

The Impact of Byzantium's Political and Economic History on Mediterranean Seafaring

Since the birth of archaeology in the 19th century, Classical Antiquity was considered as the golden era of cultural, economic and political development in Europe. In contrast, the later centuries, especially Late Antiquity and the Early Middle Ages, have been seen as a time of decline – a period of decay, deterioration and downfall, lacking in finesse and seeking for previous glamour¹. Indeed, until comparatively recently, archaeologists tended to ignore and obliterate those later strata in their desire to reach earlier, more appealing, strata. Consequently, the periods of Late Antiquity and Early Middle Ages lack fundamental knowledge and therefore still often being called the Dark Ages². But recent historical and archaeological research³ provides a different picture, showing that it was not a time of decline but rather a time of transition and change within a general continuity of Roman culture and tradition⁴. Especially the Eastern Mediterranean shows equally flourishing economic and political activities and development, as well as cultural and social prosperity from the 4th century onwards⁵.

After the last major naval battle of Antiquity at Actium 2nd September 31 BC⁶, the Roman Empire finally controlled the whole Mediterranean Sea, forming a so-called *Mare internum*⁷. The incorporation of the sea started a period of political and economic prosperity and peace for some 300 years, known as the *Pax Romana*⁸. Following those centuries of stability in a world with an enclosed maritime economic system, during Late Antiquity the European landscape changed dramatically in all respects, entering a time of political and economic destabilization⁹. Due to human migration (*Völkerwanderung*), new civilizations and kingdoms such as the Huns (4th-5th century), the Goths (3rd-6th century), the Vandals (5th century), the Lombards (6th century), the Slavs (6th century), the Avars (6th-7th century) or the Arabs (7th century) spread around the Mediterranean and changed the economic situation and political balance. Classical forms of

society got confronted and intermixed with new institutions and cultures, introducing different levels of communication and interaction¹⁰. By realizing quickly that only the control over the seas would secure economic and political power, the Roman Empire suddenly was not only faced with hostile fleets along its coasts again, but also with new institutions taking over the leading part in commerce and communication. This crucial period of transition, however, evokes important alterations and innovations for developments, later inventions and other milestones in human history. This can be observed, among many other facets, particularly in the transition of ship-construction¹¹.

Over the past few decades numerous researchers such as Parker, van Doorninck Jr., Bass and Steffy dealt with and presented various reasons for the development of shipbuilding in Late Antiquity – may it be the decline of labour market, the change of the nature of the cargo, a change in availability and access to resources of construction material or the progress and knowledge of technology¹². The reason for the transition and development in Eastern Mediterranean shipbuilding practices should be seen more as a combination of and an interplay between multiple factors such as commercial, economic, cultural and political-geographical ones instead of one or the other (as will be shown later). Of course, changes neither took place consistently in all regions nor in a short time. Nevertheless, a main transitional period for Eastern Mediterranean shipbuilding, particularly the transformation and adaption of methods or characteristics such as the hull, the rigging and the oaring, as well as the steering system, can be placed between the 4th and the 14th century and particularly between the 6th/7th and the 11th century¹³.

Closely related to the complex and unprecedented rich events of Late Antiquity and the medieval period with their political, economic, social and cultural transformation and even more to the factors behind the transition of shipbuild-

1 Kingsley, *Barbarian Seas* ix. – See Gibbon, *The History of the Decline*.

2 Kingsley, *Barbarian Seas* x. – Oxford English Dictionary (online).

3 Mainly due to the steady increasing activities in Nautical Archaeology, the study of shipbuilding, seafaring and maritime trade.

4 Brown, *The World of Late Antiquity* 7.

5 Kingsley, *Barbarian Seas* x. – See further Kingsley/Decker, *Economy and Exchange*.

6 Pitassi, *Navies* 197. – Starr, *The Roman Imperial Navy* 7. 53.

7 First mentioned by Pomponius Mela and Pliny the Elder: Pomponius Mela, *De Chorographia* 1.4. – Pliny Secundus, *Naturalis Historia* 3.4.

8 The *Pax Romana* or also called *Pax Augusta* characterizes the Roman period between the 1st and 3rd century, experiencing a time of peace and economic

prosperity around the Mediterranean introduced by the emperor Augustus. – For the *Pax Romana* see: Bianchi, *Ara Pacis Augustae*. – Ginalis, *The Northern Sporades* 282.

9 Kislinger, *Verkehrsrouten* 149.

10 Kingsley, *Barbarian Seas* 1.

11 For shipbuilding in that period see: Ginalis, *Byzantinische Seefahrt* 32-65. – Steffy, *Wooden Ship Building* 79-100.

12 Parker, *Shipwrecks* 24-30. – Van Doorninck Jr., *Byzantium* 139. – Steffy, *Wooden Ship Building* 85-87.

13 Ginalis, *Byzantinische Seefahrt* 33. – Ginalis, *Maritime Traditions* 2. – Steffy, *Wooden Ship Building* 84 figs 4. 8.

ing, is the impact of Byzantium's political and economic history. The Byzantine Empire (4th-15th century) was long-lived and rose and fell with its capital Constantinople at the most decisive geographically strategic crossroad of the Mediterranean, connecting Europe with Asia¹⁴. But similarly to the study of Late Antiquity, only in the last decades has the Byzantine Empire been recognized as an extremely important part of the European history, affecting and influencing not only its political and economic, but also its cultural, social and religious development. As such, for a long time it was considered as being the sad story of a continuous imperial decay¹⁵. Only in recent years this has changed and the Byzantine world has started to be studied carefully¹⁶. But following the traditional way of defining this empire, Byzantium is still characterized by three main elements, also called the pillars of this empire: Christianity, Roman tradition and ideology as well as Greek cultural heritage¹⁷. But in fact, the real element of its power and its development was the control over the seas. The formula of success throughout Byzantium's history of more than a thousand years was the role and importance of seafaring and its consciousness of the need for swift action at sea in order to sustain its leading and dominating power in a period of sweeping changes¹⁸. Communication as the new key role, particularly political and economic exchanges with different neighbouring civilizations, regions and spheres of influence, was a product of but also influenced the late antique and medieval history of the Byzantine Empire in the Mediterranean and beyond. This interaction is expressed by the intense and wide activity of navigation, naval seafaring and sea trade. Consequently, the Byzantine Empire played a major role in the history of seafaring and particularly in the closely related transition in ship-construction.

