in tangible infrastructures, harbours can still be studied by comparing different kinds of data: literary sources, fragments of pottery found *in situ*, temples or other kinds of buildings used as reference points, and nautical considerations. Naturally, this implies a change of focus, in the sense that the research must be aimed not just at the identification of harbour-works, but at a reading of the seascape.

Traditionally, archaeological interest in Greek harbours intensifies from the 6th century BC. This tendency could easily be explained by the fact that the 6th century BC represents a turning point in Greek harbour architecture. Indeed, from this moment onwards, the construction of large monumental harbour-works is broadly documented, becoming more intense during the Hellenistic era. In particular, two events are considered as key dates in Greek harbour history: the construction of the breakwater in Samos in 530 BC, attributed by Herodotus to the tyrant Polycrates,[84] and the Themistoclean works at the Piraeus, which began in 493 BC.[85]

Nevertheless, these two events are quite late to be considered as the *terminus post quem* for analysing the history of Greek harbours. As a matter of fact, Greek settlements could have used active harbours already extant from a previous period, and there are several factors which can prove the need to rely on operational ports. These factors can be summarised into two main observations: the high level of mobility (both in terms of people and goods) experienced by the eastern Mediterranean in the early centuries of the 1st millennium BC, and the existence of many coastal settlements. As underlined earlier in this chapter, the first observation finds archaeological and literary confirmation in the regular contacts between Aegean and Levantine traders, which hark back at least to the LMIIIC. Furthermore, if we consider Homer's poems as texts which condense the system of experiences and knowledge of the early 1st millennium BC, we can easily recognise the existence of a substratum of maritime culture. For Homeric heroes, seafaring appears to be a normal activity; travelling by sea, they often disembark at foreign harbours; and there are various textual passages which disclose an in-depth awareness of the maritime dynamics, as well as of the places where unloading, anchoring and hauling the ships was considered safer.[86] Archaeologically, the establishment of oversea settlements is further proof of the significance and necessity of harbours and ports at this stage.[87]

The second factor is represented by the existence of many coastal settlements, mainly located in correspondence to areas which naturally guaranteed a certain protection to the ships, and needed only minimal maritime installations to be sufficiently safe. Looking at the geography of the Aegean and eastern Ionian seas, it appears clear that the high number of islands, many of which were inhabited since the Paleolithic period, implied frequent sea-travel.[88] So, since an early period, the sea constituted for Greek culture a means of communication that made it possible to maintain commercial and political relationships between the various settlements. In this context, harbours were fundamental both for

[83] Blackman 2008.

[84] According to Herodotus (3.60.3), the breakwater in Samos would have been the first harbour-work of the Greek world.

[85] Diod. Sic. 11.41; Paus. 1.1.2; Plut. *Vit. Them.* 32. The works begun under Themistocles were then improved and expanded in the 5th century BC (Amit 1965: 73-81; De Souza 1998: 274; Garland 1987: 14-28, 96-98, and 203).

[86] E.g., Hom. *Od.* 9.115-125, 9.135-151, and 19.185-189.

[87] Pithekoussai, the first substantial settlement on the western Mediterranean is dated to *c.* 750 BC (Ridgway 1982, and 1994). On the collaboration between Greeks and Phoenicians for the foundation of Pithekoussai see Domínguez Monedero 2001: 234. On the establishment of settlements in the western Mediterranean from the 8th century BC: Bakhuizein 1981; Bartoloni and Cordano 1978; Graham 2017: 25-44. On the Greek settlements in the Black sea: Carpenter 1948; Domínguez Monedero 1991: 124-126; Graham 2017: 113-137; Labaree 1957.

[88] As it has been rightly stated, this geographical context facilitated the development of navigation (Constantakopoulou 2007: 20; Horden and Purcell 2000: 126). Aelius Aristides (44.10) noted as the Aegean was 'most gentle because of its resting places'. On the arrival of the first hominins on the Aegean islands in the Upper Paleolithic period see Broodbank 2013: 95.

allowing the population's internal sustenance[89] and for projecting the image of the city outside its boundaries.[90] Archaic and Classical Greek history could not be understood then without harbours, which acted as terminals in such an intricate connective network. Therefore, it is reasonable to suppose that already at the beginning of the Archaic period, the Greeks appropriately equipped their settlements with seaports, probably placed at short distances and aimed at ensuring that the ships could find shelter in case of bad weather.[91]

For these reasons, the next chapters will re-assess Greek harbours between the Archaic and Classical periods, with focus on three main aspects: geomorphology, harbour-works and harbour forms.[92] Indeed, even if a port 'cannot be regarded as an isolated phenomenon' (as Karmon stated in 1980),[93] it is necessary to understand the harbours themselves in the first place. Analysing geomorphology, harbour-works and harbour forms could contribute in establishing a common agreement on the appearance of Archaic and Classical harbours, their natural and artificial elements, and their layouts.

The first aspect to be examined is geomorphology, with the identification of the preferential natural situations. Indeed, in an era when technical knowledge was not sufficient for constructing complex underwater structures, the choice of the location of a harbour was mainly determined by the natural configuration of the coast. The protection against winds and currents offered by the conformation of the coast could then be considered as the determining factor in the choice of strategic locations that would be adapted to function as harbours or landing areas – it was a *conditio sine qua non*. Once the preferential natural situations are identified, harbour-works will be analysed in order to outline a brief historical profile for each kind of infrastructure. In particular, it will be emphasised that a heterogeneous range of infrastructures was in use during the Archaic and the Classical periods, in response to the different basic needs of a harbour basin. Lastly, this survey will deal with harbour forms: indeed, considering the number and location of the basins in a port, various harbour forms could be identified as in use during the Archaic and Classical periods. Some of these were used seamlessly, whereas others appeared only later on.

[89] Some of the essential supplies arrived to the city through the harbour.

[90] Through the establishment of oversea settlements and the external trade.

[91] According to Horden and Purcell (2000: 11) 'a sea is conceived as a linear route defined by a sequence of harbors or natural features'.

[92] Preliminary considerations on this topic can be found in Mauro 2014c, and 2019.

[93] Karmon 1980: 7.

Chapter 3

The Geomorphology of Greek Harbours

In the ancient Greek world, seafaring was a vital means of communication between coastal settlements. The further they travelled, the more frequently ships needed to make landfall in order to be resupplied with goods or drinkable water. In general, the fundamental characteristic of a good landing area was its capacity to offer specific advantages to vessels that were principally connected to the morphology of the place (that is, the configuration of the coast and of the surrounding territory) and its facilities.[1] In particular, the main factor that made a place suitable for use as a harbour was its coastal configuration, since it is hard to believe that for a ship and its crew there was anything more important than finding a safe haven in case of unfavourable winds. After this, ancient seafarers will have valued the availability of drinking water and – if possible – ease of entry.[2]

The first issue that arises at this point is how the configuration of the coast can be analysed by archaeologists and historians. As explained in paragraph 2.6, the fact that for a long time archaeologists looked for anchorages and harbours with an emphasis on harbour-works has resulted in a lack of information about early Greek ports. On the other hand, this same scarcity of knowledge has not been entirely compensated for by the work of geologists, whose focus in the past was exclusively on the geomorphology of the places and their environmental data. This chapter presents a different approach, according to which harbours must be looked at as a part of the seascape. Therefore, integrating geographical and geological information with historical and archaeological sources, a guide to the preferential locations of Greek harbours will be provided.

Before specifically referring to the Greek context, it is useful to emphasise that the natural environment has always been of fundamental importance for the location of harbours[3] and it still plays a major role today, despite engineering techniques that allow for substantial modification of the shoreline.[4] The absence of Archaic and Classical technical handbooks, or similar texts, represents a major obstacle in reconstructing the characteristics that were mainly appreciated. In addition, the only surviving technical text, the *Periplus of Pseudo-Skylax*, does not contain detailed nautical information, probably due to its preservation as more of a literary work than a technical handbook. Nonetheless, some scholars have argued that some of its original content (together with other sailing guidelines contained in earlier *periploi,* now lost) could have survived, influencing the production of historical texts and being perceivable in some passages, e.g. Herodotus' account of the loss of numerous ships of the Persian fleet between Thessalonica and Larissa.[5] As far as Hellenistic and Roman *periploi* are concerned, they present large sections dedicated to the description of the coasts and to the conditions of seafaring in certain sea-areas, but they do not explicitly list what were considered the fundamental natural characteristics of places to be chosen as harbours. Notwithstanding, Medas stated that, assuming that seafaring is a popular activity practiced continuously and without drastic changes over time, the main traits that a natural place may have presented to be adapted as a port could be summarised in five points:[6]

[1] Within the term 'facilities' it is possible to encompass both the jurisdiction or protection assured by the harbour (abstract or not tangible facility) and the harbour-works (physical facilities). Hereby, the focus will concentrate on the latter.

[2] Obviously, this does not imply that the geomorphology was the only factor to be considered in the choice of a specific place, since the location of a harbour was often the result of a complex interaction between morphological, topographic and socio-economic aspects. Furthermore, harbours develop differently due to their geographic location, the physical conditions of their site and the size and economic activity of their hinterland. Favourable geomorphological conditions ease the installation of harbours, which became such only when they were regularly frequented by ships (Karmon 1980: 9).

[3] On Phoenicians harbours, see Carayon 2008 and Mauro 2015b.

[4] Indeed, this *status quo* is currently maintained in various Mediterranean areas, where many marinas are fundamentally natural havens. In a collection of Diplomatic Records of the 16th century AD compiled by Albéri, there is an interesting annotation (Albéri 1839-1863: 445): 'Genoa has a harbour; however, this is not entirely natural' (Translation by the author). This statement seems to implicitly suggest that even in the 16th century AD the most important Mediterranean harbours were mainly natural landing areas where the construction of harbour-works was only considered as supplementary (the comment continues in the following way: 'Indeed, there is a part that seems to project towards the sea; apparently, it is built with a considerable amount of stones arranged in such a way as to set up a wall' [Translation by the author]).

[5] Hdt. 7.188-192. See: Hammond 1967: 471-476; Janni 1996: 68. A deep knowledge of the Aegean coasts can also be seen in the *Catalogue of the Greek Ships* (Hom. *Il.* 2.494-759, and 816-877) and in some passages of Odysseus' voyage (e.g., Hom. *Od.* 9.39-40), as emphasised by Hyde (1947: 77). The geographical treatise entitled 'Περίοδος γῆς', written in the 6th century BC by Hecataeus, could also have influenced the descriptions of the Mediterranean coasts included in later sources. Moreover, in Strabo's *Geography*, various items of geographical information and coastal distances appear which might directly or indirectly derive from other authors, e.g. Dicaearchus (late 4th century BC). See Morton 2001: 180-181.

[6] Medas (2008) deduces these five points by reading later nautical sources, mainly medieval and modern ones. In particular, these

- a basin with a narrow entrance and which was protected from various winds;
- a good sea bottom, capable of adequately holding anchors;
- an additional protection from the winds, offered by the surrounding topography of the place (in particular, the presence of hills/mountains close to the harbour may reduce the power of the winds);
- the availability of drinking water;
- the presence of offshore islands, which could be used as additional harbour areas for larger ships to anchor.

A first attempt to identify theoretical models for detecting harbours was made by Flemming in 1980.[7] He defined six types of natural harbour, providing some well-known examples for each one. From that moment onwards, Flemming's proposals have been readapted by various scholars to specific chronological periods and/or areas.[8] This chapter adapts Flemming's models to the Aegean and eastern Ionian coasts. In this case, four principal factors of protection have been identified: headlands, islands, bays, and rivers; moreover, for each one the presence of additional sub-typologies has been pointed out.[9] Therefore, the following paragraphs contain a comprehensive list of the advantages and disadvantages offered by each typology (and their respective sub-typologies).

3.1. Headlands

> 'But a violent storm arose, and there was no harbour in which the fleet could find shelter;
> so the greater part of the army re-embarked and sailed round the promontory called Ichthys towards the harbour of Pheia.'
> Thuc. 2.25.4[10]

Promontories are rock formations which stretch out towards the sea, sometimes reaching notable heights. As emphasised by Gras, Mediterranean history has been strongly influenced by headlands, which have often been seen as places where the contact between the land and the sea is realised with majesty.[11] However, the relationship between seafarers and promontories has always been problematic, for reasons that can be easily understood. Indeed, one of the main characteristics of promontories is that their presence frequently determines a change in sailing conditions.[12] As such, they mark the passage between two different sea-zones; therefore, to round them means – from a nautical point of view – to come up against the unknown, in the sense that beyond a promontory, a ship could run into unfavourable weather conditions.[13] Different currents often meet off headlands, creating strong whirlpools. Furthermore, usually parts of promontories are not visible, since they extend underwater in the form of dangerous rocks.[14]

The precarious seafaring conditions around headlands might clarify why they were often associated with the presence of monstrous maritime creatures in the literary works. The location of these figures around promontories should, therefore, be seen as an attempt

five characteristics appear to be mentioned in the *De Navigatione*, a technical handbook of the 15th century AD, written by the Dalmatian Benedikt Kotrulević (1464).

[7] Flemming 1980a: 162-163.

[8] The advantages and disadvantages of these coastal situations have been studied by various authors: Blue (1997: 31-34) identified 'anchorages on high energy' and 'on low energy', based on their offering exposure to, or shelter from, swells and stormy seas; Pinheiro Blot (2003: 47-51) adapted Flemming's models to the Portuguese context; Vann (1994: 302-320) to Cilicia.

[9] This classification is slightly different from what proposed in Mauro 2019.

[10] Translation by Jowett.

[11] Gras 1997: 16-17.

[12] The existence of these changes in maritime dynamics was already perceived to such an extent that the boundaries between the various 'seas' were often determined in relation to promontories, e.g. Strab. 7.7.4. See also Morton 2001: 41. An example of how headlands could result in dangers for seafarers is the case of the 'Hollows of Euboia' ('τὰ Κοῖλα τῆς Εὐβοίης'), where the Persian fleet was driven onto the rocks in 480 BC. This stretch of the coast, with a sudden alternation of promontories and bays, could also have been the place where the Greek navy sank on its return from Troy (Morton 2001: 73-74).

[13] In particular, the more acutely sloping the promontories were, the greater influence they had on wind and waves. Concerning the negative implications of headlands on seafaring, the case of Cape Maleas is certainly emblematic (Morton 2001: 81-85). A well-known passage by Strabo (8.6.20) runs: 'Forget your home when you round Cape Maleas' (translation by the author of the original Greek text: 'Μαλέας δὲ κάμψας ἐπιλάθου τῶν οἴκαδε'); this saying is also reported by Symm. *Ep.* 8.61 ('Vulgati quippe proverbii est enavigata Malea oblimari eorum memoriam, quos domi reliqueris'). In Antiquity, crossing this headland was considered so difficult that the epitaph of Flavius Zeuxis at Hierapolis in Phrygia (*SIG*[3] III 1229) commemorates the 72 voyages that he made between Hierapolis and Italy, rounding Cape Maleas. On dangerous seafaring around Cape Maleas, see also: Alciphr. 1.10.3; *Anth. Pal.* 7.214, 275 and 584; Hdt. 4.179.2, and 7.168.4; Hld. 16.7; Hom. *Od.* 3.276-292 and 9.80-84; Orph. *A.* 1363-5; Philostr. *VA* 3.23; Pompon. 2.49-50; Procop. *Vand.* 3.13.5; Stat. *Silv.* 1.3.97; Verg. *Aen.* 5.193. As noted in a recent study by Angelini (2012: 50), after Homer the shipwrecks at Cape Maleas became a literary *topos*, common to the *nostoi*, and Cape Maleas became the preferred location for a shipwreck, even when it was not along the sea-route, e.g. the case of Agamemnon who, returning to the Argolid, should not have passed through there (Hom. *Od.* 4.514-523), or that of Silenus' ship, which was sailing elsewhere, near the Cyclops' cave (Eur. *Cyc.* 18-20).

[14] Cape Maleas is the place where maritime currents coming from the Ionian Sea and the Aegean Sea meet, creating dangerous whirlpools (Morton 2001: 70). Cape Tainaron is also defined by Strabo (8.5.1) as 'ῥοώες κρημνός', 'a precipitous rock exposed to the currents of the sea' (Translation by the author); furthermore, nearby there are strong downdrafts, blowing down from Mounts Taigetos and Parnon. Cape Tainaron's negative reputation appears to be confirmed by the fact that ancient literary sources placed a cave near this promontory through which it was possible to enter the underworld (Eur. *Heracl.* 23-25; Paus. 3.25.4-5; Sen. *Herc. F.* 662-667, and 807-817). On this topic, see Angelini 2012.

to give an aetiological explanation to the nautical risks which sailors had to face. In other words, mermaids and maritime monsters provided a rational explanation for the numerous submerged rocks or the strong whirlpools frequently found around these places.[15]

Despite all these dangers, headlands constituted convenient stopping points and, in certain meteorological conditions, they could provide sailors with a safe place to anchor or to moor.[16] Especially in case of strong winds, it was often recommended that shelter be found on the leeward side of a promontory, waiting for a stabilisation of weather conditions which would enable the crew to continue its journey.[17] Additionally, headlands were easily recognisable even at great distances, especially when they had a particular colour or shape.[18] For this reason, they were frequently privileged sites for the construction of temples,[19] maritime signalling devices,[20] or other types of structures.[21] Lastly, from a strategic perspective, promontories allowed for control of wide sea-areas, so they were often used for naval and military bases.[22]

3.1.1. Sub-typology 1.1. Harbours/anchorages in the lee of a headland (with the utilisation of one side only)

The level of protection offered by headlands largely depended on their orientation, their geographical position, the direction of winds in that area, and the season. Indeed, harbours protected by a headland did offer shelter, but sailors knew that at any moment they could be caught up in a storm-wind and be hurled with their ships against the coast.[23]

To find shelter, ships had to reach the leeward side of the promontory; once there, they could anchor or be hauled ashore if the shoreline was suitable for beaching. Sheltered areas in the lee of a promontory would be ideal for anchorage and landing in certain weather conditions and during certain periods of the year. However, in other situations, the same areas could have been directly affected by local winds, which could have turned them into particularly difficult landing places (Figure 3.1).[24] Thus, in general, promontories did not offer total protection to ships but provided them with shelter only in favourable weather conditions. This is the reason why harbours near promontories were often improved by the construction of breakwaters, which allowed for an extension of their period of use over the year.[25]

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[15] Commonly, a headland continues underwater with submerged rocks close to the surface. A well-known example of the location of monstrous creatures near headlands is that of Scylla and Charybdis in the Strait of Messina (Ap. Rhod. *Argon.* 4.920-923; Hom. *Od.* 12.220-225). Also on the Argolid Peninsula, at the southwestern entrance of the Saronic Gulf, there was a headland named 'Scylla', near to which a marine monster was believed to live (Apollod. *Bibl.* 3.15.8; Paus. 2.34.7); the Argolid Scylla was also mentioned in the *Stadiasmus* § 273.

[16] E.g., Thuc. 2.25.4.

[17] E.g., in 479 BC the Greek fleet, after defeating the Persians at Cape Mycale, had to moor on the leeward side of Lectium (on the western side of the bay of Adramyttium) and wait for better weather conditions (Hdt. 9.114).

[18] Some cases of headlands easily recognisable due to their colour were the following: the white rocks of the Leukata Promontory on the Ionian island of Leucas (n° 94); the dark brown/grey rocks of Kastro, the headland around which Myrina's harbour system (n°113) on the island of Lemnos was organised; and the red rocks around the harbour of Erythrai (n° 51) in Ionia, from which the city's toponym derived (Morton 2001: 191; Smith, W. 1854-1857: 852; Tozer 1873: 367). With regard to headlands with a peculiar shape, there are the cases of Cape Ichthys (meaning 'fish', in front of which the harbour of Pheia in Elis, n° 143, was located), and the promontory of Kynosoura (literally 'dog's tail'), on the southern side of the harbour of Salamis (n° 164).

[19] In particular, temples were built on the top of headlands both for visibility and religious reasons, since sailors frequently interpreted promontories as divine gifts and often deposited votive offerings in their environs. Examples of temples located on the top of headlands are Poseidon's temples at Cape Sounion (n° 177) and Cape Tainaron (between Achilleios Limen, n° 3, and Psamathus, n° 156), at Geraistos (n° 54) and at Hermione (n° 65). Some cases are known where the sanctuaries placed on a headland became seats of amphictyonies (regional religious councils), i.e. Poseidon's temple at Kalaureia, Panionion at Cape Mycale (opposite the Strait of Samos), or Apollo's Pan-Hellenic sanctuary at Actium. On temples built on promontories, a reference text, albeit dated, is Semple 1931: 613-637. On the religiousness of Greek sailors see Rodríguez López 2008; and Romero Recio 1997, and 2010.

[20] It is unclear whether it is possible to speak of lighthouses in the Archaic and Classical periods. However, systems for rudimentary maritime signalling certainly existed, sometimes simply as 'πυρά', fires burning on high points along the coast. I would like to thank Jonathan Christiansen from the University of Lyon for the e-mail exchange on this topic. For more information, see par. 4.2.4.

[21] There are numerous testimonies to the erection of tombs on headlands. Homer tells us that Hector vowed to return the body of whichever Achaean hero he killed so that it could be buried overlooking the Hellespont (*Il.* 7.85-91), whilst the tomb of Elpenor occupied the peak of a promontory on the island of Circe (*Od.* 12.11-15). This tradition was also preserved in later periods, as the construction of Themistocles' tomb, on the southern side of Kantharos, Piraeus (n° 72), testifies.

[22] E.g., during the Peloponnesian War, the Athenians attempted to take possession of harbours in proximity to headlands on various occasions, as in the case of Pylos (n° 158), utilised as a base in 425 BC to ensnare the Spartan forces (Thuc. 4.3), and of Kardia (n° 73). See Morton 2001: 310-317.

[23] Flemming (1980a: 162-163), having identified shelters in the lee of promontories as one of the six main types of natural anchorages, admits that such harbours were effective only with certain wind directions, adding that in such coastal configurations permanent ports do not develop.

[24] Carayon 2008: 585.

[25] I.e., on the Ionian island of Leucas (n° 94). The usability of this harbour (a 'mixed harbour', see par. 3.5), which appears in Skyl. 34 ('πόλις Λευκὰς καὶ λιμὴν· αὕτη ἀνέχει ἐπί τὸν Λευκάταν, ὅ ἐστιν ἀκρωτήριον πόρρωθεν ἐν τῇ θαλάττῃ'), was improved thanks to a breakwater, probably built at the end of the 5th century BC. On the Leucas breakwater: Lehmann-Hartleben 1923: *s.v.* 'Leukas', n. 152; Marees, von 1907: 10-18; Murray 1988: 101; Negris 1904: 354-360. In addition to Skylax, Thucydides (6.104) makes reference to Leucas, but he does not explicitly mention its harbour. The historian says that in 414 BC a Peloponnesian fleet, led by the Spartan Gylippos and charged with bolstering Syracuse's resistance to the Athenians, passed through Leucas. Here, they received the false news that

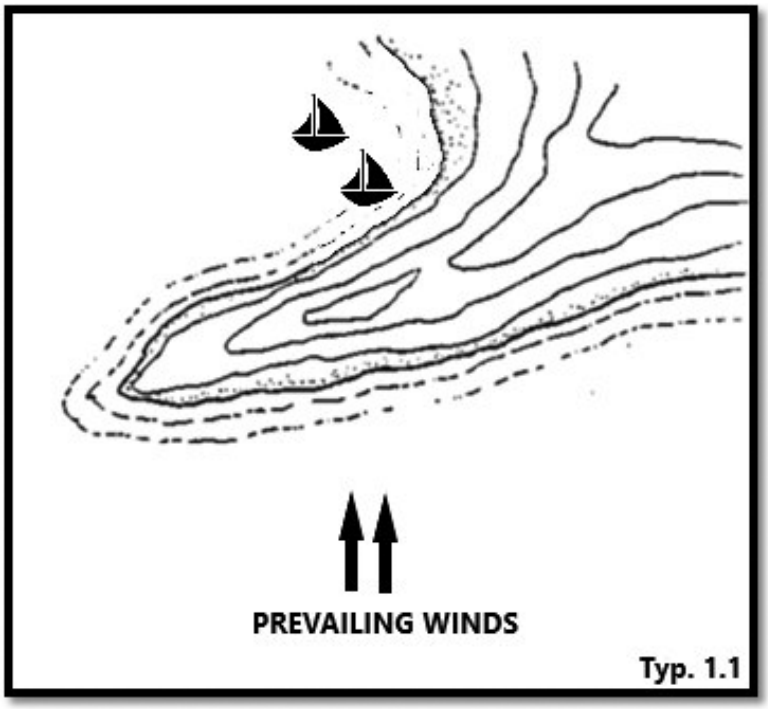

Figure 3.1. Example of the possible configuration of a harbour in the lee of a promontory (with the utilisation of one side only). After Blue 1997: 33.

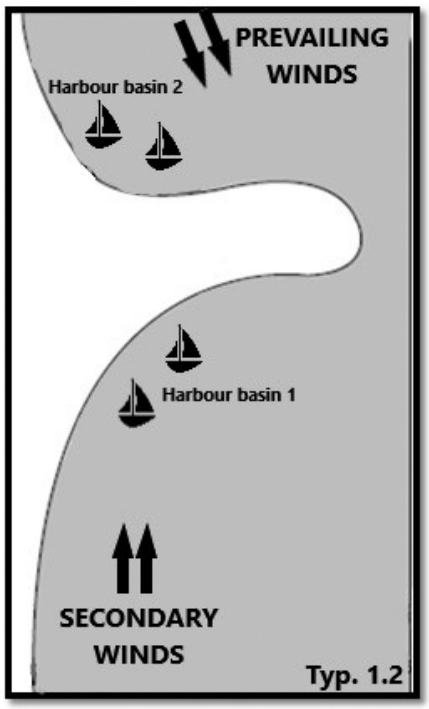

Figure 3.2. Example of the possible configuration of a harbour in the lee of a promontory (with the utilisation of both sides). After Carayon 2008: 1328.

In the Archaic and Classical periods many harbours and anchorages took advantage of their location in the lee of a promontory. In particular, this solution was commonplace in Asia Minor, where the east-west orientation, common to many headlands, ensured reasonable protection for ships. A clear example can be seen at Notion in Ionia (n° 123), where the main harbour lay on the eastern side of the promontory. In the Hellenistic period, in order to improve this protection, a breakwater was built.[26] At the southern tip of Attica, ships sailing east which were not able to reach Euboia because of the *meltemi* winds, could find shelter on the northeastern side of Cape Sounion (n° 177). In the Ionian Sea, the harbour of Pheia (n° 143) could rely on the protection offered by the Ichthys (i.e., 'fish-shaped') promontory, the extension of which out to the sea created a buffer against the force of the wind.[27]

3.1.2. Sub-typology 1.2. Harbours/anchorages in the lee of a headland (with the utilisation of both sides)

As previously mentioned, the level of protection offered by a headland largely depended on various physical factors. Nevertheless, some promontories were located in geographical areas which enabled the use of both sides for harbour purposes. This kind of geomorphological situation was particularly appreciated, since it allowed for the creation of a 'double harbour' ('ἀμφίδυμος λιμήν'[28] or 'ἀντίπυγος λιμὴν')[29] (Figure 3.2). The use of both sides of a promontory was possible when headlands were located within a broader protected sea-area (e.g., a gulf),[30] or in a region affected by winds coming from alternate directions throughout the year.[31] Both these situations permitted both sides of a cape to be used for harbour purposes, also allowing for the construction of harbour-works where required.

The settlements which took advantage of both sides of a promontory could alternate their use according to the time of the year (this seems to have been the

Syracuse was now fully blockaded by the Athenians, so Gylippos decided to hasten their voyage across the Ionian Sea. At Klazomenai in Ionia (n° 79), archaeologists from the Ankara University Research Centre for Maritime Archaeology identified two breakwaters which were used in the Archaic and Classical periods to define the harbour basin (Erkanal *et al.* 2014: 45).

[26] The chronology of the breakwater is unclear, but it seems to be connected to the city-walls, which can be dated to the Hellenistic period (Bean 1984: 111).

[27] An Athenian fleet found shelter here in 431 BC (Thuc. 2.23-25).

[28] Hom. *Od.* 4.845-847; Chryssoulaki 2005: 77-90. On 'double harbours' see also Casson 1971: 360.

[29] Skyl. 46, and 108.

[30] As could have been the case at Pagasai (n° 132) in Thessaly, within the Gulf of Pagasai.

[31] E.g., the harbour of Myrina (n° 113), on the island of Lemnos (Morton 2001: 124).

case of Myrina, n° 113, on the island of Lemnos)[32] or allocate them to different purposes (e.g., using one of them as a commercial harbour, and the other for military vessels).[33] Furthermore, the settlement itself was commonly located on the top of the headland, maintaining visual contact with both of the harbour basins.

Identification of 'double harbours' can be problematic, since it is not easy to state with absolute certainty when both sides of a headland were used as anchorages or landing areas. However, there are elements which can suggest the allocation of some harbours to sub-typology 1.2. For example, the finding of harbour-works on both sides of a promontory, which, apparently, was the case of Pagai in the Megarid (n° 131), where possible shipsheds have been identified on both sides of Akra Loutsa.[34] In other circumstances, the utilisation of both lees can be ascertained from nautical or meteorological conditions which affected a particular area. Amongst these cases are those of Hermione (n° 65) and Epidauros (n° 47) in the Argolid, Pagasai (n° 132) in Thessaly, Myrina (n° 113) on Lemnos and Methymna (n° 102) on Lesbos. Lastly, there are settlements which certainly made use of two harbours in later periods, as attested to by literary sources or archaeological findings, and for which it is conceivable that a 'double harbour' already existed in earlier periods.[35]

3.1.3. Sub-typology 1.3. Complex harbour systems articulated around a promontory (with the utilisation of more than two basins)

To complete the overview of the harbours which benefitted from the presence of a headland, it is necessary to point out the case of settlements which used several harbour basins articulated around a single promontory. In some cases, on the two sides of a promontory, several bays were available, which were employed for harbour purposes. The best-known case of this kind of configuration is Piraeus, the Athenian harbour complex. The Piraeus Peninsula, used as the main harbour from the 5th century BC, presented three advantageous natural indentations: two on the eastern side (Mounychia and Zea, n° 116 and 194) and one to the west (Kantharos, n° 72).[36] Whilst Kantharos, one of the Mediterranean's larger natural basins, was used mainly for commercial purposes, Zea and Mounychia principally served the Athenian fleet.[37] These three

[32] *Ibidem*

[33] There is insufficient evidence to support this hypothesis, at least as far as the Archaic and Classical periods are concerned, but the possibility is often stressed in archaeological and historical publications on ancient harbours. For the earlier stages, it seems that a clear separation in the use of harbours did not exist, although the phrase 'λιμήν κλειστός', which appears in the *Periplus of Pseudo-Skylax*, has often been interpreted as a synonym for 'military harbour', and harbours included within city-walls have been considered as bases for fleets (Gerkan, von 1924; for a new evaluation of this phrase see Mauro 2017: 551-562). Some *poleis*, e.g. Corcyra (n° 34, 35 and 36), included more than one basin within their urban fortifications (Blackman and Rankov 2013: 320, figure B6.1). The presence of shipsheds cannot be used to claim the exclusive military nature of the harbour, as seen in Kantharos (n° 72), Piraeus, which – despite being considered the Athenian commercial basin – hosted 96 shipsheds (Judeich 1931: 448; Panagos 1968: 224; Steinhauer 2000: 83-84.)

[34] Blackman and Rankov 2013: 580-581.

[35] Nauplia (n° 118) in the Argolid, about which Pausanias (2.38.2) wrote that he had seen the remains of its 'harbours' ('λείπεται δὲ καὶ τειχῶν ἔτι ἐρείπια, καὶ Ποσειδῶνος ἱερὸν καὶ λιμένες εἰσὶν ἐν Ναυπλίᾳ καὶ πηγὴ Κάναθος καλουμένη'); Chalcis (n° 30) on Euboia, where Livy (28.6.8-9) reports the existence of two harbours ('ex patenti utrimque coactum in angustias mare speciem intuenti primo gemini portus in ora duo versi praebuerit; sed haud facile alia infestior classi statio est'); Tenedos (n° 186) in the Troad, where Strabo (13.1.46) refers to two harbours ('ἔχει δὲ τὴν περίμετρον ὅσον ὀγδοήκοντα σταδίων καὶ πόλιν Αἰολίδα καὶ λιμένας δύο καὶ ἱερὸντοῦ Σμινθέως Ἀπόλλωνος') and Arrian (*An.* 2.2.2) seems to confirm his testimony, specifying that Pharnabazus (together with Autophradates) arrived at the northern harbour of Tenedos ('κατακομισθέντες δὲ τῆς Τενέδου εἰς τὸν Βόρειον καλούμενον λιμένα'); Pitane (n° 149) in Aeolis, where two harbours seem to have been used at least from the Hellenistic period (Lehmann-Hartleben 1923: n. 218) and are also mentioned by Strabo (13.1.67: 'εἶτα Πιτάνη πόλις Αἰολική, δύο ἔχουσα λιμένας'); Myrina (n° 112) in Aeolis, where the excavations carried out within a joint programme promoted by the Louvre and the Museum of Istanbul revealed archaeological traces of the utilisation of both sides of the headland (Martinez and Verger 2010: 123); Phocaea (n° 144) in Ionia, for which Livy testifies to the existence of two harbours (37.31.8-10, 'in sinu maris intimo posita haec urbs est, oblonga forma; duum milium et quingentorum passuum spatium murus amplectitur, coit deinde ex utraqueparte in artiorem velut cuneum; Lamptera ipsi appellant. Mille et ducentos passus ibi latitudo patet; indelingua in altum mille passuum excurrens medium fere sinum velut nota distinguit; ubi cohaeret faucibus angustis, duos in utramque regionem versos portus tutissimos habet. Qui in meridiem vergit, Naustathmon ab re appellant, quia ingentem vim navium capit; alter prope ipsum Lamptera est. Hos portus tutissimos cum occupasset Romana classis'); Myndo (n°110) in Karia, where the use of a western harbour has been proposed by Şahìn (2014: 65) on the basis of archaeological findings; and Rithymna (n° 162), where the existence of a double harbour has been hypothesised by Spandagos (1999: 1-87).

[36] The use of Piraeus as a principal harbour is connected to Themistocles' policies and to the exploitation of the mines of Laurion (Garland 1987: 7). On Themistocles' proposal see Diod. Sic. 11.41.2; Nep. *Them.* 6; Plut. *Vit. Them.* 19.2-3; Thuc. 1.93. The three Piraeus basins were naturally well protected: Mounychia (n° 116) was exposed only to the southeast wind; Zea (n° 194) had a naturally narrow entrance, open only to the south; Kantharos (n° 72) was more exposed than the other two, but it provided other advantages, such as its size (Morton 2001: 126). Before Themistocles' intervention, the main Athenian harbour was Phaleron Bay, n° 142 (Paus. 1.1.2-3; Strab. 9.1.24).

[37] Kantharos' original dimensions were slightly smaller than the current ones. Its basin, with an approximately rectangular shape, measured around 1000 x 750 m. For more information, see Navis II project: *s.v.* Piraeus. Referring to the years 330-329 BC, 326-325 BC and 325-324 BC, naval inventories documented the existence of 372 shipsheds within Piraeus; these shipsheds were distributed as follow: 196 at Zea (n° 194), 96 at Kantharos (n° 72) and 83 at Mounychia (n° 116) (*IG* II² 1627.398-405; 1628.552-9; 1629.1030-6; 1631.252-6). Kantharos' military development was later than that of Zea and Mounychia, and it was due to the enlargement of the Athenian fleet. On Kantharos, see: Judeich 1931: 448; Panagos 1968: 224; Steinhauer 2000: 83-84. Zea was the second largest of Piraeus' harbour basins. It had an almost circular shape, with a diameter measuring 450 m. Mounychia, the smaller basin, had an elliptical shape of 360 x 220 m

basins were included within the Piraeus circuit of walls constructed in 477-476 BC, and later connected to the city of Athens in 458-457 BC through the northern Long Wall.[38]

The exploitation of various bays around a headland, as documented in Piraeus, is not unique. Indeed, during the Archaic and Classical periods, other cities benefitted from more than two bays on the sides of a headland. The *polis* of Aigina, for example, could also rely on three natural harbour basins located on two sides of the Kolonna Hill, one to the north (n° 7) and two to the south (n° 8 and 9).[39] Corcyra's harbour system was articulated around Cape Kononi, relying on three basins (n° 34, 35 and 36).[40] Lastly, Rhodos (n° 163), after the synoecism of Ialysos, Kamiros and Lindos, made use of at least four harbour basins, three on the east and one on the west of the headland.[41]

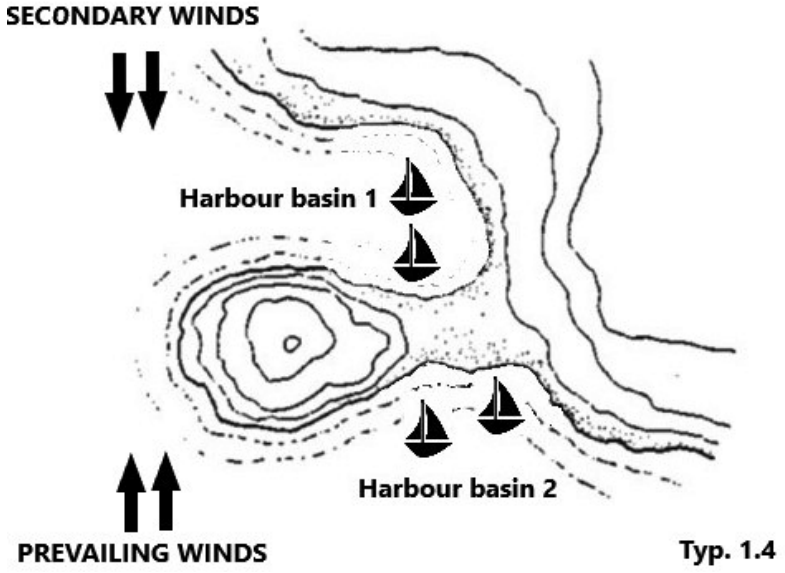

Figure 3.3. Example of the possible configuration of harbours behind an anvil-shaped headland. After Blue 1997: 33.

This kind of configuration can be considered as a complex harbour system, so it will be analysed in detail later, in the chapter on the harbour forms documented during the Archaic and Classical periods.[42]

3.1.4. Sub-typology 1.4. Harbours/anchorages behind an anvil-shaped promontory

Promontories that project towards the sea come in different shapes and sizes. In the Mediterranean, there are several cases of headlands characterised by a narrow landward section and a wide seaward section, which are commonly known as 'anvil-shaped promontories' (Figure 3.3). These promontories are usually the result of a (natural or artificial) process of union between an islet and the mainland through an isthmus or tombolo.[43] Harbours like Rheneia (n° 161) in the Cyclades, Knidos (n° 80 and 81) and Karyanda (n° 74) in Karia benefitted from the presence of anvil-shaped promontories.[44] Whilst Karyanda and Rheneia seem to have exploited only one side of the headland as a harbour,[45] in the 4th century BC Knidos used the two basins (n° 80 and 81) on the lees of the Triopion promontory.[46]

(Travlos 1971: 442-456).

[38] Thuc. 1.107.1, and 108.3; Blackman and Rankov 2013: 420-423.

[39] Skylax (53) refers to only two harbours on Aigina ('Κατὰ δὲ ταύτην νῆσός ἐστι καὶ πόλις Αἴγινα καὶ λιμένες δύο'). In 1830, Leake (II, 436) also identified two main harbours, but he added that the southern side of Kolonna Hill was composed of various smaller bays, which could have been used for harbour purposes. Recent archaeological and geological surveys seem to agree in identifying three harbour basins, one to the north and two to the south of Kolonna Hill (Blackman and Rankov 2013: 285; Mourtzas and Kolaiti 2013). However, due to the construction of the current harbour, ancient Aigina's harbour system cannot be fully understood (Gerding in Blackman and Rankov 2013: 284).

[40] As confirmed by Skyl. 29 ('Κατὰ δὲ Χαονίαν νῆσός ἐστι Κόρκυρα, καὶ πόλις Ἑλλενὶς ἐν αὐτῇ, λιμένας ἔχουσα τρεῖς κατὰ τὴν πόλιν· τούτων δ' εἷς κλειστός'). Archaeologically, the third basin has not been identified with certainty, but it could have been located in or near the 'Arion site' on the northwestern side of the promontory (see Blackman and Rankov 2013: 323-329).

[41] Gerding in Blackman and Rankov 2013: 509.

[42] Here, according to the definition established within the *Rome Mediterranean Ports Project* (RoMP), a harbour system is considered 'a set of harbour-sites working together as parts of a maritime potential, related and geographically linked to a focal point'.

[43] The case of Tyre has been extensively studied (Marriner, Morhange and Carayon 2008; Morhange, Carayon and Marriner 2011). The city was initially set on an islet, but it was artificially connected to the mainland by means of a narrow sand-line, as a result of Alexander the Great's siege works.

[44] Even the harbour-works identified at Kaloi Limani, and probably carried out by the *polis* of Antissa (n° 20) on the island of Lesbos, were found to the east of an anvil-shaped promontory (Theodoulou 2011: 502).

[45] In mentioning Karyanda, Skylax (99) refers to the presence of only one harbour: 'Καρύανδα νῆσος καὶ πόλις καὶ λιμὴν (οὗτοι Κᾶρες)'. Currently, there are no archaeological studies that can be used to confirm or reject Skylax's testimony. There is even less information on the harbour of Rheneia. Herodotus (6.97) reports that the Persian fleet, led by Datis and Artaphernes, docked at the harbour of Rheneia to respect the sanctity of Delos. The only harbour-works identified at Rheneia are located on the southern side of the anvil-shaped promontory, in an area known as the 'Lazzaretto', but they could date to the Roman period (Negris 1904: 354-360). However, given that it was well protected from the northern wind, it is possible that this same bay served as a harbour in earlier periods.

[46] The 'new' Knidos was founded in the 4th century BC on the site of the current village of Tekir. Due to the partial silting up of the northern harbour and to the continual use of the southern one, it has not been possible to understand clearly the first phases of the fortifications around the coastline (Blackman and Rankov 2013: 217-220).

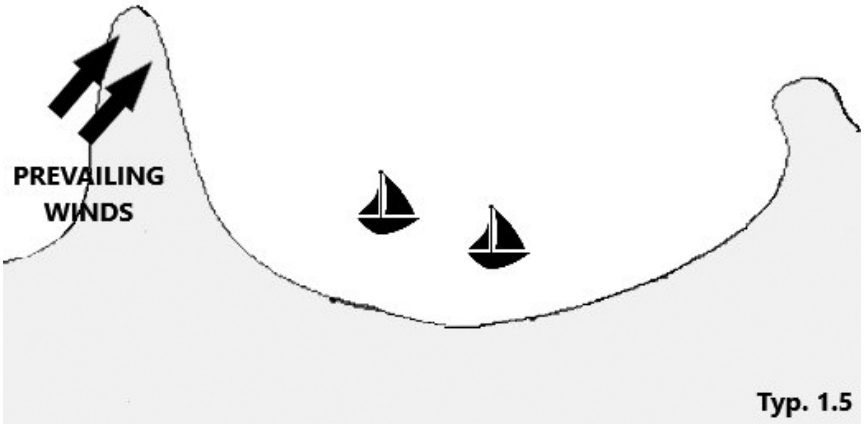

Figure 3.4. Example of the possible configuration of harbours between two headlands.

