

Harbours of Byzantium

The Archaeology of Coastal Infrastructures

Edited by

Alkiviadis Ginalis



ARCHAEOPRESS PUBLISHING LTD
Summertown Pavilion
18-24 Middle Way
Summertown
Oxford OX2 7LG
www.archaeopress.com

ISBN 978-1-80327-813-1
ISBN 978-1-80327-814-8 (e-Pdf)

© the individual authors and Archaeopress 2024

Cover: Southwestern harbour of Byzantine Kassandreia in Chalkidiki, Greece (A. Ginalis)

All rights reserved. No part of this book may be reproduced, or transmitted, in any form or by any means, electronic, mechanical, photocopying or otherwise, without the prior written permission of the copyright owners.

This book is available direct from Archaeopress or from our website www.archaeopress.com

Contents

List of Figures	ii
Editor's Preface	vii
1. Byzantine Imperial Policy Towards Building and Maintaining of Ports in the Eastern Mediterranean in the 6th Century AD and the Technology Involved.....	1
<i>Ruthy Gertwagen</i>	
2. Was Roman Marine Concrete Used in Byzantine Harbour Construction? An Unanswered Question....	34
<i>Robert L. Hohlfelder</i>	
3. Ports, Harbours, and Landings of the Byzantine Terra d'Otranto	46
<i>Paul Arthur</i>	
4. The Late Antique and Byzantine Port of Thessalian Thebes – The Archaeology of its Coastal Infrastructures	65
<i>Alkiviadis Ginalis and Anna Gialouri</i>	
5. The Port Facilities of Thessaloniki up to the Byzantine Era	86
<i>Marina Leivadioti</i>	
6. Remarks on the Urban Transformations of the Harbours of the North Aegean Coastline during the Early Christian Era as well as on their Links with the Road Network	100
<i>Flora Karagianni</i>	
7. An Interdisciplinary Approach to the Study of the Ancient Harbour Site of 'Karon Limen' or 'Portus Caria/Carea', Bulgaria	113
<i>Preslav Peev, Alkiviadis Ginalis, Bogdan Prodanov, Grigori Simeonov</i>	
8. Bathonea (?): A Newly Discovered Ancient Port in the Hinterland of Byzantium/Constantinople	127
<i>Şengül G. Aydingün</i>	
9. A Late Antique and Byzantine Harbour in Constantinople: The Theodosian Harbour at Yenikapı. History, Archaeology, and Architecture	134
<i>Ayşe Ercan-Kydonakis</i>	
10. Between Yavneh-yam and Rhinocorura: The Byzantine Portals of the Southern Levant	149
<i>Gil Gambash</i>	
11. The Harbour Installations of Lake Mariout (Alexandria Region) in the Late Roman Empire (4th–7th Centuries AD)	158
<i>Valérie Pichot</i>	
Appendix 1. Conference Programme International Conference on 'Harbours of Byzantium' (January 11th–13th 2018).....	178
Appendix 2. Contributors in Alphabetical Order.....	179

Editor's Preface

Christianity, Roman tradition and ideology, as well as Greek cultural heritage, have been labelled as the pillars of the Byzantine Empire. In fact, the real crux and enabler of power in an empire that combined the Occident with the Orient was its control over the seas. As such, seafaring constituted the formula of success for dominance of the Mediterranean, playing a key role in communication, military activities, and, especially, economic exchange. But how does one get from land to water? The linking gates are coastal installations, i.e. ports, harbours, and other infrastructures. These function as economic hubs, cultural and social meeting points, as well as gateways for communication and connection.

Even though the study of harbour sites and port networks of the Byzantine Empire constitutes a relatively new research field, it has nevertheless received significant attention over the last few years, as we can see from the instigation of various projects and the staging of conferences. However, attention is rarely paid to analyses of physical harbour remains and their impact on the general development of Late Antique and Medieval architecture, economy, or trade networks.

As such, in 2018, an international conference on the *Harbours of Byzantium* was organised at the Institute for Advanced Study of the Hanse-Wissenschaftskolleg in Delmenhorst, Germany. This event was intended to focus particularly on the archaeology of Byzantine coastal sites, including both harbour infrastructures *per se*, as well as associated facilities and affected landscapes. Leading scholars in the field from twelve different countries presented new material and data with which to understand the development of harbour architecture and coastal activities from Late Antiquity to the Middle Ages. The papers set out to cover sites from all provinces of the Byzantine Empire, stretching from Italy in the West to the Levantine coast in the East, and the Black Sea in the North to Egypt in the South. This allowed a general overview for comparative analyses and discussions on various aspects of Byzantine harbour networks and maritime connectivity.

Accordingly, the current volume provides a series of scientific papers deriving from presentations given at the conference. Beyond general approaches to the study of Byzantine harbour archaeology, the contributions offer a representative picture of harbour activities across the historical and geographical boundaries of the Byzantine Empire. Although it is impossible to reflect a comprehensive picture of the entire sweep of coastal landscapes, this work hopefully provides a basis for future comparative research in Byzantine harbour studies – on a local, regional, and supra-regional level.

The conference programme is included in the Appendices. The differences between the conference programme and the final version of this volume are explained by the fact that some scholars who submitted abstracts were ultimately unable to attend, and some who did attend and gave their papers did not submit them for publication. Fortunately, other colleagues agreed to contribute to this volume and I am most grateful to them for so doing.

I would like to express my deepest gratitude to all participants in the Delmenhorst Conference for presenting papers that provided unique insights, not just into ongoing excavations and investigations related to harbour installations, but also into hitherto understudied aspects of coastal infrastructures. It has been a considerable challenge to assemble this volume, and I am therefore particularly indebted to all authors who contributed and enriched this publication. Bearing in mind the time-consuming work of editing and unifying the papers, etc., as well as the difficulties brought on by the COVID pandemic, I have done my best to ensure as prompt a publication as possible.

Thanks must go here to Dr Susanne Fuchs and her team from the Institute for Advanced Study of the Hanse-Wissenschaftskolleg for their support in organising the conference in Delmenhorst. I am also sincerely grateful to David Davison and Mike Schurer from Archaeopress for agreeing to publish this volume and for guiding this work through to publication, their technical help, and the quick production of the printed version.

Alkiviadis Ginalis

1. Byzantine Imperial Policy Towards Building and Maintaining of Ports in the Eastern Mediterranean in the 6th Century AD and the Technology Involved¹

Ruthy Gertwagen

This contribution seeks to analyse the Byzantine Imperial policy in the 6th century AD regarding building and maintenance of ports and the technology involved. This is an interdisciplinary study that includes history, marine archaeology, geo-archaeology, urban landscape, and construction engineering. It deals mainly with the sites where modern scholarship, either historians, archaeologists, or both, claims to have identified Imperial initiations and infrastructures. The paper mostly focuses on Constantinople and its immediate surroundings. It argues that the policy of 6th-century emperors towards building and maintenance of ports in the capital, around the Sea of Marmara, and in the straits of the Dardanelles in the south and of the Bosphorus in the north, reflects their strategy in Late Antiquity *Palestina Prima*, focusing mainly on Caesarea Maritima, which has been the object of more underwater archaeological and geo-archaeological surveys and excavations than any other ancient harbour site in the Mediterranean, roughly between 1975 and 2007; references to other places, when necessary, are also made. Since we deal with historical periods and the various disciplines involved in this research, and historical evidence is used to prove and support their arguments, the paper starts with the historic documentation.

The historic evidence

The number of documents directly dealing with Imperial instigation or sponsoring of building and maintenance of ports and the technology involved in the Early Byzantine period and in the Byzantine geographic space is very limited. Two types of historic evidence are introduced: one is panegyrics of ruling

emperors, and the other, administrative. Both are used by archaeologists and historians to point to direct Imperial interventions, some of which they claim to have identified also on site.

There are three panegyrics directly connected to our subject in the 6th century AD: the first is that of **Procopius of Gaza** (AD 460-530) relating to the emperor **Anastasius I** (AD 491-518); the second is of **Procopius of Caesarea** of Justinian I (AD 527-565), the *De Aedificiis* (AD 554) (on the dating see **Cameron** 1985: 9-10; **Greatrex** 1994). The third is **Corippus'** poem in four books entitled *In laudem Iustini Augusti minoris/In praise of the younger Justin (II)* (AD 565-574). **Averil Cameron** contends that this poem is not a formal panegyric, but a hybrid comprised of panegyric and epic (**Cameron** 1976: 2).

This contribution looks at three sets of 6th-century administrative evidence, written by historians with background in rhetoric, philosophy, or law, who worked in the Imperial bureaucratic mechanism. The first is **Marcellinus** (d. AD 534), usually designated *comes*, who was an emigrant resident of Constantinople yet served as Justinian I *cancellarius* before the crowning of Justinian I as emperor. His chronicle, constituting an important contemporary source for the reigns of the emperors Anastasius I and Justin I, as well as for the early years of Justinian I, was based on the so-called 'City Chronicle' of Constantinople (**Marcellinus** 1995: xix-xxv). The second source is **John the Lydian**, who was originally from Philadelphia in Lydia in Asia Minor and lived during the first half of the 6th century AD in Constantinople, where he made a career spanning the reigns of Anastasius I (AD 491-518), Justin I (AD 518-527), and Justinian I (AD 527-565). Having criticised the reign of emperor Justinian I as being responsible for the chaos in administration, finances, and cultural environment, he had to end his public life in late 551 or early 552 at the age of 61 or 62. On his retirement, however, he was placed by Justinian I as professor at the *Pandidakterion*, where he worked on writing various historical works (**Mass** 1992: 24-31). The third set of evidence is provided by **John Malalas** (AD 491-578), who was originally from Antioch. He served in the early 6th century as an official in the civilian and military bureaucracy at this city's

¹ I would like to thank Dr Alkiviadis Ginalis for inviting me to the conference on *Harbours of Byzantium* that generated this article, which is an enlargement of the original paper. The Greek and Latin texts, unless otherwise indicated, were translated by the present author. I would like to thank Dr Ivor Ludlam of the University of Haifa for following my reading of the Greek texts. I would like to dedicate this paper to Prof. Robert L. Hohlfelder, who was the initiator of the Joint Expedition at Caesarea Maritima (CAHAP) and one of its directors; Prof. Hohlfelder encouraged me through my MA studies to follow my interdisciplinary research and to insist on my PhD thesis and later studies regarding medieval ports within the difficult environment for female scholars during the evolving period of the field of marine archaeology in Israel.

office of the *comes Orientis*, which was responsible to the emperor, through the Praetorian Prefect, for the whole Eastern diocese – *Palestina Prima* and *Secunda* included. He therefore must have had access to the archives in this office, which contained information to the whole region, both military and civilian, administered from Antioch. Malalas left Antioch for Constantinople following Justinian I's abolishment of the office of the *Comes Orientis* in AD 535 (Malalas 1986: xxi-xxiv). What follows is an analysis of the historic evidence related to the renovations and maintenance of ports or marine installation of each of the relevant emperors.

Anastasius I

Chronologically speaking, the first historic evidence that allegedly points to this emperor's intervention in renovation and maintenance of ports or marine installation is the panegyric of Procopius of Gaza. This encomium was delivered at the setting up of the statue of the emperor Anastasius I in Gaza. The date of its compilation in writing is controversial, between AD 498 and AD 503/4 (see discussion by Jones 2007: 456, n. 4; Haarer 2006: 278), or even AD 513-514 (Chauvot 1986: 107).

Four chapters (18-21) at the end of the encomium describe the emperor's allegedly generous deeds for the benefit of four cities in his realm. The first of these chapters concerns a certain *Holy City* (πόλις ἱερά), which is not explicitly named. The next is implicitly entitled 'a city named after Caesar' (τοῦ Καίσαρος πόλιν ἐπώνυμον); due to the maritime environment it is evidently *Caesarea Maritima*. The third is also implicitly named: 'the (city) of Alexander' (τὴν τοῦ Ἀλεξάνδρου); since this chapter discusses the repairs made at the Pharos or the lighthouse, it can be obviously identified as *Alexandria* in Egypt. The last chapter concerns an unnamed city; however, the indirect reference to its topography and the praise of the long wall, generally known as the Anastasius wall (referred to later), makes it clear that it refers to *Constantinople* (Procopius of Gaza 1865).

Two chapters discuss repairs in relation to port infrastructure, i.e. Chapter 19, dealing with the port of Caesarea Maritima (Panegericus, cited in transl. by Hohlfelder 2000: 44),² and Chapter 20, with the Pharos/lighthouse at the north-western end of the port of Alexandria (Procopius of Gaza 1865: 2817D-2820A). Procopius knew both cities intimately: in Alexandria he studied and started his career as a rhetor; in Caesarea Maritima he stayed on his way back from Pamphylia to Gaza between AD 491-495 (Chauvot 1986: 91, n. 63). His descriptions of both cities, therefore, are those of an eyewitness. The chapter on Caesarea Maritima deals

with the marine space and the free-standing moles in the sea of the former outer basin of the Herodian harbour, accurately described by Josephus Flavius in the 1st century AD (Hohlfelder 1993: 687-9; Hohlfelder 2000: 317), whereas at Alexandria the light house was originally built on a reef.

The chapter relating to Caesarea Maritima includes the following:

'The harbour [λιμὴν] of the city named after Caesar had disintegrated through age and lay open to every threat of the sea. Its structures no longer measure up to the category of harbour, but its former condition it kept *in name* alone. You did not ignore her as she asked for help continually, bewailing the merchant vessels, which, after escaping the open sea, often suffered shipwreck in the harbour. Indeed, those requiring the goods had the more pitiable anguish, for seeing the wares they needed perish, all they could do was watch. But by your will the city is rejuvenated, boldly receives ships, and is full of supplies.' (Hohlfelder 2000: 44)

The difference between Procopius' detailed description of the derelict state of the port of Caesarea and the lack of specifics regarding its alleged renovation by Anastasius I is striking; the panegyric only vaguely declares that, thanks to the emperor's intervention, the city could welcome ships and prospered once more. It is highly likely, from the elaborate description of the derelict condition of the former Herodian port, and the effects on the citizens, that the summary was provided by an eyewitness, i.e. Procopius himself, when, as noted above, he stayed at Caesarea Maritima between AD 491-495. In other words, the port had been in its ruinous, fatal state by the late 5th century AD.

That said, there is an inevitable question that begs for an answer: how can one explain Procopius' ambiguity regarding the specifics of the renovations at Caesarea Maritima? Undoubtedly, in contrast to the specific contributions he attributed to Anastasius I in the other three cities mentioned above, the vagueness regarding Caesarea Maritima is conspicuous and perplexing. Was it, as suggested, that Procopius specifically did not want to repeat the obvious that the port had been rebuilt to accommodate ships and those enabling the restoration of prosperity to Caesarea (Hohlfelder 2000: 46)? The Pharos at Alexandria, one must admit, was of no less importance than the port of Caesarea, and yet Procopius details the works accomplished there; and, for that matter, the vagueness regarding Caesarea's port is at odds with the descriptions in the chapters that deal with all the cities in this group. One might suggest that we avoid literally adapting the text regarding Caesarea Maritima.

² Detailed discussion below.

A correct reading of the text should be made within its original textual setting, i.e. its inclusion in the specific style of literature known as *panegyric* that was aimed at glorifying the emperor and, therefore, prone to rhetorical symbolism and exaggeration. Furthermore, this special chapter on Caesarea Maritima does not stand by itself, but is to be taken with the other three, which Procopius treated as a separate and distinct group. The scholars who have translated and interpreted the entire encomium have scrutinised the opus from the perspectives of literature and rhetoric, concentrating on literary allusions and language against the political and cultural background of the period. Regarding these four cities, however, they translated the chapters without analysis, merely introducing available historical and archaeological information, taking them at face value. (Chauvot 1986: 159-163, Amato *et al.* 2014: 323-327). Of the four chapters, only two have been thoroughly studied by modern scholarship, albeit each in isolation, i.e., as said above, Caesarea Maritima and the *Holy City* (discussed below). A fresh, thorough examination of the four chapters as a separate and whole group, something that is urgently required, is beyond the scope of this current contribution. Nevertheless, since it is claimed that no scholar has yet challenged the core message of an Anastasian harbour restoration at Caesarea Maritima (Hohlfelder 2000: 44), and that the text of this panegyric was used as it is, it seems important to try and shed light on several hitherto overlooked problematic facts that stress the dangers in treating the text literally.

Carefully reading these four chapters, one notices the common denominators shared by the cities. First, none of the cities is explicitly mentioned by name. As a matter of fact, the names of the first and last are missing. Of the four cities, the first, named *Holy City*, is most problematic in terms of identification. Several scholars have contended for Hierapolis in Syria (Chauvot 1986: 160-161; Di Segni and Hirschfeld 1986: 264; Haarer 2006: 232, n. 11) and others for Jerusalem (Amato *et al.* 2014: 323, n. 104; Amity and Gibson 2014; Jones 2007: 458-463, 465). As is argued later, the omission of the explicit names of the cities is not accidental.

The second common denominator is the inability to provide solid evidence for the contribution of Anastasius I to specific building or repair projects in the first three cities, as attributed to him by the panegyric and starting with the *Holy City*. Jones, who strongly advocated for Jerusalem, claimed that the aqueducts originally built by King Herod the Great to direct water from the area of Hebron to Jerusalem were repaired, according to Procopius of Gaza, by Anastasius I. To support his argument, Jones introduces allegedly strong archaeological evidence: an inscription, datable to the 6th century AD, on the treatment of the precincts of the aqueducts to avoid impediments to the flow of water.

However, one should emphasise that the inscription was not found in situ, but first seen in the hands of an antiquities dealer in Jerusalem. A typed document from the Palestine Exploration Fund's archive in London, together with a photograph and letters from British Museum specialists (1934), specifies that the inscription was found 'in the region of the aqueduct which conveyed the waters of 'Ain Arroub in the Hebron District to Jerusalem' (Amity and Gibson 2014: 6, n. 23). This comment was made arbitrarily, without scientific backing. Nevertheless, Jones uses it as it is, although he himself admits that: 'While it would be rash to infer from Procopius that the inscription must refer to Anastasius I, nevertheless the juxtaposition with his speech is at the least intriguing.'

Jones claims that the inscription should be dated to the reign of Anastasius I, c. AD 500, and not to Justinian I, as has been hitherto argued. In his opinion, Procopius was speaking about the repairs and reinforcements of these two aqueducts prior to AD 501 or 502 (Amato *et al.* 2014: 325, n. 109; Jones 2007: 464-465). David Amity and Simon Gibson³ hold that the inscription is meant to refer to the rebuilding of only the lower aqueduct in AD 500, which fits the evidence from the excavations in 1898, showing that the aqueduct cut through the 5th-century Byzantine walls of Jerusalem. It is, however, noteworthy that this is only a relative and a long-durée dating. Furthermore, Amity and Gibson seek to rely on the afore-mentioned arbitrarily made speculation by Jones (Amity and Gibson 2014: 29-20, n. 129). The evidence adduced here points to a lack of solid, archaeological proof for dating the repairs to AD 500. Furthermore, Jones' attribution to Anastasius I of the repairs to the aqueduct (or aqueducts) around Jerusalem, and his use of the inscription and the panegyric to support his identification of the *Holy City* in Procopius of Gaza's encomium as Jerusalem, should be dismissed. The identification of the *Holy City* must remain, therefore, unresolved.

There is no solid evidence linking Anastasius I to direct intervention in the repairs of the foundations of the *Pharos at Alexandria*, the third city in the group. The great lighthouse was originally erected in the 3rd century BC on the eastern edge of the eponymous Pharos Island, at the northern extremity of the eastern harbour; the immense structure measured 113 m in total height and acted as a beacon for sailors far, far out to sea. It guided the mariners' course among the treacherous reefs that lay just beyond the Pharos – by day using a mirror to reflect the sun's rays, and by night a fire burned at its top. Procopius vividly describes, highly likely having seen it himself, the mariners

³ The archaeologists who, in the course of their fieldwork, dated these two aqueducts and the periods in which they were subsequently used.

cheering the Pharos, grateful for their safe arrival (Gkikaki and Lemi 2014: 155-156), and commenting on its poor state of repair: 'The sea had beaten it from the rear and had gradually stripped it of its defences (?), so that, having by now come close to it, it began to shake it and was just short of razing it to its foundations' (Panegyricus: 2817D-2820A).

