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The Economic History of Byzantium:
From the Seventh through the Fifteenth Century

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Ships

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The most striking characteristic about the involvement of the Byzantines with the sea is its continuity. Discontinuity or even disruption, in conjunction with upheavals on a wider scale, is to be noted only where technologically advanced ships are concerned. Today we possess reliable works about the Byzantine navy, which give an overview of the subject, and specialized studies that allow us to form a clear picture of the importance of that service[1]—a picture that will become more complete as naval archaeology develops[2] and as the written sources (first and foremost the Venetian archives) are studied systematically.

As far as the merchant navy of the middle Byzantine period (to the 12th century) is concerned, we have only isolated pieces of evidence from the written sources. The *Chronographia* of Theophanes provides spurious information about the measures taken

This chapter was translated by John Solman.

[1] The classic study of the navy, particularly as a fighting force, of the middle and late Byzantine periods is H. Ahrweiler, *Byzance et la mer* (Paris, 1966). For the interdependence between the economy and the navy in Byzantium, as elsewhere, see R. W. Unger, *The Ship in the Medieval Economy, 600–1600* (London-Montreal, 1980), 50 ff. Among publications of a general nature, see Ph. Koukoules, "Ὁ ναυτικὸς βίος," in Βυζαντινῶν βίος καὶ πολιτισμός, 6 vols. (Athens, 1948–57), 5:344–86, reprinted from ΕΕΒΣ 21 (1951): 1–48; F. H. van Doorninck, Jr., "Byzantium: Mistress of the Sea," in *A History of Seafaring Based on Underwater Archaeology,* ed. G. Bass (London, 1972), 133–58; and the hundreds of entries on maritime topics and the Byzantines compiled by St. E. Lykoudis in the Μεγάλη Ἑλληνικὴ Ἐγκυκλοπαιδεία, 24 vols. (Athens, 1926–34).

[2] The work of A. Jal, *Archéologie navale,* 2 vols. (Paris, 1840), esp. 1:234 ff, was groundbreaking. Cf. also numerous entries in his monumental *Glossaire nautique: Répertoire polyglotte de termes de marine anciens et modernes* (Paris, 1848), or the new and augmented edition, which has twelve fascicules to date, *Nouveau glossaire nautique d'Augustin Jal: Revision de l'édition publiée en 1848* (Paris–The Hague, 1970–98). The wreck of a Byzantine commercial vessel of the early 7th century off the island of Yassı Ada, to the west of the peninsula of Halikarnassos, has been excavated and published in exemplary fashion: G. F. Bass, F. H. van Doorninck, Jr., *Yassi Ada. A Seventh-Century Byzantine Shipwreck* (College Station, Texas, 1982). For further information on underwater archaeology, cf. F. H. van Doorninck, Jr., "Byzantine Shipwrecks," *EHB*. The recent development of underwater archaeology has led to new perspectives on the history of shipbuilding. For a catalogue of known shipwrecks in the Mediterranean, see A. J. Parker, *Ancient Shipwrecks of the Mediterranean and the Roman Provinces* (Oxford, 1992).

by Nikephoros I (802–811) in connection with the navy.[3] In 982, after his defeat at Croton, Otto II fled to Rossano on a Greek merchant vessel. Information about the presence of Byzantine merchants in Egypt at this time has been preserved in documents of the Cairo Geniza.[4] In the late Byzantine period, the source material becomes more abundant, even though the nautical activities of the Greeks were overshadowed by the domination of the Italian maritime republics—Venice and Genoa in particular—in the waters of the eastern Mediterranean. On the local level, these activities retained the characteristic of continuity already noted, while in the context of the eastern Mediterranean they became supplementary. Nonetheless, this supplementary role was useful to Venice and Genoa, which were able to draw on the Greek lands for human resources to man their own fleets, as did the advancing Turks, the development of whose navy relied largely on the Greek populations.[5]