In a paper published in 1997, Blue stated that anvil-shaped promontories were ideal for setting 'double harbours'. In accordance with her theory, she attributed the Homeric expression 'ἀμφίδυμος λιμήν' exclusively to the harbours pertaining to this specific sub-typology.[47] However, even though the anvil-shaped promontories were certainly more suited for the installation of two harbour basins, it is necessary to extend the definition of 'ἀμφίδυμος λιμήν' to also include those cases in which two harbours were situated either side of a simple headland (sub-typology 1.2). Indeed, as previously mentioned, there are some certain or possible cases of 'double harbours' set around headlands which were not anvil-shaped.[48] On the other hand, some cities located on an anvil-shaped headland do not seem to have used both sides for harbour purposes.[49]

3.1.5. Sub-typology 1.5. Harbours/anchorages between two promontories

The rugged coasts of Greece and the Anatolian Peninsula have numerous promontories, some close to one another, and it was not uncommon to find harbours located on the shoreline extending between two headlands. In terms of seafaring advantages, these kinds of harbours were less exposed to the winds compared to sub-typologies 1.1, 1.2 and 1.3 due to the presence of the second headland, which offered additional protection (Figure 3.4).[50] This particular configuration of the coastline guaranteed the convergence of the waves in relation to the two headlands, where the maximum impact occurred, so that they arrived at the inlets with diminished strength and height.[51] Obviously, in this case, the orientation of the coastal indentation with regard to the wind regimen was a determining factor for achieving a satisfactory level of natural protection.

Over time, harbours located between two promontories were strongly affected by changes in their coastal configuration, which frequently caused a decrease in their width. While the erosive phenomena which affected the lees of promontories initially determined the build-up of a sheltered area, in time they caused infilling of the indentation, undermining its potential as a harbour.[52]

If we imagine a cove between two headlands in an area affected by prevailing northeastern winds, the wave fronts would arrive here diagonally, heading for the central part of the basin (Figure 3.5). In the long term, this process would determine the accumulation of fine sediments from the windward lee of the headlands towards the central part of the inlet. Initially the basin would assume a typical half-moon shape, offering ships the chance to anchor or be hauled onto the beach. Subsequently, the inlet would be filled, eventually disappearing.

The protection offered by two headlands was exploited by the harbour of Salamis (n° 164), located between the Kynosoura headland to the south and the Pounta headland to the north, where, from the Archaic period, the settlement was located. The two promontories prevented both northern and southern winds from affecting the basin.[53]

[47] Blue 1997: 31-44.

[48] E.g., Pagai (n° 131).

[49] E.g., Karyanda (n° 74) and Rheneia (n° 161).

[50] E.g., Hom. *Od.* 13.96-101. Homer describes the harbour of Phorkys (n° 146) on Ithaca as located between two projecting promontories, which provide the harbour with protection from 'the great waves raised by heavy winds', allowing the ships to 'lie unmoored when they have reached the point of anchorage' (Translation by Murray). The harbour of Phorkys has not been identified with certainty, but if Cusenier's proposal (2003: 71-72) is correct and it can be identified with the current harbour of Vathy, according to the classification conducted in this book, it should be considered as a harbour in an embayment (sub-typology 3.2) rather than a harbour between two promontories (sub-typology 1.5). On the harbour of Vathy and its advantages, see *Greek Water Pilot* 1982: 52.

[51] Bigelow and Edmondson 1947: 159; Bryant 1991: 60; Gresswell 1957: 61; King 1972: 96; Morton 2001: 33. Awareness of the convergence of waves around promontories may possibly be seen in Hom. *Il.* 2.394-397, and 4.422-426.

[52] Morton 2001: 28.

[53] Other harbours that were placed between two headlands in the Archaic and Classical periods were those of Aigosthena in Megaris (n° 10), Kenchreai in Corinthia (n° 77), the harbour of Las (n° 91) and Side (n° 170) in Laconia, Epidauros (n° 47) in the Argolid, Kolones (n° 84) on the island of Salamis, Geraistos (n° 54) on Euboia, Aphetai (n° 21) in Magnesia, Elaious (n° 44) in the Thracian Chersonese, Panormos

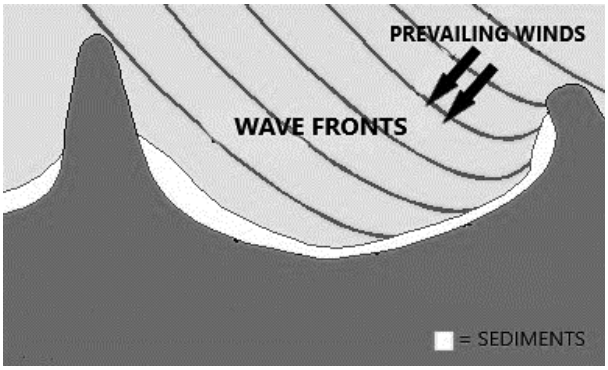

Figure 3.5. Graphic exemplification of the change undergone by a basin between two promontories.

3.2. Islands

Islands often play a determinant role in seafaring, particularly in the Mediterranean context. As with promontories, they are also visual aids for seafarers.[54] They form a natural barrier that reduces the force of winds, and an obstacle to the path of nearshore currents (Figure 3.6).[55] It emerges from the reading of nautical documents that the importance of islands resided principally in the opportunity that they offered to break up long maritime routes, acting as way stations.[56] For this reason, they are often mentioned in succession in nautical texts, almost as though their main function were to direct maritime routes.[57]

Like headlands, islands also guaranteed a certain level of protection, but this could vary significantly according to wind direction. Hence, a favourable coastal situation was also required to make the installation of a permanent harbour possible. The major danger for ships sheltered in the lee of an island was the possibility that the wind could change direction, driving them onto the same coast where they had previously found a haven.[58]

In the Aegean and eastern Ionian contexts, two main types of harbours benefitting from the presence of islands can be found: the first comprises harbours

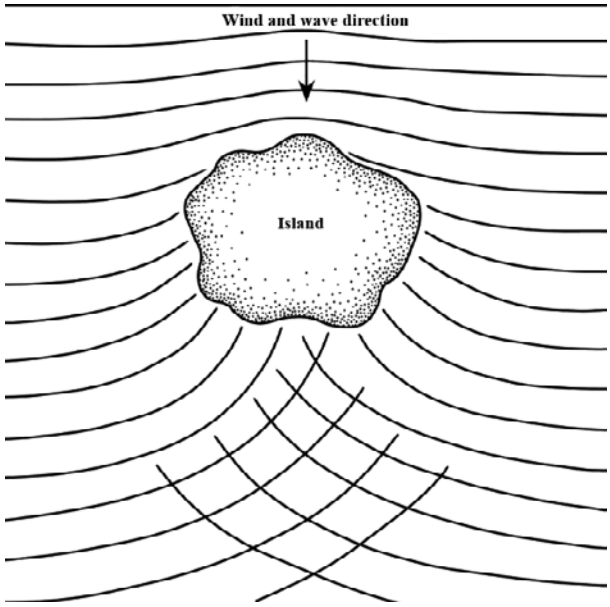

Figure 3.6. Graphic representation of the effects of wave refraction when waves approach an island.

situated on insular inlets (sub-typology 2.1), whilst the second harbours located on the mainland, but protected by the presence of offshore islands (sub-typology 2.2) (Figure 3.7).[59]

3.2.1. Sub-typology 2.1. Insular harbours/anchorages

'Insular harbours' cover all harbours for which location on an island was the main factor offering protection. These harbours were generally found in the channels between islands, or between an island and the mainland (Figure 3.8). The level of protection could be higher or lower, depending on the coastal configuration and on their position on the island. 'Insular harbours' were usually installed within inlets or coves, which did not themselves guarantee shelter against all adverse meteorological conditions, unless supplemented by other elements.

The use of offshore islands as harbours, and – more generally as places for settlement – is widely documented in the ancient Greek world, islands or islets close to the coast being considered prime locations.[60]

The harbour of Mytilene (n° 114 and 115) could fall within this sub-typology, since it was located in the space between the island and the mainland, relying on this particular configuration.[61]

(n° 134) and Humei Tepe (n° 108), one of the Miletos harbours, in Ionia, Rheithron (n° 160) and the Telemachus bay (n° 185) on Ithaca, Zacynthus (n° 192), Palaiopolis (n° 133) on the island of Andros, Tenos (n° 187), Paros (n° 136) and Naussa (n° 119) on the island of Paros, Naxos (n° 120), Skiathos (n° 168), Chios (n° 31) and Lissos (n° 96) on Crete.

[54] Constantakopoulou 2007: 20-3; Medas 2000: 115. A good example of the importance of islands as visual references is the island of Prote (n° 155), probably named because it was the first visual reference point when approaching the Peloponnese from the west; see *IG* V[1] 1539, 1541, 1544, and 1548.

[55] Medas 2000: 86; Morton 2001: 39.

[56] On this function of the Aegean islands see Hdt. 6.95. See also Aelius Aristeides (44.10) cited in Chapter 2, note 88.

[57] See Medas (2008: 108) concerning the *Stadiasmus Maris Magni.*

[58] Morton 2001: 119-124.

[59] So, not all the harbours located on islands have been included in sub-typology 2, but only those harbours whose protection depended mainly on the presence of an island or on their location on an island.

[60] Offshore islands were often used as trading posts, often being the initial location of overseas settlements, e.g. Pithekoussai, Strab. 5.4.9. See also: Constantakopoulou 2007: 6; Gras 1997: 153-154.

[61] Mytilene was originally set on an islet (Antissa) separated from the

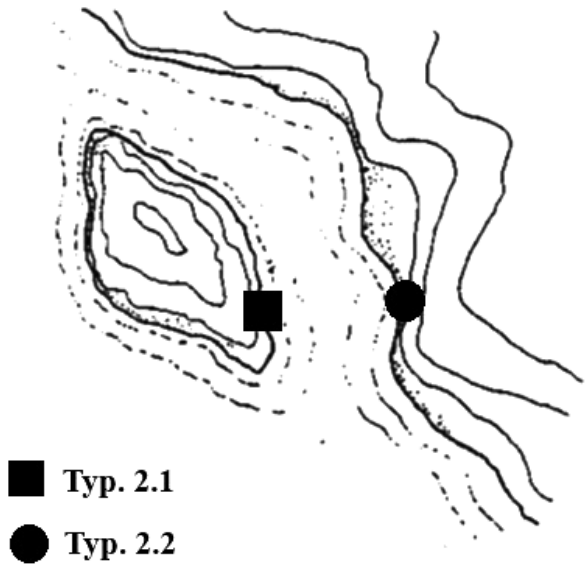

Figure 3.7. Graphic exemplification of the two sub-typologies of harbours benefitting from the presence of an island. Sub-typology 2.1 is found where harbours are located in a channel between two islands, or between the island and the mainland. Sub-typology 2.2 comprises those harbours which are located on the mainland, but which benefit from the protection offered by the presence of one or more offshore islands. After Blue 1997: 33.

3.2.2. Sub-typology 2.2. Harbours/anchorages protected by the presence of offshore islands/islets

Some harbours were located on the mainland but still benefitted from the presence of one or more offshore islets close to the coast, which acted as natural barriers and, by producing wave refraction, created a relatively still basin beyond them, which could be used for harbour purposes. In the lee of offshore islands, ships could find good protection in certain meteorological conditions,[62] but in order to improve the protection of this kind of configuration and allow the harbour to be usable all-year-round, it was necessary to construct barriers against the winds and the waves.

A harbour which could rely on the protection offered by islets was that of Eresos (n° 49), on the island of Lesbos. The harbour was protected by a group of islands on its southeastern side and some offshore islets facing the *polis*. To increase the level of protection, a breakwater was built, probably in the Archaic period.[63] Starting from

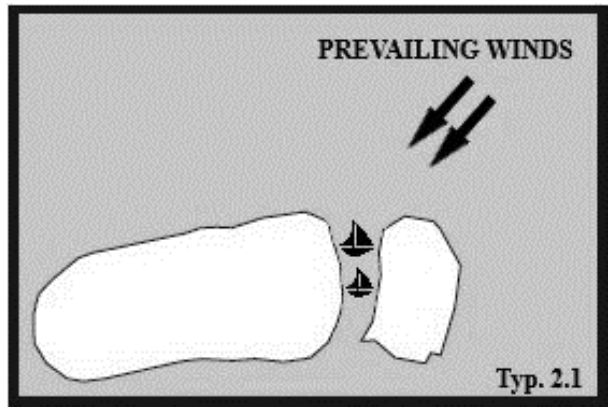

Figure 3.8. Example of the possible configuration of a harbour in a strait between two islands. After Carayon 2008: 1326.

the shoreline, this breakwater exploited, in its final part, one of the small natural islets.[64]

The harbour of Sybota (n° 179), mentioned by Thucydides as the scene of a naval battle between the Corinthian and the Corcyreans (supported by the Athenians)[65] and defined as 'ἐρῆμος' ('uninhabited'), was probably located on the Thesprotian mainland, protected by the presence of two islands (Mavron Oros and Hagios Nikolaos).[66]

Since the protection offered by the presence of islets was only partial, permanent harbours usually developed in areas which could also rely on other favourable natural features, e.g. headlands, bays, or river mouths.[67]

3.3. Bays

A bay is defined as a coastal inlet that generally has smaller dimensions than a gulf. Its origins typically lie in the erosive processes which, by eroding the softer

mainland by the Euripos Channel; the two harbours of the city were located on the two sides of the island (Skyl. 97).

[62] Morton 2001: 127.

[63] Theodoulou 2011: 503. However, not even the construction of this breakwater was capable of providing Eresos with complete protection from the strong southern wind. Diodorus Siculus (14.94.3) states that the Athenian general Thrasybulus of Steiriea lost 23 triremes here, which anchored off the coast. Diodorus dates this incident to 392 BC, but Xenophon's date of 389 BC is more likely (Xen. *Hell.* 4.8.25-30). I am indebted to Philip de Souza for providing this latter reference.

[64] Theodoulou 2011: 503. Unlike the ancient harbour, which had its entrance on the southwestern side, the modern harbour of Eresos is accessible from the northwest.

[65] Thuc. 1.50.3. This episode (433 BC) was a prelude to the outbreak of the Peloponnesian War. On Sybota harbour see also Ptol. *Geog.* 3.13.2.

[66] Graauw, de 2017: *s.v.* Sybota; Morrison, Coates and Rankov 2000: 62-69.

[67] The harbours of this kind, which are defined here as pertaining to a 'mixed typology', will be analysed later on, in a separate paragraph. An example of a harbour benefitting from offshore islands and a promontory was that of Hermione (n° 65), protected by the islands of Dokos and Hydra on the southwest and – at the same time – by the Bitsi headland on the south (Paus. 2.34.9-11 refers to the presence of a temple dedicated to Poseidon on the headland). On the harbour of Hermione, see also Skyl. 51. Here, it is necessary to note the distinction between those harbours which were protected by simple offshore islands and those harbours which were protected by barrier islands (groups of islands that obstruct the entrance to the basin); barrier islands are usually found at the entrance to a natural bay or in front of an estuary. See sub-typologies 3.3 and 4.3 for details.

rocks, create indentations along the coast (Figure 3.9).[68] Harbours and anchorages located inside a bay present similar advantages to those situated between two promontories.[69] The breaking of the waves against the protruding shorelines allows only a small part of them to reach the inlet's coastline. Furthermore, entering the concave shoreline of the bay, waves enlarge laterally, losing height and strength.[70] This means that bays provide ships with a relatively wide basin, allowing them either to anchor or to be hauled ashore.[71]

Depending on their configuration, bays could offer different levels of protection to ships. The shelter's efficacy was strongly influenced by the bay's geographical location, which determined its precise pattern of winds and waves to which it was subjected, and by the orientation of the entrances. Here, bays have been classified into four sub-typologies which will be analysed on a rising scale, in terms of the level of natural protection they offered. We will start with open bays (sub-typology 3.1) which provide only partial shelter to ships, moving on to natural embayments (sub-typology 3.2), then bays protected by offshore islands or barrier islands (sub-typology 3.3), concluding with those bays which have a naturally narrow entrance (sub-typology 3.4).

3.3.1. Sub-typology 3.1. Harbours/anchorages in open bays

Along the coastline of Greece and Asia Minor there are numerous open bays. To be used for harbour purposes, it was essential that they were not open to the prevailing winds but to winds from other cardinal points. As with harbours in the sub-typology 1.5, open bays could provide a safe haven at certain times of the year, but they did not offer total protection, unless they were augmented by the construction of defensive harbour-works. Indeed, 'open bays', as the name itself indicates, were not protected by any other natural features (e.g., islets, spits), so they were exposed to the force of the sea (Figure 3.10).[72] In the majority of cases, active harbours were found in bays open to the southwest or the southeast, and therefore sheltered from northern winds, which in these areas could be a major problem for vessels.[73]

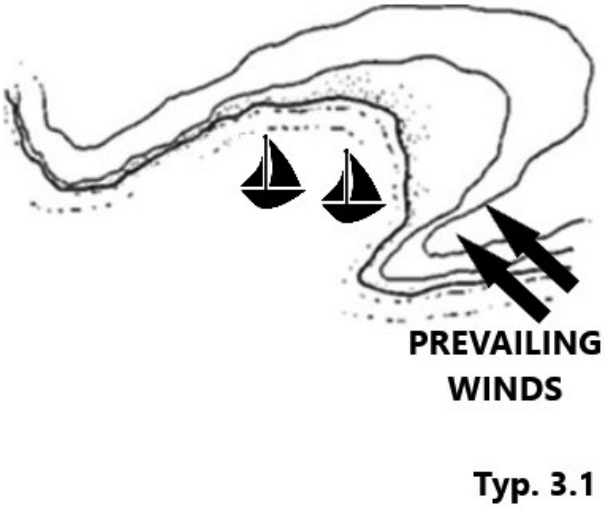

Figure 3.9. Example of the possible configuration of a harbour in a bay. After Blue 1997: 33. According to the subdivision proposed in this book, such a configuration would correspond to the sub-typology 3.1.

The harbour of Perachora (ancient Heraion, n° 64), near Corinth, was located inside a small open bay[74] that today has been partially silted up due to the transportation of sediments by the process of longshore drift.[75] Its harbour basin would have been modest in scale during the Archaic and Classical periods, when it could shelter only two or three boats at a time.[76]

[68] Horrocks 1981: 151; Morton 2001: 19.

[69] See sub-typology 1.4. Nicolas Carayon (2008: 579) considers inlets between two promontories as bays in his PhD dissertation.

[70] Kings 1972: 96-7; Morton 2001: 34.

[71] The shoreline of the bay is usually filled with material eroded from softer rocks, blowing from the hinterland or supplied by river mouths. This material consists of sand or gravel sediments of different sizes (Bird 2001: 96). Both sandy and coarse shores permitted the hauling of boats on the shores.

[72] Carayon 2008: 581.

[73] The only cases found in the Aegean and western Ionian seas of harbours/anchorages in bays open towards the north were Histiaia (n° 66), Artemisium (n° 23) and Ialysos (n° 67). The harbour of Histiaia (Skyl. 58) was located in the strait between Euboia and Thessaly, so it was not completely open on the northern side. Furthermore, the River Callas flowed into the sea not far from where the harbour is supposed to have been situated. This area has a particular bad reputation for seafarers, since it is mostly harbourless, with few bays or headlands to provide shelter (Cary 1949: 45-47; Morton 2001: 130, and 141; Rougé 1981: 18; Trozer 1893: 273). The winds constantly change, so that the direction of the currents within the strait varies. To complete the protection of Histiaia's harbour a breakwater was built, probably in the Archaic period (Lehmann-Hartleben 1923: 52; the information is taken by Lehmann-Hartleben from Georgiades [1907: 9], but it has not been confirmed by recent archaeological surveys). Artemisium was an anchorage used by the Greek fleet (Diod. Sic. 11.12.4; Hdt. 8.6) located within Histiaia's territory (Hdt. 7.175). It was subject to the same meteorological and morphological conditions which affected Histiaia's harbour. Lastly, the harbour of Ialysos (n° 67) occupied a strategic position at the southeastern entrance to the Aegean, within the sea way between the island of Rhodos and the Asia Minor shorelines. Inhabited since the 9th century BC (Coldstream 1969: 1-8), it was equipped with a breakwater, the remains of which were pointed out by nineteenth-century travellers (Billiotti and Cottret 1881: 386: '...les restes d'un mole que l'on peut voir lorsque les vagues soulevées par un fort vent de Nord'. From this quotation, it emerges that the area of the harbour of Ialysos is affected by strong northern winds. This breakwater is included in Lehmann-Hartleben's catalogue. Lehmann-Hartleben 1923: *s.v.* Ialisos).

[74] This harbour was firstly controlled by the *polis* of Megara, then, in the 7th century BC, it came under the Corinthians.

[75] Gaki-Papanastassiou, Papanastassiou and Maroukian 2007: 45-56.

[76] Probably, other ships could anchor outside the small open bay, as this area was sufficiently protected by high cliffs from the northern and northwestern winds. Blackman 1966: 192-194.

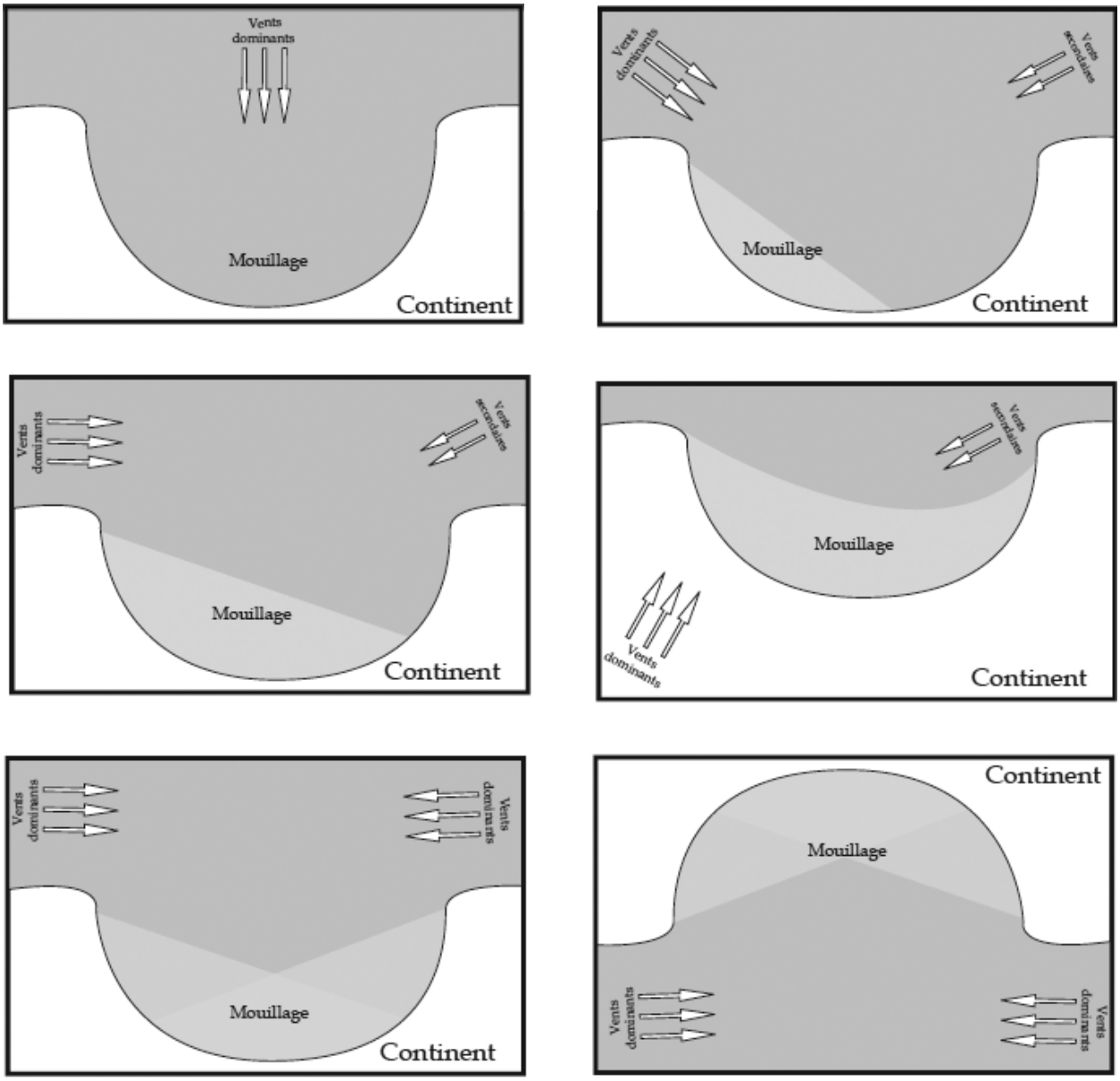

Figure 3.10. Example of the possible configuration of a harbour in an open bay, with the identification of the sheltered areas according to the direction of the winds. Carayon 2008: 1327.

Its natural protection was probably improved in the Archaic period by the reinforcement of a natural shoal to form a breakwater.[77] Other harbours which possibly benefitted from their location in an open bay were those of Imbros (n° 68) and Karpathos (n° 75).[78]

3.3.2. Sub-typology 3.2. Harbours/anchorages in natural embayments

Amongst the harbours located within a bay, a considerable number were situated inside natural embayments, significant coastal indentations the depth of which was greater than their width (Figure 3.11). In these cases, with the coastal inlet set further back compared to the rest of the shoreline, these

[77] Initially excavated by the British School at Athens between 1933 and 1936. The most exhaustive publication on the harbour of Perachora so far is Blackman (1966: 192-194). Blackman maintained that, even if the currently visible phase of the breakwater pertains to the Classical era, it could have been built in the Archaic period.

[78] For both these harbours, harbour-works not clearly dated but generally defined as 'ancient' have been identified. According to Herodotus (5.26), Imbros was subdued by the Persian general Otanes before 500 BC. Around 450 BC it was repopulated with Athenian cleruchs. In the area identified as the 'Cleruchs' harbour', Fredrich (1908: 83-84) saw ancient harbour-works (probably breakwaters), which have not been studied in detail. On the Cleruchs' harbour, see also Andreou and Andreou 1991: 96; Fredrich 1915: 63; Oberhummer 1898: 300; Ruhl 2010; Wujewski 1995: 160. At Karpathos, which is described as 'rugged' by Apollonius of Rhodos (4.1635-1637), traces of possible slipways have been observed by Flemming in 1974 south of Pighadia Bay, in a site called Makriyalo (Blackman and Rankov 2013: 571). In the same area Lehmann-Hartleben (1923: *s.v.* Poseidion, n. 225) identified a breakwater and the remains of ashlar blocks.

harbours were less exposed to the complex nearshore hydrodynamic system. Therefore, winds and waves reached the shores of the embayment fairly dissipated, and boats could afford to anchor or to moor in relative safety.[79] Harbours located within a natural embayment could be found at Kalaureia (n° 71), now the island of Poros, and Miletos, where the so-called 'Lion Harbour' (n° 104) occupied a deep coastal recess.

The harbour of Kalaureia (n° 71), mentioned in various literary sources,[80] has been archaeologically identified within the Bay of Vayonià, one kilometre far from the *polis* and the sanctuary of Poseidon.[81] Here, presumably because of the good level of protection provided by its location, no harbour-works to shelter the basin were built. The only infrastructure pertaining to the harbour might have been a shipshed complex.[82]

The Lion Harbour at Miletos (n° 104) was located within a deep, U-shaped inlet between the limestone hills of Nergiz Tepe,[83] within an indentation extending 300 m back from the shoreline. Thanks to its position, this harbour offered good protection from the *imbat* wind, which in this area is perceived as blowing from the west.

3.3.3. Sub-typology 3.3. Harbours/anchorages in bays protected by barrier islands

A bay can be protected by barrier islands located along its entrance, which reduce the force of the winds entering into the basin (Figure 3.12). Barrier islands can be formed by various processes, as the result of the longshore growth of spits, the emergence of an offshore bar, the partial submergence of a previous coastal ridge, or the concurrence of several of these mechanisms.[84]

The presence of barrier islands in front of a bay obstructs the wind regimen and thus the waves and currents generated by it, creating an area usable for harbour

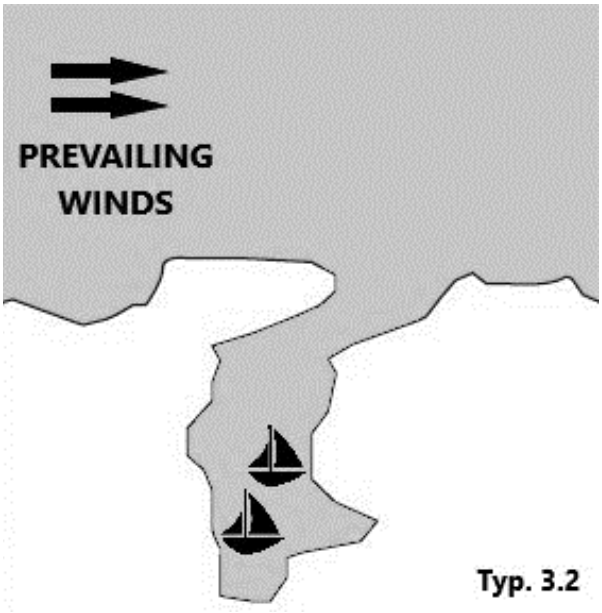

Figure 3.11. Example of the possible configuration of a harbour in a natural embayment. After Carayon 2008: 1333.

purposes in most meteorological conditions. It is likely that in the 15th century AD, Benedikt Kotrulević, when discussing the presence of offshore islands as one of the five fundamental requirements for a harbour to be efficiently sheltered, referred precisely to the benefits that barrier islands can offer.[85]

The harbour of Pylos (n° 158), which was used by the Athenian fleet as a naval base during the Peloponnesian War, was suitably located in a natural bay, further protected by a barrier island, the island of Sphakteria. The role of the island in increasing the shelter of the harbour is explicitly emphasised by Thucydides, who says that 'stretching along the land and being quite close to it, the island of Sphakteria made the harbour safe and the entrances narrow'.[86] Later, Diodorus Siculus also stressed the contribution of the island in making the haven safer, reducing the wind force.[87]

[79] Hom. *Od.* 13.96-101. See note 50.

[80] Dem. 49.13-16; Skyl. 52.

[81] Blackman and Rankov 2013: 569-570; Wide and Kjellberg 1895: 285-286. The harbour of Kalaureia was used for a fleet by Timotheus in 374 BC (Dem. 49.13-16). Kalaureia was the seat of an amphictyony in the sanctuary of Poseidon. *IG* IV 842; Strab. 8.6.14.

[82] Observed by Wide and Kjelberg 1895: 285-286; the identification as shipsheds was confirmed by Dörpfeld, who visited the site in the 1894, having worked at the excavation of Zea, Piraeus (Blackman and Rankov 2013: 569-570). According to Pakkanen (in Blackman and Rankov 2013: 569-570), the place where the shipsheds were located (the northern part of the bay) was protected from any wind and provided a natural inclination which could easily have been used for slipways. Unfortunately, the remains of this complex of shipsheds cannot now be identified, so they appear as 'possible shipsheds' in the *Catalogue of Shipsheds* edited by Blackman and Rankov.

[83] The name is due to the finding of two marble lions found near the entrance of the harbour, dated to the second half of the 4th century BC by Wolkmar von Graeve (Brückner *et al.* 2006, and 2014).

[84] Bird 2001: 173.

[85] 'It is recommended that the harbour basin has an islet offshore, in order to benefit of other harbour zones and where ships of great dimensions can anchor' (Translation by the author). See Kotrulević 1464: XXXXVIII.

[86] Thuc. 4.8.5: 'ἡ γὰρ νῆσος ἡ Σφακτηρία καλουμένη τόν τε λιμένα παρατείνουσα καὶ ἐγγὺς ἐπικειμένη ἐχυρὸν ποιεῖ καὶ τοὺς ἔσπλους στενούς' (Translation by Jowett [adapted]).

[87] Diod. Sic. 12.61.4: 'εἰς δὲ τὴν νῆσον τὴν καλουμένην Σφακτηρίαν, παρατεταμένην δ' ἐπὶ μῆκος καὶ ποιοῦσαν εὔδιον τὸν λιμένα'. In referring to the harbour of Pylos, Pausanias (4.36.6) compares its configuration with that of the harbour of Delos, stating that the harbour of Pylos was protected by the island of Sphakteria in the same way as the harbour of Delos (n° 39) benefits from the protection offered by the island of Rheneia.

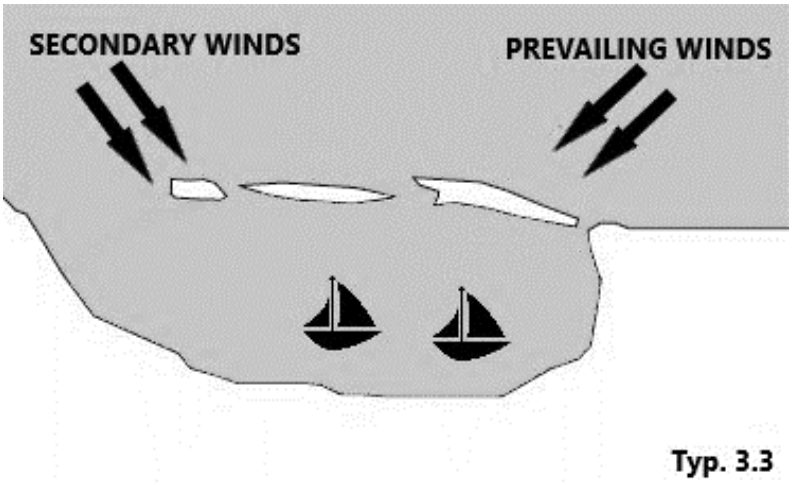

Figure 3.12. Example of the possible configuration of a harbour in a bay protected by barrier islands. After Carayon 2008: 1324.

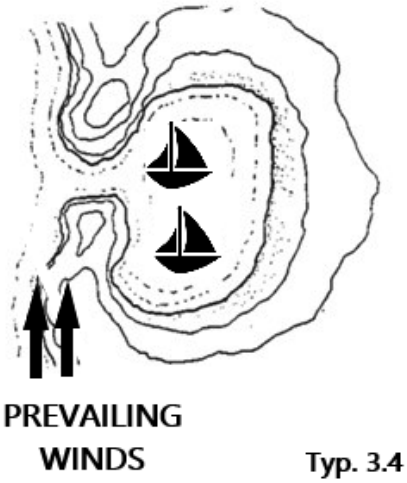

Figure 3.13. Example of the possible configuration of a harbour in a landlocked bay (with double spits). After Blue 1997: 33.

3.3.4. Sub-typology 3.4. Harbours/anchorages in landlocked bays

> 'But when we are about to enter the city, around which runs a lofty wall, a fair harbour lies on either side of the city and the entrance is narrow, and curved ships are drawn up along the road, for they all have stations for their ships, each man one for himself.'
> Hom. *Od.* 6.262-5.[88]

Harbours situated in landlocked bays are protected by spits which narrow the entrance to the basin, contributing to the creation behind them of a sea-area sheltered from winds and waves (Figure 3.13).[89] Starting from the land, spits have their ends at sea, eventually enclosing the body of water into which they extend.[90] They usually develop along the coast where there is an indentation or a change in direction: here, the longshore current deposits sediments that it is no longer able to transport.[91] Cases of single spit and paired (or double) spits are attested to.[92] This kind of coastal morphology facilitates the development of harbours which can easily be used all-year-round, without the need to build significant infrastructure. Passing through narrow entrances, waves are modified due to diffraction and expanded in the wider body of water lying beyond.[93] The importance of a narrow entrance to a harbour is well reflected in Homer's description of the harbour of the Phaiakians quoted above, where he states that all the ships could safely anchor, moor or be hauled ashore.

The harbour of Cos (n° 37), used from the 4th century BC when the settlement was founded after the Koan synoecism, was located in a bay landlocked by a spit.[94] Its position guaranteed safe shelter for ships, so that the harbour was included within the city-walls and equipped with two shipsheds.[95]

3.4. River mouths

> 'But when, as he swam, he came to the mouth of a fair-flowing river, where seemed to him the best place, since it was smooth of stones, and besides there was shelter from the wind.'
> Hom. *Od*. 5.440-445. [96]

As this passage from the *Odyssey* shows, the presence of a river is a strong attraction for the location of ports or anchorages, since this situation develops conditions that are particularly suitable for harbour operations. Furthermore, when navigable, rivers can be used

[88] Translation by Murray.

[89] Spits are depositional bars which emerge from the sea, diverging from the coast (Bird 2001: 164; Evans, O.F. 1942). Harbours of this kind are defined by Blue (1997) as 'harbours in an almost enclosed bay'.

[90] Evans, O.F. 1942: 846.

[91] The formation of spits occurs when the longshore drift reaches an area where the coast has a change in direction greater than 30°. It is for this reason that they can be frequently found at the entrance of a bay or behind a headland. Over time, the growth of the spit can cause the transformation of the area into a salt marsh (Bird 2001:163-77). The harbour of Anactorium (n° 16) in Acarnania was probably located in a landlocked bay (Skyl. 34). In 1835, when Leake visited the site, he drew a 'marsh' in the area occupied in ancient times by the harbour (1835: III, 493).

[92] Bird 2001: 163-168.

[93] Bird 2001: 11.

[94] It is defined 'κλειστός' by Skylax (99). A medieval fort was built on the spit. On the use of the harbour during the 3rd and 2nd centuries BC, see Blackman and Rankov 2013: 362. Due to the presence of the spit, in Late Antiquity the ancient harbour basin eventually became a lake or a marsh (Kontogiannis 2001: 413-414). It was probably reopened by the Italians in the 20th century AD (Blackman and Rankov 2013: 362).

[95] The fortifications date from the end of the 4th century BC, while the chronology of the shipsheds is between the second half of 4th century BC and the 3rd century BC (Blackman and Rankov 2013: 362-371).

[96] Translation by Murray.

as a way to communicate with the hinterland, facilitating the movement of people and goods.[97]

The outflow exiting the river, altering the nearshore hydrodynamic system and delaying the breaking of the waves, creates sea-areas with calmer water.[98] Sediments carried into the sea by the fluvial discharge may also form a seaward fan, which contributes to isolating the river outlet, acting like a natural breakwater.[99]

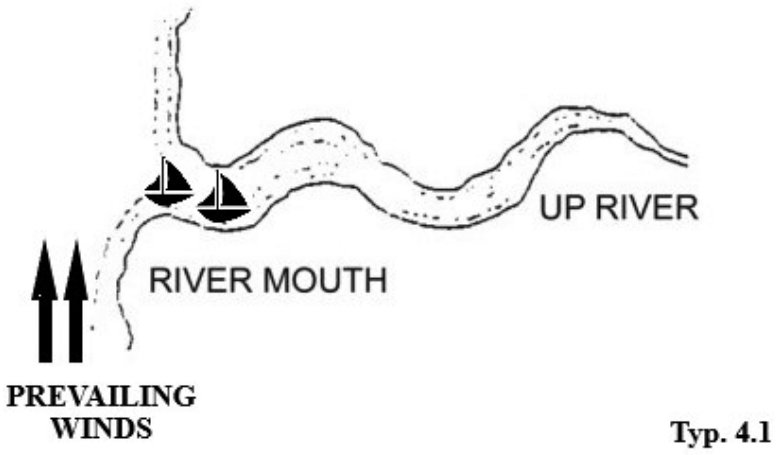

Figure 3.14. Example of the possible configuration of a harbour in a river mouth. After Blue 1997: 33.

Nevertheless, the main problem of harbours located in river mouths is siltation, i.e. the increased accumulation of fine sediments carried down by the river. Due to this phenomenon, harbours in river mouths are affected by considerable changes in their appearance over time, and they are thus unstable spaces.[100] Harbours can be located directly in river mouths, e.g. Pyrrha (n° 159) on the island of Lesbos (see sub-typology 4.1); in the area between two river mouths, e.g. Naupaktus (n° 117) (sub-typology 4.2); or in estuaries, e.g. Ephesus (n° 46) (sub-typology 4.3).[101]

3.4.1. Sub-typology 4.1. Harbours/anchorages located in river mouths

Harbours located in river mouths can benefit from the decrease of the wave inflow due to the fluvial discharge and, in some cases, the possibility of easy access to the hinterland.[102] Where the banks of the river are naturally low, ships can also be easily hauled ashore.[103] Where they are high, they supply additional protection from the winds (Figure 3.14).

The shelter offered by simple river mouths against the winds is only partial, however. River banks can moderate the action of the winds, but they are insufficient to repel strong winds. Thus Odysseus, having found shelter in a river mouth on the coast of the island of Scheria, was afraid that at any moment he could be caught by a storm-wind and carried once again out to sea.[104] Harbours of this type certainly had potential, but in order to be used all-year-round, it was necessary that the surrounding coastal configuration be supplied with some kind of supplementary protection. In particular, the use of river mouths sheltered by a promontory was widely attested to.[105]

An example of a harbour located in a river mouth was Pyrrha (n° 159), on the island of Lesbos, which is mentioned by Thucydides and Pseudo-Skylax.[106] This harbour may have been equipped with infrastructures

[97] According to Morton (2001: 230), the number of navigable rivers in the ancient Greek world was relatively small, since during the summer season their riverbeds were almost dry. However, it has to been emphasised that rivers could be used all-year-round, where the weather conditions were propitious. Their employment was not restricted to summer, and brief fluvial journeys could be organised on a daily basis. Furthermore, some major watercourses can be found in Asia Minor and Northern Greece, which could have provided entry to the hinterland. For example, in the foundation of Eion (n° 43) on the Thracian coast, a key factor was certainly the presence of the Strymon River, which could be used to reach Bisaltia, as well as the silver and gold mines on Mount Pangaion (Tiverios 2008: 67).

[98] Morton 2001: 115.

[99] Bird 2001: 23.

[100] Cities located on river mouths learnt to live with its changing environment, as was masterfully shown by the *polis* of Ephesus (n° 46), which changed the location of its port several times in response to the coastal evolution at the mouth of the Kaister River (current Küçük Menderes). Kraft *et al.* 2007, and 2011; Stock *et al.* 2013. Even at Abdera (n° 1), on the eastern side of the River Nestos, the siltation of the Archaic harbour forced the city into a relocation of its harbour installations (Baika in Blackman and Rankov 2013: 270; Koukouli-Chrysanthaki 1991: 193-199; Syrides and Psilovikos 2004: 351-359). On the deposition at river mouths, see also Hom. *Il.* 21.316-323.

[101] An estuary is a partially enclosed body of water with a free connection to the open sea (Pritchard 1967).

[102] Bird 2001: 23.

[103] E.g., Ap. Rhod. *Argon.* 2.743-751.

[104] Hom. *Od.* 5.417-420. It was not always easy to find shelter in river mouths, as also found in Hom. *Od.* 19. 188-189, where the harbour of Amnisos (n° 14) is described as a 'difficult harbour' ('λῖμήν χαλεπός').

[105] Harbours benefitting from more than one natural factor of protection will be analysed within the next paragraph (par. 3.5). The harbour of Amnisos (n° 14) was located between two headlands on each side of the eponymous river (now called the Karteros). As Evans (1928: 238) stated: 'the natural conveniences of the place as a seaport were not such as would have led us to expect such a flourishing community. The protection afforded by the headland to the east was not itself of great value, since the wind in this part of Crete blows rarely from that quarter. On the other hand, the Western horn of the bay gave but little shelter against the prevailing north-west gales'.

[106] Mentioned by Thuc. 8.23; and Skyl. 97.

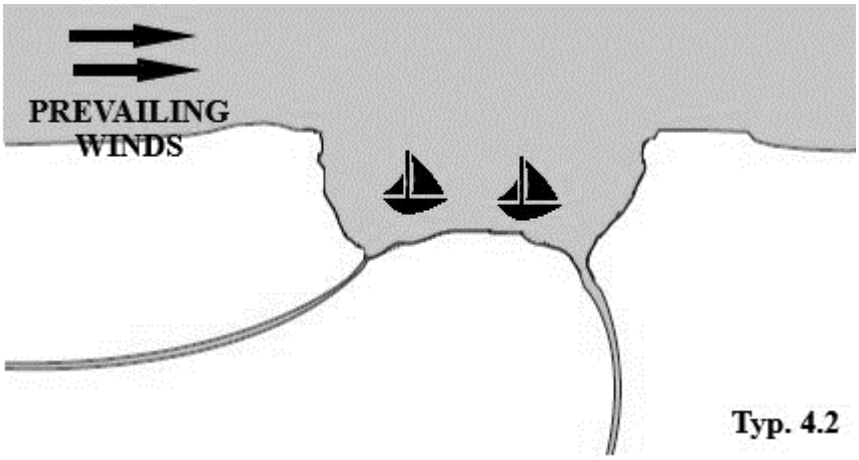

Figure 3.15. Example of the possible configuration of a harbour in the area between the mouths of two rivers.

aimed at enhancing the protection it offered to ships.[107] Despite the siltation to which it was subject, Pyrrha's harbour continued to be used in later periods, as documented in literary sources.[108]

3.4.2. Sub-typology 4.2. Harbours/anchorages in the area between the mouths of two rivers

Some harbours were not located in a river mouth but in the area between the outflow of two watercourses. From a nautical perspective, this situation allowed ships to benefit from the fluvial discharge, but with a wider harbour basin (Figure 3.15). However, the deposition of sediments carried by two rivers considerably altered the coastal configuration of these harbours, whose ancient layout is only partially understandable thanks to the testimony of literary sources.[109] Moreover, like the harbours located directly in the river mouths, those located between two fluvial outflows were only relatively sheltered coastal areas.