According to the *panegyric*, Anastasius I allegedly ordered it to be encircled with rocks (προβόλοι), capable of holding back the depredations of the waves. There is an epigram recording the function of the Pharos and mentioning a certain Ammonius, who is not known from any other source as being responsible for the repairs. Chauvot, who introduced the epigram after translation, arbitrarily hypothesised that it might have been related to the repairs mentioned by Procopius of Gaza's encomium (Amato *et al.* 2014: 325, n. 113; Chauvot 1986: 163, 260-261, n. 390). Following Chauvot, Haarer adds that Ammonius was a patrician of the 5th-6th century, venturing, without any scientific support, that the repairs may have been instigated by Anastasius I (Haarer 2006: 232, n. 13).

It should be pointed out that local initiatives, with the emperor's direct financial support, are explicitly indicated by written sources or inscriptions in direct connection to the specific building projects; such was the case with the fortifications and towns in the eastern provinces, e.g. Dara or Euchaita in northern Syria, as well as the defensive building enterprises undertaken in the Balkans and the Black Sea (Haarer 1986: 66-68, 70-71, n. 161-162, 165, 174, 187-188). There the epigraphic evidence goes hand-in-hand with numismatics, or in connection with the construction of monumental buildings, e.g. the bathhouse, portico, and basilica at Scytopolis/BeitShean in *Palestina Secunda* (synthesised by Haarer 1986: 109-114, 235-238, n. 37-38).

This evidence is in sharp contrast to the absence of any direct connection of Anastasius I with the repairs to the Pharos at Alexandria and the alleged renovation of the former Herodian port of Caesarea Maritima. In other words, one might safely claim that both historians and archaeologists made the same mistake, i.e. literally adapting the *panegyric* of Procopius of Gaza. Chauvot and Haarer did this within the framework of describing the emperor's projects, including the Pharos at Alexandria; Jones did so to support his identification of the *Holy City*. The underwater archaeologists used the text to support their theories regarding the lifespan of the port at Caesarea Maritima, thanks to Imperial intervention, and the alleged infrastructures involved they claim to have identified. The archaeologists working on the aqueducts taking water to Jerusalem literally adapted the encomium in their dating of the structures to the reign of Anastasius I.

If by the information so far adduced it could be safely argued against the *panegyric* as a provider of trustworthy facts regarding the involvement by Anastasius I in repairs or building enterprises in those three cities, there is, however, one exemption in the list of these four chapters that cannot be ignored, which concerns the fourth city. As stated above, although not mentioned by name, it can safely be identified as Constantinople.

While generally mentioning the richness of the city and its ports, Procopius of Gaza emphasises the long wall built by Anastasius I to protect the city. Several other sources of the 6th century AD, e.g. Procopius of Caesarea, also attribute the building of the wall to Anastasius I, which, by the 6th century AD, was already known as the 'Anastasian Wall'. The building enterprise took place probably in AD 502, after the Bulgar raid into Thrace. It was constructed west of Constantinople and stretched, over 56 km, from the Sea of Marmara in the west, to the Black Sea and Lake Derkos in the east, so as to provide effective security to the capital and its suburbs (Crow and Ricci 1997: 239, n. 28; Di Segni 1986: 264, n. 43).⁴

Two questions spring to mind here: why put Constantinople in the same list as the previous cities, and why was it not mentioned by name? The reply, which is complicated, reveals the third common denominator the four cities share, i.e. each was a capital. Based on the geographical data regarding the *Holy City*, it was a regional religious capital of the Eastern Mediterranean; Caesarea Maritima was the capital of the Roman and Byzantine Province of *Palestina Prima*; Alexandria was the capital of Egypt; and Constantinople the capital of the entire Roman/Byzantine Empire. If it were so obvious, why not mention the cities by their real names?

We also notice that Procopius referred to two of the four cities not by their names but by the persons they had originally been named after: Alexandria after Alexander the Great, and Caesarea after Octavianus Caesar, both founders of empires.⁵ After the annexation of Egypt in 22 BC, Octavianus received the title *Augustus*, an adjective derived from the verb *augere* (meaning to increase, to expand; Angelova 2015: 22-23). Both, Alexander and Augustus were considered Gods according to the Hellenistic cultural mentality introduced after Alexander's conquests in the east

⁴ Di Segni contends that Anastasius I only restored the Long Wall, a project that may have taken place according to the *Chronicon Paschale* between AD 507 and AD 518 (the exact year is lost), although some historians indicate an earlier date of AD 497.

⁵ Alexander as the founder of the Hellenistic and Octavianus Caesar as the first emperor of the Roman Empire, during whose time its territories were greatly expanded. I am aware that the Latin term *empire* is anachronistic for the Hellenistic period.

and implemented by his heirs, first by the Ptolemies in Egypt. This Hellenistic mentality was later adapted by the Romans. In the post-heroic era of the ancient Mediterranean world, only the founding of a city could legitimately be considered a godlike act and only founders were able to have their human faults overlooked and receive divine honours. Drawing on Roman and Hellenistic ideas on founding, Augustus' exceptional authority in the State was justified and explained (Angelova 2015: 4). One can safely presume that by Procopius of Gaza's attribution to the building programmes of the emperor Anastasius I, which were essential for the daily life of these four capitals, although Anastasius did not found them, Procopius rhetorically aligned the emperor with Alexander the Great and Augustus Caesar, i.e. as a ruler of vast territories and even as a God, even if only in allusion. In one of the previous sections of the *panegyric*, Procopius provides Anastasius I with a lineage to Heracles through his grandparent and through him to Zeus himself (Amato *et al.* 2014: 284, lines 23-25). It is analogous to Octavianus/Augustus, whose family claimed descent from two deities – Venus and Mars (Angelova 2015: 23-24, 60). No doubt such 'pagan' *topoi* used by Procopius of Gaza contradict the Christian ethos of the period. One can safely add that it was also heavily ironic, due to the obscure parents and lineage of Anastasius I and that, in his early life and career, he never even reached the rank of senator. Anastasius became emperor mainly due to the preference of the empress, and only then did he receive the support of the senate, the army, and the populace of Constantinople, after which he was crowned by the patriarch (Haarer 2006: 1-6; Lee 2013: 161).

This pagan representation of Anastasius enabled Procopius to avoid mentioning the name of Constantinople, since it would be directly connected to Constantine I. In doing so, Procopius drew a line, that was not to be crossed, preventing explicit comparison of Anastasius to Constantine, the founder of Constantinople as the 'New Rome' and the 'first Christian ruler of the Christian Roman Empire'. Founding Constantinople, the city named after Constantine, announced the first Christian emperor as the progenitor of a new Imperial line. Christianity adapted the pagan idea while processing it to its needs. Thus, founding was a divinely sanctioned accomplishment in which a son of a deity undertook to establish a city (Ahrweiler 1966: 541-548).⁶ The ambitious building projects in Constantinople and other parts of the Empire by Constantine I linked him to the first Roman Imperial founder, i.e. Augustus (Angelova 2015: 5, 27, 115).

⁶ The promulgator of this idea was Eusebius of Caesarea, the man behind Constantine's move. After Constantine's death, Eusebius 'revised' his opus, emphasising Constantine's status as subordinate and his devotion to God (Angelova 2015: 205-218).

However, since Anastasius I was, after all, Christian, Procopius bestowed him, although not overtly, with similar Christian virtues by emphasising in previous chapters of the encomium his generosity and compassion towards people. These 'divine' virtues politically legitimised the sovereignty of Anastasius; and the population of Constantinople would unanimously choose him as emperor. In other words, before taking the title of *basileus* he behaved as a holy man. Procopius portrays the reign of Anastasius I as the counterweight for all the negative periods the empire had to suffer until then, and extolled the emperor's two traditional Roman roles – secular and divine (Amato *et al.* 2014: 250-256).

To sum up, these four chapters that end the panegyric were designed, as their style of writing and symbolic motifs show, to idealise, and thus legitimatise, Anastasius I as the Imperial authority of the Roman Empire. The use of pagan *topoi* by Christian intellectuals was typical for the Late Antique period, and mainly in Gaza, which, in the late 5th and 6th centuries AD, continued to preserve its pagan attitudes despite the introduction of Christianity, which ushered in the destruction of pagan institutions. Moreover, Bishop Porphyrius, who converted Gaza to Christianity with Imperial support, introduced new institutions which, in reality, were continuations of the old ones, i.e. the festivals within the framework of which Procopius delivered the encomium. (Bas Ter 2007: 174-77). Furthermore, considering the deliverance of the panegyric at the setting up of the emperor's statue in Gaza as part of his public role – Procopius was a sophist teacher at Gaza's school – it is therefore safe to argue that the encomium was deemed a rhetorical exercise and not in relation to real events. In other words, the ambiguous description regarding the alleged renovation of the former Herodian port at Caesarea Maritima was because such a project was not carried out. Indeed, only in connection with Constantinople was Procopius to refer to a real monument initiated by Anastasius I, i.e. the eponymous wall. However, Procopius bypassed this exception by omitting the name of the city and by depicting the building enterprise in terms of the distant mythological/legendary past: 'Homer himself, it is alleged, on seeing this would have forgotten about the wrath of Achilles and summoned the Muses to celebrate it worthily' (Amato *et al.* 2015: 300, Ch. 21).

On the other hand, the three contemporary historians with bureaucratic backgrounds did report on the alleged enterprises of Anastasius I that were connected to ports. The first two, John the Lydian and John Malalas, included these initiatives among various other projects of Anastasius I, but only in general terms, without specifying the names and locations where they were carried out. According to John the Lydian:

'Consequently, no city, fort, harbour, or any place at all in the whole Roman State went without its share in the grants made by him [i.e. Anastasius I], if it had need of one' (John the Lydian 1971: iii. 47.2).

It is indeed argued that, according to the panegyric of Procopius of Gaza, Caesarea needed and was granted aid (Hohlfelder 2000: 44). However, the panegyric is the only historical evidence that allegedly connects Caesarea Maritima to the generosity of Anastasius I, and, as stated above, this opus is deemed a rhetorical exercise, unconnected to real events, and therefore should not be taken at face value. Malalas is specific regarding the type of maintenance project: 'In every city of the Roman State he carried out a variety of building projects, including walls and aqueducts; he dredged harbours, constructed public baths from their foundations and provided much else in every city' (Malalas 1986: 229, 16. 21).

Only Marcellinus comes was precise regarding the location of the emperor's intervention, the project performed, and the date. Indicating the year AD 509, he records: 'The harbour of Julian was first drained of its waters by wheeled machines and deepened by excavating the mud' (Marcellinus 1995: 35, 31st August AD 509).⁷

In contrast to Marcellinus' report, the fragments of John the Lydian and Malalas might be defined as 'mini panegyrics'. One can safely argue that much as Anastasius I did not support construction projects in every city in his realm, he did not contribute to the building or maintenance of ports in every coastal site that functioned as a port city. John the Lydian may well have overpraised this emperor who demonstrated concern for the welfare of teachers whose education was based on ancient philosophy and science that had been sidelined by Justinian I within the framework of his Christian reforms. Thus he indirectly criticises Justinian, the same emperor who removed him from his bureaucratic post. Malalas' comments come as part of summarising Anastasius' good works in his realm just before his death, as in the next article he records that shortly afterwards Anastasios fell ill and died (Malalas 1986: 229, 16. 22).

Justinian I

Procopius of Caesarea's encomium for Justinian I was written at the emperor's request to celebrate his building projects – including ports. This panegyric, entitled *On the buildings / De Aedificiis* has been thoroughly studied, in contrast to the encomium of Procopius of Gaza. It is accepted now that large sections

are unreliable and that this opus is unrevised. Averil Cameron indicates that archaeologists have been too eager to take this treaty at face value and to credit Justinian with building activities undertaken in the 6th century AD, although historic and other types of archaeological evidence clearly show that Procopius of Caesarea attributed to Justinian – at the emperor's behest – also several projects that had been initiated or carried out by his predecessors, mainly Anastasius I. Since the *De Aedificiis*, more than any other of the works by Procopius of Caesarea, is constrained by its political and literary agendas, it cannot be taken as a factual record, despite its appearance of documentary authenticity, and calls for extremely sophisticated and cautious interpretation, even in its more 'factual' parts (Cameron 1985: 84-89, 109-111).

In the *De Aedificiis* (compiled in AD 554), Procopius details three ports constructed on the direct orders of Justinian, indeed including his personal involvement. These were built in different techniques (discussed below). Two, with identical construction engineering, were placed at the narrowest northern section of the Bosphorus, known as the 'Straits of Hieron'; another was at Heraeum (today Rumeli Kavağı), along the European side of the Strait; and the other at Eutropius (today Anadolu Kavağı), along the opposite (Asian) side (Fig. 1.1). The port at Heraeum was built with palaces, stoas, markets, public baths, and holy shrines – the whole area, according to Procopius, being not inferior to the royal quarter of Constantinople. Procopius emphasised the great sum of money and resources invested in this project. At Eutropius, however, Justinian only ordered infrastructures in the sea to form the port (*De Aedificiis*, I. xi. 14, 18-19). On land he erected a church to the Archangel Michael on an unidentified nearby promontory named Mochadium (*De Aedificiis*, I. ix. 14).

Emperor Justinian's third enterprise concerned the building of a port also along the European shores of the Bosphorus, at a place south of Heraeum, which in the 6th century was called *Anapulus* (today Arnavutköy) (Fig 1.1). The port was constructed at a natural haven, bordered by a headland, upon which stood a derelict church dedicated to the Archangel Michael; Justinian built a new church to the Saint with the port (*De Aedificiis*, I. viii. 5-10). For all these projects, Procopius of Caesarea provides elaborate descriptions of the construction techniques (see below), contrasting greatly with Procopius of Gaza's vague *panegyric* account of Caesarea Maritima.

Regarding the construction of the ports, Procopius of Caesarea's *De Aedificiis* can, it seems, be taken literally, as in his other opus, the *Secret History/Ancedota*, he criticises Justinian for building structures in the sea that obstructed the force of the waves, i.e. breakwaters

⁷ Günsenin (2017: 417) arbitrarily indicates that Anastasius I, in addition to draining the anchorage area, also had a breakwater built.



Figure 1.1: Straits of Hieron and Eutropius = Rumeli Kavağı and Anadolu Kavağı (Creative Commons Attribution-Share Alike 3.0 Unported).

or moles, in short, man-made ports, which Procopius considered a waste of money (*Anecdota*, VIII. 7-8; XIX. 6). It is puzzling why the emperor should bother to build *ex nihilo* two artificial ports on the Strait of Hieron – the one at Heraeum (as mentioned above) comprising a whole quarter. Could it be that the emperor intended to shift permanently the royal quarter outside the walled city of Constantinople? If so, why invest resources at a new site instead of developing the already existing quarter at Hebdomon (today Bakirköy), along the Via Egnatia, west of the southwestern end of the Theodosian Walls, already a site of political and military importance and before Justinian? By the end of the 4th century AD, Hebdomon had developed as a suburban Imperial residence and a place of coronation for several emperors. Justinian himself established there a ‘novum consistorion’, modelled on the council hall of the Great Palace at Constantinople, where he occasionally undertook political and legislative duties (Taddel 2014: 79). According to a chapter related to the 6th century AD in the 10th-century *Book of De Ceremoniis*, the Hebdomon was an important stopover on the land route from Thrace to Constantinople, entering via the Golden Gate (Mango 2000: 179). Furthermore, at that time Justinian I encouraged urban development on the European side of the Bosphorus Strait. At Heraeum, for example, he invested in the construction of a palace at the Hebdomon, as well as several churches, which seems to have been as luxurious as the one built at Heraeum (*De Aedificiis*, I. 11. 16-18; Taddel 2014: 77-84).⁸ One church, dedicated to John the Baptist, was as magnificent as the one built for Saint Michael at Anapulus, and others were dedicated to the martyrs Menas and Menaeus (*De Aedificiis*, I. viii. 1-16; I. ix. 16).

The answer to the first question can be found in the dating of this great building programme. It is worth noting that the *Anecdota*, which criticised the building of artificial ports, was written c. AD 548-550, i.e. before the *De Aedificiis* of AD 554. However, when writing the *Anecdota* the *De Aedificiis* was already in Procopius’ mind (Cameron 1985: 8-10). In other words, AD 550 provides one of the *terminus ante quem* dates, at the latest, for the building operations criticised in the *Anecdota*. On the other hand, since the empress Theodora, who died in AD 548, eventually spent most of her time at Heraeum (*Anecdota*, XV. 36), one can narrow the *terminus ante quem* for the building projects at Heraeum, Eutropius, and Anapulus to AD 547. The *terminus post quem* is, however, problematic. It is very tempting to date this vast building project to the beginning of the first wave of bubonic plague that hit Constantinople for four months, from late March and early April until August AD 542 (Stathakopoulos 2004: 113-115; Stathakopoulos 2002: 99-106). It seems, therefore, highly likely an

⁸ The author’s identification of Hieron with this port should be dismissed.

environmental hazard motivated the emperor to plan leaving his capital permanently.

That said, it should be noted that Justinian I was neither the first nor the last emperor to abandon the capital and build land, and sometimes port, infrastructures at new sites following environmental catastrophes. According to Malalas, Constantinople's great fire in the second half of the 5th century AD caused Leo I (AD 457-474) to leave the city for St. Mamas (today Beşiktaş) on the northern side of the Golden Horn, along the southwestern (European) side of the Bosphorus. (Fig. 1.1). There he built a port and colonnade, which Malalas calls the 'New Colonnade', as it was known in his time; however, the emperor stayed there for only six months (Malalas 1986: 206, 14. 43). Malalas does not provide detailed information on the port's infrastructures – i.e. if these were breakwaters or moles/piers below water, or structures built on land, quays, etc. Each of these types of structures (discussed below) required their own building techniques of course. A later example involves the emperor Constantine V, who left Constantinople for Nikomedia⁹ until the last wave of bubonic plague (AD 745-748) was over (Stathakopoulos 2004: 147, n. 171). In both cases, however, the emperors left for existing settlements and stayed away from Constantinople for limited periods, and thus the scope of their building projects was minor compared to those of Justinian I.

There was one clear difference for Justinian I however – he was actually infected by the plague (*Anecdota*, IV. 1-3; *De Aedificiis*, I. vi. 5; *History of The Wars*, II. xxxiii. 20), and it must have been this traumatic experience that drove him, once the epidemic had ended, to take extreme measures, including preparing a temporary Imperial refuge away from Constantinople in case such an event repeated itself, or even to move permanently away from his capital. One should also remember that this was the second time Justinian made plans to leave Constantinople during a life-threatening crisis. The first threat came during the Nika riots of AD 532, however Theodora persuaded him not to flee (*History of The Wars*, I. xxiv. 32-39). Theophanes, in the 9th century AD, echoes the historical rumour that the frightened emperor planned to load all his wealth on a galley and make for Herakleia in Thrace (Theophanes 1982: 276, [AM] 6024 [AD 531/2], 279 and n. 43). The emperor eventually stayed in Constantinople; however, after the riots ended he spent large sums on building projects intended for future self-protection. According to Malalas, within his palace Justinian built a complex of granaries, bakeries, and cisterns capable of providing sufficient water for in case of further riots (Malalas 1986:

281, 18. 277). It is very likely that Procopius' criticism of Justinian's extravagant building projects before the end of the AD 542 plague was to do with the apparent waste of money spent on building artificial ports at a time of such crisis, as well as the emperor's alleged intention to escape a second time and set up his capital at Heraeum permanently. The emperor eventually backed down from his intention to leave Constantinople in AD 542. As such, the expensive building projects by the Bosphorus were a total waste of money. As we learn from the harsh criticism in the *Anecdota* (XV. 36), it was only Theodora who elected to spend the greater part of the year at Heraeum.

