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Res Historica 29, 33-51

2010

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Despite the dynamic development of navigation and shipbuilding technologies throughout the ancient world, nowhere else did this phenomenon manifest itself as significantly as in the Greek world[1]. Century after century this area exerted a special influence on the development of Roman maritime arts, not only during the Roman Republic but even as late as the Roman Empire. The other important source of standards for the Romans to follow were the Etruscans, although their role in the work of introducing the descendants of Romulus onto the vast realm of the Mediterranean appears far more difficult to establish. The more so that unlike the Greek world, Etruscan navigation, and especially Etruscan shipbuilding skills and technologies, still remain a little-explored territory in the present day.

In the Greek written sources, warships (long and narrow) first appeared as early as in the Homeric poems: the *Iliad* and the *Odyssey*, where they were present in different forms, from smaller ships propelled by twenty men to warships with 50 or even 100 oars[2]. The conventional and traditional author of the two works, Homer, in his descriptions of the seemingly Achaean warships, obviously presents warships of the far later period than the events depicted, although he fails to mention the type of warship characteristic of the eight century BC: the triacontor, a ship, as the name suggests, with 30 oars, 15 per each side. Descriptions in Homeric verses correlate surprisingly with the images of Greek warships presented on Greek Geometric pottery dating from the ninth to late

* The article has been already published in *Ancient shipbuilding*, ed. R. Karotky, Odessa 2004, 89–101.

[1] A. J. Parker, *Maritime cultures and wreck assemblages in the Graeco-Roman world,* IJNA, 24, 1995, 2, 87–89.

[2] Hom., *Il.* II 718–720; XVI 169–170; I 26, 308, 309; II 509, 510, 719, 720; XVI 168–170; *Od.* I 280; IV 669; VIII 34–36; IX 322; I 211; XII 229–230, 411–414; VIII 34–36, 48; IX 60, 289, 311, 344; X 203–210; cf. J. Morrison, *The ship. Long ships and round ships. Warfare and trade in the Mediterranean 300 BC – 500 AD,* London 1980, 14–21.

eighth centuries BC[3]. Both the Homeric descriptions and paintings on bowls and vases show two forms of warships: one – open warships entirely without decks and thus providing no cover to their crews, especially the oarsmen, and the other – ships with distinctly marked half-decks astern and on bow[4]. It is probably from this type that later warships would develop with full decks running fore and aft, with topwales protecting oarsmen from enemy missiles and waves.

The basic type of warship that Greeks used starting from at least the early eighth century BC was the πεντηκόντορος (pentecontor – a ship with 25 oars a side), a vessel mentioned in the sources also as the μονοκρότους because of the positioning of the oars in one file only[5]. The pentecontor was well above 30 m long, or even 35–37 m, 4.5–5 m broad, with the draft of under 90 cm and the total crew numbering 60 men[6]. An almost standard representation of the Greek pentecontor are the paintings of longships on the Corinthian vases of the late sixth century BC, which distinctly show the strong and dominant ram built on the warship's bow[7]. Following other representations one can conclude that the depicted ram built on Greek warship bows may have first appeared there in the region of ca. 1000 BC or shortly thereafter, since it can be observed in its fully developed

[3] E. Pernice, *Geometrische Vase mit Schiffsdarstellung,* JDAI, 15, 1900, 92–96. Not only on the pottery of the period, A. F. Tilley, *The ship of Odysseus,* „Antiquity", 44, 1970, 100–104; L. Casson, *Odysseus' ship,* AJP, 85, 1964, 61–64; Idem, *Odysseus' ship,* IJNA, 21, 1992, 1, 73–74; S. E. Mark, *Odyssey (5.234–53) and Homeric ship construction: a clarification,* IJNA, 25, 1996, 46–48. These comparisons cannot however lead to exaggerated glorification of the *Iliad* and giving it the status of primary source – D. V. de Lucca, *The ship of Odysseus: a comment,* „Antiquity", 45, 1971, 53–54.

[4] That is with partial upper covers of the inside of the warship hull, which were under 2 m long and could be used at best only by some part of the crew. Contrary to the views of some scholars, half-decks of this type did not need to have solely a military function. They were a good cover for the gallery against waves when navigating on close-to-the-wind-courses and decidedly reduced inconveniences of sailing. The stern half-deck in turn was ideal for the helmsman, who, owing to which, had far better visibility and thereby greater possibilities of manoeuvring, not only during fighting, cf. Liv. XXXVI 43.

[5] J. Davison assumes the date of construction of the pentecontor to be the late eight century BC (J. A. Davison, *The first Greek trireme*, CQ, 41, 1947, 190).

[6] W. W. Tarn, *The Greek warship*, JHS, 25, 1905, 147; R. B. Nelson, P. Norris, *Warfleets of antiquity*, Sussex 1973, 15; Morrison, *The Ship. Long ships...*, 14–21; L. Rodgers, *Greek and Roman naval warfare*, London 1981, 37–41; J. S. Morrison, R. Williams, *Greek oared ships, 900–322 BC,* Cambridge 1968, 73–92. A different length is given by J. Warry, estimating it at barely 20 m (J. Warry, *Histoire des guerres de l'antiquité,* Paris 1981, 18). A similar view seems acceptable exclusively in relation to smaller warships, for example triacontors, because the hull of only 20 m long is certainly too short to hold as many as 25 oars in one line. Cf. C. M. A. Torr, *Ancient ships*, Cambridge 1894, 3, 21–22, 42, 106–116.

[7] L. Basch, *Some observations on the interpretation of representations of ancient ships,* „Mariner's Mirror", 68, 1982, 4, 353–355; Idem, *One aspect of the problems which arise from the interpretation of ancient ships,* „Mariner's Mirror", 62, 1976, 231–233; A. F. Tilley, *Ours is to reason why: the iconography of ancient ships,* IJNA, 9, 1980, 2, 153, fig. 3.

form on pottery from the ninth century BC[8]. The aforementioned warship of the period, triacontor, must have clearly had smaller dimensions, the hull length being at least 7–9 m less, while the beam was similar to that of the pentecontor[9]. These considerable differences in length must have stemmed from the need to retain at least 90-centimetre spaces between oarsmen sitting one by one at the same side of the vessel. Galleys with twenty oars, ten per each side – ἐικωσόρος – were even smaller. The second file of oars did not appear until later. Although Homer already mentions a warship with even 118 oars but it must have been an exception among the others and was not the standard warship type[10]. Despite great speeds attained by means of numerous oars and oarsmen (each oarsman manning only one oar), the 30–50 oared vessels had one major defect: with the great length of the hull they were prone to its mechanical damage, both during the fight and routine sailing due to the impact of waves, which could, with the comparatively long and unfortunately weak hull, even break the warship in half. Furthermore, vessels with such structure were not agile enough and exceptionally unstable to sail at athwart sea, which may have even threatened to overturn the ship. Not without significance was also the commonly used ram that had been introduced earlier as shown by iconographic sources. The great length of the warship limited the possibility of using the ram and reduced manoeuvrability. Moreover, ramming the enemy vessel required one's own warship to be of solid build, where the compactness of structure was decidedly of value.