The harbour of Kyme (n° 89) in Aeolis could be considered as belonging to this sub-typology, as it was a gentle bay located between two river mouths. In particular, on the southern side there was a small watercourse whose mouth is still used today as a shelter by local fishermen's boats; while on the northern side, the River Xanthos was partially navigable.[110]

3.4.3. Sub-typology 4.3. Harbours/anchorages in estuaries and coastal lagoons

Sometimes river mouths create semi-enclosed coastal bodies with an unimpeded connection to the open sea, which are known as estuaries.[111] When alluvial deposits form barrier islands or spits, estuaries develop into coastal lagoons, the size and depth of which varies considerably.[112]

Coastal lagoons present significant nautical advantages, and for this reason they have always been preferential areas for the installation of harbours.[113] They usually have one or more narrow entrances from the sea and an inner coastline whose extent is significantly wider.[114] Their physical separation from the open sea creates particular internal conditions, which isolate these areas from the nearshore hydrodynamic system. This

[107] At the end of the 19th century AD, Koldwey reported the presence of walls sloping towards the sea (6.5 x 20 m), which he interpreted as shipsheds (Koldewey 1890: 27); this structure is also reported by Lehmann-Hartleben (1923: n. 236) and Kontis (1977: 347-38). Due to alluvial deposit, the visibility of this structure has diminished, so that neither Baika and Blackman nor Theodoulou could identify it (Baika in Blackman and Rankov 2013: 577-578; Theodoulou 2011). Additionally, Theodoulou (2011: 506) reports the presence of a breakwater, but further archaeological investigations are needed in order to clarify the chronology of these harbour-works (Baika in Blackman and Rankov 2013: 578).

[108] Diod. Sic. 17.29.2; Plin. *Nat.* 5.39; Strab. 13.2.4. On Pliny the Elder's controversial testimony, that the city was swallowed by the sea, see Mason 1987.

[109] E.g., the harbour of Naupaktus (n° 117) is currently small, and, as documented by Leake (1835: II, 608), 'the present town occupies only the lowest enclosure; in the middle of which is the small harbour which made so great a figure in ancient history: it is now choked with rubbish, and is incapable of receiving even the larger sort of boats which navigate the gulf'. Thus, sediments transported by the rivers have reduced its size and potential as a harbour from that implied by Thucydides' comments on its importance as a naval base during the Peloponnesian War (Thuc. 2.83-86). In some cases, the coastal modifications caused by siltation have prevented archaeologists from identifying with certainty the location of an ancient settlement and its harbour: e.g. in Helike (n° 61), the Achaian *polis* for which a location between the Selinous and the Kerynites Rivers has been proposed (Álvarez-Zarikian, Soter and Katsonopoulou 2008: 123–124; Edgerton and Throckmorton 1970: 135–141). Helike was destroyed in 373 BC by an earthquake, reported by later sources: Diod. Sic. 15.48.3; and Strab. 8.7.2.

[110] Gianfrotta *et al.* 2002. On Phaleron Bay (n° 142), two different scenarios have been proposed. The first is that two rivers (the Kephissos and the Ilissos) flowed into this bay (Conwell 1992: 203-213, and 2008: 5; Strab. 9.1.24); the other is that the Ilissos River met the Kephissos at the western side of the coastal plain (Milchhöfer 1889: 5; Travlos 1971, fig. 213). This latter hypothesis seems to be confirmed by geologists (Goiran *et al.* 2011: fig. 5).

[111] Pritchard 1967: 3-5.

[112] Bird 2001: 233-240.

[113] The use of lagoons as harbours has also been documented in the Phoenician world, as the cases of Motya, Salamis on the island of Cyprus, Karalis, Nora, Bithia, Sulcis and Othoca show (Carayon 2008).

[114] Bird 2001: 233. Some lagoons were wholly separated from the sea and channels were cut or artificially reinforced to allow ships to enter the basin, as for example at Lechaion (Pallas 1965: 139-140; Stiros *et al.* 1996: 251-263). The harbour system of Phalasarna is still not clear but, according to the hypotheses of the archaeologists in charge of its excavation, two artificial channels existed, connecting the inner harbour with the open sea (Hadjidaki 1988: 50-57).

situation results in a high level of natural protection, which in Antiquity led to the preferential use of lagoon areas as 'inner harbours'.[115] Harbours located in estuarine areas were almost completely protected from winds and waves, which had dissipated most of their energy in entering the estuary. The lagoons' shores were usually shallow, so that they were accessible only to vessels with a shallow draught (which could also be easily beached), whereas big merchant ships would have had to anchor outside the lagoon (Figure 3.16).[116] The location of harbours in estuaries and lagoons allowed for their continual utilisation throughout the year, and they were not subject to seasonal cycles. The construction of defensive structures, e.g. breakwaters or moles, was then not necessary.[117] Examples of harbours in estuarine and lagoon areas could be found at Glykys Limen (n° 55) and Ambracia (n° 13) in Epeirus,[118] Oiniadai (n° 126) in Acarnania,[119] Ainos (n° 11) in Thrace,[120] Ephesus (n° 46), Priene (n° 154), Myous (n° 111), Miletus (n° 104-109) and Caunus (n° 29) in Ionia.[121]

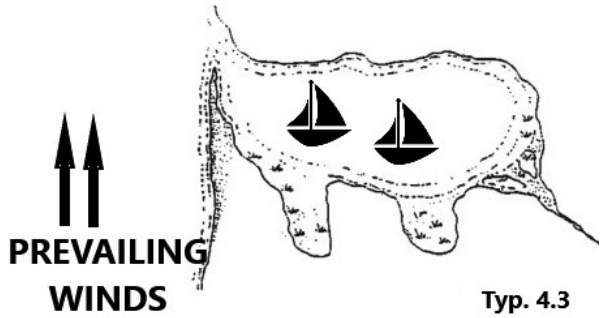

Figure 3.16. Example of the possible configuration of a harbour in estuaries (lagoon-type). After Blue 1997: 33.

3.5. Harbours benefitting from various concurrent natural factors (mixed typology)

Some harbours were located in sea-areas which could rely on the presence of more than one natural protective factor amongst the aforementioned ones. Therefore, in this book they are considered as pertaining to a mixed typology. Generally, these harbours were better sheltered, and they developed into permanent ports. As pointed out by Morton, areas considered to be barely sheltered, e.g. river mouths (sub-typology 4.1), would have been preferred when they were protected by additional factors, such as headlands projecting into the sea.[122] In addition to the case of Amnisos (n° 14) mentioned earlier,[123] the harbours of Nauplia (n° 118),[124] Abdera (n° 1),[125] and Pitane (n° 149)[126] presented a similar geomorphological situation.

Beside the case of harbours protected from the nearshore system by the combination of a river mouth and a close headland, other examples of 'mixed typology' harbours can be reported. The harbour of Gytheion (n° 57) in Laconia, which was the principal harbour of the Spartans, was located in a small open bay (sub-typology 3.1) and benefitted from the additional protection of the island of Kranae on its southern side (sub-typology 2.2).[127] The harbour of Epidauros-Limera (n° 48) in southeastern Laconia was located between a headland (sub-typology 1.1) and an island (sub-typology 2.2).[128]

[115] In the Greek world, the harbour of Phalasarna appears to have been originally located in a lagoon, which was later used to artificially create an inner harbour (after 335 BC). The layout, chronology and development of Phalasarna's harbour are still under discussion (Hadjidaki 1988; Hadjidaki and Frost 1990).

[116] Carayon 2008: 607.

[117] Breakwaters or moles are rarely documented in this type of harbour. Where present, they served the outer harbour: e.g., the three moles to the north of the Lechaion harbour that served Corinth (Georgiades 1907: 4-5; Paris 1915: 5-16). Rothaus (1995: 296) maintains that building similarities exist between two of the external moles and the 'διολκος'.

[118] On Glykys Limen: Besonen 1997; Besonen, Rapp and Jing 2003; Dakaris 1971; Hammond 1967; Soueref 1995. On its costal configuration see also Skyl.30; and Strab. 7.7.5. On Ambracia: Karatzeni 2011; Leake 1835: I, 205. The Arachtos River was probably navigable until the Classical period (Karatzeni 2011: 145-146).

[119] A detailed description of the geomorphology of the coast around Oiniadai is provided by Vött *et al.* 2004.

[120] Recently, a project on the harbour of Ainos has been started by the Römisch-Germanisches Zentralmuseum.

[121] According to the latest geomorphological studies, the Archaic harbour of Ephesus was located on the slopes of Koressos Hill (Kraft et *al.* 2007 and 2011; Stock *et al.* 2013). Herodotus (5.100) and Xenophon (*Hell.* 1.2.7) seem to confirm this hypothesis, reporting news of ships disembarking near Koressos. On Priene: Brückner 2003. On Myous: Brückner 2003. On Miletos: Brückner *et al.* 2006, and 2014. On Caunus: Brückner 1997.

[122] Morton 2001: 116. Examples of river mouths protected by a promontory are mentioned in Ap. Rhod. *Argon.* 2.743-751; and Thuc. 1.46.4.

[123] See notes 104 and 105. Despite being further protected by the presence of two headlands, the harbour of Amnisos was still considered only partially sheltered.

[124] Skyl. 49. This is the main harbour for Argos, Tiryns and Mycenae, located at the mouth of the River Manessi and protected to the south by the Palamidi headland. On the changes to the configuration of the coast due to the progradation phenomenon, see Zangger 1994.

[125] At the mouth of the river Nestos (Baika in Blackman and Rankov 2013: 270-276).

[126] Skyl. 98. On the eastern side of the promontory currently called Çandarli, at the mouth of the River Kaikos.

[127] Homer (*Il.* 3.445) states that this island was the place where Helen and Paris had a dalliance. Gytheion is defined by Xenophon (*Hell.* 6.5.32) as the place where Lacedaemonians had their dockyards ('ἔνθα τὰ νεώρια τοῖς Λακεδαιμονίοις ἦν'). Skylax (46) also confirms the presence of a dockyard at Gytheion, maintaining that it was a place with fortifications and dockyards ('Γύθειον ἐν ᾧ νεώριον, καὶ τεῖχος'). Later on, Strabo (8.5.2) describes Gytheion as the Lacedaemonians' naval base, reporting that, according to what he had heard ('ὥς φασι') in his time, the naval base was artificially excavated ('ναύσταθμον ὀρυκτόν'). On Gytheion see also: Diod. Sic. 11.84.6; Liv. 34.29; Paus. 1.27.5, and 3.21.6; Polyaenus, *Strat.* 2.9; Polyb. 5.19. For archaeological investigation in this area, see: Edgerton and Scoufopoulos 1972: 202-206; Scoufopoulos and McKernan 1975: 103-116; Scoufopoulos and Stavrolakes 1985: 49-66.

[128] Kremidhi Cape, to the north, and the island of Monemvasia, to the south. According to Pausanias (3.23.11), the indentation created

At Pogon (n° 150) in the Argolid, the protection of an embayment (sub-typology 3.2) was supplemented by that offered by offshore islands (sub-typology 2.2).[129] Lastly, Erythrai (n° 51) in Ionia was located in a natural embayment (sub-typology 3.2), protected by four islets (sub-typology 2.2), at the mouth of a small watercourse (sub-typology 4.1).[130]

3.6. Further Cases

To conclude this overview of the preferential coastal situations for the installation of harbours and anchorages, two last cases should be mentioned, which do not come under any of the aforementioned typologies. The first case is the harbour at Akanthos (n° 12) on the Chalcidice Peninsula, the protection of which was provided only by its location within the Ierissos Gulf. The shelter offered by this situation, together with the geographical context within which the *polis* was located,[131] was apparently enough to allow fleets to anchor safely, as revealed by Herodotus' testimony.[132] The second case is the harbour of Delos (n° 39), which, despite being located within a strait between two islands, was on a straight stretch of coastline. The example of Delos is not unique in the Archaic Mediterranean, since the use of a rectilinear shoreline for harbour purposes is attested to in the Phoenician world.[133] In this case, the rationale for its location involves factors both related to and extraneous to seafaring. With regard to the former, it has been highlighted that Delos is an island without good natural harbours,[134] but with abundant availability of drinking water,[135] and partially protected by the presence of Rheneia on its western side[136] (this, too, was a useful shelter in case of storms originating from Tenos).[137] In addition to these nautical advantages, the island of Delos was, according to mythology, Apollo's birthplace and, as such, it had hosted his worship since the pre-Hellenic era.[138] Furthermore, it occupied a central position in the Agean Sea, which gave it both symbolic and economic importance.[139]

3.7. The level of protection offered by the various sub-typologies: 'λιμὴν εὔορμος' vs 'λιμὴν κλυτός'

None of the natural factors from which a harbour benefitted could provide complete shelter to ships. The degree of protection they provided differed, depending on the type as well as the geographical position of the harbour.[140] Considering exclusively the various natural protective factors, their efficacy would have varied

by the headland and the island was easily recognisable for being composed of coloured pebbles with strange forms. Strabo states (8.6.1) that the epithet 'Limera' was due to the excellence of this harbour. However, a Thucydides scholiast (7.26) maintains that it means 'dry', or 'imperfect'. See also Skyl. 46; Thuc. 6.105.

[129] Pogon is mentioned by Skylax (52) as 'the harbour of Troizen'; see also Hdt. 8.42. An explicit reference to the presence of an island (the island of Kalaureia) in front of the harbour of Pogon comes from Strabo (8.6.14). In this case, the island of Kalaureia is not a barrier island, so that Pogon harbour should not be considered as falling into sub-typology 3.3.

[130] Skyl. 98. Strabo (14.1.31) says that the harbour is protected by four islets called Hippoi. Their toponym, meaning 'horses', is probably due to racing chariots pulled by four horses.

[131] The importance of this harbour can be understood by looking at its peculiar seafaring conditions. In this area, the *meltemi* wind does not strongly affect seafaring, since it does not blow with great force (*Greek Water Pilot* 1982: 235). Therefore, in spring and early summer, winds rarely exceed force 4 on the Beaufort scale. Furthermore, violent gusts can rapidly descend from the slopes of the nearby Mount Athos, making navigation between Pinnes and Akrathos particularly difficult. The Persian fleet was probably affected by one such gust in 492 BC, when it was decimated by a sudden northeasterly wind (Hdt. 6.44). These conditions for seafaring convinced Darius to avoid passing through the area a year later (Hdt. 6.95). The only way to avoid downdrafts from Mount Athos after rounding Akrathos was to follow the coast and reach the harbour of Akanthos or to seek shelter on the island of Thasos (Corvisier 2008: 90).

[132] Hdt. 6.44; later on, also Diod. Sic. 11.5. According to Herodotus (7.22) and Thucydides (4.109), a channel was cut through the Akte isthmus to avoid sailing around Mount Athos. Additionally, in order to improve the protective level of the harbour, a breakwater was built. The chronology of this infrastructure, though, has still not been determined. The mole is mentioned in Leake 1835: 147, and Struck 1907: 66.

[133] In Carayon's catalogue (2008) there are 13 harbours located on rectilinear shorelines. In his conclusion, Carayon argues that these places were used as a shelter only in certain meteorological conditions. This theory cannot be applied to Delos, the harbour of which certainly played an important role throughout the Archaic and Classical periods. To improve the shelter in this area, a breakwater was built. Archaeological studies on this structure are still in progress, but, if the 8th-7h century BC date is confirmed, the Delos breakwater could have been one of the first harbour infrastructures of the Greek world.

[134] Blackman 1982a: 79-104; Paris 1916: 8.

[135] Jardé 1905: 33. The availability of water was an indispensable factor for ships on long voyages.

[136] In a 16th century AD map of Delos and Rheneia, the space between the two islands is defined as *optimus portus* (British Library MS 23925: 20). However, sailing in the strait between Delos and Rheneia is extremely dangerous when the *meltemi* wind blows, since the sea-bottom is shallow (*Greek Water Pilot* 1982: 150-160).

[137] On the storms from Tenos, see also Archil. *Elegies*, Fr. 105 W: 'Glaucus, see, the waves are rising and the deep sea is disturbed; all about the heights of Gyrae stands a towering mass of cloud – that's a sign of storm. I fall a prey to unexpected fear' (Translation by West); Cic. *Att.* 5.12: 'Accordingly, my intention is not to be at all in a hurry, nor to leave Delos unless I see the Gyreos headlands with no sign of bad weather' (Translation by the author).

[138] Gallet de Santerre 1958: 113-147. Apollo was worshipped here especially after the arrival of the Ionians (at the end of the 2nd millennium BC, or at the beginning of the 1st millennium BC), as seems to be documented by the Hymn to Apollo, 3.147-152. In the *Odyssey* (6.162-165), Odysseus compares Nausicaa to the palm that he saw in Delos near the altar of Apollo.

[139] Delos was located midway between the coasts of Greece and Asia Minor.

[140] According to the geographical position, an area could be affected by different wind regimens. This means that in some areas, a promontory could be enough to provide boats with safe shelter, whilst in other cases the shoreline was so strongly beaten by the winds that the presence of a simple headland did not guarantee the necessary protection.

widely: the more long-term, secure harbours would have developed in correspondence to certain sub-typologies, whilst other configurations of the coastline would have tended to result in locations being used only as temporary havens, or as places to which seafarers would resort only in case of unfavourable conditions, to avoid sinking or being driven far from their planned route.[141] In general, those situations considered more naturally advantageous were preferred, or locations where protection was provided by several concurrent factors.[142] However, in regions where particularly favourable configurations were not available, more problematic stretches of shoreline were used for harbour purposes, and harbour-works were eventually set up in order to improve their security.[143]

Analysing the nearshore hydrodynamic system, it appears clear that the geomorphological situations capable of providing a medium-high level of protection were the following: natural embayments (sub-typology 3.2), bays protected by barrier islands (sub-typology 3.3), bays with a narrow entrance (sub-typology 3.4), and estuarine areas (sub-typology 4.3). In general, harbours which could rely on the presence of more than one natural protective factor were considered fairly secure (mixed typology). On the other hand, the presence of promontories (sub-typologies 1.1, 1.2, 1.3, 1.4, and 1.5), islands (sub-typologies 2.1 and 2.2), simple river mouths (sub-typologies 4.1 and 4.2) or open bays (sub-typology 3.1) did not themselves ensure a sufficient level of protection for a location to be considered a safe harbour but rather guaranteed only partial shelter.

The literary evidence indicates that the ancient Greeks were familiar with the different degrees of protection offered by various natural factors.[144] However, it is not possible to determine to what extent this awareness was reflected in a technical terminology with specific phrases for identifying harbours with good natural protection (utilisable almost all-year-round without the need of being artificially improved), and for differentiating those from seasonal harbours.

Unfortunately, the only surviving source – the *Periplus of Pseudo-Skylax* – is rather controversial and, at least in the form in which it is preserved, no lexical traces of this differentiation exist.[145] Broadening the view to consider written sources in general, it is possible to discern various terms which tend to be associated with harbours and anchorages. Although their precise meanings have not been adequately investigated, the majority of these terms seem to refer to the ports in terms of a socio-economic 'hierarchy' rather than to the level of protection that they offered.[146] However, as noted by Morton, a distinction between secure harbours and relatively sheltered areas emerges from scrutiny of the Homeric *corpus*, at least in terms of a common awareness. Indeed, in the *Odyssey* harbours are mentioned where waves never rise and ships can be safely moored,[147] and places in which the seafarers can find temporary protection, but from which they should go away before the wind starts to blow again.[148] With reference to the former, in Book 9 of the *Odyssey* Homer employs the phrase 'λιμὴν κλυτὸς', which can be translated as 'renowned harbour':

> 'When we had come thither into the *renowned* harbour, about which on both sides a sheer cliff runs continuously, and projecting headlands opposite to one another stretch out at the mouth, and the entrance is narrow, then all the rest steered their curved ships in, and the ships were moored within the hollow harbour close together; for therein no wave ever swelled, great or small, but all about was a bright calm'.[149]

On the other hand, in Book 10 of the *Odyssey*, the adjective 'εὔορμος' ('good mooring') is associated with a harbour that can be used only in certain meteorological conditions, where the shelter was temporary:

[141] Morton 2001: 106.

[142] See par. 3.5.

[143] As partially highlighted in this chapter, harbour-works were built especially in those cases where the natural harbour was considered barely sheltered; this topic will be analysed further in Chapter 4. Naturally 'harbourless' coasts include the southern coasts of the Patras and Corinthian Gulfs (*Greek Water Pilot* 1982: 94), and the western side of Euboia. On the harbourless southern Euboian coast, see: Dio Chr. *Or.* 2. In the *Mediterranean Pilot* (1918: IV, 237), one can read the following: 'From Cape Doro [Geraistos] at the southeastern end of Euboia, the northeast coast of that island trends in a westerly and then northerly direction and consists principally of high precipitous rocks without even shelter for the smallest description of boats, nor scarcely a place where a boat can land'.

[144] On this aspect, see the citations in the previous paragraphs.

[145] Skylax only refers to the presence of one (i.e., Skyl. 34: "Ακτὴ καὶ πόλις Λευκὰς καὶ λιμὴν') or more harbours (i.e., Skyl. 57: 'Θορικὸς τεῖχος καὶ λιμένες δύο') associated with a settlement or a city. On some occasions, he also utilises the adjective 'κλειστός' ('closed'), the meaning of which has not been sufficiently clarified. On the utilisation of this adjective see: Baika 2009: 435; Blackman 2008; Gerkan, von 1924: 110-114; Lehmann-Hartleben 1923: 65-74; Moreschini 1997; Rougé 1966: 116-117. For a re-evaluation of the phrase, see Mauro 2017: 551-562.

[146] For example, the use of the terms 'ναύσταθμον' (e.g., Thuc. 3.6.2), 'ἐπίνειον' (e.g., Hdt. 6.116; Thuc. 2.84.5) and 'ἐμπόριον' (e.g., Thuc. 4.102.3) for a harbour is attested to in the Archaic and Classical periods. However, the scholarly consensus is to interpret them in relation to the harbour's purpose (military, in the case of 'ναύσταθμον' and 'ἐπίνειον'; commercial, in that of 'ἐμπόριον').

[147] Hom. *Od.* 10.87-93.

[148] Hom. *Od.* 9.136-140.

[149] Hom. *Od.* 10.87-93 (Translation by Murray [adapted]). It is interesting to note that Homer seems to be describing a harbour at the mouth of which two promontories stretch, forming a naturally narrow entrance (see above par. 3.4). This fits the sub-typology 3.4 (bays with a narrow entrance).

'...and in the island, too, is a *good mooring* harbour, where there is no need of moorings, either to throw out anchor-stones or to make fast stern cables, but one may beach one's ship and wait until the sailors' minds bid them put out, and the breezes blow fair.'[150]

Applying Homer's terminology to the identified typologies in order to differentiate between what were generally temporary mooring places and what were stretches of the coast that instead offered a high level of protection throughout the year, the situation can be synthesised as follows (Figure 3.17):[151]

'λιμένες κλυτοι'	**'λιμένες εὔορμοι'**
- Harbours in natural embayments (sub-typology 3.2). - Harbours in bays protected by barrier islands (sub-typology 3.3). - Harbours in bays with a narrow entrance (sub-typology 3.4). - Harbours in estuarine areas (sub-typology 4.3). - 'Mixed-typology' harbours (typology 5).	- Harbours near a headland (sub-typologies 1.1 and 1.2). - Harbours around a headland (sub-typology 1.3). - Harbours in the lee of anvil-shaped headlands (sub-typology 1.4). - Shelters between two promontories (sub-typology 1.5). - Island harbours (sub-typology 2.1). - Harbours behind islands (sub-typology 2.2). - Harbours in open bays (sub-typology 3.1). - Harbours in river mouths (sub-typology 4.1 and 4.2).

Figure 3.17. The various sub-typologies of harbours according to their level of protection: high ('λιμένες κλυτοι') or medium-low ('λιμένες εὔορμοι').

[150] Hom. *Od.* 9.136-140 (Translation by Murray [adapted]). Phrase mentioned also by Hes. *[Sc.]* 207; and Eur. *Tro.* 125.

[151] Obviously, these considerations are theoretical, since each case should be evaluated according to its geographical position, the nearshore hydraulic system, and the presence of infrastructures which eventually increased its natural protection. Harbours offering a medium or low level of protection which were equipped with breakwaters or moles could attain an excellent level of protection. Thus, this table has to be considered simply as an initial tool for determining whether the protection offered by a particular factor was generally good or only partially efficacious. It is merely indicative and it should be borne in mind that binary distinctions tend to be too crude to convey the nuances of real situations; i.e., shelters in the lee of anvil-shaped promontories (sub-typology 1.4) were not perfectly safe, but still they provided ships with a level of protection that was higher than that offered by simple headlands (sub-typologies 1.1, 1.2 and 1.5).

Chapter 4

Harbour-works in the Greek World

As remarked in the previous chapter, the main characteristic of the harbours of the Greek world in the Archaic and Classical periods was their natural location: they were places whose defensive position was chiefly guaranteed by the geomorphology of the coastline. However, the natural configuration was not always in itself sufficient to ensure safe shelter, nor should it be considered free of change over time. In fact, a number of factors may alter its appearance, including changes in sea level due to the melting of the ice sheets, subsidence, bradyseism, other general volcanic activity, and siltation. Thus, in some cases the body of water was improved by the construction of harbour facilities whose aim was to increase its natural protection and afford safer use. In this sense, the presence of man-made interventions should be read as a complementary factor and not an essential condition for harbours during the periods under examination.[1]

The purpose of this chapter is to survey and explain the various infrastructures found in harbour areas of the Greek world in their Archaic and Classical phases, based on archaeological evidence and literary sources. However, we should take into account that the exposed data could be partial, since the absence of infrastructures in harbour areas is not itself proof of their actual non-existence. Indeed, it might be due to poor archaeological knowledge of certain areas, or to their non-survival because of the *spolia* of architectural material, their destruction after traumatic events (natural or warlike),[2] their construction using perishable materials, or their incorporation into later buildings.[3] Therefore, the following information and subsequent considerations should be intended as strictly connected to the current state of knowledge. Should the aforementioned harbour areas become the focus of further archaeological campaigns, they may require some modifications.

Problems related to the study of harbour-works

Harbour areas can be conceived as the result of a constant search for balance between whatever nature supplied and human attempts to turn it to one's advantage.[4] Until fairly recent times, the planning of maritime space had remained 'a scarcely rigorous building process chiefly based on practical knowledge – primarily sailors' and local people's own experience – or reliant on trial and error'.[5] This pre-industrial state of the art is confirmed by Pigonati, who, in 1781, referring to harbour structures, stated:

> '... in the Mediterranean, the majority of the directors of harbour-works do not have theoretical notions, so they proceed by chance; when well-known architects are asked to build harbours, their work depends on the advice of sea people and this is why maritime constructions are not always successful...'.[6]

[1] Arnaud 2017: 225.

[2] E.g., the breakwater at Nauplia in the Argolid (n° 118) was seriously damaged by dredging in 1900 (Negris 1904: 352). Piraeus also underwent considerable interventions with the construction of a new urban plant, the best known of which was probably the one carried out by Dragatsis between 1880 and 1920 (Dragatsis 1885, and 1900); on this occasion, the shipsheds at Zea (n° 194) was unearthed. All these later interventions in harbour areas made archaeological documentation extremely fragmentary; furthermore, seamless occupation of harbours caused continuous additions, subtractions, extensions and remodelling, which deeply altered the original configuration (Felici 2001: 161-178).

[3] E.g., the quay of Anthedon in Boeotia (n° 19), the remains of which can be attributed to the Byzantine era, could have covered pre-existing structures (Blackman, Schafer and Schlager 1967). With regard to harbour-works probably built from perishable materials, it is possible to mention the case of Kyllene in Elis (n° 88). Thucydides (1.30) reports that its harbour was burnt by the Corcyreans because the inhabitants of Kyllene helped the Corinthians in providing them with ships and money. Even if he did not refer explicitly to the presence of wooden structures (or structures made from flammable materials), but simply to a fire in the harbour area, the passage reveals that the harbour of Kyllene was the Corcyreans' main target, since it was the place from which the ships sent to the Corinthians departed. So, the Corcyreans may have wanted to seriously damage the *polis* of Kyllene with this action, aware that a fire could have destroyed part of the infrastructure of their enemies' harbour. The presence of wooden structures has also been hypothesised for the harbours of Lechaion (n° 92) and Chalcis (n° 30). In the Aegean and eastern Ionian seas, there is no record of wooden harbour facilities, but at Massalia (southern France) a quay with wooden posts was found, which has been dated to the first quarter of the 6th century BC (Hesnard 1994, and 1998; Hesnard *et al.* 1999, and 2001). Further evidence for the existence of timber elements in harbour facilities was found in non-Greek contexts, such as the harbour of San Rossore (Pisa), where a wooden pier has been identified dating to the 6th-4th century BC (Camilli 2004), or in the harbour at the mouth of the river Guadalhorce, where the timber huts belong to the early first-millennium-BC-phase (Martín Ruiz 1995: 64). In addition, ethnographic comparisons show how structures of reusable materials are fairly common nowadays, e.g. the wooden shipsheds on the island of Ibiza (Balearic Islands), or the metal slipways at Arrecife de las Sirenas (Cabo de Gata, Spain).

[4] Felici 2002: 422.

[5] *Ibidem* (Translation by the author).

[6] '...nel Mediterraneo il maggior numero de' direttori de Porti sono stati sforniti di teorie, ed han proceduto per azzardo; o sono stati grandi architetti chiamati per la prima volta a costruir de' porti, nei che han dovuto dipendere dal consiglio della gente di mare, che non è sempre causa della riuscita degli Edifici marittimi...' (Pigonati 1781: 219. Translation by the author). Cited by Felici 2002: 422.

Thus, the history of harbour-works is basically an account of attempts that were aimed at satisfying practical needs and, apart from some major interventions, were not invasive. Unlike other branches of architecture, for which a kind of evolutionary framework can be traced, harbour-works did not have a linear development, the process of human modification (and later monumentalisation) of harbour areas scarcely having become a common practice.[7] This may partially explain the difficulties confronting scholars who deal with this topic and, at the same time, the absence of specific monographs.[8] Starting from the 6th-5th century BC, a tendency to increase harbour sizes and improve facilities can be noticed, partly as a consequence of the economic developments, spurred on in some cases by changing political circumstances.[9] Some Classical *poleis* played a fairly active role in building harbour-works as a response to the opening of new markets and to the widespread use of the *trireme.*[10] However, the majority of coastal settlements continued to rely on minor harbour facilities, or undeveloped harbours.[11] Breakthroughs in harbour architecture were not adopted everywhere at the same time or in the same way, but in the various settlements conservative elements – derived from the local workers' traditions – continued to persist.[12] Furthermore, even when accurately excavated, harbour structures are usually difficult to date, as they were built using techniques that have remained popular over time. For instance, moles and breakwaters were often composed of rubble or blocks of ashlar masonry joined together without any mortar, so that it is almost impossible to establish a chronology for these interventions, unless they are found in connection with indirect dating elements.[13] The slipways cut into rock surfaces have been identified in many harbour areas are equally difficult to contextualise.[14]

4.1. Natural harbours, modified-natural harbours and artificial harbours

In his PhD dissertation, Carayon made an effective distinction between natural, modified-natural and artificial harbours.[15] Natural harbours, 'λιμένες ἀυτοφυεῖς', were the simplest and most commonplace of ancient Greek harbours. Their functionality was based on the exploitation of a favourable natural coastal situation (e.g., a sheltered bay, a headland, an island or the mouth of a river) and they were not supported by any stable infrastructure.[16] Harbours of this kind were familiar to both Homer and Hesiod, who frequently mention the presence of ships hauled onto the shore.[17] Completely natural harbours are attested to at Emporio (n° 45), on the southern coast of the island of Chios, where – despite the large number of *ex-voto* dedications by seafarers at the sanctuary – there are no signs of any artificial modification of the harbour basin,[18] and Zagora (n° 193), on the island of Andros, which is considered to have been in use since the Middle-Geometric period.[19]

Modified-natural harbours were limited to increasing the natural protection that already existed. The basins of these harbours were mostly defined by people who expanded the protected body of water by building breakwaters or moles. Modified-natural harbours were common in the Archaic and Classical periods, and they represent the great majority of harbours with artificial structures at that time.

Lastly, artificial harbours, 'λιμένες χειροποιήτοι', could be considered as entirely built by people excavating the coast. These harbours, which are chiefly documented in later periods, are rather limited between the Archaic and the Classical eras.[20] Their rarity might be explained by the fact that the Aegean and Ionian seas had so many

[7] In opposition to Lehmann-Hartleben (1923), who believed that the development of harbours was a consistent process, Blackman argued (2008: 638-640) that heterogeneous situations can be found in harbour areas.

[8] Recently, a multi-authored monograph on shipsheds has been edited by Blackman and Rankov (2013). In addition to what has been stated in par. 2.6 in reference to the tendency of archaeologists and historians to look exclusively for harbour-works, it is necessary to remark that the study of marine infrastructures was neglected for a long time. As proof of the position assumed by scholars of Antiquity, in an Italian edition of *De Architectura* by Vitruvius dated to the 1960s, Silvio Ferri (1960: 1) refrained from commenting on paragraph 5.12 of Vitruvius' work, which relates to harbour architecture, offering only a sentence that perfectly summarises the typical scholarly stance at that time: 'It is my intention to deal only with those parts of the text that can directly interest archaeologists and art historians' (Translation by the author).

[9] The importance of the availability of resources (intended as economic, material and human resources) in the construction of harbour-works has been briefly outlined in Blackman 1986.

[10] Beltrame 2012: 251.

[11] Blackman 2008: 639-645.

[12] *Ibidem*

[13] E.g., anchors, pottery, or city-walls. In some cases, literary and epigraphic sources are also useful for casting light on the chronology of harbour structures.

[14] E.g., the slipway described by Pirazzoli and found at Aigila (n° 5), on the island of Antikythera, on the eastern side of the Potamos Bay (Flemming and Pirazzoli 1981: 73). On the different hypotheses about its chronology, see: Baika in Blackman and Rankov 2013: 277-283; Lawrence 1979: 183-184; Sekunda 2004-2009: 595-600; Stais 1889: 237-242.

[15] Carayon 2008: 637.

[16] Casson 1971: 361-362. For an approach to the study of natural harbours, see Chapter 3.

[17] Hes. *Op.* 624-627; Hom. *Od.* 9.135-151, and 10.87-97.

[18] Boardman 1967: 64; Morton 2001: 109.

[19] Cambitoglou *et al.* 1988: 99-105; Morton 2001: 107, note 61.

[20] Indeed, the only harbours that can be defined as 'artificial' at this stage in this geographical context are those at Lechaion (n° 92) and, maybe, Phalasarna (n° 141). Later on, Strabo (8.5.2) defines the harbour of Gytheion (n° 57) as *'ὀρυκτός'* ('artificially dug'). However, there are no testimonies prior to Strabo that can allow us to think of a *kothon*-type harbour existing from a previous era.

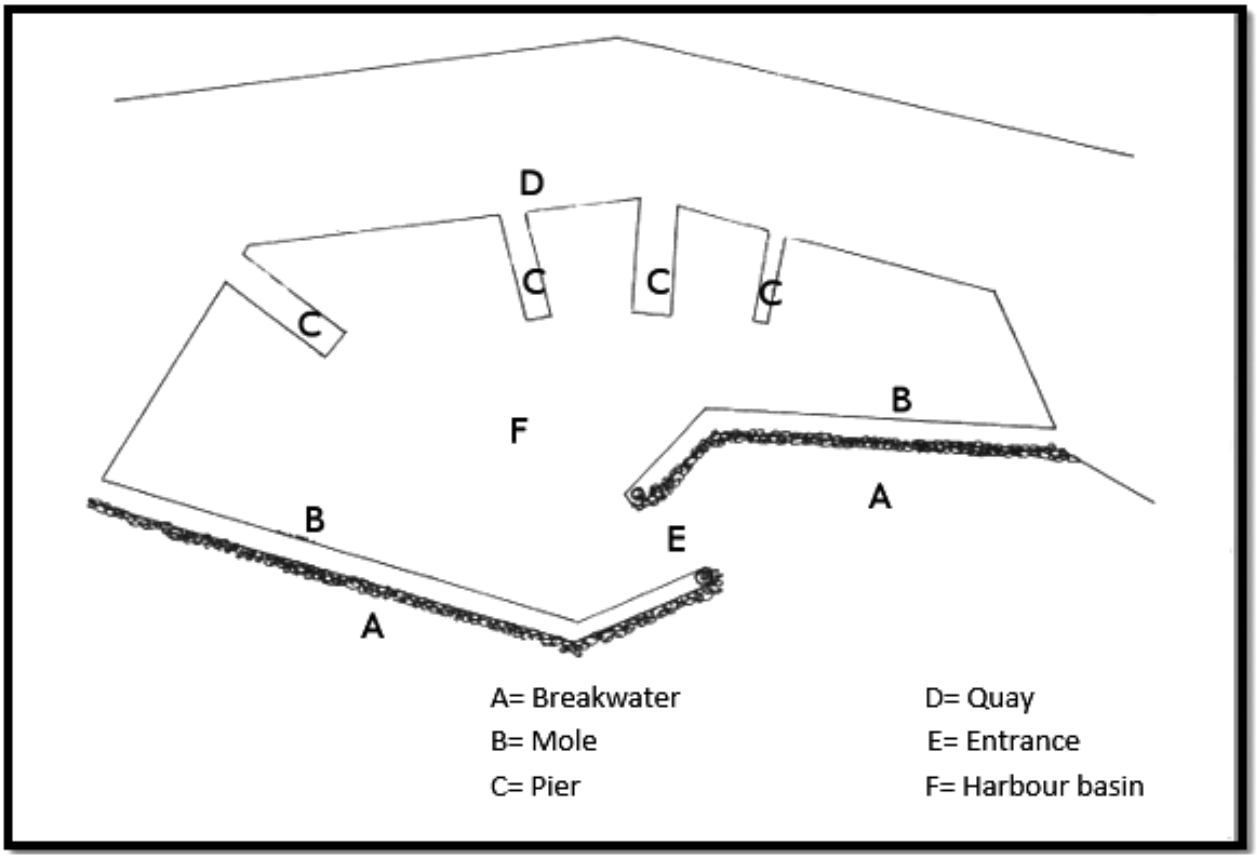

Figure 4.1. Constitutive elements of a harbour basin, according to the terminology adopted in this book.

stretches of sheltered coastline as to render the effort of creating basins *ex-novo* essentially worthless. In many cases, the construction of a mole or a breakwater was sufficient to afford ships sufficient protection.

4.2. Artificial structures

Data from the Archaic and Classical periods reveal a heterogeneous range of infrastructure designed to have four main functions:

- to protect the basin from in-shore dynamics and enemy attacks (breakwaters and moles);
- to moor and facilitate loading and unloading manoeuvres (piers, quays and mooring devices);
- to facilitate the beaching and maintenance of vessels (shipsheds and slipways);
- to increase the radius of visibility around the harbour (proto-lighthouses and towers) (Figure 4.1).[21]

4.2.1. Defensive structures for the harbour basin: breakwaters and moles

Breakwaters are dam-shaped walls built at the edges of a harbour basin to protect it from breakers and enemy attacks.[22] Starting from the shoreline, they continued in a direction influenced by the angle of wave approach (Figure 4.2),[23] simultaneously protecting and widening the harbour basin. In addition to defensive advantages, these structures often offered a partial solution to the problem of siltation, since their presence altered the normal dynamics of longshore drift.[24]

The idea of creating barriers capable of restraining the action of meteo-maritime dynamics probably derived

[21] As will be underlined, some harbour-works simultaneously fulfilled more than one purpose. In this case, only those artificial interventions that improved harbour functionality from a ship's point of view will be analysed (therefore, mainly breakwaters, moles, shipsheds, slipways and proto-lighthouses); other buildings relating to harbour areas, but aimed at satisfying other needs, will not be examined (e.g., colonnades, stoas, customs buildings).

[22] Blackman 2008: 647.

[23] E.g., the slight curvature of the breakwater at Delos protected the harbour basin from the Etesians and the katabatic winds coming from the area of Tenos (Duchêne and Fraisse 2001: 93; Paris 1916: 34-35).

[24] Blackman 2008: 654-655. Siltation principally affects harbour basins located in river mouths, but the progressive accumulation of sediment takes place along every kind of coast and is determined by longshore drift. The construction of moles was not always effective in slowing down the filling of the basin. On the contrary, there are later testimonies which prove that some artificial interventions accelerated the deposit of sand inside the harbour basin. At Ephesus (Ionia), for example, the narrowing of the harbour entrance ordered by King Attalos II Philadelphos (159-138 BC) resulted in the filling of the entire basin (Strab. 14.1.24).

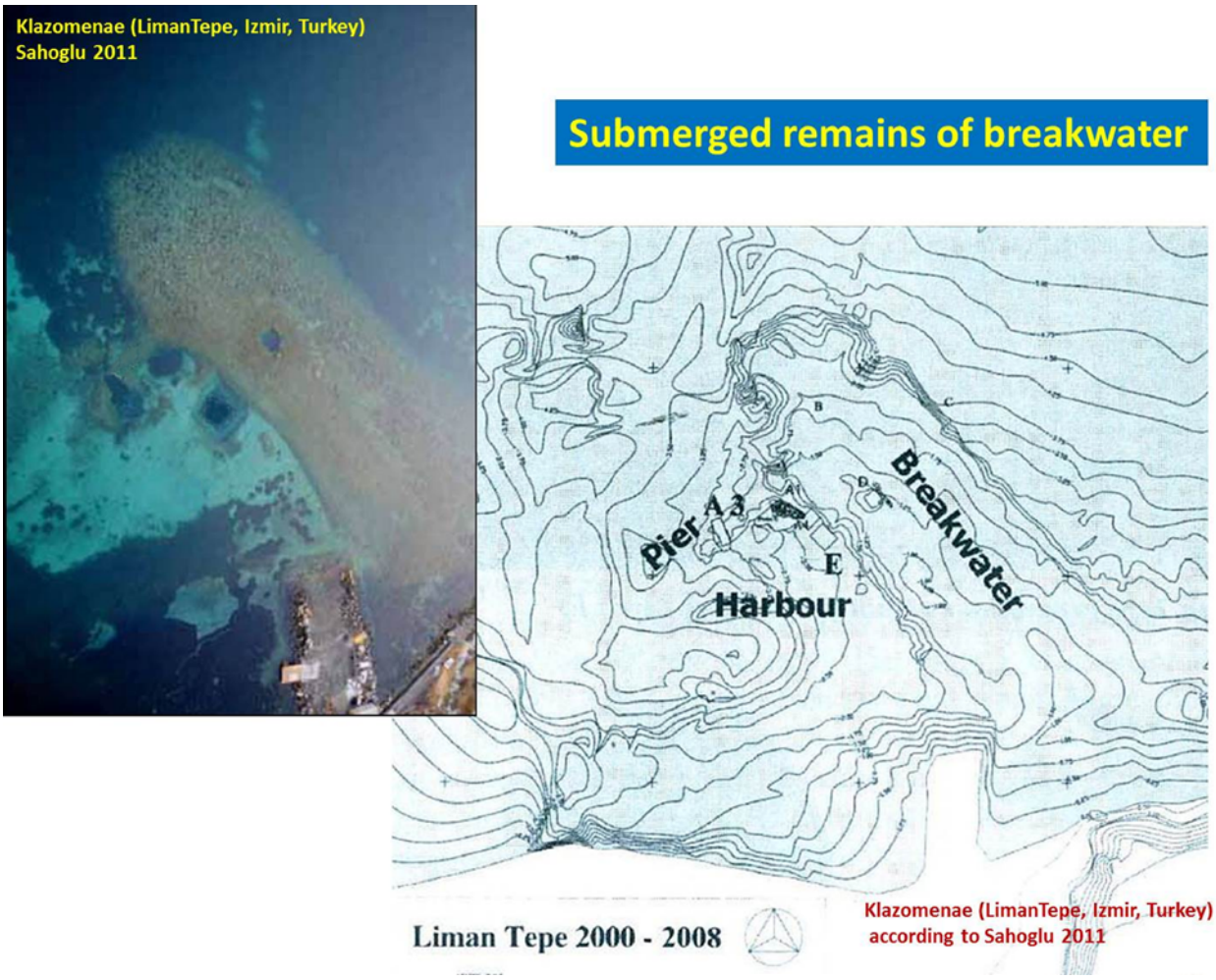

Figure 4.2. The breakwater at Klazomenai (n° 79), dated to the 6th century BC (140 x 45 m). In the inner part of the breakwater, a device for mooring was found. Graauw, de 2015: fig. 2.

from nautical practice, the inspiration for these being the natural offshore sandstone formations and headlands.[25] The observation of the behavioural pattern of waves against ridges or promontories reveals that a natural obstacle causes waves to dissipate, protecting the shore from their direct action. Therefore, breakwaters were born as an attempt to artificially replicate a phenomenon that already existed in nature. Since their origin, breakwaters had a close connection with moles; the latter were essentially breakwaters that performed a double function, being used – on their inner sides – as mooring spaces through the installation of bollards, rings or drilled stones.