It is highly likely that the choice between the Hebdomon and Heraeum was also influenced by the plague. Despite the location of Hebdomon beyond the city's southwestern walls, the infection brought to Constantinople from Alexandria also spread to Hebdomon and the epidemic raged in this quarter as well. Furthermore, as already mentioned above, the Hebdomon was an important stopover on the way along the Via Egnatia in Thrace to Constantinople through the Golden Gate; a route taken by high dignitaries, i.e. the emperor and his staff, as well as by merchants, and thus a transmission hub for disease. The Strait of the Bosphorus, on the other hand, due to its underdevelopment, was clean and more healthy, especially Heraeum. That said, it is odd that Justinian I should invest in building activity at Hebdomon at the same time as his projects along the Bosphorus, unless his plans for Hebdomon were to disguise his original intention to leave the capital permanently for Heraeum, and the new Imperial quarter there. According to Procopius, both the Jucundianae palace at the Hebdomon and the one at Heraeum were constructed under the emperor's personal supervision and their building required a sum of money '... so great that it cannot be computed by any reckoning' (*De Aedificiis*, I. xi. 16-18). Ultimately, the emperor did not initiate the construction of an artificial port at Hebdomon, but only a maintenance project there in AD 551, i.e. some nine years after the end of the plague, he ordered the bay dredged. Malalas must have witnessed this operation, or had direct hearsay information, since he was in Constantinople from AD 535 onwards; Theophanes was to repeat this data in the 9th century AD (Malalas 1986: 293, 18. 114; Theophanes 333 [AM 6044, AD 551/2]).

We might also suggest that the plague had a direct bearing on the decision to build the artificial port at Anapulus, adjacent to the re-constructed church dedicated to Saint Michael, in order to replace the commercial activity hitherto conducted along the south-western shore of the Golden Horn. This assertion contradicts Paul Magdalino's argument that, following the accounts by Theophanes (9th-

⁹ The metropolis of Bithynia already had an artificial harbour, built by Theodosius II (AD 405-450) after a devastating earthquake that razed the city to the ground, after which the sea inundated it (Malalas 1986: 98-9, 14. 20).

century) and the *Patria* (10th-century) and *Parastaseis* (8th-century) collections, Justinian I, because of the plague, transferred the wholesale import market for foodstuffs sold at moderate to low prices from the Neorion¹⁰ to the Julian Harbour along the southern shore of Constantinople. Magdalino wrongly argues (as indicated below) that Justinian turned the natural haven of Julian into an artificial port and that later it was renovated by Justin II (AD 565-574) (Magdalino 2007a: 20-22, n. 22-23; Magdalino 2007c: 212, n. 19).

It is, however, hard to believe that any commercial activity would have been shifted due the plague to another site inside Constantinople's walls, fatally infected by the epidemic (*History of The Wars*, III. XXIII. 4-12). Furthermore, Theophanes should be carefully used, as he often provides inaccurate information on events before his time, e.g. he wrongly attributes the construction of the palace to Sophia (wife of Justin II) to Tiberius (Theophanes 371, [AM 6072, AD 579/80]). Magdalino admits that the historical information provided by sources such as the *Parastaseis* and the *Patria* collections, which preceded their compilation date, often mixed fact with fiction and urban legend, and, therefore, must arouse suspicion. On the other hand, there is no doubt that their information reflects the material reality of the times when the information was written (Magdalino 2007a: 12, 20-22, n. 23) – if adding Theophanes, then this would cover from the 8th to the 10th century AD. Only by then was the Port of Julian the home for the wholesale import market for foodstuffs.

Having said that, the area of the Neorion during the plague was, indeed, the place where all the infected corpses were brought to be allocated for 'burial' at Sikai/Galata; many of the corpses were also just thrown by the shore or in the water (*History of The Wars*, II. 23. 9-11; John of Ephesus, cited by Stathakopoulos 2017: 148, n. 177). The plague must have drastically depopulated this area, which, before its outbreak, had been the most densely crowded area of the city, with the highest concentration of ordinary dwellings (Magdalino 2001: 56; 2007c: 218-219). If we are to believe Procopius, the population of Constantinople was reduced by half, with 5000-10,000 victims being buried daily (*History of The Wars*, II. xxiii. 2). Anapulus, however, was located outside Constantinople's walls, far from the plague-affected zone. It is therefore reasonable that Anapulus would be the new location, however temporarily, for the new wholesale import market. Furthermore, it is not accidental that the building of the port and the renovation of the church dedicated to Saint Michael were done at the same time. Saint Michael was revered as a healer saint (Mango 1986: 39-62), with more

significance than ever during that hazardous period. The church was renovated to attract the surviving shrinking population, while promising continuous daily economic life. Procopius himself indicates that the ship-owners and merchants brought their trade there in return for local products produced by emigrants from the infected city (*De Aedificiis*, I. viii. 9-10).

Considering the propagandistic tone of the *De Aedificiis*, it is safe to speculate that the emperor found it important to show that, in addition to thinking about himself and his family, or to hide his 'cowardly' intention to leave Constantinople for Heraeum permanently, while spending considerably on his personal needs, he was also caring for the welfare of his ordinary citizens. Justinian I also demonstrated his care for the populace by the promulgation of a law in AD 544 (two years after the end of the epidemic) aimed at reducing prices to their pre-plague levels. It turned out that merchants, artisans, farmers, and seamen, including those who worked at disposing of the many thousands of corpses from the city, demanded two or three times more for their services, taking advantage of the shortage of human resources, and thus adding to the general inflationary pressures (Stathakopoulos 2004: 164, n. 30).

Justin II

Justin II is the third emperor attributed with the building port installations. It is argued that Justin's involvement is indicated in Corippus's poem *In laudem Iustini minoris* (*In praise of Justin the younger*) delivered in AD 566/7 for the emperor's accession to the throne in AD 565. The poem describes Justin and his wife Sophia observing the port, which was enclosed by two banks, with walls topped with marble, that broke the force of the winds and the waves; the couple are also described watching the ships along its waterfront sail between the Bosphorus strait and the Dardanelles (Cameron 1976: 2-7, 89, 97-114, I. 104-108).

The *Patria* collections, recorded in the 10th century AD, reference that the Port of Julian was renovated by Justin II and his wife Sophia. This has led Magdalino to conclude that the Port of Julian had already been rebuilt by Justinian I; he also applies Procopius' criticism of Justinian's profligacy in building expensive sea walls, moles/breakwaters to the works carried out for the Harbour of Sophia (Magdalino 2007a: 21, n. 25). It should be noted, however, that Procopius of Caesarea in his *opera* never credits such a project to Justinian I – nor did any of the above-mentioned contemporary administrative sources.

The *Patria* collections may have been the source used by Pseudo Cidonius, who, in the late 14th century AD, records that Justin II initiated the building of the port

¹⁰ The arsenal and dockyard along the south-western end of the Golden Horn, opposite Galata.

at the request of his wife, Sophia. Having seen from her palace the ships being battered in the waters below, in her distress she asks Justin to provide the funds to build a harbour there; this harbour was eventually named in her honour – the above-mentioned Harbour of Sophia. Following this 14th-century account, Cameron wrongly credits Justin II for transforming the natural harbour into the Port of Julian, i.e. an artificial one (Cameron 1976: 133). There is no reference made by Corippus, however, attributing any building activity linked to the port's infrastructures in the 6th century to Justin II. He only describes the layout of the port in his time, i.e. the comment we have just seen above, that the harbour was formed by two banks, with walls topped with marble, to break the force of the winds and the waves. The only further works done to this port in the 6th century AD was the dredging, authorised by Anastasius I in AD 509 (for the first time since its creation in the AD 360s) (Marcellinus 35, 31st August AD 509). We can therefore be safe in maintaining that by the 10th century AD the port had been 'renovated' (whatever this entailed) and named after Sophia. By the late 14th century AD, the port accommodated commercial vessels, thus seeing its transformation from a private Imperial port into a public one.

An overview of Imperial policy in the 6th century AD

The historic evidence of the written documents on one hand, and the silence of the sources on the other, shows that the Byzantine emperors of the 6th century AD avoided building new ports around Constantinople, except when unique circumstances arose, i.e. when the bubonic plague hit the city for four months in AD 542. Indeed, Justinian I was the only emperor in the 6th century AD who favoured the construction of ports – three in number, and all in the Bosphorus strait, outside the walled capital: two at the northern far end, along both the European and Asiatic sides (Heraeum and Eutropius respectively), and the third, towards the southern end of the strait (i.e. Anaplus, along the European side). The motives behind these enterprises were, however, personal ones, for the emperor's own benefit, stemming from the emperor's state of mind after having contracted the plague in AD 542.

To escape the infected city, and ensure a refuge in case of similar future outbreaks, the emperor ordered a secure and sanitary environment to be built for his family, i.e. a complete royal quarter at some distance from the walled city. As we have seen, the area chosen for this was at the far north-western end of the Bosphorus, at Heraeum, along the European side. As the natural topography was unsuitable, an artificial port was essential for those wanting to disembark and reside there – in this case the emperor and his wife.

On the face of it, it remains puzzling that the emperor should select for this Eutropius, along the Asiatic side of the strait, just over 1 km to the east of Heraeum, constructing there only an artificial port, without further developing the urban landscape, despite its strategic importance which surpassed that of Heraeum. Eutropius (today Macar Bay) provides protection from the strong north-eastern (Etesian) winds that blow during the summer (the sailing season up into the Black Sea). These winds, along with the strong southward surface current, have always been notorious obstacles to all who sailed into the Black Sea from the Bosphorus. The rate of the current is strongest at the northern section of the strait, being the narrowest section (Ritchie 1969: 39-41, 45). Indeed, already in the Archaic and earlier periods, as various historic sources show, and reiterated in the 6th century AD by Stephanus of Byzantium, the natural haven of Macar Bay (i.e. Eutropius, then known as 'Phrixos') was the only site on the northern Bosphorus that provided crucial shelter in bad weather; it became a repository, trading place, and the location from which all Black Sea navigational charts took their measurements. The stream that flows through the nearby fertile valley provided sailors with fresh water, vital during the high-summer navigational season into the Black Sea. Consequently, Eutropius became a place of worship and thanksgiving – the *Hieron* – for those entering or leaving the Black Sea, seeking safe and favourable voyages. On the high promontory that juts into the sea at Kavak Point, Dionysus of Byzantium's itinerary (2nd century AD) references a small fort, over which the Byzantines built a castle of their own – today *Yoros* – in the 12th century AD. The name *Yoros* is a contraction of the name *Jovisurios*, being the Latin translation of the Greek Zeus Ourios ('of the fair winds'), the pre-eminent divinity at Hieron from at least the 1st century BC. In the ancient periods there may have been a lighthouse adjacent to the castle. The temple and main part of the sanctuary must have been on the lower, western plateau of this promontory (Moreno 2008: 655-671).

Until the project by Justinian I, neither he nor Anastasius I before him had taken the trouble and expense to construct an artificial port at the natural haven where Eutropius is located, although the site served two essential functions during their time. The first was the installing of a form of customs house to control ships trading in the Black Sea and prevent the smuggling of forbidden merchandise. During the reign of Anastasius I, the person in charge at Eutropius was unpaid, in contrast to his counterpart at Abydos, on the Dardanelles. According to Procopius, after his crowning as emperor Justinian I formally established a customs house at Eutropius, with a salaried official (*Anecdota*, XXIV.3-5; Ahrweiler 1961: 239-242). The other important function served by the natural harbour of Eutropius

was a strategic one, it being a forward position against hostile threats to the Empire from the Black Sea, and the main anchorage for the Byzantine navy. The fleet sent by Justinian I against the Huns in the Black Sea in AD 528/9 (Malalas 1986: 250, 18. 14) must have anchored there due to the prevailing conditions.

Given this factors, why did Justinian I opt for building only an artificial port at Eutropius, whereas at the same time he commissioned a port and a royal quarter at Heraeum? The developments at Heraeum had the potential for transforming this site into an important settlement, extremely attractive for mariners and merchants sailing to and from the Black Sea. Eutropius, on the other hand, had a major disadvantage (from an economic point of view) compared to Heraeum. The topography at Eutropius, characterised by the rough mountains of coastal Bithynia, made this site difficult to access by land, and so unsuitable for agriculture (Moreno 2008: 663-665). With this reduced possibility of developing a substantial urban settlement, and restricted access to its hinterlands, Eutropius was unlikely to become a productive and transitional centre of trade and consumption – essential qualities for commercial exchanges. If only one port had been built on the Bosphorus strait, mariners might have taken advantage of the difficult and hard navigational conditions and made for Heraeum, in the hope of safe anchorage, and not to Eutropius as previously done. To increase the attraction of Eutropius as the only anchorage in the northern Bosphorus for commercial shipping, the emperor commissioned a church dedicated to Saint Michael at Mochandium, on a nearby promontory. The saint was venerated as a healer (Mango 1986: 39-62), and it very likely that the emperor, reflecting the precarious times, i.e. the bubonic plague and its ramifications, took the opportunity to build for those sailing to and from the Black Sea a pilgrimage shrine when at anchor at Eutropius. The rationale for constructing the port at Eutropius, with its church dedicated to Saint Michael, at the same time as the harbour and royal quarter at Heraeum, was to try and preserve the relative isolation of the latter and hopefully keep infections out; it is probable, therefore that guards were stationed on the moles at Heraeum. Procopius criticised this prohibition on entering Heraeum and its vicinity, blaming the empress Theodora for depriving those sailing in the strait of provisions and safe anchorage, especially during prevailing storms. As we learned above, eventually it was Theodora who predominantly resided at Heraeum (*Anecdota*, XV. 36-38).

The third port we need to consider is the one at Anapulus. This project was primarily undertaken for the benefit of the local population who managed to survive the plague, the emperor it seems demonstrating

compassion by offering the latter a refuge at Anapulus, complete with economic advantages provided by protecting the natural harbour with a breakwater. The choice of site, of course, was not accidental. As well as its favourable features – a natural bay that could easily be enhanced by the addition of a breakwater – the location also had religious significance, i.e. its church dedicated to Saint Michael. As mentioned above, taking into account the general mood of the time, the anxieties resulting from the plague, it would have been only natural for the inhabitants to want to be near a church dedicated to the healer saint. As well as building the port, the emperor took the opportunity to reconstruct this church, previously in a derelict state. There must have been an element of self-interest in this deed: by demonstrating compassion in this way, the emperor could perhaps divert attention from his perceived cowardice in escaping the possible perils of his capital (i.e. the Nika riots) by taking refuge in Heraeum; he could also use this act of public benefit to cover up the huge sums of money his overall building programme was costing.

Apart from these three large projects, no other harbours were developed in the 6th century AD for Imperial purposes. Other feasible sites remained relatively untouched, i.e. the Boukoleon, ‘portus olim palatii imperatoris’. The date of creation of this port is unknown, with the name Boukoleon only appearing in the 10th and 11th centuries AD, even though the use of the harbour itself goes back to the 5th and 6th centuries AD. The site provided a safe landing place for the Hormisdas, the palace used by Justinian I as a residence before becoming emperor (Mango 1997: 45, 47). For some reason, the emperor did not develop this landing spot into an artificial port after his coronation in AD 527, although he refurbished the Hormisdas palace magnificently to match his main palace, to which it was adjoined (*De Aedificiis*, I. iv. 1-3). No mole/pier or breakwater was built at the Boukoleon landing site by any of the emperors in the 6th century AD after Justinian I. It was only in the 12th century AD that the natural haven was transformed by the addition of two piers (...τούς προβλήτας...) (Choniates Niketas 1984: 74, IV. 129).

Furthermore, neither of the 6th-century emperors built ports due to strategic and economic considerations, as the above-mentioned case of Eutropius shows. A further example of this is provided by the site of Abydos, Eutropius’ counterpart in the south-western section of the Dardanelles. Because of the prevailing winds and currents in the straits here – the descriptions of which by Procopius of Caesarea (*De Aedificiis*, V. i. 8) agree with modern sailors – as well as the topographical features on both sides (Ritchie 1969: 85-90), the anchorage at Abydos, in the narrowest, south-eastern section of

the straits, offered crucial shelter for vessels sailing from the Aegean towards Constantinople, and vice versa. Such was its importance, an inspection station for controlling shipping already existed here in the 5th century AD, on the look-out for smugglers of contraband, weapons, etc., and for the purposes of taxation. By his 'Edict of Abydos', Anastasius I regulated shipping around Constantinople and set out the status and salaries of the officials in charge. Justinian I made further reforms, establishing official customs houses at both Abydos and Eutropius and regulating salaries for the state officials at Abydos (Ahrweiler 1961: 239-241; Haarer 2006: 216-220). Procopius criticised the corrupt archons at Abydos, who abused their positions for Justinian's benefit and profit (*Anecdota*, XXV. 2-6). Despite the importance of the location, and the intensive shipping using it, **Abydos was never given artificial features.**

The emperors of the 6th century AD displayed similar attitudes towards the **maintenance projects of ports.** Only two such enterprises were carried out and these were limited to keeping adequate depths of water for the draft of the ships using the harbours. One such project involved the artificial **Julian Port**, dredged in AD 509 at the command of Anastasius I; the other, in AD 551, at the instigation of Justinian I, at the natural haven at the **Hebdomon**, southwest of the Theodosian walls of Constantinople, along the northern littoral of the Sea of Marmara. What prompted Anastasius is unknown, but we note that Marcellinus reports that it was the first time the harbour had been dredged since its construction in the AD 360s. Thus, either the port only silted up during Anastasius' time, or the emperors before him had not bothered to have it dredged. **From Marcellinus we also learn that there was a mechanical dredging device (Marcellinus 1995: 35, 31st August 509).** Regarding the Hebdomon site, we should remember that it was Justinian I who initiated the building of the Jucundiana palace, under his personal supervision, while, at the same time, he gave orders for the construction of the royal quarters at Heraeum (*De Aedificiis*, I. xi. 16-18). As stated above, the *terminus ante quem* for this enterprise is the late AD 440s at the latest; dredging the natural harbour at Hebdomon may have been the last phase of this project. Interestingly, in contrast to the work at Heraeum, no moles or breakwaters were built at Hebdomon, probably because Justinian, as mentioned above, was planning his new residential place at Heraeum, and the artificial port to be built there was for the protection of the Imperial family and the vessels on which it depended.

Furthermore, no maintenance projects were undertaken by the 6th-century emperors at the artificial ports under direct Imperial control involved in commercial

activities, such as the Proosphorion and the Neorion¹¹ (Günsenin 2017: 415), or at the Port of Theodosius, located at the southwest corner of the walled city, at the mouth of the River Lycus. Documents relating to this period seem to have ignored these three ports and their involvement in any maritime activities.

The history of the working conditions of the Proosphorion and Neorion harbours are obscure; scholars use vague terminology. Günsenin (2017: 414), relating to the Proosphorion, says that it had turned into swampland and ceased to be a harbour by the end of the 1st millennium AD; Mango (2001: 24) argues that both ports were gradually filled up in the course of the Middle Ages. If we believe Theophanes (1982: 516-517, AM 6190 [AD 697/8]), the Neorion was dredged in AD 698, and this is the only surviving evidence on its status in late antiquity, i.e. by the end of the 7th century AD the harbour had silted up. Although Theophanes has nothing to say about the Proosphorion, it can be assumed that it also suffered the same fate. This leaves the question as to when this silting process began. Indeed, we do not know how sufficient depths of water for the drafts of ships in both ports were maintained from the time of their construction in the archaic period – perhaps by some method of dredging or by letting the currents of the Golden Horn flush the ports through circulation channels. For this latter 'natural method' to work, the topography of the Golden Horn must have been completely different from that described by Procopius of Caesarea, who writes that the Golden Horn is not flushed out by currents and waves, being very calm, even during the stormy winter months – a quality he praises (*De Aedificiis*, I. v. 11-13). By the 6th century AD, the topography of the shores of Constantinople had radically changed, due to the measures employed to create the urban space of the Byzantine city, starting from the period of Constantine I and then continued by future emperors. Along the Golden Horn, the development of the urban space included land reclamation from the sea in the second half of the 5th century AD, specifically for the rebuilding of the church of St. Irene in the Perama district (Mango 2001: 20).