The most notable craft built during the heyday of the Byzantine navy was the *dromon,* which is first attested in the sixth century as an oar-powered vessel with sails for auxiliary use only. Although the *dromon* was a continuation of the Roman shipbuilding tradition, it reached such an advanced stage of development as to constitute a purely Byzantine type. In the sixth century, the term *dromon* referred to a single specific type of ship, but by the ninth century it had come to include all the long warships, the predominant type of which was the hundred-oar bireme. A few decades later, in the reign of Constantine VII (913–959), we find references to *dromons* with banks of oars for 230 rowers and, as their main weapon, the *siphon* from which Greek fire was sprayed. The length of these large tenth-century *dromons* has been estimated at 60 m, their breadth at 10 m, and their height from the keel to the top of the bow and stern towers as 5–6 m. Their draft was 1.5 m. With a displacement of more than 100 tons, these vessels could cruise at 5 knots and developed a battle speed of 7 knots.

Similar speeds could be attained by the Venetian galleys (κάτεργα), ships powered by both oars and sails and fully fitted out for war, which in the summers of the late Byzantine period regularly sailed from Venice, in convoy, on commercial voyages to the eastern Mediterranean. The Byzantines sometimes made use of the ships in these convoys that crossed the Aegean (the κάτεργα τῆς πραγματείας), but not often, because

[3] τοὺς τὰς παραθαλασσίας οἰκοῦντας μάλιστα τῆς Μικρᾶς Ἀσίας ναυκλήρους, μηδέποτε γηπονικῶς ζήσαντας, ἄκοντας ὠνεῖσθαι ἐκ τῶν καθαρπαγέντων αὐτῷ κτημάτων: Theophanes, *Chronographia,* ed. C. de Boor, 2 vols. (Leipzig, 1883–85; repr. Hildesheim, 1963), 1:487, 13–16; Τοὺς ἐν Κωνσταντινουπόλει ναυκλήρους συναγαγὼν [Nikephoros I] δέδωκεν ἐπὶ τόκῳ τετρακεράτῳ τὸ νόμισμα ἀνὰ χρυσίου λιτρῶν δώδεκα, τελοῦντας καὶ τὰ συνήθη κομμέρκια: ibid., 487, 17–19. For a critical interpretation of these passages, see A. Christofilopoulou, Βυζαντινὴ Ἱστορία, vol. 2 (Athens, 1981), 169ff.

[4] For the sources of the middle Byzantine period, see S. Runciman, "Byzantine Trade and Industry," *The Cambridge Economic History of Europe* (Cambridge, 1952), 2:86–118; M. F. Hendy, "Byzantium, 1081–1204: An Economic Reappraisal," *Transactions of the Royal Historical Society,* 5th ser., 20 (1970): 31–52; A. E. Laiou, "Byzantine Traders and Seafarers" in *The Greeks and the Sea,* ed. S. Vryonis, Jr. (New Rochelle, N.Y., 1993), 79–96.

[5] For an overall examination of the relevant evidence, see G. Makris, *Studien zur spätbyzantinischen Schiffahrt* (Genoa, 1988), 102ff. Linguistic documentation of this development is provided by H. and R. Kahane and A. Tietze, *The Lingua Franca in the Levant: Turkish Nautical Terms of Italian and Greek Origin* (Urbana, Ill., 1958).

1. Representation of a two-masted ship with lateen rig on a plate, ca. 1200 (after C. H. Morgan, *The Byzantine Pottery*, Corinth XI. Results of Excavations Conducted by the American School of Classical Studies at Athens [Cambridge, Mass., 1942], 108, fig. 84)

the cost was high. For the Venetians themselves, however, such voyages, which lay at the heart of the Serene Republic's economy, were profitable because the goods carried (spices, perfumes, silk) were of high value.