The direct antecedents of defensive structures found in the Aegean and Ionian seas should be sought in the Phoenician world of the 9th-8th century BC, where interventions with lithic material are attested to in sites such as Tabbat el Hammam (9th century BC), Athlit (9th century BC) and – possibly - Sidon (a chronology oscillating between the 8th and 6th centuries BC has been suggested for these interventions).[26] In the Greek world, defensive structures can reasonably be considered as the first harbour interventions. Indeed, although literary sources date their appearance only to the 6th century BC (Figure 4.3), archaeological remains from Delos (n° 39) seem to allow us to consider the 8th-7th century BC as a possible scenario for their adoption and diffusion.[27] Here, a free-standing breakwater, made up of massive rough-hewn blocks of local granite, was erected to allow for the use of an otherwise unprotected area.[28]

Starting from the 7th century BC, both reinforcements of pre-existing natural reefs and free-standing breakwaters are documented in harbour areas.

[25] Flemming 1980b: 166.

[26] For further details on these interventions, see par. 2.4.

[27] Herodotus (3.60) attributes the building of the breakwater ('χῶμα') of Samos (n° 165) to the tyrant Polycrates; Aristotle refers to this same breakwater (*Pol.* 5.1313b), mentioning it as one of the 'Πολυκράτεια ἔργα'. On the breakwater at Delos, see Paris 1916: 34-35. Duchêne and Fraisse (2001: 93) proposed a 7th century BC chronology, while Flemming (1980b: 168) suggested the 8th century BC.

[28] Mouterde in Poidebard and Lauffray 1951: 17-18.

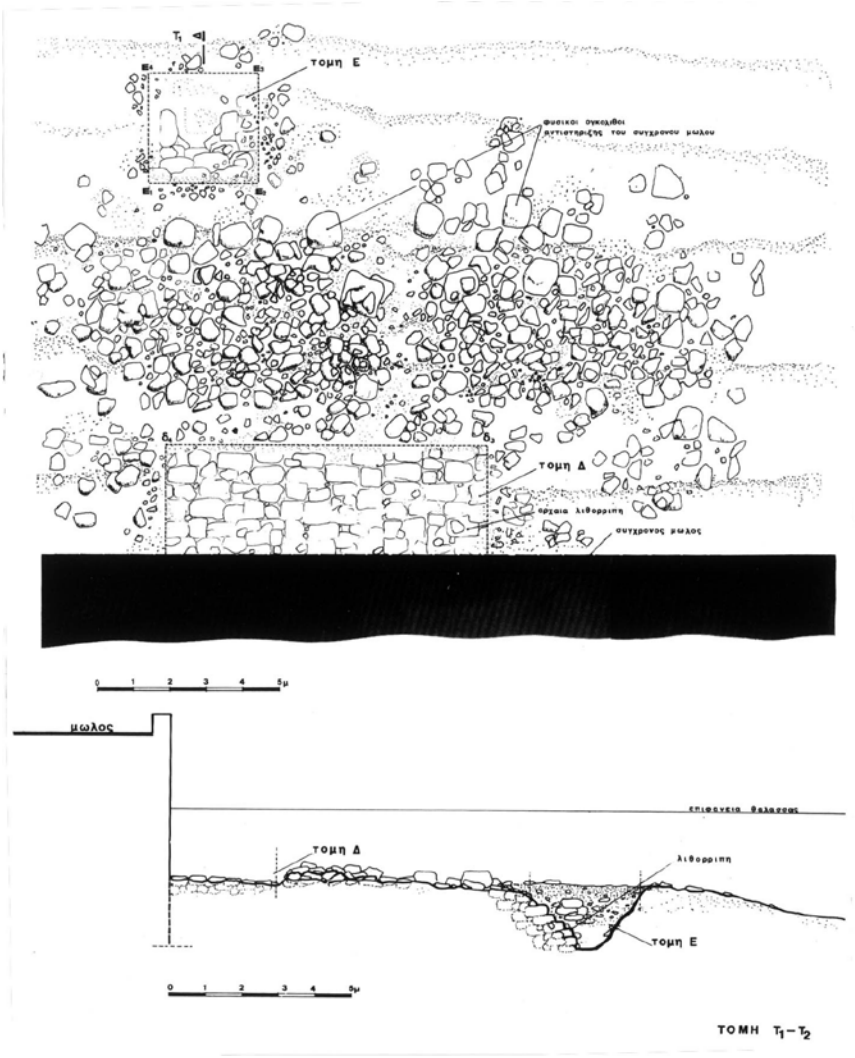

Figure 4.3: Plan and section of the structure identified as one of the moles of the ancient harbour of Samos (n° 165). Simossi 1994: 860, fig. 3.

Examples of the first type come from the northern harbour of Aigina (n°7),[29] Perachora (ancient Heraion) in Corinthia (n° 64),[30] and Antissa on the island of Lesbos (n° 20),[31] and they are heirs to a long tradition already adopted on the Levantine shores.[32] *Ex-novo* breakwaters can be found at Histiaia on Euboia (n° 66),[33] Klazomenai in Ionia (n° 79)[34] and Palaiopolis on the island of Andros (n° 133),[35] and they also have Eastern precedents.[36]

With regard to construction techniques, various methods can be detected, but in general their rationale was relatively simple, and this might explain their early appearance and diffusion. The common way of proceeding was to jettison stones (the size of which could greatly differ) into the sea, at a depth of 10-15 m.[37] On the Levantine shores dressed blocks were used (e.g., Tabbat el Hammam), and this technique was soon borrowed in the Greek world. This can be seen in the examples from Kolones on the island of Salamis (n° 84),[38] and Lechaion (n°92), where two breakwaters of the outer harbour were built using this technique.[39] The use of massive masonry for the formation of breakwaters was similar to the construction of land structures,[40] and it consisted in superimposing parallel courses of squared blocks of similar height. A system of this type was probably already employed in the Classical breakwater of Kyme in Aeolis (n° 89).[41] Mortar was not used, but blocks were occasionally fastened with dovetailed lead clamps (horizontally), tenons and pivots of lead, wood or iron (vertically).[42] For example, the two jetties which narrowed the entrance of Kantharos had in their upper part large rectangular stones of local porous limestone, held together by clamps sheathed in lead.[43]

[29] The breakwater originated in the reinforcement of a ridge by hewn blocks that were simply piled against each other. Knoblauch 1969, and 1972. This structure is already mentioned by Leake 1830: II, p. 436.

[30] Blackman 1966: 192-194.

[31] Here, a natural rock formation was reinforced and extended in a northeasterly direction with irregular stone blocks (Theodoulou and Kourtzellis 2011: 139-140).

[32] At Sidon a sandstone ridge was reinforced to create a shelter for vessels. Similarly, to the south of the settlement of Tyre, submerged reefs were exploited (Flemming 1980b: 167).

[33] In Lehmann-Hartleben's catalogue (1923: 52), the breakwater is generally defined as 'Archaic'; the information offered by Lehmann-Hartleben is derived from Georgiades 1907: 9. On the Histiaia harbour, see also: Skyl. 58.

[34] Erkanal, Şahoğlu and Tuğcu 2014: 45.

[35] Lehmann-Hartleben 1923: n. 28; Theodoulou 2015.

[36] Tabbat el Hammam (Flemming 1980b: 166-167).

[37] The term 'jetty', which is sometimes attributed to breakwaters and moles, derives from this practice.

[38] Blocks between 75 cm and 1.25 m in length. Dodwell 1819: 576-577; Lolos 1995: 291-297.

[39] Georgiades 1907: 4-5.

[40] Blackman 2008: 639.

[41] Gianfrotta *et al.* 2002: 34. The chronology of the breakwater of Kyme is complex, since it has been subject to successive readjustments up to the Byzantine period. The use of large blocks, however, seems to be attributable to the first phase of the structure.

[42] Felici 2001: 163.

[43] Navis II: *s.v.* Piraeus. Lead clamps were also found in the breakwaters of Mounychia (Mazarakis-Ainian, Ph. 1992: 81).

Another way of proceeding consisted in building breakwaters simply by piling irregular rubble into the sea. Rubble breakwaters were probably the commonest kind of sea defence, and they are still used today by coastal engineers to create protection from wave action. The inner part, the core, was made up of heaped stones of small size that, in some cases, were clad with larger stones, creating an outer armour layer capable of protecting the core from the waves hitting the structure.[44] This system guaranteed excellent cohesion between the core and the cladding, ensuring strong resistance to wave motion. Indeed, the external stones slowed down wave approach, while the gap existing between the stones allowed them to move, dissipating wave energy without intense impacts.[45] Heaped rubble breakwaters are documented at Halicarnassus (n° 58)[46] and Abdera (n° 1).[47]

The system of laying large blocks was achieved by using special machinery that allowed heavy materials to be lifted. The use of cranes is attested to from the late 6th century BC, whereas pulleys may only have been invented and adopted in the 4th century BC.[48] Once the structures were built and the mounds of stone proved to be stable, it was possible to use them as a base for the construction of towers or walls.[49]

The technique of jettisoning stones – on which the building systems of moles and breakwaters were based – poses a complex chronological problem. This technique was in continuous use, so that it did not undergo remarkable changes over the centuries. This implies that breakwaters and moles cannot usually be dated *per se*, but their chronology can be established thanks to the presence of external dating elements, e.g., their inclusion within the city-walls, pottery finds associated with the structure, literary or epigraphic sources which provide a date for their construction. Therefore, in the majority of cases, breakwaters and moles are not clearly dated, but are rather attributed to fairly wide time frames, e.g., Archaic period, Classical age. Sometimes they are more generically defined as 'ancient'.

Another controversial aspect of the study of breakwaters and moles is the height that they could have reached above sea-level. As for how accurate archaeological data are, there are too many question marks, since various events could have altered the structure over time, such as loss of material in consequence of particularly violent storms, intentional removal of stones carried out in later periods, collapse of the structure under its weight, action of earthquakes.[50] Ethno-archaeological comparisons allow us to trace a heterogeneous scenario in which both submerged and emerging breakwaters are attested to.[51] The crest of simple breakwaters could have been above or below still water level, since their aim was mainly to protect the water basin from the waves. On the other hand, breakwaters included within the city-walls could have reached so significant a height as to prevent both waves and enemies from rising above them. Lastly, it is reasonable to believe that those structures that were also used as moles on their inner side could have had a surface more or less level with the ships' decks in order to facilitate the unloading of cargo.[52]

Concerning the number of breakwaters, one or two are generally attested to in Archaic and Classical harbours. The most elementary type is represented by a simple and straight jetty.[53] However, sometimes – according to wave direction – breakwaters turned towards other cardinal points, assuming an elbow (or L) shape.[54] In cases in which two breakwaters were present, they were built in such a way as to aim at reducing the width of the entrance.[55]

Breakwaters had a fundamentally defensive function and, as such, they reinforced the natural protection offered by the configuration of the coast. For this reason, their construction is usually documented in those places which were considered barely sheltered (in the previous chapter, these places have been defined as 'λιμένες εὔορμοι') and needed to be improved in order to guarantee safer use. Therefore, they are commonly found near headlands,[56] islands[57] and simple river mouths,[58] or they could be found in open bays and between two promontories to narrow harbour entrances.[59]

[44] Grauuw, de 2015.

[45] Flemming 1980c: 168-169.

[46] This breakwater supported two towers (Flemming *et al.* 1971: 45).

[47] Where the breakwater of the so-called 'Archaic Harbour' was of the heaped rubble type (Samiou 1993: 363-368).

[48] Before the 6th century BC it is possible to think that heavy materials were raised thanks to earthen ramps, as documented in the Egyptian world (Wilson 2008: 362). On the use of cranes in harbour construction, see also: Blackman 2008: 653; Felici 2001: 163.

[49] Flemming 1980c: 168-169.

[50] Baika 2009: 429-431; Blackman 2008: 647.

[51] Grauuw, de 2015.

[52] Blackman 2008: 649-651; Grauuw, de 2015.

[53] E.g., the breakwater of the so-called 'commercial harbour' at Thasos (n° 182). This structure was built in a straight E-W direction, measuring 115 m. At its end, it had a circular shape (the diameter of which was 20 m) that may have served as a base for the erection of a tower (Empereur and Simossi 1993).

[54] E.g., the breakwater at Perachora (n° 64), in Corinthia, which seems to have turned towards the southwest (Blackman 1966: 192-194).

[55] E.g., in Piraeus, where two breakwaters were built for each harbour basin (n° 72, 116 and 194) in order to narrow their entrances (Garland 1987: 26).

[56] E.g., Tenedos in the Troad, n° 186 (Chandler 1817: I, 21; Lehmann-Hartleben 1923: 279).

[57] E.g., Leucas in Acarnania, n° 94 (Murray 1988); Gytheion in Laconia, n° 57 (Scoufopoulos and McKernan 1975: 103-116).

[58] E.g., the breakwaters at Kirra (n° 78), in Phocis, which were placed near a river mouth and in an open bay (Negris 1904: 354), or at Histiaia (n° 66) (Georgiades 1907: 9; Lehmann-Hartleben 1923: 52).

[59] E.g., at Palaiopolis on the Cycladic island of Andros, n° 133 (Lehmann-Hartleben 1923: n. 28; Theodoulou 2015: *s.v.* Palaiopolis).

A peculiarity of Greek harbour building: moles as extensions of the fortifications

Starting from the late 6th or the early 5th century BC, some *poleis* began to build breakwaters which were extensions of their city-walls into the sea, with their extremities fortified by structures such as towers or lighthouses.[60] These moles were built using the same techniques employed for breakwaters, but – in these cases – particular attention was paid to the outer part, which was raised above sea level and fortified to prevent any possible enemy ship from attacking and reaching the city. These kinds of structures should be considered as a Greek architectural introduction. Although harbour basins located inside the city-walls are attested to since the 3rd millennium BC,[61] no previous examples of urban walls extending into the sea to create narrow entrances are known.[62]

According to the available data, the origin of this intervention can be found within the chronological horizon of the 6th century BC on the coast of Asia Minor, where the harbours of Abdera and Miletus employed this kind of defence. At Abdera (n° 1), in Thrace, the three harbours that were in use between the Archaic and the Classical periods were protected by moles which were extensions of the fortifications.[63] The first chronological intervention is found in the so-called 'Archaic Harbour', where the city-walls were extended to the southwestern corner of the North Enclosure.[64] During the Classical period, this system was adopted once again. After the siltation of the 'Archaic Harbour', the whole settlement was displaced further to the south, and Abdera began to use the two sides flanking the headland for harbour purposes.[65] The western harbour, located in the same place where the modern harbour lies, was included within the Classical city-walls by means of a 180-m-long breakwater made up of roughly-hewn granite blocks. The eastern harbour, located on the site today called Agios Gioannis, was formed by the extension of the eastern part of the city-walls, which ended in a semi-circular tower with a diameter of 6 m.[66]

The case of Miletus is more uncertain. Here, an Archaic chronology has been proposed for the two moles at the edges of the Lion Harbour (n° 104).[67] This hypothesis is mainly based on the fact that during the 6th century BC, the urban pattern was re-organised, with the *agora* extending towards the southern extremity of this harbour. According to the multi-disciplinary team working at Miletus, this would have provided an ideal scenario for including the Lion Harbour inside the city-walls.[68] However, this chronology is rather speculative and cannot be definitively confirmed or rejected until archaeological studies are undertaken. The two extensions of the city-walls have been identified and investigated through non-invasive analyses (geomagnetic surveys) so far.[69]

The fortifications encompassing the military harbour at Thasos (n° 183) are attributed to the beginning of the 5th century BC.[70] Here, the inclusion of the basin within the urban circuit corresponds to its separation from the urban space by means of a dividing wall (Figure 4.4).[71] At the same time, two moles (ABC and FGH) were created as extensions of the city-walls, enclosing a harbour basin of approximately 4.46 ha. (Figure 4.5).[72] However, the towers B, C and G, located at the end of these moles, were added only at the end of the 4th century BC.

After the Spartan attack in 429-428 BC, the Athenians decided to carry out a similar intervention in the basins of Kantharos (n° 72), Zea (n° 194) and Mounychia (n° 116).[73] This is probably the most emblematic example of moles as extensions of the fortification system in the Greek world. In this case, the circuit walls were extended in order to incorporate all three harbour basins. Two moles were built on either side of each harbour's mouth. Despite being virtually included within the city-walls, the three harbours were separated from the rest of the settlement by means of a dividing wall: Kantharos by a wall (*peribolos*) running at the rear of the emporium, and located at a distance of 50 m from the coastline;[74] Zea and Mounychia by the shipsheds covering their perimeters.

[60] On lighthouses, see par. 4.2.4.

[61] The docking basins at Ur, dating back to the Third Dynasty, were inside the city-walls (Shaw 1990: 429); see Chapter 2. On this topic, see also Raban 1995a: 163-165.

[62] At Sidon the city-walls extending on the *languette rocheuse* seem to be dated to the Hellenistic period (Carayon 2008: 289). The mention of Sidon as a 'closed harbour' in Skylax (104) probably dates to the late-4th century BC.

[63] The harbour area of Abdera was excavated between 1990 and 1993 by the Archaeologike Etaireia of Athens, led by Koukouli-Chrysanthaki; geological analyses were carried out by the Universities of Patras and Thessaloniki (Koukouli-Chrysanthaki 1991: 193-199; Syrides and Psilovikos 2004: 351-359).

[64] Samiou 1993: 363-368.

[65] The layer of destruction at the shipsheds in the Archaic harbour is dated between the 5th and 4th centuries BC, which could mean that the siltation of the basin was already under way by that time (Baika in Blackman and Rankov 213: 270).

[66] Samiou 1993.

[67] Brückner *et al.* 2014: 75-88.

[68] Brückner *et al.* 2006: 63-83.

[69] Brückner *et al.* 2014: 70

[70] Thus, it may precede the order to destroy the wall given to the Thasians in 491 BC. Hdt. 6.46-47; Blondé et *al.* 1999: 59, n. 45.

[71] Blondé *et al.* 1999: 56.

[72] Grandjean and Salviat 2000: 53.

[73] Garland 1987: 26.

[74] The foundations of this structure were identified by Dragatsis (Steinhauer 2000: 91).

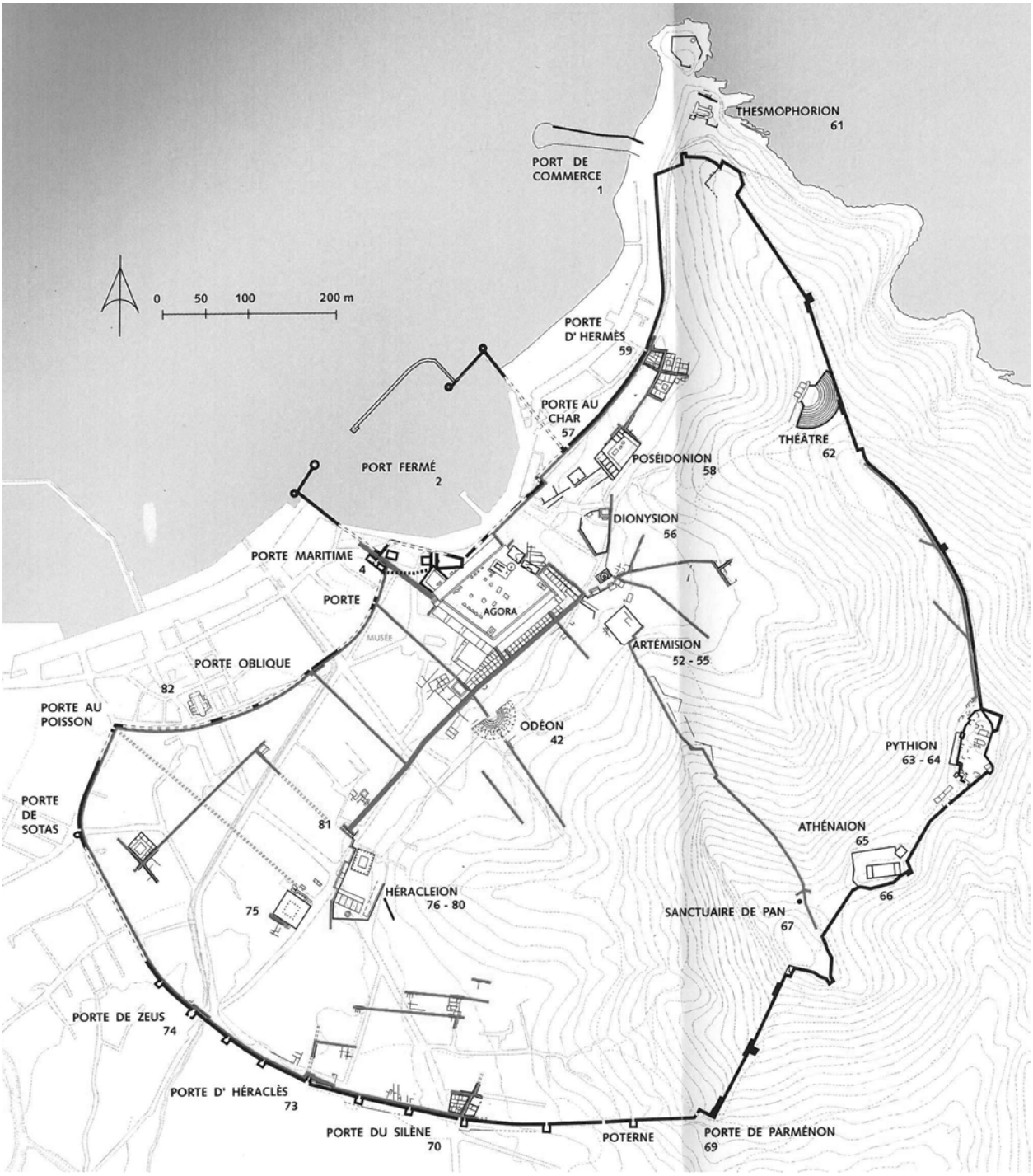

Figure 4.4. General plan of Thasos with the two harbours (n° 182 and 183), and the city-walls. Grandjean and Salviat 2000: fig. 12.

From the end of the 5th century BC, perhaps under Athenian influence, the construction of moles as extensions of the fortifications underwent rapid diffusion. The case of Halieis (n° 59), in Argolid, which, in 1969, Jameson interpreted as a harbour delimited by two moles with a gap of 20 m between them (Figure 4.6),[75] was questioned in 1985 by Frank Frost. The latter considered the archaeological evidence to be insufficient to prove the existence of a harbour in that place, believing instead that this area could possibly have been the market place.[76] However, the hypothesis of a sea-wall has recently been reaffirmed by Jameson, who justified the adoption of this defensive system as a consequence of the episode narrated by Herodotus,

[75] Jameson 1969: 311-342; Jameson *et al.* 1994: 13–56. According to Jameson (2005: 93), in a later phase this entrance could have been narrowed to 7 m. The harbour of Halieis is also mentioned by Skyl. 50.

[76] Frost, F. 1985: 63-66.

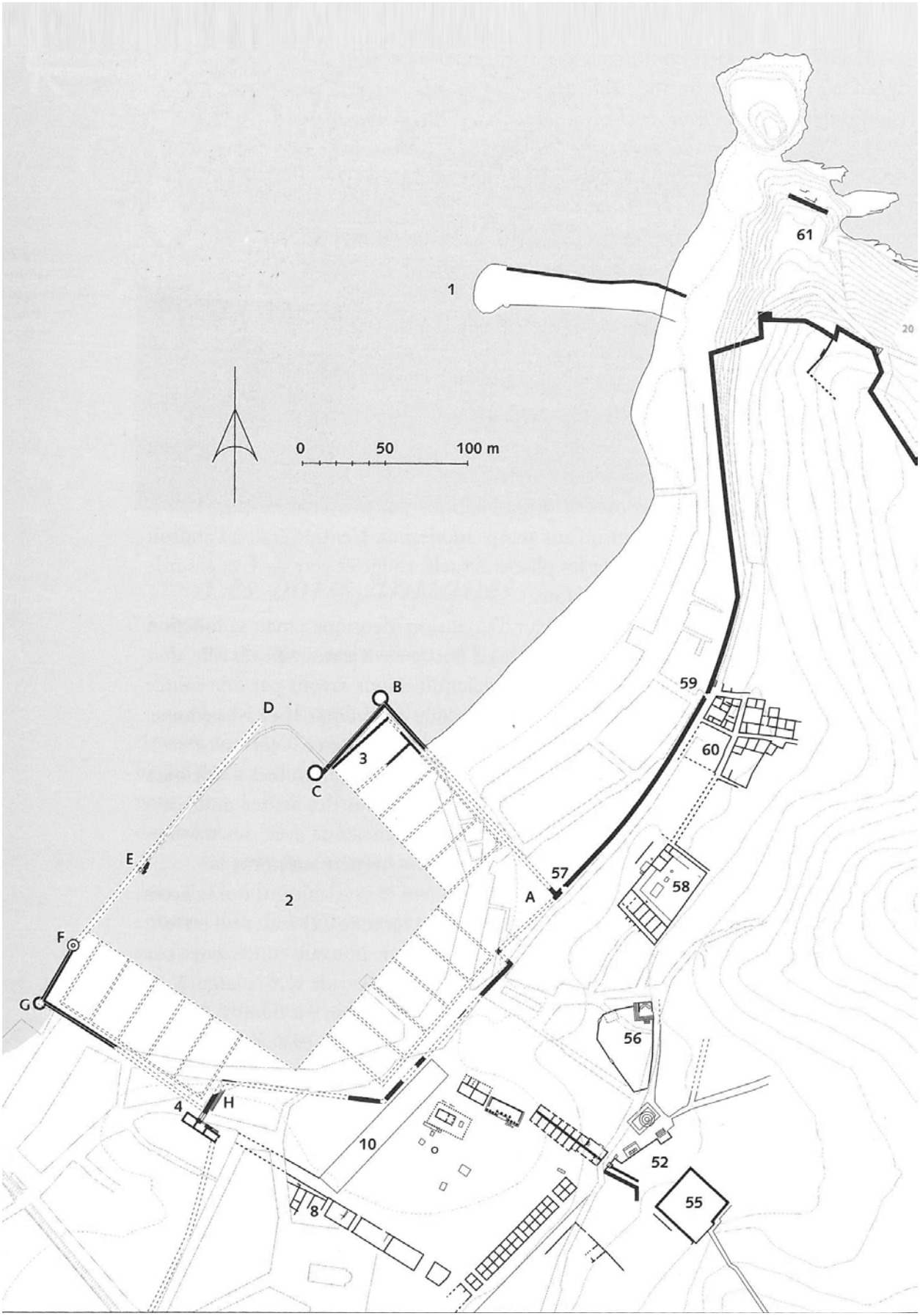

Figure 4.5. Plan of the two certain harbours (n° 182 and 183) of ancient Thasos. Simossi 1994: 136.

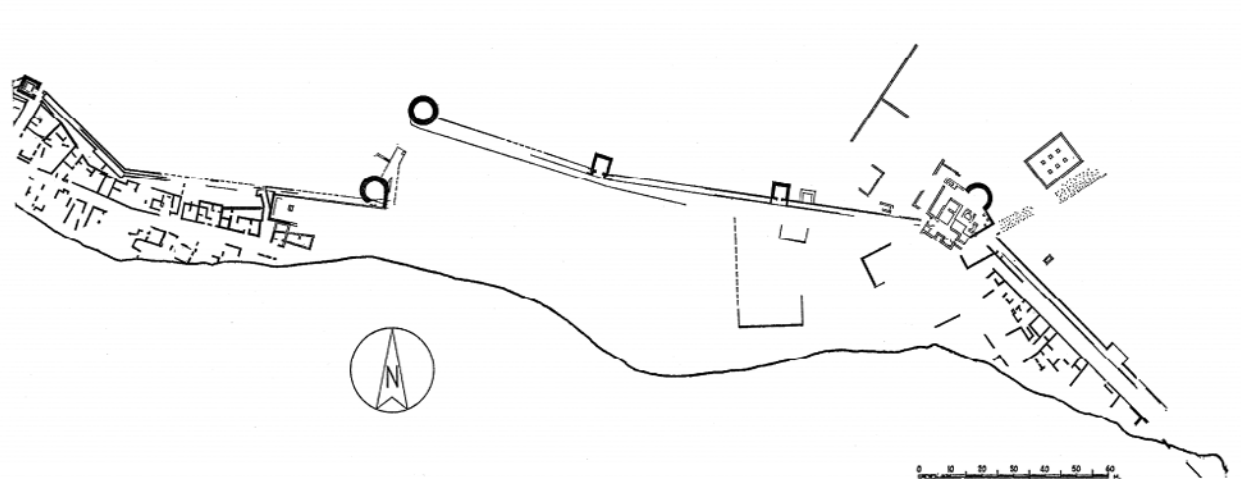

Figure 4.6. Plan of the submerged area, Halieis (n° 59). According to Jameson (1969), the harbour should be located inside the gate and it was accessible through the narrow gap between the two arms of the city-walls. Jameson 1969: 327.

according to whom the Spartan Aneristos was able to conquer Halieis with a merchant ship full of soldiers.[77] Plundered by the Athenians in 430 BC,[78] the *polis* had to reach a truce with them in 424-423 BC. This forced it to station troops there while allowing Athens to make use of the harbour.[79]

At the end of the 4th century BC, the two harbours of Mytilene (n° 114 and 115) were also included within the city-walls through the construction of an extension in the military harbour[80] and two at either side of the commercial harbour (Figure 4.7).[81] The examples coming from Methymna (n° 102) on the island of Lesbos,[82] from the inner harbour of Eretria (n° 50) on Euboia,[83] and from the harbours L1 (n° 82) and L2 (n° 83) of ancient Knidos in Karia can be dated back to the same period.[84]

Further cases of moles as extensions of the fortifications that are not clearly dated but could belong to this time span (late Archaic or Classical period) have been found at Siphai (n° 172) in Boeotia,[85] Palaiopolis (n° 133) on the island of Andros[86] and Antissa (n° 20), on the island of Lesbos.[87] The case of the moles at Samos (n° 165) is uncertain: the 'χῶμα' commissioned by Polycrates does not seem to be related to the urban fortifications but the structure found below the current mole appears to be an extension of the wall.[88]

4.2.2. Mooring structures: quays, piers and mooring devices

Although some breakwaters were used on their inner side as moles,[89] the main mooring space of a harbour would have been found within its basin, close to warehouses and custom offices.[90] The quay was the space covering the perimeter of the harbour basin bordering the sea. Usually, the equipment intended for the mooring of boats and the handling of goods (e.g., cranes, warehouses, offices) was installed on it. On the other hand, piers were structures (made of stone or timber) protruding from the quay into the sea, and they were intended to increase the mooring space of the harbour, which was otherwise restricted to its natural borders and to the moles.[91] Unlike the latter, quays and piers were not intended to have a defensive purpose, since they simply provided places for boats to moor, waiting for goods to be unloaded.[92]

[77] Hdt. 7.137.2; Jameson 2005: 93. This passage has been considered as a later interpolation and thus deleted by some editors. However, it is retained in the latest text, edited by N. G. Wilson (Oxford 2015).

[78] Thuc. 2.56.

[79] *IG* I^3 75.

[80] The mole occupied the western part of the basin, while – on the eastern side – the wall circuit ended on the coastline with a tower (Koldewey 1890: 8; Kourtzellis 2013b: 47). The presence of two harbours in Mytilene is confirmed by Skyl. 97.

[81] The southern breakwater was 250-260 m long x 7.5 m wide, while the northern one had an original extension of 75-100 x 8.5 m. These two breakwaters left a gap between them of *c.* 100 m. Koldewey (1890) proposed a 5th century BC chronology for this intervention. Recently, the date has been postponed to the end of the 4th century BC (Kourtzellis 2013a: 11).

[82] Koldewey 1890: 16-19. Theodoulou (2011: 497-500) highlights building similarities between the intervention at Methymna and the harbour-works at Mytilene.

[83] Skyl. 22; Navis II: *s.v.* Eretria.

[84] Greene, Leidwanger and Tuna 2014: 8.

[85] Skyl. 38; Schwander 1977: 513-520.

[86] Theodoulou 2015.

[87] Theodoulou and Kourtzellis 2011: 139-140.

[88] 170-190 x 20 m (Simossi 1993: 592-595, and 1994: 133-160).

[89] See par. 4.2.1.

[90] Blackman 1982b: 196-199.

[91] *Ibidem*

[92] Another possible option was for large cargo ships to anchor and wait until their goods were transferred onto barges; after that, they could leave the harbour without docking (Garland 1987: 86).

Figure 4.7. Satellite image of the commercial harbour of Mytilene, on the island of Lesbos (n° 115). Under the water it is possible to notice the remains of the southern and northern breakwaters which were extensions of the city-walls. Google Earth.

The existence of artificial quays can be traced back to the 3rd millennium BC, as proved by the chronology of the small quay in mudbrick and bitumen from Ur.[93] From the second half of the 2nd millennium BC, in addition to the archaeological evidence,[94] iconographic sources allow us to follow the continual use of these structures in the Mediterranean area.[95] Given the scarce evidence available for them, however, we can assume that loading and unloading may have commonly been carried out on beaches, some equipped with rudimentary mooring devices made from perishable materials.[96] The situation did not evolve considerably during the Archaic and Classical periods, when the number of quays and piers documented in the Aegean and eastern Ionian seas remains relatively low. On the other hand, whenever present, the installation of quays and piers in a harbour is a clear indicator of the community's will to facilitate the arrival of ships, and it can probably be justified by the frequent visits of large and medium cargo ships to the harbour basin.[97]

[93] Blackman 1982a: 92; Shaw 1990: 429.

[94] The interventions at Thebes and Birket Habu date back to this period (Blackman 1982a: 92).

[95] About this, see Chapter 2.

[96] For the wooden pier documented at the mouth of the river Guadalhorce (Spain) and dated to the early 1st millennium BC (Martín Ruiz 1995: 64).

[97] There is no evidence so far, at least for the Archaic and Classical periods, that small merchant ships were required to unload their cargoes onto simple beaches rather than in harbours. However, later harbour regulations clearly show that some harbour basins did not allow boats under a certain tonnage to enter and make use of their infrastructures, i.e. the Thasos harbour regulation of the 3rd century BC (*IG* XII Suppl. 348).

At the same time, quays and piers are usually associated with larger harbour interventions, frequently aimed at the demarcation of the harbour basin by means of breakwaters, as seen for example in Kantharos (n°72), Piraeus.

Quays and piers shared the same building technique used for moles. Their upper surface was kept fairly level in order to facilitate the transferral of cargo. For the same reason, it can be assumed that their height above still water level broadly corresponded to the ships' deck, thereby facilitating the movement of goods and people between water and land.[98]

A clear image of the function of quays and piers can be deduced from data coming from Kantharos, where from the quay, which ran along the entire perimeter of the basin, three piers stretched into the sea. Traces of these installations were visible until 1840, when they were destroyed to allow for the construction of the modern harbour.[99] The three piers had different functions. The 'δια μέσου χώμα', located in the northern part of Kantharos, separated the main basin from the northern area. The 'χώμα' was located in the deepest recess of the gulf, its pattern broadly corresponding to the mole that nowadays can be seen in the area of Karaiskaki Square, and was used for the inspection of Athenian warships.[100] Lastly, the 'διάζευγμα' was probably the dividing element which circumscribed the commercial area.[101]

Mooring manoeuvres were supported from the mainland. When a ship was approaching the quay, on-board hawsers were cast ashore to be attached to specific devices. Ropes and hawsers were then manually pulled by crewmen to allow the ship to moor at the quay or piers and secured. Unfortunately, only a few examples of mooring devices dating to the Archaic and Classical periods survive, probably because most of them were made of timber or metal.[102] However, it is likely that they were inserted vertically into the piers or on the quay (bollards), or protruding from them (pierced mooring stones).[103] The installation of wooden mooring devices has been hypothesised on the upper part of the external moles at the Lechaion harbour (n° 92).[104] The mooring stones found at Methymna (n° 102), on the island of Lesbos, should be dated to the late Classical period.[105] Similar (but not clearly dated) blocks were also attested to at Myrina (n° 112), in Aeolis, and became frequent during the Hellenistic and Roman ages.[106]

4.2.3. Structures to assist beaching and maintenance: shipsheds and slipways

On the mainland, harbours made use of functional infrastructures, the more distinctive of which were probably shipsheds and slipways. The Greek word indicating 'shelters for ships' was 'νεώσοικοι', which literally means 'houses for ships' (derived from 'ναῦς' and 'οἶκος'). From the mid-19th century onwards German scholars have adopted the translation *Shiffshäuser*;[107] in English, the Greek word is usually translated as 'shipsheds'.[108] In literary and epigraphic sources, in addition to 'νεώσοικος', the word 'νεώρια' often appears, which seems to allude to an entire complex of buildings (Figure 4.8), whereas 'νεώσοικος' would have been appropriate for single, covered slipways.[109]

Recently, a monograph entirely dedicated to the study of ancient Mediterranean shipsheds has been edited by David Blackman and Boris Rankov. Based on his research and on-field experience, Blackman maintains that shipsheds were aimed at accommodating exclusively military vessels, since merchant ships, which often had their hulls sheathed in lead, would not have needed frequent maintenance.[110] On the other hand, warships,

[98] Greek ships were usually moored by the stern, so that they could leave the harbour once loading and unloading was completed (Hom. *Il.* 15.716-717; Garland 1987: 86; McGrail 2008: 628-630)

[99] Alten 1881: 11-15.

[100] It was the place where trierarchs annually presented their triremes for inspections at the mouth of Mounychia (Garland 1987: 157).

[101] Navis II: *s.v.* Piraeus. See also Garland 1987: 157; and Theophr. *Char.* 23.1-2: 'ὁ δὲ ἀλαζὼν τοιοῦτός τις, οἷος ἐν τῷ διαζεύγματι ἑστηκὼς διηγεῖσθαι ξένοις ὡς πολλὰ χρήματα αὐτῷ ἐστιν ἐν τῇ θαλάττῃ' ('The fraud is the sort who stands on the breakwater and tells strangers how much of his money is invested in shipping' [Translation by Rusten and Cunningham]).

[102] A much later example of berthing (1st century AD) was found during excavations at San Rossore (Pisa). Here, the ship 'Alkedo' (this was the name carved on a plank fastened to one of the oarsmen's benches), was found still moored to a timber bollard by ropes (Camilli and Setari 2005: 91).

[103] Nowadays wooden bollards are frequently used for mooring in river mouths (Blackman 2008: 647-654).

[104] Here, the existence of flutes has been justified as necessary to connect the blocks of the moles with their upper layers, or as cavities for wooden scaffolds and wharfs to be built (Pallas 1995).

[105] On Methymna, see Kourtzellis 2010: 190-195; and Theodoulou 2015: 497-500.

[106] E.g., the pierced mooring stones from Gerai (n° 53) in Ionia have been dated to the Hellenistic period due to affinities with the city-walls (Bean 1984: 110).

[107] Blackman in Blackman and Rankov 2013: 5; Ulrichs 1863.

[108] Blackman in Blackman and Rankov 2013: 5. In French, these structures are known as *loge* or *hangar à bateau*. In Italian and Spanish there are no unanimously accepted words to indicate these kinds of buildings. They are usually referred to, respectively, as *ricoveri/rifugi per navi* or as *refugios para barcos,* but the word 'hangar' is frequently found in both languages.

[109] From the 5th century BC, both words are documented. E.g., 'νεώσοικος' appears in Hdt. 3.45 and in Thuc. 7.25, while 'νεώριον' in Eur. *Hel.* 1530 and Thuc. 3.92. See Blackman in Blackman and Rankov 2013: 16-17.

[110] *Ibidem.* This is the reason why, when shipsheds are identified, a harbour is often defined as 'military'.

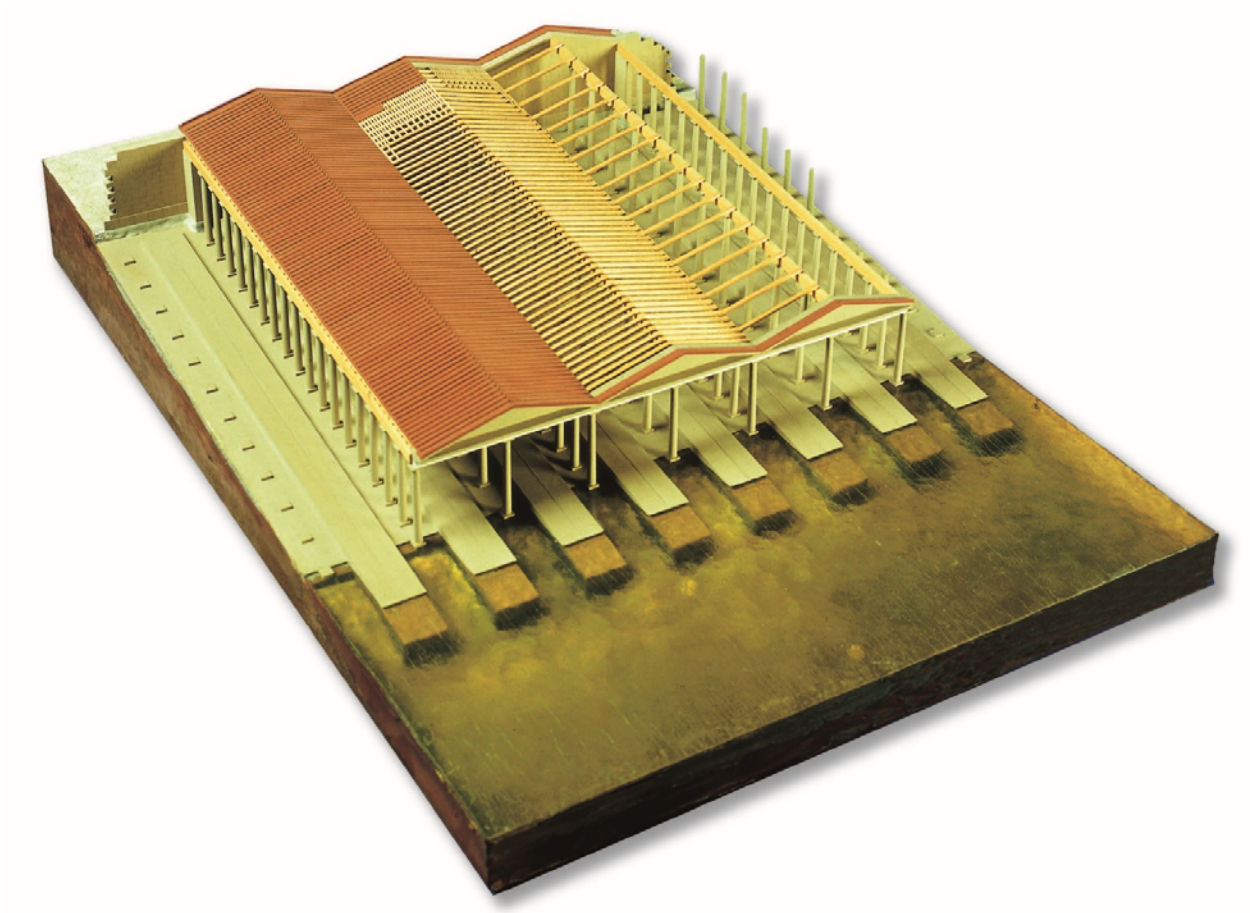

Figure 4.8. Reconstructive model of a 'νεώριον'. Photography supplied courtesy of the © Greek Hellenic Maritime Museum.

the wood of whose hulls was not covered so as not to compromise their speed and manoeuvrability, would have required regular attention, since they were particularly affected by the harmful effects of *Teredo Navalis.*

Until the 1980s, shipsheds were considered as a sixth-century-BC innovation, the introduction of which, in Greece, had to be connected to the rise of the Archaic tyrannical regimes. As underlined in Chapter 2, however, the discovery at Kommos and Poros/Katsambas of buildings with galleries at a certain distance from the coastline has contradicted this assumption.[111] Although the chronology of shipsheds has been raised remarkably thanks to the excavations in Crete, the use of similar structures in the Greek world (and, more generally, in the Mediterranean) has not been documented during the 8th and 7th centuries BC so far. Additionally, when they reappear in the 6th century BC, some changes can be noticed in their features. If Minoan shipsheds were meant to be storage buildings located at some distance from the shore, Archaic shipsheds were located more precisely in the harbour areas, not far from the coast and other harbour facilities.[112] Therefore, it is possible to hypothesise that during the 8th and 7th centuries BC, ships were simply hauled onto the beach with the aid of trenches (corresponding to Homer's 'οὐρός') and wooden sleepers ('φάλαγγες').[113] In the 6th century BC, in response to the intensification of maritime traffic, installations were built that had greater dimensions and were constructed from durable materials.