The question regarding the silting of the Proosphorion and the Neorion is relevant due to the economic-commercial importance of the ports, as demonstrated by the commercial facilities near the Proosphorion (today the Sirkeci quarter). These infrastructures included four warehouses – three for grain and one for oil ('*Horrea Olearia*'). The *Annona* commodities were brought there by sea. Two of the granaries, the *Horrea Constantinaca* and the *Horrea Valentiana*, were built by Constantius II (AD 337-361) and emperor Valens (AD 364-378) respectively (Magdalino 2007c: 211). The 5th-/

¹¹ Both already built in the Archaic period along the southern shores of the Golden Horn.

early 6th-century text preserved in the 10th-century *Book of Ceremonies*, recording the practice to be followed when the emperor made his inspections of these warehouses, emphasises their importance (McCormick 1998: 37-40; Magdalino 2007c: 212). This ceremony had an important political role, symbolising Imperial prestige and the connection between the emperor and his citizens, i.e. it was the emperor who responsible for taking care of his people (McCormick 1998: 38-40). One can safely assume, therefore, that the ports were dredged regularly.

Progressing, the bubonic plague can be considered as a solid *terminus post quem* for the silting process in the 6th century AD. It should be remembered that this zone (mainly near the Neorion harbour) was where the infected corpses were taken for transfer across to Sikai/Galata opposite during the epidemic, and that during this process many of the corpses were just left on the shore or thrown in the water; no measures were taken to dredge the ports when the epidemic was petering out. As mentioned above, only when the plague was retreating did Justinian I initiate the building of the ports of Hieron and Anaplus, clearly pointing to the abandonment of the directly infected area along the south-eastern shores of the Golden Horn. Due to the lack of historic sources, however, it is hard to say when the southern shores of the Golden Horn were repopulated and when maritime activities resumed in both ports before the late 7th, and certainly during the late 6th century AD. Indeed, according to Malalas, the rebellious 'Blues' faction of Sikai/Galata crossed to the opposite (southern) shore of the Golden Horn and burnt some of the nearby magazines and the House of Andreas at the Neorion in AD 559 (Malalas 1986: 400, n. 135). However, the port is not mentioned in this context and the question is whether the four above-mentioned warehouses near the Proosphorion were also burnt in AD 559.

That said, according to Procopius of Caesarea, there was no need to build ports to protect ships against winds and storms inside the Golden Horn in his time. All along this gulf there were natural havens (sing. = λιμὴν) that provided safe anchorages, where the ships could anchor and their crews rest on land (*De Aedificiis*, I. v. 11-13). From Procopius' description, one can hypothesise that even the pre-plague vessels of Late Antiquity (including those that brought the *Annona* commodities) anchored in natural bays, not necessarily in the Proosphorion and Neorion harbours. They certainly could have done so after the plague, when this area was re-populated (at a date still unknown for certain). Among the best known of these anchorages were the Zeugma, at the Staurion (modern Unkapani), beside the Golden Horn, and the Chalcedonian landing stage, at the east end of the Golden Horn (Magdalino 2007b: 61-62, 64). Indeed, one

might venture to conclude that such nearby alternatives obviated the need for Imperial interventions to construct artificial ports in the vicinity; however, the building of the Port of Theodosius goes against such a conclusion.

Installed at the mouth of the River Lycus, near the southwestern end of the Theodosian wall of the city, the eponymous port named after Theodosius I (AD 379-395) may have been begun by Valens (AD 364-378). The uncertainty stems from the port's omission in our sources until the 5th century AD; it is the *Notitia Urbis Constantinopolitanae*, compiled in AD 425, that is the first to mention the *Portus Theodosiacus*; and by that time, the port was already in existence. However, the *Notitia* is also the last source to mention the port until the late 7th century AD (Mango 2001: 25). Between it and the Julian Port, to its west, stood two warehouses built by Theodosius I – the *Horrea Alexandrina* and the *Horreum Theodosianum*. These magazines stored some of the grain shipments coming from Egypt, as well as other products, but were marginal in importance compared to those in the Golden Horn. This marginality is attested by the fact that they are ignored in the afore-mentioned text of the 5th/6th century AD preserved in the 10th-century *Book of Ceremonies*. The questions remain: Why was the port not mentioned in the late 5th and 6th centuries AD? Why was the *Notitia* the last source to mention it in late antiquity? The extensive excavations at the Port of Theodosius to date have failed to provide answers, the interests of the archaeologists and geo-archaeologists involved primarily being focused on understanding the environmental reasons for the port's demise and failure to function.

These researchers argue that the sediment sequence in the port points to a distinctive, chaotic event, indicating that in the 6th century AD the harbour suffered from one sudden and short-lived disturbance (e.g. a tsunami, see below), or several such events, that led to the silting up of the anchorage, which became more and more shallow through the 6th century and afterwards. Many shipwrecks of the 6th century were found badly damaged and in a very bad state of preservation due to some high-energy disturbance. The wooden piers inside the port also broke during this destructive event (or events), and the remaining parts were covered by sediments of the 7th century AD. The geo-archaeologists suggest that the environmental hazard involved was either a great storm, or, more likely, a sequence of tsunamis caused by earthquakes that led to the inundation of the low-lying, southern shore of Constantinople (Algan *et al.* 2010: 175-179; Perinçek 2010: 201-204, 215).

Arguing that they are supported by historic documents, one of the two groups of geo-archaeologists favouring

a solitary tsunami event striking Constantinople, suggests one of several dates: AD 543, 545, 549, 553, and 557, the latter being a particularly strong candidate (Perinçek 2010: 201-204, 215). The other group suggests AD 553 (Algan *et al.* 2010: 175-179). A third group of geo-archaeologists maintains that no solid evidence points to there being one single event resulting in one, devastating tsunami. According to radiocarbon and archaeological data from the 5th-7th centuries AD, they suggest five possible dates for the tsunami events: AD 447, AD 477-480, AD 553, AD 557, AD 558. This same group also claims to have the support of historical sources, according to which the tsunami of AD 447, resulting from a very strong earthquake, struck Constantinople with extreme violence; the AD 558 tsunami was felt throughout the Bosphorus Strait (Bony *et al.* 2012: 117-130).

On the other hand, dendrochronological analysis of the wooden posts of one of the four piers (defined by them as docks) at this port, the Metro Iskele 3, indicates that the window for the deposition of the above-mentioned chaotic sedimentary layer was a time after AD 581, and perhaps also after AD 588. The anthropogenic material within the layer, which, according to geo-archaeology dates between the 5th and 17th centuries, corresponds with its deposition after AD 581. However, due to the scarcity of documents regarding tsunami events after AD 557, it could be argued that the dates tend to support the geo-archaeological evidence for a chaotic sedimentary sequence representing a longer duration of deposition than a single catastrophic event. To improve our understanding of the stratigraphical context of datable dendrochronological samples for several jetties, the immediate aim is to focus on Iskele I, the first jetty to have been built (in AD 527), to verify whether there are other posts within this pier that date to AD 543±7 – a period for which there are several tsunami records, including one for AD 543 (Pearson *et al.* 2012: 3410).

Re-examination of the historical sources introduced by all the various groups of geo-archaeologists shows that several of the suggested dates did not impact Constantinople. In AD 447, it was only Nikomedia that was razed to the ground and then flooded following a catastrophic earthquake (Evagrius Scholasticus 2000: 44-45, I, n. 160; Malalas 1986: 198-199, 14. 20-21). In AD 543, only Kyzikos¹² was to suffer from an earthquake, but no flood or tsunami was recorded there (Malalas 1986: 287, 18). The 6th-century documents record no earthquakes in AD 545 and 549, but other dates (i.e. AD 557, etc.) did concern Constantinople and show that the city suffered from strong earthquakes that caused the collapse of parts of the city walls and their towers, as

well as monumental buildings and churches, including part of the dome of Hagia Sophia. However, none of these earthquakes at Constantinople were followed by floods caused by tsunamis. There was no flooding after the powerful earthquake in AD 554 (Malalas 1986: 293-4, 18. 118), nor after the one that affected the Hebdomon – an event that continued for three days, also causing loss to human life (Malalas 1986: 295-296, n. 124). In AD 558 and 559 there were three life-threatening events unconnected to earthquakes or floods: in February AD 558 there was a fresh outbreak of bubonic plague that lasted for six months, and in 559 conflagrations across the urban hinterland around the Julian Port and the district of the Kaisarios quarter to its west (Malalas 1986: 296, 18.127; 299, n. 131, 132). No fatal events are recorded by the sources for AD 581 and 588.

We note that when floods, or phenomena like present-day tsunamis, occurred in the 6th century AD, the contemporary sources described them in detail. The above-mentioned case regarding Nikomedia is an example, and there two other noteworthy incidents. According to Malalas and Theophanes,¹³ the Bulgarian shoreline on the Black Sea was severely flooded in AD 541/2 when the sea encroached for over 6 km, covering the territories of Odysos, Dionysopolis, and Aphrodision (Theophanes, AM6037 544-5). Many were drowned, but, according to the authors, God intervened and the waves retreated. The other incident took place along the Lebanese shores. In AD 550/1, a severe earthquake struck this zone and Malalas listed the cities affected: Tyre, Sidon, Beirut, Tripolis, Byblos, and Botrys. The earthquake caused a tsunami at Beyrut, with Malalas describing it cursorily (1986: 291, 18). In the 6th century AD, John of Ephesus elaborates and his account corresponds well with modern tsunami events (cited in Malalas 1986: 291-292, n. 112).

Such evidence suggests that the archaeologists and geo-archaeologists who worked in the area of the former Port of Theodosius (Constantinople) would do well to re-consider their interpretations of the environmental factors that resulted in the chaotic layer (P5 and Unit 4) currently dated to the 6th century AD, and to re-evaluate the exact date of this event. This would help to answer two questions: Why was the port not mentioned in the documents of the period and why was it not dredged during the 6th century AD? It is tempting to argue that one of the effects of the plague of AD 542 was that the port was neglected; however, this does not explain why the port was also not maintained during the 550s, and later, until the work of the 7th century AD.

It is argued that the decrease in the use of the largest vessels and a decline in demand for mooring space may explain why there is no literary reference to the dredging

¹² Located on the shoreward side of modern Kapıdağ Peninsula along the southern shore of the Sea of Marmara.

¹³ Theophanes drew on Malalas but dated the event three years later.

or renewal of the Theodosian harbour, even though it was already silting up by the 7th century AD (Pulak *et al.* 2015: 41). It is also argued that the trend towards smaller ships may have begun with the construction of a large granary on the island of Tenedos, under Justinian, where the large grain transports from Alexandria could leave their cargoes to be carried onwards by local vessels (Magdalino 2007c: 215). Interestingly, both arguments mainly relate to the 6th century AD, while ignoring the period between the compilation of the *Notitia Urbis Constantinopolitanae* in AD 425 (the last opus that mentions the port) and the beginning of the 6th century AD. In any event, these statements do not really stand up to critical examination, i.e. if the port of Theodosius was so important, as is generally claimed, why was it not dredged by Justinian I? after all, the natural haven at Hebdomon, west of Theodosius, was dredged in AD 551. In addition, why was the Port of Theodosius not dredged by Constantinople's emperors after Justinian I?

Furthermore, the epigraphic and historical sources show that the early Roman Empire's merchant fleet already consisted of mostly smaller vessels, i.e. below 100 tons, with those of the *Annona* service even below 75 tons, none lasting over six years in this service (Houston 1988: 553-560). Larger vessels, between 200 and 500 tons, carrying massive cargoes (amphorae, building materials, obelisks, etc.) were already rarer and a short-lived phenomenon in the Roman period. The great vessels (1000-1200 tons) used for the transport of grain from Egypt to Rome were sporadic visitors (Wilson 2011: 39-40; McCormick 2001: 95-105). During the 4th - 6th centuries AD, most vessels of coastal navigation had a carrying capacity of 12 tons; those for longer distances 60 tons (Mor 2012: 55, n. 54); the largest *Annona* ships arriving at Constantinople from the 4th century AD were averagely 60 tons, and it was this size of vessel that the Port of Theodosius was built to accommodate.

Moreover, there was no connection between the construction of the huge granary on Tenedos and the decrease in ship sizes. The emperor had this granary built to avoid any possible delays in the arrival of (mostly) cereals to Constantinople caused by environmental circumstances; such delays could lead to riots. As Procopius of Caesarea himself explained, the pattern of prevailing northerly winds through the Dardanelles made navigation from the Aegean to the capital difficult: sailing ships had to wait for southerlies. Thus, when ships coming from Egypt encountered adverse winds they would discharge their cargoes at Tenedos and use the same northerly winds to return to Egypt (promptly collecting the next grain loads). Meanwhile, the ships from Constantinople also took advantage of the north winds to sail to Tenedos to

pick up the cargoes and then returning to the city when the favourable winds blew (*De Aedificiis*, V. i. 7-16).

The reason for the reduction in ship sizes was purely economic. The financial reforms of Diocletian (late 3rd century AD) and Constantine I (4th century AD) that were intended to solve the economic crisis of the Roman Empire, eventually negatively impacted the faction of landowners, the *navicularii*, who also supplied ships, maintaining and operating them, for the Roman commercial fleet, and whose first duty was the *Annona* line. From the late 3rd century AD, the *navicularii* were no longer able to fulfil their public duties as well as run their private businesses, and the state stopped providing them with the timber they needed to construct their ships. From Constantine's reign onwards, and throughout the 5th century AD, the *navicularii* were compelled to ship the state's commodities at a loss: e.g. in the 4th century AD, 22 voyages were needed to recoup construction costs (McCormick 1998: 69-70). As highlighted in the *Codex Theodosianus* (early 5th century AD), which codified the laws from the reign Constantine I and set out the legalities concerning the *navicularii* and their financial issues, it is clear that the *navicularii* were seeking to cut their losses in various ways, including by reducing the sizes of their ships and modifying hull design. This codex was later incorporated into the *Justinianic Codex* of the 6th century AD (Mor 2012: 48-56). Among others, Law 371 attempting to revive a law of Constantine I (8 March, AD 324), to do with the state's and province's provisioning of the *navicularii* with wood for commercial ship construction, was not retained (Mor 2012: 48-49, n. 25). It seems timber was only provided by the state for the construction of warships. A strategic treatise by a retired army engineer in the later years of the reign of Justinian I says that the Imperial exchequer was mainly concerned with ensuring soldiers were paid yearly, and only on some occasions supported the building of ships and walls (clearly here warships) (*Anonymous Treatise on Strategy*, VII. 3. 13; contra Mor 2014: 56; McCormick 2001: 88, n. 24).

Wrecks of commercial vessels of the 5th and early 6th centuries AD show that the *navicularii*, including their privately owned ships, sought economies in ship-construction costs via new technology, i.e. hull and frame planking (e.g. commercial wrecks 26, 35, and 22 from Yenikapı, all dating between AD 430 and AD 606 (Kocabaş 2015: 17, 23-26)), or by changing from a shell-based to frame-based assembly, with no need for planking edge-joints. The earliest wrecks we know of to date with such changes were discovered at Dor Lagoon, along the Israeli coastline, dating to the late 5th/turn of the 6th century AD (Tantura A and Tantura 2000/11). Some shipwrecks point to a complicated transitional evolution, with different regional traditions of

construction until the 11th century AD (for a synthesis with detailed bibliography, see Gertwagen 2014: 159). Some such wrecks are known from Constantinople's Port of Theodosius (Kocabaş 2015: 10-35; Kocabaş *et al.* 2010: 115-119). Other developments included the lateen/settee rigging, which began to replace the square sail. Although both provided identical sailing performance, the lateen/settee equipment required less material and maintenance than the square sail and was therefore of lower cost (Whitewright 2012).

Although there was no connection between the decreasing size of vessels and the building of the huge granary on the island of Tenedos, this enterprise resulted in a mutually beneficial situation for both the emperor and the ship masters: for the emperor, this meant constant provisions for the population of Constantinople, ensuring food supplies and avoiding riots; and for the shipmasters this enterprise allowed them to make several voyages back and forth before winter, thus cutting some of their losses. Although no artificial harbour was built in the Byzantine period on the island, the natural haven on the eastern side of Tenedos provided shelter against prevailing winds and adequate depths for the draft of the ships.

Thus, we may adduce from the documentary evidence we have from late antiquity that there was no direct connection between the decrease in the size of ships and the fact that the Port of Theodosius was not dredged. Magdalino's argument (2007c: 211-212) appears convincing, i.e. that the *Horrea Alexandrina* and the *Horreum Theodosianum*, between the ports of Theodosius and Julian, were built partly for storing food and partly for holding the building materials for the mass building activity of palaces and public monuments undertaken by the Theodosian dynasty (AD 378-457) from the late 4th to the mid 5th century AD. These building enterprises along the southern shores of Constantinople were preceded by a project of land reclamation from the sea, southwest of the Forum of Theodosius, between the ports of Julian and Theodosius (as the name of the quarter, Kainopolis/New City, attests). The reclamation was undertaken during the time of Valens, and may have continued by Theodosius I (AD 379-385) until AD 380, when the city began to be densely populated (Mango 2004: 17-18, 45; 2001: 18-20, 28). The Port of Theodosius may have been built to accommodate vessels involved in all these activities. It is indeed tempting to associate wreck YK3 – a medium-sized merchantmen that carried bricks and marble, probably from Proconnesos Island in the Sea of Marmara, which was an important source for marble, with these building works. However, there is a discrepancy between the 5th-6th century AD dates of the bricks and the radiocarbon analyses we have so far from the timbers of the wreck, which give dates

between AD 668-987 (Kocabaş 2015: 18-19). It seems also safe to assume that the food stored in the magazines was for the workers occupied with these projects, and later for residents of Kainopolis. First, however, the food was presumably brought to, and discharged from the granaries in the Golden Horn; these were built before those in the Port of Theodosius, which, as stated above, were the main storehouses under direct Imperial control. From these granaries the food was distributed to the city, as well as to the *Horrea Alexandrina* and the *Horreum Theodosianum*. We may also safely assume that once the massive building enterprises in this area had been concluded, in the mid 5th century AD, the emperors found it unnecessary within the framework of their above-mentioned policy to maintain the Port of Theodosius, and thus there was no need to go to the trouble and expense of dredging it (contra Kocabaş 2015: 7). The wrecks of the 6th century, and of those until the 11th century AD, show that shallow vessels continued to anchor in the port.

Based on the dendrochronological data, then, despite the shallow depth of water, four sets of wooden piers/wharves (described by the archaeologists as docks) were built in the harbour – the first in the western section being already in place during the time of Justinian I in AD 527, and twice repaired through the 6th century AD; two others were built c. AD 543, and the fourth in AD 581 (Pearson *et al.* 2012: 3408-3409). Since no emperor has been credited with the construction of the wooden piers, it is likely that they were built by ship-owners, merchant captains, or, indeed, by the shipwrights themselves. It seems highly likely that these individuals would also wish to maintain these piers over time, as indicated by the repairs made to the wooden posts of the first structure (Iskele 1). These repairs, broadly correlating with the construction of the other three piers, may suggest an increase in use of the harbour from c. AD 570-590 (Pearson *et al.* 2021: 3410). Bearing in mind that the customs houses at Abydos on the Dardanelles and at Hieron on the Bosphorus were set up to prevent smuggling and enforce payments of duties, the initiatives of the ship-owners/merchants at the Port of Theodosius did not threaten to Imperial authority and revenues. In other words, neither environmental hazards nor shallow water would deter vessels from anchoring within the port; the ships of the time could be comfortably accommodated. Unfortunately, none of the reports we have on the wrecks provide information on likely drafts; with this information, of course, it would be possible to establish water depths inside the port.

It seems a feasible assumption that the emperors were not actively concerned about building harbours to protect ships against storms and high seas. The case of the Julian Port is instructive. As mentioned previously,

according to the commentator Pseudo-Codinus, writing in the late 14th century AD, Justin II initiated the building of the port at the request of his wife Sophia.¹⁴ Nevertheless, the difficult navigation conditions in the Sea of Marmara, during strong southern or northern winds, did not change between the 6th and 14th centuries. However, it was only in the 14th century that the private Imperial Julian Port, known as the Port of Sophia, was opened to public commercial anchorage. In other words, in the 6th century AD the commercial vessels operating in Constantinople and its surrounding waters were very familiar with the difficult navigational conditions, without options for sheltering in artificial harbours, or were accustomed to anchor within shallow-water refuges, i.e. the Port of Theodosius.