So far around 200 wreck-sites of the 4th to the 15th century of Byzantine provenience or of Byzantine context have been recorded and documented, revealing the important impact of this empire to that revolutionary period of seafaring¹⁹. But despite the large number of shipwrecks, many aspects of Mediterranean seafaring and especially the study of shipbuilding is still a puzzle. Sadly, nautical archaeologists still tend to handle archaeological material and remains as isolated features. Despite recent developments in connecting the study of maritime archaeology, in particular that of shipwreck assemblages, with archaeological sites on land such as settlements, kilns and other production centres²⁰, scholars in

that field so far fail to fully utilise the evidence from archaeology for a wider social- and political-historical context in order to get a full picture and a better broader understanding of this interaction. Historians again ignore archaeological studies, trying to rely exclusively on image and textual sources. However, a general historical background on social, political and economic aspects and developments helps to interpret the archaeological evidence. Vice versa, archaeological material and other human remains of all kinds provide essential pieces of information to put the puzzle together and answer questions such as why? and how?. Why are the late antique and medieval periods confronted with changes and how are these transformations expressed? The following is an overview of the progress in Mediterranean shipbuilding integrated within Byzantium's political and economic history, attempting to change a one-sided approach.

As a novice at sea, with the First Punic War (264-241 BC) the Roman Empire took over the classical and Hellenistic shipbuilding traditions of the trireme, quadrireme, quinquereme and other subsequent larger types²¹. But the establishment of a *Mare nostrum*²² with the lack of any organized naval opponent in the Mediterranean made the maintenance of a strong navy with heavy naval ships unnecessary. As such, despite the fact that Rome owed its power and domination over the Mediterranean and beyond to an efficient and superior navy²³, the organization of the Roman navy shifted towards smaller units guarding and patrolling along the coastline as well as used for escorting and transporting purposes²⁴. Except for the two main fleets of *classis Ravennatum* and *classis Misenatum*²⁵ (which consisted mainly of triremes and a few bigger types²⁶), the provincial fleets possessed almost exclusively Liburnae – small, light, swift and manoeuvrable Illyrian ships with one or two rows of oars, a single mast and a ram²⁷. The commonly used construction method for Mediterranean ships at that time was the nailed hull-first technique, which had been well-known and used for centuries. In this method, planks were butted up against each other, edge to edge, with the ship's hull being built from the keel up. The planks were fastened with pins, which were in turn fixed vertically by means of mortise and tenon joints (fig. 1). As soon as the floor timbers were set in place, lending shape to the ship, the hull's upper part was pulled up and afterwards strengthened with the key ribs and framing timbers, using mainly copper nails²⁸.

14 For the history of Byzantium see: Mango, *The Oxford History of Byzantium*.

15 Wells, *Sailing* xxix.

16 Especially concerning its economy: Laiou, *The Economic History of Byzantium*. – McCormick, *Origins*.

17 Wells, *Sailing* xxix-xxx.

18 Ward-Perkins, *The Fall of Rome* 60.

19 See: Ginalis, *Byzantinische Seefahrt* 135-146.

20 Like Günserin for the Marmara sea and Kingsley for the Levantine coast: Günserin, *Medieval Trade* 125-136. – Kingsley, *Shipwreck Archaeology*.

21 de Donato, *Mare Nostrum* 1. – Morrison, *The Trireme*. – Morrison, *Hellenistic Oared Warships*.

22 Pomponius Mela, *De Chorographia* 1.7., 1.22., 1.41. – Tellegen-Couperus, *Roman Law* 32.

23 It can be estimated that under Octavius the Roman Empire possessed a naval fleet of around 700 ships of all types: Pitassi, *Navies* 197. – Rankov, *Fleets of the Early Roman Empire* 78.

24 de Donato, *Mare Nostrum* 11. – Hocker, *Late Galleys and Fleets* 86. – Rankov, *Fleets of the Early Roman Empire* 78-80.

25 Suetonius *Tranquillus, Divus Augustus* 49.

26 Rankov, *Fleets of the Early Roman Empire* 79.

27 Appianus *Alexandrinus, Historia Romana* I. 10.1.3. (347) and II. E.111.15. – Casson, *Seamanship* 123f. 142. – de Donato, *Mare Nostrum* 11-13. – Hocker, *Late Galleys and Fleets* 87f. – Morrison, *Hellenistic Oared Warships* 72f. – Pryor, *Geography* 57f. – Rankov, *Fleets of the Early Roman Empire* 80. – Starr, *The Roman Imperial Navy* 54.

28 de Donato, *Mare Nostrum* 24-27. – Steffy, *Wooden Ship Building* 37-72.

At the same time the formation of the *Mare internum* caused a time of peace and economic prosperity around the Mediterranean between the 1st and the 3rd century, the *Pax Romana*. This period of intense maritime trade and traffic throughout the Mediterranean, the Red Sea and the Black Sea is characterized by impressive brisk imperial activities. The imperial government not only increased its activity in building coastal structures and started constructing grand artificial harbours beyond their functional necessity, such as that of Ostia, Portus or Caesarea Maritima²⁹, but also started building big commercial ships with more than 300t of capacity, transporting various goods (mainly grain, oil and wine) under state monopoly³⁰. The State's active involvement especially in the supply of grain and oil to Rome in form of the *Annona militaris* and *Annona civica*, allowing only the marginal surplus of civilian and military requirements to enter the free market and trade as commercial products, reaches its peak in the 1st and 2nd century³¹.