On the basis of experience with one-file galley, the ancient shipbuilders built vessels with two files of oars positioned on two different levels[11]. Owing to such structural changes, the ship's length was generally reduced (precisely by positioning oarsmen in two files), which directly produced greater manoeuvrability and indirectly – strengthened the hull by shortening it and thereby reducing bending

[8] F. H. Doorninck, *Protogeometric longships and the introduction of the ram,* IJNA, 11, 1982, 277–287. A similar view was also shared by L. Cohen, who even extended his surmises as far back as the sixteenth century BC (*Evidence for the ram in the Minoan period,* AJA, 42, 1938, 486–494); cf. S. Wachsmann, *The ships of the Sea Peoples,* IJNA, 10, 1987, 187–220; idem, *The Thera waterborne procession reconsidered,* IJNA, 9, 1980, 287–295; for more on the fresco itself – P. Warren, *The miniature fresco from the West House at Akrotiri. Thera and its Aegean setting,* JHS, 99, 1979, 115–118). Marx, for example, was of a different opinion: when seeking the origins of the ram he did not take into account only the resemblance of particular parts (*The origin of the ram,* „Mariner's Mirror", 34, 1948, 118–190; this problem was viewed in almost identical way by Ch. E. Gibson, *The origin of the ram,* „Mariner's Mirror", 33, 1947, 164–169.

[9] Ch. E. J. Singer, A. R. Holmyard, T. I. Williams, *A history of technology,* vol. 1, Oxford 1956, 734–738.

[10] A warship with 118 oars: Hom., *Il.* II 509, 510.

[11] A correct reconstruction of a Greek two-file ship in the side and bird's-eye views is included in the popular science paper by W. Monaco (*Birema greca del IV Sec. a. C.,* „Navi e Modelli di Navi", 4, 1980, 7, 161–163).

stress values along the whole keel length[12]. According to Pliny, the first to have introduced a warship with two oar-files were the Eretrians[13]. Galleys with two files of oarsmen or biremes (Greek *diereis*) were known without doubt in Phoenicia as early as about the late eighth century BC, because this is the type of vessel that is represented on an Assyrian relief from the palace of Sennacherib[14]; nevertheless, their best known and established historical forms derives from the naval fleets of the Greek *polis*[15]. It is difficult today to ascertain who was the first to introduce the innovation, yet the Greek world certainly cannot be regarded exclusively as the importer of new trends in shipbuilding, not only because of Pliny's account.

Triacontors and pentecontors in their original, single oar-file form would survive, in the opinion of many scholars, at least until as late as the third and even second centuries BC and it was only then that they would be gradually superseded by new, entirely different types of light warships[16]. The fact is beyond dispute that these types of warships generally operated as late as in the fifth and fourth centuries BC and even much later, in the third century BC[17]. After all, those are such warships that the Romans had to borrow from their allies at the outbreak of the First Punic War[18]. However, during that period 50-oared ships, derived from pentecontors, must have operated solely as vessels with two oar-files (δίκροτος). To maintain them in the form of one-oar-file warships would be against common sense: why would shipbuilders continue to build warships after the old models, less functional and less useful in battle against entirely different,

[12] Hull rigidity in the longitudinal plan, especially of the keel, generally decides about the strength of the whole vessel structure, both with metal (modern) and wooden (ancient) construction – A. Potyrała, *Konstrukcja kadłuba okrętowego*, Gdynia 1967, 32–37; 50sqq; cf. Idem, *Wytrzymałość wiązań okrętowych*, Łódź 1956, 24sqq.

[13] Plin., *NH* VII 56, 207.

[14] T. C. Lethbridge, *Ships and shipmen*, London 1952, 114; Morrison, Williams, *op. cit*., 159; Ch. G. Starr, *The ancient warship*, CQ, 35, 1940, 357; W. W. Tarn, *Hellenistic military and naval development*, Cambridge 1930, 125; P. Banbury, *Man and the sea*, London 1975, 108.

[15] It was first of all an open-deck vessel, with the bow and stern decks at most. H. T. Wallinga, *Ships and sea-power before the Great Persian War: the ancestry of the ancient trireme,* Leiden–New York 1993, 45–53; cf. B. Rankov, [rev.] *Wallinga H. T., Ships and Sea-Power before the Great Persian War. The Ancestry of the Ancient Trireme, Leiden, New York, Cologne 1993,* CR, 44, 1994, 1, 115–116; R. T. Williams, *Early Greek ships of two levels*, JHS, 78, 1958, 121–125; Idem, *Addenda to Greek warships of two levels (JHS 78:121–130),* JHS, 79, 1959, 159–160. Regarding Greek pentecontors we can sometimes speak about a high degree of unification between individual *polis* (A. Jackson, *War and Raids in the World of Odysseus*, [in] *War and Society in the Greek World,* ed. J. Rich, G. Shipley, London 1993, 64–76).

[16] L. Casson, *Ships and seamanship in the ancient world,* Princeton 1971, 125; cf. Liv. XXXVIII 38, 8, Polyb. XXI 43, 13; A. McDonald, F. Walbank, *The treaty of Apamea (188 BC): the naval clauses*, JRS, 69, 1969, 30–39.

[17] For example the Peloponnesian war – Thuc. VI 44; the First Punic War – Polyb. I 20; cf. 72, 2.

[18] A. Milan, *I socii navales di Roma*, „Critica Storia", 10, 1973, 195sqq.

far larger enemy vessels. We should also exclude the often referred-to „longevity" of some maritime vessels, reportedly too costly to be disposed of prematurely by the ancient naval fleets. Both the specific purpose of warships, connected nevertheless with a high risk of the vessel being sunk or otherwise destroyed, and the low durability of organic material, which was wood, decidedly limited the duration of the ship's use at best to more than a dozen, or in exceptional cases, to several dozen years. Similar considerations can be substantiated at least by representations of ancient warships painted on Greek pottery. For example, an Attic vase of 520–515 BC (despite the small vase dimensions – 33.6 cm in diameter, 50.8 cm high) distinctly shows five vessels, some of which are beyond doubt warships with two oar-files[19]. The vase-painter's realism is astounding in these cases: it renders the details of the positioning of oarsmen in the warships with exceptional fidelity. All the vessels are doubtless representations of warships because of the presence of rams in the shape of wild boar's head. Similar vessels are painted on another Attic vase[20] of 540–530 BC. As in the foregoing case, they represent a type of warships with two oar-files[21]. We could probably propose a thesis that representations from this period relate to vessels characteristic of the epoch, thus also predominantly built in shipbuilder's yards, at least the Greek ones.

Apart from broader discussion on the development of vessel typology in other regions of the Mediterranean[22], we should dwell longer on the issue of evolution and transformations that occurred in this realm in the Graeco-Roman world at a broader space of time, not only during the Republic but also the Principate. A continuation of pentecontors in the area of warship construction, both in the form of μονοκρότους and δίκροτοι, was a warship with three independent files of oars, each manned by one oarsman. This vessel was probably the most common in the fifth and fourth centuries BC and at the same time, historiographically, an almost leading standard typical of ancient shipbuilding in the first mid-millennium BC[23]. This amazingly parametrically successful warship was probably constructed as a result of ancient shipbuilders striving to enhance the positive properties of the existing vessels, i.e. to obtain the highest speed possible of the vessel retaining

[19] The Cleveland vase 71.46 in the Cleveland Museum of Art, cf. B. Kathman, *A Trio of late black-figure vase-painters*, „CMA Bulletin", 66, February 1979, 55–57, fig.8, 9, 11.

[20] University of Chicago gallery, 1967.115.141, F. P. Johnson, *A fragment of an Attic dinos,* „Art in America", 29, 1941, 208–216; cf. J. D. Brazley, *Attic red-figure vase-painters*, Oxford 1963.

[21] Cf. Morrison, Williams, *op. cit.*, 92–116; Casson, *Ships and seamanship...*, 60–65; D. Gray, *Seewesen*, Göttingen 1974, 26–28. For more information on representations of Greek two-file warships on pottery – Williams, *Early Greek...*, 121–130.