The 6th-century Imperial policy regarding the building and maintenance of the ports of Constantinople and its immediate surroundings, excluding the three ports built by Justinian I during unusual circumstances, mirrored their strategy towards derelict ports in the periphery. Sites along the Levantine coast, mainly Caesarea Maritima, which has been excavated on land and underwater for nearly three decades in the last century, are illustrative of this strategy.

The historic documents of the 6th century AD that comment on the port of Caesarea Maritima make no mention of any interventions by contemporary emperors, except for the early 6th-century encomium of Procopius of Gaza in praise of the work of Anastasius I. As analysed in detail above, this latter panegyric, read today as a rhetorical exercise, full of symbolism and exaggeration, was delivered by Procopius at the erection of the emperor's statue in Gaza. Procopius, a sophist teacher at Gaza, wrote it in his role as a public official. Caesarea Maritima was one of four cities treated in the encomium separately from the others. Caesarea, as with the other cities in the group, is not explicitly mentioned by name, and the identification of one of the other cities (*The Holy City*) is problematic. Undoubtedly, in contrast to the specific enterprises undertaken at the other three cities in the group, the lack of detail on the alleged renovation work at Caesarea Maritima raises doubts that such initiatives took place there. It is also noteworthy that the encomium's vagueness is at odds with the panegyric delivered in AD 534/6 by Choricus¹⁵ for the glorification of Stephanus (AD 530-536), governor of Palaestina Prima during the reign of Justinian I. Choricus details the deeds of Stephanus, among others, at Caesarea Maritima, for which he merited praise, i.e. the actions he took to improve the supply of water to the city (Mayerson 1986: 269-272) and his handling of

the threat of famine in Caesarea, guaranteeing plentiful reserves of food and thus avoiding starvation, disease, and riots (Di Segni 2006: 576, 579). Furthermore, the fact that contemporary administrative sources overlooked Caesarea Maritima as well also supports this argument. Among these sources dealing with the Levantine coast and Caesarea Maritima, we have the writings of John Malalas. Originally from Antioch, he is an instructive figure, serving as an official within the civilian and military bureaucracy of the *Comes Orientis*¹⁶ in Antioch until his departure for Constantinople in AD 535. As such, he must have had access to the city archives, which contained data on the whole region administered from Antioch, both military and civilian, i.e. regarding Caesarea Maritima, he reports on the Samaritan riot in AD 484 (Malalas 1986: 212, 15. 8). His omission of any references to renovation and maintenance work at the port of Caesarea Maritima, therefore, cannot be put down to oversight – Anastasius I undertook none.

Despite this, all the marine archaeologists and geoarchaeologists working at Caesarea Maritima have accepted the encomium of Procopius of Gaza at face value. However, the long-running debate among them about the state of preservation and functionality of the artificial harbour in the centuries following its construction, i.e. on the demise of the former Herodian port on the one hand, and the nature and extent of the alleged renovation operations supported by Anastasius I on the other (synthesis by Hohlfelder 2000: 47-51), unsurprisingly indicate the difficulties faced by the relevant archaeologists in terms of proving that such an enterprise ever actually occurred.

Among the archaeologists, the debate has mainly been between the three co-directors of the international joint expedition to Caesarea Maritima, namely Avner Raban, John Oleson, and Robert Hohlfelder. Raban has suggested several dates over the years for the decline of the port's facilities (cited with bibliography by Hohlfelder 2000: 47); his last dating is the late 1st century AD (Raban 1998: 75). He, however, refutes any later restoration to the facilities until the alleged intervention by Anastasius I in the early 6th century AD, i.e. a rubble rampart discovered on only the submerged, northern Herodian breakwater. The same researcher suggests that the rampart was extended to the north-western end of the former submerged south-western mole, blockading the original entrance to the Herodian harbour. This restoration made the alleged renovated port seasonable, due to its exposure to the prevailing strong to stormy southern and western winds; thus anchorage would have been possible only during spring and autumn (Raban 1998: 72; Raban 1991: 358-359). It

¹⁴ As already stated above, this is an incorrect 14th-century interpretation of the original 6th-century Codinus.

¹⁵ A disciple of Procopius of Gaza.


¹⁶ The office of the *Comes Orientis* was responsible for the entire Eastern diocese including *Palaestina Prima* and *Palaestina Secunda* through the Praetorian Prefect in the early 6th century AD.

should be noted that there is no material evidence to date the rampart. Furthermore, such a reconstruction would mean that the allegedly restored port would have to face two main problems. First, the northern rampart would become a trap for the sand brought in by the longshore southern currents. Second, neglecting to restore the south-western Herodian breakwater left the port exposed towards the west, thus enabling the silting of the anchorage by sand brought in with the western currents. As a matter of fact, the shape of the former Herodian port points to the awareness of both these dangers (winds and silting), thus explaining the free-standing moles encircling the Herodian artificial harbour (from the southeast towards the northwest, and along its northern side). If Raban's proposed reconstruction is correct, then both mooring near the northern breakwater and access to the town from the west, with the inner harbour in the east, would have been blocked by the sand.

Oleson contends that the chronological patterns in the finds from the harbour make it more likely that the breakwaters had begun to collapse and break up in the 2nd century AD, which might have been due to geological reasons, although there is as yet no way to date this catastrophic event with certainty. The numerous lead fishing-net weights found within the harbour that may have been lost by local fishermen may indicate that the former Herodian breakwaters were used more as artificial reefs, increasing catches, than purely as protection from the sea; and, as such, they became hazards to navigation. Oleson was unable to detail with any certainty the history of the later port facilities, only that they were somehow restored in the 3rd or 4th century AD, most likely by the addition of rubble to the tops and outer faces of the breakwaters. Nevertheless, the effect of wave action, and possibly continuous submergence or slumping of the sub-bottom, continued to cause problems, so that by the end of the 5th century AD the breakwaters were once again ineffective. Oleson's reference to the alleged restoration of the port, sponsored by Anastasius I, is again speculative. Perhaps rubble was once again tipped on the tops of the breakwaters. The same researcher also argues that the material evidence (mostly Byzantine ceramics and coins) found on the south face of the northern breakwater and in the entrance of the former Herodian port does not prove that the rubble layer sealing the deposit is fill, laid down by engineers during the reign of Anastasius I c. AD 502, and also that some obviously later material should be expected had the area remained open. In this way, Oleson supports Raban's suggestion that the northern part of the port witnessed renovated. Speculating that the restoration also concerned the submerged southwestern breakwater, Oleson leaves the location of

the alleged 6th-century entrance of the port unclarified. Oleson admits that it is unclear how long the alleged restoration work commissioned by Anastasius I held, the Muslim conquest of Caesarea in the 7th century AD is a good candidate for a *terminus ante quem* (1996: 375-377).

Hohlfelder, who admits that the exact chronology of the sequential cycle of use, damage, repair, and subsequent reuse cannot yet, and may never be established with irrefutable certainty for the Roman and Late Antiquity centuries (Hohlfelder 2000: 42), is the only scholar to argue in favour of intentional Imperial intervention in the 6th century AD for the reconstruction and maintenance of the port of Caesarea. According to him, neglect of Caesarea Maritima by Anastasius I and Justinian I 'would have been inexplicable considering their policies and proclivities and the growing importance of the Levant in the truncated world state they ruled after the loss of western territories in the fifth centuries' (Hohlfelder 2000: 42).

Hohlfelder contends that adequate, though rudimentary, harbour facilities did exist until the 5th century AD. Although only a shadow of the scale of the former Herodian mole, they met the needs of the capital, the province, and the Empire. In his opinion, a sudden catastrophic event, like an earthquake or a tsunami, might have accelerated the process of demise, which started with neglect, as indicated by Procopius of Gaza. Hohlfelder cites three such earthquakes (AD 419, 447, 502) that might have damaged the city (2000: 42). It should be noted that the sources referring to these earthquakes ignore Caesarea: the event in AD 419 (classified as moderate to severe) devastated the city of Aphek/Antipatries and many villages; in AD 447, only Hammat Gader's thermal bath was destroyed (Amiran *et al.* 1994: 266); Caesarea Maritima was not affected by the earthquake of AD 502. 

Joshua the Stylite, who lived at the time of the earthquake on 22nd August, AD 502, explicitly indicates that it only affected Syria and settlements along the Israeli coastline; according to eyewitnesses, it was only Acre in the north that was totally destroyed: 'We received, however, a letter from some acquaintances of ours, who were travelling to Jerusalem, in which it was stated that, on the same night in which that great blazing fire appeared, the city of Ptolemais or 'Akko' was overturned, and nothing in it left standing. Again, a few days after, there came to us some Tyrians and Sidonians, and told us that, on the very same day on which the fire appeared and Ptolemais was overturned, half of their cities fell, namely Tyre and Sidon. In Berytud [Beirut] only the synagogue of the Jews fell down on the same day Akko was overturned' (Joshua the Stylite 1882: XLVII).

In other words, the panegyric of Procopius of Gaza neither commemorates the alleged renovation of the ruined breakwaters of the port after the earthquake of AD 502, nor was this written after this event (contra Hohlfelder 2000: 42, 44, 46, followed by Amato *et al.* 2014: 244, n. 23).

Like Oleson, Hohlfelder arbitrarily argues that all the former freestanding breakwaters were renovated, thus preserving the general outline of the previous Herodian port. Hohlfelder reaches this conclusion from the panegyric's use of the term 'λιμὴν'. Only the width of the original entrance was reduced to accommodate the smaller ships of late antiquity (Hohlfelder 2000: 43, 51-58; note the important comments made by Hohlfelder under Fig. 3). Furthermore, he supports his opinion regarding the authenticity of the encomium by arbitrary presuppositions: 1) the importance of *Palestina Prima* in the new order of the Late Antique world in terms of commerce and pilgrimage (i.e. Christianity), picturing Caesarea Maritima as the maritime gateway to the Holy Land; 2) Caesarea Maritima was an occasional stationing point for units of the Imperial fleet; and 3) contemporary historians, such as John Malalas and John the Lydian, attributed to Anastasius I the dredging of ports all over the empire, or as providing the funds for such operations; Anastasius, like Justinian I, had the financial resources for such enterprises. Hohlfelder concludes with the statement that repairing the existing structures would have been much easier than building entirely new installations, and that Byzantine engineers had the experience and skill for such operations (2000: 43-44). Like Oleson, he contends that the renovations sponsored by Anastasius I continued into the 7th century AD and beyond (Hohlfelder 2000: 58).

These arguments, however, do not stand up to critical examination. The previously mentioned Malalas, who also lived throughout the reign of Justinian I, makes no mention of this emperor's alleged support of any enterprise regarding either the city of Caesarea or its port. Malalas does comment, on the other hand, on Caesarea Maritima in the context of the Samaritans' murder of the governor at Caesarea in AD 556 (Malalas 1986: 294, 18. 119). Procopius of Caesarea's *De Aedificiis* sustains the argument that no sort of intervention was made by Justinian I in relation to this port. Bearing in mind that this work was written as a panegyric at the request of Justinian I himself to celebrate his building enterprises, attributing to Justinian initiatives performed by previous emperors, it is very unlikely that Procopius would have dared, for whatever reason, to omit Caesarea Maritima (contra Hohlfelder 2000: 43; Hohlfelder 1988: 54-55). It should also be emphasised that when Procopius finds it expedient he reminds his readers that Caesarea was his home town, i.e. when

commentating on Samaritan resentment towards Justinian's law of religious conversion in the city, when he writes 'My own Caesarea' (*Anecdota*, 136-137, line 26; contra Hohlfelder 1988: 55). Additionally, we have no specific evidence for the presence of units of the Imperial fleet at Caesarea in late antiquity (contra Hohlfelder 2000: 44; Hohlfelder 1988: 59, 62, n. 21). However, the *Doctrina Iacobi*, compiled in the early 7th century AD, and relating to three emperors – the earliest being Mauricius (AD 582-602) – refers to Acre as a port town, with a mole (μοῦλος), a customs house, and docks for building and storing ships (τά νεώλκια) (Dan 1972: 58-60). After the Muslim conquest in the 7th century AD, Mu'awiya, the Moslem Governor of Syria, transported Byzantine/Coptic shipwrights from Egypt to Acre. Acre then became the Moslem naval base for campaigns against the Byzantines (Gertwagen 1996: 560). One could safely argue that the mole at the port of Acre, which was first built by the Phoenicians and later rebuilt in Roman times, survived the devastating damage the town suffered during the above-mentioned earthquake of AD 502. Furthermore, the town recovered from that calamitous event and became main artificial port in late antiquity along the Israeli coastline – not Caesarea – for both commercial and shipbuilding activities by an unknown date in the 6th century AD. This must have been happened after the bubonic plague, as Acre was not frequented by infected ships.

In addition, the term 'λιμὴν' does not necessarily have to refer to man-made ports. Procopius of Caesarea, for instance, uses this term to denote natural havens or anchorages in the Golden Horn (*De Aedificiis*, I. v. 13). When referring to built ports at Anapulus and Hieron (discussed below), he uses the term *sheltered limen* ('σκέπη λιμὴν') (*De Aedificiis*, I. viii. 7; I. xi. 18). Thus, one should not conclude from the term 'λιμὴν' in the panegyric by Procopius of Gaza that he meant a constructed port at Caesarea which followed its former Herodian contour, and that the alleged renovation work returned to Caesarea its former level of commercial activity that was at the heart of the city's former life (contra Hohlfelder 2000: 46). The only accurate picture we get of Caesarea Maritima in this panegyric is the derelict condition of the port in the late 5th century AD, which Procopius of Gaza witnessed when staying in the city (AD 491-495). The sorry state of the port was caused by the long-term neglect of its infrastructure (as mentioned in the panegyric), perhaps from as far back as the late 1st century AD (as contended by Raban), or from the 2nd century AD (as suggested by Oleson).

On the other hand, a joint team of archaeologists and geo-archaeologists argues that the breakwaters were destroyed once and for all by the tsunami of AD 551, never to be re-constructed (Hendrik and Goodman-Tchernov 2010: 265-284). This claim, however, does not

hold water for several reasons. The scholars' starting point is the presupposition that Caesarea Maritima was actually struck by this tsunami, and, accordingly, they oblige their evidence to adhere to this. The evidence they introduce is the single layer of freshly broken shells and other debris that stands out in sharp contrast to the thick strata of largely homogeneous, sandy sea-floor deposits that bracket them, as well as according to them the well-dated carpet of rubble on the seabed far beyond the confines of the harbour (Hendrik and Goodman-Tchernov 2010: 268, 278-279, 281-282). To further support their hypothesis they refer to the documents that mention the particular earthquake that resulted in tsunami hazards elsewhere; Palestine is, indeed, included among the zones hit by the earthquake. However, the only area that suffered the effects of the tsunami following this earthquake was the Lebanese coastline. The sources that so vividly describe the tsunami phenomenon explicitly mention the cities affected: Tyre, Sidon, Beirut, Tripolis, Byblos, and Botrys. The emperor sent money to assist all these Lebanese cities (John of Ephesus, cited in Malalas 1986: 291-292, 18. 112). None of our sources refer to Caesarea, and, as a matter of fact, the whole Palestinian coastline is ignored. The third reason for questioning the hypothesis by these scholars that the breakwaters of Caesarea were destroyed by the tsunami of AD 551, is that they have taken the panegyric of Procopius of Gaza at face value, i.e. that the breakwaters were restored with the assistance of Anastasius I. Accordingly, they suggest that the tsunami destroyed the infrastructures allegedly renovated by Anastasius' engineers, the same breakwaters that had been previously hit by the tsunami of AD 502 (Hendrik and Goodman-Tchernov 2010: 271). As mentioned above, along the Palestinian coastline it was only Acre that was actually devastated by the great earthquake of AD 502. Furthermore, since it can now be established that no enterprise to restore the former Roman breakwaters sponsored by Anastasius I ever occurred, this suggestion should also be rejected. Clearly both the dating of the 'geological' layers and the accompanying interpretation of the fate of the harbour in the mid 5th century AD made by these scholars should be reassessed.

Based on the discussion so far, we may safely argue that the archaeological analysis of what happened to the former Herodian breakwaters in Late Antique Caesarea Maritima, along with the fate of the whole port, should be reconsidered – including the interpretation of the rubble rampart. Is it a breakwater constructed at an unknown date on the ruined Herodian breakwater, or is it the remains of the structures originally built with, and on, the Herodian mole?

Furthermore, contrary to the modern research claims and suggestions, there is no evidence at any time in the

6th century AD of Imperial intervention in the rebuilding and maintenance of the port at Caesarea Maritima that could have restored the former role of this port within the context of Mediterranean commerce. Indeed, the material finds to date point to imports. However, one must bear in mind that Caesarea was the capital of the province and therefore a consumption centre. It can be safely speculated that the governors and the local elite wanted to preserve high standards of living. Furthermore, as is indicated by the panegyric, the local population watched with dismay as the provisions they were expecting were lost as the ships foundered. No mention is made of commodities from other nations arriving into the city. As a matter of fact, like those of the 5th century AD, the 6th-century sources exclude Caesarea Maritima as a maritime entry to Palestine (Di Segni 1996: 588, n. 70). The account by St Nicholas of Sion of a journey from a monastery in the mountainous hinterland of Myra in Lycia¹⁷ to Jerusalem and back, points to Ascalon, on the southern Palestinian coastline, as the gateway to Jerusalem by sea. Before leaving for Jerusalem, St Nicholas went down to the 'Metropolis of Myra' to visit the Martyrium of the 4th century AD. Here, a skipper from Ascalon came to meet him and invited him aboard his little boat to sail to the Holy City with him (Ševčenko and Ševčenko 1984: 29, line 8). The second voyage to the Holy Land that he, or his uncle, who bore the same name (on this see: Ševčenko and Ševčenko 1984: 15), made was on an Egyptian ship bound for Ascalon (Ševčenko and Ševčenko 1984: 51, line 51), but he was diverted by storm to the Egyptian Delta, where he boarded a ship to Ascalon and from there went to Jerusalem (Ševčenko and Ševčenko 1984: 57, lines 32, 61-62). Leaving Jerusalem, he returned to Ascalon, where he found a Rhodian ship sailing to Constantinople. Originally, this ship was part of a group and its captain told the saint that, due to mysterious circumstances, he was held up in Ascalon city for three days and that the other ships in the group had already departed (Ševčenko and Ševčenko 1984: 63, line 36). It is unclear where the ships anchored at Ascalon, it lacking a man-made port;¹⁸ in the *Vita* of St Nicholas, the author provides no adjective associated with 'anchorage' or 'port' in connection to Ascalon. Reaching Ascalon, the text reads: 'εἰς Ἀσκάλωνα' (Ševčenko and Ševčenko 1984: 62, 30A, line 9) and 'ἐπὶ Ἀσκάλωνα' (Ševčenko and Ševčenko 1984: 50, 24, line 9). On the other hand, Andriake, the port of Myra where St Nicholas embarked on the Ascalon-bound ship for his first visit to the Holy Land, is attributed with the term 'λιμὴν' (Ševčenko and Ševčenko 1984: 82, 83). However, as confirmed by archaeological excavations, Andriake was a naturally protected harbour at the mouth of Andrakos Creek and had substructures and facilities on land, including perhaps a quay on land

¹⁷ In southwestern Asia Minor.

¹⁸ On Ascalon, see Gil Gambash in this volume.

(Akyürek 2016: 471-477, 481, Figs 2-3). The lack of a protected anchorage at Ascalon exposed ships to danger and loss. We know of two merchants who lost merchandise when their ships foundered at Ascalon and they were held accountable by their creditors: one was imprisoned in Ascalon, the other in Tyre (Di Segni 2006: 583, n. 46). In the 12th century AD, William of Tyre commented that the location of Ascalon on the coast was unfavourable for shipping – there being no harbour or safe anchorage. During storms, rough waves broke on Ascalon's sandy beach (Huygens 1986: 790-791, 17. 22). The absence of a man-made harbour, however, did not prevent Ascalon from being an active centre of trade in the Eastern Mediterranean, and, as such, along with Gaza to the south, it fell victim to the bubonic plague in AD 541 (Stathakopoulos 2002: 100-101). According to Procopius of Caesarea, the plague was spread from the coast inland by visiting ships (*The History of the Wars*, II. 11. 22. 9; John of Ephesos, *History of the Church*, II. 77, cited by Stathakopoulos 2002: 101, n. 12). Antioch was subsequently badly affected by the plague¹⁹ (Stathakopoulos 2002), as well as Myra, further to the north, infected through its natural port (Andriake) (Ševčenko and Ševčenko 1984: 82, 83). Caesarea Maritima, and the whole Palestinian coastline from Ascalon northwards, escaped the infection, as ships did not visit the Palestinian coastal cities north of Ascalon.