But from Late Antiquity (3rd-7th century) onwards, after centuries of that existing *Mare nostrum* with an enclosed maritime world and economic system, the Roman Empire was confronted with enemy fleets, new markets and political, economic and social antagonists again. Although various tribes and nations, such as the Goths and the Franks, pressured the Roman frontiers and threatened its autarchic sea power during the 3rd century³², the 4th century especially marks a crucial turning point for the Mediterranean (attested both historically and archaeologically)³³. After the previously unified Roman Empire split into a western and eastern part, the sea became the key element for operations and the decisive factor in economic and state policy again. The battle of the Hellespont at Gallipoli between Constantine the Great and Licinius in 324 was the first major naval engagement in the Mediterranean for 355 years and heralded a new era. According to the historian Zosimus, Constantine defeated his opponent by using small single-decked liburnian-type ships, so-called triacontors (thirty-oared galleys)³⁴, whereas Licinius' fleet consisted of classical triremes. The victory of the much lighter Liburna over the trireme caused the disappearance of the big classical ship types and initiated a trend towards smaller and flexible ships in terms of moving³⁵. Deriving from the preceding Liburna, that trend resulted in

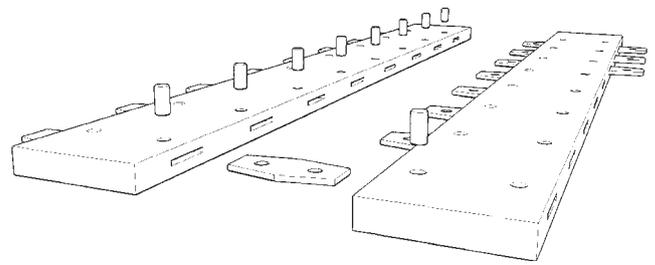


Fig. 1 Mortise and tenon joinery. – (Illustration A. Ginalis).

the development of new types during the Byzantine period, such as the characteristic Dromon³⁶ and other types like the Katergon, Chelandion, Galea and Pamphylon. Early Byzantine sources such as Procopius' *De Bello Vandalico* attest the small ship-dimensions. His book, which describes the Vandal wars of the 530s, documents 2000 marines (soldiers and rowers)³⁷ on 92 single-decked Dromons, which gives an average crew of 22 men³⁸. Although, unfortunately maritime archaeology lacks fundamental knowledge of warships in general (the recently excavated shipwrecks of Yenikapı may contribute significantly and provide new information), the wreck-find of a Byzantine warship (probably a Dromon) from the 6th century, found at Cefalù off Sicily³⁹, illustrates the written accounts. With an estimated length of about 30m and width of around 6m, its dimension seems fairly small compared to warships of the classical and Hellenistic periods. The same development can be observed also at merchant vessels.

From the 4th century onwards Byzantine merchant ships (generally reflecting late antique and early medieval shipbuilding traditions) underwent a change in size and tonnage. Underwater archaeological material, either from shipwrecks, such as the Yassı Ada, Saint Gervais B, Dramont E & F and in particular that of Serçe Limanı as well as the recently discovered and excavated wrecks of Yenikapı⁴⁰, or concentrations of amphorae and other trading goods, lead to the assumption that particularly in contrast to the Hellenistic and Imperial Roman periods⁴¹, during the Byzantine period small and middle sized ships were predominant⁴². By comparing the proportions of early to late Byzantine ships, a general trend towards narrower

29 For Ostia, Portus and Caesarea Maritima see: de Donato, *Mare Nostrum* 54-57. – www.ostia-antica.org/portus/plan-trajan.htm (24.10.2016). – Keay, Portus. – Testaguzza, Portus. – Oleson et al., *The Harbours of Caesarea Maritima*.

30 de Donato, *Mare Nostrum* 15. 27. 49. – Karagiorgou, *Urbanism and Economy* 206. – Parker, *Shipwrecks* 26.

31 Karagiorgou, *Urbanism and Economy* 205f. 212.

32 de Donato, *Mare Nostrum* 59. – Rankov, *Fleets of the Early Roman Empire* 83.

33 Kingsley, *Barbarian Seas* 4f.

34 Zosimus, *Historia Nova* II.23.3 (80f.).

35 In the 5th century Zosimus reports that the construction of triremes has been forgotten since long ago: Zosimus, *Historia Nova* V.20. – Pitassi, *Navies* 293. – Rankov, *Fleets of the Early Roman Empire* 85.

36 Similar to the characteristics of the Liburna, its name derives from the word δραμουμαι (to run), expressing its high speed. Furthermore, it possessed a similar arrangement of oars. For more information see: Oxford Dictionary of Byzantium, vol. I, 662. – Pryor/Jeffreys, *The Age of the Δρόμων* 123f.

37 Procopius, *De Bellis* I. 11. 15-16 (362f.).

38 Kislinger, *Zwischen Vandalen, Goten und Byzantinern* 31. – Christides, *Byzantine Dromon* 112f.

39 Purpura, *Il Relitto Bizantino di Cefalù*. – Parker, *Shipwrecks* 137f. – Kingsley, *Barbarian Seas* 122-130.

40 Bass/Van Doorninck Jr., *Yassı Ada*. – de Donato, *Mare Nostrum* 61-64. – Parker, *Shipwrecks* 168f. 372f. 455. – Joncheray, *Mediterranean Hull Types*. – Bass et al., *Serçe Limanı*. – Pekin, *Gün Işığında* 188f. 196-201.

