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### Appendix S: Trireme Warfare in Herodotus

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# APPENDIX S

## Trireme Warfare in Herodotus

§1. Herodotus describes a vigorous era in the history of the maritime traffic and warfare in the Mediterranean. Greek<sup>a</sup> and Phoenician colonies anchored far-flung trading networks north to the Black Sea and west along the African and European coasts to Spain and even beyond the Straits of Gibraltar.<sup>b</sup> Sea lanes had to be policed, colonies protected, parochial navies developed and increased. Furthermore, naval strength, always a prerogative of coastal and island states, became an important factor in the expanding domains of inland powers such as Sparta<sup>c</sup> and Persia. The jostling of all these escalating commercial and political interests in the seas of the Mediterranean fostered developments in ship design, construction, and handling.

§2. Herodotus is one of our primary sources for these developments. But he assumes a firsthand familiarity with seagoing ships of the Greeks and Persians, and so his abbreviated references do not provide us with the complete manual of ancient seafaring in the archaic Aegean<sup>d</sup> that we would have liked. It is not easy to complete the picture. There are images of ships, primarily on Attic pottery, but they are difficult to interpret. Underwater explorations have yielded only cargo ships; ancient warships have left few traces. Men jumped off sinking ships, and without the weight of human ballast, the empty wooden hulls floated just below the surface and were often salvaged before they sank completely. Those hulls that did sink to the seafloor had no cargo to protect them from marine predators and deterioration, and so there is now little or nothing left for underwater archaeologists to discover. Especially conspicuous is the lack of Phoenician testimony; we know of the ships and maritime achievements of these most excellent seafarers and sea fighters mostly through secondhand, often hostile accounts. Thus Herodotus' story remains the essential account of archaic maritime history.

S.1a Greece (Hellas): Map S, AX.  
S.1b Europe, Phoenicia, Euxine (Black) Sea, Africa (Libya), Spain (Iberia), Straits of Gibraltar (Pillars of Herakles): Map S, locator.

S.1c Sparta: Map S, BX.  
S.2a Aegean Sea: Map S.

### Warships

§3. He recounts the age of the development of the *triereis* (anglicized as “trireme”), the oared vessel that would become the premier warship of the classical world. In the centuries between Homer and Thucydides, warships evolved from transports that carried warriors to the battlegrounds where they disembarked and fought on land, to fighting machines designed to ram and sink opponents on the seas. During the long transitional period before triremes achieved their classical form and purpose (and even then), many navies relied on a third option: using ships to carry troops on deck for launching missiles at the enemy and engaging in pirate-style boarding at sea. Whether the battle plan depended on boarding or ramming, successful maneuvers against the enemy depended on the rowers (sailing and wind being too variable to be counted on in battle), and thus developments in warship design focused on increasing the number of oars, and thereby power, without sacrificing efficiency. There came a point beyond which it was not feasible to lengthen wooden hulls for the purpose of adding rowers—the increased length made the hulls either fragile or too cumbersome—and the most significant change in warship design thereafter, in the centuries preceding the Persian War, was the incorporation of a second and eventually a third level of oarsmen. There is no unambiguous evidence for where and when these advances were made or how quickly they spread. Scholarly debate on these topics is lively.

§4. Herodotus’ narrative portrays a general adoption of triremes over the course of the sixth century, but the specific dynamics of that shift are difficult to define, partly because Herodotus so often uses vague vocabulary. The term that he uses most frequently in his catalogs of fleets and descriptions of naval maneuvers is *neus* (the Ionic form of *naus*, whence “nautical” and “naval”), a word that simply means ship. Context is the indication that *neus* means a warship (rather than a merchant ship),<sup>3</sup> and sometimes it is clear that Herodotus is referring specifically to triremes. But there are many instances when the reference cannot be defined. His narrative does indicate that the changeover was gradual, for the fleets of the early fifth century are still an amalgam of older and new-model warships. The old-fashioned vessels were triaconters (thirty-oared) and penteconters (fifty-oared, with either one or two levels of rowers). Triaconters are listed in the catalog of Xerxes’ fleet (7.97), and a triaconter served as messenger ship to the Greek navy stationed at Artemision (8.21.1).<sup>b</sup> Penteconters were still substantial elements of the navies mustered in 480.