There were also lighter *dromons,* while the imperial *dromonia* were used by the emperor as pleasure craft. One of them was always moored in Boukoleon harbor, ready to sail at a moment's notice. The battleships were accompanied by auxiliary vessels, transports, horse transports, and multipurpose craft such as the *chelandia* and the heavy *pamphyloi.* Our sources for these types of ship—the *Taktika* of Leo VI and the *De administrando imperio* of Constantine VII—are compilations and often use nautical terms with inconsistency. While Constantine VII refers to *chelandia* as warships (the meaning, too, of the Arabic term *shalandī* from which the word is derived), in the documents of Patmos the term is used to describe ships of any kind. Among the other words used by the sources are *sandalion* (covering everything from rowboats to small ships), *platidion* (a small cargo vessel), *koutrouvion* (for transporting liquids), and *grippos* (a fishing boat). That some terms are used for both warships and commercial vessels lends further weight to the view that as a rule the development of naval architecture for warships was in advance of that for commercial craft.

During the siege of Constantinople by the Crusaders (1203–4), there is no evidence of the use of either large *dromons* or Greek fire: the know-how had been lost. By the twelfth century, the nautical technology of the West had begun to impress the Byzantines: Anna Komnene, writing around 1150 of three-masters powered by oars[6] or sails,[7] was speaking of Latin craft. In 1171, in the reign of Manuel I, the Byzantines were amazed by the size of a ship, also with three masts, that the Venetians used as they fled from Constantinople[8] and that, because it was so large, was called the *Kosmos* (*Totus Mundus,* in the original Latin). This was the biggest of the Venetian transport vessels later employed in the Fourth Crusade.[9] There is no evidence of the existence of three-masted Byzantine ships. In the Middle Ages, there were no vessels with three banks of oars on either side, and although the Byzantine writers often refer to warships as triremes, the usage is an archaism.

The wide range of pure warships in the tenth century—at a time when, in the West, there was no distinction between transports and military craft[10]—is proof of the high

[6] Ναῦν ληστρικὴν μισθωσάμενος τριάρμενον . . . ἐν ᾗ ἐρέται μὲν διακόσιοι: *Alexias* 10.8.2 (*Anne Comnène, Alexiade,* ed. B. Leib, 3 vols. [Paris, 1937–45], 2:215.19–20).

[7] Ἀπεῖργε παντάπασι τοὺς ἐκεῖθεν πρὸς τὸ Ἰλλυρικόν διαπερῶντας, οὐ τριάρμενον, οὐδὲ μυριοφόρον ὁλκάδα οὐδὲ μυοπάρωνα δίκωπον τὸ παράπαν ξυγχωρῶν πρὸς τὸν Βαϊμοῦντον διαπερᾶν: *Alexias* 10.8.2, ibid., 3:115.26–29.

[8] Τοῖς νεωρίοις ἐνώρμει τῆς πόλεως ναῦς τῶν τριαρμενίων, ἧς δὴ πολυχανδεστέραν ἢ τὸ μέγεθος προφερεστέραν οὔ ποτε καιροῦ ναυλοχήσειν ἐλέγετο: *Nicetae Choniatae Historia,* 6.5.3, ed. I. A. van Dieten (Berlin–New York, 1975), 182 (hereafter Choniates). Cf. also the corresponding passage in Kinnamos, *Epitome rerum ab Ioanne et Alexio Comnenis gestarum,* ed. A. Meineke (Bonn, 1836), 283.

[9] πλοίων . . . ὧν ἓν Κόσμος παρ' αὐτοῖς ὠνομάζετο ὡς πολὺ τῶν ἄλλων ὑπερφέρον εἰς μέγεθος: Choniates, 16.21.6, van Dieten ed., 539.

[10] Cf. W. Unger, "Warships and Cargo Ships in Medieval Europe," *Technology and Culture* 22 (1981): 233–52.

level of the Byzantine navy in general. However, the construction of large warships does not mean that commercial vessels of a similar size, comparable to the vast Roman grain ships of the first and second centuries A.D., were also built. Flexible and economical vessels of small and medium size were much more suited to the trade of the period. A radical change in the technology of sea transport came about when the earthenware storage jar gave way to the wooden barrel: this reduced the weight of liquid cargoes by 30% and made it possible to reduce the size of ships correspondingly, but we do not yet know when the use of wooden storage vessels became general in Byzantine ships.