41 Casson, *Seamanship* 170-173. – de Donato, *Mare Nostrum* 23. 27.

42 However, it has to be mentioned here that ancient merchant ships, such as the Roman wreck of Comacchio from the 1st century BC with a length of about 21m and a width of about 5.6m (a ratio of 4:1) generally were not bigger than later ones. See **tab. 1** below. – de Donato, *Mare Nostrum* 18-20.

| shipwreck | length | width | ratio | century | capacity |
|--------------------|-----------|-------------|---------------|--|--------------------|
| Yassi Ada B | 20m | 8m | 2.5:1 | 4 th century | -75 t (?) |
| Isis | 12-15m | 5m | 2.4-3:1 | 4 th -5 th century | 30-35 t |
| Port Vendres A | 18-20m | 8m | 2.25-2.5:1 | 4 th -5 th century | 70-75 t |
| Dramont F | 10-12m | 4-5m | 2.5:1 | 5 th century | -30 t (3t) |
| Parco di Teodorico | 9m (7.22) | 3.1m (2.75) | 2.9:1 (2.6:1) | 5 th century | ? |
| Marzamemi B | 27m | ? | ? | 5 th -7 th century | 200-300t (76-77 t) |
| Iskandil Burnu A | 20m | 5m | 4:1 | 6 th century | ? |
| Tantura A | 12m | 4m | 3:1 | 6 th century | ? |
| Pantano Longarini | 30m | 9m | 3.3:1 | 7 th century | >200-300t |
| Saint Gervais B | 15-18m | 6m | 2.5-3:1 | 7 th century | 41-49t |
| Yassi Ada A | 20.52m | 5.22m | 3.9:1 | 7 th century | 60t |
| Marmara VI | 7m | 2,3m | 3:1 | 9 th century | ? |
| Tantura B (Dor) | 18-23m | 5m | 3.6-4.6:1 | 9 th century | ? |
| Marmara III | 9.12m | 2.28m | 4:1 | 10 th -11 th century | ? |
| Olbia R8 | 12m | >2.5m | -4.8:1 | 10 th -11 th century | ? |
| Serçe Limanı | 15.66m | 5.2m | 3.1:1 | 11 th century | 35 t |
| Sporades B & C | 20m | 5m | 4:1 | 11 th -12 th century | ? |
| Pelagonnisos | 25m | 8m | 3.1:1 | 12 th century | 100t |
| Peristera A & B | 16m | 5m | 3.2:1 | 12 th century | 200t |
| Contarina | 16.5m | 5.2m | 3.2:1 | 13 th /14 th century | ? |
| Logonovo | 8.65m | 2.55m | 3.4:1 | 15 th century | ? |

Tab. 1 Ship-size and tonnage relations of Byzantine wreck-finds. – (Table A. Ginalis).

hulls can be observed⁴³. The average ratio of the 4th/5th century is around 2.5:1, in contrast to an average ratio of about 4:1 in the 9th-12th century. Accordingly, the loading capacity sank as well. While the cargo of more than 1000 amphorae of the 4th century Isis wreck weigh up to 75 t and the 850-900 amphorae of the 7th century Yassi Ada A wreck 60 t, the 11th century wreck of Serçe Limanı only had a capacity of 35 t (**tab. 1**)⁴⁴.

The wreck-finds presented above, however, should not be taken as absolutes and so we find, in accordance with Parker's categories⁴⁵, examples of big ships with capacities of 100-200t in later centuries. This is confirmed by written sources. While the transport ships of Belisar in the 6th century supposedly had capacities of up to 50,000 *Modioi* (854 m³ or around 300 t)⁴⁶, ship-sizes of up to 30,000 *Modioi* (512 m³ or around 181 t) are also documented for the 12th century⁴⁷. Nevertheless, the large commercial transport ships with more than 300t of capacity from the time of the *Pax Romana*, which supplied Rome and later Constantinople with grain and various other goods from the North African coast and Egypt, disappeared.

Observing a general trend towards smaller ships, many scholars believe in a total economic decline, arguing with the loss of land and consequently the loss of resources, markets and taxes, as well as with the decrease of population in Late Antiquity. In effect they are trying to legitimate the picture of the Dark Ages from maritime evidence⁴⁸. However, it just shows a change of trade patterns. The division of a centralized empire into west and east with their allocated territories made the big ships of the 1st-2nd century, such as the grain transporter Isis or the Nemo wrecks⁴⁹, unnecessary. The rich natural products and other resources of Egypt shifted now to Constantinople, the new Rome in the east. Despite the fact that the supply of Constantinople did not depend exclusively on Egypt but could also rely on other rich and much closer regions like Thessaly and Thrace⁵⁰, the distance of the trading routes of the *Annonae* became shorter.

Further, with the migration of new nations and the emergence of new kingdoms, exciting new markets appear, starting flourishing free market economies. The commercial »Golden Age« for the Eastern Mediterranean, especially be-

43 During the Byzantine period the so-called θαλάσσιος μόδιος was used as arithmetic unit for the measurement of ships and the determination of their capacity. A θαλάσσιος μόδιος or equivalent to 40 λογαρικά λίτρα (of grain) correspond to 12.8l: Schilbach, *Byzantinische Metrologie* 95-97. – Oxford Dictionary of Byzantium, vol. II, 1388. – Letsios, *Das Seegesetz der Rhodier* 87.

44 Ginalis, *Byzantinische Seefahrt* 54f.

45 Based on archaeological analyses of wreck-finds from all over the Mediterranean, Parker divides ships into a system of three main categories: 1. Small ships with a capacity of less than 75 t or around 1500 amphorae, 2. Middle-sized ships with a capacity of 75-200t or 2000-3000 amphorae and 3. Big ships with a capacity of more than 250t or more than 6000 amphorae: Parker, *Shipwrecks* 26.

46 Unger, *The Ship in the Medieval Economy* 36. – Müller, *Getreide für Konstantinopel* 9f. – Koder, *Der Lebensraum der Byzantiner* 71.