§5. Probably during the tyranny of Polykrates of Samos<sup>a</sup> (533–522), and certainly by the time of the Ionian Revolt (499), the trireme had become the cutting edge of naval power. The trireme is thought to have taken its name from the arrangement of

S.4a Herodotus occasionally modifies *neus* with *makre* (“long”) to specify a warship; a *neus strongule* (“round”) means specifically a cargo ship. The term *ploua* usually signifies vessels other than warships.

S.4b Artemision: Map S, AX. Triaconters in the Persian fleet, 7.97; among Gelon’s ships, 7.163.1; among the Greeks at Artemision, 8.12; at Salamis, 8.48.

S.5a Samos: Map S, BY.

rowers. In its classical form, the hull enclosed two levels of rowers, and a third row of oarsmen sat in outriggers mounted along the topsides of the hull. Only the topmost rowers were in a position to see the oar blades enter the water, and each rower in the upper bank was responsible for guiding the two rowers below him to adjust their stroke to fit the general cadence. Thus the trireme crew worked in teams of three, and this is why the Greeks referred to these warships as *trieris*, “three-fitted.” This configuration packed 170 rowers into a hull about 120 feet long and 15 feet wide, and optimized the balance of power, speed, and maneuverability: a longer boat with more rowers would have been heavier and more difficult to maneuver without gaining much in the way of increased speed, while a smaller boat with fewer rowers would have lacked sufficient speed and striking power. During the classical period, since ramming was the primary offensive technique, and since lightness and speed were paramount, the rest of the crew was pared down to a bare minimum. In addition to the rowers, the standard complement for an Athenian trireme during the Peloponnesian War consisted of only ten marines, four archers, and about sixteen other crew to sail the boat.<sup>b</sup>

§6. At what point the trireme attained its classical specifications is a matter of debate. There is likely to have been significant variability among the earliest models. Certain fleets of archaic triremes had a reputation for better performance. Herodotus praises especially the ships of the Sidonians among the Phoenicians, and the Samians, Athenians, and Aeginetans<sup>a</sup> among the Greek fleets. But he does not specify whether this is a matter of construction, crew, or condition; his stock praise is simply that the ships “moved best in the water.” If this was a matter of design, the differences cannot have been conspicuous, since there are several incidents of confusion between enemy and friendly ships in the *Histories* (for example, 7.194.1, 8.87.4). Herodotus does mention that Phoenician triremes could be distinguished by the figureheads on their prows<sup>b</sup> (3.37.2), and at least some ships carried individual insignia (8.88.2, 8.92.2), but in general and at least externally all triremes must have looked essentially alike.<sup>c</sup>

§7. The number of marines on the decks of these early fleets of triremes did vary,<sup>d</sup> and scholars debate whether these differences in the number of fighting men are indicative of substantive differences in ship design and/or battle tactics. Essentially the question is whether marines played a primary or auxiliary role in offensive tactics. Or, put another way, at what point did ramming strategies supersede the old-fashioned conception of warships as troop carriers? How one understands Herodotus is the linchpin to this debate. Can Herodotus’ descriptions of certain ships/fleets as “better at sailing” or “heavier” (8.60.α) be understood in terms of number of marines on board and/or modified designs? How many marines would necessitate modifications to ship design (added deck space, for example)? Does a report by Herodotus of an increased number of marines indicate a fleet built for

S.5b See Figure S.1 for a photograph of the *Olympias*, a full-scale trireme constructed in Greece and sailed, rowed, and tested in the 1990s; and Figure S.2 for a construction and manning diagram of the ship.

S.6a Sidon: Map S, locator. Athens, Aegina: Map S, BX.

S.6h See also Samian ships (not triremes) with boars’ heads on their prows (3.59.3).

S.6c In the catalog of Xerxes’ fleet (8.89–95), the differ-

ent contingents are described in terms of their armor, weapons, and dress, but not by distinctive triremes.

S.7a The Chians at Lade fought with a complement of 40 marines (6.15.1). (Chios, Lade: Map S, BY.) Xerxes sailed with an additional 30 marines on deck (7.18.4.2). Kleonias’ crews of 200 conform to the classical standard, namely, 10 marines (8.17).