At a literary level, the first mention of shipsheds appears in Herodotus, when the Egyptian Pharaoh Necho is said to have ordered their construction to shelter his fleet in 593 BC.[114] In the second half of the same century, the harbour at Samos (n° 165) must also have been equipped with shipsheds. Although Herodotus does not explicitly attribute their construction to Polycrates,

[111] Period of use of the building at Poros/Katsambas: between LMII-IIIA and LMIIIB; the structure at Kommos can be dated to the LMIIIA1-2/LMIIIB. The structures were different from other Minoan warehouses found on the island of Crete because they have larger corridors, do not have either doors or windows and are open towards the sea. See Chapter 2 for more details.

[112] Baika in Blackman and Rankov: 214.

[113] Hom. *Il.* 2.151-154, and 557-558. Some scholars claim that the existence of rudimentary shipsheds in Homer can be endorsed by Hom. *Od.* 2.263-265. On this topic, see Baika 2003: 203-206.

[114] Hdt. 2.159.1.

nor does he include them amongst his 'ἔργα', he states that, having unsuccessfully sent his least loyal citizens as troops in aid of Kambyses' expedition to Egypt in 525 BC, expecting that they would not return, the tyrant reacted to this failure by dispatching another contingent to intercept the returning Samians. As a precaution, he imprisoned the exiles' wives and children within the shipsheds ('νεώσοικοι'), threatening to burn them.[115] This episode suggests the existence of shipsheds in the harbour at Samos in the last quarter of the 6th century BC, leading to the hypothesis that the 'νεώσοικοι' could have belonged to the same building programme that also provided for the construction of the mole.[116] Although Samos' shipsheds have not been archaeologically identified so far, evidence of other late-6th - early-5th century BC 'νεώσοικοι' comes from the so-called 'Archaic Harbour' at Abdera (n°1), and probably also from Thasos (n° 183), Corcyra (n° 34-36) and Aigina (n° 8).[117]

Typically, 'νεώσοικοι' were made up of long corridors open onto the sea-front, closed at the rear and separated from each other by columns (e.g., Oiniadai, n° 126)[118] or pillars (e.g., the complex Corcyra 1–Kokotou, in Alkinoos harbour, Corcyra, n° 34). The use of non-continuous walls guaranteed the necessary ventilation for the wood, while the roof offered protection from intense sun or excessive rain.[119] The natural slope of the coast and the presence of rocks that could be carved eased the construction of the ramps, which could have been partially built in stone (this is the case of the shipsheds of Piraeus, n° 72, 116 and 194) or cut into the rock (e.g., Oiniadai, n° 126). The gradient of the slopes ranged between 1:9 and 1:11.[120] Beaching was carried out by means of winches placed at the top of the ramps and wooden sleepers placed on the inclined plane.[121]

Compared to defensive interventions and structures that increased the mooring space, the 'νεώρια' had a later diffusion process. Having (re)appeared in the late 6th century BC, they became common only in the late Classical period, when they met the new demands of the city-state. Their construction was funded through a solid fiscal system,[122] and their public nature is confirmed both by epigraphic and literary testimonies relating to various contexts, including the harbours of Zea (n° 194) (Figures 4.9, 4.10 and 4.11),[123] and the Lion Harbour in Miletus (n° 104), [124] as well as by an inscription found on one of the roof tiles of Corcyra 1-Kokotou (Alkinoos harbour, n° 34).[125]

Shipsheds became a status symbol, their monumentalisation and efficiency being considered in proportion to the *polis*' prestige.[126] This peculiar nature seems to be confirmed by the fact that many defeats were sealed by demands to destroy shipsheds[127] or by military actions which culminated in setting 'νεώρια' on fire.[128] Starting from the 6th century BC, shipsheds became a central element in the topographic configuration of a *polis*, being integrated within the

[115] Hdt. 3.45; Blackman in Blackman and Rankov 2013: 18; De Souza 1998: 282.

[116] Despite the literary testimony, archaeological evidence of this structure has not been found so far.

[117] Baika in Blackman and Rankov 2013: 211. In the central Mediterranean, the shipsheds known as 'Syracuse 1' at the Small Harbour of Syracuse could be ascribed to the 6th century BC (Basile 2002: 159), while the complex named 'Syracuse 2' was probably built in the 5th century or at the beginning of the 4th century BC (Basile 2002: 171-172). The dockyards of Syracuse are mentioned by Diod. Sic. 14.7.3; Thuc. 7.22.1-2, and 25.5-6 (Gerding in Blackman and Rankov 2013: 539). The Athenian shipsheds were built after 480 BC. In the 5th century BC, the *poleis* sending ships as a contribution to the Delian League may have been equipped with similar structures (i.e., Thasos, Naxos, Chios and Lesbos).

[118] In the case of Oiniadai, corridors are divided by 18 columns and a T-shaped pillar (Gerding in Blackman and Rankov 2013: 413).

[119] Blackman in Blackman and Rankov 2013: 256.

[120] A ramp with a major inclination is documented at Sounion, n° 177 (15.05°, 1:3.72). See Baika in Blackman and Rankov 2013: 532.

[121] Sleepers and beaching machinery dated to the 3rd-2nd century BC were found during excavations at Place Jules Vernes in Marseilles (Hesnard 1994: 195-217). Circular holes, which could denote the presence of beaching structures, were also discovered at Aigila (n°5). The presence of capstans, used to position the ships inside the shelters, could be hypothesised starting from the existence of a horizontal space, not inclined, which measured 6 x 10.35 m in the shipsheds at Sounion (n° 177), immediately in front of the rear wall. See Baika in Blackman and Rankov 2013: 243.

[122] Baika in Blackman and Rankov 2013: 186.

[123] Inscription from the mid-5th century BC. *IG* I² 889 = I³ 1103: '[h] όρμο δ[ε]μοσίο hόρος' (Hill 1932).

[124] An inscription dating to the 1st century BC or the 1st century AD is an instruction by the *epimeletes* Sophilo, who declares that the harbour is public property (Rehm and Herrmann 1997: 9-11, 197 n.188).

[125] The word 'ΔΑ[ΜΟΣΙΟΣ]' ('public') appears on this shingle (Blackman in Blackman and Rankov 2013: 22).

[126] Part of their prestige also derived from their cost, an expense that only wealthy *poleis* could have afforded; Isocrates (7.66) states that Athenian shipsheds were worth 1000 talents.

[127] In 404 BC Athens was ordered to destroy its Long Walls after being defeated by the Spartans (Xen. *Hell.* 2.2.20; Plut. *Vit. Lys.* 14.4). The pro-Spartan oligarchic government of the Thirty installed in Athens after this defeat sold for destruction the shipsheds for a sum of 3 talents (Isoc. 7.66). As denounced by Lysias (*Against Eratosthenes* 99), the demolition probably begun, but it was not completed, since we know that the shipsheds were still in place, even if damaged, in 399 BC (Lys. *Against Nicomachus* 22), and that a ship was launched from there in 397-396 BC (*Hell. Oxy.* 1.1; for more details see Baika in Blackman and Rankov 2013: 421).

[128] In 455 BC, the Athenian general Tolmides set the Spartan naval base of Gytheion (n° 57) on fire, as testified by Thuc. 1.108.5 and Diod. Sic. 11.84; in 433 BC, the Corcyreans burnt the harbour of Kyllene (n° 88) because the Eleans provided ships and money to Corinth (Thuc. 1.30).

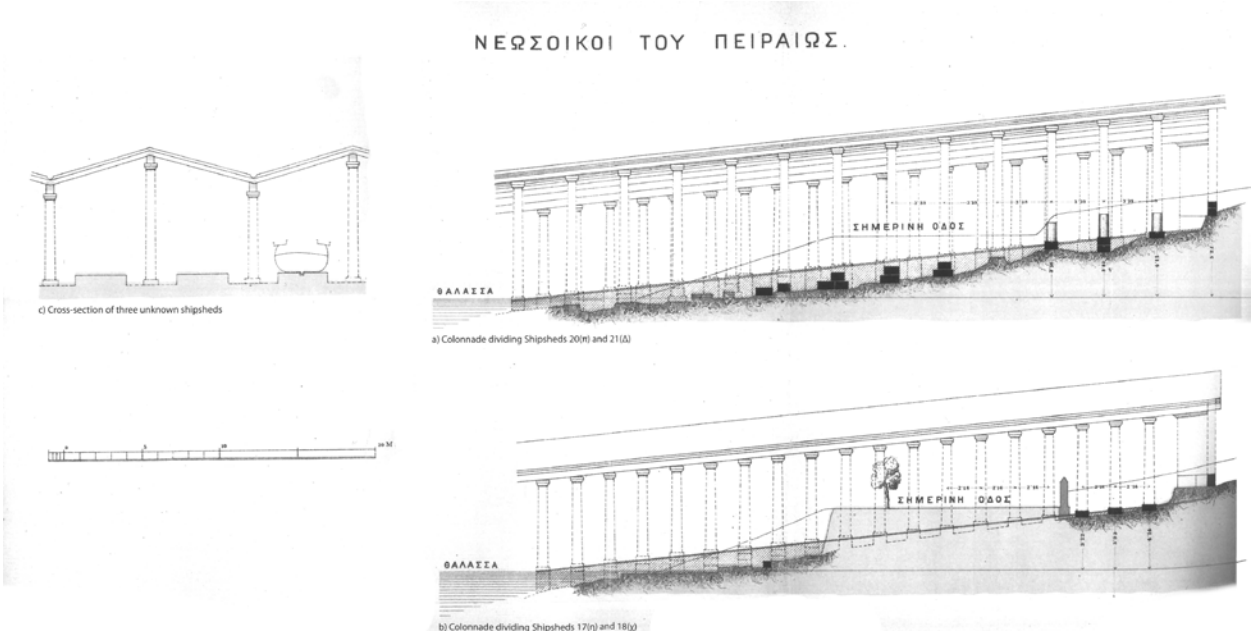

Figure 4.9. Shipsheds of the harbour of Zea (n° 194), section. Dragatsis and Dörpfeld in Dragatsis 1885: pl.3.

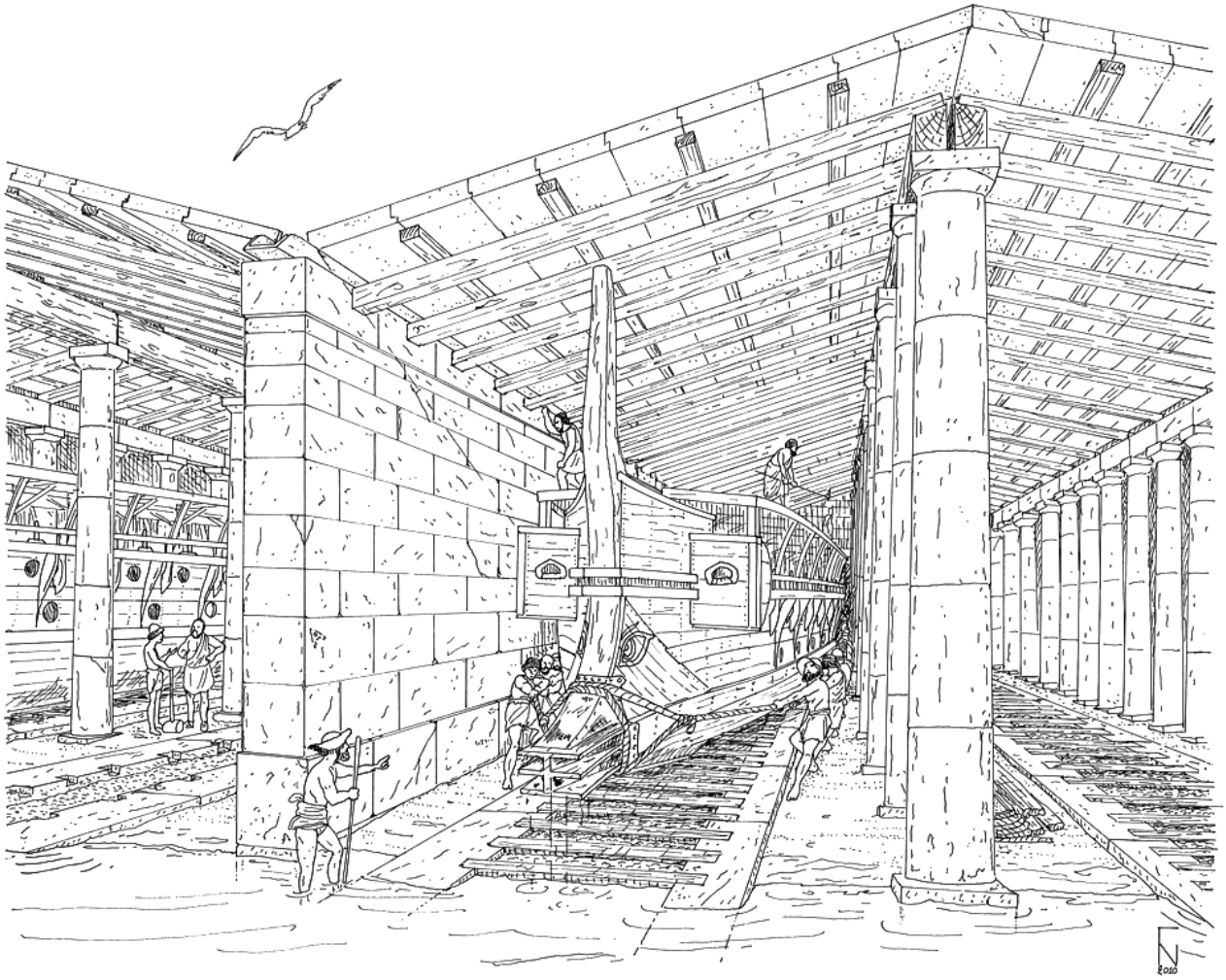

Figure 4.10. Reconstructive drawing of shipsheds in Zea. Lovén 2011: vol. II, p. 313, figure 240.

Figure 4.11. 3D reconstruction of the Zea shipsheds (n° 194). Courtesy of the © Zea Harbour Project, viewed 18 September 2018, <http://www.zeaharbourproject.dk/>

urban grid,[129] included within the walls[130] (or at least connected to them),[131] and frequently accompanied by further harbour-works.[132] Moreover, at least in Athens, the curatorship of the shipsheds was entrusted to dedicated officials, as testified to by the Naval Lists.[133]

Although a roof was fundamental for protecting the ships when they were pulled out of the water, outdoor solutions were also fairly common.[134] As underlined earlier, recourse to the latter is already documented in the Homeric poems, where wooden sleepers were used to convey ships onto the shore. However, as testified to by the Athenian Naval Lists (357-356 BC), ships were also beached outdoors ('ὕπαιθρος') in later centuries.[135] Temporary arrangements such as sleepers or stone props can hardly be documented by archaeology.[136] Sometimes permanent solutions (i.e. slipways) were adopted, and they can be identified, even if their chronology might only be barely established in the absence of stratigraphic material.[137] Slipways often exploited the natural slope of the coast, being frequently carved into the rocks (Figure 4.12). Such structures are also mentioned by Plato with reference to the mythical city of Atlantis.[138] As Blackman has

[129] In the 6th century BC, the agora of Miletus was expanded to the southern boundaries of the Lion Harbour (n° 104). The existence of a central axis formed by the sequence harbour-agora-Apollo Delphinion's temple allows us to hypothesise that the settlers left the city from the Lion Harbour after receiving the god's *placet* rituals (Brückner *et al.* 2006: 63-83). The 'military harbour, of Thasos (n° 183) and the Alkinoos harbour at Corcyra (n° 34) were located near the agora.

[130] Almost half of the harbours equipped with shipsheds were included within city-walls, e.g. Oiniadai (n° 126) in Acarnania and possibly Pagai (n° 131), in the Megarid.

[131] Walls connecting the city to the harbour are documented between Nisaia (n° 121) and Megara (Hammond 1954), Piraeus (n° 72, 116 and 194) and Athens (Thuc. 1.108.3; Garland 1987: 23), Lechaion (n° 92) and Corinth (Xen. *Hell.* 4.4.12-13), and at Patras (n° 138) (Thuc. 5.52.2; Plut. *Vit. Alc.* 15). At Sounion (n° 177) in Attica, two shipshed complexes have been identified (a double shipshed and a small slipway), both of which are located outside the settlement's fortifications. However, the so-called 'Sounion 1' (the double shipshed complex) had direct access from one of the towers (Tower 14) through steps carved into the rock. The tower belongs to the Hellenistic period, while the chronology of the shipshed is under discussion, as some scholars attribute it to the end of the 5th century BC (Petrakos 1994: 229; Stais 1917: 172-175) and others to the Hellenistic era (Goette 2003: 158-160; Kenny 1947: 196-198). The remains seem to be Hellenistic, even if they could have covered an earlier naval base (Baika in Blackman and Rankov 2013: 531). 'Sounion 1' was composed of two slipways measuring 20.5 x 11.55 m; its chronology, together with that of the fortifications, fluctuates between 413-412 BC (Thuc. 8.4) and the Hellenistic period. 'Sounion 2' was located further to the north and it consisted of a single shipshed carved into the rock which measured 17.43 x 2.78 m; it was located outside the fortifications. All the data are derived from Baika in Blackman and Rankov 2013: 525-533.

[132] E.g., Sounion (n° 177) in Attica, where the shipsheds are associated with a small slipway and a fortified wall with towers (Chroniques 1923: 510; Kenny 1947: 194-200; Baika in Blackman and Rankov 2013: 526); Geraistos (n° 54) on Euboia, where the harbour area may have been protected by a breakwater (Baumeister 1864: 71; Blackman and Rankov 2013: 568; Chidiroglou 2009: 1090-1092; Lehmann–Hartleben 1923: *s.v.* Geraistos; Sackett *et al.* 1966: 80-83); Abdera (n° 1) in Thrace, in the so-called 'Archaic harbour' (Koukouli- Chrysanthaki 1991: table 120a; Samiou 1993).

[133] At first, these officials were called *neoroi* or *epimelomenoi to(u) neorio(u)* (*IG* I^3 498-500; II^2 1604-1642). At the end of the 5th century and the beginning of the 4th century BC, they are referred to as *epimeletai ton nerion* (*IG* I^3 153.19). In the *Athenian Constitution,* 'φρουροὶ νεωρίων' (soldiers acting as shipsheds guards) are mentioned (Arist. *[Ath. Pol.]* 24.3, and 62.1). See Blackman in Blackman and Rankov 2013: 22.

[134] Blackman in Blackman and Rankov 2013:124.

[135] *IG* II^2 1611.6

[136] On the use of stone props for beached ships, see Hes. *Op.* 624-625; Hom. *Il.* 1.484-486, and 2.154; Blackman 2008: 107; Rankov in Blackman and Rankov 2013: 103.

[137] Baika in Blackman and Rankov 2013: 241.

[138] Pl. *Criti.* 116b.

Figure 4.12. Ramp carved into the rock at Agios Demetrios (harbour of Kirra, n° 78), view from the north. Valavanis in Blackman and Rankov 2013: 240, fig. a12.6

pointed out, being difficult to detect, the number of ancient slipways that have been archaeologically and historically studied is probably under-represented so far.[139] Single slipways have been identified along the Aegean and Ionian seas, where they are usually found close to promontories. Their location has been justified by the need of the cities' fleets to control important sea-routes; to offer shelter to the 'patrol ships', which were boats whose aim was to monitor pirates; lastly, in some cases, they have been interpreted as shelters used by the same pirate ships.[140] With regard to their position in relation to the walls, records show that – unlike shipsheds – slipways were often located outside the fortifications.[141] At Sounion (n° 177), in Attica, the small slipway (Sounion 2) was located outside the settlement's fortifications.[142] In the case of Aigila (n°5), on the island of Antikythera, the situation is less certain, since the fortifications have not been wholly excavated. However, the slipway cut into the rock seems to have been outside the walls of Palaiokastro, a gate of which opened to the slipping area.[143] Finally, at Poiessa (n° 151), on the island of Keos, a case has been recorded where the slipway had intentionally been excluded from the city-walls. According to Baika, this decision could have been caused by the difficulty in building the walls on a rocky spur.[144]

4.2.4. Structures built to improve harbour visibility

We could say that it is difficult, and perhaps incorrect, to trace a picture of systems for improving harbour visibility before the 3rd century BC, the date of construction of the lighthouse of Alexandria, on the island of Pharos.[145] However, already from a previous period, it is possible to detect in coastal areas the presence of devices aimed at increasing the visibility radius of the harbours, as well as their recognisability. Although towers appeared in harbour areas only from the 6th century BC, rudimentary forms of systems for improving harbour visibility must have existed long before, even if they left no material trace. Indeed, when sailing, for seafarers it was indispensable to determine the position of the ship, both in absolute terms (that is, in what place it was located) and in relative terms (that is, where it was situated with regard to the coast). Thus, the presence of clearly recognisable coastal features or other elements must have eased this practice, playing a prominent role since the beginning of the 1st millennium BC.[146] From the 6th century BC, these structures began to acquire a monumental and permanent nature, eventually evolving into free-standing towers and proto-lighthouses.[147]

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[139] Blackman in Blackman and Rankov 2013: 138.

[140] Baika 2007-2008; Beltrame 2012: 268.

[141] This assertion has to be read in light of the available data from the Aegean and Ionian contexts so far. E.g., the slipways at Rhitymna (n° 162), on the island of Crete (Baika in Blackman and Rankov 2013: 501-508; Flemming and Pirazzoli 1981; Spandagos 1999).

[142] See notes 131 and 132.

[143] Baika in Blackman and Rankov 2013: 278. Palaiokastro is currently being excavated and studied by Tsaravopoulos. Two slipways were identified in the 1970s by Pirazzoli (Flemming and Pirazzoli 1981: 73). Three hypotheses on the chronology of these slipways have been put forward. Stais (1889: 237-242) claimed that the Athenians were responsible for their construction during the Peloponnesian War; he also referred to Athenian control over nearby Kythera between 424 and 413 BC. Stais' proposal could find support in Tsaravopoulos (1997: 108), who dated the fortification of the settlement to the 5th or to the 4th century BC. Sekunda (2004-2009: 595-600) sought to find in the 335-330 BC Persian offensive the context for the construction of the ramps at Aigila. Lastly, Lawrence (1979: 183-184) attributes both complexes to the Hellenistic period, connecting them to the dispute between the Seleucids' and Ptolemies' fleets to control this sea-area.

[144] Baika 2010: 69-82. Based on the fact that between 360 and 350 BC Athens – which had control over Keos – ordered the three cities of the island to be fortified (*IG* II^2 404), Baika attributes the ramp to the mid-4th century BC. The harbour of Poiessa is mentioned in Skyl. 58, based on Müller's restoration (Müller 1885).

[145] Strab. 17.1.6-10.

[146] The importance of promontories as prominent coastal points has already been underlined in Chapter 3 (par. 3.1); their recognisability, together with the protection they offered, make them preferential places for the location of harbours. On the importance of visibility as a navigational aid, see Cerezo Andreo, Pérez-Reverte Mañas and Mauro 2016. Obviously, coastal landmarks were not the only kind of aid used for orientation purposes, since also the position of the sun or of the stars at night could have helped seafarers in determining their routes (Morton 2001: 186, and 215).

[147] Compared to previously analysed structures that were distinctive of harbour areas (e.g., moles, breakwaters, shipsheds, slipways), towers and proto-lighthouses are not strictly related to harbours, since they could also have been located in other places (in any case along the coast, as lighthouses are concerned; in contrast, the construction and location of towers was not connected to the coast). Beresford (2012: 192) also considers towers in harbour areas as the natural evolution of signal fires for sailing purposes, yet he dated the appearance of free-standing towers to the Hellenistic period.

The most basic and ancient method to signal the presence of harbours must have consisted in positioning and lighting fires on high points along the coast. During the night, their flames were easy to glimpse, while during the day, smoke would have been a good leading-mark. Recourse to light signals is often mentioned in Homer, who – in a passage of the *Iliad* – compares the 'immense and steady' shield of Achilles to 'the moon, or to the gleam of the blazing fires which burn on the mountains and appear to seamen when the storm-winds keep them far from their friends'.[148] The use of fires in coastal environments is not limited to the early stages of Greek history, but it is also attested to in later periods, even if the literary sources attribute their employment mainly to the necessity of controlling and communicating, rather than to practical seafaring reasons. It is in this sense that the fires lit to warn Athens of the Peloponnesian attack in 429 BC should be read,[149] or the beacons lit to confuse the enemies during the dispute between the Plataeans and the Peloponnesians.[150]

Temples and sanctuaries, which were often located on strategic and elevated sites along the coasts, probably provided seafarers with some kind of orientation, foreshadowing the role of coastal towers.[151] Therefore, fires burning on the shrines were certainly helpful for sailors, who, in this way, could identify safe shelters more easily along the shore.[152] Moreover, other artificial structures could have performed similar tasks, as confirmed by the erection of tombs (the Greek word for which was 'σῆμα', literally meaning 'sign') on conspicuous sites along the coast since the Bronze Age.[153]

From the 6th century BC, fires could have been hosted within specific structures located in harbour areas or, more generally, very close to the shore. It is likely to suppose that the diffusion of coastal towers, other than having surveillance functions, could have been due to their use as proto-lighthouses, or – in any case – as navigational aids.[154] Coastal towers are documented not only in relation to places of safe shelter, but also in other places along the coast, where they were also conceived as a means of directing sea-routes, serving as distance markers, or warning sailors against possible dangerous areas.[155] As visibility is strictly connected to height, it is possible to believe that, in order to be effectively useful to sailors, a landmark needed only to stand above the rest of the coast.[156] In light of this consideration, coastal towers can be read as the architectural consolidation of a practice already in use (coastal fires). A clear example of a coastal tower acting as a marker for seafarers comes from Pyrgos Cape (on the island of Thasos) and it is dated to the late Archaic period. It bears an inscription that openly reflects a purpose in playing a protective role ('σωτήριον').[157]

With regard to towers located in harbour areas, one of their functions was to help seafarers in identifying the harbour and its entrance.[158] Instead, their height above sea-level should have in itself increased the visibility of the shelter. Additionally, the possibility of lighting fires on their roofs should have facilitated even more

Archaeological evidence shows that the chronology of towers within harbours might be extended to the 6th century BC.

148 Hom. *Il.* 19.375- 378 (Translation by the author). The use of 'πυρά' as signalling tools can also be found in Hom. *Il.* 18.207-214, and *Od.* 10.30. On this topic, see Mark 2005.

149 Diod. Sic. 12.49.2-5; Thuc. 2.93-94. These light signals were transmitted from Bouduron (n° 27), a naval station on the island of Salamis, which was in visual communication with Piraeus (Baika in Blackman and Rankov 2013: 226).

150 Thuc. 3.22.

151 Semple 1931: 613-637. The role of sanctuaries in guiding ships towards safe harbours can only be hypothesised. However, their location, together with archaeological evidence (*ex-voto* dedications found in these sanctuaries and connected to sea activities, e.g. boats, inscriptions, anchors), give a hint of them having an important nautical meaning. Honor Frost (2002) claimed that the 'Tower Temple' at Byblos, dated to around the 23rd century BC, could have served maritime signalling purposes. She also attributes the same aim to Baal's tower-like temple at Ugarit, supporting her theory with a Late-Bronze-Age clay tablet referring to sacrifices burnt on its roof. An explicit connection between temples and signals for seafarers is provided by Aelius Aristides (*Panegyric in Cyzicus* 17), who – speaking to the inhabitants of Cyzicus – compares their city temple with the mountains, 'and you alone have no need for beacons, signal fires, and towers for those putting into port. But the temple fills every vista' (Translation by Behr).

152 On the location of temples and shrines along important sea-routes, see Frost, H. 2000; Gianfrotta 1977.

153 *Anth. Pal.* 7.345; Ap. Rhod. *Argon.* 1.582-590, 2.659, 2.833-836, 2.842-844, and 2.911-917; Eur. *Hec.* 1273; Hom. *Il.* 7.85-91, *Od.* 11.71-79, 12.11-12, and 24.80-84; Plut. *Vit. Them.* 32; Skyl. 58; Strab. 11.2.7, 13.1.28, and 13.1.31; Thuc. 8.102. On this topic, see Morton 2001: 194-197.

154 The phrase 'proto-lighthouses' referred to elevated structures near the coast was coined by Frost, H. 2002.

155 Morton 2001: 193-200. The aim of coastal towers is under discussion, and they are interpreted differently by various scholars, who attribute to them control purposes or connect them to the exploitation of resources in the countryside. Collections of evidence for towers (not limited to coastal environments) are Nowicka 1975; and Young 1956.

156 Strab. 17.2.6: 'for since the coast was harbourless and low on either side, and also had reefs and shallows, those who were sailing from the open sea thither needed some lofty and conspicuous sign to enable them to direct their course aright to the entrance of the harbour' (Translation by Jones).

157 Its chronology has been established thanks to the following inscription (*IG* XII.8.683) in Late Archaic lettering: '[Ἀ]κηράτο ε[ἰ]μὶ μνῆμα τõ Φ[ρασ]ιηρίδο, | κεῖμαι δὲ ἐπ› [ἄ]κρο ναυσ[τ]ά[θ]μο σωτήρ[ι]ον | νηυσίν τε κα[ὶ ν]αύτησιν· ἀλλὰ [χ]αίρετ[ε]' ('I am the memorial of Aceratus, son of Phrasierides. I am here, on the extremity of the harbour, as a protective signpost for ships and sailors. So, farewell' [Translation by the author]). On the towers of Thasos, see Osborne 1986.

158 Within this paragraph, the role of towers is analysed mainly as artificial landmarks. Their use as navigational aids does not exclude them from also having military aims, since the two functions may have been simultaneously fulfilled.

the identification of otherwise ill-defined and low-lying harbours.[159] The first example of harbour towers could come from Abdera (n° 1) in Thrace, where – at the western end of the 'archaic mole' – a widening has been interpreted as a foundation for a rectangular tower.[160] In the Classical period, the two harbours flanking the headland – the use of which replaced that of the 'Archaic Harbour', silted probably between the 5th and the 4th century BC – were also equipped with towers.[161] Dated between the 5th and the end of the 4th century BC are the harbour towers identified at Halieis (n° 59) in the Argolid,[162] Kolones (n° 84) on the island of Salamis,[163] Kantharos (n° 72) (Figure 4.13),[164] Zea (n° 194),[165] and Mounychia (n° 116),[166] the harbour L2 (n° 83) of the ancient Knidos,[167] Alkinoos (n° 34),[168] the military harbour of Aigina (n° 8),[169] the military harbour of Mytilene (n° 114),[170] Phalasarna (n° 141),[171] and Thasos (n° 183).[172]

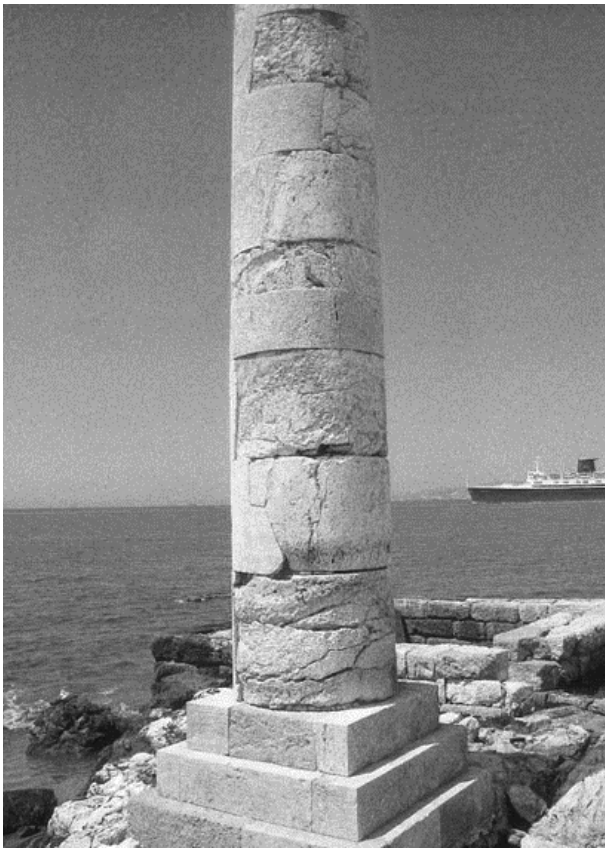

Figure 4.13. Column within the precinct of the so-called Tomb of Themistocles (Kantharos, n° 72). Reconstructed in 1952 from seven drums. Steinhauer 2000: 81.

4.2.5. Other structures

In addition to the previously analysed harbour-works, other infrastructures must have been present in harbour areas. Nonetheless, due to their difficult identification, their presence is only barely documented.

The construction, as well as maintenance and repairing, of ships was carried out in shipyards, which were probably non-permanent structures or equipped outdoor areas.[173] In the Aegean and eastern Ionian contexts, no shipyard has been archaeologically identified, while in the western Mediterranean an area

[159] Frost 2002: 62. Towers were erected not only in harbour areas but also on other coastal locations in order to help sailors in establishing what coast they were approaching. On towers along the coast, see Morton 2001: 199, note 77 with related bibliography.

[160] Baika in Blackman and Rankov: 272; Koukouli-Chrysantaki 1991: 196, and 2004: 244.

[161] Two towers were located in the harbour corresponding to the current one; one at Agios Gioannis (Samiou 1993).

[162] The two towers narrowing the entrance of the harbour have been dated to the 4th century BC on the basis of similarities with the tower on the acropolis (Jameson 1969: 311-342; Jameson *et al.* 1994: 13–56). On the not unanimously accepted interpretation of the harbour of Halieis, see note 76.

[163] The tower had a diameter of 10.7 m and was built with large blocks measuring *c.* 80 cm–1.5 x 0.5 m; based on ceramic fragments, it is dated to the Classical-Hellenistic period (Lolos 1995).

[164] Two towers have been identified, one to the north, in the area of the Podhosaki Fertilizer Company, and the other on the south corner. Both of them have been interpreted as the Tomb of Themistokles (Steinhauer 2000: 81-83). Firstly, Dragatsis found two column drums and a circular foundation on the north side of Kantharos, on the promontory called Kavos Krakari; he stated that the hole within the circular foundation could have contained a marble cinerary urn (see Wallace 1972). The second 'tomb of Themistokles' was identified on the southern corner (Garland 1987: 148). Furthermore, it has been claimed that the two moles that were extensions of the city-walls could have ended with towers (Rankov in Blackman and Rankov 2013: 436).

[165] Eickstedt, von 1991: 33; Garland 1987: 26; Lóven 2011: 67-68; Rankov in Blackman and Rankov 2013: 436.

[166] Mazarakis-Ainian, Ph. 1992: 81. In particular, the tower on the northern mole is dated to the later 4th century BC or after, while the tower at the corner of the southern mole could hark back to the 5th century BC (Lóven 2011: 71-73; Rankov in Blackman and Rankov 2013: 436).

[167] Two rectangular towers possibly dated to the late Classical period, based on similarities with the fortifications (Greene, Leidwanger and Tuna 2014).

[168] On the eastern side, a tower built with isodomic ashlars has been found (7.9 x 9.45 m); it has been dated to the second half of the 5th century BC, or to the beginning of the 4th century BC. Remains of a possible second tower (near the site called Mon Repos) have been identified in the southeast (Baika in Blackman and Rankov 2013: 323; Spetsieri-Choremi 1987: 16, n. 4)

[169] Knoblauch 1969, and 1972; Welter 1838: 39.

[170] Kourtzellis 2013b: 47.

[171] Hadjiaki and Frost 1990.

[172] Empereur and Simossi 1990: 881-892, 1991: 712-720, and 1992: 721-726; Grandjean and Salviat 2000: 55-56. The towers at Phalasarna and Thasos were probably built at the end of the 4th century BC. More uncertain is the case of Sounion, where the excavated towers are likely to be Hellenistic. However, Kalliopi Baika recently identified a Π-shaped structure, currently submerged, northwest of the small slipway, the chronology of which might be established only through further investigations (Baika in Blackman and Rankov 2013: 531).

[173] Blackman 2008: 662.

Figure 4.14. Reconstruction of the Philon's Arsenal. Marstrand (1922: plan IV), based on IG II^2 1668.

designated to the construction of boats was found in Marseilles (France). The shipyard, which occupied an area of approximately 75 m in length, presented a clay-cut basin that was probably used to dip timber in water; it was in use between the 5th and the 4th century BC.[174] However, literary sources reveal a livelier scenario, with many *poleis* involved in the construction of ships, perhaps carried out in specific zones within the harbour boundaries. The toponym of Naupaktos, for example, derives from shipbuilding, being the result of the association of 'ναύς' with the Doric spelling of the verbal adjective 'πηκτός'.[175] Shipyards might also have been present in Boeotian cities, where Epaminondas might have put into practice his naval programme in 364-363 BC,[176] as well as in Corinth (n° 77 and 92),[177] Gytheion (n° 57) in Laconia,[178] Leucas (n° 94) in Acarnania,[179] Antandros (n° 18) in the Troad,[180] and Samos (n° 165).[181]

Ships' gear was stored within the 'σκευοθήκη'. The so-called Arsenal of Philon at Athens, meticulously described by the inscription *IG* II^2 1668,[182] was built around 347-346 BC and completed by 330-329 BC;[183] however, it probably replaced less majestic structures with the same aim.[184] The Athenian arsenal was located between the southern side of the Hippodamian agora and the northwest of Zea[185] and was oriented in a NE-SW direction, which allowed the interior space to have adequate ventilation. The building was 18 m wide x 130 long, and it was accessible through both of its short sides. Internally, it was divided into three naves by two rows of columns (Figure 4.14).[186]

At Corcyra, the presence of a 'σκευοθήκη' is documented with certainty only from the 2nd century BC in the Alkinoos basin (n° 34) thanks to an inscription which

[174] Hesnard 1994: 203-205. For later shipyards, see Blackman 2008: 662.

[175] Apollod. 2.8; Paus. 10.38.10; Strab. 9.4.7.

[176] Diod. Sic. 15.78-79. Part of this programme should have been carried out at Siphai (n° 172), whose harbour is mentioned by Skylax (38) and Thucydides (4.76, and 4.89). See also Baika in Blackman and Rankov: 582; Fossey 1988: 167.

[177] Thucydides (1.13.2-3) states that the Corinthians built the first trireme for the Samians, some 300 years before the end of the Peloponnesian War.

[178] In 408 BC, Alcibiades went to Gytheion to view the construction of 30 triremes that the Lacedaemonians were constructing there (Xen. *Hell.* 1.4.11).

[179] According to Thucydides (1.27, and 6.104), it fabricated and equipped ships.

[180] Xen. *Hell.* 2.1.

[181] Here, the Samians developed a new kind of ship called 'Σάμαινα' (Plut. *Vit. Per.* 26; see also Shipley 1987: 91).

[182] For a comprehensive study of the building, see Marstrand 1922: chapters 2-8.

[183] Garland 1987: 156-158.

[184] Gabrielsen 2014: 37.

[185] Steinhauer 1996: 472.

[186] *Ibidem*

mentions the roof of a dockyard.[187] In 1966, a rescue excavation revealed the remains of a fifth-century-BC building, which Dontas proposed to identify as a 'σκευοθήκη',[188] had a NE-SW orientation, and was 10.75 m wide.[189] The existence of another possible storage building for ships' gear has also been proposed for Corcyra, but in the Hyllaikos basin (n° 35), located near the shipsheds.[190]

Lastly, the excavation of channels in harbour areas to allow flow of water or communication between different basins has been documented at Lechaion (n° 92) and Phalasarna (n° 141), two *kothon*-type harbours.[191] According to Pallas, the Lechaion harbour was the result of the artificial modification of a pre-existing lagoon separated from the sea. During the Archaic period, this basin was given access to the sea through the excavation of a channel whose sides were flanked by ashlars.[192] The reconstruction of the harbour at Phalasarna seems to be more controversial, as an inner basin seems to have been connected to the sea by means of two artificial channels.[193] The first, 20 m long, was excavated into the rock and was intended for the transit of ships; the second, less long and deep, has been interpreted as being reserved for smaller boats, or rather as a dredging system to prevent the siltation of the *kothon*.[194] Other canals or passages conceived to facilitate seafaring are documented, e.g. the Leucas' canal (n° 94)[195] and the 'διολκος'.[196]

The Diolkos

In the 6th century BC, Periander of Corinth sought to facilitate mobility between the Aegean and the Ionian seas and vice versa by cutting a canal across the Isthmus of Corinth. Such a solution, besides allowing ships to avoid the dangers of sailing around Cape Maleas and Cape Tainaron, would have at the same time increased Corinth's incomes, formalising and underlining the *polis*' control over the two gulfs.[197] Periander's attempt was only partially successful, in the sense that the original project was turned into a trackway ('διολκος') over which ships could have being carried on sledges or, more likely, wheeled vehicles.[198]

The remains of this impressive work were first noticed by Lolling and Frazer, but it was not until the 1950s that the 'διολκος' was excavated and studied.[199] Its vestiges run in a non-linear direction for almost 6 km, connecting the Gulf of Corinth with the Saronic Gulf.[200] This curvilinear path was justified by topographic necessities, since it avoided removing large quantities of earth, making for a more efficient exploitation of the natural gradient of the ground. Conventionally, the 'διολκος' has been divided into 13 sectors (Figure 4.15), to each of which an alphabet letter has been assigned. The first sector (named 'Sector A') can be found on the Gulf of Corinth, while the last one ('Sector N') is located near the Saronic Gulf.[201] However, the eastern terminus of the 'διολκος' on the shore has not as yet been identified. Sector A corresponds to a limestone platform gently sloping towards the sea, the dimensions of which are approximately 10 x 10 m, although it may have undergone substantial changes over time.[202] This was probably the place where ships could berth and be hauled onto the mainland before being transported to the other side of the isthmus.[203] Between 'Sector A' and 'Sector B', which represents the actual initial point of the way, there is a distance of 25 m. No architectural link has emerged so far between the limestone platform and the road, which is located further south. From 'Sector B' onwards, the road has an irregular width, from the 3.4-4.0 m of 'Sector G' to the 5.5-6 m of 'Sectors J-N'. Along the way, the discovery of blocks inscribed with Corinthian letters allowed Verdelis to argue for a seventh-sixth century BC dating, linking this work directly to Periander's tyranny.[204] In addition to the palaeographic elements, Verdelis used the finding of late-seventh or early-sixth-century-BC fragments of pottery on the same level of the trackway

[187] *IG* 9.1.692.

[188] The chronology has been established thanks to ceramic remains found *in-situ*. Baika in Blackman and Rankov 2013: 322, and 328; Dontas 1966: 87-92.