In the Greek public and private documents, ships are referred to first by stating their ownership and then by their type and capacity. In describing the vessels belonging to the Great Lavra, expressions such as "ships, 4, capacity 6,000,"[11] or "fishing ships, 2" (1263) were used.[12] In the credentials that, in 1415, the monks of the monastery of St. George on Skyros issued for their little boat, they wrote simply that "all of this boat belongs to St. George."[13] The expressions that come down to us about the vessels belonging to the monastery of Patmos include "wholly owned ship with a capacity of 500 modioi" (πλοῖον ἰδιόκτητον χωρήσεως μοδίων πεντακοσίων) (1088),[14] while the founder of the monastery, St. Christodoulos, in his will, uses characteristic wording in describing a vessel he bequeathed to the foundation: "another ship, a *platidion* with two masts, entrusted to Vasileios Evripiotis son of Moroioannis, now out on charter, 42 hyperpyra."[15] The names of ships owned exclusively by Greeks of Constantinople are found for the first time in the documents drawn up in 1360/61 at Kellia, on the Danube estuary, by the Genoese notary Antonio di Ponzò;[16] the vessel of a certain Konstantinos Mamalis was called *Sanctus Nicolaus,* while that of the monastery of St. Athanasios was the *Sanctus Tanassius.* The naming of ships, which for the Latins—but not for the Byzantines—was a component of their existence in law, must have become general in later times.

In the twelfth century, the civil service department responsible for the merchant navy was the *sekreton* of the sea,[17] which also seems to have kept the register of ships. It ceased to exist after 1204, and some of its responsibilities passed to the *kommerkiarioi.* The official unit of measurement of capacity was the sea modios, equivalent to 17.084 liters. From the middle Byzantine period, we have three texts preserved in a fourteenth-century document from Cyprus; they are addressed to state officials and describe the way in which the capacity of ships is to be measured ("Instructions . . . concerning the

[11] πλοῖα τέσσερα ἐπιχωρήσεως χιλιάδων ἕξ: *Actes de Lavra,* ed. P. Lemerle et al., 4 vols., Archives de l'Athos (Paris, 1970–82), 1:285, no. 55, line 16 (hereafter *Lavra*).

[12] πλοῖα ἁλιευτικὰ δύο: cf. ibid., 2:15, no. 72, line 50.

[13] τὸ καράβι τοῦτο εἶναι τοῦ Ἁγίου Γεωργίου ὅλο: ibid., 3:216.

[14] Ἔγγραφα Πάτμου, vol. 1, Αὐτοκρατορικά, ed. E. Vranousis (Athens, 1980), 72, no. 7.

[15] ἕτερον πλοῖον πλατίδιον δικάταρτον, πιστικευόμενον παρὰ Βασιλείου Εὐριπιώτου τοῦ Μω[ρο]ϊωάννου, ἀπερχόμενον νῦν εἰς ναῦλον, νομίσματα τεσσεράκοντα δύο ὑπέρπυρα: *Lavra,* 1:48.

[16] G. Pistarino, *Notai genovesi in Oltremare: Atti rogati a Chilia da Antonio di Ponzò, 1360–61* (Genoa, 1971), 80, no. 47, and 141, no. 80. Cf. also the index s.v. "lignum."

[17] Cf. N. Oikonomides, "The Role of the Byzantine State in the Economy," *EHB* 1007.