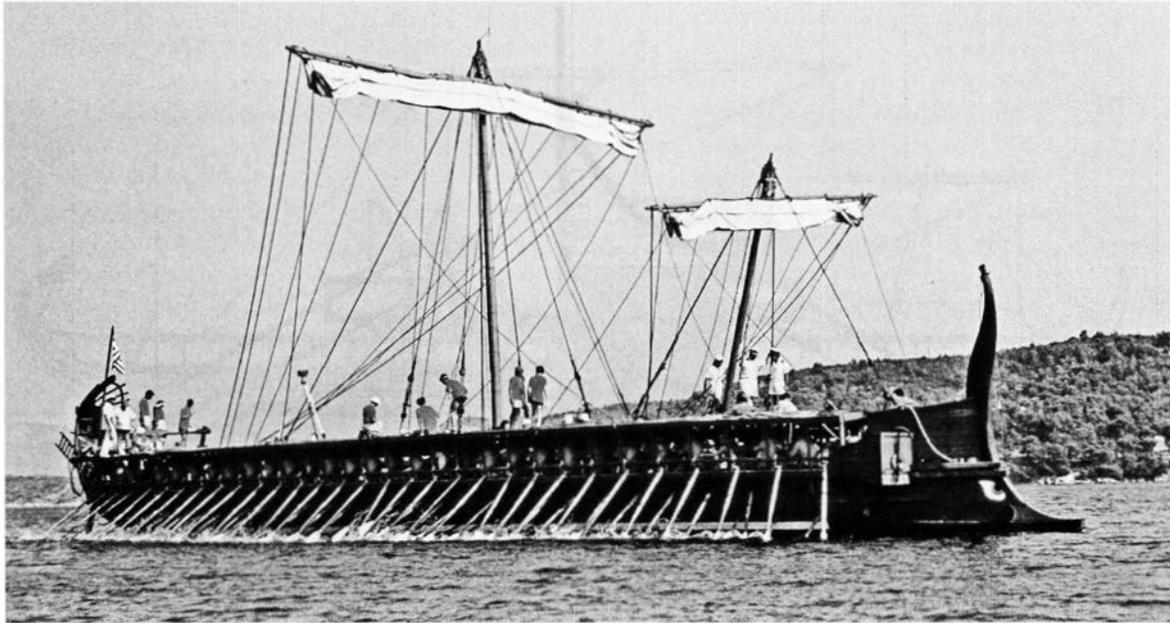


FIGURE S.1. THE MODERN TRIREME *OLYMPIAS*, BEING ROWED BY STUDENTS.

boarding tactics, or does a small number of marines suggest a battle strategy reliant on ramming?

§8. One indirect indication of an increased emphasis on ship handling might be the existence of facilities for hull maintenance. Hull speed would have become a vital factor with the advent of ramming tactics. Thucydides records that the naval commanders of the Peloponnesian Wars, when ramming warfare reached its apogee, were concerned with keeping their hulls from becoming waterlogged while on campaign,<sup>a</sup> and archaeologists have uncovered the foundations of the shipsheds in which classical Athenian triremes were berthed in Peiraicus, their home port.<sup>b</sup> Herodotus also mentions such concerns in connection with triremes. He states it clearly when he specifies that Xerxes' fleet (powered by triremes) halted at Zone<sup>c</sup> to "dry out" (7.59.2). The connection is not made explicit in his passing reference to Polykrates' boathouses, but perhaps it is not chance that this is the same ruler whom he records making the transition from penteconters to triremes.<sup>d</sup> Whether or not Herodotus' description of Nechos' (610–594) fleet of triremes is anachronistic, it is perhaps not coincidental that he mentions gear for pulling ships out of the water (*holkos*) in the same sentence (2.159.1).

S.8a Thucydides 7.12.3–5.

S.8b The size of these trireme shipshed berths has helped scholars and marine designers determine at least the maximum dimensions of triremes. See Figure S.4.

S.8c Zone: Map S, AY.

S.8d The term which Herodotus uses for "shipshed" in 3.45.4, *neuwikoi*, is a general one, and it

is possible that these boathouses had been built for the penteconter fleet, or even for nonmilitary use.