[189] *Ibidem*

[190] Kanta-Kitsou 1992: 340.

[191] On this harbour type, see Carayon 2005.

[192] Pallas 1965: 139-140; Stiros *et al.* 1996: 251-263.

[193] The existence of a second inner harbour at Phalasarna is currently under discussion, but it seems unlikely.

[194] A similar system is also attested to in Troy and Pylos, which have been discussed in Chapter 2 (Zangger *et al.* 1997: 549-641, and 1999: 89-103).

[195] According to Strabo (10.2.8), Leucas was originally a peninsula connected to the mainland by an isthmus. Strabo attributes the creation of the canal to the first occupants of Leucas (Murray 1987). Thucydides mentions the hauling of ships across the isthmus of Leucas in 427 BC (Thuc. 3.81.1) and 425 BC (Thuc 4.8.2).

[196] Another work intended to facilitate seafaring is the channel through the Akte isthmus ordered by Xerxes and cut between 483 and 481 BC to avoid sailing around Mt. Athos (Hdt. 7.22; and Thuc. 4.109). This has to be considered as a Persian harbour-work, and it probably did not have a long life (Isserlin *et al.* 2008).

[197] See Diog. Laert. 1.99. On taxes on seaborne movements, see Purcell 2017: 319-334.

[198] Skyl. 40. On the technical arguments which support the second theory, see Werner 1997: 111-114.

[199] Baedeker 1883: 220; Frazer 1898: 5.

[200] Verdelis 1956.

[201] Werner 1997.

[202] Fowler reported it to measure 40 m (Pettegrew 2011: 554).

[203] Werner 1997: 111-114. This installation is the only harbour-work associated with the 'διολκος' that has been identified so far. As for the trackway, establishing a chronology for this infrastructure is rather difficult, since no external dating elements are associated with it.

[204] Verdelis 1957: 649. Although their aim is not clear, the likely purpose of these letters was to serve as markers for adjusting the vehicles (Werner 1997: 103).

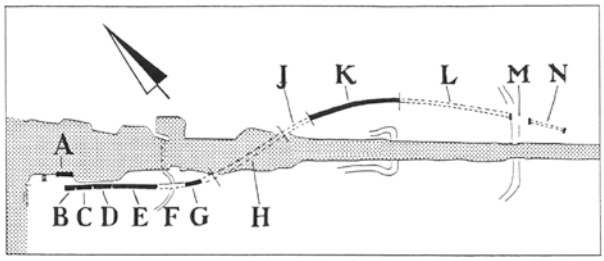

Figure 4.15. The *diolkos* divided into sectors. Werner 1997: 99, fig. 2.

as a clue to its chronology.[205] However, in recent times scholars have raised doubts about the validity of these assumptions, since the letters could not be precisely dated,[206] and accuracy of the excavations has not been stratigraphically verified.[207]

Despite being unique in the Greek world, its mentions in the literary sources present several problems. Its use can be inferred only on seven occasions between 428 and 30 BC,[208] and its primary function is not clear. With regard to the frequency of its use, some scholars claim that it was barely employed, due to the economic and human cost of transporting vessels on it,[209] while others suggest a moderately common use.[210] The debate on its employment is strictly connected to its interpretation. Scholars who believe it to have been rarely used explain their position with reference to its military employment and its exclusive function as a portage for military ships. On the other hand, those who champion its employment for non-military, everyday purposes admit the possibility that merchant ships of small to medium size would have resorted to it more frequently.[211]

[205] Verdelis 1957: 649.
[206] Jeffery and Johnston 1990: 375.
[207] Pettegrew 2011: 559.

[208] In 428 and 412 BC, it was used by the Spartans (Thuc. 3.15, and 8.7); Polybius refers to its use by Demetrius of Pharos in 220 BC (4.19.7-9) and Philip V in 217 BC (5.101.4); Livy (42.16) testifies that King Eumenes resorted to it in 172 BC; a Corinthian inscription mentioned portage of Marcus Antonius' ships in 102-101 BC (Corinth Inventory No. I 788-791); Dio Cassius (51.5) documents its use by Octavian in 20 BC to quickly transfer his fleet to Asia. Later on, in the 9th century AD, its use by Niketas Ooryphas is attested in the *Vita Basilii*.

[209] See note 209 for references to its use relating to military episodes (Pettegrew 2011: 571; Salmon 1984: 139).

[210] This hypothesis is mainly based on Ar. *Thesm.* 647-648 and scholium; Hsch. *s.v.* 'διολκος'; Plin. *Nat.* 4.8.10, and 18.18; Strab. 8.2.1, 8.6.4, and 8.6.22. These authors refer to everyday purposes. Raepsaet (1993) admits that it could have been advantageous to transfer goods between the two gulfs while stressing that taxation and practical difficulties could have made it difficult to consider the portage of the 'διολκος' as being better than the circumnavigation of the Peloponnese.

[211] Raepsaet 1993. MacDonald (1986) proposed that the trackway was used only for cargo and not for the ships themselves. Personally, without denying the major efforts which the transfer of ships and their cargoes entailed, and considering the scale of harbour-works built in the same period in the Greek world, I find it rather hard to believe that the *polis* of Corinth embarked on such a considerable infrastructure to use it only on few occasions. As the literature shows, for a small merchant ship the process of unloading and restacking the cargo would have required between one and two days, which would have been considerably less than the time employed for circumnavigating the Peloponnese (Pettegrew 2011: 562). Literary sources referring to the military use do not explicitly express the idea that it was rarely employed, underlying instead the difficulties in transferring ships and the fact that using the trackway required a considerable amount of preparation (Thuc. 3.15). However, the proposal that Raepsaet (1993) seems to suggest in his conclusion (that the possible chronology of the 'διολκος' and the almost contemporary diffusion of lithic architecture could be interrelated) is more debatable, since the loading and unloading of heavy materials would have significantly slowed down this process and made it more difficult.

Chapter 5

Variation in Harbour Forms

Although sometimes the concepts of harbour basin and harbour coincide, these two phrases do not necessarily correspond. Indeed, most Archaic and Classical harbours were composed of a single basin, but a significant number of settlements could rely on more than one basin for harbour purposes. Thus, the focus of this chapter will not be limited to an analysis of single basins exclusively but will include those harbour forms that exploited multiple basins.

Considering the number of basins of which a harbour could be composed, it is possible to distinguish between the following:

- Harbours with a single basin;
- Harbours with two basins;
- Harbours with multiple basins.

In the next paragraphs, these different harbour forms will be detailed to see how they were structured, and when and where they were more likely found.

5.1. Harbours with a single basin

Harbours with a single basin represented the most common harbour form, being composed of only one body of water used to serve different functions (e.g., military, commercial) (Figure 5.1).

Second-millennium-BC harbours were basically harbours of this kind: natural havens, with a single basin and no further subdivision. The great majority of the harbours used by the Mycenaeans on their routes to the Central Mediterranean,[1] as well as those later used by the Phoenicians, were frequently composed of a single basin.[2] Taking into account the type of harbour with which Homer was familiar, as well as considering the available archaeological evidence, it is likely to suppose that in the Geometric period the situation was still the same. Examples of Early Archaic harbours come from Emporio (n° 45) on the island of Chios, which was active

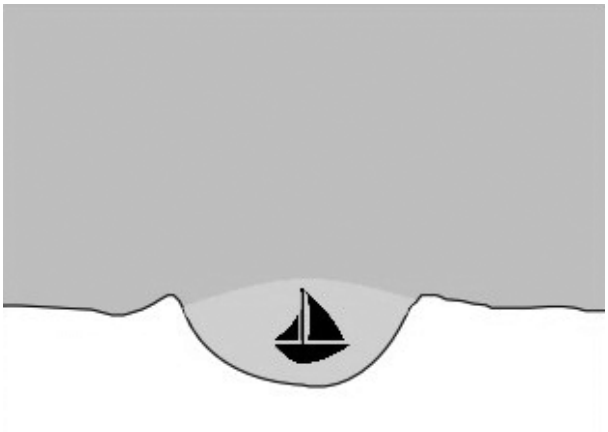

Figure 5.1. Example of 'harbour with a single basin'.

between the 8th and the 7th century BC, benefitting from its location within a natural embayment;[3] from the island of Ithaca, where Homer documented the existence of anchorages and landing areas with a single basin;[4] or from Helos (n° 62) in Laconia[5] and Geraistos (n° 54) on Euboia.[6]

Single-basin harbours were used continuously. There are examples of single-basin harbours that started to be used only in later periods and which concentrated different functions within the same area, e.g. Carteria (n° 32) in Aeolis,[7] and Eion (n° 43) in Thrace.[8]

During the Archaic and Classical periods, in the Aegean and Ionian areas, single-basin harbours represented more than half of the cases. However, their number could have been even higher, considering all those minor harbours whose existence is not supported by archaeological or written evidence so far.

[1] Single-basin harbours that were already in use in the Mycenaean period were Glykys Limen (n° 55), in the Ionian Sea, and Dyme (n° 42), in Achaia. On Glykys Limen, see Soueref 1995: 404; on Dyme, see Rizakis 1992: 67-68. Both these harbours exploited lagoon areas located at the mouths of water courses.

[2] For example, the harbour of Thasos (see n° 182-184) probably used by the Phoenicians (Hdt. 2.44), before the creation of a second basin by the construction of two breakwaters, was a single-basin port. The harbour of Ialysos (n° 67), on the island of Rhodos, benefitted from the body of water to the west of Cape Zonari (on the Phoenician presence at Ialysos, see Coldstream 1969: 1-8; Ialysos is also mentioned in Hom. *Il.* 2.655).

[3] Boardman 1967: 249.

[4] Rheitron: Hom. *Od.* 1.185-186; Cuisenier 2003: 73-74. Phorkys: Hom. *Od.* 13.96; Cuisenier 2003: 71-72. Telemachus bay: Hom. *Od.* 15.36-37; Cuisenier 2003: 67-68. Landing area near Odysseus' palace: Hom. *Od.* 4.778-785; Cuisenier 2003: 52-56.

[5] Harbour probably located in a lagoon area near the actual village of Stephania (Graauw, de 2017: n. 1242). The same toponym recalls the marshes along its coast. Helos is also mentioned in Hom. *Il.* 2.184.

[6] Harbour located between two headlands. Mentioned in Hom. *Od.* 3. 176-179.

[7] The use of its harbour is documented for the first time in Thuc. 8.101.

[8] The use of its harbour is documented for the first time in Thuc. 4.102-108, who refers to it as an Athenian naval base. Greek civilization arrived in the area of the Strymon River at the end of the 6th century BC (Tiverios 2008: 67).

5.2. Harbours with two basins

From the 2nd millennium BC, some harbours benefitted from two basins. The situation of two-basin harbours in the Greek world was not homogeneous, since it may have given rise to different harbour forms. In particular, it is possible to distinguish between harbours in which the two basins were located near to one another, and basins located at a certain distance but under the control of the same settlement. Moreover, amongst the former, the following harbour forms can be observed: harbours with two juxtaposed basins, double-basin harbours, and harbours composed of an inner basin and an outport (Figure 5.2).

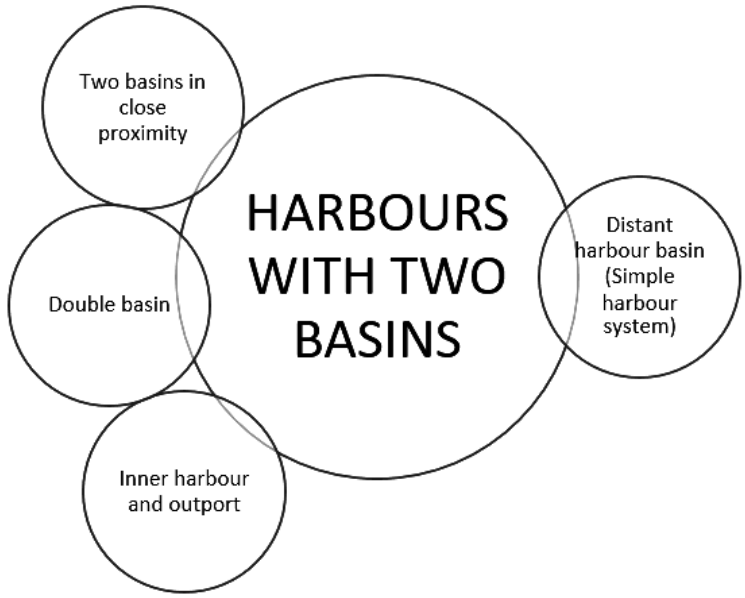

Figure 5.2. Harbours with two basins and the different harbour forms to which they give rise in the Greek world.

5.2.1. Harbours with two basins in close proximity

Some harbours were made up of two basins close to one another, which could be natural or artificially created through the construction of harbour-works. This harbour form might often be found in harbours located between the mouths of two water courses (typ. 4.2), as was the case of Kyme in Aeolis (n° 89). The harbour of Kyme benefitted from its location in a bay where two water courses flowed, so that vessels could have anchored or be hauled onto the shores at the mouths of the two waterways.[9] Particularly, on the southern side there was a stream whose mouth offers haven to local fishermen's boats even today, while to the north the river Xanthos provided the ships with the possibility to follow their journey, since in Antiquity it was partially navigable.[10]

In other places, the juxtaposition of two harbour basins was artificially created by building moles or breakwaters. As an example, at Thasos, at the end of the 6th or the beginning of the 5th century BC, two basins (n° 182 and 183) were created by constructing the NE breakwater in the 'military harbour' and a mole in the 'commercial harbour' (Figure 5.3).[11]

5.2.2. Harbours with a double basin

One of the most recurring forms amongst harbours with two basins was represented by double basin harbours, which have been partially discussed in par. 3.1. This kind of harbour was often found around headlands, where the two coves flanking the cape could be used with different aims (e.g., commercial and military), or according to weather conditions (Figure 5.4).

In Laconia, both sides of Cape Tainaron hosted a harbour basin, as documented by the *Periplus of Pseudo-Skylax*. On the west, there was the Achilleios Limen (n° 3), while on the east the harbour of Psamathus (n° 156).[12] Because of their position, these two harbours were defined as *'ἀντίπυγοι'* ('opposite') by Skylax.[13] Moreover, they were both visible from Poseidon's temple erected on Cape Tainaron.[14]

Another case of harbour with a double basin could be considered that of Torone, on the Chalcidice Peninsula. Here, in addition to the use of a harbour close to the

[9] Gianfrotta *et al.* 2002. Strabo (13.3.36) states that the inhabitants of Kyme were famous for their stupidity; among the reasons that generated this belief, he claims, they realised the importance of applying harbour taxes only three centuries after the foundation of the settlement. If what Strabo affirms corresponds to the truth, then Kyme should have been a 'free trade zone' until the 9th or 8th century BC. Indeed, its foundation is generally attributed to the period following the Trojan War (Lagona 2006: 9-26).

[10] Gianfrotta *et al.* 2002.

[11] Empereur and Simossi 1990: 881; Sintès 2003: 135, fig. 6. The existence of a 3rd harbour basin at Thasos (n° 184) is only conjectural. Even at Eresos (n° 49) on the island of Lesbos, the construction of a breakwater could have created two juxtaposed basins (Theodoulou 2010: 99).

[12] Skyl. 46: 'Λακεδαίμων ἔθνος, καὶ πόλεις ἐν αὐτῇ εἰσὶν αἵδε· Ἀσίνη, Μοθώνη, Ἀχίλλειος λιμὴν καὶ ἀντίπυγος τούτου Ψαμαθοῦς λιμήν. Τούτων ἀμφοτέρων ἐν μέσῳ προέχον εἰς θάλασσαν ἱερὸν Ποσειδῶνος, Ταίναρος' ('Achilleios harbour and back to back with this Psamathus harbour. In the middle of both, projecting into the sea, is a sanctuary of Poseidon, Tainaros' [Translation by Shipley]). Harbours also mentioned in Paus. 3.25.4.

[13] See Skyl. 108.

[14] See note 12. In par. 3.1.2 it has been noted as Skylax's 'ἀντίπυγος λιμὴν' could correspond to that which Homer defines 'ἀμφίδυμος λιμήν'.

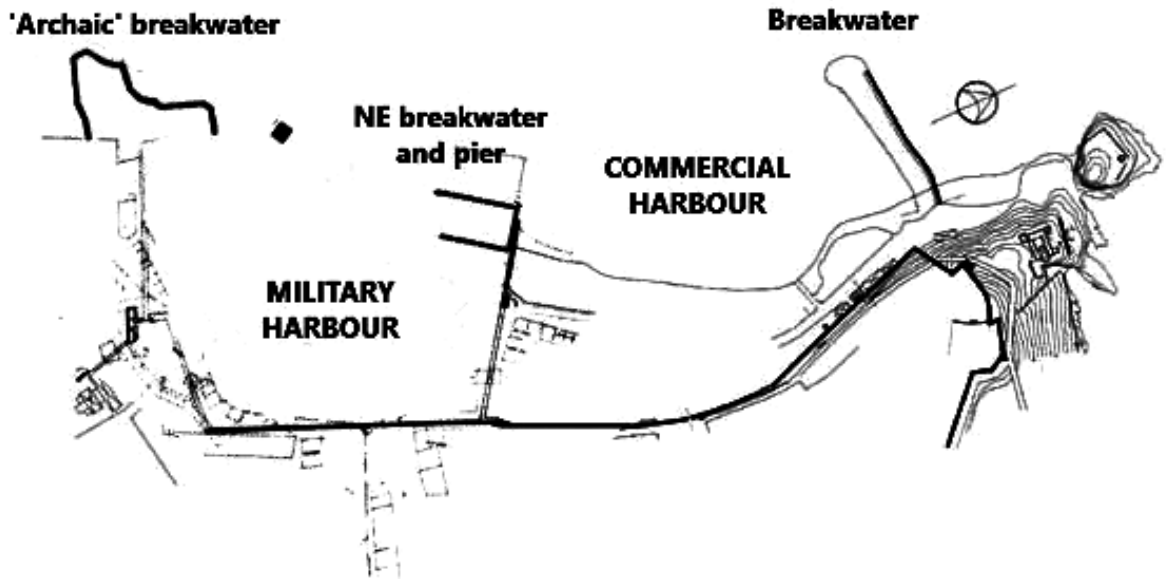

Figure 5.3. The two basins of the harbour of Thasos. After Sintès (2003: fig. 6) and Simossi (1994: fig. 1).

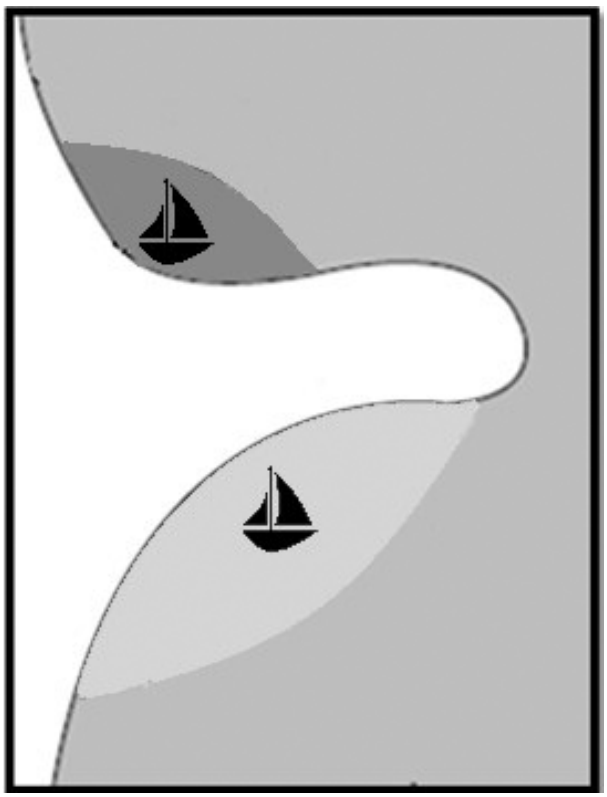

Figure 5.4. Possible configuration of a 'double basin harbour'.

settlement,[15] the city monitored the 'Kophos Limen' (n° 85), located approximately 3 km far from the *polis,* on the south of the cape.[16]

Other '*ἀντίπυγοι* λιμένες' could likely be found at Abdera (n° 1) in Thrace,[17] Teos (n° 188) in Ionia,[18] Knidos (n° 80 and 81)[19] and the ancient Knidos (n° 82 and 83) in Karia,[20] and Delphinion (n° 38), on the island of Chios.[21] Even at Pagai (n° 131) in the Megarid and Halicarnassus (n° 58) in Ionia, the two sides of a headland were possibly used as harbours, but in these cases double basins were inserted within wider harbour systems, involving the control of other harbour areas.[22] Lastly, the identification of further double-basin harbours might be hypothesised for other settlements, based on the later utilization of two basins (which is not attested

[15] According to some scholars (Dunn, Beness and Hillard 2007: 85; Beness *et al.* 2010: 70), Torone controlled both the harbour to the north of the Lekythos Peninsula and the Kophos Limen on the southern side of the cape. Their hypothesis is based on Thuc. 5.2; the existence of a harbour in Torone is also attested to in Skylax (66), even if its location is not further specified.

[16] On the Kophos Limen, see Thuc. 5.2. The adjective 'κωφὸς' ('calm, quiet') is also used by Xenophon (*Hell.* 2.4.31) to identify an area of Kantharos (n° 72), Piraeus.

[17] At least after the siltation of the 'Archaic Harbour'.

[18] As proposed by Kadioglou (2012), Teos probably also monitored the harbour of Gerai (n° 53), 2 km from the *polis*. The *Periplus of Pseudo-Skylax* (98) mentions both the harbours of Teos and Gerai, stating that the latter belonged to the 'Γέραι πόλις'. These two harbours also appear in Liv. 37.27, and Strab. 14.1.30.

[19] The use of the two harbours is archaeologically attested to (Blackman and Rankov 2013: 218; Gerkan, von 1924; McNicoll 1997). For a later period, there is also Strabo's testimony (14.2.15). The military harbour is mentioned in Diod. Sic. 14.83.5.

[20] During the Archaic and Classical periods, the harbours labelled by the archaeologists of the 'Burgaz Harbours Project' as L1 and L2 were considered in use (Greene, Leidwanger and Tuna 2014: 8-13), and they were located, respectively, to the north and to the south of a cape. The harbour L1 was equipped with two breakwaters, probably during the Archaic period, and in the Late-Classical era it was joined to the city-walls. In the harbour L2, two moles ending in towers have been dated to the Late Classical period due to similarities in the building technique used for the city-walls.

[21] Delphinion is defined by Thucydides (8.38) as a place equipped with good harbours. Here, a cape extending towards the sea and the presence of the islet of Tauros divided the cove into two basins. On the harbour at Delphinion, see also Diod. Sic. 13.76.3; Xen. *Hell.* 1.5.15.

[22] See par. 5.3 for details. Pagai belonged to Megara's harbour system, while the harbour system of Halicarnassus included the utilisation of further bodies of water.

to in the Archaic and Classical periods so far), or on nautical observations.[23]

5.2.3. Harbours formed by an inner basin and an outer one

During the Archaic and Classical periods, some harbours were composed of an outer basin through which it was possible to reach a second, inner body of water (Figure 5.5). This harbour form was particularly effective, in that it allowed for monitoring and regulating access to the inner basin. Commonly, outer basins have been interpreted as commercial harbours, as they were provided with a wide space in which merchant ships with a substantial draught could anchor or be moored. On the other hand, whenever an inner basin is documented, it has been considered as a harbour for the city fleet, where warships could have found protection and be lesser exposed to enemy raids. Chronologically, the first harbour to adopt this organisation was probably that of Lechaion (n° 92), but in this case its inner and outer basins formed part of a wider harbour system that also included the control of another basin on the Saronic Gulf: Kenchreai (n° 77).[24]

The creation of an inner basin was always artificial or semi-artificial, and it occurred through the construction of bastion-moles (e.g., Eretria, n° 50), inner moles, or a *kothon* (e.g., Phalasarna, n° 141).

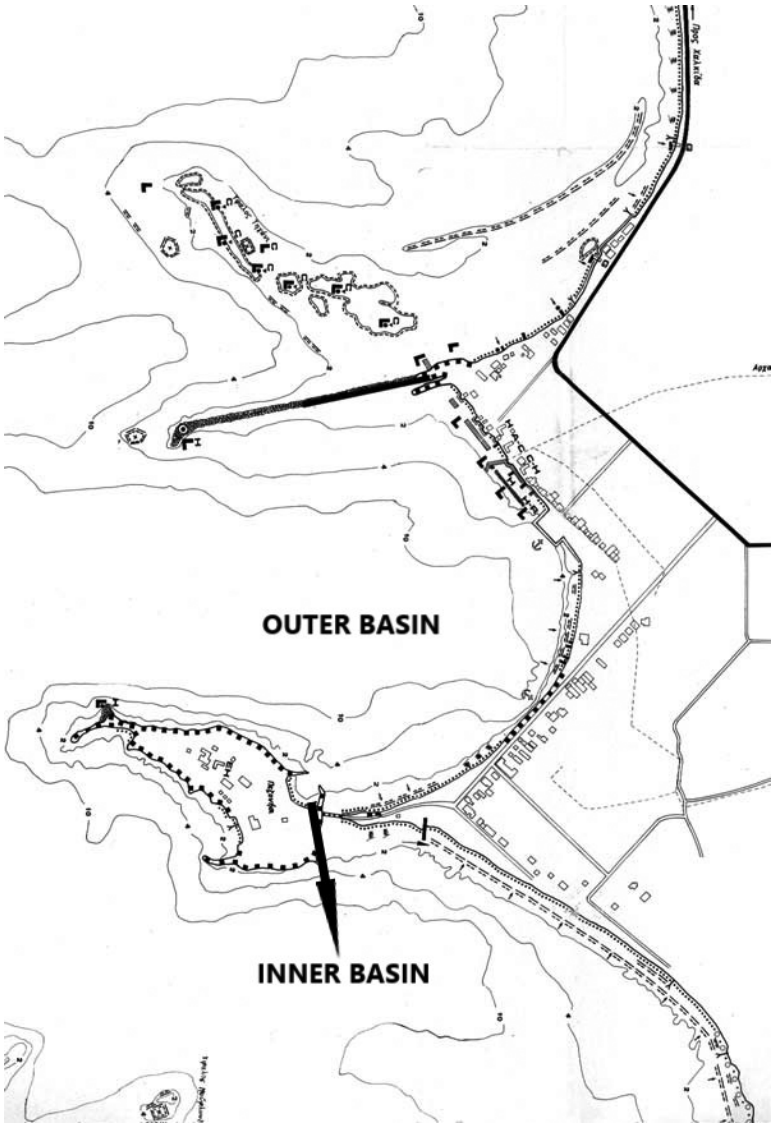

Figure 5.5. The sequence of inner and outer basin in the harbour of Eretria (Euboia). After Iniotakis in Navis II: *s.v.* Eretria.

At Eretria the external harbour occupied the gulf, being protected by a mole on the eastern side and the Petsonisi Cape on the west.[25] To the west, an inner basin was located within a small cove on the Petsonisi headland, surrounded by moles which were extension of the city-walls.[26] Used since the Geometric period, the inner harbour was silted up in the Hellenistic era. This is documented by an inscription which contained the terms and conditions relating to the drainage of a swamp area inside the port, and which is generally thought to be referred to the inner harbour.[27]

Lastly, at Phalasarna, on the island of Crete, an inner basin (a *kothon* measuring 100 x 75 m) was created at the end of the 4th century BC. This basin was accessible via a channel whose depth in Antiquity might have been between 1.1 and 2 m.[28] The area along the coast was instead used by merchant ships with a draught of more than 2 m.

5.2.4. Harbours with two independent basins (or 'simple harbour systems')

In areas of great strategic value, the case is found of settlements controlling two non-contiguous basins. Such kind of configuration could be termed a 'simple

[23] See par. 3.1.2 and particularly note 35 for further information and references.

[24] On complex harbour systems, see par. 5.3.

[25] Navis II: *s.v.* Eretria. The eastern mole was probably built in the second half of the 4th century BC.

[26] The chronology of these moles corresponds to the 5th-4th century BC.

[27] *IG* XII.9.191, dated to around 322-308 BC. This project was entrusted to the entrepreneur Khairephanes (Holleaux 1897: 189)

[28] Frost, F. 1997; Hadjidaki 1988, and 1996; Pirazzoli *et al.* 1992. The existence of a second inner basin has been hypothesised, but evidence to support this is currently too weak to validate this thesis.

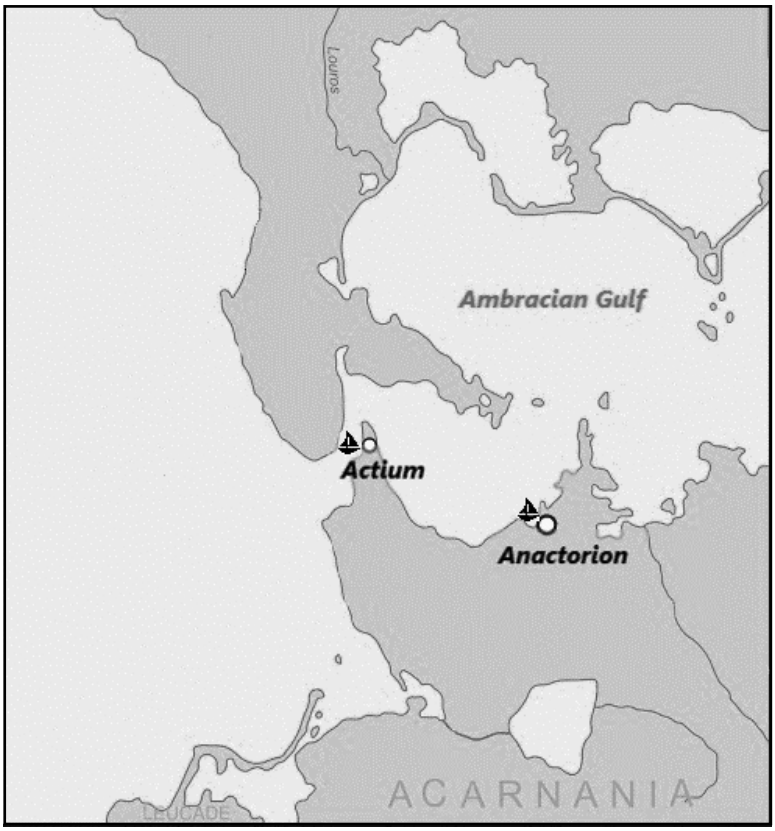

Figure 5.6. Anactorium's (in the figure 'Anactorion') simple harbour system, which – by controlling Actium – monitored entry to the Ambracian Gulf.

harbour system'.[29] Indeed, whereas the term 'harbour' could recall the idea of a single entity (even if composed of various parts), the expression 'harbour system' rather suggests that of 'a set of harbours and harbour-sites worked together as parts of a maritime potential, related and geographically linked to a focal point'.[30]

Basins belonging to simple harbour systems, despite not presenting topographical continuity, gravitated around the same power axis, being usually in visual contact. For example, the harbour of Anactorium (n° 16) in Acarnania, on the southern part of the Ambracian Gulf, also controlled the basin of Actium (n° 4), a landing area in the lee of the eponymous cape situated at a distance of 40 stadia.[31] In this way, Anactorium ensured the monitoring of ships entering and exiting the Ambracian Gulf (Figure 5.6).

By managing the basins of Kalaureia (n° 71) and Pogon (n° 150), Troizen was able to monitor the ships that sailed along the western Argolic coasts.[32] This was also the case of Samos (n° 165), which, by controlling Cape Mycale (n° 28), dominated the key point for accessing the Gulf of Ephesus and for monitoring all the vessels transiting the Samos Strait.[33] Other simple harbour systems were in use at Kirra (n° 78) in Phocis,[34] and Antissa (n° 20), on the island of Lesbos.[35]

5.3. Harbours with multiple basins (or complex harbour systems)

The most complex harbour form during these periods is represented by harbours with multiple basins. These harbours extended their control over various bodies of water, which were often located at some distance from one another. In some cases, this was underpinned through the construction of fortifications that incorporated the whole harbour system (e.g., in Athens, where the harbours monitored by the city were linked to the *polis* by the Long Walls); in others, literary sources allow us to infer that different basins

[29] To differentiate them from 'complex harbour system', where the basins controlled were more than two.

[30] Definition provided by the *Rome Mediterranean Ports Project* (RoMP).

[31] From the Archaic period, Actium also housed a temple of Apollo, which during the Peloponnesian War became the Acarnanian League's federal temple. On the harbour of Anactorium: Skyl. 34; the *Periplus of Pseudo-Skylax* also mentions Actium, but it does not record the existence of a harbour here.

[32] Kalaureia belonged to Troizen from the 6th to the 4th centuries BC (Pakkanen in Blackman and Rankov 2013: 569-570); its harbour was used in 374 BC as an Athenian naval base by Thimoteus (Dem. 49.13-16). On Pogon, see also: Hdt. 8.42; Pompon. 2.3; Skyl. 52; Strab. 8.6.14.

[33] Cape Mycale belonged to Samos' *peiraia*. During the Classical period, two fortresses were erected on Cape Mycale, while a tower was built on the other side of the strait (Blackman and Rankov 2013: 562).

[34] Kirra was the harbour where the pilgrims arriving by sea and directed towards Delphi disembarked; it was located within an open bay at the mouth of the Pleistos River. On the harbour of Kirra, where a breakwater and possible shipsheds have been identified, see Blackman and Rankov 2013: 572-573; Luce 1990: 29; Negris 1904: 354. Kirra also controlled the landing area located on the Agios Demetrios islet, where rock-cuts have been interpreted as possible slipways for boats. The naval station at Agios Demetrios was visually connected with Kirra, and it was probably established in the Late Classical era to control this area and to secure the pilgrims' arrival (Blackman and Rankov 2013: 557. Blackman links this intervention to the 4th Sacred War).

[35] The harbour of Antissa was located on the eastern side of a rocky headland today known as Ovriokastro, on the north coast of Lesbos. At the end of the 19th century, Koldewey noticed that a breakwater existed. Recently, archaeological research found that this breakwater was originally a natural rock formation, which was artificially reinforced at its northern end and extended towards the northeast by adding irregular blocks. According to Theodoulou and Kourtzellis (2011: 139-140), the initial part of this breakwater was connected to the Archaic fortifications. Additionally, underwater surveys identified another breakwater at a site called Kaloi Limani (or Tsamour Limani), east of Antissa. Kaloi Limani has been interpreted as a second harbour basin belonging to the city of Antissa; thus, in this case the use of a second basin seems to have been motivated by practical (commercial functions), rather than strategic, concerns (Theodoulou 2011).

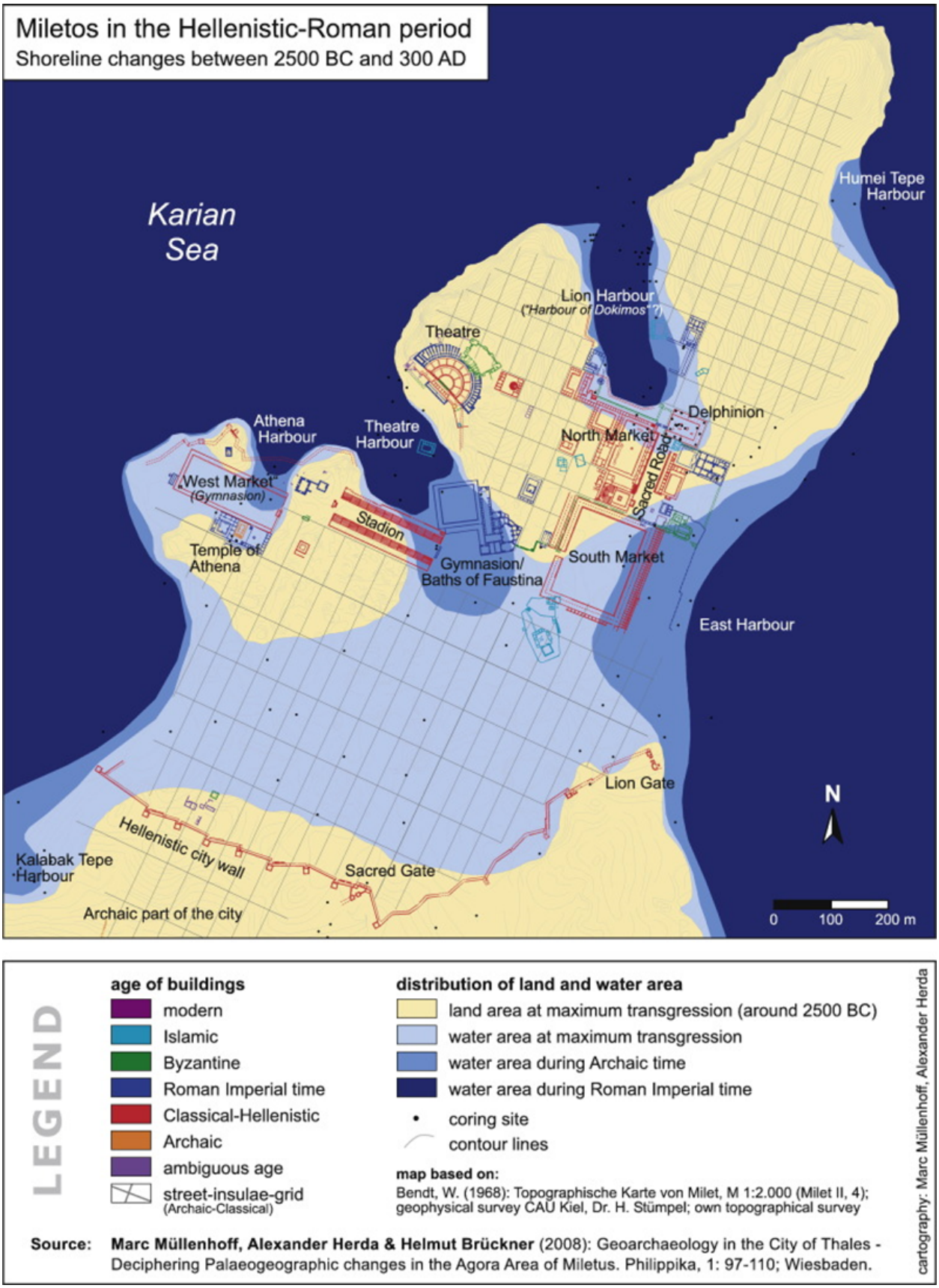

Figure 5.7. Miletus' complex harbour system, excluding Lade. The map reflects the situation of the Hellenistic-Roman period, but buildings from different periods are included. The six harbour basins could have been in use from the Archaic period. Brückner *et al.* 2014: fig. 10.

belonged to the same community (e.g., the case of the Megara complex harbour system, which consisted of the basins of Nisaia, Pagai and Aigosthena).[36]

Even if some harbours developed control over different anchorage points and landing areas already from the 8th-7th century BC, at this stage there was no willingness to organise them as a unique harbour system, as shown by the case of Delos. Here, a series of anchorage points and landing areas are archaeologically documented but no attempt to artificially improve or connect them was made.[37]

Starting from the 6th century BC, the utilization of various basins started to be clearly sought by some *poleis*, probably as a way to meet the community's demand. The first example of this kind could be considered that of Corinth.[38] Here, Periander possibly promoted the creation and equipping of two harbours (this intervention also included the excavation of an artificial basin), which were ideally linked by means of a trackway.[39] Additionally, Lechaion (n° 92) itself – as noted earlier – was composed of a series of basins, i.e., an outer harbour and two inner basins.

The harbour system at Miletus could also be likely dated to this period. According to the latest geological and archaeological research, the latter might have been composed of six basins (i.e., Lion Harbour,[40] Theatre Harbour,[41] Kalabak Tepe Harbour,[42] Athena Harbour,[43] Humei Tepe Harbour,[44] and East Harbour)[45] around the city, plus an anchorage point on the island of Lade (n° 90) (Figure 5.7).[46]

In the 5th century BC, Athens complemented the use of Phaleron Bay (n° 142) with that of the three basins at Piraeus (Kantharos, n° 77; Mounychia, n° 116; and Zea, n° 194). Eventually, the four harbour areas were connected to the city by means of long wall passageways (Figure 5.8), as to underline that they all pertained to the *polis* of Athens.

Between the Archaic and Classical periods, other *poleis* that managed complex harbour systems were Megara (see n° 10, 121 and 131),[47] Halicarnassus in Karia (n° 58),[48]

[36] See n° 121, 131 and 10.

[37] For an overview of the various anchorage and landing points used at Delos, see Dalongeville *et al.* 2007: fig. 2. According to Gallet de Santerre (1958: 226), the main anchorage during the Archaic period was Skardhana Bay, which was located near the Terrace of the Lions. However, this bay was dangerously exposed to northern winds, so that the sea was rarely calm in this area. For this reason, it is possible to suppose that Skardhana Bay (probably together with Ghournia Bay, located in the northeast) played an auxiliary role at this stage, while the main harbour should be located further south, where Paris (1916: 34-35), Duchêne and Fraisse (2001: 93) identified the 'grand môle'.

[38] Before the 6th century BC, some *poleis* that would later develop complex harbour systems were in use as single-basin harbours: e.g., Aegina or Athens, where before the 5th century BC the main harbour was Phaleron Bay.

[39] On Lechaion harbour, see Pallas 1965: 139-140; Rothaus 1995: 295; Stiros *et al.* 1996: 251-263. At Kenchreai, two moles belonging to the Roman harbour have been identified (Scranton, Shaw and Ibrahim 1978). However, this area could have been in use from a previous period (literary references regarding the use of Kenchreai during the 5th century BC can be found in Thuc. 4.42.4, 8.10, and 8.20-23). Rothaus (1995: 296) states that building similarities exist between the moles of the external harbour of the Lechaion and the 'δίολκος'. The 'δίολκος' did not directly connect Lechaion and Kenchreai, but it facilitated communication between the two gulfs. See par. 4.2.5 for further information.

[40] N° 104. In the 6th century BC, this harbour was connected to the agora, which was extended onto its southern boundaries. It was the main harbour and it probably accommodated the majority of the fleet (Brückner *et al.* 2014: 93).

[41] N° 105. The siltation of this basin began in the Late Classical-Hellenistic period. It has been hypothesised that part of the fleet was accommodated within the Theatre Harbour. This basin had sandy shores that facilitated the beaching of ships. *Ibidem.*

[42] N° 106. To the west of the eponymous headland. Geological studies have revealed that in the Archaic period this basin had a low depth, which means that it could probably have been used only by vessels with a small draught. It was abandoned at the beginning of the Classical period. *Ibidem*.

[43] N° 107. Close to Athena's temple. It was a small basin, partially open to the *imbat* action, which was silted up during the Hellenistic age. *Ibidem.*

[44] N° 108. It had been used since the Archaic-Classical period, and it was located on the NE of the Milesian headland. It was protected by a headland of the same name. *Ibidem*.

[45] N° 109. On the east side of the peninsula, within a leeward bay, naturally protected from the northern and western winds. Its use probably dated back to the Geometric period, and its sandy shores allowed for the beaching of ships. It has been proposed that the East Harbour functioned as the main commercial basin, since it has a topographical continuity with the southern market. *Ibidem*.

[46] The island is currently joined to the mainland. In the Archaic and Classical periods, it was an island located in the Latmian Gulf, around which two battles took place (the conflict between the alliance of Ionian cities and the Persian Empire in 494 BC, and between Philip V and the navy of Rhodos in 201 BC). Lade underwent many alterations over time, due to the accumulation of sediment transported by the Meander. In 1873, Tozer (1873: 288) described this area, stating that 'At the present day the coastline has been advanced so far, that the island of Lade, off Miletus, has become a hill in the middle of a plain'.

[47] Megara controlled the basin of Aigosthena, Nisaia and Pagai. On Aigosthena see: Benson 1895: 314-324; Blackman and Rankov 2013: 581. Nisaia, control over which by Megara is made explicit by literary sources (e.g., Theoc. *Id.* 12.27; Thuc. 2.93.2), was also connected to Megara by Long Walls (built in 459 BC, as documented by Thuc 4.66; the Long Walls were destroyed in the second half of the 5th century BC and re-built by Phocion around 343 BC, as testified to by Plut. *Vit. Phoc.* 15). Pagai (Thuc. 1.111) was probably connected to the city by means of fortifications (Lebègue 1875: 43-46; Sakellariou and Pharaklas 1972: fig. 33; Smith, P.J. 2008: 35-38. *Contra*: Hammond 1954).