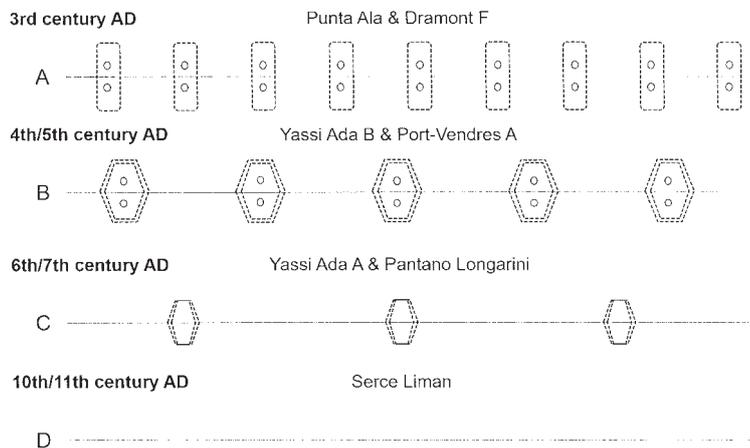
47 Koder, *Der Lebensraum der Byzantiner* 71. – Antoniadis-Bibicou, *Etudes d'Histoire Maritime* 131-133. – Dimitroukas, *Reisen und Verkehr* 419-421.

48 Kingsley, *Barbarian Seas* 1. – Steffy, *Wooden Ship Building* 85. – Ward-Perkins, *The Fall of Rome* 41 f.

49 de Donato, *Mare Nostrum* 49.

50 For the role of Thessaly as a main exporter of grain and other products see: Karagiorgou, *Urbanism and Economy* 167-183.

Fig. 2 Transition of mortise and tenon joinery with examples of wreck-finds. – (Modified after Steffy, *Wooden Ship Building* 84 figs 4-8).



tween the 4th and the 7th century, brought also an unprecedented period of social activity and mobility. During the 4th and 5th century the Byzantine society experiences a religious transition to Christianity, which gets a decisive factor for the influence and impact on maritime trade⁵¹. As such, the execution of trade shifts from the empire as an entrepreneur itself during the Imperial Roman period towards new powers. From Late Antiquity onwards mainly private businessmen and in particular the Church with its numerous monasteries and Metochia, such as Patmos or Lavra, act as independent ship-owners and trading centres, dominating the commercial landscape⁵². Accordingly, the imperial authority limited its role solely as controlling power behind the scene as shown for example by the 10th century book of the eparch⁵³.

Closely connected to the development and circumstances of ship-sizes and tonnage, also the method of ship-construction underwent fundamental changes during Late Antiquity and the early medieval period. Due to the fragmentation of the Mediterranean into independent kingdoms, the Byzantine Empire had to cope with new political and economic challenges. Consequently, not only did its own fleet need to be flexible and outmatch the enemy but also merchant ships had to be built with less labour and more efficient use of available material in order to be more competitive. So a heightened production demanded a reduction in the time and costs a ship needed to be built. As such, the first signs of a transformation, where the focus shifted from stability to a faster and lower-priced production process, became evident with the adaption of the so-called skeleton-first technique⁵⁴. Unlike the hull-first technique, the skeleton-first construction

method places priority on the framework of the ship. Here the frame or skeleton of the vessel is erected first, and is subsequently covered with the planks of the hull⁵⁵. The frame skeleton, however, is not limited to the ship's floor, but instead expands upward to cover the entire body of the ship.

Archaeological evidence from shipwrecks, such as the Pantano Longarini or the Yassi Ada A wreck, both from the 7th century, suggest the first indications of this shift in method by virtue of their mixed construction technique⁵⁶. They thus demonstrate a slow turning away from the hull-first method during the early Byzantine period. The first fully documented wreck to be built entirely in the skeleton method and thereby lending evidence to a completed development is the well-known Serçe Limanı wreck of the 11th century. Unfortunately, however, the development of this transition is not that simple. As mentioned already, changes did neither take place consistently nor in a short time. The shift towards the new method of construction occurred differently in smaller and bigger ships. Smaller ships generally adapted innovations much faster. While the Tantara A wreck with an approximate length of 12 m × 4 m, and representative for small ships shows a mixed construction as early as the 6th century, the relatively large 9th century ship of Tantara B (19-23 m × 5 m) or the wrecks of Yenikapı (the Marmara VI, Marmara I, III and Yenikapı I, II, IV, V wrecks) from the 9th-10th century⁵⁷ represent a similar stage of transition and confirm that shipbuilding in the Byzantine Empire underwent a period of technological transformation at least until the 10th century⁵⁸. Nevertheless, a general pattern of development is observable in the ways in which hull planks were fastened together (fig. 2)⁵⁹.

51 Kingsley, *Barbarian Seas* 5f. For ecclesiastical activities, executing commercial and inter-connective operations with their independent staple markets and harbour installations etc. see monastery documents such as that of Patmos and Lavra: Lemerle et al., *Actes de Lavra*. – Nystazopoulou-Pelekidou, Βυζαντινά Έγγραφα. – Vranousi, Βυζαντινά Έγγραφα.
 52 Like for example reported by the 12th century pilgrim Saewulf or the 12th century reference of Patriarch Leontios about a monk being synchronously sea trader: *Peregrinationes tres* 60f. 76f. – Theodosios Goudelis, *Life of Leontios* cap. 55. 58f. 94. 98-100. – Kingsley, *Barbarian Seas* 5f. – Kislinger, *Verkehrsrouten* 170. – Lopez, *The Role of Trade*. – Steffy, *Wooden Ship Building* 85.
 53 Leo the Wise, *Book of the Eparch*.
 54 Ginalis, *Byzantinische Seefahrt* 32. 35-38. – Ginalis, *Maritime Traditions* 5.