[22] J. Hornell, *Naval activity in the days of Salomon and Ramses III,* „Antiquity", 21, 1947, 66–73; Idem, *Egyptian shipping of about 1500 BC,* „Mariner's Mirror", 23, 1937, 105–107.

[23] A. F. Tilley, *Three men to a room – completely different trireme*, „Antiquity", 66, 1992, 610.

the necessary endurance (construction) parameters of the hull, and above all – as high combat worthiness as possible.

For many centuries the triere, and specifically the so-called „riddle of the triere" continued to attract the attention of numerous scholars[24]. According to Thucydides and Pliny the Corinthians were reportedly the first to have introduced this type of galley already in the late eighth century BC, specifically, as Pliny reports, owing to Ameinocles[25]. Accepting the two historians' accounts as credible and basically with no reservations by some scholars as well as the fact of so early introduction of a three-file warship to sea appears to be hasty at best[26]. A series dilemma arises here since it is difficult to explain why the triere as a sensational type of warship was absent at sea for 250 years after the alleged date of its invention given by Thucydides. Moreover, the images of warships coming from Greek pottery of the second half of the sixth century BC are still dominated by ships with two oar-files exclusively[27]. If we accepted Thucydides' opinion, we would have to assume that Greek shipbuilders brought into naval service at the same time both a two-file and a three-file warship (therefore with different fighting capabilities), which may not have been a very reasonable move. Therefore, trieres should have been introduced circa the late seventh or early sixth centuries BC at the earliest, when there were already vessels with two files[28].

The partially differing dating, at ca. the mid-sixth century BC (550–525 BC), was given by J. A. Davison, who, however, proposed it without solid arguments, perhaps in an attempt to average Thucydides' early chronology and further accounts, ascertained regarding the time and place, about trieres from the fifth century BC, and possibly following the earlier findings of German historians[29]. A crucial argument for determining the date of triere construction seems to be, for some scholars, Herodotus' account about the circumnavigation of Africa organized during the reign of pharaoh Necho II ca. 600 BC and the participation in it of

[24] Doletus, *De re navali liber*, Leiden 1537; Gyraldus, *De re nautica libellus*, Basel 1540; T. Rivius, *Historia navalis antiqua*, London 1638, vol. III, 38; P. Languedoc, *Traite sur triremes, ou les vaisseaux de guerre des anciennes*, Paris 1721; P. P. de Châtles und Sandon, „Journal de Trevoux", Sept. 1722.

[25] Thuc. I 12–15, cf. Tarn, *The Greek warship*..., 147.

[26] P. K. Newman, *Triremes,* CR, 20, 1906, 280.

[27] For example the following black-figure vases: of University of Chicago gallery (1967.115.141) and Cleveland Museum of Art (71.46); cf. Kathman, *op. cit*., 55–62.

[28] Cf. L. Casson, *Starożytni żeglarze basenu Morza Śródziemnego*, Warszawa 1965, 98; C. S. Starr, *The influence of sea power on ancient times*, Oxford 1989, 14–28; J. S. Morrison, *The First Triremes,* „Mariner's Mirror", 65, 1979, 53–57. It is generally assumed that even the Athenian fleet still had, at the close of the sixth century and at the beginning of the fifth century BC, not only a small number of warships (as compared with the neighbouring Aegina) but they were of worse quality – C. J. Haas, *Athenian naval power before Themistocles,* „Historia", 34, 1985, 29–46.

[29] Davison, *op. cit.,* 18–24; C. Merkel, *Die Ingenieurtechnik im Alterthum,* Berlin 1899, 321.

three-file vessels, which came from Phoenician towns[30]. However, can we accept similar views uncritically? Three-file warships constituted, without doubt, the core of all naval fleets at least from the early fifth century BC, as exemplified by Persian-Greek wars[31] or conflicts between Sparta and Athens[32]. They were com-

[30] Herod. II 159; Plin., *NH* VII 57; L. Basch, *Phoenician oared ships,* JHS, 100, 1980, 198–199; Idem, *Phoenician oared ships,* „Mariner's Mirror"..., 231; Casson, *Ships and seamanship...*, 81; Wallinga, *op. cit.,* 104 sqq; cf. Morrison, Williams, *op. cit*., 38; C. Branigan, *The circumnavigation of Africa,* „Classical Ireland", 1, 1994, 1–2. M. Lloyd proposed a thesis that the first three-file warship came from Phoenicia (M. A. B. Lloyd, *Were Necho's triremes Phoenician,* JHS, 95, 1975, 45–61; Idem, *The so-called galleys of Necho,* JEA, 58, 1972, 307–308; Idem, *Triremes and the Saite navy,* JEA, 58, 1972, 268–279). It appears however that his opinions are not substantiated enough by iconographic sources. A critical opinion about this thesis is contained in a study by L. Basch, who essentially almost disregarded written sources – L. Basch, *Trieres grecques, phéniciennes et égyptiennes,* JHS, 97, 1977, 1–10 (esp.4–7).

[31] The presence of triere in both combatant fleets is evidenced for example by Athen's preparations for the war against the Persians (Herod. VII 144; Plut., *Them.,* 4, 1–4,2) or the course of war operations themselves in 480 BC, when trieres also constituted the core of the Persian fleet – W. W. Tarn, *The fleet of Xerxes,* JHS, 28, 1908, 202–233; I. Whitehead, *Xerxes' fleet in Magnesia: the anchorage at Sepias,* „Mariner's Mirror", 74, 1988, 3, 283; W. K. Pritchett, *Xerxes' fleet at the „ovens",* AJA, 67, 1963, 5; J. F. Lazenby, *The strategy of the Greeks in the opening campaign of the Persian War,* „Hermes", 92, 1964, 3, 276; Aesch., *Persai,* 341–343 (for example the naval battle of Artemisium – Herod. VIII 1–3, 86–90; H. J. Diesner, *Kriege des Altertums,* Berlin 1971, 36; G. Busolt, *Griechische Geschichte,* vol. 2, Gotha 1895, 672; C. Hignett, *Xerxes invasion of Greece*, London 1963, 155; S. Starr, *A history of ancient world,* Oxford 1965, 288; H. Delbrück, *Geschichte der Kriegskunst im Rahmen der politischen Geschichte,* Berlin 1900, Bd 1, 147sqq; or of Salamis – Herod. VIII 84–96, 56–63; Plut., *Them.,* 11, 2–11, 7; 13–15; Aesch., *Persai,* 249–514; Paus. I 35, 2–1, 36, 2); N. G. L. Hammond, *The Battle of Salamis,* JHS, 76, 1956, 33–35; W. Markov, H. Helmert, *Battles of world history,* Leipzig 1978, 39–40; C. Rodos, *La bataille de Salamine*, Paris 1945; J. Baelen, *Salamine 480,* Paris 1961, 24sqq; B. H. Delorme, *Deux notes sur la bataille de Salamine,* BCH, 102, 1978, 87sqq. There also conceptions that some Ionian *polis* learned the triere construction only during the preparations of the Persians for the confrontation with the Greeks of the Balkans. They managed to do it thanks to the Egyptian fleet, cf. Thuc. I 13, 6; H. T. Wallinga, *The Ionian revolt,* „Mnemosyne", 37, 1984, 404–407; Idem, *Ships and sea-power...,* 66sqq. The presence of two-file warships as dominating with their numerical strengths in both the fleets is entirely erroneously assumed by (*The battle for Salamis,* „History of Ships", 3, 1982, 46–48). Of a different opinion concerning the position and equipment of the fleets of Greek cities, especially of Athens, is P. Millett (*Warfare, economy and democracy in the classical Athens,* [in] *War and society in the Greek world,* ed. J. Rich, G. Shipley, London 1993, 177–196); according to B. Jordan, the triere already dominated earlier, during the Ionian uprising – B. Jordan, *The Athenian Navy in Classical Period,* California 1975, 102–110; A. Köster, *Das Antike Seewesen*, Berlin 1923, 208; R. B. Nelson, P. Norris, *Warfleet of antiquity,* Sussex 1973; cf. P. Tozzi, *La rivolta ionica*, Pisa 1976 (especially the battle of Lade).