[48] The site of Halicarnassus is controversial, since the settlement was built *ex-novo* by Mausolus around 370 BC. Skylax (99) states that Halicarnassus had two harbours, one of them 'closed'. Later on, Vitruvius (*De Arch.* 2.8.13-14) supports this statement, writing that one of the harbours was visible from the royal palace and was located 'ad dextram partem', while the other one was near the city-walls ('*sub sinistram secretus sub moenibus latens portus*'). According to recent archaeological studies, Halicarnassus actually managed a complex harbour system composed of a large commercial basin to the east;

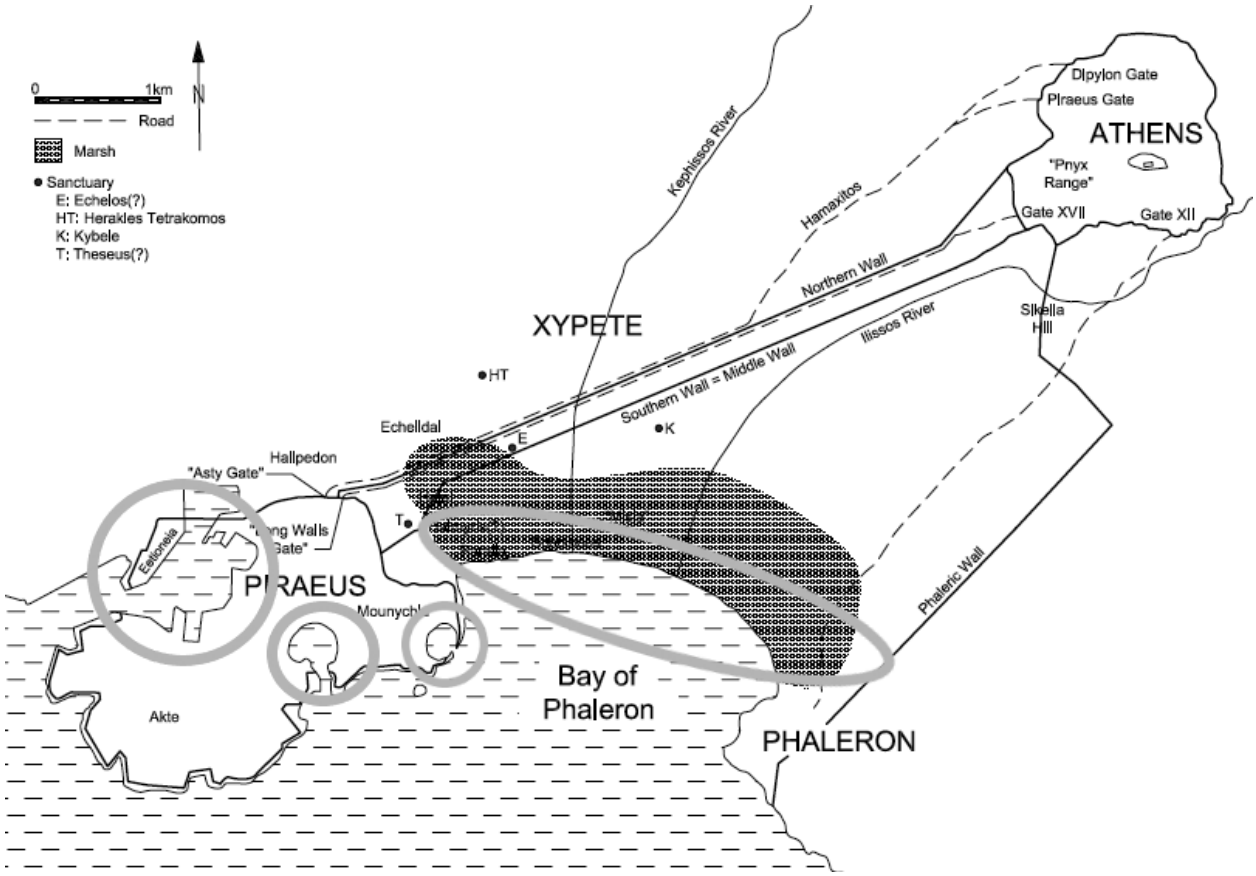

Figure 5.8. The Athenian harbour system, which includes control of the three Piraeus basins and the Phaleron Bay. After Conwell 2008: 233, fig. 3.

Corcyra (n° 34, 35 and 36),[49] Aegina (n° 7, 8 and 9)[50] and Rhodos (n° 163).[51]

5.4. Discussion

Single-basin harbours appear to have been the most common harbour form in the Aegean and eastern Ionian areas, and it is reasonable to hypothesise that during the Archaic and Classical periods the prototype of harbours

a small landing area near the royal palace with a slipway (probably private); and a large harbour to the west from which, after rounding a mole, it was possible to access an inner basin (perhaps corresponding to the 'closed harbour' mentioned by Skyl. 99). Pedersen, on the *Halicarnassus project*'s official webpage <https://www.sdu.dk/en/Om_SDU/Institutter_centre/ih/Forskning/Forskningsprojekter/Halikarnassos/Sites_and_places/The+fortifications>, viewed 28 September 2018.

[49] Corcyra controlled three harbour basins, one (Hyllaikos) on the western side of the Kononi headland, the other two probably located on the eastern side (the location of Alkinoos is certain, while the identification of the Arion site with the third harbour basin, mentioned by Skyl. 29, is only hypothetical. Some scholars suggested that the third harbour could have been located within Garitsa Bay). On Corcyra's complex harbour system, see Baika in Blackman and Rankov 2013: 319-334.

[50] One of the harbours of Aegina was already in use in the Archaic period, and it was formed by an impressive (and non-continuous) artificial breakwater (Mourtzas and Kolaiti 2013: 151-171). In the 5th century BC, perhaps as a consequence of the measures adopted in Piraeus, Aegina equipped two basins on the southern side of Kolonna Hill, the so-called military and commercial harbours (Skyl. 53 probably refers to these two basins). On the harbours of Aegina and their harbour-works, see Gerding in Blackman and Rankov 2013: 289-291; Knoblauch 1969 and 1972; Leake 1830: vol. II, 436; Mourtzas and Kolaiti 2013: 151-171. The Archaic breakwater stands today below the water level, which makes entering the harbour of Aegina particularly dangerous. However, it was still visible in the 16th century AD, since Thevet (1586: f. 31-32), in the second half of that century, wrote: '[Egina] a trois beaux ports, l'un qui vise au Nord, capable of cent grands vaisseaux l'entrée en est bonne et la sonde aussi tellement qu'il s'y trouve douze et [treize] de parfonds').

[51] Rhodos was founded as a federal city by Ialysos, Kamiros and Lindos in 408-407 BC on the northeastern part of the island. Three natural harbour basins were located on the eastern side, while another area that could be used as a harbour was present on the western side of the headland. The works that aimed at improving the harbour system probably began only during the Hellenistic era, a period to which the two shipshed complexes are dated (Gerding in Blackman and Rankov 2013: 509–517). However, the inclusion within the city fortification of three basins (the western harbour, the naval harbour and the great harbour) could have occurred in the 4th century BC. The Rhodian city-walls experienced several phases. The first phase, which is only partially preserved, dated back to the 4th century BC, its *terminus ante quem* being Demetrius Poliorcetes' siege, which occurred in 305-304 BC. Successively, the fortifications were repaired after the earthquake in 227 BC. Polybius argues that the seismic movement destroyed the colossus, part of the walls and the shipsheds (Polyb. 5.88-90).

was that of a bay or – more generally – a sheltered area used to accommodate heterogeneous activities. Single-basin harbours show an early occupancy compared to the other harbour forms, with many of them being in use from the beginning of the Geometric period or even earlier. The harbour of Pylos (n° 158), for example, was already used between the LHIIB and the LHIIIB, and a single-basin harbour at Ialysos (n° 67) played an important role at the beginning of the 1st millennium BC, when Phoenician traders moved into a pre-existing settlement.[52]

Usually, single-basin harbours were used continuously. However, some of them had a rather chronologically limited occupancy,[53] while others were used as such only until the Classical period, when they were gradually complemented by additional basins (e.g., Athens), or abandoned (e.g., Abdera) in favour of the adoption of more complex harbour forms.[54]

The construction of harbour-works in single-basin harbours was rather common in harbours controlled by *poleis* with strong maritime interests (e.g. Klazomenai, Abdera, and Gytheion),[55] in harbours which offered only partial natural protection (e.g., Akanthos)[56] or in harbours located along relevant sea-routes (e.g., the already mentioned case of Ialysos, which was situated in a strategic passageway to access the Aegean Sea from the eastern Mediterranean; or Geraistos, an important stop on the routes both between southern Greece and the northern Aegean, and between Cyclades and the eastern Aegean).[57] On the other hand, the majority of the other single-basin harbours continued to rely exclusively on their natural protection over time.

With regard to two-basin harbours, even if their existence can already be inferred from the Homeric *corpus*,[58] they experienced a definitive diffusion during the Classical and Hellenistic periods, as their frequent mentions in the *Periplus of Pseudo-Skylax* (e.g., at Psamathus and Achilleios Limen,[59] Thorikos,[60] Thasos,[61] Priene)[62] and by other sources (e.g., at Mytilene, and Delphinion)[63] reveal. Two-basin harbours often consisted of a small protected harbour and a second basin, greater in size, which were sometimes connected by a channel. The rise of two-basin harbours should be probably linked to the spread of city fleets. Starting from the Persian Wars, warships – the property of which was initially private – became to be publicly funded or, at least, owned by individuals who acted on the behalf of the city.[64] This new situation brought concrete repercussions on harbours organisations, since harbours now needed to have appropriate spaces in which to accommodate the fleet. Additionally, a significant number of two-basin harbours were equipped with infrastructures, as in the cases of Chalcis (n° 30),[65] Rhitymna (n° 162),[66] and Thorikos (n° 190) (where fortifications were built to facilitate surveillance of the harbour).[67]

As simple and complex harbour systems are concerned, differently from the cases of single-basin harbours and harbours with two basins in close proximity which were already in use along the Mediterranean coasts before the 1st millennium BC, they made their first appearance during the Archaic period in the Greek world.[68] Their birth was probably determined by

[52] The Phoenicians settled at Ialysos created an important centre of trade specialising in the production and exportation of perfumed oils (Coldstream 1969).

[53] The harbour at Emporio (n° 45), for instance, was mainly used between the 8th and the 7th century BC. Zagora (n° 193) is known to have been abandoned probably around 700 BC. The harbours on the island of Ithaca are mentioned exclusively by Homer (Rheithron, n° 160, and Phorkys, n° 146), while their employment might have declined in later periods, as further validation is not found.

[54] Athens facilitated the use of Phaleron Bay with the fortification of the three basins of Piraeus. In the Archaic period, Abdera used a single-basin harbour. When this basin was filled by sediment carried by the river, the city began to construct two basins, one at each side of the headland.

[55] N° 79, 1 and 57.

[56] N° 12.

[57] Both Xenophon (*Hell.* 3.4.4) and Homer (*Od.* 3.176-179) attest that ships coming from the Asian Minor coasts arrived at Geraistos, n° 54. Ialysos, n° 67.

[58] E.g., Hom. *Od.* 6.262-266.

[59] Skyl. 46. Achilleion Limen, n° 3; Psamathus, n° 156.

[60] Skyl. 57, n° 190.

[61] Skyl. 67, n° 182 and 183.

[62] Skyl. 98, n° 154.

[63] On Mytilene, Thucydides (3.2-3) generally talks about the existence of 'harbours', and he does so (8.38) when he refers to Delphinion (Chios). Mytilene, n° 114 and 115; Delphinion, n° 38.

[64] Examples of private ownership of vessels during the Archaic period can be found in Hdt. 5.47, and 8.17; starting from the Persian Wars, the image of public fleets emerges from literary sources (e.g., Aesch. *Pers.* 302-471; Hdt. 5.83, 6.89, 7.185, and 8.43-48). As underlined by De Souza (1998: 273), private ships continued to survive during the 5th century BC (e.g., Hdt. 8.17).

[65] Thucydides (8.95) mentions the construction – in collaboration with the Boeotians – of two moles in 411 BC, one on each side of the Euripos Strait. A breakwater generally defined as 'ancient' has been identified at Liani Amnos Bay (Lehmann-Hartleben 1923: *s.v.* Chalkis; Papavasileius 1891: 607).

[66] Here, the construction of the two slipway complexes fluctuates between the Classical and the Hellenistic periods (Blackman and Rankov 2013: 501-509; Flemming and Pirazzoli 1981: 66-81; Spandagos 1999: 1-87).

[67] In 412 BC, at the same time as the interventions at Cape Sounion (n° 177), Thorikos was fortified with walls aimed at controlling and protecting both the mines of Laurion and the sea-routes entering the Saronic Gulf.

[68] They appear on the Levantine shores in the 9th century BC, where some harbours (e.g., Sidon, Arwad) consisted of juxtaposed basins. At Arwad, an island 2.5 km from the mainland, two harbour basins located within two natural bays were utilized. Additionally, some areas on the mainland were used to beach ships at certain times of the year (Carayon 2008: 236-242). A similar case has been hypothesised for Delos, where already in the 8th-7th centuries BC, various anchorages and landing areas were in use, together with the main harbour. However, at this stage, it is not possible to identify any clear intention on the part of the city to exploit these different harbour

mature and conscious territorial policies exercised by city-states, which strove to maintain control over both the sea and the hinterland.

Corinth could be considered the first harbour system to be settled, and it extended its power over two gulfs through dominance over Kenchreai (n° 77) and Lechaion (n° 92). The complex harbour system of Miletus (n° 104-109) should probably be attributed to the same period (interestingly, Thrasybulus, the tyrant of the city, established a political dialogue with Periander of Corinth between 625 and 600 BC).[69] The establishment of these harbour systems should be understood as aimed at guaranteeing vigilance over precise maritime areas, as well as allowing the cities to increase their economic wealth by imposing sea-borne taxes.[70]

In the middle of the 6th century BC, the political scenario rapidly changed with the advent of Cyrus. With the imminent Persian threat, some *poleis* started to adopt more secure and well-structured harbour forms. At the beginning of the 5th century BC Athens abandoned the convenient Phaleron Bay (n° 142), visible from the city, to opt for Piraeus (n° 72, 116 and 194), which could have been better defended and used in a functional way. Between the 5th and 4th century BC, other cities followed the Athenian example, so that in the Greek world it is possible to see a proliferation of interventions intended to rationalise the various harbours and harbour systems. At that point, it was already clear that the survival of a city – as well as of its political and commercial growth – depended greatly on the possession of a harbour (or better still, of a harbour system) which was adequately organised and equipped.

Additional note. Insight into the regional maritime sphere: widespread harbour systems (or maritime networks based on the possibility of using harbour facilities)

To complete our overview of the development of harbour forms between the 8th and the 4th centuries BC, it is necessary to broaden our horizons further by also considering regional maritime spheres.[71] Already from the Archaic period, it is possible to observe the creation of more extensive harbour alliances, which can be defined as 'widespread harbour systems'. They were supra-state harbour organisations, which consisted in a city-state controlling, and having access to, harbour basins belonging to different settlements.[72] Their diffusion can be found within the 5th century BC, when the intensification of disputes between Athens and Sparta forced both *poleis* to rely on support points along the coast which could facilitate the operations of their respective fleets. After the Persian threat was warded off, the Greek world experienced an internal war in which the interests of Athens and Sparta were opposed.[73] Both being conscious of the importance of maintaining control of the sea, Athens and Sparta began to interweave alliances and treaties which allowed them to create complicated inter-urban maritime networks acting as supports to their military actions.[74] They realised the importance of having the possibility, during naval expeditions in foreign water, of resorting to allied harbours in which to stock up and repair the vessels, but also from which to carry out raids.[75] This situation eventually evolved into the creation of widespread harbour systems, or maritime networks, based on the possibility of using other settlements' harbour facilities. The use of these naval bases could have been temporary or permanent, and the outposts were located at various points along the coast, either inside or outside the main city's territory.[76] Therefore, from the second half of the 5th century BC onwards, we can see Athens making use of the harbours of Sounion (n° 177) and Passa Limani (n° 137) in Attica, but equally relying on the harbours of Sigeion (n° 171) in the Troad,[77] and Oiniadai (n° 126) in Acarnania,[78] outside its boundaries, for its naval operations.

Widespread harbour systems left no material traces, and their identification largely depends on their being mentioned in the written sources. Furthermore, since their creation and subsequent modifications varied according to dynamic political situations, their physiognomy was subject to considerable changes over the 5th and the 4th centuries BC, with some harbour basins moving from the Athenian maritime network (thus, from the Athenian widespread harbour

areas as a whole unique complex. Rather, the different basins were used by the ships depending on their needs (therefore, vessels were anchored or moored where they considered it appropriate, according to their sizes or depending on the weather).

[69] Abulafia 2013: 16

[70] Alessandrì 1998: 9-30; Meijer 1986: 63-86.

[71] On the concept of 'regional maritime spheres', see Tartaron 2013: 187-2011.

[72] The existence of these maritime networks of land-based facilities has been reported by Baika (in Blackman and Rankov 2013: 231-253) and analysed in light of the available archaeological and literary evidence. This paragraph is chiefly based on the considerations that she expressed in the chapter entitled 'Small-scale and rock-cut naval bases'.

[73] References to the Peloponnesians' harmful actions by sea against the Athenians and their allies can be found in Thuc. 2.69, and 3.51.

[74] *IG* I^3 65, treaty between Athens and Mytilene for prohibiting Peloponnesian pirates from accessing the harbours of Athenian allies.

[75] On sea-power and its contrasting interpretations in Greek thought, see Momigliano 1944.

[76] *IG* I^3 75, treaty between Athens and Halieis (n° 59) in which the latter make their harbour available to the Athenians. See also De Souza 2002: 32.

[77] Conflicts for control of Sigeion probably began during the Solonian period, when this basin was a point of contention between the Athenians and the Mytileans (Isaac 1986: 162–166; Tiverios 2001: 122).

[78] Xenophon (*Hell.* 4.6.14) reports that around 389 BC, the Athenians blocked the passage from Calydon to the Peloponnese with their triremes, using Oiniadai as a base.

system) to the Spartan sphere and vice versa (i.e., Torone, Halieis, Geraistos).[79] As a consequence of these continuous processes of modification, and because of their intangibility, their identification would require further analysis.[80] Therefore, even if this topic would undoubtedly constitute a stimulating research field, it will be abandoned for the time being, as it would lead us along different routes from those initially planned.

[79] N° 191, 59 and 54.

[80] Besides the difficulty connected to the passage of some harbours from the Athenian sphere to the Spartan one and vice versa, it should be borne in mind that some basins were used as naval bases only for short periods of time.

Conclusion

In the previous chapters, I have sought to engage in a discussion on the topic of Archaic and Classical harbours of the Greek world by using different kinds of evidence in order to understand their configuration. Interdisciplinary sources (geographical, geological, nautical, textual, iconographic and archaeological) have been integrated into a historical perspective for decoding harbour areas and following their evolution during the periods examined.

In Chapter 3, I have highlighted that, as occurred during other historical periods, Archaic and Classical harbours were established in places which required few changes to be implemented. In particular, I have shown that the preferred situations fell within four main typologies of coastal configuration: headlands (Typology 1), islands (Typology 2), bays (Typology 3), and river mouths (Typology 4).[1] Furthermore, for each of these typologies, I have stressed that some recurring sub-typologies could be identified.

The nautical and strategic advantages and disadvantages presented by the various sub-typologies have already been discussed. However, here I would like to summarise the main ideas that came to light earlier. During the Archaic and Classical periods, the fundamental discriminating factor for the choice of a harbour area was the possibility of turning to natural protection to one's advantage with minimum effort. Therefore, many harbours were naturally sheltered areas where the protection of the ships was often left at the mercy of nearshore maritime dynamics, in the hope that it would have been in itself be sufficient to reduce the action of weather pattern disturbance. The majority of harbours relied on the protection offered by only one natural factor (i.e., headland, island, bay or river mouth); however, the exploitation of 'mixed-typology' harbour areas (where ships could find shelter thanks to the presence of more than one natural protective factor) was also quite common.[2]

By looking at the literary and nautical evidence, it has been emphasized that not all the propitious locations guaranteed the same degree of protection, but rather presented specific characteristics. Therefore, I looked for rudiments of nautical knowledge emerging from the careful reading of literary sources, arguing that it is likely to suppose that ancient seafarers were aware of the benefits and drawbacks presented by these different natural locations. I then considered the distribution of harbour-works in the various sub-typologies and the kinds of natural factors which were preferentially exploited when found concurrently with other advantageous situations,[3] and I have used this information to establish which places were more or less suitable for the installation of harbours or shelters. In particular, I found that there were geomorphological situations capable of providing a medium-high level of protection (e.g., sub-typologies 3.2, 3.3, and 4.3), whereas others generally guaranteed only partial shelter (e.g., sub-typologies 1.1, 2.1, and 4.1).[4] Naturally, I am aware that these reflections should be intended as merely theoretical, since – as I have underlined in par. 3.7 – other factors beyond geomorphology could have played a fundamental role in determining the level of protection of a place. However, I consider that the available evidence denotes that – to a certain extent – in Antiquity there was awareness of the existence of secure harbours, which could have been safely used all-year-round, and seasonal mooring-places. I have sought to understand if this awareness could have had practical consequences for the technical jargon, but unfortunately, the lack of contemporary seafaring handbooks prevented me from further following in this direction. Under these circumstances, I have proposed to employ two phrases used by Homer ('λιμὴν κλυτὸς' and 'λιμὴν εὔορμος') to identify these differently protected locations. By doing this, I am not suggesting that these expressions could have been used as nautical technical terms, rather than they could be a bridge to better understand to what extent practical nautical rudiments were common at that time.

In Chapter 4, I have dealt with harbour-works in the Greek world. In particular, I have sought to stress two antithetical ideas. On the one hand, my purpose was to demonstrate that harbour facilities in the Greek world during the Archaic and Classical periods were more widespread than what it is generally thought,[5] so that – even if it can be denied that the cases of Athens and Corinth were emblematic – they were certainly not the only examples of semi-artificial harbours that we have. On the other hand, I have argued that artificial interventions should not be considered as a reliable proxy for identifying active harbours, since many harbours continued to exist as underdeveloped areas or to rely exclusively on infrastructures which

[1] This is an adaptation of Flemming's model (Flemming 1980a: 162-163) to the Aegean and eastern Ionian contexts. See the introduction to Chapter 3.

[2] See par. 3.5.

[3] Morton (2001: 116) stated that areas considered barely sheltered would have been preferred when they were protected by additional factors.

[4] See figure 3.16.

[5] The diffusion of harbour-works can also be endorsed by consulting Appendix 1.

left no material trace. Subsequently, I have traced a framework in which I have highlighted the main steps in the development of the various infrastructures found in harbour areas. As initially stated, all the data and considerations expressed should be regarded as far from definitive, as it would be impossible to draw a picture which takes into account all the extant factors.[6]

During the Archaic and Classical periods, a heterogeneous range of infrastructures, intended to respond to specific harbour needs, was already in use. These harbour-works were generally built in harbours belonging to *poleis* with strong maritime interests (e.g., Aigina, Eretria, Miletus),[7] or in shelters with a medium-low protection located along relevant sea-routes (e.g. Delos, Sounion).[8]

Defensive structures, namely breakwaters and moles, were widely attested to (see Appendix 1), with a significant number of places equipped with at least one mole or breakwater. Furthermore, amongst the cases of harbours equipped with a mole or breakwater, there are a relevant number of places where the defensive structure was not the only harbour-work. On the other hand, the opposite case (that is to say harbours equipped with infrastructures other than breakwaters or moles) is very uncommon. Moreover, it is almost always found in locations which presented a favourable natural situation so as to make the addition of artificial means of protection unnecessary (e.g., the harbour of Oiniadai, n° 126, located within a coastal lagoon, or the harbour of Cos, n° 37, located in a natural embayment with a naturally narrow entrance).

The high frequency of moles and breakwaters could be interpreted in two different ways, not necessarily contradictory. Firstly, it could be maintained that breakwaters and moles were aimed at satisfying a primary and fundamental need of the harbour: that is, its protection. As such, their construction was sometimes essential to enhance harbours' usability and provide an all-year-round safe shelter. On the other hand, it could be stated that their high number in Appendix 1 should be justified by the fact that they are more easily preserved if compared to other harbour facilities. As a matter of fact, this need (i.e., the protection of the harbour basin) could hardly have been guaranteed by building something other than lithic structures. Whereas other harbour necessities could have been fulfilled by means of rudimentary devices or interventions made from perishable materials,[9] moles and breakwaters were the only harbour-works whose effectiveness relied on the building materials used, which had to be resistant and long-lasting. Their construction from durable materials might also explain why – by looking exclusively at the archaeological data – breakwaters and moles were the first artificial interventions to be adopted in the Greek world, probably as early as the 8th-7th centuries BC. This situation may not inevitably reflect the reality, in the sense that perishable piers or rudimentary slipways could have been already used at that time, but they did not survive (in the case of perishable infrastructures) or they have not been dated with a sufficient degree of certainty (in the case of rock-cut slipways).

Following the chronological order, stable piers and quays appeared in harbour areas at the beginning of the 6th century BC.[10] However, as stated in par. 4.2.2, in the majority of harbours, ships continued to simply anchor offshore, to be hauled onto the beach or to moor on piers made from perishable materials. Unlike moles and breakwaters, which were often the only artificial interventions within a harbour, the construction of piers and quays was almost always incorporated into broader interventions, most of the time aimed at delimiting the perimeter of the harbour.[11]

At the end of the 6th century BC, the beaching and maintenance of ships, which at an earlier time was carried out on the shores, also began to be carried out in specific spaces known as 'shipsheds'. Shipsheds were chiefly attested to in harbours where other infrastructures existed, and they were often characteristic of those harbours which were included within the fortifications. Similar to shipsheds, slipways were also used to haul ships onto the beach, but due to the difficulty in identifying and dating these structures, their number could certainly have been larger than what can be seen in the Appendix 1.

The last infrastructures to appear in harbour areas, amongst the harbour-works that have been examined, are those aimed at improving harbour visibility. However, the presence of temples, tombs or shrines next to the harbours, analysed along with literary sources, allows us to suppose that since the Archaic period it was common to signal the existence of a shelter by positioning and lighting fires on high points along the coast. Starting from the 6th century BC, this function was performed by monumental and

[6] Firstly, many harbour-works, due to their spoliation or construction using perishable materials, have not survived and could hardly be detected. Secondly, as emerges from the Appendix, a considerable number of structures have been identified by early travellers, but so far, they have not been studied to understand their chronology and functions.

[7] Aigina, n° 7-9; Eretria, n° 50; and Miletus, n° 104-109.

[8] Delos, n° 39; Sounion, n° 177.

[9] E.g., the necessity for a harbour to be recognisable from great distances could have been fulfilled by lighting fires on high spots of the coasts, and the ships could have been hauled onto the shore with wooden layers.

[10] This is the proposed chronology for the construction of the *kothon* at Lechaion, n° 92.

[11] As seen for example in the three basins of the Piraeus.

permanent structures, eventually evolving into free-standing coastal towers.

Considering all the artificial interventions found in the Greek world, I have maintained that all these harbour facilities were already present in the Mediterranean context before the 8th century BC. However, two innovative elements can be detected, which seem to find their roots in the Greek world. The first refers to signalisation of the harbour. As I have just underlined, in Greek harbour areas this function was performed by specific buildings (i.e., towers in harbour areas), whilst in other contexts the same purpose was instead achieved by other structures (e.g., temples), not necessarily incorporated within the harbour areas and that were occasionally used also as navigational aids. The second innovation refers to the construction of moles which were the extension of the fortifications into the sea and which are attested to in the Greek world starting from the 6th century BC. To the best of my knowledge, even if the existence of walls running along the coast is documented in other areas (e.g., on the Levantine shores), it is in the Greek world that fortifications projecting *into* the sea are found. According to some scholars, harbours defended by these structures might have corresponded to the 'closed harbours' mentioned in the *Periplus of the Pseudo-Skylax*.[12] Additionally, I have proposed to insert the appearance of moles as extensions of the fortifications within a wider historical scenario and to read them as a practical response to the political changes that occurred in the Aegean and, more generally, in the Mediterranean during the 6th century BC.[13]

In Chapter 5, I have emphasized how the 6th century BC was not only the moment when the majority of changes in harbour-works occurred (e.g., diffusion of moles and breakwaters, appearance of moles connected to the fortifications, construction of quays and shipsheds, towers found in harbour areas), but it also represented a turning point in shaping the forms of Greek harbours. Indeed, while during the Middle Geometric and the Early Archaic periods harbours mainly consisted of simple shelters with only one basin, with occasional evidence of double-basin harbours, in the 6th century BC significant changes can be detected. When tyrants came to power and *poleis* became an emerging reality, harbour-works began to be implemented on a large scale, and new harbour forms were created. Examples of these changes can be observed in the construction of the breakwater ordered by Polycrates in Samos (n° 165), the rationalisation of Corinth's harbour system demanded by Periander (n° 77 and 92), and the creation of Miletus' harbour system (n° 104-109). In particular, I have argued that the case of Corinth should be regarded as the first example of a complex harbour system. While before the 6th century BC the most popular harbour form consisted of single-basin harbours, Corinth broke new ground and raised the standard. From the 6th century BC onwards, many other city-states began to expand and implement their harbours. From a geopolitical point of view, this initiated a process of 'humanisation of the sea', which became particularly intense at the end of the Archaic age, resulting in a constant and irreversible increase in human activity within coastal environments.

Finally, in the Classical era profound transformations occurred, with some *poleis* exerting their influence to non-contiguous harbour basins. At that point, naval supremacy had already become a necessary prerequisite to ensure the economic health and political autonomy of a *polis*, so much so that – after the Persians were defeated – the conflict between Sparta and Athens was supported by harbours which, even though they belonged to other settlements, fell into their widespread harbour systems.

[12] See, lastly, Baika 2009: 435. For another perspective on the meaning of this phrase, see Mauro 2017: 551-562.

[13] On the eastern front, the Persians began to constitute a threat for the Greek *poleis* from 546 BC, when Cyrus conquered the Lydian kingdom. On the west, the worsening of relationships with Etruscans and Phoenicians culminated in the battle of Alalia in 540 BC. Winter (1971: 297) noted that, from the 6th century BC, there is further evidence for carefully built walls, probably as a response to the Persian advance to the Aegean.

Appendix

Preface

This Appendix contains a catalogue of the harbours and havens which constitute the documentary basis of this volume. These harbours are all thought to have been in existence between the Archaic and the Classical periods and located within the area examined, between the eastern Ionian coasts (from Epeirus southwards) to the southern limit of the Aegean Sea (in correspondence with the strait between the island of Rhodos and the Asia Minor's coasts). They are listed in alphabetical order. Harbours and havens on the southern coast of Crete have been included, even if in theory they are not located in the Aegean, but it seemed appropriate not to forcibly divide the island into two parts.

As stated in the Introduction, this catalogue is indebted to previous works (i.e., de Graauw, Lehmann Hartleben, Theodoulou and the Navis II project),[1] which were all carefully consulted for the compilation of the present list. Compared to the other studies, this catalogue offers a list of harbours and havens based on two main factors: the presence of harbour-works dated to the Archaic or Classical periods, and/or their mention in contemporary written sources.[2] Additionally, sites where significant archaeological findings allowed archaeologists to label a certain place as a 'harbour' have been recorded.[3] Therefore, this catalogue should not be regarded as comprehensive, since several other harbours or havens could have been active during these periods, even if harbour-works have not been identified or these places were not mentioned as 'harbours' in contemporary textual sources. If we consider the existence of settlements on the numerous islands located in this geographical area, it is logical to infer that every island where human presence is documented must have had (at least) an active harbour/landing area;[4] however, if it is not explicitly mentioned, then this place has not been recorded within this Appendix.

An open-access version of this catalogue is already available online at <http://www.ancientgreekharbours.com> and it will be regularly updated, should future archaeological and geological studies disclose new data.

[1] Graauw, de 2017; Lehmann-Hartleben 1923; Navis II; Theodoulou 2015. See also Theodoulou and Memos 2006. On an early stage of this project, see Mauro 2016.

[2] When reporting on travels by sea, literary sources often refer to several places that ships overshot. In those cases, I have recorded only the places from which ships departed, to which they arrived or where the crew (or part of the crew) disembarked or spent the night dropping anchor (in the latter case, they have been labelled as 'anchorages').

[3] This has been done only where the function of a place as 'harbour' is widely accepted.

[4] Broodbank 2013.

Guide

Number.	Each entry has been assigned a number to facilitate the consultation of the Catalogue and allow the reader to easily find the harbours mentioned within the text of this volume.
Ancient Toponym.	It has been chosen to adopt the spelling used by Pleiades. In case the ancient toponym is not known, this field has been completed with the name of the current location, in order to make the alphabetical order possible.
Current Location.	It is mainly based on the Barrington Atlas, Pleiades and de Graauw (2017).
Area.	Region where the harbour was located.
Harbour-works.	This field records the presence of infrastructures identified in a specific harbour. In scholarship, there is some confusion between the words 'breakwater' and 'mole', which are used indiscriminately to identify structures that define the seaward perimeter of the harbour (for more information on harbour-works and their purposes, see Chapter 4 of this volume). Where possible, I have sought to differentiate between simple breakwaters and structures used also for mooring purposes ('moles'). However, in the cases where only 19th-century travellers' accounts were known, I have reported the terms found in the publications. Additional information on harbour-works can be found in the field labelled 'Notes'.
Sources.	In this field, there are sources that are contemporary to the chronological periods examined here but also later sources (abbreviations have been made according to the 4th Edition of the *Oxford Classical Dictionary* and they appear in alphabetical order). The choice to include these is because they often provide interesting information on the harbour (water depth, protection against particular winds, options for anchorage), or the changes that occurred in its geomorphology. Sometimes, they have been recorded because they document the continual use of the harbour over time. Obviously, information inferred by literary sources should be interpreted with great caution, as they are subjective, their descriptions depending on the authors' greater or lesser familiarity with maritime-related issues. The list of sources is not exhaustive. Rather, they have been independently appraised by the author, who selected only those citations which, in her opinion, contain relevant information, referring explicitly to the existence of a harbour, to ships departing from, arriving to or anchoring at a specific place (in this case, the place is labelled as 'anchorage' in the field 'Notes'). With regard to the *Periplus of Pseudo-Skylax*, reference has been made only when the harbour is explicitly mentioned, e.g. 'καὶ Ἀνακτόριον καὶ λιμὴν' (Skyl. 34).
Notes.	In this field, readers can find relevant information on the harbour (e.g., proposed chronology of the harbour-works, possible mention of the harbour as a 'λιμὴν κλειστός'). Where the note 'Anchorage' is present, it means that the place has simply been referred to as a location where ships anchored.
References.	It contains the main works (in alphabetical order) where it is possible to find information on a certain harbour.
(?)	In almost all the fields it possible to find a question mark (often in parentheses) to highlight uncertain information. In the case of harbour-works, it could mean that either the identification is not indisputable, or that scholarship reports the presence of a structure generally referred to as 'ancient', which could be (or not be) dated to the Archaic or Classical periods.

N°	ANCIENT TOPONYM	CURRENT LOCATION	AREA	HARBOUR-WORKS	SOURCES	NOTES	REFERENCES
1	ABDERA	Lefkippos	Thrace	-Shipsheds ('Archaic harbour') - Moles as extensions of the fortifications ('Archaic harbour', 'western harbour' and 'eastern harbour') -Towers ('western harbour')	Hdt. 6.46-48.	Archaic harbour: shipsheds and moles (6th-5th cent. BC). Western harbour: moles and towers (4th cent. BC). Eastern harbour: moles (Classical period).	Blackman and Rankov 2013; Graauw, de 2017; Koukouli-Chrysanthaki 1991; Samiou 1993; Syrides and Psilovikos 2004; Theodoulou in Navis II.
2	ACHILLEION	Beşika Burnu; 2 km south of Yeniköy	Troad		Liv. 37.9; Plin. *Nat.* 5.33; Pompon. 1.18; Skyl. 98; Strab. 13.1.36, and 14.3.5.		Graauw, de 2017.
3	ACHILLEIOS LIMEN	Marmari, on Cape Tainaron	Laconia		Paus. 3.25.4; Skyl. 46.		Graauw, de 2017.
4	ACTIUM	Headland at the mouth of the Ambracian Gulf	Acarnania		Skyl. 34; Strab. 10.2.7.	Apollo's Pan-Hellenic sanctuary on the top of the headland. Harbour under the control of Anactorium.	Graauw, de 2017; Lehmann-Hartleben 1923.
5	AIGILA, Antikythera	Cerigotto bay, on the island of Antikythera	Ionian islands	- Slipway - Beaching structures (?)	Plut. *Vit. Cleom.* 31.	Slipway: Classical or Hellenistic.	Blackman and Rankov 2013.
6	AIGILIA	Islet of Dipsa, between Styra and Marathon (?)	Attica		Hdt. 6.107.	Landing place	
7, 8 and 9	AIGINA	Near Kolona hill, on the Island of Aigina	Aegean islands	See each harbour basin	Dem. 211; Hdt. 6.92; Paus. 2.29; Skyl. 53; Thuc. 1.14, and 1.105-108; Xen. *Hell*. 2.2.3-9.		Blackman and Rankov 2013; Graauw, de 2017; Knoblauch 1969 and 1972; Leake 1830; Mourtzas and Kolaiti 2013; Welter 1838.
7	AIGINA, Northern harbour	Aigina, north of Kolona hill	Aegean islands	- Breakwater (?)	See above		See above
8	AIGINA, Military harbour	Aigina, south of Kolona hill	Aegean islands	- Moles - Towers - Shipsheds	See above	Two shipsheds complexes (possibly built around 480 BC). Harbour within the fortifications.	See above
9	AIGINA, Commercial harbour	Aigina, current harbour	Aegean islands		See above		See above

N°	ANCIENT TOPONYM	CURRENT LOCATION	AREA	HARBOUR-WORKS	SOURCES	NOTES	REFERENCES
10	AIGOSTHENA	Porto Germeno	Megarid	- Slipways (?)		Within the fortifications (end of the 4th cent. BC).	Benson 1895; Blackman and Rankov 2013; Graauw, de 2017.
11	AINOS	Enez	Thrace	- Mole (?)	Skyl. 67		Graauw, de 2017; Isaac 1986; Lehmann–Hartleben 1923; Tiverios 2008.
12	AKANTHOS	Ierissos	Chalcidice Peninsula	- Mole (?)	Hdt. 6.44; Strab. 7.8.		Graauw, de 2017; Leake 1835; Lehmann-Hartleben 1923; Struck 1907.
13	AMBRACIA	Phidokastro	Epeirus		Dion. Calliphon. 28-30; Plin. Nat. 2.87; Skyl. 33.	Referred to as a 'closed harbour' by Skylax. Within the fortifications (4th cent. BC).	Graauw, de 2017; Karatzeni 2011; Leake 1835; Lehmann-Hartleben 1923.
14	AMNISOS	Palaiokhora/Amnisos	Crete		Hom. *Od.* 19.189; Strab. 10.4.8.	Defined as a 'λιμήν χαλεπός' ('difficult harbour') by Homer.	Evans, A.J. 1928; Flemming and Pirazzoli 1981; Graauw, de 2017; Schäfer 1991.
15	AMORGOS	Yamurgi, on the island of Amorgos	Cyclades		Skyl. 58		
16	ANACTORIUM	Agios Petros, near Nea Kamarina	Acarnania		Skyl. 34		Graauw, de 2017.
17	ANAPHLYSTOS	Agios Georgios	Attica		Skyl. 57; Xen. *Vect.* 4.43		Blackman and Rankov 2013; Graauw, de 2017; Lehmann–Hartleben 1923; Milchhöfer 1889; Pritchett 1965.
18	ANTANDROS	Near Altınoluk	Troad	- Shipyard (?)	Xen. *Hell.* 2.1.	Area for refitting and building vessels (see Xen. *Hell.* 2.1)	
19	ANTHEDON	Loukisia, near Cape Paladimni	Boeotia	- Byzantine period structures probably covering previous port structures (?)	Strab. 9.2.		Blackman, Schafer and Schlager 1967; Graauw, de 2017; Leake 1835; Theodoulou 2015.

N°	ANCIENT TOPONYM	CURRENT LOCATION	AREA	HARBOUR-WORKS	SOURCES	NOTES	REFERENCES
20	ANTISSA, on the island of Lesbos	Near to Cape Sigrium.	Aegean islands	- Mole as extension of the fortifications - Breakwater at Kaloi Limani (east of Antissa)	Strab. 13.2.4.	Archaic mole connected to the city-walls.	Graauw, de 2017; Koldewey 1890; Lehmann–Hartleben 1923; Theodoulou and Koutzellis 2011; Theodoulou 2010 and 2015.
21	APHETAI	Platania/Kato Yeoryios	Magnesia		Diod. Sic. 11.12.3; Hdt. 7.193-196, and 8. 4; Strab. 9.5.15.		Graauw, de 2017.
22	ARGINUSA	Makronisi, on the Arginusai islands (?)	Aeolis		Thuc. 8.101		Graauw, de 2017.
23	ARTEMISIUM	Artemisium	Euboia		Diod. Sic. 11.12.4; Hdt. 8.4-6.	Anchorage	Graauw, de 2017.
24	ASTAKOS	Astakos	Acarnania		Skyl. 34.		Graauw, de 2017.
25	ASTERIA	Islet known as Daskalion, between Ithaca and Cephalonia	Ionian islands		Hom. *Od*. 4.843-845; Strab. 10.2.16.	Referred to as a 'double harbour' by Homer.	Cuisenier 2003; Graauw, de 2017.
26	AULIS	Mikro Vathy	Euboia		Hes. *Op.* 650-55; Hom. *Il.* 2.303; Ov. *Met.* 12.1, and *Pont.* 13; Soph. *El.* 564; Xen. *Hell.* 3.4.		Graauw, de 2017.
27	BOUDURON, on the island of Salamis	Near Stenos, island of Salamis	Attica		Thuc. 2.94.		
28	CAPE MYCALE	Cape Mycale	Ionia	- Shipsheds (?)		Defensive system probably built during the Classical period. A tower, located on the island of Samos, complemented this system. The Panion at Cape Mycale could have been used as a reference point by seafarers.	Blackman and Rankov 2013.
29	CAUNUS	Dalyan	Karia		App. *Mith*. 4.26; Diod. Sic. 14.79; Skyl. 99; *Stadiasmus* § 265; Strab. 14.2.2-3; Thuc. 1.108, and 1.116.	Referred to as a 'closed harbour' by Skylax and Strabo.	Brückner 1997; Graauw, de 2017.