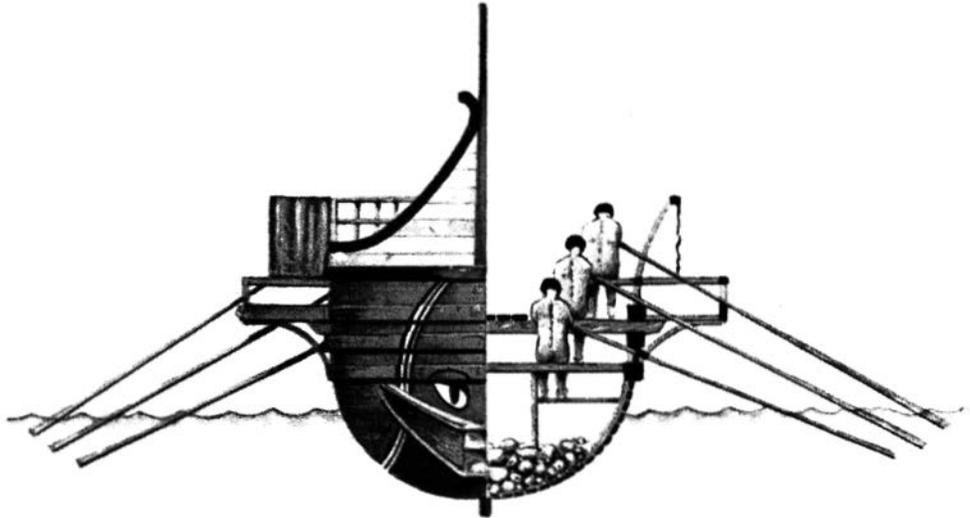


FIGURE S.2. CROSS-SECTIONAL DIAGRAM OF A TRIREME, SHOWING PLACEMENT OF ROWING STATIONS.

### Sea Battles

§9. Herodotus' account of the battle of Salamis<sup>a</sup> is his most detailed description of a naval engagement; he was a boy when the battle took place, and as a native of Halicarnassus,<sup>b</sup> he must have heard about it—and especially Artemisia's role—directly from participants on the Persian side. There exists a second contemporary source, the Athenian tragedian Aeschylus, who probably took part in the battle. His drama *The Persians* played before an audience that undoubtedly included many who had fought at Salamis eight years earlier. The two authors disagree about the numbers of ships on each side<sup>c</sup> and the locations of their ships and tactics at the initial attack.<sup>d</sup> These discrepancies highlight the uncertainties of Herodotus' method, reliant primarily upon oral and, most often, secondary or even tertiary sources.

§10. It should be remembered, too, that literary considerations influenced his narrative. So, for example, the figure of Artemisia, who certainly existed and whose reported actions may well reflect reality, also serves to illustrate the themes of inversion<sup>a</sup> and transgression<sup>b</sup> and resulting confusion that pervade this history. Herodotus'

S.9a Salamis: Map S, BX.

S.9b Halicarnassus: Map S, BY.

S.9c Herodotus: 1,207 Persian vs. 380 Greek.  
Aeschylus: 1,000 Persian vs. 300 Greek.

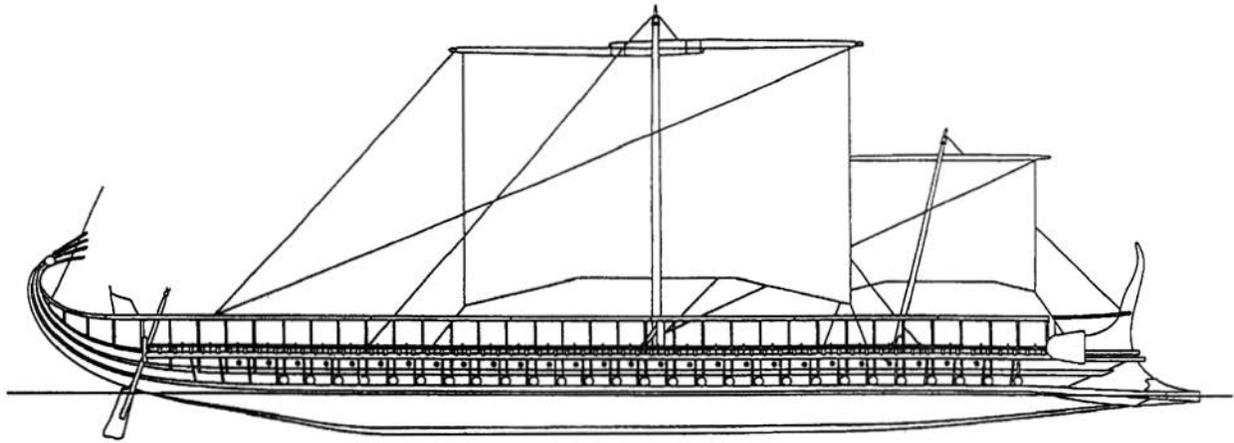
S.9d For detailed discussions, see J. S. Morrison and J. F. Coates, *The Athenian Trireme* (1986), 59–60, and, most recently, D. Porter, *Bryn Mawr Classical Review* 2006.03.29 (a review of R. T. Wallinga, *Xerxes' Greek Adventure: The naval perspective. Mnemosyne supplement 265* [Leiden: Brill, 2005]).