[32] Cf. Thuc. VIII 39, 4; 41, 3; 42, 1; 42, 5; C. L. Falkner, *The Battle of Syme, 411 BC – Thuc. 8.42,* AHB, 9, 1995, 3–4, 118–120; R. Sealey, *Die spartanische Nauarchie,* „Klio", 58, 1976, 335–358. A. French, *A note on size of the Athenian armed forces in 431 BC,* AHB, 7, 1993, 2, 43–48. At that time trieres determined the strength and quality of naval fleets, as exemplified by the battle of Notium, although F. Russell is more inclined to attribute victory to the „genius" of the Athenian commander (*A note on the Athenian defeat at Notium,* AHB, 6, 1992, 3, 117–126). Even later, in the early fourth century BC, despite considerable financial difficulties of Athens, the

monly used during this period by ancient Greeks, Phoenicians, and the countries in the eastern and middle Mediterranean.

We should perhaps actually determine two basic points of reference rather than focus on finding one common dating, impossible to establish. First, what is important, is the date itself of invention of the triere, which may have occurred only after two-file vessels had become widespread earlier. Second, the period during which the trieres, having demonstrated their indubitable advantages, became commonly known (without being widely used in naval fleets yet) and at the same time the most sought after as a warship prototype. The time interval between the two periods may have been fairly considerable, even several dozen-years long, while the technological specifications of the new type of warship were most probably kept secret. However, the time between the second period and the introduction of the new type of ship in most fleets, making it the numerically dominant one, was merely a matter of a few years.

The reasons why the ancient naval fleets were so evidently dominated by this type of vessel must be sought in its excellent sailing and combat properties as compared with its predecessors (pentecontors in both forms). It is impossible to compare the performance and nautical properties of the triere with its „ancestors", nevertheless, on the basis of certain comparisons between them and the values obtained while testing the replica of an Athenian triere one can arrive at very interesting results. First of all, this warship had at least two or three times as many oars as its predecessors or even more (the pentecontor – 50, the triere – up to 170[33]). Even assuming also a far greater displacement of the vessel, greater skin friction, and wave resistance, this large difference must have manifested itself in gaining a considerable speed increase. All properties of the galley are centred around enhancing its combat capabilities: the ship's speed had its prominent position here with the ram being commonly used, and later, with the emergence of two main forms of fighting at sea, where it was speed that frequently decided about victory (διέκπλοι and περίπλοι)[34]. Larger dimensions of the warship in turn provided an advantage in close engagement and boarding combat, and, interestingly enough, also with ramming owing to the greater impact force of the ram, which changes its shape with the arrival of the triere and assumes a more solid form.

core of the fleet consisted of trieres (Diod. XVIII 15, 8; 16, 1; CIG II^2 1611.400sqq; 1622.249sqq; G. L. Cawkwell, *Athenian naval power in the fourth century,* CQ, 34, 343).

[33] H. I. Chapelle, *The Oarage of Greek warships,* „Mariner's Mirror", 20, 1934, 229; A. J. Graham, *Thucydides 7.13.2 and the Crews of the Athenian Triremes,* TAPhA, 122, 1992, 259–267.

[34] *Periplous* and *diekplous* – J. S. Morrison, *Greek naval tactics in the 5th century BC,* IJNA, 3, 1974, 1, 21–23; J. F. Lazenby, *The Diekplous,* GR, 34, 1987, 169–170; G. Kirk, *Ships on Geometric Vases,* „Annual of the British School at Athens", 44, 1949, 97–101; 129–134 sqq.; I. Whitehead, *The Periplous,* GR, 34, 1987, 179sqq.

Probably the greatest divergences in opinion among the scholarly community relate to the dimensions of the tiere. In the early stages of their development, the trieres, according to L. Rodgers, were ca. 23 m long and 3.5 m broad[35]. Greater dimensions were or are taken almost for granted by J. Warry, R. B. Nelson, J. Coates, G. McGrail, C. Torr[36]. They assume that the warship should have been 36.7–38 m long and 5.45–5.8 m broad. In the early stages of its development the triere length, most of these scholars concede, was indeed smaller, nevertheless it was still above 30 m (ca. 33.5 m)[37]. W. O. Stevens and A. Westcott assume that most three-file warships were over 40 m long. This would be determined by the fairly large crew of the triere[38]. Theories about the dimensions of the triere are largely based on the measurements taken of the excavated remains of ship-sheds[39].

The breadth of three-file warships was as a rule not more than 1/7 of its length. These dimensions, reportedly ideal for an ancient warship, determined not only the beautiful, well-proportioned, elongate profile of the triere but, more importantly, they allowed the ship to attain great speeds. Practical tests made on the reconstruction of the triere show that already at preliminary sea trials it was able to sail at a maximum speed of 6–7 knots[40] (with planned 9.5 – 11 knots), which was impossible to attain for medieval and modern warships[41]. It appears that the most reliable source in establishing the outer dimensions of three-file warships, at least for the period of 480–390 BC and for Greek vessels, are the stone remains

[35] Rodgers, *Greek and Roman*..., 42–53.

[36] Warry, *op. cit*., 30–31; Nelson, Norris, *op. cit*., 23; Torr, *op. cit*., 80–84; J. F. Coates, G. McGrail, *The Greek trireme of the 5th century BC,* Greenwiche 1986, 138; J. F. Coates, *The trireme sails again,* „Scientific American", 260, 1989, 98; C. S. Starr, *Trireme,* [in] *The Oxford classical dictionary*, ed. N. G. L. Hammond, H. H. Scullard, Oxford 1970, 1095.

[37] Nelson, Norris, *op. cit*., 23.

[38] W. O. Stevens, A. Westcott, *A History of Sea Power*, Garden City–New York 1944, 9.

[39] D. J. Blackman, *The Shipsheds,* [in] Morrison, Williams, *op. cit*., 1968, 181–186. In these discussions based on the remains of the ancient ship-sheds we should obviously take account of certain divergences relating to their dimensions – H. Hurst, *Third Interim Report,* „The Antiquaries Journal", 58, 1978, 232–261. The manoeuvrability of ancient warships was probably high, which is why it is difficult, exclusively on the basis of harbour basins, to accept any parameters of vessels stationed therein; Idem, *Second Interim Report,* „The Antiquaries Journal", 56, 1976, 177–197; Idem, *Excavations at Carthage, 1974 – First Interim Report,* „The Antiquaries Journal", 55, 1975, 11–40. For more general information on the harbour itself: Idem, *A metropolitan landscape: the late Punic port of Cartage,* „World Archaeology", 9, 1978, 334–346.

[40] Coates, *op. cit*., 100; B. H. Dolley, *Second Symposium on Ship Construction in Antiquity,* „Mariner's Mirror", 373; J. S. Morrison, *The British Sea trials of the reconstructed trireme, 1–15 August 1987,* „Antiquity", 61, 1987, 455–459; Idem, *The sea trials of the trireme: Poros 1987,* IJNA, 17, 1988, 2, 173–174.