55 Jézégou, *L'Apparition* 166-168. – Jézégou does not speak of a new method but a reapplication of a known but forgotten technique. Roman shipwrecks, however, show that the Romans employed a mixed construction method only sporadically: Steffy, *Wooden Ship Building* 84.
 56 The lower part of the hull up to the waterline being constructed in hull-first and the upper part in the skeleton-first method.
 57 Pekin, *Gün Işığında* 200f. 208-215.
 58 Ginalis, *Byzantinische Seefahrt* 36f. – Ginalis, *Maritime Traditions* note 24. – Kingsley, *Barbarian Seas* 99-101. – Kingsley, *Shipwreck Archaeology* 47. – Pekin, *Gün Işığında* 208-215.
 59 Steffy, *Wooden Ship Building* 84.

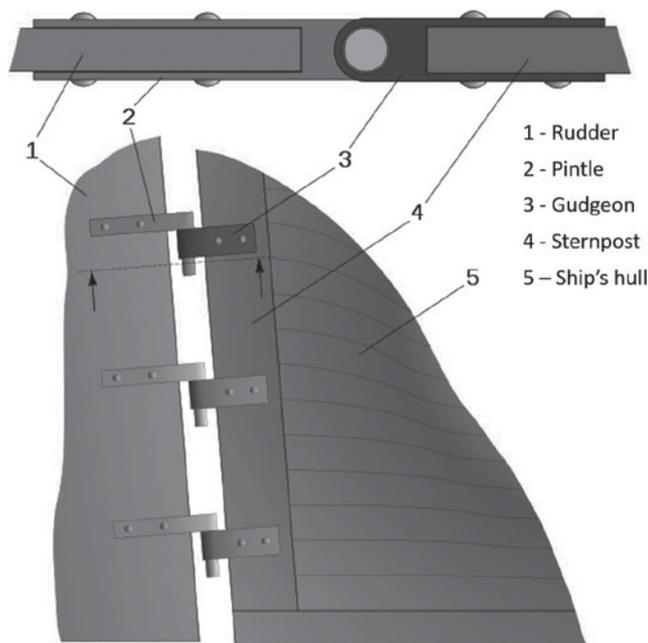


Fig. 3 Sketch of the pintle-and-gudgeon system. – (Modified after Mott, Rudder 83 fig. 7, 2).

With the skeleton-first method mortise and tenon joints were no longer necessary since the planks were fixed evenly and densely to the frame with metal nails and bolts, whereas the hull-first method utilizes nails and bolts only sporadically⁶⁰. The Yassi Ada B wreck of the 4th century and the wreck of Port Vendres A of the 4th-5th century show very uneven and scattered planking. In contrast, the 7th century Saint Gervais B wreck⁶¹, as well as the Yassi Ada A and the Pantano Longarini wrecks were already evenly planked for the most part.

Apart from fundamental changes in ship-construction itself, economic competition had an impact also on innovations concerning the Mediterranean rigging system. From Late Antiquity on, a new rigging system, the so-called triangular lateen or settee sail seems to have been developed and slowly come to be the predominant sail-type in the Mediterranean, superseding the classical square rigged sail⁶². The lateen sail was rigged along the keel line of the ship, which provided sailors with the advantage of being independent of any wind direction in order to make good speed. Consequently, sailing

against the wind became more efficient. Although, first signs of the triangular sail become evident for the Mediterranean as early as the 2nd century⁶³, its definite adoption started with the economic and political necessity of the early Byzantine period⁶⁴. For a long time the lateen sail has been attributed to the Arabs⁶⁵, who successfully introduced it into the Mediterranean from the Indian Ocean in the course of their expansion during the 7th century (635 conquest of Damascus and 642 conquest of Alexandria). The appearance of the Arabs on the political-historical map of the Mediterranean, however, just reinforced the urgent need for innovations. The conflict between Byzantium and the Arabs throughout the 7th to 10th centuries with the struggle for naval supremacy (which implied also an economic and strategic-political predominance) over the Mediterranean, brought important inventions. With the Byzantine temporary re-conquest of Alexandria in 645, where for the last time a military operation could rely entirely on a fleet, the Arabs realized quickly that only an efficient and superior navy could ensure a permanent establishment of power. This initiated strong Arab efforts in Mediterranean seafaring in order to command important trading routes and shipping lanes, as well as gain control over strategic stations, such as Cyprus and later Crete (654 conquest of Cyprus and around 824 conquest of Crete)⁶⁶. An even more serious impact on the Arab-Byzantine conflict and especially on the political history of Byzantium in the following centuries, is the invention and utilization of the apparatus and mechanism for the use of the so-called »Greek« or »liquid fire« (υγρὸν πῦρ)⁶⁷ on ships, the siphon, by the architect Kallinikos Heliopolis in the 670s. That crucial naval development came at a critical moment in the Empire's history, repelling the Arab sieges of Constantinople between 674 and 678 and preventing any further attempt to threaten the Byzantine capital⁶⁸. After the long Byzantine-Sassanid war from 602-628, the Byzantine Empire was considerably weakened and therefore unable to effectively resist Arab conquests. As such, it was the adaption of that destructive weapon on Byzantine Dromons which changed the tide in this war and the history of the empire, securing numerous crucial victories over the Arabs with the result of a Byzantine territorial expansion in the late 9th and early 10th centuries⁶⁹. But not only did inventions and innovations in seafaring influence Byzantine history, politics influenced seafaring, since the sea was the key to power and the

60 Although shipwrecks of all periods between the 6th century BC and the 5th century AD contained copper nails, their use reached its greatest density during the 1st century AD. In contrast, the use of iron nails is rare throughout the 1st and 2nd centuries, but increases during the 3rd century and becomes predominant from the 4th century onwards. As such, in close relation to the shift of the hull-construction and its planking itself, the 3rd and 4th century AD also form a transition period for the use of different metal as construction material: de Donato, *Mare Nostrum* 27. – Parker, *Shipwrecks* 27.