We can see, therefore, that the absence of a man-made port in dangerous locations was not a precondition for emperors either to build artificial facilities or reconstruct derelict ones; nor did it mean that a coastal town without a good harbour was not visited by commercial or other vessels in late antiquity. Skippers anchored wherever there was a profit to be made, even if their vessels might be put at risk. Ascalon provides a good example of why the situation at Caesarea Maritima did not elicit Imperial assistance in terms of renovating the former Herodian port in the 6th century AD, despite its role as capital of *Palestina Prima*, and making an exception to the policy adapted in Constantinople and its immediate environs. The unfavourable shipping conditions in the Sea of Marmara did not prompt emperors in Constantinople to protect ship-owners. The Julian Port was not opened for public anchorage until the 14th century AD, and by then Port of Theodosius had long since silted up, becoming from the 12th century onwards a dump for rubble from the surrounding area, and from the late 13th century the settlement area for the Jewish community (Günsenin 2017: 417; Kocabaş 2015: 7). The apparent Imperial neglect in the 6th century AD did not prevent, indeed it may even have obliged ship-owners and merchant captains to provide anchorage facilities

for themselves, i.e. the wooden piers and wharves in the Port of Theodosius.

Technology of harbour construction

The technology involved in the building and maintenance of ports includes two main components, each requiring special marine-construction engineering skills. The first involves the building of structures in the sea for the protection of the anchorage zone and along the shoreline, so that vessels can moor and load and unload their cargoes. Such infrastructures include breakwaters, moles, jetties/piers, and quays. Naturally enough, only the bigger ports would include at the same time all these structures, which differed then, as they do now, in terms of their function and construction engineering (Quinn 1961: 173, 189, 214-242).

The second factor essential in the building and maintaining of ports is keeping sufficient depths of water inside the anchorage zone to accommodate the drafts of ships at that time. In riverine environments, rivers could be diverted to prevent their fluvial deposits from silting-up the anchorage zone. However, in marine environments it required special expertise to prevent silting caused by wave action, calling for the construction of breakwaters and moles and an understanding of the directions of local currents, their force, and how to use them to clear the ports of sand coming in from the sea.

The first to learn such marine-engineering skills in the Mediterranean were the Phoenicians, followed by the Greeks and Romans. The artificial device mechanisms built into sea walls to clear the anchorage zone of sand are known as 'circulation gaps', as they allowed the sea currents from one direction to carry out sediments of all sorts coming from the opposite direction. Another method, as revealed at Roman and Byzantine Acre, for instance, was to lay the stones of the breakwater or mole in such a way as to create intervals or gaps between them (Gertwagen 1996: 558-559).

Our information on the technology involved in the Imperial building and maintenance of ports in late antiquity is mainly provided by historical documents, specifically relating to the Port of Theodosius, which had already been constructed by the late 4th century AD. As stated above, it was not maintained, i.e. not dredged, in the 6th century AD, and the only additions, again in in the 6th century, were wooden piers, and possibly also wharves, commissioned by ship-owners or merchant captains, and probably also using their craftsmen. The administrative documentation by Malalas and Marcellinus only refers to dredging activities, although not at the same locations where Procopius reports marine infrastructures were built.

¹⁹ The capital and natural marine gateway to Syria.

The *De Aedificiis* refers to various types of marine construction: a breakwater, moles, jetties, and a quay. We should note that it is unclear whether Procopius witnessed the construction projects himself or only reported on them, and that he was an historian, not an architect or engineer. As he himself writes, when dealing with the construction of the Hagia Sophia and the stability measures adopted, he did not understand all the information he was provided with and could not explain it using technical vocabulary (*De Aedificiis*, I. i. 50).²⁰ Procopius could not explain the static problems leading to the collapse of the first dome of the church, caused by the mortar drying too quickly in the various elements that carried the loads of the vaults supporting the dome (*De Aedificiis*, I. i. 67-78). His technical deficiency can reasonably be applied to the building of ports as well, and his vocabulary should therefore be treated carefully.

One of these structures was erected at Anapulus (modern Arnautköy) (Fig. 1.1) where, following the end of the plague, Justinian I promoted the building of a port for the daily economic lives of the local population who survived the epidemic. According to Procopius, Justinian took advantage of the local topographic setting: 'Using a protrusion of boulders [πετρῶν], he turned that headland inwards, making a harbour shelter [σκέπη λιμῆν], and brought the seashore into transformation towards a market; for the sea being very calm there, it calls for transactions with the land. And the sea-traders tie up their vessels along the protruding boulders [παρά τὴν ἐμβλήν τῶν πετρῶν]...' (*De Aedificiis*, I. viii. 7-8; the present author's translation differs from Dewing 1961: 71)

Procopius speaks here of a mound-shaped breakwater built from rubble and boulders. However, since, according to him, vessels could tie-up along this structure and trade from their decks, this structure must have been built next to a quay with the facilities for the ships to be tied to.

Rubble mound breakwaters (as is still the case) are built with layers of boulders – the lowest form wide foundations and the upper layers narrow as they rise above the sea surface. The width of the foundation layers and the rate of the upward slope depend on the depth of the water. Construction skills are required for such calculations. Unfortunately, Procopius does not detail the building process, but it seems more than likely that the necessary shape for the whole structure, from the seabed to the surface, could only have been accomplished in the 6th century AD with the help of

divers. For maximum stability, below the foundation layer there should optimally be a bed of rubble to ensure the natural material (sand, etc.) was not eroded by waves and thus making the breakwater eventually collapse; divers would also be required to lay this initial bed of rubble, where the procedure was employed. The boulders for the breakwater could have been brought to the right place by barges.

Quays are usually built above the water surface. If built close to level of the water, the quays were provided with 'headers' – long, shaped, ashlar stones, with their narrow sides facing the sea, since the erosive force of the waves was much less than on the wide face of the stones; this 'header' technique, designed to ameliorate the power of the waves, is indicative of marine technology. There are also known moles and jetties constructed this way, as at the Roman/Byzantine port of Acre (Figs 1.2a-b) (Gertwagen 1996: 558-559). A contrasting technique, referred to as 'stretcher', for quays built high above sea level, entails placing the wide faces of the ashlars towards the sea, as at the quay at the Port of Theodosius, built of large blocks of stone in two rows (Kocabaş 2015: 10-35; Kocabaş *et al.* 2010: 122, Fig. 4). Since the wider faces of stones are eroded more rapidly by the waves, the 'stretcher' technique is characterised as terrestrial technology. There was, however, a common denominator for both technologies, i.e. the binding material employed for the 'headers' as well as the 'stretchers' that formed the structures, which was a concrete mix adapted from that used for terrestrial buildings (see below).

We find on both the northern side of the Bosphorus (i.e. at Heraeum, along the European side) and at Eutropius (on the Asian side), a third type of marine installation. In contrast to Anapulus, at both these locations the emperor commissioned in the open sea harbours that afforded complete shelter to vessels; the facility at Heraeum was constructed on an unfavourable shoreline. The construction technique was identical in both places:

'There too he skilfully contrived a sheltered harbour [σκέπη λιμῆν] which had not existed before. Finding a shore which lay open to winds from two directions and to the beating of the waves, he converted it into a refuge for voyagers in the following way. He prepared great numbers of what are called chests [κιβωτούς]²¹ and threw [αππορίτω] them out for a greater distance from the shore along oblique lines on either side of the harbour, and by constantly setting a layer of other chests in regular courses upon those underneath he erected two long walls [τοίχους] which lay at an angle to each other on the opposite sides of the harbour, rising from their foundations deep in the water up to

²⁰ In contrast, Zanini (2007: 389) insists on attributing to Procopius the necessary skills in describing architectural projects, correctly using somewhat complex technical language, despite Procopius' declaration to the contrary.

²¹ A box-shaped formwork of huge size.



Figure 1.2a: The headers that build the southern mole at the port of Acre (R. Gertwagen).



Figure 1.2b: The southern mole at the port of Acre (R. Gertwagen).

the surface on which the ships float. Then upon these walls he threw rough-cut stones [πέτρας] which are pounded by the surf and beat back the force of the waves; and even when a severe storm comes down in the winter, the whole space between the walls remains

calm, a single entrance left between the moles for the ships to enter the harbour.' (*De Aedificiis*, I. XI. 18-19)²²

²² The Greek text should be consulted.

The use of wooden forms or *caissons*, set in layers one on top of the other, shows that the engineers tried to achieve structures *square in plan* suitable for moles/piers – a technique that contradicts the use of boulders for a breakwater, as in the case of Anapulus. On both sides of the Strait of Hieron, however, the two construction techniques were used: first, square in plan walls. i.e. moles or jetties were built underwater, rising above the surface of the sea, with or without additional paving to form a walking surface covering the upper level. The outer sides of moles, facing the open sea, were built over by rough stones that formed breakwaters.

Procopius, however, does not detail the technicalities of sinking the above-mentioned ‘chests’. That said, the text should not be read literally – Procopius was an historian, not an engineer, and his terminology was not that of a specialist. For example, the verb ‘*ἀπορίτω*’, which literally translated means to ‘throw’ the chests, could have had another meaning at the time. One meaning might be intended to express distance, or the wide contours of the walled extent of a port, with a second meaning being ‘sinking’, i.e. the chests were not thrown but sunk. In this case both meanings could be adapted, e.g. the chests were sunk at a distance from the shore and formed the wide contour of the port.

It should be emphasised that the *caissons* by themselves could not function as walls, or a load-bearing system of construction, but were containers for some sort of solid material; unfortunately, Procopius does not specify what. Dewing contends that the *caissons* contained stones, probably suggestive of a rubble mound breakwater (Dewing 1961: 93, n. 2) – a theory not supported by Hohlfelder (1988: 56). More recently, Oleson said something similar, i.e. if the engineers at the time did not have hydraulic concrete (see below), they might have filled the forms with stones (alternatively defined as blocks); the forms were a more temporary type of construction that Oleson refers to as ‘cribs’; he also refers to foundation layers (Oleson 2014: 35, 2. 16). Hohlfelder suggests that the *caissons* held hydraulic concrete – a mix of pumiceous volcanic ash called ‘pozzolana’. Since this material hardens when reacting with lime (or lime-based compounds) and water to form a water-resistant product, this concrete is also referred to as ‘hydraulic’. This medium is discussed by Vitruvius at the end of the 1st century BC (*De Architectura*, 5. 12. 2-6) and is encountered, among other sites, at Caesarea Maritima from 20 BC.²³ Hohlfelder argues that this building technique survived in late antiquity at Anthedon, another Byzantine port of the 6th century AD, as well as at Acre, on Israel’s northern coast, 400 years later. Muqaddasi, the 10th-century Muslim geographer-historian from Jerusalem,

records the building of the eastern sea wall at Acre, constructed by an architect from Jerusalem called Abu Bakre. As at 10th-century Acre, Hohlfelder argues that the Heraeum engineers also employed a barge for the formwork of the harbour (Oleson 2014: 35; Hohlfelder 1988: 57-60).

As already discussed at length elsewhere, these hypotheses do not stand up to critical examination (Gertwagen 1996). If we are to believe the excavators at Anthedon, no moles or jetties were constructed underwater, but there were only quays built on shore to form part of the sea wall. To strengthen the foundations of the quay, and to bind the stones to each other, the builders there favoured the same type of concrete they used in the town’s terrestrial buildings. This concrete was made of pulverised tiles and potsherds, and these mineral components are found in pozzolana, but this is not the standard formula for hydraulic concrete according to Vitruvius (Schläger *et al.* 1968: 21-98).²⁴

The type of concrete in use at Anthedon is classified in Turkey as *khorasan*, and it occurs in sections of Hagia Sophia (Livingston 1993), the jetties at the Port of Theodosius (Başaran and Kızıltan 2016: 49, 50, Fig. 7), as well as in some 10th-century and Ottoman buildings in Constantinople (Akman *et al.* 1987: 9-10). For terrestrial buildings, including quays, *khorasan* concrete, made using slaked lime mixtures with well-fired, crushed clay-brick/tile particles, is strong enough for structural use. When clay is burned at high temperatures some of its basic elements (silicates) are partially broken down and will react effectively with lime. *Khorasan* could also be re-applied later if surfaces had suffered wave erosion (wells and aqueducts could be treated similarly). However, to achieve the strength and durability required for underwater structures, such as moles or jetties, the use of an hydraulic binder – made by mixing pozzolana, which has been burned at extremely high temperatures, with well-burnt and slaked lime – is crucial. When using *khorasan*, it is important that the amount of the fine fraction of this material, which is chiefly responsible for the development of pozzolanic activity, should be at a sufficient level (Livingston 1993; Akman *et al.* 1987: 9-10). When building jetties and moles, two prerequisites are essential if only *khorasan* is used: first, huge quantities are called for, since the pozzolanic elements of this medium are not as effective as those of pure pozzolana (on the unique character of Roman pozzolana, see: Oleson 2014: 2-4, 1. 2, 238, *passim*). Second, great skill and experience is required in calculating the right proportions of *khorasan* in the concrete mix.

²³ For other Mediterranean harbours using pozzolana, see Oleson 2014: 55-120.

²⁴ The survey at Anthedon, part of the ROMACONS project in 2007, among whose members was also R. Hohlfelder, looked only at the rubble behind the clamped ashlar marginal walls which was naturally concreted, not at the binding material between the ashlar stones or at their foundations (Oleson 2014: 135).

As far as is known, no underwater surveys or excavations have been carried out at the ports of modern Rumeli Kavagi and Anadolu Kavađi in the Strait of Hieron, nor at the site of modern Arnavutköy (Anapulus). The only harbour thus far excavated at Constantinople is the Port of Theodosius at Yenikapı; the only underwater installations built there in the 6th century AD were wooden piers (Pearson *et al.* 2012: 3408-3409).

It should be noted that at the ancient sites where moles or jetties were built using pozzolana, and which for various reasons collapsed, the remains comprise very often of scattered concrete blocks, above or below the water (e.g. Oleson 2014: 56, 63, 67-68, 74-5, 140, Figs 4.9, 4.11, 4.13-4.14, 4.16, 4.22, 4.25, 6.80, *passim*). This is not the case for those jetties or moles built without pozzolana. The example of the above-mentioned Muslim port of Acre is instructive; and it was the already mentioned geographer-historian Muqaddasi (AD 945-991) from Jerusalem who reported on this project. Although he was neither engineer, architect, nor builder, his account can be trusted as the architect Abu Bakre, who built the eastern mole at the port in the 9th century AD, was Muqaddasi's paternal grandfather. Abu Bakre gave his grandson various details, including that he ordered large beams of sycamore wood that he lashed together to make a great raft:

'These beams he then caused to be floated on the surface... and upon these beams he raised a structure with stones and lime [Hijara washid]. After every five courses he strengthened the same by setting in great columns [of marble or granite], until at length they became so weighted that they began to sink, but this little by little, and finally he knew that they rested on the sand. Then he ceased building for the whole year, that the construction might consolidate itself [as with mortar or concrete], after which, returning, he began again to build.' (Goeje 1906: 153; Gertwagen 1996: 556-557)

This method of construction has two inherent problems: the first is the use of lime alone as a binder, i.e. without pozzolana or at least components of *khōrasan*. High-calcium limes from carboniferous and pure oolitic limestone, or white chalk, are not hydraulic, even if slaked with water, and it dissolves. The methods described by Abu Bakre are associated with terrestrial construction techniques. He uses cement components based on lime and waits a year for the material to cure before continuing; it should be noted that cement is a concrete component (Davey 1961: 97-111). The delay of a year was to allow the slaked lime to react with the atmosphere – taking up carbon dioxide so that it resumes its original limestone constitution, like calcium carbonate (CaCO₃), as a rigid solid. (Wright 2005: II/1, 146). It is intriguing how the

carbonation of the lime worked underwater at Acre. Eventually the lime dissolved, and the wooden frames disintegrated, resulting in the collapse of the eastern mole. In the Crusader period it was named 'the reefs of the Tower of the Flies' (Gertwagen 1996: 556-557, n. 17).

That Abu Bakre should lack expertise in building walls underwater is not surprising; he was, after all, an architect from Jerusalem. He was summoned by Ibn Tūlūn, the governor of Egypt and Palestine on behalf of the Abbasid regime (AD 845-884), having been recommended to the latter by the carpenters and builders along the coast, who admitted their limited understanding of such a project. One of these workers mentioned the name of Abu Bakre, the old architect from Jerusalem (Gertwagen 1996: 555; Goeje 1906: 153), and that he was probably still knowledgeable of the former 'Byzantine' building traditions. However, his limited marine-engineering construction skills are also apparent, i.e. his placement of the structure right on the sand, without bedding the seafloor under the foundation layer with rubble to prevent the sand from being washed away by the waves, potentially causing the whole thing to collapse (Gertwagen 1996: 557).

The underwater surveys and archaeological excavations of this structure at Acre revealed that the remains consisted of small ashlar stones and pillars scattered at a depth of 1-2 m; the foundations however were not reached. By consulting the English translation of Muqaddasi's text, not the Arabic original, the excavators misinterpreted the remains (Gertwagen 1996: 557, n. 19-20). The condition of the remains at Acre is completely different from remains of pozzolana masses.

If the moles at Heraeum and Eutropius had been built with pozzolana concrete, their remains would have been expected to be traced by modern hydrographic surveys and maps of modern Rumeli Kavagi and Anadolu Kavađi. As there is currently much maritime activity along the coasts where both sites are located, these remains would have been flagged by various sources as hazards to avoid; this, however, is not the case (Ritchie 1969: 154, 160-161; United Kingdom Hydrographic Office 2003: 105-106, 2.378, 2.392). We would therefore suggest that the wooden forms defined by Procopius as 'boxes' or 'chests' that formed the moles at Heraeum and Eutropius contained concrete based on *khōrasan* as a binder, and was not hydraulic. 'Khorasan' concrete was also used for building the jetties at the Port of Theodosius. These jetties, rising on the tops of wooden forms, were built like a terrestrial wall, faced with lime and marble stones, and with their interiors filled with non-hydraulic *khōrasan* mortar and stone pieces (Başaran and Kızıltan 2016: 50, Fig. 7; Prof Başaran pers. comm.). These jetties are at the far northern end

of the port, and thus not exposed to constant attack by the violent marine environment, like the structures at Heraeum and Eutropius are. It may well be that the moles in the Strait of Hieron shared the same fate as the eastern mole at Acre, collapsing as soon as the lime dissolved and the *caissons* disintegrated. This was even more pronounced at Heraeum and Eutropius, the sea walls of which were constantly exposed and subject to the force of the strong northern current, waves, and the winds coming from the Black Sea down through the Bosphorus, which are even stronger than those experienced at Acre. After the moles in the Strait of Hieron collapsed their remains were dispersed on the sea floor.

It should be noted that Procopius also ignored the construction techniques employed for these moles in the Strait of Hieron. His description suggests, however, that each solid *khorsan* cement mixt could have been prepared and left to cure on dry land in *caissons* before being floated into position directly above the intended mole site and then ballasted until they sank – a process that agrees with the *De Architectura* (5. 12. 3-4) on the construction of walls in the open sea subject to the force of waves (Oleson 2014: 208-210, Figs 2.1c, 8.48-53). Vitruvius, however, suggests this technique only when pozzolana is available, whereas the architects and engineers at Constantinople used *khorsan* as hydraulic concrete. In a way, the building technique at Heraeum and Eutropius recalls that employed by Abu Bakre at Acre in the 9th century AD, although he used a sizeable barge divided into compartments. As with Acre, it is unclear whether the seabed was prepared with rubble layers before both Hieron's ports were begun.