[41] Equipped even with 92–114 oars (so-called *galia sottil*) – B. Landström, *The Ship,* Stockholm 1961, 128–129, fig. 319–321; R. C. Anderson, *Italian naval architecture about 1445,* „Mariner's Mirror", 11, 1925, 136–144.

of the ancient ship-sheds in Piraeus, dating from precisely the presented classical period. They are ca. 6.75 m broad and over 36 m long[42].

A characteristic property of the triere, regardless of the date of its construction, was the comparatively low draft, as a rule ca. 1 metre. There are well-known cases of soldiers in full gear jumping into water to ford it and attack the enemy ships moored at the shore, which would have been impossible, had the vessels had deeper draft, since a hoplite wearing an armour and carrying heavy weapons would not have been able to swim. This low draft would have certainly enabled the warship to operate freely even in the comparatively shallow littoral waters, furthermore, allowing the vessel not only to use small harbours but also be partially pulled on flat shore. The term „pulling ashore" does not mean, however, that the whole warship was pulled onto the shore but only its bow (usually) or stern section in order to protect the vessel from the waves that might release it from its ropes or anchor cables and set it adrift onto open sea while the crew were resting on the shore. However, this does not mean that the trieres had flat-bottomed hulls. It would have certainly facilitated pulling the vessel ashore yet it would have considerably reduced the ship's seaworthiness by increasing the effect of the ship's drifting off the chosen course and diminishing its stability while navigating. It appears that these very factors may have prevailed in rejecting the concept of the flat-bottomed hull in trieres.

It is very difficult to determine the displacement of the classical triere, if such a term can be at all used. It must have ranged from 90 to 160 tons, depending on the vessel size. Coates, one of the few, assumes this parameter to be barely 55 tons, which, however, is an isolated view since the ship had to have proper displacement to hold an after all fairly sizeable crew consisting on average of 220 men (including 170 oarsmen)[43].

The positioning of oarsmen in the triere probably depended on their numbers. Initially, when the ships were barely over 20 m long, their crew, according to L. Rodgers, numbered 120 men: 90 oarsmen, 12 seamen to man the rigging and remove water if need arose, and 18–20 heavily-armed hoplites[44]. Later, in the fifth and fourth centuries BC, when the galley size increased, its crew, J. M. Morrison

[42] W. B. Dinsmoor, *The architecture of ancient Greece,* New York 1975, 242; A. W. Lawrence, *Greek architecture,* New York 1983, 341.

[43] Wallinga (*Ships and sea-power...*, 169–183, esp.171–173) claims that the Greek fifth-century-BC trieres always had a full complement of oarsmen's crew, a view essentially shared by Graham (*op. cit.,* 259–267), of a different view are other scholars (J. F. Coates, S. K. Platis, J. T. Show, *The trireme trials 1988,* Oxford 1990, 20, 23), who propose their opinions on the basis of practical sea trials of the replica of the Greek triere named *Olympias*, especially the first two trial outings, when preliminary tests of the warship's speed and agility were made – J. S. Morrison, *The second British sea trials of the reconstructed trireme 20 July – 5 August 1988,* „Antiquity", 62, 1988, 713–714.

[44] Rodgers, *Greek and Roman...*, 42–53.

and J. Coates claim, numbered ca. 200 men, including 170 oarsmen[45]. According to those scholars, this was the largest and probably most characteristic type of triere, to which most descriptions and studies have been devoted in literature. Nevertheless, it does not appear possible to give all-embracing parameters characteristic of all vessels, regardless of origin and date of construction, thus partly acknowledging that between ancient warships of the same class there were no significant differences, as claimed, for example, by C. Torr[46]. However, the development with time of shipbuilding technology did not always have to mean generally increased vessel dimensions. One could not expect that over the stretch of a half-millennium the ancient shipbuilders should not have built warships with the same number of oar-files yet with entirely different shapes and dimensions of the hull, vessels customized to individual needs, both in the areas of the Balkan and Apennine Peninsulas[47].

It is assumed that the trieres dominated in the Mediterranean at least for a century, to later give way to larger vessels with more than three files (of oars or oarsmen) and it was only after the battle of Actium they would partly regain their previous position in the navy.

Political rivalry between the then powers resulted in the intense build-up especially of war fleets, with close attention being paid to the construction of vessels with already specified combat values that far exceeded the possibilities of the previously predominant craft – three-file warships, hitherto indisputably dominating with their universality. The place of the intricate art of manoeuvring was essentially taken by the actually stagnant, positional tactic of frontal combat, where the decisive role was played by sheer size, mass and resistance of the warship and the number of its combat crew members. The reasons for this phenomenon should probably be sought also in the political changes that occurred in the eastern and north-eastern regions of the Mediterranean during the latter half of the fourth and early third centuries BC, and in the emergence of strong states able to afford the costs of building and maintenance of huge and at the same time extremely costly war fleets made up of increasingly massive warships. This is exemplified by the monarchy of Alexander the Great and later by the Ptolemean Egypt, the rule of the Seleucids or the powerful Macedonia, competing with one another in

[45] J. E. Coates, J. Morrison, *The Athenian trireme*, Cambridge 1986, 107–128, 147; L. Casson, *Illustrated history of ships and boats*, New York 1964, 105; Idem, *Ships*..., 83; Morrison, *The ship. Long ships*..., 22–31.

[46] Torr, *op. cit.*, 24. An entirely different view was advanced by L. Basch, who concluded that for example Phoenician trieres were built according to completely different assumptions than Greek ones, differing not only in the details but also the construction of the main elements (*Phoenician oared ships,* „Mariner's Mirror", 140).

[47] R. C. Anderson, *Oared fighting ships*, London 1962, 33, fig. 5B; L. Basch, *Roman triremes and the outriggerless Phoenician trireme*, „Mariner's Mirror", 1979, 4, 325.

the eastern part of the Mediterranean and the sea power at the western gates of the Mediterranean – Carthage[48].

Already in the fourth century BC in the naval fleets of those states there started to appear larger warships than trieres. They were probably first introduced by Dionysius, tyrant of Syracuse, by launching in 399 or 398 BC (or in 396 BC) vessels with four and five files of oars or oarsmen that were to take part in the war against Carthage[49]. Somewhat later, in the second half of the century, they were reported also in the Athenian naval fleet and in the war fleets of other Greek *polis*. For example, in the 330s BC the Athenians had ca. 392 trieres, 18 tetreres and 7 penteres. In 325/324 BC there were as many as 360 trieres, and 50 „fours" and 7 „fives"[50]. New warships were still scarce, even in the powerful fleet of Philippus II and Alexander of Macedonia, but the number of larger warships gradually increased[51]. At the turn of the fourth century BC these vessels started to dominate in ancient naval fleets[52]. During the fights between the diadochs and epigons, the basic warships were penteres that replaced somewhat smaller tetreres in particular naval fleets[53].

Unfortunately, there is scarcely any detailed information available concerning the appearance and structure of both the tetrere and pentere. There are huge divergences of opinion regarding the dimensions of the tetrere, and especially the

[48] Cf. N. G. L. Hammond, *The Macedonian navies of Philipp and Alexander until 330 BC,* „Antichthon", 26, 1992, 30–41.

[49] Diod. XIV 41, 3; 42, 2; 44, 7; 58, 1; Aelianus, *Var.,* 6, 12; Torr, *op. cit.,* 5; Tarn, *Hellenistic military...*, 131–132.