S.10a A common theme of Herodotus' ethnographic

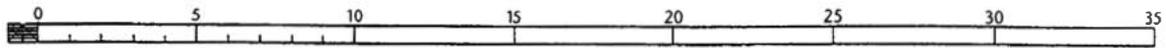
account is the depiction of foreign customs as an inversion of the normal order. So, for example, Egyptian women urinate standing up, but the men sit down.

S.10b Boundary crossings and boundary violations, physical and behavioral, are a central theme of the *Historias*. Herodotus characterizes especially the Persian Kings with such actions, as, for example, Xerxes' crossing of the Hellespont (Map S, AY) or his treatment of the son of the Lydian Pythios (Lydia: Map S, BY).

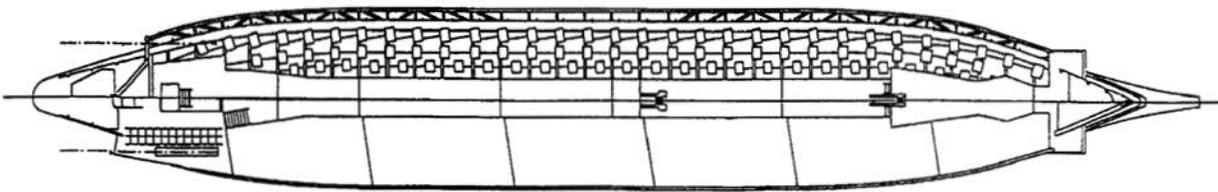
APPENDIX S



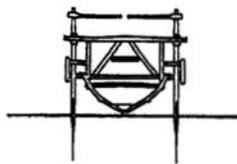
Side view



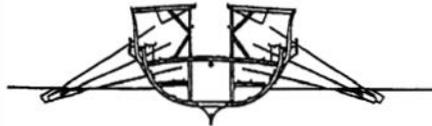
Meters



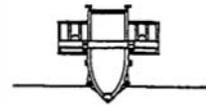
Top view



Stern



Midship



Bow

Cross-sections

FIGURE S.3. DIAGRAM OF THE MODERN TRIREME *OLYMPIAS*.

description of Artemisia ramming a Persian ship is an excellent example of this combination of historical report and literary topos.<sup>c</sup> In assessing Herodotus' historical narrative, it is important to realize that this is first of all a work of literature, in which imagery is manipulated and "facts" are tools used to advance the themes of his history.

§11. Even so, it is possible to detect in Herodotus' narrative an increasing emphasis on naval warfare (and skills) in its implementation over the course of the sixth and early fifth centuries. Fleets grow ever larger, and coalitions become increasingly broad in scope. Battle strategy grows more reliant on rowing tactics and perhaps incorporates ramming as an offensive weapon.

§12. Herodotus reports only the barest outlines of the battle at Alalie (535), between a fleet of sixty Phocaeen ships (probably penteconters) and a Carthaginian-Etruscan coalition double that size.<sup>a</sup> Of special interest is his description of the damage to twenty Greek ships: he says that they were rendered unusable by their "rams being 'bent back'"<sup>b</sup> (1.166). This is the earliest extant mention of rams in battle (although there are earlier depictions) and, as discussed above, it is possible that this awkward image of damage is indicative of newly emergent technology and tactics.