These two potential errors – the type of concrete used and the lack of rubble foundation – may, however, have slowed down the likelihood of the frequent earthquakes in the Bosphorus completely destroying the moles at Heraeum and Eutropius.

Another factor ignored by Procopius regarding the engineering of the three ports (Anapulus, Heraeum, and Eutropius) is the mention of any cleansing mechanism used to ensure that the protected anchorage zone retained adequate depths for the drafts of the ships. Nevertheless, from the information provided by Marcellinus regarding the drainage of the Julian Port in AD 509, and also by Malalas for the port at Hebdomon built by Justinian I in AD 551, we can hypothesise that the anchorage areas inside the breakwater at Anapulus, as well inside the moles at Heraeum and Eutropius, were regularly cleared by the same, or similar, mechanical devices reported by Marcellinus, i.e. wheeled machines (Marcellinus 35, 31st August 509).

Discussion

This contribution has looked at three intertwined topics. The first is the interdisciplinary methodology and the appropriate treatment of the various disciplines involved. As we are dealing with historical periods, the available documents provide our starting point. We have pinpointed the dangers facing historians and archaeologists of taking the written sources at face value: something that can lead to false presumptions regarding Imperial involvement in the building of ports, their infrastructures, and how they were maintained; as well as leading to inaccurate interpretations of stratigraphy, archaeological remains, and geo-archaeological analyses.

The second topic we dealt with is the Imperial policy regarding construction and maintenance of ports. The interdisciplinary study shows that the general attitude of the emperors in the 6th century AD was not to focus on port construction, with the significant exception of Justinian's commissioning of three ports in the Bosphorus – two in the northern section (at Heraeum and Eutropius), and the other at Anapulus (south of Heraeum). As we leaned above, Justinian's driver for this was to do with the aftermath of the bubonic plague that hit Constantinople for four weeks, and from which the emperor himself was not immune. Seeking a healthy environment for his family and retinue, either temporarily or permanently (should the epidemic return), the emperor ordered that an entire royal quarter should be built at Heraeum, far from any infection within his walled city. Since the topography of Heraeum's coastline dangerously exposed all vessels to the prevailing strong northerly winds and currents, a harbour was also included in the construction plans; this feature may have been built before the royal quarter to facilitate the transportation of the construction materials required for it. A similar strategy had been adopted involving the Port of Theodosius at Constantinople, in the south-western corner of the Theodosian walls in the late 4th and early 5th centuries AD. As we mentioned above, this port was constructed within the larger scheme of urban development along the southern shores of the city and the northern coastline of the Sea of Marmara in the late 4th century AD, with the warehouses/magazines for storing food and building materials being located between it and the Julian Port. That no references to the Port of Theodosius appear in official documentation of the mid 5th and 6th century AD may well suggest that it had been conceived for this urban enterprise and was then neglected by succeeding emperors, although the magazines continued to function as stores for grain, oil, and wine for those who settled in Kainopolis. The history of Heraeum's port was different, however. Once the new royal quarter was built, the port was regularly

used by the Imperial family and its entourage, as well as for landing their provisions. When the emperor eventually felt it was safe to return to his capital, his wife preferred to spend most of the year at Heraeum. Despite its location in a naturally favourable bay, relatively protected from dangerous winds and currents, the building of the port at Eutropius, undertaken at the same time, was to attract ship-owners and merchants going to and from the Black Sea, and thus making it unnecessary to call in at Heraeum, and thus potentially endangering the health of the royal quarter. In contrast to Heraeum, the topography of Eutropius prevented local urban development and easy contacts with the hinterland, thus curtailing its growth as an economic and commercial centre. To increase the attractiveness of Eutropius, and further obviate the need for ships to call in at Heraeum, which might well have become a commercial centre in its own right, the emperor built a pilgrimage church in the area dedicated to Saint Michael, who was venerated then as a healer saint.

The motives behind Justinian's building of the harbour at Anapulus derived from the same personal interests of the emperor, i.e. to withdraw himself and his family from his capital, but he sought to disguise them, as well as to divert public attention from the huge sums he was spending on his construction projects at Heraeum and Eutropius, and especially at such a difficult, plague-ridden time. The risks of resentment and riots were real, and the emperor took the opportunity to demonstrate his philanthropy to those of his subjects who had survived the plague by initiating a building project at Anapulus, i.e. a public port and the reconstruction of the derelict shrine of Saint Michael, the healer saint. This protected port (as stated by Procopius) provided safe anchorage for daily commercial exchange; and the renovated shrine provided a place of rest and recreation for the public. This opportunistic, if not devious, policy of Justinian's did not deceive Procopius of Caesarea, who criticised the emperor in his *Anecdota* for wasting money on projects, such as the building of ports (*Anecdota*, VIII. 7-8, XIX. 6).

The fact that the emperors of the 6th century AD did not initiate harbour construction projects at potentially beneficial sites such as Abydos in the southern Dardanelles, despite its economic and strategic importance, or at Hebdomon, despite good natural location and favourable south-westerly winds in the Sea of Marmara, seems to accentuate general Imperial strategy of not wanting to invest in the building of new ports. We should remember, however, that the natural haven at Hebdomon, where Justinian I was to lavish such expenditure in terms of urban development at the same time as his construction project at Heraeum, was to become the basis for this politically and militarily centre from the late 4th century AD onwards (Taddel

2014: 79). Within the Hebdomon quarter, Justinian commissioned great churches and the Jucundianae Palace, a residence equal in splendour to his palace at Heraeum. Among the churches was one dedicated to John the Baptist, which rivalled the church he had built for Saint Michael at Anapulus, as well as others to the martyrs Menas and Menaeus (*De Aedificiis*, I. viii. 15-16, I. ix. 16). It seems highly likely that this enormous spending spree of Justinian's was to appease the senate, elites, and military leaders, who might well earlier have resented his building project at Heraeum (and might also have seen it as a waste of money and further evidence of his cowardly behaviour – we remember that following the Nika riot Justinian attempted to flee his capital; an act of apparent cowardice he may well have wanted to disguise following the bubonic plague.

The same strategy of oversight or neglect was adapted by the emperors of the 6th century AD in terms of the maintenance operations of ports. There were it seems just two exceptions – one in the reign of Anastasius I regarding the Julian Port in AD 509, and the other by Justinian I in AD 551 associated with the natural harbour of Hebdomon. In both cases the maintenance operations only went so far as dredging so as to accommodate the drafts of contemporary vessels. Prima facie, it is intriguing that these works are only mentioned in administrative sources, i.e. Marcellinus for the Julian Port, and Malalas for Hebdomon. They are completely ignored by the panegyrics to Anastasius I by Procopius of Gaza and to Justinian I by Procopius of Caesarea. The explanation for this may have been that dredging and draining projects were not as sophisticated as port building and required fewer financial resources, especially with the available mechanical devices, such as the wheeled machines reported by Marcellinus in AD 509. The motives behind these maintenance operations is unknown. That said, it is intriguing that neither of the 6th-century emperors saw fit to clear the silted up Port of Theodosius. Clearly, the Julian Port and the Hebdomon anchorage were more significant for these two emperors than the Port of Theodosius. The Julian Port was the gateway to the Imperial palace and the Hebdomon to the Jucindanane palace and the whole quarter, which enjoyed political and military importance. The Port of Theodosius was originally built to provide various facilities during the creation of the urban space of Constantinople along its southern shore. After this project was done, in the 5th century AD, the emperor ceased to have the port maintained. Following this train of thought, one might suspect that the importance of the Port of Theodosius in the 6th century AD was emphasised by modern scholars only on account of the rich and important material evidence discovered during excavations there. That said, the dendrochronological analysis of the remains of the wooden posts of the piers, that

points to their renovation, is very likely the evidence of private interventions conducted by the ship-owners and merchants who continued to use the port; despite its silting, the facility was still deep enough to accommodate their vessels, as the 6th-century AD shipwrecks attest.

The Imperial strategy in Constantinople and its environs mirrored the emperors' policy in the periphery in the Eastern Mediterranean; and the absence of Imperial projects involving the building of ports, or their maintenance, in administrative documentation accentuates this. However, this does not preclude private initiatives undertaken at the Port of Theodosius. An epigram of the late 5th/early 6th century AD records the functioning of the Pharos at Alexandria and mentions someone called Ammonius, a character who does not appear in any other sources, as the man responsible for repairs to the foundations of the famous lighthouse. This achievement is attributed to Anastasius I in the panegyric by Procopius of Gaza, providing one of the pieces of evidence why this work should not be taken at face value; the renovation of the port at Caesarea Maritima is also attributed to this emperor, and, in contrast to the repairs to the Pharos at Alexandria, the panegyric does not detail the nature of the works allegedly done at the port of Caesarea. The fact that this port was neither mentioned in the encomium of Procopius of Caesarea, nor by any of the 6th-century commentators, raises the suspicion that, similar to the case of the Port of Theodosius, the archaeologists and geo-archaeologists have credited to the port a significance it did not actually enjoy in late antiquity. In consequence, the remains that have been arbitrarily attributed to the alleged project of Anastasius I by modern researchers should be re-evaluated.

Having said that, an inevitable question arises. Why did the emperors not build ports or maintain the ones they had? When we search for an answer to this, we run the risk of looking at history through modern eyes and concepts, according to which maritime activity (mainly commercial) could only have been carried out successfully at protected ports. However, in historic times (Late Antiquity in our case) captains anchored wherever they found it profitable to do so, even if they risked losing their vessels. Ascalon, with its shoreline dangerously exposed to the prevailing strong winds and stormy waves, illustrates this argument well, showing that a coastal town could function well as a port town without a protected haven. The natural haven at Hebdomon provides another example.

It is noteworthy that after the Early Byzantine period what was important was not commerce but the protection of the seashores of coastal towns against

hostile attacks from the sea, and this provided the motivation to build ports. At Acre, the governor of Egypt and Palestine, Ibn Tūlūn, must have ordered the construction of the eastern mole to protect the city's coast here. This was the area that gave access to the city from the sea, and it was necessary to reinforce this district against retaliatory landings by Ibn Tūlūn's overlords, against whom he had rebelled, on behalf of the Abbasids in the 9th century AD. The Abbasids eventually hired Leo of Tripoli, a Byzantine corsair, to attack Ibn Tūlūn's naval forces (Fahmy 1966: 62-63). In addition to building Acre's eastern mole, Ibn Tūlūn closed the southern entrance to the port with a chain that extended between the tower at the southern end of the sea wall and another tower to its west, at the eastern end of the Roman/Byzantine pier (Gertwagen 1966: 566-567). In the high Middle Ages, when Venice controlled many former Byzantine natural harbours and islands in the Aegean and the Ionian Seas, the Serenissima was forced by the Venetian settlers to build several new ports, i.e. along the northern coast of Crete, at Modon, on the south-western tip of the Peloponnese, on Corfu, etc., for protection against pirates and other enemies of the Venetians, e.g. the Normans and, most of all, the Genoese and their allies. The policy of Venice, which did not have an artificial port of its own of course, was that if maritime activity had been successfully conducted in natural havens up to the 13th century AD, there was no need to invest money and human resources in man-made ports. The Venetian settlers, on the other hand, threatened to abandon the territories acquired by Venice in the Ionian and Aegean unless she changed her policy (Gertwagen 2000).²⁵ It seems that in the Early Byzantine period even the Vandal threat did not spur the emperors to build new ports in strategic locations, i.e. in the Eastern Mediterranean, or at Abydos in the southern Dardanelles.

The third topic discussed in this contribution is the technology involved in the construction and maintenance of ports. We have no manuals showing how ports were built in the Early Byzantine period, and rely therefore to an extent on Vitruvius' *De Architectura*, compiled at the end of the 1st century BC. The only information available for Late Antiquity is the panegyric *De Aedificiis* to Justinian I by Procopius of Caesarea. Interestingly, Procopius makes no mention of any professional architects or engineers involved in these projects, as he does, for instance, for Hagia Sophia (for the architects mentioned by Procopius, see Zanini 2007: 390). Rather, he introduces the port projects as the work of emperor himself. Perhaps this had something to do with the unusual marine settings where the projects were carried out, and because no ports were built in Byzantium in the 5th and 6th centuries AD.

²⁵ For a synthesis, with relevant bibliography, of all the ports, see Gertwagen 2013: 157-160.

Perhaps the emperor, who ordered Procopius to write the *De Aedificiis*, wanted the attribution for such extraordinary projects to go to him alone. That said, one can safely speculate that the professionals in charge of these projects were the city's two great 'mechanikoi', Isidorus of Miletus and Anthemius of Tralles, upon whom Justinian also called to work on the dam at Dara after the appointed architect, Chryses from Alexandria, applied for the emperor's help (*De Aedificiis*, II. lii. 1-7).²⁶

Three ports were built in the 6th century AD. One at Anapulus and two on the Strait of Hieron in the northern section of the Bosphorus. The Anapulus project was the easiest, as the headland there could be utilised as one 'wall' of the future port, whereas at Heraeum and Eutropius the ports needed free-standing sea walls. As mentioned above, in contrast to Heraeum, which lacked any favourable coastal features for refuge, Eutropius was also located on the partially protected bay of Macre. However, at Eutropius the emperor ordered the building of the same type of sea walls as at Heraeum, highly likely to prevent those merchant captains sailing to the Black Sea and back from anchoring Heraeum under the pretext that it was safer and better serviced, and thus threatening to endanger the health, i.e. by bringing in the plague, of the royal quarter at Heraeum.

A further reason why the port at Anapulus was easier to build than the facility at Heraeum was down to their respective marine environments, i.e. the Hieron Strait, at the northern section of the Bosphorus, was subject to violent winds, currents, and strong waves coming from the Black Sea, whereas the landing place at Anapulus was partially protected by its headland.

These different conditions associated with the construction of sea walls at these ports, i.e. the breakwater made of boulders, and with a quay-like mole (Anapulus), and the concreted moles with a breakwater on top of their exposed sides, towards the sea (Heraeum and Eutropius). The moles were created by *caissons* or chests filled with compressed concrete. All types of sea walls required construction skills of course, but breakwaters were easier to build and called for less resources than free-standing concrete structures in the open sea and difficult marine environments.

The technique of using wooden forms containing concrete to build underwater structures was already discussed in Vitruvius' *De Architectura* (V. 12. 1-6; Oleson 2014: 20-3). Procopius of Caesarea's description of the technique used for free-standing structures in unfavourable marine environments is reminiscent of the method used at the Herodian port of Caesarea

Maritima and at Alexandria, i.e. floating concrete blocks to their intended locations after they had been cured in box-shaped forms/chests (κιβοτοί) (Brandon 2014: 212, 215-221, Figs 8.51, 8.61); this method may also tally with the modern interpretation of one of the solutions already suggested by Vitruvius (*De Architectura*, V. 12. 3-4; and see Brandon 2014: 209). However, this does not mean that later engineers/architects had access to Vitruvius' book (or to other manuals, as yet unknown, that recorded practices not mentioned by Vitruvius). Instead, the construction technique employed at Heraeum and Eutropius shows that in similar difficult marine conditions similar solutions were implemented in different periods and places.

It is noteworthy that even in the Roman period engineers developed sophisticated techniques, not mentioned by Vitruvius, to use wooden forms containing concrete blocks in marine environments, as dictated by local conditions (Brandon 2014: 210-220). Clearly, experimental construction techniques co-existed in the Roman period with 'scientific' knowledge provided by manuals, such as Vitruvius' famous work.

As we saw, Procopius does not provide details of the type of concrete in the floating chests. Perhaps it was the same concrete, i.e. *khorsan*, which had been used at Hagia Sophia (Livingston 1993), and thus its familiarity meant there was no need to mention it. As mentioned above, the same architects working at Hagia Sophia were in charge of the hydraulic project at Dara, as well as the building of the ports at Heraeum and Eutropius. For Procopius, the extraordinary process that merited description was the floating of the concrete blocks to their desired locations in the difficult marine environment. Alternatively, perhaps he did not understand the process of preparing and curing the *khorsan* concrete to be used underwater – explanations that may have been conveyed to him directly by the engineers or by the workers working under the architects. Procopius himself admits his lack of understanding of technical details and processes, as well as his inability to explain them in his text.

By the 6th century AD, knowledge of the hydraulic properties of pozzolana concrete (originating from the Gulf of Naples), and the proper way to mix it, had long been lost. It is, however, noteworthy that there is evidence that already points to failure in this technology in the Roman period. For example, the coring in the concrete at the port of Caesarea has revealed uneven craftsmanship. The concrete contained pozzolanic and non-pozzolanic ingredients, i.e. local stones aggregates that did not adhere to the pozzolana. This could have occurred from a desire to reduce costs, or, more plausibly, it was down to inexperience when it came to building structures in the sea: the local master

²⁶ Isidorus of Miletus and Anthemius of Tralles were, of course, also the architects and engineers in charge of the building of Hagia Sophia (*De Aedificiis*, I. i. 24).

builders, senior workmen, and crew chiefs all lacking adequate supervision by the Roman engineers with this new technology (Hohlfelder and Brandon 2014: 77, 79). In other words, this concrete coring evidence at Caesarea illustrates the level of knowledge required for both the type of material chosen (and where to acquire it) and the way it was used underwater; i.e. the material containing pozzolanic hydraulic qualities. Contemporary researchers working at the Port of Theodosius do not mention pozzolanic concrete containing pumiceous volcanic ash from Italy at any of its installations dating to the late 4th/early 5th centuries AD. It would appear, therefore, no knowledge of hydraulic concrete was transferred to Constantinople and local architects/engineers relied on the same local *khorsan* concrete they used on land for their underwater constructions, i.e. Abu Bakre's (from Jerusalem) application of his terrestrial building techniques for the eastern mole at the 9th-century port of Acre.

Sites in Turkey provide a good case study for showing that knowledge of the hydraulic properties of the right concrete for use underwater is required, as well as the right place to core the material. The very first time hydraulic concrete, based on pozzolana, was employed in Turkey was in the 18th century in Istanbul, with the construction there of Dry Dock No. 3 (1796-1799) and later repair works. The pozzolanic earth was imported from Italy, and it continued to be imported also in the 19th century for the construction of Dry Dock No. 2 (1821-1825) in the Golden Horn. Only later did the Turks recognise the pozzolanic qualities of earth to be found on the Cycladic island of Santorini in the Aegean, and its procurement was rewarded by the Sultan of the time; the material from Santorini was used successfully in the construction of harbours in Turkey (Akman *et al.* 1987: 3). Until the late 18th century the hydraulic concrete favoured in Turkey was based on *khorsan*.

For land buildings (including quays), *khorsan* concrete, comprising slaked-lime mixtures with crushed burnt clay brick, or well-fired tile fragments, has sufficient strength for structural use. When clay is burned at a high temperature some of its basic elements (silicates) are partially decomposed so that they react effectively with lime (Akman *et al.* 1987: 9-10). However, for building underwater, huge quantities of *khorsan* components are required to reach the status of pure pozzolana. Furthermore, to impart the maximum strength and durability to the *khorsan*, it was essential to give it sufficient time to cure and not let it dry quickly; the process of carbonation hardening is, in practice, extremely slow, as the diffusion of carbon dioxide into the inner layers takes years. In Istanbul it was observed that the carbonation of cement based on lime and *khorsan* was still not fully complete in the foundations

of buildings as much as one thousand years old (Akman *et al.* 1987: 3-4). Rushing the building of Hagia Sophia must have been the main reason why various elements supporting the dome. The correct curing process was even more important when applying poorly processed *khorsan* concrete to underwater structures in challenging marine environments. If Justinian I had wanted to finish the building of the concreted moles at Heraeum and Eutropius as quickly as possible, then rushing the project would have added another factor to the early collapse of these structures. We note, as stated above, that this project was carried out after the end of the bubonic plague and before Theodora's death in AD 548.

There is no written evidence after Procopius of Caesarea regarding the fate of these ports in the Strait of Hieron. One must wait for underwater explorations to study their remains, i.e. what were their plans, their building technologies (if any concrete components or *caissons* remain), how long did they function, what fates befell the ports, etc. Similar investigations would be welcomed regarding the breakwater and its quay-like mole at Anapulus, assuming any remains can be found.