[50] CIG^2 II 1627b, 266–269, 275–278; 1629d, 783–812; Starr, *The ancient warship...*, 354–357. More exact calculations were made by F. W. Walbank (*Athenian sea power in 323/2 BC,* JHS, 87, 1987, 93–97). The figures given relate to the peacetime strength of the standing fleet; S. K. Eddy, *Athens' peacetime navy in the age of Perikles,* GRBS, 9, 1968, 143sqq. At that time (the late fifth and early fourth centuries BC) the fleet was undoubtedly the main fighting force of Athens (cf. L. Casson, [rev.] *B. Jordan, The Athenian navy in the classical period: a study of Athenian naval administration and military organisation in the fifth and fourth century BC, Berkeley 1975,* „Gnomon", 50, 1978, 7, 688–690).

[51] The example thereof are successive fleets of the state of the Antigonides, with a large but not dominant number of large warships (over 4–5 files; F. W. Walbank, *Sea power and the Antigonidis,* [in] *Philip II, Alexander the Great and the Macedonian heritage,* ed. W. L. Adams, E. N. Bourza, London 1981, 213–236). However, in the fights with the Phoenician cities, large warships dominated, which were extremely useful in besieging Tyre (A. Abramenko, *Die zwei Seeschlachten vor Tyros. Zu den militärischen Voraussetzungen für die makedonische Eroberung der Inselfestung (332 v. Chr.),* „Klio", 74, 1992, 166–178).

[52] Cf. Diod. XIX 58, 4; 62, 7–9; XX 49, 2; 50, 2; 52, 1; Athenaeus, 5, 203d; Liv. XXXVII 8, 3; 23, 5; W. W. Tarn, *The dedicated ship of Antigonous Gonatas,* JHS, 30, 1910, 209–211. An example of the naval fleet dominated by this type of warship during the period in question are the Rhodian and Syracusan fleets; cf. J. S. Morrison, *Tetrereis in the fleets of Dionysius I of Syracuse,* CM, 41, 1990, 33sqq.

[53] N. G. Ashton, *How many pentereis?,* GRBS, 20, 1979, 237–242.

pentere. Very precise dimensions are given by Nelson[54]. He believes that the „five" (pentere) was 120 ft (ca. 36.5 m) long with the breadth of 50 ft with the ramp (or with the outrigger i.e. 6.1 m) and 14 ft without the ramp (ca. 4.3 m)., and with the draft of 4 feet (ca. 1.2 metre). Likewise precise but far lower figures are given by Rodgers: 100 ft long (ca. 30.5 m), 18 ft broad (ca. 5.5 m) and draft 4 ft, with the pentere's displacement estimated at 140 tons[55]. Entirely different dimensions are given by J. Sikorski[56]. According to him, the pentere was slightly over 50 m long, 5.5–8 m broad, and the draft – somewhat over 4 m. With such dimensions, Sikorski estimates the displacement of the vessel at as much as 300–400 tons or even 500 tons. It is difficult to say where such great divergences stem from. Even assuming that the pentere could have changed over the period of 200 to 300 years, the differences should not be so great. It is certain that at least because of the increased number of oarsmen, penteres must have been far larger than trieres (and most likely than tetreres). The thesis that the tetrere and the pentere were each ca. 100–120 ft long, that is of the same length as the triere, is untenable.

Similar differences relate to the crew of the tetrere and pentere. The most debatable is the view that the pentere held as few as 150 oarsmen, 20–30 seamen and 50–70 soldiers. Most scholars assume after Plutarch and Polybius that the oars of this type of warship were manned by ca. 300 oarsmen. The number of soldiers was presumably not constant and depended on the character of military action: it increased if the need arose by taking whole troop detachments aboard, which is obviously another argument confirming the far greater dimensions of tetreres and penteres than was the case with the triere.

Another stage in the development of forms of shipbuilding in antiquity was the construction of even larger warships with more than five files, commonly referred to as polyeres. Along with the construction of them in increasingly great numbers, there occurred a process of gradually limiting the numerical strength of naval fleets in favour of the quality of their composition or, in other words, the size of the warships composing them. This was undeniably connected with a new tactic of naval warfare, which consisted in destroying the enemy's personnel and vessels using one's own larger, heavier and more solid warships. The beginnings of this new form of fighting seems to be rooted still in the fifth century BC or even earlier. During the Greek-Persian wars, the Greek warships, especially Athenian and Corinthian ones, were distinguished not only for their excellent construction but also suitability for manoeuvre combat by means of ramming[57], unlike for

[54] Nelson, Norris, *op. cit.*, 27.

[55] Rodgers, *Greek and Roman...*, 211.

[56] J. Sikorski, *Zarys historii wojskowości powszechnej do końca XIX wieku,* Warszawa 1971, 94.

[57] A. J. Holladay, *Further thoughts on trireme tactics,* GR, 35, 1988, 149–151; J. Labarbe, *Chiffres et repartition de la flotte grecque a l'Artemision et a Salamine,* BCH, 76, 1952, 384–441.

example Phoenician ships, higher and heavier, which mostly preferred boarding, which in turn would also dominate naval tactics in the centuries that followed (fourth to third centuries BC)[58]. Some scholars see the cause of this phenomenon in the greater fighting efficiency of warships manned with many soldiers using all manner of equipment in fight (ballistas, catapults etc.) or – in the possibility of capturing the vessel under attack and using it for one's own purposes.

The problem thus perceived of the origins of development of huge warships appears to be treated too enigmatically, nevertheless. However, is the only one argument enough to account for such a spontaneous development of huge warships starting from the fourth century BC? Why did this not happen much earlier, even already in the first half of the fifth century BC, during the fierce struggle for dominance of the western region of the Mediterranean? This considerable, one-century difference constitutes a serious barrier at this point.

However, the issue of introduction of huge warships in the fourth century BC may look entirely different, when we also take into account the significant events during the conflict between Sparta and Athens (in general), and specifically the period of the Athenians' Sicilian expedition against Syracuse[59]. It took place in 415 BC, when Athens sent essentially the core of their naval and land forces, not counting subsequent reinforcements[60]. In the context of unusually bloody fighting, special attention should be drawn to innovations introduced on the Syracusan ships commanded by Gylippus, starting with the summer of 413 BC[61]. They consisted mainly in strengthening the bow-timber of Syracusan warships, and attaching extra planks to the hull (especially on the waterline) in order to neutralize to the maximum the possibility of their vessels being rammed by Athenian warships[62]. As demonstrated by the ensuing events, the idea proved correct by all means: in the narrow and limited waters of Syracuse's Great Harbour the Athenian trieres were unable to match the durability of their enemy's ships. It is perhaps from there

[58] Morrison, *Greek naval tactics...*, 21–26; J. K. Anderson, [rev.] *Morrison J. S., Williams R., Greek oared ships, 900–322 BC, Cambridge 1968,* CPh, 64, 1969, 180sqq.

[59] A. Andrewes, *The Peace of Nicias and the Sicilian expedition,* [in] *CAH*, 5, Cambridge 1992, 433–463; W. S. Ferguson, *The Athenian expedition to Sicily,* [in] *CAH*, 5, Cambridge 1927, 282–311; P. Green, *Armada from Athens,* London 1970; D. Kagan, *The Peace of Nicias and the Sicilian Expedition,* Ithaca 1981; cf. G. L. Cawkwell, [rev.] *Green P., Armada from Athens, London 1970,* CR, 86, 1972, 245–248. The account by Thucydides of this expedition was thoroughly verified, without, however, changing the interpretation of the fragments describing naval fights – B. Bosworth, *Athens' first intervention in Sicily: Thucydides and the Sicilian tradition,* CQ, 42, 1992, 1, 46–55.

[60] R. J. Buck, *The Sicilian expedition,* AHB, 2, 1988, 4, 74–76.