N°	ANCIENT TOPONYM	CURRENT LOCATION	AREA	HARBOUR-WORKS	SOURCES	NOTES	REFERENCES
30	CHALCIS	Chalkis	Euboia	- Moles	Diod. Sic. 13.47; *It. Ant.*; Liv. 27.30, 28. 6, and 44.1.4; Skyl. 58.	Bridge across the Euripos Channel (5th cent. BC).	Bakhuizen and Kiel 1985; Graauw, de 2017; Lehmann-Hartleben 1923; Papavasileiou 1891.
31	CHIOS, on the island of Chios	Chios, on the island of Chios	Aegean islands		Arist. *Pol.* 1291b; Arr. *Anab.* 3.2.4; Liv. 37.27, and 37.31; Polyaenus, *Strat.* 3.9.58, and 5.22.1; Skyl. 98; Strab. 14.1.35; Thuc. 8.23, and 8.34.		Blackman and Rankov 2013; Graauw, de 2017.
32	CARTERIA	Yenifoça (?)	Aeolis		Thuc. 8.101.		
33	CHALEION	Tolofon, formerly Vitrinitsa	Ozolian Locris	- Breakwater (?)	*IG* IX I^2,717		Graauw, de 2017; Lehmann-Hartleben 1923.
34, 35 and 36	CORCYRA	Corcyra	Ionian islands	See each harbour basin	Caes. *BCiv.* 3.7; Diod. Sic. 15.47.5; Liv. 36.42, and 44.1.3; Skyl. 29; Thuc. 3.72, 3.74.2, 4.3, 4.8, and 6.43; Xen. *Hell.* 6.2.36.	According to Skylax (29), the city would have been equipped with three harbours, one of them 'closed'.	Blackman and Rankov 2013; Graauw, de 2017.
34	CORCYRA, Alkinoos	Corcyra, Anemomylos site	Ionian islands	- Mole - Towers - Shipsheds	Scho. Dion. Calliphon 493= *GGM* II.450; Thuc. 3.74.2.	Narrow entrance controlled by a mole and towers. Two shipsheds complexes: Corcyra 1 (early 5th cent. BC), and Corcyra 2 (5th cent. BC).	See above
35	CORCYRA, Hyllaikos	Corcyra, south of Cape Kononi (Chalikiopulo Bay)	Ionian islands	- Shipsheds	Ap. Rhod. *Arg.* 4.1125; schol. Dion. Calliphon. 493 = *GGM* II.450; Thuc. 3.74.2.	Within the city-walls. The first phase of the shipsheds ('Corcyra 3') is dated to the Archaic period.	See above
36	CORCYRA, Arion (?)	Coryra, north of Cape Kononi	Ionian islands	- Mole (?) - Shipsheds (?)			See above
77 and 92	CORINTH (*s.v.* 'Kenchreai' and 'Lechaion')	Corinth	Corinthia				

N°	ANCIENT TOPONYM	CURRENT LOCATION	AREA	HARBOUR-WORKS	SOURCES	NOTES	REFERENCES
37	COS	Cos	Dodecanese	- Shipsheds	Diod. Sic. 15.76.2; *It. Ant.*; Skyl. 99; Stadiasmus §278; Strab. 10.5.16.	Referred to as a 'closed harbour' by Skylax. Harbour within the city-walls. Two shipsheds complexes (second half of the 4th cent. BC or 3rd cent. BC).	Blackman 2004; Blackman and Rankov 2013; Graauw, de 2017; Kantzia 1987.
38	DELPHINION	Delfini	Aegean islands		Thuc. 8.38; Xen. *Hell.* 1.5.15.	Within the fortifications.	Boardman 1956.
39	DELOS	Delos	Cyclades	- Breakwater - Quay (sacred harbour)	Diod. Sic. 10.3; Hdt. 6.97; *It. Ant.*; Liv. 36.43; Ov. *Met.* 3.595-599; Polyaenus, *Strat.* 3.9.36; Strab. 10.5.4.	Breakwater (possibly 8th-7th cent. BC).	Ardaillon 1896; Blackman 1982a; Duchêne and Fraisse 2001; Graauw, de 2017; Homolle 1877 and 1879; Jardé 1905; Lehmann-Hartleben 1923; Paris 1916.
40	DIKTE	Menies, east of Palaiokastro	Crete		Ap. Rhod. *Argon.* 4.1640		Graauw, de 2017.
41	DORISKOS	Doriskos, on River Maritsa.	Thrace		Diod. Sic. 11.3.7; Hdt. 5.98, and 7.59.	Harbour under the Persian control.	
42	DYME	Araxos	Achaia		Thuc. 2. 84		Graauw, de 2017.
43	EION	Near Ofriniou	Thrace		Thuc. 4.102-108; Xen. *Hell.* 1.5.15.		Graauw, de 2017; Tiverios 2008.
44	ELAIOUS	Abide, Mortolimani	Thracian Chersonese		Hdt. 6.140, and 7.22; Thuc. 8.102; Xen. *Hell.* 2.1.20.		Dhorme, Chamonard and Courby 1915; Graauw, de 2017; Lehmann-Hartleben 1923.
45	EMPORIO	Emporios, on the island of Chios	Aegean islands			Active between the 8th and the 7th cent. BC.	Boardman 1967.

N°	ANCIENT TOPONYM	CURRENT LOCATION	AREA	HARBOUR-WORKS	SOURCES	NOTES	REFERENCES
46	EPHESUS	On the northern side of Panayirdag Hill, near Selçuk	Ionia		Plut. *Vit. Lys.* 5.1; Skyl. 98; Thuc. 4.50.3; Xen. *Hell.* 1.2.6-7, and 1.5.12-11.	The harbour of Ephesus suffered several changes due to the progradation of the river (see Strab. 14.1.24). The Geometric-Archaic harbour should be probably identified with the 'sacred harbour'. In the Classical period, the main harbour was the Koressos harbour. There are other sources that mention the harbour of Ephesus, but they refer to later harbour basins.	Graauw, de 2017; Kraft *et al.* 2000 and 2011; Stock *et al.* 2013.
47	EPIDAUROS	Palaia Epidauros	Argolid		Hom. *Il.* 2.561; Ov. *Met.* 15.641-643; Paus. 2.29.1; Skyl. 54.		Graauw, de 2017.
48	EPIDAUROS LIMERA	Palaia Monemvasia	Laconia		Skyl. 46; Strab. 8.6.1; Thuc. 6.105.		Graauw, de 2017.
49	ERESOS, on the island of Lesbos	Skala Eresou, south-west of the island of Lesbos	Aegean islands	- Breakwater		Breakwater (4th cent. BC).	Graauw, de 2017; Theodoulou 2010.
50	ERETRIA	Eretria	Euboia	- Mole; - Moles as extensions of the fortifications.	Diod. Sic. 13.36.4; Hom. *Il.* 2.537; IG XII 9 1273/1274; *It. Ant.*; SEG 34 898; Skyl. 22.	Inner harbour and outport; inner harbour within the city-walls. Moles as extensions of the fortifications dated to the 4th cent. BC.	Georgiades 1907; Graauw, de 2017; Lehmann-Hartleben 1923; Navis II; Pickard 1891.
51	ERYTHRAI	Ildir, opposite the island of Chios	Ionia	- Breakwater (?)	Skyl. 98; Strab. 14.1.31.		Graauw, de 2017; Lehmann-Hartleben 1923.
52	GAURION, on the island of Andros	Gavrion, on the isle of Andros	Cyclades		Liv. 31.45; Xen. *Hell.* 1.4.22.		Graauw, de 2017.
53	GERAI	Sigacik Bay	Ionia		Liv. 37. 27; Skyl. 98; Strab. 14.1.30.	Under the control of Teos (?).	Graauw, de 2017; Kadioglou 2012; Lehmann-Hartleben 1923.

N°	ANCIENT TOPONYM	CURRENT LOCATION	AREA	HARBOUR-WORKS	SOURCES	NOTES	REFERENCES
54	GERAISTOS	Porto Kastri	Euboia	- Mole (?) - Shipsheds (?)	Hom. *Od.* 3.176-179; Liv. 31.45; Ptol. *Geog.* 3.13; Thuc. 3.3; Xen. *Hell.* 3.4.4.	Possible shipsheds (Late-Classical or Early-Hellenistic).	Baumeister 1864; Blackman and Rankov 2013; Chidiroglou 2009; Graauw, de 2017; Leake 1835; Lehmann–Hartleben 1923; Sackett *et al.* 1966.
55	GLYKYS LIMEN	Near Ormos Ag. Ioannou	Epeirus		Cass. Dio, 50.12.2; Ptol. *Geog*. 3.12; Skyl. 30; Strab. 7.7.5; Thuc. 1.46.		Besonen 1997; Besonen, Rapp and Jing 2003; Dakaris 1971; Graauw, de 2017; Hammond 1967; Soueref 1995.
56	GRYNEION	Termaşalık Burnu	Aeolis		Plin. *Nat.* 5.32; Skyl. 98.		Graauw, de 2017.
57	GYTHEION	Gythion	Laconia	- Breakwater (?) - Shipsheds	Diod. Sic. 11.84.6; Liv. 34.29; Paus. 1.27.5, and 3.21.6; Polyb. 5.19; Polyaenus, Strat. 2.9-10; Skyl. 46; Strab. 8.3.12, and 8.5.2; Xen. *Hell.* 6.5.32	Shipsheds destroyed in the 5th cent. BC (according to literary sources).	Graauw, de 2017; Lehmann–Hartleben 1923; 1923; Scoufopoulos-Stavrolakes 1985; Smith, W. 1854-1857.
58	HALICARNASSUS	Bodrum	Karia	- Moles (?) - Slipway (?)	Skyl. 99; Vitr. *De Arch.* 2.8.13-14.	Complex harbour system (?)	Blackman and Rankov 2013; Flemming *et al.* 1971; Graauw, de 2017.
59	HALIEIS	Porto Cheli	Argolid	- Moles as extensions of the fortifications (?)	*IG* I³75; Skyl. 50.	Moles (5th cent. BC) ending in towers (?).	Frost, F. 1985; Graauw, de 2017; Kapotas 2013; Jameson 1969 and 2005.
60	HAMAXITOS	Beşiktepe, Gülpınar	Troad		Thuc. 8.101		Graauw, de 2017.
61	HELIKE	Aigion	Achaia		Hom. *Il.* 2.560; Strab. 8.7.2.		Álvarez-Zarikian, Soter and Katsonopoulou 2008; Graauw, de 2017.
62	HELOS	Ayios Stephanos	Laconia		Hom. *Il.* 2.584; Thuc. 4.54.	Its toponym probably derives from its location (‘τὸ ἕλος’, ‘marshes’).	Graauw, de 2017; Navis II.
63	HEPHAISTIA	Kastro Bouni, on the island of Lemnos	Aegean islands	- Breakwater (?)	Skyl. 67 (?)		Graauw, de 2017; Lehmann-Hartleben 1923; Theodoulou 2015.

N°	ANCIENT TOPONYM	CURRENT LOCATION	AREA	HARBOUR-WORKS	SOURCES	NOTES	REFERENCES
64	HERAION	Perachora	Corinthia	- Breakwater		Temple of Hera Akraia possibly used as a navigational aid.	Blackman 1966; Gaki-Papanastassiou, Papanastassiou and Maroukian 2007.
65	HERMIONE	Ermione	Argolid		Hom. *Il.* 2.560; Paus. 2.34.10-11; Skyl. 51.	Temple of Poseidon on the top of the headland.	Graauw, de 2017.
66	HISTIAIA	Deme of Eretria between Zarex and Styra	Euboia	- Breakwater (?)	Skyl. 58	Breakwater probably dated to the Archaic period.	Georgiades 1907; Graauw, de 2017; Lehmann–Hartleben 1923.
67	IALYSOS	Ialisos, on the island of Rhodes	Dodecanese	- Breakwater (?)			Billiotti and Cottret 1881; Graauw, de 2017; Lehmann-Hartleben 1923.
68	IMBROS	Kaleköy, on the island of Gökceada	Aegean islands	-Harbour-works not clearly identified	Hdt. 6.41; Thuc. 8.102.	Harbour-works identified by Fredrich.	Fredrich 1908; Graauw, de 2017.
69	IOS	Aniye, on the island of Ios	Cyclades		Skyl. 58		Graauw, de 2017.
70	IOULIS (?), on the island of Keos	Otzias Bay, on the island of Keos	Cyclades	- Mole		Mole dated to the 4th cent. BC.	Baika 2010; Graauw, de 2017; Theodoulou 2015.
71	KALAUREIA	Bay of Vayonià	Argolid	- Shipsheds (?)	Dem. 49.13-16; Skyl. 52.	Shipsheds located 1 km far from the *polis* (currently not visible).	Blackman and Rankov 2013; Graauw, de 2014; Wide and Kjellberg 1895.
72	KANTHAROS	Piraeus	Attica	- Lighthouses - Shipsheds - Moles as extensions of the fortification - Piers	*S.v.* 'Piraeus'	Shipsheds dated to the 5th-4th cent. BC.	Garland 1987; Lovén 2011; Navis II.
73	KARDIA	Baklaburnu	Thracian Chersonese	- Slipway (?)	Dem. 23.150; Diod. Sic. 13.49.3; Xen. *Hell.* 1.1.11.	Slipway identified in 1955 and found associated with pottery dated to the 5th-4th cent. BC.	Blackman and Rankov 2013; Graauw, de 2017.
74	KARIANDA	Island of Salih Adasi	Karia		Skyl. 99; Strab. 14.2.20.		Graauw, de 2017.
75	KARPATHOS	Makriyalo, on the island of Karpathos	Dodecanese	- Mole (?) - Slipway (?)	Ap. Rhod. *Argon*. 4.1635.		Blakman and Rankov 2013; Graauw, de 2017; Lehmann-Hartleben 1923.
76	KAUKASA	Bolissos (?), on the island of Chios	Aegean Islands		Hdt. 5. 33.		Graauw, de 2017.

N°	ANCIENT TOPONYM	CURRENT LOCATION	AREA	HARBOUR-WORKS	SOURCES	NOTES	REFERENCES
77	KENCHREAI	Kenchreai	Corinthia	- Moles (?)	Apul. *Met*. 10.35; Diod. Sic. 15.68.3; Liv. 32.17-19; Paus. 2.2.3; Philo, *In Flacc.* 155; Plut. *Vit. Cat. Mi.* 38; Ptol. *Geog*. 3.14; Strab. 8.6.4; Thuc. 4.42.4; 8.10, and 8.20-23; Xen. *Hell.* 7.4.5.	Possible pre-Roman harbour-works concealed by Roman structures.	Graauw, de 2017; Lehmann-Hartleben 1923; Navis II.
78	KIRRA	Magoula Xeropigadas, near Chrisso	Phocis	- Breakwater - Shipsheds (?) - Slipway (on the islet of Agios Demetrios)	Paus. 10.1.2, and 10.37.8; Thuc. 2.93.	The slipway on the islet of Agios Demetrios could be dated to the Late-Classical period.	Blackman and Rankov 2013; Graauw, de 2017; Luce 1990; Negris 1904.
79	KLAZOMENAI	On the south-west of Urla Iskelesi	Ionia	- Moles	Skyl. 98.; Thuc. 8.14; Xen. *Hell.* 1.1.11.	Two moles (Archaic period).	Erkanal, Şahoğlu, and Tuğcu 2014; Graauw, de 2017.
80 and 81	KNIDOS	Tekir	Karia	See each harbour basin	Diod. Sic. 14.83.5; Luc. *Act. Ap*. 27.7; Strab. 14.2.15.	See each harbour basin	Blackman and Rankov 2013; Gerkan, von 1924; Graauw, de 2017.
80	KNIDOS, Northern harbour ('military')	Tekir	Karia	- Pier - Breakwaters	See above	Breakwaters dated to the 4th-3rd cent. BC. Referred to as a 'closed harbour' by Strabo (14.2.15).	See above
81	KNIDO, Southern harbour ('commercial')	Tekir	Karia	- Pier - Breakwaters	See above	According to Lehmann-Hartleben, the breakwaters dated to the Archaic period.	See above
82 and 83	KNIDO, ancient settlement	Burgaz	Karia	See each harbour basin	Thuc. 8.35-43 (?)		Greene, Leidwanger and Tuna 2014.
82	KNIDO, ancient settlement Harbour L1	Burgaz	Karia	- Moles as extensions of the fortifications	Thuc. 8.35-43 (?)		Greene, Leidwanger and Tuna 2014.
83	KNIDO, ancient settlement Harbour L2	Burgaz	Karia	- Moles as extensions of the fortifications - Towers	Thuc. 8.35-43 (?)	Harbour-works dated to the Late-Classical period.	Greene, Leidwanger and Tuna 2014.
84	KOLONES	Kolones Bay, on the island of Salamis	Attica	- Mole - Tower		Harbour-works dated to the Classical or Hellenistic period.	Graauw, de 2017; Lolos 1995.

N°	ANCIENT TOPONYM	CURRENT LOCATION	AREA	HARBOUR-WORKS	SOURCES	NOTES	REFERENCES
85	KOPHOS	Koufos	Chalcidice Peninsula		Thuc. 5.2.		Graauw, de 2017.
86	KREUSIS	Livadostro	Boeotia		Paus. 9.32; Xen. *Hell.* 4.5.10.		
87	KYDONIA	Chania	Crete	- Breakwater	Skyl. 47; *Stadiasmus* § 343.	Referred to as a 'closed harbour' by Skylax. The breakwater seems to have been a natural sandstone formation artificially reinforced.	Graauw, de 2017; Lehmann-Hartleben 1923.
88	KYLLENE	Kylleni	Elis	- Not determined harbour-works.	Dionys. Per. 5. 347; Paus. 4.23.1; Skyl. 43; Strab. 8.3.4, 6.26.4, and 8.54.3; Thuc. 1.30, 2.84, and 3.76.	There were probably infrastructures built from perishable materials, which were destroyed in 433 BC (Thuc. 1.30).	Graauw, de 2017; Pakkanen 2009; Pakkanen *et al.* 2010.
89	KYME	Nemrut Limani, south of Aliaga	Aeolis	- Mole - Shipsheds (?)	Hes. *Op.* 635; Skyl. 98; Strab. 13.3.6.	Mole dated to the 7th-6th cent. BC. Unlikely shipsheds.	Blackman and Rankov 2013; Gianfrotta *et al.* 2002; Graauw, de 2017.
90	LADE	Currently inland, near Batiköy	Ionia		Hdt. 6.7; Thuc. 8.17, and 8.24.		Graauw, de 2017.
91	LAS	Passavas, Diro	Laconia		Skyl. 46; Strab. 8.5.4.		Graauw, de 2017.
92	LECHAION	Lechaion	Corinthia	- Moles - Shipsheds - Channels - Quay - Kothon	Diod. Sic. 15.68.3; Liv. 32.23.4; Paus. 2.2. 3; Philo, *In Flacc.* 155; Plin. *Nat.* 4.6; Polyb. 5.18; Plut. *Vit. Arat.* 24.1; Ptol. *Geog.* 3.16; Strab. 8.6.22; Xen. *Hell.* 4.4.7.	*Kothon*-type harbour. Connected to the city through Long-Walls.	Georgiades 1907; Graauw, de 2017; Lehmann–Hartleben 1923; Pallas 1965; Paris 1915; Rothaus 1995; Salmon 1984; Stiros *et al.* 1996; Theodoulou 2002.
93	LEROS, on the island of Leros	Lakki Bay (?), on the island of Leros	Dodecanese		*Stadiasmus* § 277; Thuc. 8.27.		
94	LEUCAS	Kalligoni	Acarnania / Ionian islands	- Channel - Mole - Shipsheds (?)	Skyl. 34; Thuc. 1.27, 6.104, and 7.2.		Blackman and Rankov 2013; Graauw, de 2017; Lehmann– Harleben 1923; Marees, von 1907; Murray 1988; Negris 1904.

N°	ANCIENT TOPONYM	CURRENT LOCATION	AREA	HARBOUR-WORKS	SOURCES	NOTES	REFERENCES
95	LEUKAI	Kus Cenneti, now inland	Aeolis		*It. Ant.*; Skyl. 98.		Graauw, de 2017.
96	LISSOS	Agios Kyriakos, 2 km west of Sougia	Crete		Skyl. 47		Graauw, de 2017.
97	LORYMA	Bozuk	Karia		App. *B Civ.* 4.72; Diod. Sic. 14.83.4; Liv. 37.17.8; Thuc. 8.43.1.		Blackman and Rankov 2013; Graauw, de 2017; Held 2009.
98	MARATHON	Marathon, north of Mikron Helos	Attica		Hdt. 6.107		Graauw, de 2017.
99	MARONEIA	Agios Kharalabos	Thrace		Dem. 50.22.		Graauw, de 2017; Reinach 1881.
100	MELOS	Melos Bay (?)	Cyclades		Skyl. 48; Xen. *Hell.* 4.8.		Graauw, de 2017; Lehmann– Hartleben 1923
101	METHANA	Agios Andreas (?)	Laconia (?)		Skyl. 47		
102	METHYMNA, on the island of Lesbos	Methimna	Aegean islands	- Moles as extensions of the fortifications	Xen. *Hell.*1.2.12	Moles dated to the 4th cent. BC.	Graauw, de 2017; Koldwey 1890; Theodoulou 2010.
103	MENDE	Kalandra	Chalcidice Peninsula		Dem. 35.10; Liv. 31.45; Thuc. 4.129.3.		Graauw, de 2017.
104, 105, 106, 107, 108 and 109	MILETUS	Near Burhaniye	Ionia	See each harbour basin	Hdt. 5.36; and 6.8.1; Paus. 7.2.11; Strab. 14.1.10.		Brinkmann *et al.* 1991; Brückner *et al.* 2003; Graauw, de 2017.
104	MILETUS, Lion Harbour	See above	Ionia	- Pier (?) - Moles as extensions of the fortifications (?) - Shipsheds (?)		This harbour basin has not been excavated. It is only known through geophysical analyses. Harbour basin within the city-walls. Herodotus (6.8.1) refers that Miletus brought 80 ships to the Battle of Lade in 494 BC. This fleet must have been hosted in specific structures, maybe located in the main harbour(s) (Lion Harbour and Theatre Harbour).	See above

N°	ANCIENT TOPONYM	CURRENT LOCATION	AREA	HARBOUR-WORKS	SOURCES	NOTES	REFERENCES
105	MILETUS, Theatre Harbour	See above	Ionia	- Shipsheds (?)		See above	See above
106	MILETUS, Kalabak Tepe	See above	Ionia				See above
107	MILETUS, Athena Harbour	See above	Ionia				See above
108	MILETUS, Humei Tepe	See above	Ionia				See above
109	MILETUS, East Harbour	See above	Ionia				See above
110	MYNDO	Gümüslük	Karia		Hdt. 5.33; Skyl. 99; *Stadiasmus* § 276; Strab. 14.2.20.		Blackman and Rankov 2013; Graauw, de 2017; Şahin 2014.
111	MYOUS	Afşar	Ionia		Hdt. 5.36.4, and 6.8.1; Paus. 7.2.11; Strab. 14.1.10.		Brinkmann *et al.* 1991; Brückner *et al.* 2003; Graauw, de 2017.
112	MYRINA, in Aeolis	North of Aliaga, mouth of Koca Çay	Aeolis	- Mole (?) - Breakwater (?)	Skyl. 98; Strab. 14.3.5.		Graauw, de 2017; Lehmann–Hartleben 1923.
113	MYRINA, on the island of Lemnos	Kastro/Myrina, on the island of Lemnos	Aegean islands		Skyl. 67 (?)		Graauw, de 2017.
114 and 115	MYTILENE	Mytilene, on the island of Lesbos	Aegean islands	See each harbour basin	Diod. Sic. 13.77.4, and 13.78.3; Luc. *Act. Ap.* 20.14; Skyl. 97; Strab. 13.2.2; Theoc. *Id.* 7; Thuc. 3.2-3, and 8.23; Xen. *Hell.* 1.6.16-21.		Acheilara 1998; Blackman and Rankov 2013; Graauw, de 2017; Koldewey 1890; Kourtzellis 2013 a, and 2013b.
114	MYTILENE, Southern harbour (‘military’)	See above	Aegean islands	- Breakwater (?) - Tower - Shipsheds (?)	See above	Harbour within the city-walls. Shipsheds currently dated to the Hellenistic era, based on ‘movable finds’. Referred to as a ‘closed harbour’ by Strabo (13.2.2) The breakwater pertains to the Roman period, but it could be pre-Roman.	See above

N°	ANCIENT TOPONYM	CURRENT LOCATION	AREA	HARBOUR-WORKS	SOURCES	NOTES	REFERENCES
115	MYTILENE, Northern harbour ('commercial')	See above	Aegean islands	- Breakwaters	See above	Within the city-walls. Breakwaters dated to the 4th cent. BC, even if Koldewey proposed an earlier chronology (5th cent. BC).	See above
116	MOUNYCHIA	Tourkolimani	Attica	- Moles as extensions of the fortifications - Towers - Shipsheds	*S.v.* Piraeus; see also Ptol. *Geog*. 3.14.	Shipsheds built around 480 BC.	Garland 1987; Lovén 2011; Navis II.
117	NAUPAKTUS	Lepanto/Navpaktos	Ozolian Locris		*It. Ant.*; Liv. 27.30; Thuc. 2.92; and 4.76.		Graauw, de 2017; Leake 1835; Lehmann–Hartleben 1923.
118	NAUPLIA	Nauplion	Argolid	- Mole (?) - Mooring stones (?)	Diod. Sic. 4.33.9; Eur. *El.* 452, and *Or.* 50-55; Paus. 2.38; Skyl. 49; Strab. 8.6.		Curtius 1851; Graauw, de 2017; Leake 1830; Lehmann–Hartleben 1923; Negris 1907.
119	NAUSSA, on the island of Paros	Naoussa, on the island of Paros.	Cyclades	- Mole (?)	Skyl. 58 (?)	Mole at Agios Anargiroi	Graauw, de 2017; Lehmann-Hartleben 1923.
120	NAXOS, on the island of Naxos	Naxos, on the island of Naxos	Cyclades		Hdt. 5.30-31; *It. Ant.*; Ov. *Met.* 3.636; Polyaenus, *Strat.* 1.30.	Literary sources reveal the existence of a harbour on the island of Naxos, but they do not specify its location.	Graauw, de 2017.
121	NISAIA	Near Pachi	Megarid		Diod. Sic. 12.66.3; Paus. 1.44.3; Plut. *Vit. Phoc.* 15; Strab. 8.1.3, and 9.1.4; Thuc. 1.103, and 2.93.	Harbour used by Megara. Connected to the city through Long-Walls.	Graauw, de 2017; Laird 1934; Lehmann–Hartleben 1923; Müller, A. 1983; Sakellariou and Faraklas 1972.
122	NISYROS, on the island of Nisyros	Mandraki, on the island of Nisyros	Dodecanese	- Breakwater (?)	Skyl. 99; *Stadiasmus* §272, and §273; Strab. 10.5.16.		Graauw, de 2017; Lehmann-Hartleben 1923; Ross 1913.
123	NOTION	Ahmetbeyli	Ionia		Diod. Sic. 13.71; Skyl. 98; Strab. 14.1.35; Xen. *Hell.*1.5.12-14.		Graauw, de 2017.
124	ODYSSEUS' PALACE	Ormos Polis, on the island of Ithaca	Ionian islands		Hom. *Od*. 4.778-785.		Cuisenier 2003; Graauw, de 2017.
125	OIANTHEIA	Tolofon, formerly Vitrinitsa	Ozolian Locris		*IG* IX I^2,717		

N°	ANCIENT TOPONYM	CURRENT LOCATION	AREA	HARBOUR-WORKS	SOURCES	NOTES	REFERENCES
126	OINIADAI	Katoxi, Trikardo	Acarnania	- Shipsheds	Xen. *Hell.* 4.6.14.	Harbour within the city-walls. Shipsheds dated to the 4th cent. BC.	Blackman 1982, and 1996-1997; Blackman and Rankov 2013; Fouache *et al.* 1998; Leake 1835; Lehmann–Hartleben 1923; Powell 1904; Sears 1904; Vött *et al.* 2004.
127	OINOUSA, islands Oinousa	Oinousa islands, opposite Chios	Aegean islands		Hdt. 1.165.		De Graauw, 2017.
128	OLIZON	Ag. Andreas/ Palaiokastro	Magnesia		Skyl. 65; Thuc. 8.26.		De Graauw 2017; Leake 1835.
129	OLOUS	Elounta	Crete		Skyl. 47; *Stadiasmus* § 350		Graauw, de 2017.
130	OROPOS	Skala Oropou, Nea Palatia	Boeotia		Diod. Sic. 13.34.3; Strab. 9.1.3; Thuc. 3.91, and 8.95.		De Graauw 2017; Lehmann-Hartleben 1923.
131	PAGAI	Alepochori	Megarid	- Shipsheds (?)	Strab. 8.1; Thuc. 1.111.	Probably within the fortifications. Ashlar blocks found on each side of Akra Loutsa (double harbour?).	Blackman and Rankov 2013; Graauw, de 2017; Lebégue 1875.
132	PAGASAI	Nees Pagases	Thessaly		Ap. Rhod. *Argon.* 1.524; Plut. *Vit. Them.* 20; Strab. 9.5.15.	Double harbour (?)	Graauw, de 2017.
133	PALAIOPOLIS, on the island of Andros	Palaiopolis, on the island of Andros	Cyclades	- Moles as extensions of the fortification	Skyl. 58 (?)	According to Lehmann-Hartleben, the moles could be dated to the 5th-4th cent. BC. In the *Periplus of the Pseudo-Skylax*, a harbour in Paros is mentioned, but the location is not specified.	Graauw, de 2017; Lehmann-Hartleben 1923; Theodoulou 2015.
134	PANORMOS, Ionia	Canakgöl, near Selcuk	Ionia		Hdt. 1.157; Liv. 37.11; Paus. 5.7.5; Strab. 14.1.20.		Graauw, de 2017.
135	PANORMOS, on the island of Naxos	Panormou, on the isle of Naxos.	Cyclades	- Mole (?)	*Stadiasmus* § 282		Lehmann-Hartleben 1923.

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136	PAROS, on the island of Paros	Paroikia Bay, island of Paros	Cyclades	- Mole (?) - Breakwater (?)	Skyl. 58 (?)	Lehmann-Hartleben refers to the existence of an 'Archaic mole'. Skylax (58) mentions a harbour in Paros, without specifying its location (see also 'Naoussa').	Graauw, de 2017; Lehmann-Hartleben 1923.
137	PASSA LIMANI	Passa Limani, small bay located between Laurion and Sounion.	Attica	- Slipways (?) - Breakwater (?)		Infrastructures not clearly dated.	Blackman and Rankov 2013; Young 1941.
138	PATRAS	Patras	Achaia		Liv. 36.21; Paus. 7.21; Thuc. 2.84.3, and 5.52.2.	Harbour connected to the *polis* through the Long-Walls (end of the 5th cent. BC).	Graauw, de 2017.
139	PEIRAEUS, in the territory of Corinth	Fragolimano	Corinthia		Thuc. 8.10-11.		Graauw, de 2017; Leake 1830.
140	PEPARETHOS	Skopelos, on the island of Skopelos.	Sporades islands	- Mole (?)	Skyl. 58.		Graauw, de 2017; Lehmann-Hartleben 1923; Ulrichs 1863.
141	PHALASARNA	1 km north of the modern city of Phalasarna	Crete	- Kothon - Channels - Quays - Towers - Shipsheds (?)	Dion. Calliphon. 118–122; Skyl. 47; S*tadiasmus* §343.	Referred to as a 'closed harbour' by Skylax. Within the city-walls.	Blackman and Rankov 2013; Graauw, de 2017; Hadjdaki 1988; Hadjdaki and Frost 1990;
142	PHALERON	Phaleron, Paleo Faliro	Attica		Diod. Sic. 11.41.2; Hdt. 5.63, 6.116, and 8.91; Nep. *Them*. 6; Paus. 1.1.2-3; Plin. *Nat*. 4.11; Plut. *Vit. Thes*. 17.	Connected to the city through Long Walls (half of the 5th cent. BC).	Garland 1987; Graauw, de 2017.
143	PHEIA	Agios Andreas, near Cape Katakolon	Elis		Skyl. 48; Strab. 8.3.12; Thuc. 2.25; Xen. *Hell.* 6.2.31.		Graauw, de 2017; Vött *et al.* 2011.
144	PHOCAEA	Foça	Ionia		*It. Ant.*; Liv. 36.43, and 37.31; Plut. *Vit. Lys.* 5.1; Skyl. 98.	Possible double harbour.	Akurgal 1956; Graauw, de 2017; Sartiaux 1921.
145	PHOENIKUS	Egri Liman (?)	Ionia		Liv. 36.45; Thuc. 8.34.		

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146	PHORKYS, on the island of Ithaca.	Vathi Bay or Dexia, on the island of Ithaca.	Ionian islands		Hom. *Od.* 13.96.		Cuisenier 2003; Graauw, de 2017.
147	PHORON LIMEN	Keratsini	Attica		Dem. 35.28, and 35.53; Strab. 9.1.14.	Known as 'Thieves' harbour'.	Dodwell 1819; Graauw, de 2017.
148	PHYGELA	Kuşadası	Ionia		Xen. *Hell.* 1.2.1-4.		
72, 116 and 194	PIRAEUS (for more information, see each harbour basin: *s.v* .Kantharos, Mounychia and Zea)	Piraeus	Attica	See each harbour basin	Diod. Sic. 11.41.2, and 12.49.5; *IG* II² 1627-1629, and 1631; Liv. 32.16, 36.42, and 45.27.11; Nep. *Them.* 6; Paus. 1.1.2-3; Philo, *In Facc.* 155; Plin. *Nat.* 4.11; Plut. *Vit. Nic.* 30.1; Polyaenus, *Strat*. 6.2. Skyl. 57; Strab. 9.1.2; Thuc. 1.93, 2.93-94, 6.30, and 8.90; Vell. Pat. 2.23; Xen. *Hell.* 2.2.4, 2.4.31, and 5.1.9.		Garland 1987; Lovén 2011; Navis II.
149	PITANE	Çandarlı	Aeolis		Plut. *Vit. Luc*. 3.4-6; Skyl. 98; Strab. 13.1.2.		Graauw, de 2017.
150	POGON	Harbour on the north-east of Damala/ Troizen	Argolid		Hdt. 8.42; Pompon. 2.3; Skyl. 52; Strab. 8.6.14.		Graauw, de 2017.
151	POIESSA, on the island of Keos	Pisses, on the island of Keos	Cyclades	- Slipway	Skyl. 58	Slipway (Classical or Hellenistic).	Baika 2010; Blackman and Rankov 2013; Graauw, de 2017; Lehmann-Hartleben 1923.
152	POTEIDAIA	Nea Potidaia	Chalcidice Peninsula		Hdt. 7.123.1; Thuc. 4.129.3	Anchorage	
153	PRASIAI	Paralio Leonidi	Laconia		Skyl. 46; Thuc. 6.105.		Graauw, de 2017.
154	PRIENE	Güllübahçe, in the estuary of the Meander River.	Ionia		Skyl. 98	Referred to as a 'closed harbour' by Skylax. Possibly a double harbour (?)	Brückner 2003; Graauw, de 2017.

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155	PROTE, island of Prote	Island of Proti	Ionian islands		Thuc. 4.13.3	Anchorage. First visual reference point when approaching the Peloponnese from the west.	Graauw, de 2017.
156	PSAMATHUS	Porto Kagio on Cape Tainaron	Laconia		Paus. 3.25.4; Skyl. 46.		Graauw, de 2017.
157	PSYRA, island of Psyra	Island of Psara	Aegean islands	- Breakwater (?)	Hom. *Od.* 3.171		Graauw, de 2017; Lehmann-Hartleben 1923.
158	PYLOS (KORYPHASION)	Northern side of Navarino Bay, in front of the island of Sphakteria.	Elis		Diod. Sic. 12.61.4; Hom. *Od.* 3.1, and 3.183; Paus. 4.36.6; Strab. 8.4.2; Thuc. 4.3.1, and 4.8.		Graauw, de 2017; Zangger *et al.* 1997.
159	PYRRHA, on the island of Lesbos	Pyrra, on the southwest coast of the island of Lesbos	Aegean islands	- Shipsheds (?)	Skyl. 97; Strab. 13.2.4; Thuc. 8.23.		Blackman and Rankov 2013; Graauw, de 2017; Theodoulou 2015.
160	RHEITHRON, on the island of Ithaca	Frikes or Kioni, on the island of Ithaca	Ionian islands		Hom. *Od.* 1.185-186		Cuisenier 2003; Graauw, de 2017.
161	RHENEIA	Rinia, on the island of Rheneia	Cyclades		Hdt. 6. 97.		Graauw, de 2017.
162	RHITHYMNA	Rethymno	Crete	- Slipways		Two slipways complexes (single and double), probably Classical or Hellenistic.	Blackman and Rankov 2013; Flemming and Pirazzoli 1981; Graauw, de 2017; Spandagos 1999.
163	RHODOS	Rhodes	Dodecanese		App. *Mith.* 4; Luc. *Act.* 21.1; Polyb. 31.7; *Stadiasmus* §271, and §272; Strab. 14.2.	Four harbour basins; three harbour basins were located within the city-walls (4th cent. BC).	Graauw, de 2017.
164	SALAMIS, on the island of Salamis	Salamis, on the island of Salamis	Attica	- Moles - Shipsheds (?)	Diod. Sic. 11.13.4; Hdt. 8.41-42; Paus. 1.35.3; Polyaenus, *Strat.* 1.30.3; Skyl. 57.	Submerged walls have been interpreted as possible remains of shipsheds.	Blackman and Rankov 2013; Graauw, de 2017; Lehmann–Hartleben 1923; Lolos 1995; Theodoulou 2015.

N°	ANCIENT TOPONYM	CURRENT LOCATION	AREA	HARBOUR-WORKS	SOURCES	NOTES	REFERENCES
165	SAMOS, Pythagoreion	Pythagoreio, on the island of Samos	Aegean islands	- Moles as extensions of the fortifications (?) - Breakwater - Shipsheds (?)	Hdt. 3.60; *It. Ant.*; Liv. 37.13, and 37.22; Luc. *Act.* 20.15; Polyaenus, *Strat.* 3.6; Plut. *Alc.* 27; Skyl. 98; Strab. 14.1.14; Thuc. 8.51; Xen. *Hell.* 1.4.8.	Referred to as a 'closed harbour' by Skylax. Shipsheds are documented only by literary sources (Hdt. 3.45.4).	Blackman and Rankov 2013; Graauw, de 2017; Simossi 1991, 1993, and 1994.
166	SAMOTHRACE, on the island of Samothrace	Paleopolis, on the island of Samothrace	Agean islands		*It. Ant.;* Plut. *Vit. Aem.* 26; Skyl. 67.		Graauw, de 2017; Tiverios 2008.
167	SERIPHOS, on the island of Seriphos	Seriphos, on the island of Seriphos	Cyclades		Skyl. 58		Graauw, de 2017.
168	SKIATHOS	Skiathos, on the island of Skiathos	Sporades islands	- Mole (?)	Skyl. 58	A mole has been identified, generally referred to as 'ancient'. This mole could be dated to the Byzantine period; however, it is possible that it was built on an ancient mole (maybe dated to the Classical era).	Ginalis 2014; Graauw, de 2017.
169	SICYON	Vasiliko	Sicionia		Paus. 2.12.2; Polyaenus, *Strat*. 5.16.3; Polyb. 5.27; Strab. 8.6.25; Thuc. 1.111; Xen. *Hell*. 7.3.2.		Graauw, de 2017.
170	SIDE	Velanidia (?)	Laconia		Skyl. 46		Graauw, de 2017.
171	SIGEION	Promontory on the north-west of Kumkale.	Troad		*It. Ant.*; Liv., 44.28.6; Procop., *Vand.* 1.13.5; Thuc. 8.101.		Graauw, de 2017; Tiverios 2008.
172	SIPHAI	Aliki	Boeotia	- Moles as extensions of the fortifications (?) - Shipsheds (?)	Skyl. 38; Thuc. 4.76, and 4.89.	Remains on the shore have been possibly interpreted as shipsheds; however, these remains seem to pertain to the Roman period.	Blackman and Rankov 2013; Fossey 1988; Graauw, de 2017; Heurtley 1923-1925; Schwander 1977.
173	SKANDEIA	Kastri, on the island of Kythera	Ionian islands		Paus. 3.23.1; Thuc. 4.54.		Graauw, de 2017.
174	SKIONE	Skioni	Chalcidice Peninsula		Dem. 35.10; Thuc. 5.2.		Graauw, de 2017.

N°	ANCIENT TOPONYM	CURRENT LOCATION	AREA	HARBOUR-WORKS	SOURCES	NOTES	REFERENCES
175	SMYRNA	Bayrakli, Izmir	Ionia		Strab. 14.1.2, and 37.	Referred to as a 'closed harbour' by Strabo (14.1.37).	Cook 1958; Grauuw, de 2017; Kayan and Öner 2013.
176	SOLLION	Between Leucas and Palairos	Acarnania		Thuc. 2.30, and 3.95.		Murray 1985.
177	SOUNION	Sounion	Attica	- Shipsheds (?) - Slipways - Fortifications with towers (?)	Hdt. 6.87; Hom. *Od.* 3.278; Paus. 1.1.1; Philo, *In Flacc.* 156; Skyl. 57; Xen. *Hell.* 5.1.23.	The chronology of the shipsheds and fortifications is under discussion, fluctuating between the end of the 5th cent. BC and the Hellenistic era.	Blackman and Rankov 2013; Chroniques 1923; Graauw, de 2017; Kenny 1947.
178	STRYME	Cape Molyvote	Thrace		Dem. 50.22.		Arrington *et al.* 2013; Graauw, de 2017; Tiverios 2008.
179	SYBOTA	On the Thesprotian mainland, protected by the Sybota islands.	Epeirus		Ptol. *Geog.* 3.13.2; Thuc. 1.50-52.		Graauw, de 2017.
180	SYBRITA	Agia Galini	Crete		Skyl. 47; *Stadiasmus* § 332.		Graauw, de 2017.
181	SYME, island of Syme	Island of Syme	Aegean islands		Plin. *Nat.* 5.36; Thuc. 8.43.1.		
182, 183 and 184	THASOS, on the island of Thasos	Thasos, on the island of Thasos	Aegean islands	See each harbour basin	Dem. 50.22; Hdt. 6.46-47; Skyl. 67; Thuc. 4.104-105; Xen. *Hell.* 1.1.12.	See each harbour basin	Blackman and Rankov 2013; Empereur and Simossi 1990; 1991 and 1992; Graauw, de 2017; Grandjean and Salviat 2000.
182	THASOS, commercial harbour	Northern coast of the island of Thasos; west of Cape Evraiokastro	Aegean islands	- Breakwater	See above	Breakwater dated to the 6th-5th cent. BC.	See above
183	THASOS, military harbour	Northern coast of the island of Thasos; south of the commercial harbour	Aegean islands	- Moles as extensions of the fortifications - Shipsheds - Towers	See above	Moles built at the beginning of the 5th cent. BC; shipsheds built in the 5th cent. BC.	See above

N°	ANCIENT TOPONYM	CURRENT LOCATION	AREA	HARBOUR-WORKS	SOURCES	NOTES	REFERENCES
184	THASOS, third harbour (?)	South of the military harbour	Aegean islands			The existence of this harbour is only conjectural.	See above
185	TELEMACHUS BAY, Ithaca	Agiou Andreou bay, on the island of Ithaca	Ionian islands		Hom. *Od.* 15.36-37.		Cuisenier 2003; Graauw, de 2017.
186	TENEDOS	Island of Baazcaada, in front of Troy.	Troad	- Breakwater (?)	Arr. *Anab.* 2.2; Hom. *Od.* 3.157; *It. Ant.*; Liv. 44.28.1-3; Polyaenus, *Strat.* 2.24; Skyl. 95.		Chandler 1817; Graauw, de 2017; Lehmann-Hartleben 1923.
187	TENOS, on the island of Tenos	Tenos, on the island of Tenos	Cyclades	- Mole (?)	Hdt. 6.97; Skyl. 58; *Stadiasmus* §284.		Graauw, de 2017; Lehmann–Hartleben 1923.
188	TEOS	Sığacık	Ionia		Liv. 37.27; Skyl. 98; Strab. 14.1.30.		Graauw, de 2017; Lehmann-Hartleben 1923.
189	THERME	South of Thessalonike	Mygdonia		Hdt. 7.121, and 7.183.		Graauw, de 2017
190	THORIKOS	Porto Mandri	Attica		Skyl. 57; Thuc. 8. 95.	Fortifications built to facilitate surveillance of the harbour (5th cent. BC). Possible double harbour (?)	Graauw, de 2017; Lehmann-Hartleben 1923; Wordsworth 1840.
191	TORONE	Torone	Chalcidice Peninsula	- Breakwater (?)	Thuc. 5.2; Skyl. 66.		Beness *et al.* 2010; Graauw, de 2017; Dunn, Beness and Hillard 2007.
192	ZACYNTHUS, on the island of Zacynthus	Zakynthos, on the island of Zakynthos	Ionian islands		*It. Ant.*; Skyl. 46; Thuc. 4.8.		Graauw, de 2017.
193	ZAGORA, on the island of Andros	Plaka Bay, on the island of Andros	Cyclades			Abandoned around 700 BC.	Cambitoglou *et al.* 1988; Graauw, de 2017; Torelli and Greco 1983.
194	ZEA	Piraeus	Attica	- Moles as extensions of the fortifications - Towers - Shipsheds	*S.v.* 'Piraeus'	Shipsheds built around 480 BC.	Garland 1987; Lovén 2011; Navis II.

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