Bibliography

Primary Sources

- Amato, E., Corcella, A., Ventrella, G., Marechaux, P. 2014. *Procopé de Gaza, discours et fragments*. Paris: Les Belles Lettres.
- Anonymous Treatise on Strategy 1985. In G.T. Dennis (transl.) *Three Byzantine Military Treatises*: 1-136. Washington, DC: Dumbarton Oaks.
- Cameron, A. (transl.) 1976. *Corippus, In laudem Justini: Flavius Cresconius Corippus, In laudem Justini Augusti minoris libri IV*. London: Athlone Press.
- Choniates Niketas 1984. 'O City of Byzantium'. *Annals of Niketas Choniates* (H.J. Magoulias transl.). Detroit, MI: Wayne State University Press.
- Evagrius Scholasticus 2000. *The Ecclesiastical History* (M. Whitby transl.). Liverpool: Liverpool University Press.
- Goeje, de, M.J. (ed.) 1906. Shams al-Dīn Abū 'Abd Allāh Muḥammad ibn Aḥmad ibn Abī Bakr al-Maqdisī. *Aḥsan al-taqāsīm fi ma'arfat al-aqalim*. Leiden: Brill.
- Huygens, R.B.C. (ed.) 1986. *Willelmi Tyrensis Archiepiscopi Chronicon*. Corpus Christianorum Continuatio Mediaevalis 63 & 63a. Turnholt: Brepols.
- John the Lydian 1971. *De Magistratibus Populi Romani* (T.F. Carney Lawrence transl.). Kansas City, KS: Coronado Press.
- Joshua the Stylite 1882. *The Chronicle of Joshua the Stylite, composed in Syriac in AD 507*. (W. Wright transl.). Cambridge: Cambridge University Press.

- Malalas, J. 1986. *The Chronicle of John Malalas* (E. Jeffreys, M. Jeffreys, R. Scott et al. transl.). Melbourne: Melbourne University Press.
- Marcellinus 1995. *The chronicle of Marcellinus*, ad. A.509 (B. Croke transl.). Leiden: Brill.
- Procopius of Caesarea 1961. *De Aedificiis*. Loeb Classical Library, Vol. VII (H.B. Dewing transl.). Cambridge, MA: Harvard University Press.
- Procopius of Caesarea 1961. *The History of the Wars*. Loeb Classical Library, Vol. I. (H.B. Dewing transl.). Cambridge, MA: Harvard University Press.
- Procopius of Caesarea 1960. *The Anecdota or Secret History*. Loeb Classical Library, Vol. VI (H.B. Dewing transl.). Cambridge, MA: Harvard University Press.
- Procopius of Gaza 1986. Panegyricus in Imperatorem Anastasium, in A. Chauvot (transl.) *Procopé de Gaza, Priscien de Césarée, Panégyriques de l'empereur Anastase Ier*. Antiquitas, Reihe I, 35. Bonn: Habelt.
- Procopius of Gaza 1865. Panegyricus in Imperatorem Anastasium, in J.P. Migne (ed.) *Patrologiae Cursus Completus*, Vol. 3: 2793-2826. Series Graeca 87. Paris: Geuthner.
- Ševčenko, I. and N.P. Ševčenko (transl.) 1984. *The Life of Saint Nicholas of Sion*. Archbishop Iakovos Library of Ecclesiastical and Historical Sources 10. Brookline, MA: Hellenic College Press.
- Theophanes Confessor 1997. *The Chronicle of Theophanes Confessor Byzantine and Near Eastern History AD 284-813* (C. Mango and R. Scott transl.). Oxford: Clarendon Press.
- Theophanes 1982. *The Chronicle of Theophanes* (H. Turtledove transl.). Philadelphia, PA: University of Pennsylvania Press.
- Secondary Literature**
- Ahrweiler, H. 1996. Eusebius of Caesarea and the Imperia Christian Idea, in A. Raban and K. C. Holum (eds) *Caesarea Maritima. A Retrospective after two millennia: 541-548*. Leiden: Brill.
- Ahrweiler, H. 1961. Fonctionnaires et bureaux maritimes à Byzance. *Revue des études byzantines* 19: 239-252.
- Akman, M.S., A. Güner, I.H. Aksoy 1987. The History and Properties of Khorasan Mortar and Concrete, in K. Çeçen (ed.) *2nd International Congress on the History of Turkish and Islamic Science and Technology Congress, Istanbul Technical University (Istanbul, 28 April - 2 May 1986)*, Vol. 2: 1-11. Istanbul: Istanbul Technical University.
- Akyürek, T.E. 2016. Andriake: The Port of Myra in Late Antiquity, in P. Magdalino and N. Necipoğlu (eds) *Trade in Byzantium. Papers from the Third International Sevgi Gönül Byzantine Studies Symposium: 465-487*. Istanbul: Koç University's Research Center for Anatolian civilizations (ANMED).
- Algan, O., B. Alpar, C. Gazioğlu, D. Vardar and K. Öztürk 2010. Geo-Archaeology of the Theodosian Harbour at Yenikapı, in U. Kocabaş (ed.) *Proceedings of the 1st Symposium on Marmaray-Metro Salvage Excavations (Istanbul, 5th-6th May 2008): 175-179*. Istanbul: Directorate of Istanbul Archaeological Museums.
- Amiran, D.H.K., E. Arieh and T. Turcotte 1994. Earthquakes in Israel and adjacent areas. Macro seismic observations since 100 B.C.E. *Israel Exploration Journal* 44: 260-305.
- Amity, D. and S. Gibson 2014. Water to Jerusalem: the Route and Date of the Upper and Lower Level Aqueducts, in C. Ohlig and T. Zuk (eds) *Cura Acquarum in Israel II: Water in Antiquity. Proceedings of the 15th international Conference on the history of Water Management and Hydraulic Engineering in the Mediterranean Region (Israel, 14th-20th October 2012): 1-33*. Siegburg: Deutsche Wasserhistorische Gesellschaft.
- Angelova, D.N. 2015. *Sacred Founders: Women, Men, and Gods in the Discourse of Imperial Rounding, Rome through Early Byzantium*. Berkeley, CA: University of California Press.
- Başaran, S. and Z.S. Kızıltan 2016. The Archaeology of the Historic Peninsula. A World Heritage Istanbul Special Issue, in Y. Zekiye and F. Ünsal (eds) *World Heritage. Special Issue on Istanbul: 40-57*. Istanbul: İstanbul Sit Alanları Alan Başkanlığı.
- Bony, G., N. Marriner, Ch. Morhange, D. Kaniewski and D. Perinçek 2012. A high-energy deposit in the Byzantine harbour of Yenikapı, Istanbul (Turkey). *Quaternary International* 266: 117-130.
- Brandon, C.J. 2014. Roman Formwork used for Underwater Concrete Construction, in J.P. Oleson (ed.) *Building of Eternity. The History and Technology of Roman Concrete Engineering in the Sea: 189-222*. Oxford: Oxbow Books.
- Cameron, A. 1985. *Procopius and the sixth century*. Berkeley, CA: University of California Press.
- Cameron, A. 1967. Notes on the Sophiae, the Sophianae and the Harbour of Sophia. *Byzantion* 37: 11-20.
- Chauvot, A. 1986. *Procopé de Gaza, Priscien de Césarée, Panégyriques de L'Empereur Anastase Ier*. Antiquitas, Reihe I, 35. Bonn: Habelt.
- Crow, J. and A. Ricci 1997. Interim report of the Anastasian Long Wall at Constantinople. *Journal of Roman Archaeology* 10: 235-262.
- Dan, Y. 1972. Information about Acre in a Greek work of the seventh century, in B. Oded, U. Rapoport, A. Schochat and Y. Shatzmiller (eds) *Studies in the history of the Jewish people and the Land of Israel: 52-62*. Haifa: University of Haifa.
- Davey, N. 1961. *A History of Building Materials*. London: Phoenix House.
- Di Segni, L. 1996. Metropolis and Provincia in Byzantine Palestine, in A. Raban and K.C. Holum (eds) *Caesarea*

- Maritima. A Retrospective after two millennia: 575-589.* Leiden: Brill.
- Di Segni, L. and Y. Hirschfeld 1986. Four Greek Inscriptions from Ḥammad Gader from the Reign of Anastasius. *Israel Exploration Journal* 36: 251-268.
- Fahmy, A.M. 1966. *Muslim Sea-Power in the Eastern Mediterranean from the Seventh to the Tenth Century AD.* Cairo: National Publication & Printing House.
- Geoffrey, G. 1994. The Dates of Procopius' Works. *Byzantine and Modern Greek Studies* 18: 101-114.
- Gertwagen, R. 2014. Nautical Technology, in H. Peregrine and Sh. Kinoshita (eds) *Companion to Mediterranean History: 154-169.* Hoboken, NJ: Wiley Blackwell.
- Gertwagen, R. 2013. Fiscal and Technological Limitations on Venetian Military Engineers in the Stato da Mar in the fourteenth and fifteenth centuries, in B. Lenman (ed.) *Military Engineers and the Making of the Early Modern State: 155-178, 326-330.* Dundee: Dundee University Press.
- Gertwagen, R. 2000. The Concept of Medieval Ports in the Medieval Eastern Mediterranean: Construction and Maintenance. The Case on Crete to the end of the 15th Century. *International Journal of Maritime History* 12/1: 63-133.
- Gertwagen, R. 1996. The Crusader Port of Acre: Layout and Problems of Maintenance, in M. Balard (ed.) *Autour de la Première Croisade: 553-582.* Paris: Sorbonne.
- Gkikaki, M. and E. Lemi 2014. The Pharos of Alexandria as a Total Work of Art and a Soundscape. *Archaeoacoustics: The Archaeology of Sound* 2: 153-159.
- Greatrex, G. 1994. The dates of Procopius' works. *Byzantine and Modern Greek Studies* 18: 101-114.
- Günsenin, N. 2017. Harbours and shipbuilding in Byzantine Constantinople, in M. Balard (ed.) *The Sea in History. The Medieval World: 412-424.* Woodbridge: The Boydell Press.
- Haar Romeny, B.T. 2007. Procopius of Gaza and his Library, in H. Amirav and B.T. Haar Romeny (eds) *From Rome to Constantinople: Studies in Honour of Averil Cameron: 173-190.* Leuven: Peeters.
- Haarer, F.K. 2006. *Anastasius I Politics and Empire in the Late Roman World.* Cambridge: Francis Cairns.
- Hendrik, D. and B. Goodman-Tchernov 2010. Tsunamis and the port of Caesarea Maritima over the longue durée: a geoarchaeological perspective. *Journal of Roman Archaeology* 23: 265-284.
- Hohlfelder, R.L. 1988. Procopius de Aedificiis I.ii.18-20: Caesarea Maritima and the building of harbours in late antiquity. *Mediterranean Historical Review* 3/1: 54-62.
- Hohlfelder, R.L. 1993. Anastasius I and the restoration of Caesarea Maritima's harbour: the numismatic evidence, in A. Biran and J. Aviram (eds) *Biblical Archaeology today 1990: Proceedings of the Second International Congress on biblical Archaeology, Jerusalem June-July 1990: 687-696.* Jerusalem: Israel Exploration Society.
- Hohlfelder, R.L. 2000. Anastasius I, Mud, and foraminifera: Conflicting views of Caesarea Maritima's Harbor in Late Antiquity. *Bulletin of the American Schools of Oriental Research: 41-62.*
- Hohlfelder, R.L. and C. Brandon 2014. Narrative of the ROMACONS Fieldwork, in J.P. Oleson (ed.) *Building for Eternity - The History and Technology of Roman Engineering in the Sea: 55-101.* Oxford: Oxbow Books.
- Houston, W.G. 1988. Ports in Perspective: Some Comparative Materials on Roman Merchant Ships and Ports. *American Journal of Archaeology* 92/4: 553-564.
- Jones, Ch. 2007. Procopius of Gaza and the Water of the Holy City. *Greek, Roman, and Byzantine Studies* 47: 455-467.
- Kocabaş, U. 2015. The Yenikapı Byzantine-Era Shipwrecks, Istanbul, Turkey: a preliminary report and inventory of the 27 wrecks studied by Istanbul University. *International Journal of Nautical Archaeology* 44.1: 5-38.
- Kocabaş, U. and I.Ö. Kocabaş 2010. Shipwrecks at the Theodosian Harbour, in P. Pomey (ed.) *Transferts technologiques en architecture navale méditerranéenne de l'Antiquité aux temps modernes: identité technique et identité culturelle. Actes de la Table Ronde d'Istanbul 19-22 mai 2007: 109-127.* Varia Anatolica 20. Istanbul: Institut Français d'Études Anatoliennes Georges Dumézil.
- Livingston, R.A. 1993. Materials analysis of the Masonry of the Hagia Sophia Basilica, Istanbul. *Transactions on the Built Environment* 3: 849-865.
- Magdalino, P. 2007a. Medieval Constantinople, in P. Magdalino (ed.) *Studies of the History and Topography of Byzantine Constantinople: 1-111.* Variorum Collected Studies 855: Aldershot, Ashgate.
- Magdalino, P. 2007b. Aristocratic Oikoi in the Tenth and Eleventh Regions of Constantinople, in P. Magdalino (ed.) *Studies of the History and Topography of Byzantine Constantinople: 53-69.* Variorum Collected Studies 855. Aldershot: Ashgate.
- Magdalino, P. 2007c. The maritime neighbourhoods of Constantinople: commercial and residential functions, Sixth to Twelfth Centuries, in P. Magdalino (ed.) *Studies of the History and Topography of Byzantine Constantinople: 209-226.* Variorum Collected Studies 855. Aldershot: Ashgate.
- Mango, C. 2004. *Le développement urbain de Constantinople, IVe-VIIIe siècles.* Paris: De Boccard.
- Mango, C. 2001. The shoreline of Constantinople in the fourth century, in N. Necipoğlu (ed.) *Byzantine Constantinople, Monuments, Topography and Everyday Life: 17-28.* Leiden: Brill.
- Mango, C. 2000. The Triumphal way of Constantinople and the Golden Gate. *Dumbarton Oaks Papers* 54: 173-188.

- Mango, C. 1997. The Palace of the Boukoleon. *Cahiers Archéologiques* 45: 41-50.
- Mango, C. 1986. St. Michael and Attis. *Deltion tes Christianikes Archaologikes Hetaireas* 12: 39-62.
- Mass, M. 1992. *John Lydus and the Roman Past: Antiquarianism and Politics in the Age of Justinian*. London: Routledge.
- Mayerson, P. 1986. Choricus of Gaza on the Water Supply System of Caesarea. *Israel Exploration Journal* 36/3/4: 269-272.
- McCormick, M. 2001. *Origin of the European Economy: communications and commerce A.D. 300-900*. Cambridge: Cambridge University Press.
- McCormick, M. 1998. Bateaux de vie, bateaux de mort: maladies, commerce, transport, annonaires et les passages économique du Bas-Empire au moyen âge, in *Morfologie sociali e culturali in Europa fra Tarda Antichità e Alto Medioevo*, Vol. I: 5-122. Settimane di Studio della Fondazione Centro Italiano di Studi sull'Alto Medioevo 45. Spoleto: Centro italiano di studi sull'alto Medioevo.
- Mor, H. 2012. The socio-economic implications for ship construction: Evidence from underwater archaeology and the Codex Theodosianus, in R. Gertwagen and E. Jeffreys (eds) *Shipping, trade and Crusade in the Medieval Mediterranean*: 39-64. Farnham, Ashgate.
- Moreno, A. 2008. Hieron. *Hesperia* 77: 655-709.
- Oleson, J.P. 2014. Ancient Literary Sources Concerned with Roman Concrete Technology, in J.P. Oleson (ed.) *Building of Eternity. The History and Technology of Roman Concrete Engineering in the Sea*: 11-36. Oxford: Oxbow Books.
- Oleson, J.P. 1996. Artifactual Evidence for the history of the Harbors of Caesarea, in A. Raban and K.G. Holum (eds) *Caesarea Maritima, A retrospective after two millennia*: 359-377. Leiden: Brill.
- Oleson, J.P. and M.D. Jackson 2014. The Technology of Roman Maritime Concrete, in J.P. Oleson (ed.) *Building of Eternity. The History and Technology of Roman Concrete Engineering in the Sea*: 1-10. Oxford: Oxbow Books.
- Pearson, C.L., C.B. Griggs, P.I. Kuniholm, P.W. Brewer, T.J. Wazny and L. Canady 2012. Dendroarchaeology of the Mid-First Millennium AD in Constantinople. *Journal of Archaeological Science* 39: 3402-3414.
- Perinçek, D. 2010. Geoarchaeology of the Excavation Site for the Last 8000 Years and Traces of Natural Catastrophes in the Geological Profile, in U. Kocabaş (ed.) *Proceedings of the 1st Symposium on Marmaray-Metro Salvage Excavations (Istanbul, 5th-6th May 2008)*: 191-218. Istanbul: Directorate of Istanbul Archaeological Museums.
- Pulak, C., R. Ingram and M. Jones 2015. Eight Byzantine Shipwrecks from the Theodosian Harbour Excavations at Yenikapı in Istanbul, Turkey: an introduction. *International Journal of Nautical Archaeology* 44/1: 39-43.
- Quinn, A.D. 1961. *Design and Construction of Port and Marine Structures*. New York, NY: McGraw
- Raban, A. 1998. Combined Caesarea Excavations. *Excavations and Surveys in Israel* 17: 58-77.
- Raban, A. 1992. Sebastos. The Royal harbour at Caesarea Maritima – a short-lived giant. *The International Journal of Nautical Archaeology* 21.2: 111-124.
- Raban, A. 1991. The Subsidence of Sebastos: when the Breakwaters at Caesarea Maritima were flooded. *Thracia Pontica* 4: 339-360.
- Ritchie, G.S. (ed.) 1969. *Black Sea Pilot* (11th edn). Taunton: Hydrographic Department, Ministry of Defence.
- Schläger, H., D.J. Blackman and J. Schäfer 1968. Der Hafen von Anhedon mit Beiträgen zur Topographie und Geschichte der Stadt. *Archäologischer Anzeiger* 83/1: 21-102.
- Sthakopoulos, D. 2004. *Famine and Pestilence in the Late Roman and Early Byzantine Empire. A Systematic Survey of Subsistence Crises and epidemics*. Birmingham Byzantine and Ottoman Monographs 9. Aldershot: Ashgate.
- Sthakopoulos, D. 2002. Travelling with the plague, in R. Macrides (ed.) *Travel in the Byzantine World. Papers from the Thirty-fourth Spring Symposium of Byzantine Studies (Birmingham, 2000)*: 99-106. Society for the Promotion of Byzantine Studies 10. Aldershot: Ashgate.
- Taddel, A. 2014. Notes on the so-called 'Palace of Ioukoundianai' at Hebdomon (Constantinople). *Hortus Artium Medievalium* 20/1: 77-84.
- United Kingdom Hydrographic Office. 2003. *The Black Sea and the Sea of Azov Pilot*. Marmara Denizi, Black Sea and Sea of Azov with adjacent coasts of Turkey, Bulgaria, Romania, Ukraine, Russia and Georgia. London: Crown Publishing.
- Whitwright, J. 2012. Technological continuity and change: the lateen sail of the medieval Mediterranean. *Al-Masāq* 25/1: 1-19.
- Wilson, A. 2011. Development in Mediterranean shipping and maritime trade from the Hellenistic period to AD 1000, in D. Robinson and A. Wilson (eds) *Maritime Archaeology and Ancient Trade in the Mediterranean*: 33-60. Oxford Centre for Maritime Archaeology Monograph 6. Oxford: Oxbow Books.
- Wright, G.R.H. 2005. *Ancient Building Technology: Materials*, Vol. 2. Technology and Change in History 7. Leiden: Brill.
- Zanini, E. 2007. Technology and Ideas: Architects and Master-Builders in the Early Byzantine World, in L. Lavan, E. Zanini and A. Sarantis (eds) *Technology in Transition A.D. 300-360*: 381-406. Late Antique Archaeology 4. Leiden: Brill.