measurement of ships, how they are to be measured and how the capacities of them are to be stated" [Εἴδησις . . . τοῦ ἐξάμου τῶν πλοίων, πῶς ὀφείλουσιν ἐξαμώνεσθαι καὶ δηλοποιεῖσθαι αἱ τούτων χωρήσεις]). The texts provide makeshift instructions on how to calculate capacity, with more detailed guidance as to how to convert the capacity into the corresponding tariff categories for wheat, timber, and liquid cargoes after deducting the noneffective parts of the ship. They were obviously intended for use in customhouses.[18] As long as the *sekreton* of the sea was in existence, ships were liable for the payment, according to circumstances, of charges for registration, docking, arrival, departure, passage, and measurement of their capacity (known, respectively, as the ναυλοκαταρτιατικόν, λιμενιατικόν, ἐμβλητικόν, ἐκβλητικόν, διαβατικόν, μετρητίκιον), while the population was obliged to contribute cash and corveé labor to the preparation and arming of the fleet (ἐξέλασις πλωΐμων, ἐξάρτισις πλωΐμων, κατεργοκτισία). In the time of the empire of Nicaea and thereafter, these charges were collected as a *kommerkion,* that is, as a percentage tariff on merchandise, while levies in favor of the fleet (τὰ νομίσματα τῶν πλωΐμων) existed in name only; in fact, these were a form of tax.

Some shipping issues—for example, the protection of such goods as were salvaged from ships that ran aground or sank—were settled by the executive authorities in accordance with the details of the case. Andronikos I Komnenos (1182–85) introduced Draconian penalties for the theft of such cargoes[19]—a practice to which we have direct and indirect testimony dating from the Palaiologan period as well.[20] The general legislation on merchant shipping was contained in the *Rhodian Sea Law* (6th or 7th century), which was a digest of earlier provisions,[21] while the next codification—one that retained its prestige throughout the Balkans down to modern times—was that carried out in the fourteenth century by Constantine Harmenopoulos in section 21 ("Concerning maritime law" [Περὶ ναυτικῶν]) of book 2 of his *Hexabiblos.*[22] The *Rhodian Sea Law* also included regulations for work and safety at sea, while Harmenopoulos put the emphasis on questions of civil liability stemming from charter parties in the event of damage (to ships or goods).

The choppy Black Sea and the Aegean with its frequent storms, its Etesian winds (the *meltemia,* strong and steady northerly winds that blow during the daytime in the eastern Mediterranean from spring to summer), and its steep, highly indented coastline were convenient mainly for sailing vessels of small or medium displacement and limited length. The principal requirement of natural harbors was that they should be

[18] E. Schilbach, *Byzantinische metrologische Quellen,* 2d ed. (Thessalonike, 1982), 126–33.

[19] Choniates, van Dieten ed., 1:326–29.

[20] G. L. F. Tafel and G. M. Thomas, *Urkunden zur älteren Handels- und Staatsgeschichte der Republik Venedig mit besonderer Beziehung auf Byzanz und die Levante,* 3 vols. (Vienna, 1856–57; 2d ed. Amsterdam, 1964), 3:215; MM 3:81 and 92. For the case law on shipwrecks, see also S. Troianos, "Τὰ ναυάγια, ἡ νεαρὰ 64 Λέοντος τοῦ Σοφοῦ καὶ τὸ κείμενο τῶν Βασιλικῶν," Πειραϊκὴ Νομολογία 14 (1992 [1994]): 488–95.

[21] A. Ashburner, ed., *The Rhodian Sea Law* (Oxford, 1909); cf. G. Letsios, Νόμος Ῥοδίων Ναυτικός = *Das Seegesetz der Rhodier* (Rhodes, 1996).

[22] For the most recent edition, K. G. Pitsakis, Κωνσταντίνου Ἀρμενοπούλου Πρόχειρον νόμων ἢ Ἑξάβιβλος (Athens, 1971).