61 The Saint Gervais B wreck was essentially planked using nails and only contained some isolated mortise and tenon joints at the planks of the bow and stern.

62 For details on the origin and characteristics of the triangular lateen sail see: Casson, *The Origin of the Lateen*. – Ginalis, *Maritime Traditions* 7-9. – Whitewright, *The Mediterranean Lateen Sail*.

63 Such as the relief on a tombstone of Alexander of Miletus or a graffiti from Thassos: Casson, *Seamanship* fig. 181. – Ginalis, *Byzantinische Seefahrt* 43 figs 7-8. – Makris, *Ships* 96.

64 Byzantine depictions of lateen sails, such as the mosaic and graffiti of the Kelenderis and Kellia ships, from the 5th-7th centuries confirm a date to the early Byzantine period: Whitewright, *The Mediterranean Lateen Sail* 98-103.

65 Bowen, *Eastern Sail Affinities* 192. – Hourani, *Arab Seafaring* 103.

66 Christides, *The Conquest of Crete*.

67 An explosive mixture of saltpetre, crude oil, resin and sulphur, which was heated, inflamed, and tossed through a siphon on the bow of the ship onto other ships. – For the production and use of the Greek fire see: Haldon/Byrne, *A Possible Solution*. – Haldon, »Greek Fire«. – Korres, *Υγρὸν πῦρ*.

68 Pryor/Jeffreys, *The Age of the Δρόμων* 26 f. 31 f.

69 Pryor/Jeffreys, *The Age of the Δρόμων* 61 f. 72.

political events in that period required urgent measures which affected shipbuilding. The use of the Greek fire on ships as the new characteristic weapon of the Dromon, replaced the ram, although by then it no longer existed in its classical form but probably in the shape of pointed spurs above the waterline and slanted upwards⁷⁰.

Finally, Byzantium's economic and political history not only affected the development of Mediterranean shipbuilding, it also played a decisive role for sea-trade and its network⁷¹. With human migration and the emergence and expansion of kingdoms the shipping lanes, providing access to important goods and necessary materials, gained in importance⁷². Especially during the conflict with the Arabs, the Byzantine state was well aware of the strategic importance of certain goods, particularly the access to and trade in wood. Since the Arabs faced lack of timber resources along the North African coast, the Byzantines prohibited all export of timber in the 9th and 10th century and probably until the end of the 12th century⁷³. The disregard of Byzantium's prohibition by the Italian city-states, and above all by Venice, caused the economic progress of the west. The growth of Venetian and Genoese maritime power resulted in economic and political agreements throughout the following centuries. Both were granted with various valuable trade privileges in exchange for naval support⁷⁴. This consequently formed a new era in the history of Mediterranean seafaring and beyond, initiating the predominance of western naval powers by replacing slowly the Byzantine Empire⁷⁵.

Finally, the development of Byzantium's later economic and political history, together with intense western activities in the Eastern Mediterranean and later increasingly in the Black Sea, led to further impacts on Mediterranean seafaring and particularly on the history of shipbuilding. The transition to a new steering system is among various others, one of the main influencing factors. Like Roman ships, the Byzantines continued using the classical tradition of the quarter rudder. Here, the helmsmen or *ναυκλῆρος* used two oars, one on each side of the ship lashed to the stern, in order to navigate the ship⁷⁶. Around the 13th century, however, Western powers acting in the seas of Byzantium, introduced a different way of steering from Northern Europe. This new system did not use rudders lashed on either sides of the ship anymore, but

a single rudder mounted on the stern centre. Developed by the Arabs around the 10th-12th centuries under the influence of Chinese junks, North European engineers elaborated the stern-mounted rudder system for their cogs⁷⁷ and consequently innovated the so-called pintle-and-gudgeon system (fig. 3)⁷⁸.

This formed another milestone in the history of shipbuilding, since it influenced again a change of ship-construction. In order to use that pintle-and-gudgeon stern rudder the ship required a totally vertical sternpost and a transom on which the rudder could be fixed. In contrast to the round hull shape of middle Byzantine ships (strongly curved bows and sterns are attested by mosaics, illuminations and archaeological reconstructions)⁷⁹, late Byzantine or rather Trebizondian frescoes and graffiti, such as that in the church of St. Sophia depicting a ship with a totally vertical sternpost, assume the adoption of the stern rudder also on Byzantine ships by the 14th century at the latest⁸⁰.

Although the history of Mediterranean seafaring in the late antique and early medieval periods is still a huge puzzle, the history of Byzantium provides an insight into the background of social, economic, and political impacts. As a main engine of this empire, developments in seafaring influenced and affected but were also influenced and determined decisively. As such, the history of Byzantine ship-construction can fill the gaps of knowledge. Nevertheless, the study of Byzantine ships still lacks fundamental data. Therefore, the shipwrecks of Yenikapı may contribute significantly to that research and provide new crucial information – not only concerning ship-construction but also providing a better understanding of other important aspects of seafaring and the Byzantine economy between the 7th and the 11th centuries due to their very rich cargoes. This article tries to strengthen what other recent studies and excavations show⁸¹, namely that Late Antiquity and the Middle Ages are not periods of decline but rather periods of challenge, which bring innovations reflecting the history of the Mediterranean.

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70 Both, Byzantine and Arabic reports of the Battle of Dhat Al-Sawari in 655/656, confirm that no classical rams were employed anymore: Christides, *Byzantine Dromon* 113f. – For the adaption and development of the ram on Byzantine warships see: Ginalis, *Byzantinische Seefahrt* 39f.