§13. Less than half a century later (494), at Lade,<sup>a</sup> ramming may have been integral to battle strategy. It is perhaps no coincidence that here, too, the primary role is played by a Phocaeen commander (Dionysius), in spite of the fact that he heads one of the smallest contingents (only three ships!) of the Ionian fleet. Dionysius concentrates especially on two maneuvers: sailing in column (*epi keras*) and the *diekplous*,<sup>b</sup> which in classical times consisted of breaking through an enemy line and then turning rapidly to ram his defenseless side or stern.

§14. By 480, at Artemision,<sup>a</sup> the Greeks have become adept at rowing maneuvers. The significantly outnumbered Greek fleet successfully defended itself by drawing up into a tight circle (*kuklos*), bows facing outward against the enemy. They were able to maintain formation and fight successfully until nightfall put a halt to the action.

### Dangers on the Waters

§15. The greatest danger to ships was not battle but storm, and no ancient naval expedition ever set sail in the Mediterranean during winter months. The Persian disasters at Athos (6.44.2) and along the coasts of Magnesia (7.168) and Euboea<sup>a</sup> (8.13) vividly confirmed Artabanos' caution to Xerxes: the greatest threat to a large-scale naval expedition against Greece lay in the lack of adequate havens from storms

S.10c For more on Artemisia, see R. V. Munson, "Artemisia in Herodotus," *Classical Antiquity* 7 (1988), 91–106.

S.12a Alalie (Corsica), Carthage: Map S, locator. Phocaea: Map S, BY.

S.12b Literally, "They were bent back as to their beaks." Other suggested translations: their rams were "buckled," "twisted off," "badly bent."

S.13a Lade: Map S, BY.

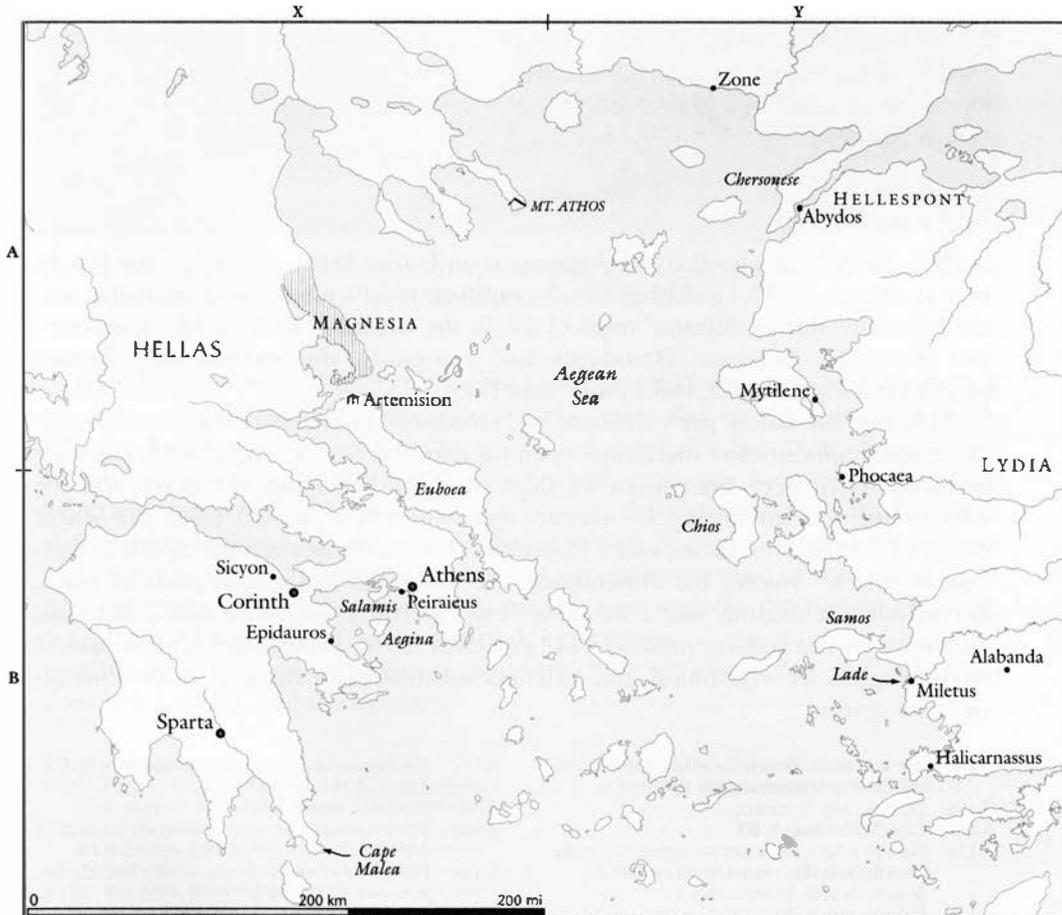
S.13b Literally, "to sail through and out." Later sources associate this maneuver specifically with ramming,