sheltered, regardless of the kind of coastline on which they were located (e.g., Piraieus, Ephesos, Thessalonike, Alexandria, the Golden Horn). Mooring in these harbors, the fact that ships sailed close to the coast, and the short distances that were the rule called for vessels with high levels of maneuverability. One of the radical changes in shipping in the Middle Ages was the introduction of the triangular lateen sail, whose use had begun to spread through the eastern Mediterranean in Roman times and which predominated after the sixth century. This was attached to the mast by means of a long inclined crossbar (in larger ships, this consisted of two elongated, thin wooden bars joined together), and it greatly facilitated tacking (even at angles of more than 30 degrees) and maneuvering. A simple adjustment was sufficient to cause the sail to billow upward, converting part of the force of the wind into a vector that counterbalanced the shallow draft of medieval ships and their smooth keels, thus making it more difficult for them to capsize. The lateen sail, the short length, and the pointed bow and stern (Fig. 1) reduced the risk of the bottom of the ship thumping down violently into the troughs between waves, thus enabling the vessels to sail even when the usual strong northerly winds were blowing. Such specifications are still used today in boat-building in the eastern Mediterranean for small-capacity wooden craft (caiques for fishing or trade, though these are now mechanically powered). When combined with the principle of tacking, these characteristics made it possible for boats to sail even in bad weather. The long warships, on the other hand, were vulnerable and needed tailwinds when the oarsmen were not rowing. In the open sea, maneuvers into a head wind were a time-consuming business, and so ships preferred to sail along the coast in order to exploit the occasional gusts of wind that blow there from various directions even during the period of the Etesian winds, especially when the shore is mountainous. This, and not a fear of the open sea, was one of the main reasons why coastal navigation was so widespread in antiquity and the medieval period.

From the large *dromons* to the merchant vessels, ships were steered by means of two broad oars fitted to the stern quarters. These were in the charge of a sailor. Single rudders, like those used in caiques today and consisting of a broad plank of wood attached to the sternpost and operated by a tiller, first appeared in the western Mediterranean in the thirteenth and fourteenth centuries, and their use in the eastern Mediterranean cannot have been general down to the time of the fall of Constantinople. The sailors of Byzantium, like those of antiquity, relied on experience when navigating and at night oriented themselves by the stars, or they would drop anchor when darkness or cloud cover overtook them in unknown waters. The compass is mentioned for the first time as a curiosity in Byzantine texts of the century prior to the fall of Constantinople and was not associated exclusively with navigation, which continued to be empirical until the end of the empire. In the Mediterranean, the compass was in any case of much less importance than it was for sailing on the open ocean. In general, technological developments tended to come only gradually into use, and any speculation as to who introduced, for example, the compass or the single rudder in the Mediterranean is an oversimplification.

In merchant vessels, rowing was uneconomical and played only a secondary role.

The approach from the Aegean to Constantinople was difficult and time-consuming because the current in the Hellespont always runs from north to south and a north wind is usually blowing. Patriarch Gregory (George) of Cyprus (1283–89) took two days to sail from Constantinople to Gallipoli and seven days to make the return trip, even though the sailors rowed continuously all the way back. However, with a steady tailwind it might even have been possible to sail from Ainos at the mouth of the Hebros to Crete in five days and nights, as one Greek captain claimed to have done in 1402.[23] Shortly after 1300, the learned monk Theodoulos (Thomas Magistros) traveled on a Greek sailing ship from Thessalonike to Constantinople.[24] The ship must have been large and two-masted (see Fig. 1), and it had a numerous crew and a lifeboat. It carried passengers, but also carried on entrepôt trade. Magistros was impressed by the skill of the helmsman and of the sailors as they scrambled up the masts when the vessel was under sail.[25] He also states that the crew tended to use "mixed Greek" when at work, and this is, perhaps, the earliest reference to the *lingua franca*. The voyage to Constantinople lasted twenty days, and the return trip, during which the ship called at a number of harbors, took forty-five. Bearing these instances in mind, with the generally unstable weather conditions to be encountered in the area, it is difficult to speak of "typical" lengths of time that journeys might take or "representative" speeds at which such commercial craft might sail.

Vessels such as that on which Magistros traveled formed the bulk of the Byzantine merchant fleet at all times in the empire's history. We can only speculate as to what was the maximum cargo such ships could transport. Some special craft might be able to carry up to 300 tons of cargo, or perhaps even more, but vessels of this size (army transports of the period when the empire was at its zenith, special ships to transport the huge stones needed for monumental structures) were of course not representative. The rule was undoubtedly closer to merchant vessels such as that of Yassı Ada: of medium size, it was 20 m long and had a beam of 5.22 m. When it sank, it was carrying passengers and 40 tons of amphoras, but its capacity would have enabled it to transport more cargo.