[61] T. Łoposzko, *Starożytne bitwy morskie,* Gdańsk 1992, 152–154; J. Mitchell, E. S. Creasy, *Twenty decisive battles of the world,* New York 1964, 31–36.

[62] Thuc. VII 32, 2–3. There is still a dispute going on about the authorship of construction changes, these being sometimes ascribed to Hermocrates – E. F. Bloedow, *Hermocrates' strategy against the Athenians in 415 BC,* AHB, 7, 1993, 3–4, 115–119.

that later shipbuilders borrowed the idea of building possibly slower yet heavier and more durable and resistant warships.

According to the ancient opinion, a great role in the development of this warship category (polyere) was played by Demetrius Poliorketes (336–283 BC), who, together with his father Antigonos, started building in 315 BC a new fleet that would be able to rival the naval fleet of the Ptolemys. Which is why he equipped it with ships, in which, in the opinion of many scholars, there were six or seven files. Around 313 BC Demetrius reported had 313 vessels, the largest being „thirteens" with ca. 1800 oarsmen[63]. A dozen or more years later he included in his fleet also the „fifteens" and „sixteens", which in any case were captured in 286 BC by Ptolemy. Demetrius himself, in the battle near Salamis (Cyprus), commanded the fleet aboard a „sixteen"[64].

The next stage of the shipbuilding art was the construction by Demetrius Poliorketes' son, Antigonos Gonatas, of a warship with 18 files. The peak of construction attempts were the „twenties" and „thirties" put to sea by Ptolemy Philadelphus (285–240 BC), and Ptolemy Philopator's „forty"[65]. It is not known how these warships were built just as the dimensions of these monstrous vessels still remain a mystery. Experts in this area give estimated figures regarding only some of the polyere ships[66]. According to them, for example, the heptere may have been 140 ft (ca. 42.7 m.) long and 30 ft (ca. 9.2 m.) broad including the ramp (without which – 28 ft or ca. 8.54 m.) with the draft of ca. 6 ft (1.83 m.). The warship's crew reportedly consisted of 350 oarsmen, 20 seamen working the sails and ca. 200 soldiers. Altogether it would hold 575 men. Of controversial nature is the description of Lysimachus' famous octere. We can agree that it was ca. 150 ft long (ca. 45.8 m.) and 24 ft (ca. 1.25 m) broad. It appears however that the figures for the draft, which Rodgers[67] estimates at barely 4.1 ft (ca. 1.25 m.), and displacement estimated at 230 tons are decidedly miscalculated. Also the crew strength given by this author is probably too small, the total numbering only 550 men: 320 oarsmen, 50 seamen, and 180 soldiers and officers.

Of the same length as the octere would be another, larger warship – the decatere. Its estimated dimensions were: 150 ft long, 40 ft broad (ca. 12.2 m.) with the ramp (32 ft, ca. 9.75 m without). The draft of this vessel with ten files, where 600 oarsmen and 40 seamen reportedly worked and 400 soldiers were stationed,

[63] Tarn, *The dedicated ship...*, 209–222.

[64] Plut., *Demetrius*, 43; H. Hauben, *Fleet strength at the battle of Salamis (306 BC),* „Chiron", 6, 1976, 1–5.

[65] Some scholars find the fact of the existence of this vessel highly controversial, J. Kotłowski, *Okręty hellenistyczne w opisie Atenajosa. Tłumaczenie z j. greckiego i komentarz,* „Nautologia", 1, 1966, 1, 37–45; Idem, *Okręty hellenistyczne,* „Filomata", 187, 1965, 373–387.

[66] Nelson, Norris, *op. cit.*, 25–33; Rodgers, *Greek and Roman...*, 254–259.

[67] Rodgers, *Greek and Roman...*, 254.

would be only 6 ft. Only 1.5 foot deeper (7.5 ft or ca. 2.2 m.) would be the draft of the sixteen-file flagship of Demetrius Poliorketes, which was probably 180 ft long (ca. 64.9 m.) and 30 ft broad. The tonnage of the „sixteen", which would hold 800 oarsmen, 100 seamen and 440 soldiers, would be 640 tons.

All the above figures are obviously only hypothetical, the more so that in none of the polyere types described could it be possible to establish its parameters except one – the number of files. It might not be even too exaggerated to classify them as science fiction. Under the circumstance when there are no solid grounds for any hypotheses, can we propose so far-fetched conclusions and give almost centimetre-exact representations of ancient warships with many files? The most certain possibilities of establishing vessel dimensions, if we can use this word at all, seem to relate to the three-file warships. Apart from this type and practically several entirely exceptional vessels (e.g. the „Syracusan", Ptolemy IV's tessarakontere), each type remains a great unknown. We can at best acknowledge a priori that, 1) many-filed warships should be larger than three-file vessels, 2) a vessel that contained a larger number (of files) in its name was probably larger than those with a lower number. Therefore, all attempts to describe these ancient warships without a thorough analysis and solid foundations derived from concrete accounts are nothing but an individual vision of an ancient vessel proposed by a specific scholar. This certainly does not refer to vessels about which there are detailed accounts by the ancient authors or other reliable sources.

The aforementioned forty-file warship of Ptolemy IV has been regarded by many experts in the field as mythical, being equally incredible. Strangely enough, not only because of allegedly as many as forty oar files used in this warship but on account of the great dimensions of the hull. The vessel was reportedly 124 m long and over 17 m broad (280 ells by 38 ells)[68]. Sceptics have been citing the example of the nineteenth-century sailing „Wyoming", which was „only" 108 metres long. How could the ancients have constructed a vessel that was far longer than this boat? It appears, however, that we have not taken account of the realities, and specifically the fact that the tessarakontere was used exclusively for ceremonial

[68] Athenaeus, 5, 203e; Plut., *Demetrius,* 43,5. These dimensions are calculated in different ways: M. Schmidt, *Über griechische Dreireiher*, Berlin 1899, 7–8; A. Bouche-Leclercq, *Histoire des Lagides,* vol. 1, Paris 1903, 326; E. Bevan, *Histoire des Lagides, 323–30 av. J.-C.,* Paris 1934, 266. Sometimes the correct length is given as 124–125 m long: A. Neuburger, *Die Technik des Altertums,* Leipzig 1919, 505. B. Kozłowski's view is entirely absurd when he reduces the tessarakontere's length to 100 m without any apparent reason (B. Kozłowski, *Dzieje okrętu,* Gdańsk 1974, 79). For more on the warship itself, see S. Ducin, *Największa galera antyku? Wymiary i kształt kadłuba,* „Annales UMCS", s. F, 46/47, 1991/1992, 91–102; L. Basch, *The Tessarakonteres of Ptolemy IV Philopator,* „Mariner's Mirror", 55, 1969, 381–382; R. C. Anderson, *Triremes and polyremes,* „Mariner's Mirror", 19, 1933, 234–238; A. W. Sleeswyk, F. Meijer, *Launching Philopator's „forty",* IJNA, 23, 1994, 115.

purposes, to attest to the everlasting power of the Ptolemys[69]. Detailed descriptions by Athenaios (Athenaeus) regarding not only the appearance of this extremely astounding vessel but also its crew are highly convincing[70]. In this respect the ship might have attained huge dimensions, the more so that Ptolemy Philopator was famous for his megalomaniac wishes[71].