but Cawkwell argues that the fully developed *diekplous* was not employed until the Peloponnesian War and that Herodotus' use of the word indicates only a maneuver used to bring the marines into fighting range. See Appendix H, The Ionian Revolt, n. 4Cf, and G. Cawkwell, *The Greek Wars. The Failure of Persia* (Oxford: Oxford University Press, 2005).

S.14a Artemision: Map S, AX.

S.15a Mount Athos, Magnesia: Map S, AX. Euboea: Map S, BX.

APPENDIX S



MAP S

(7.49.2–3). Ancient naval fleets by necessity hugged the very coasts that posed their most imminent danger, for the cramped quarters of warships required regular stops for the crew to eat and sleep. Even in good weather, long stretches in triremes became exceedingly uncomfortable for the oarsmen. Rowers on the modern *Olympias*<sup>b</sup> were much bothered by the heat and stench that quickly permeated their close wooden quarters; in the prelude to Lade, Dionysius' rowers endured only one week of daylong training regimes on shipboard before rebelling (6.12.2–4).

§16. Ships also stayed within sight of coasts because these were their guideposts. Stars were no aid to navigation in the narrow latitudes of the Mediterranean; preserved ancient “admiralty charts” (*periplois*) indicate that mariners set their courses primarily by coastal landmarks and estimated speeds and distances. Herodotus may have obtained some of the information he cites for the areas of seas and lengths of rivers from such mariners' handbooks. Apparently Darius could not get his hands on such a guide, and so his first step in the invasion of Greece was to send ahead an expedition to reconnoiter the Greek coastline (3.136.1). In fact, Herodotus notes several instances in which lack of detailed knowledge of the Aegean coastline caused troubles for the Persian fleet (7.183.2, 8.107). The Corcyrians,<sup>a</sup> on the other hand, used local knowledge of geography and weather to their advantage, citing the well-known storms off Cape Malea<sup>b</sup> as a plausible excuse for not joining the Greek coalition at Salamis (7.168.4, 4.179.2).

### Seafaring Nations

§17. Herodotus says that the Aeginetans and, after them, the Athenians fought best at Salamis (8.93.1).<sup>a</sup> Other Greek contingents have their moment in the sun: the Milesians<sup>b</sup> during Alyattes' reign (1.17.3), the Chians at Lade (6.15.1), and several times the Samians.<sup>c</sup> Herodotus also recognizes the wide-ranging Samian (4.152) and Phocaean (1.163.1) merchant fleets.

§18. But the sailors par excellence of Herodotus' account are the Phoenicians.<sup>a</sup> Phoenician colonists and merchants open his narrative (1.1.1) and Phoenician ships permeate its entirety. Phoenician warships were the backbone, the heart, and the stars of the Persian fleets,<sup>b</sup> Phoenician merchant ships (*ganioi*) plied the whole sweep of the Mediterranean, and a Phoenician fleet accomplished the circumnavigation of Africa.<sup>c</sup> Among the Phoenicians, the Sidonians had special pride of place: Xerxes' chosen flagship was a Sidonian vessel (7.100.2, 7.128.2), and a Sidonian warship won the rowing match (7.44; especially 7.96) at Abydos.<sup>d</sup> Unfortunately, archaeological, iconographical, and other textual sources for the ships of the Phoenicians are sparse.

S.15b The keel of the *Olympias* was laid down in 1985 and the ship was launched in 1987.

S.16a Corcyra: Map S, locator.

S.16b Cape Malea: Map S, BX.

S.17a See also 5.83.2 for Aeginetan superiority at sea (shortly thereafter contradicted by 5.86.2).  
Aegina, Athens, Salamis: Map S.