The most important harbors were, naturally enough, the shipbuilding centers of the empire, with Constantinople occupying first position. In the middle Byzantine centuries, many ships must also have been built in the seafaring themes of Asia Minor and

[23] G. T. Dennis, "Three Reports from Crete on the Situation in Romania, 1401–1402," *StVen* 12 (1970): 247.

[24] The text in which Magistros describes his journey was published in M. Treu, "Die Gesandtschaftsreise des Rhetors Theodulos Magistros," *Festschrift C. F. W. Müller* (= *Jahrbücher für classische Philologie,* suppl., 27) (Leipzig, 1900), 5–30. Cf. also I. Dimitroukas, "Τὸ ταξίδι τοῦ ρήτορα Θωμᾶ Μαγίστρου (1310): Μία ἐπανεξέταση," Σύμμεικτα 10 (1996): 163–88. Cf. also A. Avramea, "Land and Sea Communications, Fourth–Fifteenth Centuries," *EHB* 76.

[25] τόν τε μελεδωνὸν τῆς νεὼς τούς τε ναύτας αὐτούς, τὸν μὲν τούς οἴακας ὡς εἰκός, τοὺς δὲ μεταχειρίζοντας τὰ ἱστία καὶ νῦν μὲν ἐνταῦθα, νῦν δ' ἐκεῖσε χωροῦντας, ἄνω καὶ κάτω στρεφομένους πολλάκις πρὸς τὸ δοκοῦν εὐτυχές, ὥσπέρ τινας ὄντας πτηνοὺς καὶ τοῖς ποσὶν ἐλάχιστα κεχρημένους. ὧν ἦν ἀκούειν φωνὰς ἀσήμους, καὶ πολὺν θόρυβον, ὑποβαρβαριζόντων ἐν τοῖς τοιούτοις ὡς ἔθος. Treu, "Gesandtschaftsreise," 5.25–6.1.

the Aegean and at the naval bases of southern Italy and along the Adriatic. Timber was not only a basic commercial product but also a raw material of strategic importance, and for that reason trade in it was controlled. One of the first measures taken by the emperors after the recapture of Crete (960/961) was to forbid the exporting of timber to the Arabs—a ban with which Venice refused to comply, even when John I Tzimiskes threatened to burn the Venetian fleet. The shrinkage in the territory of the empire, and especially the loss of Asia Minor, meant that the shipyards and the forests from which timber could be obtained were no longer accessible. In 1348 John VI Kantakouzenos had trouble in procuring raw materials with which to build ships, in Constantinople, to face the Genoese of Galata; and since a blockade made it impossible to transport timber to the capital, wood suitable for shipbuilding was moved overland from the Little Haemos mountains.[26]

Until only a few years ago, it was believed that the method of shipbuilding by which the bent timbers that make up the frame of the ship were attached laterally to the keel, with the planking nailed on to them, was developed in Italy during the tenth and eleventh centuries, and that it was to this innovation, which made it possible to build safer ships at lower cost, that the navies of the Italian cities owed part of their superiority. Under the earlier method of boat-building, the skillfully fitted planking, with the cross beams, was the bearing frame of the vessel. However, thanks to underwater archaeology we now know that this improvement was gradually introduced all over the Mediterranean, beginning in the early Middle Ages. The Yassı Ada ship had been constructed by a mixed method;[27] rudimentary bent timbers—short, only slightly curved, and of varying sizes—were attached to either side of the keel and contributed, with the planking, to keeping the hull stable. The degree to which requirements in shipbuilding timber were specialized can be seen from the fact that the planking of the flat bottom was of cypress wood, as were the keel and the sternpost; the planking of the sides was made of (umbrella) pine, the bent timbers were of pliable elm, and the other beams were of oak, a wood that does not rot easily.