All the types of warships described above seem to substantiate a nineteenth-century thesis, still espoused by many, about distinct tendencies in the evolution of ancient warships, which progressed almost linearly towards their constant enlargement. However, this is an unusual oversimplification of the problem. In the shadow of the huge ones there appear, almost inconspicuous, also other, far smaller vessels that constitute a very large group of ships difficult to identify and – not infrequently – to classify their typological origins. Most often, these were warships that frequently performed exclusively (or predominantly) auxiliary functions such as patrolling or reconnaissance, and sometimes also with multi-purpose traits, not necessarily confined to exclusively military functions. This clearly sizeable group of warships should include vessels mentioned earlier such as τριχημιολίας, *trihemiolia*, *liburnae* (liburnians) and λέμβοι.

The fact alone of being characterized by smaller dimensions and performing secondary functions in the naval fleets, seemingly degrading these vessels, should not however put them entirely on the peripheries of this discussion. Although they were ships with several oar files at best, usually with one, but they possessed distinct combat properties, for example the ram or its development forms. The first two names are today the source of heated debates among experts in maritime knowledge. These warships, so characteristic of the Greeks, owed their name, as many experts on the subject claimed, to the features of construction and had a non-typical arrangement of oars, unevenly divided throughout the ship. The views of scholars can be essentially classified into three groups. One is a thesis that τριχημιολίας and *trihemiolia* are warships of the same type, only using

[69] Plut., *Demetrius*, 43, 6–7; cf. L. Casson, *The ancient mariners. seafarers and sea fighters of the Mediterranean in ancient times,* New York 1967, 145; J. Rougé, *La marine dans l'antiquité*, Paris 1971, 104; E. Henriot, *Kurzgefasste illustierte Geschichte des Schiffbaus von den Anfangen bis Ausgang des 19. Jahrhunderts,* Rostock 1971, 25.

[70] An example thereof is the detailed analysis of a specific method of launching, which some experts in the field acknowledge to be highly probable – Sleeswyk, Meijer, *op. cit*., 115–118.

[71] Cf. E. van't Dace, *Ptolemaica selecta. Études sur l'armée et l'administration lagides,* Lovanii 1988, 28. Most evidence concerning the dimensions of ancient maritime vessels relates to merchant ships, nevertheless, their considerable dimensions confirm the practical possibilities of building warships over 50–60 m long, J. Horvat, *About the sizes of Roman vessels,* „Archeološki Vestnik", 37, 1986, 247–254; G. W. Houston, *Lucian's Navigium and the dimensions of the Isis,* AJP, 108, 1987, 446–450. The scale of size of Greek and Roman vessels can certainly be compared with medieval ship, a different view being held by for example F. C. Lane (*Tonnages, medieval and modern,* „Economic History Review", 17, 1964, 221sqq).

something different as a distinguishing factor. According to these scholars, the warships had only one level of oarsmen, seated in three files next to one another on one level. Two outer files of oarsmen would man one file of oars per side. The oars propelled by oarsmen in the middle row would alternate on port and on starboard. There would thereby be three files of oarsmen altogether (hence perhaps the name of *trihemiolia*). Moreover, each side would have one and a half the total number of oars, hence perhaps the term τριχημιολίας. According to a different view of other scholars, τριχημιολίας and *trihemiolia* are two different terms[72]. The former would denote a warship that had two oar-files from midships to fore, and from midships to aft – only one file. On average – one a half file. The latter term would denote a warship with three oar-files in the bow part and no more than two in the stern part. The arrangement of oars would likewise be irregular here. The last group of scholars share a similar view of the warships, also with an irregular arrangement of oar-files, yet only a temporary one. These would be vessels so constructed as to allow some part of oarsmen to leave their oars (in the vessel's stern part) in order to reinforce the ship's boarding party[73]. Which is why these galley types were probably identified with the operations of pirates, vessels that allowed for considerable, *ad hoc* reinforcement of the fighting crew. Before the fight, the warship, propelled by all oars, was able to attain high speed and catch up its potential victim, while during the fight it had a considerable number of men to win the boarding duel. A confirmation of this thesis can be found in Appianus' accounts, attributing one-and-half file warships (τριχημιολίας) to pirates[74]. The two warship categories were essentially absent from Roman squadrons, but this should not however be explained exclusively by their *sensu stricto* pirate origin, which *liburnae* also had but it was treated entirely differently by the Romans[75]. It is possible that τριχημιολίας and *trihemiolia*, apart from high speed, also had a too delicate structure, which disqualified them from the so-called line (basic fleet composition).

Liburnae, λέμβοι are, contrary to appearances, a separate, also unequivocal group of warships, which may have owed their Latin name to their place of origin or, which should be also assumed, to the people that predominantly used these vessels. They were, which is rather not contested, warships with one or at most two oar-files. The maximum dimensions of the warship would be up 20–25 m in length

[72] L. Robert, *Trihemiolies atheniennes (Hellenica, XXI),* „Revue de Philologie", 18, 1944, 11–17; J. S. Morrison, *Hemiolia, trihemiolia,* IJNA, 9, 1980, 2, 121.

[73] L. Casson, *Hemiolia and trihemiolia,* JRS, 78, 1958, 15–17.

[74] App. XII 92, 416–418; 94, 431–433.

[75] Appianus' mention of the participation of one-and-half-file warships in the expedition to Utica commanded by consul Lucius Martius Censorinus is of a single-case character and cannot decide about classifying this type of vessel as the main one in the Roman fleet – App. VIII 75, 349–351.

and ca. 4–5 m in breadth. The structure of all these smaller vessels is still a great unknown despite many representations and descriptions (mosaics, reliefs, images on coin, sculptures, clay models etc.)[76]. Only to a certain degree do they allow us to feel at home with the specific transformations of Greek and first of all Roman shipbuilding, including *liburnae* and λέμβοι. These vessels had been originally used by Illyrian pirates for their lightness and speed, low draft and incredible manoeuvrability, subsequently to be adopted in almost mass numbers by the Romans[77].

The only thing therefore that could have distinguished them from other warship types are slight, even negligible structural details or at best their origins. However, this very common view disregards many issues. First of all, the problem of the positioning of oarsmen. Where are therefore the grounds for special emphasis on the distinctive nature of *liburnae*, and for what partially explains their subsequent domination of the Mediterranean? The matter would look different if we assumed that this type of warship had a different pattern of arrangement of oarsmen than the other vessels, with more than one man rowing one oar, which was decidedly different in comparison with other ships. This innovation might be the very secret reason why *liburnae* are treated in a special way and just as their successes at sea in the latter half of the first century BC.

Rome's drive to conquer put an end to all previous naval powers with Carthage in the lead. However, it did not eliminate from the seas their instruments, especially great polyeres, many of which must have been captured by the Romans. However, they did not make these ships only the background for their triumph but used them in practice by returning the huge warships to active duty. Livy's account of the triumphant floating of a sixteen-file warship on the Tiber is widely quoted. The transformation by the Romans of the Mediterranean into the *mare internum* practically wrecked and ended the dynamic evolution in the typology of ancient warships, which continued to develop to lay the foundations for the experiences of the subsequent, already medieval generations of shipbuilders, although the transformations that were already taking place at the time are difficult for the historian to record and they essentially relate first of all to modifications of the already existing forms of warships rather than the construction of new, genetically different type.

[76] The most characteristic and partly best-known is probably the relief of Praeneste, showing warships with two oar-files classified as *liburnae*: F. Miltner, *Das praenestische Biremenrelief*, JOAI, 24, 1929, 88–111; problems with dating it – R. Heidenreich, *Zum Biremenrelief aus Praeneste,* MDAIR, 51, 1936, 337–339.

[77] Cf. H. Pohl, *Die römische Politik und die Piraterie im östlichen Mittelmeer vom 3. Bis zum 1. Jh. v. Chr.,* Berlin–New York 1993, 58, 92; Liv. XL 18, 4; XLI 1, 3; Polyb. III 16, 1.