71 For the distribution and trade of Byzantine commodities see: Kislinger, *Verkehrsrouten*.

72 Kislinger, *Verkehrsrouten* 149f.

73 Dunn, *Exploitation and Control* 263f. – Lefort, *The Rural Economy* 262.

74 The first of such treaties are the trade privileges given by the emperor Alexios I Komnenos in 1082: Wells, *Sailing* 42.

75 Avramea, *Land and Sea Communications* 87.

76 Casson, *Seamanship* 224-228 fig. 114.

77 For northern European shipbuilding and particularly cogs see: Steffy, *Wooden Ship Building* 100-114.

78 For the development of the rudder see: Ginalis, *Maritime Traditions* 10f. – Mott, *The Development of the Rudder*. – For details on the pintle-and-gudgeon system: Mott, *The Development of the Rudder* 82-90.

79 Like in the Skylitzes-Matritensis manuscript and in the cathedral of Monreale (Sicily), both of the 12th century or the reconstruction of the 11th century Serçe Limani shipwreck.

80 Graffiti of numerous Byzantine merchant and warships (dated by myself to the 7th/8th-12th centuries) at the Gemile Adasi church complex on the south-west coast of Turkey, however, show still the use of the quarter rudder at least up to the 12th century. Comparable examples from Arab ship depictions from the Indian Ocean, such as the »Book of Fixed Stars – Suwar al Kawakib« of al-Sufi from 1130, suggest a period of transition in the 12th-13th centuries. – Christides/Christidou/Apostolopoulos, *Treasures* 159. – Ginalis, *Maritime Traditions* 10. – Mott, *The Development of the Rudder* 92-95. – For information on Gemile Adasi see Kazuo, *Island of St Nicholas*.

81 Ward-Perkins, *The Fall of Rome* 41f.

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Zusammenfassung / Summary

Der Einfluss der politischen und ökonomischen Geschichte von Byzanz auf die Seefahrt im Mittelmeerraum

Die Entwicklung des Schiffbaus und die daraus hervorgehenden regionalen sowie überregionalen maritimen Traditionen und Typologien stellen einen der zentralen Aspekte der mediterranen Schifffahrtsgeschichte dar. Aufgrund des Zusammenspiels einer Reihe von Faktoren, seien es wirtschaftliche, politisch-geographische oder soziale Einflüsse, vollzog sich die Entwicklung des Schiffbaus weder einheitlich noch in kurzer Zeit. Im Mittelmeerraum können vor allem das 1.-4. Jahrhundert, das 6./7.-11. Jahrhundert und das 13.-15. Jahrhundert als wesentliche Transformationsperioden für Veränderungen am Schiffsrumpf sowie für die Entwicklung des Segels und militärischer Ausstattung angesehen werden. Es ist nun hervorzuheben, dass die Herausbildung maritimer Technologien in diesen Jahrhunderten stark mit der Politik und Wirtschaftsgeschichte des Byzantinischen Reiches verbunden ist. Insbesondere der Kampf mit der arabischen Welt und dem Westen um die Vormachtstellung im Mittelmeerraum übt großen Einfluss aus. Allerdings ist die Aufmerksamkeit historischer und vor allem archäologischer Forschung bisher lediglich einseitig ausgerichtet, indem wirtschaftliche Wechselbeziehungen sowie politische Zusammenhänge durch die Untersuchungen von Wrackfunden zu erklären und verste-

hen versucht werden. Aus diesem Grund präsentiert dieser Artikel erstmals den entgegengesetzten Ansatz: Schiffe und ihr historischer Kontext. Hierzu werden die zuvor erwähnten Entwicklungsstadien der mediterranen Seefahrt auf der Grundlage bestimmter historischer Ereignisse sowie sozialer und wirtschaftlicher Veränderungen untersucht. Dies reicht von der Völkerwanderung und der sich wandelnden Gesellschaftsstruktur des 3.-7. Jahrhunderts, über die arabische Invasion im Osten und ihre Expansion auf den Mittelmeerraum während des 7.-10. Jahrhunderts bis hin zur Konfrontation mit westlichen Handelsmärkten und Kolonien im Osten vom 13. bis zum 15. Jahrhundert. Dieser stetige politische und wirtschaftliche Wandel verursachte und erforderte sogar die Notwendigkeit technischen Fortschritts zur See, um im Mittelmeerraum konkurrenzfähig zu bleiben. Übersetzung: A. Ginalis

The Influence of Byzantium's Political and Economic History on Mediterranean Seafaring

The development of shipbuilding and the regional and supra-regional maritime traditions and typologies represent one of the central aspects of the history of Mediterranean seafaring. As a result of the interplay of a series of factors, be it economic, politico-geographical or social influences, the development of shipbuilding took place neither uniformly nor in a short period of time. In the Mediterranean basin substantial periods of transformation in the changes of ships' hulls, as well as the development of sails and military equipment, can be observed especially during the 1st to 4th century, the 6th/7th to 11th century and the 13th to 15th century. One must emphasise that the development of maritime technologies during these centuries is closely linked with the politics and economic history of the Byzantine Empire. Particularly the struggle with the Arab world and the West for the hegemony of the Mediterranean region exerted a huge influence. However, the attention to historical and especially archaeological research has hitherto been very much one-sided, in that economic interactions and political relationships have been attempted to be explained and understood by investigating shipwrecks. For this reason, this paper presents for the first time an opposite approach, discussing ships and their historical context. For this the aforementioned development stages of Mediterranean seafaring will be investigated on the basis of certain historical events, as well as social and economic changes. This ranges from the Migration Period and the transforming social structure of the 3rd to 7th century, through the Arab invasion in the East and its expansion in the Mediterranean region during the 7th to 10th century, up to the confrontation with the western trade markets and colonies in the East during the 13th to 15th century. This constant political and economic change caused and even required the need for technical improvement on the seas, in order to remain competitive in the Mediterranean basin. Translation: C. Bridger