In 1348 the shipyards of Constantinople were moved from the Golden Horn to Kontoskali, a harbor on the Propontis that afforded greater safety from the Genoese, and they remained there even after the fall of the city. There is evidence that among the shipbuilding centers of the late Byzantine period were Smyrna, the coast near Prousa, Gallipoli, Lemnos, Monemvasia, Rhodes, Ainos at the mouth of the Hebros, and Patmos. The raw materials for fitting out and maintaining ships, such as hemp for the sails and ropes, and tar and fat for caulking, originated primarily on the north side of the Black Sea. Byzantium was under a contractual obligation to repair and fit out Venetian ships in Constantinople.[28] The receipts for such work done on Catalan ships in 1352, which have survived, indicate that the naval bases of the Byzantine capital

[26] *Ioannis Cantacuzeni Historiarum libri quattuor,* ed. L. Schopen, 3 vols. (Bonn, 1831–32), 3:70–77.

[27] G. F. Bass and F. H. van Doorninck, Jr., "An Eleventh-Century Shipwreck at Serçe Liman, Turkey," *International Journal of Nautical Archaeology* 7.2 (1978): 119–32.

[28] Cf. MM 3:91.

were capacious and possessed skilled craftsmen.[29] Regardless of its outcome, the undertaking of Kantakouzenos, to which I have already referred, of building an entire war fleet at top speed in 1348 presupposed the existence of well-organized shipyards. The vessels built at this time were fitted with battle towers, but they sank off the capital in the first spell of rough weather.

The Venetians made full use of the shipbuilding tradition of the Greeks, as we can see in the case of the Palopanos family, a dynasty of shipbuilders. The founder of the family and the most skillful builder of galleys in his time, Theodore Vasos (Theodoro Baxon in the Venetian sources), died in 1407, and it was not until seventeen years later that the Serene Republic succeeded in enticing his nephew Nicholas Palopanos (Nicolò il Greco) to come from Rhodes to take his place, in return for very generous remuneration. Nicholas managed the shipyards until 1437, passing on his post to his son George (Giorgio il Greco).[30] In Venice, the title *proto* (from πρῶτος = master craftsman) was given to the chief shipbuilder.

The technology of galley construction was a state secret in Venice. In earlier times, the Byzantines had attached similar significance to marine technology, and the death penalty was laid down for those who, in the days of their thalassocracy, revealed the secrets of shipbuilding to foreigners.[31] On the other hand, the Venetians differed from the Byzantines in that they were interested in importing know-how and not just in protecting and developing the existing shipbuilding skills.

As for the attitude of the Ottomans toward the Greek shipbuilders, it is indicative that when Constantinople was taken and emptied of almost all its Greek inhabitants, Mehmed II introduced a policy that gave special protection to shipbuilders—in order that he might make use of them himself.[32]

[29] A. Rubió i Lluch, *Diplomatari de l'Orient Català* (Barcelona, 1947), 732–35.

[30] Cf. F. Lane, *Venetian Ships and Shipbuilders of the Renaissance* (Baltimore, Md., 1934), 54ff.

[31] ναύκληρος ὁ βαρβάρους κατασκευάζειν διδάσκων ναῦς, ἤγουν ὁ πλοῖα ποιεῖν ἔθνεσιν ἀλλογενέσι ὑποδεικνύς, κεφαλικαῖς τιμωρίαις ὑπόκειται, ὡς τοῖς ῥωμαίων ἐχθροῖς διδοὺς ὅπλα καὶ ἰσχυροὺς ἐκείνους κατὰ τούτων ἀπεργαζόμενος: *Synopsis minor* N, chap. 17 (Zepos, *Jus,* 4:471). Cf. also Ἐπαναγωγή, title 40, § 40 (Zepos, *Jus,* 2:362).

[32] [Mehmed II] *et totam Urbem infra paucos dies fere omni habitacione evacuit. Mechanicos autem, et presertim fabros ac constructores navium, vivos reservavit et eos sibi operari instituit,* we are told by the humanist writer Poggio Bracciolini [1459†]: N. Jorga, "Notes et extraits pour servir à l'histoire des croisades au XVe siècle," *ROL* 8 (1900–1901): 276.

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