S.17b Miletus: Map S, BY.

S.17c The Samians are mentioned on four occasions; 3.44.2, 3.122.2, 5.117, 6.14.3.

S.18a Phoenicia: Map S, locator.

S.18b The Phoenicians are mentioned in this capacity at 3.19.2–3, 5.109.3, 6.6, 6.28.1, 6.31.1, 6.33.

S.18c Phoenician circumnavigation of Africa: 4.42; also, perhaps 2.102.2, 4.43.

S.18d Abydos: Map S, AY.



FIGURE S.4. A LATE-NINETEENTH-CENTURY PHOTOGRAPH OF THE REMAINS OF FOUNDATIONS AND COLUMN SUPPORTS OF THE ATHENIAN SHIPSHEDS AT PEIRAEIUS.

§19. It makes sense that Xerxes turned to his expert Phoenician sailors to provide the cables that spanned the Hellespont.<sup>a</sup> He turns also to the Egyptians (7.25, 7.34.2). Egypt was, of course, the source of papyrus.<sup>b</sup> But there are hints in Herodotus' narrative that the Egyptian facility with cables was due to more than their being the source of the raw materials. It is possible that these people of the Nile were also premier builders and sailors of seafaring vessels. Herodotus associates triremes with Nechos (2.159.1), which would be the earliest appearance of these ships. Further indication of Egyptian seamanship may perhaps underlie the reports (2.102.2, 4.43) that "Sesostris" and Sataspes started their voyages of exploration in Egypt.<sup>c</sup>

§20. In contrast to the seafarers, there are those who are not so inclined: Amazons, the Lydians, and the Persians.<sup>a</sup>

S.19a Hellespont: Map S, AY.

S.19b Egypt: Map S, locator. Papyrus was normally used in place of paper in the ancient Mediterranean, but in this case it was used to create some of the immense cables which were used to hold Xerxes' boat bridges in place (7.25.1, 7.34, 7.36.3).

S.19c It is likely, however, that they hired Phoenician vessels there (4.42).

S.20a The Lydians under Croesus (1.27); the Persians at

1.143.2 (although Persian troops served on ships as marines), and the Amazons (4.110.1-2).

### Merchants and Colonists

§21. Herodotus' enumeration of fleets only occasionally makes reference to the supply ships that accompanied and outnumbered the warships. In contrast to the sleek lines of the oared ships designed for speed, cargo ships<sup>a</sup> were built for capacity, and thus their profiles were rounded and full. Merchant traffic through the Hellespont was particularly important, for the fertile fields of the Greek colonies in the Black Sea provided vital resources of grain to their homelands. Thus, control of these straits was strategically important for both sides. But Dionysius' acts of piracy against Carthaginian and Tyrrhenian<sup>b</sup> merchant shipping in Sicily illustrate that dangers beset merchant shipping throughout the Mediterranean (6.17). It is perhaps because of such dangers that oared warships are regularly associated with colonization movements.<sup>c</sup>

### "Other" Watercraft

§22. It is only when he discusses foreign watercraft, such as the Armenian boats or the baris of the Nile, that Herodotus provides details. In both instances, archaeological, iconographic, and/or ethnographic evidence corroborates his descriptions. Round, skin-covered boats (Arabic: *kufah*) were sailed down the lower Euphrates into the early twentieth century, and just as in Herodotus' account (1.149), they were broken up at the end of the journey, their skins carried back upstream and refitted for another trip downstream. Herodotus also accurately describes the construction of Nile riverboats;<sup>2</sup> the use of short lengths of acacia wood and a construction technique reliant upon beams at deck level for the hull were foreign to Greek shipbuilding. His descriptions of the mechanics of towing the Nile boats upstream and keeping them on course downstream also ring true.

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- S.21a Greek merchant ship: *holkas*, Phoenician: *ganlos*.  
S.21b Carthage, Tyrrhenia (Etruria): Map S, locator.  
S.21c Warships associated with colonization: triaconters, 4.148.3; penteconters, 1.163.1, 4.153, 4.156.2; triremes, 5.47.1.  
S.22a C. Haldane and C. W. Shelmerdine. "Herodotus 2.96.1-2 Again." *Classical Quarterly* 40 (1990), 535-539, with references.